4 Wetlands in drylands

Large-scale appropriations for agriculture, conservation, and mining in Africa

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Introduction

In regions where water is scarce, wetlands stand in stark contrast to the surrounding dry environments. 'Wetlands in drylands' come in many forms: they may be large and linear as they follow rivers (floodplains, riverbanks, interior deltas) or small and dotted across the landscape (isolated inland lakes); they may be permanent or temporary, and disappear (due to siltation) or appear in new places; they include highland swamps and lower-lying areas where rainwater accumulates or streams converge; and they may be modified by small-scale users through the excavation of wells, the construction of small dams, and the digging of canals or ponds. In a context where rainfall is low, unpredictable, and seasonal, wetlands are key for human life because they remain wet throughout—or at least far into—the dry season, and during periods of drought they may be the only source of water available in a wide region. The presence of water also means that other important resources accumulate in and around wetlands (e.g. fish, pastures, fertile soils, and wildlife) and become useful to people, depending on the period of the year. Wetlands thus constitute a crucial source of livelihood for people living in the drylands, and to benefit from them local populations have developed institutions that allow for the flexible, seasonal, and common use of resources (Scoones 1991; Adams 1993; Woodhouse et al. 2000; Haller 2010a; Haller 2016).

Because wetlands in drylands hold such valuable resources and act as safety nets in times of drought, they are prone to conflict and competition (Scoones 1991; Woodhouse et al. 2000; Haller 2016). Conflicts may arise from resource pressure and resource use overlap (e.g. due to population growth), resource scarcity (e.g. drought), or because resources gain economic value and become attractive to new, commercially oriented actors (Scoones 1991; Woodhouse et al. 2000; Haller 2010a, 2010b). The literature has identified a variety of changes that may underlie these conflicts: climate change (affecting resource availability, such as that of fish); greater commoditization, monetization, and commercialization of

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resources; diversification, intensification, and expansion of wetland agriculture for cash cropping; government and donor-sponsored 'development' projects and schemes that introduce new technologies (e.g. pumps) and management systems (e.g. paddocked grazing schemes); growing demand for rice and other crops due to ongoing urbanization; and, last but not least, institutional changes since the colonial period that gradually eroded local institutions of access and use (Scoones 1991; Adams 1993; Woodhouse et al. 2000; Brouwer 2002, 2014; Haller 2010a, 2010b, 2016).

The literature on wetlands in drylands has mostly focused on the resource use dynamics that emerge from the gradual and diffuse processes of rural differentiation, market integration, and institutional and agrarian change described in the previous paragraph. Less studied are the large-scale interventions and investments that suddenly appropriate or claim control over whole wetland areas (or large parts thereof) and that interact with these processes of rural change. Whether in the name of development or conservation, or for the private gain of companies and investors, these interventions dramatically affect local access and resource use. In this chapter, we present three cases of large-scale appropriation of wetlands in Africa and discuss what they *do* on the ground to the wetlands and dryland populations. We contribute to the 'wetlands in drylands' emerging field of study that recognizes the importance of wetland use for dryland livelihoods, especially during droughts and dry seasons, highlights the seasonal complementarity of wetland and dryland resources, and thus approaches wetlands as an integral part of wider dryland resource use systems (Scoones 1991; Adams 1993; Brouwer 2014).[2] Each case of wetland appropriation will illustrate a process of change related to resource use, institutions, and livelihoods. The first case, on large-scale irrigation schemes in the Sahel, will illustrate a process of rigidization of resource use and is based on the work by authors Marina Bertoncin and Andrea Pase, who together with colleagues studied several irrigation projects between 2000 and 2018 in the Lake Chad region (Nigeria and Cameroon) and along the River Nile in Sudan. This research has been published in a number of works (Bertoncin and Pase 2012, 2017; Bertoncin et al. 2015, 2019, 2021). The second case, on conservation in Cameroon, exemplifies a pathway of institutional change (from common property to state property to open access) and is based on fieldwork carried out by Gilbert Fokou in and around the Waza National Park in the Logone floodplain in 2005–2006, which was supervised by author Tobias Haller and published as a book chapter (Fokou and Haller 2008). To complement this work, we also draw from two publications (Kelly 2013, 2014) based on more recent research (2008–2011) in the same area. The third case, on mining in Mozambique, will show how wetland appropriation may lead to less resilient livelihoods, and it draws from field research carried out by authors Angela Kronenburg García, Sá Nogueira Lisboa, and Luís Artur in 2018, which followed the public consultations on resettlement and compensation in the context of a new mining project in a wetland area. It also draws from an analysis of resettlement planning

documents and studies commissioned by the mining company. This research has not been published yet.

Institutions and wetland resource use by dryland populations

Junk et al. (1989) and Odum et al. (1995) have referred to wetlands in drylands' hydro-periods as 'pulses'.[3] The strong seasonality of rainfall in the drylands endows wetlands with a seasonal pulse and the year-to-year variability (i.e. droughts) with an inter-annual pulse. In floodplains, for example, seasonal rains (locally and in remote mountainous areas) feed the rivers so that large areas adjacent to the rivers inundate; towards the dry season, the water gradually retreats to the riverbeds. The rainy season and the flood season do not coincide; in the Sahel, for example, the rainy season is between June and September, while the floods are between September and December. This succession of seasons allows for the availability of different natural resources throughout the year, while the dynamic of flooding and recession gives local users differential access to resources, which may vary from year to year (Haller 2010a). Based on knowledge developed over time, dryland populations have adapted to this highly variable pulsing dynamic with flexible, mobile, and multiple resource uses, which, in turn, have shaped these landscapes and infused them with cultural meaning (Haller et al. 2013). Wetlands may be used by single user groups or by different groups for farming (wetlands hold rich soils), for the grazing of livestock, for fishing, for hunting and gathering, and for wood collection (Scoones 1991; Adams 1993; Haller 2010a, 2016; Bertoncin and Pase 2012; Brouwer 2014). In some places, wetlands accommodate sacred sites, such as cemeteries and prayer sites.

Wetlands function as 'pools of resilience' because they provide common-pool resources that may be vital for the survival of sedentary and mobile dryland populations (Haller 2016).[4] Common-pool resources include fish, pastures, wildlife, woodlots and natural products (e.g. honey, edible herbs, and roots), fertile soils, and water for agriculture (Haller 2010a; Haller 2010b; Haller 2016). Farmers, for example, may survive dry seasons by complementing rain-fed agriculture with dry season recessional farming in wetlands (i.e. when crops are sown in the moist soil as water recedes). In addition, wetlands provide the opportunity for diversification into crops that cannot be grown in the surrounding drylands (Scoones 1991). For transhumant pastoralists, who use particular wetlands only during a limited period of the year, wetlands are vital for the survival of their herds. Without access to wetlands, especially during extreme dry seasons when fodder is unavailable, their pastoral livelihoods may even collapse (see Haller 2020). Thus, wetlands not only facilitate the use of the surrounding drylands (Scoones 1991; Adams 1993; Brouwer 2014), but they also give the opportunity to buffer (climatic) risks through diversification and to foster resilient livelihoods, as they provide crucial resources when farming is otherwise impossible and pastoralism is under pressure.

In the drylands, access to the common-pool resources of wetlands has historically been regulated by rules that coordinate the different uses of different

users and user groups (Kouassigan 1966; Mizzau 1988; Lavigne Delville 1998; Pase 2011). Although these institutions mostly take the form of a common-property regime, wetland resources may sometimes be open to all (open access) or be held as private property. For example, in floodplains, fisheries and wildlife may be subject to an open-access regime during periods of high flood (because they are spread widely), a common-property regime at the beginning of the dry season (when water retreats and fish and wildlife are found in and around standing ponds), and a private property regime in dry times when families exclude others from use (Haller 2010b). Control over access and use typically lies with the 'first-comers', who enforce the locally developed rules and regulations and resolve conflicts (Haller 2010b, 2016). Access is thus not equal, as first-comers take precedence, but they also often grant those in need reciprocal access and coordinate the use of other groups (e.g. seasonal users, 'late-comers'), when protocols for asking permission are followed (Haller 2010b; 2016).

Large-scale wetland appropriations

The expansion of large-scale irrigated agriculture in the Sahel

Sahel wetlands have a long history of being targeted for large-scale irrigation projects. These projects, initially state-run and donor-supported and later under private investment (Kuper 2011; Bertoncin and Pase 2017), targeted the riverbanks and floodplains of major rivers, or major lakes and interior deltas. Large irrigation projects implemented during the colonial period include the Gezira in Sudan (Gaitskell 1959) and the Office du Niger in Mali, primarily for the production of cotton and rice (Morabito 1977, 1995). Under the creed of agricultural modernization, they involved huge infrastructures such as massive pumping systems, large dams, and hundreds of kilometres of channels; promoted mechanization and monocultures; and employed thousands of people. This trend continued after independence with a new wave of mega-irrigation projects, such as the Semry in Cameroon, and the Managil extension of the Gezira and the Rahad scheme in Sudan. If at first, these irrigation schemes seemed successful, they soon became marred by managerial and financial problems (often only a few years after the start of cultivation). In combination with fierce international competition (particularly cheap rice from Asia) and declining agricultural commodity prices, the strict work discipline imposed on project beneficiaries or 'allottees' (often consisting of both local and immigrating farmers), and the introduction of the structural adjustment programmes that reduced public funding in agriculture, they slowly collapsed. In some projects, production stopped completely; in others, large areas that had been prepared for irrigation were abandoned; and in yet others, operations continued but with considerable difficulties.

One wetland area intensively targeted by mega-irrigation projects has been Lake Chad, a very large but shallow lake located at the boundary intersection of the countries Niger, Chad, Nigeria, and Cameroon. One of the most significant projects implemented along the shores of the lake is the South Chad

Irrigation Project (SCIP) in Nigeria (Bertoncin and Pase 2012, 2017). It was part of a larger programme in the 1970s that sought to develop irrigation agriculture in the north-eastern region of the country to, on the one hand, counter a growing trend of rural-to-urban migration by offering migrants an alternative as project allottees, and on the other hand, to consolidate the local economy in what was considered a strategic (because peripheral) area along the international border. SCIP targeted a floodplain along two tributaries of the lake, comprising an area of about 9,300 ha, which was used intensively for the cultivation of sorghum through recessional agriculture, and millet, onions, okra, and peanuts through rain-fed agriculture, as well as for grazing and fishing, by 18 villages with a total population of about 10,000. In a very short period of time, channels and pumping stations were constructed for the mechanized production of wheat, rice, and cotton, as well as offices, warehouses, and 'modern' villages for the allottees. More than 3,000 workers were employed.

After a peak harvest in 1983–1984, nothing was harvested the following year and the project stopped. An important reason for this failure was the lack of water due to a receding lake in the context of the 1980s' droughts. When the water returned in 1988, the structures, having been inactive for so long, no longer worked effectively and there was no money available to repair them. Nigeria had been thrown into an economic crisis, following a drastic reduction of petroleum income, and the government had ceased to fund agricultural modernization. In the following years, the pumps were reactivated from time to time to irrigate ever-decreasing areas of land, and many former allottees moved on to other places. Some of the farmers that stayed, however, gradually re-appropriated parts of the project for productive use. Inside the project area, they used improvised pumps to irrigate a few hundred hectares, and in the lower zones where rainwater accumulates or inside the channels of the project, they returned to cultivating sorghum. Outside the project area, but along the intake channel, which draws water from the lake and which started working again after the droughts, farmers installed small pumps to irrigate land. In the surrounding floodplain, they have resumed recessional agriculture.

Although significantly transformed by irrigation infrastructure, the (re-)claiming of wetland areas by local farmers and immigrant allottees from failed mega-projects has also been observed in Cameroon's Semry II project (Bertoncin et al. 2015). In Sudan's Gezira scheme, one of the largest irrigation projects in Africa, the Sudan state handed over the management of the Gezira scheme to the allottees and recognized their autonomy and land rights—although the state still manages the dams that feed the Gezira and therefore continues to control the availability of water for cultivation (Bertoncin et al. 2019).

Large-scale irrigation in the Sahel received a new impetus in the context of the 2008 global land rush by investors, following the abrupt rise of agricultural commodity prices. Host governments in Africa welcomed these investments, seeing in them a new opportunity to realize old ambitions of agricultural modernization (Woodhouse 2012). Different from the 'solid and heavy' projects characteristic of the earlier mega-irrigation schemes of the colonial and postcolonial period,

domestic and foreign investors set up 'light and mobile' hydro-agriculture projects that were medium to large scale. They tended to avoid large costs for infrastructures (favouring light irrigation systems instead) and employed a very small number of personnel, which was possible thanks to the push towards complete mechanization. Most investors and entrepreneurs avoided the lands once developed by the earlier mega-projects, re-occupied as they often were by local farmers, but also because of the bad state of the infrastructure and the complicated bureaucracy to acquire them legally.[5] As a result, they targeted the wetland areas next to or near the old mega-projects or totally new areas far from rivers, targeting groundwater for large, mechanized irrigation agriculture and creating, in the latter case, new, artificial, and extremely fragile wetlands in the middle of the desert.

A case in point is the 'green circles in the desert' along the River Nile in Sudan, named after their central pivot technology, which creates round irrigated fields (Bertoncin et al. 2019) (Figure 4.1). While the Gezira and other irrigation schemes are located south of Khartoum between the White and the Blue Nile, to the north of the capital city new irrigation projects (ranging from 2,000 to 100,000 ha in area) started to appear in the early 2000s. This trend accelerated following the food price spike of 2007–2008 and received a new boost in 2013 with the passing of investor-friendly legislation. These projects, driven by foreign investors, mainly produce fodder (alfalfa) for the Gulf countries, who are outsourcing their agricultural production owing to water shortage at home. The potential for expansion of alfalfa cultivation in Sudan is enormous, as the demand for fodder in countries such as Saudi Arabia and the United Arab Emirates is ever-growing, and

Figure 4.1 Irrigated area with central pivot system in River Nile State, Sudan, for the production of fodder destined for the markets of Saudi Arabia (2015). Photo taken by Marina Bertoncin.

therefore these irrigation enclaves are likely to continue multiplying northwards from Khartoum and outwards from the River Nile. Even though these projects are not located immediately adjacent to the river—sometimes they are even tens of kilometres away into the desert—and may also make use of groundwater, they still often have to acquire the strip of land that connects their project to the river to access water from the river through underground pipes or canals. The lands along the river are usually densely populated and intensively used for horticulture and cultivation of fruit trees, while the more inland areas are used for nomadic and semi-nomadic grazing. These projects, with their fences and sometimes police checks, are clearly separating irrigated areas from the surrounding drylands and creating new agricultural spaces completely controlled by investors, to the exclusion of former users.

Shifting conservation approaches in the Waza National Park in Cameroon

With the Ramsar Convention in 1971,[6] an international treaty for wetland protection, the issue of wetlands in drylands was placed squarely on the conservation agenda. Initially valued as habitats for migratory water birds and later for their 'ecosystem services' (Tooth et al. 2015), protected wetlands in Africa have undergone various institutional changes in line with changing international conservation priorities and discourses. 'Fortress conservation', a conservation model that rests on the belief that a strict separation between local populations and conservation areas is best for biodiversity protection, excluded all consumptive use of protected areas and was for a long time the dominant conservation approach in dryland areas and elsewhere (Neumann 1998; Brockington 2002). Following criticism of this approach, a shift occurred towards participatory and more community-inclusive conservation in the 1970s and 1980s (Adams and Hulme 2001; Galvin and Haller 2008; Bollig and Lesorogol 2016). Conservation approaches then took two different trajectories. On the one hand, there is a so-called back to the barriers tendency, advocating for stricter preservationist measures (Wilshusen et al. 2002; Hutton et al. 2005). One of the most significant examples of this new trend is the 2014–2019 banning of trophy hunting in Botswana (including areas around the Okavango Delta and the Chobe floodplain), which represented one way in which local people could benefit from wildlife conservation, as community trusts were entitled to a percentage of the trophy-hunting revenues (LaRocco 2016; Mbaiwa 2018; Blaikie 2019). On the other hand, starting in the early 2000s, there was a move away from 'biodiversity hotspots' and charismatic megafauna to conservation strategies accommodating climate change scenarios (Kelly 2013). The case we present below suggests that as a result of this latter development, conservation funding for wetlands in dryland areas started to dry up as international environmental organizations shifted their attention towards more humid and forested ecosystems.

The Logone floodplain is located in the southernmost tip of the Sahel and forms part of the Lake Chad basin, covering over a million hectares of land in

Figure 4.2 Channels for catching fish when the flood recedes from the Logone floodplain, Far North Region, Cameroon (2021). Photo taken by Aboukar Mahamat.

Chad and Cameroon. It is considered one of the most productive inland fisheries of Sub-Saharan Africa (Figure 4.2). The floodplain also supports a rich variety of wildlife and birds, including migratory birds from Europe. It is for this high biodiversity that the Waza National Park was created in Cameroon, which is partly situated in the Logone floodplain and covers an area of 170,000 ha (Fokou and Haller 2008). The park was initially established as a French colonial hunting area in 1934 to gain control over the highly mobile people of northern Cameroon (Kelly 2014), and it was declared a UNESCO Man and Biosphere Reserve in 1979 (Fokou and Haller 2008). The strict 'fortress' approach adopted by the park affected several specialized user groups that had long profited from the rich diversity of natural resources in the area. These included sedentary Kotoko fishermen and Musgum agro-pastoral-fishermen, and the pastoral Choa Arabs and Fulbe coming in from the north (including from Nigeria and Chad) during the dry seasons in search of lush pastures and watering sources (Fokou and Haller 2008). As the first settlers in the Logone floodplain, the Kotoko claimed common ownership of the land and, as such, regulated access to fishing and pastoral resources. Fisheries were managed as the common property of the village. The Fulbe and Choa Arabs had to request permission to access pastures and they paid taxes and tributes, while the Musgum had to follow different rules for different seasons and also paid taxes. Local Kotoko chiefs decided over and coordinated the activities of the various users regarding timing, intensity, and seasonal conditions. This flexible coordination of resource use during and between seasons was important in limiting conflicts between the different user groups (Haller 2020).

Waza National Park was known for its strict and violent enforcement of fortress conservation, which banned all local resource use inside the park but kept the area open to tourists (Kelly 2014). While historical users lost agricultural fields and legal access to pastures, fisheries, and hunting grounds, and those living within the perimeter of the park were evicted without compensation, they never really stopped using the resources of the park, going there overnight or during the flood season when it was more difficult for the guards to patrol the park boundaries (Fokou and Haller 2008). Continued access to the park was important to supplement their food supplies, especially during the dry seasons when resources were scarce elsewhere but still abundant in the park. Also, as Kelly (2014) explains, some people were able to maintain limited access to the park through their relationships and negotiations with park guards, gaining advantage over people who lived further afield and were thus unable to foster relationships with guards. It was these 'outsiders' that were violently excluded from the park, suffering from the brutal and sometimes deadly punishments by guards for trespassing into the park (Kelly 2014).

In the 1970s and 1980s, severe droughts and the construction of a dam upstream of the Logone River for a large-scale rice irrigation project (Semry II) had a major impact on the Logone wetland (Bertoncin and Pase 2012). Flooding area was reduced by 30% (IUCN 2013 in Fokou and Haller 2008), which severely decreased the availability of fish, pastures, and wildlife in the floodplain. Poaching increased in the park, and resources in the larger floodplain became overexploited. Eventually, about 40% of the population that depended on the wetlands' natural resources left the area (Scholte 2003 in Fokou and Haller 2008). In the mid-1980s, as Cameroon entered a prolonged economic crisis and government funding for the park was cut, park infrastructure slowly deteriorated and the pay of park managers and guards was severely reduced. In response to declining government control of the Waza National Park (Kelly 2014), but also to mitigate the changes caused by the dam, international actors stepped in and in 1992 an IUCN-led co-management project was initiated that integrated conservation and development through a 'return of the water' policy (Fokou and Haller 2008). The project targeted the buffer zones around the Waza National Park and was in line with a more participatory approach to conservation adopted by the park authorities (following new international conservation discourse), which aimed at involving local communities in the decision-making process of a new management plan. The plan included new rules for fishing and allowed the consumptive use of some resources (wood, resin, thatch), but hunting, agriculture, and grazing continued to be forbidden. Although the IUCN re-flooding programme improved the ecological condition of the larger wetland, the implementation of the management plan was very slow, and while some use of resources in the park was now officially permitted, for local communities the losses (crops and livestock, due to lions and elephants) continued to be far greater than the gains from conservation (compensations, tourism, and trophy-hunting revenues).

As climate change mitigation became the new international conservation focus in the early 2000s, donors and international NGOs involved in the IUCN

project shifted their attention towards Cameroon's southern—more forested—areas (Kelly 2014). The IUCN project was phased out, and by 2008 the Waza National Park was practically abandoned. Without national or international control over resource use in the Waza National Park, 'outsiders' (i.e. those formerly excluded from the park) began flooding the area and included

> agriculturalists and pastoralists leaving places like Chad and Niger due to drought, political refugees from surrounding nations, decommissioned soldiers from places like Chad, militants from Nigeria, and the unemployed (Cameroonian and foreign-nationals alike) created by the region's economic crisis.
>
> (Kelly 2014: 739)[7]

While some of these new actors were drawn by the newly accessible natural resources of the park, other more violent actors (thieves, kidnappers) used this now unprotected and unsupervised area to hide. As a result, local resource users who had enjoyed limited access to the park (illegally or through arrangements with guards) not only saw their food security being threatened by the uncontrolled use of resources by outsiders, but—because of the presence of violent actors in the park and increasing insecurity—were increasingly unwilling to enter the park at all.

Mining, resettlement, and compensation in Mozambique

Africa has experienced a boom in mining and extraction since about 2000 (Chuhan-Pole et al. 2017). Growing interest by investors and international companies in the region's abundant natural resources, ranging from oil and natural gas to all sorts of metals and minerals, has led to increased resource exploration, new deposit discoveries, and increasing mine openings. Although large-scale resource extraction in Africa has a longer history associated with imperialism and colonialism, what makes this boom new is that it is being facilitated by host governments through the introduction of new, investor-friendly policies in the name of socioeconomic development (Jacka 2018). Reforms in the mining sector, often under pressure from structural adjustment programmes, have pushed commodity prices up and have spurred a global wave of international mining companies targeting resource-rich countries in Africa and elsewhere (Jacka 2018). Wetlands in drylands are increasingly being affected by this corporate rush in search of mineral wealth. Often this happens indirectly, such as when extractive activities elsewhere have a downstream impact on wetland areas.[8] But sometimes, the wetland itself holds resource wealth and is the target of mining operations. We present such a case from Mozambique, a country whose economic model of development has taken an 'extractive turn' (Wiegink 2018) following the discovery of enormous reserves of coal, natural gas, heavy mineral sands, graphite, rubies, and gold since 2003 (EITI 2008).

Kenmare Resources PLC ('Kenmare') is an Irish company and the first one to exploit Mozambique's large deposits of heavy mineral sands. The company has

a relatively good reputation in Mozambique.[9] Heavy sands are primarily found along the coast and contain zircon and titanium minerals, which are important for the construction sector and are used in paints and coatings, PVC piping, decorative laminates, and ceramic tiling. Kenmare began constructing their first mine in 2004 on the coast of Nampula Province in northern Mozambique and first achieved production in 2007. About a decade later, as the mine's ore concentrates were diminishing, it redirected its attention to a new deposit further south, in a heavily utilized wetland area along the coastline but separated from the sea by dunes, and acquired a land-use right (called DUAT) of 3,263 ha, of which it planned to mine 1,267 ha. This inland wetland area extends over a lower-lying stretch of land of no more than 2-km wide, containing a large lake and a river running in parallel to the coastline, which is fed by numerous smaller rivers coming from the higher-lying land and forming a floodplain and swampland in the northern part of the area.[10] Overlooking this lowland are five villages of shifting cultivators and fishermen who make intensive use of the wetland area. Many villagers (approx. 40%; see CES 2018a) have agricultural fields in the wetland, where they grow crops such as cassava, beans, peas, okra, groundnuts, and pumpkin, as well as crop trees such as cashew, banana, and mango trees. Many families also grow water-hungry crops such as rice and sugarcane, and some have excavated vegetable gardens in the swampy areas. Maritime fishing is an important livelihood activity, and crisscrossing the wetland are a number of pathways to reach the sea. When coastal fishing is not possible (e.g. due to weather conditions), fishing takes place in the lake and rivers, which are also used for bathing and washing. The area is a source of firewood, building materials (wood, grasses, reeds, sand, clay), and wood for making furniture and boats, and a place for gathering fruits and plants for consumption and for medicinal use. There are some boreholes, and several cemeteries, individual graves, and sacred sites for ceremonies and prayers. Although most families live in the villages, a few live in the wetland area on a permanent basis. Along the coastline, there are a number of temporary shelters used by people who live further inland on an ad-hoc basis throughout the year for fishing.

The mining process would involve a drastic transformation of the landscape and included stripping the land of its vegetation, removing the topsoil, diverting half of the river, and dredging the swampy areas in order to excavate an artificial pond to extract the zircon and titanium from the sand. But before these activities could begin, people living in the wetland area and using its resources would need to move and stop using the area.

Government regulations in Mozambique require companies to resettle and compensate anyone who lives on or uses the targeted land. A guiding principle in resettlement practice is to ensure that no affected person or community is worse off after resettlement. In early 2017, Kenmare hired a specialist consultancy company to develop a Resettlement Action Plan (RAP) in consultation with government authorities and affected community members. Numerous meetings were held in this process, including the four legally required public consultations with the affected villages, and numerous studies were carried out to identify potential

impacts and losses. An important task of the consultancy company was to take inventory of all 'assets' in the wetland area that would be affected by the new mine and to determine whether and how to resettle or compensate its owners. For this, Mozambican legislation on land and resettlement was followed closely,[11] the most determinative principle being that as the land belongs to the state, it cannot be bought or sold and hence it cannot be compensated for. Instead, what is compensated for is the *use* of land, or more precisely what is *on* the land (i.e. the assets: houses, crops, etc.), and lost agricultural fields should be replaced with new agricultural fields. Thus, while land ownership is not recognized (even though local users consider themselves the owners of the land), ownership of assets is. The consultancy company identified 14 houses that would need to be physically resettled[12] and 4,224 agricultural fields for which new land of the same size would need to be found. Compensation would be paid for lost crops and crop trees and for secondary structures (e.g. outside kitchens, crop storages, livestock enclosures). However, the loss of communal resources would not be compensated. Instead, the consultants advised the company to reserve as much as possible of the lake, cemeteries, and sacred sites (those cemeteries and graves that could not be preserved would need to be relocated) and to create access routes to these sites as well as to the rivers and coastline for fishing. It was also proposed to create access corridors for harvesting other common-pool resources such as firewood, grasses, medicinal plants, and fruits. The RAP also detailed special support to vulnerable individuals, additional cash payments to resettled farmers (e.g. for the effort of preparing the new field), financial assistance for registering their new landholdings, and agricultural extension services for two agricultural seasons. Finally, all five villages would be integrated as CSR beneficiaries of the company-funded NGO.

Processes of change

All three cases of wetland appropriation presented above have brought (or were about to bring) drastic changes to the lives of the local populations in terms of resource use, institutions, and livelihoods. We distil and discuss three processes of change (rigidization, institutional change, loss of resilience) apparent in all cases to a greater or lesser extent, and we illustrate each by digging deeper into one of the cases.

Rigidization

Large-scale irrigation projects brought rigidity to wetlands where flexibility had previously reigned (Bertoncin and Pase 2017). As we have seen, dryland's irregular seasonal and inter-annual rainfall and the strong variability in river water levels affect the resource dynamics in wetland areas. Based on knowledge developed over time, local populations have adapted to these dynamics with flexible and mobile practices and institutions that accommodate multiple resource uses and users at different times and seasons. Mega-irrigation projects dismissed this flexible resource use, introduced rigidity that 'intercepts and blocks space, relationships,

knowledge and organizations' (Bertoncin and Pase 2017: 245), and created boundaries of exclusion. The SCIP in north-eastern Nigeria brought modern technology that radically modified the landscape into geometrically partitioned spaces, controlling what entered and left (water, people, produce), when, and how much. It also introduced new institutions and power hierarchies imposing an iron discipline, techno-scientific expertise that comes from the global North, and agro-industrial production practices and procedures (e.g. monocultures) directed from above through scheduled timetables. In the process, it marginalized local institutions and authorities; ignored local knowledge of the land and the rhythm of the water; and kept the natural floods, traditional crops, and the herds outside the project perimeter. SCIP's rigidity was unable to deal with the Sahel's climate variability, which eventually added to its failure. Even though its hydrographic interventions had managed to master the wetland's seasonal pulse, it was unprepared for its inter-annual and longer-term pulsations. Lake Chad is capricious, and its surface changes rapidly depending on how much water comes in through its tributaries. There are in fact three Lake Chads, depending on the water level; the Small, the Medium, and the Great Chad. The SCIP was designed for the conditions that existed in the 1950s and 1960s (i.e. those of Medium Chad). However, with the 1970s and 1980s droughts, the lake rapidly switched to Small Chad and the project was left without water for agricultural irrigation. SCIP's rigid water control structures turned out to be inappropriate for a climate characterized by the erratic rainfall of the Sahel and the unpredictability of river floods. We also saw that farmers re-appropriated the wetland area. In doing so, they challenged the rigidity of the project by 'planting where it was not expected, accessing water where it was not allowed, [and] growing what was not permitted' (Bertoncin and Pase 2017: 251). In effect, they reintroduced flexibility and common use by repurposing project infrastructures, coming up with innovative solutions, and taking advantage of project expertise. This was thus not a 'going back to the old ways' but a creative and unexpected integration of modern knowledge and traditional expertise. This hybrid form of resource use combined the flexibility that seasonal rainfall demands (recession agriculture after the rainy season) with new technologies and project infrastructure—namely, using small motor pumps along the intake channel to draw the only water available in the area during the dry season (Bertoncin et al. 2015).

Institutional change

While the failure and defunding of Lake Chad's irrigation project led to re-appropriation and re-use, in the case of the Waza National Park in Cameroon it led to insecurity and open access. At the heart of this unfolding lies the violent nature of the institutional transformations that this portion of the Logone wetland underwent as it followed the tune of international conservation discourse. In the course of these developments, the very institutions that for a long time had quite effectively regulated the common use of resources by different groups were weakened and undermined (Fokou and Haller 2008). When the Waza National

Park was created, the designated conservation area became state property, and state rules now dictated the terms of access. Institutions enforcing fortress conservation were introduced that criminalized local resource use—particularly livestock grazing, which was seen to compete with herbivores during the dry season (cattle found in the park were shot or confiscated). However, as we saw, even though local institutions were replaced and local chiefs lost resource control, this new institutional framework *did* allow for some local resource uses—however limited—in the park during different periods. Between 1930 and the late 1990s, park authorities tolerated some access by local users, while violently excluding those living further away from the park (Kelly 2014).[13] In the more participatory era of the park, in the 1990s and early 2000s, when international actors stepped in to fill declining state funding, a new management plan legalized some resource uses, while it continued to prohibit others. What was declared participatory conservation was thus still very much a top-down approach (Fokou and Haller 2008). However, when these international actors also withdrew funding and left the park, local chiefs whose villages had previously been within park boundaries lacked the authority to retake control and re-introduce their institutions of use and access (Kelly 2014). Nomadic pastoralists, for example, coming from outside Cameroon to graze their animals in the Logone floodplain, no longer recognized Kotoko institutions, because they had been paying taxes to the state; and once paid, they were told by state authorities that they were free to go wherever they wanted, an argument they used to ignore local rules of access and use (Fokou and Haller 2008; Haller 2020). Thus, more than 70 years of enforcing biodiversity conservation had effectively erased local institutions, and as conservation actors left, an institutional vacuum was created (Kelly 2014). By 2008, the park became a *de facto* open-access space characterized by uncontrolled overuse (Kelly 2014). It also became a hideout for violent actors, deterring local resource users from entering the park (Kelly 2014). With this, long-term users finally lost the little access they still had. As access to the relatively abundant resources in the park had been important for them in times of food shortage, it also critically threatened their food security—a major problem in an environment where resources fluctuate drastically, both seasonally and annually (Haller 2020).

Loss of resilience

While the Sahel and the Cameroon cases concern appropriations that took place a long time ago (allowing us to assess long-term impacts and changes), the Mozambique case covers a recent appropriation. Also, because the last field visit was undertaken before the resettlement took place and the new mine was established (in 2020), we cannot comment on the actual impacts of this large-scale wetland appropriation. We can, however, apply a 'wetlands in drylands' lens to analyse the pre-resettlement public consultations and the RAP and show how this appropriation will likely undermine the resilience of local livelihoods, despite Kenmare's best intentions and intensive engagement with stakeholders to ensure that livelihoods are maintained or improved after resettlement.

In developing the RAP, Kenmare made sure to adhere to Mozambican regulations. In doing so, however, it also incorporated some biases inherent in national legislation that account for a number of 'invisible losses' (Witter and Satterfield 2014), some of which reduce the capacity of local resource users to cope in dryland environments. One bias is the snapshot understanding of agricultural land use—that is, considering only land that is under cultivation at a certain point in time, with the result that fallow land is not replaced or compensated for, even though it is an integral part of the agricultural system of shifting cultivators. The standard answer during public consultations to questions by villagers about fallow land was: 'The land belongs to the government, and fallow land is not compensated'. Another bias is the narrow understanding of 'asset' and property, with the result that only those assets with clearly identifiable (individual) owners were considered for compensation. The loss of common-pool assets or resources (e.g. medicinal plants, woodlots) was not slated for compensation. Yet access and use of some common-pool resources are key to people's year-round food security. Wild fruits and roots, for example, are mostly gathered at the end of the rainy season and during the dry season to complement cultivated food supplies. Reduced access to these resources thus threatens people's resilience in times of food scarcity.

These two examples illustrate how the RAP took no notice of the seasonal and inter-annual use of land and natural resources in dryland livelihoods, uses which are crucial when the main economic activity is rain-fed agriculture. On top of this, it overlooked how the use of certain resources forms part of a wider system of natural-resource use—meaning that when access is reduced to one resource, the whole system is put under pressure if no adequate compensation is provided. Although some resources (e.g. wood) can be found both in the lower-lying wetland area and in the drier upland, a number of key resources (fish, an important source of protein for the local diet) are particularly abundant in the wetland, illustrating the 'niche' (Scoones 1991) function of wetland use in dryland areas. This nuance—that is, the relationship between wet lowland and dry highland and its socioeconomic significance—was missing in the studies, with the wetland impact assessment (CES 2018b) focusing exclusively on ecological functions, while the study on land and natural resource use (CES 2018c) insufficiently emphasized the wetland particularity of resource use. The most problematic consequence of this oversight is that agricultural fields in the wetland were replaced with agricultural fields in the dryland. In this process, resettled people lost wetland-specific agricultural resources, such as fertile land and water for irrigation, and the opportunity to grow water-hungry crops (rice, sugarcane, bananas), thus losing an important diversification option and the ability to spread food security risks. Income from bananas in particular is key during poverty cycles and hunger months.

In summary, by failing to consider the significance of wetlands in drylands as 'pools of resilience' (Haller 2016) for local livelihoods, people's resource needs during times of stress (e.g. dry seasons, droughts, food scarcity) were not taken into consideration in the resettlement planning process.

Conclusion

Large-scale appropriations of wetlands in drylands by powerful actors (states, companies, international environmental organizations) restrict access to natural resources that are vital to the livelihoods and food security of dryland populations. Sometimes negotiated or stealthy access is still possible (albeit at the risk of violent retribution, as in Cameroon), but in other cases appropriations involve such drastic changes to the landscape (mining in Mozambique) that there are simply no resources left to access, even illegally. When large-scale investments or interventions in wetlands fail or end and their proponents leave, either wetland resources can be re-appropriated by the local population (irrigation projects in the Sahel), or wetlands can become ungoverned spaces such that those who had retained limited access now lose all access, while other more violent actors (re-)gain (new) access (Cameroon).

Reduced or lost access to wetlands has impacts in the wider region, as former users move elsewhere or overuse nearby resources to compensate for lost resources, potentially triggering conflict and competition over resources. Further work could better tease out how sudden changes due to large-scale appropriations interact with the well-documented piecemeal and gradual changes of rural differentiation, market integration, population growth, and so on that underlie many of the resource use conflicts and competition in and around wetlands in drylands.

Large-scale appropriations set processes of change in motion that have important implications for wetlands and their long-time users. New actors often introduce rigid ways of using and managing resources that are out of sync with the climatic variability of drylands and the pulsations of wetlands, supplanting the flexible resource use practices of dryland inhabitants. Along with changes in resource use and access, institutions for managing and governing resource use in wetlands also change, as new institutions undermine and sometimes erase local rules of access, coordination, and conflict resolution. Last but not least, dryland users stand to lose resilience as wetland appropriation takes away common-pool resources that are vital for surviving the variable climatic and low rainfall conditions of drylands. Overall, we may conclude that large-scale appropriations of wetlands in drylands displace and dispossess historical dryland users from a key livelihood resource and thus further marginalize a population that is already among the most marginalized and food-insecure in the world.

Notes

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2 See also, The Wetlands in Drylands (WiDs) Research Network: http://wetlandsindrylands.net [Accessed 2 July 2021].

3 Hydro-periods are the number of days per year that an area of land is wet.
4 Resilience is broadly understood here as the capacity to recover from times of emergency (e.g. droughts, political insecurity, economic crises).
5 In a few places, as along the Blue Nile River (Bertoncin et al. 2021), new investments *do* take place in former irrigation schemes.
6 Named after the Iranian city where the convention took place.
7 For nomadic pastoralists, whose access to dry season grazing elsewhere in the floodplain had been gradually reduced over the decades (owing to agricultural expansion, more fishing canals, conflicts, large-scale irrigation projects), going to the park may have been the only option available (Haller 2020).
8 As is the case of oil exploration in Namibia, which is impacting the Okavango Delta in Botswana: https://www.nationalgeographic.com/animals/article/oil-company-reconafrica-accused-of-ignoring-communities-concerns [Accessed 9 June 2021].
9 In a study on social impacts of heavy sands mining in Mozambique, it compared favourably with the other company (Chichava et al. 2019), and in 2020 it was proclaimed the most transparent company in the extractives sector in Mozambique by watchdog organization *Centro de Integridade Pública* (CIP).
10 The wetland study (CES 2018b) follows an ecological and narrower definition of wetland, focusing exclusively on the marshes, peatlands, and water bodies in this lower-lying area, while our understanding of wetland is broader, taking into account its social and livelihood functions, and includes the adjacent areas, thus covering the general lower-lying area. The other study we draw on is the soil, land, and natural resource use study (CES 2018c), which focuses on all the natural resources that the affected villages rely on, both in the higher-lying and the lower-lying lands.
11 Performance Standard 5 of the International Finance Corporation (IFC) was also followed, which defines best practices in terms of resettlement.
12 Eventually only eight required resettlement.
13 Pastoralists, also 'local' users, appear to have been tolerated less than sedentary users, whom interacted with guards stationed in their villages on a daily basis and hence were able to forge stronger relationships (Kelly 2013).

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