Pluralizing the oasis extensions: Heterogeneous farming profiles and practices in Toudgha (Morocco)

Hassan Er-rayhany*, Zakaria Kadiri*, Fadma Ait Mous*,
Lisa Bossenbroek**

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Abstract

Oases around the world have undergone significant changes over the past 30 years. In different parts of North Africa for example, irrigated farms are increasing outside the ancient oases, on land previously reserved for extensive livestock farming. Studies of these extensions are relatively recent and have frequently analysed these dynamics from the perspective of economic, agricultural and water resource use, and framing them as processes of water and/or land grabbing. However, there are significant differences between the people who farm in the extensions and their farming practices. In this article we aim to account for the wide variety of farms, and to improve our understanding of these Saharan spaces. To this end, we use a case study of the Toudgha Valley in south-eastern Morocco, where we analyse the different trajectories of new landowners and their families who settled in the extensions. The results of a qualitative survey of 49 farms show three types of farms are involved. The first is a small farm people move to, to look for accommodation and work opportunities on other farms. The second is a medium-sized farm where farmers seek to reproduce three-layered cropping system and to access more land than in the ancient oases. The third type is a large farm where investors seek to intensify production. This typology, far from being fixed, allows us to reflect on the dynamics of these different extensions and their future.

Keywords: *Oasis, Extensions, Land, Water, Heterogeneity, Morocco.*

1. Introduction

Oases around the world have undergone significant transformations. Drivers of change may be endogenous or exogeneous and can be characterized by processes of capital accumulation swooping down on the economic potential offered by peculiar combination of soil and water (and sun) resources (Molle, 2017). These transformations have led to the emergence of new irrigated lands on the margins of historical oases. In the oases of the Province of Mendoza (Argentina), former cores became secondary, and what used to be desert margins were developed until they became the new economic centre of the Province (Lavie *et al.*, 2017).In Peru, territorial enclaves adjoin

* LADSIS Laboratory, Hassan II University, Casablanca, Morocco.
** IES - Institute for Environmental Sciences, University of Koblenz-Landau, Landau, Germany.
Corresponding author: errayhany.hassan@gmail.com

the old irrigated areas, the logic of their changes is based on the assumption of the greater competitivity of large agricultural companies; these enclaves reorganise, paradoxically, the whole of the spaces in which they develop (Mesclier *et al.*, 2017).The scientific community has often analysed these transformations as forms of continuity versus a rupture of the oasis system (Lavie and Marshall, 2017). For example, remittances following migration have contributed significantly to economic development by diversifying the rural economy, improving living standards, and partially emancipating subaltern ethnic groups by stimulating social ascension (De Haas, 2003). Tourism has also opened up ancient oases to both local and foreign investors. In addition, the encouragement of states and donors has added patrimonialisation of the ancient oases in response to an urban tourist clientele (Carpentier, 2021; Battesti, 2009).

In this article, we focus on the agricultural lands located in the immediate vicinity of the ancient oases commonly referred to as "oasis extensions." These lands are collective.[1] They were traditionally used for grazing livestock before becoming individualized and coveted by different actors to practice irrigated agriculture (Mahdi, 2020). The extensions do not have millennia of social and agricultural history like the oases themselves (Bouaziz *et al.*, 2018; Fassi, 2017), which are known for their history and social organisation. For example in Morocco, even when individual wells exist, water in the oases used to be subject to strong collective management of natural resources and an ancient stratified society (Hammoudi, 1982). The fragmented small plots in the oases are irrigated according to a traditional system of water rights. In contrast, the plots in the extensions are larger and are irrigated through the individual use of groundwater resources. The different kinds of farmers in the extensions use modern agricultural techniques (mechanisation and drip irrigation systems).

The dynamics in the extensions have been strongly encouraged by the national states, which facilitated access to land, provided subsidies, or took a *laissez-faire* approach to the use of groundwater resources (Daoudi and Lejars, 2016; Côte, 2002; Bensaâd, 2011). In Tunisia, except where the state created the extensions, these lands are considered illegal but still play an important role in the oasis economy thanks to private investments and their extent has increased rapidly in the last two decades. For example, the agricultural extensions in Kebili (Tunisia), are four times bigger than the original oasis (Benmoussa *et al.*, 2022; Mekki *et al.*, 2021). In Morocco, oasis extensions are an integral part of the agricultural and collective land liberalisation policy (Mahdi, 2020; Kadiri and Er-rayhany, 2019).[2] This is also the case in Algeria, where the State "put more emphasis on the success of land development programmes and consider it fairer to allocate land to those who can actually develop it" (Daoudi *et al.*, 2021). In terms of agricultural production, since 2008 and the launching of the Green Morocco Plan (2008-2020), Morocco strongly supports the production of dates, especially in oasis extensions. This Plan established a programme for the date sector aimed at creating 17,000 ha of new date palm plantations nationwide. As part of the new agricultural strategy (Generation Green, 2020-2030), the Moroccan date palm planting programme aims to plant 4 million palms on 42,000 ha, i.e., 2,6 million by restoring existing palm groves and 1.4 million in new plantations in the extensions (Ministry of Agriculture of Morocco, 2022).

Studies of extensions are relatively recent. The few studies of the extensions have often been

[1] The oasis extensions are primarily collective lands. This particular status allows rights-holders who belong to local tribes to benefit from the right of use but not from full ownership, despite informal transactions that take place. These lands are subject to partial distribution among the rightful landowners according to a customary law recognized by the State. This gives them an individual right of use to the plot. These lands, which fall under the responsibility of the Ministry of the Interior, can also be leased to investors or others but require a contract drawn up with the Ministry and accepted by the tribe to which the rights-holders belongs (Kadiri and Er-rayhany, 2019).

[2] As of 2019, under certain conditions, new laws allow rights-holders to become full owners. The analyses conducted in this article predate the implementation of these laws.

conducted from the perspective of economic, agricultural and water resource use. Within this body of work, agricultural initiatives in extensions are considered to be mainly driven byindividual entrepreneurship guided by a search for profit and productivity (Carpentier *et al.*, 2021; Hadeid *et al.*, 2018). The oasis extensions have attracted the interest of large investors and capitalist entrepreneurs who have managed to start new farms in the extensions, alongside legal rights holders to the land but who do not have the same investment potential (Aloui *et al.*, 2019; Mahdi, 2014). These tendencies have often been analysed as processes of water and/or land grabbing (McMichael, 2012; FAO *et al.*, 2009). However, there are significant differences between the people who farm in the extensions, such as national investors, other investors from the region and (local) rightful landowners, who each have different farming practices and different financial resources. In addition, some divergent interests characterize the relations between the rightful landowners and the new investors, taint their perception of the original rights holders of the future of the collective lands that are the object of extensions. This has been the case in Morocco, and has triggered protest movements led by young people who believe that they have the right to exploit the extensions (Mahdi, 2020).

In some cases, local young people have benefited from the agricultural lands in the extensions. This has been the case in Boudnib, Morocco, where young graduates were granted the right to use collective land through long-term leases, mainly to plant date palms. In Algeria, for instance in Biskra, young people who had some capital and knowledge acquired in other regions set up greenhouses and remain anchored in a highly intensive model characterised by rapid financial ascent (Amichi *et al.*, 2015).

These different actors and modes of installation in the extensions raise the question of the development model of the farms established there. From the outset, we consider these models as hybrids, and changeable rather than fixed (van der Ploeg, 2018). Some studies have shown that when the extension is located close to the farmer's residence in the ancient oasis, the extension is firmly integrated in the family model (Mekki *et al.*, 2021). A very strong link may thus exist between the ancient oasis and the extension (Hamamouche *et al.*, 2018). The few existing analyses of the origin and trajectories of farm investments in the extensions have so far not focused enough on the different types of farms and the profiles of the farmers who settle in these relatively new agricultural areas.

In this article, we aim to account for the diversity of these farms by not systematically limiting them to a specific farming model – like the capitalist one, whose objective is only productivity. By accounting for the wide variety of farms, we aim to improve our understanding of these Saharan spaces and their future forms. To this end, we use a case study of the Toudgha Valley in south-eastern Morocco, where we analyse the different trajectories of new landowners and their families who settled in the extensions. We established a link between the status of these lands and the social structures in the study area that enabled us to better understand how the extensions emerged. Based on an empirical inquiry and the distinctive traits of farms according to the type of equipment they use and the owners' means of production, we characterise 'ideal types' of farms, that account for the heterogeneity of the extensions. In the end, the apparent differences between the farms are reflection of the variety of profiles of the people who farm the extensions.

2. Study area and methodology

The study was conducted in Toudgha Valley in the Province of Tinghir. The oasis extensions in Toudgha are collective lands. The emergence of extensions on the outskirts of Toudgha oasis can be linked to the distribution of collective lands to those who were entitled, but also to the lack of water and land in the ancient oasis which led to increasing pressure on these resources, and then to State measures to facilitate access to collective land.

We conducted our interviews and observations in two oasis extensions – Tangarfa and Ghellil – located about 12 and 20 kilometres from the city of Tinghir, respectively. The two sites differ both in how the extension emerged and in the issues surrounding their establishment. Even though both sites are located in the same valley, we chose

Figure 1 - Location of the Province of Tinghir on a national scale.

Source: Google Maps, 2022.

them because they include a variety of owners and types of farms. In March 2020, 27 farms were counted in the Tangarfa extension where extension is recent and the farms are being established gradually. Our other study area, Ghellil, is a plain where collective lands have been allocated to rights-holding landowners since the 1970s. There are more than 3,000 inhabitants in this area which comprises more than 4,000 hectares (Er-rayhany, 2020). Already in 2000, 2,000 hectares were being cultivated by a group of 270 farms (de Haas and El Ghanjou, 2000).

The quaternary water table in the Toudgha valley is depleting. The piezometric level of the Toudgha water table dropped by about 20 m between 1980 and 1993, especially in its upstream part (Baki *et al.*, 2016). Today, the water table in Toudgha valley varies from 20 to 40 m while in Ghellil, which is further downstream, it is 20 to 60 m deep (Rachid *et al.*, 2020).

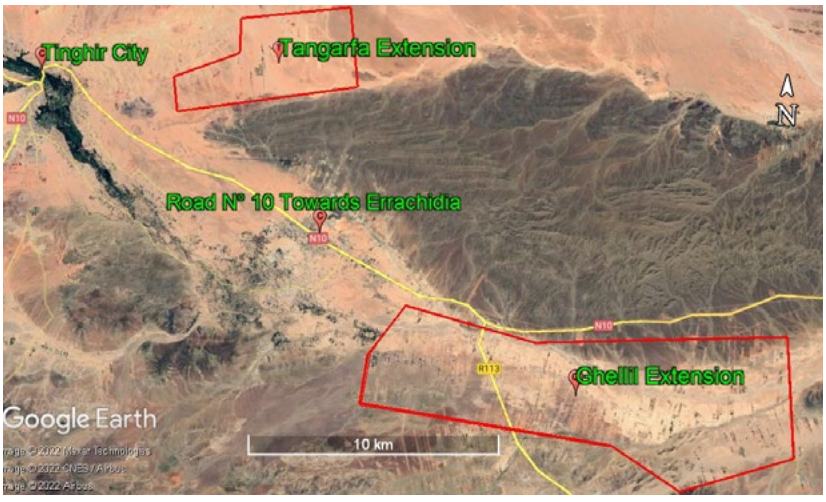

Figure 2 - Location of the extensions (Tangarfa and Ghellil) in the region of Tinghir.

Source: Authors and Google Earth, 18.09. 2022.

We have adopted a qualitative approach rather in rural sociology to identify the heterogeneity of farms in extension (van der Ploeg, 2018). We conducted 49 semi-structured interviews including with seven women, with landowners and workers at both sites and made field observations during several visits between 2019 and 2021. In Tangarfa, we surveyed all 27 existing farms, whereas in Ghellil, due to their large number, we randomly selected 22 farms of varying size. It was not easy to interview the owners of a number of large farms because they often do not live on them. In these instances, when possible, we interviewed the farm managers. The interviews focused on 1) the farmer's profile (profession, origin, etc.); 2) how the land had been acquired, the farm establishment strategy and trajectory; 3) the production resources mobilized and the characteristics of the farms, etc. We also paid two visits to 10 farmers who farmed land both in the ancient oasis and in the extensions to be sure we understood how their farms functioned. We then linked our typology of farms on the oasis extension and the profile of the farmers who settled there. This typology is not based on statistical analysis but rather on "ideal types" identified by observing the most visible characteristics, i.e. those most accessible to the observer, and those whose variability was the most obvious (Perrot and Landais, 1993). We identified three types of farms (small, medium and large) based on the distinctive features of each of the owners interviewed and by analysing how they acquired their land, their trajectories, and the characteristics of their farms (whether or not there was a homestead on the farm, access to groundwater, crops cultivated, type of irrigation, type of pump source of irrigation water, etc.).

3. Results

3.1. *The emergence of differentiated oasis extensions in Toudgha valley*

In the Ghellil plain, the Qsar Harate Al-Morabitine ethnic group and their counterparts Ait Aissa O'Brahim share this vast land taking into account the tribal and ethnic affiliation of each group.[3] The lands in Ghellil were divided up in the mid-1970s. However, the status of the land remains collective and formally, the beneficiary only has the right of use. The majority of rights-holders settled in the extensions between 1993 and 2000 following years of drought which resulted in degradation of the ancient oasis in which they lived. The lands in the plain were divided up among all the rights-holders according to a traditional system known as *tagourte*.[4] This resulted in division into seven sectors: in the Ghellil plain, three for each of the two beneficiary communities – Ait Aissa O'Brahim and Harate Al-Morabitine. The seventh sector is Amazdagh, which groups families from both communities, in addition to non-members of the two ethnic groups who had monitored and protected the land during the period of dissent, when the two tribes attacked each other. Ghellil is irrigated only by groundwater.

For its part, Tangarfa extension belongs exclusively to the Aït Aissa O'Brahim tribe. Unlike in Ghellil, the distribution in Tangarfa was based on *naffs* (individuals): all the members of the tribe, especially from the three Qsours that comprise the Aït Aissa O'Brahim tribe (Tloulte, Agoudim, Boutaghate), received a plot of land regardless of age and gender. The three Qsours are located in the ancient oasis. The Tangarfa extension, which, according to our interviewees, has significant groundwater reserves, was distributed in the 1990s due to the drought which

[3] Periodically, the tribes can distribute parts of the land among the rightful owners for housing and agriculture. They are subsequently approved by the guardianship, allowing each rights-holder to individually use the allocated land. Rights-holder status may differ from region to region and even among the 5043 collectives in the country.

[4] The *tagourte* system involves a division of an agricultural area into perpendicular rectangular bands along the Toudgha Valley. The number of bands, and the width of each band, is determined by the total number of adult males who belong to that ethnic group.

resulted in lack of water in the irrigation channels of the ancient oasis.[5]

The distribution of land among the beneficiaries of Aït Aissa O'Brahim and Harate Al-Morabitine in the two extensions, (Tangarfa and Ghellil), combined with the lack of financial resources and means of productionof some of the beneficiaries, led some of them to sell their land to investors or to members of neighbouring tribes. These lands, which before distribution were intended for extensive livestock production, were gradually converted into agricultural land and irrigated with ground water. In addition, the ease with which administrative certificates of land use were issued by the supervisory authorities in coordination with the advice of the representatives of the collective lands encouraged different types of investors and from different regions to acquire land in the extensions. These different land dynamics gave rise to different types of farms, differing in size, in the type of crops cultivated, and in financial investment.

3.2. *Owner profiles and farm typology*

In Tangarfa, where the extensions are relatively new, among the 27 farmers installed, only five are rightful landowners. The remaining 22 are owners by purchase and do not belong to the tribe: instead they come from and continue to live in the city of Tinghir, or are members of neighbouring tribes (Ait Snan, Ait Oujana, Oualkim). These owners are those to whom the extension offered the opportunity to settle and live there, like two nomads who settled after buying a few plots of land. In Ghellil, 17 out of 22 owners are natives of the region whereas the remaining five are not members of the two beneficiary tribes. More people live permanently in the Ghellil extension than in the Tangarfa extension. In Ghelli, owners in the extension were able to obtain a home for their family and a small vegetable garden, as well as the opportunity for their extended families to provide housing for their descendants. The extensions also offered new work opportunities; this was the case of three farmers in Tangarfa and two in Ghellil. For others, Tangarfa and Ghellil extensions offer possibilities that go beyond housing: the opportunity to cultivate larger plots than those in the oasis itself and to access groundwater for irrigation to grow crops. For farmers with this profile, their land not only represents an agricultural extension but also a "family extension", ensuring the continued functioning of the family farm. Such an extension involves multi-activities and is based on the distribution of roles between different members of the family.

The final farmer profile is that of holders of larger agricultural areas. These farmers do not live on the land but practice monocropping particularly date palm, using drip irrigation, and employ both permanent and seasonal workers.

Table 1 liststhe main distinguishing features of the three categories of farmers who are expanding into Ghellil and Tangarfa extensions, which we term "ideal types".

The main characteristics of the farms highlight the inequality of access to land and capital. For example, farmers do not use drip irrigation, solar energy and diversify their agricultural projects equally. Table 2 shows that all the small farmers together have only 11 wells, while medium farmers have a total of 40 and large farmers 30. While the number of wells is not a sufficient indicator to assess inequality between farms in terms of access to groundwater, particularly because if the number of wells is linked to the surface area, there would be no positive correlation, this inequality is visible in access to land and having the capital needed to invest in irrigation equipment. Indeed, only four out of 10 small farmers have drip irrigation equipment, compared to all medium size and large farms which have it. In terms of groundwater pumping equipment, small farmers have four storage basins and four solar energy plants, compared to, respectively, 30 and 36 for medium farmers and 16 and 21 for large farmers. In addition, large farmers plan to continue to deepen their deep tube wells, whereas smallholders do not have the means to dig such

[5] See Er-rayhany (2020) for more details on land distribution in Ghellil and Tangarfa.

Table 1 - Characteristics of the different types of farms in the extensions.*

Type and number of farms	*Characteristic features*
Small farms (10)	- Have a homestead on their farm in the extension - Practice subsistence farming and local marketing - Use family labour - Have on average one well - 6 farms use gravity irrigation and 4 drip irrigation - Total area is less than 3 ha; cases of houses with micro plots also exist
Medium size farms (25)	- Have a homestead on their farm in the extension - The housing accommodates the sharecropper - Practice three-layered crop production - House the family, plus a permanent and a seasonal workforce - Sale on the ground to the regional and national market - Have at least two wells and deep tube-wells - Use drip irrigation - Have a water storage basin - Have solar panels - Total area ranges from 5 ha to 15 ha
Large farms (14)	- Sale on the ground and total production is destined for the market - Have at least one big water storage basin - Use drip irrigation - Have solar panels - Have two or more deep tube wells - Have a permanent and a seasonal workforce - Total area more than 15 ha, several farms are 60 ha in size

** Some of these farms have both land in the extension and in the historic oasis. These data only concern land in extension*

Table 2 - Distinctive features of the 49 existing farms.

	Small farms	*Medium farms*	*Large farms*
Number of each type of farms (total 49)	10	25	14
Number of wells and boreholes	11 (8 drilled wells and 3 manually dug wells)	40 (32 drilled wells and 8 manually dug wells)	30 drilled wells
Maximum depth	65 m	85 m	85 m
Drip irrigation equipment	4	25	14
Storage basin	4	30	16
Solar pumping station	4	36	21

deep boreholes and have few resources to install solar pumps.

Overall, the extensions reproduce the classic agricultural disparities in access to land, capital and means of production. This is particularly true since the three types of farmers do not have the same access to government subsidies. For example, up to 80% of the cost of drip irrigation projects is subsidised, but solar pumps depend on individual investment capacity because the State does not provide any financial support. As a result, medium and large farms use individual investments to purchase solar panels and motor pumps.

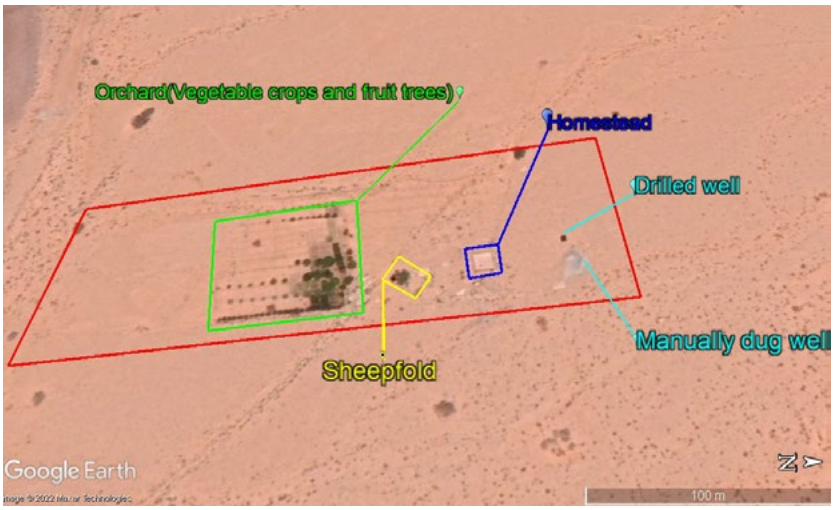

Figure 3 - Components of Ahmed's farm (nomad).

Source: Authors and Google Earth, 29. 09.2022.

While the size of the farm remains a specific criterion in the typology, the owners have neither the same goals nor use the same strategies; each farmer chooses his or her own working method in order to achieve his or her goals. For example, some owners who have significant financial capacity nevertheless chose to build up their farms gradually. Other farmers immediately started monocropping date palms or even olive trees while others established their farm progressively while they build up their cash flow. In the following section, we present three profiles that characterise three categories of farms. The first profile is that of Moha[6] whore presents a small farm, the second is that Ali, who manages the Aârab family farm who represents a medium farm, and the third is that of Brahim, who represents a large farm.

3.2.1. *The extension provides housing and new work opportunities*

The small farms in the extensions are less than 3 ha in size. They are reserved for homesteads, with possible space for market gardening and a pond for domestic consumption. None of the 10 owners of the small extensions belong to the tribe. The extensions gave them the opportunity to buy land and settle, which is the case of nomads and labourers who work for other farmers in the area.

Two owners of small farms in Tangarfa extension are – or were previously – nomads. They rely on working for the owners of large and medium-sized farms as their main activity until they adapt to a sedentary lifestyle. Extended families have also found an appropriate solution in oasis extensions which allows them to expand without having problems with their neighbours in the ancient oasis. For example, they allocate part of their extension land to one of the members of their family so they can be independent in their married life and have a home of their own.

One example is Ahmed. He was originally a nomad and, in 2012, bought 3 ha of land from a family of rightful owners who had benefited from the collective lands. He invested his savings in settling. First, he built a two-room dwelling. Like most small farms, Ahmed's farm contains a 28m deep well (Figure 3) and a 38m borehole that he dug six years after the first well. Ahmed's farm is not fenced, although it is isolated from the rest of the expanding farms in Tangarfa. Groundwater is pumped manually from the well and from the borehole using electric power, but he does not use solar energy like the other types of farms.

[6] All the names of interviewees are pseudonyms.

To increase his income, Ahmed works on more than one farm with the aim of gradually developing his own farm. Small farm owners like Ahmed usually work for several owners at the same time, taking advantage of the fact that the farms they work on are well equipped and have localized irrigation systems, so they do not have to work there every day. In addition, Ahmed is still attached to livestock, including goats, as a way of diversifying and ensuring a stable income. He feeds his livestock with cereals (wheat, barley) and lucerne. Ahmed's profile is a good example of the different activities the owners of small farm engage in.

Ahmed and other small farmers whose families live in homesteads in the extension have created small vegetable gardens for family consumption. Ponds to water the gardens have been dug around the homestead, where there are also about 15 fruit trees (olive and fig) and date palms. Crop diversification is part of small farmers' strategy to improve their food security and increase their income by working elsewhere while still raising small livestock. However, material resources remain an obstacle to expansion for this type of farmer. For example, while Ahmed has access to groundwater, other small farmers have not been able to dig boreholes. In addition, Ahmed bought his land at a relatively low price because it is located on the edge of the wadi and maybe flooded, whereas large landowners buy more expensive land to avoid being flooded during heavy rainfall.

3.2.2. *Expanding the family farm and three-layered crop production*

Twenty-five out of the 49 farms are medium-sized. They can be distinguished by the variety of farmers profiles who are of different origin: entrepreneurs, traders and liberal professions like lawyers. In their strategy, market gardening allows them to manage their cash flow before investing in orchards and a three-layered cropping system. In Ghellil, according to our interviewees, "There are a lot of medium sized farms, most of which belong to the rightful owners who use them as their main residence". The farms include a homestead for the owner, where he or she lives either permanently or irregularly, as well as accommodation for the worker or family who manages the farm. Sometimes a young married member of the extended family moves in. The main distinctive feature of the medium-sized farms is the reproduction of the three-layered production model used in the ancient oasis: date palms in the top layer, fruit trees in the second, and market gardening and cereals in the bottom layer. However, unlike in the ancient oases, farmers in the extensions use localized irrigation and the plots are larger than the micro-plots in the oases. These farmers use State subsidies to acquire equipment, use localized irrigation and plant fruit trees, including date palms. These farms increasingly use solar energy to pump groundwater. They have at least one well and several boreholes, usually drilled to a depth of 80 m.

The Aârab family farm, managed by Ali, illustrates how this type of establishment is organized. The Aârab family consists of four brothers, two of whom migrated to France. Omar, the eldest brother, manages the farm in Tangarfa extension (Figure 4) where he moved with his young married son. Ali continues to live with the rest of the family in the ancient oasis in Ait Snan, 22 km from the extension. Ali'sand Omar's eldest sons manage retail stores in Tinghir. The Aârab family farm functions under the direction of Ali, who also serves as a representative of the collective land (*naïb*) in Ait Snane. This family farm depends on various sources of income from the many activities carried out by its members. In addition to agriculture and immigration, the family can rely on trade, entrepreneurship and construction work in the city of Tinghir.

The Aârab family invested in their first farm in Aghbala in the Atlas Mountains. After selling it, they gradually moved to Tangarfa extension. In 2002, they purchased their first 6 ha, followed by another 7 ha in 2008, bringing the total land up to 13 ha. Their first task after purchasing the land was digging and equipping a 38 m deep well, and building a traditional house using local materials (stones and earth) in addition to the house they own in the ancient oasis. The Aârab family's image of the house in the extension oasis does not conform to the signs of modernity found throughout the oases (both ancient and extension) and elsewhere in rural areas where concrete construction is the symbol of modernity. On the contrary, the Aârab family's stone house in the extension is surrounded by a vegetable garden. In fact, in

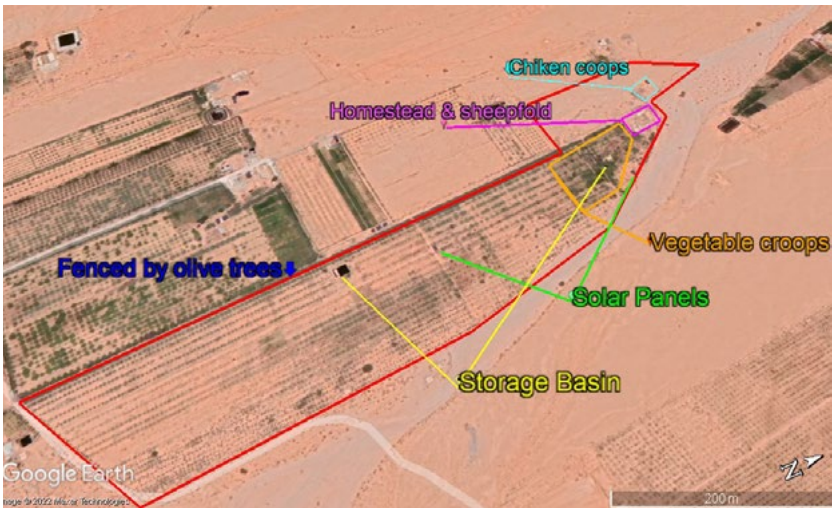

Figure 4 - Components of the Aârab family farm.

Source: Authors and Google Earth, 2022.

this extension, the family wants to keep the same characteristics as in an ancient oasis but with more land, "We expand" said Ali.

The expansion of agricultural activities and the increase in owners' needs, combined with the decrease in the flow of water in traditional wells, are prompting them to create more water points. Ali dug two 60 m deep tube wells, bringing the total number of water points to five. Owners of this type of farm in both Ghellil and Tangarfa also resort to deepening their wells and boreholes. For the Aârab family, drip irrigation has been consolidated by the installation first of a water storage basin and then of another one equipped with solar panels.

The Aârab family has not only kept up the family farm in the ancient oasis but has also kept the same agricultural model, i.e. the three-layered production system. To do this in the extension, they invested progressively by planting market garden crops during the first few years until they had the cash they needed to plant fruit trees. They also surrounded the farm with olive trees, which function as a fence. They currently cultivate 700 date palms belonging to three varieties – including 200 of the highly valued *Majhoul* – as well as 800 olive, 40 pomegranate and 50 almond trees. All the products are destined for the Moroccan market. If the Aârab family, like other medium sized and large farms, planted the Majhoul variety, it

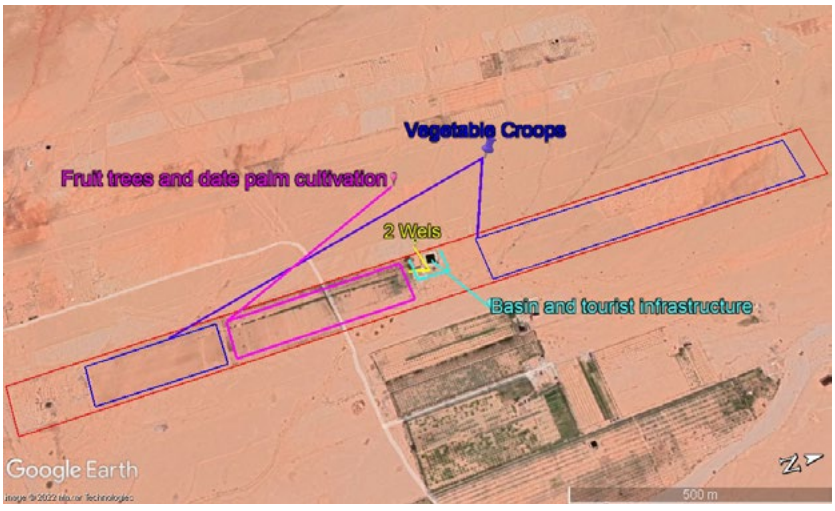

Figure 5 - The Boumalek farm.

Source: Authors and Google Earth, 29.09. 2022.

is because the latter is both encouraged by the State for new farms in the extensions and the variety is prized on the Moroccan market. The Aârab family, like other medium-sized farms in the area, uses the vegetables they grow in their own garden for domestic consumption and the lucerne to feed their small livestock.

The second case that represents monocropping in large farms and extensions is that of Boumalek, one of the first farmers who settled in Tangarfa in 1998. Boumalek lives abroad. He bought a farm comprising 60 ha, of which he currently farms around 20 hectares.

Boumalek had both tourist and agricultural projects, so he built tourist facilities, a large swimming pool and chalets. At the same time, he started farming and planted orchards and 500 date palms. Management of the farm has been entrusted to his younger brother. In Boumalek's own words, the farm is far from efficient. They subsequently rented out 3 ha to market gardeners from the city of Tinjdad, located about 40 km from the farm, who drilled two wells.

3.2.3. *Extension of intensive cultivation or monocropping*

Large farms mainly grow monocrops or engage in intensive cultivation. The owners of these farms do not live on the farm; growing monocrops means they do not have to constantly be present on the farm, unlike intensive crops, which require a daily commitment. Management of this type of farm requires a large number of workers and during peak periods.

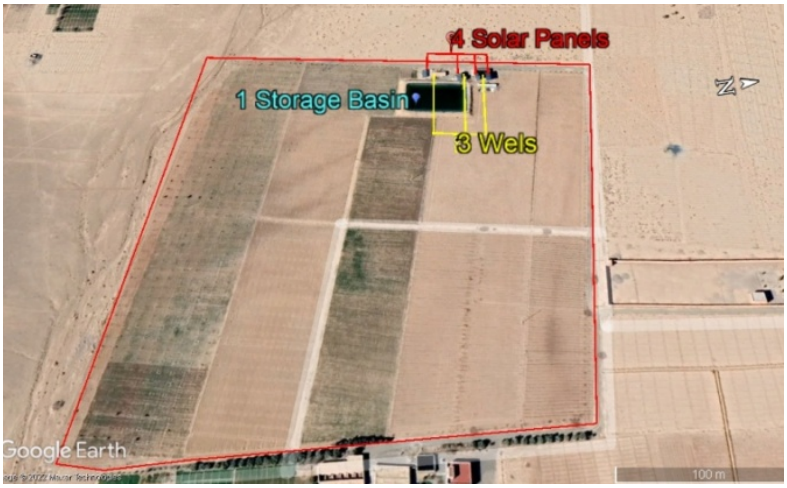

Figure 6 - Components of the farm of Rachid.

Source: Authors and Google Earth 26.09.2022.

Rachid is a young man from Harate Ait Elyamine, one of the oases in the Toudgha Valley. He is an immigrant who lives in Morocco and in Spain. He bought two plots of land in Ghellil, one of 5 ha and the other of 10 ha. The first plot is dedicated to housing and cultivation mainly of watermelons. As soon as he settled, Rachid planted vegetables on the rest of his farm before planting his second plot with 700 *Majhoul* date palms. We included Rachid's profile with the profiles of large-scale farmers because he specialises in vegetables production and *Majhoul* dates, both intensive types of production, and because he uses big farm equipment like tractors. Indeed, the means of production Rachid uses can be described as modern, and include drip irrigation, tractors and ploughs. He also has three wells more than 80 m deep, equipped with three mobile solar energy pumps which rotate automatically tracking the sun, meaning he can irrigate longer. Rachid wants to intensify his farm and aims to obtain the best possible yields and supply the markets. Hence, he relies on a qualified workforce composed of three permanent and four seasonal workers who specialise in market gardening.

4. Discussion

4.1. *The variety of farmers' profiles in the extensions reveals the hybridization of agricultural models*

The heterogeneous profiles of the owners and their expanding farms are visible through the resources they use, their water and land resources, as well as their financial means and farm and irrigation equipment. However, the development trajectory of each farm is neither linear nor fixed. Rather, they are dynamic trajectories in which the model of the farm is closely linked to the owner's profile and his/her strategies to exploit them, depending on their productive resources, and also on their capacity for investment. Our analysis improves current knowledge on extensions by making it possible to avoid homogeneity or automatically associating the extensions with large-scale enterprises or with land grabbing. Although some large farms in the extensions that use intensive monocropping systems are part of this mode of production, our results show that rather than seeing these farming models as dichotomous and typical farming models (capitalist, peasant or entrepreneurial modes of farming) they should rather be seen them as hybrid farming models with no clear-cut boundaries (van der Ploeg, 2018). For example, medium/large scale farmers who employ smaller farmers or nomads who have become sedentary and are strongly oriented towards the market can be considered as capitalist farmers. However, this model may also be characteristic of family farming (Errahj, 2017) that is not solely based on family labour, particularly because some of the social changes that peasant families are currently undergoing are due to the mobility of their members. Moreover, these medium-sized farmers still rely on subsistence farming and engage in several activities, characteristics that are usually attributed to the peasant farming mode. We have described how this hybridisation becomes visible through farming practices and the establishment of certain farms thanks to combining investment in land and equipment while the organisational structure of the farm remains embedded in the family. Finally, these farming modes are not fixed but can also be regarded as processes, continuously being established, re-established and transformed (van der Ploeg, 2018).

Further, we described how a farm of 60 ha can face problems during its establishment, at the same time, we described how families reproduce a model of life and a production system that is strongly inspired by that used in the ancient oasis. This concerns both homes built of local materials and a three-layered farming system where domestic consumption merges with market production and multi-activities. The example of Ali, whose extension borders the wadi and who built a canal to benefit from flood waters, also testifies to how particular practices used in the ancient oasis are reused in the extensions thereby ensuring a certain continuity between the oasis and the extension in the ways used to cope with the arid and harsh Saharan climate. This type of analysis makes it possible to go beyond a "fixed" dichotomy of ancient oases, which are awarded heritage status and the extensions, which overexploit groundwa-

ter resources (Carpentier *et al.*, 2021). Other studies clearly showed that farms in the ancient oasis that lack water tend to cultivate monocrops, while in the extensions; farms tend toward crop diversification and to a 2-3 tier system (Benmoussa *et al.*, 2022). Further studies would improve our knowledge of the links between the ancient oases and their extensions. Particularly since the results of some studies show that the binary framing of agricultural development in the Algerian Sahara is inadequate, as it ignores the temporal and spatial continuities and the hybridity of landscapes (Hamamouche *et al*., 2018).

In the end, thinking about extensions could take place at two levels of hybridisation. The first is hybridisation of the model of family farms which, although capitalist and market-oriented, seek to reproduce the family group. However, this hybrid model seems to us to be out of step with the capitalist model vehicle by large entrepreneurs with strong financial capital who do not have the same territorial anchorage and do not seek to reproduce family agriculture. A second level of hybridization is that between the ancient oasis and the extension, where we can observe continuities between the two spaces through the circularity of knowledge and the mobility of people who keep one foot in each.

4.2. *The future of extensions, reproducing inequalities*

We have shown that the land undergoing expansion presents the paradox of being "new" land, where a sit may reproduce the power relations and modes of exploitation based on access to land and means of production that also exist in the ancient oases. The hybridisation of agricultural models and the heterogeneity of farms raise questions about the future of these extensions with respect to research and development. In Tunisia, public and cooperative initiatives are underway to regulate the status of these areas. Even though these areas are considered illicit and informal, their place is highlighted in, for example, the productive potential of dates (Mekki *et al.*, 2021). This clearly involves State recognition of the extensions as an economic reality. In addition, the heterogeneity of the profiles analysed in this article also demonstrates a particular social reality as the extensions contribute to new family-farming opportunities and new farming experiences for women, men, the young and the elderly. For example, young people find opportunities offered by the extensions for self-emancipation from collective rules, from the tutelage of their elders and to escape the limitations posed by lack of access to land (Bossenbroek *et al*., 2021; Kadiri and Bekkar, 2021).

Nevertheless, the heterogeneity of profiles and productive resources renders access to natural resources unequal. This is true even if the exploitation of these resources has become individual and no longer depends on ethnicity or even on existing social stratification in the oases. Indeed, our analysis has shown how access to groundwater, the possibility of drilling multiple boreholes on the same farm, the deepening of these boreholes, and solar pumping equipment, depends on the type of farmer and the size of the farm. The larger the farm, the more financial capital the farmers have, the greater the possibility of accessing groundwater. This creates and reinforces pre-existing situations of inequality. Moreover, this phenomenon is also prevalent in other regions, for example in the Saiss plain in Morocco, where there is competition for groundwater between local farmers and new investors (Bossenbroek, 2016). On the other hand, some studies show that access to land in extensions may also enable ascent from the lowest social strata, like that enabled by income from migrants since the 1980s (De Haas, 2003). That said, more study is needed to extrapolate this to the cases we studied here.

4.3. *A future intimately linked to the sustainability of water*

Reflection on the future of these areas should be supported by studies on the socioeconomic and ecological impacts of the different developments occurring in these areas, including of large farms or investment firms. Moreover, this cannot be dissociated from consideration of the sustainability of groundwater resources in these arid Saharan environments (Zwarteveen *et al*.,

2021; Mekki *et al*., 2021). This is particularly true since some studies reported that farmers in the extensions have similar concerns about the depletion of groundwater resources as farmers in the ancient oases (Farolfi *et al*., 2022).

Today, top-down governance initiatives based on laws and formal control frameworks, have not been successful in limiting access to – or overexploitation of – groundwater resources. Very often, these initiatives have taken form without considering social and economic realities. At the same time, some extensions, like those we analysed here, or other extensions such as in Zagora where watermelon cultivation is widespread (Bossenbroek *et al.*, forthcoming), exploit groundwater in the absence of any regulatory instrument. Thus, the challenge facing the different stakeholders as well as scientific research, is identifying and analysing the capacity of populations in the ancient oases and in the extensions to conceive and implement innovations (Saidani *et al.*, 2022) and collective actions (Ftouhi *et al.*, 2021) to ensure the sustainable use of water resources.

5. Conclusion

We have shown that "ideal types" are characterised by the hybridisation of farming models: some have the characteristics of the peasant, entrepreneurial, and or capitalist farming modes. This result adds nuances to existing scholarly work describing recent developments in the extensions as processes of land and water grabbing. Instead, our results are evidence that different processes are underway. These indeed include characteristics of capitalist farming but at the same time also of peasant farming. The peasant form of farming is considered to be based on the continuous use of ecological capital and oriented towards defending and improving peasant livelihoods (van der Ploeg, 2018). Although this requires further analysis, the peasant mode of farming is potentially less destructive and therefore deserves more recognition and should be supported by public policies.

Further, our results reveal growing inequalities among the different farms around access to land and to groundwater. Small-scale farmers have difficulty competing with farmers who drill deep tube wells and practice monocropping or reproduce the three-layered production system combined with high value agriculture. Without strong collective action or government initiatives, water sustainability will be strongly challenged. The results of this study, supported by extensive studies and data on the state of the water resource, could contribute to a concerted and participatory response regarding the role of the extensions in the development of the oasis regions.

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