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Rethinking Land Endowment and Inequality in Rural Africa: The Importance of Soil Fertility

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Summary. — Access to land has been a major emphasis of previous work on socioeconomic differentiation within rural African communities. Land endowment has generally been measured in terms of area without much consideration to variation in the qualities of land at the level of village territories. Building from work on the variation of soil fertility, this paper considers the potential relationship between soil fertility variation and wealth inequality within rural communities in Sahelian West Africa. The management history, yields, and characteristics (livestock and land wealth, labor, tenure security, cropped area) of the households managing and owning 181 sampled fields within two village territories in southwestern Niger are analyzed to evaluate the relative importance of land area and soil fertility in affecting the ability of households to produce food and the factors that affect household investments into soil fertility. Soil fertility variation is found to play a major role in the crop production achieved in the study area. This variation results in part from contemporary and historic investments by farmers largely through manure application. Manuring rates are found not to be affected by the extent of land owned or managed nor by the security of land tenure. Instead, these investments are determined by livestock wealth, the major store of wealth in rural parts of the Sahel. These findings point to a major mechanism for increased inequality in areas where subsistence cropping prevails—a mechanism that is mediated through soil fertility variation.

Key words — West Africa, Niger, livestock, agropastoralism, intensification

1. INTRODUCTION

Soil infertility is portrayed by a wide range of commentators as the major constraint to agricultural development and improved food security in Sub-Saharan Africa (Breman, Groot, & van Keulen, 2001; Jones, 1973; Mueller *et al.*, 2012; Pieri, 1992; Sanchez, 2010; The Montpellier Panel, 2014; World Bank, 2003). The attention to soil quality is consistent with the longstanding interests of rural Africans. Land, as the physical embodiment of lineage and community, has long held significant cultural importance for African societies (Bassett & Crummey, 1993; Downs & Reyna, 1988; Fairhead & Scoones, 2005; Richards, 1985; Shipton, 1994). Studies of local understandings of soil quality demonstrate attention by African farmers to the full range of variables (slope, texture, depth, organic matter content, chemistry) that contribute to agronomic potential, not captured by standard soil classifications (Krogh & Paarup-Laursen, 1997; Neimeijer & Mazzucato, 2003). Production strategies apply this understanding of natural variation to match micro-niches to different crops and inputs (Carter & Murwira, 1995; Kessler & Breman, 1991) or to redistribute nutrients to fields in the form of manure or crop residues (Giller, Cadisch, Ehaliotis, Adams, & Sakala, 1997; Nyamapfene, 1986). As a result, inherent geomorphologic variation reinforced by generations of agropastoral use holds the potential to lead to agroecologically significant variation in soil fertility at multiple scales (Stoorvogel & Smaling, 1993; Tittonell, Vanlauwe, Leffelaar, Shepherd, & Giller, 2005).

Despite widespread concerns about declining soil fertility and evidence that African farmers have long sought to concentrate nutrients on the landscape to address fertility constraints, there has been little biophysical work on differences of soil fertility between more than several farmers' fields within village territories—the primary scale at which farmers' access to land is shaped. This is despite the fact that prior work suggests there is significant variation at this scale (Gray, 2005; Prudencio, 1993; Samake, Smaling, Kropff, Stomph, & Kodio, 2005; Turner & Hiernaux, 2015; Waswa *et al.*, 2013). For example, the variation observed at the village territory level (e.g., soil carbon varying from 0.2% to 2.2% across a village territory—Prudencio, 1993) can equal the stated variation observed at the subcontinental level (e.g., mean soil carbon varying from 0.3% to 2.5% for soils from the equatorial forests to the Sudan savannas—Windmeijer & Andriesse, 1993). In this way, differential productivity (yields) between fields may play a much more important role in affecting differential vulnerabilities to food shortage within rural African communities than is typically assumed.

Despite its potential importance, social analyses of inequality within African communities have generally not considered the implications of soil fertility variation at the local level. Most studies focussing on the social aspects of land and land tenure have ignored land quality variation with "land endowment" simply measured by the surface area of households' fields (e.g., Haggblade & Hazell, 1988; Hill, 1972; Jayne *et al.*, 2003; Matlon, 1981; Tschirley & Weber, 1994; Whitehead, 2006). Building from prior work in the *Fakara* region of southwestern Niger (Turner & Hiernaux, 2015), this paper treats soil fertility variation as being shaped by investments by farmers—investments that have a potential

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for reinforcing or transforming long-standing inequalities within the rural communities. In this way, land endowment is, at the least, two-dimensional—incorporating not only access to land area but also to the land's quality. For subsistence farmers with limited access to cash, manure is the major means, beyond fallowing, for maintaining or increasing soil fertility. An understanding of households' productive land endowment requires an understanding of the surface area and location (affecting inherent and historically produced fertility differences) of their fields as well as their access to the means for maintaining or increasing soil fertility (manure). This paper reports on work conducted in two adjoining village territories where the soil fertility of 181 georeferenced fields was measured (Turner & Hiernaux, 2015). Using these data, this paper will assess the variation in the quality and quantity of land farmed; the social factors that shape farmers' investments into soil fertility; and how these investments affect the relative ability of households to produce food. The implications of this empirical work will be then placed within the broader context of political economic change in the region where the shifting importance and control of two important forms of capital, land and livestock, figure prominently in the ability of rural households to support themselves.

2. LAND QUALITY VARIATION AND ECONOMIC DIFFERENTIATION

Treatments of the underlying factors contributing to the differentiation in wealth accumulation among small-scale rural households within African communities are diverse, ranging from those that emphasize the characteristics (entitlements, assets, capabilities) of the relatively poor and rich (Bebbington, 1999; Deere & de Janvry, 1981; Ellis, 1988; Sen, 1992) to those that focus on the political economic processes that reinforce or exacerbate differentiation (e.g., Watts, 1983b). In West Africa, differential wealth within rural communities has been attributed to household size, the household life cycle (e.g., Chayanov, 1966), lineage, entrepreneurialism, access to capital, remittance income, political power, and household positions with respect to the market and usury (Bolwig, 2001; Hill, 1972; Hopkins, Levin, & Haddad, 1994; Mortimore, 1989; Raynaut, 1988; Reardon, Matlon, & Delgado, 1988; Shipton & Goheen, 1992; Toulmin, 1992; Watts, 1983b; Whitehead, 2006). Arguably, the post-1980s social science literature on Sahelian poverty developed in reaction against portrayals of the Sahelian region's poverty as simply resulting from its resource poverty and episodic drought (Franke & Chasin, 1980; Raynaut, 1997; Watts, 1983a). Poverty was not seen as predetermined by physical geography but was produced by differences in power and interest as mediated by markets and institutions. This perspective is consistent with the broader food security literature that developed around the idea that famine and food insecurity are not simply outcomes of external biophysical shocks (drought, floods, epidemics) but are shaped by markets (Sen, 1981) and broader structural changes in agrarian political economies (Watts, 1983b; Watts & Bohle, 1993).

Given this intellectual history, it is not surprising that the less-than-obvious soil quality differences between cropped fields have not been research foci for researchers interested in the persistence of wealth inequities with rural African communities. In the Sahel in particular, rainfall variability is seen as the major agronomic constraint with vulnerability to rainfall deficit and resulting wealth differentiation socially constructed. This dominant perspective has been called into question by agronomists and soil scientists who have shown that Sahelian crop yields are significantly limited by low soil fertility (Bationo, Lompo, & Koala, 1998; Breman *et al.*, 2001; Pieri, 1992; Powell, Fernandez-Rivera, Hiernaux, & Turner, 1996). Moreover, smallholders recognize this and make significant investments (relative to their limited assets) to maintain or increase the fertility of their fields (Fairhead & Scoones, 2005; Gray, 2005; Krogh & Paarup-Laursen, 1997; Neimeijer & Mazzucato, 2003; Warren, Osbahr, Batterbury, & Chappell, 2003). Therefore, the quality as much as the quantity of land can be seen as important landesque capital (Blaikie & Brookfield, 1987; Hakansson & Widgren, 2014) that increases crop yields, reduces vulnerability, and provides a means for further capital accumulation (within limits). In this way, investments into soil fertility can be seen as contributing to processes of accumulation with resulting variation in land quality both a symptom of and contributor to local differentiations of wealth. It is through this lens that we will review the existing literature on soil fertility management in rural Africa.

3. SOCIOECONOMIC FACTORS BEHIND SOIL FERTILITY MANAGEMENT

The nutrient status of cropland is shaped not only by its inherent fertility but by a range of management factors including: the rate of fallowing, tree/shrub management (e.g., agroforestry), crop residue management, livestock manuring, green manuring, legume use, and inorganic fertilizer use. With the growth of rural populations, fallowing alone is not sufficient to maintain soil fertility in most rural areas of Africa. Prior socioeconomic work on the soil fertility management has focussed on the incentives for soil fertility investments. Soil fertility maintenance lies at the heart of Ester Boserup's model of population-induced intensification where land shortage provides incentives to find alternatives to fallowing for maintaining the productivity of fields (e.g., Boserup, 1965; Gray & Kevane, 2001; Netting, 1993; Turner, Hyden, & Kates, 1993). Following the same tradition, other treatments have incorporated access to markets and cash cropping as stimuli for more intensified production (e.g., Tiffen & Mortimore, 1994). One important finding of this work is that different households within the same community may experience quite different levels of land scarcity which will be reflected in their field management practices (Gray, 2005; Murton, 1999).

Another major strand of research has emphasized the importance of the security of soil fertility investments. The security of land tenure (and with it, access to credit to purchase fertilizer) is seen as increasing the incentives of smallholders to invest in their land (e.g., Barrows & Roth, 1990; de Zeeuw, 1997; Gavian & Fafchamps, 1996). Some argue that land scarcity and market access actually increases the incentives for communities to invest in more secure land tenure institutions (c.f. Platteau, 1996). Others have pointed out that the causal direction can work in the opposite direction where investments in soil fertility are made to obtain greater security in tenure by continuous cropping (Gray & Kevane, 2001). A major area of confusion and uncertainty lies in how researchers think about tenure security. For some, tenure security is synonymous with land title when in fact a wide range of studies have shown that variable levels of security can be gained informally through social networks and relations (Bromley, 1989; Ouedraogo, Sawadogo, Stamm, & Thiombiano, 1996; Platteau, 1996).