

Practical guide

Site visit & development plan of an inland valley

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About AfricaRice and Afrique-learning

AfricaRice:

AfricaRice is a leading pan-African rice research organization committed to improving livelihoods in Africa through solid science and effective partnerships. AfricaRice is a research center of CGIAR, which is part of a global research partnership on future food security. It is also an intergovernmental association of African member countries. Today, it has 30 member countries. The mission of AfricaRice is to contribute to poverty reduction and food security in Africa through research, development and partnership activities, aimed at increasing the productivity and profitability of the rice sector so as to guarantee the sustainability of the agricultural environment.

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Afrique-learning is a Beninese cooperative which creates and manages vocational e-learning courses specially designed for African youth. Courses are tailor-made in collaboration with experts in the field with the aim of producing interactive, illustrated, interesting and easy-to-study courses that provide the student with important information in simple and appropriate language. Learning is done independently at the student's own pace, it is assessed and a course certificate is attained following a final test. Courses are available on computer, smartphone or android tablet. They only require a very modest bandwidth and are therefore within the reach of students. Registration and classes are free.

Acknowledgements

Development of the toolkit was supported by AfricaRice project: "Fostering the Impact of Rice Technologies for Better Livelihoods in Sub Saharan Africa (FIRITEL)" funded by the Belgian Development Cooperation.

Context of the guide

This guide will show you in the practical way how to do the site visit and how to elaborate the development plan which are the first two stages of the development of the inland valleys according to the *Smart-Valleys* approach. You will find several other guides for the rest of the steps.

I. Elaborating the map of the inland valley during the site visit

Field visit

In general, the development of a site requires knowledge of the terrain. So during the field visit, for the construction of the water control structures, it is essential to know the topography, the elements on the ground (slope, water lines, types of soil) and additional information such as intensity of floods and rains or planned crops.

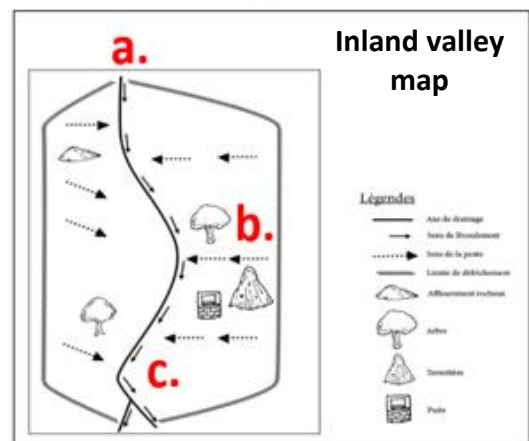
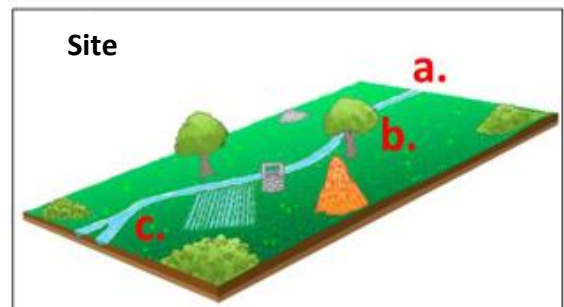
Map of the inland valley

During the site visit, a map of the inland valley must be drawn up on the basis of the information received. All observations influence the construction of the structures. Documentation as precise as possible of these observations is essential for the realization of works well adapted to the site.

Transforming site observations into a map of the inland valley

- Ensure that you transfer the site observations to the map as accurately as possible
- Here are some examples of key points to transfer:
 - a. water inflow on site
 - b. land-related characteristics
 - c. watercourse indication

NB: supplementary information from inland valley farmers should also be included



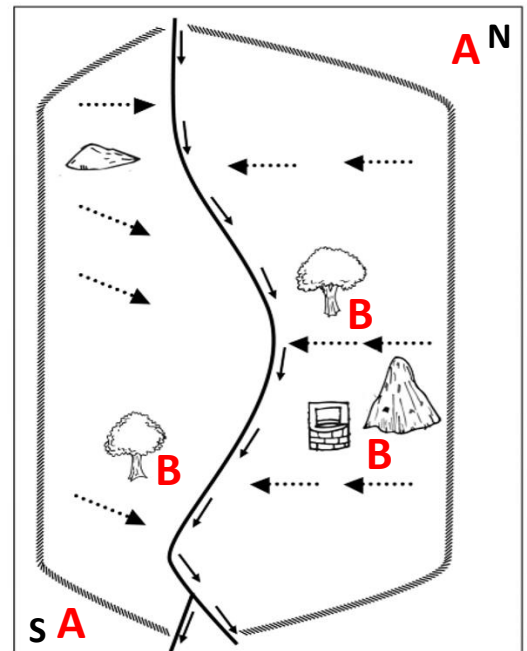
Transfer of site observations to the map [1]

Procedure

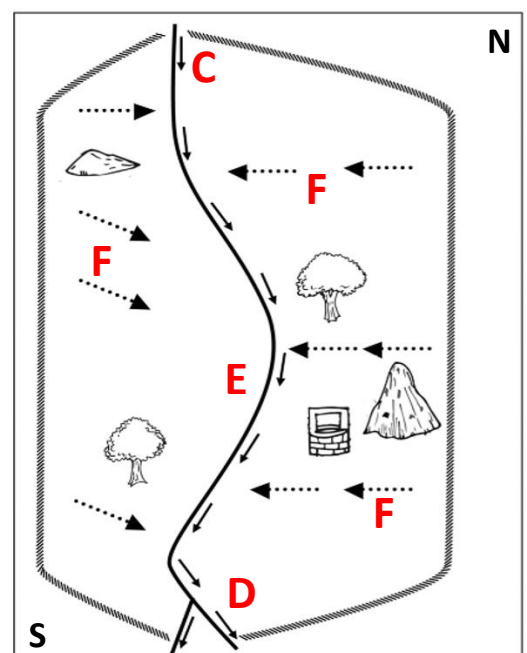
1. Go around the entire inland valleys site
2. Agree on the limits and size of land to be developed
3. Starts sketching the outline of the inland valley (its shape)
 - the precise inland valley dimension is surveyed such as: length, width (measuring at different places, to take into account that the shape can be irregular) by counting steps
4. Note the “North-South” orientation (N – S) (see **A** on the map below)
 - the map should slightly exceed the area to be developed in large inland valleys (if it helps to determine water circulation)
5. Identify and place precisely on the map the points of interest (trees that were left, termite mounds, rock outcrops, etc (see **B** on the map below))
 - it will serve as benchmarks for other map features (for example, if the water flow is on the right or on the left of the termite hill ...)
6. Sketch the water circulation
 - the essential point to learn from inland valley users, who know the land best, concerns the natural water paths and circulation

Here's how it works :

- a. Identify and note the entry points (**C**), water outflow (**D**) and the natural drainage canals (**E**)
 - check the inland valley's position, as well as the clearings, in the local hydrographic network
- b. identify the slope direction and assess its intensity on the different parts of the inland valley
 - here again, especially when the slope is poorly marked or the topography complex, local farmers' knowledge of the site constitutes an essential source of information
- c. The slope direction and its intensity is indicated on the map with arrows (**F**)



A map of the inland valley with orientation and the points of interest marked [1]



A map of the inland valley with the following components: water entry point (C), outflow (D), natural drainage canals (E), direction of the slope (F) [1]

II. Interpreting supplementary information from inland valley farmers

Along with observations of the topography and elements in the field, additional information can be crucial for the planning of structures. This information includes, among other things, the use needs of the inland valley, the rain conditions or the water force. This information should then be noted on the map of the inland valley to adapt the structures to these circumstances.

Water supply

- Rainfall
 - in case of regular heavy rainfalls you will need to increase the height of the structures
 - steeper slopes increase water speed and a combination of both creates pressure on the structures In this case, it is necessary to reduce plot dimensions in order to decrease water pressure
- Inland valley's water entry point
 - if the water quantity and pressure are high it is necessary to reinforce the bund belts at the level of the development's water inlet



Plot development [4]

Possible damage due to water pressure

- Erosion:
 - structures can be destroyed by high water pressure in the upstream part of the inland valleys (fringes and slopes)
 - it is therefore necessary to reinforce the structures which will be exposed to damage from high water pressure
- In case of potential flooding and excessive water damage during heavy rainfalls, you must:
 - reinforce the structures by elevating the bunds and widening the drainage canals
 - inspect regularly the structures and reinforce them after every heavy rainfall
- Inland valley silting:
 - this happens when sand is carried into the inland valleys by water
 - it is related to the slope and soil of the inland valleys upstream (a steeper slope and sandy soil can increase inland valleys silting)



Structure damaged by heavy rainfall [5]

Soils

- Soil properties:
 - determine the structures' shape (sandy soils require higher structures)
- Soil characteristics vary in different seasons
 - sandy soil is more permeable and does not retain water much after the raining season
 - silty clay soil gets flooded easily and does not dry out quickly
- Soil development
 - working with silty clay soils is more difficult as it is hard work
 - but the structures' lifespan lasts longer when compared to structures made in sandy soil



Silty clay soil site [5]



Sandy soil site [5]

Crops

- Type of crops and periods
 - this determines the period to construct the development structures
 - example: if corn or cowpea are cultivated on site before rice, the development structures need to be constructed earlier
- Previous crops can make structures' readiness delicate to obtain
 - after harvesting the previous crops, you must get the development structures ready for rice cultivation
 - it includes:
 - profiling bunds and drainage canals
 - levelling plots



Cowpea cultivation before rice [2]

III. Creating the development plan

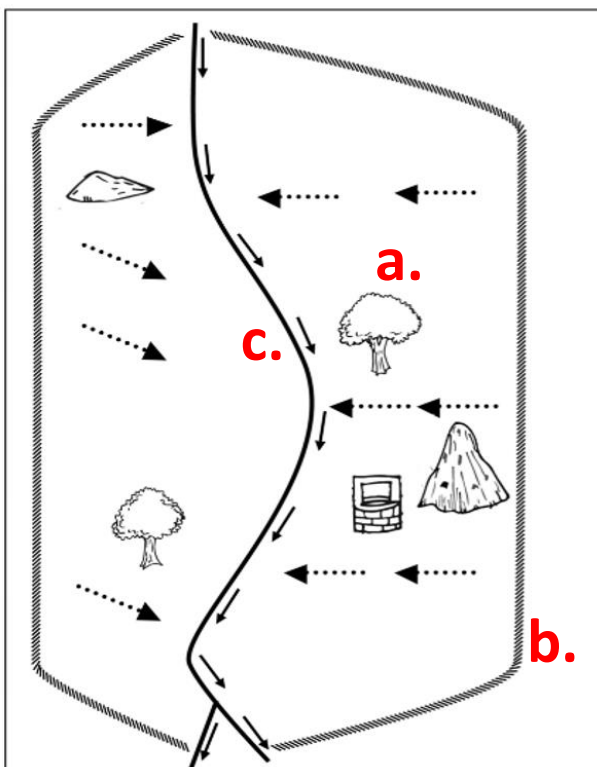
From the map of the inland valley, on an A4 sheet of paper, develop the provisional development plan. Begin by drawing the structures like bund belts, drainage canals and finally, position the plots. The provisional development plan will then be verified by the inland valley farmers. This layout plan must be as precise and clear as possible to facilitate its implementation.

Principle transfer of elements from the map to the plan

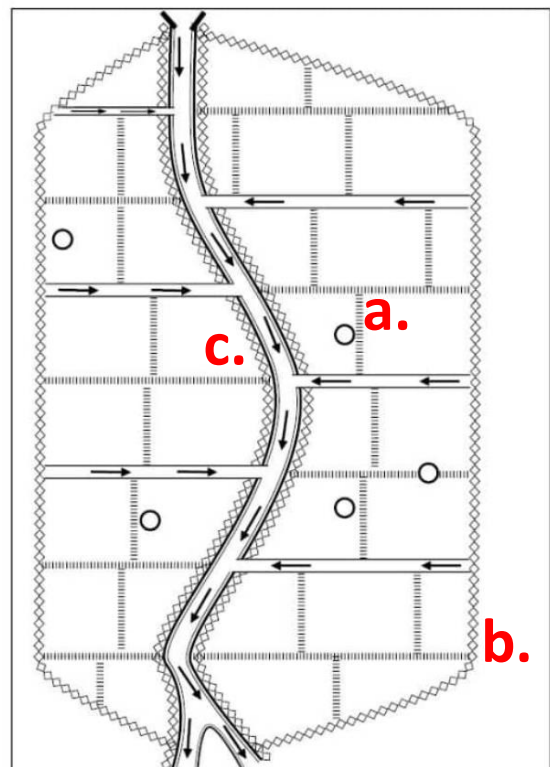
This example shows the transfer of some elements

- Each point of interest (here a tree) is represented with a circle
- The clearing limit is indicated with the bunds sign
- In the development plan, the water line is marked as a main drainage canal (also indicated with the bund belts sign)

Map of the inland valley



Provisional development plan

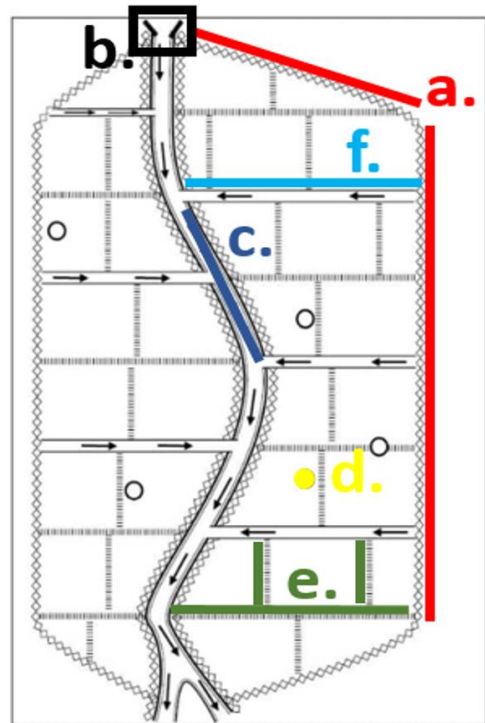


From the map of the inland valley to the development plan [1]

Composition of the development plan

The development plan comprises:

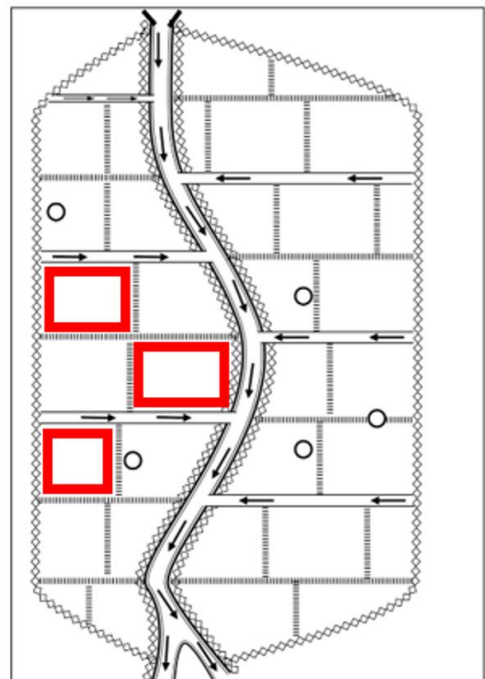
- a. inland valley dimensions, which are demarcated with red bunds belt
- b. Water inlet into the inland valley, in black
- c. Natural drainage canals in dark blue
- d. Points of interest in yellow
- e. Partition bunds in dark green
- f. Transversal drain canals in sky blue



A layout with various components marked [1]

Plots positioning on the development plan

- The plots length is perpendicular to the slope while its width is along the slope direction
- The first plot after the belt is has a transversal drainage canal as its boundary
- This then followed by two juxtaposed plots followed themselves by a drainage canal which brings in and lets out water if necessary

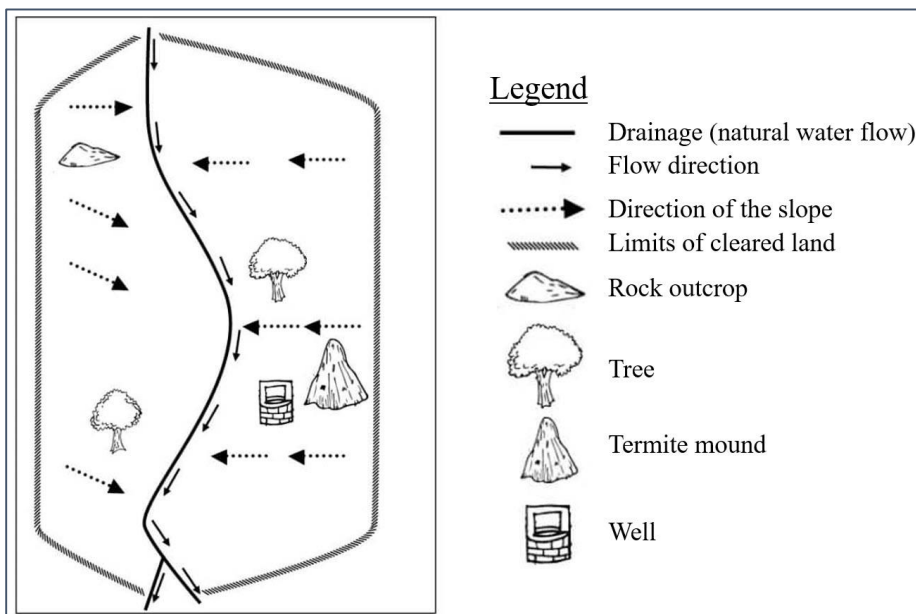


Example: plots are marked in red [1]

Legend of the map of the inland valley and the development plan

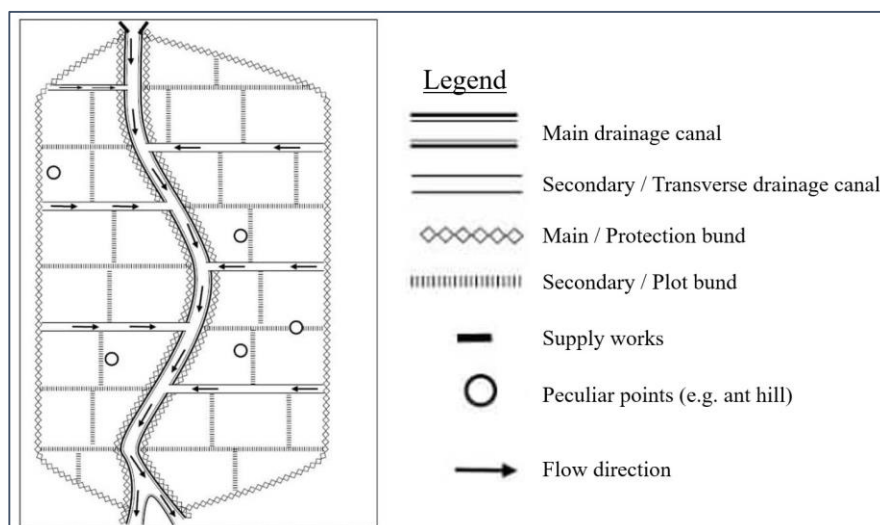
- The development plan depends a lot on the individual who creates it
- Each development plan must include a legend explaining the structures and all the components
- The objective is for farmers to easily identify the necessary information they will require to develop their inland valleys

Suggested Legends –map of the inland valley



Suggested legend [1]

Suggested legend – Development plan



Suggested legend [1]

Glossary

Inland valley development: Improvement of an inland valley agricultural area by implementing water control works such as bunds and drains [a]

Upstream: the side where a stream comes from, the direction of its source. [b]

Water inflow: Water inlet into the field (for example a stream) [a]

Downstream: Situated or moving in the direction where water flows, in the direction of the watercourse current. [B]

Drainage canal: Natural or artificial canals that control the movement of water, especially to drain excess water (in inland valleys field, they are reinforced by bunds). [a]

Inland valleys: A generally humid agricultural area with characteristics of soil moisture and fertility, making it better than agricultural lands of the plateau. [a]

Plots: The space between the dividing bunds where the rice is actually grown. [a]

Bunds: small walls that partition the plots, so that their water level is managed for rice production [a]

Map of the inland valley: In the context of 'smart-valleys' development, this is an illustration of the field, a sketch made during the site visit while positioning all the elements of the field. This map of the inland valley is the basis for the design of the development's layout plan. [a]

Hydromorphic fringe: In this context, it is the area between the inland valley and the slope. The slope in this area is steeper than in the inland valleys. [a]

Pegging: In this context, it is the transfer of information from the development layout plan to the field, through the marking and planting of stakes. The actual development of the inland valley will then follow these markings. [a]

Legend: Explanatory list of the conventional signs of a plan or a map, placed beside or below it, which facilitates the reading and understanding of the said map. [a]

Work: in this context, the work is an element of the inland valleys development that is built with earth, on the ground, for example bunds or drainage canals. [a]

Slope: inclination of a surface with respect to the horizon. [vs]

Leveling: is the action of creating a flat or even-ground surface, in this context, it is to level the plot for better water distribution. [a]

Profiling: the act of giving a defined shape or profile to a bund, a drainage canal. [a]

Flow direction: The direction where the water flows on the field, it is always in the direction of the slope. [a]

Site: This is the inland valley to be developed or under development. [a]

Transversal: A line intersecting another line or any other shape, in which case it can then be perpendicular to its width or to its height. [a]

Slopes: Inclined areas of an inland valley, oriented in the same direction. [a]

Sources of images / illustrations

- [1]: Photos taken by Justin Djagba, AfricaRice
- [2]: Illustrations produced by Eudox Béatitudes for AfricaRice
- [3]: Photos provided by AfricaRice
- [4]: Photos taken by Dr Soklou Kodjo WOROU
- [5]: Smart -valleys: Manual of trainer-facilitator (Defoer et al., 2017), AfricaRice

Sources of glossary

- [a]: Justin Djagba, AfricaRice
- [b] : <https://cartebateau.com/fr/amont-aval-definition>
- [c] : <https://www.larousse.fr/dictionnaires/francais/pente/59310?q=pente#58949>

Material reference

This guide is based on the online course “Field visit & development plan” which is based on the materials developed by Dr. Soklou Kodjo WOROU and the guide “*Smart-Valleys: Trainer-facilitator's manual*” (Defoer et al., 2017) developed by AfricaRice.