

Lowlands hydraulic developments: an evolution at the heart of the agricultural expansion in forest-savanna mosaic in Guinea

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Introduction

Faced with the announced doubling of African population, lowlands offer strong potential for increasing and intensifying food production. Since the 1960s, lowland hydraulic systems play a central role in the agrarian dynamics of the forest-savanna mosaic, in the north of Forested-Guinea.

This study seeks to **characterize the evolution of lowlands hydraulic systems** in this region.

Material and Method

This study focuses on a standard village, Konardo, which presents a succession of hills interspersed with lowlands sometimes opening into larger plains.

165 interviews have been realized with farmers, members of their families and local authorities.



Fig. 1: Location map

The study was carried out over 6 months and crossed 4 approaches:

- Descriptions of the hydraulic systems evolution and rice management sequences, at the irrigated plot level,
- Farm trajectory analysis,
- Farming system analysis,
- Measurement of the area of improved lowlands based on ground photographs, GPS data, and satellite image analysis, linked with farmers' interviews.

Results

Lowlands hydraulic development: a combination of adapted techniques

Rice is the main staple food in the region. It is one of the major crop in terms of cultivated area and contribution to the farm's value added.

The diverse flooded rice crop systems offer a higher labour productivity than the rainfed rice crop systems: **between 0.72 to 1.1€/man-day against 0.37 to 0.67 €/man-day.**

Until the end of the 1950s, the agrarian system of the village was based on a long wooded upland fallow cultivation. In the 1960s, slash-and-burn practices were extended to a part of the lowlands and repeated more or less continuously. Lowland cultivation was generalised in the 1970s, and is still growing today.

Simultaneously, since the 1960s, farmers develop hydraulic systems in their lowlands in order to:

- Take advantage of the better performances of flooded rice cultivation,
- Maintain a water sheet during the crop cycle to improve the rice yields,
- Introduce flexibility in the work schedule.

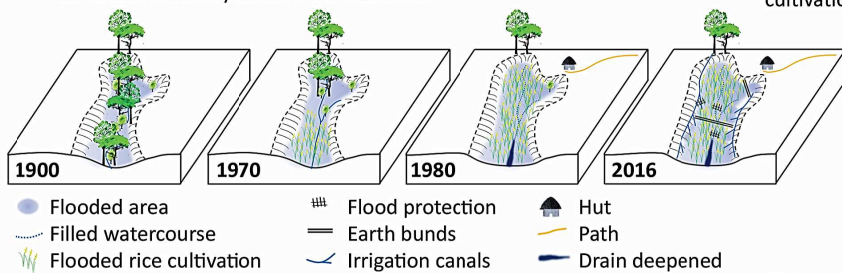


Fig. 2: Block diagrams showing the evolution of lowlands in Konardo

Lowlands hydraulic systems are a combination of techniques, adapted to the valley profile and to the water regime of lowlands:

- Increase the level of the riverbed for water to overflow into the neighbouring area,
- Straighten the violent watercourse,
- Installation of drains to evacuate excess water,
- Reprofiting of plots to better distribute the water sheet,
- Construction of irrigation canals,
- Construction of earth bunds,
- Expansion of lowlands by excavating hillsides and using the excavated earth to plan the lowlands.

Thus, farmers have gradually implemented a system based on cultivation of shorter wooded fallow and lowlands.

A double evolution of improved area

The evolution of techniques of lowland irrigation improvements leads to a double process:

- Progressive extension of the size of the plots
- Increase in the number of improved lowlands

Depending on the topography, the nature of the soil and the water regime, the increase of the flooded area ranges between 30% for the driest lowlands to more than 200% for the wet flat lowlands with a permanent watercourse.

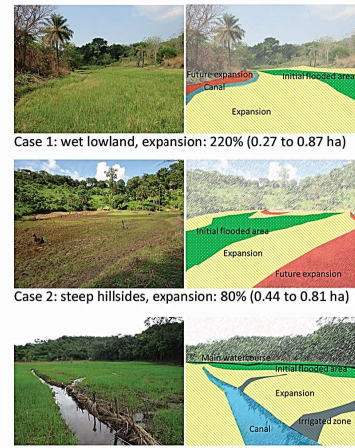
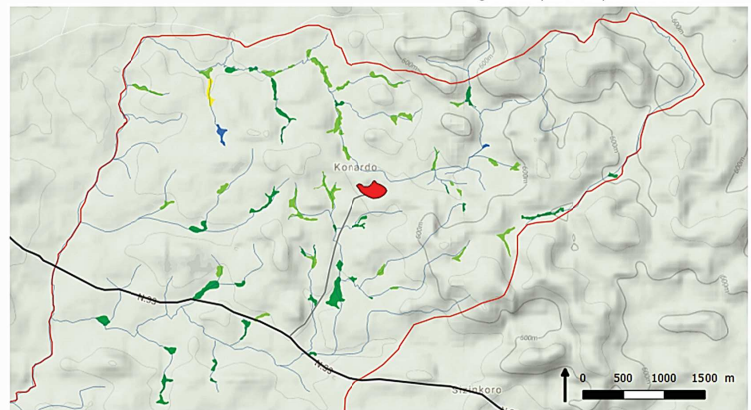


Fig. 3: Examples of improved lowlands



- Village: Konardo
- National road
- Secondary road
- River system
- Village boundary
- Lowlands cultivated continuously
- Before 1960
- Since 1960-1980
- Since 1980-2010
- Since 2010-2016

Data: oral history interview, 2016
Map base: Google, 2017
Map completion: Petit-Roulet R., 2017

Fig. 4: Evolution of the number and area of improved lowlands in Konardo

Date of continuous cultivation	Before 1960	Since 1960-1980	Since 1980-2010	Since 2010-2016
Number of cultivated plots	1	41	78	80
Cultivated area (ha)	1,48	27,82	57,66	58,51

Table 1: quantitative data evolution of cultivated lowland plots and global area from 1960 to 2016

The evolution of the number of cultivated and improved lowlands is due to farmers without access to lowlands as well as farmers who want to extend their lowland cultivation. Today, this increase is limited by the remoteness of lowlands still available.

The improvement of hydraulic systems, a great indicator of labour resource availability

The access to lowland is unequal. It leads to particular farming strategies:

- Farmers with important lowland areas concentrate their labour force on flooded rice cultivation and diversify their activities in dry season.
- When lowland areas aren't sufficient to meet family's needs, farmers spread their agricultural workforce over a longer period between rainfed and flooded rice cultivation.

Discussion

The increase in the area with improved hydraulic systems and the evolution of techniques reflect an **endogenous dynamic that enables a better valorisation of lowland areas**. This dynamic isn't the answer to demographic growth. In the contrary of the usual discourse, in a context marked by the emigration of many village inhabitants, **the development of hydraulic systems in lowlands is an answer to the lack of labour force which leads to seek a greater labour productivity.**

Conclusion

Lowlands are the results of the history of their cultivation and represent part of a farmer's capital. This endogenous dynamic is the proof of the farmers' extended know-how and of their knowledge of such territorial units. **The analysis of such dynamics is of major importance for development actions** because it enables to put the impact of projects in perspective, and gives information on the social character, the water regime, the uses and the agro-economic performance of lowlands.

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