



MOBILE PASTORALISM AND PROTECTED AREAS: CONFLICT, COLLABORATION AND CONNECTIVITY

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ABSTRACT

For thousands of years, mobile pastoralist communities have been moving through the rangelands with their herds in search of forage and water, making the most of scarce resources. This traditional form of livestock husbandry has persisted over the centuries because of its harmonious interaction with nature. Yet ironically the advent of protected areas has become a real threat to the lives and livelihoods of mobile pastoralists in many parts of the world. In this paper, the authors consider the many benefits of mobile pastoralism, in particular those related to movement. Pastoral migration routes move through and around protected areas, forging ecological corridors between different habitats, avoiding isolation and fragmentation. As a case in point, the authors look at the network of Spanish drove roads, with new data on the overlap between these routes and protected areas and other areas of high biodiversity. This paper raises some serious questions for reflection by the protected area community vis-à-vis the practice of mobile pastoralism. From basic human rights issues to acknowledging the services pastoralists provide, readers are invited to reflect on an issue that is not clear-cut and requires much more dialogue, as well as concerted action to mitigate conflict and promote collaboration.

Key words: mobile pastoralism, protected areas, rangelands, OECM, connectivity, migration routes

INTRODUCTION

Mobile pastoralism and protected areas meet and interact in many different ways. Sometimes this meeting is complementary, or symbiotic. Other times it causes conflict. Overgrazing is an oft-cited threat to protected areas, yet in many places the practice of mobile pastoralism has been shown to be beneficial for biodiversity and in principle can provide many benefits to society at large. This paper looks at some of the conflicts and enquires into the opportunities for these two diverse practices to work together for nature conservation.

We use the term ‘mobile pastoralism’ to encompass the varying ways that people move through the landscape with their livestock. The word pastoralism derives from the Latin *pastoralis* meaning ‘of herdsmen, of shepherds’¹ and refers to raising livestock (Salzman, 2002), mostly domesticated herbivore species. It is an extensive livestock rearing strategy and way of living

that occurs in the world’s rangelands and is entirely different in essence to intensive livestock production systems that emerged in the last century (McGahey et al., 2014). We add ‘mobile’ to differentiate from sedentary pastoralism, which is conducted from a permanent location. Mobile pastoralism therefore emphasises the mobility of people and their livestock in search of forage and water as the core feature of the practice.

There are three main forms of mobile pastoralism: nomadic, semi-nomadic and transhumant. The differences are mostly based on whether or not the entire family or community moves with the herd. In nomadic or semi-nomadic pastoralism, the entire family or community moves, but in the case of transhumance only a part of the community or an individual moves during the migration period while the rest of the family or community remains at a home base (Chatty, 1973).

These definitions are not static. Mobile pastoralism has always been, and remains, an adaptive livestock management and livelihood practice. If and when environmental and cultural conditions change, the communities adjust accordingly (Bhasin, 2011). The mobility is not occasional but a repeated seasonal movement to pastures depending on the availability of forage and water, which is strongly linked to climatic conditions and changes (Salzman, 2002; Coughenour, 2008). It is a millennia-old survival strategy to ensure the sustainable use of diffuse and scattered resources of rangeland ecosystems in arid, semi-arid and mountain regions (Biber-Klemm & Rass, 2008), following temporal and spatial patterns.

Another common feature of mobile pastoralism is its reliance on common property systems, also devised to efficiently manage the lands and share risks, as a community, arising due to environmental challenges such as drought (Niamir-Fuller, 1999). Changes in land use therefore – including for nature conservation – manifestly impacts the lives of pastoralists all over the world. The practice of mobile pastoralism relies on a constant interaction and interdependency with the landscape and this has led to a rich body of traditional ecological knowledge, which in turn has maintained their lifestyle, as well as the rangeland ecosystems they rely on, for thousands of years.

The advent of formal protected area systems over the past century is one of the big changes in land use that has affected the mobility of pastoralists. In some regions the difficulties are such that they have resulted in nature conservation being cited as one of the key threats to the lives and livelihoods of pastoralists. FAO's Pastoral Knowledge Hub for South Asia states:

"Main pastoralist issues in the region include the intensification of agricultural production and the collapse of agro-pastoral systems, the disruption of mobility routes and the land acquisition processes associated with industrialization and nature conservation."²

Conversely, many protected areas cite overgrazing as a key threat that needs to be tackled, with some states opting for hard-line strategies using relocation or settlement, which is rarely welcomed by pastoralist communities and often has undesirable results for the environment (Studley, 2019; Homewood & Rodgers, 1984). Solutions are not clear-cut and protected areas thinking has greatly changed in recent years, but what is still apparent is that communication and collaboration between mobile pastoralists and protected area administrations remain poor at best.

In this paper, we examine these issues firstly by looking at some examples of conflict between protected areas and mobile pastoralists. We then outline some of the proven benefits of mobile pastoralism based on work within the Mediterranean Consortium for Nature and Culture³ and the Roads Less Travelled Global Initiative⁴ in order to show why a new dialogue is necessary between these two practices that both aim to maintain healthy landscapes. We subsequently look in more detail at key issues of connectivity and the potential role of mobile pastoralism in maintaining and enhancing corridors between areas of high biodiversity (a major threat to protected area systems worldwide) by looking at Spain's system of drovers' roads. We end by considering needs and opportunities for a much better collaboration going forwards.

MOBILE PASTORALISM AND PROTECTED AREAS: CONFLICT AND COLLABORATION

As mobile pastoralism is mainly practised in remote areas with low population density, pastoral lands and territories are often a retreat for wildlife and have a distinct biodiversity. This makes them prime targets for legal protection (Biber-Klemm & Rass, 2008). Some pastoral lands are amongst the most emblematic 'conservation areas' in the world (e.g. Serengeti).

The general view among conservationists has been that mobile pastoralism is environmentally harmful and thus incompatible with nature conservation. Mobile pastoral communities were and still are in many cases perceived as a threat to biodiversity and therefore the adoption of protection measures against these traditional land-users is perceived as required (Boyd et al., 1999; Sullivan & Homewood, 2003).

Here we have two very different land use strategies: Mobile pastoralism as a millennia-old livelihood strategy that makes the most of marginal lands and that is grounded on understanding the landscape and keeping it healthy; and protected areas as a more recent strategy to achieve the 'long-term conservation of nature' (Dudley, 2008), otherwise to maintain healthy landscapes and seascapes. In essence these two strategies have a very similar aim.

However, the establishment and management of protected areas has been a significant driver in the decrease of mobile pastoralism by restricting mobility and land grabbing – dispossession and appropriation by either expropriation or privatisation – of lands and resources used traditionally and collectively by mobile pastoralists (Toutain et al., 2004). Grabbing implies the transfer of ownership, user rights or control over

rangelands and resources that were once owned or managed communally by mobile pastoralists (Fairhead et al., 2012). Over the past decades, there has been a dramatic increase in the number and extent of protected areas established globally (UNEP-WCMC and IUCN, 2016a). Yet the commitments under the Convention on Biological Diversity (CBD) to expand the global network of protected areas so far have been achieved mostly with a preventive and alienating approach by states, violating the rights of mobile pastoralists as has been the case for many other indigenous and local communities (Ykhanbai et al., 2014; Toutain et al., 2004).

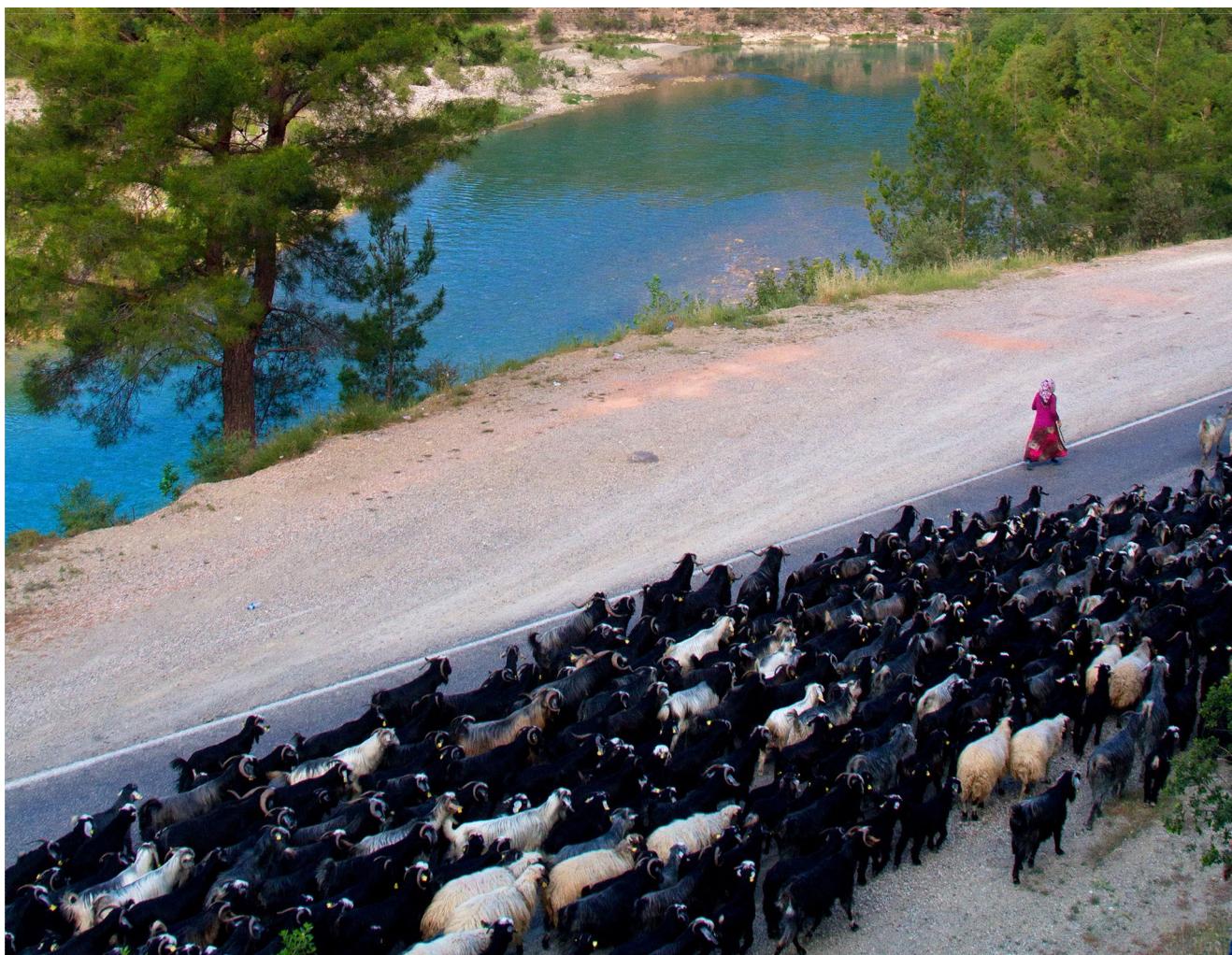
When protected areas are established on traditional pastoral rangelands a number of situations can occur:

- Mobile pastoralism continues within the protected area and/or buffer zone (e.g. Monfragüe National Park, Spain)

- Mobile pastoralism continues within the buffer zone only (e.g. Al Shouf Biosphere Reserve, Lebanon)
- Mobile pastoralism continues outside the protected area and/or buffer zone (e.g. Serengeti National Park, Tanzania)
- Mobile pastoralism is stopped, pastoralists are relocated to other areas (e.g. Rajaji National Park, India)
- Mobile pastoralism is stopped, pastoralists are settled and encouraged to adopt new livelihoods (e.g. Hoh Xil World Heritage Site, China)

The above options are mainly decided by protected area authorities.

Because the landscape benefits of mobile pastoralism have been little understood or acknowledged, and because protected areas have often been superimposed



Restrictions to mobility is a significant driver in the decrease of mobile pastoralism (© Barış Koca)

on traditional rangelands with very little or no consultation, the historical relationship between protected areas and mobile pastoralists has, generally speaking, been one of conflict.

In India, the state policy on forests has reaped havoc amongst forest dependent communities (Agrawal, 2014), many of whom are mobile pastoralists and there have been mass evictions from protected areas since 2002 (Ykhanbai et al., 2014). The Van Gujjar tribe of Rajaji National Park (Uttarkhand and Uttar Pradesh) is a pertinent example of the conflict. The Van Gujjars are the only Muslim forest dependent community in the country. Their official classification as a people in the states of Uttarkhand and Uttar Pradesh is ‘Other Backward Classes’. Their wintering sites lie within the National Park boundaries and their “*finely tuned transhumance helps to regenerate vegetation in the upper Himalayan stretches*” (Agrawal, 2014). Thousands of Van Gujjars have been relocated far from their traditional lands and it is claimed that remaining families in the park are being “*harassed and beaten by RNP (Rajaji National Park) officials and police...*” (Agrawal, 2014).

Similarly in the recently inscribed World Heritage property of Qinghai Hoh Xil, China, many of the traditional Tibetan herders have been evicted and resettled to work in factories. The management of this World Heritage property on the Tibetan plateau falls under the two administrations of Hoh Xil and Sanjiangyuan National Nature Reserves. Chinese legislation for Nature Reserves prohibits activities such as grazing within park boundaries (Studley, 2019; Stoltz & Dudley, in press). Yet the Tibetan herders have always lived in harmony with their natural environment and for the past 30 years have been more formally spearheading species and landscape protection there (Lafitte, 2017).

Some of the world’s most emblematic protected areas have been established on rangelands, which for millennia have been home to mobile pastoralists. The Serengeti in Tanzania is a case in point. Heavy-handed evictions of the Maasai from their ancestral lands in the name of nature conservation have led to years of continued clashes (Tanzania Natural Resource Forum, 2011), and heightened conflict with wildlife. Further, after initial evictions from the protected areas, many Maasai have been evicted once again in order to make way for luxury game hunting (The Ecologist, 2015).

Al Shouf Nature Reserve and UNESCO Biosphere Reserve in Lebanon is home to a quarter of the remaining Lebanese Cedar forests, some of which are

over 2,000 years old. When the Nature Reserve was established in 1996, an old migration route for mobile pastoralists still ran through the middle of it. In accordance with the protected area thinking of the time, the protected area’s management stopped the grazing within the park boundaries, which caused considerable conflict. In time the incidence of forest fires became more important due to the lack of grazing and management decided it was time to re-build relationships with local shepherds. Today grazing is permitted in the buffer zone and development zones of the Shouf Biosphere Reserve and park staff look forward to new collaborations and less conflict (Personal communications with the manager of Al Shouf Nature Reserve and mobile pastoralist shepherds, 25–26 January 2017).

The above incidents were impossible in the case of Monfragüe National Park in Spain because of the long-standing legislation that has protected the country’s drove roads since the 13th century. As such when the protected area was established, first as a Natural Park in 1979, then as a Special Protection Area for birds in 1991, subsequently a UNESCO Biosphere Reserve in 2003 and finally a National Park in 2007, there was no question as to what to do with the transhumant shepherds who for centuries have used the *cañada* that runs through it. Today, both the transhumants and the park staff talk of mutual understanding and a collaborative relationship (Personal communications with the manager of Monfragüe National Park and mobile pastoralist shepherds, 6 March 2017). Interestingly Jesus Garzon, who established the Natural Park in 1979, went on to be one of the key propagators of the long distance transhumance renaissance in Spain, arguing that transhumance in Spain is a necessity for the environment.

As is the case with the Monfragüe National Park example, the experience of the global nature conservation movement over the last few decades has resulted in a shift towards recognising that humans, with their cultural diversity, are an integral component of ecosystems (Nakashima et al., 2012). This recognition has been supported by a growing body of evidence on the strong linkage between the maintenance of mobile pastoralism and the protection of rangeland biodiversity considering particularly that rangeland landscapes account for between one quarter and one half of the world land area and are dependent on herbivore action for their maintenance which is mostly ensured by pastoral grazing management (McGahey et al., 2014).

Whether inside or outside protected areas, the many benefits for the environment related to mobile

pastoralism can no longer be ignored as more literature and concrete examples emerge (Niamir-Fuller et al., 2012). The migration routes used by mobile pastoralists play a critical role in habitat connectivity (Manzano-Baena & Salguero-Herrera, 2018) and if properly acknowledged could certainly provide protected areas with some bio-cultural solutions to the major problems of fragmentation (Ervin et al., 2010) they currently face. The following section of the paper looks at benefits specific to biodiversity, and then considers the scale of pastoral mobility's role in terms of connectivity.

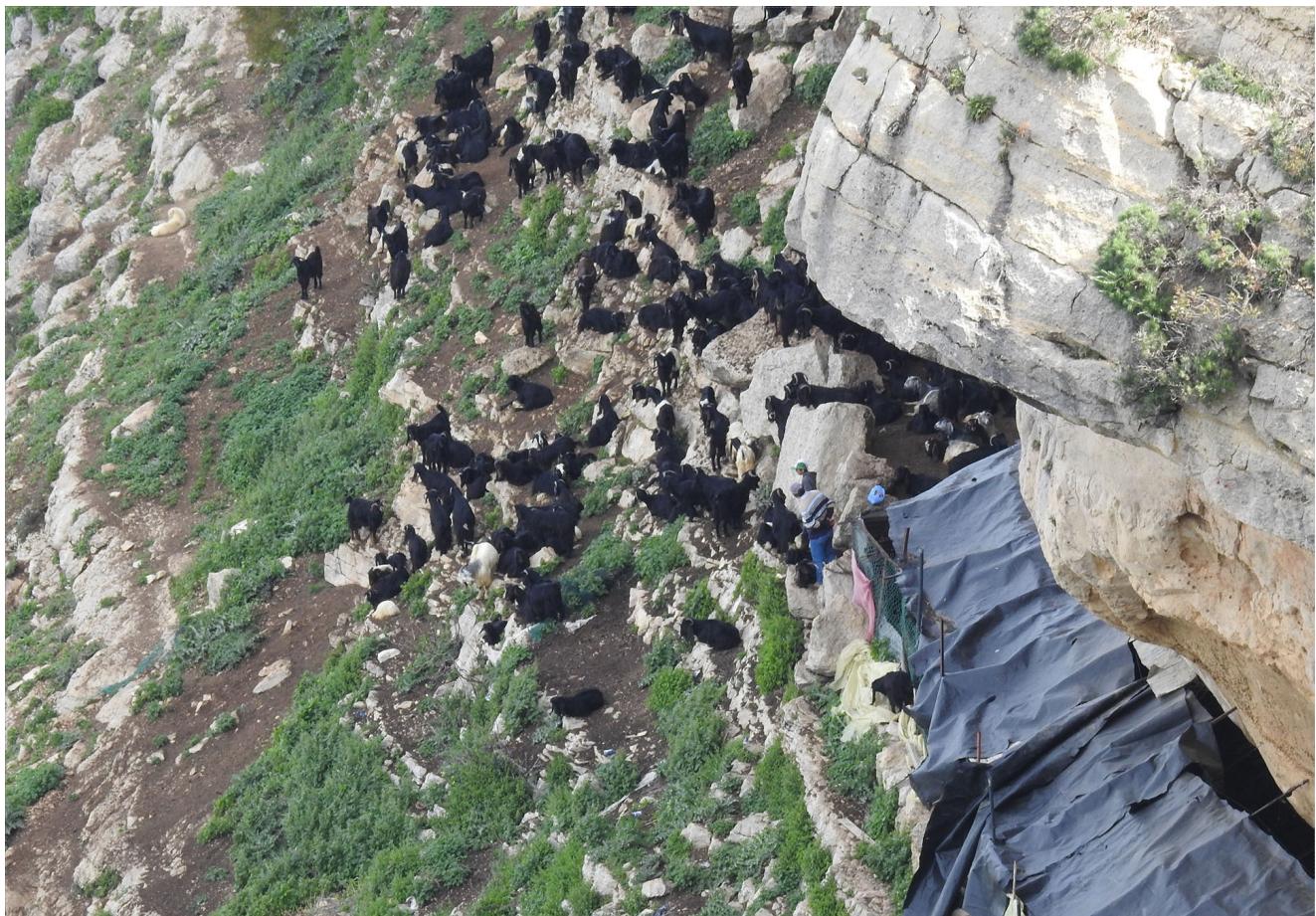
THE BENEFITS OF MOBILE PASTORALISM FOR BIODIVERSITY

Rangeland ecosystems in arid, semi-arid and mountain regions encompass a wide range of vegetation formations: grassland with or without shrub, bush or woodland cover, savanna woodlands. These systems are the product of continual disturbance through patchy and unpredictable rainfall, fire, grazing, browsing and physical disturbance (Homewood, 2004). In particular, temporal variability shapes virtually all ecological

processes in arid and semi-arid rangelands (Hobbs et al., 2008a). Due to insufficient rainfall to sustain agriculture, pastoralism has offered the only sustainable way to turn sunlight into food for people in these areas (Hobbs et al., 2008b).

In response to environmental variabilities and unpredictability in rangeland ecosystems, adaptability, flexibility and opportunism have characterised the evolution of mobile pastoralism and form the basis of their socio-ecological resilience (Niamir-Fuller, 1999; Coughenour, 2008). Moreover it is mobile pastoralists who have been a major agent in the evolution of rangeland ecosystems for thousands of years (McGahey et al., 2014; Reid et al., 2015). Particularly their mobility and the common property systems they depend on have allowed them to access and conserve forage and water resources that are unevenly distributed and vary over time (Reid et al., 2008).

Mobile pastoralists access the complex resources of landscapes, including those that are rare or ephemeral, by moving (Reid et al., 2008). These movements are



Mobile pastoralists, Al Shouf Biosphere Reserve, Lebanon © Marc Hockings

analogous in spatial and temporal scales to a wild herbivore species' movements (Reid et al., 2008; Galvin, 2008; Manzano-Baena & Casas, 2010) and they have very similar effects on ecosystems (Root-Bernstein & Svenning, 2017; Avgar & Fryxell, 2014).

As is the case with wild herbivores, domesticated herbivores exert numerous effects on plant communities and ecosystems (Coughenour, 2008). Among them a major beneficial effect is the generation of spatial heterogeneity (Coughenour, 2008; Manzano-Baena & Salguero-Herrera, 2018).

Certain frequencies and intensities of herbivory and thus movement are required to maintain plant species diversity and rangeland ecosystems that depend upon interactions between herbivores and a variety of resources (Coughenour, 2008). These resources can be assigned to categories such as vegetation types, elevation zones, plant functional groups, and water (Hobbs et al., 2008a).

Thus herbivores cope with temporal variability by exploiting resources that vary in quantity and quality over space and tracking a 'green wave' of nutritious vegetation (Hobbs et al., 2008a). Being central to the process of patch dynamics, this movement of herbivores between patches allows vegetation in previously visited patches to regenerate (Coughenour, 2008).

This is also the case at large spatial scales between seasonal ranges. The mobility of herbivores decreases the interaction frequency between animals and plants and allows the seasonally grazed ranges to recover (Hobbs et al., 2008b). When mobility is restricted, this not only leads to a decrease in heterogeneity but also leads to degradation (Hobbs et al., 2008a). For instance denying access to protected areas within the Ngorongoro Conservation Area in Tanzania, which has been inhabited by pastoralists and abundant wildlife for nearly two thousand years, forced Maasai pastoralists to consistently use the highlands. The diminished ability to compensate temporal variables led to the degradation of these highlands, which were traditionally used only seasonally (Galvin et al., 2008). Similarly, the impact of abandoning grazing in Gran Paradiso Natural Park in north-western Italy had significant effects on vegetation causing shrub encroachment and loss of rangelands and led to an unfavourable conservation status for grazing dependent species such as grassland birds (Laiolo et al., 2004).

Movements create a shifting mosaic of patches in different stages of regrowth or succession in the landscape. As a result, plant species diversity at

landscape scales is increased due to the occurrence of plant species with different life history strategies (growth rate, etc.) in disturbed versus recovered patches (Coughenour, 2008). Spatial heterogeneity with diverse plant species promotes diversity of species of different taxonomic groups by increasing available niche space and thus allowing more species to coexist, by providing shelter and refuges from adverse environmental conditions and by increasing the probability of speciation (Stein et al., 2014). This is not only the case for seasonal ranges but also for migration routes. For instance, a study comparing the routes still used by the domestic herbivores of mobile pastoralists versus abandoned routes in Spain suggests a significantly higher level of ant taxonomic diversity on the used routes. It was found that the used routes have a higher potential as functional reservoirs compared to those that were abandoned (Hevia et al., 2013). Particularly in environments where grazing is negligible or absent, the heterogeneity created by mobility along the migration routes creates local but crucial refugia for species (Manzano-Baena & Salguero-Herrera, 2018; Azcárate et al., 2013).

Movement is also central to the maintenance of a diversity of herbivores due to its involvement in grazing succession. Based on their body sizes and dietary differences (grazer, browser, etc.), they create suitable habitats for each other or they force each other to move on to new patches, which is essential for the succession of vegetation with low leaf:stem ratios (more stem, less leaf) or higher leaf:stem ratios (more leaf, less stem) (Coughenour, 2008). Large-bodied herbivores facilitate energy flow to smaller-bodied species by converting the vegetation with low leaf:stem ratio to a vegetation with a higher leaf:stem ratio which smaller-bodied herbivores utilise. Selectively foraging smaller-bodied herbivores may reduce the quality of the patch forcing less selective large-bodied herbivores to move on to new patches (Coughenour, 2008). For instance, the broad-scale separation of the ecosystem, whose shifting landscape mosaic was historically created by the dynamic interaction of pastoralists and elephants, has had important ecological implications for vegetation patterns in Amboseli National Park in Kenya. The distribution and abundance of wildlife at local and landscape scales has also been impacted since the forced removal of the Maasai and their livestock from the protected area. In the absence of livestock (grazers) forcing large-bodied herbivores to move on, the woodlands within the park collapsed, with elephants (browsers) preventing their regeneration. The collapse of the woodlands has resulted in a change of composition of other species and thus a loss of species, such as Coke's hartebeest (*Alcelaphus buselaphus cokii*)

and Gerenuk (*Litocranius walleri*). The decline of woodlands has led to significant shifts in primate distributions and has also certainly had implications for taxonomic groups such as ants, butterflies and birds (BurnSilver et al., 2008).

One other major effect involving movement is related to the role of herbivores in the dispersal of plants by epizoochory (the transportation of seeds attached to animal coats or hooves) and endozoochory (dispersal by ingestion and later defecation). Seeds attached to the fleece of livestock can be transported distances of up to several hundred kilometres in substantial numbers (Manzano & Malo, 2006). Another study reveals that a herd of 1,000 sheep can transport as many as 200 million ingested seeds along the migration routes between seasonal ranges during their 1,500 km migration with a mean dispersal distance of 40 km (Manzano-Baena & Salguero-Herrera, 2018). As the other processes resulting in the occurrence of long seed dispersal distances are ocean drift and tornadoes, dispersal by epizoochory and endozoochory may be critical mechanisms for plant species to escape the effects of global climate change (Manzano & Malo, 2006).

Herbivore movement also plays an important role in soil nutrient cycling, contributing to nutrition transfer across the landscape (Coughenour, 2008). Mineralisation of organic matter in rangeland ecosystems is to a large extent done by bacteria in the dung that dung beetles, ants and termites further help to incorporate into the soil (Manzano-Baena & Salguero-Herrera, 2018). Movement also allows a slow release of nitrogen and other nutrients, therefore preventing water pollution by leaching (Mekonnen & Hoekstra, 2012; Manzano-Baena & Salguero-Herrera, 2018).

The mobility of herbivores also has a direct effect on many scavenger species (Marinković & Karadžić, 1999; Xirouchakis & Nikolakakis, 2002; Mateo-Tomás, 2013), predators and insects with its role in nutrient cycles (Manzano-Baena & Salguero-Herrera, 2018). For instance vulture species, whose populations are in decline all over the world, typically rely on organic tissues from the carcasses of herbivores (Botha et al., 2017).

Additionally the movement of herbivores makes habitats less prone to wildfires by consumption of understory and their migration routes serve as natural firebreaks (Manzano-Baena & Salguero-Herrera, 2018).

All these effects of herbivore movement contribute to an increase of ecosystem resilience by creating mosaics of patches with varied functions necessary to respond to changing environmental conditions (Coughenour, 2008). It is also through movement that this heterogeneity is maintained by the connectivity it ensures (Galvin, 2008), integrating these separated patches (structural connectivity) with the species diversity and movement and ecological processes they support (functional connectivity) into a single functioning system so the patches start to affect each other indirectly (Coughenour, 2008).

Herbivores and their movement therefore play a critical role in maintaining connectivity. In addition to structural and functional connectivity, considering the forced shifting of species' ranges to track suitable conditions due to climate change and other threatening processes (Worboys et al., 2016), migration routes also contribute to evolutionary connectivity for plant species.

As such, in light of declining wild herbivore populations and/or their increasing inability to migrate over long distances, mobile pastoralists and their herds provide substitution for these roles (Manzano & Malo, 2006). The spatial scale of the migration routes functioning as ecological corridors along with the amount of movement between patches determine the scale of ecological interactions. This is central to the structure and functioning of ecosystems and the ecological integrity of landscapes (Hobbs et al., 2008a; Galvin, 2008; Galvin, 2009).

This is also the case with protected areas and other sites of importance for biodiversity such as Key Biodiversity Areas (KBAs) and Important Bird Areas (IBAs). In many cases the landscapes that are so coveted by conservationists have been created and maintained over centuries by the presence and movement of mobile pastoralists and their domesticated herbivores (Biber-Klemm & Rass, 2008; Reid et al., 2015).

The migration routes which function as ecological corridors do not only connect protected areas to each other but also to the wider semi-natural and natural landscapes thereby avoiding their isolation and fragmentation (Manzano-Baena & Salguero-Herrera, 2018). The scale of the connectivity and ecological integrity ensured by the movement of herbivores, with the effects described above, is an integral component of the habitats and species that are conserved by protected areas particularly in arid and semi-arid ecosystems (Coughenour, 2008; Hobbs et al., 2008a).

DROVE ROADS IN SPAIN

In order to assess the scale of connectivity ensured by migration routes through a case study, we have conducted a mapping exercise in Spain⁵. The Spanish case provides us with a good example for several reasons: its rich biodiversity, habitat fragmentation and loss being a significant threat, a long history of mobile pastoralism and the availability of good documentation and cartography.

Spain is a semi-arid country hosting an estimated 85,000 species of animals and plants, representing 54 per cent of the total species inventoried in Europe and could represent more than 5 per cent of the species in the world. Of the total number of 2,233 species assessed in the country more than one fifth are considered threatened and at least 10 per cent are Near Threatened at European level (IUCN, 2013). Being a highly developed country, fragmentation along with habitat loss and degradation are the most significant threats identified for these species (IUCN, 2013).

Spain also has a long history of mobile pastoralism with domestic herbivores inheriting the ancient routes of their wild ancestors and acting as a major agent in the evolution and maintenance of landscapes (Manzano-Baena & Casas, 2010; Bunce et al., 2004).

Due to the importance of this traditional practice, a professional association of breeders, the *Concejo de la Mesta*, was created in the 13th century, which acquired legal recognition and classification of the network of migration routes called drove roads (Manzano-Baena & Casas, 2010; Martin, 2004). Yet as is the case worldwide, mobile pastoralism has experienced a sharp decline since the 19th century in Spain which led to the abandonment and degradation of drove roads (Manzano-Baena & Casas, 2010; Martin, 2004). In response to this trend the Spanish Government passed a law safeguarding the network of drove roads in 1995 (Mangas-Navas, 2004). This legislation and the strong legacy and cultural value of transhumance in the



Monfragüe National Park in Spain is among the protected areas through which the routes cross © Concha Salguero

country has led to better preserved roads than in other countries of the Mediterranean basin (Azcárate et al., 2013).

The main typology of the drove roads network is based on the width of the road: *Cañadas Reales/Cañadas* are 75 metres wide, *Cordeles* 37 metres and *Veredas* 20 metres. *Cañadas Red Nacional*, refers to the *cañadas* crossing different regions. The smaller routes connected to these major ones are known by local names (Martin, 2004).

We collected mapping data from official authorities at different levels and compiled the information in ArcGIS®. In addition to the official cartography of the Ministry of Agriculture and Fisheries, Food and Environment, the relevant departments at regional government level were also contacted to collect mapping layers. The drove roads that were used for transhumance on foot in 2017 were identified with the help of the Asociación Trashumancia y Naturaleza (TyN) who contacted transhumant herders to acquire this information. All of the collected data in different formats and scales were georeferenced, homogenised and integrated with the official cartography of the Ministry following the above-mentioned typology (Figure 1). In order to understand the spatial relationship between these transhumance routes and protected areas and Natura 2000 Areas, Key Biodiversity Areas (KBAs) and Important Bird Areas (IBAs), we overlaid these designations with the transhumance routes. The number of protected areas, Natura 2000 Areas, KBAs and IBAs found to intersect

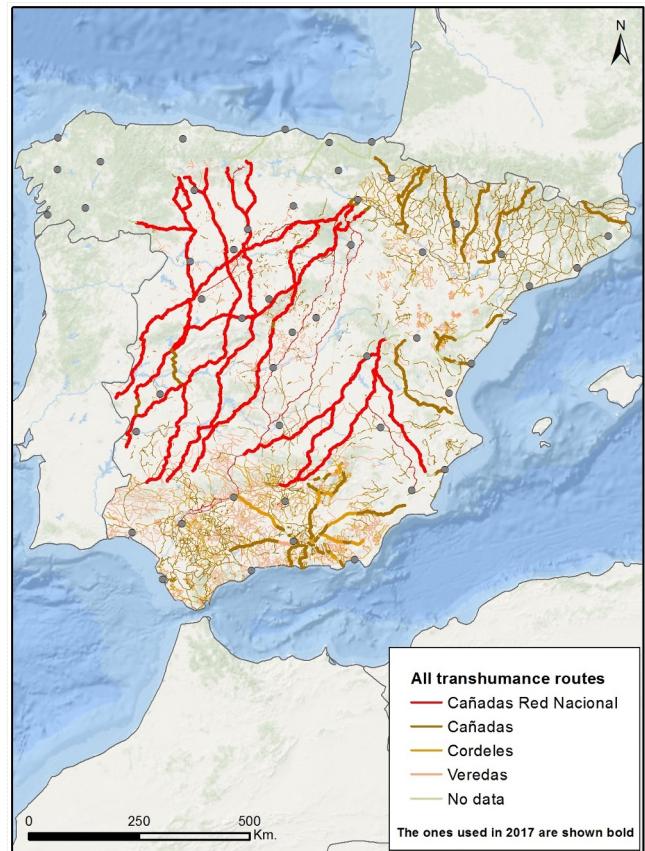


Figure 1. Transhumance routes in Spain

with transhumance routes were computed. The spatial overlapping fragments of route lengths were computed for each area type.

The geographical configuration of the network is coherent with the ecological rationale of mobile pastoralism with major routes beginning in lowland landscapes in the southern parts (or from coastal plains), which are the winter ranges, to summer ranges in highland landscapes in the northern parts of the country (Manzano-Baena & Casas, 2010).

The total length of the routes mapped is 88,296 km. With its fractal structure, the network covers almost the entire territory of the country and forms a matrix connecting various landscapes at very long distances (Azcárate et al., 2013; Manzano-Baena & Casas, 2010).

Despite the sharp decline in the practice in the country, the total length of the drove roads used in 2017 is still very significant at 11,792 km.

Overlay of the GIS mapping data of migration routes with mapping data of protected areas (UNEP-



Grazing in dehesa (a type of agropastoral system) only in winter allows regeneration of vegetation, Spain © Engin Yilmaz

Table 1. Correspondence of routes used in 2017 with protected areas and other sites of importance for biodiversity

	Total number of areas	Number of areas which routes cross	Percentage	Length of the intersections (km)					No data
				Total	Cañadas Red Nacional	Cañadas	Cordeles	Veredas	
Protected Areas	3,121	331	10.6	2,184.7	1,326.9	632.1	105.1	14.7	105.1
Natura 2000 Areas	1,451	230	15.9	2,153.8	1,314.3	617.4	106.8	16	99.1
Key Biodiversity Areas	214	65	30.4	3,313.7	2,894.6	293.9	110.6	8	6.4
Important Bird Areas	331	102	30.8	4,450.4	3,399.4	760.5	163.2	8	119

WCMC and IUCN, 2016b), Key Biodiversity Areas (BirdLife International, Conservation International and partners, 2011)⁶ and Important Bird Areas (BirdLife International, 2016) also reveals the scale of the connectivity that mobile pastoralism ensures between them and with wider landscapes.

The routes used in 2017 (Table 1) cross through 331 protected areas (Figure 2a), 230 Natura 2000 Sites (Figure 2b), 65 KBAs and 102 IBAs (Figure 2c). Even considering the sharp decline of the practice in Spain, these figures show that mobile pastoralism and the migration routes still ensure connectivity at a significant scale and contribute to the maintenance of a connected protected area system integrated into the wider landscape. As the scale of connectivity and heterogeneity are inextricably linked (Hobbs et al., 2008a), the movement of transhumants with their livestock along these routes between winter and summer ranges contributes to habitat heterogeneity against habitat loss and fragmentation and to the diversity of species of different taxonomic groups that this heterogeneity allows in the country.

Considering the low percentage of KBAs covered by the protected areas network globally, which is 19.2 per cent (UNEP-WCMC and IUCN, 2016a), these routes managed by mobile pastoralists not only contribute to well-connected systems of protected areas but also safeguard important places for biodiversity not covered by the protected areas network.

Opportunities for collaboration

The maintenance of pastoral mobility in the world's rangelands therefore seems critical in the current context of a changing climate and with protected areas

becoming less and less viable for biodiversity due to fragmentation and isolation. A number of opportunities for collaboration exist both within the folds of IUCN protected area categories I-VI as well as in new thinking on other types of effective measures to protect landscapes. Some of these are examined below.

Protected area management

In contrast to the traditional view of conservationists that mobile pastoralists are unconcerned or ignorant of the ecological consequences of their actions (Fernandez-Giménez, 2000), the pastoralists themselves bear the highest costs of a degraded environment (Naimir-Fuller et al., 2012). Thousands of years of experience has created an awareness that their survival and that of future generations depends on the results of their management decisions which leads to a deep sense of responsibility and connectedness to the landscapes they manage (Knapp & Fernandez-Giménez, 2008; Sonneveld et al., 2017).

The practices, strategies, social institutions and evolving knowledge of mobile pastoralists, all based on a constant interaction with the environment and ecological processes (Reid et al., 2008; Hobbs et al., 2008a) culminate in a valuable body of what can be termed traditional ecological knowledge.

Fikret Berkes defines this as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes, 2012). This knowledge consists of biophysical observations, skills and

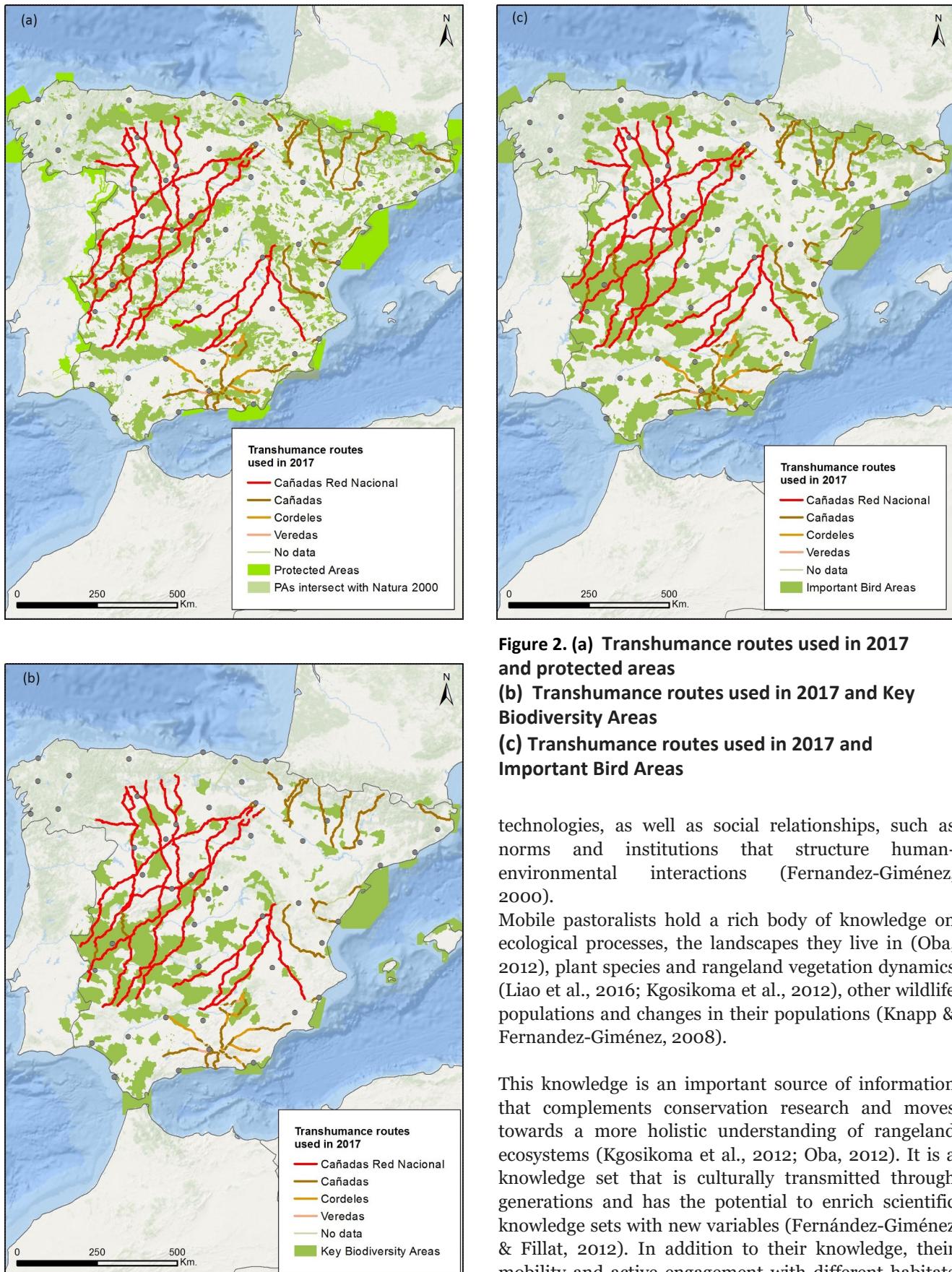


Figure 2. (a) Tranhumance routes used in 2017 and protected areas

(b) Tranhumance routes used in 2017 and Key Biodiversity Areas

(c) Tranhumance routes used in 2017 and Important Bird Areas

technologies, as well as social relationships, such as norms and institutions that structure human-environmental interactions (Fernandez-Giménez, 2000).

Mobile pastoralists hold a rich body of knowledge on ecological processes, the landscapes they live in (Oba, 2012), plant species and rangeland vegetation dynamics (Liao et al., 2016; Kgosikoma et al., 2012), other wildlife populations and changes in their populations (Knapp & Fernandez-Giménez, 2008).

This knowledge is an important source of information that complements conservation research and moves towards a more holistic understanding of rangeland ecosystems (Kgosikoma et al., 2012; Oba, 2012). It is a knowledge set that is culturally transmitted through generations and has the potential to enrich scientific knowledge sets with new variables (Fernández-Giménez & Fillat, 2012). In addition to their knowledge, their mobility and active engagement with different habitats

throughout the year make them very useful partners for systematic observations and monitoring changes at species and ecosystem levels (Niamir-Fuller, 1999; Fernández-Giménez & Fillat, 2012).

Most rangelands of the world have been communally governed and these common property systems have coordinated the activities of each member (Niamir, 1995) and have been devised to efficiently manage the lands by regulating resource use and mobility (Rogers et al., 1999; Butt, 2016), develop collective responses and share risks (Niamir-Fuller, 1999; Butt, 2016), and develop mechanisms to enable negotiation and conflict resolution (Salpeteur et al., 2017).

Given the pastoralists' depth of experience and knowledge in managing rangelands including the strategy of mobility, they have critical contributions to make with context-specific and empirically-grounded recommendations towards constructing robust management structures and mechanisms (Liao et al., 2016; Oba, 2012). The adaptive, flexible and opportunistic character of mobile pastoralists, facilitates adaptive management towards enhancing the resilience of rangeland ecosystems (Liao et al., 2016).

This is also the case with climate change adaptation and mitigation efforts. The consequences of climate change on ecology will vary in different locations and the interactions between climatic changes and non-climate factors, such as land use, are very complex (NRC, 2010; Briske et al., 2015). Therefore, any response to address the effects of climate change at local or global levels calls for a finer scale understanding of the issue. This means taking the diversity of landscapes into consideration and including mitigation and adaptation actions not only at institutional but also at community levels. With their traditional ecological knowledge ensuring attentiveness to environmental variability, shifts and trends, mobile pastoralist communities provide a crucial foundation for protected area managers in researching and responding to climate change and developing geographically-specific adaptation and mitigation strategies (Nakashima et al., 2012; Fernández-Giménez & LeFebre, 2006).

The above-mentioned opportunities for protected area operations are one side of the story. There is also an urgent need to re-evaluate perceived threats to protected areas from mobile pastoralists. When the traditional capability of mobile pastoralists to develop sustainable solutions cannot cope with externally imposed changes such as land appropriation, they either abandon the practice completely or diversify and differentiate their management systems, which can lead

to the development of responses that in some cases may create conflict with wildlife or institutionalised conservation mechanisms, for example human-carnivore conflict and overgrazing (Sonneveld et al., 2017; Fernandez-Giménez, 2000). Such cases must be thoroughly investigated to understand the root causes and to develop sustainable responses that solve the problem rather than simply restricting mobility and preventing mobile pastoralists from using their traditional resources – a strategy that has proved counter-productive in many cases.

Other Effective Area-Based Conservation Measures

Aichi Target 11 states that “By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes” (CBD, 2010).

This target of the Convention on Biological Diversity presents a new opportunity for the conservation community to acknowledge the important contribution of mobile pastoralists and the rangelands and migration routes that they manage.

In the voluntary guidance document drafted by the World Commission on Protected Area's Task Force, an OECM (Other Effective area-based Conservation Measure) is described as “a geographically defined area, other than a Protected Area, which is governed and managed in ways that achieve positive and sustained outcomes for the in-situ conservation of biodiversity, with associated ecosystem services and cultural and spiritual values” (CBD, 2018; Jonas et al., 2018).

Mobile pastoralism and the lands they manage fulfil the core elements of the OECM definition. As Jonas et al. (2018) state, the most significant elements that combine to constitute an OECM are:

- a geographically defined space;
- not a protected area;
- governed and managed (including customary governance and management structures);
- positive biodiversity outcomes and effective in-situ conservation; and
- long-term (conservation outcome is expected to

be ongoing).

As evidenced in this paper, the lands and migration routes mobile pastoralists have managed over millennia in protecting threatened species and habitats, ensuring ecological integrity of landscapes and supporting ecological processes, maintaining areas of importance for ecological connectivity, and providing critical ecosystem services such as carbon storage, etc. makes these areas strong candidates to be considered as OECMs.

Given that governments, conservation and other implementing agencies are often under-resourced and understaffed (Jonas et al., 2018), recognition and engagement of mobile pastoralists within the OECM framework could contribute to improved management and restoration of areas that may usefully support the long-term in-situ conservation of biodiversity.

The high incidence of intersection between migration routes and KBAs (30 per cent) as revealed in our mapping study also shows the potential of migration routes as OECMs to contribute to “representativeness and connectivity, and to contribute to conservation in important places such as Key Biodiversity Areas (KBAs), especially in cases where protected areas are not an option” (UNEP-WCMC and IUCN, 2016a) and towards well-connected conservation systems integrated within wider landscapes.

Areas of connectivity conservation

The migration routes of mobile pastoralists can also be considered in the framework of Areas of Connectivity Conservation (ACCs).

IUCN Draft Guidelines for Areas of Connectivity Conservation defines them as:

“A recognised, large and/or significant spatially defined geographical space of one or more tenures that is actively, effectively and equitably governed and managed to ensure that viable populations of species are able to survive, evolve, move and interconnect within and between systems of protected areas and other effective area based conservation areas. The vision and purpose of an Area of Connectivity Conservation is to connect protected areas and other effective area based conservation areas and to maintain or restore ecosystem function and ecological and evolutionary processes of species and ecosystems across (and between) landscapes, freshwaterscapes or seascapes for biodiversity conservation in areas that may also be used and occupied for a variety of human purposes, so that people and other species are able to survive and to adapt to environmental change, especially climate change” (Worboys et al., 2016).

As put forward in this paper, the declining wild herbivore populations and/or their inability to migrate over long distances as in the past, means that the importance of mobile pastoralists and their herds in maintaining connectivity and therefore the ecological integrity of landscapes is even more critical. In addition, pastoral migration routes serve as areas that maintain or restore ecosystem function and ecological and evolutionary processes of species and ecosystems across and between landscapes.

Our ongoing mapping study, currently being undertaken across the Mediterranean, shows that mobile pastoralism still ensures connectivity at a significant scale despite the strong decline in the practice and can contribute to the maintenance of a connected protected area system, integrated into the wider landscape, even in very developed countries like Spain, where fragmentation poses one of the most significant threats.

CONCLUSIONS AND RECOMMENDATIONS

Recognising the long-standing role of mobile pastoral communities in the maintenance of the world’s rangelands and the function of domestic herbivore mobility in connecting landscapes, the lack of proper collaboration in the majority of formal protected area systems seems like a missed opportunity to say the least. Further, acknowledging the rich body of traditional ecological knowledge held by mobile pastoralist communities and their continual interaction and dependence on the landscape, the development of more symbiotic relationships and respectful exchange would almost certainly be mutually beneficial.

Instead of knee-jerk responses to issues of grazing by protected area management, the critical role of mobile pastoralists as ‘mobile agents of change in ecosystems’ needs to be integrated into protected area strategies in order to ensure connectivity and integration into the broader landscape (Coughenour, 2008). Finding win-win solutions for pastoralists and wildlife should become an urgent priority in the many areas where the two co-exist (Niamir-Fuller et al., 2012).

To ensure the needed shift from conflict to collaboration, the following recommendations are strongly suggested:

- All existing and future protected areas should be managed and established in full compliance with the inherent rights of mobile pastoral communities, especially their land and other natural resources-related rights, avoiding policies

- harming the physical, cultural and spiritual integrity of communities such as forced evictions, sedentarisation and restrictions to their mobility.
- Accordingly protected area authorities should develop policies, mechanisms and measures, which ensure effective participation of mobile pastoral communities in the designation and management of protected areas. This approach should also recognise the traditional ecological knowledge of mobile pastoralists including traditional common property systems as an integral part of new collaborations going forwards.
 - In line with progressive protected area thinking, a new understanding, based on respect, dialogue, and basic human compassion, addressing the root causes of any conflicts including land degradation in or around protected areas is urgently required in areas where conflict has arisen or has the potential to arise.
 - Protected area authorities should be supported in order to find mutually beneficial solutions regarding governance and management in systems of protected areas, starting with the development of good practice guidelines, fully informed by mobile pastoralist communities.
 - The role of mobile pastoralists in maintaining rangeland ecosystems and avoiding fragmentation between protected areas and with wider landscapes needs to be better assessed and recognised by the conservation community and concerned states.
 - Mobile pastoralists should be supported and empowered to protect their traditional lands and resources and migration routes. New conservation approaches such as OECMs, ACCs and other mechanisms may support these processes.

ENDNOTES

¹ Online etymology dictionary: [etymonline.com](http://www.etymonline.com)

² <http://www.fao.org/pastoralist-knowledge-hub/pastoralist-networks/regional-networks/south-asia/en/>, accessed 18 July 2018.

³ Mediterranean Consortium for Nature and Culture: DiversEarth, MedINA, Society for the Protection of Nature in Lebanon, Trashumancia y Naturaleza, WWF-North Africa, Yolda Initiative, funded by the MAVA Foundation.

⁴ Roads Less Travelled is a global initiative in support of mobile pastoralists, founded by DiversEarth, Yolda Initiative and

Trashumancia y Naturaleza in collaboration with pastoralist communities and their supporting organisations worldwide.

⁵This work was initiated within the Mediterranean Consortium for Nature and Culture and is continued within the Roads Less Travelled Global Initiative.

⁶ BirdLife International, Conservation International, and partners (2011). Global Key Biodiversity Areas. Cambridge, UK and Arlington, VA, USA: BirdLife International and Conservation International. [These data represent the combination of global Important Bird Areas developed and maintained by the BirdLife partnership and Key Biodiversity Areas developed and maintained by Conservation International and partners. For a full list of collaborators and supports please contact science@birdlife.org or data@conservation.org]

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RESUMEN

Durante miles de años, las comunidades de pastores móviles se han estado desplazando por los pastizales con sus rebaños en busca de forraje y agua, impulsados por la necesidad de aprovechar al máximo los escasos recursos disponibles. Esta forma tradicional de cría de ganado ha persistido a través de los siglos debido a su interacción armoniosa con la naturaleza. Sin embargo, irónicamente, la llegada de las áreas protegidas se ha convertido en una amenaza real para las vidas y los medios de subsistencia de los pastores móviles en muchas partes del mundo. En este artículo, los autores abordan los numerosos beneficios del pastoralismo móvil, en particular los relacionados con el movimiento. Las rutas migratorias de los pastores discurren a través y alrededor de las áreas protegidas, formando corredores ecológicos entre los diferentes hábitats y evitando el aislamiento y la fragmentación. A manera de ejemplo, los autores examinan la red de carreteras españolas con nuevos datos sobre la superposición entre estas rutas y las áreas protegidas y otras áreas de alta biodiversidad. El presente artículo plantea algunas cuestiones que llaman a la reflexión de la comunidad de áreas protegidas en relación con la práctica del pastoralismo móvil. Desde temas básicos de derechos humanos hasta el reconocimiento de los servicios que aportan los pastores, se invita a los lectores a reflexionar en torno a una cuestión que no está clara y que exige un análisis más profundo, así como acciones concertadas para mitigar los conflictos y promover la colaboración.

RÉSUMÉ

Depuis des milliers d'années, les communautés pastorales nomades se sont déplacées à travers les terres de parcours avec leurs troupeaux à la recherche de fourrage et d'eau, tirant le meilleur parti des ressources rares. Cette forme traditionnelle d'élevage a persisté au cours des siècles grâce à son interaction harmonieuse avec la nature. Pourtant, paradoxalement, l'avènement des aires protégées est devenu une véritable menace pour la vie et les moyens de subsistance des pasteurs nomades dans de nombreuses régions du monde. Dans cet article, les auteurs considèrent les nombreux avantages du pastoralisme nomade, en particulier ceux liés au mouvement. Les routes de migration pastorale passent à travers et autour des aires protégées, créant des corridors écologiques entre différents habitats, évitant ainsi l'isolement et la fragmentation. À titre d'exemple, les auteurs examinent le réseau des routes migratoires espagnoles, apportant de nouvelles données sur le chevauchement entre ces routes et des aires protégées et d'autres zones riches en biodiversité. Cet article soulève de sérieuses questions qui appellent à une réflexion de la part de la communauté des aires protégées par rapport à la pratique du pastoralisme nomade. Les lecteurs sont invités à réfléchir sur cette question ambiguë qui mérite un dialogue nettement plus large, allant de la notion fondamentale des droits de l'homme à la reconnaissance des services fournis par les pasteurs nomades, en passant par des actions concertées pour atténuer les conflits et promouvoir la collaboration.