Van der Geest, K., K. Burger, A. Yelfaanibe & T. Dietz (2015). Not the usual suspects: Environmental impacts of migration in Ghana's Forest-Savanna Transition Zone. In: Chabay, I., Frick, M. & Helgeson, J. (eds). Land Restoration: Reclaiming Landscapes for a Sustainable Future, pp. 463-481. Elsevier.

CHAPTER 7.2

NOT THE USUAL SUSPECTS: ENVIRONMENTAL IMPACTS OF MIGRATION IN GHANA'S FOREST-SAVANNA TRANSITION ZONE*

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7.2.1 INTRODUCTION

In 2008, the United Nations Environment Program (UNEP) released the *Atlas of Our Changing Environment: Africa*, which is a collection of satellite images and ground photographs that aims to expose major environmental changes on the African continent. The atlas contains two LANDSAT satellite images depicting large-scale land degradation in Ghana's forest-savanna transition zone (see Figure 7.2.1). On the first image,[1] captured in 1973, the area is densely vegetated with only small patches of more barren land in the north and around major settlements. The dark green areas in the image are forest reserves. The white dots in the south and midwest of the first image are clouds. In the second image,[2] taken in 2002 and 2003, much of the vegetation in the northern part has disappeared (UNEP, 2008, p. 185).

In the atlas, UNEP primarily blames farmers for environmental degradation: "about one-third of the land area [of Ghana] is threatened by desertification, caused mainly by slash-and-burn agriculture and over-cultivation of cleared land, resulting in widespread soil erosion and degradation." Other factors that contribute to land degradation, such as surface mining and logging, are also mentioned (UNEP, 2008, pp. 182–185), but the villains in UNEP's discourse are small-scale farmers who use unsustainable farming methods that cause land degradation.

*Fieldwork for this paper was conducted in the context of a PhD project at the University of Amsterdam, funded by the Dutch Council for Scientific Research (NWO).
[1]Landsat-1 MSS, November 25, 1973, bands 2, 4, and 1 (UNEP, 2008: 360).
[2]Landsat-7 ETM+, December 24, 2002, and February 19, 2003, bands 7, 4, and 1 (UNEP, 2008, p. 360).

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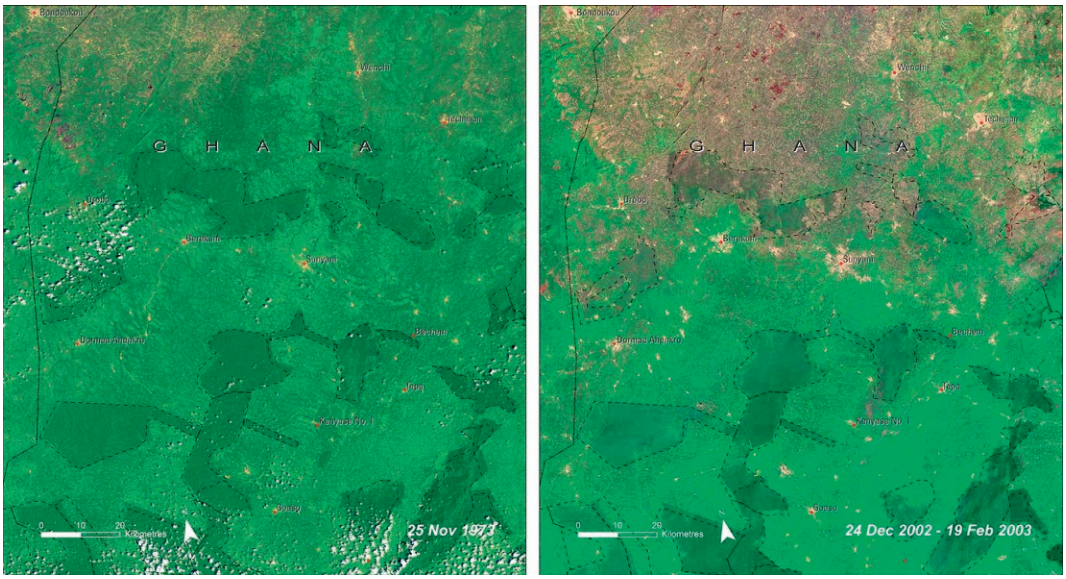

FIGURE 7.2.1

Land degradation in the Brong Ahafo Region (LANDSAT, 1973–2003) (UNEP, 2008, p. 185).

The area covered by the LANDSAT images is primarily located in Ghana's Brong Ahafo Region (see Figure 7.2.2). The northern part of the LANDSAT images, which experienced the most degradation, is a prime destination area for migrants from Ghana's Upper West Region, who belong to the Dagaba ethnic group. Most of the degraded area lies in the Wenchi District.[3] The vast majority of migrants from the Upper West Region who settle in the Brong Ahafo Region are small-scale farmers who migrate to rural areas in search of better agroecological conditions (Abdul-Korah, 2007; Van der Geest, 2011a, 2011b; Rademacher-Schultz et al., 2014). Their native home in the north of Ghana has only one rainy season, the soils are less fertile—especially in the more densely populated parts of the Upper West Region—and agroecological conditions have deteriorated over the past decades (Van der Geest, 2004, 2009; Amanor and Pabi, 2007; Dietz et al., 2013). This section investigates what role settler farmers from Northwest Ghana have played in the alleged "savannization" of the Northern forest-savanna transition zone.

Theoretically, the environmental impact of immigration can follow two lines. First, migration alters the population size in the areas of origin and destination. As Hugo (1996, p. 121) states, "Other things being equal (which of course they rarely are), emigration will reduce environmental pressures at the origin and increase them at the destination." Second, if other things are not equal, the impact of migrants on the natural environment differs from that of non-migrants. Hugo uses Ehrlich and Ehrlich's (1990, p. 58) IPAT equation—environmental impact (I) is a function of population size (P), affluence (A), and technology (T)—to indicate that the differential environmental impacts of migrants and

[3]In this section, we use the boundaries of the Wenchi District as it existed until 2004. In that year, the district was split into the Wenchi Municipal District in the West and the Tain District in the East.

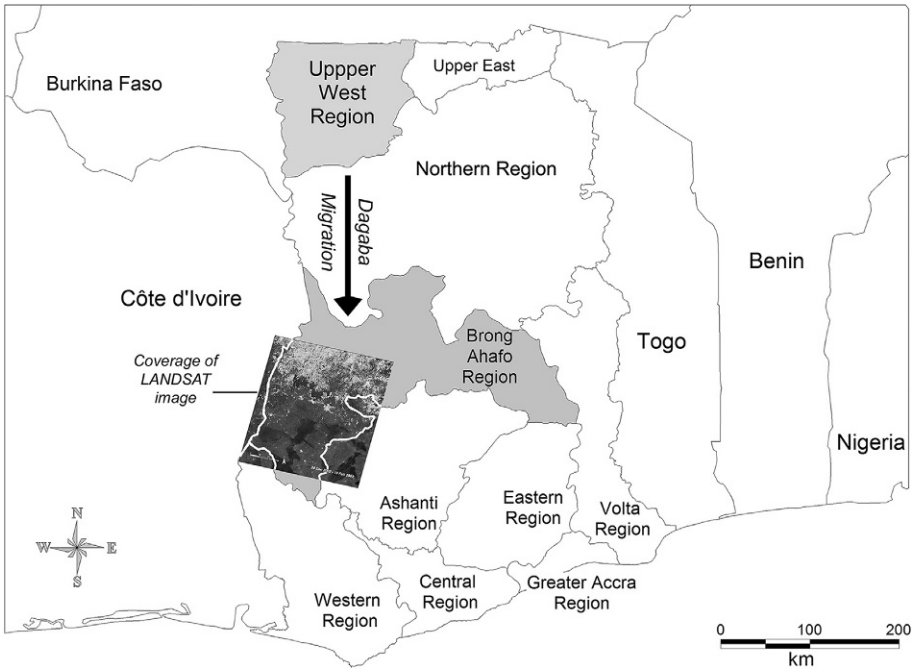

FIGURE 7.2.2

Ghana, Dagaba migration, and coverage of the LANDSAT image.

natives can be caused by differences in the productive and consumptive domains. This section focuses on the productive domain.

Migrant farmers are often thought to have less sustainable cultivation practices than native farmers. An important explanation is that they usually do not own the land they farm and often regard their stay on this land as temporary, which might reduce the incentive to apply environmentally sound farming methods. Moreover, they often have to rent land, which might encourage them to "mine the soil" (Afikorah-Danquah, 1997; Codjoe, 2006). Another common explanation is that migrant farmers do not have the same knowledge about local environmental conditions as native farmers, which can also lead to unsustainable farming practices (Lambin et al., 2001).

In an analysis of narrative structures in environmental discourses, Adger et al. (2001) distinguish three archetypal actors: heroes, villains, and victims. These archetypes are clearly discernible in three existing studies by Southern Ghanaian scholars about the differential impact of settlers' and natives' farming practices on vegetation cover (Adjei-Nsiah, 2006; Afikorah-Danquah, 1997; Codjoe, 2006). The authors of these three studies portray native farmers as the "heroes" who preserve soil fertility and vegetation cover and even convert savanna to forest. Meanwhile, settlers play the role of "villains" who cause deforestation and mine the soil. To complete the narrative of heroes, villains, and victims, Codjoe (2006, p. 103) argues that settlers have invaded areas "to the detriment of indigenous people," thereby assigning native farmers the victim role. Below are some characteristic quotes from these studies:

> "… [migrants] tend to be more aggressive in their farming practices compared with indigenous populations mainly because of insecurity of tenure."
>
> **(Codjoe, 2006, p. 103)**

> "… practices which hasten the conversion of the forest to savannah are intentionally employed by the migrants … so that the environment will resemble that of their home of origin…."
>
> **(Adjei-Nsiah, 2006, p. 58)**

> "[Native] landowners … generally use a minimum tillage system of cultivation based on cutlass technology, and show a preference for long fallows.… such practices … generally allow the regeneration of forest fallows.…"
>
> **(Afikorah-Danquah, 1997, p. 42)**

> "… immigrants' practices … can be associated with the savannisation of forest and fallow, reduction of tree cover in savannas and in some circumstances soil degradation."
>
> **(Afikorah-Danquah, 1997, p. 43)**

These studies conclude that migrants have less sustainable farm practices because of their use of hoe technology (with mounds and ridges), the land tenure system that does not allow them to plant trees, their larger farm sizes, crop rotations,[4] and their alleged preference for savanna conditions. All studies focused on insecure land tenure conditions as an important underlying cause of migrants' short-term exploitation of the land.

The remainder of this chapter is structured as follows. We first use census data to study migration from the Upper West Region to the Brong Ahafo Region and to identify periods and areas of increased population growth in the region (1960–2000). The following sections are structured around six lines of evidence showing that migrant farmers from the Upper West Region have been falsely accused of causing environmental degradation through unsustainable farm practices. First, we show that the extent of deforestation is much less than UNEP's alarming picture suggests. Second, remotely sensed vegetation data are used to show that most environmental degradation took place before the large-scale arrival of migrants from the northwest. Third, we use the key findings of studies on local land use/cover change (LUCC) to assess the most detrimental and beneficial types of land use systems for vegetation cover; this review shows that those researchers who blame migrants for environmental degradation fail to consider the most crucial factors. Fourth, local discourses of environmental change and its causes in the study area show that the immigration of farmers from northwest Ghana hardly plays a role in this degradation. Fifth, an analysis of perceptions of land use by "the other" confirms that native farmers do not think that migrants' farm practices cause environmental degradation. Sixth, socioeconomic and land-use survey data are used to show that migrants' farm practices differ from those of native farmers, but no evidence suggests their practices are less sustainable. Further, there are strong indications that migrants' low external input agriculture in bush fallow systems allows for land regeneration, while the capital-intensive agricultural practices of native farmers lead to more permanent land cover change. The findings challenge earlier studies that blamed settler farmers for environmental degradation.

[4] Adjei-Nsiah (2006) considers crop rotations with pigeon pea (common among native farmers) to be a positive strategy and crop rotations with cowpea or groundnuts (common among migrant farmers) to be negative.

7.2.2 DAGABA MIGRATION

The Dagaba people hail from the savanna of northwest Ghana, but many have migrated southward. At the time of the population census in 2000, 51% of the Dagaba were living outside the Upper West Region and 36% had migrated to southern Ghana. Within this group, 51% had migrated to the Brong Ahafo Region, where they constituted 6.8% of the total population (Ghana Statistical Service, 2002). Apart from the movement of the more permanent Dagaba settlers, there is also a seasonal inflow of Dagaba migrants who utilize the off-season in the north to earn some money as farm laborers in the South.

Within the Brong Ahafo Region, the most popular destination districts of the Dagaba migrants are situated in the north of the region (see Figures 7.2.3a and 7.2.3b), with the Wenchi District having the largest number and proportion of Dagaba people, followed by the neighboring Techiman District. The districts in the southwest of the Brong Ahafo Region are not important destination areas for these migrants. Figure 7.2.3 also shows the location of the LANDSAT image that reveals large-scale environmental degradation. The districts that have received more Dagaba immigrants have experienced much more degradation than the other districts. The question is whether there is causality in this association and, if so, whether degradation is just a consequence of increased population pressure or also due to differences in land use sustainability between the migrants and native farmers.

Between 1970 and 2000—roughly the time between the first and second LANDSAT images shown in the introduction of this section—population growth in the northern districts of the Brong Ahafo Region was much higher (over 3% per year) than in the southern districts (approximately 2.5% per year). In the 1960–1970 intercensal period, when Brong Ahafo South was an important cocoa frontier, population growth was higher (4.3% per year).[5] In those periods, more than half the population in Brong Ahafo South was composed of immigrants from outside the region or outside of Ghana (60.9% in 1960 and 51.4% in 1970).[6] Brong Ahafo North had a much smaller proportion of immigrant population (12.3% in 1960 and 20.2% in 1970). In the 1970s and early 1980s, when the cocoa sector was in crisis and some hitherto poorly accessible and uninviting areas in the north of the region had been "opened up" through government interventions (Amanor and Pabi, 2007), the agricultural frontier shifted from south to north and from cocoa cultivation to food crop farming.

The rest of this section is structured around six lines of evidence that migrant farmers are erroneously blamed for environmental degradation in the forest-savanna transition zone.

7.2.3 FIRST LINE OF EVIDENCE: ENVIRONMENTAL DEGRADATION OVERSTATED

LANDSAT images, published in UNEP's *Atlas of Our Changing Environment*, show large-scale land degradation in Ghana's forest-savanna transition zone (1973–2003). However, UNEP does not state that the first image was taken at the end of the rainy season and the second image at the peak of the dry season. The 1973 LANDSAT image, in which the environment looks very green, was taken on November 25, while UNEP used a combination of two dates[7] for the 2002/2003 image, in which

[5] Census Office (1964); Central Bureau of Statistics (1984); Ghana Statistical Service (2005). See van der Geest (2011b, p. 72).
[6] Census Office (1964: 27; 1973, p. xxxviii).
[7] UNEP does not provide any information about the motivation behind this choice and the procedure followed.

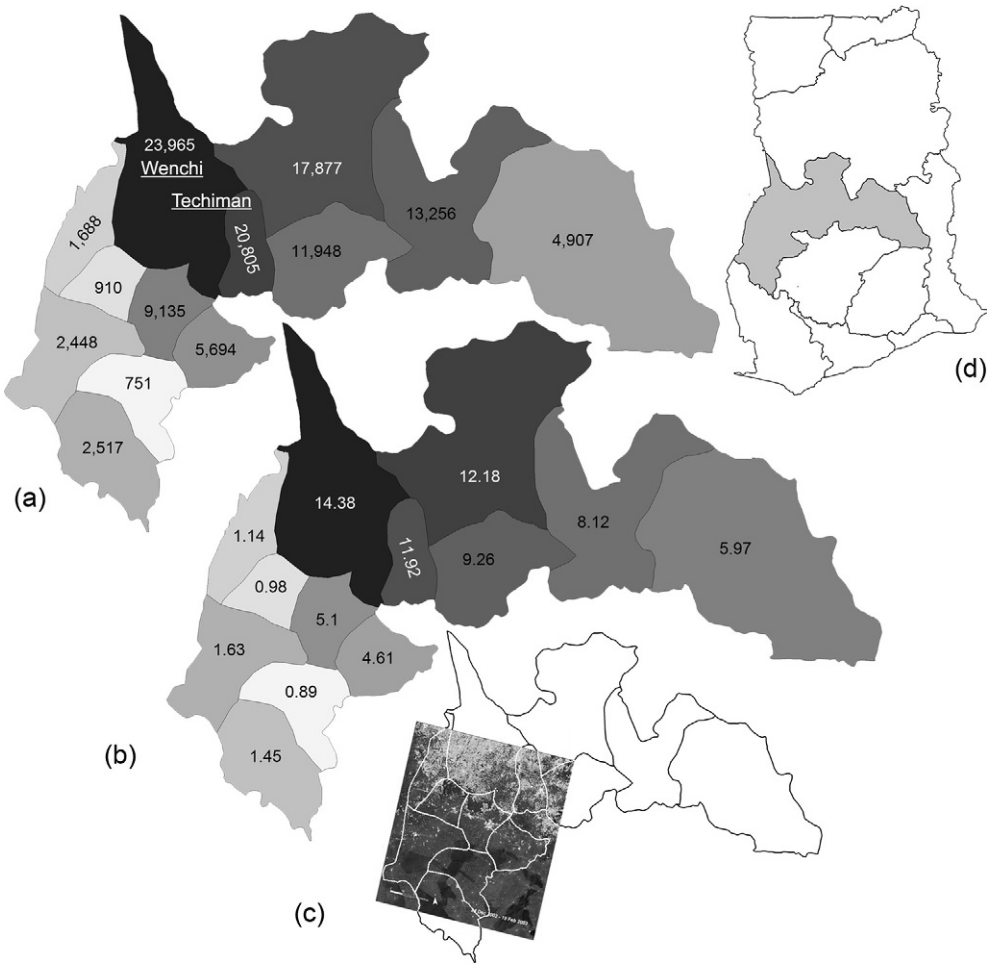

FIGURE 7.2.3

Dagaba immigration per district of the Brong Ahafo Region. (a) Total number of Dagaba immigrants; (b) percentage of Dagaba population by district; (c) districts covered by LANDSAT image; (d) location of the Brong Ahafo Region in Ghana.

Source: Maps drawn by authors; data from Ghana Population and Housing Census (2000). The district data on Dagaba immigration were acquired through a special data request at the Ghana Statistical Services.

the northern part of the area looks barren: December 24, 2002, and February 19, 2003. Figure 7.2.4 depicts the seasonality and long-term trend of vegetation cover in the Wenchi District, located in the center of the allegedly degraded area. The figure is based on remotely sensed Normalized Difference Vegetation Index (NDVI) data over a period of 25 years.[8] November is the last month of the rainy

[8]The NDVI database is described in more detail in van der Geest et al. (2010)

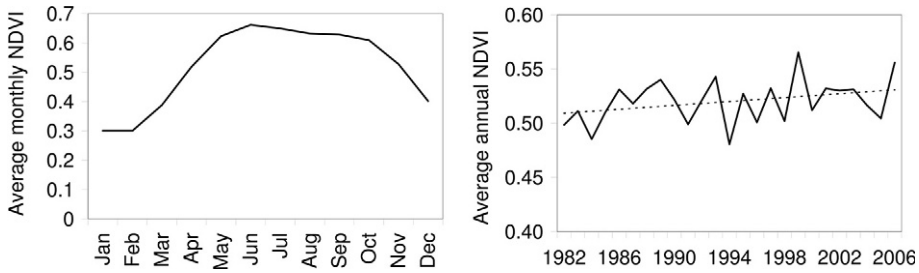

FIGURE 7.2.4

Average monthly NDVI and NDVI trend in the Wenchi District (1982–2006). Note: On the NDVI scale, a value of zero indicates bare soil and a value of 1 indicates dense forest.

Source: Figures by authors; the NDVI database was described in more detail in van der Geest et al. (2010).

season in the northern part of the LANDSAT image. January and February are the driest months of the year. In the NDVI scale, a value of zero indicates bare soil and a value of one indicates dense forest. The average NDVI value in the Wenchi District (1982–2006) is 0.300 for January and February, while in November, the average NDVI value is 0.528. If the latest LANDSAT image had been recorded in November 2002, the contrast with the 1973 image would have been much smaller and the extent of environmental degradation would have appeared much less alarming.

This is not to say that the area has not experienced land degradation. Most studies and the inhabitants (discussed next) confirm a negative long-term trend in vegetation cover. However, the timing of the changes is important and will be discussed in the second line of evidence.

7.2.4 SECOND LINE OF EVIDENCE: MOST ENVIRONMENTAL DEGRADATION, IF ANY, OCCURRED BEFORE THE LARGE-SCALE IMMIGRATION OF SETTLER FARMERS FROM THE NORTH

In the Wenchi District, located in the allegedly degraded area, the population grew slowly, from 98,091 to 105,115 inhabitants in the 1970–1984 intercensal period (0.5% per year).[9] In 1988, the administrative boundaries changed (Ghana Statistical Service, 2005, p. 18). A part of the old Wenchi District was lost to the neighboring Kintampo and Techiman districts. Despite this reduction in territory, the district population increased to 166,641 in 2000 (2.9% per year).[10] Thus, the population within the old district boundaries must have grown by well over 3% annually. The low growth figures for 1970–1984 and the high growth figures for 1984–2000 are a strong indication that most migrants came to the Wenchi District in the late 1980s and 1990s. This is confirmed by household survey data.[11]

The second graph in Figure 7.2.4 shows the vegetation trend for the 1982–2006 period. In this period of 25 years, NDVI values *increased* moderately, especially after 1984 (see Figure 7.2.4).[12] This

[9] Central Bureau of Statistics (1984).
[10] Ghana Statistical Service (2005). The population density in the Wenchi District was 33.3 people/km^2 in 2000.
[11] Of the 203 migrants we interviewed, only 16.4% arrived before 1984.
[12] See also van der Geest et al. (2010).

would mean that most degradation took place between 1973 and 1984, which was a period of widespread drought in West Africa (Hulme, 2001; Mortimore and Adams, 2001; Batterbury and Warren, 2001). In Ghana's forest-savanna transition zone, drought and bush fires decimated cocoa plantations (Dei, 1992; Ruf, 2007). In focus group discussions, covered next, farmers explained that in the affected areas, cocoa was usually not replanted because of increased risk of fire invasion, resulting in a southern shift of cocoa cultivation. Cocoa was usually replaced by field crops, such as maize and cassava, with significant effects on green cover—especially in the dry season.

If large-scale immigration of settler farmers from northwest Ghana started in the 1984–2000 intercensal period and if longitudinal vegetation data suggest that most environmental degradation took place before 1984, then clearly immigration has not been a primary cause of environmental degradation in the district.

7.2.5 THIRD LINE OF EVIDENCE: THE STUDIES THAT BLAME MIGRANTS FOR ENVIRONMENTAL DEGRADATION NEGLECT THE MOST CRUCIAL CAUSES OF LAND DEGRADATION

Several scholars have studied LUCC in Ghana's forest-savanna transition zone, most of which used LANDSAT images combined with socioeconomic and agricultural surveys. Pabi and Attua (2005) analyzed land cover change in six locations in the Wenchi District based on 1984 and 2000/2001 LANDSAT images. They found that "dense woodland" (forest) had reduced in five out of the six sites. However, they emphasize that land conversion in the forest-savanna transition zone is not a unilinear process toward degradation but rather a complex, dynamic, and multidirectional interplay of human and natural factors, such as farming systems, land tenure, market access, and policy environment. The sites with mechanized and high-input agriculture showed the least potential for regeneration, because all vegetation, as well as the stumps and roots, were removed. In areas where bush fallow systems dominated, there was not only much conversion of forest to farmland but also many changes in the opposite direction. Based on the same data, Amanor and Pabi (2007, p. 61) conclude: "In contrast with the main narratives of modern environmentalism, there is considerable evidence that the activities of farmers in the transition zone do not lead to a downward spiral of degradation. Localized farming practices often encourage regeneration of the root and coppice mat in the soil and promote rapid regeneration of many species." The exceptions are fields that are permanently cultivated and on which farmers use tractors to plow the land and inorganic fertilizer to replenish the soil. In the mid-1980s, when Ghana implemented structural adjustment policies, subsidies on inorganic fertilizer were removed and the output prices of food crops declined because of cheap imports. The fields that were used for more permanent cultivation could no longer yield adequately and were largely abandoned. Even after more than 10 years, these areas showed very few signs of regeneration. Areas under bush fallow, on the contrary, showed considerable conversion of fallow land to open or dense woodland (Amanor and Pabi, 2007).

The authors of the studies that conclude that migrants have more detrimental farm practices (Adjei-Nsiah, 2006; Afikorah-Danquah, 1997; Codjoe, 2006) did not look at factors that turned out to be crucial in analyses of land cover change under different farming systems. Rather, they use some questionable criteria for pronouncing migrants' land use to be less environmentally sustainable. For example, in Adjei-Nsiah's (2006) work, crop rotations with pigeon pea—common among native farmers—are

considered positive, while those with cowpea or groundnuts—common among migrant farmers—are not. Similarly, migrants' habit of using hoes to make ridges—usually considered a sustainable soil and water conservation technique—is negatively assessed by these studies, while "zero tillage" is assessed positively, despite the fact that the pesticide (Roundup, made by Monsanto, Ltd.) used in this farming method has a very bad record with regard to environmental sustainability and has been banned from European markets. Another questionable argument is migrants' alleged and inadequately documented preference for savanna conditions (Adjei-Nsiah, 2006, p. 58). The negative assessment of migrants' farming practices could be due to some degree of scapegoating. As Hugo (1996, p. 123) warned: "there are considerable dangers that the migrants involved can become scapegoats for a general failure to adopt sustainable policies of land and other resource use in the destination areas." Interestingly, as discussed in the fourth and fifth lines of evidence, the native farmers we interviewed do not share the view of these academics. They do not think that migrants have more degrading farm practices and point to other drivers of environmental change.

7.2.6 FOURTH LINE OF EVIDENCE: IMMIGRATION OF FARMERS FROM NORTHWEST GHANA HARDLY PLAYS A ROLE IN LOCAL DISCOURSES OF ENVIRONMENTAL DEGRADATION

Focus group discussions were held in eight study sites in the forest-savanna transition zone with the aim of capturing people's—possibly conflicting—perceptions of environmental change and its causes. The discussions were structured by a community questionnaire, which included several questions about trends in soil fertility, vegetation, and rainfall. In the case of negative trends, the respondents were asked about the causes of these trends and whether, and if so how, the arrival of settlers from northern Ghana had contributed to negative trends in soil fertility and vegetation cover.

The group discussions yielded an interesting overview of local perceptions of environmental change and its causes. The participants perceive the trends to be mostly negative: they thought that soils had become less fertile and that the vegetation cover and rainfall amounts had reduced. They attributed these negative trends to a combination of timber logging, increased pressure on farmland, charcoal burning, and uncontrolled bush fires caused by hunters, palm wine tappers, and charcoal burners. Reduced fallows were seen as an important cause of soil fertility decline in the more densely populated study locations, while, in the sparsely populated areas, uncontrolled bush fires were perceived to be the most important cause of fertility decline and of deforestation.

When asked specifically about the contribution of migrants from northern Ghana to soil fertility decline, most groups could not think of any, but one group mentioned that the land tenure system (fixed rent for a number of years) contributed to soil fertility decline. One participant said: "If the land is given out for four years, the settler will make sure he gets the maximum out of it and won't leave the land to rest." The same group also thought that settler farmers contributed more to loss of forest cover. They said: "Migrants try to make their farms as large as possible so they have to cut more trees."

In sum, only one out of the eight group discussions cited immigrant farmers from the North as drivers of environmental degradation. Moreover, they were not mentioned initially as such; it was only after specifically asking about possible contributions of immigrants to soil fertility decline and deforestation that the comments surfaced.

Table 7.2.1 Perception of Differences in Farming Methods by Settlers and Natives

Description	Settlers (75)	Natives (72)	Total (147)
There is no difference.	22	7	29
Settlers have bigger farms; they farm on a larger scale.	12	16	28
Settlers use their own strength; natives hire labourers or tractors.	11	12	21
Settlers use hoes and natives use cutlasses.	6	11	17
Settlers achieve better yields or larger produce.	6	8	14
Settlers have to rent land or do sharecropping.	7	7	14
Settlers go to the farm every day.	0	10	10
Settlers depend on farming more than natives.	3	6	9
Settlers organise labor parties.	1	6	7
Settlers cultivate more food crops, natives more cash and tree crops.	4	3	7
Settlers work harder.	3	3	6
Settlers do more intercropping; natives do more monocropping.	3	2	5
Natives don't weed properly.	5	0	5

Note: Only differences mentioned by five respondents or more are included in the table. The total number of households surveyed was 155, but eight respondents failed to answer this question.

7.2.7 FIFTH LINE OF EVIDENCE: NATIVE FARMERS SEE DIFFERENCES IN FARMING TECHNIQUES BETWEEN THEMSELVES AND SETTLER FARMERS, BUT THEY DON'T THINK THAT SETTLERS' METHODS ARE MORE DESTRUCTIVE

A questionnaire was administered among 155 farm households in four study locations[13]; about half the respondents were settler farmers and half were native farmers. As part of the questionnaire, we asked respondents to identify differences in the way settlers and natives farmed. This was an open question without set answers to choose from. The answers of both settlers and natives were coded and clustered. Table 7.2.1 shows the most frequently mentioned differences identified by both settlers and natives in descending order of frequency.

About a quarter of the settler farmers and about a tenth of the native farmers said they could not think of any differences in farming methods between the two groups. The other perceptions listed in Table 7.2.1 give a rough idea about some differences in farming behaviour. First, settlers are perceived to have bigger farms and larger harvests than natives. Second, farming is more often the main occupation of settlers. Third, native farms are more capital-intensive, while settler farms are more labor-intensive. Fourth, native farmers are more likely to farm on their own land, whereas settlers have to rent land. Fifth, settlers and natives grow different crops: natives are more likely to grow cash crops, while settlers tend to grow food crops. Sixth, settler farmers tend to use hoes to prepare the land and weed, while natives prefer a cutlass.

[13]The methods and study sites are described in more detail in van der Geest (2011b, pp. 76–79).

Natives did not explicitly accuse settler farmers of contributing to land degradation through environmentally unsustainable farm practices. Only one native respondent said that the migrants' use of hoes "spoils the soil." The use of mounds and ridges, which Adjei-Nsiah (2006) laments was not linked to negative effects on the land at all. In general, natives' perception of settlers' farming skills was quite positive. They seem to admire the Dagaba's strength and dedication. Settler farmers did have some negative statements about natives' farm practices and behavior: five of them mentioned that natives do not weed properly and two settlers also complained that natives keep the best lands for themselves and only allow settler farmers to cultivate the infertile portions.[14]

In the sixth and final line of evidence, discussed next, the results of a socioeconomic and agricultural survey among native and settler farmers are analyzed. Some of the findings on perceptions are confirmed, some are refuted, and some additional differences are identified.

7.2.8 SIXTH LINE OF EVIDENCE: A SURVEY AMONG SETTLER FARMERS AND NATIVE FARMERS SHOWS DIFFERENCES IN FARMING TECHNIQUES BUT NO EVIDENCE THAT SETTLERS' METHODS ARE MORE DEGRADING

This section compares the environmental sustainability of migrants' and natives' farm practices. Several aspects of their farming systems are discussed, such as land tenure, farm size, crop mix, tools used, tillage methods, capital inputs, and tree cutting and planting. The analysis shows that there are differences in farming techniques between migrant farmers and native farmers, but there is no evidence that settlers' methods are more degrading to the land.

Before this comparison is made, however, some basic socioeconomic information of the respondents and their households is provided (see Table 7.2.2). The main difference between settlers and natives in the four localities is that the native farmers had higher education levels and more nonfarm income.

Table 7.2.2 Socioeconomic Profile by Migrant Status

	Native Farmers	Settler Farmers
Households	73	82
Average household size	5.5	5.8
Female-headed households	11%	8%
Average age of household head	49	42
Education years of household head	5.6	2.1
Households with nonfarm income	84%	45%
Average nonfarm income (€)	369	168
Settlement year (average)	N/A	1995

[14]See also Leach and Fairhead (2000, p. 34).

Table 7.2.3 Land Tenure (% of Fields)

Land Tenure System	Native Farmers	Settler Farmers
Borrowed	44	6
Owned	43	0
Fixed rent	10	30
Sharecropping	1	33
Stool land	0	27
Taungya	2	1
Other	0	2
Total	100	100

Note: Taungya = Reforestation land of the government (see Owusu, 2007, p. 46).

Table 7.2.4 Farm Size, Crop Mix, and Sales (€)

	Native Farmers		Settler Farmers	
Farm size (acres)	6.0		8.0	
Total crop sales (€)	422		419	
Crop Mix	**Households**	**Sales (€)**	**Households**	**Sales (€)**
Maize	92%	234	96%	183
Yam	86%	23	91%	74
Cassava	97%	25	78%	16
Sorghum	26%	5	37%	27
Legumes*	56%	20	83%	71
Vegetables**	92%	79	79%	31
Cashew	58%	17	10%	0

Notes: Legumes included groundnuts, beans, bambara beans, and cowpeas (in order of frequency). Vegetables included okra, pepper, tomato, garden eggs, and peppers (in order of frequency).

As noted in other studies dealing with farm practices of migrants and natives, the land tenure situation of these groups varies, which may give rise to differences in decision making at the farm level. In Adjei-Nsiah et al. (2004, p. 343), a migrant farmer explains why he does not invest in long-term soil fertility management strategies, illustrating the role of land tenure conditions in land-use decisions:

"I will never plant pigeon pea again because when I planted pigeon pea to improve the fertility of my farmland, the landlord asked me to quit the land because one of his sons was coming to farm on the land when he observed that the fertility of the land had improved."

In our study areas, land tenure conditions for settler farmers are also quite insecure. Table 7.2.3 (Owusu, 2007, p. 46) confirms that the majority of natives farmed on their own land or on borrowed land (free of charge), but that most settler farmers had to rent land, engage in sharecropping, or pay a fixed amount per year to traditional authorities to use communal land. In most arrangements, tenant farmers are not sure whether they can rent the land next year. However, as we will see next, this does not necessarily mean that these farmers apply environmentally destructive farming methods.

The qualitative analysis of differences in farming styles showed that settlers are perceived to have larger farms than native farmers. The perceptions analysis also gave some clues as to why their farms are larger: settlers have to farm more and work harder to survive, because—in comparison with most native farmers—they have to rent land or sharecrop, and they have less non-farm income. In addition, they are expected to send remittances to their relatives in the Upper West region. The perception that settlers have larger farm sizes than natives is confirmed in Table 7.2.4. The fact that settlers' farms tend to be larger than natives' farms could be an indication that migrants contribute more to the conversion of forest to farm and fallow land than native farmers do. However, as we will see next, settler farmers usually farm the old fallows of native farmers, and there are indications that their style of farming, which is less capital-intensive and more labor-intensive than that of native farmers, allows for faster regeneration of soil and vegetation after farms have been abandoned.

In the literature on land use and land cover change in Ghana's forest-savanna transition zone, an important distinction is made between indigenous and modern farm practices: the environmental impact of the traditional system of bush fallowing differs from that of modern systems that are more sedentary and rely more on external inputs in that, for modern, intensive, and sedentary cultivation, less land has to be cleared, but recovery once the fields are abandoned is slow. Amanor and Pabi's (2007) analysis of farming systems and land cover change showed that high-input farming systems are more detrimental than cultivation under bush fallow systems because they cause a more permanent conversion from forest to savanna. Conversion in the opposite direction, from fallow to woody vegetation, was common in areas where bush fallowing was dominant.

The most typical crop to be cultivated under a modern, mechanized and high-input regime is maize, especially when monocropped. As shown in Table 7.2.4, maize is an important cash crop for both natives and settlers, though native farmers record slightly higher sales of maize. The most typical crop in the bush fallow system is yam. On yam farms, most trees are left standing, because yam does well under shady conditions. Similar proportions of settlers and natives cultivate yam, but for settler farmers, yam is much more important as a cash crop: they recorded more than three times the yam sales of native farmers, indicating that they plant a larger proportion of their fields with yam (see Table 7.2.4).

Besides maize, other crops that are cultivated under modern regimes are cashew and vegetables (when cultivated commercially). Table 7.2.4 shows that both these crops are more popular among native farmers, for whom vegetables were the main cash crop after maize. Settler farmers also engage in vegetable cultivation, but this is mostly done at a very small scale, for home consumption. Cashew cultivation is relatively new in the area: more than half the native respondents had planted cashew trees, but most trees are still young and have only recently started to bear fruits. Although cashew plantations add to green cover in the area, this new crop may also have some environmental drawbacks (see

Table 7.2.5 Tools Used for Land Preparation and Weeding (% of Farmers)

	Native Farmers	Settler Farmers
Fire	100	95
Cutlass	100	100
Hoe	97	99
Tractor	10	5
Chemicals	18	7

Amanor and Pabi, 2007). Interestingly, as Table 7.2.4 shows, settler farmers are also going into cashew cultivation, especially in the savanna zone, where tenure arrangements are less exclusive. Apparently, the rules that prevent migrants from planting trees are more flexible than often assumed.

Integrating legumes in the crop mix is an important strategy to protect the soil from erosion and depletion (Amanor and Pabi, 2007). Table 7.2.4 shows that legume cultivation is much more common among settler farmers who are used to this practice from their home areas.

Despite the fact that settlers have larger farms, their crop sales were similar to those of native farmers. This is an indication that native farmers practice a capital-intensive style of agriculture, but it should be noted that part of the produce from sharecroppers is not included in tenants' crop sales.

An important aspect of land use sustainability is the type of tool used to clear the land and to weed. Most studies that conclude that settler farmers from northern Ghana have less sustainable farm practices lament their use of hoes and praise the natives' use of cutlasses. Table 7.2.5 shows that this conclusion may be primarily based on stereotyping, as no significant differences were found in the three most common tools used for land preparation and weeding—fire, cutlass, and hoe—by migrant and native farmers. More pronounced differences between settlers and natives exist in the use of tractors for plowing and chemicals for weeding, which are both more commonly used by native farmers. The use of tractors is associated with a more permanent conversion from tree cover to grassland and the most common chemical used for weeding is Monsanto's Roundup. At the time of the survey, this herbicide was, somewhat contraintuitively, promoted by Ghana's Ministry of Food and Agriculture as an environmentally sound alternative to manual weeding. Over the past decade, however, evidence has increasingly shown the very negative consequences of applying Roundup herbicide to soil fertility, biodiversity, and human health (Relyea, 2005; Samsel and Seneff, 2013).

Besides the tools used for land preparation and weeding, the questionnaire also inquired about the specific farm practices and tillage methods used by settlers and natives. Regarding intercropping, we specifically referred to sowing different crops intermixed in the same field. Thus, intercropping does not refer to a field having several portions, each with a different crop. Regarding crop rotation, we inquired specifically about the application of crop sequences that aim to restore soil fertility. Soil and water conservation (SWC) measures involved anti-erosion measures, such as ridges along the contours. Table 7.2.6 shows that a higher proportion of settlers employ methods that are meant to improve

Table 7.2.6 Farming Techniques (% of Farmers)

	Native Farmers	Settler Farmers
Practice intercropping	40	43
Practice crop rotation	27	46
Application of inorganic fertilizer	21	14
Application of animal dung	0	8
Application of compost	0	1
Planting cover crops	58	64
Physical SWC	3	32

Note: Physical SWC are physical soil and water conservation methods.

Table 7.2.7 Farm Expenditure (€)

	Native Farmers	Settler Farmers
Hired labor	53	70
Fertilizer	12	2
Chemicals	6	2

Table 7.2.8 Tree Cutting and Planting

	Native Farmers	Settler Farmers
Cut trees?	56%	41%
How many?	162	87
Planted trees?	72%	14%
Tree acreage	2.14	0.49

the fertility of the soil. The only method that was more common among native farmers was the application of inorganic fertilizer, which is associated with soil impoverishment in the long term.

These findings go against the "received wisdom" (Leach and Mearns, 1996) that migrant farmers do not invest in soil fertility management strategies. In fact, Dagaba farmers in the Wenchi District apply some of the techniques that they are accustomed to at home—where soils are less fertile and rain is scarcer—to maintain the fertility of the soil. This phenomenon has been noted by Lambin et al (2001, p. 263) who write: "In some cases, these 'shifted' agriculturalists exacerbate deforestation because of unfamiliarity with their new environment; in other cases, they may bring new skills and understandings that have the opposite impact."

The picture that emerges is that native farmers have a more capital-intensive style of farming, while Dagaba migrants farm in a more labor-intensive way. In the section about perceptions of farming methods of "the other," an important difference noted by both groups was that natives depend more on hired labor, though the survey results do not confirm this (see Table 7.2.7). Dagaba farmers in the sample spent more money on hired labor than native farmers did. Possibly, the perception is fed by the fact that most laborers, both on settlers' and natives' farms, are Dagaba seasonal migrants. Other capital inputs obtained in the questionnaire are the purchase of inorganic fertilizer and chemicals, which are much more common among native farmers, indicating that they tend to farm in a more "modern" way.

The last aspect of land-use sustainability analyzed here concerns farmers' direct impact on tree cover. To establish a field, one would expect farmers to remove trees. Table 7.2.8 shows that this is not necessarily the case: almost 60% of settler farmers and 44% of native farmers indicated that the tree cover on the lands they farmed was sufficiently open to start farming without removing any trees. On average, settler farmers estimated that they removed 87 trees on the fields they presently cultivated (11 trees per acre). Native farmers removed an average of 162 trees on an average farm size of 6 acres, amounting to 27 trees per acre. From a mainstream environmentalist point of view, it could be argued that asking farmers how many trees they cut is similar to asking a thief how many wallets he has stolen. In the local setup, however, this was quite a matter-of-fact question, as removing trees to farm is just

one of many activities that need to be carried out for a good harvest. The fact that migrant farmers removed fewer trees from their fields than native farmers did is not all that surprising: clearing trees is a demanding job and—perhaps somewhat paradoxically for a Western audience—is seen as an investment in the farm, at least when tree densities are high. With low tenure security, a settler farmer would prefer to farm on land that is already more open. Moreover, native landowners usually do not give out their more virgin and woody lands, because they prefer to cultivate these lands themselves. Settler farmers tend to cultivate the old fallows of native landowners.

Native farmers tend to cut more trees on their farmlands, but they also plant more trees. Almost three quarters of the native respondents had planted trees, mostly cashew, with 90% of these tree plantations established in the 10 years prior to the survey. The average size of native farmers' tree plantations was more than 2 acres. It would be interesting to find out whether a positive effect of cashew plantations on vegetation cover will be visible in the next round of LANDSAT images.

The survey revealed that settler farmers—though they plant fewer trees than native farmers—are much more involved in tree planting than previously thought: about a third of the settler farmers in the savanna and forest zones have planted trees on their farms. In the forest zone, tree planting was usually part of the land tenure arrangement, but settlers in the savanna zone have started to establish their own cashew plantations.

7.2.9 EVALUATION OF SURVEY FINDINGS ON LAND-USE SUSTAINABILITY

The land-use survey conducted among settlers and native farmers revealed a number of differences in farm practices, both between settlers and natives. However, the findings do not confirm that migrants have more detrimental farm practices, as is commonly believed. Although they have larger farms and plant fewer trees than natives, migrants' performance on most other aspects of land-use sustainability was better. Settlers cut fewer trees; they make less use of tractors and other capital inputs that are associated with more permanent land cover change; they cultivate more yam, which is associated with less tree removal and faster regeneration of vegetation cover; they integrate legumes in the crop mix, which is an effective soil fertility management strategy; and some also maintain their use of physical soil and water conservation measures, which they brought from their home areas in the north, on their farms in the Brong Ahafo Region, a practice which is not common among native farmers.

7.2.10 CONCLUSION

This chapter aims to investigate the role of settler farmers from northwest Ghana in the alleged "savannization" of the forest-savanna transition zone. Several sources suggest that this role has been considerably negative. First, LANDSAT images from 1973 and 2003, published by UNEP (2008), reveal large-scale land degradation in a prime destination area for Dagaba migrants from Northwest Ghana, identifying population growth and primitive agricultural practices as major causes of deforestation in this region. Second, several studies that compare the land use of migrant and native farmers in Ghana's forest-savanna transition zone conclude that migrants' farm practices are less sustainable, contributing to deforestation and soil fertility decline. The picture that emerges from these studies is that immigration contributes to

environmental degradation, both by increasing the human pressure on natural resources and because immigrants allegedly use less sustainable farm practices. This text has challenged, with a variety of data, the notion that migration must be an important cause of land degradation—there can be no smoke without fire.

First, UNEP's land degradation narrative is challenged by the seasonality of vegetation cover. The 1973 LANDSAT image, in which the vegetation looks lush, was taken in November, at the end of the rainy season, while the 2003 image, in which the area looks more degraded, was taken at the peak of the dry season. NDVI data suggest this makes a large difference and further shows that between 1982 and 2006, the trend in vegetation has not been negative. This could mean that most land degradation took place in the 1970s and early 1980s, that not much degradation has occurred at all, or that it is a combination of these two possibilities.

Second, census data show that most population growth in the study area took place in the 1984–2000 intercensal period (annual growth rates of more than 3%), while in the 1970–1984 intercensal, annual growth rates were less than 1%. The census data for 1984 do not provide district-level immigration data, but the settlement history of Dagaba migrants in the area suggests that most arrived between 1984 and 2000. If most of the degradation took place before the mid-1980s and population growth and immigration increased sharply after the mid-1980s, other factors must have been at play. Possibly, the widespread drought and bush fires that caused havoc in the early 1980s have had a lasting impact.

Third, in group discussions with both settlers and natives, we inquired after participants' perceptions of environmental change. In most areas, people perceived more negative than positive environmental trends (less rainfall, more deforestation, and less fertile soils). In the local discourse of environmental change, a variety of causes is given for negative trends: uncontrolled bush fires, caused mainly by hunters, charcoal burners, and palm wine tappers, played an important role, as well as increased pressure on natural resources because of population growth and timber logging. When asked specifically about the role of migrant farmers, all but one group said that migration does not play a role, other than altering population size. Besides the group discussions, native farmers were also asked individually whether they perceived any differences in farming methods between themselves and migrant farmers; many differences were mentioned, but native farmers did not perceive migrants as having less sustainable farm practices.

Fourth, a land use survey was conducted among settlers and native farmers to assess differences in farming methods. Again, substantial differences were found, but migrants' methods were not found to be less sustainable. While they have larger farms and the land tenure system limits their rights to plant trees, they do perform better on most other indicators. Migrant farmers tend to have more labor-intensive practices that are associated with faster regeneration of vegetation cover, while native farmers tend to have more capital-intensive practices that cause a more permanent conversion from forest to grassland.

The findings of this study challenge the validity of earlier studies, which blame migrants for land degradation in the forest-savanna transition zone. The arrival of migrants from northwest Ghana may have increased pressure on farmland and vegetation cover, but no evidence was found that their farm practices have a more negative environmental impact than the practices of native farmers. Earlier studies comparing the farm practices of settlers and native farmers were all carried out by academics from southern Ghana who may be more familiar with land-use practices of southern Ghanaians than of farmers from northern Ghana. The results of these studies can lead to the scapegoating of migrant farmers from northern Ghana, which is a known danger in studies dealing with the environmental impact of immigration (Hugo, 1996).

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