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ABSTRACT

Popular and official representations of the environment in Burkina Faso present soils as fragile and potentially subject to catastrophic collapse in fertility. In the cotton growing zone of southwestern Burkina Faso, researchers and policy makers attribute changes in land cover and land quality to population growth. This paper presents evidence questioning the dominant 'population-degradation narrative' as applied to Burkina. We find that farmers are intensifying their production systems. While population has led to land scarcity, farmers are responding to both the resulting uncertainty in land rights and reductions in soil quality by intensifying the production process. Investments are used both as a soil-building and a tenure-building strategy.

But instead of producing an optimistic intensification counter-narrative, we contend that intensification is a process with social costs. A more complex intensification narrative should encompass elements of changing asset distribution, expropriation, and conflict in the process whereby individuals and social groups vie for land rights and invest in intensified production processes.

Keywords: Land tenure, Africa, intensification, degradation, environment, Burkina Faso

1. INTRODUCTION

Popular and official representations of the environment in sub-Saharan Africa present soils as fragile and potentially subject to catastrophic collapse in fertility. These representations have justified a variety of policies, from draconian land takings to participatory community land management initiatives. Burkina Faso is a case in point. The Burkinabè state has cooperated actively in donor-financed 'anti-desertification' campaigns. One of the principal planks of the revolutionary Sankara regime (1983-87) was an afforestation campaign. The Compaoré regime (1987-present) has backed a comprehensive land policy emphasizing local control and participation.

Population growth is commonly cited as a key causal factor in degradation. The recent National Environmental Action Plan (1993:1) notes that: "In modern times these [traditional] practices have been overwhelmed by population growth. A burgeoning population means that there is simply not enough land to leave fallow, with serious consequences in terms of overutilization of the land." In the cotton growing zone of southwestern Burkina Faso, researchers and policy makers likewise attribute changes in land cover and land quality to population growth (PNGTV 1989). It is true that in the span of a decade population almost doubled, due mostly to large-scale migration from the more heavily populated and drought-affected north and central regions of the country. Large reductions in fallow periods are well-documented in southwestern Burkina (Berger et al 1988; Gray 1999; Serpantier 1992). Several authors have asserted that tree densities in farmers' fields are declining (Gijsbers et al. 1994; Kessler 1992).

This representation of the relationship between population and the environment as one of increasing land degradation is not specific to Burkina. It constitutes a dominant narrative in the range of population-environment narratives (Cleaver and Schreiber 1994). The degradation narrative, repeated frequently and with considerable authority, has become

conventional wisdom and as such has provided the 'enabling assumption' around which donors form programs (Roe 1995; Hoben 1995). The degradation narrative has become important where political actors have discovered environmental constituencies, and development policy has taken an environmental turn. Political actors have learned that packaging development projects with environmental projects can generate broad opportunities for coalition-building (especially in donor countries).

In contrast to this degradation narrative, some researchers have advocated characterizing the relationship between population and environment as one of intensification. That population growth may lead to agricultural intensification is not a new idea. Much of the theoretical understanding of intensification emerged from Boserup (1965) who argued that reductions in land availability forced people to develop and adopt new technologies either by using more labor or more capital per unit area. In the process of intensification, fallow times are reduced and cropping frequency increased. While Boserup focused on population growth as the main stimulus for agricultural intensification, others argue that markets, credit, services and government policy are equally important (Lele and Stone 1989; Pingali and Binswanger 1987). A spate of recent empirical papers offer detailed case studies from sub-Saharan Africa suggesting that agricultural systems are intensifying, thus sustaining or improving ecosystems and yields (Tiffen et al. 1994, Netting et al. 1993, Turner et al. 1993). These various studies show that with growing population pressure and reductions in fallow times, farmers are using techniques to substitute for the inability to fallow fields. Productivity is frequently augmented or restored with fertilizer, manure, agro-forestry, or cover crops. Irrigation, likewise, intensifies production by enabling techniques of more continuous cultivation across seasons over the year.

Debates about land tenure as a key institution that mediates between population changes and environmental outcomes have shaped policy and research priorities. Many government policy makers and academics continue to believe that communal tenure systems impede agricultural investment, despite the fact that research has consistently failed to demonstrate impacts of titling and formal individualization on investment behavior (Migot-

Adholla et al 1991; Platteau 2000, Sjaastad and Bromley 1997). This is particularly true for Burkina Faso, where studies have found no link between tenure status and agricultural practice (Matlon 1994, De Zeeuw 1997, Braselle, Gaspart and Platteau 1998). Nevertheless, the prior belief persists, justified by several 'self-evident' arguments. First, population growth and increased competition for land are thought to be resulting in uncertain land rights, which in turn lead to tragedies of the commons. Farmers clear land in order to lay claim to it, occupying land not in order to cultivate efficiently but as a way of staking a claim (Brider 1990). Second, because farmers' claims are insecure they are hesitant to invest in soil quality (Faure 1995). Third, degradation is thought to be especially pervasive among migrant farmers, who not only have insecure tenure, but are often characterized as being destructive of agrarian landscapes (Benoit 1982).

This paper considers evidence on these parallel debates over degradation and tenure insecurity, as applied to southwestern Burkina Faso. The data, from surveys conducted in three villages in the 'cotton zone' of southwestern Burkina, supports the alternative narrative of intensification. We will show that the *more* densely populated village has more intensive production practices, that the supposedly 'environmentally irresponsible' migrant farmers are probably *less* destructive of the local agro-ecology, and that less secure land status plays *little* role in local degradation. While land area under cultivation has increased at the expense of forest, farmers are making changes in their management strategies that result in improved soil quality. They use manure and fertilizer, rotate crops, leave trees in fields, and build soil/water conservation structures.

This process of intensification has implications for soil quality, but also for land rights (Platteau 1995). By investing in soil quality, farmers are simultaneously building land rights. A growing literature puts the individual actor in the dynamic position of creating land rights through cultivation and investment strategies (Besley 1993, Braselle, Gaspart and Platteau 1998, Platteau 2000). Burkinabè farmers seem to be quite conscious of how intensification gradually strengthens rights to land. The longer one can stay on a field, whether one is a

local or migrant farmer, the more difficult it is to take the land away and the less authority lineages and communities have over the field.

Instead of concluding with a happy coincidence of intensification and evolving land rights, however, we contend that intensification is a process with social costs. There are winners and losers. More specifically, because intensification involves changing land rights there is essentially a process through which wealthier farmers who have access to inputs strengthen rights while poorer farmers lose rights to land. The gradual polarization in rights exacerbates an already tense political atmosphere, and encourages conflicts over land. A more complex intensification narrative should encompass elements of changing asset distribution, expropriation, and conflict in the process whereby individuals and social groups vie for land rights and invest in intensified production processes. These elements are probably general to the intensification process, and their absence from the usual intensification narrative is troubling. They are particularly troubling because this process has straightforward implications for government policy. In Burkina Faso, the government has weakened the principle of individual or household usufruct rights, and relied on informal mediation to solve conflicts. This strategy probably ends up further undermining the rights of poorer farmers or marginalized groups (including women), who cannot sustain continuous cultivation and who cannot influence the process of informal mediation. A fairer policy might reverse this trend, and embrace more security for individual tenure among the most vulnerable.

2. DEMOGRAPHIC AND AGRICULTURAL CHANGE IN SOUTHWESTERN BURKINA FASO

Over the past two decades, southwestern Burkina has undergone rapid change associated with population movement, cotton cultivation and animal traction. Most of the population growth has come from migration of Mossi farmers from the drought affected central and northern regions of the country. When they initially started to migrate in large numbers in the 1970s, they were welcomed and given land by local Bwa farmers who

leveraged the growth in population into more political clout at the regional and national level. Population growth rates of the *zone cotonnière* increased much more rapidly than the country as a whole, more than doubling from 1975 to 1985.[1] In recent years, migration has slowed down, primarily because local Bwa farmers themselves perceive a land shortage and no longer easily grant fields to Mossi migrants. Some villages are experiencing now population reductions as Mossi migrants continue to move southwards in search of fertile lands in other parts of the country.

Population change has been accompanied and followed by large-scale changes in agricultural practices and technology (Pingali & Binswanger 1987, Nobere 1988, Tersignel 1992; Sanders el al. 1996). Cotton yields and area under production grew dramatically: from 1980 to 1990 cotton/grain production went from 62,000 to 189,000 tons (Schwartz 1991). The emergence of agricultural extension, financial and marketing services were among the key reasons why cotton production and yields increased during the 1980s. In 1979, after CFDT (*Compagnie Française pour le Développement des Fibres Textiles*) partnered with the government of Burkina to create a new cotton organization called Sofitex, external donor resources began to pour into the cotton sector. The price of cotton increased and agro-chemical and financial inputs became available. Grower cooperative associations known as *Groupements Villageois* (GV) began channeling short-term loans for fertilizer, seeds and herbicides.

Animal traction was a key element of this technological package. Day et al (1992) estimated that improved animal traction packages could generate up to 45 times more net farm income for Sahelian households. In 1980, Sofitex began its *motorisation intermédiare* program that financed purchase of animals for traction and plows (Schwartz 1991). Members of the GV were able to apply for medium-term loans for the equipment and oxen for animal traction through CNCA *(Caisse National de Crédit Agricole*). This led to a rapid region-wide adoption of animal traction.

While cotton production has propelled the region into one of the wealthiest in Burkina, it has not been without problems. Group indebtedness and consequent inefficient political

negotiations over credit programs and repayments have plagued the program. This, along with reliance on expensive inputs with concomitant price and supply risk, and pest-control failures due to lax regulations and low farmer education, have led to many farmers abandoning cotton production altogether.

3. THREE VILLAGES IN THE COTTON ZONE

We investigate the degradation narrative in the province Tui (formerly Houet), in the heart of the cotton growing region of southwestern Burkina. A sample of 106 farm households were surveyed in three villages- Dohoun, Dimikuy, and Sara- during the 1995-96 agricultural season. The villages were similar in most regards. They were approximately 20 kilometers apart down an unpaved cotton road. They had similar ethnic make-ups; each village had both local Bwa and Mossi migrant populations. The sample was selected to ensure adequate representation of both groups. Farmers were asked about their agricultural practices, household demographics and perceptions of environmental change. Although much of our data is cross-sectional, by comparing three villages with similar agricultural potential but with different population densities, we are able to get a glimpse at different stages of the population-environment nexus.

[Table 1 about here]

There were large differences in socio-economic indicators among farmers and across villages and ethnic groups. Table 1 presents some summary statistics. Large household compounds of the past had disappeared; most household consisted of parents and married son, or a pair of married brothers, with the average number of adults slightly less than five. A relatively crude index of animal wealth- constructed by weighting numbers of animals by average market prices- shows that Mossi tended to invest their wealth much more heavily into livestock. The value of animals owned by Mossi was almost three times the value owned by Bwa. The investment priorities of the Bwa, however, tended to steer towards education and housing. An index of housing stock constructed as the sum of five zero-one measures of housing investment (in walls, roofs and courtyards) is moderately higher for the Bwa,

especially in Sara (though not statistically significant for the whole sample because of missing observations from Dohoun). Farm assets were not significantly different between the two groups. The percent of households owning oxen was very high, ranging from 75% in Sara and Dimikuy to 40% in Dohoun. Even the low rate of adoption in Dohoun was quite high for Burkina at the time. Most of those who owned oxen owned a pair, and also owned their own plows. About half of the farmers owned carts for transporting manure and farm produce. The average family cultivated roughly six hectares, often as a single field divided into separate plots for the different crops. Mossi were more likely to have two fields.

Comparing the villages, residents of Dimikuy were wealthier than their neighbors. Dimikuy families were larger than the families of the other two villages; Dimikuy households had double or more the value of livestock; housing investment was higher; and farm capital was higher. Farms were bigger. Dimikuy and Dohoun farmers tended to have a single field, reducing transportation and coordination costs. The fields of Sara farmers were more likely to be scattered, primarily because of the difficulty of finding fields in close proximity due to land scarcity. (Rainfall in this part of Burkina Faso is fairly heavy and consistent, reducing the economic incentive to scatter fields.)

Farmers in 1995 were growing cotton and maize on slightly less than half of their acreage, which averaged around six hectares. Sorghum, millet, groundnuts and beans were grown on the rest. Partly as a consequence of their relative lack of oxen, Dohoun farmers tended to grow the largest fraction of their land (51%) in sorghum and millet, while the more prosperous Dimikuy and Sara farmers were able to pursue a fuller range of diversified production.

4. SOURCES OF DEGRADATION AND INTENSIFICATION IN THREE VILLAGES

The Burkinabè population-degradation narrative has three strands which are intermingled in the discourses of policymakers, government officials and farmers themselves. First, population growth is thought to lead to land degradation through fairly direct means- more people means more land cultivated which in turn leads to less shifting cultivation and

increased degradation. The second strand offers a cultural explanation, relating Mossi traditions of 'conquest' to their present attitude toward their natural resource base. Mossi migrants in particular are blamed for reductions in fallow periods and soil degradation due to poor agricultural practices. Researchers, government officials, and local farmers alike perpetuate a stereotype of migrant farmers who like to cut down trees (Benoit 1982). The final strand of the Burkina narrative is that population growth and land scarcity have led to uncertain land rights. Throughout western Burkina, land-holding continues to be based on usufruct and is regulated through membership in corporate groups. With continuous in-migration and changing production patterns, however, land conflicts and uncertainty regarding rights have become more common.

We examine each component of the Burkinabè degradation narrative- population growth, Mossi short-sightedness, and tenure insecurity- in turn, by looking at non-degrading practices such as manuring and tree-presence on fields. These practices are commonly associated with intensification, and portend a more sustainable agricultural future. We also combine the explanatory variables in a multivariate setting.

(a) Population growth as source and cause of degradation

The primary difference among the villages is in land availability. The southwest in general has had low population densities, ranging from 15 to 30 people per square kilometer, but the densities in the three villages are higher because of the increased migration. Table 2 presents population densities for the three villages. Population densities were calculated from land area data culled from aerial photographs and satellite imagery and from population figures from the decennial censuses (Morant 1990). Population essentially doubled in all three villages between 1975 and 1985, but growth has slowed down as land is not available for potential migrants. The densities have been calculated for both total land area and for land that is considered arable.

[Table 2 about here]

The villages have very different population densities over available land. Sara has much a higher population density than the other two villagers. Land of Sara was taken away

with the establishment of classified forests, and much of the remainder is on steep slopes and uncultivable. Dimikuy's medium population density can also be attributed to the fact that much land has also been put into classified forest. Dohoun, on the other hand, still has an abundant amount of land available for cultivation.

The much higher population density in Sara was clearly associated with measures of intensification (the regression analyses below will confirm the statistical significance of these comparisons). Table 3 shows that fertilizer use was in general very high; it was applied to 65% of all fields. Manure use was lower; overall only 20% of fields were manured, and 20% had animal corralled. Of the hand-manured fields, four-fifths were also fertilized, and for those farmers who used manure, the number of sacks used per hectare was positively correlated (0.26) with the amount of fertilizer used, rather than negatively correlated. Both fertilizer and manure use were sharply higher in Sara compared with Dohoun, despite the preference of farmers not to use fertilizer on sloped fields. Recall that Dohoun had the lowest incidence of draft animal ownership, and very low levels of animal ownership generally.

[Table 3 about here]

Table 3 also shows the density of trees on agricultural fields in the three villages. Sara, with an average of 18 trees per hectare, had the highest number of trees of the three villages. (Incidentally, Sara fields also had the fewest number of stumps, and more trees on more recently cleared fields, indicating that the higher number of trees are part of deliberate strategies not to cut down trees.) Of the trees counted, approximately 75% were *karité*, 6% *néré*, 2% *Acacia albida* and 17% other types of trees such as tamarind (*Tamrindus indica*), *caicedrat* (*Khaya senegalensis*) or *raisinier* (*Lannea microcarpa*). Farmers leave many of the species from the 'other' category in their young fields; often they are removed within the first several years of cultivation.

On some measures, however, there were clear effects of the higher population density: Sara fields were cultivated longer (though Sara field were not found to have declined as much in terms of lowered harvests over recent years or heavier weeds- at least not according to the self-reported descriptions of farmers, and this result is not significant in the

regression analysis); Sara did have more observed erosion (though its fields were more often sloped, and this also explains the low frequency of corralled herds on the fields); and Dohoun had more evidence of anti-erosion measures (an intensive agricultural extension project in Dohoun explains the difference).

Overall, the data show that intensification was higher in the higher density villages, and suggests that there is no easy correspondence between population density and land degradation.

(b) Mossi as source of degradation

Table 3 furthermore shows there is no clear evidence for the perception of Mossi as adopting more land-degrading practices. The did not have fewer trees on their fields, nor did they cultivate their fields longer. They were more likely to use manure (though less of it than Bwa farmers who also used manure) and more likely to have anti-erosion investments (though also more likely to have erosion, partly because of a preponderance of sloped fields among the Mossi). Most Bwa used fertilizer rather than manure as soil amendment, but when Bwa did use manure (on only ten fields) they tended to use twice as much manure per hectare as Mossi. Bwa in Sara had higher densities of trees in their fields than migrants. In Dimikuy and Dohoun, however, the relationship was reversed. Mossi in the two villages had significantly higher numbers of trees in their fields than did Bwa. Interviews with farmers confirmed that they left trees on their fields purposefully. Dohoun did, however, have the highest incidence of cattle corralled on Bwa fields depositing manure directly; 72% of the Bwa (only 20% of the Mossi) responded that their fields were indeed renewed in this manner, many from Peulh herders. Again, no obvious correlation between ethnic status and land degradation across the range of outcomes or sustainable farming practices.

(c) Insecure tenure status as source of degradation

In the three study villages, Mossi and Bwa differed sharply in tenure status, and these differences in status are closely connected to different levels of insecurity. Table 4 breaks down fields according to mode of acquisition. Mossi fields were all borrowed except for 5% of the Mossi fields in Sara where cultivators claimed to have inherited their fields. in general

Mossi are ‘strangers’ and can have no claim to the mystical ties to land created when an ancestor opens the bush for the first time. Nevertheless, land once borrowed is often difficult to regain, and inheritance from father to son is a powerful principle of the modern economy that may serve to justify and legitimate claims to land. It is not surprising then to find the occasional Mossi claiming to have inherited his land. There are similar ambiguities in borrowing; many of the Mossi borrow from their local Mossi sponsor (or *tuteur* in French) who has ‘presented’ them to the Bwa inhabitants and allocated them land without going through- except formulaically- normal Bwa ritual sacrifices. The incidence of obtaining land indirectly is increasing; average time in the area for a Mossi who obtains land from a *tuteur* is only fifteen years, as opposed to an average of twenty years for those Mossi fields obtained directly from Bwa.

Normally, a Mossi borrowing a field would be required to present a ritual gift of grain to the Bwa lineage head controlling the land. The situation on the ground is more variable: some Mossi give no grain, others give one *tiin* (about 10 kg.) and still others, particularly in Dimikuy where tenure tensions have increased, give two *tiin*. In addition to varying by village, these payments vary in an expected way with source of land and time acquired. Land obtained by Mossi from their *tuteur* is less likely to carry with it the implicit gift of two *tiin*, while land obtained directly from Bwa is more likely to carry a high gift. There has also been evidence of a trend towards larger gifts.

[Table 4 about here]

The sources of Bwa fields are also varied. In Dimikuy and Dohoun, Bwa are most likely to have obtained their fields through lineage allocation. A substantial fraction borrow fields from outside the lineage; the incidence of ‘borrowing’ land within lineages is slight. The situation in Sara is different, reflecting higher population density. As much land is borrowed as inherited, and a substantial fraction of land is inherited across lineages.

In order to examine the effects of different tenure status, we adopt a multivariate framework estimating reduced form equations for input demands. We control for village (proxying for population density) and field characteristics, as well as the wealth of the

farmer. A problem with estimating input demand relations concerns the prevalence of zero values of manure and fertilizer use on fields, and many of the other practices coded as zero-one values. We estimate the equations using Tobit and Probit procedures. The spirit of these estimates of the determinants of fertilizer and manure use, and tree density, is exploratory (for econometric investigations using data from other countries see Jha and Hojati 1993; Gavian and Fafchamps 1996; Savadogo et al. 1994; Hayes, Roth, and Zepeda 1997; Clay, Reardon and Kangasniemi 1998; and Pender and Kerr 1998). Table 5 presents the estimated coefficients for models explaining the various practices described earlier in Table 3.

Note that given the limitations of the sample and data we are unable to control for the possible endogeneity of tenure security. A recent paper that offers an excellent introduction to the difficult and still unresolved econometric issues at issue is Braselle, Gaspart and Platteau (1998). In our case, we are not explicitly measuring tenure rights (which may well be endogenous) but rather tenure status (e.g. Mossi borrowing from Bwa, or from Mossi *tuteur*, etc.). Status may also be endogenous in that farmers deliberately select who to borrow land from, or who to lend to. But given the usual long-term nature of most of these borrowing arrangements that endogeneity is likely to play less of a role in this specific situation.

[Table 5 about here]

The regression results confirm the thrust of this section, that major components of the degradation narrative as applied to Burkina do not apply to the study area. First, the variables for tenure insecurity are only significant in a small fraction of the regressions. These tenure variable are: *moborbwa*, whether a Mossi farmer had borrowed from a Bwa lineage; *mborfrer*, whether a Mossi farmer had borrowed from a *frère* or *tuteur*; and *bwabor*, whether a Bwa farmer had borrowed the field. The omitted category is whether the field was managed by a Bwa farmer who had inherited. There are seven dependent variables, and three explanatory variables having to do with tenure status, for a total of twenty-one possible coefficients. Of these, only one is significant at the 1% level, tw are significant at the 5% level, and tw at the 10% level. This contrasts with the coefficients for field characteristics (*slopdum*, a dummy

variable for whether the field is sloped, *farfield*, a dummy variable for whether the field is farther away from the village, *stony*, the percent of the field that is stony soil, and *silty*, the percent of the field that has silty soils), which are significant at the 5% or 1% level in 11 of 28 instances, and the coefficient on farmer assets which is significant in 6 of the 7 regressions.

Moreover, even when they are significant, tenure status variables are not necessarily best interpreted as signifying that insecurity leads to poor practices. In the regression explaining manure and fertilizer use, the tenure variables for the Mossi have similar coefficients, and are basically proxying for the Mossi ethnic group as a whole, excluded in general from the formal structure for obtaining fertilizer and hence resorting to more manure use. In the probit equation explaining whether erosion was observed to be a problem, this may be more an indication that more recent Mossi arrivals are given, by their *tuteurs*, already eroded land.

Second, the village of Sara, the most densely populated, is associated with better practices (trees, fertilizer) in two cases, and with worse practices (animals corralled, anti-erosion investment) in two cases.

Third, as suggested above, and confirmed by regressions with only dummy variables for ethnicity instead of the tenure variables, there is no justification for the idea that Mossi have different practices from Bwa. In those regressions, the ethnic dummies follow the basic direction of practices for the ethnic groups established in Table 3.

Finally, the regressions are most consistent in revealing that the level of household assets is a significant determinant of intensification practices. Wealthier farmers apply more manure and fertilizer, they corral animals on fields, they adopt anti-erosion techniques, and they farm fields for longer periods.

5. ALTERNATIVE INTENSIFICATION NARRATIVES

Population growth and technological change have resulted in land scarcity in the study area. This in turn has propelled farmers to begin a process of intensification, applying more

inputs to land and sustaining output without significant soil degradation.[2] In many regards the study area is similar to others described through Africa where processes of intensification are also underway. Tiffen et al. (1994) find that Machakos district in Kenya has more trees and less erosion as population and household incomes have increased. Turner et al. (1993) demonstrate these relationships in a number of case studies of agricultural growth and intensification in sub-Saharan Africa. In most of the case studies of populations over 200 people/square kilometer, farmers have fairly intensive agricultural systems. Netting et al. (1993) have documented the process by which Kofyar farmers have responded to demographic pressures by intensifying their agricultural production through the use of bio-chemical inputs. Simulation studies predict similar processes. Barbier (1998), for example, conducted a simulation exercise of a typical Burkina village in the cotton zone, subject to population growth, and found that intensification was the profitable strategy (though). These studies typically offer optimistic counter-narratives explaining the intensification process (though Barbier predicts declining welfare as soil quality deteriorates even with intensification).

The usual intensification narrative neglects an alternative that is not so optimistic. As we have seen, adoption of intensification practices depends on assets (i.e. wealth). This has an important and neglected effect: since intensification facilitates continuous cultivation, and continuous cultivation changes land rights, a subset of wealthier farmers are developing new, more secure rights to land. Poorer farmers who have to abandon fields because they cannot sustain cultivation through intensification become less and less secure in their tenure rights. Most studies of intensification do not mention this process. Barbier, for instance, implicitly assumed that every villager's tenure rights were secure, and so assumed that intensification benefits were divided up evenly among village residents according to their landholding.

Farmers across the three villages agreed that continuous cultivation, irrespective of the source of land, was a necessary and perhaps even sufficient condition for secure tenure. A field was generally secure while an individual cultivated it, but as soon as it was left fallow, a process of competition for that land began, a process in which an individual's status was key

in determining whether that individual would be able to maintain rights to it during the fallow period. The ability to maintain control over fallow land depended on several factors: whether that land was borrowed or inherited; whether it belonged to one's lineage; ethnicity; length of time of cultivation of that parcel; and the social and economic status of competitors for land. Only migrant farmers who had resided in the area for a long period and who had developed ties of marriage or friendship said they could be confident in leaving land fallow.

Almost all Mossi farmers in the sample stated that would not leave land fallow for fear that it would be taken away from them. A Bwa farmer in Sara expressed a sentiment common to both Bwa and Mossi alike: "A Mossi farmer will never leave a field fallow because they are afraid of having it taken away." For the Mossi, the threat of losing land left fallow was seen as a deliberate political strategy of the Bwa. In their view, Bwa youth had pushed their elders to encourage Mossi out-migration. This 'encouragement' took three forms: taking fallow land back; only giving old and infertile fields to resident Mossi who requested new fields; and denying fields to new Mossi migrants.

More and more, this problem applied to local Bwa farmers as well, who were also hesitant to leave land fallow. They feared that relatives would ask to use the land, requests which which they might have little choice but to fulfill. One Bwa farmer in Sara counted over seven requests for his land from both Bwa and Mossi farmers in the two years it had been left fallow. He was easily able to deny Mossi requests, but not easily able to decline requests from Bwa kin and friends.

Maintaining access to land required farmers to pursue strategies of continuous cultivation, which could be effective regardless of the initial tenure status of the field (borrowed or inherited, migrant or local). Thus at one extreme the wealthiest Mossi farmer in Dimikuy had planted mango trees on one of his fields, an act expressly prohibited by the Bwa. His wealth and standing in the community made him immune to normal restrictions concerning land. A more common strategy used by farmers was to leave a portion of a field in fallow, while cultivating the remainder. By not abandoning the field completely, farmers could assert control over the entire field. Several Mossi farmers applied manure to plots left

fallow within larger fields, thus improving the quality of the fallow. The strategies of farmers in the three villages were similar to those described elsewhere. Matlon (1994), finds that in Burkina manure application is higher on plots that are borrowed non-lineage lands than on plots borrowed from lineage land. He speculates that farmers may use manure to prolong cultivation, increasing their ability to farm land in situations where tenure security is marginal. More generally, the assertion that there is a relation between agricultural investment and land rights has been made in Besley's (1993) study of tree planting in Ghana and Braselle, Gaspart and Platteau's (1998) study of land investment in Burkina. These demonstrate that tenure becomes more secure through the act of planting trees and other investments. Land rights are endogenous; the evolution of land rights and economic investment in agriculture occur simultaneously.

We have seen above that wealth was a key determinant of whether farm households adopted intensification techniques. This implies that the process of intensification will be uneven in terms of distribution. If wealthier farmers intensify and gain more secure land rights, poorer farmers are the ones who gradually lose tenure rights because of their inability to maintain their investments in land. Tallent (1997) warns of this process in southwestern Burkina, as does Lund (1998) in a study of farming in northern Burkina.

This uneven process opens the door to costly conflict, as poorer and land-short farmers (particularly the young) use political discourses (infused with the language of ethnicity) to halt incipient processes of intensification and 'privatization'. Land scarcity has indeed led to open conflict over land. In Sara, for example, Bwa farmers have expelled Mossi migrant farmers from an entire village area. Bwa farmers in an attempt to regain land that had been long settled by Mossi used threats of violence. Groups of young men with guns went door to door to warn Mossi who were cultivating there to leave "or else". In the end, though, it was not overt violence but sorcery that convinced Mossi farmers to abandon their fields. Stakes were placed in Mossi fields, which were translated by most Mossi farmers as "you had better leave or you will die". In local cosmology, land is controlled by the ancestors who watch over the actions of the living. It is widely perceived that they will intervene if they

sense that people are not respecting the land. Bwa farmers argued that the evictions were just; Mossi farmers moved into the area without permission and had not conducted the proper rituals. By early 2000, four years since Mossi left their land and despite official decisions on their behalf, most were unwilling to return for fear of revenge from the "ancestors". Many had left Sara and migrated to southern Burkina near the Côte d'Ivoire border.

In Dimikuy, a project to reorganize land holdings based on the *Gestions des Terroirs Villageois* (Painter et al., 1994) model broke down after Bwa villagers used the rhetoric of sustainable land management to advocate evicting Mossi farmers from the village. They invoked the stereotype of Mossi farmers who like to cut down trees as justification for asking Mossi villagers to leave the village. Conflicts between young and older Bwa also surfaced as younger villagers accused their elders of giving away their land for payment. The leaders of the reorganization project recognized the tense situation and suspended plans to implement land management programs. In several neighboring villages, however, land conflicts resulted in violence and murder. Local and regional government has been very aware of the tensions over land and the great potential for conflict as land becomes scarcer. There have been many attempts to officially mediate conflicts, particularly between Bwa and Mossi farmers. The highest official of the province, the *Haut Commissaire*, visited several of the study villages to discuss issues of violence and land with local people.

6. CONCLUSION

Debates on the causes of degradation being population growth, or culture, or tenure insecurity, and over whether degradation is in fact taking place, and of the causes of intensification and investments in sustaining soil quality, are the basis for competing environmental 'narratives' that shape policy and politics. These narratives operate at local, national and international levels. Furthermore, these narratives have material implications for residents in the region. Organizations such as the World Bank and *Caisse Française* are attempting to alter local institutions for land management through *Gestion des Terroirs* programs.

This paper has argued for a more nuanced version of the intensification narrative and the inappropriateness of the degradation narrative. Three villages in southwestern Burkina-- Sara, and Dimikuy and Dohoun-- differ greatly in availability of arable land. Farmers in Sara speak gravely of land shortage. They complain that they no longer have fallow land. Yet this population pressure, as in other parts of sub-Saharan Africa, does not appear to be leading to unsustainable farm practices. Instead, Sara villagers, and wealthier villagers in Dohoun and Dimikuy, appear to be well on their way to having permanent fields. They leave large numbers of trees on their fields, and they use fertilizer and manure frequently. In accordance with other research on intensification in sub-Saharan Africa, population is not the sole variable that has led to higher input use; intensification is closely connected to other changes in policy, credit, markets and services which have developed simultaneously with population increases.

Moreover, Mossi farmers do not degrade their resource base more than local Bwa. If anything, the direction is reversed, with Mossi using more manure. Mossi also leave just as many trees on their fields as Bwa farmers.

Finally, this paper argues that tenure status matters little in a farmers' decision to invest in soil quality. If anything, Mossi farmers, who generally have the most insecure land tenure and fear that land will be taken away from them, invest in soil quality to secure access to land. They are, through their investments, improving tenure security. Rights to land become stronger the longer an individual can farm a plot of land.

Unfortunately, these tenure-building strategies of intensification are not distributionally neutral. Building individual rights means appropriating community rights (Berry 1997), and building individual rights requires some financial wherewithal. Those farmers less able to adopt the tenure-building strategies are increasingly left out of the process. Their claims to land become more tentative.

What policy implications does this study hold? The problem in Burkina lies in an effective policy of neglect. Because the government intervenes only lightly in the tenure terrain, and when it does intervene it is usually through the indirect arm of donor-funded

projects that lack institutional depth and legitimacy, local processes determine outcomes. In the scenario we have described, wealthier farmers intensify, cultivate continuously, and build tenure rights. Poorer farmers are unable to maintain their property rights. Land tenure issues increasingly become the sites of ethnic conflict. Governments try to settle conflicts with mediation, but because local farmers in Burkina, as in other regions of Africa, realize that the government has very little desire to enforce outcomes, one way of assuring success is by presenting local authorities with a *fait accompli* (Moore 1998; Lavigne Delville 2000). It is an interesting contradiction that in Burkina even though the state is nominally in control of agricultural land (the Agrarian and Land Reform of 1984 declared that land belonged to the state) it is very hesitant to use its power in settling land disputes. In many instances in Burkina, villagers have gone directly against government will by taking action, creating facts on the ground and in general succeeding with that strategy. This has lain the foundation for greater uncertainty, unilateral action and ultimately conflict on the village level.

From a distributional perspective, low-cost interventions to assure tenure rights of poorer farmers must be developed. First, if farmers are investing in soil quality to build rights to land, then government efforts should be geared towards ensuring equitable access to already available credit. Farmers grow a range of crops that could benefit from increased input use, but unless a farmer is tied into the cotton credit and marketing system, these inputs are difficult to obtain. Second, some measures that recognize the growing individual control over land must be devised. In much of Africa, attempts to formalize tenure relations have either created greater tenure uncertainty or have failed because of the inability of resource poor states to effectively monitor land systems. Several authors have advocated adopting incremental or contractual approaches to tenure formalization. Lavigne-Delville (2000: 120-121) suggests one simple low-cost method for formalizing tenure relations would be to document land transactions, ensuring "that the person transferring the rights has the power to do so and by specifying the content of the transaction". These might be used in cases where decisions could be contested, land that is borrowed by migrants, for example. Gradually, the 'paper trail' for land becomes substantial enough to facilitate the emergence of more efficient

markets for land transfer and land collateralization. At that point land becomes valuable enough that private parties will be willing to support the cost of more substantial verification and enforcement of tenure rights. Third, the government needs to devise mechanisms that allow it to credibly commit to decisions regarding land use that follow impartial and accessible procedures. Informal mediation by its nature favors wealthier farmers, in part because of its bias to ratifying the status quo. Again following an incremental approach, certain narrow categories of land disputes might be automatically assigned to specialized government bureaucrats or courts, with appeals handled by a provincial body, with decision-making power by other authorities (formal or informal) expressly prohibited. The immediate, and very basic, priority is to establish sustainable and incentive-compatible structures to ensure detailed record-keeping. At present it is in the interest of most low-level government bureaucrats to keep discussions strictly verbal, as this allows positions to be shifted as power balances fluctuate. That situation is, of course, inimical to longer term intensification, and to protection of rights for the poor and marginalized.

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Endnotes

1. In past and present-day Burkina , migration has been an important strategy of those escaping both short-term and long-term economic crises. International migration has been extremely important; an estimated 1-2 million migrants were leaving for the neighboring countries of Côte d'Ivoire and Ghana each year (Cordell et al. 1996). Migration to these wealthier countries south of Burkina has tended to be circular; migrants, mostly Mossi, returned after a year or two and invested their income in their natal villages or regions. Internal migration, except for rural-urban migration and movements of transhumant populations, remained insignificant until the droughts of 1970s and 1980s which, along with growing population in the central Mossi region, spurred a large-scale migration into the southern and western regions of the country. Many Mossi migrated to the less drought prone and land-abundant areas in the south and southwest. Unlike international migrants, migrants within Burkina did not return to their home villages, but instead settled permanently in their new communities, in the process creating a migratory chain for hometown kith and kin who followed the trail of opportunity to the agricultural regions of the southwest.

2.Gray (1999) notes in a restudy of soil quality in Dohoun that there has been very little change in soil quality between 1988 and 1996.

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Table 1: Household means from three village sample

	Three villages		Dimikuy		Dohoun		Sara	
	Mossi (n=53)	Bwa (n=53)	Mossi	Bwa	Mossi	Bwa	Mossi	Bw
Age of head	51.17	44.38[a]	49.28	45.38	57.78	45.00	46.18	43.05
# of adult men	2.40	2.36	2.11	2.56	3.00	2.53	2.06	2.05
# of adult women	2.60	2.21	2.94	3.75	3.22	1.47	1.59	1.60
Ratio of workers to consumers	0.54	0.53	0.47	0.58	0.55	0.53	0.62	0.48
Years in village (for migrants)	18.69	.	15.29	.	13.06	.	28.06	.
Years of schooling	2.08	6.00[a]	2.56	3.88	0.33	4.59	3.41	8.90
Value of livestock (100,000 CFA)[b]	9.00	3.14[a]	13.07	4.51	7.56	2.09	6.21	2.94
Housing index[c]	0.94	1.19	1.38	1.47	.	1.08	0.50	1.05
Assets[d]	2.35	2.18	4.14	3.48	3.67	2.97	3.14	3.04
Own oxen?	0.64	0.62	0.78	0.75	0.33	0.47	0.82	0.65
Number of oxen, if own	3.15	2.70	3.57	2.92	3.33	2.63	2.64	2.54
Number of carts	0.45	0.57	0.61	0.69	0.17	0.41	0.59	0.60
Number of plows	0.87	0.85	1.17	1.00	0.39	0.71	1.06	0.85
Total area cultivated (hec.)	6.15	5.81	8.07	8.08	4.97	5.00	5.47	4.80
Number of fields	2.04	1.53[a]	1.78	1.44	1.94	1.06	2.41	2.00

Source: Author survey, 1996.

Number of households = 106

[a]Indicates that means of ethnic groups different at 5% level, for whole sample

[b]Value of animals using market prices.

[c]Housing index is sum of five 0-1 indicators of housing investment

[d]Assets index is computed as .25*(# of carts + # of plows)) + (# of oxen) + 4*(# of tractors)

Table 2: Population Density of Sara, Dimikuy and Dohoun

Village	Persons per sq. kilometer (total land area)	Persons per sq. kilometer (arable land area)
Sara	96	210
Dimikuy	47	57
Dohoun	19	28

Source: Author survey 1996

Table 3: Differences in agricultural practices according to village, characteristics of field, ethnicity

	Applied manure?	Manure per hectare if applied (sacks)	Applied fertilizer?	Fertilizer per ha. if applied (sacks)	Years since last fallow	Manure from corralled animals?	# of trees per hectare	Any anti-erosion investment?	Any observable erosion?
Whole sample	0.20	16.41	0.64	1.83	11.46	0.22	14.65	0.13	0.18
Village									
Dimikuy	0.29	29.59	0.67	1.42	10.03	0.27	12.76	0.06	0.08
Dohoun	0.18	4.75	0.57	1.22	11.24	0.38	12.39	0.29	0.19
Sara	0.27	21.12	0.88	2.63	15.85	0.11	17.60	0.14	0.24
Field characteristics									
near field	0.46	21.86	0.70	1.84	14.53	0.17	10.46	0.16	0.13
farfield	0.06[a]	9.42	0.74	1.91	12.17	0.26	17.30[a]	0.16	0.23
no slope	0.22	17.03	0.68	2.06	10.63	0.21	14.22	0.10	0.09
slope	0.16	15.33	0.43[a]	1.17	14.93	0.24	19.70	0.25	0.57[a]
Ethnicity									
Bwa	0.15	37.57	0.83	2.34	12.00	0.30	14.23	0.11	0.09
Mossi	0.31	11.74[a]	0.65[a]	1.55[a]	13.42	0.18[a]	15.23	0.19	0.25[a]

Source: Author survey, 1996.

[a]Indicates that means different at 5% level

Table 4: Tenure status of fields (proportions of total number of fields, by ethnic group)

	ALL	Dimikuy	Dohoun	Sara
		Bwa		
Inherited from lineage	0.43	0.54	0.50	0.33
Inherited from outside lineage	0.07	0.00	0.00	0.15
Borrowed from lineage	0.04	0.04	0.06	0.03
Borrowed from outside lineage	0.46	0.42	0.44	0.49
		Mossi		
Inherited from outside lineage	0.02	0.00	0.00	0.05
Borrowed from a tuteur	0.43	0.26	0.59	0.42
Borrowed from Bwa	0.55	0.74	0.41	0.52
No tiin of grain given	0.23	0.03	0.31	0.32
One tiin of grain given	0.35	0.26	0.17	0.56
Two tiin of grain given	0.42	0.71	0.51	0.12

Source: Author survey, 1996.

Table 5: Multivariate analyses of soil fertility management

	Sacks of manure per hectare (Tobit)		Sacks of fertilizer per hectare (Tobit)		Years cultivated since last fallow (OLS)		Animals corralled on field? (Probit)		Trees per hectare (OLS)		Erosion observed to be problem? (Probit)		Anti-erosion technique used on field? (Probit)	
VARIABLE	coeff.	std. error	coeff.	std. error	coeff.	std. error	coeff.	std. error	coeff.	std. error	coeff.	std. error	coeff.	std. error
moborbwa	16.59	9.68*	-0.72	0.47	3.06	1.95	-0.18	0.06**	-0.71	2.24	0.06	0.10	0.02	0.07
mborfrer	11.86	10.30	-1.11	0.50**	3.36	1.92*	-0.11	0.07	1.94	2.75	0.36	0.16***	0.09	0.09
bwabor	6.63	10.23	-0.03	0.48	2.73	1.97	0.01	0.08	-0.89	2.45	0.05	0.11	-0.05	0.07
dimikuy	11.93	12.17	-0.76	0.55	-4.98	2.01**	-0.21	0.07**	3.03	2.16	-0.00	0.11	-0.22	0.07***
sara	12.28	11.62	1.44	0.53***	1.48	2.14	-0.35	0.08***	6.89	2.73**	0.17	0.10*	-0.23	0.09**
farfield	-26.95	7.41***	0.48	0.37	-2.87	1.87	-0.01	0.07	5.87	1.78***	0.17	0.05***	-0.06	0.06
slopdum	11.82	9.16	-1.40	0.46***	-0.67	1.96	-0.00	0.09	6.67	2.42***	0.60	0.11***	0.24	0.10***
stony	6.06	9.72	-0.01	0.53	-2.99	2.16	0.03	0.10	2.49	2.77	-0.02	0.09	-0.25	0.10**
silty	-10.82	10.47	0.28	0.48	-4.61	2.18**	-0.24	0.10**	0.76	2.65	0.19	0.08**	-0.10	0.09
assets	4.40	1.82**	0.33	0.09***	1.18	0.44***	0.05	0.02***	-0.65	0.41	0.03	0.01**	0.02	0.01*

constant	-39.23 15.52**	0.70 0.70	12.68 2.76***		5.25 3.59		
	n=151	n=151	n=154	n=114	n=156	n=156	n=156
	pseudo R^2=.10	pseudo R^2=.10	R^2=.09	pseudo R^2= .26	R^2=.27	pseudo R^2= .26	pseudo R^2=
				.26			
	log L = -158.16	log L = -158.16		log L = -267.86			
		log L = -45.76	log L = -52.36				

Source: Author survey, 1996.

Note: All standard errors are robust standard errors except for Tobit; In probit models coefficients are marginal effects for continuous variables, and effect on probability of varying dummy variable from 0 to 1(thus no constant term is included in probit model).

* is significant at 10% level, ** at 5%, *** at 1%