TTLM – Flood-based Farming

Learning Outcome 1: Introduction to the concept of Flood-based Farming

Guiding questions for discussion (page 33)

1. How are the farming practices in the lowlands of Ethiopia?
   Answer: most community members have a pastoralist background and crop cultivation will be new to them.
2. What is the understanding of the community regarding floods in the lowlands?
   Answer: Floods have for a long period been seen as a threat, but communities are increasingly becoming aware of the productive use of floods for agricultural production, livestock and drinking water supply, among other socio-economic benefits.
3. What are the benefits and challenges of floods in the lowlands?
   Answer:
   Benefits: floods deposit nutrient-rich sediments on the soil, contributing to soil fertility. Floods also provide moisture enabling crop growth/biomass production. They recharge groundwater and fill reservoirs for livestock and drinking water supply.
   Challenges include floods, which, if not properly managed, can result in damage to agricultural areas (affecting both food and fodder crops), the landscape, and urban and rural habitats. In the worst-case scenario, floods can lead to human and livestock mortality.
4. What is Flood-based Farming?
   Answer: Flood-based Farming (FBF) is a traditional agricultural practice that involves using floodwaters for agricultural (food and fodder) crop cultivation. This technique is typically used in areas with seasonal floods, such as

ephemeral river basins and floodplains, where the floodwaters can provide nutrients and moisture to support crop growth.

5. Why is FBF important for the lowlands of Ethiopia?
   Answer: To boost agricultural productivity and mitigate the negative impacts of floods.
6. What are the (four) types of FBF?
   Answer:
   - *Flood plain agriculture*
   - *Spate irrigation*
   - *Flood inundation canals*
   - *Depression agriculture*

Self-Check Test (page 34)

Part I: Short Answer

1. What is FBF (2pts)?
   Answer: As defined in the above.
2. List three types of FBF more appropriate for your area (3pts).
   Answer:
   - *Flood plain agriculture*
   - *Spate irrigation*
   - *Depression agriculture*
3. List 4 ways to increase the productivity of FBF (4pts).
   Possible answers:
   - *floodwater diversion, distribution and management*
   - *groundwater recharge and use*
   - *agronomic practices*
   - *governance and institutional arrangements*

4. How can Water Spreading Weirs (WSWs) have a role in FBF (3pts)?
   Answer:
   - *WSWs are masonry structures that span the entire width of a riverbed or large parts of a valley floor to spread floodwater over the adjacent land area.*
   - *They are designed to spread and redistribute as much floodwater – including its sediment load – as possible, as well as to reduce soil erosion.*
   - *WSWs are low-based structures made of natural stones and cement.*
   - *WSWs are different from a dam, which is designed to retain water, a WSW does not block the water flow completely but spreads water and its sediments, reducing the velocity of water flow by enhancing the length of the waterway.*
   - *The areas upstream and adjacent to a weir are temporarily flooded, allowing water to infiltrate into the soil and sedimentation to accumulate, thereby recharging groundwater stores, increasing vegetation, and creating favourable drainage patterns.*

Learning Outcome 2: Flood-based Farming as part of DVRPU

Guiding questions for discussion (page 54)

1. What is your understanding regarding WSWs?
   Possible answers:
   - *WSWs are low retention walls designed to dissipate flash floods into rangelands and farms along with fertile sediments while also reducing runoff and soil erosion. Sedimentation could improve the physical, biological, and chemical properties of soils; build up soil depth, increase crop production, and keep production costs low as no cost of fertilizer is involved.*

- *WSWs are made of natural stone and cement and consist of a spillway in the dry riverbed itself, lateral abutments for stabilization, and wing walls that span the width of the valley perpendicular to the dry river on both sides of the spillway.*
- *WSWs alter flood velocity, direction, and spatial pattern of moisture and sediment deposition modifying spatial distribution of soil moisture, soil chemical characteristics, and thereby productivity depending on how effectively water and sediment load from flood events are spread over the command area.*

2. How are FBF as part of DVRPU practised in the lowlands of Ethiopia?
   Answer: In the DVRPU FBF system, the planting area is divided into multiple zones that match plants and crops to the different moisture gradients caused by flooding. This enhances productivity and maximizes the benefits derived from the rehabilitated areas.
3. What are the benefits and challenges of FBF as part of DVRPU?
   Answer:
   <u>Benefits:</u> Reducing runoff and soil erosion FBF contributes to the productive use of the WSWs, increasing the socio-economic benefits of the DVRPU approach.
   <u>Challenge:</u> WSWs may alter the flood course and distribution of fertile sediments and nutrients. FBF can lead to the weakening of and contribute to the failure of the physical structures in case tillage is done too close to the structures.
4. Why is FBF as part of DVRPU important for the lowlands of Ethiopia?
   Answer: Within the DVRPU approach, the implementation of productive use of floods forms an important building block and the final step. The productive use of the valleys, mainly through FBF, is one of the major ways of harvesting the benefits of the rehabilitation efforts.

Self-Check-Test (page 55 & 56)

Part I: Multiple-choice

1. On what source of water does farming in the lowlands depend on the most?

A. Groundwater
B. <u>Floodwater</u>
C. Rainfall
D. Dew water

2. What does 'field capacity' mean?
Answer: field capacity refers to the water content in the soil that remains after excess water has drained away, leaving the soil moist but not waterlogged.

Part II: Short answer

1. Explain what WSW is. (2pts)
   Answer: WSWs are low retention walls designed to dissipate flash floods into rangelands and farms while also reducing runoff and soil erosion. They are made of natural stone and cement and consist of a spillway in the dry riverbed itself, lateral abutments for stabilization, and wing walls that span the width of the valley perpendicular to the dry river on both sides of the spillway.
2. What is the main difference between WSW and a dam? (2 points)
   Answer: WSW is different from a dam, which is designed to retain water. A WSW does not block the water flow completely but spreads water and its sediments, reducing the velocity of water flow by enhancing the length of the waterway.
3. Explain FBF as part of DVRPU. (3 pts)
   Answer: As explained in the above.
4. What is the most essential information required for practising FBF as part of DVRPU? (2 pts)

Possible answers:

- *Flood timing, number and volume.*
- *Soil moisture holding and infiltration capacities.*
- *Frequency and intensity of rainfall*
- *Moisture zonation*
- *Planting zones*
- *Climate and meteorological data*

5. Explain soil moisture and its importance in FBF as a part of DVRPU (2 points)
   Answer: Soil moisture: refers to the entire quantity of water in the soil pores or on its surface.
   - *The moisture content of soil depends on such factors as type of land, and vegetation cover.*
   - *Soil moisture determines the field's readiness for agricultural processing.*
   - *Ultimately, the soil moisture effect on plant growth and yield is vital, particularly in FBF where plants complete their growth cycle based on residual moisture – there is no water supply during plant growth.*
   - *Soil moisture also affects the physical, chemical, and biological properties of the soil.*
6. List factors affecting soil moisture (2 pts)
   Answer:
   - *Texture: Finer soil particles contribute to better moisture retention due to increased surface area and water-holding capacity.*
   - *Structure: Porous soil structure with high aggregation enhances water retention by providing spaces for water to be held within the soil.*
   - *Organic Matter Content: Higher organic matter content is associated with increased water-holding capacity, as organic matter acts as a sponge, holding water in the soil.*
   - *Density: Higher soil density can limit water penetration, reducing the amount of water available to plants.*
   - *Temperature: Moisture content tends to be higher at lower temperatures, influencing the availability of water for plants.*

- *Salinity: Higher salt content in the soil can decrease the ability of plants to absorb water, as salt acts as a natural absorbent.*
- *Depth: The depth of the soil profile affects the amount of water available to plants; deeper soils generally provide more water and nutrients to plants.*

7. List 3 ways you can use to identify soil moisture around the WSWs (3 pts)
   Answer:
   - *Visual observations*
   - *Feel method.*
   - *Gravimetric method*

Learning Outcome 3: Crop production using Flood-based Farming

Guiding questions for discussion (page 64)

1. Which crops are commonly (if any) produced in your area/region?
   Answer to be provided by the learner, depending on his experience/context.
2. What are the benefits and reasons for the production of this particular crop?
   Answer to be provided by the learner, depending on his experience/context.
3. Do you see the potential for another crop? Which and why?
   Answer to be provided by the learner, depending on his experience/context.
4. Are there any other criteria, not listed in the Information Sheet, that you can think of?
   Answer: criteria provided in the TTLM:
   - *Water/moisture availability: Water is often the limiting factor in semi-arid regions, so crop types that are drought-resistant and can tolerate low moisture conditions should be selected. Some examples of crops that can survive in low-water conditions include millet, sorghum, and legumes.*

- *Soil type: Soil type is also an important consideration, as semi-arid areas often have sandy or loamy soils that are low in nutrients. Crops that can thrive in these soil conditions include sunflower, pearl millet, and cowpea.*
- *Temperature: Semi-arid regions have high temperatures during the day and cold temperatures at night. Crops that can tolerate extreme temperatures, such as maize and beans, are good options.*
- *Market demand: The selection of crops should also take into account market demand. The selected crops should have a market value and should be profitable for agropastoral communities. Some crops that have a high market demand in semi-arid regions include cotton, sesame, and groundnuts.*
- *Pest and disease resistance: The selected crops should also be resistant to pests and diseases that are common in the region. Some crops that have good resistance to pests and diseases include cowpea, sorghum, and groundnuts.*
- *Community or personal preference for the use of the crop, will influence the demand for the crop, besides the market demand.*
- *Distance of the fields from the home. This will influence the time available for the cultivation of the field and the management of the crop. With a greater distance, there will likely be a preference for a crop which is less demanding in terms for instance, weeding.*

Self-Check-Test (page 65 & 66)

Part I: choose the best answer.

1. How do you recognize when maize is ready for harvest (2pts):

A. The cops (maize fruit) fall on the ground.
B. Blackened at the top of the crop.
C. Leaves turn yellow.
D. The leaves around the crop open up.

2. Which of the following characteristics is not a criterion for the crop in the lowlands of Ethiopia (2pts)?

A. Short maturity
B. Pest and disease tolerant
C. Profitability on the market
D. Drought tolerant
E. <u>Water intensive</u>

Part II: short answer

1. Explain the importance of crop type selection for FBF as part of DVRPU in the lowlands (3pts)
   Answer: The choice of appropriate varieties is very important for the success of Flood-based Farming in terms of its productivity, income generation and sustainable uptake by the community.
2. List 4 Crop type selection criteria for FBF as part of DVRPU in the lowlands (4pts)
   Possible answers:
   - *Biomass productivity*
   - *Less nutrient-demanding crop*
   - *Short maturity (2-3 months)*
   - *Drought resistance*
   - *Pest and disease resistance*
   - *Multi-purpose crops*
   - *Community preference*
   - *Availability of market for the produce*
3. What crop types are proposed for FBF as part of DVRPU in the lowlands (3pts)
   Answer: Cereals, pulses, oil seeds, vegetables and fruits, fodder and multipurpose trees.

Learning Outcome 4: Farming System Management

Guiding questions for discussion (page 93)

1. What does Farming System Management include and what is the importance?
   Answer: Farming system management includes all the side activities that need to be done next to the farming itself. Proper management will help utilize the potential of the crops and the available moisture and gives clarity on the steps to take.
2. What is generally the understanding of the community regarding farming?
   Answer to be provided by the learner, depending on his experience/context.
3. What do you think are the benefits and challenges of farming in the pastoralist community?
   Benefit: Providing a source of income and stability, providing water for the livestock
   Challenges: Farming in pastoral areas brings challenges to the free movement of livestock. Proper management is required to avoid conflicts between livestock grazing and crop production.
4. How do you think communities would participate in farming?
   Answer to be provided by the learner, depending on his experience/context.

Self-Check Test (page 94 & 95)

Part I: choose the best answer.

1. Which of the following is not necessarily important in the storage of crop harvest: (2 pts)

A. Dry space
B. Well- ventilated
C. <u>They are transported within 1 month.</u>
D. Use of multi-layer bags

E. Free from the floor

2. What is essential in horizontal learning practices? (2 pts)

A. <u>Peer-to-peer learning, no hierarchy</u>
B. Communities have shared meetings.
C. There needs to be someone who supervises all the time.
D. Scientific proof for good practices

Part II: short answer

1. Explain farmland preparation and how it can be done. (3 pts)
   Answer: Farmland preparation aims at preparing the land for the seeds to be sown, including storing soil moisture. Options are:
   - Ploughing before floods to stimulate infiltration (applicable for low infiltration rate soils). For ploughing use can be made of livestock or single axle tractors or 4-wheel tractors, depending on the availability of the machinery.
   - Conservation agriculture (Minimum/zero tillage farming)
   - Mechanized agriculture
   - Mulching
2. List crop protection and management hazards that should be considered in Flood-based Farming as part of DVRPU and explain the prevention mechanisms. (4 pts)
   Answer: The main hazards are pests, diseases and weeds. Prevention mechanisms are:

   <u>A. Pests:</u>

   - Removal of dead crop material (e.g., maize) residues to reduce the possibility of pests. Near the end of the flooding season, make sure to keep

the residues somewhere, as these can be used to cover the soils to retain moisture for a short second growing season of pulses and legumes.
- Locust outbreaks
- No barns close to the fields, as they attract rodents (rats).
- Integrated Pest Management (IPM) instead of using chemicals.
- Inter-cropping with sunflower and pigeon peas can reduce the pest white grub.
- Place a stock with some old clothing on to scare birds.

B. Disease:

- Inspect the crop regularly for diseases. If you spot one, collect the infected plants and burn them away from the field so that the disease does not have a chance of spreading. Be sure to check more often after the identification of a disease, as it might have spread to other crops.
- Dead crop material is attractive for diseases to form. Therefore, make sure to remove and process the dead crop material safely, for example through composting.

C. Weed:

- Especially in the early stages of crop growth, the crop needs enough moisture, nutrients, and light.
- To avoid the competition for these resources, make sure that the fields are weed-free during this period.
- Afterward, weed by hand regularly.
- A general scheme for cereal crops (maize, millet, sorghum) can look as follows (could be altered for specific crops).
    - First weed control around 2-3 weeks (15 - 25 days)
    - Second weed control after 5 weeks (35 - 40 days), and
    - Third weed control after 7 weeks (50 - 55 days).
    - For weed control, field cleaning before planting is a smart additional practice.

3. List methods of farmland protection. (2 pts)
   Answer: (1) Protection of farmlands (fencing) and (2) by-law creation among community members