

## 6 The 'open cut' in drylands

### Challenges of artisanal mining and pastoralism encountering industrial mining, development, and resource grabbing

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#### Introduction

The history of mining in drylands extends for thousands of years. In antiquity, the Persians, Egyptians, and Romans were masters of extraction as gold, copper, silver, and so on were mined across the Middle East and Africa (Bromehead 1940). Mining is documented for millennia across the Central Asian and Mongolian steppe (Hsu et al. 2016). Nixon et al. (2011) write about copper extraction in the Sahel a thousand years ago and note that the Malian empire was the world's major gold producer in the Middle Ages (Kevane 2015). While the context and methods have evolved over the centuries, mining continues to configure society and arid environments from the Sahara to the Gobi. In these locales, pastoralists and agrarians have practised customary livelihoods for generations; today artisanal mining, multinational corporations, terrorist groups, and states all seek to control or derive benefit from resource extraction. State actors, mine license holders, and armed groups compete and conflict with communities over traditional land use. In marginal drylands, mining's detrimental impacts affect inhabitants, local governance, security, and livelihoods.

Drylands are contentious mining zones due to limited water, marginal environments, and extensive livelihoods such as pastoralism and subsistence farming. The common notion is that drylands are wastelands and thus exploitable (Mortimore et al. 2009). Here, we investigate mining struggles in two drylands—the Sahel (Niger, Mali) and Inner Asian Gobi (Mongolia)—where a confluence of forces present mining-related challenges to agro-pastoralism, including challenges of reduced mobility, social viability, pollution of resources, and state security (Niederberger et al. 2016; Sternberg et al. 2020). Previously considered 'remote', drylands are now at the forefront of climate change, sociopolitical conflict, resource extraction, and state fragility. Residents, often mobile pastoralists, agriculturalists, or artisanal miners, experience rapid transitions that reconfigure lives, land tenure, mobility, and common-property institutions. Degradation and fragmentation of grazing lands from mining processes impact land use, migration, and animal and human health, and they undermine resilience and livelihoods

(Haller 2020). In the Sahel, armed militia and terrorist groups assert authority over vast regions as state control dissipates. In Mongolia, climate variability and water conflicts related to mines threaten pastoralists where precipitation is less than 100 mm annually. Dryland marginality—low moisture, limited ecological productivity, distance from services—is further exacerbated by the new social and economic forces initiated by mining.

Outsiders from urban centres or foreign investors can control land and overrule customary tenure patterns. Commons grabbing, a consequence of resource extraction, undermines local people (Haller 2020) via state legal enforcement, where mining licenses exert economic influence and impose overriding, legalized rights (Niederberger et al. 2016). The endemic challenge of access to water as a scarce and unpredictable resource is complicated by mining's massive demand for water. Furthermore, climate factors disproportionately affect environmentally based agro-pastoral lives. Here, historically rooted land-grabbing processes can nullify notions of territoriality and acceptable land use, as core livelihoods are peripheralized and made untenable (Haller 2019).

The inexorable demand for minerals, funded by international investments, has long dominated desert spheres. Driven by the market value of certain minerals (e.g. lithium, rare earth elements, graphite) for so-called green technology intensifies mineral production (Vidal et al. 2013; Sovacool et al. 2020). Mining-community conflicts, once about jobs, local benefits, and degradation, and intensified by climate factors, are now also about investment schemes and state development. These processes are tracked on social media by civil society and international agencies. Reflecting global agendas, our Sahel case study, with its mines important for France in relation to its colonial legacy, is a context hosting the French military and encountering insecurity driven by extremist groups and migration routes to Europe. Mongolia, on China's border, has become the latter's largest source of coal imports: it promotes resource nationalism, though mining accounts for 80% of exports (Enkhjargal 2021). Business models and infrastructure development seldom consider desert residents, nor does the rush to extraction recognize artisanal mining as a worthy or viable option. Licenses are issued in capital cities, while impacts are felt in rural peripheries; the story on the ground is one of rapid transition, a struggle to sustain livelihoods, and communities deprived of state support and even minimal public services.

The business strategies and perspectives in our focus regions centre on multi-national extraction by corporations such as Rio Tinto in Mongolia, Centerra in Kyrgyzstan, and Areva in the Sahel, joined by Chinese firms as part of the Belt and Road Initiative. These multi-million to multi-billion US dollar investments generate significant state revenue and political support. Their ability to obtain mining licenses often contravenes existing communal land use and tenure systems, contributing to local uncertainty and income loss. The intensification and technological levels require skills beyond those of local communities, with residents neglected or displaced in this approach. Existing livelihoods are disrupted as control and militarized enclosures (fencing, securitization, closing off of water access) discourage artisanal mining, livestock grazing, and farming. Responses

vary from an exodus to urban centres, to affiliation with non-state organizations such as the many extremist groups that have mushroomed in the Sahel. Residents are unable to hold responsible parties to account—industry claims license requirements are satisfied, while government engagement in rural drylands is weak or absent and is increasingly discharged to mining companies (Bolay and Knierzinger 2021). Mining activities transition communities away from past practices to new uncertainties.

This chapter illustrates mining implications, through dryland case studies in the Sahel region (uranium in Niger, gold in Mali) and arid Mongolia (gold, copper). State involvement enables a discourse promoting development that contributes to a positive framing of mining in drylands. Resulting economic dependency and environmental degradation are externalized, borne by local people, their livestock, and future generations. In weak states, this opens access for the most powerful actors. Common strategies of transnational mining companies across drylands reflect their collaboration with state actors and their impact on development discourse.

Asymmetric power conflicts surrounding mining activities are often presented negatively as being between local actors and companies and states. Yet one case study identifies how a community and mine were able to reduce conflict through dialogue and mediation (Sternberg et al. 2020). Here, the mega-mining transition has already occurred; the community now adapts to the resultant changes, which are improved by facilitated discussion.

Though separated by distance, history, and culture, the Sahel and Gobi share the *process* of mining, experiencing the disruption to communal lands and mobile lives and the uncertainty about future roles for the actors involved or affected by mining projects. This reflects the arid zone conundrum of protecting lives in regions considered expendable wastelands. Moving beyond local contexts, the points raised are common across global resource extraction: its impacts and local responses to them. Our insights expand documentation and discussion of communities facing the 'open cut' (surface excavation) of mining that challenges dryland homes, mobility, and flexibility. They also exemplify different ontologies regarding what constitutes the so-called environment or cultural drylands landscapes for local actors, on the one hand, and a mineral asset for exchange between local actors and the mining companies, on the other hand. However, our study also shows that there have always been local mining strategies embedded in early empires as well as in today's transnational corporate business, which is a further 'glocal' link full of power asymmetries.

### **Undermining pastoralism: uranium mining in Niger**

The case of uranium mining in the Sahel-Sahara in northern Niger is a paradigmatic example of the 'faux construction' of drylands as 'marginal' regions. Niger is consistently considered a 'poor' and politically powerless country, ranked at the bottom of all global development indexes and hardly ever mentioned in international press coverage, unless for the surge of violent extremism. Even more,

the desert of northern Niger is further marginalized within the national political setting dominated by ethnic Haussa elites from the southern capital of Niamey. However, this perception of marginality is also faux, if one takes into account that uranium from Arlit has been a central element to every French household and industry, as well as to the geo-political positioning of the former colonial power that became one of a select few 'nuclear powers', with a permanent seat on the UN Security Council. France, which relies on nuclear energy for 80% of electricity production, sources between 25 and 40% of its uranium fuel from Niger (Granvaud 2012: 63), with Australia, Canada, and Kazakhstan also notable suppliers. The marginal position of Niger, which may at first glance seem an 'obvious consequence' of its 'remote and hostile geography', is in fact the result of a systematic process of invisibilization along the production line of a key ingredient to the French economic and political model, a model that revolves around nuclear power for electricity and the deterrence effect of nuclear weapons.

The Niger case also shows how large-scale mining has severe impacts and transforms the entire political and ecological landscape far beyond the surroundings of actual mining sites. It illustrates some of the specific characteristics of mining impacts on the inhabitants of drylands: (1) the increasing scarcity and contamination of water and the resulting aggravated competition over this vital resource; (2) the impact on movement and migration patterns, including the sedentarization of (formerly) mobile pastoralists; and (3) the intensified political marginalization of already discriminated-against indigenous peoples (in this case, the Tuareg Berber nomadic pastoralists), leading to very limited options for them to express opposition through democratic deliberation, which in turn favours a pattern of retreat and sometimes violent confrontation. Not all of these impacts can be attributed exclusively to the mining activity; however, all of them are further exacerbated by it.

Uranium mining in Niger began in 1971 at the open-pit mine SOMAÏR (Société des Mines de l'Air) in the proximity of the northern Niger settlement called Arlit, which consequently grew into a major town. This was followed in 1978 by the underground mine COMINAK (Compagnie Minière d'Akouta), close to Akouta. Both mines were under majority ownership and operated by Areva, a company controlled by the French state. Due to high prices, uranium exploration activities multiplied in the 2000s, bringing in a multitude of investors from different countries (notably, Chinese) (Gagnol and Afane 2010; Oxby and Walentowitz 2016). The uranium price fell following the Fukushima nuclear disaster in 2011, and the projected boom came to an abrupt halt. The Imouraren project by Areva, planned to become the second-largest uranium mine in the world, was stalled at an advanced stage of development. Areva was finally restructured and renamed Orano in 2018. In March 2021, production at Akouta (COMINAK) was terminated definitively, after 75,000 metric tons of uranium had been extracted over its 40 years of existence. The closure leaves 600 employees and at least 800 subcontractors behind, besides an unknown number of people who depended on secondary income from the mine.<sup>1</sup>

In the 2000s, uranium exports made up 60–80% of Niger's foreign exchange revenues (Oxby and Walentowitz 2016: 165). However, the inhabitants of northern

Niger have seen little benefits from this. The region is part of the vast ancestral territories of the five Tuareg confederations (the Kel Ahaggar and Kel Ajer in the north, the Kel Tademakkat and Kel Ayer in the east, and the Kel Tagaraygarayt at the centre). Traditionally, the Tuareg are nomadic pastoralists who combined camel pastoralism with long-distance trade across the desert, using water sources and seasonal pastures on the way, with annual transhumance to the salt pastures in the south (Claudot-Hawad and Lefèvre-Witier 2009). The latter took the shape of large social gatherings known as *tenekkart* or *cure salée*, with an important centre in the Nigerian locality of La Gall. These gatherings, which also served as political assemblies, were prohibited by the colonial administration. Also, the complex and highly adaptive system of customary rights of access to pastures and water sources was systematically ignored, neglected, and obstructed by colonial and postcolonial authorities. Tuareg refers to this oppression as *ahluk n temust* and *ahluk n tamattay*, 'meaning the "annihilation of a nation" or "people" through the avoidable destruction of elements, persons, resources or cultural assets that are critical for its cohesion and survival'. In their perception, it is an existential threat to their society and to the environmental conditions for survival (Oxby and Walentowitz 2016: 160–161).

The imposition of mining areas and towns on customary Tuareg lands led directly to the disruption of access to water sources and pastures and the distortion of migration routes. The production processes of uranium require large quantities of water, which is pumped up from underground, in part from non-replaceable, fossil aquifers (Dixon 2010: 21–22). Underground mining lowers the water table and may make wells run dry. Then there is the contamination by radiation and the use of chemical agents for the leaching process, which affect all dimensions of the cultural landscape ecosystem: water, air, and soil, as well as human and non-human health (Collectif Tchinchaghén 2008; Dixon 2010; Oxby and Walentowitz 2016: 196–176). There is a lack of systematic data collection on environmental and health impacts; however, the available sources indicate elevated radiation levels, while data on incidence of cancer cases is being suppressed by local hospitals, which are under the control of Areva (Granvaud 2012; Oxby and Walentowitz 2016; Weira 2016). This points to a common corporate strategy of producing 'doubt' on the actual costs of extraction (Nixon 2011: 39).

However, a focus on these direct impacts alone risks neglecting the severity of indirect impacts related to the change of movement patterns of the Tuareg nomadic pastoralists. The disruption of their traditional trade routes and associated relationships with settled farmers, exchange of agricultural products with animals, salt, and manufactured goods brought across the desert, which dates back to the colonial period, was further perpetuated and exacerbated by the arrival of uranium mining in Arlit (Oxby and Walentowitz 2016). It continues to do so: for the (later stalled) project at Imouraren, the company Areva again ignored the presence of pastoralists in the 200 sq km extension of the area it acquired for the mining pit and industrial installations, thereby denying its responsibility to agree on compensation with customary owners (Gagnol and Afane 2010: 9–13).

The development of mining towns, with their promise of economic opportunities and access to services, incentivized the sedentarization of pastoralists. However, the access for pastoralists to education and better-paid formal employment remained very limited, leaving as options only the most precarious jobs and subsidiary economic activities, such as petty trading and services. The precarious nature of the informal economy around the mining sites in Niger is illustrated by the fact that for many years the trading of radioactively contaminated scrap metals from the mine was adopted as an income-generating activity by some Arlit residents, until this was apparently brought to an end by the company (Weira 2016).

For younger people, especially men, the lack of alternatives contributed to migration to neighbouring countries, sometimes to work as mercenaries in Libya under Muammar Gaddafi (Krings 1995). After the droughts of the 1970s and 1980s, many lost their livestock and had no choice but to move to look for other occupations (Spittler 1993). After the fall of the Gaddafi regime in 2011, many returned to Niger and sought other income opportunities, related to the transformation of ancient trade routes across the desert. Some of them became involved in the transport of migrants from Sub-Saharan Africa to the north (labelled as ‘human trafficking’), illicit activities such as the arms and drug trade, and the ‘business’ of kidnapping ‘expat’ mine employees to negotiate political influence and ransom payments (Scheele 2012). Since 2011 many have also joined Muslim extremist groups (Bøas 2015; Thurston 2020; Chapter 9, this volume). Such activities obviously play into the framing of the region as home to ‘unruly tribes’, which dates to colonial times, and a renewed negative labelling as an ‘extremist’ and potential ‘terrorist’ space, seen from a European, especially French, perspective.

The region has a history of Tuareg armed rebellions, such as those in 1990–1995 (Krings 1995) and in 2007 (*Mouvement des Nigériens pour la Justice*; see Denis et al. 2008; Keenan 2008, 2009). However, this became of special concern internationally in 2012 with the AZAWAD movement, due to the strategic (if temporary) alliance of certain Tuareg leaders with Al Qaeda-related groups, who quickly managed to take control of northern Mali (Claudot-Hawad 2013; Zounmenou 2013; Oxby and Walentowitz 2016: 158). Although many Tuareg leaders were killed by Al Qaeda activists trying to take control of what started as a rebellion led by Tuareg, the episode led to the Tuareg’s becoming a target as potential ‘terrorists’, within a fortified labelling of the Sahel as part of a dangerous ‘terrorist ideoscape’ (see also Andersson 2016; Haller 2020).

In contrast to other minerals, it is impossible to develop artisanal mining for uranium, and in contrast to other examples described in this chapter (Mali–Guinea and Mongolia), northern Niger did not know artisanal gold mining until recently. The discovery of gold by small-scale gold diggers, first in the Ténéré desert in 2014 and later in the Aïr Mountains, came as a big surprise (Grégoire and Gagnol 2017). Within months, the region became crowded by thousands of artisanal miners and providers of related services, including many Tuareg, impoverished city dwellers from Arlit and Agadez, and ‘Libya returnees’, as well as people from southern regions of Niger and neighbouring countries—in total, estimated

in 2017 at 70,000 people, mostly men (ibid. 15). Though new in the region, this source of livelihoods extends the space of artisanal gold mining, whose dynamics have been at play for a number of years in the southern regions of Liptako-Gourma, and more broadly along the Birimian Belt in Mali and Guinea. While the government of Niger first tried to prohibit the irregular mining owing to security concerns in and around the fast-sprawling mining camps in the 'unruly' border region, it quickly became clear that the income generated there constitutes a stabilizing factor, keeping unemployed youth away from more problematic activities and preventing the risk of another Tuareg rebellion (Chevrillon-Guibert et al. 2019; Afane and Gagnol 2021).

The emerging scenario in northern Niger is thus marked by a new dynamic between a declining, highly centralized, industrial type of mining (uranium), controlled by a quasi-state-like power, Areva, and the sprawling dynamic around the informal gold-mining camps, each with its own boom-and-bust cycle. The recent closure of the uranium mine at Akouta and the loss of related subsidiary economic activities may also contribute to a further push into artisanal mining. The situation presents stark evidence for what has been criticized by local activists and NGOs: although built on a discourse of 'development' and 'progress', uranium mining has left little lasting benefits in the area. Instead, its legacy is a polluted environment, exhausted natural resources, and severe health problems. In contrast, for the gold mining at least, the distribution of income seems to be comparatively more equal, and local Tuareg has greater chances to participate thanks to their superior knowledge of the territory. This does not change the fact that artisanal mining causes considerable damage to the environment and health condition of workers, especially where mercury and cyanide are used. It remains uncertain how long the currently exploited deposits, and others yet to be discovered, will last.

The adaptation strategies of Tuareg (former) pastoralists to mining can be described as a combination of changing movement patterns and related income-generating activities, especially forms of trade, with temporary settlement in the mining towns and, recently, the adoption of artisanal gold mining. A fundamental opposition to uranium mining is apparently absent; rather, the unjust distribution of mining incomes, the lack of investment in public infrastructure and services, and the impacts on health and the environment have been questioned, especially since the last peak of uranium prices in the 2000s (see e.g. Collectif Tchínaghén 2008). However, the chances of successfully achieving significant improvement in these areas have been quite limited. It is notable that some of the frequently observed strategies adopted by communities in conflicts related to large-scale mining worldwide do not seem to be very effective in northern Niger—including mobilization through civil society networks, social movements, labour unions, and political parties on different scales, and from local to international advocacy networks, with mass protest and direct action such as roadblocks to disrupt production (see Niederberger et al. 2016: 468–488). One reason may be that the characteristic 'drylands' social structure of mobile pastoralists does not favour the everyday resistance practice of 'staying put' (Jenkins 2017)—that

is, the refusal of settled communities to be reallocated elsewhere to make way for mining operations, which again forms the basis on which political mobilization can build. Another main hindrance is the political marginalization of the Tuareg people, which was further accentuated after they were branded as potential ‘terrorist supporters’ and drawn into the field of the global ‘war on terror’. This makes legitimate resistance against environmental impacts and the unfair distribution of mining incomes more difficult. The ‘terrorism ideoscape’ here works as an anti-politics machine, which closes the space for democratic deliberation and makes invisible the underlying power relations that are at the root of the problem.

### **Local artisanal mining as an alternative? Views from gold mining in the Sahel**

If one analyses the case of a classic mining constellation such as that in Arlit, one wonders if, from a drylands perspective, local mining activities might be a much better option in drylands. Gold has been mined for centuries in this region and historically was the founding economic element of large states in the Sahel (e.g. Mali empire, Songhai empire, and Kanem Bornu between the 14th and 16th centuries; see Ki-Zerbo et al. 1979). However, gold mining in the area is not only a resource use strategy from the faraway past; over the last 20 years, gold mining has literally exploded in West African drylands along the Birimian Belt, which spans eastern Senegal, upper Guinea, southern Mali, Burkina Faso, and Niger, and more recently across the Sahara, with artisanal mines mushrooming in northern regions of Mali close to Kidal, and in the Aïr and Djado in Niger. In these countries, artisanal mining is estimated to provide direct employment to at least 2.2 million persons and livelihoods for at least five times more dependants (Delve database, IGF 2017). Driven by massive unemployment, food insecurity and poverty, and conflict-induced displacement from northern areas controlled by extremist groups, artisanal mining, which is found ubiquitously beyond the controls of legal formality, has become the second source of income for rural livelihoods in the region. In parallel, the wave of the fourth generation of mining codes since the 2000s (Besada and Martin 2015) also led to an increase in industrial mining operations and an unprecedented allocation of exploration and exploitation mining licenses, currently covering nearly every portion of the Birimian Belt. This generates state revenues through permit fees, royalties, export taxes, and government shares in industrial mining ventures. Yet, this ‘mineralization of Africa’ (Bryceson et al. 2014) also drives notable negative consequences. Among the most prominent ones, both the use of mercury and cyanide, in artisanal and small-scale mining (ASM) operations, and massive landscape destruction in and around industrial mines are important causes of environmental degradation. Competition over access to mineral deposits between various operators on the artisanal/informal—industrial/formal continuum is also a recurring source of social conflict, whose violent responses sometimes provoke dramatic outcomes (e.g. Dessertine 2019; Bolay and Knierzinger 2021). More broadly, the uneven distribution of the extractive rents is also a frequent matter of political contestation.



In contrast to mining expansion in so-called new gold frontiers (Verbrugge and Geenen 2019) such as Mongolia (Sternberg et al. 2020), these issues take on particular meanings in West Africa, where gold mining dates back to the former African empires during the Middle Ages. Not only has this long history of mining led to robust local institutions governing access to gold deposits and control of mining dividends, but it has also fostered a peculiar sense of ownership in mining regions that new technologies, legal frameworks, and migrations destabilize and transform. Gold is found both in primary (rock) and secondary (alluvial) deposits and is artisanally extracted and processed in strongly gendered work arrangements, whereby men team up to excavate wells and tunnels to access and extract the ore, which women then process and wash on the surface. Following a common-pool resource conception of land, the repartition of the gold then follows a complex arithmetic, usually involving the local landowner, the sponsor of the diggers, the operators providing technical supports (mechanized crushers, air pumps, water pumps), the male diggers themselves, and the female washers with whom they are associated, as well as the payment of local taxes to village authorities (see for instance Bolay 2014; Teschner 2014; Lanzano and Di Balme 2017; Brottem and Ba 2019).

In historical zones of extraction, such as in the Bouré and Bambuk areas of current Senegal, Guinea, and Mali, the governance of mining sites is performed by a local non-state police (*tom bolomaw*), who regulate conflicts and collect informal local taxes that contribute to financing most public infrastructures, such as mosques and road maintenance. In more recently exploited deposits, such as in Burkina Faso, the governance of mining sites has more tenuous ties with local governance structures. While first relying on Big Men logics (Werthmann 2003), *comptoirs* (private buying houses holding capital) took over this role by navigating formal and informal spheres of access (Di Balme and Lanzano 2013). Yet the prominent role of *comptoirs* is increasingly contested by local groups reclaiming governance prerogatives (Lanzano and Di Balme 2021). In both historical and new mining areas, by providing employment, revenues, and tangible local development, artisanal mining is systematically preferred locally to industrial mine projects, which are perceived overall by local populations as a threat to access to land, gold deposits, and labour options.

The tense relations between the artisanal (and informal) and industrial (and formal) sectors have been at the core of international-level policy concerns and are the object of various governmental measures to 'formalize' the artisanal sector—that is, to expand property rights systems to absorb the extra-legal economy (Siegel and Veiga 2009: 53), as promoted by major donor institutions. Yet, this agenda has so far brought at least ambiguous outcomes. Legal projects to formalize the artisanal sector have so far inevitably been paired with the marginalization, or even exclusion, of the most vulnerable actors (e.g. Hilson 2013) and the sector as a whole being *de facto* placed mainly in the realm of illegality. Different approaches have been taken, ranging from the establishment of legally dedicated ASM corridors to imposed registration and acquisition of a *carte d'orpailleur* (miner's card). A common trend has been the progressive institutionalization of governments'

practices of the expulsion of illegal miners from the temporary mining camps next to the artisanal mines (e.g. Dessertine and Noûs 2021) or from corporate-owned leases (e.g. Bolay 2016). While such context-specific interventions tend to occur at the early stage of exploitation, when competition between large-scale and small-scale operators is the most salient, attention to previous and subsequent stages of the life cycle indicates that the boundaries between both sectors are more blurred than they at first appear.

Indeed, as shown by Luning (2014) in Burkina Faso, artisanal miners often serve as easily removable ‘pathfinders’, whose activity is an indicator of the potential viability of gold deposits for junior mining companies conducting exploration. In addition, as observed in Mali, the acquisition of exploration licenses also happens to be used by trade actors, with no future prospects in formalized operations, as a means of exerting pressure on artisanal mining communities—by upholding the threat of eviction—to secure access to their product (Bolay 2021a). Conversely, once industrial operations have reached their limits, artisanal miners frequently occupy abandoned sites to scavenge the leftovers, a practice also noted in Mongolia. This trend has been reinforced with the relative retrenchment of industrial mines due to decreasing prices since 2012–2013 and by the booming use of cyanidation, techniques to retrieve gold from tailings (Lanzano and Di Balme 2021), without which such leftovers would not be profitable to artisanal operators. This is even more so in African drylands where scarce access to water is largely compensated by the use of chemicals to process the ore (OECD 2018).

Yet the ‘dryland’ characteristic of a region cannot be subsumed to water scarcity. It also needs to be considered from the perspective of the fragmented sociopolitical configuration of the Sahara–Sahel, where postcolonial states always had a limited presence and where populations have long resorted to flexible and diverse livelihood strategies (van Dijk 2017: 120)—making use of both their own mobility and the mobility of people and goods across loosely controlled territories (see for example Scheele 2012). Miners’ intense transnational mobility across the region is a key driver of the sector’s transformation from below. Besides playing an important role in the discovery and exploitation of new deposits, the mobility of miners also sustains the circulation of new processing techniques, such as with the boom in the use of mercury 15 years ago in Ghana and progressively across the continent, and that in cyanide more recently. The recent ‘rush’ in northern Mali illustrates such dynamics. Rather than an expansion of long-standing mining practices from the Birimian Belt up north, the artisanal mining boom in the northern Sahel results from a ‘pioneering front’ initiated in early 2010 in Egypt, which steadily expanded across Sudan, Chad, Niger, Mali, and Mauritania (Chevrillon-Guibert et al. 2019). In the Kidal area (Mali), where artisanal mining operations have multiplied since 2016, workers are rarely Malian, Guinean, or Burkinabés such as in the cases mentioned above. While governance and financing are controlled by local Malian Tuaregs—with or without the support of various rebel groups that govern fragmented portions of territory along fast-shifting alliances and allegiances (Sandor and Campana 2019), under equally fast-changing qualifications of rebellion, jihadism, or terrorism (Pérouse de Montclos

2018: 12–17)—most miners came from Niger, Chad, or Sudan, together with their experience and techniques of extracting gold in Sahelo–Saharian contexts. In the artisanal mining sites around Kidal and Tinzawaten, primary ore is extracted in shafts up to 40 m deep. Then it is transported to Kidal, where several cyanide-processing plants were set up (Bolay 2021a) in a similar way to what Afane and Gagnol (2021) describe for the sites surrounding Agadez and Arlit in Niger. In these areas that constitute important transit points for aspiring migrants to North Africa or Europe, increasing numbers of impoverished irregular migrants deported from Algeria and Libya may also turn to mining, which sometimes constitutes a temporary safety net (Bolay 2021b).

To conclude, artisanal mining in the Sahel is shaped by heterogeneous drivers that, besides the geological features of the deposits or the dry environment, also depend on whether or not artisanal and industrial modes of production intersect, and at which stage of the mining cycle (i.e. exploration, development, production, closure, possible rehabilitation, or re-occupation), with actors that most effectively control portions of the territory. In addition, while artisanal mining constitutes a growing source of income in the region, its economic role is as diverse as to seasonally complement agriculture, to become a full-time job involving frequent relocations induced both by forced expulsions and the search for new deposits, or to temporarily provide incomes to people whose mobility or economic activity have been hampered.

### **Mining and pastoral engagement in drylands: the Mongolian context**

In our case study from Inner Asia, the relation between local mining and mining by corporations is again shaped in a different way. This case shows how local mining activities are possible after large transnational mining companies terminate mining. It also illustrates a context where local dryland inhabitants, mainly pastoralists, were able to successfully challenge mining companies (see also Chapter 13, this volume). Both processes coexist across the communal landscape (Figure 6.1).

Across the Inner Asian steppe, mining drives economic development, exports, foreign relations, and political outcomes (Sternberg 2020). Yet in Central Asia and Mongolia, complaints about a lack of local jobs, environmental damage, community disruption, and elite capture frame national discourse. This segues into resource nationalism as citizens clamour for clear social benefit from resource extraction and state takeover of foreign mining investments (Myadar and Jackson 2019). In Mongolia, such topics lead to struggles over mining with a government focused on industrial operations, while 20% of the rural labour force work as artisanal miners (Bryceson 2018). Both approaches affect landscapes and water quality and access, and cause pollution. Processes initiated by extraction lead to rapid social change and disorientation, as herders may lose access to limited water points, be excluded from pasture claimed by mines, or become part- or full-time miners to sustain livelihoods. Perceived income opportunities, or lack of



*Figure 6.1* Herders' view of mine in Mongolia. Photo provided by Troy Sternberg.

alternatives, drive both migration to mining hotspots and displacement to towns and the capital when rural endeavours lose viability.

Mining lifecycles reflect a well-documented process of exploration, extraction, and closure that is common around the globe. In Inner Asia, the process is framed by Soviet legacies and practices that were followed by state collapse, impoverishment, and a turn to mining for income and revenue (Sternberg *et al.* 2021). Hope for mining-led development is moderated by awareness of potential damage. Whereas Soviet-era companies created mining towns with schools and infrastructure (Tursalieva 2021), today's large-scale investments (often Chinese- or Western-owned) sign licenses and pay taxes in the capital, with limited engagement in rural communities. Historical memory raises expectations, yet contemporary extraction provides limited jobs for rural residents, as workers are often brought in from China (Sternberg 2020). A more common practice is artisanal mining, known colloquially in Mongolia as 'ninja mining', which has numbered 100,000+ miners over the years (Lahiri-Dutt and Dondov 2017; Munkherdene and Sneath 2018). The process was driven by poverty, opportunity, and extreme climate events (temperatures as low as  $-45^{\circ}\text{C}$ ) that displaced pastoral lives (Lahiri-Dutt and Dondov 2017). The intersection of industrial and small-scale mining flourished in the 2000s when, as a mine site was closed, locals scavenged through mine tailings in search of gold flecks missed by mechanized processes. In time, artisanal miners expanded over abandoned and informal sites, bought rudimentary equipment, and drew in herders and migrants in search of income.

The vast scale and poor conditions of ninja mining drew government scrutiny and NGO attention to sites in Mongolia such as Uyanga and Zaamar. Dangerous

and deadly work, child labour, use of mercury and harmful chemicals, and undrinkable water for livestock at artisanal sites were matched with polluted water sources, acidification, damaged riverbeds and ecosystems near mine sites, and reduced water access (Gantumur et al. 2017). Here a Sustainable Artisanal Mining project was initiated to license and improve artisanal mining conditions (Munkherdene and Sneath 2018; SDC 2018). Working with local governments, this formalized artisanal mining as a recognized livelihood, established safety standards, and conferred modest health and social benefits. Some progressive companies hired these miners for their local expertise. However, at about 7,000 miners a year, enrolment in the programme has been less than expected (SDC 2018), perhaps because of perceived limited practical benefits, due to regulatory and reporting restrictions imposed upon artisanal miners.

The physical challenges of extraction reconfigure environments near mining. The repercussions are compounded in drylands, as a lost water source or fenced-off pasture affects dominant livestock herding for several kilometres. If available water is contaminated, identifiable even without formal testing by sight, smell, and taste, local residents are unable to water herds and must drive long distances for safe drinking water. Remarkably, camels are able to identify and 'hear' groundwater at locked boreholes that herders are unable to access. Here, pastoralists and large- and small-scale mining compete fiercely for the same minimal water resources with herders least able to afford alternative water supply (e.g. deep boreholes, trucked-in water). As sources are polluted, diverted, or become unproductive, it adds to the litany of community complaints about mining and social conflict, and often to lost livelihoods.

This then raises the issue of migration related to development and mining in Mongolian drylands. One discourse features the mobility and safety net that artisanal mining offers (Bryceson 2018; Munkherdene and Sneath 2018). This posits that small-scale mining offers a potential, though difficult, source of income that keeps residents in the countryside as people move from site to site. By turning a blind eye to the illegality and informality, the process costs the government little and may limit out-migration from drylands to the capital (Munkherdene and Sneath 2018). A more grounded approach identifies reduced livelihood opportunities due to mining combined with increased climate variability, which drive locals from the land and out of herding, often to become unskilled workers in urban shantytowns. The key point is that long-serving rural practice—pastoralism sustaining small communities—is transitioning to a mixed industrial/artisanal mining and herding model for sustenance, with resulting dramatic movement towards towns and the capital as the final locus, after disappointing rural livelihoods.

Similar to Niger and the Sahel context, large-scale mining reorients customary local practice and livelihoods. Company mines provide low-skilled employment for some, yet pastoral work supports more families. As mine license areas (extending up to 80 sq km) displace herders, communal customary land tenure and family pasture rights lead to conflict, especially over access to water. Artisanal mining is impossible in the vicinity of large mines; locals are known to travel far afield when new small-scale discoveries are made. While there may be protests locally and in

the capital, there are no disruptive non-state actors. Here, legitimate enterprises, usually Mongolian, Chinese, and Russian companies, exploit minerals for export to neighbouring China. The process of acquiring licenses and export permits has led to elite capture and rocketing corruption levels. The (in)famous case of Oyu Tolgoi (owned by Rio Tinto) is now known more positively as a case where ‘Mongolian herders [...] took on a corporate behemoth—and won’ (Sternberg et al. 2020: 536). The mediated community settlement represents constructive engagement between a mine and pastoralists, made possible by an open, democratic society and a company’s interest in corporate responsibility. Though the mine and government are currently in contract renegotiation, common in Mongolia, on this matter there was no interference (or attention) from the government. The long mediation reflected the contentious livelihood challenges and development process.

### Summary

The open cut recognizes the challenges and contestation between mining and development in rural dryland communities. Focused on the Sahel and the Gobi, this chapter has identified how access to common-pool resources, such as pasture and water, may be undermined by powerful actors and states. The conflict may be characterized as being one between pastoralists, agrarians, and communities vs mining, yet it also reflects the struggle between local artisanal and industrial-scale mining. Mobile livelihoods, usufruct rather than legal land rights, and competition for and contamination of resources differentiate stakeholders and reflect power imbalances and threats to livelihoods. Particularly challenging in the Niger uranium case is the intersection of colonial history and postcolonial dismantling of the commons, state insecurity, and the ideoscape of terrorism. In contrast, the Mongolian case reflects an ongoing transition that reflects the co-existence of mining and herding in rural communities.

As marginal environments, drylands are resource-limited in water, vegetation, and ecological productivity. Here altered land use and land cover by extractive industries with state alliances disrupt customary mobile livelihoods and may reduce pasture access, pollute environments, and necessitate resettlement from homelands. Alternative work in mining, out-migration, and new economic activity (perhaps illicit) reflect the resultant waning pastoral viability. Displacement distorts land use and rights, increases competition, and drives overuse of available resources. Extractive benefits accrue to companies and the state yet foster local insecurity, while this is hidden behind discourses of development and sustainability, acting as anti-politics machines (see Ferguson 1994). Added burdens of colonial legacies, power inequities, and violent movements in the Sahel make pastoralism a problematic pursuit, because of the narrative of being a negative and underdeveloped form of resource use that is also linked to overuse and terrorism. The same can be said about artisanal mining, which is often labelled negatively in order to render it illegitimate and a dangerous livelihood. However, local people have their strategies and react to the dominant pressures in their own ways, which may be termed ‘weapons of the weak’ (see Scott 1985), and the anti-politics

machine in this drama of the grabbed commons can turn into a politics machine (see Niederberger et al. 2016; Gerber and Haller 2020).

In Mongolia, local pastoralists were able to claim their rights based on the recognition of global and national legal standards. On the other hand, cases in Mali and Niger show little prospect of positive engagement or resolution. State and company hegemony, violent state and non-state groups, and a lack of outside support—as well as being labelled negatively (terrorism-scape; see also Chapter 3 on drylands narratives, this volume)—have left pastoralists and artisanal miners with few ways to ameliorate conditions. Global efforts towards responsible mineral supply chains, increased demand for critical minerals, and continued efforts of the Extractive Industries Transparency Initiative (EITI) (joined by Mali, Niger, and Mongolia) bring attention to mining impact on communities. Yet legality, health and safety measures, and human security benchmarks have limited impact as voluntary initiatives and standards, and they may not be adequate to improve precarious living conditions (Calvão et al. 2021; see also critical discussions on CSR in Gerber and Haller 2020). Power asymmetries, historical legacies, weak institutions, and corruption continue to disadvantage pastoralists and their communities. This leads them to pursue their actions differently, from low-level resistance to successful claiming of rights also based on external support.

This chapter has shown how mining changes local livelihoods, dryland landscapes, their cultural environments, and property rights such as access to former pastoral commons. Responses have to deal with imbalances between large mining companies and local actors, including artisanal miners and pastoral lifestyles. Developing feasible processes is essential to mitigate extractive impacts on communities and increase the distribution of extractive rents. Desert marginality is part of the dynamic that mining exacerbates for local inhabitants. As in Chapter 13 (this volume), the current chapter has considered the role of local institutions in regulating access and of resource governance (constitutionality) when approaching the mining sector. Successful engagement in the Mongolian case was possible with cooperative effort and external support, and without the threat of violence. This may be an exception, with the challenges confronted in Niger and Mali more typical of dryland mining conditions. Throughout marginal drylands, limited on-the-ground understanding of reproduced colonial structures and of power inequities suggests that more just and robust institutions and the processes outlined in this volume are fundamental to improving extractive practices and community lives. It also critically questions the role of the global North—especially of European countries with their colonial and postcolonial legacies and their hosting of large mining companies (e.g. by Switzerland) with or without direct colonial pasts.

## Note

- 1 <https://www.orano.group/en/news/news-group/2021/march/a-new-stage-commences-for-the-cominak-mine-in-niger>; and <https://www.rfi.fr/en/africa/20210315-niger-uranium-mine-closure-arlit-cominak-hundreds-of-jobs-cut-concerns-for-environment-africa-economy-orano>

## References

- Afane, A. and Gagnol, L. (2021). Une ruée vers l'or contemporaine au Sahara: l'extractivisme aurifère informel au nord du Niger. *Vertigo-la revue électronique en sciences de l'environnement* 20(3): 1–26.
- Andersson, R. (2016). Here be dragons: Mapping an ethnography of global danger. *Current Anthropology* 57(6): 707–731.
- Besada, H. and Martin, P. (2015). Mining codes in Africa: Emergence of a 'fourth' generation? *Cambridge Review of International Affairs* 28(2): 263–282.
- Bøas, M. (2015). Crime, coping and resistance in the Mali-Sahel periphery. *African Security* 8(4): 299–319 <http://ds.doi.org/10.1080/19392206.2015.1100506>
- Bolay, M. (2014). When miners become 'foreigners': Competing categorizations within gold mining spaces in Guinea. *Resources Policy* 40: 117–127.
- Bolay, M. (2016). Artisanal gold miners encountering large-scale mining in Guinea: Expulsion, tolerance and interference. In: Niederberger, T. et al. (eds.). *The open cut: Mining, transnational corporations and local populations*, pp. 187–204. Munster: LIT Verlag.
- Bolay, M. (2021a). Des réseaux aux chaînes d'approvisionnement. Économies morales et performances de moralisation dans le commerce de l'or au Mali post 2012. *Politique Africaine* 164: 1–10.
- Bolay, M. (2021b). Disentangling mining and migratory routes in West Africa: Decisions to move in migranticised settings. *Social Inclusion* 9(1): 235–246.
- Bolay, M. and Knierzinger, J. (2021). Corporate gift or political sacrifice? State-sponsored CSR and electricity provision in Guinean extractive enclaves. *Political Geography* 84: 102300.
- Bromehead, C.E.N. (1940). The evidence for ancient mining. *The Geographical Journal* 96(2): 101–118.
- Brottem, L.V., and Ba, L. (2019). Gendered livelihoods and land tenure: The case of artisanal gold miners in Mali, West Africa. *Geoforum* 105: 54–62.
- Bryceson, D.F. (2018). Artisanal gold rush mining and frontier democracy: Juxtaposing experiences in America, Australia, Africa and Asia. In: Lahiri-Dutt, K. (ed.). *Between the Plough and the Pick*, pp. 31–61. Acton: Australian National University Press.
- Bryceson, D.F., Fisher, E., Jønsson, J.B. and Mwaipopo, R. (eds) (2014). *Mining and social transformation in Africa: Mineralizing and democratizing trends in artisanal production*. Abingdon: Routledge.
- Calvão, F., McDonald, C.E.A. and Bolay, M. (2021). Cobalt mining and the corporate outsourcing of responsibility in the Democratic Republic of Congo. *The Extractive Industries and Society* 8(4): 100884.
- Chevillon-Guibert, R., Gagnol, L. and Magrin, G. (2019). Les ruées vers l'or au Sahara et au nord du Sahel. Ferment de crise ou stabilisateur? *Hérodote* (1): 193–215.
- Claudot-Hawad, H. (2013). La 'question touarègue': quels enjeux? In Galy, M. and Badie, B. (eds) *La guerre au Mali: comprendre la crise au Sahel et au Sahara: enjeux et zones d'ombre*, 125–147. Paris: La Découverte.
- Claudot-Hawad, H. and Lefèvre-Witier, P. (2009). Désertification et civilisation nomade au Sahara: naissances conjointes. *Antropo* 18: 87–94.
- Collectif Tchinquaghen (2008). *La malédiction de l'uranium. Le Nord-Niger victime de ses richesses*. Agadez (Niger): Dossier d'Information, Collectif Tchinquaghen, Paix et Solidarité pour le Nord-Niger.
- Denis, F., Manier, S. and Siby, N. (2008). *Niger. La bataille de l'uranium*. France 5 and Galaxie Presse (Film)



- Dessertine, A. (2019). And justice for all land? Power and land in the context of gold mining (Guinea). *Revue internationale des études du développement* 2: 141–164.
- Dessertine, A. and Noûs, C. (2021). Hybrid territorialisation: A reconfiguration of rural spaces through gold mining in Upper Guinea. *Political Geography* 86: 102348.
- Di Balme, L.A. and Lanzano, C. (2013). 'Entrepreneurs de la frontière': le rôle des comptoirs privés dans les sites d'extraction artisanale de l'or au Burkina Faso. *Politique africaine* (3): 27–49.
- Dixon, A.A. (2010). *Left in the dust. AREVA's radioactive legacy in the desert towns of Niger*. Amsterdam: Greenpeace International.
- Enkhjargal, E. (2021). Mining's shadow on Mongolia's environment and heritage. In Sternberg, T., Toktomushev, K. and Ichinkhorloo, B. (eds) *The impact of mining lifecycles in Mongolia and Kyrgyzstan: Political, social, environmental and cultural contexts*. Abingdon: Routledge.
- Ferguson, J. (1994). *The anti-politics machine: 'Development', depoliticization, and bureaucratic power in Lesotho*. Minneapolis: University of Minnesota Press.
- Gagnol, L. and Afane, A. (2010). Quand l'injustice est spatiale. Le nomadisme pastoral face à l'impératif territorial dans le Sahara nigérien. *Justice Spatiale/Spatial Justice* 2: 1–16.
- Gantumur, A., Mętrak, M., Wilkomirski, B. and Suska-Malawska, M. (2017). Environmental and social consequences of gold mining in Mongolia. *Monitoring Środowiska Przyrodniczego* 19(1): 11–15.
- Gerber, J.D. and Haller, T. (2020). The drama of the grabbed commons: Anti-politics machine and local responses. *The Journal of Peasant Studies* 48(6): 1304–1327. <https://doi.org/10.1080/03066150.2020.1758673>
- Granvaud, R. (2012). AREVA en Afrique. Une face cachée du nucléaire français. *Dossier Noires* 24. Marseille: AGONE.
- Grégoire, E. and Gagnol, L. 2017. Ruées vers l'or au Sahara: l'orpaillage dans le désert du Ténéret et le massif de l'Air (Niger). *EchoGéo*. <http://journals.openedition.org/echogeo/14933>
- Haller, T. (2019). The different meanings of land in the age of neoliberalism: Theoretical reflections on commons and resilience grabbing from a social anthropological perspective. *Land* 8(7): 104. <https://doi.org/10.3390/land8070104>
- Haller, T. (2020). Institution shopping and resilience grabbing: Changing scapes and grabbing pastoral commons in African floodplain wetlands. *Conservation and Society* 18(3): 252–267.
- Hilson, G. (2013). 'Creating' rural informality: The case of artisanal gold mining in Sub-Saharan Africa. *SAIS Review of International Affairs* 33(1): 51–64.
- Hsu, Y.K., Bray, P.J., Hommel, P., Pollard, A.M. and Rawson, J. (2016). Tracing the flows of copper and copper alloys in the Early Iron Age societies of the eastern Eurasian steppe. *Antiquity* 90(350): 357–375.
- Intergovernmental Forum on Mining, Minerals, metals and sustainable development (IGF). (2017). Global trends in artisanal and small-scale mining (ASM): A review of key numbers and issues.
- Jenkins, K. (2017). Women anti-mining activists' narratives of everyday resistance in the Andes: Staying put and carrying on in Peru and Ecuador. *Gender, Place & Culture* 24(10): 1441–1459.
- Keenan, J. (2008). Uranium goes critical in Niger: Tuareg rebellions threaten Sahelian conflagration. *Review of African Political Economy* 117: 449–466.
- Keenan, J. (2009). *The dark Sahara: America's war on terror in Africa*. London: Pluto Press.
- Kevane, M. (2015). Gold Mining and Economic and Social Change in West Africa. In Monga, C. and Lin, J. (eds.), *The Oxford Handbook of Africa and Economics: Volume 2: Policies and Practices*. Oxford: Oxford University Press.

- Ki-Zerbo, J., Hammer, E. and Klicker, J.R. (1979). *Die Geschichte Schwarz-Afrikas*. Wuppertal: Hammer.
- Krings, T. (1995). Marginalisation and revolt among the Tuareg in Mali and Niger. *Geoforum* 36(1): 57–63.
- Lahiri-Dutt, K. and Dondov, H. (2017). Informal mining in Mongolia: Livelihood change and continuity in the rangelands. *Local Environment* 22(1): 126–139.
- Lanzano, C. and Arnaldi di Balme, L. (2017). Des ‘puits burkinabè’ en Haute Guinée: processus et enjeux de la circulation de savoirs techniques dans le secteur minier artisanal. *Autrepart* (2): 87–108.
- Lanzano, C. and Arnaldi di Balme, L. (2021). Who owns the mud? Valuable leftovers, socio-technical innovation and changing relations of production in artisanal gold mining (Burkina Faso). *Journal of Agrarian Change* 21(3): 433–458.
- Luning, S. (2014). The future of artisanal miners from a large-scale perspective: From valued pathfinders to disposable illegals? *Futures* 62: 67–74.
- Mortimore, M., Anderson, S., Cotula, L., Davies, J., Facer, K., Hesse, C., Morton, J., Nyangena, W., Skinner, J. and Wolfangel, C. (2009). *Dryland opportunities: A new paradigm for people, ecosystems and development*. Gland: International Union for Conservation of Nature (IUCN).
- Munkherdene, G. and Sneath, D. (2018). Enclosing the gold-mining commons of Mongolia. *Current Anthropology* 59(6): 814–838.
- Myadar, O. and Jackson, S. (2019). Contradictions of populism and resource extraction: Examining the intersection of resource nationalism and accumulation by dispossession in Mongolia. *Annals of the American Association of Geographers* 109(2): 361–370.
- Niederberger, T., Haller, T., Gambon, H., Kobi, M. and Wenk, I. (eds) (2016). *The open cut: Mining, transnational corporations and local populations*. Hamburg: Action Anthropology. Lit.
- Nixon, R. (2011). *Slow violence and the environmentalism of the poor*. Cambridge, MA: Harvard University Press.
- Nixon, S., Rehren, T. and Guerra, M.F. (2011). New light on the early Islamic West African gold trade: Coin moulds from Tadmekka, Mali. *Antiquity* 85(330): 1353–1368.
- Organisation for Economic Co-operation and Development (OECD) (2018). *L’or à la croisée des chemins, Etude d’évaluation des chaînes d’approvisionnement en or produit au Burkina Faso, au Mali et au Niger*. Paris: OECD.
- Oxby, C. and Walentowitz, S. (2016). Uranium mining in Niger: Undermining pastoralist lifeworlds. In Niederberger, T., Haller, T., Gambon, H., Kobi, M. and Wenk, I. (eds) *The open cut: Mining, transnational corporations and local populations*, pp. 155–186. Hamburg: LIT.
- Pérouse de Montclos, M.-A. (2018). *L’Afrique, nouvelle frontière du djihad?* Paris: La Découverte.
- Sandor, A. and Campana, A. (2019). Les groupes djihadistes au Mali, entre violence, recherche de légitimité et politiques locales. *Canadian Journal of African Studies/Revue canadienne des études africaines* 53(3): 415–430.
- Scheele, J. (2012). *Smugglers and saints of the Sahara: Regional connectivity in the twentieth century*. Cambridge: Cambridge University Press.
- Scott, J. C. (1985). *Weapons of the weak: Everyday forms of peasant resistance*. New Haven: Yale University Press.
- SDC (Swiss Development Corporation) (2018). Sustainable artisanal mining project – Factsheet. [https://asmhub.mn/uploads/files/factsheet-english-2018\\_1.pdf](https://asmhub.mn/uploads/files/factsheet-english-2018_1.pdf)
- Siegel, S. and Veiga, M.M. (2009). Artisanal and small-scale mining as an extralegal economy: De soto and the redefinition of ‘formalization’. *Resources Policy* 34(1–2): 51–56.

- Sovacool, B.K., Ali, S.H., Bazilian, M., Radley, B., Nemery, B., Okatz, J. and Mulvaney, D. (2020). Sustainable minerals and metals for a low-carbon future. *Science* 367(6473): 30–33.
- Spittler, G. (1993). *Les Touaregs face aux sècheresse et aux famines: les Kel Ewy de l'Air (Niger)*. Paris: Karthala.
- Sternberg, T. (2020). Conflict and contestation in Kyrgyz mining infrastructure. *The Extractive Industries and Society* 7(4): 1392–1400.
- Sternberg, T., Ahearn, A. and McConnell, F. (2020). From conflict to a community development agreement: A south Gobi solution. *Community Development Journal* 55(3): 533–538.
- Sternberg, T., Toktomushev, K. and Ichinkhorloo, B. (2021). Mining lifecycles in Mongolia and Kyrgyzstan. In Sternberg et al. (eds) *The impact of mining lifecycles in Mongolia and Kyrgyzstan: Political, social, environmental and cultural contexts*. Abingdon: Routledge.
- Teschner, B.A. (2014). 'Orpaillage pays for everything': How artisanal mining supported rural institutions following Mali's coup d'état. *Futures* 62: 140–150.
- Thurston, A. (2020). *Jihadists of North Africa and the Sahel: Local politics and rebel groups*. Cambridge: Cambridge University Press.
- Tursalieva, A. (2021). Gold mining conflicts in Kyrgyzstan: When context and culture matters. In Sternberg, T., Toktomushev, K. and Ichinkhorloo, B. (eds) *The impact of mining lifecycles in Mongolia and Kyrgyzstan: Political, social, environmental and cultural contexts*. Abingdon: Routledge.
- van Dijk, H. (2017). Climate change, drylands and conflict in Africa. In van Beek, W., Damen, J. and Foeken, D. (eds) *The face of Africa. Essays in honour of Ton Dietz*, pp. 115–129. Leiden: ASCL Publications.
- Verbrugge, B. and Geenen, S. (2019). The gold commodity frontier: A fresh perspective on change and diversity in the global gold mining economy. *The Extractive Industries and Society* 6(2): 413–423.
- Vidal, O., Goffé, B. and Arndt, N. (2013). Metals for a low-carbon society. *Nature Geoscience* 6(11): 894–896.
- Weira, A. (2016). *Lacolèredanslevent*. Film <https://vimeo.com/ondemand/lacolèredanslevent/216672169>
- Werthmann, K. (2003). The president of the gold diggers: Sources of power in a gold mine in Burkina Faso. *Ethnos* 68(1): 95–111.
- Zounmenou, D. (2013). The National Movement for the Liberation of Azawad factor in the Mali crisis. *African Security Review* 22(3): 167–174.