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Determinants of lowland use close to urban markets along an agro-ecological gradient in West Africa

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Abstract

Lowland development efforts in West Africa have a mixed record. The paper argues that this is due to the neglect of market opportunity as a driving force for lowland use and the agro-ecological gradient as an important modifier. The gradient is linked to three modifiers of lowland use: the relative value of lowland cropping with respect to other livelihood strategies; the biophysical productivity of lowland cropping; and the access rights to lowlands. The paper applies a regression-based decomposition framework to analyze the factors affecting lowland use in West Africa. It uses community-level data from 1014 geo-referenced lowland units around four urban centers along an agro-ecological gradient in Côte d'Ivoire and Mali. Tobit models are used to explain the extent of lowland non-use in terms of seasonal fallow, its diversity in terms of rice and other crop cultivation and its land use intensity in terms of double cropping. A multinomial logit model is used to explain lowland cropping systems. Results highlight a positive link between closeness to urban markets and the extent, diversity and intensity of lowland use. The agro-ecological gradient in West Africa has a pronounced influence on agricultural lowland use, which tends to be more widespread, diverse and intensive proceeding towards the drier ecologies. Lowland development did increase the extent and intensity of lowland use, but by favoring the cultivation of rice, had a negative impact on the diversity of lowland use. Lowland use is also associated with migrants, particularly in the more humid ecologies. Research, policy and development implications are explored. An important lesson for scaling out is that it is not proximity to urban markets per se, but the associated market access which is the key driver for more significant lowland use.

Keywords: Urban–rural linkages; Market access; Agro-ecological gradient; West Africa; Lowland use; Peri-urban agriculture

1. Introduction

Addressing the challenge of sustainable agricultural development in Sub-Saharan Africa will be helped by better understanding intensification processes. Factors driving change in agricultural land use have previously been related to land scarcity induced by population-growth (Boserup, 1965; Ruthenberg, 1976; Andriesse and Fresco, 1991; Turner et al., 1993) and policy and market opportunity (Pingali et al., 1987; Lele and Stone, 1989; Izac et al., 1991; Smith, 1992; Goldman, 1993; Manyong et al., 1996; Lavigne-Delville and Boucher, 1998). Specifically, market opportunity is associated with increasing urbanization, development of transportation infrastructure, changing food consumption patterns and general economic liberalization. In West Africa such trends provide increasing opportunities for intensification of agricultural systems, particularly around towns and secondary urban centers (Club du Sahel, 2000). Simultaneously, there has been an explosion of interest among researchers in the development potential of farming in and around Africa's urban areas, or what is now widely referred to as 'urban and peri-urban agriculture' (Egziabher et al., 1994; Smit et al., 1996; Moustier and Mbaye, 1998; Ellis and Sumberg, 1998; Bruinsma, 2001; Drechsel and Kunze, 2001; FAO, 2002).

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There is a long-standing interest in greater and more effective use of lowlands for crop production in West Africa (Adams, 1993; Andriesse and Fresco, 1994; Kolawole et al., 1994; Ahmadi and Teme, 1998; Hirose and Wakatsuki, 2002). Lowlands are defined here as areas that are subject to some degree of annual flooding and comprise wetlands, swamps, inland valleys and flood plains. Lowlands and hydromorphic fringes are estimated to occupy more than 22 million ha of land in West Africa (Andriesse and Fresco, 1994). Much of the interest in lowland development in West Africa has focused on the potential for increased rice production (Pearson et al., 1981; Richards, 1986; Andriesse and Fresco, 1991; Raunet, 1993; Windmeijer and Andriesse, 1993). Improving rice production and productivity are priorities throughout the region and it is imperative to gain full value from investments in lowland improvement and irrigation development. Nevertheless, lowland development efforts in West Africa have a mixed record of success. Lowlands are biophysically complex and heterogeneous (Windmeijer and Andriesse, 1993; Andriesse and Fresco, 1994) and lowland research and development efforts have focused on biophysical constraints and corresponding technological needs. Socio-economic factors have been largely ignored, or acknowledged only in passing. Proximity to urban markets, or linkage to urban markets by efficient transportation networks, offers particular promise for more significant agricultural use of lowlands.

A more significant use of lowlands for crops can take various forms: extending the area under cultivation, increasing the frequency of cropping per unit area and/or increasing the value of agricultural production per unit area by changing lowland use. In the end, whether farmers extend, intensify and/or diversify agricultural lowland use is likely a reflection of both biophysical and socio-economic factors (Izac et al., 1991; Lavigne-Delville and Boucher, 1998; Erenstein et al., 2006). Yet little is known of the relative contribution of these factors to the choice of agricultural lowland use strategies in West Africa.

It is in this light that further analysis of the factors affecting lowland use close to towns in West Africa is warranted. In this paper we analyze the dimensions of lowland use in the proximity of four urban centers along an agro-ecological gradient in West Africa and present empirical models to test the contribution of the driving and modifying factors. Finally we discuss some research, policy and development implications of the analysis.

2. Research sites, data and methods

2.1. Site characteristics

Four West African urban centers were selected along an agro-ecological gradient ranging from the humid forest in the South to the Guinea savanna zone in the North (Table 1). Each site has a large urban settlement surrounded by "satellite" villages. Each town is located on a major transport axis and functions as a market hub integrated in regional trade networks, thereby exhibiting strong urban–rural linkages (Bah et al., 2003). Across all sites, farming is the predominant economic activity in the villages. All sites have an abundance of lowlands in and around town. The agro-ecology is a major discriminatory factor amongst sites, particularly in terms of the duration of the growing season, precipitation and any tradition of lowland use. In addition, the sites also vary in terms of town size, the structure and organization of agricultural systems and markets, the origin of lowland users and the local policy environment. Their characteristics and regional importance has been variously documented (Alla, 1991; Coulibaly et al., 1998; ICEF et al., 1999; Club du Sahel, 2000; ICEF and ENSEA, 2002; Erenstein et al., 2004).

Each urban center serves as a hub for regional agricultural development efforts. Around each site various lowlands have been developed through outside intervention; for example in Côte d'Ivoire between 1970 and 1975 by Soderiz (a rice development parastatal, now defunct) and in Mali in the

Table 1
Selected characteristics of research sites

Urban center	Daloa (Côte d'Ivoire)	Bouake (Côte d'Ivoire)	Korhogo (Côte d'Ivoire)	Sikasso (Mali)
Agro-ecological zone	Forest	Transition forest-savannah	Southern Guinea (SG) savannah	Northern Guinea (NG) savannah
Rainfall (mm year^{-1})	1300	1000	1100	1100
Humid period	March–November	April–October	May–September	June–September
Location	6°53′N, 6°27′W	7°41′N, 5°02′W	9°27′N, 5°39′W	11°19′N, 5°40′W
Urban population (estimate, 2000)	260000	550000	190000	130000
Rural population density (inhabitants km^{-2})	39	30	44	35
Lowland inventory data:				
Number of villages (n = 500)	84	122	144	150
Number of lowland units (n = 1014)	345	226	292	151
Average number of lowland units per village [max.][a]	4.11 a [13]	1.85 b [6]	2.03 b [14]	1.01 c [2]

Source: Erenstein et al. (2004).
[a] Data followed by different letters differ significantly—Duncan (0.10), within row comparison.