



HAL
open science

Watermelons in the Desert in Morocco: Struggles Around a Groundwater Commons-in-the-Making

Lisa Bossenbroek, Hind Ftouhi, Zakaria Kadiri, Marcel Kuper

► **To cite this version:**

Lisa Bossenbroek, Hind Ftouhi, Zakaria Kadiri, Marcel Kuper. Watermelons in the Desert in Morocco: Struggles Around a Groundwater Commons-in-the-Making. *Water alternatives*, 2023, 16 (1), pp.87-107. hal-03996883

HAL Id: hal-03996883

<https://hal.science/hal-03996883v1>

Submitted on 20 Feb 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

Bossenbroek, L.; Ftouhi, H.; Kadiri, Z. and Kuper, M. 2023.
Watermelons in the desert in Morocco: Struggles
around a groundwater commons-in-the-making.
Water Alternatives 16(1): 87-107



Watermelons in the Desert in Morocco: Struggles Around a Groundwater Commons-in-the-Making

Lisa Bossenbroek

iES Institute for Environmental Sciences, RPTU (Rhineland-Palatinate Technical University) Kaiserslautern-Landau, Germany; lisabossenbroek@gmail.com

Hind Ftouhi

Centre de Recherches et d'Études sur les Sociétés Contemporaines (CRESC), Rabat, Morocco; hindftouhi@gmail.com

Zakaria Kadiri

Hassan II University of Casablanca, Casablanca, Morocco; zakariaa.kadiri@gmail.com

Marcel Kuper

University of Montpellier, Cirad, UMR G-Eau, Montpellier, France; kuper@cirad.fr

ABSTRACT: Groundwater is essential for early-season agriculture in many arid regions. In such regions, however, groundwater recharge is generally low, leading to groundwater degradation. State responses are seldom effective in addressing this issue, which leads to fatalist narratives of the unsustainability of profitable agricultural growth and the collapse of aquifers. We argue that such narratives make it difficult to recognise more promising instances in which communities find solutions to groundwater degradation. We call for a fine-grained analysis of the social practices around the use of groundwater, which, we argue, represent a process of commoning. We do so while recognising that the collective action of communities is embedded in an intricate set of relations with other stakeholders including the state, and that the positive environmental and transformative social change that is often associated with commoning cannot be taken for granted at the outset. Building on the case of the arid Drâa Valley in Morocco where watermelon production has expanded rapidly, we illustrate how the process of commoning evolves through different social practices, including: 1) the use of new farming practices that reveal the potential of the aquifer; 2) the representation of the aquifer as severely degraded and the development of a narrative around it being a collective good to be protected against outsiders; 3) the defining and negotiating of rules to control groundwater access and use; and 4) the engagement in negotiations and the resolving of conflicts. Our analysis shows that commoning, as performed by young local farmers, is about extending the lifespan of the aquifer for agricultural production rather than preserving it indefinitely; however, an examination of commoning practices also reveals the capacity of the community to change the course of the future.

KEYWORDS: Commoning, groundwater, collective action, arid regions, social practices, Drâa Valley, Morocco

INTRODUCTION

Globally, groundwater resources are playing an increasingly important role in irrigated agriculture (Siebert et al., 2010). Access to groundwater has enabled major agricultural development, particularly in arid regions around the world. The Ica desert in Peru, for example, is renowned for its asparagus and Peru has become a leading country in the export of fresh asparagus (Shimizu, 2006). The valley's

favourable climate, strategic location and fertile soil favour agricultural development, despite the fact that the desert only receives 50 millimetres of rain per year (Boelens et al., 2014). Similar trends can be observed elsewhere in the world. The region of Biskra, Algeria, for example, known as the gateway to the Sahara desert, has undergone major agricultural transformation in the last few decades (Naouri et al., 2020). Access to groundwater has enabled the conversion of desert and rangelands into intensive greenhouse horticulture and this region now produces one-third of Algeria's tomatoes (Daoudi and Lejars, 2016). Access to groundwater has also transformed the desert lands of southern Morocco into irrigated farmland where high value crops are cultivated (Er rayhany et al., 2022). The rate of groundwater recharge in semi-arid and arid regions is generally low and infrequent due to scarce rainfall. In the absence of alternative water resources, intensive agriculture in these fragile regions generally relies on groundwater (Margat and van der Gun, 2013). This often leads to the degradation of groundwater resources both in quality and quantity, with potential detrimental effects on the poor who are increasingly excluded from access to groundwater (Shah, 2010). Given the growing use of groundwater globally, as well as the accompanying drop in groundwater tables (Siebert et al.; 2010) and the impact of this on nature and society, scholars and practitioners have started paying more attention to the governance of this resource (Molle and Closas, 2019a). Understanding and governing groundwater is particularly challenging however, at least in part because of its invisibility (Kuper et al., 2017). Using groundwater also involves "high subtractability, meaning that one person's use can change the availability or quality for other current and future users" (Zwarteveen et al., 2021: 89). Groundwater abstraction dynamics therefore involve tension between individual and collective interests and between short-term gains and longer-term sustainability (ibid).

In light of these challenges, intensive farming practices in arid environments raise key questions regarding environmental sustainability and modes of groundwater governance. State responses tend to consist of control mechanisms such as aquifer contracts and water policing; however, even in the rare instances where such measures are implemented, they are seldom effective in addressing groundwater over-exploitation (Shah, 2010). States sometimes deliberately apply a laissez-faire approach. In some instances, they even encourage continued groundwater use in light of its economic benefits and the resulting social peace. They do so by, for example, giving agricultural subsidies or streamlining the procedure for obtaining groundwater access (Kuper et al., 2016). Such modes of governance contribute to the creation of a fatalist image of desert farming; according to this image, agricultural growth is unsustainable and impossible to control and it also results in the depletion of groundwater resources. This fatalistic attitude is further reinforced by certain terms that are used in the literature to refer to these dynamics; they include "mining groundwater resources", "ecological disaster", or "water grabbing" (Llamas et al., 2006; Margat and van der Gun, 2013; Franco et al., 2014). In line with this body of work, the authors of the present article are also worried about the impacts of such intensive water practices in arid regions and about the rapidly depleting groundwater resources. We believe, however, that using such terms helps create a gloomy image of unsustainable, but inevitable, agricultural growth. This makes it difficult to recognise the promising experience gained by local communities and farmers and the experiments they have conducted, often in close interaction with the state and other stakeholders (Zwarteveen et al., 2021). We thus call for a fine-grained analysis of social practices around the use of groundwater – practices that are considered here as essential elements in a process of commoning (Bollier, 2020). Considering an aquifer and its associated practices and relations as a commons – that is, "not just (...) a resource, but (...) a *community* that manages a *resource* by devising its own *rules, traditions, and values*" (ibid: 6; italics added by authors) – is a stiff call, as most scholars consider aquifers, especially large ones, to be under an open access regime (Rouillard et al., 2021).

To illustrate our thesis, we use a case study conducted in the arid Drâa Valley of south-eastern Morocco, where the cultivation of watermelons has rapidly expanded over the last two decades. In the Drâa Valley, it is certain large, primarily profit-driven, entrepreneurial investors who contribute most to water shortages and who may even cause problems for the domestic water supply. As we illustrate in

this article, however, it is precisely their unsustainable but profitable farming practices that have helped reveal the value of the aquifer to members of the local community. Some young local farmers have also turned to watermelon production as part of a strategy to diversify farming and increase their income; they are consciously designing rules to regulate groundwater use and are adjusting their farming practices with a view to extending the lifespan of the aquifer they are exploiting. We argue that these social-territorial dynamics can contribute to the process of commoning groundwater resources; however, we question the use of the term 'commoning' as it is used in the literature. There, it is often associated with positive notions of environmental sustainability and social justice while at the same time dealing with social dilemmas (Wamsler and Riggers, 2018); it also focuses solely on communities, while underestimating the role of the state and other stakeholders (Tang and Tang, 2001).

In this paper, we begin by reflecting on the process of commoning and on the social practices that underlie the commons. We then describe the study area and the methods we used. In the results section, we trace back and analyse the collective action of the local community engaged in watermelon cultivation. We then again reflect on the process of commoning, this time illustrating how it evolves through multiple social practices. Our analysis shows how commoning, as it is performed by young local farmers, is about extending the lifespan of the aquifer for agricultural production rather than preserving it; even so, the practices of commoning also reveal the capacity of the community to change the course of the future.

COMMONING AS A SOCIAL PRACTICE

In recent years, renewed scholarly attention has focused on the dynamics and the becoming of the commons as they face ever greater pressures and over-exploitation. Within this body of work, more attention has been paid to the social relations, rules and activities involved in creating the commons, which are referred to as 'commoning' (Bresnihan, 2016). Commoning is understood as the collective action that fosters both new means of production, exchange and the use of resources (Gibson-Graham, 2011; Dombroski et al., 2019). It also regenerates people's social connections with each other and with 'nature', gives rise to the possibility of building new identities and aspirations, and introduces people to new social roles that embody wholesome cultural values and entail both responsibility and entitlement (Bollier, 2020: 4). It has been described as a messy and fragmented process in which transformation may happen over a long timeframe (Gibson-Graham et al., 2016).

Invoking the commons may thus create possibilities for new forms of participation and benefit-sharing (Oldham, 2009); however, the ability to benefit from, or access, a particular resource can be contested by actors having competing claims over it (Sikor and Lund, 2009). Here, the work of Bollier (2020) adds an important element by emphasising the social practices that underlie the process of commoning. These practices consist of "acts of mutual support, conflict, negotiation, communication and experimentation that are needed to create systems to manage shared resources" (Bollier 2020: 2). Gibson-Graham et al. (2016) offer another valuable insight into this by stressing the multiplicity of actors engaged in the process of commoning; they reveal how, "commoning is enacted through assemblages comprised of social movements, technological advances, institutional arrangements, and non-human 'others'" (ibid: 193).

The literature stresses that the process of commoning is community driven; however, communities and community activities have often been eulogised in natural resource governance (Clement et al., 2019). Scholars argue that community-based resource management does not function in isolation from the outer world (ibid). In addition, feminist political ecologists have raised critical questions concerning the homogeneity of the community and the power dynamics of collective action (Cleaver, 1999). They draw attention to existing power relations based on gender and other social differences that define who has access to, and control over, particular resources and who may be excluded. In their opinion, strong communitarian relations do not necessarily lead to commoning for all (Nightingale, 2019) and assert that

there are many "concerns on a disembodied construction of the commons, the collective and the community" (Clement et al., 2019: 2).

Commoning also often implies a normative understanding of the kind of transformation that drives such processes. As such, transformations driven by commoning practices are usually considered to be guided by principles of social justice and ecological sustainability in the transforming and reconnecting of human and more-than-human communities (Harcourt, 2021). Commoning, however, cannot come into being *ex-ante*; rather, it appears *through* social practices. It is therefore important to remain critical of the kind of transformations brought about by commoning practices.

METHODS AND PRESENTATION OF THE CASE STUDY

Research approach

The study was based on empirical data collected in the Drâa Valley in the province of Zagora, Morocco, between 2019 and 2022 (Figure 1). Semi-structured interviews in the field and phone interviews during the pandemic were combined with field observations at two specific study sites where watermelons are grown, the Feija Plain and Mird. A total of 89 interviews were conducted with farmers of all ages, agricultural labourers, local representatives, civil society actors and institutional actors (Table 1). We were not able to interview large-scale farmers as they often do not live on the land concerned but rather cultivate watermelons through arrangements with local farmers. We used a snowball sampling method by which our interviewees suggested others to be interviewed. During the interviews, topics discussed included: farmers' access to resources (land, water and capital), agricultural practices, the effects of these practices on the availability of natural resources, the past development of watermelon production in the study area, the tribal organisation of local communities and, finally, the challenges faced by farmers. As the interviews progressed, we focused increasingly on groundwater-related problems and on how farmers organise themselves to deal with them, as this was a topic often brought up by the interviewees. From then on, our questions focused on local initiatives dealing with groundwater dilemmas. We wanted to understand the origin of these initiatives, their objectives, the actors involved, and their effects on groundwater availability and on the future aspirations of young farmers. All the interviews were conducted in Darija, the local dialect; they were recorded with the consent of the interviewees and were then transcribed and translated into French.

The interviews were conducted over a period of three years. Combined with our observations, they allowed us to witness the expansion of watermelon production in the study area. During the study period, we also carefully noted the different standpoints of the actors involved and how their practices and/or discourse changed over time.

We compared the data derived from the interviews and from our observations with the content of public debates triggered by these dynamics as reported in, for example, media articles and ministerial statements. Opinions were expressed by various state departments (notably the Ministry of Agriculture and the Ministry of the Interior), civil society organisations (in particular an environmental association from Zagora city), experts, and local community representatives. These entities also strategically used different media to communicate, especially since the social movements around domestic water that occurred in 2017. We analysed a dozen press articles published in different media on different dates. We also obtained reports from the Water Basin Agency and the Chamber of Agriculture to better understand the position of the actors involved in the issue.

Table 1. Overview of the interviewees.

Rural actors	Number of interviews
Farmers (male/female)	66
Local representatives (m)	3
Members of environmental associations (m)	4
Agricultural labourers (m/f)	10
Institutional actors (m/f):	6
<ul style="list-style-type: none"> • Regional Office of Agriculture of Ouarzazate (Office Régional de Mise en Valeur Agricole, or ORMVAO); • Water Basin Agency Drâa-Oued-Noun (Agence du Bassin Hydraulique Drâa-Oued-Noun, or ABH); • National Agency for the Development of the Oasis and Argan Zones (Agence Nationale de Développement des Zones Oasiennes et d'Arganier, or ANDZOA); • National Office of Water and Electricity (Office National d'Électricité et d'Eau potable, or ONEE). 	
Total	89

Study area and recent dynamics

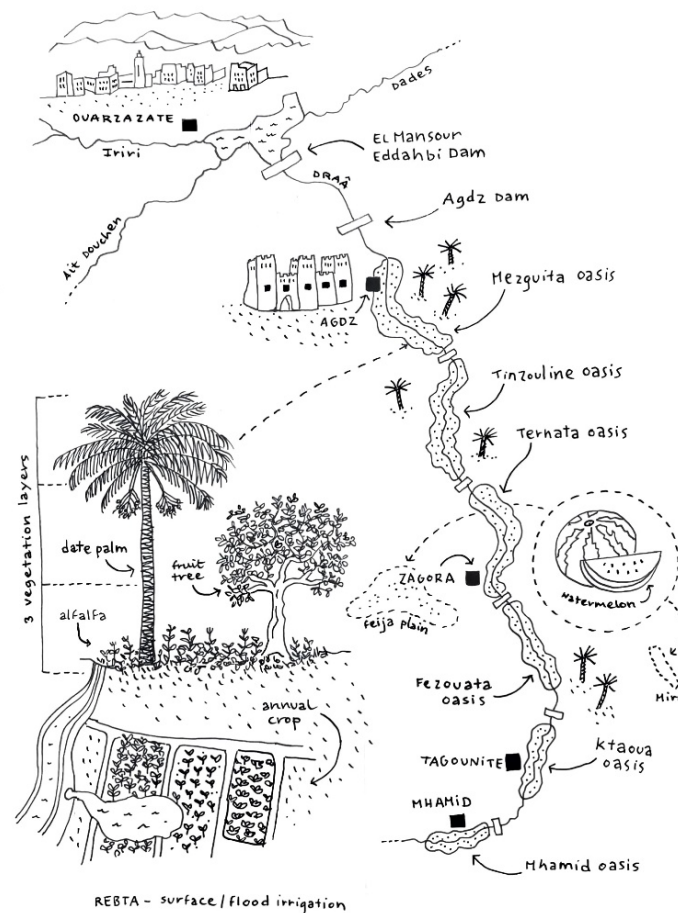
This article focuses on the Drâa Valley in south-eastern Morocco, a valley that is characterised by an approximately 200 km belt comprising 6 oases. The main water resource is floodwater from the Drâa River and its tributaries, which flow from the High Atlas Mountains. The water is stored in the El Mansour Eddahbi reservoir, which was built in 1972 and is located next to the city of Ouarzazate. The two main cities in the valley are Ouarzazate, with 71,067 inhabitants (HCP, 2015), and Zagora, with 40,067 inhabitants (*ibid*). While Ouarzazate depends on the El Mansour Eddahbi dam for its drinking water supply, the city of Zagora¹ has, since 1985, relied on the valley's groundwater resources (ABH, 2020).

Irrigated agriculture is essential to the livelihoods of the area's farming families. Due to its arid climate, with an annual rainfall of around 70 mm (Moumane et al., 2021) and average potential evaporation of up to 3000 mm (Karmaoui et al., 2015; Schulz, 2006), farmers mostly rely on dam releases to irrigate their land. For the last two decades, however, farmers inside the oases have increasingly fulfilled their need for irrigation water through drawing groundwater from shallow individual wells. In the past, groundwater was considered to be a backup resource to supplement surface water in dry years and in the summer. The use of groundwater in the oases consequently remained moderate for many years and allowed renewal of the resource (Ouhajou et al., 2017).

Subsistence agriculture associated with livestock is essential for farming families in the valley's oases. Farming is characterised by a stratified production system that combines date palms, fruit trees and annual crops, and by collective management of irrigation water. From the second half of the 20th century, however, new agricultural practices emerged in the rangeland outside the Drâa Valley's ancient oases; these were linked to the availability of land and groundwater, and to the expanding demand for fresh fruit and vegetables (Lamqadem et al., 2019; Bossenbroek et al., 2021), a situation that is replicated in

¹ A project is currently being realised to reinforce the drinking water supply in the province of Zagora. This project consists of the construction of a new dam close to the city of Agdz and pipelines diverting the dam water to the city of Zagora. How these new water provision utilities will influence Zagora's groundwater use, however, remains unclear.

Figure 1. The Drâa Valley showing the location of the case study sites, Feija and Mird.



Source: Drawing by Caroline Sarah Straub.

other oasis regions in North Africa (Hadeid et al., 2018; Hamamouche et al., 2018; Kadiri et al., 2022). Pastoral communities are also increasingly settling new land and starting to practice sedentary agriculture (Amsidder et al., 2021). Local farmers and investors cultivate food crops and high value crops such as date palms, fodder crops or watermelons on these so-called agricultural 'extensions'. Although watermelons were previously grown in the Drâa Valley's oases, it was usually on a small scale, on micro plots in farmers' gardens inside the oases. In the extensions, by contrast, watermelons are cultivated on large land parcels ranging from one hectare to dozens of hectares, using an intensive market-oriented mode of production. This land is collectively owned by local tribes and was originally used for grazing livestock.

In the Drâa region, particularly in the region of Zagora, an agricultural 'boom' began in 2007 around the production of watermelons in the rangeland outside the ancient oases; this boom depended on individual access to groundwater. There are four main reasons for the introduction of watermelon production to the area. First, it is a short-cycle crop that grows between December/January and May/June. Second, it is a profitable crop that sells at high prices at a time of year when there is little competition; the climatic characteristics of the area – a desert zone – mean that Zagora's watermelons mature before those of other regions and are thus the first to reach national and international markets. Third, the availability of groundwater resources and land makes these developments possible. Fourth and finally, the production of watermelons is to some extent encouraged by a number of state programmes

and subsidies under the Green Morocco Plan (PMV) and the Generation Green strategy (GG).² These subsidies cover different types of equipment, including the installation of drip irrigation systems and water storage basins. The use of storage basins is widespread in the extensions of the Drâa Valley; there are, for example, 954 basins in the Feija area (ABH, 2020) that are used by individual farmers, the construction of which often accompanies the installation of a drip irrigation system on a farm.

In this study, we focus on two sites where watermelons have been grown for several years: the Feija Plain and Mird. The Feija Plain, located west of Zagora, is the site where watermelons were first grown. Since then, they have been grown in other extensions in the area, including Mird. In both areas, farmers also grow other crops including date palms, henna and fodder (alfalfa), but so far watermelons constitute the main crop. We chose the Feija Plain because watermelons are cultivated just outside the city of Zagora, which has faced problems of drinking water supply; the drinking water shortage has made this a clear and emblematic example of unsustainable farming, as evidenced by the multiple media articles on the subject.³ We argue that the local community's process of commoning groundwater happened both in spite of, and thanks to, coming under the spotlight of (inter)national media that pinpointed watermelon production as the main source of the city's drinking water problems. In contrast, the local community in the Mird plain, only 50 km away from Feija, only had to deal with the agricultural dilemma of who was entitled to use groundwater and thus reap its benefits.

Land tenure in the area is complex, as most of the land is collectively owned by local tribes who used to be nomads. The determination of who has the right to use the land is the responsibility of the Ministry of the Interior.⁴ In Feija, rights-holders belong to the Messoufa Tribe and each is entitled to 5 to 10 hectares (ha) of agricultural land. In Mird, rights-holders belong to the Ait Isfoul Tribe and each can make use of 4 ha of collective land; in practice, however, at both sites some farmers were using up to 10 ha. A farmer can prove their right to farm a plot by applying for a farming certificate. This document is delivered by the local authorities after being approved by the *naibs*, that is, the representatives of the tribes who are in charge of the collective lands. The document is important because it gives the farmer access to state subsidies, particularly those intended for drip irrigation.

RESULTS

We now turn to the 'messy' (Gibson-Graham et al., 2016) everyday social practices of commoning in the study area. We illustrate how the process of commoning has evolved through different social practices, including: 1) the use of new farming practices that reveal the potential of the aquifer; 2) the representation of the aquifer as severely degraded and the development of a narrative around it being a collective good to be protected against outsiders; 3) the defining and negotiating of rules to control groundwater access and use; and 4) the engagement in negotiations and the resolving of conflicts.

New farming practices reveal the potential of the aquifer

Watermelon production in the Drâa Valley has increased in size and importance over the last two decades. In Feija in early 2007, a local *mostatmir* (Arabic for investor) started to cultivate watermelons; this initiative was soon followed by that of other investors. In 2010, aware of the profits being obtained

² These agricultural and rural development strategies were launched in Morocco to take place between 2008 and 2020, and between 2020 and 2030, respectively.

³ The local environmental association, for example, continues to pinpoint the environmental issues related to watermelon production – and indeed to intensive farming as a whole – by saying that, "The watermelon continues to destroy our soils and deplete our water resources"(Bentaleb, 2021).

⁴ Tribes periodically distribute plots of land for agriculture and housing. This is done under customary rules of distribution under the supervision of the naib, a representative of the tribe who is responsible for managing the tribe's land and who is approved by, and liaises with, the Ministry of the Interior (Kadiri and Er rayhany, 2019). Since 2019, however, there has been a shift in the conditions under which rights-holders can obtain individual land plots.

in Feija, a local investor in Mird started to cultivate watermelons on less than one hectare. In both areas, the financial profits soon attracted large-scale investors who were referred to by the community as *barrani* (outsiders).

According to the farmers we interviewed, the term *barrani* refers to investors from other regions in Morocco as well as those belonging to tribes other than the Ait Isfoul (in Mird) and the Messoufa (in Feija), even though they may be from the region. These investors are both traders and producers. They buy the watermelons from local producers through extensive national trade networks. These investors do not have any monopoly on trade and there are many other traders active in the area. As regards watermelon production, they establish different arrangements with different local farmers. Either they rent the land from rights-holders and recruit a local farmer to tend to the farm throughout the season, recruiting day labourers when needed, or they establish land use arrangements with rights-holders who must first acquire a land use certificate from the naib. In the latter case, the investor provides the capital (investment cost,⁵ inputs and labour) and *khtia âla hssabhom* (assumes the risk in the case of marketing problems), while the rights-holder provides the land, attends to it, and is responsible for all farming operations. The benefits are then usually divided between the investor (two-thirds) and the rights-holder (one-third). Several farmers to whom we spoke explained that investors, by multiplying these arrangements, are able to exploit dozens of hectares of land (sometimes up to 100 ha) where they grow watermelons as a monoculture.

The new farming practices introduced by the investors revealed the economic value of the aquifer and resulted in a process of commodification of groundwater. Local young farmers were attracted by the profitability of growing watermelons; they were also attracted by the fact that watermelon production uses 'modern' farming equipment in the form of drip irrigation systems with a pumping station, a basin to store water, solar energy to pump the water (Figure 2), and the use of fertilisers in the irrigation water in a method called fertigation. Until recently, these farming techniques were rare in the region. Most young local farmers acquired know-how in the production of watermelons by working as labourers, as associates with the investors, or through working with local farmers.

Figure 2. A water storage basin and solar panels in Mird; the latter are used (sometimes in combination with LPG) to pump up groundwater.



Source: Photo courtesy of Lisa Bossenbroek, Hind Ftouhi and Zakaria Kadiri (2021).

⁵ Part of the investment cost – typically for the drip irrigation system and the irrigation basin – is often subsidised by the state.

Working on the farms in the region also allowed some of these young farmers to acquire the capital they needed to finance their own project. Others returned from abroad or from other cities in Morocco, bringing their own financial capital. Young local farmers initially cultivated watermelons on only a couple of hectares of land; gradually, however, some were able to extend the area under watermelons to 5 to 10 ha. These young local farmers thus experimented with watermelon production and increasingly began to use large quantities of groundwater. In contrast to the investors, however, they usually practice mixed cropping, combining watermelons with vegetables for domestic consumption.

Although the official data is not always consistent, since 2012 it all shows a strong and unmistakable upward trend in watermelon production in the Drâa Valley. The total irrigated area in Feija increased from 1358 ha in 2014 to 3055 ha in 2019, with the main crop being watermelons (81%) (ABH, 2020). A similar process was described by farmers in Mird; as we were told by 25-year-old Rachid (all names of interviewees have been changed), "It was in 2013-2014 that the cultivation of watermelons began to become known and to spread among farmers".

Representing the aquifer as severely degraded and developing a narrative around it being a collective good to be protected from outsiders

The expansion of watermelon production in the Drâa Valley resulted in declining groundwater tables (ABH, 2020). As a result, young local farmers gradually became aware of the limits to watermelon production. They constructed a social representation and a narrative of the aquifer as a common (tribal) good that was being threatened by the practices of investors.

Indeed, the agricultural boom has been accompanied by a rapid increase in the number of wells and boreholes; for example, the River Basin Agency reported that in Feija, the number had increased from 344 in 2014 to 850 in 2019 (ibid). Although official permits are required for drilling a well and extracting water, many wells are used with no formal authorisation. It is thus not clear if these numbers cover only authorised wells or whether they also include those that have been dug without authorisation. The agency also estimated an annual deficit of 5 million cubic metres (Mm³) (ibid). Between 1980 and 2020, the increased use of groundwater caused the water level to drop by approximately 15 to 40 metres, depending on the area (ibid). After 2015, the rapid increase in cultivated area stabilised somewhat, suggesting that it may have been affected by the drop in water levels (Lamqadem et al., 2019; ABH, 2020). Although the interviews we conducted in Mird testified to similar trends, we did not find any official record of declining groundwater tables.

During our interviews, local farmers often complained about the large number of investors who had come to the region to grow watermelons. They explained that this had a negative impact on the availability of groundwater resources in the form of lower groundwater levels; they also mentioned the negative economic repercussions, including the increased difficulty faced by 'small' local watermelon producers in selling their watermelons.

As one young farmer told us,

foreign farmers *emro lblad* (invaded the region) (...). The large-scale farmers who have the money come and dig wells and pump the groundwater. If they don't find any water in one plot, they move on and try somewhere else. When they find the right plot, they exploit it, and when they've used up all the groundwater, they move on to another site.

Young local farmers thus clearly identified how the investors' farming practices contributed to the depletion of groundwater. The rapidly declining groundwater levels were also confirmed by other farmers we interviewed; for example, 34-year-old Omar, from Feija, explained that, "Even if we dig deeper, there is no water. There is no water even at a depth of 100 metres. I dug down to 100 metres but I didn't find any water. There is just enough water to drink". Morad, 25 years old, from the Feija Plain added that,

I have two boreholes. The first one is 106 metres deep and the other 98 metres (...). The water level goes down every year. The water level goes down in this period [he is referring to the month of May] and then increases in the winter depending on rainfall. In winter, we pump at a depth of 40 metres whereas right now we go down to 80-90 metres (...). Some farmers have a low water flow and others have wells that dry up completely.

Indeed, in April-May, with the watermelon harvest approaching, the demand for water increases. This results in a greater sensitivity to water deficits, and the water level in some wells and boreholes drops to the point of drying up. Additionally, as testified by Omar, some farmers dig boreholes without finding any water. The local farmers accuse the barrani of being responsible for this situation because, in their opinion, the outsiders exploit large extents of land and only think about making a profit. As explained by a 34-year-old farmer from Feija, "The problem is the barrani who come here to exploit the natural resources (...). For example, we have just realized that one investor from Chichaoua cultivates almost 100 hectares of land all by himself". This statement also underlines the fact that the presence of investors is rendered invisible by the arrangements the barrani have with local farmers; that is, they bankroll watermelon cultivation and handle their sale, but are usually not physically present in the field.

Local farmers increasingly complain about the negative economic repercussions of investors from other areas coming to the area to grow watermelons. As testified by 34-year-old Mohamed, from Mird, their presence makes it difficult for local farmers to farm; as he describes it, "Two or three barrani can farm up to 150 hectares of watermelons alone, whereas 30 or more local farmers could cultivate the same amount of land". Indeed, while local farmers initially appreciated and even encouraged the presence of investors in their role as traders, their role as producers who rent land is increasingly contested. The traders purchase the entire harvest of local farmers, thereby guaranteeing their sale; this is especially welcome to small farmers who have difficulty accessing the market. As soon as some traders became investors and produced their own watermelons, however, they were no longer interested in purchasing the watermelons produced by local farmers. This makes it difficult for local farmers to negotiate a good selling price with other traders and intermediaries. Additionally, due to the arrival of investors in large numbers, the production of watermelons increased; this resulted in supply outstripping demand, which negatively affected the market selling price of watermelons. This overproduction is a consequence of watermelon production by the area's investors. However, it is also a result of the production by farmers and investors in neighbouring areas like Tata. This happened acutely in 2019. During our fieldwork, we observed watermelons left in the fields to rot because the cost of harvesting was higher than market prices; at the same time, local farmers said it was difficult for them to prevent investors from producing watermelons as they paid a good price to rent the land and employed local farmers to do the farming.

Persistent droughts in recent years have further contributed to the growing desire of local farmers to prevent outsiders from accessing 'their' groundwater. They consider the rapid aquifer depletion to be a looming tragedy of the commons, as described by 56-year-old Hassan, who farms in Feija; he told us that, "for me, the expansion of the watermelon culture in Zagora is similar to a person who is climbing a mountain and is close to the peak, once the peak is reached, it crumbles". This statement symbolises the trajectory of groundwater economies as theorised by Llamas et al. (2006) and Shah (2010). The rapid aquifer depletion eventually prompted some members of the local community to act.

Defining rules for groundwater access and use

State regulations: Multiple interests and priorities

While the local farming community was developing the narrative of a common resource that needed to be protected from outsiders, the inhabitants of Zagora increasingly faced drinking water shortages. Initially the city relied for its drinking water on 11 wells (6 dug wells and 5 tube wells), but over the years 4 fell dry (ABH, 2020). The urban dwellers made the link between the rapidly expanding watermelon

production and the problems they were experiencing with their drinking water supply. According to a local environmental association,

The watermelon continues to destroy our soils and deplete our water resources. We are facing months of more severe drought than in previous years (...). If there is a water crisis, it is because there is a laxity and a laissez-faire attitude regarding the digging of wells and the exploitation of the latter, notably towards the producers of watermelons whose cultivation requires enormous quantities of water (Bentaleb, 2021).

Indeed, according to official data, the production capacity of the Feija aquifer decreased from 1.8 Mm³ in 2005 to 0.7 Mm³ in 2018 (ABH, 2020). Activists and media characterised watermelons as a water-guzzling crop or as a crop that was contributing to the export of groundwater and thus negatively affecting the drinking water supply; in doing so, they further contributed to the growing tensions around the use of the Feija aquifer.⁶ Drinking water shortages led to social unrest in Zagora, and in 2017 a social movement called *Massira al Atach* (March of Thirst) was formed to combat the drinking water shortages and to bring the subject of "the population's thirst" to the attention of the general public and of the state (Le Monde, 2017).

Faced with severe aquifer depletion and social unrest in the Drâa Valley, the Moroccan state tried to develop different mechanisms to control and regulate groundwater extraction. As we illustrate in what follows, however, the different government ministries (Regional Office of Agriculture, Water Basin Agency, Ministry of the Interior, and National Office of Water & Electricity) did not necessarily share the same interests and concerns.

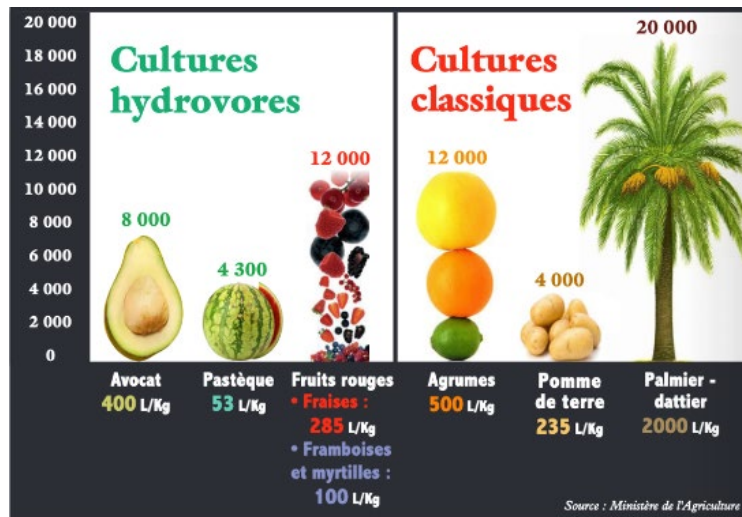
Following the social unrest caused by drinking water shortages, it was up to the Ministry of the Interior to restore social peace and to ensure access to safe drinking water for the city of Zagora and its surroundings. By the end of September 2017, the Prime Minister "promised urgent strategic measures" (Le Monde, 2017). This was followed by an order issued by King Mohamed VI to create a commission "to find adequate solutions in the next few months" to the drinking water crisis (ibid). In 2018, the National Office of Water & Electricity (ONEE) deepened four out of the seven wells and installed a desalination station in Feija to treat the additional abstracted groundwater resources (ABH, 2020). This took drinking water production to 1.5 Mm³ in 2019 (7% of the total water consumption), which can be compared to that year's estimated annual agricultural water use of 21 Mm³ (the remaining 93%) (ibid).

The Ministry of Agriculture initially facilitated agricultural development in the valley through its system of subsidies; this included subsidies of watermelon cultivation. The Ministry contributed indirectly to the agricultural extensions by subsidising irrigation basins and drip irrigation equipment by up to €5000/ha and by accepting applications for subsidies without formal authorisation from the Water Basin Agency for access to groundwater. Yet, the droughts of the last couple of years, together with the surge in the amount of land used to cultivate watermelons and the growing public critique of the cultivation of watermelons in a desert area caused this 'blind eye policy' to be questioned. It was nevertheless only in September 2022, following an extreme drought event in Morocco, that the Ministry of Agriculture positioned itself clearly in the public debates by claiming that watermelons are not a water-guzzling crop, while simultaneously admitting that the water demand for watermelons needed to be regulated depending on the annual climatic conditions in Zagora province⁷ (Figure 3). By the end of that month, however, this effort at communicating was accompanied by a joint decree issued by the Ministry of Agriculture and the Ministry of Finance which banned subsidies for drip irrigation for watermelons, avocados or citrus fruits (Agrimaroc, 2022).

⁶ On the other hand, the naibs of the local communities categorically refused any proposal to ban watermelon production, since the livelihood of many families came from this crop (Chakiri, 2022).

⁷ In an article in the Moroccan electronic newspaper, *Media 24*, the head of the agricultural production department of the Regional Office of Agriculture of Ouarzazate commented that, "As there is no alternative to watermelon in the region, the best solution is to opt for flexibility, adapting production according to climatic conditions" (Chaabi, 2021).

Figure 3. Comparison of crop water requirements of watermelons (only one crop/year in the Drâa Valley), avocados and red fruits, (which are designated in the media as 'water-intensive crops') and other 'classical' crops such as oranges, potatoes and date palms.



Source: La Vie Eco, 23/09/2023, citing data from the Ministry of Agriculture.⁸

Note: Through this image, the Ministry of Agriculture aims to communicate that the water requirement of so-called 'water-intensive' crops, including avocado (8000 m³), watermelon (4300 m³), red berries (12,000 m³), is equivalent to that of 'classical' crops, including citrus fruits (12,000 m³), potatoes (4000 m³) and palm trees (20,000 m³). The water requirements are also converted to the number of litres of water required to produce a kg of certain fruits (for example, 53 l/kg for watermelons).

The Water Basin Agency has yet other aims, including ensuring water security in the region and promoting sustainable groundwater use. It plans to do this primarily by controlling the drilling of new wells through permits and enforcement by 'water police'. Officials at the Water Basin Agency mentioned, however, that they face difficulty in enforcing these regulations because they lack the financial means and the necessary staff. They also explained that their reluctance to disturb the social peace makes it difficult to penalise farmers who dig wells with no permit. In 2019, following the 2017 social movement that called for better (urban) access to drinking water, the River Basin Agency launched a study to develop an 'aquifer contract' for the Feija Plain.⁹ In 2020, the agency held its first meeting with the different stakeholders to draw up such an aquifer contract. Farmers were informed through the provincial services that groundwater associations would be created in different districts. This initiative of the Water Basin Agency happened at a time when young local watermelon farmers in Feija were discussing how to control the expansion of the area under watermelons. As explained by Hichem, a 35-year-old Feija farmer,

Before we decided to control the amount of land used to grow watermelons, they [the province administrators] held a meeting to sign an aquifer contract. Recently they invited us to this meeting. I attended because I am a member of an aquifer association. They talked about this association, but it has not yet been officially created (...). They said they would install a water meter to give each person specific amounts of water. The farmers will not accept this proposal. If the amount of water they can pump is not enough (for the water requirements of the crop concerned), they will have to take more.

⁸ In *La Vie Eco*, the Ministry of Agriculture affirms, with supporting statistics, that watermelon production does not consume as much water as 'classic' crops such as date palms, especially when they are irrigated with drip irrigation (Benchanna, 2022).

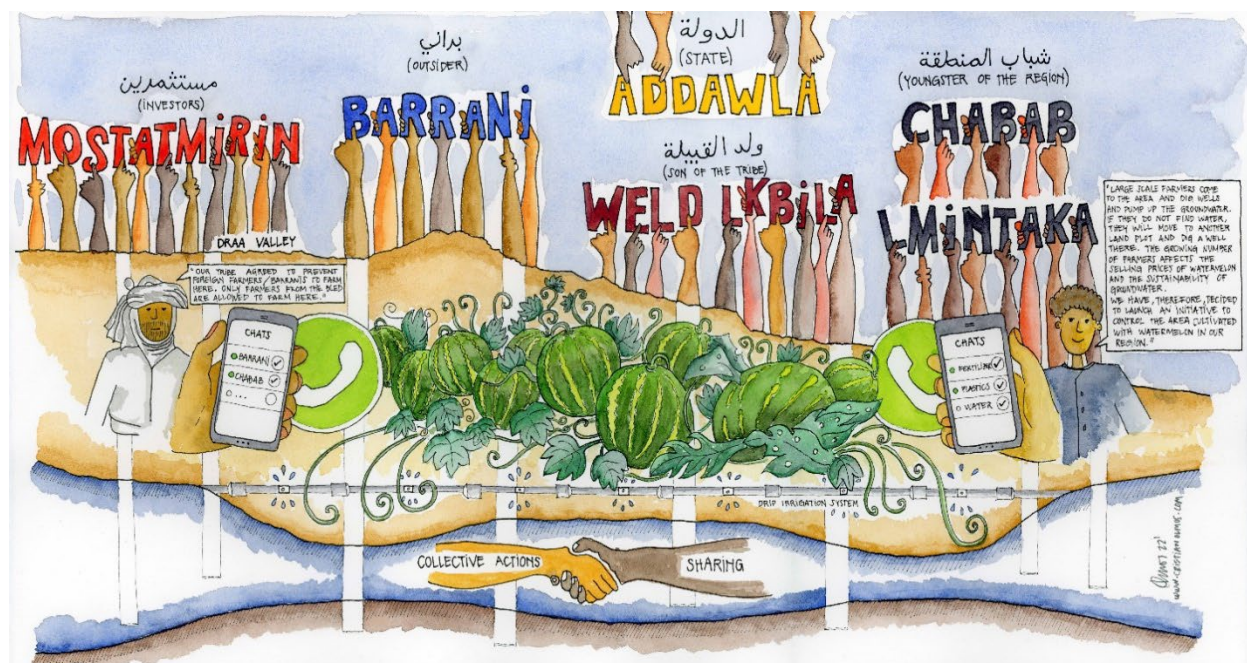
⁹ An aquifer contract is a set of technical, regulatory and institutional measures that is put in place in consultation with all regional and local stakeholders who are concerned with the management of groundwater resources in a given territory; its aim is to ensure the sustainable management of the water table through a participatory approach (ABH, 2020).

This shows the importance of young local farmers retaining the initiative in regulating watermelon production. They were given to understand that the rules envisaged under the aquifer contract would not be in their favour; they therefore decided to accelerate their collective action on groundwater. The first meetings between the various water users of the Feija Plain were held in 2020; at the time this research was conducted, however, the process had not yet resulted in the establishment of an aquifer contract.

New community initiatives to extend the life span of groundwater resources

As the watermelon boom continued, the local community became increasingly worried about groundwater shortages and about the marketing problems linked to the overproduction of watermelons. Some young local farmers thus decided to take action (see Figure 4). Their aim was twofold: 1) to draw up rules to reduce the pressure on the aquifer and ensure a supply of irrigation water that could be shared among the members of the community as long as possible; 2) to sell their watermelons at better prices. Our field results enabled the documenting of two different farmers' initiatives, one in Feija and one in Mird. They have in common that: 1) local youths initiated the actions; 2) they attempted to ban *barrani*¹⁰ from their land; 3) they determined that identity and origins should define who is authorised to use groundwater; and 4) the Ministry of the Interior played a key role in formalising these community initiatives. In what follows we describe the two collective actions in more detail; this is followed by a description of their limitations.

Figure 4. Different actors involved in the collective actions in Mird and Feija.



Source: Drawing by Cristian Olmos Herrera, co-produced by Lisa Bossenbroek, Hind Ftouhi and Zakaria Kadiri.

Note: The investors (*mostatmirin*) are also referred to as outsiders (*barrani*) by the sons of the tribe/rights-holders (*weld lkbila*); this was especially the case during the period when the community wanted to exclude them from watermelon production. *Chabab lmintaka* refers to the young people from the region who launched the collective action among the rights-holders. The state, through the local representatives of the Ministry of the Interior, supported the collective action.

¹⁰ When local farmers discuss protecting the groundwater, they are more likely to refer to large farmers as *barrani* (outsiders) rather than as *mostatmirin* (investors).

Mird: "All barrani are forbidden to grow watermelons on our land"

In Mird, watermelon production reached a peak in 2013-2014. Over that period, local farmers and investors began increasingly to suffer from shortages and to express their frustration. In 2016, young local farmers met to discuss the situation which, from their point of view, was being caused by the barrani. The young farmers had observed the massive arrival of barrani in Feija and the subsequent degradation of the groundwater resources. According to Driss, a 28-year-old farmer, "*chabab Imintaka*" (the young people from the region) proposed to ban investors from farming their lands and to dissuade local farmers from associating with them. When Driss was asked why the young farmers had started this action, he replied that, "young people think about such initiatives, because they are the ones who are faced with the problems".

The young farmers organised several meetings to discuss how to proceed and to think of solutions. First, they agreed on who should be banned, how to define 'barrani' and, following from that, who would be able to benefit from the resource. Tarik, a 25-year-old farmer from Mird told us that,

For us, even a farmer from Zagora is a barrani. As long as he is not from our tribe, he is a barrani. For example, in our Ait Isfoul tribe, if the person belongs to this tribe, no one can forbid him to farm, but if he is from another tribe, he cannot farm here.

According to this definition, tribal identity legitimises who can have access to and farm the land. While women may also obtain legal access to collective land in Morocco (see Berriane, 2021), this is not (yet) the case in the study area. Although various women we interviewed engaged in farming and/or farming-related activities, none participated in the collective action. When we talked to several young women in the area about this issue, they mentioned that "farming is not their [women's] domain, men are in charge of farming". The collective action thus only concerns men who belong to the tribe.

Second, once the young farmers reached a shared understanding of the collaborative action, they sought to formalise it. They did so by contacting the naib of the collective lands and the *cheikh* (employee of the Ministry of the Interior). The latter was responsible for liaising between the local authorities; he had the responsibility of transmitting the farmers' proposals to the *caïd* (the local representative of the Ministry of the Interior) and then informing the farmers of the approval by the local authorities. The *caïd* gave a verbal agreement and encouraged the local farmers in their action without producing an official written document attesting to his position.

The farmers asked the cheikh to circulate the information well before the beginning of the watermelon campaign in order to avoid financial and material losses for the investors. As Tarik testified,

We warned them [the local authorities] that if a *barrani* comes to grow watermelons in our area, we will rip up the watermelons. We warned the authorities well before the beginning of the watermelon season to avoid having a barrani plant a watermelon crop and then accuse us of making him loose money.

When operationalising the action, its initiators realised that some investors still had ongoing farming arrangements with local farmers. In these cases, the local farmers proposed to let them continue to use the land until the contract ended, on the condition that they would not grow dozens of hectares of watermelons and would let the local farmer manage it without the investor coming to the village. As they stated,

They [the investors whose contracts were still valid] were required to only grow small plots of watermelons [even when the arrangement concerned a larger area] and were forbidden to access the *douar* [a 'rural village', in the Darija dialect]. They could send the money [to finance the crop] and inputs to the owner of the land but it is the owner who has to do the farming. We don't want to see them [the barrani] in the village anymore, because if we let those who still have valid contracts access the douar, the others will accuse us of favouritism.

Thus, the only barrani who are now admitted to the douar are the intermediaries who come to buy watermelons.

As compensation for farmers who could not afford to grow watermelons themselves and who had been associated with the barrani, the leaders of the collective action encouraged them to make farming arrangements with local farmers, that is, with the '*weld lkbila*' (sons of the tribe/rightsholders).

According to local farmers, if this initiative does not have a significant impact on groundwater recharge, it at least has the merit of preventing a drastic decrease in the groundwater reserve. As testified by Hmad, a farmer from Mird, "The water situation has remained the same, except that it is no longer deteriorating. Before, the water level decreased drastically over the years, but now it has stabilized and it is not decreasing anymore".

Feija: Controlling the area planted with watermelons to discourage barrani

In the summer of 2020, a 32-year-old local farmer suggested to a friend of his that they take action to *taknin* (control) the watermelon-growing area of Feija. The first discussions around this initiative were virtual and were held via WhatsApp. The idea was that the local farmers,

will make a list signed by all members of the tribe, the rights-holders; they will write the rules on which they have agreed; they will then submit this request to the Ministry of the Interior and inform them of their decision which will be valid for one or two years; after this period they would either renew it or change it.

Once the idea took hold, it spread to a wider circle and a meeting of farmers was organised. Respected elders from the tribe played an important role by sharing the ideas among the other farmers. We were told that almost 100 farmers supported the initiative. The meetings leading to the action were attended by the naibs of collective lands, by Feija farmers of all ages, by the elected municipal representatives of the area's douars, and by local officials of the Ministry of the Interior. The discussions focused at first on banning the barrani from producing watermelon as had been done in Mird; finally, however, the attendees decided to limit the surface area under watermelons that could be cultivated by each farmer to two ha per rights-holder (a rights-holder being a man who belongs to the tribe and is at least 18 years old, and who thus holds identity papers). An additional stipulation was that a household comprising more than three rights-holders would not be able to cultivate more than six ha of watermelons. As Mohamed explains in more detail,

At the start, we were looking for ways to rationalize the area under watermelon cultivation. At the beginning we thought of agreeing on giving the right to each right-holder with a national card to grow two ha, but it is possible that in this case some households will have 14 ha and others only six ha. For this reason, we decided to give the right to grow six ha of watermelon as the maximum area per household.

The objective of this initiative was twofold: to reduce the surface area producing watermelons and to discourage the barrani from growing watermelons in Feija. Now, an investor who wants to produce 30 or 40 ha of watermelons must make arrangements with 15 to 20 farmers. Setting up such arrangements is complicated. After a first test of this initiative in the 2021 agricultural season, farmers claimed that the number of barrani had decreased and that, like in Mird, this had had a positive impact on the selling price of watermelons. In Feija, similar to what happened in Mird, the Ministry of the Interior tacitly validated the initiative without producing an official document or communicating about it.

Negotiations and conflicts: The challenges of commoning

Although the initiatives described above were presented as solutions to groundwater depletion, in both regions they have been accompanied by new challenges to commoning. Not all the actors concerned share the same vision, which causes tension and conflict within the tribe; it also causes problems between

the tribe and those who are now (through the practice of commoning) considered to be 'external' actors, which includes the barrani, the urban inhabitants of Zagora, and the state.

Our interviews with farmers of all ages revealed that the resistance faced by these initiatives is primarily generational. Indeed, in both Feija and Mird, young people are the instigators of the collective actions. When the proposal was announced, it was not to the liking of some of the elders who questioned the chances of its success. Those who remained indifferent were, according to the young people, "not as sensitive as others to the danger that threatens the aquifer". As confirmed by 34-year-old Karim, one of the initiators of the action in Feija,

[T]here are several young volunteers who wanted to make a change in the tribe. The older people of the tribe are not very interested in this idea, because they grew up in a time when such initiatives did not exist. The older people are only interested in oasis agriculture and do not have a vision for the future of agriculture. The idea comes from the young people; if farming is destined to stop in 10 years (because of water scarcity) we will do our best to extend this period to 30 years, for example.

A more-pragmatic type of resistance to this initiative comes from farmers who consider the farming arrangements they have with investors or the renting out of their land to be advantageous. As Hamid explained, "Some of us who associate with others to make watermelons do not accept the control of areas cultivated with watermelon"; this resistance is because they either do not have the financial means to grow watermelons themselves or because they want to supplement their income by renting out the land.

The actions thus did not receive the unanimous support of the community in either Mird or Feija and, as a result, the new rules were often violated or circumvented. In Feija, for example, according to one of the instigators of the initiative, a farmer made an illegal identity card for his 3-year-old son to be able to cultivate watermelons on a larger area; his aim was for the son to be considered as a rights-holder and thus to be allowed to cultivate an additional two ha of watermelons. Likewise, in both Mird and Feija, some local farmers continue to make secret arrangements with barrani. In such instances, investors transfer the money without openly admitting that it is to be used to fund the growth of watermelons. As explained by Ali from Mird, "even with this decision, there are still people who associate with large scale farmers. They finance the crop and share the profit with the farmer at the end of the season. People believe the investors (barrani) no longer come, but this isn't true".

The fact that those who circumvented the rules were not punished during the first year after the rules were put in place also inspired other people to do the same. In Feija, for example, in the first year, the majority of farmers reduced the watermelon area but some farmers did not respect the two-hectare rule. As there were no negative consequences from either the community or the state, the following year other farmers followed their example.

Despite various constraints, the initiatives have succeeded in reducing the number of watermelon-growing barrani. The young farmers are thus trying to keep the action going and make it sustainable. In Mird in 2020, for example, which was about four years after the collective action was first launched, the young farmers discovered that a barrani had already started preparing the land to plant watermelons. Despite his protests they asked him to leave, pointing to the statement signed at the launch of the collective action. As they told us, "He [the barrani] was asked to leave the land because the rule that we introduced in 2016 prohibited his installation".

During this process, the role of the state was ambiguous regarding agricultural water use. On the one hand, they did not prohibit the collective action, and not acting is also an act; on the other hand, they did not follow up very actively on the collective action in 2021, which indirectly encouraged some community members and outsiders to break the rules. In 2022, however, the situation changed considerably. Following a severe drought, the state imposed new rules to prevent water shortages – rules that were clearly inspired by the community's initiative. As stated in *Le Matin* (2022), "the governor indicates that the area for watermelon cultivation will be limited to between 5000 m² and 1 hectare [per farmer], which

must not be exceeded during the 2022-2023 crop year". This decision shows how the state has taken over the initiative created by the local population in order to solve the critical water shortage.

As regards drinking water, the role of the state was far less ambiguous. In 2018, when the public water utility deepened four wells in the Feija aquifer and installed a desalination plant to solve Zagora's drinking water crisis, members of the local community used vandalism to try to prevent the utility from implementing the programme, but the National Office of Water & Electricity immediately secured the drilling sites by posting guards. The state also strictly forbids watermelon production in drinking water protection zones (Le Matin, 2022).

CONCLUSION

Research pointing to alternative and endogenous options for governing groundwater resources remains scarce. Although such research is important to pluralise existing ways of managing groundwater resources (Norström et al., 2020), only a few studies have acknowledged the importance and potential capacity of grassroots organisations to govern groundwater (Zwarteveen et al., 2021). In this paper we support this fact. We have done so by analysing the everyday social practices surrounding the commoning of groundwater in the Drâa Valley, Morocco, with the aim of showing how desert communities fared in their struggle to *taknin* (control) what they considered to be 'their' aquifer. Inspired by the work of Bollier (2020), we identified four sets of social practices. First, we showed the emergence of new farming practices that were introduced by local farmers and investors to produce watermelons, which contributed to the commodification of groundwater. Second, we analysed how young local farmers socially represented the commons in the face of the groundwater decline by developing a narrative of a collective good that needed protection from over-exploiting outsiders. Third, we examined how the rules to regulate groundwater use were defined and negotiated. Fourth and finally, we looked at the engagement of young local farmers in conflictual relations with investors and with members of their own tribe who were working with these investors; we also looked at their interactions with the water utility that was providing groundwater to the city of Zagora, and at their efforts there to enforce the rules and to avoid use of groundwater by 'outsiders'.

The process of commoning happened through messy everyday practices involving both the local community and other actors. The agent of change, the commoner, becomes an assemblage (Gibson-Graham et al., 2016) that includes humans, non-humans, institutions, and different state agencies. The state is characterised by multiple interests and priorities that lead to different, and at times contradictory, state regulations. The expansion of the watermelon boom and the drop in the groundwater table happened at the same time as a drinking water crisis that erupted in 2017. In response to the growing social unrest, the Moroccan state developed various mechanisms to control and regulate groundwater extraction in order to secure sufficient drinking water for the city of Zagora; however, its role in the management of agricultural water use was more ambiguous. Through the watermelon boom, young farmers from the area understood the social and economic importance of the aquifer. They decided to protect it from outsiders in an attempt to ensure their revenues and their livelihoods over a long(er) time period. The resulting action of commoning involved the lived experience of young local farmers facing economic challenges and aquifer depletion, and crafting rules of belonging, access and use. The emerging community of farmers also understood that they would not be able to implement these rules without enrolling the state, in particular the local authorities. This contributed to the emergence of a situation where a community took on the management of a common resource. We showed, however, that these community initiatives of caring for, and sharing, aquifers are intensely negotiated both within the community and with other stakeholders through multiple struggles, confrontations and negotiations. Based on our analysis, we agree with other scholars who claim that, "there is merit in complementing the current focus on government efforts to better regulate and control extraction, with efforts to document

and learn from community initiatives to care for, share or recharge the aquifers they depend on for livelihoods and incomes" (Zwarteveen et al., 2021).

In this paper, we have argued that a perspective of social practices of commoning renders everyday experiences, struggles and negotiations visible, revealing instances in which communities attempt to find solutions to combat groundwater degradation. Most scholars consider groundwater to be ungovernable as it comes under an open-access regime (Rouillard et al., 2021); using a social practices approach, however, we showed how the young local farmers that we interviewed were actually contesting this open-access. We therefore call for pluralising the perspectives on groundwater governance by investigating the messy everyday social practices of groundwater communities, both in their multiple interactions within the community and in their interactions with other stakeholders and with the more-than-human world.

Commoning is not a romantic practice; rather, it is anchored in power relations and harsh realities (Clement et al., 2019) which, in turn, are linked to agricultural markets. In revealing these complex interrelations, our practice-based approach allowed us to further illustrate the multiple interactions between different stakeholders in which the state and society are considered to be neither separate nor homogeneous entities (Molle and Closas, 2019b).

Finally, we showed in our analysis how processes of commoning can produce transformative change. We also showed that the course of change cannot be known ex-ante but rather that it appears through the social practices of commoning that are happening on the ground. Ground experiences illustrate how transformations are not necessarily clear-cut improvements in terms of environmental sustainability and social justice. In our case, young members of the local community used their tribal identity to fight for social justice by excluding the large-scale investors who were over-exploiting the aquifer. Their practices of commoning, however, produced new inequalities by, for example excluding the women of the community from the direct benefits of the aquifer. Similarly, protecting the aquifer from large-scale investors – labelled as 'outsiders' – was not about preserving the aquifer; the efforts of the local farmers, rather, were aimed merely at its more sustained use, and they continue to use chemicals and to intensively exploit the groundwater. Our examination of the practices of commoning in these communities, however, revealed their capacity for meaningfully changing how the future unfolds.

ACKNOWLEDGEMENTS

This research was supported by the T2SGS (Transformations to Groundwater Sustainability project), funded as part of the Belmont Forum and NORFACE research programme Transformations to Sustainability (T2S); the Programmatic Cooperation between the Directorate-General for International Cooperation (DGIS) of the Dutch Ministry of Foreign Affairs and IHE Delft in the period 2016-2020 (DUPC2); and the German Ministry of Education and Research (BMBF) in the framework of the project SALIDRAAjuj-01UU1906. Finally, we thank Elisabeth Berger and three anonymous reviewers for their constructive comments.

REFERENCES

- ABH (Agence du Bassin Hydraulique de Draa-Oued Noun). 2020. Étude d'élaboration du contrat de nappe de Feija Mission 2: Etat des lieux, tendance de l'évolution future et identification d'axes stratégiques d'amélioration de la situation actuelle. Sous-Mission 2.1: Etat des lieux.
- Agrimaroc. 2022. Fin de la subvention de l'irrigation localisée pour les cultures gourmandes en eau! September 9.
- Amsidder, L.; Alary, V. and Sraïri, T.M. 2021. An empirical approach of past and present mobility management in the desert societies of camel breeders in South Eastern Morocco. *Journal of Arid Environments* 189: 104501.

- Benchanna, I. 2022. Irrigation: Ces cultures « hydrovores » noyées de reproches ! *La Vie éco*, 12 (September). <https://www.lavieeco.com/journal-electronique/?fbclid=IwAR1FyxLISfT2IhnYwSWK-3i9rpdPM0yol45ODy2AtbmccKa1UxB30agsUiQ#live-pdf-23-septembre-2022/12/>
- Bentaleb, H. 2021. Zagora watermelon destroys soil and groundwater. *Libération*, May 11. https://www.libe.ma/La-pasteque-de-Zagora-destructrice-du-sol-et-de-la-nappe-phreatique_a125799.html.
- Berriane, Y. 2021. "La part des femmes". La judiciarisation de l'accès des femmes aux terres collectives au Maroc. *Cahiers d'Etudes Africaines* 242(2): 417-438.
- Boelens, R.; Gaybor, A. and Hendriks, J. 2014. Water grabbing in the Andean region: Illustrative cases from Peru and Ecuador. In Kaag, M. and Zoomers, A. (Eds), *The global land grab, beyond the hype*, pp. 100-16. London: Zed books.
- Bollier, D. 2020. Commoning as a transformative social paradigm. In Speth, J.G. and Courier, K. (Eds), *The new systems reader*, pp. 348-361. New York and London: Routledge.
- Bossenbroek, L.; Ftouhi, H. and Kadiri, Z. 2021. Watermeloenen in de Marokkaanse woestijn. *ZemZem* 1: 64-72, <https://www.zemzemtijdschrift.nl/2021/06/watermeloenen-in-de-marokkaanse-woestijn/>
- Bresnihan, P. 2016. The more-than-human commons: From commons to commoning. In Kirwan, S.; Dawney, L. and Brigstocke, J. (Eds), *Space, power and the commons*, pp. 93-112. New York and London: Routledge.
- Chaabi, C. 2022. A reduction in watermelon cultivation is envisaged in Zagora. *Media 24*. September 14, <https://medias24.com/2022/09/14/une-reduction-des-cultures-de-pasteques-est-envisagee-a-zagora/>
- Chakiri, M. 2022. الأحمر البطيخ زراعة لتقنين التحرك إلى الداخلية يدفع المغرب في الجفاف. *Hespress*. September 13, <https://www.hespress.com>
- Cleaver, F. 1999. Paradoxes of participation: Questioning participatory approaches to development. *Journal of International Development: The Journal of the Development Studies Association* 11(4): 597-612.
- Clement, F.; Harcourt, W.; Joshi, D. and Sato, C. 2019. Feminist political ecologies of the commons and commoning. *International Journal of the Commons* 13(1): 1-15.
- Daoudi, A. and Lejars, C. 2016. De l'agriculture oasienne à l'agriculture saharienne dans la région des Ziban en Algérie. Acteurs du dynamisme et facteurs d'incertitude. *New Medit* 2: 45-52.
- Dombroski, K.; Healy, S. and McKinnon, K. 2019. Care-full community economies. In Harcourt, W. and Bauhardt, C. (Eds), *Feminist political ecology and the economics of care: In search of economic alternatives*, pp. 99-115. New York and London: Routledge.
- Er rayhany, H.; Kadiri, Z.; Ait Mouss, F. and Bossenbroek, L. 2022. Pluralizing the oasis extensions: Heterogeneous farming profiles and practices in Toudgha (Morocco). *New Medit A Mediterranean Journal of Economics, Agriculture and Environment* 5: 159-174. DOI: [10.30682/nm2205m](https://doi.org/10.30682/nm2205m).
- Franco, J.; Feodoroff, T.; Kay, S. and Santos, R. 2014. *The global water grab a primer*. Amsterdam: Transnational Institute.
- Gibson-Graham, J.K.; Cameron, J. and Healy, S. 2016. In Commoning as a postcapitalist politics. Amin, A. and Howell, P. (Eds), *Releasing the commons*, pp. 192-212. New York and London: Routledge.
- Gibson-Graham, J.K. 2011. A feminist project of belonging for the Anthropocene. *Gender, Place and Culture* 18(01): 1-21.
- Hadeid, M.; Bellal, S.A.; Ghodbani, T. and Dari, O. 2018. L'agriculture au Sahara du sud-ouest algérien : Entre développement agricole moderne et permanences de l'agriculture oasienne traditionnelle. *Cahiers Agricultures* 27(1): 15005.

- Hamamouche, M.F.; Kuper, M.; Amichi, H.; Lejars, C. and Ghodbani, T. 2018. New reading of Saharan agricultural transformation: Continuities of ancient oases and their extensions (Algeria). *World Development* 107: 210-223.
- Harcourt, W. 2021. Rethinking life-in-common in the Australian Landscape. *Environment and Planning E: Nature and Space* 4(4): 1330-1345.
- HCP (Haut-Commissariat au Plan Direction Régionale d'Errachidia). 2015. Annuaire statistique regional Draa <https://www.hcp.ma/draatafilalet/attachment/998567/>
- Kadiri, Z.; Benmihoub, A.; Farolfi, S.; Khamassi, F. and Faysse, N. 2022. Making sense of on-going dynamics and innovations in oases and newly irrigated areas of North African arid regions: Towards more sustainable development pathways. *New Medit, A Mediterranean Journal of Economics, Agriculture and Environment* 5: I-VII.
- Kadiri, Z. and Er rayhany, H. 2019. La politique foncière de privatisation des terres collectives à l'épreuve des réalités d'appropriations et des conflits. *Alternatives Rurales* 7: 111-29.
- Karmaoui, A.; Ifaadassan, I.; Messouli, M. and Khebiza, M. 2015. Characterization of common environmental indicators of the Moroccan Oasean Biome pilot study in the reserve biosphere of oases in southern Morocco. *Advances in Research* 5(5): 1-15.
- Kuper, M.; Faysse, N.; Hammani, A.; Hartani, T.; Marlet, S.; Hamamouche, M.F. and Ameer, F. 2016. Liberation or anarchy? The Janus nature of groundwater use on North Africa's new irrigation frontiers. In Jakeman, A.J.; Barreteau, O.; Hunt, R.J.; Rinaudo, J.D. and Ross, A. (Eds), *Integrated groundwater management*, pp. 583-615. Cham: Springer International Publishing.
- Kuper, M.; Amichi, H. and Mayaux, P.L. 2017. Groundwater use in North Africa as a cautionary tale for climate change adaptation. *Water International* 42(6): 725-740.
- Lamqadem, A.A.; Saber, H. and Pradhan, B. 2019. Long-term monitoring of transformation from pastoral to agricultural land use using time-series Landsat data in the Feija Basin (Southeast Morocco). *Earth Systems and Environment* 3(3): 525-538.
- Le Matin. 2022. Zagora : la province impose des restrictions sur la culture de la pastèque. October 31, <https://lematin.ma/express/2022/zagora-restrictions-culture-paste-imposees/382564.html>
- Le Monde. 2017. Dans le Sud marocain, des « manifestations de la soif » contre les pénuries d'eau. May 13, https://www.lemonde.fr/afrique/article/2017/10/13/dans-le-sud-marocain-des-manifestations-de-la-soif-contre-les-penuries-d-eau_5200650_3212.html
- Llamas, M.R.; Martinez-Santos, P. and de la Hera, A. 2006. The manifold dimensions of groundwater sustainability: an overview. In Ragone, S.; de la Hera, A. and Hernandez-Mora, N. (Eds), *Proceedings of the International Symposium on Groundwater Sustainability*. OH, USA: National Ground Water Association Press.
- Margat, J. and van der Gun, J. 2013. *Groundwater around the world: A geographic synopsis*. CRC Press.
- Molle, F. and Closas, A. 2019a. Why is state-centered groundwater governance largely ineffective? A review. *Wiley Interdisciplinary Reviews: Water* 7(1): e1395.
- Molle, F. and Closas, A. 2019b. Comanagement of groundwater: A review. *Wiley Interdisciplinary Reviews: Water* 7(1): e1394.
- Moumane, A.; El Ghazali F. E.; Al Karkouri, J.; Delorme, J.; Batchi, M.; Chafiki, D. and Karmaoui, A. 2021. Monitoring spatiotemporal variation of groundwater level and salinity under land use change using integrated field measurements, GIS, geostatistical, and remote-sensing approach: Case study of the Feija aquifer, Middle Draa watershed, Moroccan Sahara. *Environmental Monitoring and Assessment* 193 (12): 769.
- Naouri, M.; Kuper, M. and Hartani, T. 2020. The power of translation: Innovation dialogues in the context of farmer-led innovation in the Algerian Sahara. *Agricultural Systems* 180: 102793.

- Nightingale, A.J. 2019. Commoning for inclusion? Political communities, commons, exclusion, property and socio-natural becomings. *International Journal of the Commons* 13(1): 16-35.
- Norström, A.V.; Cvitanovic, C.; Löf, M. F.; West, S.; Wyborn, C.; Balvanera, P.;... and Österblom, H. 2020. Principles for knowledge co-production in sustainability research. *Nature sustainability* 3(3): 182-190.
- Oldham, P.D. 2009. An access and benefit-sharing commons? The role of commons/open source licences in the international regime on access to genetic resources and benefit-sharing. *The Role of Commons/Open Source Licences in the International Regime on Access to Genetic Resources and Benefit-Sharing*. Initiative for the Prevention of Biopiracy, Research Documents, Year IV (11).
- Ouhajou, L.; Jadaoui, M. and El Mahdad, E. 2017. La gestion de l'eau et le changement climatique dans les oasis marocaines. *Hespéris-Tamuda* 52: 193-218.
- Rouillard, J.; Babbitt, C.; Pulido-Velazquez, M. and Rinaudo, J.D. 2021. Transitioning out of open access: A closer look at institutions for management of groundwater rights in France, California, and Spain. *Water Resources Research* 57(4): e2020WR028951.
- Schulz, O. 2006. Analyse schneehydrologischer Prozesse und Schneekartierung im Einzugsgebiet des Oued M'Goun, Zentraler Hoher Atlas (Marokko). PhD dissertation, Universitäts- und Landesbibliothek Bonn, Germany.
- Shah, T. 2010. *Taming the anarchy: Groundwater governance in South Asia*. New York and London: Routledge.
- Shimizu, T. 2006. Expansion of asparagus production and exports in Peru. *Institute of Developing Economies, Japan*.
- Siebert, S.; Burke, J.; Faures J.M.; Frenken, K.; Hoogeveen, J.; Döll, P. and Portmann, F.T. 2010. Groundwater use for irrigation – A global inventory. *Hydrology and Earth System Sciences* 14: 1863-1880.
- Sikor, T. and Lund, C. 2009. Access and property: A question of power and authority. *Development and Change* 40(1): 1-22.
- Tang, C.P. and Tang, S.Y. 2001. Negotiated autonomy: Transforming self-governing institutions for local common-pool resources in two tribal villages in Taiwan. *Human Ecology* 29(1): 49-67.
- Wamsler, C. and Riggers, S. 2018. Principles for supporting city-citizen commoning for climate adaptation: From adaptation governance to sustainable transformation. *Environmental Science and Policy* 85: 81-89.
- Zwarteveen, M.; Kuper, M.; Olmos-Herrera, C.; Dajani, M.; Kemerink-Seyoum, J.; Cleaver, F. et al. 2021. Transformations to groundwater sustainability: From individuals and pumps to communities and aquifers. *Current Opinion in Environmental Sustainability* 49: 88-97.

THIS ARTICLE IS DISTRIBUTED UNDER THE TERMS OF THE CREATIVE COMMONS ATTRIBUTION-NONCOMMERCIAL-SHAREALIKE LICENSE WHICH PERMITS ANY NON COMMERCIAL USE, DISTRIBUTION, AND REPRODUCTION IN ANY MEDIUM, PROVIDED THE ORIGINAL AUTHOR(S) AND SOURCE ARE CREDITED. SEE [HTTPS://CREATIVECOMMONS.ORG/LICENSES/BY-NC-SA/3.0/FR/DEED.EN](https://creativecommons.org/licenses/by-nc-sa/3.0/fr/deed.en)

