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SCALE
Strengthening Capacity in Agriculture Livelihoods and Environment

Resilience Design Training Facilitator's Guide

Resilience Design Training Overview

Session A. Introductions and establishing a safe learning environment | 30 mins			
Learning Objectives | Participants will be able to… 1. Get to know each other. 2. Understand what is expected of them and what they should expect from the course.			
Session A: Activities		**Tools + Training Materials**	**Timing**
A1	Introductions and establishing a safe learning environment | *Discussion*	• Flipchart and markers	30 mins

Session B. What is Resilience Design and why is it important? | 2 hours 30 mins			
Learning Objectives | Participants will be able to… 1. Create a vision for how they would like their landscape to look in the future. 2. Identify the root causes of the threats they face on their farms. 3. Understand how meeting the basic needs of plants leads to a healthy and thriving farm. 4. Understand resilience as the ability to bounce back from a threat to their farm or household. 5. Distinguish between a 'typical' farm and RD farm and how they respond to climatic challenges. 6. Identify local resources around them that are useful to create a healthy, productive farm.			
Session B: Activities		**Tools + Training Materials**	**Timing**
B1	History and future vision of the landscape | *Discussion*	• Flipchart and markers	30 mins
B2	Basic needs of plants and people | *Discussion*	• Flipchart and markers	20 mins
B3	Rubber and mud ball activity | *Demonstration*	• Flipchart and markers • Rubber ball • Mud balls	10 mins
B4	What distinguishes RD farms and RD farmers from their neighbors? | *Discussion + Demonstration*	• Hoe • 2 jerrycans/ buckets of water • Mulch materials • Small sticks • Stones • Manure or finished compost • Lighter or matches	30 mins
B5	Identifying resources around us | *Resource Walk*	N/A	60 mins

Session C. Observing and analyzing our landscape | 2 hours and 15 mins

Learning Objectives | Participants will be able to…

1. Identify the key markers of healthy soil and assess soil health.
2. Analyze a landscape to see if it meets the basic needs of plants and soils.
3. Map key elements and influences of the landscape.

Session C: Activities		Tools + Training Materials	Timing
C1	Healthy soils: meeting the basic needs of our soils | *Discussion + Soil Testing*	• Flipchart and markers • Shovels • Bottle or jerrycan of water • 80–100 cm long stick	45 mins
C2	Observing our landscape | *Discussion + Walk*	• Flipchart and markers	45 mins
C3	Mapping the demonstration farm | *Activity*	• Flipchart and markers	45 mins

Session D. Designing resilient water management systems using earthworks | 5–6 hours

Learning Objectives | Participants will be able to…

1. Build and calibrate an A-frame
2. Understand the concept of "on contour"
3. Plan the earthworks design for a site using six design questions
4. Survey and mark contours within the landscape and dig three primary kinds of earthworks

Session D: Activities		Tools + Training Materials	Timing
D1	Building and calibrating an A-frame | *Activity*	• A-frame materials • Hammer • Saw	60 mins
D2	Understanding contours and using earthworks to control erosion and slow, spread, sink, and manage water | *Discussion + Demonstration*	• A-frames • Pegging materials • Hoes • Shovels	40 mins
D3	Planning the earthworks design | *Discussion + Walk*	• Flipchart and markers	30 mins
D4	Creating an earthworks design map | *Discussion*	• Flipchart and markers • Maps of the demonstration farm from Session C	60 mins
D5	Marking out the earthworks design by surveying and pegging | *Activity*	• A-frames constructed in D1 • Pegging materials	45 mins
D6	Constructing earthworks | *Activity*	• A-frames constructed in D1 • Shovels • Hoes • Mulching materials	1–2 hours

Session E. Designing a resilient farm | 4 hours

Learning Objectives | Participants will be able to…

1. Understand how a diversity of plants – including trees – and animals contribute to a resilient farm.
2. Add a layer of biodiversity to their resilient farm design
3. Implement key RD practices for soil preparation and biodiverse planting.

Session E: Activities		Tools + Training Materials	Timing
E1	Designing for biodiversity | *Discussion*	• Flipchart and markers	30 mins
E2	Integrating biodiversity into our earthworks | *Discussion + Mapping Exercise*	• Flipchart and markers • Design map from Session D	60 mins
E3	Building healthy soils and biodiverse planting | *Activity*	• A-frames and pegging materials • Hoes • Shovels • Seeds and other planting materials • Compost and other soil amendments	2.5 hours

Session F. Continuously improving design + building a community of RD farmers | 3.5 hours

Learning Objectives | Participants will be able to…

1. Use the Resilience Design Checklist to ensure the site meets minimum standards.
2. Observe what is working and where to make adaptations to the RD design.
3. Adjust and expand their RD designs.
4. Identify ways that they can support each other on their learning journey.

Session F: Activities		Tools + Training Materials	Timing
F1	Gathering feedback from plants and the land | *Discussion + Checklist Exercise*	• Flipchart and markers • RD checklist	30 mins
F2	Adjusting and growing our design | *Activity*	• Design maps from Session E • Materials to build an A-frame • Hoes • Shovels • Seeds and other planting materials • Compost and other soil amendments • Mulching and fencing materials	2.5 hour
F3	Where do we go from here? | *Discussion*	• Certificates of training completion	30 mins

How to do a Resilience Design training

How To Use This Guide

This Resilience Design (RD) Facilitator's Guide is a training tool that can be used to cascade the **Resilience Design in Smallholder Farming Systems** approach (RD approach). Facilitators should ideally have received prior training in the RD approach, agroecology, or agriculture before conducting an RD training session. It is also helpful for facilitators to have experience conducting large-scale field trainings and understand best practices for organizing such events. Prior to conducting an RD training, facilitators should review the RD approach document, and this Guide, in their entirety.

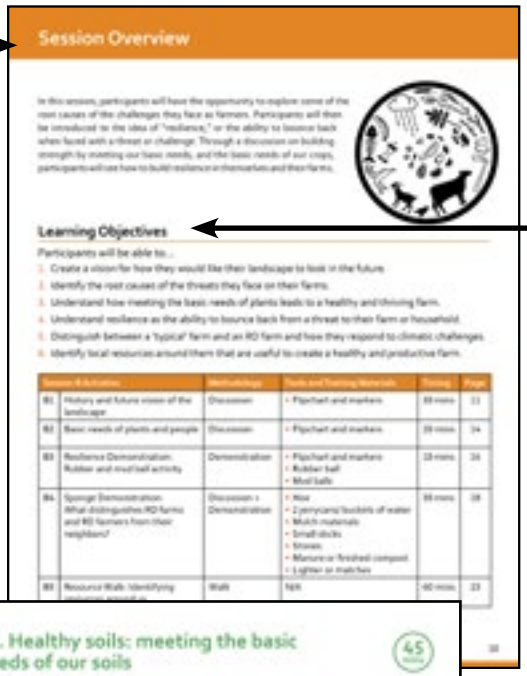
Sections of the Guide

In preparation for a training, a facilitator should consult the **Facilitator Notes** for each session closely. This section contains detailed information about RD principles and the implementation of RD techniques. The facilitator should also consult the **Facilitation Tips,** which give ideas for making sessions more interactive or creatively explaining concepts, and the **Take Home Messages** section for each activity, which reminds facilitators of the key messages to emphasize during discussions. Activities that use creative and participatory ways to explain key RD concepts also have suggested narratives in text boxes to support facilitators and ensure they remember key concepts.

When it is time to conduct a training, facilitators should follow the Facilitator Instructions. Novice facilitators may want to keep the Facilitator's Guide close at hand during the training and follow the step-by-step instructions. Italicized cues are available to read out loud or summarize for participants. More experienced facilitators who are well versed with the session activities and the flow of each session may prefer to simply refer to the Session Overview at the top of each session that provides an outline of the discussions and activities for that day. However, even well-experienced RD facilitators may want to keep the Facilitator's Guide at hand during training as it contains a lot of technical information and useful graphics.

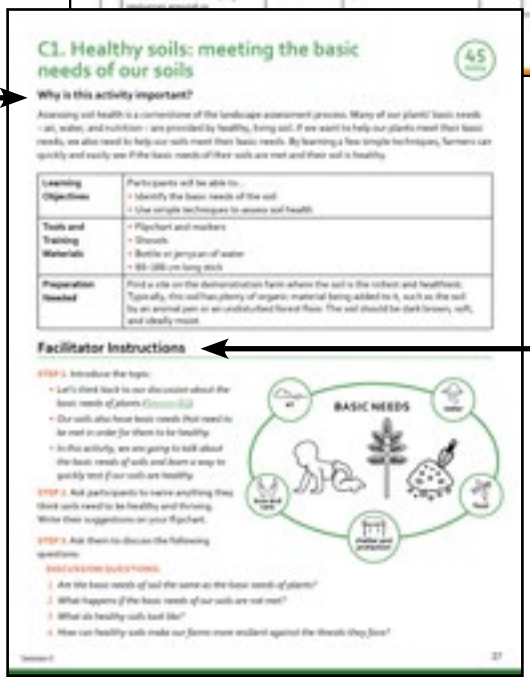
Ultimately, each RD facilitator is encouraged to develop their own style and draw upon their own experience when teaching.

Session Overview:
Bigger picture



Learning Objectives:
What participants will learn today

Why is this activity important?
How this activity links to larger RD concepts



Facilitator Instructions:
Step-by-step instructions and suggested cues *(italicized text can be read out loud to participants if desired)*

FACILITATION TIPS

Tips to better engage participants

FACILITATOR NOTES

Key RD concepts and technical information

TAKE HOME MESSAGES

Important points to emphasize in discussions

Planning a Resilience Design Training

The sessions in this training are modular and can either be delivered during an intensive 3-day training, slowly throughout the course of a season, or as material integrated into other training programs. The sessions should always be presented to participants in the order they appear in the Facilitator's Guide so that participants can master each concept before another is introduced.

For a successful RD training, plan for the trainings to coincide with the planting season. Dry season plantings that are prone to failure are likely to discourage participants. More importantly, rain is needed to facilitate the digging and planting done during the training. Rain will also enable participants to observe how well their earthworks can slow, spread, and sink water after a big rainfall. In particular, Session F requires participants to observe how the landscape and plants respond to a big rainfall. Scheduling of this session should be flexible for this reason.

It is also helpful to gain the support of the relevant chief or respected elders, particularly women, before the training and invite them to come to the opening of the training to say a few words.

Setting a Meeting Schedule

Consult participants before creating the training schedule. Participants will be busy with their own farming and household responsibilities during the planting season. Any RD training should be sensitive to these needs, including those specific to men and women, and work to minimize additional time burdens placed on participants. Some RD trainings have seen success by conducting both morning and evening sessions so that participants can still work in their fields during the day.

It is nice to ensure that there is a shared meal and/or snack at the training, especially if the training is long or involves a lot of manual labor. Sitting down to share some food is a great way to build trust and community and gives an added opportunity to discuss and share ideas.

Selecting a Demonstration Farm

The demonstration farm is a place where participants will meet regularly for discussions and training activities. The site should be a place where participants can practice observing the landscape and experimenting with new farming techniques. The farm should also have a place where participants can comfortably sit for discussions. This is usually outside under a big tree so participants can reference the landscape around them during the discussion.

The demonstration farm is selected after consultation with participants and is usually land volunteered by a willing participant. It should be made clear from the beginning that the

demonstration farm will be fully managed by the participants and that any inputs (seeds, fertilizers, equipment, and so on) used on the site will also be contributed by the participants. The owner of the demonstration farm may need to be introduced to the RD concept well before the onset of the rainy season to allow for adequate preparation time, which means groups should convene to pick the demonstration farm in the preceding dry season.

It is easy to think that the best place for a demonstration farm is a plot with a lot of potential – good soil, access to water, and well regarded by local farmers. Community members may even offer their prime land for the demonstration farm. However, the primary goal of an RD demonstration farm is to show that the RD approach can transform an unproductive landscape into a productive one. It will do little to change the mindset of community members if they see a prime plot of land producing an abundance of crops; but it will greatly excite and energize community members to see marginal "problem areas" become water reservoirs with fertile soil and a rich diversity of beneficial plants growing year-round. Ask participants to choose a site with several distinguishable "problems" that they would be interested in fixing during the training.

It can also be useful preparation for the training to scout around the local area to see if there are any farmers who are already practicing some of the RD concepts. The technical concepts in RD build upon indigenous farming techniques; often there are local innovators who have—without formal training—created their own Resilience Design farms slowly over time. These sites can provide excellent opportunities for farmer-to-farmer learning and for participants to see concepts in practice.

Using Locally Available Materials During Sessions

Resilience Design teaches farmers to more efficiently use the natural resources already at their disposal rather than purchasing additional materials to improve their farms. This means that any farmer, regardless of income level, can benefit from Resilience Design. As a facilitator, take time to learn what community members like to eat, what plants and trees are highly regarded, what medicinal plants are used, and where seeds and other planting materials are informally exchanged. This knowledge will orient you for the discussion topics with participants. Take care to only use locally available materials sourced from participants themselves during the training sessions to reinforce this message.

Capitalizing on Local Knowledge

Throughout their lifetimes, farmers have built up a reservoir of knowledge about their local environment. RD trainings show farmers how they can best use this knowledge to improve their productivity. As a facilitator, be sure to encourage participants to share what they know about a subject first and see where it leads the conversation rather than jumping into a lecture.

Introductions and establishing a safe learning environment

Session Overview

In the first session of this training, the facilitator will create a safe learning environment so participants feel free to share their knowledge, ask questions, and participate in group exercises. Through some introductory games, participants will get to know each other and start to establish trust. The facilitator will orient participants to the course objectives and logistics and answer any questions participants have.

Learning Objectives

Participants will be able to...

1. Get to know each other
2. Understand what is expected of them and what they should expect from the course

Session A Activities	Methodology	Tools and Training Materials	Timing
Introductions and establishing a safe learning environment	Discussion	Flipchart and markers	30 mins

A1. Introductions and establishing a safe learning environment

30 mins

Why is this activity important?

To understand how to apply Resilience Design on their farms, participants need to be actively engaged in the training. This requires spending time at the beginning of a training getting to know each other, establishing trust, and agreeing on the objectives of the training. These activities help establish a safe learning environment and set the tone for the rest of the training. This process also helps the facilitator better understand and connect with the group. Presenting the overview of the training, in the beginning, helps to orient participants and helps to manage expectations.

Learning Objectives	Participants will be able to… • Get to know each other • Identify ways to work together • Understand what is expected of them and what they can expect from the course
Time	30 mins
Tools & Training Materials	Flipchart and markers
Preparation Needed	Draw a 'Course Journey Map' on a flipchart with the titles for each session and some keywords in bullet points underneath

Facilitator Instructions

STEP 1. Welcome everyone to the course. Introduce yourself and the aim of the first session:

- *We are here to learn about Resilience Design and how to make our farms more resilient.*
- *The best way to learn Resilience Design is to go to the field and do it.*
  In this course, we will do a lot of practical work and create an RD farm together.
- *This will involve everyone learning from each other, including me as the facilitator.*
- *We will start by getting to know each other, as we all have something to teach each other.*

STEP 2. Allow the group to open the session in a manner that is customary to them, such as by saying a prayer or having an elder speak.

STEP 3. Have all participants stand in a circle and play one of the three Introductory Games described below.

STEP 4. Have participants sit in a circle and share their reasons for attending the course and their expectations for what they will do and learn here. Note everyone's expectations on the flipchart. When everyone has finished, discuss any expectations that may be unrealistic and explain why.

STEP 5. Explain the importance of all participants actively taking part in group discussions and activities so that everyone may learn from each other. Ask participants to take a moment to discuss with their neighbors what helps them to freely talk and engage in group activities. Share a personal example for participants, for example:

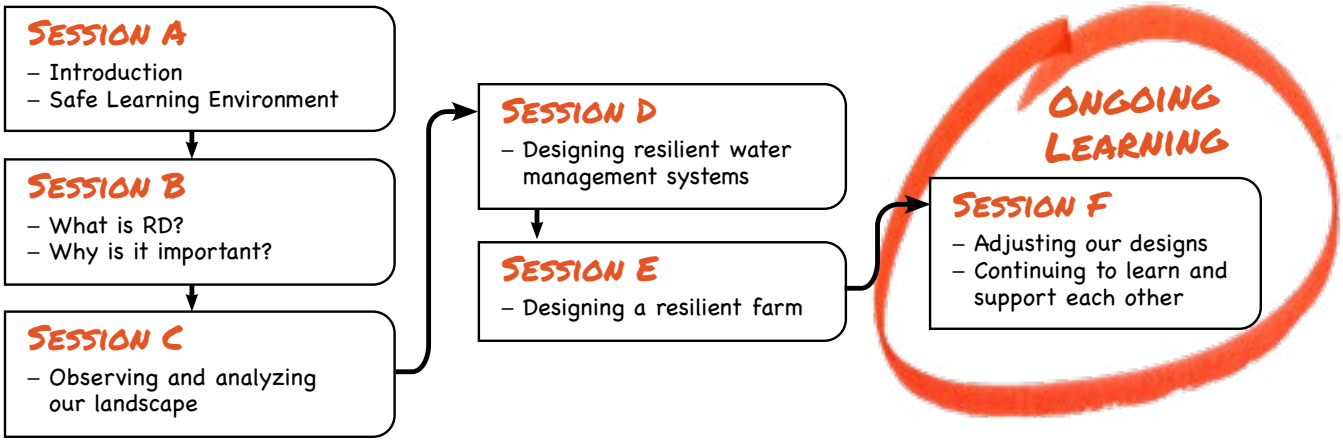
- *When I'm in a training, I find it helps if people listen when I speak.*
  This makes me feel respected and safe to share my opinion.

STEP 6. Ask each participant what helps their neighbor participate in group discussions and activities. Note these down on your flipchart and introduce it as the **Group Agreement** (see example below). Discuss how these actions will help maintain group cooperation so the course can progress smoothly.

STEP 7. Go through the **Course Journey Map** (see example below) on the flipchart with the participants, briefly explaining what will happen in each session.

STEP 8. Discuss relevant logistics, such as the timing of course sessions, breaks, transportation, and so on. Ask participants if there is anything that would help them fully participate in the course, such as ending the training by a certain time in the day or providing snacks or lunch if participants will be missing meals in order to attend.

Course Journey Map Example



Introductory Games

Option 1: Go around the circle, and ask each participant to share something about themselves that they believe makes them different from everyone else at the training. You can provide an example to help get everyone started, such as *"I have 9 siblings."*

Option 2: Starting with one participant, have them say three statements about themselves – two true statements and one that is a lie. Have the other participants raise their hands to vote which statement is the lie. Keep statements short to move the activity along.

Option 3: Break the group into smaller groups of 4–5 participants. Have them identify something they all have in common with each other and then something unique about each participant. Bring the group back together so that they may share what they had in common and what was unique about each participant.

Example Group Agreement

FACILITATION TIPS

Each RD course is an opportunity for facilitators and participants to learn from each other. Making an effort in the first session to establish a safe and collaborative learning environment that values participants' knowledge will help participants feel encouraged to develop their own solutions to the challenges they face using knowledge they already possess.

What is Resilience Design and why is it important?

Session Overview

In this session, participants will have the opportunity to explore some of the root causes of the challenges they face as farmers. Participants will then be introduced to the idea of "resilience," or the ability to bounce back when faced with a threat or challenge. Through a discussion on building strength by meeting our basic needs, and the basic needs of our crops, participants will see how to build resilience in themselves and their farms.

Learning Objectives

Participants will be able to...

1. Create a vision for how they would like their landscape to look in the future.
2. Identify the root causes of the threats they face on their farms.
3. Understand how meeting the basic needs of plants leads to a healthy and thriving farm.
4. Understand resilience as the ability to bounce back from a threat to their farm or household.
5. Distinguish between a 'typical' farm and an RD farm and how they respond to climatic challenges.
6. Identify local resources around them that are useful to create a healthy and productive farm.

Session B Activities		Methodology	Tools and Training Materials	Timing	Page
B1	History and future vision of the landscape	Discussion	• Flipchart and markers	30 mins	11
B2	Basic needs of plants and people	Discussion	• Flipchart and markers	20 mins	14
B3	Resilience Demonstration: Rubber and mud ball activity	Demonstration	• Flipchart and markers • Rubber ball • Mud balls	10 mins	16
B4	Sponge Demonstration: What distinguishes RD farms and RD farmers from their neighbors?	Discussion + Demonstration	• Hoe • 2 jerrycans/ buckets of water • Mulch materials • Small sticks • Stones • Manure or finished compost • Lighter or matches	30 mins	18
B5	Resource Walk: Identifying resources around us	Walk	N/A	60 mins	23

B1. History and future vision of the landscape

30 mins

Why is this activity important?

This visioning exercise encourages participants to create a better future for themselves by designing a resilient and thriving landscape. The vision should be clearly written out and generate excitement among participants. The vision of the future produced by participants will be referred to throughout the training.

Learning Objectives	Participants will be able to… • Draw key lessons from the shared history of their landscape • Identify the root causes of the threats they face on their farms • Create a vision for what they would like their landscape to look like moving forward
Time	30 mins
Tools and Training Materials	Flipchart and markers
Preparation Needed	Ask locals about historical land use, farming, and livestock practices used in the area if you do not already know.

Facilitator Instructions

STEP 1. Introduce the discussion:

- *We are here to learn how to make sure our farms really thrive. We can do this once we understand the landscape and the challenges we face with farming.*

STEP 2. Ask participants the following questions:

DISCUSSION QUESTIONS:

1. *What did your landscape look like in the time of your parents and your grandparents?*
2. *What was life like for your grandparents or ancestors?*
3. *What does your landscape look like now?*
4. *What is life like for you now?*

STEP 3. Ask participants the following questions and note answers on a flipchart.

DISCUSSION QUESTIONS:

1. *What are some key threats that exist in your area that affect your farms (for example, flooding, dry spells, pests, and diseases)?*
2. *Have the threats you face on your farm changed over time?*
3. *How do people normally cope?*

STEP 4. Encourage them to think about how the threats they listed are linked to poor soil and water management as in the example conversation below:

What are some key threats to your farm?

A major threat to our farm is that our crops are attacked by pests and so our crops fail.

Why do pests attack our crops?

Because our crops are weak.

Why are the crops weak?

Because we don't have good seeds and fertilizer.

OK, so that could be one reason. Can you think of other reasons why crops are weak?

Because soils are poor and there is a lot of erosion.

Why is there so much soil erosion?

Because the soils are bare and when it rains, they are washed away.

Great, so we can see pest attacks are linked to poor soil management; leaving soils bare causes soil erosion, which reduces the quality of our soils. When our soils are poor quality, we produce weak crops that are prone to pest infestations.

STEP 5. Ask participants to envision what they would like their landscape to look like in the future. Write the key elements of their vision clearly on a flipchart.

STEP 6. Conclude the discussion by:

- Asking if there are any questions.

TAKE HOME MESSAGES

The events in our lives as farmers, such as rising food prices or flooding, are intimately connected to the condition of the landscape around us. Many communities are now experiencing stronger storms, longer droughts, erratic rainfall, and higher temperatures. Poor soil conditions make the effects of these weather events much worse for crops. Landscapes that are not designed to receive and absorb rainfall will experience flooding and erosion when there is a storm. Plants growing in poor soils are weak and unhealthy and prone to pest infestations and disease problems. When the soil is not able to store any water in it, crops will not survive if the rainfall stops mid-season.

When farmers invest in proper soil and water management, they build a farm that can support them and their households despite these harsh conditions.

FACILITATION TIPS

Keep the conversation focused. The aim of this conversation is to show that many of the threats farms face are rooted in poor soil and water management. Make sure you use examples of challenges that you know you can clearly link back to poor water and soil management.

One way to help draw out the root cause of something like a flood or a mid-season dry spell is to keep probing participants with the question 'why' to help them move beyond what they are observing on the surface. Our goal is to move their thinking away from something they cannot do anything about to something they do have control over.

Define drought clearly. Changing global weather means that the rainfall patterns people are used to – and that their farming systems are based upon – are no longer the same. It is important to clarify what a participant means when they say "drought." Often participants mean that the rain is more unpredictable and may not be well distributed throughout the growing season – not that there is no rain. As the training progresses, participants will learn solutions for farming successfully even with unpredictable rainfall.

B2. Basic needs of plants and people

20 mins

Why is this activity important?

Everyone knows what a child needs in order to grow strong and healthy, but we rarely apply this same logic to our plants. Having first identified and discussed how we work to fulfill the basic needs of our children on a daily basis, we then think about how this same care can be applied to our plants. This discussion is foundational for building awareness within participants that strong and resilient farms are deliberately designed to fulfill the needs of their plants.

Learning Objectives	Participants will be able to… • Understand how meeting the basic needs of plants leads to a healthy and thriving farm.
Time	20 mins
Tools and Training Materials	• Flipchart and markers
Preparation Needed	None

Facilitator Instructions

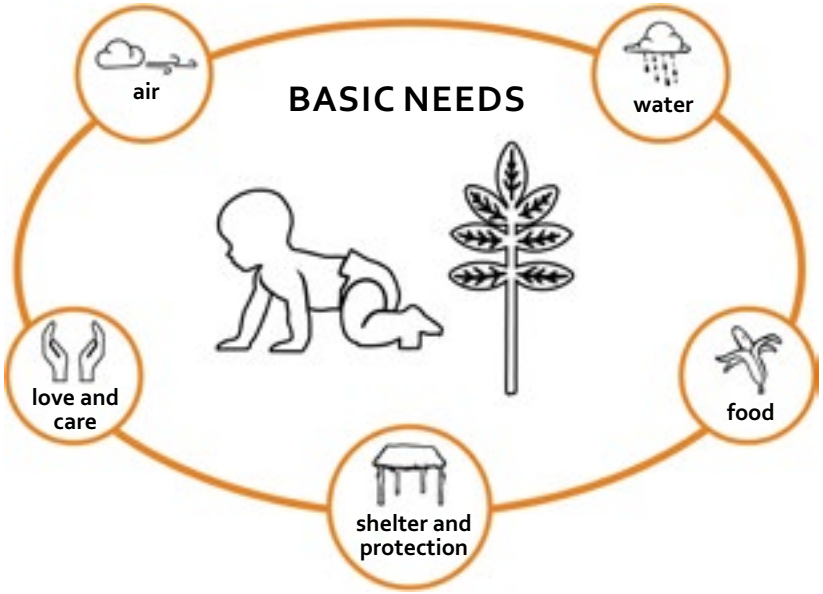
STEP 1. Introduce the activity:

- *We have discussed how we are facing major threats to our farming and livelihoods.*
- *We are now going to think about the things that make people strong so that they can cope – and maybe even thrive – despite these threats.*

STEP 2. Ask participants to envision a child and draw a simple picture of a child on the flipchart.

STEP 3. Ask participants to name the things a child needs to grow well and be healthy. Write the suggestions on your flipchart.

STEP 4. Draw a picture of a plant on the flipchart next to the child. Now ask participants to name the things plants need to grow well and be healthy. List these out next to the list of what a child needs. Ask if there are similarities between the lists. During the discussion, emphasize how the basic needs of a plant are the same as those of a child.



STEP 5. Ask participants what happens if the basic needs of a child are not met, then relate this to plants. Discuss if participants take as good care of their plants as they do their children.

STEP 6. Ask participants if there is any natural system around them that they can think of that takes care of the basic needs of their plants. Discuss with participants how a forest often provides plants with shade, healthy soil, protection, water, and so on. Tell them that this is a theme we will keep exploring throughout the training.

STEP 7. Conclude the discussion by:

- Asking participants to share something they learned.

TAKE HOME MESSAGES

In order to survive and thrive, a child needs food, water, air, shelter and protection, and love and care. If children do not have these basic needs met, they will be weak and unhealthy. For example, if there is a cholera outbreak, children who do not have their basic needs met are more likely to get severely ill than children who are well-nourished and have access to clean water and medical attention.

Our plants are also more likely to get sick if they are not well nourished or if they do not have enough clean water and care. If we do not provide our crops with all of these things, they will be weak and unproductive.

B3. Resilience Demonstration: Rubber and mud ball activity

10 mins

Why is this activity important?

This demonstration uses a rubber ball and a mud ball to show the concept of resilience. Participants will observe the more resilient rubber ball easily bouncing back after it is dropped, whereas the mud ball splatters on the ground and cannot recover from the fall.

Learning Objectives	Participants will be able to... • Understand resilience as the "ability to bounce back" from a challenge such as drought or flooding
Time	10 mins
Tools and Training Materials	• Rubber ball • Several mud balls (same size as rubber ball)
Preparation Needed	None

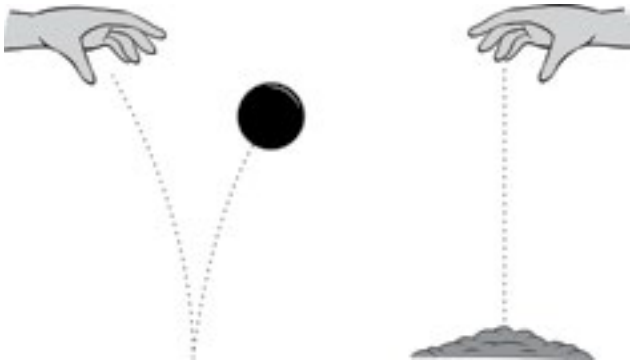
Facilitator Instructions

STEP 1. Introduce the activity:

- *We have discussed the different challenges or problems our farms face and how important it is to meet the needs of our plants so that we can do more than just cope during hard times.*
- *We are going to do a little demonstration to show what resilience looks like.*

STEP 2. Hold the rubber ball in one hand and a mud ball in the other. Personalize the demonstration by having the rubber ball represent the household of a community member and the mud ball represent your household or that of another staff member.

- *The rubber ball household has put a lot of effort into ensuring that the basic needs of the crops on their farm are met. They have implemented many different resilience strategies everywhere they can.*
- *The mud ball household has not put effort into implementing any resilience strategies on their farm.*
- *Ask participants to choose a challenge they identified earlier and ask them to imagine that this has happened to both households.*



STEP 3. Gently throw each ball into the air at the same time and let them land on the ground. Ask participants to observe what happens.

STEP 4. Discuss with participants:

DISCUSSION QUESTIONS:

1. *What happened with the two different households?*
2. *Which household would you say is more resilient? Why?*
3. *Which household would they rather be?*

STEP 5. Repeat the demonstration two more times, first throwing the rubber ball very gently so that it does not rebound as high as in the first demonstration, and then throwing the rubber ball hard so that it rebounds even higher. Discuss with participants how resilience can look different depending on the scenario. Ask participants to discuss what they think would make the ball rebound to a lower or a higher level.

STEP 6. Conclude the discussion by:

- Asking participants to share something they learned during the discussion.
- Sharing the key message:
  - *We want our farms and our households to become more resilient so that they can more easily 'bounce back' from the challenges we face just like the rubber ball.*

TAKE HOME MESSAGES

At the heart of resilience is the ability to 'bounce back' from threats such as flooding or drought.

When we do not meet the basic needs of our crops, our farms and our households will be like the mud ball. Something like inconsistent rain during the growing season can cause our crops to be stunted and our yields diminished. If we have no other source of food, our household will easily become hungry.

However, when we prepare in advance by ensuring the basic needs of our crops are consistently met, then our farms can bounce back like the rubber ball. We may first bounce back a bit lower if, for example, we have an illness in the family or food prices are rising. But, with continued effort, our farm will become stronger and more resilient and we will emerge even better than we were before.

B4. Sponge Demonstration: What distinguishes RD farms and RD farmers from their neighbors?

30 mins

Why is this activity important?

This activity helps participants visualize how an RD farm is different from a typical farm. The demonstration can be a very powerful 'hook' that helps participants understand the key elements of RD and gets them interested and excited about building an RD farm.

Learning Objectives	Participants will be able to… • Distinguish between a 'typical' farm and an RD farm and how they respond to climatic challenges.
Time	30 mins
Tools and Training Materials	• Hoe • 2 jerrycans/ buckets of water • Mulch materials, such as leaves and dry grass • Small sticks • A pile of fist-sized or smaller stones • Manure or finished compost • Lighter or matches
Preparation Needed	Select a spot for the demonstration in advance where everyone can see the demonstration on the ground. The location should have a gentle to moderate slope to show the effect of water flowing.

Facilitator Instructions

STEP 1. Bring participants to the spot you have chosen and invite them to form a circle.

STEP 2. Scratch an outline of two 1x1 m squares side by side into the ground. Present one as a 'typical' farm and one as a 'Resilience Design' farm. Personalize the demonstration by making yourself, or another facilitator, the 'typical' farmer and casting a participant as the 'RD farmer.'

STEP 3. Use a narrative like the Sponge Demonstration Narrative to introduce participants to the 'typical' farm. As you are talking, demonstrate the actions of the farmer in the square as indicated.

STEP 4. Continue with the Sponge Demonstration Narrative to introduce participants to the 'RD' farm. Demonstrate the actions of the farmer in the square as indicated.

STEP 5. Ask two volunteers to take the two buckets/ jerrycans of water. Ensure participants have gathered around so that they can see properly. Tell participants that there is going to be a rainstorm hitting the two farms.

STEP 6. Ask one volunteer to pour water over the typical farm, first as a gentle rain and then mimicking a strong storm. Then ask the other volunteer to do the same over the RD farm.

STEP 7. Ask participants what happened to the two farms when the rainstorm hit. Invite them to come up and feel how the soil is on the two farms. Discuss what happened to the rain, seeds, and manure that was applied to the two farms.

STEP 8: Share that this is a small exercise to introduce RD techniques and the impact of applying them. Discuss how these techniques will be learned and applied slowly over bigger areas. An important RD principle is to start small and keep it simple in the beginning.

STEP 9. Gather participants in a circle and discuss:

DISCUSSION QUESTIONS:

1. *Which farm behaves more like the rubber ball when a big storm hits and which is more like the mud ball? Why?*
2. *What are some differences you noticed about the process used by the RD farmer and her neighbor?*
3. *Which of the two farmers do you think will have higher yields and more income?*
4. *Which farmer would you rather be?*

STEP 10. Conclude the discussion by:

- Asking the participants to share something they learned.

FACILITATION TIPS

Use this demonstration to show the power of pulling all the elements of RD together. Many participants are amazed to see how much water the RD farm can hold. They learn that it is possible to transform their farms from what they always knew into something they never expected. This motivation will carry them through the rest of the training.

Begin to build participants' identity as an "RD farmer." This new identity will also help motivate them to think differently about how they approach farming.

Leave the demonstration squares where they are and come back to them later in the day, inviting participants to again check the moisture in the soil on the two different farms.

SPONGE DEMONSTRATION NARRATIVE: Typical Farm

Our typical farmer here has cleared his land and left the ground bare. He has cleared it the way he always has, by burning the weeds and remaining crop residues.

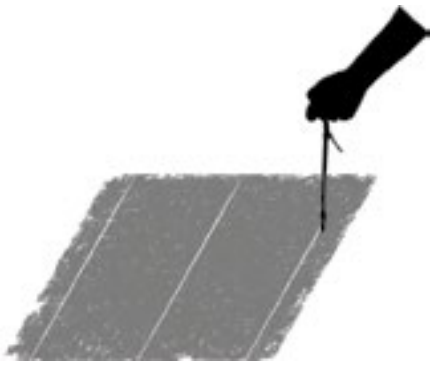
1

Clear the square of any vegetation or leaves that may be in it and brush it clean with your hand.

Take some dry grass and burn it with a lighter or matches. Spread the ashes throughout the square.

The farmer then tills the land, not caring if the rows are running down the slope.

2



Mark lines representing rows running down the slope.

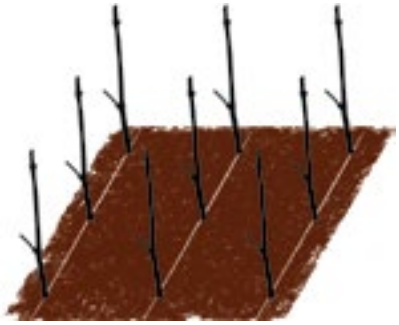
He then fertilizes with some manure or compost he has, but he does not take time to incorporate this into the soil where it is protected.

3

Sprinkle a small amount of manure or compost evenly across the square.

He then plants his maize and is done.

4

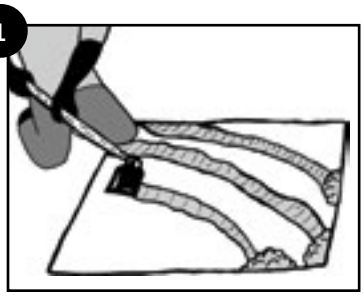


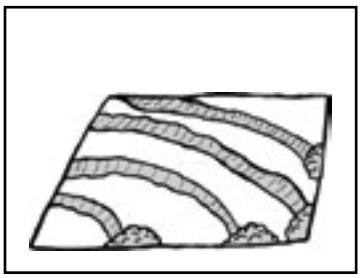
Put some sticks in the ground to represent the plants.

SPONGE DEMONSTRATION NARRATIVE: RD Farm

Our RD farmer has decided that first, she will pay attention to how water falls on her farm. She has seen that her land often has heavy rainfall, but her fields are dry the very next day. She has decided to capture as much of this water as possible by digging swales on contour across the slope. To ensure that the swales capture water properly, our RD farmer also creates a berm by piling up the soil on the downslope side of the swale. We will learn how to create swales and berms later in the training.

1

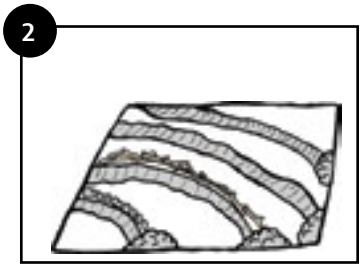




Find the slope within the square and use your hoe to dig mini-swales along the contour. Pile up the soil on the downslope side of the mini-swale and cap the ends. Add 2–4 mini-swales and berms to the square so that they stretch from the top to the bottom of the square.

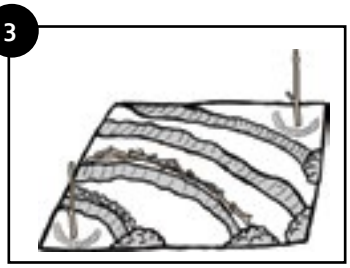
The RD farmer uses stones as check dams to slow water as it flows downhill and protects her trees with some half-moon berms, which we will also see.

2



Add stones or sticks along the contour between the swales to act as check dams to help slow the flow of water and nutrients.

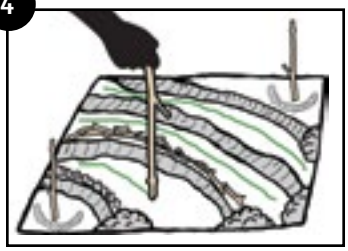
3



Place some sticks in the ground to represent trees and mound the soil up into a half-moon downslope of the stick.

She does not want her seeds to wash away if there is a heavy storm, so she makes sure the furrows in her field are along the contour of the slope. We will learn how to find contours within the landscape later in the training.

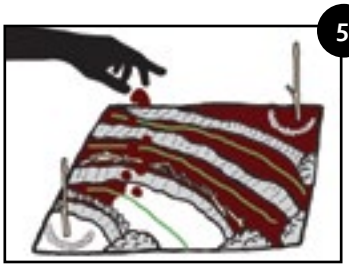
4



Mark lines representing rows running on contour to the slope.

Now she can fertilize and plant.

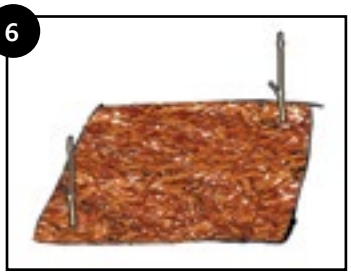
5



Sprinkle lots of manure or compost within the rows. Put sticks to represent some plants.

She wants to protect the plants she just planted from the "thieves of rain" (sun, wind, and slope) so she covers her fields well with mulch. She covers all the bare ground she sees because she also wants to protect her soil from erosion.

6



Spread a thick layer of mulch and dry grass across the entire square. Make sure some mulch is laid on contour within the swales.

Additional Activities to Illustrate the Sponge Demonstration

- Make a mini A-frame and use it to identify contours on the square before 'digging' mini swales to show participants how RD farms are built.
- Take two bills of local currency and put one on each square. Watch as the RD farmer's money stays on her square during the rainstorm while the typical farmer's money flows away. This demonstration reinforces the concept that water and topsoil running off a farm is like money running off the farm.
- Do a simple **calculation** to help participants understand exactly how much rainfall they could save in their soil by using RD techniques. Find out the average annual rainfall for your region and estimate an average plot size. Put those numbers in the calculation below and see how many jerrycans of water enter the field as rain every year.

EXAMPLE RAINFALL CALCULATION

Farm size (sq mt) x Annual rainfall (mm) = Total liters of water that falls on farm every year

Total liters of rainfall each year ÷ 20 L ÷ 365 days = **Number of jerrycans per day** provided by rainfall rather than the farmer

For example, a quarter-hectare farm (**2,500 sq mt**) in eastern Congo will receive on average **1,200 mm** of rain every year:

2,500 sq mt x **1,200 mm** = **3,000,000 liters** of rainfall enter the farm every year

3,000,000 L ÷ 20 L ÷ 365 days = **410 jerrycans of water** provided daily by rainfall alone

FACILITATOR NOTES

RD farmers use a process of OBSERVE → PLAN → DO to build resilience on their farms. RD farmers…

OBSERVE their landscape and think about the best ways to use the resources they have available to them. They know how water and nutrients are flowing across their farm, and they have observed if their crops' needs are met or not.

PLAN how to use their resources wisely. They have made a plan for how to meet all their crops' needs, including protecting them from harm. They have thought about what else they can do on their farm so they can achieve their goals.

DO build their farm's resilience by adding biodiversity, improving the health of their soil, saving water in the soil, and protecting their plants from harm.

OBSERVE AGAIN what works and what does not work on their farm. They know that it takes time to build a strong and resilient RD farm, so they are constantly looking for ways to capture more water, improve the health of their soil, and increase their biodiversity as a way to achieve their goals.

B5. Resource Walk: Identifying resources around us

60 mins

Why is this activity important?

This activity encourages participants to think differently about the materials freely available in the landscape around them. When participants collect examples of waste materials, useful plants, and animal byproducts from their landscape and collectively discuss their value, they start to appreciate the wealth of resources around them and their own expertise in the subject.

Learning Objectives	Participants will be able to… • Identify local resources they have freely available around them. • Identify how these resources are useful to their farms.
Time	60 minutes
Tools and Training Materials	None
Preparation Needed	None

Facilitator Instructions

STEP 1. Introduce participants to the activity:

- *Being an RD farmer does not mean we need to buy expensive inputs to have better production or to meet our household goals. RD farmers start with observing what resources they already have available to them. Once we start looking, we realize that our local environment is rich in resources that can benefit us and our farms. Many of these are considered waste and are therefore freely available.*

STEP 2. Ask participants what a 'resource' is. Encourage them to give a few different examples and say how this resource can help them on their farms.

STEP 3. Invite participants to take 30 minutes to walk around the local area and gather examples of resources that could be useful to their farms. Allow participants to walk freely and gather any items they want.

STEP 4. When everyone has returned from the walk, gather the group into a circle for discussion and put the collected resources in the center of the circle. Invite participants to talk about a resource they collected and explain its use.

STEP 5. Conclude the discussion by:

- Sharing the key messages:
  - *A resource is something that helps us meet a goal we have.*
  - *A resource does not have to be expensive; in fact, we already have many of the resources we need for our households and our farms freely available in the environment around us.*

FACILITATION TIPS

Encourage a diversity of voices to speak so that knowledge is freely shared between participants, however, do not force participants to speak if they do not want to. A good technique is to rotate between men and women speaking to keep the training balanced between genders.

Mention any additional resources that might have been missed and explain how you see them as a resource.

To keep the discussion moving forward, ask in advance that participants not repeat the same information as someone who already spoke.

Allow as much time as participants want for this exercise. If participants are eager to continue searching for resources or discussing, then allow them to keep going. An important outcome of this exercise is that participants have a new sense of confidence in their capabilities and appreciation for the knowledge they already possess about their environment.

TAKE HOME MESSAGES

Our environment contains an abundance of plants and other materials that are rich in nutrients and can be used as a natural fertilizer. Our environment also contains plants that can repel insect pests when crushed or planted around fields, medicinal plants, termite-resistant woods, drought-resistant plants, and local varieties that take advantage of micro-climates and conditions. Farmers have often gathered a great wealth of information about these local resources through sharing experiences with each other and their own trial-and-error.

However, farmers are often told that it is not possible to be a successful without investing a lot of money into their farms. This message discourages them from valuing—and therefore taking advantage of—the resources that are freely available to them in their community. For example, many types of waste materials are important resources that can help build and maintain soil fertility, such as charcoal dust, crop residues, animal manure, wood ash, dried leaves, dried bones, dried grass, and kitchen waste.

As a facilitator, encourage participants to share their knowledge on the resources around them with the group. When this knowledge is openly shared, participants often recognize their own expertise in the subject and begin to appreciate the value these resources can bring to their farms.

SESSION C

TOTAL TIME: 2 hours and 15 mins

Observing and analyzing our landscape

Session Overview

In this session, farmers will learn the first step in designing an RD farm: observing their landscape. Farmers will learn a set of questions they can use to assess if the basic needs of the plants growing there are being met or not. After observing and analyzing their landscape, farmers will design a map to see how these different features work together to influence plant growth.

Learning Objectives

Participants will be able to...

1. Identify the key markers of healthy soil and assess soil health.
2. Analyze a landscape to see if it meets the basic needs of plants and soils.
3. Map key elements and influences of the landscape.

Session C Activities		Methodology	Tools and Training Materials	Timing	Page
C1	Healthy soils: meeting the basic needs of our soils	Discussion + Soil Testing	• Flipchart and markers • Shovels • Bottle or jerrycan of water • 80–100 cm long stick	45 mins	27
C2	Observing our landscape	Discussion + Walk	• Flipchart and markers	45 mins	31
C3	Mapping the demonstration farm	Activity	• Flipchart and markers	45 mins	34

C1. Healthy soils: meeting the basic needs of our soils

45 mins

Why is this activity important?

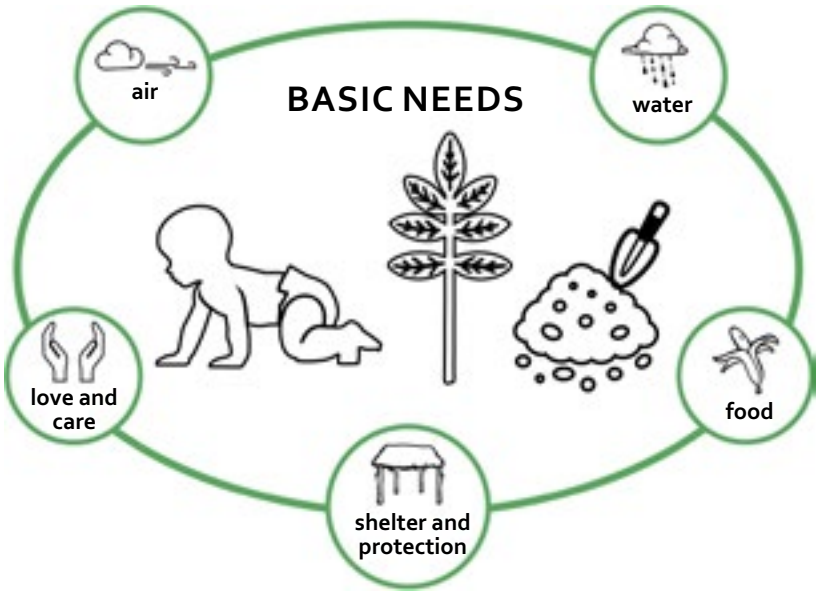
Assessing soil health is a cornerstone of the landscape assessment process. Many of our plants' basic needs – air, water, and nutrition – are provided by healthy, living soil. If we want to help our plants meet their basic needs, we also need to help our soils meet their basic needs. By learning a few simple techniques, farmers can quickly and easily see if the basic needs of their soils are met and their soil is healthy.

Learning Objectives	Participants will be able to… • Identify the basic needs of the soil • Use simple techniques to assess soil health
Tools and Training Materials	• Flipchart and markers • Shovels • Bottle or jerrycan of water • 80–100 cm long stick
Preparation Needed	Find a site on the demonstration farm where the soil is the richest and healthiest. Typically, this soil has plenty of organic material being added to it, such as the soil by an animal pen or an undisturbed forest floor. The soil should be dark brown, soft, and ideally moist.

Facilitator Instructions

STEP 1. Introduce the topic:

- *Let's think back to our discussion about the basic needs of plants (Session B2).*
- *Our soils also have basic needs that need to be met in order for them to be healthy.*
- *In this activity, we are going to talk about the basic needs of soils and learn a way to quickly test if our soils are healthy.*



STEP 2. Ask participants to name anything they think soils need to be healthy and thriving. Write their suggestions on your flipchart.

STEP 3. Ask them to discuss the following questions:

DISCUSSION QUESTIONS:

1. *Are the basic needs of soil the same as the basic needs of plants?*
2. *What happens if the basic needs of our soils are not met?*
3. *What do healthy soils look like?*
4. *How can healthy soils make our farms more resilient against the threats they face?*

STEP 4. Bring participants to a site you have chosen with healthy soil and demonstrate the steps involved in the Rapid Soil Health Test. Use the instructions in the Rapid Soil Health Test box. Stop after each step to discuss the questions listed.

STEP 5. Break participants up into small groups and have them each pick a site to test around the demonstration farm. Make sure there is a good mixture of sites (covered by vegetation versus uncovered, disturbed by humans versus undisturbed, shady versus sunny, and so on) selected by the groups. Each group should note the characteristics of their site before they begin. Have groups discuss:

1. *How do you think the characteristics of your site have impacted the health of your test soil?*
2. *Are the basic needs of your test soil met or not?*

STEP 6. Bring participants back together again. Review the key findings from each group and discuss:

- *How can RD farmers be "soil farmers" and grow the health of their soils?*

TAKE HOME MESSAGES

Soils need food, water, air, protection, and care just like our plants do. If we look after the basic needs of our soils, then our plants will be healthier, less prone to pest and disease attacks, and therefore more productive.

Rapid Soil Health Test *Adapted from Permaculture Association, UK*

Read this first	Follow these steps with participants
• The temperature of a healthy soil surface is that of a normal healthy human. • Below the surface the soil should be cooler to allow plants to grow well. • If the soil surface is exposed to the sun it will overheat, this makes it difficult for plants to grow and for the soil life, such as earthworms, to survive. • Covering soils with either mulch or living plants is the best way to keep the soil temperature optimal for plant growth and soil life.	 **Soil temperature** **DO:** Put your hand or wrist on the soil. Compare the surface temperature of soil that is both covered and uncovered. **DISCUSS:** • Is the temperature hot like a child with fever or is it cool? • What happens when the soil is too hot? Compare with a child with fever.
• A healthy soil has an earthy and fresh smell. • If there is no smell at all, which is often the case with very sandy and dry soils, the soil needs lots of organic matter added to it. • If there is a strong putrid smell, the soil is waterlogged because it is not draining properly. These soils should not be used for crop production, or they should be amended with a lot of dry material and compost. • If the soil has a strong chemical smell, it is best not to use it.	 **Soil smell** **DO:** Dig a small hole and carefully smell a handful of soil. **DISCUSS:** • Does the soil have no smell, a slightly sweet earthy smell, or a bad or very bad smell? • What is the smell of healthy soil?
• Soils that are compacted do not have pore space between soil clumps where air and water can easily flow and roots can easily grow. Soils easily get compacted by people and animals walking on them. It is difficult to cultivate a field with a hoe deeper than 20 cm, but roots on healthy plants often need 60 cm or deeper to grow. • In order for plants to grow well, soils should be deep, loose, =and easy to dig. An ideal depth of soil before hitting compaction is 60 cm. • Adding organic material and keeping soils covered with vegetation will reduce compaction over time as plant roots break up compacted areas and organic material clumps soil so that pores can re-form.	 **Soil compaction** **DO:** Find a stick about 80-100 cm long. Ask one of the participants to push the stick down and see how far down it can be pushed before it hits compaction. Remove the stick and measure the depth of loose soil. **DISCUSS:** • How does compaction of the soil happen? • What happens to the plant roots when the soil is compacted? • What is the ideal depth of loose soil we want to see in our fields?

- A healthy soil is soft and crumbly and made up of clumps of different sizes that retain their shape even when wet. The pore spaces between these clumps allow water and air to flow through the soil. Pores are used by soil life to burrow through the soil. Soil life also creates more pores as they move through the soil that are then used by plant roots to grow and access air and water.
- In degraded soils, there is a lack of organic matter and soil life, which makes it difficult for these pores to form. This means there is poor water infiltration and water runs off the soil quickly rather than soaking into the soil.

Soil structure

DO: Carefully remove a few large clumps of soil from the hole. Examine their outer surface and break them apart to see if they have any air pockets or pores running through them.

DISCUSS:

- How many of the large clumps you examined had evidence of air and water pores running through them?
- What is the structure of a healthy soil that can support plant growth?
- Why might stepping on wet soil affect a soil's structure?

- Soil that is best for plant growth contains just enough clay and silt to make it stick together into a sausage shape. This kind of soil is called loam. It is good for growing plants because it has the right balance of sand, silt, clay, and organic matter to enable it to act as a 'sponge' that will retain enough moisture for plants to use.
- If soil has heavy clay content, you will be able to roll the sausage into a ring. Clay soils will easily become waterlogged and are difficult for plants to grow in unless they are heavily amended with compost and composted manure.
- A soil that falls apart when you try to roll it into a sausage is a sandy soil. Sandy soils lack organic materials and nutrients and will drain very quickly. They will need a lot of organic materials added to them to get a sponge-like texture.

Soil texture

DO: Take a handful of soil, wet it slightly, and roll it into a sausage shape.

DISCUSS:

- Does it fall apart immediately or does it hold its shape?
- Can you bend the sausage into a ring or does it begin to crumble?
- Which soil texture is best for growing plants?

- Too dry: There is no moisture when you squeeze the soil, and it does not stick together. This soil will need lots of organic matter added to help it retain moisture and allow plants to grow.
- Moist: No water comes out when squeezing the soil, but it still feels wet. This is perfect for growing plants.
- Wet: If there is water coming out when you squeeze the soil, then the soil is too wet. This will cause plant roots to rot. Raised beds can be built for crop production, however soil that is very water logged should not be used.

Soil moisture

DO: Take a handful of soil and squeeze it.

DISCUSS:

- Does the soil feel wet or dry?
- Why is soil moisture important?
- How does soil moisture differ if the soil is covered or exposed?

- A healthy soil is filled with earthworms, bugs, and other soil critters.
- Earthworms and other soil critters help decompose plants so that the nutrients in this material can be returned to the soil. They also help create pores in the soil, which aid in the infiltration of water and air into the soil.
- Lots of earthworms, other soil critters, and decaying organic material are an indication that the soil also contains soil microbes. Soil microbes are impossible to see, but they are essential to returning nutrients to the soil. Soil microbes can even help plants fight off many soil diseases. Soil microbes flourish in moist soil because they need water to move around to feed on decaying organic material.

Soil life

DO: Make the hole slightly bigger and sift through the soil looking for signs of soil life.

DISCUSS:

- Why is soil life important?
- Why do some soils have a lot of soil life and others have very little?

Tips for building healthy soil

Protect soils from compaction by creating walking paths and establishing fences to ensure they are not stepped on by humans or animals

Protect soils from sun and wind exposure by covering them with mulch or vegetation

Add organic material and compost to soil as much as possible

C2. Observing our landscape

45 mins

Why is this activity important?

The process of observing and analyzing the landscape helps provide RD farmers with the foundation for a clear and thoughtful farm design. This process gives participants valuable insight into their landscape that can save them time, labor, and resources. This guided walk around the demonstration farm helps farmers understand the key things to look for when assessing their own farm.

Learning Objectives	Participants will be able to... • Analyze a landscape to see if it meets the basic needs of plants and soils.
Tools and Training Materials	Flipchart and markers
Preparation Needed	Before you do the site observation with participants, familiarize yourself with the site. Find your starting place and assess the water flows yourself so that you can point out major channels and areas of erosion to participants. Look for nutrient flows and deposits, sun and wind direction and anything unique about the demonstration farm site that you may want to point out to participants.

Facilitator Instructions

STEP 1. Introduce the activity to participants:

- *The first step when creating an RD farm is to observe our farm and the surrounding landscape to see how it meets, or doesn't meet, the basic needs of our plants.*
- *We are going to do a walk around our demonstration farm and use a set of key questions to better understand our site and assess how resilient it is.*

STEP 2. Together with participants, do a walk around the demonstration farm following the Site Observation Guidance steps and questions.

STEP 3. After the walk, gather in a shaded spot to discuss the process with participants using these questions.

DISCUSSION QUESTIONS:

1. *Did you find any signs of water or nutrient resources being stored in the landscape?*
2. *Did you see any signs, such as erosion or flooding, of water or nutrients flowing across the landscape that were not being captured?*
3. *Which direction do you expect harsh winds to typically come from? Could this be disruptive to the plants in any way?*
4. *Which part of the demonstration farm would receive morning or afternoon sun? How could this impact the plants growing at this site?*

FACILITATION TIPS

One powerful way to show how landscape features work together to support or hinder plant growth is to use examples of crops or other plants growing nearby. Look for plants growing in depressions in the ground where water and nutrients might collect or a shady spot that is supporting more plant growth. Point these plants out to participants and discuss the landscape features that might be impacting its growth.

5. *Is there any form of protection from harsh elements (wind, sun, strong rains) for our plants and soils on this site?*
6. *Are our crops protected from damage by livestock or wild animals?*

STEP 4. Conclude the activity by:

- Asking 2–3 participants to share something they learned during the discussion or walk.
- Sharing this key message:
  - *Before we can make a plan to build the resilience of our farm, we need to understand how each site is affected by elements such as water, nutrients, sun, and wind.*
- Ask participants if there are any remaining questions before you leave.

Site Observation Guidance

Read this first	Follow these steps with participants
Sites with erosion indicate opportunities to capture and utilize rainwater later in the season.	**Walking the water** **DO:** Start at the top, or the highest elevation, of the land. Have participants imagine they are the water flowing over the landscape, moving down the slope as water would. What path do they follow? Look for the signs of erosion as well as places where water is being captured by the soil or plants. **DISCUSS:** • Where do you see erosion in the landscape? What is contributing to this erosion? • Where do you see places where water is concentrating? What features in the landscape allow water to concentrate here? • How are the plants growing at each of these sites?
Soils disturbed by human activity are very prone to loss of nutrients. Soils need constant replenishment of nutrients through organic material to minimize the damage caused by a disturbance.	**Nutrient flows and deposits** **DO:** Ask participants to use the rapid test methods they just learned to see if patches of soil are healthy or not. Ask participants to point out soils that appear to be losing fertility due to erosion, overgrazing, or continuous cropping. **DISCUSS:** • How are the healthy soils being continuously enriched with nutrients? Recall the forest example given earlier. • If soils are unhealthy, what basic needs are not being met? • What is causing some soils to lose their fertility?
Heat stress causes plants to put a lot of energy into conserving water inside themselves rather than growing, flowering, and fruiting. Flowers are especially heat sensitive and will abort if they become too hot.	**Sun direction** **DO:** Encourage participants to stand in the full sun and see how it feels in their own body, then go under the shade of a tree and see how it feels there. Ask participants to note areas that receive morning and/or afternoon sun on the site and observe how plants are growing in those areas. **DISCUSS:** • How did it feel in your body in the full sun compared to the shade? • How might a plant feel if it was always in the strong sun? • How might this affect the plant's growth?

Some plants, especially annual crops, are not strong enough to continue to stand in a strong wind and are at risk of falling over, especially if their root systems and stalks are weak. Their leaves, flowers, and fruits are also at risk of blowing off. For example, if the flowers blow off a bean crop before they have a chance to fertilize, then the crop will be unable to produce beans. Trees that are frequently exposed to strong winds will put their energy into growing structural support rather than growing new branches, flowers, and fruits.	**Wind direction** **DO:** Encourage participants to imagine their own bodies trying to stand straight while a strong wind blows. Have them also imagine a young child or an elderly person trying to stand straight in a strong wind. Ask participants to note areas that seem exposed or protected from strong winds on the site and observe how plants are growing in those areas. **DISCUSS:** • How do you feel in your own body when exposed to strong winds? How might the young child or the elderly person feel? • How might a plant grow if it was frequently exposed to strong winds? • How might this affect the plant's growth?
Potential risks to plants are sun, wind, rain, pests, theft, people walking through gardens and fields, and grazing and wild animals.	**Protection** **DO:** Observe sites where the landscape appears protected from strong sun, winds, rain, livestock, wild animal, and human elements. **DISCUSS:** • What would happen to a child that was left outside without shelter and exposed to strong sun, wind, and rain? How would the child feel? • What risks might plants face that we need to protect them from? • Are there areas in the landscape where plants are better protected than others?

C3. Mapping the demonstration farm

45 mins

Why is this activity important?

Making a map of the landscape they observed during their walk will help participants understand the unique features of the landscape at the demonstration farm and how these features work together to influence plant growth.

The map developed during this exercise will incorporate findings from the resource walk in Session B and the observation walk in Session C. The maps will be continuously added to as the participants progress through the design process.

Learning Objectives	Participants will be able to… • Map existing key elements and influences of the landscape
Tools and Training Materials	• Flipchart and markers • Extra paper and pens if participants need in order to do site observation at home.
Preparation Needed	None

Facilitator Instructions

STEP 1. Break the group up into smaller groups of 3–4 people. Make sure each group has a piece of flipchart paper and markers.

STEP 2. Give each group 30 minutes to develop a map of the demonstration farm that highlights the important landscape and infrastructure features listed in the Facilitator Notes.

The map should contain:

- Markings to indicate the highest and lowest point on the land
- Sketches of important infrastructure, like houses, animal kraals, chicken coops, water points, food storage buildings, kitchen, latrine, dishwashing stands, paths, and roads
- Arrows to indicate sun and wind direction
- Arrows to show where water and nutrients are currently being captured and where they are flowing across the landscape
- Sketches indicating sites of valuable plant resources

STEP 3. Have each small group present their map to the group. To save time, have groups only present ideas that were not covered by any previous group.

STEP 4. Ask participants how they think the maps can help them plan for their crops better.

FACILITATION TIPS

Be sure to save the maps developed by participants so that they can be used again in Sessions D, E, and F. If possible, take pictures of the maps so they can be reproduced again if needed.

Push each group to provide as much detail as possible on the maps; the greater the level of detail, the easier it will be to design solutions during the next session.

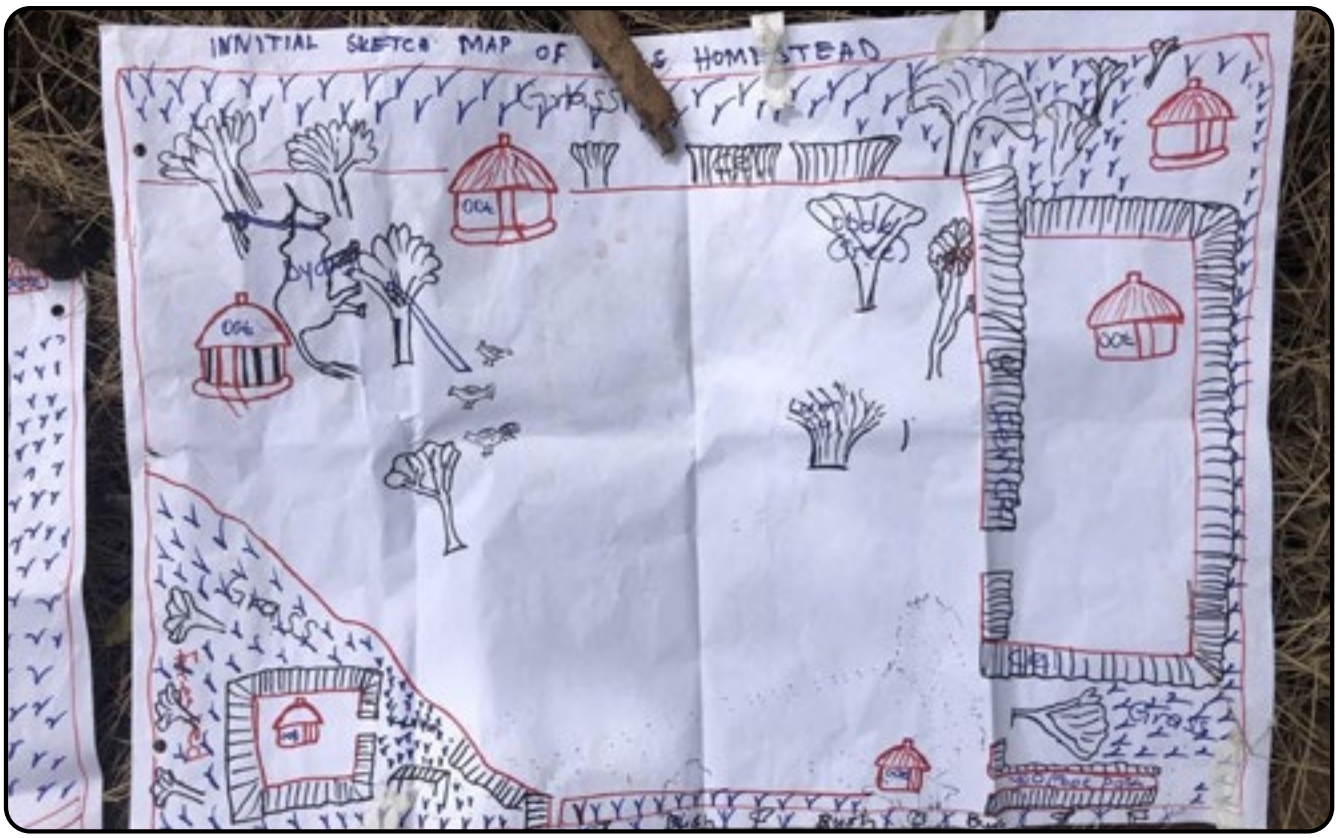
STEP 5. Conclude the discussion by:

- Asking participants if there are any remaining questions.
- Summarizing the key messages:
  - *Crops respond to the elements they are exposed to within the landscape.*
  - *If we want crops to grow better, we first have to see if they are getting too little, or too much, of these elements.*
  - *Mapping important features of our landscape helps us understand how these elements are behaving so that we can use them efficiently.*
- Hand out extra pens and paper and encourage participants to do a site observation and mapping of their own farm when they get home.

FACILITATOR NOTES

Maps do not have to be fancy to be effective. Participants can use flipchart paper and markers, or they can draw a map in the dirt if these supplies are not available. All maps should include:

- Markings to indicate the highest and lowest point on the land
- Sketches of important infrastructure, like houses, animal kraals, chicken coops, water points, food storage buildings, kitchen, latrine, dishwashing stands, paths, and roads
- Arrows to indicate sun and wind direction
- Arrows to show where water and nutrients are currently being captured and where they are flowing across the landscape
- Sketches indicating sites of valuable plant resources



Sample homestead map

Designing resilient water management systems using earthworks

Session Overview

Every farm is different and needs its own design to become more resilient. In this session, participants will learn a set of questions that will guide them as they plan what earthworks they will use. Using a simple tool called an A-frame, participants will learn about the concept of "on contour" and how working with contours can slow, spread, and sink water on their farms. Participants will then practice building three primary kinds of earthwork structures on the demonstration farm.

Learning Objectives

Participants will be able to...

1. Build and calibrate an A-frame
2. Understand the concept of "on contour"
3. Plan the earthworks design for a site using six design questions
4. Survey and mark contours within the landscape and dig three primary kinds of earthworks

Session D Activities		Methodology	Tools and Training Materials	Timing	Page
D1	Building and calibrating an A-frame	Practical activity	• A-frame materials • Hammer • Saw	60 mins	38
D2	Understanding contours and using earthworks to control erosion and slow, spread, sink, and manage water	Demonstration + Discussion	• A-frames • Pegging materials • Hoes • Shovels	40 mins	42
D3	Planning the earthworks design	Discussion + Walk	• Flipchart and markers	30 mins	44
D4	Creating an earthworks design map	Discussion	• Flipchart and markers • Maps of the demonstration farm from Session C	60 mins	46
D5	Marking out the earthworks design by surveying and pegging	Practical activity	• A-frames constructed in D1 • Pegging materials	45 mins	48
D6	Constructing earthworks	Practical activity	• A-frames constructed in D1 • Shovels • Hoes • Mulching materials	1–2 hours	50

D1. Building and calibrating an A-frame

60 mins

Why is this activity important?

This exercise introduces farmers to an A-frame, which is a tool that helps find the contours hidden from our eyes within the landscape. A-frames can be constructed by farmers using locally sourced materials. This exercise equips farmers with an easy-to-use tool that can help them manage water and protect soil on their own farms.

Learning objectives	Participants will be able to... • Construct and calibrate an A-frame
Time	60 minutes
Tools and Training Materials	• Materials to make A-frames – Enough 2m x 5cm x 5cm (or thinner) pieces of lumber, branches, or bamboo to make an A-frame for each group of 4–5 participants. – Strips of used rubber from the inner tube of car or bike tires – 50–100g of nails – String that is a minimum of 10m (polypropylene rather than jute) • Hammer • Saw If possible, bring enough materials for participants to bring home to make an A-frame of their own.
Preparation Needed	Practice making an A-frame yourself before leading this exercise. Gather all the materials you need in advance of the training.

Facilitator Instructions

STEP 1. Begin the session by asking participants what they remember from the previous session.

Encourage a diversity of voices to share. Make sure the key points from the previous session are covered:

- *Resilience is the ability to 'bounce back' from a threat your farm faces.*
- *RD farmers make sure the needs of their crops (food, water, air, care, and protection) are met.*
- *When we carefully assess our landscape, we can find resources all around us. These resources help us meet the needs of our crops and become better farmers.*

STEP 2. Check in with farmers about the landscape analysis they did of their own farms.
Ask a few volunteers to share something specific they noted during their assessment. For example:

- *What did you notice about water and nutrient flows on your farm?*
- *Did you notice areas on your farm that are more exposed to harsh sunshine or wind?*
- *Are there places on your farm that are protected from wind, sun, and grazing animals? What kind of protection is that?*

STEP 3. Introduce the activity:

- *We have seen that RD farmers are able to save water in their soil so their crops can use it later.*
- *When we did the sponge demonstration exercise, we saw how digging ditches that follow the slope of the landscape helps us slow, spread, and sink water into our soils. (If possible, inspect the sponge demonstration squares done previously for any residual moisture.)*
- *It is impossible to see contours on our own, so we need a tool called an A-frame to help us mark where the contour is on the land. A-frames are made with locally available materials.*

STEP 4. Go through the materials with the participants. Ask participants where they can find each material locally. Model how to put the A-frame together.

STEP 5. Divide participants into groups and give each group 30 minutes to construct an A-frame.

STEP 6. Demonstrate how to calibrate an A-frame in front of the group and then ask participants to get back into their groups to calibrate their own A-frames.

STEP 7. Conclude the activity by telling participants that the next activity will be using the A-frame to practice marking the contour lines. These will be important for informing us where to place earthworks in the farm design.

FACILITATION TIPS

As the A-frames are being built, walk around to ensure each group is constructing their frame correctly.

Make sure each participant knows where they can find the materials for an A-frame around their own farm or house.

If time allows, challenge participants to make a second A-frame using only materials they find around the site (sticks, rocks, etc.). This exercise will reinforce the idea that A-frames do not need to be made using purchased materials.

FACILITATOR NOTES

How to build an A-frame

STEP 1

– Build the A-frame by making the "A" with the wood
– Secure connections with nails and/or rubber (make sure to stretch the rubber tight)

STEP 2

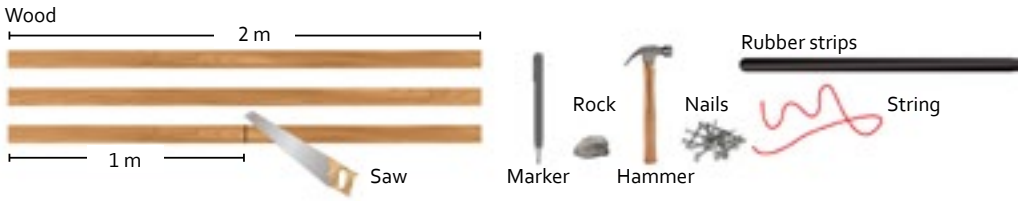
– Tie a piece of string or twine at the top of the "A" and ensure that it hangs straight down. Secure it tightly with a piece of rubber.

STEP 3

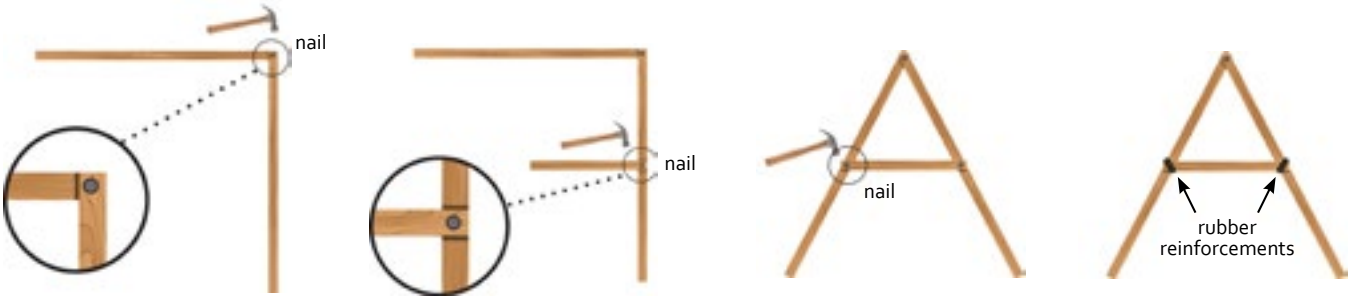
– Find a stone to serve as a weight. Tie it securely with the string or rubber strip so it does not slip and so it hangs 5–6 cm below the crossbar of the A-frame
– Be sure the crossbar is smooth at the areas that intersect the string (i.e. no bumps, splinters, or holes)
– Inner tube rubber can be used as a final wrap to help secure the string to the A-frame, as well as the string to the rock. This ensures the string does not become loose when used in the field. Rubber can also be used to strengthen where the pieces of wood have been nailed together.

Note: For larger field-level use, A-frames can have a 2 m wide spread between the legs. For household use, A-frames can have a 1 meter or less spread between the legs.

Materials



STEP 1



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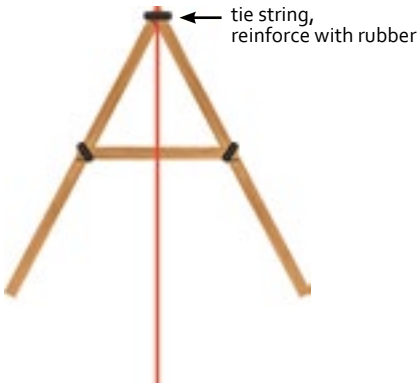
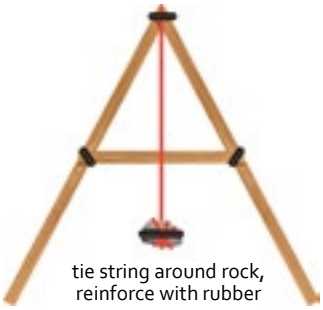


STEP 3



FACILITATOR NOTES

How to calibrate an A-frame

STEP 1

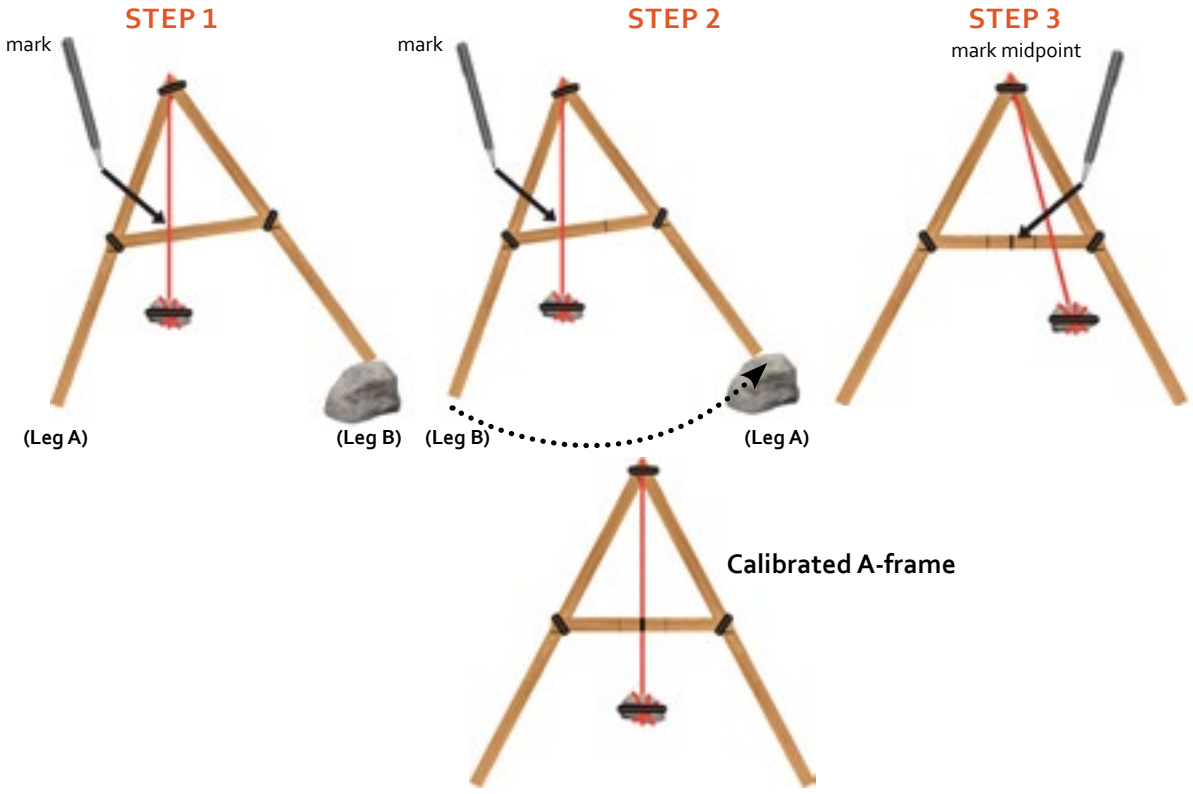
- Place the A-frame so that both legs touch the ground.
- Elevate one leg of the A-frame about 3–5 cm off the ground using a stone or piece of wood.
- In the soil, mark where the leg of the A-frame and the stone/wood support under the other leg is resting on the ground. These markings will allow the A-frame to be rotated later and then returned to the same spot.
- Allow the string and rock to naturally stop swinging and then use a pencil or charcoal to mark the exact place on the crossbar where the string falls. Do not carve the mark with a knife because the string will not swing freely.

STEP 2

- Rotate the A-frame legs 180˚ so that the elevated leg is now on the mark on the ground and the leg from the ground becomes elevated. Be sure to place the legs on the existing marks on the ground.
- After the string and rock stop swinging, mark with the exact place where the string stops along the crossbar of the A-frame with charcoal or a pencil.
- You should now have two charcoal or pencil lines on the crossbar.

STEP 3

- Use a string, piece of paper, or blade of grass to measure the distance between the two marks. Fold it in half to find the halfway point. This is called the "center-mark."
- Mark the center-mark with pencil or charcoal. This center-mark completes the calibration.



D2. Understanding contours and using earthworks to control erosion and slow, spread, sink, and manage water

40 mins

Why is this activity important?

Building earthworks on contour is fundamental to saving water in the soil and preventing soil erosion, but "on contour" can be a difficult concept to grasp. This exercise helps participants to visualize the contour and, through an interactive game, understand how working on contour helps slow, spread, and sink water. The experiential nature of the activity helps participants understand this difficult concept and prepares them to plan where to integrate earthworks into the landscape.

Learning objectives	Participants will be able to… • Explain the concept of "on contour" and how working on contour helps slow, spread, and sink water. • Name three kinds of earthworks and how they can be used to control erosion and manage water.
Time	40 mins
Tools and Training Materials	• A-frames constructed in D1 • Pegging materials, such as 30 cm sticks or stones gathered on site • Hoes • Shovels
Preparation Needed	Find a site on the demonstration farm where you will demonstrate how to use the A-frame to find a contour. The site should have a gentle slope. It should be big and open enough so that everyone can gather around the A-frame as they mark a sample contour line for 20–30 meters. Thoroughly review the steps to constructing a swale with a berm and spillway, a half-moon berm, and a one rock check dam in Appendix 1. Identify where you will construct each structure before the group arrives.

Facilitator Instructions

STEP 1. Introduce the activity:

- *We will use our A-frames to find the contour of the land and see how this helps us slow, spread, and sink water into our soils so that we can save it for later.*

STEP 2. Have the group gather around the site where you will mark a sample contour line. Model for participants how to survey and rotate the A-frame for each peg to start the contour for a couple of meters, then have the group take turns surveying the rest. Make sure everyone in the group operates the A-frame. Assign two volunteers to help do the pegging. Peg about 20–30 meters.

STEP 3. Ask participants to stand on the pegged line of the contour to "be" the contour. Let them see that, as they stand on the contour line, they are now all at the same elevation and no one is above or below the slope from them.

STEP 4. Ask participants to remain in their places on the contour while you and other staff members move uphill from the pegged line. Ask participants to imagine that they are a ditch that has been dug along the contour. The ditch has a wall of soil rising up behind it and is planted with plants to stabilize it. You and other staff members are water running downslope. Slowly walk downslope towards the participants. When you meet them, ask:

- What happens when the water hits this structure?
  - *Does it pass over the structure? Does it move left or right? Does it sink?*
  - *Why is it important that this structure is built on contour? What would happen to water running downslope if the ditch was just dug perpendicular to the slope?*

FACILITATION TIPS

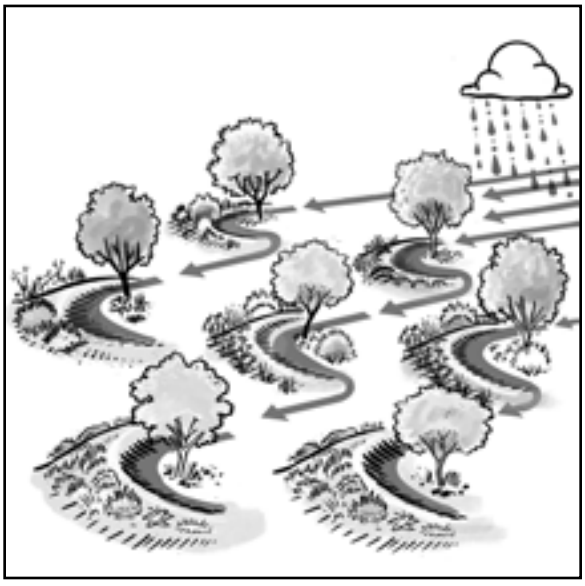
This exercise should be fun and interactive so participants take time to visualize how water moves across a landscape, something they may never have stopped to do before.

STEP 5. Explain the concept of an earthwork to participants as structures dug into the soil that control erosion and capture water as it moves across the landscape. Introduce three major kinds of earthworks: a swale with a berm and a spillway, a half-moon, and a one rock check dam using the information in Appendix 1 to guide you. Gathering participants in a circle, discuss:

- *Imagine multiple rainstorms feeding water into a swale over the course of a season. How can swales dug on contour help us save water in our fields?*
- *How can adding half-moons around important trees make them more productive?*
- *What can be done to slow water flow when there is a very heavy rainstorm that could damage earthworks structures? Discuss solutions, such as building spillways for overflow water, multiple swales across the same slope to absorb water slowly, planting on berms, and one rock check dams.*

STEP 6. Model for participants how to dig a swale with a berm on the downslope side. Get participants to take turns digging a few meters along the marked contour line so they visually understand what a swale is.

STEP 7. Select a tree on the site and model for participants how to mark out a half-moon berm on contour. Model how to dig the half-moon berm following the existing edge of the tree crown, including a spillway for overflow water. Engage a couple of participants to finish the process of digging. Ask participants:



DISCUSSION QUESTIONS:

1. *What will happen to the rainwater as it hits this structure?*
2. *How is this going to help the tree?*

STEP 8. Install a one rock check dam in the spillway of your swale or within another drainage site you have found. Ask participants:

DISCUSSION QUESTIONS:

1. *How will this slow water and prevent erosion?*
2. *Where would it be helpful to install one rock check dams?*

STEP 9. Conclude the activity by asking participants if there are any questions.

D3. Planning your earthworks design

30 mins

Why is this activity important?

The first step of the design process is to plan what earthworks can help us capture water and spread it evenly over our fields so that we can use it to boost our farm's productivity. In this activity, participants will learn how to use six questions when planning the placement of their earthworks. Planning our design before we start digging makes sure we use all our resources, including our time and energy, efficiently.

Learning Objectives	Participants will be able to... • Design an earthworks plan that saves water in soil, builds new planting areas, supports tree growth, and stops erosion on the farm.
Time	30 mins
Tools and Training Materials	• Flipchart and markers
Preparation Needed	None

Facilitator Instructions:

STEP 1. Introduce the activity:

- *We have seen how we can use an A-frame to find the contour and slow, spread, and sink water.*
- *Before we start placing our earthworks, we need to think about the best place to put them.*
- *In Resilience Design, we observe the landscape and then plan how we will build on it so that every resource is used to its fullest. Then we can start digging.*
- *Right now, we will plan our site using six design questions to help us.*

STEP 2. On your flipchart, write down the six questions that RD farmers should ask themselves when planning where to place the earthworks for their farm.

DESIGN QUESTIONS:

1. *How does this help me and my farm to put this earthwork here?*
2. *How can this help meet the basic needs of my crops?*
3. *How can this help me meet the basic needs of my soil?*
4. *How can I turn problems on my farm into solutions?*
5. *Is this resource protected?*
6. *Are there any risks to placing this resource here and how can I reduce that risk?*

STEP 3. "Walk the water" again with participants. This time, ask participants to use the six questions listed above to discuss what earthworks can be introduced and where they should be placed. Start your walk at the highest point of the land and again ask participants to imagine that they are the water, imagining how the water would move across the landscape. As you walk, look for signs of erosion, water pooling, and dry areas. Notice any plants that have benefited from water and nutrients infiltrating the soil they are growing in. Look for plants that are protected, and unprotected, from harsh elements and potentially human and animal disturbances. Use these observations to fuel your discussion of the six questions above.

STEP 4. Conclude the discussion by:

- Asking participants how they think planning could help them improve the resilience of their farms.
- Sharing these key messages:
  - *Planning the design of your earthworks saves you time and energy and helps you use them effectively.*
  - *An RD farmer can often turn problems into solutions by taking the time to plan.*

FACILITATOR NOTES

Using the design questions

1. How does it help me and my farm to put this earthwork here?

This question helps participants think about why they want to build a certain earthwork structure before they build it. Earthworks are best used to turn unproductive water into productive water. For example, a swale can be used to capture water running down a slope that normally pools near a house, creating an unlivable environment. If this swale supports a garden or field upslope from the house, then this water can now be used for a productive purpose and a problem the household is facing has been solved. Similarly, water running off the sides of roads often create gullies and hazardous walking conditions. Earthworks can be used to direct this water to fields so that it can be used for food production instead.

2. How can this help meet the basic needs of my crops?

Earthworks can help a farmer meet the water needs of their crops. An RD farm will have multiple strategies to slow, spread, sink, and manage rainwater around fields. It is especially important that overflow of water is well managed around fields so that all water is used and crops are protected from erosion. This involves linking earthworks so that the overflow from one feeds into another. Fields can also be planted on contour so that any water applied – whether through hand watering or rainfall – sinks into the ground rather than running off.

3. How can this help me meet the basic needs of my soil?

When we bring water to dry soil, we are helping it spring back to life. Healthy soils are moist, but not flooded. Earthworks can be used to bring water to dry soil and decrease the pooling of water in low-lying depressions. Water should spread out evenly over our landscape so that we have plenty of moist, healthy soil to support and feed our crops.

4. How can I turn problems on my farm into solutions?

An RD farmer sees opportunities where others see problems. This question helps participants think about problems they want to solve or benefits they may reap by using earthworks. For example, rainwater flowing off a roof could be destabilizing the soil in frequently used areas next to the house. An RD farmer might decide to divert this water into a nearby garden growing bananas and vegetables, thus growing extra crops and protecting the area next to their house. Another RD farmer may see a slope that is getting destabilized and unusable because of erosion. Properly placed earthworks can capture this water and save the topsoil, thus turning an unproductive slope into a productive growing area.

5. Is this resource protected?

Crops and other valuable plants can suffer yield losses when they are exposed to harsh elements (sun, wind, rain) and when they are left vulnerable to predation by grazing animals, wild animals, or people. The same goes for our soils; if our soils are left exposed to the elements, animals, and people they become vulnerable. These losses lower the productivity of our farm. This question helps participants think about the many methods that can be used to protect our crops and soils. Crops can be protected from harsh elements with windbreaks or shade. If crops are vulnerable to predation by animals or people, a physical barrier, like an acacia branch fence, can be constructed around crops. Other times, arrangements can be made with neighbors, herders, or other community members so that grazing animals are kept away from crops during certain parts of the year. Soils can be protected by living or dead mulches and by creating pathways to ensure they are not tread on.

6. Are there any risks to placing this resource here and how can I reduce that risk?

Water harvesting structures can absorb a lot of water over time. This could destabilize foundations and weaken structures, such as houses or latrines. Use structures to move water away from important infrastructure and into sites where it can enhance the production of food crops and useful plants. Note if any structures could put children or livestock in harm's way, for example, by creating ditches or placing rocks in commonly used pathways. Livestock feces are an important plant fertilizer but should be kept separate from children's play and living areas so that children do not inadvertently ingest feces.

D4. Creating an earthworks design map

40 mins

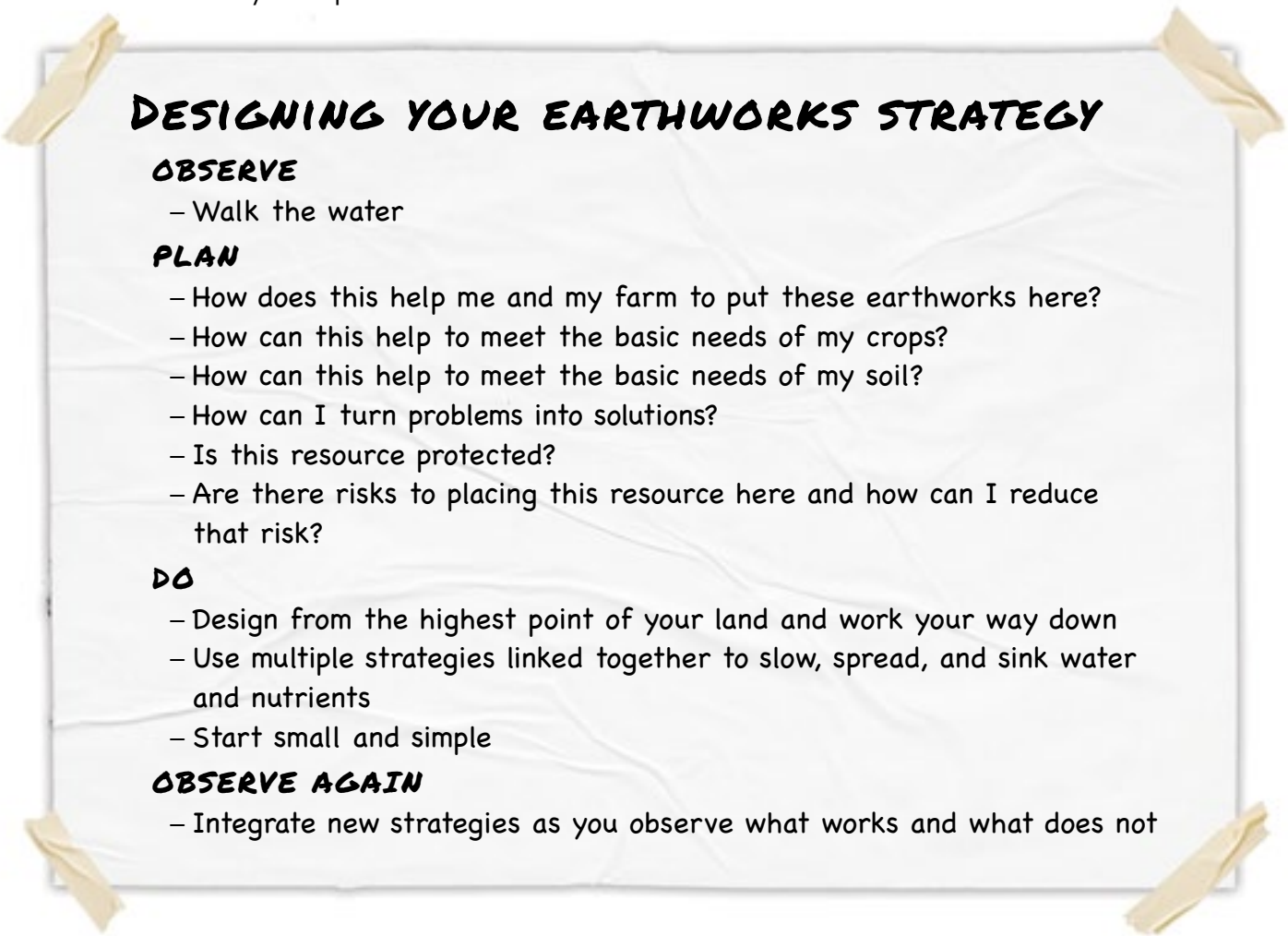
Why is this activity important?

In this activity, participants will decide what earthworks are needed at the demonstration farm and where they should be placed to maximize production. This gives them practical experience designing a site, which will help them when it is time for them to design their own farms.

Learning objectives	Participants will be able to… • Identify relevant earthworks for increasing production on the demonstration farm and determine their placement to most efficiently slow, spread, and sink water and nutrients.
Time	1 hour
Tools and Training Materials	• Flipchart and markers • Maps of the demonstration farm from Session C
Preparation Needed:	Make sure to bring with you participants' maps from the previous session. Prepare your flipchart before meeting with participants.

Facilitator Instructions:

STEP 1. Have visible on your flipchart:



STEP 2. Explain to participants they are now going to bring all of this together to determine the placement of the earthwork structures for the demonstration farm.

STEP 3. Split participants into groups of 4–5. Redistribute participants' maps from Session C along with extra flipchart paper as needed. Tell participants to draw the earthworks they envision slowing, spreading, and sinking water throughout the site on their maps. Encourage them to reference your flipchart and walk around the demonstration farm again as they plan.

STEP 4. Have each group present their maps. Allow time for participants in the other groups to ask questions after each presentation. Encourage each group to explain:

- What strategies they chose
- Why they chose them
- Why they placed each earthwork where they did
- How the earthworks are linked together

STEP 5. Draw a master map of the site on new flipchart paper and, together as a group, decide upon a final earthworks design for the demonstration farm. Draw on the strategies presented by the different groups to agree upon your final design.

STEP 6. Conclude the activity by walking the farm and describing the final earthworks design. As you walk, you can ask the following questions:

DISCUSSION QUESTIONS:

1. *What were your main takeaways from the design process?*
2. *How might you use the design process at home?*
3. *Do you see any examples that could prove useful in your own home?*
4. *Are there any potential risks to implementing these earthwork designs? How can we eliminate or mitigate those?*

FACILITATOR NOTES

Determining the placement of earthworks

- Start at the top of the land.
- Look at where crops and trees are currently planted and determine what is needed to support them.
  - Earthworks can be placed above a field or around the sides of the field to slow and sink water and nutrients if fields are experiencing flooding or need extra water.
  - If crops need shade protection, earthworks on the west side of the field can be planted with trees that eventually shade the field.
- Look for water running onto the plot from an uphill road or neighboring farm and identify how to place earthworks to divert it and use it for crop production.
- Place earthworks so that overflow water can be passed on to the next earthwork downhill until the bottom of the farm.
- Assess if there are any risks to placing an earthwork in each spot. For instance, is the earthwork too close to a house or a latrine? Could a ditch or rocks in that spot harm children or livestock that walk there?

D5. Marking out the earthworks design by surveying and pegging

45 mins

Why is this activity important?

Accurate surveying and pegging are necessary to ensure the design will be effective and well implemented. In this activity, participants will mark out the placement of their earthworks using an A-frame. This activity will give participants valuable practice marking out earthworks so they can replicate this process on their own farms.

Learning objectives	Participants will be able to... • Survey and peg an earthworks design into the farm landscape
Time	45 mins
Tools and Training Materials	A-frames constructed in D1 Pegging materials, such as 30 cm sticks or stones gathered on site
Preparation Needed	Select key earthworks that should be completed during the session.

Facilitator Instructions

STEP 1. Introduce the activity:

- *We are going to mark out the key earthworks we have drawn on the design. We will start at the top of the landscape and work our way downhill.*

STEP 2. Split participants up into groups of 4–5 members and make sure each group has an A-frame. Assist participants as they calibrate the A-frame and make sure everyone understands how to use it correctly.

STEP 3. Assign each group 1–2 earthworks to peg from the design. Remind participants to start at the top of the demonstration farm and work their way down. Walk around between groups as they peg their earthworks. It is best to measure twice and dig only once!

STEP 4. Conclude the activity by gathering participants together at one of the pegged earthworks and asking them what they learned from this process.

FACILITATION TIPS

It is rarely possible to complete all the earthworks decided upon for a site during Session D; the number of earthworks you peg now will depend on the size of your group and the amount of time you have for construction. Consider the following when choosing which earthworks to complete during Session D:

- Select at least one swale with a berm and spillway, a half-moon berm, and a one rock check dam so that participants gain experience constructing each of the three main types of earthworks.
- Start at the highest point of the demonstration farm.
- Select earthworks that demonstrate how to link structures together to manage overflow water.

FACILITATOR NOTES

Surveying and Pegging

STEP 1

– Calibrate the A-frame before starting (see Session D1, page 38)

STEP 2

– Peg, or mark, the starting point with a stick or stone

STEP 3

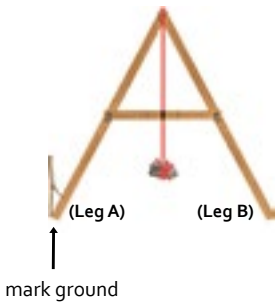
– Keeping one leg of the A-frame against the first peg, move the other leg up or down the slope until the string is aligned over the calibrated center-mark
– Keeping the A-frame still, put another peg where the second leg of the A-frame is
– After marking the second leg's position, slightly lift the A-frame and turn it 180º so it is "walking" across the land
– Be sure to peg in the same place every time relative to the leg, for example, on the outside of the leg as shown in the graphic

STEP 4

– As before, move the non-stationary leg up or downslope to find the place where the string is aligned across the calibrated center-mark of the A-frame and peg that spot with a stick
– Continue the process across the slope, giving each person in your group an opportunity to use the A-frame
– It is helpful to scratch a line between the pegs so the contour line can be clearly seen

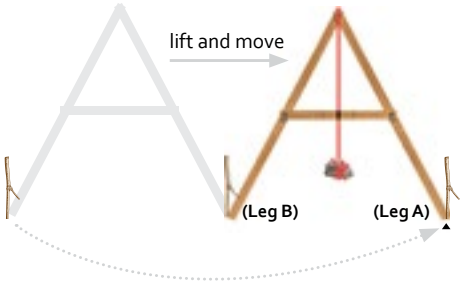
Sometimes there are obstacles, like tree stumps, along the contour line. Go around obstacles by either going downslope from the obstacle and raising the A-frame's legs with stones to the proper height or going upslope behind the obstacle and digging into the ground where the legs would go to maintain contour then continue until you arrive back to the contour at the original grade.

STEP 2



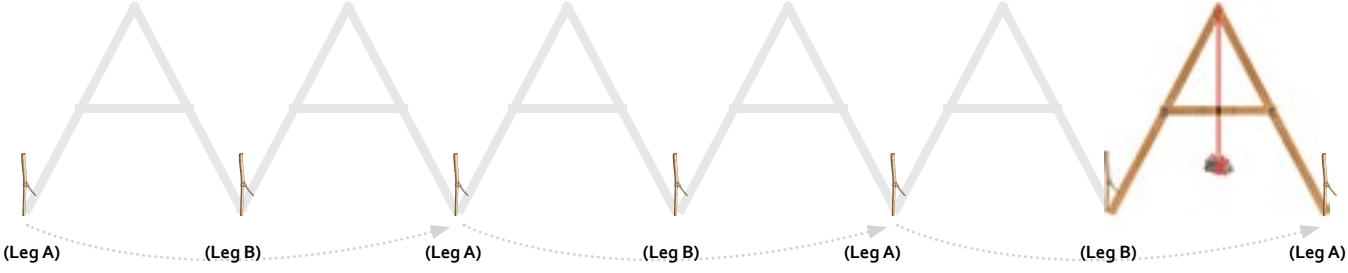
STEP 3

After marking Leg B, lift and rotate the A-frame 180º around Leg B to find the next position to peg. Do not rotate with legs resting on the ground to avoid the A-frame grinding into soil.



STEP 4

Repeat the lift, move, mark process



D6. Constructing earthworks

1-2 hours

Why is this activity important?

In this activity, participants will practice building earthworks so that they can build them into their own farms. Participants should leave the session confident that they understand how to construct all three types of earthworks (a swale with a berm and a spillway, a half-moon, and a one rock check dam) so that the earthworks function properly, are structurally sound, and are long-lasting.

Learning objectives	Participants will be able to... • Construct technically sound earthworks
Time	1–2 hours depending on structures to complete
Tools and Training Materials	• A-frames constructed in D1 • Shovels • Hoes • Mulching materials to cover earthworks
Preparation Needed	Review the steps to constructing each type of earthwork in Appendix 1

Facilitator Instructions

STEP 1. Introduce the activity:

- *We have pegged our design onto the site and marked where all the earthworks are to be located. It is time to work together to construct our earthworks.*

STEP 2. Answer any lingering questions about how to construct a swale with a berm and spillway, a half-moon berm, and a one rock check dam.

STEP 3: Form groups of 4–5 people and assign them a manageable number of earthworks to dig. It might be necessary to assign multiple groups of 4–5 people along different portions of a long swale. Typically, only one group is needed to complete a half-moon. Rotate groups so they get experience constructing each type of earthwork.

STEP 4. Visit each group throughout the exercise to support them and troubleshoot any problems they encounter.

STEP 5. When earthworks are finished, mulch them heavily to protect them.

STEP 6. Conclude the activity by:

- Asking participants what they learned during the session.
- Summarizing the key points:
  - *We always start at the highest point in the landscape and work our way down.*
  - *We make sure there is always a spillway for each earthwork, and each earthwork is linked, in case there is a big rain.*
  - *We start small with our implementation, observe the results, then build more as we see what works and what does not.*
- Make a plan for returning to the site after the first rainfall to observe how the earthworks have performed.

Designing a resilient farm

Session Overview

A resilient farm is able to have year-round production by incorporating a wide range of crops and animals. Resilient farms also use a diversity of soil management strategies to build healthy soil. In this session, participants will learn how they can integrate plants, trees, and animals into their designs in a way that supports their household's basic needs. They will also learn how to diversify their soil management strategies.

Learning Objectives:

Participants will be able to...

1. Understand how a diversity of plants – including trees – and animals contribute to a resilient farm.
2. Add a layer of biodiversity to their resilient farm design
3. Implement key RD practices for soil preparation and biodiverse planting.

Session E Activities		Methodology	Tools and Training Materials	Timing	Page
E1	Designing for biodiversity	Discussion	• Flipchart and markers	30 mins	53
E2	Integrating biodiversity into our earthworks	Discussion + Mapping exercise	• Flipchart and markers • Design map from Session D	60 mins	56
E3	Building healthy soils and biodiverse planting	Practical activity	• A-frames and pegging materials • Hoes • Shovels • Seeds and other planting materials • Compost and other soil amendments	2.5 hrs	60

E1. Designing for biodiversity

30 mins

Why is this activity important?

RD farms use a diversity of plants and animals to build a healthy ecosystem, a diverse income stream for households, and a nutritious diet. In this session, participants will learn how biodiversity makes farms more resilient.

Learning Objectives	Participants will be able to... • Understand how cultivating a diversity of plants, trees, and animals leads to a more resilient farm.
Time	30 mins
Tools and Training Materials	• Flipchart and markers
Preparation Needed	None

Facilitator Instructions

STEP 1. Ask participants to recap the key points of the previous session. Conclude by telling participants:

- *By observing our landscape, we can identify where to place earthworks to help us slow, spread, and sink water and nutrients into the soil to enhance productivity. We will save time, energy, and resources by making a good plan for what earthworks to use where.*
- *The contour line is a guide for most of our earthworks and the A-frame is the tool we use to understand where these lines are to ensure water is spread evenly across our landscape.*

STEP 2. Introduce the activity:

- *When we look at a forest, we see multiple layers: a tree canopy, perennial shrubs, annual plants like vegetables, and ground covers. This diversity of plants – and the insect and animal species that feed off of these plants – allows the forest to constantly produce a variety of valuable products and things to eat.*
- *Forest systems can support such a large diversity of plants and animals because they have some areas that are shady, some that receive partial sun, and some that receive full sun. This allows a broad array of plants to thrive in the forest. Forests protect their water resources by storing water in the soil. They continuously break down old plant material into soil so that the nutrients can be used again.*
- *When we model our farm after a forest, our farms will be better able to support our household's diverse nutrition and income needs. We will have more crops to eat or sell, more protection from erosion, and more organic material returning to our soil.*
- *We are going to talk about how we can model our farm to be more like a forest and how different plants and animals have different functions that serve different purposes on our farms and how this diversity is what builds our farm's resilience.*

STEP 3. With the image of a forest in mind, ask participants to name ways that having a diversity of plants and animals makes farms more resilient. List them on your flipchart. Make sure all the ideas in the Facilitator Notes below are discussed.

STEP 4. Conclude the brainstorming by having the group create broad categories that summarize the ways plants and animals can make a farm more resilient, such as:

- "helps my plants grow"
- "helps make my soil healthy"
- "protects my plants"
- "helps my animals"
- "supports the health of my family"
- "provides me extra income"

STEP 5. Break participants up into smaller groups. Ask participants to list specific plants and animals under each category developed in Step 4. Encourage them to include species they encountered during the resource walk they took in Session B. Participants can list the same species as often as needed if they find that a plant, tree, or animal has multiple benefits.

STEP 6. Bring the group back together and pick one group to share their list with the others. Ask a second group to name any additional plants or animals they thought of that have not been mentioned yet. Repeat for the remaining groups. Make a master list on your flipchart or share the list verbally depending on the preference of your group.

STEP 7. Conclude the discussion by:

- Asking if there are any questions.
- Sharing the key messages:
  - *An RD farmer should design their land with multiple layers (tree canopy, shrubs, vegetables, and ground covers) like a forest to help meet the needs of the soils, their crops, and their households.*
  - *We can achieve many of our goals if we select plants and animals that serve multiple functions.*

FACILITATION TIPS

Encourage participants to choose the crops they prefer in the demonstration farm. Projects focused on food and nutrition security often encourage farmers to grow a standard set of crops. When farmers are instead allowed to choose the crops that they would like to grow, they often select a very different set of crops. Farmers like to choose plants that they know how to grow and that showcase the diversity of foods they like to eat. They will also choose plants that do not create extra problems for them if they have to buy seeds in the future or figure out how to sell any surplus they have.

FACILITATOR NOTES

A diversity of plants and animals can provide an RD farmer with...

...something to eat or sell throughout the year

...fencing materials to protect their crops from grazing animals

...building materials

...medicine

...livestock fodder

...a way to keep their soils cool and protected from erosion

...mulching material for their growing areas

...shade from the afternoon sun for their sensitive crops

...food for pollinators

...a source of plant nutrients that they can add to their compost piles or fields

...pest control from trap crops planted on the edges of their fields or plants they can make a pest repellent spray from

An RD site should incorporate a diversity of plants, trees, and animals. It should mimic healthy and resilient living systems nearby to support regenerative growth and to provide multiple nutrition and income-generation opportunities year-round. At a minimum, the RD site should integrate perennial plants, such as trees, shrubs, herbs, ground covers, and vines, including support species that enhance nutrient availability, protect soil resources, encourage pollination, and deter pests.

– Resilience Design Checklist

E2. Integrating biodiversity into our earthworks

60 mins

Why is this activity important?

In this activity, participants finalize their demonstration farm design by adding plants and animals. Participants will learn how to use a plant or an animal on their farm to fulfill a need or solve a problem they have.

Learning Objectives	Participants will be able to... • Add a biodiversity layer to their farm designs
Time	60 minutes
Tools and Training Materials	• Flipchart and markers • Master design map from Session D
Preparation Needed	Bring enough copies of the master map for each group to work on or plan some advance time for each group to copy the master map

Facilitator Instructions

STEP 1. Introduce the activity:

- *Can anyone share our future vision for the landscape from Session B?*
- *To achieve that vision, we have been observing our landscape and planning a design for our farms to be healthy, productive, and resilient.*
- *Now we are going to complete our design map by adding the plants, trees, and animals that fulfill different functions around our farm.*
- *We are going to take a walk around our demonstration farm and identify opportunities where we can increase the biodiversity of our farm. Some new opportunities will have been created by the earthworks we constructed since we did our observation walk in Session C.*

STEP 2. Walk around the demonstration farm with participants. Highlight planting areas and animal enclosures that have the potential to increase biodiversity, such as those mentioned in the Planting Tips below. Recalling the list generated in E1, discuss potential plants or animals that could be used in each location and how they can help build resilience. Encourage participants to take notes and discuss where they might be able to source seeds and seedlings.

STEP 3. Come back and split participants up into small groups, each with a copy of the master design map from Session D. Explain to participants that they are going to be adding a layer to their maps that shows the crops, trees, and animals they will incorporate into the demonstration farm. Remind the group that earthworks create more opportunities to grow useful crops, trees, and other perennial plants. Just like a forest, fields and garden beds can be intercropped and have vertical layers of plants that create microclimates and add biodiversity.

Review the previous design questions and explain that now we are expanding the questions to include all resources rather than focusing on earthworks.

DESIGN QUESTIONS:

1. *How does this help me and my farm to put this resource here?*
2. *How can this help me meet the basic needs of my crops?*
3. *How can this help me meet the basic needs of my soil?*
4. *How can I turn problems on my farm into solutions?*
5. *Is this resource protected?*
6. *Are there any risks to placing this resource here and how can I reduce that risk?*

Introduce an additional question.

7. *What opportunities do I see to increase biodiversity on my farm?*

STEP 4. Have each group present their map and discuss what they have placed where, and why. For each presentation, allow questions from the other participants.

FACILITATION TIPS

Encourage participants to look for planting spaces beyond fields and garden beds. Each site will have its own opportunities where plants can be placed.

Encourage participants to think about what each species needs to grow well. For example, a west-facing slope will grow tomatoes better than a north-facing slope.

STEP 5. Pick one area of the demonstration farm that you will plant as a group. The area should be big enough to contain a good mix of typical planting locations, like fields or garden beds, and earthwork structures. Agree together what will be planted in this area.

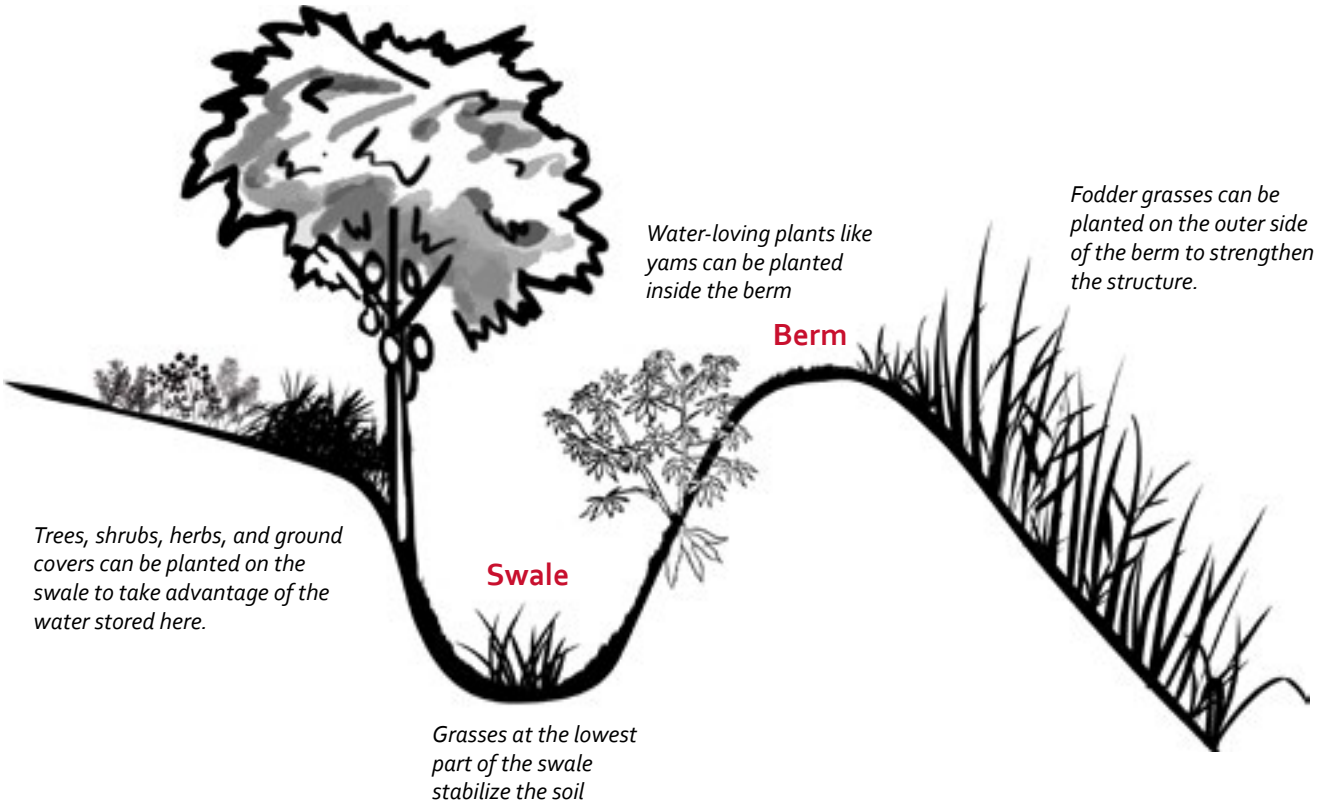
FACILITATOR NOTES

Using the design questions

What opportunities do I see to increase biodiversity on my farm?

This question helps participants think about ways to increase the number of plants and animals on their farm. Earthworks create many additional planting areas since plants are necessary to stabilize the earthworks. New species can be added that serve as fences, windbreaks, shade trees, or fertility plants. Animals can be incorporated to utilize waste streams and create new nutrient sources for soil. Participants should be encouraged to look for planting spaces beyond fields and garden beds. Each farm will have its own unique spaces that can be made more productive with the addition of new plants and animals.

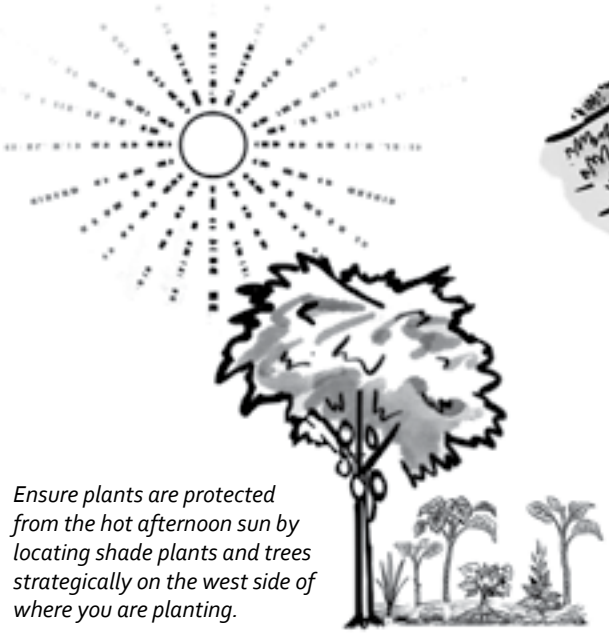
Planting tips to increase biodiversity



All parts of the swale and berm should be mulched.

Provide useful trees with additional water and nutrients by building a half-moon around them.

Shade-loving plants can be planted in the partial shade of the tree.



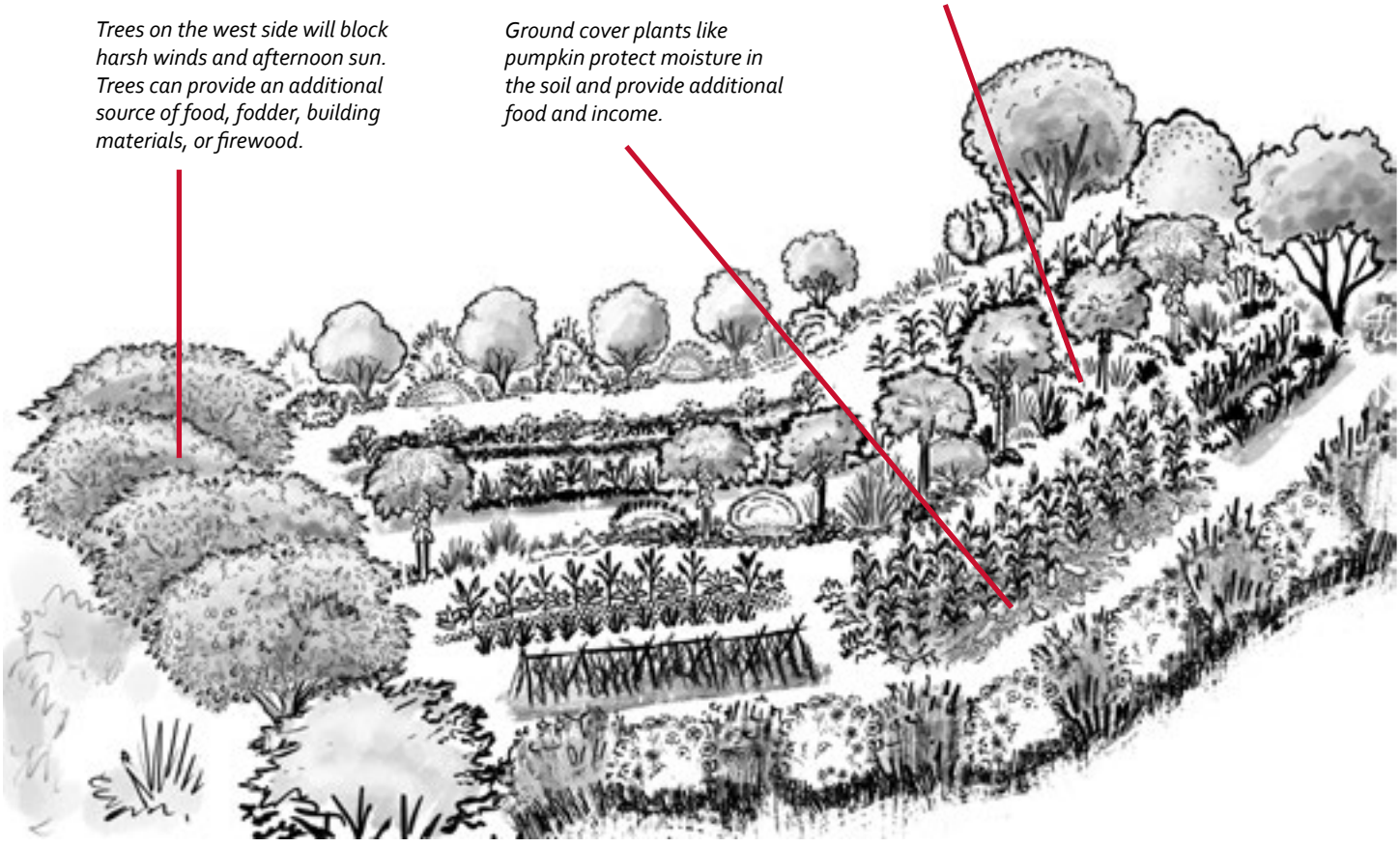
Ensure plants are protected from the hot afternoon sun by locating shade plants and trees strategically on the west side of where you are planting.

Fodder grasses on the west side will reduce sun stress on animals and provide easy access to fodder.

Shady spots under trees can grow food crops during the dry season or perennial shrubs.

Trees on the west side will block harsh winds and afternoon sun. Trees can provide an additional source of food, fodder, building materials, or firewood.

Ground cover plants like pumpkin protect moisture in the soil and provide additional food and income.



E3. Building healthy soils and biodiverse planting

90 mins

Why is this activity important?

This activity allows participants to practice healthy soil preparation and biodiverse planting that they can later implement in their own farms.

Learning Objectives	Participants will be able to... • Implement key RD practices for soil preparation and biodiverse planting.
Time	2.5 hours
Tools and Training Materials	• A-frames and pegging materials • Hoes • Shovels • Seeds and other planting materials, including trees • Compost, chopped fertilizer plants, and other soil amendments (dried and green leaves, charcoal dust, wood ash)
Preparation Needed	Discuss with participants what seeds, other planting materials, and organic material they can bring to the site in advance

Facilitator Instructions:

STEP 1. Bring participants to the area they picked in E2. Start at the field within the site. Together with participants, determine the depth of compaction within the field using an 80–100 cm stick. Ask participants to continue assessing the health of this soil using the rapid testing methods they remember.

STEP 2. Discuss with participants:

- *What are the basic needs of soil again? Let's review.*
- *What happens if a child is fed just one type of food, like rice? Do they grow up to be healthy? How can soils benefit from being fed many different types of fertilizer?*
- *What can we do to better meet the basic needs of the soil in this field?*

STEP 3. Give an overview of the different methods of building healthy soils using the Facilitator Notes below for guidance.

STEP 4. Discuss the importance of planting on contour within a field. If there are existing rows within the field, see if they are oriented to contour or not. Ask what happens when rain hits the current furrows between rows. Dig a row with furrows that follow the contour and discuss how rain will hit this row and furrows and sink into the soil rather than run downslope.

STEP 5. Build on contour rows within the field. Incorporate any compost or other organic materials you have brought into the rows and gather your mulching materials. Demonstrate how to increase the depth of the soil in a field by piling up soil from the paths and edges of the fields into the growing area. Review the planting decisions made for the field; plant and mulch as a group.

STEP 6. Move the group to a swale. Review the planting decisions made for that swale, ditch, and berm in the mapping process in E2. Incorporate compost and chopped fertilizer plants into the soil and then plant and mulch as a group.

STEP 7. Move the group to a half-moon earthwork and demonstrate how to plant a tree in the half-moon. Discuss shade-loving plants that can be planted later on the berm.

STEP 8. Divide participants into small groups to plant the remaining areas. Move from group to group to make sure each group is digging deeply into the soil where needed, incorporating compost and other soil amendments, and adding mulches to the top of their soil.

STEP 9. Conclude by:

- Asking participants what key insights they had from the activity.

  Share the key messages:

  – *Good soil preparation helps us meet the basic needs of our soil and the plants growing within it.*

  – *Planting fields on contour can keep rainwater within the field instead of allowing it to run downslope.*

  – *Healthy soils and a biodiverse farm help us meet our own needs and achieve our future vision.*

- Give participants the homework of making a design for their own biodiverse farm.

Planting a tree

1. Identify the location of the tree.
2. Make a 30 cm deep hole. Place topsoil to one side.
3. Loosen the next 30 cm of soil with a hoe.
4. Mix a diverse selection of amendments into the loosened subsoil.
5. Pre-moisten the hole with a jerrycan of water.
6. Return the topsoil into the hole and mix in several handfuls of dried compost or manure.
7. Remove any binding or plastic bag around the root ball and plant the tree into the hole. Lightly compact the soils around the roots.
8. Create a micro basin on the downslope of the tree planting.
9. Mulch the entire planting area leaving an open ring around the tree base so that mulch does not rot the tree trunk. Fill the surrounding half-moon excavation and berm with a diversity of organic mulches.
10. Water the tree.

FACILITATOR NOTES

Building and maintaining healthy soils

Dig or plow strategically

- Prepare planting rows and furrows on contour to better capture water and reduce erosion of seeds and soil.
- Once the growing area is prepared with rows or furrows on contour you can further increase the soil depth in fields by moving soil from paths and the edges of fields onto planting areas.
- When finished with these strategies, you can take a stick and push it into the soils to ensure there is a minimum of 40 cm depth in the planting zones.

Keep soils covered

- Grow ground covering plants like pumpkin, melons, desmodium, or sweet potato to protect soil moisture.
- Add dry grasses, leaf litter, or crop residue as mulch in between plants. If mulch is scarce, prioritize the area around the base of crops.
- Protect soil with mulch even when fields do not contain crops.

Nourish the soil

- Add a diversity of organic amendments as often as possible to all growing areas.
- If organic amendments are scarce, concentrate them by adding them to small planting pits strategically placed throughout a field rather than broadcasting them.
- Intercrop fields and beds with a diversity of complementary crops that can use different root zones.
- Cover crop with green manures and other leguminous plants like beans, cowpeas, and soybeans whenever possible.
- Build compost piles or pits near fields and garden beds to have ready access to compost.
- Incorporate crop residues and native vegetation into the soil or use as mulch rather than burning. Burning plant material releases nutrients into the air; when plants are allowed to decompose in the soil then their nutrients are incorporated into the soil and available for other plants to use them.
- Incorporate chopped tree leaves and branches into soils to build organic matter.

Protect soils

- Rather than burning natural fallows or crop residues, incorporate them into the soil or compost them.
- Protect soils with earthworks by positioning swales upslope from fields to slow water before it enters the field.
- Mulching the growing areas either with dead materials or with a living cover like desmodium.
- Strategically plant trees for beneficial shade and wind protection.

SESSION F

TOTAL TIME: 3.5 hours

Continuously improving our design and building a community of RD farmers

Session Overview

A Resilience Design is never finished. An RD farmer is constantly observing their farm to see what is working and what is not. If there are signs things are not working, it is an opportunity to improve. If there are signs things are working well, it is an opportunity to replicate and scale. In this session, participants will take stock of their demonstration farm design by observing it after a major rainfall has occurred. This could be immediately after the rain or a few weeks later, depending on what is most convenient. They will learn a feedback collection process to help them slowly improve their design over time and will make corrections and additions to the demonstration farm based off of what they observed. They will conclude the training with a discussion on how they can support each other and build a community of RD farmers now that the program has finished.

Learning Objectives

Participants will be able to...

1. Use the Resilience Design Checklist to ensure the site meets minimum standards.
2. Observe what is working and where to make adaptations to the RD design.
3. Adjust and expand their RD designs.
4. Identify ways that they can support each other on their learning journey.

Session F Activities		Methodology	Tools and Training Materials	Timing	Page
F1	Gathering feedback from plants and the land	Discussion + Checklist exercise	• Flipchart and markers • RD Checklist	30 mins	65
F2	Adjusting and growing our design	Practical activity	• Design maps from Session E • Materials to build an A-frame • Hoes • Shovels • Seeds and other planting materials • Compost and other soil amendments • Mulching and fencing materials	2.5 hour	68
F3	Where do we go from here?	Discussion	• Certificates of training completion	30 mins	69

F1. Gathering feedback from plants and the land

30 mins

Why is this activity important?

As RD farmers, we OBSERVE ➞ PLAN ➞ DO and then OBSERVE AGAIN. Observing what is working well and what is not working will help us to adjust and grow our designs slowly over time to maximize our productivity. This session must occur after a major rainfall has occurred – either immediately after or up to a few weeks after – so that participants can observe how the landscape has changed because of the rain. In this session, participants collect feedback from plants and the land and use this feedback to adjust the existing design and expand it to include new earthwork structures and plants.

Learning Objectives	Participants will be able to... • Understand the importance of constant observation, adjustment, and growth as an RD farmer • Use the RD Checklist to track a site's path towards greater resilience
Time	30 mins
Tools and Training Materials	• Flipchart and markers • RD Checklist for each participant
Preparation Needed	Check on the demonstration farm before scheduling the final training. Make sure that at least one big rainfall has happened so that it is possible to see how the earthworks and plants have responded.

Facilitator Instructions

STEP 1. Introduce the topic:

- *Our biodiverse farm with strategically placed earthworks is now more prepared to help us bounce back from challenging times faster and stronger than we did before.*
- *The last step in the RD process is to observe and adapt our growing system accordingly. Each season, we take time to observe how the plants and the land are doing and use this feedback to adjust and grow our designs.*
- *Each big rainfall is a new opportunity for us to observe how our plants and the landscape have responded to this influx of water.*

STEP 2. Ask participants these questions and write the answers down on your flipchart:

DISCUSSION QUESTIONS:

1. *What signs could you look for to know if what you are doing is working? (Ex: soil becoming more fertile, plants growing well, fewer signs of erosion)*
2. *What signs could you look for to know if what you are doing is not working? (Ex: crops still suffering after dry spells, high soil temperatures)*

Refer to the Facilitator Notes as a basis for discussion.

STEP 3. Explain that, once we have observed what is working and what is not, we can think of ways to adjust and build upon what we are doing. Remind farmers of the rubber and mud ball demonstration from Session B:

- *When our rubber ball bounced even higher than it did initially, this was because the farmer kept building healthy soils, harvesting water, and building their biodiversity so that the household's needs were always met. As we continue to expand what we do, our farm can support us even more.*
- *Ask participants to share their ideas for how their farms could continue to grow and support them.*

STEP 4. Introduce the Resilience Design Checklist in Appendix 3 and demonstrate how to use it while walking through the demonstration farm. Share how your particular program intends to use the Resilience Design Checklist to monitor progress, and what the participants should expect moving forward. For instance, will program staff and/or extension agents visit regularly to complete the Checklist together with the participants? Or will the participants complete the Checklist on their own?

STEP 5. Have everyone score the site together using the checklist criteria. Discuss each score, and the reasoning behind it, as well as steps they would take to elevate the site to a higher score.

STEP 6. Have participants imagine that a local official or village chief is interested in touring farms in the region to see what forms of innovation are happening in the area. Would they want to bring that person to this farm? Why or why not?

TAKE HOME MESSAGE

The Resilience Design Checklist is a tool that can be used again and again to ensure your design is functioning properly. Especially when new planting areas are being established, it is important to frequently use the Checklist and adapt your design as needed. It may take several seasons before a design is working as intended.

FACILITATION TIPS

Asking participants who they would want to come to view the demonstration farm is a good way to assess how much work has been put into building the resilience of a site and if this work is yielding something productive. When designing their own farms, encourage participants to ask themselves who they would want to view their work. Someone important and influential? Someone without high expectations, like a close friend? Or no one at all? The answer will tell them how well designed their farms are.

Resilience is built when all the individual components (water, soil, biodiversity, and protection) that have been added to a site start working together to reinforce each other. When using the Checklist, reiterate to participants that the goal is to identify opportunities for these features to work together to build resilience.

FACILITATOR NOTES

An RD farmer is constantly observing their farm looking for signs that things are either not working and need to be adjusted, or are working very well and can be replicated and scaled up. Below are some examples of common challenges on farms and some examples of how to address them. For more in-depth information on common challenges and ways to support farmers in addressing the challenges, see Appendix 4.

Signs that things are not working	How to address them
Water in swales overflowing and causing erosion	• Make sure there are spillways to allow overflow water to flow into the next earthworks or somewhere where a lot of water is needed. • Create a one rock check dam to slow the water flow in the swale. • Stabilize the berm by planting perennials on the lower side.
Biodiversity on farm low	• Look for microclimates created by earthworks where new species could be planted. Think vertically about what could be planted from tree height to ground cover. Think seasonally about what could be harvested at different times of the year.
Soil health not improving	• Remove silt captured in swales and use as a fertilizer in fields. • Plant fertilizer plants around fields to increase access to organic materials. • Make and apply organic fertilizers (see further instructions in the RD manual).
Crops being eaten	• Use thorn bushes to form a protective fence around garden areas. • Grow a productive fence around fields. • Discuss and agree upon grazing norms with neighbors.

F2. Adjusting and growing our design

2.5 hours

Why is this activity important?

In this activity, participants will use the insights they gained from the Resilience Design Checklist to make modifications and adjustments to their earthworks that improve their ability to capture water on the site. They will also have time to add new earthworks and growing areas to the demonstration farm.

Learning Objectives	Participants will be able to... • Adjust their RD design to use their resources more efficiently • Grow their RD design to cover a larger area
Time	2.5 hours
Tools and Training Materials	• Design maps from Session E • Materials to build an A-frame • Hoes • Shovels • Seeds and planting material • Compost, chopped fertilizer plants, and other soil amendments (dried and green leaves, charcoal dust, wood ash) • Mulching and fencing materials
Preparation Needed	None

Facilitator Instructions

STEP 1. Determine what areas of the farm you will fix today by discussing with participants:

DISCUSSION QUESTIONS:

1. *According to the Resilience Design Checklist, what areas of the demonstration farm need improvement?*
2. *In what ways should we adjust our design or fix our earthwork structures? Do we need to add any plants to our farm? Do we need to better protect certain elements of our farm?*

STEP 2. Select new earthwork structures to construct, areas to plant, and methods to protect the site by consulting the master map from Session E and discussing with the group.

STEP 3. Assign participants to groups and have them select the different areas of the farm where they will be working.

STEP 4. Have each group make an A-frame out of materials they find around the demonstration farm. They should also gather together the fertilizers, planting materials, mulch, and fencing materials that they will need.

STEP5. As groups are working, go around to each group to make sure they are implementing the techniques they have learned correctly. Answer any questions they have.

STEP 6. Using the RD Checklist, re-score the site as a group. Discuss how the changes made by the group today resulted in any new scores assigned to the site.

F3. Where do we go from here?

30 mins

Why is this activity important?

The skills that are needed for RD are best built through knowledge sharing and problem solving together. Farmers will greatly benefit from having a supportive group where they can share experiences, discuss solutions, experiment with new ideas, and exchange tools and labor, especially when constructing large earthworks. This activity helps participants identify ways they can help each other and lays the foundation for continued peer-to-peer support.

Learning Objectives	Participants will be able to... • Identify ways that they can support each other on their learning journey.
Time	30 mins
Tools and Training Materials	• Certificates of training completion
Preparation Needed	None

Facilitator Instructions

STEP 1. Ask participants to sit in a circle and discuss:

DISCUSSION QUESTIONS:

1. *What are the ways that we can support each other in our process of becoming better RD farmers?*
2. *Can your skills as RD farmers also be used to make practical improvements in your community?*

At the end of the discussion, encourage participants to share some next steps for how they are going to support each other after the course.

STEP 2. Conclude by congratulating participants on completing the course. Hand the pile of certificates to the person whose name is on top. Have that person share either a brief reflection on their experience in the course or some next steps they will be taking on their farm. After this participant takes their certificate, have them hand the pile to the person whose certificate is now on top. Repeat the process of having participants present certificates to each other and taking a moment to share their thoughts until the last certificate is handed out.

FACILITATION TIPS

Encourage farmers to think of practical ways they can support each other. If they do not have an existing farmers group, encourage them to set up an informal group. Encourage them to find places in their communities that would benefit from the RD skills they have practiced in this course.

FACILITATOR NOTES

Resilience Design is a long-term learning journey. Communities that have had good success with implementing Resilience Design have established strong peer-to-peer support systems that provide both a place for exchange of knowledge, experience, and ideas, as well as an opportunity to share resources and labor.

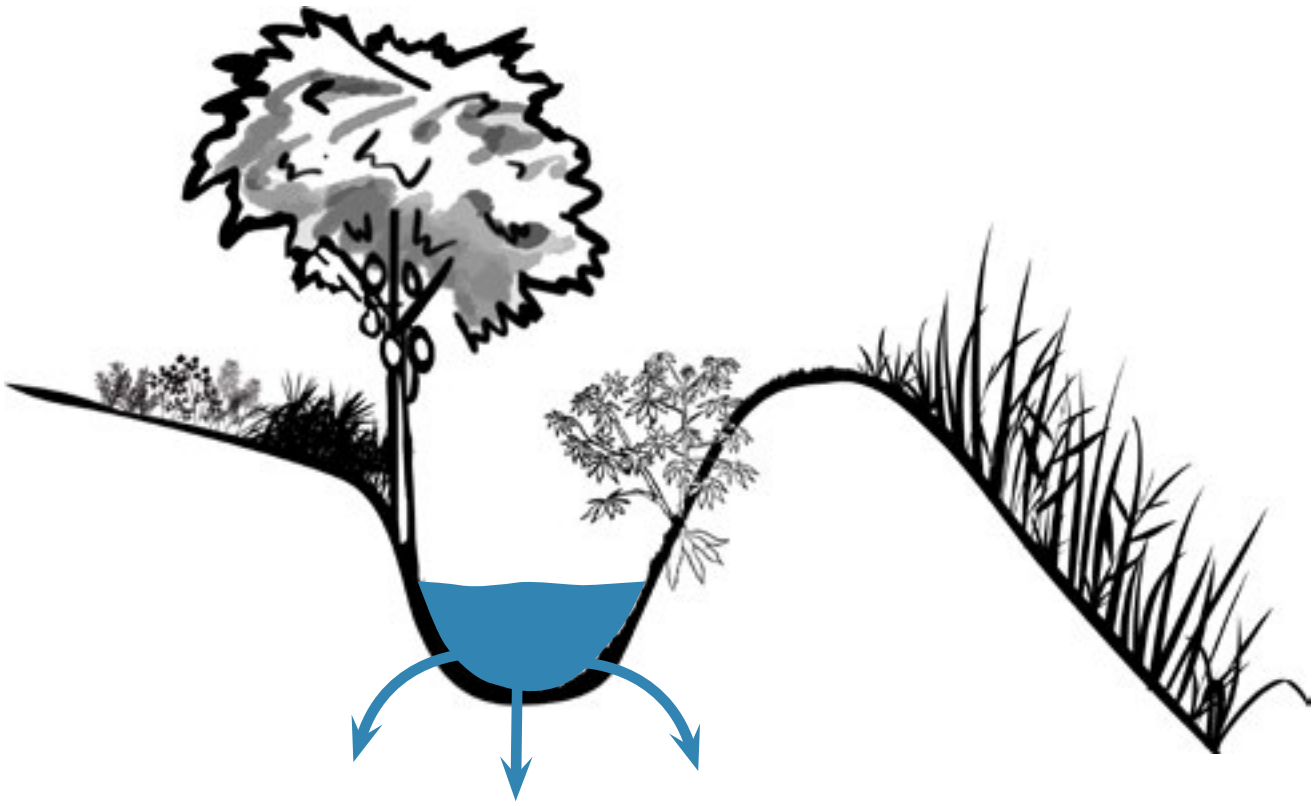
Peer-to-peer support systems can:

- Share seeds and propagated planting material
- Share tools and equipment
- Have work parties to help members with larger earthworks
- Organize exchange visits to advise members and share insights and ideas
- Invest in communal resources, such as a shared oil press or other equipment, that brings income opportunities
- Have regular meetings to plan new projects or track members' progress

Swales

Swales are ditches and the associated berm that are dug on contour. Because swales are dug to follow the contours of the land, each swale creates a level basin that collects rainwater as it moves down the slope so that water sinks slowly into the soil rather than continuing to flow downward. A berm is constructed from soil excavated out of the ditch on the downslope side of the swale. Berms are often reinforced with annual or perennial plants to prevent erosion. A spillway dug into the berm allows for overflow water to be gently redirected to the next swale or other water harvesting structure. A waterline is measured starting at the spillway to ensure the full length of the berm is half a meter higher than the spillway. The waterline is the maximum height within the ditch that water will reach before it overflows through its designated spillway. Measuring the waterline ensures that the berm is high enough to hold the water so that it flows through the spillway rather than through a part of the berm that dips down or an uncapped end.

The size of the swale depends on the context of the site. Smaller swales can be dug above kitchen garden beds or other planting areas, while longer and larger swales can be constructed at the top of the compound to help protect against larger water flows. Swales should be large enough to handle a typical large rainstorm for the area.



Constructing the swale and berm:

1. **Determine where to locate a swale:**
   Swales should be strategically located where water needs to be spread out over a broader part of the compound, and/or where a growing system needs protection from upslope water flows.

2. **Determine the size of the swale:**
   Larger swales should be located at the top of a compound to accommodate larger water and sediment flows. Smaller swales can be located above garden beds and other planting areas.

3. **Use an A-frame to mark the contour:**
   Use a recently calibrated A-frame to mark the contour across the slope.

4. **Remove any topsoil present:**
   Before digging the swale, remove any topsoil from where the ditch and berm will be constructed. Save it downslope.

5. **Dig the swale:**
   Dig a ditch on the downslope side of the contour line, using the line as a guide. Pile the excavated soil on the downslope side of the ditch to create a berm.

6. **Shape the ditch:**
   As you dig, ensure the walls of the ditch are gently sloped and that the bottom of the ditch is flat.

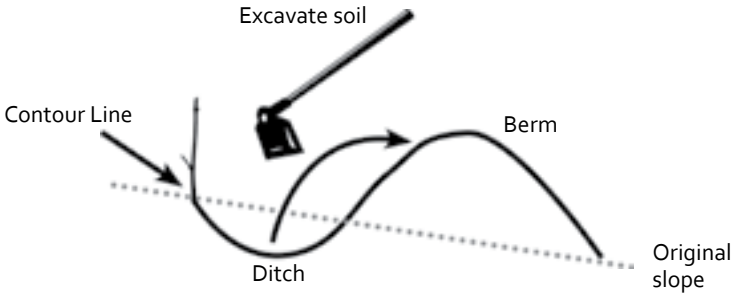
7. **Shape the berm:**
   Be sure the berm is well rounded, rather than vertical edges, and also follows the contour. Once the berm is well shaped, the previously saved topsoil can be spread over the berm.

8. **Cap the ends of the swale:**
   Close, or cap, the ends of the swale by digging an infiltration pit in the bottom of the ditch and using the excavated soil to create an extended berm that wraps up slope and closes the end of the swale. Do this on both sides.

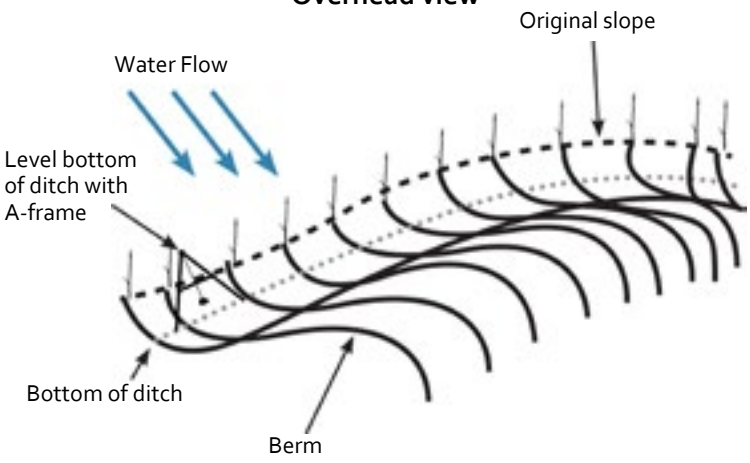
9. **Level the bottom of the ditch:**
   Use an A-frame to check that the bottom of the ditch is level across the entire swale. Adjust the depths as necessary for high points. Low points will eventually fill with silt and can be left.

DIGGING THE SWALE

Side view



Overhead view



Constructing a spillway:

10. **Determine where to locate the spillway:**
Identify where there is a natural downslope path below the berm where water can overflow to the next water harvesting structure.

11. **Measure the spillway:**
Measure the size of the swale ditch and berm from the upslope side of the ditch (beginning at the cut) to the downslope toe of the berm.

12. **Construct the spillway:**
Make a cut in the berm for the spillway that is equivalent to the measurement of the swale ditch and berm. See the image to the right for more detail. This distance is best measured and marked with sticks even before the ditch is dug and the berm created. Preserving the soil, and any plants or grasses growing in the soil where the spillway will be, will help reduce erosion of the spillway in the future.

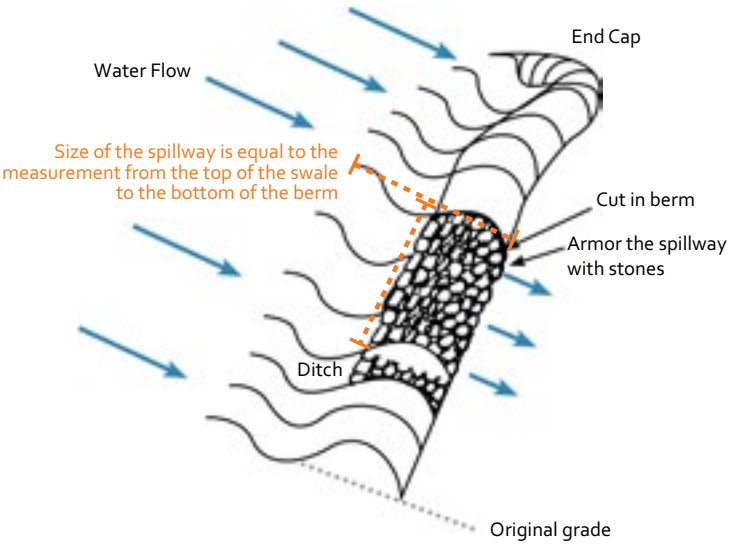
13. **Armor the spillway:**
Reinforce the spillway with stones, replanted grass or grass seeds, or other materials that will help protect the spillway.

Finishing the berm:

14. **Determine the waterline:**
Once the spillway is constructed, mark a contour line with an A-frame starting at the flat part of the spillway, i.e. the original grade, then continue along the inner side of the berm. Check that the height of the berm above the waterline is a minimum of half a meter all the way along the berm.

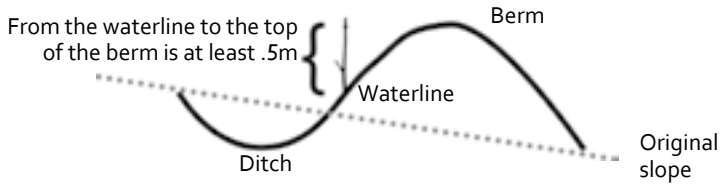
15. **Amend, plant, and mulch the berm:**
Make sure the soil is not too dry or too wet for planting. Incorporate any soil amendments you are using, remove rocks and break up large soil clods, and then plant seedlings or seeds along the length of the berm. Intensively planting the berm ensures its long-term structural integrity. Water any seedlings or seeds as needed. Apply mulch to all parts of the berm, including the bottom of the ditch. Mulch materials can include animal manures, cut branches, leaves, grasses, sticks, other organic matter, or stones.

CONSTRUCTING SPILLWAY

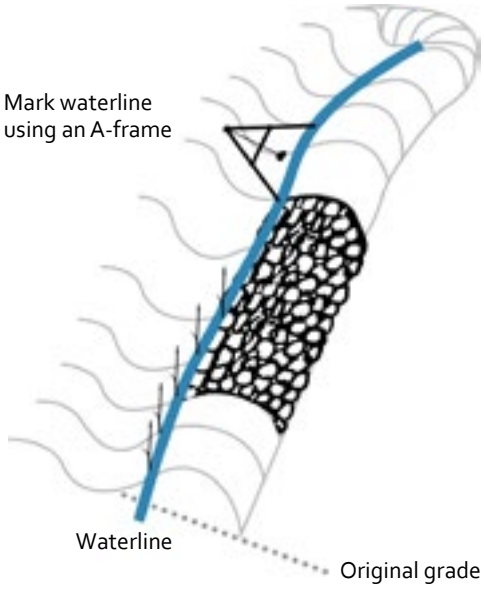


DETERMINING THE WATERLINE

Side view



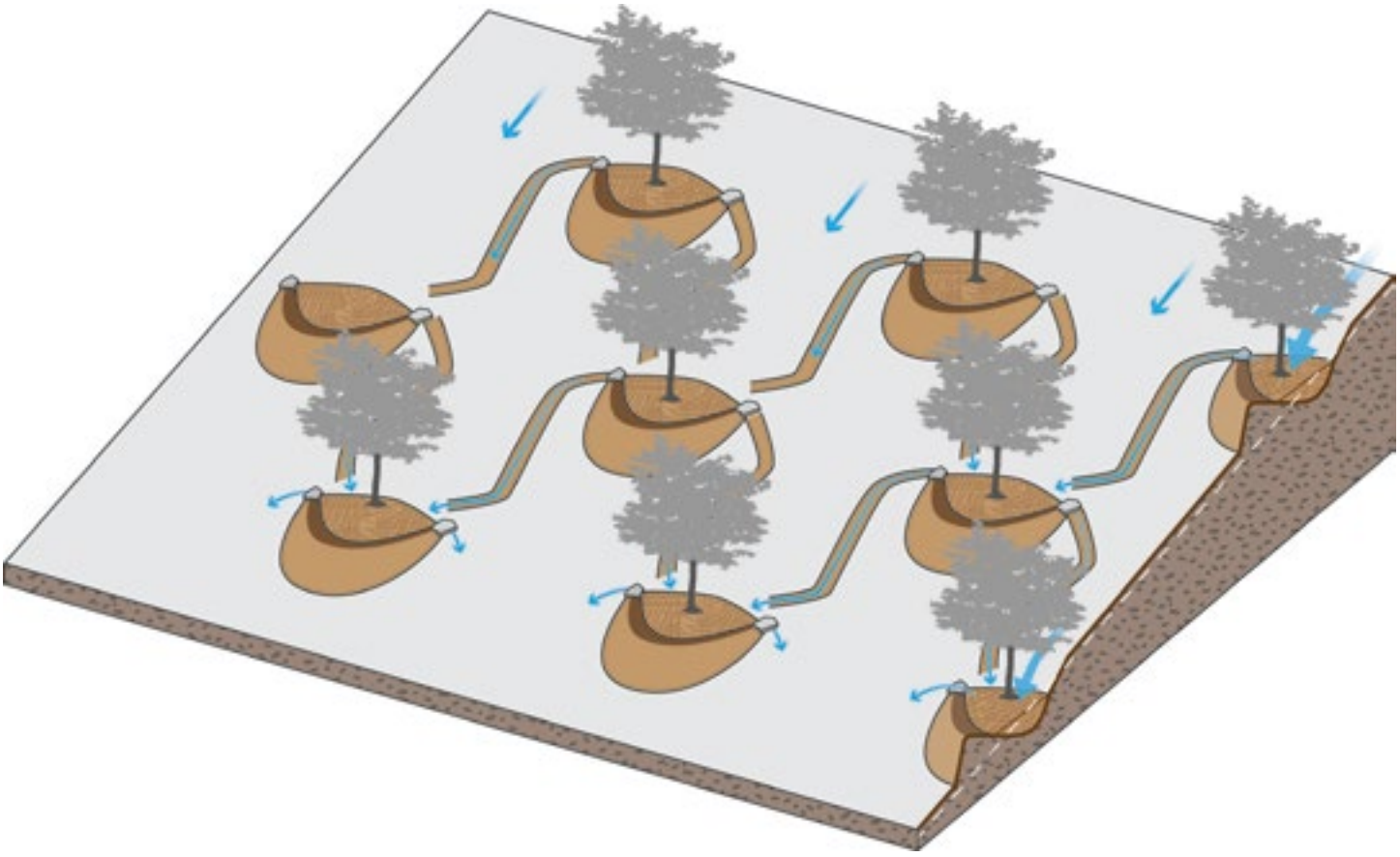
Overhead view



Half-moon berms

Half-moons are berms in the shape of a semi-circle used to capture and retain water and nutrients so they can be used by newly planted trees or existing trees. Half-moons are also known as 'boomerang' or 'smile' berms because of their shape, while in Francophone areas they are known as demi-lunes. Half-moons are generally 1–3 m in width when used in the household. The end tips of the half-moon are located along the contour of the slope, pointing uphill to receive the water flowing downhill. The area within the half-moon, and the berm itself, is often amended with compost, manure, or another soil amendment and the berm can be planted with annual or perennial crops.

Half-moons can be placed in a 'net' or 'triangle' pattern across the landscape to catch overflow water as it continues down the slope.



Constructing a half-moon berm:

1. **Determine where to locate the half-moon:**
   Half-moons can be used to support existing trees or newly planted trees. Check to make sure there is enough space around an existing tree to construct a half-moon that follows the existing crown of the tree. For new trees, half-moons are approximately 2-3m from tip to tip and 0.5 to 1.5m from the tree hole to the lowest downslope part of the berm.

2. **Use an A-frame to find the tips of the half-moon:**
   For a new tree: Mark the spot where the tree hole will be. Use an A-frame to find a contour line. Measure one meter out from the tree hole on either side to determine where the two tips of the half-moon should be.

   For an existing tree: The tips of the half-moon are located at the outer point of the tree crown. Identify a point on one side of the tree crown that is approximately in line with the tree. Use the A-frame to find another point on the opposite side of the crown and mark that place as the other tip of the half-moon.

3. **Mark the arch of the half-moon:**
   For a new tree: Once the tips are located, use the A-frame to mark the arch by placing one leg of the A-frame at the tree hole then scratch an arch in the soil from one marked tip to the other.

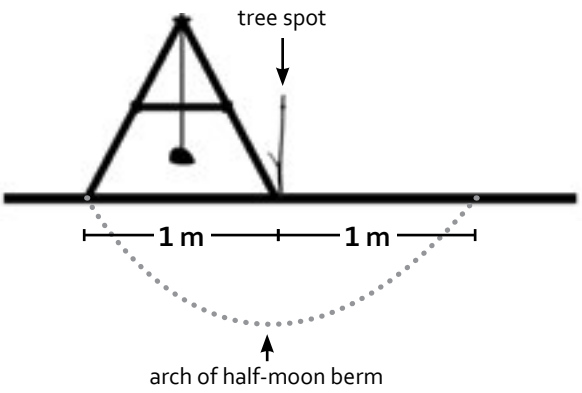
   For an existing tree: Scratch the arch between the two tips along the approximate edge of the crown. For trees that have been pruned, you can extend the berm beyond the crown as needed to create an adequate catchment.

4. **Dig the ditch:**
   Dig a ditch on the upslope side of the marked arch, using the marked line as a guide. Use the excavated soil to create a berm. Dig deeper at the lowest downslope part of the excavation to ensure the berm is higher than the waterline.

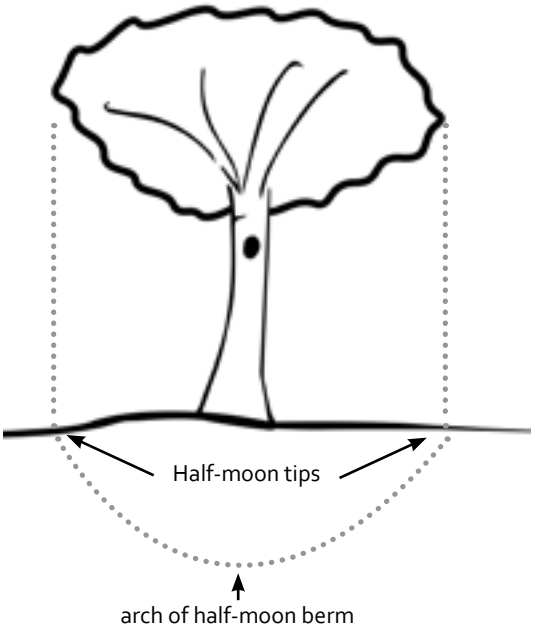
5. **Shape the berm and find the waterline:**
   Ensure the sides of the berm are well rounded. Use a small A-frame to find the waterline to make sure the berm is high enough to retain water. Start by placing a peg at the upslope point where the tip of the half-moon meets the native soil. This is the place where water will "spill" when the structure is full of water. Create the waterline by marking the contour along the inner side of the berm, pegging as you go. Ensure the berm has a minimum of 15+cm height above the waterline. Since the tips of the half-moon berm are on the same contour, they should both spill evenly in high water events. If you desire to have the spilling of water only from one side, add more to the berm on one edge to bring the tip higher than the contour of the desired spillway.

MARKING THE HALF-MOON BERM

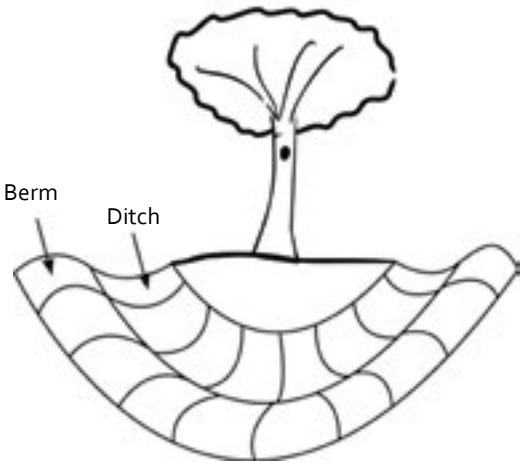
For a new tree



For an existing tree



DIGGING THE DITCH

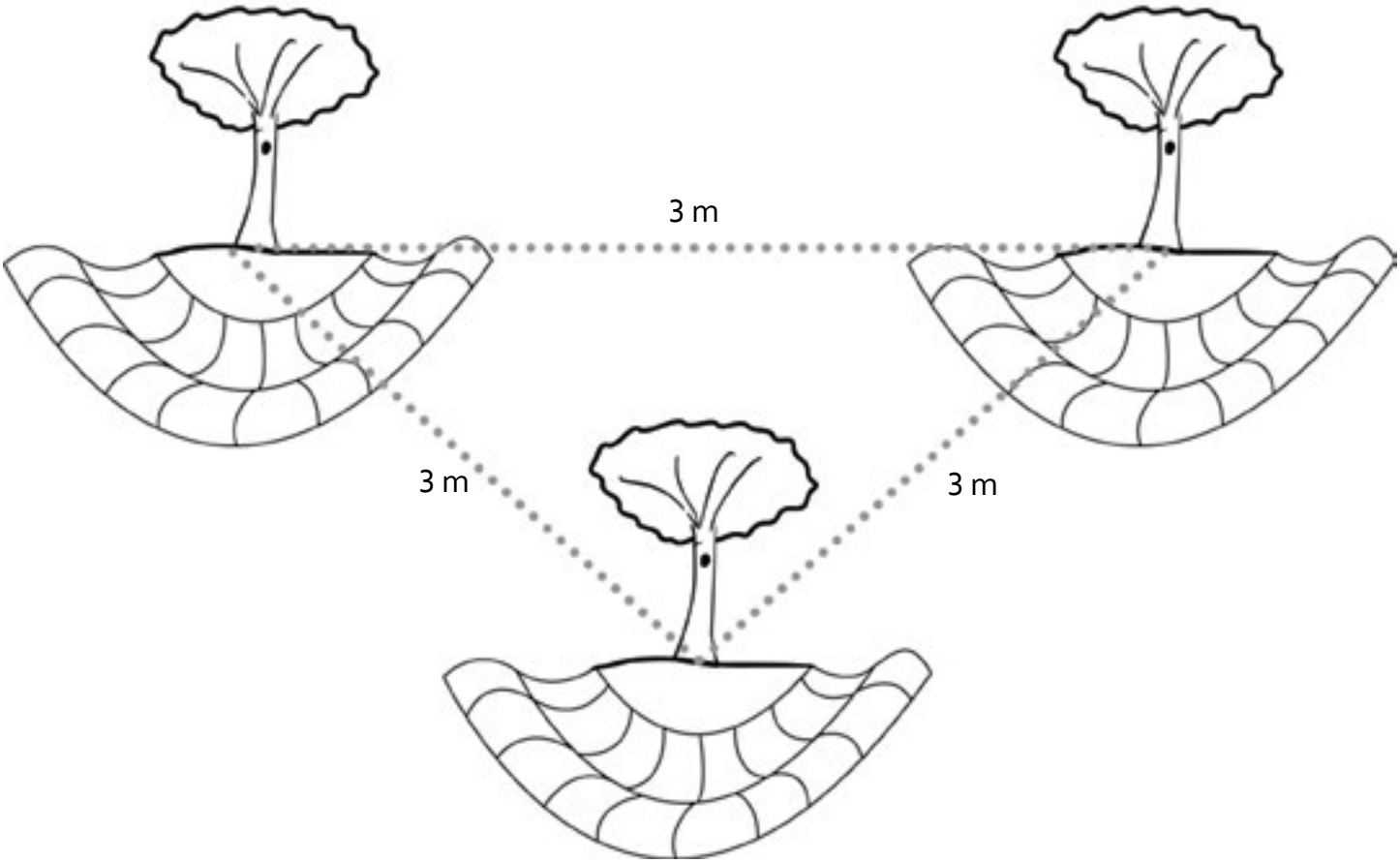


6. **Dig the tree hole:**
   In dry climates, place the tree hole below the contour line between the tips. In wet climates, place the tree hole above the contour line. Dig the tree hole at least 30cm in diameter and 30cm deep. Place the excavated soil downslope to create a small half-moon berm right at the edge of the tree hole to support the tree's early growth. Leave the upslope area open to allow for water and nutrients to flow into the half-moon berm. Loosen the next 30cm of soil in the hole for a total of 60cm depth of uncompacted soil.

7. **Amend, plant and mulch the half-moon:**
   Add a diversity of soil amendments (at least several large handfuls) to the lower 30cm of loosened soil. These amendments can include diverse animal manures, leaves, charcoal dust, crushed bone, and other chopped organic plant matter. Make sure the soil is sufficiently moist, then seed and/or plant seedlings on the berm. The berm can be planted with a variety of fodder or vegetables. Pumpkins are a good ground cover that can be integrated by planting along the inner waterline of the berm. It is important that the berm is planted to ensure its long-term structural integrity. Mulch the berm and around the tree, taking care to not place mulch directly on the tree trunk as mulching materials may rot the tree base. Mulch materials can include animal manures, cut branches, leaves, grasses, sticks, other organic matter, or stones.

Creating a net pattern on the landscape:

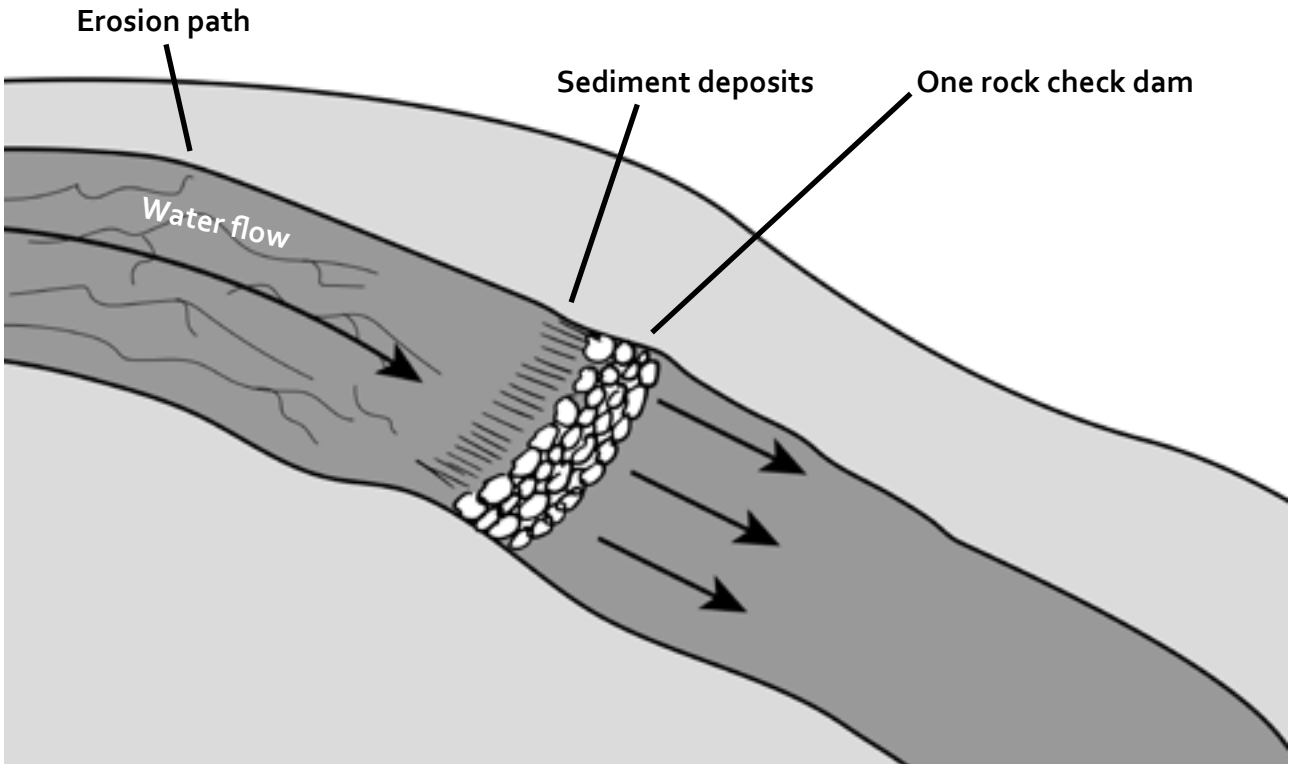
When doing multiple half-moon berm structures, pattern them in a net or triangle pattern. For a 1.5m wide half-moon, you may want to space the tree holes 3m apart. Tie three pieces of string together to make a triangle. Have three people each hold a knot and stretch the string into a triangle to determine the approximate location of each tree hole. Mark each hole. This works well for marking out larger numbers of structures over a broad area, however it is also possible to pace out the triangle by foot.



One rock check dams

A **one rock check dam** is a small dam used in low-volume, low-speed water channels. A single layer of rocks is used to stabilize eroding gullies, roads, or paths and reduce erosion below culverts. One rock check dams slow water down as flowing water passes over the rocks. In the process, soil sediment and seeds that are being carried by the water is filtered out in between rocks. This creates a place for grasses and other plants to colonize, further contributing to the slowing of water and the reduction of further erosion downstream. For vegetation to grow through the rocks and to stabilize the structure, never lay rocks in the check dams more than one layer high. Multiple one rock check dams can be placed along an erosion path if desired.

1. **Determine the location of a one rock check dam:**
   Find places that have erosion marks along the soil and select a point upstream.
2. **Construct the one rock check dam:**
   Lay a one-meter-wide line of rocks across the erosion pathway. Follow the contour when placing the rocks. This will help slow the water flow and deposit debris and seeds close to the rocks, creating favorable conditions for plants to grow and assist in slowing or stabilizing the erosion.
3. **Construct additional one rock check dams:**
   If desired, construct additional one rock check dams at various points along the erosion path.



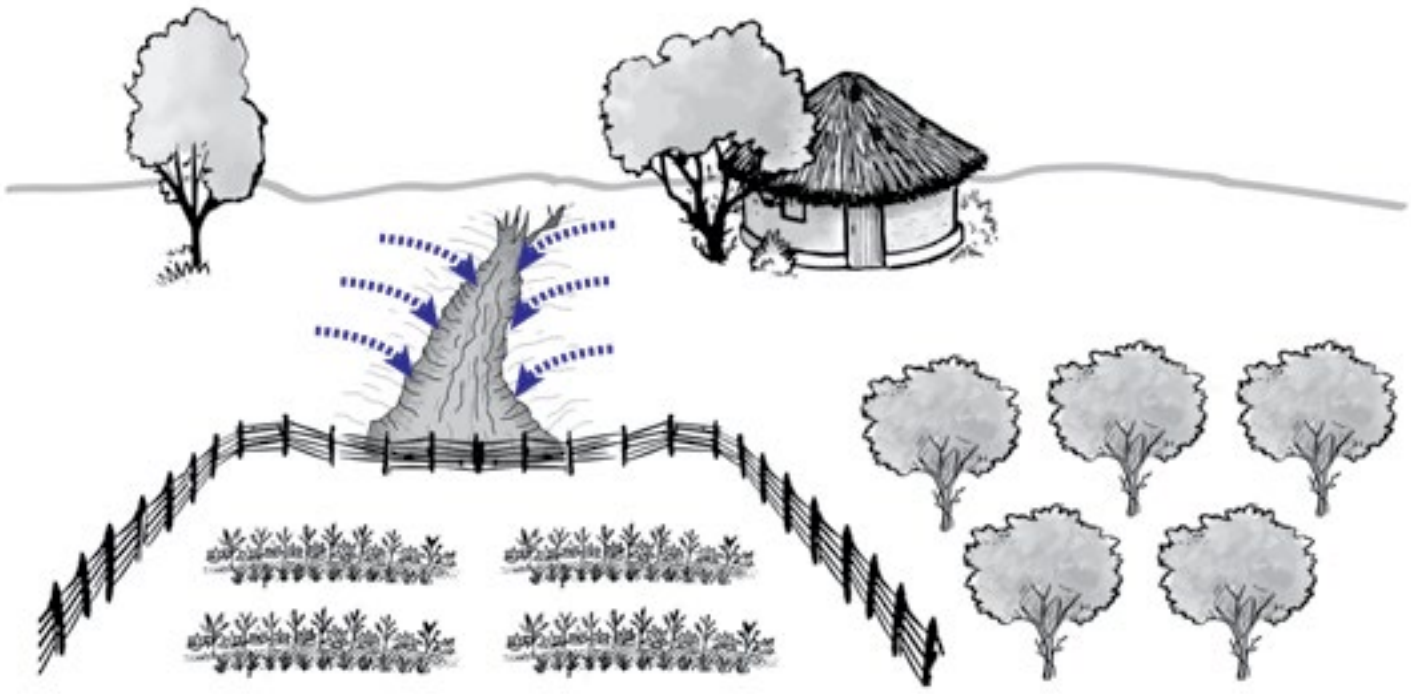
APPENDIX 2: Where do you start?

It can be difficult to approach a new site and know how to get started. Often ideas can be generated by finding the highest point on the site and walking the water thoroughly, noting the impact of any other external influences, like sun and wind. Ideas can also be generated by talking with the household about challenges they face with growing crops. Even if the landscape presents big challenges, it is recommended to start with a small intervention. One properly dug swale with all the necessary features—a spillway, capped ends, contoured and leveled bottom, gently sloped ditch, mulched and amended soil, and a diversity of plants stabilizing the soil—can benefit a household more than several off-contour and unfinished swales. Below are examples of common scenarios and tips for how to get started developing a design.

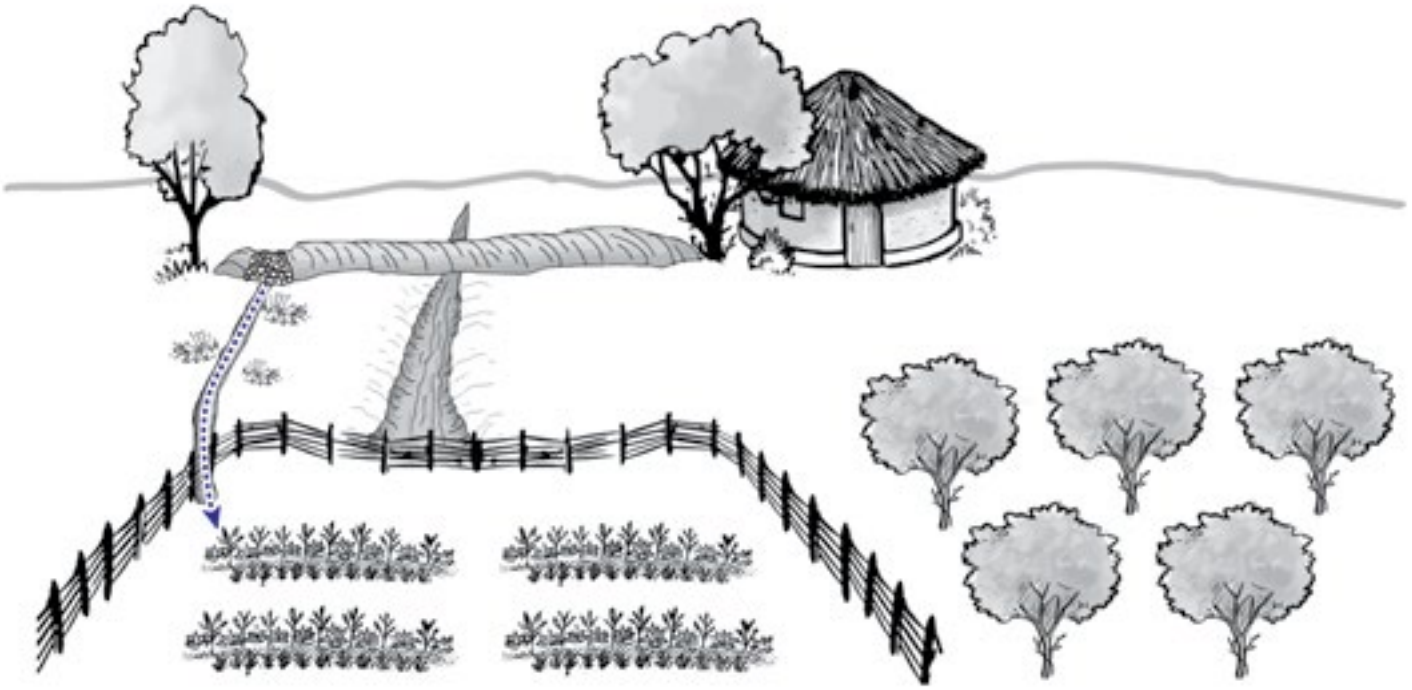
Scenario 1: Erosion and gullies

What do you do…

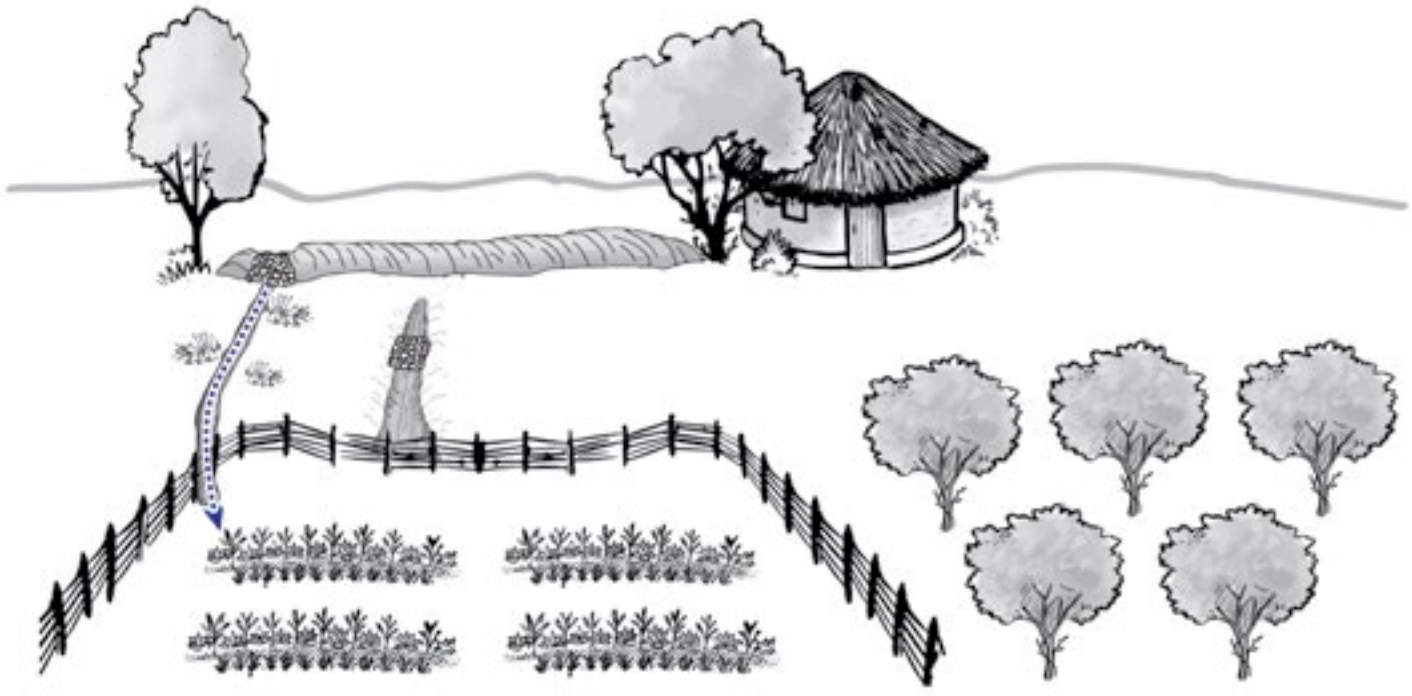
1. Start at the highest point on the site and map water flow down to the point of most severe erosion, which could be a gully. Water may be flowing into the gully from several points along the landscape. Larger gullies indicate that more water is flowing downhill and will need to be slowed, spread and infiltrated into the soils through swales, half-moon berms, and one-rock check dams built above the heavy erosion point. Water will also flow faster in steeper landscapes. If water cannot penetrate into the soils because they are compacted and contain little vegetation, then this will also contribute to more water flowing downhill.



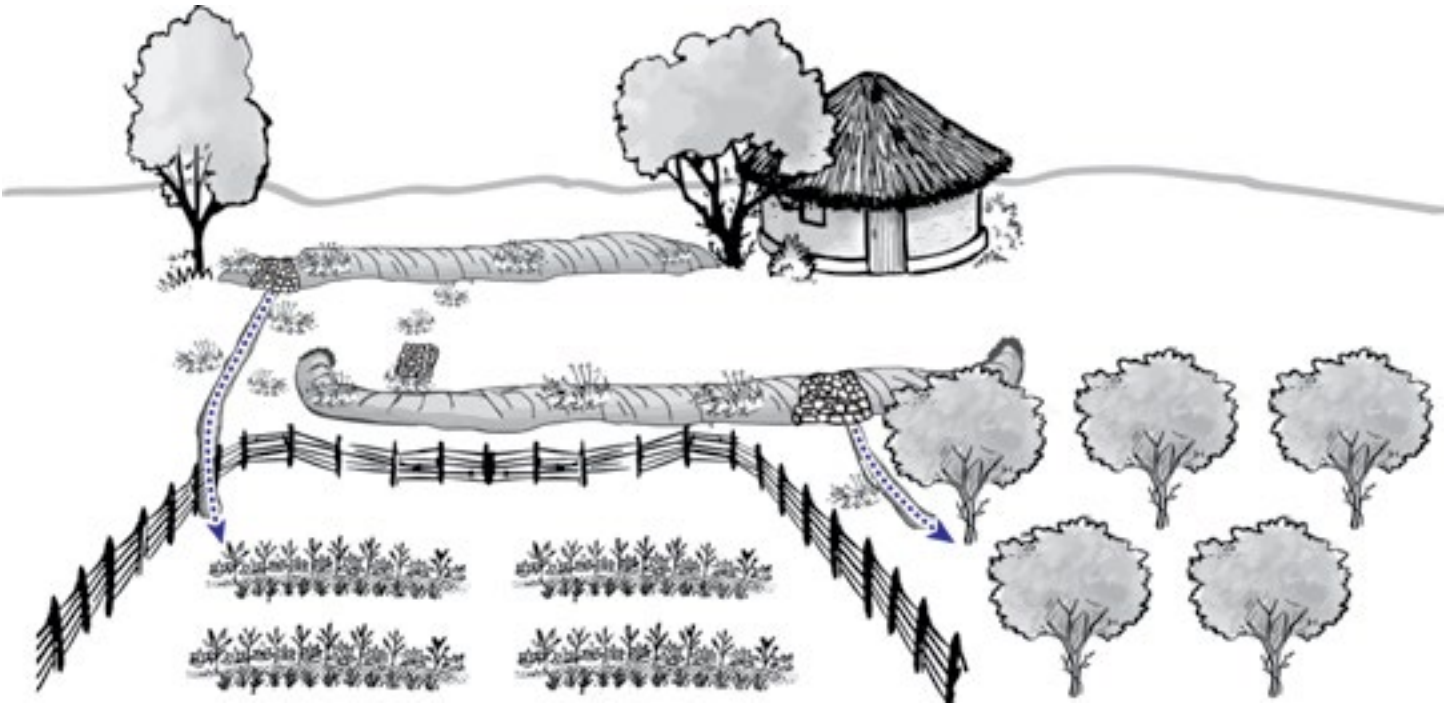
2. Using a calibrated A-frame, mark a contour line and peg out a large swale at a high point in the landscape where the most water is passing. Be sure to cap the ends of the swale and incorporate a spillway that leads to a place where water can be used effectively, such as a plantation, another water harvesting structure, or a mulch pit that is planted with useful species.



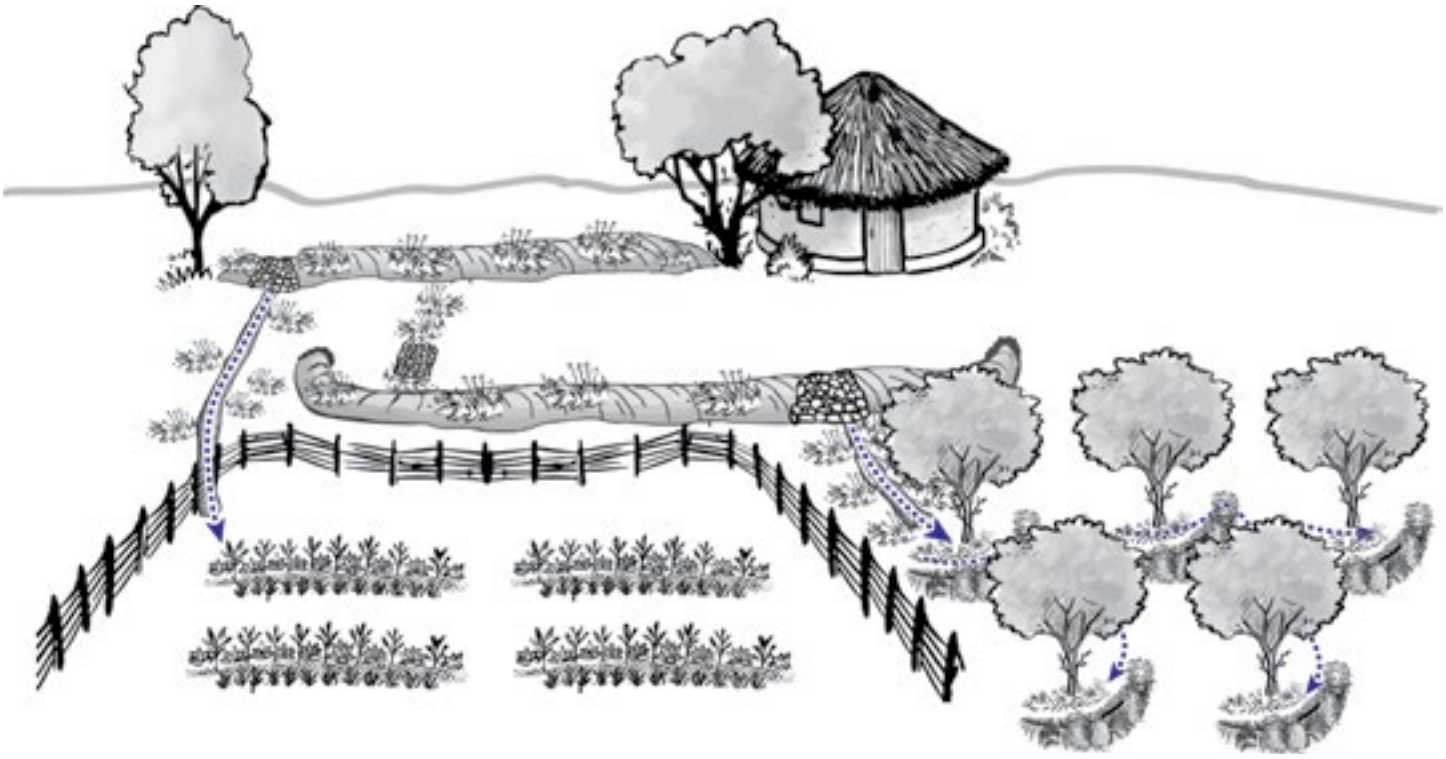
3. A one-rock check dam can be used in addition to a swale. Lay a 1-meter-wide row of rocks along the erosion pathway to slow water down as it is flowing downhill. Several 1-meter-wide dams can be placed along the gully.



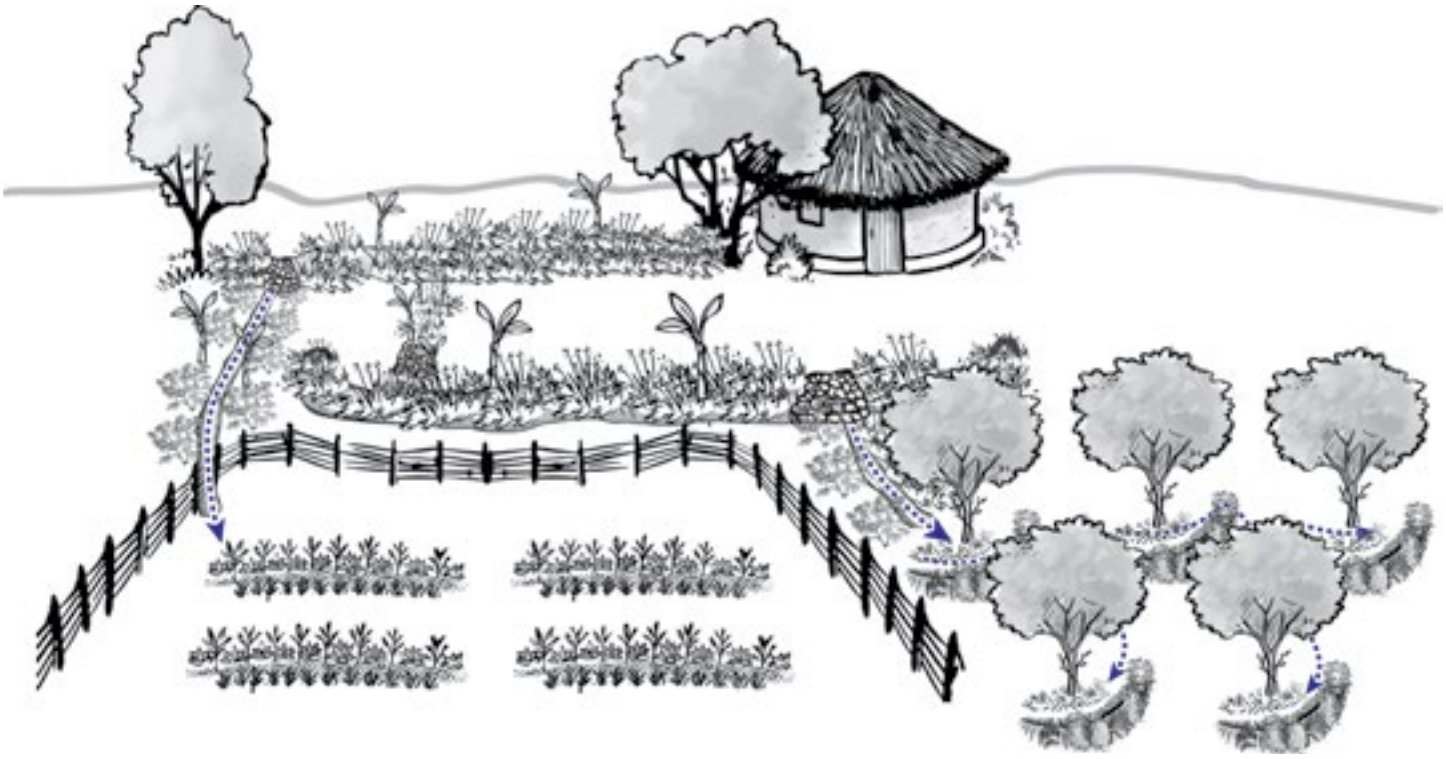
4. Additional swales might be needed on the upslope side of any growing areas to infiltrate water for production and protect the growing beds from flooding.



5. Half-moon berms can be built to harvest rainwater and nutrients to increase the production of existing trees or to support planting new trees. Be sure to plant the berms with other useful and productive crops.

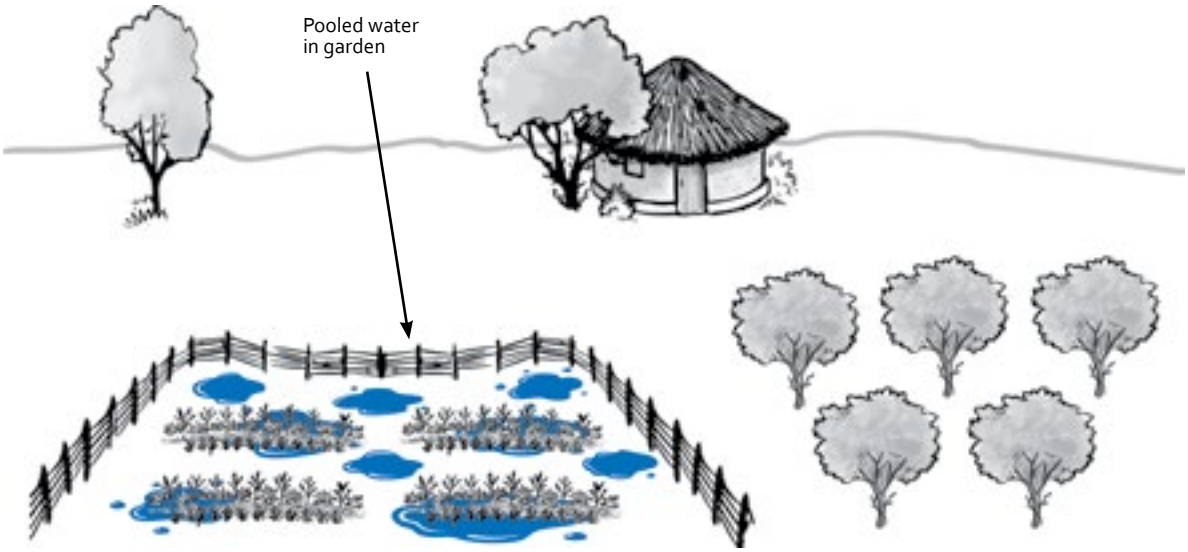


6. Vegetation, such as productive trees, herbs, shrubs and grasses, should be added at all possible points along the landscape to stabilize soils and encourage water to penetrate into the soil rather than flow downhill.

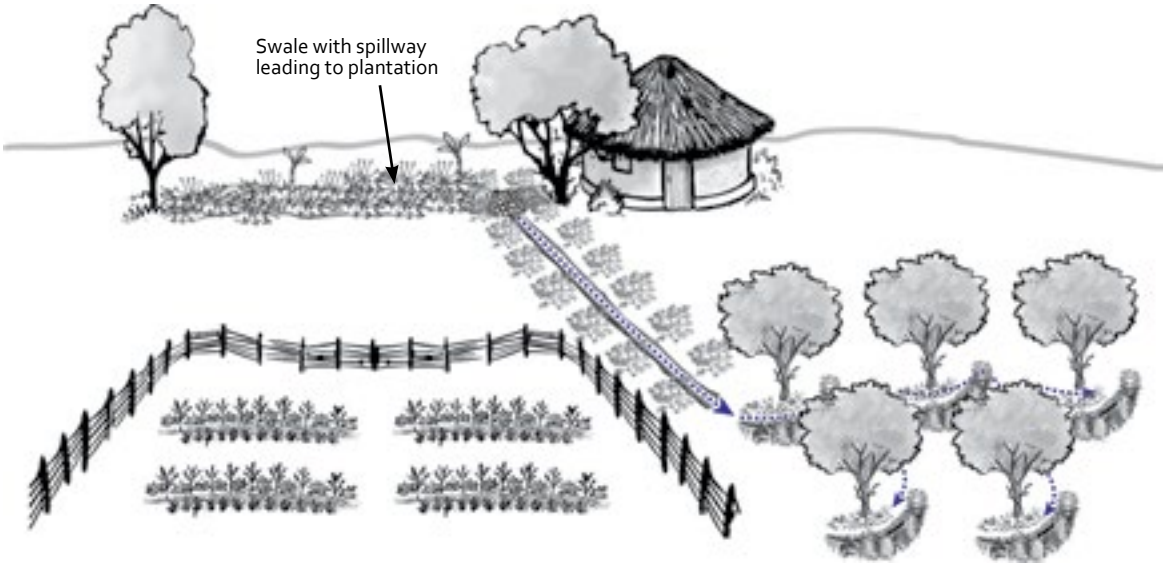


Scenario 2: Flooded and low-lying land

BEFORE



AFTER



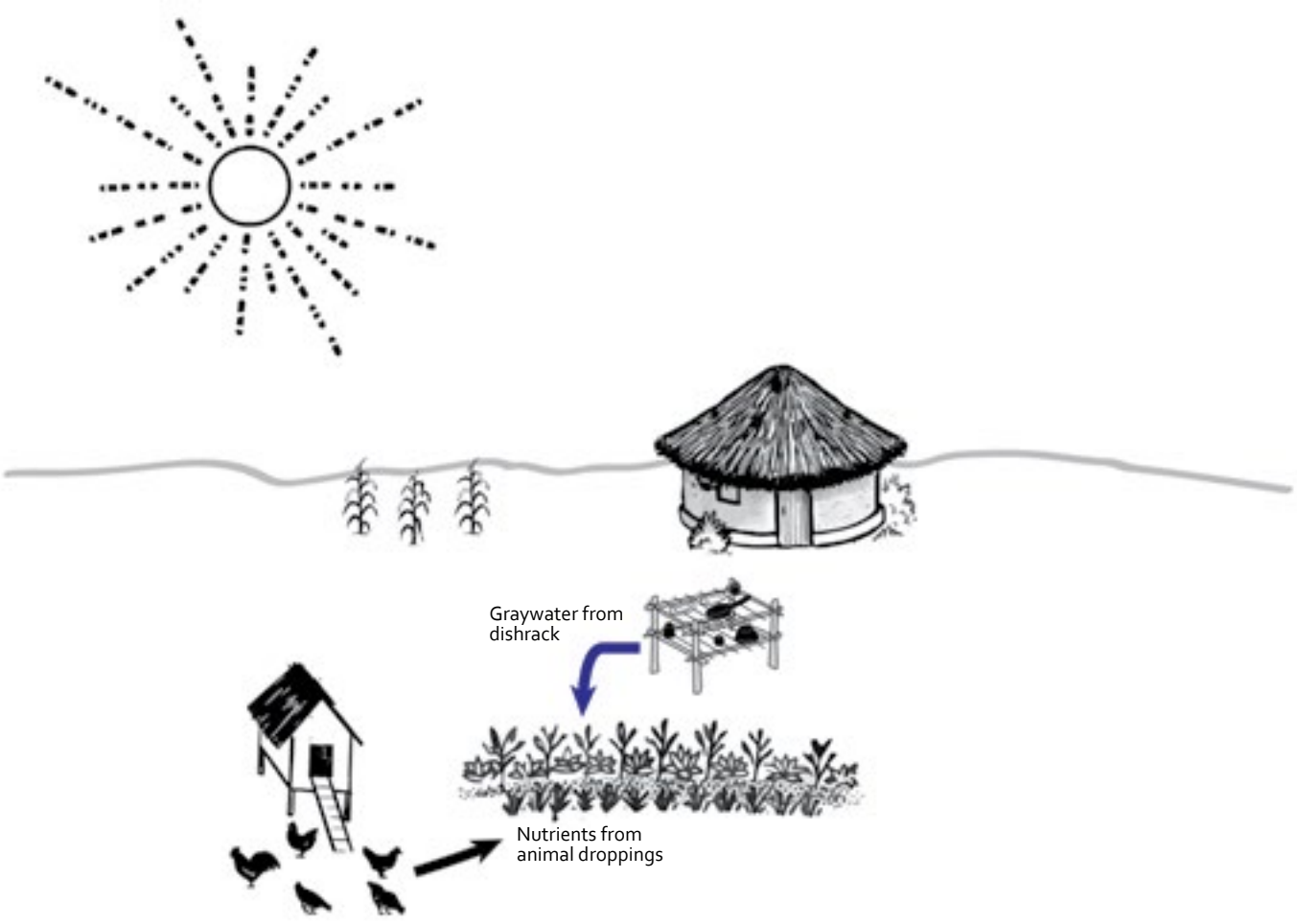
What do you do…

- Find points where water is likely to enter the compound and points where it is pooling. Often, a large swale can be placed at the top of the compound to catch water and divert it before it enters the compound. Water can be diverted to an area where it can be more productive, like a mulch pit, fruit tree, or garden bed.
- Design water harvesting structures with spillways that can drain excess water away from household compounds and growing areas. Make sure the berms and sides of swales are planted so that heavy water flows do not erode them and the spillways are reinforced with stones and planted with grasses. (See Appendix 1)
- Make raised beds digging deeply to prepare the soil (a minimum of 40–60 cm). Reinforce the sides of beds with heavy stones, banana stems, wood, or bamboo. (See "Facilitator Notes: Building and maintaining healthy soils" in section E3)

Scenario 3: Compacted, low-fertility soil

What do you do…

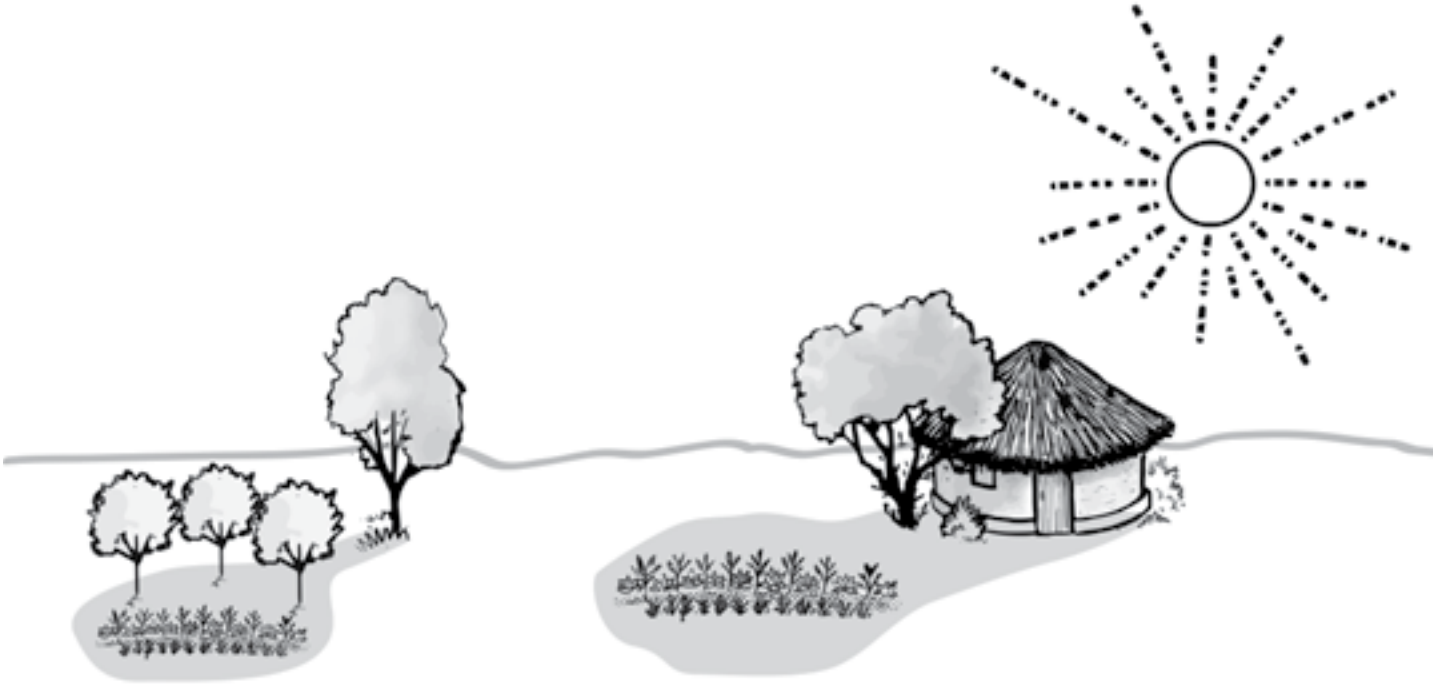
- It is important to first demonstrate to the household the productivity gains that can be made by using deep soil preparation and an abundance of diverse soil amendments. This means starting small, perhaps with just one intensively planted and deeply dug garden bed.
- Pick a location that has easy access to water, for instance near the kitchen, for a small deeply dug bed. The bed does not have to be very big; a 1m x 2m bed can produce enough food to supplement a household's diet and demonstrate what can be achieved with deep soil preparation and a biointensive planting strategy.
- Mark out the area for the garden bed using a stick.
- Using an A-frame, also mark out and dig a small, protective swale upslope from the garden bed.
- Using deep soil preparation, dig the garden bed (a minimum of 40–60 cm). Use the A-frame to make sure the bed is aligned with the contour.
- Add as many diverse soil amendments as are available to the subsoil and topdress the topsoil layer of the bed with a small amount of dry manures and ash.
- Plant the bed with a diversity of crops and mulch heavily around the seeds and seedlings without covering the seeds with mulch.
- If the household is also experiencing a large amount of runoff passing through their compound, which is contributing to soil erosion problems, then an additional, larger swale can be placed at the top of the compound to catch water and divert it before it enters the compound. (See Scenario 1)



Scenario 4: Extreme wind and/or sun exposure

What do you do…

- Identify the direction of the most sun and wind exposure. For sun, identify what areas are most affected by the harshest afternoon rays.
- Plan new growing areas so that they are sheltered by existing infrastructure or trees or plant new trees to create shade. This could mean planting on the western side of buildings or trees to avoid afternoon sun exposure. It could also mean sheltering smaller plants under larger plants.
- Since sun and wind exposure can lead to greater water loss from soils, cover soils adequately with a heavy layer of mulch.



- Devise a plan for protecting existing growing areas, such as erecting a shade structure where possible and/or creating windbreaks.
- In arid regions, use mulched sunken garden beds to capture and retain any available water and protect it from the sun and wind.

Scenario 5: Animal intrusion into growing areas

What do you do…

- Evaluate the integrity of the fences surrounding the main growing areas.
- Determine if any living plants can be added to the fences to help strengthen them in the long term.
- Discuss a plan with any neighbors or community groups to contain animals during sensitive growing or harvest periods.

APPENDIX 3: Resilience Design Checklist

Name:																					
Date:	Transect #1					Transect #2					Transect #3					Transect #4					Notes
Location:	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
1. DESIGN: Site has a context-specific design that optimizes resources and external influences.																					
2. WATER: Site has water harvesting strategies to slow, spread, sink and manage water.																					
3. SOIL HEALTH: Site creates a soil food web that supports sustained production and growth.																					
4. BIODIVERSITY: Site has diversity of plant, tree and animal species that work together to support overall health and production.																					
5. PROTECTION: Site's soil and plants are protected from any negative effects of people, animals, insects, disease, and other external influences.																					

Resilience Design Checklist – Scoring Criteria

1. DESIGN. Site has a context-specific design that optimizes resources and external influences.	
✓-	No site design. Site does not work with local context or use external influences for enhanced benefits (no water harvesting, planting not on contour). Basic ag techniques.
✓	1+ functioning on-contour water harvesting structure (e.g. swale, terrace). Crops on contour. Some mulch. Basic protection from wind, sun, people. Use of local organic resources.
✓+	Multiple strategies to strengthen resilience and extend production. Crops growing along on-contour berms. Mulch covers most soil. Biological fertilizers used and animals integrated.
*	Water harvesting structures are well vegetated with cover crops. Year-round production of plants. Trees are integrated. Farmer observes feedback and adjusts to enhance productivity.
2. WATER. Site has water harvesting strategies to slow, spread, sink and manage water.	
✓-	Water harvesting structures not present or not functioning (e.g. water draining from site). Garden beds off contour. No mulch on beds or compound pathways. Crops and trees show signs of water stress.
✓	+1 structure to slow, spread, or sink water. Permagarden protected from seasonal floods. One on-contour swale and berm, located directly above the permagarden beds. Only one strategy to reuse wastewater. Beds on-contour and mulched. Crops and trees continue to grow during drier times.
✓+	Water harvesting structures and infiltration pits capture excess water from compound. Wastewater captured from 2–3 sources. Greywater mulch basin near kitchen. Garden beds shaded. Adequate mulch. Every tree/plant has catchment basin. Crops and trees show minimal signs of water stress.
*	Water harvesting systems capture and re-use all forms of wastewater (e.g., washing areas for clothes and dishes, hand-washing stand). System catches run-on water from offsite. Living mulches present. One-rock check dams used. Multiple shade strategies (e.g., trellis, trees, taller crops to sunside). Entire site mulched, including pathways. Crops and trees show no sign of water stress.
3. SOIL HEALTH. Site creates a healthy soil food web that supports sustained production and growth.	
✓-	No soil improvement strategies. No compost pit. Beds shallow (<40 cm) and off-contour, with 0–1 soil amendments. No mulch. Farmer only uses inorganic fertilizers or pesticides. Plants show visible stress. Brix reading is below average for the specific crops.
✓	Some use of soil improvement strategies. Compost pit filled with organic materials from regular sweeping of compound. Trees in compound mulched. Animal droppings placed into tree basins. Beds on contour and >40 cm deep. 2-4 soil amendments used. Mulch present. Farmer has single biofertilizer strategy (e.g., compost teas to fertilize crops). Brix reading is average for the specific crops.
✓+	Multiple, separate pits in compound for trash and organic materials. Compost soil used in permagarden beds and tree basins. Beds > 50 cm in depth with +5 soil amendments. Top 10cm of beds fertilized with compost before each planting. Shade structures protect plants and water. Area mostly mulched. Farmer practices intercropping and crop rotation. Farmer makes their own liquid biofertilizers. Brix reading above average for the specific crops.
*	Farmer grows plants to use as garden amendments. Compost pits linked to water harvesting structures to ensure adequate moisture, with food scraps, kitchen waste and organic materials regularly added. Farmer applies multiple fertilizer strategies (foliar feeding, root drenching, layering of mulch materials). Brix reading is at the top of the scale for the specific crops.

4. BIODIVERSITY. Site has a diversity of plant, tree and animal species that work together to support overall health and production.	
✓-	No intentional diversity of plants, trees, and animals on the site. < 3 plant and tree species in compound. < 5 different types of plants in permagarden. Little vegetation coverage and mostly bare ground. Only one crop is growing in the garden beds (monocropping).
✓	4–5 multi-functional plants (herbs, trees, vines, shrubs) present in compound. 1–2 recently planted trees. Permagarden has 6–9 types of plants (fertility, medicinal, pollinators, fruit, fodder, pest repellent) and 2-3 crop varieties, some from local seeds. Berms planted. Mix of annuals, biennials and perennials.
✓+	6–10 multi-functional plants and 3+ new trees planted strategically in compound (e.g., west side of house for shade, windbreak and habitat for bees). 10–12 plants growing within fenced permagarden and surrounding berm. 4+ crops in beds for year-round production, with 1–2 crops grown to provide food in the lean/hungry times and dry season. Entire bed area planted to the edges. Quick maturing plants intercropped with longer maturing varieties.
*	10+ multi-functional plants present in compound which provides year-round production for food and marketing. 13+ multi-functional plants growing and providing shade, soil fertility, fruit, organic material, fodder, pollinators, and pest deterrents. Fence has 3+ species of living plants growing within it. Site has year round growth and +3 crops growing for hunger season harvest. Farmer practices intercropping, crop rotation and seed saving.
5. PROTECTION. Site's soil and plants are protected from any negative effects of people, animals, insects, disease and other external influences.	
✓-	Ground is bare (no mulch or shade). Damage is visible from water flows and wind. There are no protective structures to guard against wind, animals or pests/disease.
✓	1+ water harvesting structure is present up-slope from crops and within fields. Soils have mulch and trees that protect from sun, wind and loss of moisture. Fence or community strategy limits animal access.
✓+	Multiple strategies to protect from water damage and nutrient loss and to protect soil resources (mulch, shade, groundcovers, etc.). > 30 trees/ha to protect against sun exposure/ winds. Site has a living fence.
*	Complete mulch coverage. Trellises protect water harvesting structures from evaporation. Site has a living, productive fence including various plants. Intercropping and push-pull system for pest management.

APPENDIX 4: Common Challenges

RD trainings teach and demonstrate a lot of new concepts. And farmers are constantly observing their farms after implementing RD techniques to look for signs that things are either not working and need to be adjusted, or are working very well and can be replicated and scaled up. When challenges emerge, they present an opportunity to improve the site so that it functions better. Follow-up visits can be a great time to revisit technical concepts learned during the training, such as the proper dimensions of a swale, or to use the checklist to ensure the site is meeting minimum standards. Below are some common challenges, along with ways to understand the challenges and support farmers to address them. See section F1 for more information on observing the farm and adjusting as needed.

COMMON CHALLENGES	HOW TO ADDRESS THEM
Water Harvesting Structures	
Water is draining from the site, not infiltrating	• Check that the A-frame was properly calibrated and used. See section D1. • Next, check that the bottom of the swale is on contour. • If the structure is not on contour, use the A-frame to mark out and reshape the swale along the contour, filling in places that are off contour and digging new sections as needed. • Finally, re-check that the bottom of the swale is on contour using the A-frame. See section D2 and Appendix 1.
Water is escaping the structure	• Ensure there are spillways to allow for a controlled overflow of water into the next structure or to areas of the site where water is needed. • If the spillways are not big enough to accommodate overflow water or the berm is not high enough above the waterline (.5m) to prevent overflow, expand the spillway and/or raise the berm. See Appendix 1. • Again, make sure the swale is on contour and adjust as needed. • Check that the ends of the swale are capped so water can only exit through the spillway.
Structure is eroding	• Stabilize the berm by planting crops, ground covers, useful fodder grasses, and other plants desired by the household. Mulch all bare surfaces to further protect structure from erosion. • Check that the berm and/or ditch angles are not too sharp; adjust so the berm is rounded and the ditch is gently sloped. See Appendix 1.
Biodiversity	
Biodiversity is low or lacking	• Ask the household if they have faced barriers in planting a more diverse range of plants. • Support the household in thinking about innovative locations for plants and how to layer them together. For example, discuss how to plant vertically from tree height to ground cover. See section E2. • Discuss seasonal plant options and what could be harvested at different times of the year. Brainstorm what planting materials can be sourced from their household or their neighbors. • Show the household photos of biodiverse farms to illustrate how many different species the land can accommodate.

Soil	
Ground is bare and/or erosion is present	• Ask the household if they have faced any barriers in covering the ground with mulch or ground covers. • Encourage the household to use any available organic materials without weed seeds or visible disease/pests as mulch (such as branches, leaves, sticks); to incorporate stones; and/or to plant low growing spreading plants. See Appendix 1. • Remove eroded silt that has been captured in swales and use it in fields.
Soil compaction or poor quality soil are present	• Encourage them to use deeper soil preparation in other growing areas, even those outside of the garden beds. • Demonstrate that a diversity of soil amendments should be added to soil around new trees, along fence lines, and any other growing spaces. See section E3. • Encourage planting fertilizer plants around fields to increase access to organic materials. • Ensure growing beds are protected from compaction by animals and humans; encourage the use of fencing and walkways around beds.
Protection	
Animals have broken through the fence and crops are being eaten	• Encourage households to grow a living fence around fields, using plants such as thorn bushes, to provide long term protection. • Until a living fence is established, fences can be constructed with cuttings of trees, shrubs, and/or vines and reinforced with dead material. • Encourage households to discuss and agree upon grazing norms with neighbors.

About SCALE

SCALE (Strengthening Capacity in Agriculture, Livelihoods, and Environment) is an initiative funded by USAID's Bureau for Humanitarian Assistance (BHA) and implemented by Mercy Corps in collaboration with Save the Children. SCALE aims to enhance the impact, sustainability and scalability of BHA-funded agriculture, natural resource management, and off-farm livelihood activities in emergency and non-emergency contexts.

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