

Making a transect walk in the inland-valley lowlands and the catchment area

Making a transect consists of walking through a pre-determined pathway that goes through the major land sub-units of the catchment area of the inland-valley lowland as indicated on the map (Module 2). The purpose is to gain a better understanding of the catchment area and to describe the drainage system, hydrology, vegetation, soil types, and other biophysical features of the lowland. The transect walk will thus preferably be carried out in two ways: *laterally from the upland area to the valley bottom*, covering the major land sub-units of the toposequence, and *longitudinally along the valley bottom*. Farmers will bring along with them the map they produced during the previous session (Module 2).



Learning objectives

At the end of this session farmers will be able to:

- Have an overview of the catchment area, which comprises the upland area and slopes, the hydromorphic zone and the actual valley bottom.
- Analyze the functioning of the valley, identify constraints and potentials and, more particularly, understand the main effects of (a) soil type, field position and water supply, on (b) discharge, vegetation, management practices, soil fertility, yield, and problems related to crop production.
- Check and complete the information already visualized on the valley catchment-area map with the additional information observed during the transect walk.
- Reflect on activities to improve the functioning of the inland valley and realize that these activities often require collective effort.

- 1 Visualize the direction of the transect lines on the inland-valley catchment-area map produced during the previous session (Module 2).
- 2 Walk from the upland area towards the valley bottom and then downstream or upstream along the valley bottom.
- 3 Describe the upland area and slopes, the hydromorphic zone and the valley bottom in terms of soil type, vegetation, etc.
- 4 Sample and describe the various soil and vegetation types.



Procedure

1. Farmers and the PLAR-IRM team meet at the PLAR-IRM Center. The facilitator briefly reviews the previous module and invites farmers' feedback.
2. One of the PLAR-IRM team members explains the learning objectives and procedures for the current module.

Module 3

Making a transect walk in the inland-valley lowlands and the catchment area

3. A transect line is visualized on the inland-valley catchment-area map, taking into account the diversity of the landscape and the need to ensure good coverage:
 - The lateral section from top to bottom: upland area and slopes, hydromorphic zone and lowlands.
 - The longitudinal section: moving from the upstream to the downstream section and taking into account:
 - Various soil types;
 - Water inlets;
 - Areas that experience seasonal flooding or drought;
 - Various types of vegetation and weeds;
 - Management practices;
 - The width of the valley bottom and the slope of the hydromorphic zone.
4. Farmers and the PLAR-IRM team then proceed to the field—to one end of the first transect line, normally the highest part (the upland area) so as to have an overview of the overall catchment area. The group then moves downward along the slope towards the hydromorphic zone and the valley bottom.
5. When the group arrives at the valley bottom, the facilitator invites farmers to list any features that allow them to distinguish between upland area and slopes, the hydromorphic zone and the valley bottom. The group proceeds to the boundary between the lower slope and the hydromorphic zone, and then to that between the hydromorphic zone and the valley bottom. The facilitator stimulates a debate on the differences between these zones in terms of topography, vegetation, cropping practices, hydrology (depth to groundwater) and soil types.
6. With a soil auger, a shovel or a knife, soil samples are taken in the hydromorphic zone, close to the valley bottom.
 - The facilitator invites farmers to describe the soil in terms of color and texture.
 - Afterwards, he/she shows how soil texture can be determined in the field and reviews with farmers the links between the soil's natural fertility, color and texture (Reference 3).
 - Samples are taken at various depths with the soil auger or shovel. The facilitator encourages farmers to observe differences in color and texture. At some point, the groundwater table will be reached in the auger hole. The facilitator explains that it is in fact the same water as that in the valley bottom and that there is a groundwater movement towards the valley bottom.
 - If there are red stains or red concretions in the soil, the facilitator asks farmers if they recognize these. He/she stimulates a discussion to improve farmers' understanding of iron toxicity. He/she explains the relation between water movement (infiltration) and the iron content in the water and the iron concentration in the soil at places where the groundwater table comes to the soil surface, i.e. between the hydromorphic zone and the valley bottom. The facilitator stimulates a discussion on the effects of iron toxicity on plant development and yield (Reference 4).

Module 3

Making a transect walk in the inland-valley lowlands and the catchment area

How to determine soil texture

- Take a soil sample large enough to fill about a quarter of the palm of a hand.
- Remove extraneous pieces (roots, seeds, etc.) and any material over 2 mm (gravel).
- Add some water to the sample and mix it to form a paste. The soil must be evenly moist without aggregates.
- First rub the paste between the thumb and the index and then form a ball or a cylinder, by moving the paste from the palm of the hand towards the fingers and back towards the wrist; this will allow you to determine whether the soil is mainly:
 - *Sandy*: grits are felt between the fingers and the soil does not stick to the fingers; there is no consistency and the ball breaks easily when squeezed between the fingers; the cylinder is not shaped easily;
 - *Loamy*: the paste sticks partly to the fingers; a ball can be made, that does not break easily when squeezed between the fingers; a cylinder can be shaped; when the cylinder is bent into a U, it cracks;
 - *Clayey*: the paste is very elastic and sticks to the fingers; it is very easy to make a ball of paste and push a hole inside or mold it; it is easy to shape a cylinder that does not crack when bent into a U-shape.



7. The group then moves on to the valley bottom and stops at any place where farmers identify a specific soil type. For each soil type:
 - The facilitator invites farmers to describe the soil, including its color and texture.
 - The facilitator stimulates a discussion on the difference between this and other soil types encountered and on their differences in terms of natural soil fertility, vegetation, management practices, hydrology, opportunities and specific constraints.
8. After all major soil units have been visited, the group returns to the PLAR-IRM Center to assess the module. Farmers are invited to draw up a summary of the observations made and the main lessons learnt.
9. Evaluation: the facilitator asks what the farmers appreciated (or did not appreciate), what they learnt, and what they intend to do with their newly obtained knowledge.
10. The facilitator asks a volunteer farmer to conclude the session, and then invites all the farmers to the next session.



Time required

- Two to four hours



Materials required

- Soil auger, shovel or bush knife.
- Sheets of strong packing paper and markers.
- Plastic bags.
- Bottle filled with water.

Module 3

Making a transect walk in the inland-valley lowlands and the catchment area

Box 3

A group of about 20 farmers attended Module 3 in Bamoro. The group first came down from the upland area towards the valley bottom, crossing the hydromorphic zone. There, farmers explained how they distinguish the upland slopes (hillside) from the so-called vegetable-growing (hydromorphic) zone and the actual valley bottom. After a few minutes, everyone agreed on the extent of the hydromorphic zone, which is between the two other zones. Farmers discussed differences between the three zones (upland, hydromorphic, valley bottom). Farmers mentioned that there is a difference in slope between the zones: the uplands (hillside) have a steeper slope than the hydromorphic zone and the valley bottom. The distinction between hydromorphic zone and valley bottom is the presence of abundant stagnant water in the valley bottom. Next, farmers discussed differences in soil type. In the upland areas, soils are rather sandy-gravel-like, while they are more sandy-loam in the hydromorphic zone. Soils are loamy-clayey in the valley bottom. Farmers discussed the various weed species and the natural vegetation found in the upland area, hydromorphic zone and valley bottom.

A soil sample was taken from the hydromorphic zone. The soil was sandy-loamy and black. We demonstrated how to determine the soil texture (wet and then try to make a ball or a 'cigarette'—if it works and if it sticks then it is clay, otherwise it is sand or loam; loam is a texture between sand and clay).

The group then proceeded to the valley bottom. Farmers first located the valley bottom on the map and the exact place where they were. Farmers took a sample with the soil auger. The soil was sandy-clayey, black with reddish spots. By rolling the soil between the hand and the fingers, farmers experimented and rolled a ball or a rod; which showed that it was clay. When we tried to fold the 'cigarette,' it broke, which showed that it was not pure clay but contained a good amount of loam. We then explained that the red spots are like rust on a hand-hoe and these same spots make the water become red. Iron is a problem for rice production. One farmer said that red water is hot. Another farmer said that the iron comes from the uplands. Farmers gave several mechanisms through which rice is affected by iron. One young farmer said that iron does not allow roots to develop properly. We likened this to a situation where the rice plant 'drinks' the red water—it is like drinking poison.* One old farmer said that it was possible to remove the iron through drainage. We also talked about the possibility of testing rice cultivars resistant to iron toxicity. It was decided that we should discuss all aspects of iron toxicity during a later session. Farmers explained that the problem of iron toxicity is particularly severe in the parts of the valley bottom bordering the hydromorphic zone, i.e. towards the periphery of the valley bottom.

Next, we discussed spatial variability of the various soil types in the lowland. Some farmers explained that sandy soils are mainly located towards the valley periphery and that clayey soils are more present towards the center of the valley bottom, near the drainage canal. Some farmers were able to explain that this was due to the fact that the water moves soil particles from upland slopes (upper slopes and hillcrest) towards the lower slopes or bottom (valley lowland); the gravely and heavier sand particles are deposited at the periphery of the valley, whereas the finer and lighter clay particles that are suspended in water are deposited at the valley bottom through sedimentation. One old farmer explained that this phenomenon has been occurring for a very long time.

We then continued along the valley bottom, on the west side. We saw a field of courgettes (hardly emerged) on mounds in the hydromorphic zone. Mounds were made in the direction of the slope. The farmer said that this allowed the water to move better. His colleagues said that it is better to make mounds across the slope so as to avoid erosion. We introduced the concept of the groundwater table to the farmers and showed the depth of the water table close to the valley bottom and further up towards the uplands. To demonstrate this, we dug a hole with the soil auger. The water table was 1.3 m deep. The soil that came out from the soil auger had very high iron content. This allowed us to discuss about the movement of iron from the upland to the lowland. Finally, farmers understood the principle of water movement through the soil by surface runoff, sub-surface lateral flow and capillary rise ('sponge' effect of the soil).

We also took soil samples from the bunds. Farmers make these bunds every year by accumulating farm debris (cleared grasses, weeds, etc.) on top of the old bunds. We observed that this soil had a high organic-matter content and a good structure. Before taking the sample, one of the farmers said that the soil was too poor to allow crops on the bunds. Sampling revealed that the soil is actually very rich in organic matter because of decomposition of the accumulated weeds. We suggested that farmers could use these bunds for okra, maize or even perennial shrubs. We showed farmers a leguminous plant (*Sesbania*) and explained its fertilizing effect. Farmers said they consider the presence of *Sesbania* as a sign of soil fertility; there are many around the irrigation canal where the soil is richer and where the water arrives early in the season inducing the germination of *Sesbania* seeds.

* In fact, the toxic effect is due to the concentration of reduced iron in the soil solution (Reference 4).