



FLOOD MITIGATION AND RISK MANAGEMENT

INTERNATIONAL RESCUE COMMITTEE

WHAT IS THIS USER'S GUIDE?

This guide is a user's guide for training on the basics of flood risk management. Each lesson can be used independently if desired by the program. It was written in Central Virginia, however most of the concepts are transferable across geography.

The need: As weather patterns become more unpredictable and extreme, it is evident that farmers need to develop skills and plans for mitigating and responding to these events if they are to manage successful, sustainable farms for the future. In Charlottesville, VA, our program experienced two 100-year flood events in 2018.

Who made this guide?

ACKNOWLEDGMENTS: This teaching resource was developed by Andy Blunk and Elizabeth Moore of the International Rescue Committee in Charlottesville, Virginia in partnership with the Institute for Social and Economic Development (ISED Solutions). This material is funded by USDA, Risk Management Agency, under award number RM18RMEPP522C018: 'Producing and Using Risk Management Educational Resources and Methods for Refugee Farmers.'

VARIATION:

Throughout this guide, boxes (like this one) contain variations and adaptations that serve varying programs and farmers. They are suggestions and reflections from other programs based on how they made this workshop work for them.

ICONS: You will find the icons below throughout this guidebook. They are there so you are prepared for the activity and can get an idea of what it will bring at a glance.



SIGNS/CARDS



POWERPOINT



WORKSHEET



DISCUSSION



VOCABULARY



INDOOR



OUTDOOR



TALKING POINTS

Is this guide right for you?

- AUDIENCE:**
- **Who:** Refugee farmers and growers
 - **Language / Literacy:** Basic, low literacy
 - **Farming Experience:** Beginner - Advanced
 - **Prerequisites: Skills, experience, and knowledge:** Participants should understand crop planning, basic food safety.
 - **Region/Climate:** This module was developed in the Mid-Atlantic region, but can be used in any climate where there is a risk of flooding on agricultural land.
 - **Program Structure:** This guide is based on a project in which participants grow for home use and sell to restaurants, a farm stand, and to value-added companies.
 - **Season:** This can be taught at any point in the season, but might be best just before the typical wet season of the year so that farmers can put what they learn into practice.

- RESOURCES NEEDED:**
- **Time:** 2 hours
 - **Staff/Interpreters:** 1 staff person + interpreters
 - **Location:** Field with outdoor seating ideally

Resources and Materials Needed to Complete this Module:

- 'Introduction to Risk Management' Flashcards
- 'Different Farms' Flashcards
- 'Low Risk, Medium Risk, High Risk' Activity Poster
- 'Preparing Your Farm for a Flood' Worksheet
- Whiteboard and markers
- Cell phones and a weather app
- 'Preparing Your Farm for a Flood' Flashcards
- 'Preparing Your Farm for a Flood' Poster
- Handout 'Preparing Your Farm for a Flood'
- Surveyor Flags if using actual crops in the field
- 'Harvest or Don't Harvest' Flashcards

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9 LESSON 2 / HOW CAN YOU MITIGATE THE RISK OF FLOODING? 20 MINUTES

- Participants discuss factors that contribute to flooding, and identify how they can mitigate the factors under their control.

12 LESSON 3: WEATHER FORECASTING AND PREDICTIONS 30 MINUTES

- Participants practice using weather forecasting applications to predict flooding events.

16 LESSON 4: FLOOD PREPARATION 30 MINUTES

- Participants discuss how to mitigate damage from flooding in different farm scenarios.

19 LESSON 5: POST-FLOOD FOOD SAFETY CONCERNS & PROTOCOLS 30 MINUTES

- Participants learn how decide which crops are and are not safe to harvest and sell post-flooding.

Objectives and Skills

VOCABULARY: Lesson 1, Introduction: Risk, Risk Mitigation, High Risk, Low Risk, Prevention
Lesson 2, Flood Prevention: Infiltration, Berm, Swale
Lesson 3, Weather Forecasting and Predictions: Radar, Prediction, Forecast, Soil Saturation
Lesson 4, Post-Flood Food Safety: Food safety, Protocol, Cross Contamination



OBJECTIVES: **By the end of this module, farmers will:**

- Understand what risk is and how to mitigate against risk.
- Be able to explain the difference between low-risk and high-risk flood areas.
- Be able to assess the risks of potential flooding.
- Understand how to reduce the risks of flooding.
- Be able to assess options and choose the best areas to plant crops based on flood risks.
- Understand how to prepare their farm for a flood before a flood has occurred.
- Be able to describe/ explain the steps to take to prepare a farm for a flood.
- Understand food safety concerns concerning crops contaminated by flood water.
- Be able to describe/ explain how to prevent cross-contamination after floods.
- Be able to assess options and choose which plants to harvest for market and which to not harvest.

PROOF OF LEARNING: **I will know that farmers have achieved learning objectives because:**

- When there is a possible flood event in the weather forecast, farmers are aware of it, and communicate with one another about their plans.
- Short-term: During planning, farmers include flood planning in their crop planning process
- Long-term: Before a flood, farmers harvest crops that could possibly be affected. After a flood, farmers will know which crops they can still harvest, and will take proper precautions to avoid cross-contamination after floods.

Introduction: What is Risk Mitigation?

1

TIME: 20 Minutes

OVERVIEW:

This lesson introduces the general concept of risk mitigation. It includes group discussion and a game where the group decides which scenarios fit into the categories of high and low risk.

MATERIALS NEEDED:

- 'Introduction to Risk Management' Flashcards
- 'Low Risk, Medium Risk , High Risk' Activity Poster
- 'Different Farms' Flashcards
- Whiteboard and markers

OBJECTIVES / LEARNING:

By the end of this activity, participants will:

- Understand what 'Risk' and 'Risk Mitigation' are.
- Understand the difference between low risk and high-risk flood areas.

VOCABULARY

- Risk
- Risk Mitigation
- High risk
- Low risk
- Prevention

LESSON STEPS



1. **Discussion:** Ask participants if they know what the word "risk" means.

- Definitions of 'Risk':
 - A situation involving exposure to danger
 - The possibility of damage, loss, or injury
- Risk includes the amount of possible damage from an event plus how likely that event will happen.

LESSON STEPS, CONTINUED



- Something very dangerous/ damaging and likely to occur is a 'high risk.'
- Something not very dangerous/ damaging and not very likely to occur is a 'low risk.'



2. High Risk/Low Risk Activity: Using the 'Introduction to Risk Management' Flashcards, give examples of different life scenarios and ask if they are high risk or low risk. Ask the participants to divide the scenarios in the flashcards into 'high' and 'low' risk. Create three columns on the board -one column each for high, medium, and low risk- and place each flashcard in the appropriate column as the participants suggest.

- Eating after washing hands; Walking on a sidewalk—low risk
- Walking in the road—medium-high risk
- Eating after not washing hands; Driving in a car without a seat belt and while texting; crossing the street on a busy road with many cars around—high risk
- Ask if there are any things that people could do to reduce these risks and write their suggestions on the whiteboard
 - Wear a seatbelt
 - Not text while driving
 - Wash hands
 - Walk on the sidewalk

LESSON STEPS, CONTINUED

| Low risk | Medium Risk | High Risk |
|---|------------------------|---|
| Walk on sidewalk | Walk in the road | Walking in the road in front of a car |
| Driving in a car with a seatbelt, no texting | Wearing a seatbelt | Driving in a car without a seatbelt while texting |
|  | Risk Mitigation |  |



- Using the ‘Different Farms’ Flashcards, show examples of different farming scenarios and ask if they are high risk or low risk. Place each of these in the appropriate column on the whiteboard.
 - Farming in a low area right next to a creek, that also receives runoff from higher elevations—medium to high risk
 - Farming in a low area right next to a creek that never rises in height even during heavy rains—low to medium risk
 - Farming in an area with a lot of wildlife--medium risk
 - Farming in medium elevation area far from creeks, with good fencing—low risk
- Ask if there are any things that farmers could do to reduce the risks from flooding or wildlife. Write their ideas on the board.
- Explain that these actions, which reduce risk, are called ‘risk mitigation.’ They might move something from the high risk column to the medium risk column, or the medium risk column to the low risk column.

How Can You Mitigate the Risk of Flooding?

2

TIME: 20 Minutes

OVERVIEW:

This lesson includes a discussion and brainstorming about factors that contribute to flooding, separates factors which farmers can and cannot control, and covers how farmers can mitigate the factors under their control.

MATERIALS NEEDED:

- Whiteboard
- Whiteboard markers

OBJECTIVES / LEARNING:

By the end of this activity, participants will:

- Understand what is under their control to mitigate against floods.
- Be equipped with some tools for mitigating the effects of flooding.

VOCABULARY:

- Infiltration
- Berm
- Swale

LESSON STEPS



1. **Discussion:** “Have you experienced flooding before? Where and when?” “Some aspects of flooding you can’t control and some you can. What sort of things are outside your control? What is in your control?”

Write on the board two columns ‘Can Control’ and ‘Can Not Control.’

LESSON STEPS, CONTINUED

| Can Not Control | Can Control |
|--|---|
| <ul style="list-style-type: none">• How much it will rain in a year or a single event• Building development and increased pavement runoff upriver | <ul style="list-style-type: none">• Farm management and systems• Decisions about crop and livestock• Equipment management• Movement of materials• Timing of planting and farm activities• Shaping the land |

From the list above, provide whatever information is not brainstormed by the participants.

- **Know your land**

If you have some land in a flood area and some land that doesn't flood as much, place your long-term crops in the non-flood area, and shorter rotation crops in the flood prone area. That way, if it floods, you can quickly replant and haven't lost an entire season. Some crops also may be more flood resistant, and these could be good candidates for the flood prone areas as well.

LESSON STEPS, CONTINUED

- **Encourage Water Infiltration** by treating your soil well. Infiltration is the movement of water into soil (It can be helpful to compare this to the movement of water into a sponge). The more water that infiltrates (goes into) the soil, the less water there will be to flood over the surface of your farm.

What you can do:

1. Reduce heavy machinery usage to reduce soil compaction
2. Organic matter in soil improves water holding capacity and infiltration of soil.

- **Physical Prevention** - preventing extra water from standing or running through your fields

What you can do:

1. Run-off ponds, rain gardens, berms—can direct water into focused areas away from fields
2. Water catchment off of buildings—can capture some water and prevent it from going into fields
3. Riparian buffers—can prevent waterways from eroding banks
4. Drainage channels—can help water exit quickly

Weather Forecasting and Predictions

3

TIME: 30 Minutes

OVERVIEW:

This lesson begins discussion of planning for floods. Participants learn how to use weather forecasting applications on their cell phone to recognize when weather forecasts indicate that potential flood is likely to occur.

OBJECTIVES / LEARNING:

By the end of this activity, participants will:

- Use cell phone apps to understand weather forecasts
- Use weather forecasts to predict potential flood events

MATERIALS NEEDED:

- Cell phones and a weather app

VOCABULARY:

- Radar
- Prediction
- Forecast
- Soil Saturation

LESSON STEPS

- 1. Introduction:** Ask “How do we know when to prepare for a flood?” “What tools do we have to predict when a flood might happen?”

LESSON STEPS, CONTINUED

Explain that there are internet sites which tell the weather forecast.

A *weather forecast* is a description of what kind of weather we will have in the future: tomorrow, over the next 5 days, or longer. Scientists use technology to learn in advance if there will be rain, snow, storms, or other weather conditions.



Discussion: How did you forecast rain and other types of weather before you came to the U.S.?

Ask if anyone has ever used their phone or computer to look up the weather.

2. Practice with Cell Phone Weather Forecasting Apps:

Have everyone take out their cell phone and look at the weather forecast. Different weather apps have slightly different layouts, so it is helpful to group farmers together by their phone/app type.

- Talk about different symbols (rain, sun, clouds, snow).
- What does the percentage of rain mean?
 - 0% means it will not rain
 - 100% means that it will definitely rain
 - Numbers between 0 and 100 show how much chance of rain there is.
 - 50% means a 50-50 chance. 5% means almost no chance. 95% means a high chance of rain.

LESSON STEPS, CONTINUED

- What is humidity?
 - Humidity is the amount of water vapor in the air. Air that feels dry has low humidity. Air that feels sticky or damp has high humidity.
- How do we know how much rain might fall?
 - Some weather apps include special forecasts for farming/gardening which will include predicted rainfall in inches.
 - Some apps include severe weather warnings or maps that farmers can use to learn whether flooding is predicted.

Using radar can provide very accurate forecasts of the near future.

- Have everyone bring up radar on their phones and look at the future radar predictions
- Discuss how the clouds, and different precipitation levels are represented in radar if people are unfamiliar.

Show the difference between looking at the hourly, 5-day, and 10-day weather forecasts. Knowing that it may rain for 3 or 4 days in a row gives you more information about whether you may have trouble with flooding than looking at the weather for just one day.

Closing: Checking the weather daily is an important practice to track weather events and inform flood preparations and farm/garden management.

LESSON STEPS, CONTINUED

3. Discussion: In order to predict flooding in your specific location, it is important to know how much rain, and in what context, has caused flooding in the past. For example, during 2018, flooding occurred in Charlottesville, VA when, with the ground already saturated, 6 inches of rain fell in 1 night.

Important considerations:

- **Soil Saturation** before a rain event
 - Soil is saturated when it already holds as much water as possible. Any additional water/rain will sit on (puddles) or run-off of the surface, contributing to the risk of flooding.

To illustrate this, you can use a sponge: saturate it and then pour more water onto it, demonstrating that it cannot hold any more and water will run off.

- **Duration** of rain event
- **Duration** of rain event (how long it rains)
- **Intensity** of rain event (how much rain falls - in inches)
- **Frozen Soil** is a concern in colder regions because frozen soils prevent water infiltration.



Review and discuss the possible effects of different amounts of rain and soil conditions on your specific land. How might you imagine some different scenarios with 6 inches of rain?

- Does 6 inches of rain always result in a flood?
- What if that 6 inches falls over 7 days instead of one?
- What if the soil is dry when it starts raining?

Flood Preparation

4

TIME: 30 minutes

OVERVIEW:

In this lesson, participants will go over different scenarios of farm layouts, and develop plans for how they will protect and prepare their farm if a flood event is predicted.

OBJECTIVES / LEARNING:

By the end of this activity, participants will:

- Understand how to prepare their farm for a flood before it has occurred.

MATERIALS NEEDED:

- 'Different Farms' Flashcards
- 'Preparing Your Farm for a Flood' Flashcards
- Handout 'Preparing Your Farm for a Flood'
- Poster 'Preparing Your Farm for a Flood'

LESSON STEPS



1. 'Preparing Your Farm for a Flood' Flashcards:

- Hold up or pass around a scenario photo of a farm with various farm materials in the field. Or, you can divide people into groups and give each group a photo. Ask participants to describe what they see in each photo.
- They may mention that there are livestock pictured, or harvest/wash station equipment, or other tools around, and that these things would need to be moved prior to a flood event. They may also mention the possibility

LESSON STEPS, CONTINUED

of installing some of the land features mentioned in an earlier lessons (berms, rain gardens). Participants can be encouraged to talk about where they would put berms or other flood mitigation features.

- Explain that flooding is possible in each of the scenes in the photos. Provide information about high, intense rainfall predictions and state that the soil is already saturated.
- Ask participants what actions the farmer needs to take to prepare each pictured farm for the predicted flood. As they name actions, place a photo on the board that represents the categories below (and the one that refers to what they said). When they have finished offering ideas, put up the remaining photos and ask what they need to do to protect those items.
- What would they need to do to protect:
 - **Human safety?** - Communication systems. Put up signs and call or text people.
 - **Machinery and equipment ?**- Move it to high ground ahead of time.
 - **Fencing?** - Move it if transportable. Reinforce. Open gates to allow a passageway for water.
 - **Crops?** - Harvest things that can be harvested ahead of time.
 - **Livestock?** - Move to higher ground and provide shelter from rain.
 - **Chemicals/fuels?** - Move to high ground. Reduce risk of it contaminating water.

LESSON STEPS, CONTINUED

- Contingency plan for **market** - Have a plan in place to communicate with markets you sell to to let them know you will not be able to deliver and what was affected.



2. **Small Group Discussion:** Ask the participants, “Can you think of other things you would do to prepare for a flood, especially at your current garden site?” Or ask them to talk about what they did to prepare for a flood in the past. What might they do differently in the future? Have participants talk in groups and discuss other preparations they might make. Ask each group to share their ideas with the class, and post their ideas on the board under the appropriate category (Human safety, machinery and equipment, crops).



3. After the above discussion, give each participant a copy of the ‘Preparing Your Farm for a Flood’ Handout to each participant.

Place the Poster ‘Preparing Your Farm for a Flood’ in a readily accessible location on the farmsite or classroom for farm participants.

Post-Flood Food Safety Concerns and Protocols

5

TIME: 30 minutes

OVERVIEW:

This is an introductory lesson on food safety. It includes a game that provides different examples of flooded crops for farmers to discuss when and when not to harvest.

MATERIALS NEEDED:

- 'Harvest or Don't Harvest' Flashcards
- Surveyor Flags if using actual crops in the field

OBJECTIVES / LEARNING:

By the end of this activity, participants will:

- Understand food safety concerns and harvest protocols following flood events.
- Know when and which crops are contaminated or uncontaminated after floods.

VOCABULARY:

- Food safety
- Protocol
- Cross-contamination

LESSON STEPS



1. **Introductory Discussion:** "Why are we concerned if flood water comes in contact with our produce? What are the risks?"
 - Food safety
 - People can become sick
 - You can lose customers
 - Law suits or other legal action

LESSON STEPS, CONTINUED

2. Flood Contaminants:

- **Describe a Post-Flood Scenario:** “Our farm has been flooded in the middle of our growing season. The river rose above the bank and flowed through our farm over 2 feet high. What could be in the water that has flooded the farm? Why are we concerned about this water?”

- Flood water contains everything that is upstream from our farm:

- **Microbial Contamination**

- Bacteria, parasites, viruses, etc. from things being put into the stream
- Runoff from other farms
- Manure
- Runoff from roads
- Sewage from septic systems or overflow from treatment plants

- **Chemical Contamination**

- Heavy metals, oils, gas
- Agriculture fertilizers
- Salts etc. from farm run-off
- Developments

LESSON STEPS, CONTINUED

- **Food Safety Protocols:** The FDA has food safety protocols in place so that these dangers from flood water do not enter the food system. The rules are as follows:

- If the edible part of the plant has been exposed, it is considered contaminated by the FDA. It should not be sold and there is no way to fix it.

- The crop may not be exposed directly, if the edible part of the plant had not yet developed, or the edible part was above the flood water levels. These parts can be harvested and sold.

- Even if the edible part of the plant was above flood water levels, it may still have come into contact with flood water through splashing. For these cases the farmer must use their judgment.

- For home use, you may be willing to take the risk for crops that you will cook. Cooking long enough at a high temperature will kill some of microbes and reduce the risk of foodborne illness. Freezing will not kill them.

- **Cross-Contamination**

- Cross-contamination happens when soil that is contaminated touches vegetables or is moved to other areas where it could bring along the bad contaminants.

- Example: A farmer walks in contaminated soil that gets on her boot. Her boots carry that contaminated soil to the uncontaminated part of the farm.

LESSON STEPS, CONTINUED

- What can a farmer do to prevent cross contamination?
 - Place markers/flags at the high-water line so that they can remember what was below or above the flood level.
 - Leave a buffer between contaminated areas and where harvesting goes on, to avoid cross contamination.
 - When in an area that has been flooded, wear gloves and boots to avoid coming in contact with contaminated plants.
 - When replanting in a farm that has been flooded, it is important to wait 60 days before planting something else for human consumption.



3. ‘Harvest or Don’t Harvest?’ Game: Show participants flashcards with different scenarios of crops coming into contact with flood water. Ask them, “What risks do you see? Can these crops be harvested and sold?”

Examples:

1. Kale contacted by flood water is high risk and cannot be sold.
2. Kale untouched by flood water, but flood water was 6 inches beneath bottom leaves: This is a medium risk because leaves may have been splashed, and sometimes people eat kale raw.
3. Tomatoes trellised 4 feet up in a 1-foot flood are a low risk. Check for splashing on the surface of the tomatoes.

LESSON STEPS, CONTINUED

4. Eggplant that were flowering during the flood but completely submerged are a low risk because they were in flowering stage and will develop after the flood recedes. They can be at risk of cross-contamination if they come in contact with contaminated soil or hands (contaminants may be in the soil for 22 days).

Ask the farmers to develop their own scenario in which they are not sure whether the crop can be harvested or not. As a group, discuss each participant's scenario and the group's answers.



Advanced Alternative: For Activity 3, Instead of using flashcards, if crops are in the field, the group can do a field walk and look at actual vegetables growing. The instructor will explain where the flood reached and ask participants about specific crops: Can they be harvested and sold, or not?