



## Between all-for-one and each-for-himself: On-farm competition for labour as determinant of wetland cropping in two Beninese villages



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### ABSTRACT

In sub-Saharan Africa, unexploited land and water resources in wetlands represent an important potential for intensified, sustainable and food-secure farms through rice production and market gardening. The lack of uptake of cropping in wetlands may be related to the ways in which resources are divided between family fields and individual fields. The management system on sub-Saharan African farms comprises a family management unit or a combination of a family management unit and one or more individual management units. The family management unit or the farm head controls production in family fields to satisfy family needs while the individual management units control production in individual fields to satisfy individual needs. Our objective was to investigate the diversity in farm management systems and the resulting uptake of cropping in wetlands for different farm types, as the first step towards suggestions for enhancing rice production and market gardening in wetlands. We studied farms in two case-study villages in Benin: Zonmon in the southern part and Pelebina in the north-western part.

Farm typologies were developed based on random samples of 51 out of 134 farms (38%) from Zonmon and 50 out of 146 farms (34%) from Pelebina by combining principal component analysis and Ward's minimum variance clustering. Variables included in the PCA were related to levels of resource endowment (e.g., amounts of land, family labour, cash for purchasing chemical inputs and hiring labour) and to resource-use strategies including resource division between family fields and individual fields, and between uplands and wetlands.

We identified 3 farm types in Zonmon and 5 farm types in Pelebina based on differences in resource-use strategies and in resource endowment. We found no trade-off between the existence of individual fields and the area under rice and market garden crops in wetlands. Labour abundance was the main factor driving both the occurrence of individual fields and the expansion of cropping in wetlands. Differences in labour division strategies between family and individual fields among farm types reflected differences in food and cash division strategies. Land use appeared strongly motivated by food self-sufficiency objectives and labour productivity, leading to prioritisation of upland over wetland areas. In wetlands, most farm types opted for cultivating market garden crops during the dry season when labour demand for upland fields was low. Our results indicate that increasing labour productivity in food crops and in rice and market garden crops would enhance the uptake of rice and market garden crops in wetlands. Creating credit facilities would increase the labour resource and allow farmers to hire labour, further contributing to wetland use. We discuss the relevance of a systemic farm analysis that enables distinguishing family and individual fields for understanding farm uptake of rice and market garden crops in wetlands.

### 1. Introduction

The Sustainable Development Goals, in particular goal 2, set the

ambitious target of achieving global food security by 2030 (UN, 2015). In 2015, 23% of the sub-Saharan African population was estimated to be undernourished (FAO et al., 2015). Long-term food security is

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impaired by unsustainable land use (Bossio et al., 2010; McIntyre et al., 2009; Mirzabaev et al., 2015): in Africa, 65% of agricultural land was estimated to be affected by some form of degradation for the year 1990 (Oldeman, 1991). At the same time, unexploited land and water resources in wetlands represent an important potential for intensified and sustainable land use (Balasubramanian et al., 2007; Giertz et al., 2012; Rodenburg et al., 2014; Saito et al., 2013; Wakatsuki and Masunaga, 2005; Windmeijer and Andriessse, 1993). Following the 2008 food crisis, governments of 19 African countries developed national strategies to exploit wetland resources and ensure rice self-sufficiency (Demont, 2013; Demont and Ndour, 2014). In Benin, the government decided to enhance both the rice and the market garden crop sectors (MAEP, 2011a, 2011b), as both may contribute to farm sustainable intensification and food security (Erenstein et al., 2006; Lu et al., 2010; Singbo and Lansink, 2010).

Farm systems are described as comprising a production system and a management system, the latter controlling production (Dogliotti, 2011; McCown, 2001; Sorensen and Kristensen, 1992). In sub-Saharan African wetland agricultural systems, the production system on farms can include upland fields, wetland fields or a combination of upland and wetland fields (Rebello et al., 2010; Sakané et al., 2013). In sub-Saharan Africa, most farms are family farms. The management system on these farms comprises a family management unit or a combination of a family management unit and one or more individual management units. The literature provides evidence that 2 types of fields can coexist within family farms: family fields (also denoted as collective fields, common fields, jointly-managed fields or mixed-managed fields) and individual fields (Guirkinge et al., 2015; Kazianga and Wahhaj, 2013). Family fields are supervised by the farm head to satisfy family needs. In family fields, the whole family works as a team and the farm head decides on crops, management sequences (Sebillotte, 1974) and profit distribution among the farm family members. Individual fields are granted by the farm head to a family worker for individual use and profit. As a result, farm systems may reveal a complex combination of family fields in uplands, individual fields in uplands, family fields in wetlands and individual fields in wetlands (Fig. 1).

Different patterns of family fields and individual fields result from different ways of dividing productive resources (e.g., land, family labour, cash for purchasing chemical inputs and hiring labour) and profit (in the form of food or cash) within farms. This division may be shaped by cooperation and conflict among family farm members (Caretta and Börjeson, 2014; Doss, 2013; Himmelweit et al., 2013). In this study we address resource division between family fields and individual fields as one of the factors defining farm resource-use strategies (all-for-one versus each-for-himself resource-use strategies). Understanding the diversity in strategies is expected to help generating and identifying meaningful field and farm level options to increase food crop production and improve farmer livelihoods (Cortez-Arriola et al., 2015; Tittonell et al., 2010). Targeting of such interventions has thus far not considered resource division between family fields and individual fields. Little is known about the ways in which resources are divided between family fields and individual fields. Much less is known about how this resource division affects the spatio-temporal aspects of the farm production system, in particular the uptake of cropping in wetlands as compared to uplands. In relation to unlocking the potential of wetlands, this lack of knowledge hampers meaningful proposals on alternative farm systems as changing the existing division of resources may conflict with socially embedded allocation patterns.

Our objective was to investigate the different ways in which resources are divided between family fields and individual fields and the resulting uptake of cropping in wetlands for different farm types, as the first step towards suggestions for enhancing rice production and market gardening in wetlands. We studied farms in two case-study villages in Benin with contrasting agro-ecological and socio-economic conditions: Zonmon in the southern part and Pelebina in the north-western part. To our knowledge, this is the first report that uses farm typologies to

establish the relation between management systems and resulting production systems.

## 2. Materials and methods

### 2.1. Case-study villages

Case-study village choice was subsequent to a rapid regional assessment of the various wetland agro-ecosystems from south to north in Benin. Preliminary zoning was carried out by combining available data sources: a digital map of a number of wetlands in the upper Oueme catchment in north-western Benin (IMPETUS project<sup>1</sup>); a digital map of a number of wetlands in the Mono-Couffo region in south-western Benin (RAP project<sup>2</sup>); and digital maps of the hydrographic network, roads, villages and major urban markets (IMPETUS project<sup>1</sup>, SMART-IV project<sup>3</sup>). To ensure that rice and market garden crops were found in wetlands and to collect additional information on village conditions, pre-identified villages were surveyed. This resulted in selecting two case-study villages that were close to an urban market and situated in markedly different agro-ecological and socio-economic conditions (Table 1 and Fig. 2).

### 2.2. Farm survey

Social maps (Rim and Rouse, 2002) were drawn for each village with the help of village authorities to visualize where farm heads were living and to determine the total number of farms in each village. A random sample of 51 out of 134 (38%) farms from Zonmon and 50 out of 146 (34%) farms from Pelebina were surveyed.

In each sampled farm, semi-structured interviews with the farm head were used to gather information on the family structure and labour availability as well as to identify the management units and to locate sets of fields associated to each management unit. Family workers handling individual fields were interviewed to cross-validate farm head's information. A total of 102 family workers (51 farm heads and 51 individual family workers) in Zonmon and 143 family workers (50 farm heads and 93 individual family workers) in Pelebina were interviewed. To cover a year's cropping seasons, each family worker (the farm head or the individual family worker) was interviewed on three occasions in Zonmon: once during the 2012 long rainy season, once during the 2012 short rainy season and once during the 2013 long dry season, and on two occasions in Pelebina: once during the 2012 rainy season and once during the 2013 dry season (Fig. 2).

Fields of each farm were mapped with GPS. Information collected on a field-by-field basis included land use; production orientation, i.e., food crop production or cash crop production (a field was considered under food crops when more than a half of its harvest was intended for self-consumption); cash spent on chemical inputs, i.e., herbicides, insecticides and fertilizers in the local currency (FCFA; 655.957 FCFA = 1 €); cash spent on hiring workforce (FCFA); land ownership; and major landscape unit, i.e., upland or wetland. Fields were classified as belonging to wetlands when their manager assessed that they were suitable for wetland rice or dry-season market garden crops.

Farm types were ranked based on resource endowment described by land and labour assets; material assets; livestock assets; and cash available for purchasing chemical inputs and hiring labour. Amounts of cash credits provided by extension services for rice and cotton cultivation in Zonmon, and in Pelebina, respectively were not taken into account to bring out a farm's own cash endowment. Type x farms were classified as better endowed than Type y farms when (i) at least one

<sup>1</sup> <http://www.impetus.uni-koeln.de/en/project.html>

<sup>2</sup> <http://ongoing-research.cgiar.org/factsheets/realizing-the-agricultural-potential-of-inland-valley-lowlands-in-sub-saharan-africa-while-maintaining-their-environmental-services-rap-project/>

<sup>3</sup> <https://smartiv.wordpress.com/about/>

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