Practical guide

Situating the development plan on the land: staking

Summary

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.

Afrique-Learning:

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

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Contexte of the guide

This guide will present you in a practical way how to implement the development plan, which is the third stage of the development of the inland valleys according to the *Smart-Valleys* approach. You will find another guide for the rest of the steps.

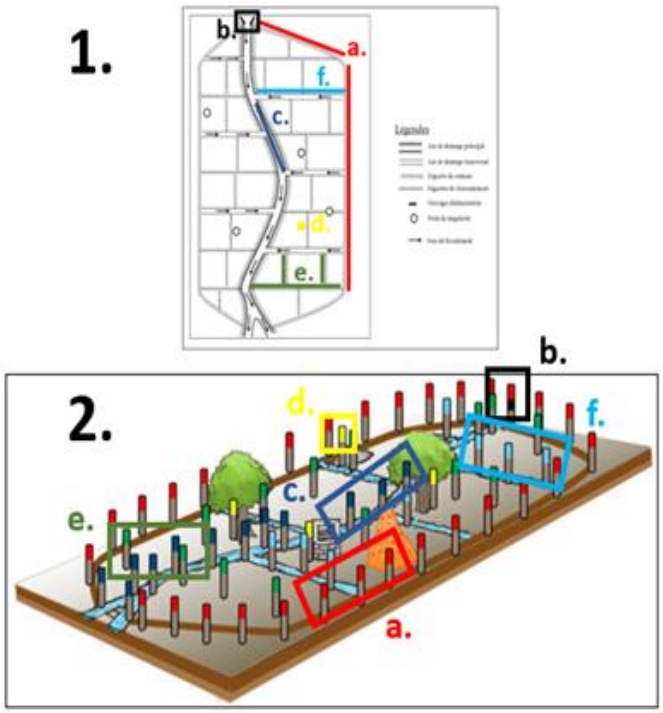
I. Transfer of the development plan on the site

Situating the development plan on the land: staking

The establishment or staking follows the development stage of the development plan. On the plan, the development structures (works) are drawn and during the installation, this plan is reproduced on the land to be developed. In addition, the works drawn up on the plan are materialized on the ground by stakes. Depending on the positioning of the posts, the layout (making the works) is carried out.

Transfer of the development plan on the site

- The two diagrams below show how the development plan is transferred to and positioned on the site
- The same letters are used to identify the future structures on the development plan (1) and on the site itself, where they are marked with colour-coded stakes (diagram 2)
- Information from the development plan should be transferred as accurately as possible



Staking (2) based on the development plan (1) [1]

General instructions on water and site topography

- If the main drainage canals is identified, it is important to outline it accordingly with stakes before anything else
- Always plan for water distribution from upstream to downstream
- The development plan is based on the site topography and its shape
- Upstream development does not depend on the downstream development
- All natural and artificial drainage canals should be marked with stakes painted in dark blue except the drainage canals perpendicular to the slope (transverse) which are marked with sky blue painted stakes

Completed drainage canal [2]

II. Materials and work tools

- To carry out the implementation, it is necessary to bring together a certain number of tools, namely:
  - development plan
  - machete
  - string (about 100 m)
  - Decameter
  - Tins of paint: Red, dark blue, sky blue, green, yellow and black
  - Paintbrush and thinner
  - Sticks for the stakes (you will need an average of 400 stakes per hectare depending on the shape of the site)

NB: To ensure that you have enough stakes, you need to start collecting them in advance

Stakes painting

- The stakes are painted with one or more of these colors: red, yellow, blue, black and green.
- This can be done before or after planting the stakes or at the same time
- It should be noted that it is easier to paint stakes during or after planting
- If paints are not available, they should be replaced with local materials:
  - threads of various colours
  - pieces of old cloths of different colours
  - notches can be sculpted on the stakes and each notch has a meaning understood by the entire team (make sure you write down the meanings of the notches combinations)

Stake painting [3]

Painted stakes [5]

Paints and solvent [3]

Staking order

Follow the below order of implementation:

1. Belt bunds: **red**
2. Water intake works: **black**
3. Natural or main drainage canal (along the slope): **dark blue**
4. Points of singularity: **yellow**
5. Transverse or secondary drainage canal (perpendicular to the slope): **sky blue**
6. Secondary or plot bunds: **green**

Development of the belt bunds [2]

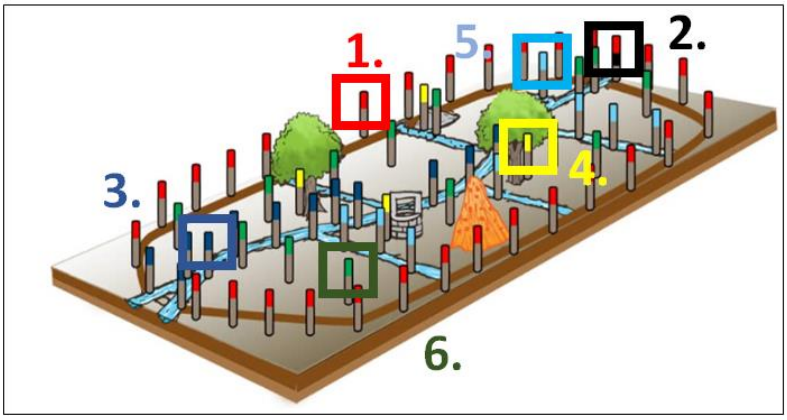


Illustration of stakes indicting various structures [1]

A stake can have more than one colour

When it is at the intersection of several structures

Examples:

- green and red stakes: indicates the crossing of belt bunds and plot (or secondary) bunds
- green and dark blue stakes: secondary bunds crossing with drainage canal
- red, green and sky blue stakes: intersection of belt bunds, secondary bunds with transverse drainage canal
- red, dark blue and black stakes: is the crossing of belt bunds, main drainage canal and water intake works etc.

Stakes with different colors and functions [5]

III. Development of the various structures in details

According to the development plan; structures such as bunds or drainage axes are made with stakes.

Belt bunds and water intake works

1. For the belt bunds, place the stakes at the boundaries of the cleared site do this based on the site land development plan:
   - the stakes (red) are first of all fixed at the two extreme ends of a straight portion
   - then a long rope is stretched between the two stakes
   - intermediary stakes (red) are fixed at a distance of 5 to 10 m depending on the features of the site
2. Then we establish the water intake works
   - this is normally done where the water enters the development site (main drainage canal + belt bunds) with black, red and dark blue colour stakes

Using a string [4]

Main drainage canals and points of singularity

3. After demarcating the outline of the development site, begin with:

- the «natural» water course or main drainage canal
- this is done with red and dark blue stakes (red indicates the bunds and blue for the watercourse)
- stakes are (solidly) planted systematically on both sides or in the middle of the main drainage canal depending on its width

4. Finally, the "yellow" stakes are planted at points of singularity indicating that these parts of the land are not to be developed

Marking of a belt bund and a point of singularity [3]

Secondary drainage canals and secondary bunds

5. The secondary drainage canals and the bunds bordering these canals are marked with stakes:

- with sky blue and green stakes:
  - green to indicate the secondary bunds and
  - blue for the watercourse
- at the intersection of a secondary drainage canal or secondary bund with a belt bund, ~~a~~ red paint is added to the stakes with sky blue or green colours

6. Thereafter the secondary bunds are marked:

- this is done with green stakes
- at the intersection of a secondary bund with a belt bund, red colour paint is added to a green stake
- for the intersection of a secondary canal with a belt bund, a red color paint is added to a sky blue stake

Farmers walking with stakes [2]

Plots dimension

- The main objectives for selecting the size of the rice cultivation plots are:
  - proper levelling of the ground
  - good water retention inside the plots
- Plot dimensions depend on the slope:
  - the less steep slope is, the bigger the plot size
  - the steeper the slope, the smaller the plot size

Plot levelling [2]

Plot dimensions	U shaped inland valley		V shaped inland valley	
	Average slope	Weak slope	Steep slope	Weak slope
Length (meter)	4–5	5–8	3–4	4–5
Width (meter)	3–4	4–5	2,5–3	3,5–4

Plot size depends on the slope [5]

Completed plots [2]

Practical advice

- In the field, plot size can be measured by counting footsteps
- It is important that this exercise is carried out by the same person to minimize errors and thus guarantee measurement accuracy
- staking is based on geometry, it is therefore important to plant stakes in a straight line
- The more straight the stakes lines, the more precise and attractive the inland valley layout will be

Staking works [2]

Glossary

Bunds: small walls that partition the plots, so that the water level is managed for rice production [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). [at]

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

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. [at]

Inland valley development: Modification of an agricultural area while carrying out water control works such as bunds and drain [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 land development plan. [at]

Peculiar points: encountered on site such as (trees, termite hill, well). [at]

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

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

Staking: This is an important component of engineering and cadastral surveying, where the proposed position of an object is marked on the ground using stakes. In the context of Smart Valleys inland valley development, it is the transfer of information from the development plan to the field, through the planting of colour-coded stakes. The actual development of the inland valley will then follow these markings. [at]

Staking: In this context, it is the transfer of information from the development land development plan to the field, through the marking and planting of stakes. The actual development of the inland valley will then follow these marking (bunds, drainage canals) [I]

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

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]

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. [at]

Sources of images

[1] Photos provided by AfricaRice

[2]: Illustrations produced by Eudox Béatitudes for AfricaRice

[3]: Photos taken by Dr Soklou Kodjo WOROU

[4]: Photos taken by Justin Djagba, AfricaRice

[5]: Smart -valleys: Manual of trainer-facilitator (Defoer et all., 2017), AfricaRice

Sources of glossary definitions

[a]: Justin Djagba, AfricaRice

[b] : https://cartebateau.com/fr/amont-aval-definition

[c] :[https://www.larousse.fr/dictionnaires/francais/pente/59310?q=pente#58949

[d]: https://fr.wikipedia.org/wiki/Piquetage_(g%C3%A9om%C3%A8tre) / Justin Djagba

[i]: https://fr.wikipedia.org/wiki/Tari%C3%A8re

[j]: https://fr.wikipedia.org/wiki/Implantation