Market integration, livelihood transitions and environmental change in areas of low agricultural productivity: a case study from Morocco.

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Abstract

Rural areas of the developing world have become increasingly integrated into the world economy through both production and consumption during the last decades. This growing integration shapes the development of communities and influences their relationship to the natural environment. In dryland environments where livelihoods are constrained by resource limitations and the productivity of labor in farm activities is low, it may result in a shift to nonfarm activities, which may under some conditions improve wellbeing and relieve pressure on natural resources. The possibility of such a “win-win” development pathway has important implications for development and environmental policy in areas of low agricultural productivity. In this article we use original qualitative and quantitative data to examine environmental and social changes during the last half century in a rural area of Southern Morocco, seeking evidence of such a pathway. While our case study supports the hypothesis that nonfarm diversification in a context of resource scarcity allowed people to improve their material living conditions, the effects of economic integration and nonfarm diversification on the environment were mixed.

Keywords: Morocco; globalization; livelihood transition; nonfarm; deforestation.

Introduction

It is now widely accepted that autarkic rural dwellings hardly existed any more during the last centuries, and that people nearly everywhere had long engaged in some form of exchange even before the industrial revolution. In some way or other, however, most rural areas in the developing world became more integrated to national and international markets during the twentieth century, particularly so during recent decades of market liberalization, infrastructure modernization and economic growth. Examining how rural communities deepened their integration into the market economy over time matters if we are to understand the social and environmental dimensions of ongoing livelihood transitions. Economic integration of areas of low agricultural productivity, has often supported a shift away from local resource-related activities and towards nonfarm activities and migration. This shift potentially allowed for a level of material accumulation otherwise impossible given resource limitations, and for environmental conservation, with some unsustainable activities and consumption habits becoming less attractive given rising labor costs and falling consumer prices. The possibility of such a “win-win” pathway away from the land is examined in this article for a specific case, the argan region in Morocco.

The argan region is characterized by the presence of argan trees (*Argania spinosa*), an endemic species of Southwestern Morocco which its ability to withstand drought allows to survive harsh climatic conditions, to the benefit of the local population who has long depended on it. The tree has attracted much attention lately with the commercial boom of argan oil and the creation of a UNESCO Man and the Biosphere reserve in 1998 in an attempt to make the region a champion of sustainable development (le Polain de Waroux

and Lambin, 2013; Turner 2009). The idea of sustainable development carried by the UNESCO and other national and transnational actors in the argan region rests on the assumption that supporting argan oil production (through women's cooperatives) will both help lift households out of poverty and create incentives for conservation (see UNESCO 2011). As in other regions (Rigg 2006), developers see agriculture-based reform as a key to development and conservation. Yet in most of the argan region arid climate, steep terrain and absent surface and underground water caused an early shift among rural communities towards internal and international migration and of nonfarm activities. It may be asked whether this shift, rather than the local natural resources, has allowed them to develop, and how this development has affected the woodlands. To answer this, we examine the extent to which resource scarcity has led to a decoupling of livelihoods from the natural environment, allowing for simultaneous material accumulation and conservation of argan trees.

While there is more to development and conservation than just material welfare and the preservation of trees, these provide useful indicators of wider social and environmental change. Material development, where basic needs are not met, is a premise of many other improvements and cannot be overlooked. Argan trees are a foundation species to the *Argania* ecosystems, and their loss is related to other changes that collectively decrease primary productivity, biodiversity, and usefulness. We discuss the limitations of these indicators in the conclusion section. Before proceeding to the specifics, we will now briefly examine the case for such a win-win pathway in the literature.

Background

Marginal areas, nonfarm diversification, development and conservation

When integrating the market economy, it is expected that rural communities will specialize into activities in which they hold a comparative advantage. It can be argued that comparative advantage is primarily a function of agricultural potential, infrastructure and population density (Brons & al. 2004). Depending on what their comparative advantage is in an extended economic space, communities may take a variety of development pathways leading to different economic and environmental outcomes. The comparative advantage of many regions with high population density and low agricultural potential, as they open up (in part through improved infrastructures) to new spaces of economic growth, may lie not in farm production but in the use of labor in other activities through *nonfarm diversification*[1] (de Janvry and Sadoulet 1993). In that case, high population density and low agricultural productivity may be understood as push factors for nonfarm diversification, and the development of infrastructure and more generally market integration, as an enabling environment activating pull factors such as new job opportunities. The role of natural resource constraints, low or falling agricultural potential, low and falling agricultural labor productivity, and land degradation and shortages in inducing nonfarm diversification has been recognized by several authors (Bryceson 1996; De Sherbinin et al. 2008; Haggblade et al. 2010; Matsumoto et al. 2006; Rigg 2006).

A movement away from scarce land resources may be expected to open up new development possibilities (Adams 2002; Rigg 2006). Actually, the economic impact of

nonfarm diversification depends on the *opportunity cost* of farm activities, on the *compatibility and complementarity* between farm and nonfarm income and activities, and on differences in *access* to nonfarm activities between people and households. Nonfarm activities are associated with higher income throughout Africa, in part because they play a role in improving income and wellbeing, and in part because wealthier households enjoy better access to high return niches within the nonfarm sector (Barrett et al. 2001). For that reason, they can be inequality-increasing (Brons et al. 2004) or -decreasing (Adams 2002).

The environmental effects of nonfarm diversification result from the combination of two factors. The first is the reduction of the labor force available for farming – the *lost labor effect* (Taylor 1999). It is due to the rising opportunity cost of labor in a context of increasing demand, and may lead to a decline in labor-intensive farm activities (Radel and Schmook 2008). Where this occurs, its effects will depend on whether the abandoned activities were ecologically unsustainable (e.g. overgrazing or excessive logging) or sustainable (e.g. terraced cultivation, oasis agriculture). While for agricultural systems the results of a loss of labor may be ambiguous or even negative (cf. Holden et al. 2004; Morera and Gladwin 2006), for forests and woodlands, the lost labor effect is more likely to be beneficial because it may lessen extraction. One recognized pathway of forest transition (i.e. forest regrowth after a period of decline) for example involves a lost-labor effect (Rudel et al. 2005). Kull et al. (2007) observed that nonfarm diversification led to more land being left fallow in Costa Rica, allowing forest to regrow. Similar dynamics were found in Mexico (Schmook and Radel 2008) and Sri Lanka (Gunatilake 1998). The second effect of nonfarm diversification is that of *income* on consumption and investments. Increasing income may be used to purchase substitutes for locally produced

goods (such as game or fuelwood), or it may be used to purchase more of these goods. Income may also be invested in conservation-adverse or in conservation-friendly technologies (e.g. chainsaws vs. drip irrigation; see for example Iiyama et al. 2008). In El Salvador remittances were invested either in fuelwood or in alternative fuels, with opposite environmental outcomes (Gammage et al. 2002, cited in de Sherbinin et al. 2008), but at the national level remittances were positively associated with forest resurgence (Hecht 2007). In Costa Rica, expatriates purchased tracts of land for conservation (Kull et al. 2007). Acknowledging the context-dependence of these effects, we can however infer that nonfarm diversification is likely to be beneficial to the environment if it leads to the abandonment, due to a lost labor effect, of unsustainable practices, of land and resources whose maintenance does not require human intervention, or if it supports investment in conservation-friendly technology and consumption goods. Figure 1 integrates these various effects into a conceptual model.

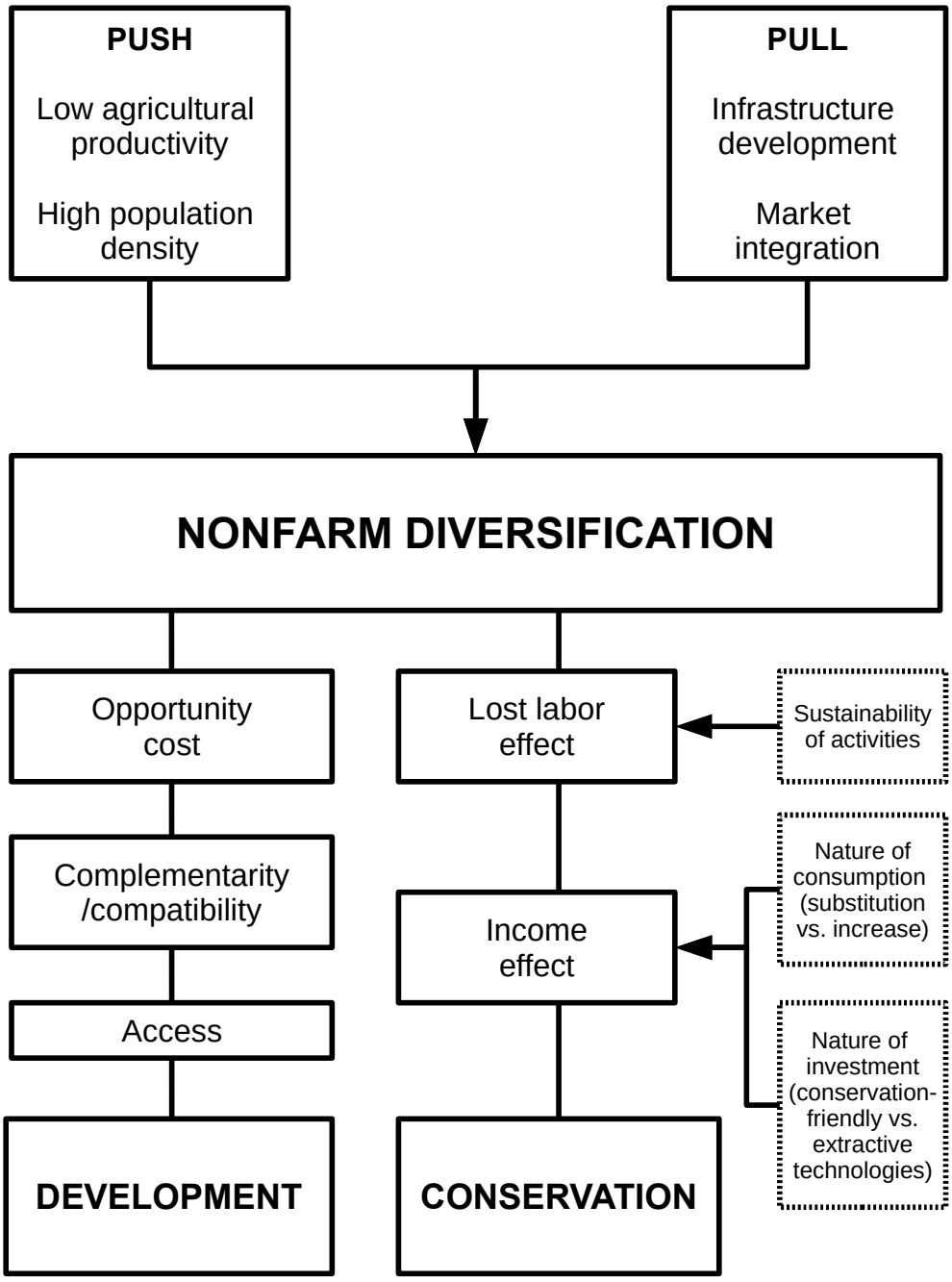

Figure 1: Conceptual model

The study of economic integration and social and environmental change in Morocco

Two schools of thought dominate studies of integration and rural development in Morocco. The first, which we call *traditionalist*, considers that a return to past institutional forms would help improve economic and social conditions. The second, which we call *modernist*, promotes the organization of society on a formal, contractual basis, around the constitution of cooperatives or associations. These two schools operate in both the field of academia and that of development expertise. Engagement with social change in rural areas started with the modernist agenda of the French and Spanish protectorates, and mostly took the form of support to modernization schemes, including the adoption of new agricultural techniques, improvements in hygiene and health, and schooling. Modernist research on rural areas, such as that of Jacques Berque in the 1930's and1940's, further supported and justified modernization efforts in the 1960's, with new policies aimed at national food sufficiency through the implementation of new agricultural techniques and of large-scale irrigation schemes. Concern about social change emerged in the 1970's, with the work of Paul Pascon on the social effects of agriculture modernization and irrigation schemes (e.g. Pascon 1975). Pascon, in a traditionalist perspective, considered that these innovations induced a cultural loss among agriculturalists.

Awareness of environmental change and the search for explanations of it have been part of Moroccan classical thought. Ibn Khaldûn opposed Berber agriculturalists to Arab pastoralists, the latter being purportedly inclined toward the degradation of natural resources – an argument that was used by the French protectorate administrators to justify colonization (see Davis 2005). Early on in the practice of researchers and

engineers in charge of the management of natural resources, the dynamics of nature were approached with the double objective of understanding arid and semi-arid ecosystems, and of developing land and vegetation protection measures. This concern was embodied in the constitution of forests as state domain in 1916-1917 and in the creation of a number of national parks from the 1930's onward. The opposition between the proponents of intensification and those of the protection of nature, present already in early studies, intensified in the last decades of the 20th century as rising global environmental consciousness paralleled the conquest of land for intensive agriculture. The State, researchers and developers have been faced since then with two antagonist projects, that of intensification, and that of the protection of nature, resulting in a burgeoning of "conservation and development" schemes such as the creation of an argan region biosphere reserve under the UNESCO.

Overall, there have been relatively few academic studies taking into account both the social and environmental dimensions of changes related to the economic integration and modernization of rural areas. The present article tries to fill this gap and answer the question of the social and environmental effects of economic integration in the argan region without making assumptions as to the desirability of modern vs. traditional livelihoods, or of intensification vs. nature protection.

Case study

The study area is located in the easternmost part of the argan woodlands region, on the northern slopes of the Anti-Atlas Mountains (figures 2 and 3). Argan woodlands come in a variety of ecological associations and morphologies, depending on micro-climatic conditions and human use. Argan trees are usually less than 5 meters high, but their crown can reach up to 12 meters. They can grow on poor soils, and their deep roots allow them to thrive in semi-arid environments. Their resilience to drought is in part due to the fact that trees will defoliate and go dormant when exposed to long-lasting droughts. Reproduction can be vegetative or by seeds, but natural regeneration has nearly completely disappeared from the region, and artificial replanting has been mostly unsuccessful. This makes the lack of regeneration of the argan woodlands the largest long-term threat to their sustainability. Other threats come from climate change, logging, urban spread, and the extension of irrigated agriculture (see le Polain de Waroux and Lambin, 2012).

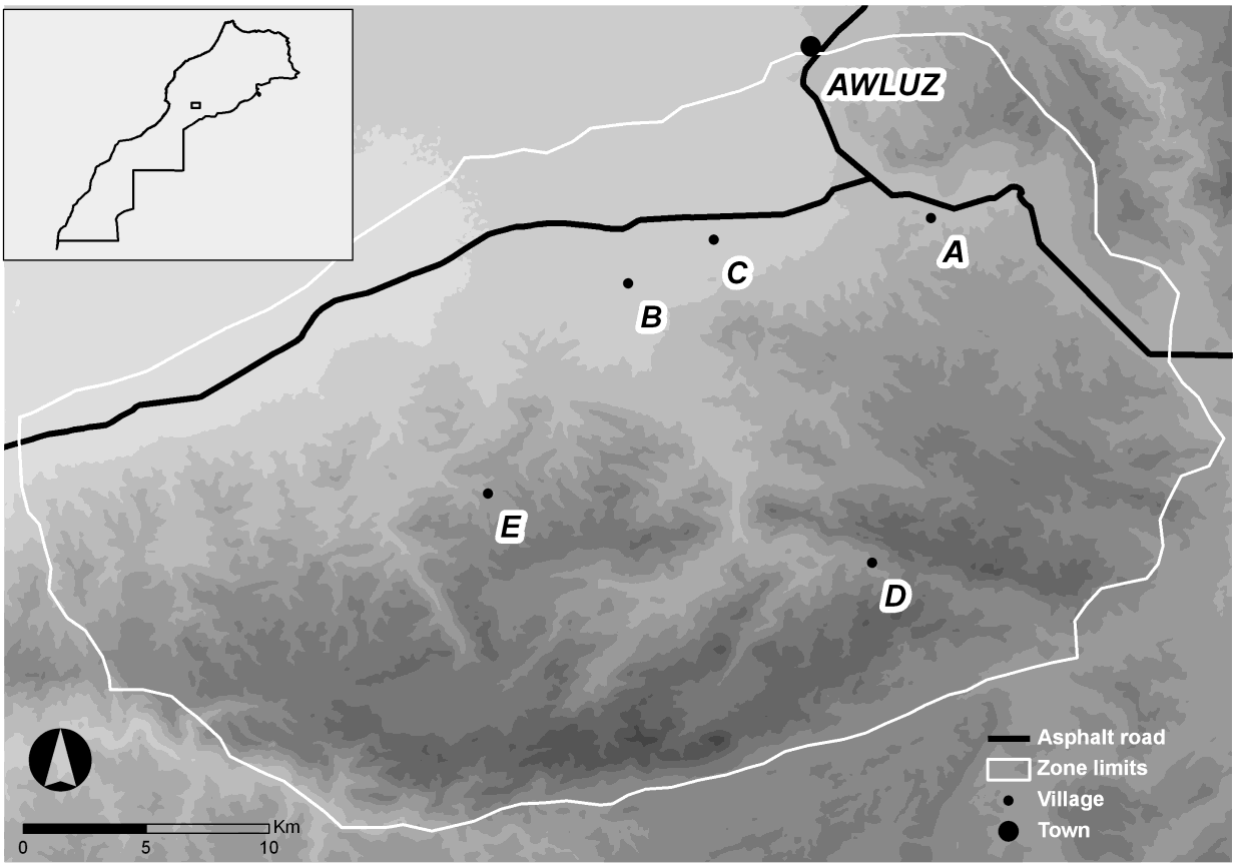

Figure 2: Study area

Argan woodlands always were the main natural resource in an area characterized by water scarcity: they provided fodder for animals, oil for local consumption and sales, wood for fuel, tool-making and construction, and they enhanced the microclimatic conditions for cultivation. Increasingly, and in view of their pending destruction, they are being valued by outsiders as well as a "barrier against the desert", and have become a regional, if not national, symbol. The forest legislation enforced in 1925 and still in use today reflects the multiple uses of the woodlands: though they are part of the state forest domain, usufruct rights are granted to local residents for the collection of argan nuts and dead wood, and for the use of the woodlands as grazing grounds. In many places, parts of the woodlands are closed during some months in the summer, in order to allow the fruits to mature, a practice called *agdal*.

The study area, as well as a good part of the argan region, can be characterized as one of low agricultural productivity[2] and of great water scarcity. It is located in an arid zone receiving 300-400mm/y precipitations on average, most often less. Argan trees dominate the vegetation, with very poor undergrowth. Two parts with different natural potentials can be differentiated based on the area's geological and topographical structure. The Southern part, on the Northern slopes of the Anti-Atlas, has steep terrain, thin soils, and hardly any surface or underground water. The Northern part, on the alluvial plain of the River Sus, is flat, with deeper soils that allow water to percolate.

Figure 3: Argan woodlands

We studied five villages, two in the plain (B. and C.)[3], two in the mountains (D. and E.), and one in an intermediate hilly setting (A.; see Figure 2). The first two were easily accessible from the road. Their territories comprised abundant flat land (over 1000 ha in each), supporting large rainfed barley and wheat fields, small vegetables plots and fruit trees. Steeper land in the Southern part of the territory was covered with medium-density argan woodlands. Livestock numbers were relatively low (400 and 800 animals). C. was connected to the electricity grid in 2001, B. in 2007. A drill dug in 2006 in C. provided water at a very low rate of flow, and another dug in 2012 in B. was not functioning at the time of writing. Traditionally, villagers obtained water from rainwater cisterns (and from the River Sus in C.), or from a spring located over 5km away. There was a primary school in B., and children in C. attended a school in a neighboring village. Village A. was located on an asphalt road, 8 km from Awluz. Its territory was predominantly steep terrain, with 1470 ha of 2300 over 10% slope, the majority of which covered with argan woodlands. There were rainfed barley and wheat plots on the better land. With 1600 animals, livestock was abundant for regional standards. Until a drill was bored in 2005 villagers depended on rainwater cisterns and a spring 5km away. The village had electricity since 2007, and a primary school since 1998. The last two villages (D. and E.) were located in the mountains, 22 and 19km away from Awluz, and accessible only through poor dirt roads. Their territories (1300 and 1000 ha) spanned mostly steep land, with only 16% under 10% slope in both cases, and were covered by medium to high-density argan woodlands (15 and 30 trees/ha). There was a small spring in D., but in E. water came exclusively from rainfed cisterns. There were respectively 500 and 600 animals in the villages. Electricity was available since 2008 in D. and since 2011 in E., and a primary school was built in 1998 in the former and in 2004 in the latter.

While villages in the plain may have produced enough food under low population density in the past, the mountain population was probably never completely self-sufficient. Demography made matters only worse during the 20th century: population doubled between the 1936 and 1960 national censuses, and doubled again between 1960 and 1994 (see Table 1). Fuelwood sales, caravan trade, some crafts, and possibly banditry and raids (de Foucault 1888) helped residents fill the food deficit until migration and nonfarm work became the preferred drought-coping strategy, as will be shown. The argan oil boom might be thought to have improved agricultural productivity in economic terms over the last two decades, but in the study area it has largely failed to deliver its promises (le Polain de Waroux and Lambin 2013). Still in the early 21st century, the study area was one of the poorer regions of Morocco. With 21.5% of the population under the poverty line of 3569 MDH/person*year, the commune belonged to the poorest fifth of all Moroccan communes in 2007[4]. The poverty rate was also significantly above the provincial and regional rates. Illiteracy reached 66.9% of the population (national rate 43%), which was young, with over 45% under 25 years (national rate 51.7%), and relatively feminized, with 54.9% women (national rate 50.3%). In the study area households consisted mostly of single nuclear families, counting an average 6 to 7 people per household. Complex households spanning several generations, though more common in the past, were a minority in 2009 (less than 10% of households).

Village	1936	1962	1971	1994	2009
A	128	331	397	503	422
B	60	149	157	250	220
C	124 (?)	390	490	652	325
D	66	131	177	186	105
E	?	61	85	116	113

NB: All data from national censuses except for 2009, based on my own censuses. Uncertainties for 1936 arise from villages or parts of villages changing names or not being mentioned. The apparent population decrease between 1994 and 2009 may be due to migration or to the reporting in 1994 of migrants as part of the village (for 2009, only people actually living in the villages most of their time are reported).

Table 1:Population data

The remainder of this study is aimed at investigating the aforementioned hypothesis of a win-win outcome of market integration through the decoupling of livelihoods from the land in the case of the argan woodlands. In order to do this we examined changes in livelihoods, land use, wellbeing and woodland cover between independence and today and then analyzed causal relationships between these trends.

Data and methods

This study draws on fieldwork conducted between 2009 and 2012 in the study area (four visits, totaling six months of full-time presence). Most quantitative information comes from the five villages mentioned above, which were selected based on their degree of isolation from the market and the diversity of land use and livelihoods. There the leading author conducted retrospective household interviews covering household structure, livelihoods history, income, and assets (86 interviews, sampling rates 30 to 62.5%, see Table 2), in the local language

(*Tashelhit*), with the help of an interpreter. Households were contacted with through local collaborators, with explicit attention to maximizing diversity in livelihood and economic status in the sample. We used village-level household censuses covering basic assets and livelihood indicators to crosscheck the representativeness of our sample. The household head (always male) was interviewed if available, or his wife or oldest son otherwise. Qualitative information on livelihoods, land use and village histories was obtained through key informant interviews with villagers and customary authorities, semi-structured and open interviews, and direct observation in the study villages and in other villages of the area. Whenever possible, we crosschecked information from several informants and from archival records to avoid biases. Two previous articles on our data provide the basis for the analysis of woodland changes (le Polain de Waroux and Lambin 2012) and of factors of assets accumulation (le Polain de Waroux and Lambin, 2013). Some archival documents were also used, e.g. descriptions of the argan woodlands by Boudy (1958), forest officials' reports, Noin's book on rural demography in Morocco (1960) and documents from the French protectorate archives (consulted in Nantes and Paris).

Village	# interviews	# households (total)	Sampling rate (%)
A	26	87	30
B	20	44	45.5
C	20	60	33.5
D	10	20	50
E	10	16	62.5

Table 2: Interview sampling

In order to understand *changes in livelihoods* we classified households into main livelihood categories at the time of independence and at present. These household categories are not meant to reflect the whole complexity of livelihoods and household

structures in the study area, but rather to highlight broad changes that occurred between the two periods. Independence, besides being the beginning of a new period of opening and modernization, was also an easy landmark for people to remember. Informants themselves provided household categories for the past, in person-to-person and small group interviews. These interviews provided insights as to past living conditions and lifestyles for each category. For the present, we conducted a hierarchical clustering using a Ward method with Euclidian distances, based on 11 variables selected from the household interviews (see table 3). We ran the clustering procedure a number of times with slight differences in the specification or the number of variables in order to test for robustness of the resulting categories. A combination of statistics from the household interviews and qualitative information from open interviews provided the material for a description of the main characteristics of these categories.

Variable	Description
Assets index	Index based on 10 assets variables (see le Polain de Waroux & Lambin (2013) for details)
Cereal harvest 2009	Harvest of barley and wheat in 2009
Argan harvest 2009	Harvest of argan nuts in 2009
Herd size	Number of sheep and goats
% time abroad	Percent of the time spent abroad over the last ten years (weighted average for all household members)
% time in cities	Percent of the time spent in Moroccan cities over the last ten years (weighted average for all household members)
Local income	Monthly income from local activities
Remittances	Monthly remittances from household members working outside the village
Argan income	Monthly income from argan sales
Livestock income	Monthly income from animal sales

Table 3: Variables used for the clustering procedure

Changes in land use and wellbeing were inferred by comparing accounts of past activities and living conditions with present observations and interviews. Quantitative

figures mostly come from the household interviews. We restricted to measurable aspects of wellbeing, namely food sufficiency, water availability, housing, education and infrastructure.

Methods used to monitor *woodland density changes* between 1970 and 2007 are described in le Polain de Waroux and Lambin (2012). In order to verify the consistence of woodland change trends before and after 1970, we compared estimates of woodland density for the study area made around the time of independence by Boudy (1958), with our own density estimates for 1970. Finally, a series of transects in the five study villages provided complementary data about woodland state and use[5].

Results

Changes in livelihoods and land use

Respondents generally agreed on the existence of three main categories of households in the past. *Small-scale farmers* cultivated barley or wheat, had a few goats and sheep, and some vegetables for those with access to water. They were in a situation of quasi-self-sufficiency in normal years, but were highly vulnerable to drought. Although they stored cereal surpluses for use during dry years, storage was usually insufficient, and they had to buy grain from the market. In order to do this they sold argan wood or charcoal, sometimes also argan oil. Their diet consisted mainly of barley porridge – meat was rare. Consumption of market goods was limited to grain, some vegetables, and tiny amounts of tea, coffee and sugar. There were also a few *large livestock breeders and landowners*, constituting no more than 10-15% of households. These people had sufficient food, could go on eating homegrown or market vegetables and meat during droughts, and consumed tea and sugar on a regular basis. Finally, there were a few *merchants* in each village, one in about ten households. These had dromedaries (no more than two or three per household), with which they joined caravans between Marrakech, the Sus plain, and the southern oases, carrying olive oil, dates, and in some cases argan oil, salt or cereals. They too could afford meat and vegetables at all times. Yet caravan trade, was only a relict at the time of independence, and the last dromedaries soon disappeared due to the competition of trucks. In marginal numbers in the area were also public servants and migrants. The latter were very few: in 1966, they were still only five to seven percent of the men in the region, of which one percent international migrants (Noin 1970). In a few villages there were craftsmen, such as

blacksmiths and basket makers. On the whole thus, the local economy, though by no means exempt of commercial exchange, was still primarily subsistence-oriented. The main marketable products of the area in terms of frequency and quantity were argan wood, argan charcoal, and small livestock. The main items bought from the market were cereals, vegetables and, increasingly, tea and sugar. Production factors as well as construction materials were locally based. Ard plows were made of argan wood and pulled by mules or donkeys, which also served to thresh cereals. Argan wood provided fuel for cooking, baking, and heating in the winter, as well as beams for traditional stone houses.

The clustering procedure for 2009 yielded four household categories[6]. The cluster tree shows the division of groups, and elements of interpretation (figure 4). We limited the analysis to four groups, named according to their main features (summary statistics are provided in table 4). 29% of the households relied heavily on temporary migration – we simply call them *migrants*. The men in these households often had low-pay jobs in grocery stores or in restaurants, but some had small businesses and remitted significant amounts of money to their family (1500 MDH/month or more for 4 households out of 25)[7]. They usually had little land, but they continued to plow it; they had few animals, and no local income. *Livestock breeders* (23%), whether they had just a few animals or a large herd, combined income from the same kind of low-pay jobs with livestock herding, and spent less time in the city, and more looking after their animals. Those with more livestock were better off, because animal sales could generate a significant income (up to 2500 MDH/month). For the others, keeping a few animals may have been a way of coping with the variability of remittances.

Variable name	«Successful migrants» (n = 7)	«Local entrepreneurs & wage workers» (n = 30)	«Other Migrants» (n = 25)	«Livestock breeders» (n = 20)
Variables used for the clustering				
Assets index	0.53 (0.11)	0.42 (0.18)	0.40 (0.17)	0.41 (0.16)
Age of head of household	62.4 (16.3)	54.0 (12.4)	57.3 (14.8)	55.3 (14.9)
Household size	7.9 (6.4)	6.2 (3.7)	6.0 (2.7)	6.7 (4.5)
Cereals harvest (2009)	188.0 (133.3)	189.8 (208.0)	107.3 (104.3)	193.9 (177.8)
Argan harvest (2009)	0.3 (0.8)	45.4 (181.8)	12.6 (18.8)	11.9 (17.9)
Herd size (2009)	4.7 (6.5)^{ab}	19.9 (50.2)^{ab}	6.9 (11.4)^{a}	**46.2 (46.4)^{b}**
% time abroad	14.6 (17.4)	3.7 (9.0)	4.6 (14.4)	0.0 (0.0)
% time in cities	69.7 (22.4)^{ab}	41.5 (32.7)^{a}	**80.7 (21.5)^{b}**	50.3 (38.4)^{a}
Local income (2009)	0.0 (0.0)b	**1573.3 (1324.4)^{a}**	38.0 (131.7)^{b}	78.8 (146.7)^{b}
Remittances (2009)	**3528.5 (1314.0)^{a}**	403.8 (566.6)^{b}	870.6 (493.8)^{c}	523.8 (441.6)^{bc}
Argan income (2009)	0.0 (0.0)	66.2 (148.12)	58.0 (161.8)	102.1 (167.4)
Livestock income (2009)	0.0 (0.0)^{a}	259.2 (529.3)^{a}	48.6 (83.1)^{a}	1183.3 (558.7)^{b}
Activity variables**				
% Time in transportation	0.0 (0.0)	9.5 (22.4)	2.7 (8.7)	0.9 (4.2)
% Time in trade	3.3 (7.2)^{ab}	18.3 (30.6)^{ab}	**24.5 (35.6)^{a}**	1.3 (5.6)^{b}
% Time in construction	58.0 (30.5)	19.9 (34.1)	30.14 (39.8)	18.0 (30.4)
% Time in services	30.2 (31.9)	38.0 (35.0)	31.3 (36.2)	34.3 (35.4)
% Time in livestock breeding	3.0 (8.0)^{a}	6.7 (20.7)^{a}	5.4 (13.9)^{a}	**33.1 (35.4)^{b}**
% Time in agriculture	2.9 (7.6)	5.7 (15.1)	2.4 (8.6)	6.6 (14.5)

*) Upper-script letters show significant differences an 90% or more between variables.

**) «% time in ...» variables are weighted household means of the time spent working in a particular employment sector as a first activity.

Table 4: Group statistics

A small group of *wealthy migrants* (8%) had high amounts of remittances (2000-6000 MDH) that constituted the sole source of household income. High remittances were due to the involvement in international migration or in profitable businesses in town. If they did not leave completely for the cities, these people continued to cultivate, hiring labor if necessary, and focusing on land that could be plowed easily with the tractor. Argan oil, if produced at all, was usually sent to family members in the cities, cereals were self-consumed, and they had few animals, if any. Finally, some *local entrepreneurs and wageworkers* (35%) earned significant nonfarm income in or around their village (from a

minimum of 600 to 7000 MDH/month in an exceptional case). The former were for example truck drivers or construction entrepreneurs; the latter were mainly construction workers or unqualified workers employed for various tasks in the villages and around. Usually, some household members worked in the city, but less than in other households. Some also had animals – two of them even had a large herd of 200.

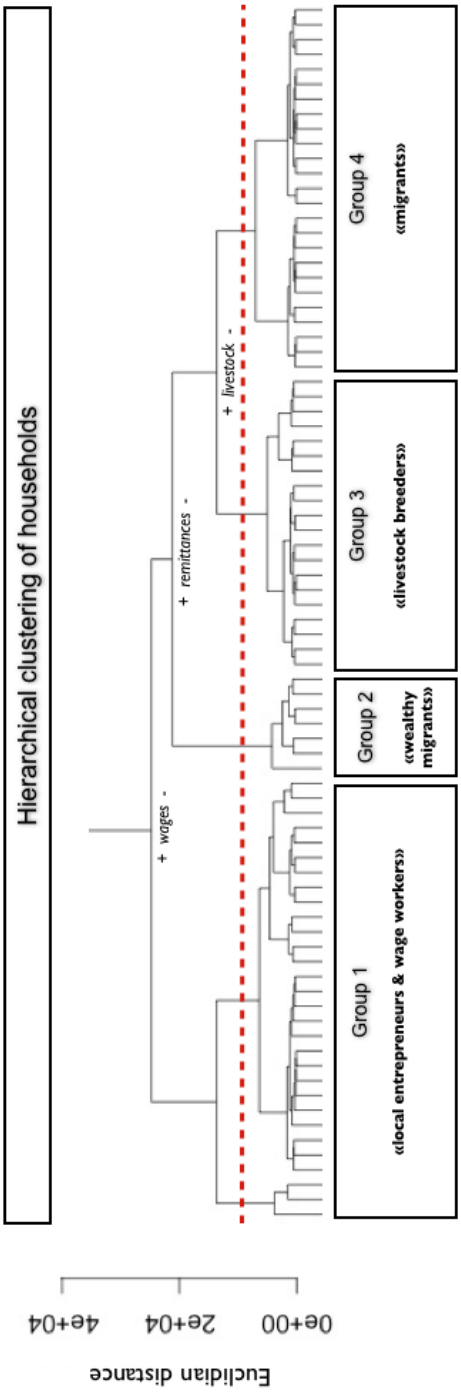

Figure 4: Household clusters

Nonfarm activities – including migration – had thus become a central part of livelihoods by 2009. On the whole, in the study villages, about two-thirds (67%; n = 243) of the men were working outside their village, mostly in the North of Morocco (39%), and especially in the economic capital Casablanca (27%). 64 households (74,5%) had an average income from remittances of 8933 MDH/year (sd = 8820 MDH). In the study area migration took off in the 1960‘s, when the first en-masse recruitments for the French mines and industries took place, and over 50 men from the study villages left for France. Once there, these men found employment for relatives, and over the decades an important number of men left for Europe, most of whom never returned home. More people also started leaving for Moroccan cities after the 1960’s, but temporary internal migration took a systematic turn only in the late 1970’s for some villages, and in the early 1990’s for others. Some migrants took their family with them to the city once they could afford it. Village censuses show that at least 186 households (or 80% as many as stayed in the village) had left the five villages by 2009, most of whom still owned a house in the village and visited once a year. But to many the only possibility was combining the advantages of the city (jobs and access to education) with those of the countryside (low expenses and identity or cultural references). A few migrants also returned to their village to practice a craft they had learned elsewhere, especially construction workers, who benefited from the housing boom in the villages of the region – a boom largely fueled by migrants themselves. The more affluent migrants employed relatives or neighbors to look after their house and their livestock or to deliver them wood. Some used the money set aside during migration to develop commercial activities, particularly in construction and transport. In this way, migration and remittances, along with increased mobility and the

development of small towns, were important factors in the development of local nonfarm activities.

Partly as a consequence of migration, the importance of *agriculture* had declined for a number of households. Some inaccessible or steep land was no longer used, especially in those villages with an important number of international migrants. In villages A. and D. for example people stopped cultivating some land on mountainous plateaus that were inaccessible with tractor (for plowing) and car (for harvesting). These lands were then used as pastureland. Though erosion on abandoned terraces is an issue in many other dry mountainous areas, in the study area the prevalence of terraces was relatively low, as compared for example with the Central Anti-Atlas. There were, however, reports by some residents of increased gully erosion during the last decades. Money earned elsewhere also freed some labor from agricultural activities; by 2009, 41 households from the sample had stopped cultivating land with ard plow and donkey (average abandonment date 1997; sd = 8.1), and used only tractors (average adoption date 1992; sd = 10.2). These were faster but cost money and could be used only on flat lands. There were few other signs of intensification, however - on the contrary. Most households sold manure (72% of those owning animals), rather than spreading it on their fields as they used to do, which was profitable but risked undermining soil productivity as no other fertilizers were used. New houses were often built on valuable agricultural land, rather than on steep slopes as earlier. Some agricultural activities were also forcibly abandoned: the greatest change occurred in B. and C., where following the completion of the Awluz dam in 1991 the water that had irrigated the fields was redirected to commercial farms, so that olive and almond trees died and irrigated crops all but disappeared. Most households, however, still pursued cereal cultivation to some extent,

and a few international migrants even planted olive trees and bought water and material for irrigation.

Livestock herding had changed in nature. The *agdal* practice had been abandoned in two of the study villages, as had some mountain sheep-pens in which shepherds used to leave herds during summer months. But we found no evidence of a strong decline in livestock numbers, contrary to the opinion of local residents. In 1973, the forest service censored about 38 shoats per household in Inda Ou Zal massif, and 13 in Aït Yahya. Based on interviews with customary authorities, we estimated the average number of shoats per household in 2009 at 23 for the former, and 13 for the latter. Although the figure is less than in 1973 for the Inda Ou Zal, the rate of decrease is in range with that of population increase in these villages, suggesting that total livestock numbers did not change much between these dates. The fragmentation of herds among a greater number of users might explain the perception that livestock numbers decreased. Likewise, residents generally shared the opinion that the number of nomad herds had increased. According to our estimates based on key informant interviews, the grazing pressure by nomad herds in recent times must have been equivalent on average to that of local herds, albeit concentrated over specific periods. The use of trucks for moving animals around may have supported an increase in herds from Berber nomads (Arab nomads from the Sahara came on foot). Unfortunately, we have insufficient data to check the validity of this opinion.

From a common small-scale activity conducted by individual households, *wood trade* seemed to have surged during the 1970‘s-1980‘s before declining dramatically from the 1990‘s. Though the trade had first been limited to the villages of the plain that could be

reached on foot (except for charcoal, which is easier to carry), the potential delivery area expanded as trucks became available after independence. Some truck owners in the area were known to deliver wood as far as 100 km away. Coupled with increasing demand from developing market and administrative centers in the wake of the agricultural export boom of the Sus plain, this probably made for an intensification of wood trade. In the early 1990's, people in one village reportedly loaded one to two trucks per week with argan wood, in addition to daily sales on a mule's back. By the late 2000's, however, wood sales had become a residual activity: in most villages, only a few men (in less than five percent of households) sold wood on a regular basis, some to people from the plain, others to richer households in their own or a neighboring village. Charcoal making had all but disappeared. Logging had always been a low-pay activity: still in 2012, a donkey-load of wood was worth 50-70 MDH only, so that a full-time worker, selling two of them a in day, would be only slightly above the local day's wage for unqualified workers (about 100 MDH/day). It was, moreover, physically hard and risky: trading wood was illegal, and although bribes had usually kept the forest services away, loggers were eligible for high fees if an officer happened to be less flexible. So from the mid-1990's, truck drivers found it more interesting and less risky to switch to other commodities (including wood from other, legally exploitable species) and stopped transporting argan wood. By the 2000's, as loggers grew older and could rely on their sons' remittances, the profession declined. Nevertheless, local fuelwood consumption was still significant. While 91% of households surveyed used gas bottles (four times more than thirty years earlier), with an average gas consumption amounting to 3801 kWh/year*household (sd = 2006), these same households also used 9.4 m^3/year (sd = 7.1) of argan wood, the equivalent of 14000 kWh[8], or several times more.

Changes in wellbeing

The description of household categories at the time of independence has shown that the average diet was basic and often even insufficient for the majority of households. Reliance on rainwater in underground cisterns meant having to travel to a permanent spring, often several hours away on foot or mule, to fetch water in case of acute drought (though at the time of independence this reliance was being eased with the increasing availability of cistern trucks and with dirt roads linking the villages nearest to the plain). Droughts could still turn into famines. People reported two such cases: in the 1930's (probably the 1936-7 famine) and in the 1960's (probably the 1966-7 drought). Houses were built of stone and earth, were often quite small and needed continuous repair. People moved around on foot or on mules and dromedaries, even for long distances, because traveling by bus was expensive, and cars were rare – dirt roads linked villages to the market in the plain only. There were no schools in the villages.

By 2009 three out of five villages had running water, and work was under way in the fourth – only E. still relied exclusively on rainwater and had no prospect of improvement in the near future. Plain hunger was no longer an issue, even for the poorer households, though wealth differences were still perceptible in the consumption of luxury foods, such as fruits, industrial foods or meat. Traditional earth and stone houses had also become a minority. Most houses were a mixture of stone, earth, and cement, and a few were built in cement alone (cement is a more stable material and offers a better protection against the rains, though less effective than earth in regulating temperature inside the house). By 2011 most had electricity and toilet, and a few had a separate shower. Eucalyptus beams

and steel doors replaced argan roofs and wooden doors. Almost everyone (over 90%) had a TV set and a mobile phone, and there was a fridge in every second house. All five villages had a primary school, which all children in age were attending, and 64% of boys (but no girl) aged between 14 and 20 attended or had attended college. Dirt roads linked almost all mountain villages and there was a project of an asphalt road linking some of the mountain villages to the main road as well. Many people owned private vehicles: 70% of households had a moped or a motorbike, and 21% had a car. While the market was still a favorite socializing platform, mobile phones had opened new venues for trade and allowed migrants to keep in touch with their families even over great distances.

		~ 1956 (Boudy)	1970	2007
Aït Yahya	Mountains	30-40	22,8 (18,0)	14,8 (9,3)
	Plain	15-20	17,1 (11,2)	11,6 (8,5)
Inda Ou Zal	Mountains	30-40	28,1 (14,6)	18,8 (9,5)
	Plain	15-20	17,6 (9,2)	5,7 (5,8)
Arrhen	Mountains	40	27,5 (21,5)	16,2 (12,5)
	Plain	70	36,2 (16,4)	12,2 (8,1)
Bou Selloum		< 30 trees/ha*	24,2 (17,6)	12,3 (10,7)

**) no value given by the author, but described as «open and dying off»*

Table 5: Comparison of values reported by Boudy (1958) for the independence period, and average values from le Polain de Waroux and Lambien (2012) (standard deviations in parentheses)

Changes in woodland cover

Boudy's (1958) estimates of woodland density for the late 1950's are relatively consistent with our 1970 density map (see table 5), suggesting, if anything, a continuous decrease in density. In 1970, the density of argan woodlands in the area was 27.4 trees/ha (sd = 13.8), and in 2007 it was 15.2 trees/ha (sd = 22.8; see le Polain de Waroux and Lambin 2012 for maps). This represented a change of -12.2 trees/ha, or -44.5% from the 1970

density (significant difference at 99%). The figure varied from one village to another, from -5 trees/ha in E. to -15 trees/ha in D. Observations along transects showed abundant evidence of earlier logging and recent scars on branches in all five study villages. Signs of whole trees cut recently were less, and none was observed in D., although it had the strongest rate of decrease between 1970 and 2007, suggesting that logging had been important but had halted (see table 6). Table 7 summarizes the main changes between the two periods.

	Density change (trees/ha)		% Observations with		
	Tree density 1970	Density difference	Recent cuts (all sizes)	Recent cuts (whole trees)	"Green rocks"
A	31,9	-8,92	32	2,7	20
B	17,7	-6,61	18,3	14,1	23,3
C	19,5	-5,15	18,2	15,2	49,3
D	29,5	-14,46	15,6	0	20,3
E	35,5	-5,33	28,6	1,3	11,3

Table 6: Transects and remote sensing results

		Around independence	Today
Livelihoods & land use	*Population (five study villages)*	1062 (1962 census)	1424 (own census, including men working outside) 1065 (own census, excluding men working outside)
	Dominant main occupations	farm work and livestock herding	services, trade, construction work
	Main occupation of the wealthier households	merchants and large landowners or livestock breeders	entrepreneurs and international migrants
	Farming	cultivation of most available land, self-consumption and storage, market grain to cover shortages	cultivation of flat areas with tractors, abandonment of some marginal land, systematic reliance on market flour, manure sales
	Men working outside the village	< 7%	~ 67%
	Remittances	--	~ $780/household*year
	Things sold	most households (hh) : animals, wood, charcoal	most hh: manure
		some hh : argan oil, handicrafts, honey, cereals	some hh : argan oil, cereals
Well-being	*Food security*	the majority of households have to restrict their diet during droughts ; cases of famine	food is sufficient at all times
	Housing	Only stone or earthen houses	Majority of mixed houses; increasing number of pure cement houses
	Education	No schools	Schools in all villages; accessible colleges
	Infrastructure	Dirt roads in the plain only; rainwater only	Dirt roads to all villages, asphalt to some; running water in all but one village
	Things bought (food)	most hh : cereals, vegetables some hh : meat, tea, sugar	most hh : cereals, vegetables, meat, oil, tea, sugar some hh : industrial foods, fruits
	Things bought (non-food)	--	most hh : TV-set, mobile phone, motorbike some hh : car, fridge, computer
Woodlands	*Woodlands density*	~30 trees/ha	12.2 trees / ha
	Wood and charcoal sales	most households	< 5 % households

Table 7: Main changes between independence and today

Village	Population	Surface (ha)	Percent village teritory under 10% slope	Territory under 10% slope in hectares per person	Shoats/ha	Tree density 1970 (trees/ha)	Tree density 2007 (trees/ha)
A	422	2300	36	2.0	0.7	32	23
B	220	1350	83	5.1	0.3	18	11
C	325	1550	70	3.4	0.5	20	14
D	105	1300	16	2.0	0.4	30	15
E	113	1000	16	1.4	0.6	36	30

Village	Distance to permanent freshwater spring (km)	Distance to market	Beginning of large-scale migration	Time outside the village*** (sd)	Time in nonfarm sector**** (sd)	Average assets index in 2009*** (sd)
A	5	8	1970's	67 (39)	83 (28)	0.43 (0.14)
B	10*	17	1980's	62 (36)	84 (24)	0.44 (0.09)
C	5**	12	1960's	69 (28)	80 (26)	0.58 (0.16)
D	<1	22	1960's	66 (30)	91 (18)	0.36 (0.18)
E	12	19	1990's	42 (39)	55 (42)	0.17 (0.12)

*) But rain irrigation channels

**) But irrigation water from the Sus river until the early 1990's

***) Average % time spent working outside the village by male household members during the last 10 years

****) Average % time spent working in nonfarm activities by male household members during the last 10 years

*****) Index ranges from 0 (poorest) to 1 (richest); see le Polain de Waroux and Lambin 2012b for the construction of this index

Table 8: Village-level indicators

Discussion

The evidence has shown that livelihoods, land use, well-being and land cover all have changed dramatically during the last half-century. But does this story fit the «win-win» hypothesis of nonfarm diversification? Here we will briefly review the evidence with respect to the different parts of the win-win hypothesis, and discuss its relevance for the literature.

The economic integration of a dryland area leading to nonfarm diversification.

We have shown how increasing integration into the regional, national and world economy allowed people in the study area to pursue activities off the farm and consume goods produced elsewhere. The dominant process of change was the reallocation of labor through the development of non-farm activities, locally or through migration. This livelihood transition went along with a shift in consumption away from local natural resources. Together, the two processes made for decoupling from the natural environment and increasing reliance on exchange. The speed of this decoupling differed among villages. As Table 8 shows, at village level there was no automatic relationship between land scarcity and diversification. D. and E., the two mountain villages with the least amount of flat land, were the ones with respectively the highest and the lowest rate of nonfarm work, and the earliest and the latest migration history. This is because in D. some of the men were hired for work in the French mines in the 1960's, initiating a migration and diversification pathway in the village early on, whereas in E. migration started only with a later generation in a changed, more difficult context. Market

integration is therefore an enabling, but not sufficient, condition for nonfarm diversification.

Neither did decoupling from the natural environment imply a sweeping and unequivocal deagrarianization. In spite of a decrease in the importance of cereal cultivation, nearly all households still did practice it to some extent, and many rented a tractor to plow their land and paid the mill to grind their grain, suggesting they still valued the activity. Some wealthy migrants planted olive trees and bought irrigation water; some even rented land from others for cultivation. Probably as many people had sheep and goats as before, and these remained an important source of cash for some. Some international migrants invested in agricultural machinery, as found elsewhere in Morocco by de Haas (2006). The recent boom in argan oil price made the oil an important source of cash to some households, although on the whole it represented relatively little (le Polain de Waroux and Lambin 2013). Finally, many people continued selling wood until relatively recently, and as shown above some even capitalized on this trade to develop other trading activities. The maintenance of farm activities, for the majority, was part of a diversified livelihood and risk-minimization strategy. For some others it was the continuation of traditional activities, and for still a few others it was a means of speculation or investment. Yet *in fine* there were very few for whom the land was the primary source of value. These findings corroborate those of studies elsewhere that have found that even in cases of strong nonfarm diversification, households tended to maintain some degree of subsistence agriculture as an economic security net, as a leisure activity, or for cultural reasons (e.g. Bryceson 2002; Jokisch 2002; Steward 2007).

Economic integration and nonfarm diversification leading to material development.

It is safe to say that many improvements to living conditions could not have happened had it not been for this decoupling. The land could not produce enough food for the growing resident population, let alone a surplus. Fragmentation of land holdings through inheritance, increasing aridity, and degradation of the woodlands made the resource base even scarcer. The combination of new income-generating opportunities with increasingly available consumption goods made it possible to overcome these limitations, become less dependent on climate variability, and start a process of material accumulation that in turn stimulated the local economy. Most people in fact acknowledged that life in the villages improved “when people left”. This may in part reflect the fact that departures “unburdened” the villages from “surplus” population, but it also reflects the growing role of remittances in livelihoods. Everywhere, when asked about the time when things “started to improve”, people pointed to the first wave of migration. Actually, more than half the economic value produced at household level in 2009 came from remittances and nonfarm work, and the amount of involvement in nonfarm activities and migration accounted for a good part of the differences in assets between households (le Polain de Waroux and Lambin 2013).

This link between diversification and wealth can, to some extent, be seen at village level as well. The richest village in terms of the asset index, C., was one of those with the earliest migration and diversification history and with the strongest migration rates; the poorest, E., was the one with the latest migration history and the least migrant labor. For other villages, however, the pattern is not as clear – for example, D. has the highest rate of nonfarm work yet is the second poorest. In fact this once more reflects the non-

automatic relationship between diversification and wealth, and shows that it is mediated by other factors. One is, in the case of D., the propensity of migrants to leave the village permanently, in part because it is less accessible and thus less amenable for “hybrid” livelihoods combining traditional activities and migration. Another factor is aid money and migrant community support. Apart from direct support from migrants to small-scale projects, at least four million MDH ($490.000) were invested between 1994 and 2009 into community development projects in the five study villages, half of which came from abroad (especially Germany, with about 40%).

It is thus clear that on average, material conditions in the study area improved, be it from the point of view of food security, housing, infrastructure, or education, and that this improvement was permitted to a large extent by the participation of the local population to a wider economic space and by the ensuing decoupling of livelihoods from local natural resources. This is consistent with other cases of nonfarm diversification (e.g. Haggblade et al. 2010; Matsumoto et al. 2006). But this development also had a dark side. For instance, greater dependence on migration implied the dispersion of family members who might see each other only once a year or less, something migrants often complained about. It also increased the vulnerability to economic cycles for some, especially the self-employed. Young boys migrating for work in the city often endured harsh working conditions, and cases of mistreatment were numerous. Women had to take over some of the tasks traditionally carried out by men, adding to their workload. On the whole, still, people usually agreed in associating these livelihood changes with improvements in their material condition.

Referring to the framework in the background section, one could say that, as integration deepened, the opportunity cost of farm labor rose, because nonfarm activities had higher labor productivity than farm activities on average. There was a degree of complementarity between farm and nonfarm work because income from the one helped buffer variations of income from the other: urban economic cycles were different from agricultural ones. Migration, especially international, fostered the local non-farm economy, as found elsewhere in Morocco (de Haas 2006). Benefits from economic integration were unequal because not everybody had equal access to new opportunities. Access was a function of skills, education, social networks and endowments, all of which were unevenly distributed. As there had been a class of poor households highly vulnerable to drought and prone to famine, there was now a class of poor households vulnerable to both drought and unemployment, but unlikely to suffer from famine any more. Inequalities, still well present, were nothing new. Rather, the nature of poverty changed, much in the way described by Rigg (2006), who pointed to the appearance of a "new" poverty, linked to job opportunities, contrasting with "old" poverty, linked to land ownership or access (see also de Haas 2006).

Economic integration and nonfarm diversification leading to woodland conservation.

It was shown in le Polain de Waroux and Lambin (2012) that increasing aridity and wood extraction had combined to cause a sharp decline in argan tree density in the area, of -44.5 % over 37 years. Urban spread and the expansion of irrigated agriculture, while important drivers of change in other parts of the argan region, were not present to any significant extent in the study area. Grazing, the most publicized driver of degradation,

may have been a key factor in preventing natural regrowth, but the article found no significant association between woodland density decrease and livestock density at village level. Where change did occur was in wood extraction, both for domestic use and, especially, for sales. This change was driven both by production and consumption changes. The effect of consumption changes was qualitatively important, because it implied a progressive shift to gas as the main domestic fuel source. But it was of minor quantitative importance, because fuelwood still was the main source of energy: indeed it was about twice as cheap as gas per kWh.

The most important change that took place was on the supply side, with a strong decline in wood trade. This decline was not linear however: integration first expanded the market for argan wood, prompting accelerated degradation, and only later made logging uncompetitive, as posited in the hypothesis. The strong decrease in tree cover suggests that the net effect of integration was negative. Village E., the least diversified, had the lowest tree density decrease, while the highest was in D., the most diversified. Actually, the arrival of trucks and the subsequent widening of the fuelwood market may just have accelerated a degradation that would have existed even without integration, due to growing fuelwood demand and cash needs. The existence of a decline in fuelwood trade, though late it came, does support the lost-labor hypothesis, and it is consistent with other studies that found fuelwood and charcoal production to be an activity of the poor, often the result of a lack of alternatives (Arnold et al. 2006; Iiyama et al. 2008). Finally, though much less than before, the level of fuelwood extraction was still more than the woodlands could stand. A shift in consumption away from argan wood and towards gas and alternative building materials had only partially occurred. In some cases migrant households actually consumed more argan wood than others. On the whole, therefore,

while there were signs of an ongoing transition of the sort posited in the hypothesis, at the time of writing the actual effects such a transition were yet to materialize.

Conclusion

To a large extent this story is one of development away from land resources, in which the economic integration of a dryland area allowed people to maintain their communities in places with little (and decreasing) natural resource endowments. Stories of people "leaving in order to stay" are recurrent in the developing world: in Morocco as elsewhere, populations of many remote and marginal regions have used nonfarm work and migration to maintain a foothold in their villages (Woods 2007). In this case, average living conditions improved following nonfarm diversification, and some people lifted themselves completely and durably out of poverty. Yet many others, though indubitably better off in material terms, still faced high uncertainty. These people really just coped as they had before, using nonfarm work as yet another safety net, but cannot be said to have completely escaped poverty. The effect of diversification on development, though real, must therefore be set in perspective. As for the effect of nonfarm diversification on conservation, a period of fast de-densification of the woodlands, in part driven by their connection to a wider market through improvements in transportation, was followed by a decline in logging resulting mostly from the availability of alternative livelihoods. Therefore integration can be said to have had a nonlinear effect on woodland conservation.

Figure 5 adapts the conceptual model proposed in the Background section (figure 1) for this particular case. Low agricultural productivity and high population density, associated with infrastructure development and market integration, combine to drive nonfarm diversification. The extent to which farm activities are maintained is influenced by factors such as cultural and identity ties, path dependence, and resource distribution. The low opportunity cost of labor in farm activities and the complementarity of some nonfarm activities with some farm activities make it profitable to switch to the nonfarm sector, but not all household are equally positioned to access the more profitable parts of that sector. On the whole, nonfarm diversification makes for an average but uneven improvement in living conditions, also supported by other factors in part dependent on integration, such as the availability of new consumer goods or of aid money. The lost labor effect causes a decline in logging but comes late, and income effects are mixed, with increased income prompting either substitution of gas for wood or increased consumption of wood and investment in wood trade. Signs of woodland conservation are therefore absent, though there are signs that a transition is ongoing, supported in part also by changes in regulation, donor projects or the valorization of woodland products such as argan oil.

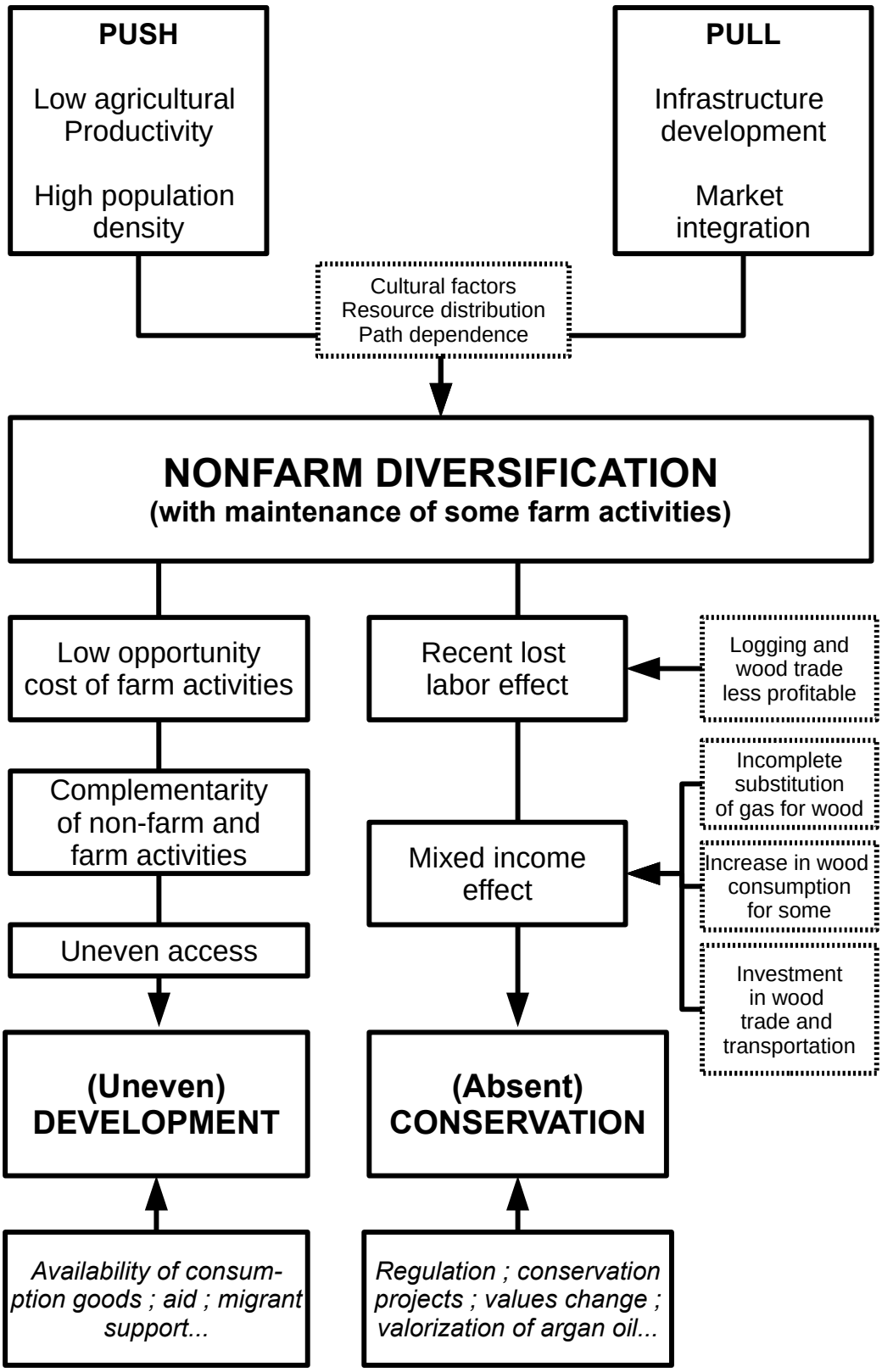

Figure 5: Adapted conceptual framework for the case study

To what extent is the situation described representative of the dynamics in other parts of the country? The study area has not been touched by some of the developments that took place in other rural areas, such as state-supported modernization of cereal cultivation, improvements in vegetable and tree crops, mining or tourism. But it does share important characteristics with the rest of the country: urbanization, temporary and long-term migration to Moroccan cities and to foreign countries, the development of international trade, and institutional support to small local enterprises such as small agricultural cooperatives, have affected rural areas throughout Morocco. Therefore the study area represents an extreme case in terms of productivity, having been left aside from many land-based developments, but embodies processes of economic integration that are found throughout Morocco and whose effects on welfare and conservation will vary locally, influenced in part by the factors proposed in figure 5.

There are a number of limitations to this study. First of all, the win-win framework used, though a useful guide for exploration, cannot accurately describe the complex changes ongoing in the study area. The relationships in the conceptual model describe mostly enabling, not sufficient conditions, and it is necessary to take into account nonlinear effects, path dependence, and other factors not all of them linked to market integration. Second, the focus on tree cover change and material development as indicators masks other aspects of environmental and social change. Tree cover change may not reflect the resilience of the argan woodlands over the long term, which may be affected by factors such as soil composition, erosion, seed storage and biodiversity, themselves a function of local land use practices. Improvements in material welfare through diversification and migration come at a cost, that of the increased dispersion of families and the disruption of

traditional social structures, and of greater vulnerability to national and international economic cycles. Third, the timing of observations may introduce biases in the results. A richer series of aerial photographs might have revealed nonlinear dynamics that were not apparent in the use of only two dates. Reliance on retrospective interviews for the reconstruction of past history carries the risk of misrepresenting events for which all respondents share a bias. And the fact that some of the phenomena of interest, such as the decline in logging, were very recent makes it impossible to know what their full effect would be on the long run.

This article has outlined the possibility of a positive development and conservation outcome of market integration as one pathway of change in areas of low agricultural productivity. In the case of the argan woodlands this has in effect been true only of development. The study highlights a number of reasons for this, some of which are specific to this area, others of which may be valid for other areas as well. The theoretical framework used in this study is a useful, if incomplete, guide to exploring the determinants and outcomes of livelihood transitions away from farm activities. Doing so is important for two reasons. Firstly, pathways of change towards nonfarm diversification are increasingly common in the developing world, as identified by Bryceson (1996), Rigg (2005) and Haggblade et al. (2010). Understanding to what extent these trends are determined by resource limitations or by other factors is an important policy and scientific challenge. Secondly, many rural development and conservation policies still tend to downplay these trends, envisioning the rural South as predominantly agricultural. In the argan region, for example, whereas piecemeal development and conservation initiatives do address issues such as access to employment, logging or the diffusion of gas stoves, more integrated policies such as the Green Morocco Plan tend to focus on an agriculture-

based pathway of development, seemingly overlooking the diversity of livelihoods in the area. A better understanding of the nature of the links between nonfarm diversification, conservation and development is needed if appropriate policies are to be designed, in Morocco as elsewhere.

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Notes

1) Indicating a movement towards more nonfarm activities, using Barrett et al.'s (2001) definition of *nonfarm* (except that we exclude charcoal-making), which includes both local non-agricultural activities and temporary migration.
2) This has changed in places where modern irrigated agriculture has been developed, mostly in the lower Sus plain, using groundwater and large quantities of inputs. It has not in the study area, where agriculture has remained very traditional.
3) The villages were named A to E for privacy.
4) See http://www.hcp.ma, last accessed 2012/09/10
5) We observed cuts on live trees along 300m transects whose origin and azimuth were generated randomly with a constant density of 1/1.5 km^2. Each transect was divided into 10 equal-sized plots for which we noted the presence of cuts and of small argan trees that were cut in the past and developed close to the ground under grazing pressure.
6) We excluded one household with extremely high income due to French retirement money and the ownership of a building for rent in Casablanca. Three households forming a separate category were re-grouped *a posteriori* with the «local entrepreneurs» category based on their high local income.
7) Moroccan Dirhams, 1 USD = 8.5 MDH.
8) Assuming 1 stere = 330 kg (from Hansfort and Mertz 2011) and a standard calorific value of 4.5 kWh/kg wood.

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