

# Global action for sustainable rangelands and pastoralism to achieve Land Degradation Neutrality (LDN)

A science-to-policy review, with recommendations for  
the UNCCD Conference of Parties

Prepared by the IYRP LDN Working Group from 2022-2023

August 2023

<https://iyrp.info>

## **Executive summary**

***More than half of the world's land mass is rangeland – and yet these landscapes and the people who inhabit and manage them have been largely neglected. They are the main source of food and feed for humanity, and yet they are also the world economy's dumping ground. It is time to shift perspective – from 'a rangeland problem' to 'a sustainable rangeland solution'. It is time to commit globally to halt indiscriminate rangeland conversion, to pass judicious policies and laws that support and enhance rangelands and pastoralism, and to upgrade the LDN as a global consensus and tool with stronger targets and funding for rangelands.***

The United Nations General Assembly (UNGA) has designated 2026 the International Year of Rangelands and Pastoralists (IYRP 2026) to enhance rangeland management and the lives of pastoralists. With this declaration, UN Member States are called upon to invest in sustainable rangeland management, to restore degraded lands, to improve market access by pastoralists, to enhance livestock extension services, and to fill knowledge gaps on rangelands and pastoralism. This brief summarizes the findings of a comprehensive science review undertaken by a team of experts from the IYRP International Support Group, a coalition of more than 320 organizations worldwide, to determine key issues to address in rangelands and pastoralism and targets to set in the 'land degradation neutrality' work proposed by the UN Convention to Combat Desertification (UNCCD) to maintain or enhance the world's land-based natural capital.

Rangelands occupy more than half of the Earth's land surface. Pastoralism has been practiced for millennia on rangelands as a way for communities to adapt to climatically variable and uncertain environments. More than two billion people today depend directly or indirectly on pastoralist livelihoods, value chains and foods. Pastoralism remains the most viable way to manage rangeland ecosystems for the benefit of both people and the environment. In addition to producing nourishing milk and meat from livestock herds, pastoralism on rangelands and farmlands provides essential ecosystem services by enriching soils, capturing carbon, dispersing seed, shaping landscapes and conserving biodiversity, including the many endangered wildlife species that make rangelands their home.

### **Challenges**

The main threats to the world's rangelands and pastoralism are conversion to land uses other than grazing and degradation of the remaining rangelands. Increasing human pressures and climatic stressors are together forcing millions of traditional rangeland users to cope with livestock production losses, water and forage scarcity, land-use conflicts, displacement, sedentarization and poverty. The major drivers behind this suite of problems are poor governance and institutional weaknesses, policy neglect, underinvestment, and large knowledge and technology gaps. In some countries, the encroachment of mining activities and of poorly planned large-scale renewable energy interventions are damaging pastoralist livelihoods and rangeland health, and compromising pastoralists' access rights. Worldwide, policies prioritizing the industrialized livestock sector are undermining sustainable pastoralist practices. A persistent lack of appreciation for pastoralism as a viable and sustainable land-use that contributes to many ecosystem services, has left rangelands and their pastoral stewards marginalized and overlooked in global agenda setting. If continued, this deteriorating situation will have dire consequences for pastoral lands and peoples and for the whole planet.

### **Shifting the perspective**

Despite these significant threats, implementation of many innovative policies and good practices has enhanced the wellbeing of rangelands and pastoralists in different parts of the world. Those demonstrable successes inform our calls to action below. These eight actions demand a shift in

view—from regarding pastoralists and their livestock as part of ‘the rangeland problem’ to seeing them as part of a time-honored and nature-based solution for the health of rangeland agro-ecosystems.

***A similar level of global commitment is needed to halt indiscriminate rangeland conversion as there has been for halting deforestation.*** Furthermore, the ***LDN as a global commitment and tool must increase attention to rangelands through stronger targets, action, and funding.***

Judicious policies and practices for sustainable rangeland management and restoration can go far in meeting national and global commitments to mitigating climate change, to meeting the UN’s 17 Sustainable Development Goals and to achieving land degradation neutrality, which the UNCCD defines as stabilizing or increasing the quantity and quality of land-based natural capital in the face of global environmental change.

**Calls to action**

The International Support Group for IYRP 2026 calls on the UNCCD Conference of the Parties to adopt eight priority actions to meet the challenges facing rangelands and pastoralists.

**#1 Stop indiscriminate conversion of rangelands**

**#1 Indiscriminate conversion of rangelands** to croplands, tree plantations, forests, minefields, infrastructure and human settlements is hurting rangeland productivity, ecosystem services and rangeland’s potential role in mitigating climate change. Halt indiscriminate rangeland conversion practices until appropriate legislation and monitoring efforts are put into effect.

**#2 Recognize the importance of pastoral mobility**

**#2** Grazing by migratory, wild and domesticated herbivores is an integral component of rangeland ecosystems. Recognize the importance of **pastoral mobility** as a nature-based solution for sustainably managing and restoring rangeland health. Provide flexible and secure land-tenure systems, well-planned and provisioned animal corridors, and waterpoints for transhumance systems.

**#3 Innovate and implement beneficial economic policies and technologies**

**#3** Re-assess **economic policies** that harm rangelands and pastoralists. Replace subsidies for supplemental feed that lead to rangeland degradation with economic alternatives, such as risk-management, livestock-insurance and mobile abattoirs. Lift market barriers, encourage animal diversity, good health and locally adapted breeds. Support decentralized and small-scale renewable energy access. Set up legal frameworks for organic certification of pastoral products.

**#4 Promote integrated, multifunctional land use**

**#4** Employ sustainable rangeland management practices and policies that seek integrated objectives, such as silvopastoralism and other agroforestry schemes, wildlife-livestock integration and eco-tourism to achieve multiple sustainability benefits through **multifunctional** land use.

**#5 Strengthen participatory land governance and equity**

**#5** Incorporate pastoralists in all decision-making on the use and management of rangelands and ensure they have well-defined **legal and customary tenure and access rights**. Adopt **participatory governance** practices that recognize that pastoralists are at the heart of rangeland stewardship. Build on traditional pastoralist knowledge and facilitate the participation of marginalized pastoralist groups such as women, youth, elders and indigenous peoples.

**#6 Increase rangeland and pastoral projects under the LDN Fund by 30%**

**#6** Invest in rangeland restoration and traditional rotational movement, transhumance and other cost-effective and sustainable rangeland management practices, including by calling on the ***Land Degradation Neutrality (LDN) Fund to increase its support to rangelands and pastoralist projects by 30%*** by 2026, year of the IYRP.

**#7 Commit LDN targets to rangelands and pastoralism**

**#7** Include rangeland restoration and sustainable pastoralism in ***UNCCD LDN targets*** and accelerate work towards them. Require Parties that have not done so to set specific LDN targets to avoid, reduce and reverse rangeland degradation and promote sustainable range management and pastoralism.

**#8 Earmark 25% of the LDN Fund for knowledge and capacity building**

**#8** Reduce significant rangeland and pastoralist knowledge gaps through participatory research and impact assessments; co-creation of knowledge; monitoring, evaluation and modeling; and strategic planning to help determine and verify global statistics, to assess the impacts of different land-management practices; and to identify, map and monitor changes in land-use and management practices. Ensure that the ***LDN Fund earmarks 25% of its funding for knowledge sharing, awareness raising, evidence-based decision-support work and capacity building*** of local pastoralist land users and decision-makers.

### **Seizing the opportunity**

The IYRP 2026 offers an excellent opportunity for UNCCD Member States and other parties to enhance the momentum for achieving the SDGs. Join us in making the Year a game-changer for rangelands and rangeland peoples and for a healthy planet.

Table of contents

**Executive summary** ..... 2

**Introduction** ..... 6

**A snapshot of rangelands and pastoralists**..... 7

*Why are rangelands and pastoralists important?* ..... 7

*Rangeland conversion* ..... 11

*Rangeland degradation*..... 12

*Underlying drivers of rangeland conversion and degradation* ..... 12

**What should be done?** ..... 13

    1. *Halt indiscriminate conversion of rangelands – mainly into cropland but also into forests and settlements – so as to support sustainable pastoral systems and their diversity* ..... 14

    2. *Recognize mobility of livestock through pastoralism as a viable management solution for healthy rangelands and resilient sustainable livelihoods* ..... 16

    3. *Identify and revise economic policies that have detrimental effects on rangelands and pastoralists and promote those that are beneficial*..... 19

    4. *Promote integrated policies that recognize the multifunctionality of rangelands*..... 22

    5. *Adopt participatory governance and tenure security models that recognize pastoralists at the heart of stewardship and care of rangelands*..... 25

    6. *Increase investment in rangeland restoration, including by calling on the LDN Fund to increase its support to rangelands and pastoralist projects by at least 30% by 2026*..... 29

    7. *Increase the level of ambition of LDN targets with specific commitments to rangeland restoration and sustainable pastoralism, accelerate the implementation of the LDN targets, and invite those Parties that have not done so to set specific LDN targets to avoid, reduce and reverse rangeland conversion and degradation and promote sustainable range management and pastoralism*..... 31

    8. *Earmark 25% of all development and conservation funding, including the LDN Fund, to global knowledge sharing, awareness raising, evidence-based decision support, capacity building of land users and decision makers, and participatory co-creation of knowledge* ..... 33

**Conclusion** ..... 35

*Acknowledgements* ..... 36

*Bibliography* ..... 36

## Introduction

The International Year of Rangelands and Pastoralists (IYRP) has been designated by the United Nations General Assembly (UNGA) for the year 2026, and it invites “*all Member States, organizations of the United Nations system, other international and regional organizations and other relevant stakeholders, including civil society, the private sector and academia, to observe the International Year, as appropriate, through activities aimed at raising awareness and the visibility of and directing attention to the relevance of the sustainable management of rangelands and pastoralism and its contribution to achieving sustainable development*”.<sup>1</sup>

The UNGA designation of IYRP 2026 also calls on Member States to “*further build the capacity of and continue or increase responsible investment in the pastoral livestock sector, including for sustainable land management practices, improved and/or restored ecosystems, balanced access to markets, livestock health and breeding, and enhanced livestock extension services, in order to improve productivity, contribute to the reduction of greenhouse gas emissions, increase adaptive capacity, and maintain and enhance biodiversity*”. In addition, it calls on “*all Member States, organizations of the United Nations system, other international and regional organizations and other relevant stakeholders, including civil society, the private sector and academia, to fill knowledge gaps relating to rangelands and pastoralism and to promote innovative solutions for the sustainable management and ecological restoration of rangelands, taking into account the traditional knowledge of pastoralists*”.

The International Support Group (ISG) of the [IYRP 2026](#) is a coalition of more than 300 organizations that have supported the process of designation of the Year and continue to support preparations for the implementation of the Year.

The IYRP Global Coordinating Group (GCG) helps coordinate efforts in this regard. This science review has been developed by the IYRP Working Group on Land Degradation Neutrality (LDN), in consultation with the IYRP GCG and the wider ISG, and addresses the 12 global themes of the IYRP (Fig. 1), especially Theme 2 (Securing mobility and access) and Theme 6 (Soils, water and land use).

Many of the issues touched upon in this review, will be developed in more detail by other Working Groups of the IYRP, including invasive species (Biodiversity WG), carbon sequestration (Climate Change WG), water management (Water WG), gender equity and women’s rights (Pastoral Women WG), youth (Pastoral Youth WG), and pastoral economies (Economics WG).



Figure 1: The 12 global themes of IYRP 2026 (Source: <https://iyrp.info/12-iyrp-global-themes-graphic-and-text>)

<sup>1</sup> UN General Assembly Resolution A/76/L.36 of January 2022

## A snapshot of rangelands and pastoralists

### Why are rangelands and pastoralists important?

Rangelands are those areas on which the “indigenous vegetation comprises predominantly grasses, grass-like plants, forbs or shrubs that are or can be grazed, and which are used as a natural ecosystem to raise grazing livestock and wildlife” (IYRP 2021a). A “rangeland” is a land-use system that can include many different ecosystems such as grasslands, savannas, shrublands, deserts, steppes, pampa, llanos, cerrado, campos, veld, tundra, alpine vegetation and marshes (Fig. 2).

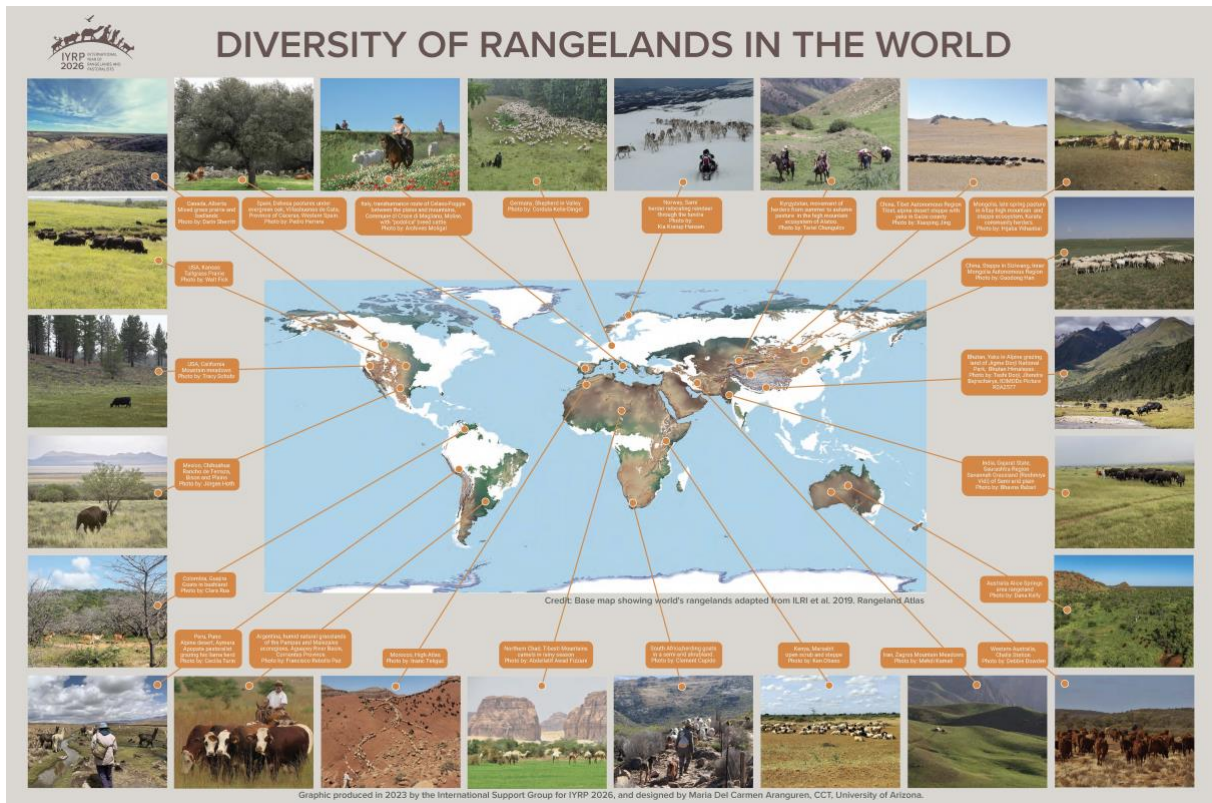


Figure 2: Diversity of rangelands in the world (Source: IYRP 2023)

Grasslands, deserts, xeric shrublands and savannas are the most widespread biomes within rangelands (WWF 2021). The terms “rangelands” and “grasslands” are often used interchangeably. Rangelands may include restored and rehabilitated lands, but are generally considered to be close to their “natural” state in contrast to pastures and paddocks that have been modified with non-native species of grazing fodder. About 63% of rangelands are in drylands (Cherlet et al. 2018). Rangelands are often complex mosaics of land uses, including grazing and browsing by domestic and wild animals, silvopastoralism and agropastoralism.

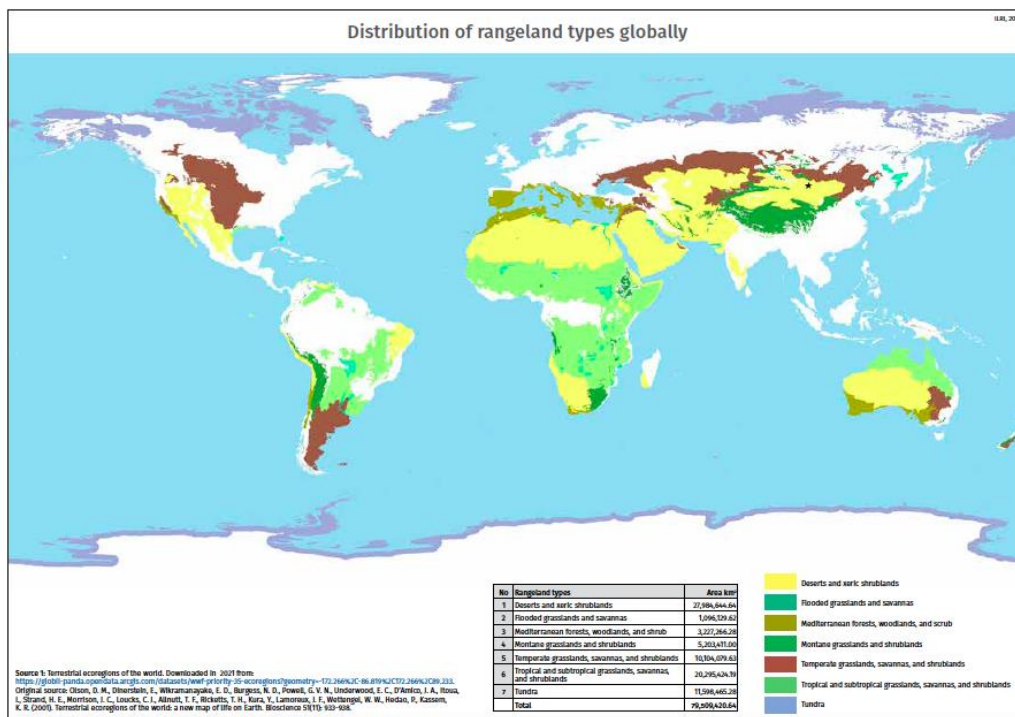


Figure 3: World map of rangelands (Source: ILRI et al. 2021 Rangeland Atlas)

Global rangelands are vital to planetary sustainability, as they **cover over 54% of the world’s terrestrial surface** (Fig. 3). They possess a multitude of economic, social, cultural and ecological values that underpin ecosystem health and function (Briske 2017; Sala et al. 2017). Rangelands contain up to 30% of the global carbon pool (Parton et al. 1995; Briske & Coppock 2023) are home to exceptional biodiversity, including numerous charismatic mammals; and contain one third of global biodiversity hotspots (Davies et al. 2012). In the Great Green Wall area, for instance, several iconic dryland species occur, including the Dama gazelle (*Gazella dama*), the vulnerable dorcas gazelle (*Gazella dorcas*) and the red-fronted gazelle (*Gazella rufifrons*) (Davies 2017). Other iconic species include the wild yak (*Bos mutus*) in Asia, the Saiga antelope (*Saiga tatarica*) in the Asian steppe, the vicuña (*Vicugna vicugna*) in South America and the American bison (*Bison bison*) in North America. Rangelands harbor 24% of all human languages and numerous world heritage sites (MEA 2005) (Fig. 4).



Figure 4: Some examples of wildlife on rangelands.

Top right: American Bison on the Plains, USA. Photo by Jack Dykinga - Agricultural Research Service, USDA, picture ID K5680-1, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=343547>

Bottom right: Wild saiga antelope, Saiga tatarica tatarica visiting a waterhole at the Stepnoi Sanctuary, Astrakhan Oblast, Russia. Photo by Andrey Giljov, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=73737597>

Middle: Vicuña vicuña at about 4000m, Chile. Simon Green. 2018, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=71995777>

Top left: Dama Gazella, Guembeul Natural Reserve, Senegal. Photo by Ji-Elle, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=1630194>

Bottom left: Moroccan Dorcas Gazella, Souss-Nassa National Park, Morocco. Photo by Charles J. Sharp. CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=77712504>



Today, some of the most evident lessons for producing food by working with nature are found in **pastoral systems** operating under extreme and uncertain conditions. Mobility of livestock through transhumance and other forms of spatial and temporal rotation of animals between landscapes has maintained **grazing-dependent ecosystems** (Arzamendia et al. 2021), often connecting rangelands with cultivated and forest areas in complex forms of crop–livestock integration, agroforestry and circular economy (IYRP 2021b).

Grazing by **migratory wild herbivores** is a fundamental component of many of the world’s rangelands. In most of these ecosystems, movement of livestock along expertly managed grazing itineraries has followed the same principles. Key ecosystem services provided by **mobile pastoralism**, compared with sedentary non-rotational livestock production, include seed dispersal, landscape management and shaping and biodiversity structuring (McGahey et al. 2014). Pastoralism contributes to food systems well beyond its livestock outputs. It provides basic food in marginal environments all around the world. Many crops depend on livestock for manure in recycling organic matter and restoring soil fertility.

In the past, rangelands have often been considered by outsiders to be degraded forests and/or wastelands. Not so by pastoralists nor by recent science. Increasing evidence from vegetation science shows that such landscapes were shaped by large, now mostly extinct wild herbivores during the whole Quaternary. Scientists now recognize that the health of such landscapes depends on herbivory by wildlife and livestock (Niamir-Fuller et al. 2012; Manzano et al. 2021).

Accurate data on the population of pastoralists rarely exist, except in a few countries such as Mongolia and the USA. Estimates of the global population of pastoralists range from 200 million to over two billion (Johnsen et al. 2019). In Africa alone, in 2013 there were an estimated 268 million herders practicing transhumance across 43% of Africa’s land mass (African Union 2013), and this did not include many more people who practice other forms of pastoralism.

**Over two billion people** – pastoralists, business people, consumers and others along the value chain – depend on the pastoral agri-food systems of our world (FAO 2021a). Rangelands nourish at least 50% of the world’s livestock (Lund 2007). The keepers of livestock in these areas are recognized by the IYRP as pastoralists, but they are also referred to and self-identify as herders, shepherds, ranchers and other terms, depending on their countries and cultures. Pastoralists practice different rangeland use and management systems around the world, such as transhumance, nomadism, natural grazing, rotational grazing, regenerative grazing, community-based grazing, holistic planned grazing and more. Pastoralists raise sheep, goats, cattle, horses, donkeys, camels, yaks, llamas, alpacas and semi-domesticated species such as vicuña, bison and reindeer (Fig. 5).

**Rangelands provide high-quality and high-value protein and other animal products** such as hides, wool and fibers (FAO 2021b). For example, the sustainable management of the wild vicuña and its fiber in the South American mountains has great potential for the sustainable development of indigenous peoples and local communities (Vila et al. 2021). Meat from pastoral livestock has been shown to contain more omega-rich proteins than meat from confined livestock or from plant protein (Leroy et al. 2022). **Pastoral products are essential for ensuring food security of millions of people in developing countries** (Krätli et al. 2013). Rangelands are multifunctional landscapes that provide a wide span of benefits and resources for pastoralists and other people, including fruits, fuel, fodder, game, honey, medicines and more.

# World map of pastoralists



Paul Mundy, League for Pastoral Peoples and Endogenous Livestock Development, paul@mamud.com

[www.pastoralpeoples.org/pastoralist-map/](http://www.pastoralpeoples.org/pastoralist-map/)

The world map of pastoralists, prepared for the 2025 International Year of Rangelands and Pastoralists, currently has information on over 800 groups of pastoralists worldwide.

A pastoralist group is a community that manages animals in a pastoralist system (one where the animals walk to their feed). They may be part of an ethnic group or caste, have a specific cultural identity and traditions, use a particular management system, raise specific species or breeds, or occupy a particular region.

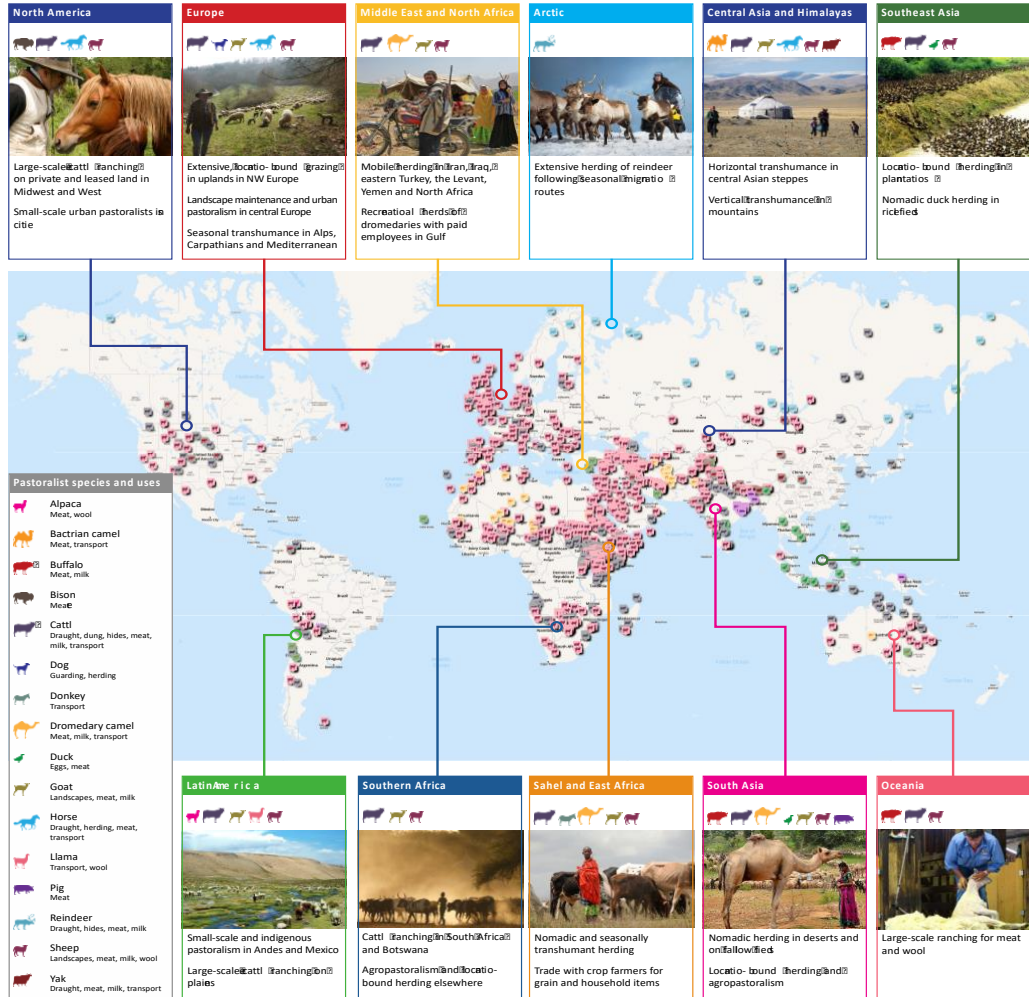
The boundaries of pastoralism are fuzzy. But we exclude livestock farming (where animals are kept in fields or enclosures) and intensive livestock raising (where they are kept indoors).

Pastoralists practice (mainly) where it is too hot, too dry, too wet, or too steep to grow crops. That means in and around the world's deserts and steppes (like in the Sahel), in mountains and on moorlands. Pastoralists also herd their animals on fallow cropland, in forests, and on roadsides and patches of land between fields.

Pastoralism includes a wide range of management approaches. These and the species kept differ from one region to another. Many pastoralists are location-bound: they stay in one place all year, allowing their animals to feed on nearby pasture and fallow fields. In mountainous areas, they practice vertical transhumance: taking their livestock up the mountains in spring and down to the snow-free valleys in autumn. In drylands they use horizontal transhumance: moving between two or more fixed locations to follow the seasonal rainfall. Or they may be nomadic: moving frequently in search of grazing and water.

In parts of the Americas, Australia and southern Africa, ranchers keep large herds of cattle and sheep on land that is privately owned or leased from the government. In subhumid parts of Africa, South Asia and Europe, agropastoralists grow crops as well as herding livestock. Urban pastoralists use sheep and goats to control weeds and prevent fires in cities.

Visit [www.pastoralpeoples.org/pastoralist-map/](http://www.pastoralpeoples.org/pastoralist-map/) to see the full map with details of each group. The map is a work in progress. Contact [mapping@pastoralpeoples.org](mailto:mapping@pastoralpeoples.org) with corrections and additions.



LEAGUE FOR PASTORAL PEOPLES AND ENDOGENOUS LIVESTOCK DEVELOPMENT

YOLDA HELSUS 100 IUBS Centre for Pastoralism misereor GEMEINSAM GLOBAL GERECHT

Figure 5. World Map of Pastoralists. 2023 (Source: League for Pastoral Peoples. <http://www.pastoralpeoples.org/wp-content/uploads/2023/07/Pastoralist-map-poster-7.23-print.pdf>)

Pastoralism is a natural adaptation to climatically uncertain and variable environments because it is generally more resilient and adaptive than sedentary farming in drylands (McGahey et al. 2014). A study in Ethiopia concludes that pastoralists practice different adaptation strategies to droughts and climate variability and therefore are more resilient than other households (Kemal et al. 2022). A modeling study for southern Morocco concludes that, with the projected reduction in precipitation of 20% by 2050, mobile pastoralists' incomes will be barely affected while the income of sedentary pastoralists will drop by 8–19% (Freier et al. 2014).

Rangelands are facing climatic and anthropogenic pressures, which are resulting in natural resource degradation, productivity losses, land-related conflicts and insecurity, poverty of land users, and

displacement and sedentarization of people (either due to living conditions or politically forced (Alene et al. 2022), leading to cultural change and loss of traditional knowledge. Anthropogenic pressures include conversion to cropland and other land uses, exploitation through selective harvesting, fuelwood removal, charcoal production (more than 53 million tons in 2014 from forests and woodlands) (FAO 2016), and livestock undergrazing and/or overgrazing, resulting in rangeland degradation, rangeland conversion to other uses, abandonment, habitat change and biodiversity loss and contributing to climate change.

### Rangeland conversion

Estimates of the rate of conversion of rangeland to cropland, afforestation and other uses vary tremendously. Human population growth and concentration in settlements have been increasing since 1700 and, by 2000, 50% of the earth's biomes were no longer wildlands (Fig. 6) (ILRI et al. 2021), estimated to be due mainly to the **expansion of cultivation** (Hurt et al. 2011).

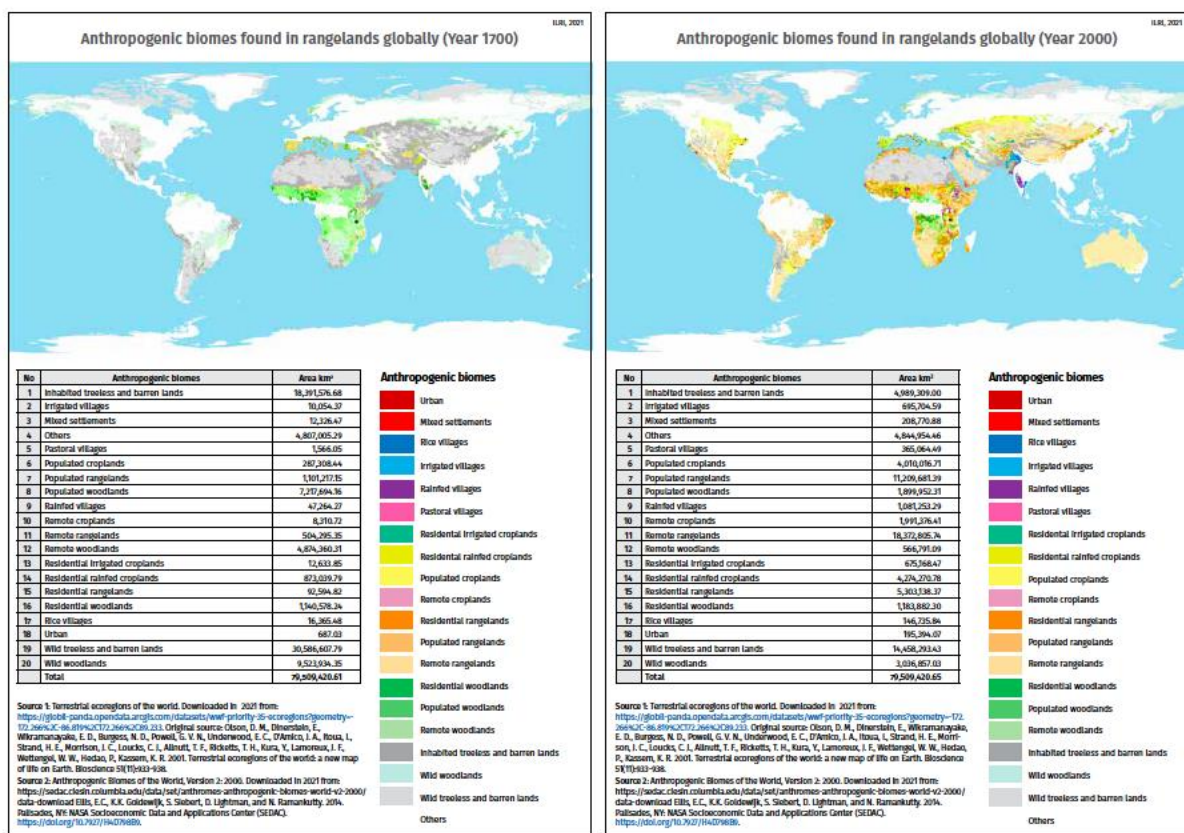


Figure 4: Anthropogenic conversion of rangelands 1700-2000 (Source: ILRI et al. 2021 Rangeland Atlas p.20)

Another estimate shows that 20% of the world's native rangelands have been converted to crops (EDF 2019). One notable exception is where livestock do not compete for land with crop farming since they normally graze on pastures above the limits of cultivation. Examples are the camelids of South American highlands and the yaks of the Himalayas.

**Afforestation is the practice of planting trees where they did not grow before**, to be distinguished from reforestation for land restoration and rehabilitation (Veldman et al. 2016). The rate of conversion of rangeland by afforestation is currently unknown, but there is a potential for a very high rate of conversion in the coming decade if Member States' pledges to combat climate change through tree planting erroneously target open-canopy rangelands (Briske & Vetter 2022).

Using IUCN's definition of a protected area (which includes areas under strict protection as well as co-managed, community managed or private), 12% of rangelands globally are **classified as protected** (ILRI et al. 2021 p.20). However, it is unclear whether the rate of protection is increasing or decreasing, largely because of the lack of a harmonized definition of rangelands. **Urbanization, the spread of settlements**, and the growth of industries such as **mining** are other global trends for land-use change causing rangeland loss (Assennato et al. 2022).

### *Rangeland degradation*

Land degradation has affected an estimated 24% of land globally (3.5 billion hectares) over the past 25 years, affecting more than 1.5 billion people, most of whom live in developing countries (Bai et al. 2008). The **proportion of rangelands that is degrading was 18.5% globally** in 2019, ranging from 10% in North America to 32% in the Middle East and 35% in South America (Cherlet et al. 2018). Nevertheless, the Rangelands Atlas also shows that, between 2001 and 2015, 48% of rangelands remained stable, 13% showed early signs of increased productivity and 18% showed increasing productivity – a total of 79% of the rangelands (ILRI et al. 2021 p.36). Furthermore, some of the gain in biomass might also be related to the spread of invasive and less desirable plant species, which would mean a degradation of the quality of vegetation and forage value. These trends towards reducing and increasing rangeland degradation need further monitoring and assessment efforts to protect and regenerate more rangelands for a sustainable future.

The root causes, drivers and pressures leading to rangeland degradation vary considerably across the world; solutions must therefore be finetuned to each region's land degradation severity, rangeland use system, challenges and opportunities (Liniger & Mekdaschi-Studer 2019).

**Both overgrazing and undergrazing need to be avoided** (Rosales & Livinets 2015). Perils of both overgrazing and undergrazing have been scientifically proven (Getabalew & Alemneh 2019), indicating how rangelands have adapted over millennia to some form of grazing. Overgrazing can lead to soil erosion, loss of biodiversity and degradation of watersheds (Mirzabaev et al. 2019). Undergrazing can result in shrub encroachment (Zhang et al. 2019), invasion by alien species (Firn et al. 2013) and loss of biodiversity (Metera et al. 2010). Furthermore, when livestock are taken off land as a supposed solution to mitigate climate change, the vacuum is quickly filled by termites, often resulting in higher methane emissions than before (Manzano & White 2019). It is not just a matter of grazing pressure or stocking rates, but also of the time needed to regenerate after use. In temperate zones for example, it has been shown that untimely grazing (too early in the spring or too late in the fall) is also a cause of degradation (Archer & Arnalds 1982). These examples show that grazing management can change the balance between palatable and unpalatable species, thus avoiding the need for costly pasture improvement. Grazing must therefore be carefully planned and conducted, respecting the critical need for temporal and spatial mobility, rest and rotation (Louhaichi et al. 2021).

### *Underlying drivers of rangeland conversion and degradation*

Underlying drivers of rangeland degradation include human population growth, institutional weaknesses, governance, knowledge and technology gaps, and neglect of rangelands and their users in restoration actions, leading to underinvestment (IUCN, WWF & UNCCD 2020). These are compounded by **benign neglect** (Sandford 1983) which stems from a lack of appreciation of the significance of rangelands and the livelihoods adapted to them. Many countries have conflicting management objectives for their natural resources, and do not give priority to rangelands – often misunderstood as “wastelands” (Kronenburg-Garcia et al. 2022). In many countries, policies favor crop intensification, production of feed as fodder for **confined livestock**, afforestation of rangelands,

**sedentarization** of pastoralists and urbanization, all of which stem from a misperception that these lead to increasing productivity and progress in the rangelands. Moreover, in many countries, governments regard pastoralists as a source of insecurity because of their mobility (Liniger & Mekdaschi-Studer 2019; Taye-Gayo 2022).

However, increasing scientific evidence is emerging that shows clear benefits from policies that support **sustainable pastoralism in rangelands** (Niamir-Fuller 2016). A pastoral system's functioning and sustainability rests on a significant level of management, access to resources and land restoration schemes, which falls well behind that of forest ecosystems (Vetter 2020) and cropland (Van der Esch et al. 2022).

The development needs of livestock production through pastoralism differ significantly from those of crop production, not only because pastoralists raise livestock, but also because of the need for **extensive grazing landscapes**, and for infrastructure and services that support livestock mobility. Many government policies do not distinguish pastoralists as different kinds of producers, and government statistics often lump them together as “farmers” or “agriculturalists” (Johnsen et al. 2019), thus hampering programming of effective and targeted development support. Non-supportive policy and legislation can lead to marginalization and exclusion of pastoralists and can be a root cause of conflicts (ILC et al. 2021; Nori et al. 2009). The lack of **land-tenure security**, especially of common property resources, and ineffective institutions to manage and govern rangelands whether collectively or not, including misrepresentation at the local level of the pastoralists themselves, contributes to the mismanagement of rangelands (Herrera et al. 2014). On the other hand, commonly held or collectively owned rangelands in developing countries have proven invaluable as sources to meet the basic needs of poorer people, and are the last resource for people displaced or let down by political shifts or conflicts (FAO 2022).

Pastoralists and other extensive livestock keepers, despite being marginalized, are the stewards of rangelands that they have been managing for centuries and restoring through sustainably managing livestock. Furthermore, global change and its drivers have contributed to an escalation of challenges that threaten the sustainability of pastoral systems. The drivers discussed above decrease the ecological capacity of rangelands to provide diverse and resilient ecosystem services to global citizens (Briske et al. 2020). A **lack of appreciation of and investment in pastoralism** has not only marginalized rangelands and their caretakers, but has also meant that the full potential of these ecosystems has not been realized.

**Lack of knowledge and capacity across the board** to support sustainable use and management of rangelands is leading governments and other stakeholders to make decisions that fail to address the root causes of rangeland degradation (Johnsen et al. 2019). Development interventions have been driven from outside of the pastoralist communities, and the agency of pastoralists – particularly of women and youth (Jobbins & McDonnell 2021) – has not been fully tapped.

## What should be done?

The sustainability of agricultural production and land management demands a deep paradigm change towards considering people and agriculture (including pastoralism) as part of the environment and working with nature rather than against it. On this path, Land Degradation Neutrality (LDN) has emerged as a prominent concept for land stewardship within the UNCCD and a tool for strengthening implementation of this new paradigm. LDN is specifically referenced in Sustainable Development Goal

(SDG) 15.3. Rangelands have, a potentially critical, but still not explicitly stated, role to play in national and global commitments on the SDGs, LDN, United Nations Food Systems Summit and others.

Based on an extensive review of scientific information and evidence, the IYRP LDN Working Group has identified eight areas as priority for action by the UNCCD COP and its Member States, Donors, Civil Society and other Parties. These address the main drivers identified above - they are common to all countries around the world, and focus on the most urgent and the most impactful. In the following pages, these drivers are explained in detail, and priorities for action are proposed.

**1. Halt indiscriminate conversion of rangelands – mainly into cropland but also into forests and settlements – so as to support sustainable pastoral systems and their diversity**

Loss of cropland productivity, growing demand for biofuels, and more recently afforestation, is resulting in the conversion of rangelands. This **conversion is taking over the best rangeland areas** that are accessible, are in relatively good shape, hold deep soils, and have potential to produce high levels of biomass and support rich flora and fauna communities. Most of these new land uses do not last under the harsh rangeland environments, but instead intensify the pressure on the natural resource base, as evident in Kenya (Sundstrom et al. 2012) and Nepal (Zhaoli et al. 2005). In the Andes of Peru, the increased demand for cultivation of *maca* (Peruvian ginseng) has resulted in 30% conversion of high Andean rangelands between 1987 and 2015 and led to erosion, land degradation and displacement of pastoralists (Turin et al. 2018). However, the exact area of expansion of cultivation and conversion of rangelands is rarely monitored or measured; hence, only anecdotal information is found in most countries (UNOWAS 2018). In many countries, rangelands held in common are not legally protected; hence, the only form of *de jure* land-tenure security is private appropriation.

**Conversion of rangelands to rainfed or irrigated crop production has often proven to be unsustainable:** soils become compacted and degraded by salinity, and groundwater resources are exhausted. For example, in the Thar Desert of India, the Government has supported irrigated cropping. This commonly goes on for a few years, during which farmers deepen their wells with dynamite from time to time, until the groundwater level sinks below the reach of their pumps. Farmers then move on to the next spot, leaving behind barren, salty ground in place of the previous drought-resistant natural vegetation valuable for pastoralism (Mathias 2005). Furthermore, the expansion of cultivation at the expense of the most fertile and nutritious areas of rangeland **compromises the functionality of the rest of the rangelands and the possible collapse of the pastoral system.** This mismanagement negatively affects grazing resources, and disrupts the movement of livestock and wildlife, thereby increasing the grazing pressure on the

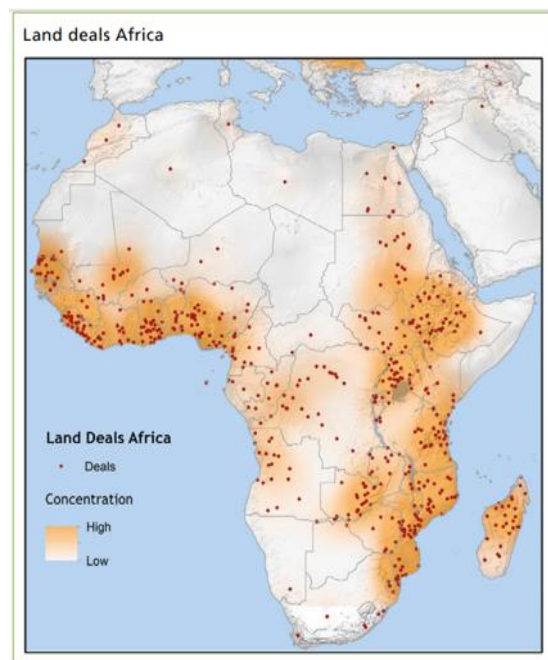



Figure 2.9: African heat map of land deals contained in the Land Matrix with the concentrations of land deals highlighted in intensity from light to dark orange. The map is limited to large-scale transnational deals in the agricultural sector. Source: Land Matrix 2016. Map: Manuel Abebe.

Figure 5: Large scale land deals in Africa, Land Matrix 2016 (Liniger & Mekdaschi-Studer 2019).

remaining rangelands leading to land degradation (Turner et al. 2005). There is a need to protect these ‘rangeland productivity hotspots’ for pastoralism (Flintan & Cullis 2010).

In addition to small-scale conversion, **large-scale conversion** for commercial agriculture is increasing. For example, of all the concluded agricultural deals in Africa recorded in the [Land Matrix](#) in 2016, 70% are in sub-Saharan Africa, of which a substantial share is in the rangelands (Fig. 7).

	<p><b>Box 1: Impact of barley encroachment in rangelands in Jordan</b></p> <p><i>Rangelands in Jordan cover over 75% of the country and they are characterized by harsh climate, limited water resources and shallow soils. One of the significant challenges facing rangelands is the encroachment of barley (<i>Hordeum vulgare</i>) cultivation. This has significant negative impacts on the Badia rangelands, such as reducing the grazing area for livestock, degrading soil quality and increasing the risk of desertification. It also poses a threat to the region's biodiversity by reducing the habitat for native flora and fauna, increasing the risk of invasive species, depleting the soil seed bank and increasing the frequency of dust storms, which affect the health of not only pastoralist communities but also society in general.</i></p> <p><a href="http://www.jordandesert.org.io/cms/uploads/Monitoring%20Land%20use%20change%20in%20the%20Badia%20transition%20zone%20in%20Jordan%20-Dr%20Jawad.pdf">http://www.jordandesert.org.io/cms/uploads/Monitoring%20Land%20use%20change%20in%20the%20Badia%20transition%20zone%20in%20Jordan%20-Dr%20Jawad.pdf</a></p>
<p><i>Barley cultivation in the Jordanian Badia showing the extent of crop encroachment into arid rangelands (Photo: Mounir Louhaichi)</i></p>	

In recent years, we are witnessing a **massive campaign to plant trees** as one element of global climate policy. The ultimate objectives of these programs are to reduce carbon emissions, increase the use of clean energy and combat climate change. No doubt, well-planned tree-planting efforts can be an important component to enhance ecological and human wellbeing and resilience. Nonetheless, large-scale planting of trees can lead to negative consequences, depending greatly on where they are planted, which species, for what purpose and for whom (Veldman et al. 2015; Fleischman et al. 2020; Braun 2022). For example, planting of *Chir* pine forests has depleted groundwater recharge, leading to the drying up of many springs in the North Indian Himalayas and loss of productivity (Liniger et al. 2020).

Tree-planting activities using exotic species have led to large areas being impacted and loss of rangeland productivity. For example, *Prosopis juniflora* was introduced in Ethiopia for soil and water conservation in the 1980s and, by 2017, had spread and created impenetrable thickets that block grazing by wildlife and livestock, creating landscapes largely devoid of life in areas now known as “green deserts”. Similar concerns have been raised throughout Eastern Africa and the Horn of Africa (Abdulahi et al. 2017).

Research has shown that rangeland afforestation, especially in arid and semi-arid ecosystems, is not a viable strategy for climate change mitigation because it sequesters little additional carbon and may even lead to a net loss of carbon, while it degrades valuable rangeland biodiversity and ecosystem services such as forage provision (Jackson et al. 2002; Briske & Vetter 2022). Grasslands, which contain approximately 20% of the world’s soil organic carbon stocks, are particularly vulnerable to afforestation, leading to a significant loss as the soils are disturbed and the massive and dense roots of grasses are taken out (Puche et al. 2019). On the other hand, recognizing the **value of rangelands for carbon capture and storage** is an important step forward for the carbon markets.

Some rangelands naturally consist of both grasses and woody cover, such as dryland forests and savannahs. In these ecosystems, a **silvopastoral perspective** that combines forestry and pastoralism in wooded rangelands where trees are a natural component, could provide positive climate outcomes (specifically an integrated perspective of mitigation and adaptation) while preserving the animal production capacity of those lands and their most prized ecosystem services.

*Today, a similar level of global commitment is needed to halt indiscriminate rangeland conversion as there has been for halting deforestation. Protection of rangeland areas from conversion can be achieved by a UNCCD COP decision. Such a decision can also endorse policy directions that, for example:*

- *Increase awareness about the importance of rangelands to land users, decision makers, and the larger society*
- *Commit to sustainable restoration of degraded (previously cropped) rangelands using science-based and site-specific innovation with full participation of the local pastoralist communities*
- *Develop robust methodologies to measure and monitor rangeland soil carbon*
- *Provide investment guidelines for the voluntary carbon market to recognize diverse rangeland ecosystems for the critically important services they provide at local, regional and global scales*
- *Promote pastoral and agrosilvopastoral management systems and fully acknowledge the specific role that the rangelands can have for carbon sequestration and the provision of essential ecosystem services*

**2. Recognize mobility of livestock through pastoralism as a viable management solution for healthy rangelands and resilient sustainable livelihoods**

**Grazing by migratory wild, semi-wild and/or domesticated herbivores** is a fundamental component of many of the world's rangeland ecosystems. Today, periodic livestock grazing is frequently used to promote ecosystem services in protected areas and prevent forest fires (FAO 2014). Agropastoralists (and farmers) depend on the fertilization and recycling of organic matter that is provided by livestock grazing. Mobile pastoralism has been shown to produce 2-10 times more meat output per unit area than commercial sedentary systems in the same arid conditions (the wide range is explained by the different pastoral systems studied) (McGahey et al. 2014 p21; Scoones 1995). There are different mobility patterns around the world, from horizontal and north-south movements to vertical altitudinal movements (Herbert & Birch 2022). For example, mountain pastoralists have managed mountain grasslands for thousands of years using a vertical stratification of the resources by altitude to move their livestock seasonally to respond to the ecological variability of mountain areas and taking advantage of new pastures in different zones of a watershed (Vila et al. 2021).

Today, it is recognized that the natural state of rangelands depends on herbivory and on frequent movement and rotation of animals. The absence or interruption of livestock mobility, for example through settlement, sedentarization or blocking of transhumance and migratory routes, has historically led to rangeland degradation (Galaty et al. 1981). The Convention on Biological Diversity (CBD) recognizes that pastoral systems have co-evolved with the ecosystems and landscapes they use, establishing close links with the ecological dynamics and mimicking natural functions (CBD 2010). Sedentarization and concentration of livestock result in overgrazing around settlements and water sources, as well as degradation of distant rangelands due to undergrazing (Niamir-Fuller 1997). **Animal mobility in pastoralism is a nature-based solution for rangeland restoration** (McGahey et al. 2014) and thereby achieving LDN in many regions of the world. Animal mobility allows a more efficient use of grazing resources that optimizes regeneration. It allows grazing resources to rest and recover, which



increases regrowth and diversity. Mobility is considered an essential way to sustainably manage pastoral resources, and sustainable grazing management depends on the way mobility is enabled and controlled.

**Pastoralists are key actors in rangeland management, and grazing planning is their core tool** (Tamou et al. 2018). They thus control vegetation and fuel, redistribute fertility, balance woody and herbaceous composition, and maintain their infrastructure (Seid et al. 2016). By arranging factors like herd composition, grazing pressure, water availability, etc., pastoralists extract the appropriate resources from each piece of land at a given time, moving then to the next spot and leaving the grazed land to rest (Fynn et al. 2017; Liniger & Mekdaschi-Studer 2019). Mobile livestock keepers use different mobility systems such as opportunistic grazing (nomadism), seasonal rotation (transhumance), rotation between pastures (e.g. holistic management and ranching), integrating grasslands with tree and shrub browsing (agroforestry schemes), etc. (FAO 2022). Pastoral mobility – managing and scheduling grazing itineraries at a variety of scales so that livestock gain a better diet than they would without management – provides the means for adapting livelihoods to high variability and for maintaining resilience. For example, in the Tibetan Plateau of Qinghai and Sichuan Provinces of China, communities responded to externally driven policy, economic and climate-change impacts by creating innovative locally adapted quota-based rotational grazing management systems that preserved valuable management technologies, conserved rangeland resources and provided individual opportunities for financial gain (Gongbuzeren et al. 2018).

The practice of **diversification of the herd** goes hand in hand with mobility, where a mixture of different but complementary species (camels and goats; cattle and sheep), or introducing compatible wildlife (e.g. zebras in Africa), creates different movements and impacts on plant diversity. Diversification is an important element of maintaining resilience to climate change, enhancing food security, protecting genetic diversity, and biodiversity conservation, hence rangeland health. Multispecies grazing, because of the species' different grazing and browsing habits, has many benefits including enhanced pasture carrying capacity and control of predators and parasites. Different parasites infect different livestock species; therefore, grazing different species together can reduce parasite populations (Rinehart 2019). Adding some yaks not only helps maintain a traditional livestock farming practice on the Qinghai-Tibetan Plateau but also protects rangelands and increases the sustainable production of yak fiber (Long et al. 2008). Maintaining mobility of animals helps to preserve the practice of diversification of the herd, because of the different grazing habits of the different animal species.

**Mobility is hampered by rangeland conversion and border closures.** The indiscriminate conversion of rangelands and the closure of administrative borders, many of which straddle traditional transhumance routes, have blocked the movement of livestock in many countries. In Africa, border closures have seriously undermined pastoral productivity, reduced pastoralists' ability to manage drought and contributed to conflict; this, in turn, has resulted in degradation where pastoralists could not find alternative grazing resources (COMESA 2010).

**Expropriation and privatization of rangelands through permanent fencing** has created inequality in pastoral areas dependent on common lands. But fencing is often promoted as a technique to improve rangeland management, following the model of ranching. For example, the Peruvian Government, NGOs and the private sector have been promoting use of permanent fencing and enclosures for rangeland management. Once someone fences, then others follow and, as a result, there is a growing trend of pastoralists demanding such fences to ensure their land-tenure security, such as in Peru (Andina 2013; Government of Peru 2016). However, these fences block mobility of other animals and

lead to unviable operations that cannot sustainably withstand climate variability and change without additional external inputs and subsidies. In most instances, the owners will continue to graze their livestock on common land while also exploiting their private lands.

**Pastoral mobility is enabled by the protection of land rights, access rights, passage rights and other legislative actions.** Other elements that require support to strengthen pastoralists' resilience include flexible land-tenure systems, well-planned and serviced corridors and infrastructure (waterpoints) for transhumance and mobility, lifting market barriers, encouraging in-herd animal diversity and creating risk-management and insurance systems. In agropastoral systems, or where pastoralists interact with settled farmers, important considerations are maintaining corridors for access to postharvest forage and to deposit manure for the next season's crop.



*Cattle coming from the pastures drinking from one of the waterpoints on a hot day. Muminabad, Tajikistan (Photo: Sady Odinashoev)*

**Box 2: Rotational grazing supported by additional waterpoints in Tajikistan.**

*After the end of the Soviet era, an increased number of livestock and decreased availability of grazing resources led to deterioration of the pastures, including overgrazing, reduction of plant diversity, poor livestock health and soil erosion. The communities identified insufficient livestock waterpoints in the pastures and poor pasture management as priority problems. To tackle this problem, livestock committees at village level introduced rotational grazing supported by extra waterpoints and resting places.*

*Together with the establishment of waterpoints, a rotational grazing scheme was introduced.*

<https://qcat.wocat.net/en/summary/6094/?as=html>

Pastoral mobility has been legally recognized in a few countries, for example, the formalization of the *vías pecuarias* in Spain (Jefatura del Estado 1995) and across national borders on a regional scale with West Africa's Transhumance Passports (ECOWAS 1998) and the recent IGAD (Intergovernmental Authority on Development) Protocol on Transhumance (IGAD 2020). Recognizing, supporting, scaling up and improving the logic of pastoral strategic mobility are key to securing relative but sustainable stability in food outputs. For example, different policies in East Africa legally recognize pastoralism as a form of land use and land development on an equal basis with crop farming (Tadesse 2016). A land law in Bolivia in 1996 created the concept of "community lands of origin" that enabled the restitution of large tracks of lands to their original inhabitants including pastoralists (Kay & Urioste 2005). The recovery of the vicuña species in Peru is a wildlife/pastoralist management success story. Before 1980, this animal of the camelid family was almost extinct due to overhunting. The decision by the Peruvian government in 1980 to give communities the right to shear and trade vicuña wool has helped the species' population recover across South America's Andes region. It has also helped improve rural livelihoods across the region, especially for women who play a central role in the animals' capture and wool processing (Kasterine & Lichtenstein 2018).



Use of a well as a water source for herds in the north of Batha, Chad (Photo: Project Almy Al Afia)

**Box 3: Securing the mobility of pastoralism through consultation and access to water sources in Chad**

*In Chad, herds are taken in regular movements with the seasons between the Sahelian and the Sudanese grazing areas. The former is nutritious but limited in quantity, while the latter is more abundant but of lower quality and not accessible until the fields are cleared after crop harvest. Therefore, securing mobility through access to water sources (open wells and ponds in pastoral areas) and marking the livestock routes for transhumance are essential. This comprises consultation by joint committees to prevent conflicts. Many meetings were held between the land users and policymakers to negotiate livestock routes and waterpoints for transhumance and to plan ways of managing and maintaining the watering structures.*

<https://qcat.wocat.net/en/summary/6012/?as=html>

*Pastoralism and animal mobility can be enabled by Member States through policy decisions for:*

- *Legal recognition and enforcement of pastoral mobility both in-county and across national borders*
- *Legal status made available for land users and communities that wish to manage rangelands through common property tenure, including ownership of buffer zones and the notion of flexible boundaries*
- *Legal recognition of pastoralism as a form of land use / management and land development on an equal basis with crop farming*
- *Effective integration of pastoralists' mobility itineraries in the sustainable development strategies of the regions hosting this activity, and increased investment in pastoral mobility-infrastructure such as transhumance corridors, water points, decentralized abattoirs, decentralized electrical supply using renewable energy, etc.*
- *Adapting administrative, social, health and educational services to the reality of mobile pastoralists and their communities, reducing the burden they bear in dealing with different regional and local governments*
- *Investing in mobility-friendly infrastructure, including 100% coverage of rural areas with mobile phone and broadband networks, marketing options, repairing roads and bridges for accessing remote pastures, providing weather forecast data for day-to-day rangeland-management activities, sourcing feed supplements and veterinary products, and vocational training and certification of herders.*

**3. Identify and revise economic policies that have detrimental effects on rangelands and pastoralists and promote those that are beneficial**

National and regional economic policies need a full review so as to better support sustainable pastoral management; however, they vary tremendously by country. At least two specific policies can be highlighted as requiring attention in most countries: a) re-assessing the subsidization of supplemental feed, and b) addressing unbalanced and unfair subsidy systems in the livestock and crop-farming sectors.

Several governments **subsidize feed resources** (barley or concentrate) to maintain livestock populations, especially but not only during droughts and other extreme events. The stated purpose of this policy is to alleviate pressure of grazing on rangelands and reach a balance between forage availability and livestock numbers (Yin et al. 2019). Unfortunately, such policies have had strong negative impact on rangeland health: the increase in the number of animals encouraged by the availability of cheap feed (Hatough-Bouran & Drisi 1995) and their concentration near the feed-provision sites have led to unbalanced grazing pressure and neglect of resting periods.

During drought, the risk-management tools embedded in most pastoral systems help reach a balance between livestock needs and rangeland forage production. But subsidized supplemental feeding, allows livestock numbers to remain constant (or even rise) at a time when rangeland vegetation is very scarce. The very few drought-resistant plant species are consumed, minimizing a chance for their recovery when conditions improve (Al-Tabini et al. 2012). For example, in Jordan, a country where 90% of the land area is rangeland, the policy of subsidizing barley as feed supplement has accelerated land degradation through the widespread encroachment of barley cropping at the expense of natural rangeland (Blench 1998). In addition to the low productivity of barley grown in rangelands, farmers know that, because of the low precipitation, they may harvest a good crop perhaps only once in ten years, so – in terms of economic return – they are not making any income, yet this practice leads to increasing homogenization of rangelands, loss of biodiversity, soil erosion and, eventually, more frequent dust storms (World Bank 2019).

Although such subsidies may increase revenues in the short term, they generally do not provide long term financial security to pastoralists, may build dependence (Drisker 2021), and therefore decrease the overall resilience of production system (Ragkos et al. 2020). Alternative solutions, such as introducing livestock insurance schemes, e.g. the [Livestock Insurance Scheme of India](#) and the Kenya Livestock Insurance Program in Wajir District (Swiss Re 2015), have had success in some countries in helping pastoralists weather these droughts and adverse climate effects.

The issue of financial support policies (subsidies, tax credits, etc.) should also be seen in a wider context. Livestock products (meat, dairy, skins, etc.) are generated from a range of systems, going from confined industrial feedlots to rangeland-based pastoralism. An increase in both human population and economic growth has been accompanied by rising per capita demand for animal products. The livestock industry is under pressure to meet this demand at low cost, but its current patterns of production are not environmentally sustainable, causing negative health impacts on humans and rising welfare concerns for animals (Niamir-Fuller 2016).



(Henry Bailey)

**Box 4: Mugie resource sharing and livestock-to-markets program in Kenya**

*Mugie Conservancy is a private company covering nearly 20,000 ha. It is involved in ecotourism, wildlife conservation and livestock production. Selected livestock are bought from the communities, then fattened and marketed by the Mugie Conservancy management on a resource-sharing basis – generating income for both the conservancy and the community. This encourages the development of local value chains and market-based incentives for better rangeland management and animal husbandry outside the conservancy area.*

<https://qcat.wocat.net/en/summary/6054/?as=html>

In most countries, the **industrialized livestock sector is offered greater facilitation than pastoralists** (better access to credit and market, low levels of environmental regulation, subsidies and tax credits), and therefore its animal products are available at lower prices to consumers, undermining more sustainable production systems such as pastoral ones (Niamir-Fuller 2016). This not only blocks huge development opportunities for rural populations but also creates perverse food systems that benefit a few rather than a majority and have a great negative environmental impact, including reducing the resilience of pastoralists (Niamir-Fuller 2008).

Products from the confined, industrial systems of meat production from feedlots are widely known and available. On the other hand, consumers are not often able to obtain products from open-range systems because of lack of product differentiation and the barriers to market entry into formal livestock product value chains in most countries (Frazee 2022).

Greater facilitation of the pastoral sector is possible. There are new opportunities for [value-chain approaches](#) to drive sustainable production from pastoral systems such as virtual and mobile auctions that bring pastoralists and commercial buyers together and mobile abattoirs that allow humane slaughter and delivery of meat and increase the market opportunities for pastoralists. Opportunities for creating greater synergies between urban and rural/pastoral enterprises should be actively sought and supported (Coppock et al. 2018). There is a need to ensure that national legislation can enable and not stifle such innovation and instead allow technology to create new value-chain opportunities for pastoral producers and those consumers seeking higher quality and fair production such as [certified natural meat](#).

*For all the reasons above, current policy decisions need to be re-evaluated and reformed and new beneficial policies put into place, including:*

- *Revise how current subsidy programs are affecting rangelands and pastoralist livelihoods and use innovative financial tools, such as livestock insurance and payment by results, to promote Sustainable rangeland management (SRM) practices such as rotational grazing and transhumance*
- *Promote favorable and supportive national and local policy processes that include all producers*
- *Enhancing synergies with the local economy and other types of production such as crops, orchards, timber plantations, silvopastoral systems, etc.*
- *Introducing differentiation and traceability systems for marketing of pastoral food products, which certify its origin, good quality value, source and sustainability and generate legal frameworks that allow differentiation of livestock products and facilitate consumer choices to support sustainable livestock-production systems*
- *Raise awareness about the efficiency and promising values of pastoral production as a future technology*
- *Advise national rangeland policy to focus on land law, economic subsidization and taxation, public investment in infrastructure and access to local and global markets, provision of insurance, promotion of self-organization, and mobile services for pastoralists to adapt to current and future climate variability*
- *Systematically apply true cost accounting to livestock products worldwide, thus ensuring balanced and equitable trade in these products, both domestically and internationally*
- *Enable pastoralists to maximize their contribution to sustainable food systems and to adopt new technologies that allow fair market access*
- *Seek opportunities to find rural development synergisms between rangeland urban centers and extensive populations that they serve.*

#### 4. Promote integrated policies that recognize the multifunctionality of rangelands

“Beyond its primary function of producing food and fibre, agricultural activity can also shape the landscape, provide environmental benefits such as land conservation, the sustainable management of renewable natural resources and the preservation of biodiversity, and contribute to the socio-economic viability of many rural areas. Agriculture is multifunctional when it has one or several functions in addition to its primary role of producing food and fibre.” (Huylensbroeck et al. 2007).

Pastoral land is, at the same time, an ecosystem providing services, a source of livelihood, and it creates the social structure of rural areas: jobs, social cohesion of communities and some level of self-sufficiency and resilience in times of crisis and disaster. Over the past decades, this multifunctionality of pastoral land (Fig. 8) (McGahey et al. 2014 p. 27) has frequently been ignored and neglected by politics, economics and science, and agricultural companies and producers themselves (IAASTD 2008).

Pastoral production is estimated to be the source of one third of global protein intake (Cherlet et al. 2018), although global statistics such as these vary considerably and are not comparable because different definitions are used. But when looked at with a multifunctional lens, the true value of livestock is not in the final sale value of meat. Animals produce milk, fiber, leather and manure, provide transport, plough fields and are the basis of savings (Scoones 2022).

Multifunctionality of land refers to both **multiple production and the multiple benefits** that land management can provide to society. It is an integrated approach that manages and invests in land simultaneously for all those benefits instead of allocating land separately for food production, biodiversity conservation and climate change mitigation. To be successful, this approach requires an enabling environment that supports the establishment of integrated institutional mechanisms.

Multifunctionality requires the high art of **balancing benefits and trade-offs** in a constant exchange with all stakeholders. The integrated approach of the SDGs and the 2030 Agenda offer the opportunity for managing trade-offs while restoring rangelands and managing pastoral areas (Niamir-Fuller & Huber-Saanwald 2020). Trade-offs can be managed by raising awareness at all levels about interdependencies and creating connections between all rangeland-related policies and institutions, including water, agriculture, forest, land, biodiversity, environment, social and economic issues (e.g. health, education) and disaster risk reduction.

There are successful **best practices of managing livestock grazing so as to regenerate vegetation and contribute to landscape multifunctionality** while also providing improved livestock-related products such as milk or meat. For example, pastoralist and agropastoralist communities in the Horn of Africa



Figure 6: Multiple benefits of sustainable rangelands and pastoralism (Source: IUCN 2017)

harvest aromatic resins (frankincense and myrrh) during the dry season as a source of livelihood. They obtain these resins mainly from the dry forest species *Boswellia* and *Commiphora* in rangelands where they also graze their livestock. Such **silvopastoral systems** are widespread around the world, thriving on the diversity of resources they use sustainably (FAO 2014). The trees provide at the same time environmental benefits to rural communities (soil protection, water flow regulation and carbon sequestration), as well as feed for livestock, and contributing significantly to rural household incomes. For instance, 39% of household income comes from the *Commiphora* tree in Ethiopia's Amhara Region. However, some tree species are threatened by inappropriate harvesting techniques and ecosystem degradation (Badal-Ahmed et al. 2019). Lack of market knowledge and inadequate prices create a competitive disadvantage for small-scale producers, with indirect impact on the resin harvest and environmental health.

**Generation of renewable energy from rangelands under grazing systems** is a growing trend. In rural areas of many dryland countries of Africa, fuelwood is the primary source of household energy. In Uganda for instance, it is estimated that 99% of the households use fuelwood for cooking and preserving food (Egeru 2014). In Sub-saharan Africa and some other regions, fuelwood harvesting and charcoal production have been associated with land degradation, especially in drylands (IPCC 2019). Alternative energy sources such as biogas, solar and wind have been tested successfully in many pastoral settings (Akpojaro et al. 2019). In recent years, however, the development of large-scale renewable energy from rangelands for the purpose of commercial export has expanded rapidly, attracted largely by the open canopy of such landscapes, low cloud cover, high winds, and perceptions that these are wastelands that need to be put to better use. Examples can be found in India for the cultivation of jatropha as biofuel (Trebbin 2021) and in Morocco's Southern Atlas region for large-scale solar-power installations (Rignall 2016).

Wind and solar power generation has expanded in many rangeland areas, increasing the impact of energy development on rangeland degradation and affecting the rights of pastoralists to their grazing areas (Waters-Bayer & Wario 2022). Recently, the Norwegian Supreme Court ruled that two giant wind farms are affecting the migration of the indigenous Sami people and the living environment of reindeer (CGTN News 2022). Transition to renewable energy worldwide is an urgent necessity, but this urgency should not result in unintended and underacknowledged negative impacts on local rural people. Wind and solar installations can be combined with grazing. Free, prior and informed consent (FPIC) and ensuring equitable benefit sharing, especially by energy-poor pastoralists, as well as reducing negative environmental impacts must be part and parcel of large-scale renewable energy development. Multifunctional land use for energy production, agriculture – including pastoralism – and ecosystem services needs to be developed in a participatory way.

Multifunctionality also includes services that rangelands provide beyond the production such as buffering extreme events climate events and being a refuge during such times, maintaining biodiversity and carbon sequestration. If rangelands are in a healthy condition, they can absorb shocks that neighboring croplands cannot and provide water and plant resources. Furthermore, through enhanced biodiversity they remain an attractive area for eco-tourism and wildlife protection as an additional and in some areas even major income for rural people living in and neighboring healthy rangelands.



Restoration of degraded agrosilvopastoral site in Central Tunisia using the forage legume "Sulla" (*Hedysarum coronarium*) (Photo: Mounir Louhaichi)

**Box 5: Native drought-tolerant forage species for enhanced dryland pasture restoration in Tunisia**

The semi-arid areas of Tunisia are prone to high temperatures and limited annual rainfall. Nevertheless, land users depend on these drylands for income through grazing their livestock. However, the land is becoming seriously degraded due to mismanagement such as overgrazing exasperated by climate change. The drought-tolerant native forage legume "Sulla" is used to restore degraded soils by covering the soil, fixing nitrogen, improving biodiversity and increasing water infiltration while fodder quality and availability is improved. A grazing plan was put in place to avoid overgrazing. The improved fodder availability decreased the costs of feed import and, as "Sulla" is suited to the local climate, few inputs are required, reducing costs and labor.

<https://acat.wocat.net/en/summary/6187/?as=html>

Many more examples can be provided. New directions towards integrated policies and institutions can help move the needle "beyond livestock" by helping pastoralists diversify as stewards of other ecosystem services (Briske & Coppock 2022).

**Multifunctional rangelands can be enabled** by Member States that promote:

- Policies that recognize and promote the multifunctionality of rangelands
- Recognition of the status of rangelands and the changing and growing claims on them for the services they provide by a multitude of users
- Institutional settings and mechanisms that support cross-sectoral and circular management of resources, and investments to achieve a better integration of landscape management and the multifunctionality of land
- Practices and policies that contribute simultaneously to achieving the LDN targets, the Nationally Determined Contributions (NDCs), and the National Biodiversity Strategy and Action Plans (NBSAPs) of countries
- Sustainable and equitable production of rangeland products such as milk and meat, and other non-livestock rangeland products/value chains that promote climate resilience and adaptation, biodiversity and ecosystem services of rangelands
- Decentralized electricity supply, using solar, wind and other alternative energy, with pastoralists benefitting from the royalties of large-scale installations or being able to sell electricity generated from their community installations.



**5. Adopt participatory governance and tenure security models that recognize pastoralists at the heart of stewardship and care of rangelands**

SRM is hindered by many constraints and barriers, but multiple factors are also recognized as being favorable. In a study of rangeland systems in sub-Saharan Africa, the most important hindering factors in over half of the documented practices were ‘policies’, ‘collaboration’, ‘land governance’ ‘markets’, ‘legal framework’, ‘institutional settings’, ‘knowledge’ and ‘workload’ (Fig. 9). These are linked to several **governance-related drivers**, including weakened enactment and enforcement of regulations shifted in scale from local to state, neglect of indigenous peoples, absence of local communities in decision-making and challenges to customary institutions. If these multiple issues are addressed, they can be turned into key enabling factors underpinning successful scaling up and implementation of sustainable rangelands and pastoralism (Liniger & Mekdaschi-Studer 2019; Louhaichi et al. 2022).

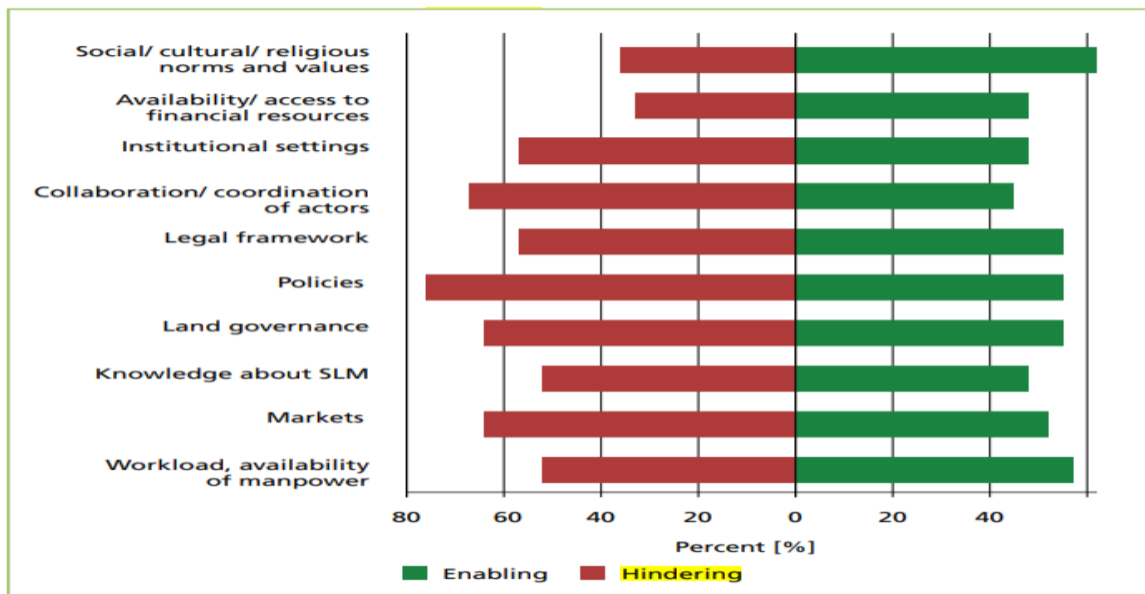


Figure 7: Enabling and hindering factors for SRM (Source: Liniger & Mekdaschi-Studer 2019)

Governments and local authorities need to adopt comprehensive strategies for land, ensuring real coordination among intergovernmental departments and scales (Briske & Coppock 2022). Sustainable models of rangeland governance are needed at local level that integrate the different functionalities and capacities of the land, balance the interests of all stakeholders involved, monitor the advances and keep the system integrity (Turin 2019). In this way, provision of all services and values will be optimized while supporting the people and livelihoods depending on them.

Pastoralists need **secure tenure rights to their land** that recognize and enforce their rights to be part of decision-making. In many parts of the world, this is still not achieved, especially in the case of rangelands held in common. Diverse pastoral systems, especially in dry, mountainous, marginal and high-nature-value areas, share the extensive use of wide expanses of common land, often divided into multiple patches or mosaics, ruled under different rights and harboring different uses and resources. **Land held under collective rights** can be instrumental for pastoralist livelihood security by providing critical assets for production, mobility and adaptation. In much of sub-Saharan Africa, use of rangeland resources, including water and forage, have historically been governed under traditional common property regimes. Customary institutions set rules and regulations on the use of resources and

management of livestock. Many continue to be governed to one extent or another by local institutions (Liniger & Mekdaschi-Studer 2019). Many of those that have disappeared or been replaced with colonial and postcolonial structures are showing degradation symptoms. The challenge is to co-adapt modern law and traditional land-tenure systems, such as finding legal terms for common property ownership, for flexible/intermittent occupancy of land, and for reciprocity that would work in a pastoralist context (Niamir-Fuller 1999).

Acknowledging the work scale and defining core objectives for land shared by the community would facilitate sound governance schemes. Incorporating pastoralists into decision-making and management of rangelands, ensuring well-defined legal and customary land tenure rights, and promoting participatory institutions of land governance would improve the health and restore rangelands while securing and enhancing the livelihoods of the people stewarding those landscapes (Reid et al. 2014).

Recognizing, respecting and supporting traditional governance and tenure systems and the people behind them is an important prerequisite to sustainable pastoralism (UNESCO 2018). Around the world, areas managed by local communities and indigenous peoples are often examples of good governance outcomes. “ICCAs—territories of Life” (ICCA-a n.d.) combine community–territory association with effective local governance and conservation of nature (Borrini-Feyerabend & Farvar 2016). The ICCAs have been recognized in a wide range of decisions of the CBD, in policies and programs of IUCN (ICCA-b n.d.) and in UNESCO (United Nations Education, Scientific and Cultural Organization) Intangible Cultural Heritage. The priority is to build synergy among the existing international policy instruments to enhance legal recognition of pastoralists’ customary rights over their territories and resources (Naghizadeh et al. 2021).

**Participation is also instrumental for equitable and just governance schemes and institutions.** Equity in this context is not only about balancing the participation of the different stakeholders involved (including pastoralists) in the decision-making, but also about actively engaging the most marginalized groups among them (Rodgers 2017), by speaking their native language; adapting the schedule of the process to their needs, capacity enhancement and technical assistance. It is important to build human and social capital among pastoralists--and notably women--in the quest to improve participatory governance (Coppock et al. 2011). Pastoralists and – among them – the women, elderly, youth and other groups that have often have been ostracized in governance institutions and participatory processes, should be given fair treatment and their representatives empowered to participate in rangeland management and governance.




Bedouin herder in the Hima of Era-Jordan (Photo: IUCN/ILC Rangelands Initiative/Mahfouz Abu Zanat)

**Box 6: Reviving Al Hima**

*Al Hima is a traditional rangeland-management system that was established in the Arabian Peninsula by tribal peoples.*

*They depended on sustainable land-use patterns that would assure long-term survival in the face of scarcity of resources, particularly water. The term ‘Al Hima’ means protected area or protected place.*

*Traditional grazing on rangelands in Jordan, which cover 90% of the country, has declined in recent years due to climate change, industrialization, the attraction of urban settlements, land and water mismanagement, as well as lifestyle changes and population pressures, including from a large influx of Syrian refugees.*

 <p data-bbox="215 403 478 459"> <b>Khatmah Al Umoosh</b>          Bani Hashem Hima Society          Member – Al Zarqa       </p>	<p data-bbox="726 190 1396 358"> <i>The traditional Hima rangeland-management system, in which land and key resources are set aside so that communities can conserve them and regulate their use, is providing some hope that degradation and biodiversity loss can be reversed in Jordan’s arid rangelands.</i> </p> <p data-bbox="726 369 1396 470"> <a href="https://www.rangelandsdata.org/">Reinstating the Hima in Bani Hashem, Jordan, to build resilience to climate change   Rangelands ATLAS (rangelandsdata.org)</a> </p> <p data-bbox="726 481 1396 537"> <a href="http://wanainstitute.org/sites/default/files/fact_sheets/HIMA.pdf">http://wanainstitute.org/sites/default/files/fact_sheets/HIMA.pdf</a> </p> <p data-bbox="726 548 1396 616"> <a href="https://www.unep.org/">Back to the future: rangeland management in Jordan (unep.org)</a> </p> <p data-bbox="726 627 1396 772"> <a href="https://www.revitalization.org/article/one-womans-impossible-landscape-restoration-story-emerges-from-jordan-and-nature-and-agriculture-are-revived-together/">Reviving Al Hima in Jordan – YouTube</a>  <a href="https://www.revitalization.org/article/one-womans-impossible-landscape-restoration-story-emerges-from-jordan-and-nature-and-agriculture-are-revived-together/">https://www.revitalization.org/article/one-womans-impossible-landscape-restoration-story-emerges-from-jordan-and-nature-and-agriculture-are-revived-together/</a>  <a href="https://www.wocat.net/library/media/251/">https://www.wocat.net/library/media/251/</a> </p>
<p data-bbox="215 470 702 795"> <i>After two years, the Hima started to regenerate and the increased availability of pasture enabled herders to save money because they bought less fodder. Khatmah and other women in the community learned how to process medicinal herbs into teabags, providing a much-needed income boost and proving the potential for generating new revenue streams from the land (revitalization.org) (Photo: IUCN ROWA).</i> </p>	

**Pastoralist women** play key roles in the development of pastoralist communities and pastoral production systems and are crucial agents of change within them (Fernández-Giménez et al. 2022). Their tasks, skills and capacities are as diverse as the pastoralist systems themselves (Onyima 2019), but often they have been overlooked and their merits not properly recognized (Valdivia et al. 2013). Pastoralist women around the world frequently see their rights being diminished (for instance, land rights, ownership of livestock and production facilities, inheritance), lacking representation and voice and their role overlooked in participatory processes and governance institutions. That is in contradiction not only to their own rights but also to their influence and potential regarding knowledge, performance, sustainability and adaptation of pastoral systems (Fernández-Giménez et al. 2019). Furthermore, beyond the important considerations surrounding women’s individual rights to private property, it is also important to secure their tenure rights within common land. Securing common land tenure for the group or community – important as a first step in many countries - has sometimes (Waweru et al. 2021) but not always led to securing women’s rights within those commons (Meinzen-Dick et al. 2021). Women’s roles in governance and management should be explicitly recognized and facilitated, under their own guidance and leadership following equitable pathways such as highlighted in the Mera Declaration of the Global Gathering of Women Pastoralists (IFAD 2010). Existing examples of pastoralist networks, such as the [Pastoral Women’s Council](#) in Tanzania or [Ganaderas en Red](#) in Spain that are advocating for the role and rights of women and celebrating their contribution to the future of pastoralism, could guide the incorporation of women into improving the governance of rangelands.

**Elders and youth** are often marginalized and their role in governance should be upgraded. As in the case with women, their contribution to governance is often overlooked, although it could be critical. In the tradition of most pastoral societies, Elders held the power of decision making, and youth were recognized with ceremonies and specific rights. But today, these traditions have largely disappeared and ageing and migration are taking a heavy toll on most pastoralist communities and deeply impacting their way of life (Turin 2023). On one hand, migration is increasing the burden of elders, especially elderly women, who are obliged to assume increasing responsibilities in production (besides the responsibilities they already have in care and household) when men and youth are absent. On the other hand, this situation promotes abandonment, leaving them even poorer and more vulnerable

than they were before. Elders' knowledge heritage and skills are crucial for the performance and adaptation of pastoral systems (Sharifian et al. 2022), while youth are instrumental for generational transfer of pastoralist enterprises (Rodgers 2017). Youth – and especially young pastoralist women facing challenges from both sides – are key for the future of pastoralism. However, strengthening the role and rights of elders and youth should not come at the expense of dismantling viable customary institutions.

Various other groups that could make important contributions to governance need to be recognized and incorporated into participatory processes; for example, hired herders, wage laborers and specialized temporary workers (e.g. shearers) are often absent, undervalued compared to owners and difficult to engage. However, because their contributions could be very important locally, their voices should also be incorporated into participatory processes related to governance and tenure security.

Thus, rangeland governance relies on the involvement and commitment of all stakeholders concerned and the development of participatory planning and management schemes that hold real decision-making capacity (Flintan et al. 2019). Participatory governance systems should be implemented to manage complex pastoral lands whenever the access to and use of resources are ruled by non-exclusive or collective rights, when the landscape is comprised of mosaics of land under different tenure regimes, or when rangelands are managed by different stakeholders. Participatory land-planning instruments could be developed at different scales, including shared grazing and mobility across borders, as demonstrated by several projects implemented in Africa and elsewhere (Flintan 2021; Ministry of Agriculture, Ethiopia 2018). Participatory rangeland planning can be particularly efficient for managing common lands and integrating pastoral uses. Once those land-planning instruments are developed, participation should continue through implementation, management and evaluation. There are innovative ways of expanding governance of pastoral lands, including new partnerships, multistakeholder platforms (Manzano et al. 2021) and an improved science–public interface (Briske & Coppock 2022).



*Celebration of the 4th Pastoral Management Forum, hosting Commune Administrators and technicians, traditional leaders, veterinarians and herders for discussions on land and animal management, Lola, Angola (Photo: RETESA)*

**Box 7: Restoration of traditional pastoral management forums (Angola)**

*The transhumance pastoral communities of Southern Angola traditionally held gatherings of chieftains and community leaders to discuss management of commonly held pastoral resources. However, the conflicts of the last century led to the breakdown in traditional governance and the majority of the traditional management systems were abandoned. The revival of these traditional systems and their adaptation to modern rangeland management theory and practice supported to develop new management plans that are based on keeping the animals in more remote, mountainous areas during the rainy season, the only time of year when water is available in these areas, and gradually bringing them back to the lowland river plains during the dry season. This system allowed for rangeland recovery and rest.*

<https://qcat.wocat.net/en/summary/6045/?as=html>

Some **pastoralist associations and producer organizations** have started to self-organize, such as the Gram Bharati Samiti of India, National Association of Dehkan Farms in Tajikistan, the Association des Femmes Peules Autochtone of Chad (AFPAT), Réseau des Peuples Pasteurs du Sahel, Association of World Reindeer Herders, European Shepherd Network, Asociación Nacional de Ganaderos Diversificados Criadores de Fauna of Chile, Ganaderas en Rede of Spain (Spanish Platform on Pastoralism), the Pastoralists' Association of West Darling (Australia) and the World Alliance for Mobile Indigenous Peoples (WAMIP), to name only a few. The UNCCD Parties, including governments and civil society, should support the self-organization of pastoralists to ensure greater legitimacy in the global participatory processes.

*Member States, civil society and international and multilateral organizations can play a supportive role in enhancing the governance of rangelands by promoting actions that:*

- *Legally recognize, respect and support customary governance and tenure systems and the people behind them, facilitating their transition when necessary towards new, inclusive and just governance systems and institutions*
- *Implement innovative and participatory processes, carefully designed and facilitated, to improve the governance of pastoral lands, incorporating the different groups and voices linked to their use and management and promote participatory land use planning across administrative borders*
- *Build synergy among the existing international policy instruments to enhance legal recognition of pastoralists' customary rights over their territories and resources*
- *Adopt comprehensive strategies for land, ensuring real coordination among intergovernmental departments and at different scales*
- *Seek, promote and facilitate the self-organization of pastoralists to strengthen their voice and representation in local and global governance initiatives.*

**6. Increase investment in rangeland restoration, including by calling on the LDN Fund to increase its support to rangelands and pastoralist projects by at least 30% by 2026**

**Rangeland restoration techniques** vary from highly mechanized operations that introduce pasture species to enhance native species, to techniques involving grazing management changes that nudge the native ecosystem toward recovery and restoration. Many restoration practices serve as examples: revitalizing transhumance (Starrs 2018); managing animal mobility through public regulations on movement and access; revitalizing traditional collective land practices or creating new community-based arrangements and cooperation in rangeland use and protection can create a “virtual fence” (Niamir-Fuller 2005; Flintan & Cullis 2010); and moving animals between different landscapes by relying on herders and mobile electric fences rather than permanent fencing (Yolda Initiative 2019). Evidence suggests that the success of such strategies relies heavily upon supportive infrastructure such as legal recognition of community tenure of grazing resources, adequate governance and enforcement structures, enhanced access to markets, and appropriate financial and social services (Addison et al. 2013).

The **average cost of restoring a rangeland** varies significantly from a few dollars per hectare to thousands of dollars (Knight & Overbeck 2021). Mechanical restoration techniques are far more costly than solutions that work with herders' know-how, including their knowledge, skills and adaptive capacity, and that rely on cooperation and mobility of animals.

The level of investment and technical assistance from **multilateral and bilateral donors for rangeland restoration** is not commensurate with the importance and value of rangelands and pastoralism worldwide. For example, in 2015, out of approximately US\$76 trillion of donor funding from the Organization for Economic Co-operation and Development (OECD) that addressed the goals of all Multilateral Environmental Agreements, only US\$257 million (0.3%) was provided for livestock and/or veterinary issues, and it is not known what proportion of this was provided for pastoralism and rangelands. From 2000 to 2018, the Global Environment Facility (GEF) provided over US\$17 billion in project funding, of which only 2.38% went for components mentioning rangelands or pastoralism (Johnsen et al. 2019). The IYRP 2026 offers a good opportunity for the LDN Fund to step up its commitments for rangeland restoration with a modest 30% increase from the status quo.

Recently, public–private partnerships have experimented with **rangeland restoration by leasing or purchasing land that is then fenced** and stocking rate adjusted for a less mobile livestock system (Naadam 2020). However, such experiences are not scalable, have resulted in degradation outside of the fenced area and, by being projectized, have contributed to increasing inequality among pastoralist communities.

One possible source of financing for **rangeland restoration is through carbon credits**. Most of the carbon pool in rangelands is primarily stored belowground in root biomass and soil organic carbon, which makes it less obvious than in forests (Veldman 2016), but more permanent, especially in future climates characterized by increasing disturbance regimes (Dass et al. 2018).

So far, there are few carbon-credit projects in grasslands worldwide, and most are based on protocols established by the American Climate Registry. Other global standards, such as the Verified Carbon Standards of [Verra](#), do not as yet cover all rangelands. Grassland carbon projects are not as expensive as forest carbon projects; however, grasslands generate fewer credits per hectare than forests, which means that [grassland projects](#) also require parcels to be at least several thousand hectares in size. This large-scale approach lends itself well to community-based projects involving pastoralists and helps in the management of the mobility of their animals. However, carbon projects are not realistic nor viable if they are done in the context of land tenure insecurity.

Recent efforts to establish a **Rangeland Stewardship Council** that monitors and certifies rangeland-friendly activities and products should be encouraged, as they can provide financial incentives to pastoralists and businesses along the value chain for rangeland restoration.

There is a need to scale up rangeland restoration and equitable pastoral development efforts globally, including actions that increase land tenure security, more participation in land planning and governance, greater regional and subregional cooperation among countries (Liniger & Mekdaschi-Studer 2019), and securing financing.

*Sustainable rangeland management and restoration can be enabled by policy decisions emanating from the UNCCD COP that:*

- *Encourage the LDN Fund to increase its support for rangeland and pastoralism projects by at least 30% by 2026.*
- *Ensure that the LDN Fund supports an enabling environment for rangeland restoration in an equitable way, such as projects that enhance land-tenure security and better local governance and participatory decision-making*
- *Assess existing global standards, tools and frameworks for rangeland restoration and certification of rangeland-friendly products*

- Further document and assess global rangeland condition, status and management practices and share them in an open access knowledge platform, including through the Global Database for Sustainable Land Management Best Practices as recommended by the UNCCD, to be used for evidence-based decision-making
- Call on carbon markets to accept the significance of grasslands and other rangelands for achieving climate goals, and develop certification and verification standards appropriate to such ecosystems and distinct from forests and other land systems
- Give value to traditional pastoralist knowledge and systems as cost-effective solutions for rangeland restoration.

**7. Increase the level of ambition of LDN targets with specific commitments to rangeland restoration and sustainable pastoralism, accelerate the implementation of the LDN targets, and invite those Parties that have not done so to set specific LDN targets to avoid, reduce and reverse rangeland conversion and degradation and promote sustainable range management and pastoralism**

LDN represents a huge opportunity to address rangeland restoration. To date, 129 countries have committed to set their LDN targets, and rangelands are included in approximately two thirds of all national LDN Target Setting Program (TSP) reports, based on the results of a study that IUCN and UNCCD conducted in 2019 (Fig. 10).

For example, according to the UNCCD Knowledge Hub on [Voluntary LDN Targets](#) Eritrea has committed to improve soil organic carbon stocks of 17,803 km<sup>2</sup> in cropland and grasslands by 2030 as compared to 2015. Jordan committed to improve the productivity of a rangeland reserve area by at least 10,000 ha by 2030. Colombia committed to improve at least 9,000 ha of pasture cover in silvopastoral systems by 2030. Turkey committed to rehabilitate 7,500 km<sup>2</sup> of pasture by 2030. These four countries combined represent 70.5 million ha of rangeland,<sup>2</sup> but their targets combined add up to only 3.4% of all their rangelands – whereas degradation affects 25–35% of their rangelands. Thus, there is room for increasing ambitions.

Some countries have included climate and conservation goals in their LDN targets. For example, Armenia committed to recover and increase by 2.8% in relation to present the carbon stock lost between 2000 and 2010 by the year 2040. This will be done by improving grassland management among others. Jordan has included the conservation of the Hima system (Box 7) as a success story of communal rangeland management, restoration and conservation

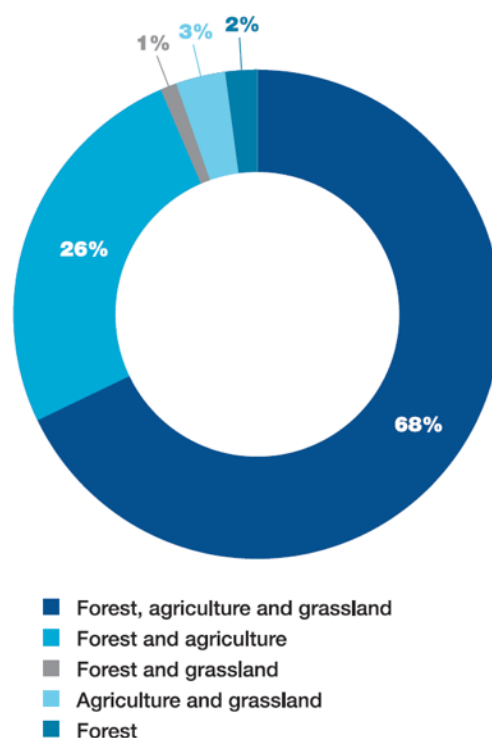


Figure 8: LDN target focus (Source: Gichuki et al. 2019)

<sup>2</sup> Area of rangeland calculated using FAO STAT 2002, using the marker for “permanent pasture”. <https://www.fao.org/3/a0050e/a0050e09.pdf>

of biodiversity by pastoralists, and the recognition of traditional management of rangelands and land rights enhancement.

However, action to meet these commitments seems to be slow. According to LDN measurements, between 2001 and 2015, only 32% of rangelands showed improvements in land cover, productivity and carbon stocks (Fig 11).

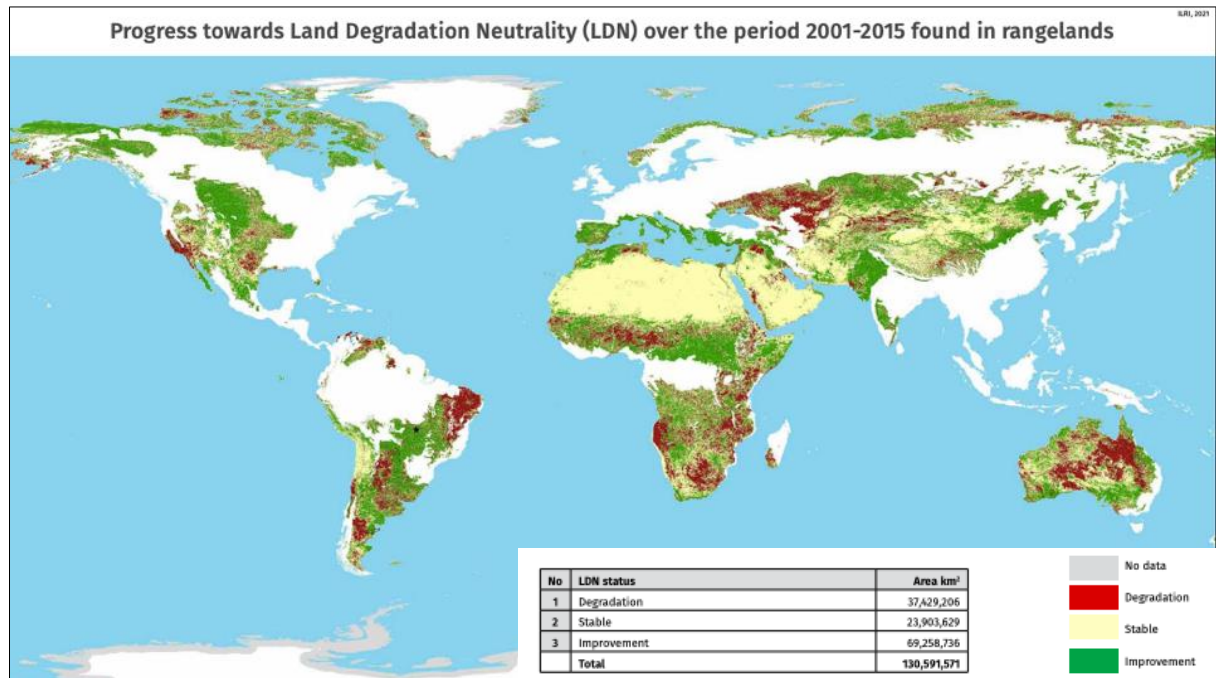


Figure 9: Progress in achieving LDN targets (Source: ILRI et al 2021 Rangeland Atlas p.32)

Further to defining their targets, the Parties should also accompany them with robust indicators and monitoring frameworks to monitor progress towards the LDN targets. Monitoring progress will help convince investors to invest, be they local pastoralists and businessmen, or external private sources, and increase multistakeholder partnerships and actions that are needed to enhance LDN achievement.



Heavy grazing and trampling can lead to heavy degradation of pastureland. Shenako, Akhmeta Municipality, Georgia (Photo: Hanns Kirchmeir)

**Box 8: Remote sensing as tool for LDN monitoring in Georgia**

Land degradation contributes to biodiversity loss and the impoverishment of rural livelihoods in Tusheti, Georgia. Above all, land degradation is triggered by climate change, as traditional land-use practices might not be adapted to new climate conditions and thus may cause or speed up degradation processes. Land degradation often leads to low biomass quantity, reducing the ecosystem’s capability to stabilize local climate conditions. The concept of LDN and the use of remote sensing for monitoring land degradation are tools to identify local planning needs. The LDN monitoring concept includes setting national targets and using appropriate tools to assess indicators, mechanisms and incentives for LDN.

<https://qcat.wocat.net/en/summary/5488/?as=html>



*Increased commitment to rangeland and pastoralism restoration can be enabled by UNCCD COP policy decisions to:*

- *Increase the level of ambition of LDN targets of Member States related to rangelands*
- *Encourage action in meeting commitments within national LDN target setting*
- *Strengthen an enabling environment for national and international funding, and public–private partnership for rangeland restoration, including partnership with the LDN Fund, that will reach an increased number of local communities and pastoralists*
- *Identify the best ways to increase interest and investment from private entities in rangeland restoration while adhering to the best standards and guidelines and building multistakeholder dialogue for rangeland restoration that provides equitable benefits.*

***8. Earmark 25% of all development and conservation funding, including the LDN Fund, to global knowledge sharing, awareness raising, evidence-based decision support, capacity building of land users and decision makers, and participatory co-creation of knowledge***

While it is true that policies and governance are a limiting factor, **lack of knowledge** of how to use previous experiences, including impacts of interventions is a basic bottleneck to implementation of SRM and rangeland restoration. If experiences are not shared and monitoring of the impacts is not an integral part of any rangeland project, both time and resources are being wasted (Liniger & Mekdaschi-Studer 2019). Currently, knowledge on pastoralism and rangeland status and management is scattered or inaccessible, not comparative because of differing methodologies and definitions, and not disaggregated enough to differentiate pastoralists from other land users (Johnsen et al. 2019).

Knowledge needs to be continuously improved by addressing existing and newly emerging knowledge gaps (Johnsen et al. 2019; Liniger & Mekdaschi-Studer 2019) such as global statistics on status, health and trends of rangelands and pastoralists using harmonized definitions and methodologies; better understanding how non-equilibrium ecological dynamics should shape policy; clarify changing and evolving rights to rangelands; assessing current and future impacts of climate change and climate extremes; and successes in conflict resolution in rangelands.

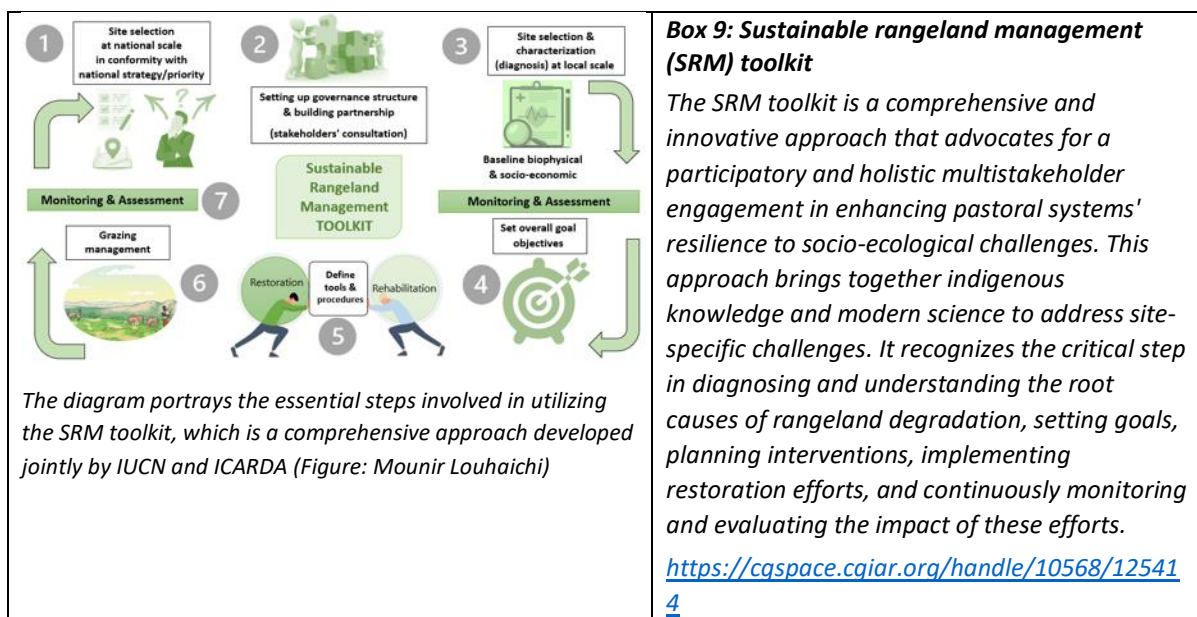
Modern science of rangelands itself has evolved considerably in the past decades, spurred by new paradigms such as the non-equilibrium theory (Benke et al. 1993) and fieldwork tracing the effectiveness of pastoralist strategies to cope with (and use) environmental variability (FAO 2021c). This knowledge and paradigm change have yet to be fully mainstreamed into government and academic institutions around the world.

There is need for improved compilation of and sharing SRM experiences using **standardized tools across countries** (facilitates comparison and data analysis), improved knowledge management and evidence-based decision making in implementation projects and agencies, in planning processes at local to national levels and in advisory services, and for improved support for a knowledge sharing platform for the rangelands.

There are very few comprehensive **global databases on rangelands**, in contrast to those available for forests, fisheries and other ecosystems. The Global Database on Sustainable Land Management [SLM Best Practices](#) is officially recognized by UNCCD as the primary recommended database to report on SLM best practices. This gives the [UNCCD-WOCAT Partnership on SLM](#) a mandate to support the 194 signatory countries in recording their SLM and SRM best practices and support institutions around the world to scale up SLM and achieve LDN. In addition, several organizations, such as ILRI (International Livestock Research Institute) and WWF (World Wide Fund for Nature), are planning to establish global

databases to collect and monitor primary data on rangelands, grasslands and pastoralism. These efforts need to be recognized by countries so that data access and sharing can be facilitated.

To address the nexus between the different rangeland resources and their management, the best SRM and restoration practices should have a **multiscale** perspective (from local landscape to national and global), a **multi-time** perspective (to address short-, medium- and long-term time impacts), and feedback loops from land-management options. It also must have a **multi-stakeholder** perspective that considers the interest and perception of various actors. Individual land users, planners and decision-makers seldom have the capacity to consider all these multiple dimensions and interdependencies without the support of research (Liniger et al. 2017).



Decision-makers at all levels can make better use of the support that **local and international research** can provide. Scientific evidence can provide direction to policy and practice, for example by considering short and long-term impacts of a plan or decision, its off-site impacts, using true cost accounting to maximize synergies and minimize trade-offs, and its long-term costs and benefits through models and foresight scenarios. Given the complexity and diversity of rangelands, the accelerated dynamics of change and their management practices, human capacity needs to be developed at all levels and for all stakeholders.

**Co-creation in research** is a strategy that is gaining more maturity as experiences are gained around the world. There are anecdotal examples of pastoralists engaging with citizen-science portals or being hired as field experts and research assistants. In Kenya, pastoral Maasai are being hired and trained as Park Rangers to monitor the health of the ecosystem and [help fight poaching](#). Also participatory approaches in which pastoralists and scientists co-develop improvements in rangeland management have been documented (Galvin et al. 2016).

**Pastoralism schools**, focusing on vocational training for herders (especially young women and men) are growing in number, for example, the [Andalusian Shepherd School and, at least, other 6 shepherd schools only in Spain](#), the Massive Open Online Course ([MOOC](#)) offered by the International Institute for Environment and Development and the Pastoralist Field Schools developed by ILRI and Vétérinaires Sans Frontières (VSF), building on FAO's [Farmer Field Schools](#). These need to be further supported.

**Funding for both primary research and action-research on rangelands and pastoralism** has declined in the past few decades. As a result, many academic institutions have reduced their range management departments (Briske et al. 2020). Additional efforts are needed to involve researchers, postgraduate fieldworkers and students in both training and development projects to address rangeland-related knowledge gaps and help raise awareness.

*There is a growing need to enhance capacities related to SRM and rangeland restoration, and this can be enabled by policy decisions emanating from the UNCCD COP that:*

- *Request the LDN Fund to earmark 25% of its funding to knowledge sharing, awareness raising and evidence-based decision support, capacity building of land users and decision makers, and participatory co-creation of knowledge*
- *Encourage all actors to better understand the new paradigms in rangeland ecology, and the value of rangelands to achieving global and local goals*
- *Improve exchange of knowledge and networking, backed up with comprehensive and up to date global databases on rangelands and pastoralism, and using newly high-tech tools methods and data, such as from remote sensing and the internet for field measurements and participatory assessment and mapping*
- *Develop local and national skills and capacities for impact and cost-benefit assessments on- and off-site, for evidence-based decision making at local, landscape and national levels*
- *Recognize and integrate pastoralist knowledge and capacities into planning, including through co-creation of knowledge and pastoral vocational schools*
- *Continue documentation of multiple unrecorded SRM and rangeland restoration practices and experiences.*

## Conclusion

This science review is intended to support policy dialogue for knowledge generation and sound interventions to improve the political, financial and institutional enabling environment for sustainable rangelands and support pastoralism as a well-functioning system and commit to reducing pressure from anthropogenic and climatic stressors. It capitalizes on the successful lessons and good practices obtained from pastoralist livelihood systems to address the challenge of sustainably producing food; and advocates for strengthening enabling policies, knowledge, capacities and incentives more investments and scaling up in LDN, sustainable development and restoration of rangelands.

Rangelands contribute to the food security and livelihoods of hundreds of millions of people across the world. It is vital that pastoralists, agropastoralists and other stakeholders are given support to address the multiple existential challenges they face. Pastoral agri-food systems should be strengthened as an integrated agroecological approach; linking new investments, research and innovations; working at different scales; transforming and intensifying sustainable production; and providing environmental services locally and globally. As UNCCD Parties continue to set and achieve their LDN targets, there is an urgent need to accelerate efforts, implement the SDGs and achieve a nature-positive world by 2030.

Committing to achieving LDN through sustainable rangelands and pastoralism with participatory governance will help address food security, climate change, economic development, insecurity, marginalization, livelihoods and human wellbeing. This requires that investment in all types of land and land use, including rangelands, forests, farmland, wetlands and others, is provided equitably.

The IYRP 2026 offers an excellent opportunity for UNCDD Member States and other parties to enhance the momentum for achieving the SDGs. Join us in making the Year a game-changer for rangelands and rangeland peoples and for a healthy planet.

### **Acknowledgements**

This review of scientific evidence has been produced in 2023 for the IYRP ISG by Mounir Louhaichi (ICARDA), Bora Masumbuko (IUCN), Pedro M. Herrera (Entretantos), Maryam Niamir-Fuller (IYRP ISG) Hanspeter Liniger and Rima Mekdaschi-Studer of the World Overview of Conservation Approaches and Technologies (WOCAT), in collaboration with other members of the IYRP LDN Working Group, namely Hossein Badripour (Forest Rangelands and Watershed Management Organization, Iran), Barbara Bendandi (WWF), Jean-Daniel Cesaro (CIRAD), Eric Chavez (FAO), Nicole Harari (WOCAT), Tezera Getahun (Pastoral Forum Ethiopia), Chris Magero (IUCN), Nahid Naghizadeh of the Centre for Sustainable Development and Environment (CENESTA), and Cecilia Turin (IYRP ISG). The main editor was Ann Waters-Bayer (Agregcol/CELEP).

### **Bibliography**

- Abdulahi M, Ute JA & Regasa T. 2017. *Prosopis juliflora* l: distribution, impacts and available control methods in Ethiopia. *Tropical and Subtropical Agroecosystems* 20: 75–89.
- Addison J, Davies J, Friedel M & Brown C. 2013. Do pasture user groups lead to improved rangeland condition in the Mongolian Gobi Desert? *Journal of Arid Environments* 94 (July 2013): 37–46. <https://doi.org/10.1016/j.jaridenv.2013.02.009>
- African Union. 2013. *Policy framework for pastoralism in Africa*. [https://au.int/sites/default/files/documents/30240-doc-policy\\_framework\\_for\\_pastoralism.pdf](https://au.int/sites/default/files/documents/30240-doc-policy_framework_for_pastoralism.pdf)
- Akpojaro, Jackson & Ofualagba, Godswill & Akpojaro, McCurtis. (2019). Electricity Generation from Cow Dung Biogas. *Journal of Applied Sciences and Environmental Management*. 23. 1301. 10.4314/jasem.v23i7.17.
- Al-Tabini R, Al-Khalidi K & Al-Shudiefat M. 2012. Livestock, medicinal plants and rangeland viability in Jordan's Badia: through the lens of traditional and local knowledge. *Pastoralism* 2(1): 1–16.
- Alene, G.D., Duncan, J. and van Dijk, H. 2022. Development, governmentality and the sedentary state: the productive safety net programme in Ethiopia's Somali pastoral periphery. *Journal of Peasant Studies*, 49(6), pp. 1158–1180. <https://doi.org/10.1080/03066150.2021.1945044>.
- Andina. 2013. Instalan mallas ganaderas a favor de comuneros de Espinar con apoyo de minera. Agencia Peruviiana de Noticias. <https://andina.pe/agencia/noticia-instalan-mallas-ganaderas-a-favor-comuneros-espinar-apoyo-minera-461016.aspx>
- Archer S & Arnalds A. 1982. Spring grazing on Icelandic rangelands: a review of factors to consider. *J.Agr.Res.Icel.* 14 (1–2): 55–68.
- Arzamendia Y, Rojo V, Gonzalez MN, Baldo LJ, Zamar IM, Lamas HE & Vila LB. 2021. The Puna pastoralist system: a coproduced landscape in the Central Andes. *Mountain Research and Development* 41(4): 38–49. <https://doi.org/10.1659/MRD-JOURNAL-D-21-00023.1>
- Assennato F, Smiraglia D, Cavalli A, Congedo L, Giuliani C, Riitano N, ... Munafò M. 2022. The impact of urbanization on land: a biophysical-based assessment of ecosystem services loss supported by remote sensed indicators. *Land* 11(2). <https://doi.org/10.3390/land11020236>
- Badal Ahmed H, Glover EK, Luukkanen O, Kanninen M & Jamnadas R. 2019. *Boswellia* and *Commiphora* species as a resource base for rural livelihood security in the Horn of Africa: a systematic review. *Forests* 10 (7): 551. <https://doi.org/10.3390/f10070551>
- Bai ZG, Dent DL, Olsson L & Schaepman ME. 2008. Proxy global assessment of land degradation. *Soil Use and Management* 24(3): 223–234.
- Behnke, R.H., Scoones, I., & Kerven, C. eds. 1993. *Range Ecology at disequilibrium: New models of natural variability and pastoral adaptation in African savannas*. Overseas Development Institute, London.
- Blench RM. 1998. Rangeland degradation and socio-economic changes among the Bedu of Jordan: results of the 1995 IFAD survey. In: Squires VR & Sidahmed AE (eds), *Drylands: sustainable use of rangelands in the twenty-first century*, IFAD, Rome, pp 397–423.
- Borrini-Feyerabend G & Farvar MT. 2016. *What are ICCAs?* COP13 of the UNCB, Cartagena MOP8 – Nagoya, MOP2, ECO 54(2).

- Braun AC. 2022. Deforestation by afforestation: land use change in the coastal range of Chile. *Remote Sensing* 14(7): 1686.
- Briske DD. 2017. *Rangeland systems: processes, management and challenges*. Springer Nature.
- Briske DD, Coppock DL, Illius AW & Fuhlendorf SD. 2020. Strategies for global rangeland stewardship: assessment through the lens of the equilibrium–non-equilibrium debate. *Journal of Applied Ecology* 57: 1056–67.
- Briske DD & Coppock DL. 2022. Rangeland stewardship envisioned through a planetary lens. *Trends in Ecology and Evolution* 38(2): 109–112. <https://doi.org/10.1016/j.tree.2022.09.012>
- Briske DD & Vetter S. 2022. Rangeland afforestation is not a viable climate change mitigation strategy. *IYRP Policy Note*. <https://iyrp.info/sites/iyrp.org/files/Rangeland%20afforestation%20is%20not%20a%20viable%20CC%20mitigation%20strategy.pdf>
- CBD. 2010. *Pastoralism, nature conservation and development: a good practice guide*. <https://www.cbd.int/development/doc/cbd-good-practice-guide-pastoralism-booklet-web-en.pdf>
- CGTN (China Global Television Network) News. 2022. *Reindeer herders demand Norway dismantles two illegal wind farms worth \$1.14bn*. <https://newseu.cgtn.com/news/2022-01-14/Reindeer-herders-demand-Norway-dismantles-two-illegal-wind-farms-16NAAIrtZK0/index.html>
- Cherlet M, Hutchinson C, Reynolds J, Hill J, Sommer S & von Maltitz G (eds). 2018. *World Atlas of desertification*. Publication Office of the European Union, Luxembourg, European Commission Joint Research Centre. <https://wad.jrc.ec.europa.eu/>
- Common Market for Eastern and Southern Africa (COMESA). 2010. *Legislation to support cross-border livestock mobility*. Policy Brief No. 14. [www.shareweb.ch/site/Agriculture-and-Food-Security/aboutus/Documents/pastoralism/pastoralism\\_biblio\\_hesse\\_2010.pdf](http://www.shareweb.ch/site/Agriculture-and-Food-Security/aboutus/Documents/pastoralism/pastoralism_biblio_hesse_2010.pdf)
- Coppock, D.L., S. Desta, S. Tezera, and G. Gebru. 2011. Capacity building helps pastoral women transform impoverished communities in Ethiopia. *Science* 334(6061): 1394-1398.
- Coppock, D.L., D. Bailey, M. Ibrahim, and S. Tezera. 2018. Diversified investments of wealthy Ethiopian pastoralists include livestock and urban assets that better manage risk. *Rangeland Ecology and Management*. 71(1): 138-148
- Dass P, Houlton BZ, Wang Y & Warlind D. 2018. Grasslands may be more reliable carbon sinks than forests in California. *Environmental Research Letters* 13.
- Davies J. 2017. *Biodiversity and the Great Green Wall: managing nature for sustainable development in the Sahel*. IUCN, Ouagadougou.
- Davies J, Poulsen L, Schulte-Herbrüggen B, Mackinnon K, Crawhall N, Henwood WD, Dudley N, Smith J & Gudka M. 2012. *Conserving dryland biodiversity*. Global Drylands Initiative, IUCN, Nairobi.
- Drisker T. 2021. *Farm Subsidies: harmful or helpful?*. Blog from Texas A&M University. <https://liberalarts.tamu.edu/blog/2021/11/03/farm-subsidies-harmful-or-helpful/>
- ECOWAS. 1998. Decision A/DEC.5/10/98 Relating to the regulations on Transhumance between ECOWAS Member States. *Official Journal Vol. 35 of the Economic Community of West African States (ECOWAS)*. <https://faolex.fao.org/docs/pdf/eco147525.pdf>
- Egeru AS. 2014. Rural households' fuelwood demand determinants in dryland areas of eastern Uganda. *Energy Sources, Part B: Economics, Planning, and Policy* 9(1): 39–45, DOI: 10.1080/15567241003716688
- Environment Defence Fund. 2019. *Avoiding conversion of rangelands: keeping rangelands intact and sequestering carbon can earn ranchers income*. <https://www.edf.org/ecosystems/avoiding-conversion-rangelands>
- FAO. 2014. *Ecosystem services provided by livestock species and breeds, with special consideration to the contributions of small-scale livestock keepers and pastoralists*. Commission on Genetic Resources for Food and Agriculture Background Study Paper No. 66. FAO, Rome. [www.fao.org/3/aat598e.pdf](http://www.fao.org/3/aat598e.pdf)
- FAO 2016. *FAOSTAT: Food and Agriculture Organization Corporate Statistical Database*. Rome: FAO. <http://faostat.fao.org/default.aspx>
- FAO. 2021a. *The State of Food and Agriculture 2021. Making agri-food systems more resilient to shocks and stresses*. FAO, Rome. <https://doi.org/10.4060/cb4476en>
- FAO. 2021b. *Pastoralism in Mongolia, a needed balance between production and sustainable use of natural resources*. Policy brief. FAO, Rome. <https://www.fao.org/3/cb5066en/cb5066en.pdf>
- FAO. 2021c. *Pastoralism – Making variability work*. *FAO Animal Production and Health Paper* No. 185. FAO, Rome. <http://www.fao.org/3/cb5855en/cb5855en.pdf>
- FAO. 2022. *Grazing with trees – a silvopastoral approach to managing and restoring drylands*. *FAO Forestry Paper* No. 187. FAO, Rome. <https://doi.org/10.4060/cc2280en>
- Fernández-Giménez ME, Oteros-Rozas E & Ravera F. 2019. *Co-creating knowledge for action with women pastoralists in Spain*. Cabezone de la Sal, Cantabria, España: Asociación Trashumancia y Naturaleza
- Fernández-Giménez ME, Ravera F & Oteros-Rozas E. 2022. The invisible thread: women as tradition keepers and change agents in Spanish pastoral social-ecological systems. *Ecology and Society* 27(2): 4. <https://doi.org/10.5751/ES-12794-270204>
- Firn J, Price JN & Whalley RD. 2013. Using strategically applied grazing to manage invasive alien plants in novel grasslands. *Ecological Processes* 2(1): 1–11.
- Fleischman F et al. 2020. Pitfalls of tree planting show why we need people-centered natural climate solutions. *Biosciences* 70 (11). <https://academic.oup.com/bioscience/article/70/11/947/5903754>

- Flintan, F. 2021. *Sustainable Rangeland Management Project, Tanzania: Lessons learned*. Nairobi, Kenya: ILRI. <https://cgspace.cgiar.org/handle/10568/116994>.
- Flintan, F. and Cullis, A. 2010. *Introductory Guidelines to Participatory Rangeland Management in Pastoral Areas*. CGIAR. Addis Ababa. <https://hdl.handle.net/10568/99430>.
- Flintan FE, Ebro A, Eba B, Assefa A, Getahun Y, Reyta K, ... Gudina D. 2019. *Review of participatory rangeland management (PRM) process and implementation*. <https://doi.org/10.13140/RG.2.2.10434.71367>
- Fraze S. 2022. *New opportunities for value-chain approaches to drive sustainable production from pastoralists*. Draft paper.
- Freier KP, Finckh M & Schneider UA. 2014. Adaptation to new climate by an old strategy? Modeling sedentary and mobile pastoralism in semi-arid Morocco. *Land* 3(3): 917–940; doi:10.3390/land3030917. <https://www.mdpi.com/2073-445X/3/3/917>
- Fynn RWS, Kirkman KP & Dames R. 2017. Optimal grazing management strategies: evaluating key concepts. *African Journal of Range and Forage Science* 34(2): 87–98. <https://doi.org/10.2989/10220119.2017.1347584>
- Galaty G, Aronson D & Salzman PC. 1981. *The future of pastoral peoples*. Proceedings of Conference 4–8 August 1980, Kenya. International Development Research Centre (IDRC), Ottawa.
- Galvin KA, Reid RS, Fernández-Giménez ME, ole Kaelo D, Baival B & Krebs M. 2016. Co-design of transformative research for rangeland sustainability. *Current Opinion in Environmental Sustainability* 20: 8–14. <https://doi.org/10.1016/j.cosust.2016.03.003>
- Getabalew M & Alemneh T. 2019. Factors affecting the productivity of rangelands. *MedPub Journals* 3(1): 19.
- Gichuki L, Brouwer R, Davies J, Vidal A, Kuzee M, Magero C, Walter S, Lara P, Oragbade C & Gilbey B. 2019. *Reviving lands and restoring landscapes*. IUCN, Gland, Switzerland. <https://portals.iucn.org/library/node/48515>
- Gongbuzeren, Huntsinger L & Li W. 2018. Rebuilding pastoral social-ecological resilience on the Qinghai-Tibetan Plateau in response to changes in policy, economics, and climate. *Ecology and Society* 23(2): 21. <https://doi.org/10.5751/ES-10096-230221>
- Government of Peru. 2016. *Agrorural Instaló 746 Hectáreas De Mallas Ganaderas*. Nota de prensa. Programa de Desarrollo productivo agrarian rurale. <https://www.gob.pe/institucion/agrorural/noticias/527996-agrorural-instalo-746-hectareas-de-mallas-ganaderas>
- Hatough-Bouran A & Disi AM. 1995. The impact of development and population growth on ecological systems: global and local issues. *Dirasat* 22A(2): 70–84.
- Herbert S & I. Birch. 2022. *Cross-border pastoral mobility and cross-border conflict in Africa – patterns and policy responses*. XCEPT Evidence Synthesis. Birmingham, UK: GSDRC, University of Birmingham. [https://gsdrc.org/wp-content/uploads/2022/01/2021-12-09\\_GSDRC-Pastoralist-Mobility-FINAL2-1.pdf](https://gsdrc.org/wp-content/uploads/2022/01/2021-12-09_GSDRC-Pastoralist-Mobility-FINAL2-1.pdf)
- Herrera PM, Davies J & Manzano Baena P. 2014. The governance of rangelands. In: Herrera PM, Davies J & Manzano Baena P (eds), *The governance of rangelands: collective action for sustainable pastoralism*, Taylor & Francis, London, pp 1–31. <https://doi.org/10.4324/9781315768014>
- Hurt GC, Chini LP, Frolking S, Betts RA, Feddema J, Fischer G, Fisk JP, Hibbard K, Houghton RA, Janetos A, Jones CD, Kindermann G, Kinoshita T, Klein Goldewijk K, Riahi K, Shevliakova E, Smith S, Stehfest E, Thomson A, Thornton P, Vuuren DP & Wang YP. 2011. Harmonization of land-use scenarios for the period 1500–2100: 600 years of global gridded annual land-use transitions, wood harvest, and resulting secondary lands, *Climatic Change* 109: 117–161. doi:10.1007/s10584-011-0153-2
- Huylenbroeck GV, Vandermeulen V, Mettepenningen E & Verspecht A. 2007. Multifunctionality of agriculture: a review of definitions, evidence and instruments. *Living Reviews in Landscape Research* 1: 1–38.
- IAASTD. 2008. *Towards Multifunctional Agriculture for Social, Environmental and Economic Sustainability*. Special Report. <https://www.globalagriculture.org/report-topics/multifunctionality.html>
- ICCA-a (indigenous peoples' and Community Conserved territories and Areas) n.d. ICCAs in International Policy, <https://www.iccaconsortium.org/index.php/international-en/>
- ICCA-b. n.d. A globally applicable governance type for areas and territories under customary management. <https://www.biodiversitya-z.org/content/indigenous-peoples-and-community-conserved-territories-and-areas-icca>
- IFAD. 2010. *Women and pastoralism*. <https://www.ifad.org/documents/38714170/39148759/Women+and+pastoralism.pdf>
- IGAD. Intergovernmental Authority on Development (2020) *IGAD Protocol on Transhumance*. <https://icpald.org/wp-content/uploads/2021/06/IGAD-PROTOCOL-ON-TRANSHUMANCE-Final-Endorsed-Version.pdf>.
- ILC, FAO & GLTN. 2021. *Land tenure and sustainable agri-food systems*. ILC, FAO & Global Land Tool Network (GLTN), Rome. <https://doi.org/10.4060/cb7154en>
- ILRI (International Livestock Research Institute), IUCN (International Union for the Conservation of Nature), FAO (Food and Agriculture Organization of the United Nations), WWF, UNEP (United Nations Environment Programme) & ILC (International Land Coalition). 2021. *Rangelands Atlas*. <https://www.rangelandsdata.org/atlas/>
- IPCC, 2019. *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. Shukla PR, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.). Chapter 7.

- IUCN, WWF & UNCCD. 2020. *Advancing international action for rangeland restoration report and background note from the first interactive dialogue to promote global action on rangeland restoration*. <https://globallandusechange.org/wp-content/uploads/2021/03/Advancing-International-Action-for-Rangeland-Restoration-EN.pdf>
- IYRP. 2021a. *Open Flyer*. Definition adapted from The International Terminology for Grazing Lands and Grazing Animals, 2011, published by the International Rangeland Congress (IRC) (<http://globalrangelands.org>)
- IYRP. 2021b. *Game Changing Idea to “Establish a transformational global Initiative for mobile pastoralism valuing rangeland variability”* submitted to the United Nations Food Systems Summit, May 2021.
- Jackson RB, Banner JL, Jobbágy EG, Pockman JT & Wall DH. 2002. Ecosystem carbon loss with woody plant invasion of grasslands. *Nature* 418. <https://www.nature.com/articles/nature00910>
- Jefatura del Estado. 1995. *Ley 3/95 de 23 de marzo, de Vías Pecurias*. Official State Gazette No. 71 of 24 March 1995.
- Jobbins M & McDonnell A. 2021. *Pastoralism and conflict: tools for prevention and response in the Sudano-Sahel*. Search for Common Ground, Washington DC.
- Johnsen KI, Niamir-Fuller M, Bensada A & Waters-Bayer A. 2019. *A case of benign neglect: knowledge gaps about sustainability in pastoralism and rangelands*. UNEP / GRID-Arendal. <https://www.unenvironment.org/resources/report/case-benign-neglect-knowledge-gaps-about-sustainability-pastoralism-and-rangelands>
- Kasterine A & Lichtenstein G. 2018. *Trade in vicuña: the Implications for conservation and rural livelihoods*. International Trade Centre, Geneva.
- Kay C & Urioste M. 2005. Bolivia’s unfinished agrarian reform: rural poverty and development policies. International Institute of Social Studies (ISS) / United Nations Development Programme (UNDP). *Land, Poverty and Public Action Policy Paper* No. 3. ISS, The Hague.
- Kemal, AW., Mohammed, AA. and Lelamo, LL.2022. Pastoralists’ Adaptation Strategies to Climate Change and Determinant Factors in Koraheh Zone, Ethiopia, *American Journal of Climate Change*, 11(02), pp. 79–102. <https://doi.org/10.4236/ajcc.2022.112005>.
- Knight ML & Overbeck GE. 2021. How much does it cost to restore a grassland? *Restoration Ecology* 29(8). <https://onlinelibrary.wiley.com/doi/10.1111/rec.13463>
- Krätli S, Huelsebusch C, Brooks S & Kaufmann B. 2013. Pastoralism: a critical asset for food security under global climate change. *Animal Frontiers* 3(1): 42–50.
- Kronenburg-Garcia A, Haller T, Samimi C, Dijk HV & Warner J. 2022. *Drylands facing change: interventions, investments and identities*. Routledge, London.
- Leroy F, Abraini F, Beal T, Domínguez-Salas P, Gregorini P, Manzano P, Rowntree J & van Vliet S. 2022. Animal board invited review: Animal source foods in healthy, sustainable, and ethical diets – an argument against drastic limitation of livestock in the food system. *Animal* 16(3): 100457. ISSN 1751-7311, eISSN 1751-732X. doi: 10.1016/j.animal.2022.100457
- Liniger, HP., Mekdaschi Studer, R., Moll, P., Zander, U. 2017. *Making sense of research for sustainable land management*. Centre for Development and Environment (CDE), University of Bern, Switzerland and Helmholtz-Centre for Environmental Research GmbH – UFZ, Leipzig, Germany
- Liniger HP & Mekdaschi-Studer R. 2019. *Sustainable rangeland management in sub-Saharan Africa: guidelines to good practice*. TerrAfrica; World Bank, Washington DC; World Overview of Conservation Approaches and Technologies (WOCAT); World Bank Group (WBG), Washington DC & Centre for Development and Environment (CDE), University of Bern, Switzerland. <https://www.wocat.net/library/media/174/>
- Liniger HP, Bandy J, Bhuchar S, Joshi R. 2020: Spring Revival through Sustainable Land Management (SLM) in the Himalayan foothills: Uttarakhand, North India. WOCAT SLM Policy Brief, No. 1. Bern, Switzerland: CDE [https://www.wocat.net/documents/1056/high\\_with\\_references\\_online\\_DEF\\_WOCAT\\_Policy\\_Brief\\_India.pdf](https://www.wocat.net/documents/1056/high_with_references_online_DEF_WOCAT_Policy_Brief_India.pdf)
- Long R, Ding L, Shang Z & Guo X. 2008. The yak grazing system on the Qinghai-Tibetan Plateau and its status. *Rangeland Journal* 30(2): 241–246. DOI: 10.1071/RJ08012 [https://www.researchgate.net/publication/240505438\\_The\\_yak\\_grazing\\_system\\_on\\_the\\_Qinghai-Tibetan\\_plateau\\_and\\_its\\_status](https://www.researchgate.net/publication/240505438_The_yak_grazing_system_on_the_Qinghai-Tibetan_plateau_and_its_status)
- Louhaichi, M., Gamoun, M., Fethi Gouhis. 2021. Benefits of Short-Duration, High-Stocking Rate Opportunistic Grazing on Arid Rangelands During Favorable Conditions. *Frontiers in Ecology and Evolution*. Vol.9. <https://doi.org/10.3389/fevo.2021.757764>
- Louhaichi, M. et al. 2022. Sustainable Rangeland Management Toolkit for Resilient Pastoral Systems. IUCN and ICARDA. 168 pages. <https://cgspace.cgiar.org/handle/10568/125414>
- Lund HG. 2007. Accounting for the world’s rangelands. *Rangelands* 29(1): 3–10.
- Manzano P & White SR. 2019. Intensifying pastoralism may not reduce greenhouse gas emissions: wildlife-dominated landscape scenarios as a baseline in life-cycle analysis. *Climate Research* 77(2): 91–97. <https://doi.org/10.3354/cr01555>
- Manzano P, Burgas D, Cadahía L, Eronen J, Fernández-Llamazares Á, Bencherif S, Holand Ø, Seitsonen O, Byambaa B, Fortelius M, Fernández-Giménez ME, Galvin KA, Cabeza M & Stenseth NC. 2021. Towards a holistic understanding of pastoralism. *One Earth* 4(5): 651–665. ISSN 2590-3322. doi: 10.1016/j.oneear.2021.04.012
- Mathias E. 2005. Camels on the way out in Rajasthan – case study. Project Report. Referenced in: Lokhit Pashu-Palak Sansthan (LPPS). 2005. Saving the camel and peoples’ livelihoods: building a multistakeholder platform for the conservation of the camel in Rajasthan. *Proceedings of an international Conference* held on 23–25 November 2004, Sardi. LPPS, Sardi, Rajasthan, India.
- McGahey D, Davies J, Hagelberg N & Ouedraogo R. 2014. *Pastoralism and the Green Economy – a natural nexus?* IUCN & UNEP, Nairobi. <http://iucn.org/wisp>

- Meinzen-Dick R, Doss C, Flintan F, Knight R, Larson AM & Monterroso I. 2021. *Women's tenure security on collective lands: A conceptual framework*. IFPRI Discussion Paper 02074. Washington DC, USA: IFPRI. <https://cgspace.cgiar.org/handle/10568/117940>
- Metera E, Sakowski T, Stoniewski K & Romanowicz B. 2010. Grazing as a tool to maintain biodiversity of grassland – a review. *Animal Science Papers and Reports* 28(4): 315–334.
- Millennium Ecosystem Assessment. 2005. *Ecosystems and human wellbeing: synthesis*. Millennium Ecosystem Assessment, Washington DC. <https://www.millenniumassessment.org/documents/document.356.aspx.pdf>
- Ministry of Agriculture, Ethiopia. 2018. *Woreda Participatory Land Use Planning (WPLUP) in pastoral and agro-pastoral areas*. Volume I: Manual. Addis Ababa, Ethiopia: Ministry of Agriculture. <https://cgspace.cgiar.org/handle/10568/99262>
- Mirzabaev A, Wu J, Evans J, García-Oliva F, Hussein IAG, Iqbal MH, Kimutai J, Knowles T, Meza F, Nedjraoui D, Tena F, Türkeş M, Vázquez RJ & Weltz M. 2019. Desertification. In: Shukla PR, Skea J, Calvo Buendia E, Masson-Delmotte V, Pörtner H-O, Roberts DC, Zhai P, Slade R, Connors S, van Diemen R, Ferrat M, Haughey E, Luz S, Neogi S, Pathak M, Petzold J, Portugal Pereira J, Vyas P, Huntley E, Kissick K, Belkacemi M & Malley J (eds), *Climate change and land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. <https://www.ipcc.ch/srccl/>
- Naadam. 2020. *Naadam Social and Environmental Impact Report*. <https://cdn.shopify.com/s/files/1/0313/7821/files/NAADAM-Impact-Report-2020.pdf?v=1619099287>
- Naghizadeh N, Badripour H, Louhaichi M, Gamoun M & Niamir-Fuller M. 2021. Rangelands and pastoralism of the Middle-East and North Africa: from reality to dream. *International Grassland & Rangeland Congress*, Kenya.
- Niamir-Fuller M. 1997. The resilience of pastoral herding in Sahelian Africa. In: Berkes F & Folke C (eds), *Linking social and ecological systems: institutional learning for resilience*, Cambridge University Press, Cambridge, pp 250–284.
- Niamir-Fuller M. 1999. *Managing mobility in African rangelands: the legitimization of transhumance*. FAO and Beijer International Institute for Ecological Economics. ISBN 1-85339-473-4
- Niamir-Fuller M. 2005. Managing mobility in African rangelands. In: Mwangi E (ed.), *Collective action and property rights for sustainable rangeland management*. CAPRI Research Brief, International Food Policy Research Institute, Washington DC, pp 89–92. <https://ebrary.ifpri.org/utis/getfile/collection/p15738coll2/id/133894/filename/134101.pdf>
- Niamir-Fuller M. 2008. Policy drivers for rangelands in developing countries. In: Organizing Committee of 2008 IGC/IRC Conference (eds), *Multifunctional grasslands in a changing world*, Vol. II: 887–892.
- Niamir-Fuller M. 2016. Towards sustainability in the extensive and intensive livestock systems. *Revue Scientifique et Technique* (International Office of Epizootics) 35(2): 371–387. [http://web.oie.int/boutique/index.php?page=ficprod&id\\_produit=1485&lang=en&PHPSESSID=f64ccc023dee99ff922f23a106909095](http://web.oie.int/boutique/index.php?page=ficprod&id_produit=1485&lang=en&PHPSESSID=f64ccc023dee99ff922f23a106909095)
- Niamir-Fuller M, Kerven C, Reid R & Milner-Gulland E. 2012. Co-existence of wildlife and pastoralism on extensive rangelands: competition or compatibility? *Pastoralism* 2(1). <http://www.springer.com/alert/urltracking.do?id=Ldbcc39Mae3aec5a>
- Niamir-Fuller M & Huber-Saanwald E. 2020. Pastoralism and achievement of the 2030 Agenda for Sustainable Development: a missing piece of the global puzzle. In: Lucatello S, Huber-Saanwald E, Espejel I & Martínez-Tagüe M (eds), *Stewardship of future drylands and climate change in the Global South: challenges and opportunities for the Agenda 2030*, Springer, pp 41–56. ISBN 978-3-030-22463-9 and ISBN 978-3-030-22464-6 (eBook) <https://doi.org/10.1007/978-3-030-22464-6>
- Nori M, El Mourid M, Nefzaoui A & Giorgi P. 2009. *Herding in a shifting Mediterranean: changing agro-pastoral livelihoods in the Mashreq & Maghreb region*. European University Institute (EUI), Robert Schuman Centre of Advanced Studies (RSCAS), EUI-RSCAS Working Papers.
- Onyima BN. 2019. Women in pastoral societies in Africa. In: Yacob-Haliso O & Falola T (eds), *The Palgrave Handbook of African Women's Studies*. Palgrave Macmillan, Cham. [http://dx.doi.org/10.1007/978-3-319-77030-7\\_36-1](http://dx.doi.org/10.1007/978-3-319-77030-7_36-1)
- Parton WJ, Scurlock JMO, Ojima DS, Schimel DS & Hall DO. 1995. Impact of climate change on grassland production and soil carbon worldwide. *Global Change Biology* 1: 13–22.
- Puche N, Senapati N, Flechard CR, Klumpp K, Kirschbaum MUF & Chabbi A. 2019. Modeling carbon and water fluxes of managed grasslands: comparing flux variability and net carbon budgets between grazed and mowed systems. *Agronomy* 9(4): 183. <https://doi.org/10.3390/agronomy9040183>
- Ragkos A, Koutsou S, Karatassiou M & Parissi ZM. 2020. Scenarios of optimal organization of sheep and goat transhumance. *Regional Environmental Change* 20(1). doi:10.1007/s10113-020-01598-6
- Reid RS, Fernández-Giménez ME & Galvin KA. 2014. Dynamics and resilience of rangelands and pastoral peoples around the globe. *Annual Review of Environment and Resources* 39 (July 2015): 217–242. <https://doi.org/10.1146/annurev-enviro-020713-163329>
- Rignall KE. 2016. Solar power, state power and the politics of state transition in pre-Saharan Morocco. *Environment and Planning A* 48(3): 540–557. Copyright the Author 2015. [sagepub.co.uk/journalsPermissions.nav](http://sagepub.co.uk/journalsPermissions.nav) DOI: 10.1177/0308518X15619176 [eprints.sagepub.com](http://eprints.sagepub.com)
- Rinehart L. 2019. *Add diversity to your pastures with multispecies grazing*. Cornell Small Farm Program. <https://smallfarms.cornell.edu/2019/01/add-diversity-to-your-pastures-with-multispecies-grazing/>
- Rodgers C. 2021. Community engagement in pastoralist areas: lessons from the public dialogue process for a new refugee settlement in Turkana, Kenya. *Pastoralism* 11(1): 26. <https://doi.org/10.1186/s13570-021-00192-7>
- Rosales M. & S Livinets. 2015. Grazing and land degradation in CIS countries and Mongolia. *E-Conference paper*. Livestock Environment and Development program, FAO, Rome.
- Sala OE, Yahdjian L, Havstad K & Aguiar MR. 2017. Rangeland ecosystem services: nature's supply and humans' demand. In: Briske D (ed.) *Rangeland systems*. Springer Series on Environmental Management. Springer, Cham. [https://doi.org/10.1007/978-3-319-46709-2\\_14](https://doi.org/10.1007/978-3-319-46709-2_14)



- Sandford S. 1983. *Management of Pastoral Development in the Third World*. John Wiley, Chichester
- Scoones I. 1995. *Living with uncertainty: new directions for pastoral development in Africa*. Intermediate Technology Publications, London.
- Scoones I. 2022. *Livestock, climate and the politics of resources: a primer*. PASTRES (Pastoralism, Uncertainty, Resilience), Institute for Development Studies, published by Transnational Institute, Amsterdam.
- Seid MA, Kuhn NJ & Fikre TZ. 2016. The role of pastoralism in regulating ecosystem services. *OIE Revue Scientifique et Technique* 35(2): 435–444. <https://doi.org/10.20506/rst.35.2.2534>
- Sharifian A, Fernández-Llamazares Á, Wario HT, Molnár Z & Cabeza M. 2022. Dynamics of pastoral traditional ecological knowledge: a global state-of-the-art review. *Ecology and Society* 27(1): 14. <https://doi.org/10.5751/ES-12918-270114>
- Starrs PF. 2018. Transhumance as antidote for modern sedentary stock raising. *Rangeland Ecology & Management* 71(5): 592–602. <https://doi.org/10.1016/j.rama.2018.04.011>
- Sundstrom S., Tynon JF., & Western D. 2012. Rangeland Privatization and the Maasai Experience: Social Capital and the Implications for Traditional Resource Management in Southern Kenya, *Society & Natural Resources*, 25:5, 483-498, DOI: 10.1080/08941920.2011.580420
- Swiss Re. 2015. *Successful Kenya Livestock Insurance Program scales up*. <https://www.swissre.com/our-business/public-sector-solutions/thought-leadership/successful-kenya-livestock-insurance-program-scheme.html>
- Tadesse, B. 2016. *Policies and Proclamations Relevant to Pastoral Areas Land Management for Ethiopia, Kenya and Uganda*. <https://icpald.org/wp-content/uploads/2021/02/Policies-and-Proclamations-Relevant-to-Pastoral-Areas-Land-Management-for-Ethiopia-Kenya-and-Uganda.pdf>.
- Tamou C, De Boer IJM, Ripoll-Bosch R & Oosting SJ. 2018. Traditional ecological knowledge underlying herding decisions of pastoralists. *Animal* 12(4): 831–843. <https://doi.org/10.1017/S1751731117002130>
- Taye-Gayo, M. 2022. Opinion: Drought in pastoral areas of Ethiopia: The missing link between problem and solution? *Addis Standard*, 30 June 2022.
- Trebbin A. 2021. Land grabbing and *Jatropha* in India: an analysis of ‘hyped’ discourse on the subject. *Land, MDPI* 10(10): 1–21.
- Turin C. 2019. *Perceptions of rangeland degradation and its causes in the Peruvian Altiplano Dry Puna*. Dissertation to obtain the Doctor of Philosophy degree at the University of Missouri-Columbia. <https://hdl.handle.net/10355/71841>. <https://mospace.umsystem.edu/xmlui/handle/10355/71841>
- Turin C. 2023. *The futures of the pastoralist systems of Southern Andean Peru*. PASTRES. <https://pastres.org/2023/02/24/the-futures-of-the-pastoralist-systems-of-southern-andean-peru/>
- Turin C, Carbajal M, Zorogastua P, Chamorro A & Quiroz R. 2018. El Boom de la Maca (*Lepidium meyenii*), transformando paisajes y sociedades rurales de la zona altoandina. In: Perú. El problema agrario en debate. *Seminario Permanente de Investigación Agraria. SEPIA XVII*. Instituto de Estudio Peruanos-IEP. ISBN 978-612-45829-8-1. <https://sepia.org.pe/publicaciones/peru-el-problema-agrario-en-debate-sepia-xvii-cajamarca-2017/>
- Turner MD, Hiernaux P & Schlecht E. 2005. The distribution of grazing pressure in relation to vegetation resources in semi-arid West Africa: the role of herding. *Ecosystems* 8(6): 668–681.
- UNESCO. 2018. *UNESCO policy on engaging with indigenous peoples*. UNESCO Digital Library. UNESCO Digital Library. <https://unesdoc.unesco.org/ark:/48223/pf0000262748>
- UNOWAS. 2018. *Pastoralisme et sécurité en Afrique de l'Ouest et au Sahel: vers une coexistence pacifique*. Report of the United Nations Office for West Africa and the Sahel (UNOWAS).
- Valdivia C, Gilles J L & Turin C. 2013. Andean pastoral women in a changing world: opportunities and challenges. *Rangelands* 35(6): 75–81. <https://doi.org/10.2111/RANGELANDS-D-13-00038.1>
- Van der Esch S, Sewell A, Bakkenes M, Berkhout E, Doelman JC, Stehfest E, ... & Ten Brink B. 2022. *The global potential for land restoration: scenarios for the Global Land Outlook 2*. The Hague, The Netherlands, PBL Netherlands Environmental Assessment Agency.
- Veldman JW. 2016. Clarifying the confusion: old-growth savannahs and tropical ecosystem degradation. *Philos Trans R Soc Lond B Biol Sci* 371.
- Veldman JW, Overbeck GE, Negreiros D, Mahy G, La Stradic S, Fernandes GW, Durigan G, Buisson E, Putz FE & Bond WJ. 2015. Where tree planting and forest expansion are bad for biodiversity and ecosystem services. *Bioscience* 65(10). <https://academic.oup.com/bioscience/article/65/10/1011/245863>
- Vetter S. 2020. With power comes responsibility – a rangelands perspective on forest landscape restoration. *Frontiers in Sustainable Food Systems* 4, 549483.
- Vila B, Arzamendia Y & Rojo V. 2021. *Vicuñas (Vicugna vicugna), wild Andean Altiplano camelids: multiple valuation for their sustainable use and biocultural role in local communities*. 4. 10.1525/cse.2020.1232692.
- Waters-Bayer A & Wario H. 2022. *Pastoralism and large-scale Renewable energy and green hydrogen projects: potential and threats*. Brot für die Welt & Heinrich Böll Foundation, Berlin. <https://www.boell.de/sites/default/files/2022-05/Pastoralism-and-large-scale-REnewable-energy-and-green-hydrogen-projects.pdf>
- Waweru T, Maina J, Liheta B & Apunda EW. 2021. *Independent impact assessment report: Participatory Rangeland Management (PRM) in Kenya and Tanzania*. Nairobi, Kenya: African Research and Economic Development Consultants Limited. <https://cgspace.cgiar.org/handle/10568/118128>

World Bank. 2019. *Sustainable land management and restoration in the Middle East and North Africa region: issues, challenges, and recommendations*. World Bank, Washington DC.

WWF (World Wide Fund for Nature). 2021. *Grassland and savannah ecosystems: an urgent need for conservation and sustainable management*. <https://policycommons.net/artifacts/2325460/grassland-and-savannah-ecosystems/3086033/>

Yin Y, Hou Y, Langford C, Bai H & Hou X. 2019. Herder stocking rate and household income under the grassland ecological protection award policy in northern China. *Land Use Policy* 82: 120–129. <https://doi.org/10.1016/j.landusepol.2018.11.037>

Yolda Initiative. 2019. *Portable electric fence as a mitigation measure against predation*. <https://yolda.org.tr/on-the-ground-support/>

Zhang Z, Zhang B, Zhang X, Yang X, Shi Z & Liu Y. 2019. Grazing altered the pattern of woody plants and shrub encroachment in a temperate savanna ecosystem. *International Journal of Environmental Research and Public Health* 16(3): 330.

Zhaoli Y, Ning W, Dorji Y & Jia R. 2005. A review of rangeland privatization and its implications in the Tibetan Plateau, China. *Nomadic Peoples* 9(1–2), 31–51