

A CASE OF BENIGN NEGLECT

**KNOWLEDGE GAPS ABOUT SUSTAINABILITY
IN PASTORALISM AND RANGELANDS**





A case of benign neglect: Knowledge gaps about sustainability in pastoralism and rangelands

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KNOWLEDGE GAPS ABOUT SUSTAINABILITY IN PASTORALISM AND RANGELANDS

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Sudan goats, camels and camp. Wolfgang Bayer

Foreword

Pastoralism is practised by millions of people worldwide and represents an intimate relationship between people, the animals they care for and the landscape. Yet despite existing for millenniums, little is known about pastoralist societies and the interlinkages between their practices and the rangelands on which these depend.

Due to widespread gaps in understanding pastoralists and rangelands, there are many questions that currently cannot be answered with confidence concerning who pastoralists are, where their natural rangelands are located, how land-use policy is affecting their land, what effect climate change is having on their land and lifestyles, and how the international community can best support and promote sustainable rangeland management and pastoral livelihoods. Finding answers to such questions is paramount, since these will have profound implications for national and international policy and thus influence how climate change is addressed.

Benjamin Mutambukah, from the Eastern and Southern African Pastoralists Network, was one of the contributors to this report. He points to the increasing competition for land between pastoralists and mining companies, resulting in pastoralist communities losing parts of their traditional land and with this, their options for mobility. This not only greatly impacts pastoralists' ability to use seasonally

available pasture and water, but increases land degradation and poverty, forcing many to search for alternative livelihoods.

Over the years, UN Environment and other United Nations organizations have compiled and assessed data and trends on various regional and global environment and socioeconomic issues. However, as this gap analysis shows, global assessments tend not to disaggregate natural rangelands from other habitats, and pastoralists from other rural dwellers, which has resulted in significant knowledge gaps.

It is hoped that a global integrated assessment of rangelands and pastoralists will provide a baseline, which is crucial for monitoring the achievement of the Sustainable Development Goals among pastoralists. Furthermore, it will help countries develop appropriate policies and programmes that reach out to the remotest and most mobile pastoralists and support their role in building a greener economy – a global challenge we all share.

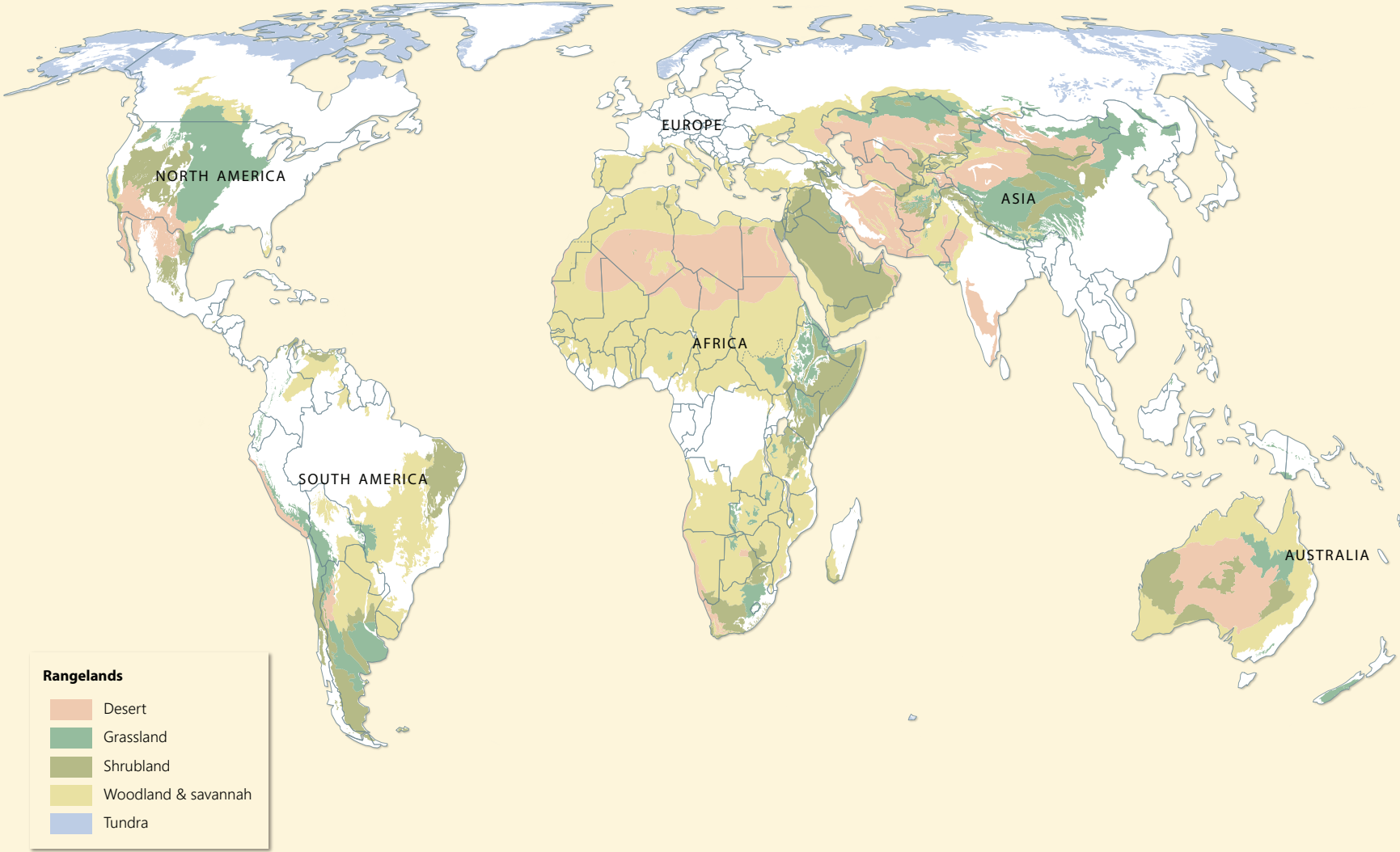
This is exciting work with great potential. Thanks to advances in the Internet, communications technologies and satellite imagery, innovative solutions can be found to generate high-quality data that can inform policymaking to support these often nomadic communities and equip them to better address climate change and other environmental challenges.



A handwritten signature in blue ink, appearing to read 'J. Msuya'.

Joyce Msuya
Acting Executive Director
UN Environment

One way of defining and illustrating rangelands of the world



Sources: Olson, D. M., Dinerstein, E., Wikramanayake, E. D., Burgess, N. D., Powell, G. V. N., Underwood, E. C., D'Amico, J. A., Itoua, I., Strand, H. E., Morrison, J. C., Loucks, C. J., Allnutt, T. F., Ricketts, T. H., Kura, Y., Lamoreux, J. F., Wettengel, W. W., Hedao, P., Kassem, K. R. 2001. Terrestrial ecoregions of the world: a new map of life on Earth. *Bioscience* 51(11):933-938. ; Natural Earth.

Executive summary

Observations and findings

Pastoralism and rangelands are globally significant, but under-recognized and undervalued.

It is often assumed that data currently being collected on agriculture, livestock and forestry are adequate for informing policymaking on rangeland-based livestock systems. The report *A case of benign neglect: Knowledge gaps about sustainability in pastoralism and rangelands* shows, however, that current statistics and data are not sufficiently disaggregated to capture the different needs, circumstances and opportunities for sustainable pastoralism and rangeland management.

Rangelands are areas with diverse ecosystems that are grazed or have the potential to be grazed by wild animals and domesticated livestock. These lands provide important benefits to humans, such as food security, medicine, local and regional economies, wildlife, biodiversity, tourism, regional climate through carbon sequestration, and land and water preservation and rehabilitation.

Pastoralists are people who raise or care for wild or semi-domesticated animals or domesticated livestock on rangelands, and include ranchers, nomads, graziers, shepherds and transhumant herders. Pastoralism is increasingly recognized as one of the most sustainable production systems on the planet and plays a major role in safeguarding ecosystems and biodiversity in natural grasslands and rangelands. Where official statistics are available, there is evidence that pastoralism contributes significantly to national gross domestic product

(GDP). For example, pastoralists contribute 10–44 per cent of the GDP in African countries and 30 per cent in Mongolia.

However, the report also shows that there is inconsistency in how pastoralism and rangelands are defined. For example, estimates of land area covered by rangeland vary from 18 per cent to 80 per cent of the world's land surface, with the estimated number of pastoralists ranging from 22 million to 500 million people worldwide. By using a wide and inclusive definition, the report finds that pastoralism and rangelands are a global phenomenon and can be found in two thirds (66 per cent) of all countries in the world.

Due to their extensive use of rangelands, pastoralists – especially nomadic and remote pastoralists – have different interests and needs than other people. Rangeland ecosystem functions and services are very different from those of forests or croplands. Without further knowledge on pastoralists and rangelands, it is not possible to judge the impacts of current policies on their livelihoods and these ecosystems. For example, underestimating the number of pastoralists and underrating the benefits of livestock mobility may mean that governments do not provide sufficient or appropriate services to pastoralists. Furthermore, insufficient attention to gender and youth issues of pastoralists may mean misunderstanding what pastoral women and children need and want.



Nomadic pastoralist boy, Turkey. Engin Yilmaz/Yolda Initiative

If governments do not value rangelands correctly, they may rush towards afforestation programmes to the detriment of biodiversity and carbon capture. Undervaluing rangelands (sometimes termed “forgotten rangelands” by scientists) may lead to a lack of resources for studying, protecting and monitoring rangeland resources, despite the increasing need to understand them as climates continue to change.

In the age of the Sustainable Development Goals (SDGs) which promise to achieve universal benefits and leave no one behind, knowledge gaps in pastoralism and rangelands should be addressed rather than ignored.

Despite the many challenges of conducting a rapid gap analysis, the conclusions and recommendations of this report are applicable to all relevant countries.

This report directly responds to one of the resolutions¹ approved at the United Nations Environment Assembly (UNEA) in May 2016, which acknowledges the dearth of information on pastoralism and rangelands. The resolution calls for a gap analysis of environmental and socioeconomic information and the provision of technical support for promoting pastoralism and rangelands. This report is also guided by the mandate of UN Environment to conduct

integrated assessments and analyses, the 2030 Agenda for Sustainable Development and specifically the SDGs and their targets and indicators related to pastoralism and rangelands.

The gap analysis is based on a rapid study conducted from May 2017 to August 2018, covering information available since 2000. It analyses the accessibility and availability of and level of confidence² in data on

pastoralism and rangelands publicly available from various Internet sources, including assessments, databases, scientific publications in Scopus (an online database of peer-reviewed literature) and multilateral environmental agreements. The gap analysis also examines types of technical support for pastoralism provided by multilateral organizations and through official development assistance (ODA) of member countries of the Organisation for Economic Co-operation and Development (OECD). In addition to the rapid study, a survey on the perspectives of different organizations and pastoralists was used to inform the gap analysis, covering issues such as information collection methods, confidence in the data, perceptions of gaps in information, and technical support for pastoralism and rangeland management. The inclusion of local and indigenous knowledge and technologies (LIKT) in the information sources reviewed was also examined as far as possible. A final worldwide peer review verified the conclusions and recommendations based on the analysis. Despite not being able to cover some types of non-English information, documents and databases, as well as some thematic areas due to the analysis' rapid nature, the authors are reasonably confident that all conclusions and recommendations are correct and applicable to pastoralists and rangelands following this peer review process.



Fulani herder in central Nigeria. Wolfgang Bayer

1. UNEA resolution 2/24 "Combating desertification, land degradation and drought and promoting sustainable pastoralism and rangelands", available at: <http://wedocs.unep.org/handle/20.500.11822/11197>

2. The level of confidence relates to the extent to which stakeholders considered data to be reliable, accurate and trustworthy.

Credible and publicly available information on the condition and trends of pastoralism and rangelands is lacking because existing assessments and databases do not sufficiently disaggregate their data. Site-specific data are valuable, but are currently too limited in scale and scope, and in some cases are contradictory. Inadequate information can lead to changes being implemented where they are not needed or to practices that work being neglected or destroyed.

The study was unable to find credible and publicly available data on most pastoral and rangeland systems throughout the world in the assessments, databases and academic publications reviewed. None of the 13 global environmental assessments reviewed disaggregate their information on pastoralists or rangelands and only one third of the 100 databases reviewed have some information about pastoralism and rangelands, with only a few providing the information in a manner that could help inform decision makers on sustainable livelihoods and ecosystem management. Specific assessments and online knowledge repositories contain more integrated information, though it is usually site or topic specific and did not provide a holistic assessment of pastoralism in particular countries or worldwide.

There are 'known unknowns' and biases that influence the type of information and data that are recorded and stored in project documents, databases and assessments. Country statistics routinely entered into United Nations portals focus on livestock production only, including animal numbers, types, offtake and export, but not specifically on pastoral livestock production, since most countries do not distinguish pastoralists from crop farmers or farmers rearing confined livestock. Regarding the databases reviewed, those with further information on pastoralist and rangeland issues often focus on livestock production, rather than ecosystem health or livelihood resilience. Statistics on rangelands are rarely disaggregated out of broader land-use types, making it difficult to separate data on natural

rangelands and grasslands. Socioeconomic statistics on pastoralists available in the United Nations portals reviewed are disaggregated for only a few countries where pastoral production dominates the agricultural sector and do not distinguish between different types of pastoralist livelihoods.



Tibet pastoralist woman mapping rangeland use. Yan Zhaoli

The study found that far more information is available in academic publications on issues such as grasslands and livestock than specifically on pastoralism and rangelands. Furthermore, there is little coverage of pastoralism-related issues compared with literature on rangeland issues, and very few publications cover pastoralism and rangelands in an integrated way.

Information is often difficult to access due to broken links, password protection and non-existing or non-intuitive search engines. Only half the multilateral organizations reviewed have open project databases with a range of information, such as objectives, budgets, targeted countries or regions of their projects, though these also provide insufficient access to detailed data. Convention texts of the multilateral environmental agreements reviewed do not show hits for keywords related to pastoralism and rangelands.

Overall, confidence in the data of the information sources reviewed is medium, with a few notable exceptions for data that have protocols and procedures in place for verifying information. In most cases, information on pastoralism and rangelands is insufficiently covered and disaggregated or grossly inaccurate. In some cases, research results contradict each other, which could lead to poor decisions or unjustified panic about the severity of a crisis. For example, inaccurate data on rangeland degradation could cause governments to blame and dismantle traditionally sustainable pastoral systems or, in other words, 'fix' something that is not broken.

There are many gaps in available information on pastoralists and rangelands, but no completely neglected areas.



*Gathered reindeer herd, Finnmark, Norway.
Lawrence Hislop/GRID-Arendal*

Most of the information reviewed was found to be descriptive (such as population size, livestock holdings, etc.), rather than analysing root causes affecting the well-being of pastoralism and rangelands. Large information gaps exist for thematic topics that are considered specifically challenging for remote and mobile populations, including mobile education and health services, representation and participation, alternative livelihoods, access to development and infrastructure, and livestock mobility within a country or across borders, among others.

While there is considerable focus on land degradation, rangeland condition and productivity, there is less coverage of specific issues such as pollution, disasters, displacements and land policy changes. Much attention is being given to land-use change (especially the conversion of rangelands to crop farmlands or protected areas), with less attention focused on land grabbing or large-scale

land acquisitions that dispossess pastoralists. There is also relatively little coverage of non-equilibrium solutions for grazing management, though it appears to be increasing.

In terms of understanding and cataloguing LIKT among pastoralists, there are large information gaps. There are also gaps in information on gender issues, which are covered less than other issues.

All of the thematic topics reviewed in this study appeared in at least one source of information. As such, it is not possible to say that there are any completely neglected thematic areas. Similarly, there are no geographically neglected areas, since there is some type of information available in every country with pastoralists or rangelands. However, the relative gaps among different themes and regions are worth noting and should indicate where additional effort is needed.

Internationally supported technical assistance does not appear to be commensurate with the estimated global importance of pastoralists and rangelands.

Sampling of OECD ODA shows that the portion aimed at the livestock sector is marginal compared with other sectors and is not commensurate with the estimated importance of the sector in the world economy. It is not possible to tell what proportion of this ODA reaches pastoralists and rangelands due to a lack of disaggregated data. Global Environment Facility (GEF) projects with pastoralist and rangeland components

comprise only 1.2 per cent of available funding. Most projects with such components focus on capacity-building, biodiversity conservation and institutional development. International development projects typically collect field data, such as population numbers in their target zones, livestock numbers or geography and land-use patterns, though such data are usually not readily available on their websites.

Although the availability of data on pastoralists and rangelands is improving, more work is needed for this information to be comparable and useful, such as ensuring the participation of pastoralists, development of a global lexicon of related and comparable terms, and harmonization of indicators and methodologies.

The amount of information on pastoralism and rangelands on Scopus has increased markedly since 2000, though it still represents only 0.001 per cent of all peer-reviewed literature available online. In recent years, more research has been carried out on important issues, such as the impacts of large-scale land acquisition on pastoralists, adaptation to climate change and the implications of livestock mobility for non-equilibrium ecosystems in drylands.

Since there is currently no standard definition, methodology, indicator set, process or structure for gathering information on pastoralists and rangelands (though there may be soon for forests thanks to the existence of an intergovernmental forum), it is not possible to compare statistics and data sets. Work is being done to harmonize terminology relating to rangelands, though this is not the case for pastoralism.

Several newly established databases and knowledge repositories are working to collect and make available more detailed information on pastoralists and rangelands. For example, the Food and Agriculture Organization of the United Nations (FAO) has developed the Land Resources Planning Toolbox, though its information and resources primarily focus on land issues. The Group on Earth Observations Global Agricultural Monitoring (GEOGLAM) initiative is also establishing a global monitoring repository, known as the Rangelands and Pasture Productivity (RAPP) Map, which was released in 2018. There is currently no comprehensive integrated approach to understanding pastoralism and rangelands. Inconsistencies in definitions, terms and methodologies will continue to hamper holistic assessments of pastoralists and rangelands unless these are harmonized and thus allow for data comparisons.

The study found that views of survey respondents on information gaps and technical support for sustainable pastoralism and rangelands vary greatly. However, this is not surprising given the geographical differences, diversity and ambiguity in terminology, general lack of data availability, and insufficient national or international platforms for dialogue on pastoralism and rangelands. Although this diversity can be seen as a challenge in communicating future needs for filling information gaps, it should also be seen as an opportunity for engaging a diverse set of stakeholders in the process.

Regarding the documentation of LIKT, the study revealed that this was limited in the databases, assessments, academic papers and projects reviewed. Despite this, survey respondents recognize that such knowledge is valuable for various types of work in this area (development, investments, empowerment, etc.) and that pastoralists should be engaged in all phases of development and research projects. At present, where there are large gaps in information and data, the involvement of pastoralists in national or international assessments will not only be vital for ownership and verification, but will also be a cost-efficient practice.



Pastoralist woman moving camp in southern Somalia. Wolfgang Bayer

Recommendations

1 Conduct an intergovernmental, integrated global assessment

Provide sufficient funding and resources to address information gaps on pastoralists and rangelands through an intergovernmental, multi-year, integrated global assessment, which is participatory and addresses terminology for a common understanding on pastoralism and rangelands.

The integrated global assessment should cover socioeconomic and biophysical issues, how pastoral systems interact with other parts of society, and past trends and scenarios for the future. The assessment should be able to collect verifiable and high-quality new and existing data, including primary field data on the gaps where data were not previously collected, incorporating new paradigms, traditional knowledge and innovative thinking. Information gaps should be addressed with a combination of remotely sensed data and local-level data collection through collaboration with pastoralists. The assessment should be updated on a regular basis.

Sufficient funding, time and resources should be provided for the integrated global assessment

to address the methodological and preparatory challenges identified in the gap analysis, such as: i) the inclusion of indigenous/local pastoralists in a participatory international process for developing a lexicon of related or comparable terms (semantic ontology) for pastoralism and rangelands; ii) the participatory selection of the most appropriate system boundary, scope and methodology; and iii) the establishment of bilateral partnerships for accessing data not freely available online. Governments should be encouraged to provide the integrated global assessment with direct access to existing local and national statistics and primary data on pastoralists and rangelands in order to help better disaggregate existing data wherever possible.



Somalia goats and camels at watering point. Wolfgang Bayer



Women selling milk in Isiolo, Kenya. Tom Martin/VSF Suisse



2 Enhance the availability and quality of existing information

Develop national and international information systems to enhance the availability and quality of existing information on pastoralists and rangelands, and include pastoralists' knowledge to understand the specifics of and dynamics between pastoralism and rangelands.

The availability of information can be enhanced by ensuring that a consistent effort is made to disaggregate data on pastoralists and rangelands in government statistics. Governments, all publicly funded projects, non-governmental organizations (NGOs) and research institutions should be encouraged to provide access to verifiable, disaggregated data and information on pastoralists and rangelands that are timely, valid, reliable, interpretable, well managed and easily accessible, including data obtained through baseline and monitoring/evaluation studies from development projects.

Government statistics on pastoralists and rangelands should also cover issues of global concern, such as conflict

and human security, adaptation to climate change and large-scale land acquisition. A comprehensive repository of information on pastoralism and rangelands is needed that has accessible, available, comparable and verifiable data, and that is based on comparable definitions and an agreed set of globally relevant indicators locally inspired by pastoralists.

New technologies and advances in satellite imagery could facilitate future monitoring of rangelands. Pastoralist organizations, and NGOs that work with such organizations, should be encouraged to document high-quality data and information on pastoralists and rangelands and make them available, including on LIKT.



Summer camp of the Dukha reindeer herders of the East Taiga, Mongolia. Lawrence Hislop/GRID-Arendal

3 Broaden the understanding of pastoralism and the value of rangelands

Increase funding and resources for participatory research on pastoralism and rangelands, and ensure that 'non-typical' topics are addressed.

Special attention should be given to developing countries and areas where data and information are lacking, through regular surveys and statistical collection, in-depth research studies, frequent analysis of remotely sensed data, and interregional exchanges.

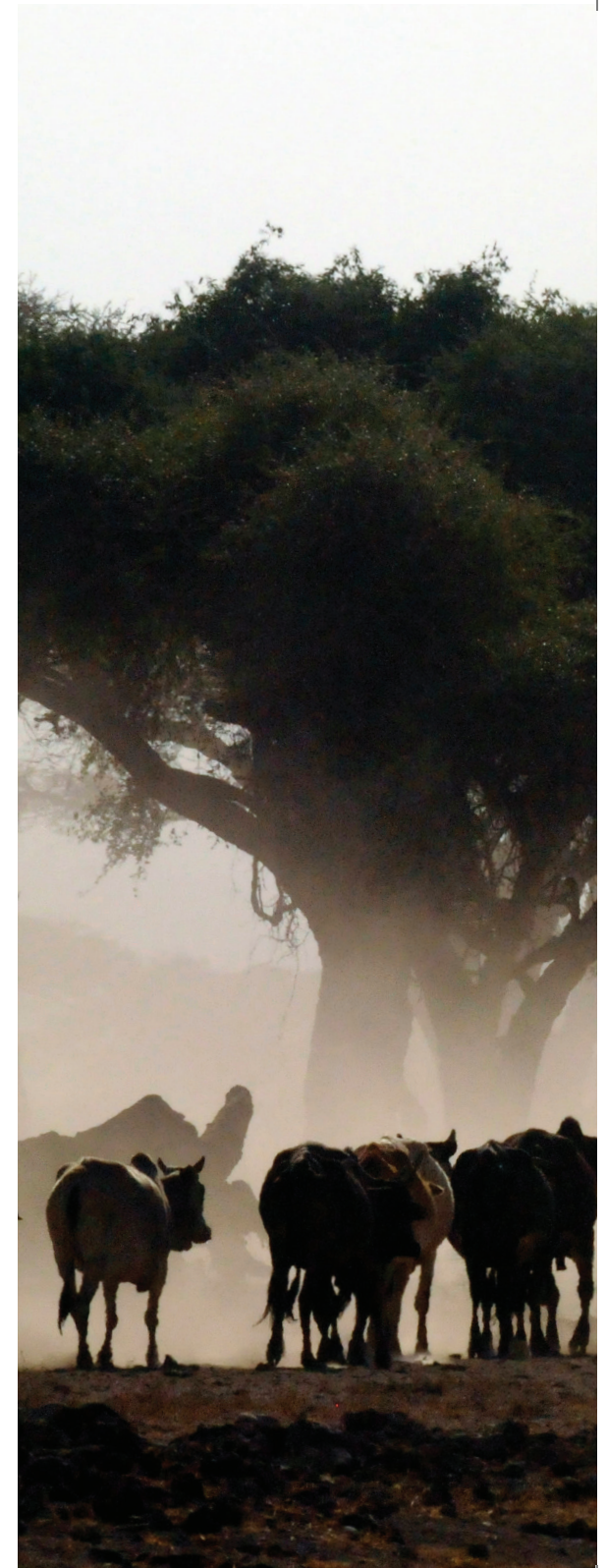
There is a need for local and international arenas that bring together pastoralists, researchers, governments and NGOs, to broaden understanding and develop a consensus on strategic approaches, priority strategies and policies for data collection and management, comparable and consistent methodologies for sharing information and data, and to contribute to

monitoring and evaluating globally agreed indicators. Parties should be encouraged to collect and share data and information that focus on non-typical topics, such as rangeland mobility, vocational and practical education, investments, pastoralist women and youth, and should cover both developing and developed countries.

All relevant international environmental agreements, protocols and conventions, as well as other relevant international agreements, should explicitly address the issues of sustainable pastoralism and rangeland health as relevant to their goals and obligations.



Herding horses across the meadow, Montana, USA. Trey Ratcliff/flickr (CC BY-NC-SA)



4 Conduct a detailed assessment of the provision of technical support to pastoralists

Develop a suitable methodology and assess the extent to which technical support provided to pastoralists is based on identified needs and interests.

Technical support assessments should include both developed and developing countries by extending their scope to take into account support from national universities, research institutions and government extension agencies focusing on community development. Furthermore,

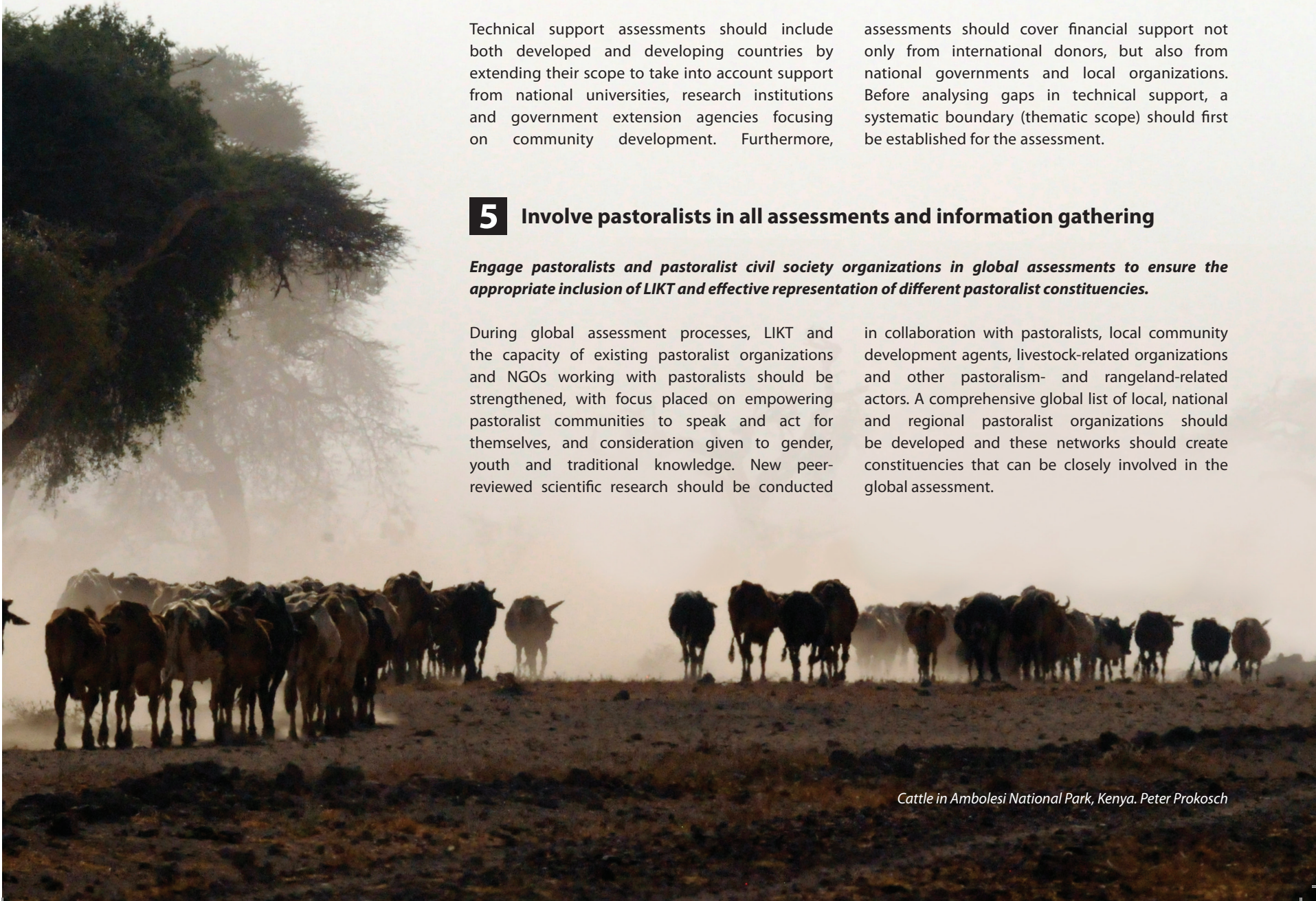
assessments should cover financial support not only from international donors, but also from national governments and local organizations. Before analysing gaps in technical support, a systematic boundary (thematic scope) should first be established for the assessment.

5 Involve pastoralists in all assessments and information gathering

Engage pastoralists and pastoralist civil society organizations in global assessments to ensure the appropriate inclusion of LIKT and effective representation of different pastoralist constituencies.

During global assessment processes, LIKT and the capacity of existing pastoralist organizations and NGOs working with pastoralists should be strengthened, with focus placed on empowering pastoralist communities to speak and act for themselves, and consideration given to gender, youth and traditional knowledge. New peer-reviewed scientific research should be conducted

in collaboration with pastoralists, local community development agents, livestock-related organizations and other pastoralism- and rangeland-related actors. A comprehensive global list of local, national and regional pastoralist organizations should be developed and these networks should create constituencies that can be closely involved in the global assessment.



Acronyms

CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification and Drought
CSO	civil society organization
DIMA	Database for Inventory, Monitoring and Assessment
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GIAHS	Globally Important Agricultural Heritage Systems
GIS	geographic information system
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRAF	International Council for Research in Agroforestry
ICT	information and communication technology
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
ILC	International Land Coalition
ILRI	International Livestock Research Institute
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
IYRP	International Year of Rangelands and Pastoralists
LIKT	local and indigenous knowledge and technologies
MEA	multilateral environmental agreement
NGO	non-governmental organization
ODA	official development assistance
OECD	Organisation for Economic Co-operation and Development
SDG	Sustainable Development Goals
UNEA	United Nations Environment Assembly
UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United States dollar(s)
WHO	World Health Organization
WISP	World Initiative for Sustainable Pastoralism
WOCAT	World Overview of Conservation Approaches and Technologies

Introduction

Global significance of pastoralism and rangelands

Definitions of the terms 'pastoralism' and 'rangelands' typically include a wide diversity of systems in the world. Grasslands, dry forests, tundra and some wetlands can all be considered natural rangelands because they provide suitable grazing for animals. Nomads, transhumants, shepherds and ranchers all practise some form of pastoralism and use natural rangelands as their life-support systems (see Box 1 for detailed definitions).

Almost every country in the world, with the exception of Pacific and Caribbean islands, has some type of rangeland where domestic or semi-domesticated animals graze, making pastoralism and rangelands internationally significant. According to a recent map collated by the International Livestock Research Institute (ILRI), rangelands are the dominant land category in some countries, such as Lesotho, Morocco, Senegal, Turkmenistan and Uruguay, where rangelands cover 98–100 per cent of the territory.

Where official statistics are available, there are indications that pastoralism contributes significantly to national gross domestic product (GDP). For example, pastoralists contribute 10–44 per cent of the GDP in African countries and 30 per cent in Mongolia. In some countries, the share of agricultural GDP attributed to pastoralism is very high, with estimated for Mauritania, Mongolia and Sudan between 70 and 80 per cent (data from 1993 reported in Hatfield and Davies 2006). Pastoralism also benefits around 1.3 billion people along the value chain worldwide (Ouedraogo and Davies 2016). Meat and dairy products from pastoralism are significant but underexploited commodities, when compared with such products

coming from commercial confinement systems. For example, the Food and Agriculture Organization of the United Nations (FAO) estimates that world trade in camel milk is 5.3 million tons, a fraction of the amount of cow milk traded, but that it has the potential to be a \$10 billion market (FAO 2012).

Although pastoralism's share of GDP in more developed countries may be relatively small, the rangelands used are a relatively high percentage of 'marginal' lands and often specialize in organic meat and dairy products. Desert-margin rangelands support 50 per cent of all global livestock production (Allen-Diaz et al. 1996). Pastoralism remains a viable livelihood for many rural dryland populations. Strong land-tenure security gives pastoralists the incentive to be environmental stewards of rangelands.

Rangelands incorporate diverse ecosystems that are grazed or have the potential to be grazed by wild animals and domesticated livestock. These lands provide important benefits to humans – they are the main feed resource for traditional livestock-rearing systems in many parts of the world and offer a livelihood to millions of people (Lund 2007). Davies et al. (2015, 1) explain that rangelands are "often highly unpredictable environments in which both nature and human societies have evolved, leading to unique biological and cultural diversity" which contribute to goods, services, knowledge and heritages that benefit humans beyond the herding communities. Such benefits include: food security, medicine, local and regional economies, wildlife, biodiversity, tourism, regional climate through carbon sequestration, and land and water preservation and rehabilitation.

Pastoralism is increasingly recognized as one of the most sustainable production systems on the planet and plays a major role in safeguarding ecosystem services and biodiversity in natural grasslands and rangelands (McGahey et al. 2014, viii). Pastoralism has been shown to promote healthier ecosystems and greater wildlife compatibility in many countries (Galvin et al. 2008, Niamir-Fuller et al. 2012). Research in Mongolia and Morocco has shown that mobile pastoralists are better able to adapt to extreme climate variability than their sedentary counterparts (Freier, Finckh, and Schneider 2014, Rueff and Rahim 2016). Furthermore, research on pastoralists conducted in the Arctic shows that "continued loss of grazing land will constrain reindeer husbandry practices and make their livelihood less capable of handling other future changes such as climate change" (Vistnes et al. 2009, 5).

Rotation and movement of animals (as opposed to confined or sedentary and continuous grazing) is a key feature that distinguishes pastoralism from other livestock production systems (adapted from Krätli and Schareika 2010). However, mobility is enhanced when rangelands are contiguous and not fragmented, and access rights are clear and unhindered.

Research and documentation of threats to the productivity and socioecological integrity of rangelands and their caretakers are available but sparse. Such evidence highlights threats that are common to both developed and developing countries, which include: restrictions on moving animals, programmes to settle pastoralists, unsustainable grazing practices, expansion of cropping into areas best suited as rangeland, breakdown of common property systems, lack of

Box 1: Definitions of rangelands and pastoralists

This report uses the terms “rangelands” and “pastoralists” as defined in the document “Calling for your support to designate an International Year of Rangelands & Pastoralists” (available at: <https://bit.ly/2A3fOgl>) created by the International Support Group for the International Year of Rangelands and Pastoralists Initiative (IYRP):

According to the ecological definition, **rangelands** are lands on which the indigenous vegetation consists predominantly of grasses, grass-like plants, forbs, shrubs, or trees that are grazed or have the potential to be grazed or browsed, and which are used as a natural ecosystem for raising grazing livestock and wildlife. Rangelands may include native grasslands, savannas, shrublands, deserts, woodlands and forests in drylands, taiga, steppes, pampas, llanos, cerrado, campos, veld, tundras, alpine communities and marshes (adapted from Allen et al. 2011).

Pasturelands and grasslands are synonymous when referring to modified or improved ecosystems that are managed for grazing. They can include meadows managed for hay and silage, cultivated and permanent pasturelands, and naturalized and semi-natural grasslands (adopted from Allen et al. 2011). Natural grasslands are a type of rangeland.

According to McGahey et al. (2014), **pastoralists** are people who raise or care for livestock, wild or semi-domesticated animals on rangelands, including nomads, transhumant herders and ranchers. In some societies, pastoralist is an ethnic label, denoting an indigenous person. This gap analysis focuses on people who are

directly engaged in pastoralism, such as animal husbandry on rangelands.

In general, there is a lack of consensus on the definition of pastoralism, especially on categorizing the ranges between subsistence and commercial, land-intensive and land-extensive, and pastoral and agropastoral, among others. This study considers a pastoralist as someone who raises animals through some form of open-space grazing involving rotational movement (mobility) of animals. They can be distinguished from others who raise animals in confined spaces (for example, feedlots) or through continuous grazing (where the animals are not rotated around different pastures or paddocks). This study also adopts the following categorization of pastoralists depending on how mobile they are: nomadic is used when mobility is high and opportunistic, and where the family often moves with the animals; transhumant refers to pastoralism with regular back-and-forth movements between relatively fixed locations, and where usually only some family members or one herder moves with the animals; and ranching is used for sedentary pastoralists where grazing is more place-bound with some form of rotational land use. This study understands that these terms may not fully coincide with how they are used in different countries, but it reflects an attempt to create a common language. The study also hopes that negative perceptions associated with some of these words (for example, nomad) can be set aside in favour of a better understanding of pastoralism.

There are different types of rangeland tenure and occupancy; some examples are sedentary leasehold, common land grazing and traditional agreements on long-range mobility.

Sometimes the term “extensive grazing” is used as a synonym for rangeland grazing (and “intensive system” for confined grazing). On the other hand, in some countries, the terms extensive and intensive refer only to the density of livestock irrespective of the type of land use. Due to this contradiction, these two terms are not used in this study.

The types of livestock that pastoralists keep depend on climate, environment, access to water and other natural resources, as well as geographical area, and may include alpacas, camels, cattle, goats, horses, llamas, reindeer, sheep, vicunas and yaks (Rota and Sperandini 2009).

This analysis includes all types of rangelands and covers pastoralists who use land-extensive systems (rotational grazing, mobile nomadism, etc.). Agropastoralist societies whose livestock production is land-extensive and dependent on the use of rangelands are also included in the scope of the study. In this report, the terms pastoralists and pastoralism are used to refer to both pastoralists/pastoralism and agropastoralists/agropastoralism.

Defining **local and indigenous knowledge and technologies** (LIKT) is challenging because there are cultural and national differences in how the term indigenous is recognized, as well as linguistic differences in describing the concepts of indigenous knowledge, traditional knowledge, traditional ecological knowledge, local knowledge, etc. The study will therefore adopt a broad understanding of LIKT.

land-tenure security, land fragmentation, generational succession³ and rural exodus, damage from fires, invasive species and harmful and unbalanced subsidies and policies. Similarly, pressures on rangelands are increasing due to one or more of the following: climate change, land degradation and fragmentation, land conversion and demands for outdoor recreation, hunting, water supply, conservation (Lund 2007), urbanization, mining, fracking and expropriation of land for renewable energy (wind farms, solar fields).

Evidence suggests that the need for sound ecosystem management and improved livelihoods is becoming more urgent, with many areas around the world reporting severe environmental crises very often linked to severe conflicts and human insecurity. For example, FAO states that long-lasting and recurrent conflicts have changed pastoralists' grazing patterns in East Africa and, when combined with extreme climate variability, have led to loss of resilience and coping strategies and to long-term food insecurity (FAO 2017).

As this gap analysis shows, information on rangeland ecosystems and pastoralism is insufficient compared with information on tropical and temperate forests or crop farming. Furthermore, the historical adaptation and current evolution of pastoralists and rangelands have been poorly understood in the past half-century. As a result, well-intentioned development activities have led, in many cases, to further degradation, poverty and conflict (Davies et al. 2015).

Providing social or economic services to mobile and remote populations is not the same as providing them for sedentary populations (Weibel et al. 2011). However, as communications and transport infrastructure improve, it is likely that providing high-quality mobile services will no longer be as challenging. With accurate data and

information, appropriate policies and programmes that nurture and support such mobility can be developed.

One of the main challenges is the myriad of definitions for pastoralism and rangelands. For example, on one hand, McGahey et al. (2014) and Blench (2001) say that pastoralism is conducted across a quarter of the world's land area, and Jenet et al. (2016) state that "estimates of the numbers of pastoralists worldwide range from 22 million to more than 200 million, depending on the definition used and the age and quality of the data". On the other UN Environment and the International Union for Conservation of Nature (IUCN) (2009) state that pastoralism is practised by between 200 million and 500 million people worldwide. Furthermore, the African Union (2013, 16) argues that "the pastoralist population in Africa is estimated at 268 million (over a quarter of the total population), living on area representing about 43 per cent of the continent's total land mass".

Likewise, there are various figures for the extent of the world's rangelands. Cherlet et al. (2018) reports that globally there are 29 million km² of rangelands, while Allen et al. (2011) found that estimates of the coverage of rangelands vary from 18 per cent to 80 per cent of the world's land surface. For example, large taiga areas in Siberia used for reindeer husbandry are often not included on global pastoralism maps (see for example, Nori, Switzer, and Crawford 2005). Figure 1 presents different maps of rangelands.

Referring to the extent of rangelands, Lund (2007) rhetorically asks "If we do not know what we have, how can we monitor it and develop a strategy for management?" Although there have been attempts to develop a uniform terminology for rangelands (for example, Lund 2007, Allen et al. 2011), it would be extremely challenging to develop standardized terminology and, as this report shows, differing definitions are still used.

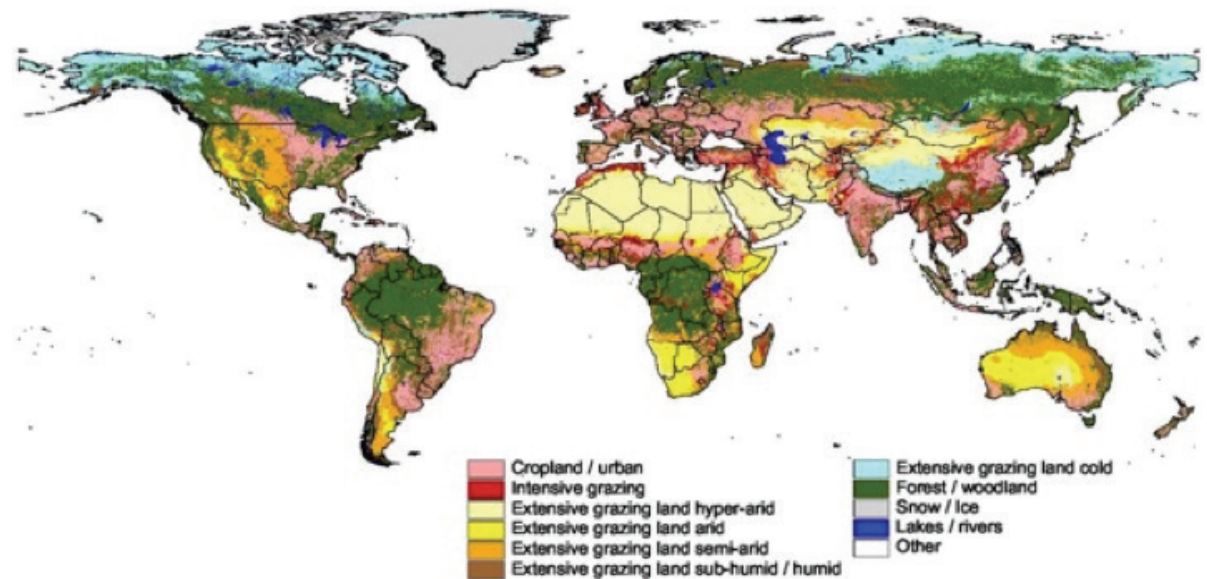


Figure 1: Map presenting the geographical distribution of pastoralism and rangelands

Notes: The map was first published in Reid, Galvin, and Kruska (2008).

3. In many developed countries and increasingly in developing countries, the younger generation is unable or unwilling to take over their family's livestock or crop-farming operations.

Justification for and objective of the report

More than 150 country representatives who met at the United Nations Environment Assembly (UNEA) in May 2016 recognized the dearth of information on pastoralism and rangelands. Many developing country representatives supported the resolution that, among other things, asked UN Environment to conduct a global assessment of pastoralists and rangelands. However, some other country representatives questioned whether existing and ongoing assessments would cover this need, such as those carried out by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). As a result, UNEA resolution 2/24 “Combating desertification, land degradation and drought and promoting sustainable pastoralism and rangelands” in its operative paragraph 9 (Box 2) called for a gap analysis of available information as a first step to any further assessments. Thus, the main objective of this report is to explore and identify where there are:

- gaps in environmental and socioeconomic information and assessments of pastoralism and rangelands, and
- gaps in the current provision of technical support in promoting sustainable pastoralism and rangelands.

This report is a direct response to this UNEA resolution. It presents the approach taken to identify the information gaps, details the findings of the gap analysis and provides a set of recommendations for filling the gaps identified. The study examined various publicly available information sources to assess the availability and accessibility of data related to pastoralists and rangelands. These sources are discussed in more detail in chapter 3. The time frame and funding available meant that some sources of information were excluded, especially offline sources such as grey literature, development project reports and many government

statistics. Only information and data that were publicly available online and freely accessible were reviewed, subject to a sampling framework. Where permission, membership or passwords were required to gain access to sources, these were not included but were duly noted for future reference.

In the past decade, Member States and civil society have increasingly recognized the significant need for highlighting pastoralist and rangeland issues. Some are concerned with continuing poverty and neglect of pastoralists, while others are concerned with increasing insecurity, conflict, criminality and lawlessness, with pastoralists often taking the blame whether rightly or wrongly. Livestock production and consumption are under scrutiny for their impact on greenhouse gas (GHG) emissions, biodiversity loss and chemical pollution. These issues have been captured in the Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development, though the time left for achieving these is drawing ever closer. Increasingly vocal and organized communities of pastoralist

associations are interested in being part of this global conversation and action. Verifiable, comprehensive and publicly accessible information and data on pastoralists and rangelands are therefore more in demand than ever before. For this reason, this gap analysis was conducted as a rapid assessment in order to deliver pertinent recommendations in a timely manner.

Information and data on livestock mobility and rangeland management by pastoralists are crucial for developing sound sustainable policies and generating investments in drylands. Mobile livestock husbandry is not an archaic system frozen in time and there are signs to suggest that it is increasing in some places, while deteriorating in others (Myint and Westerberg 2014, Niamir-Fuller 2016). There is also documentation of mobile livestock husbandry changing and adapting to stress and threats (for example, Köhler-Rollefson 2016). Thus, information and data collected decades ago may not be entirely relevant for current needs. For this reason, the gap analysis also considered the relevance of the available information.

Box 2: Operative paragraph 9, UNEA resolution 2/24

Requests the United Nations Environment Programme, within its mandate and subject to available resources, in partnership with Member States and United Nations agencies and programmes and other relevant stakeholders, including civil-society organizations, to explore whether there are gaps in the current provision of technical support and environmental and socioeconomic assessments of grasslands, rangelands, soil erosion, land degradation, land

tenure security and water security in drylands, including the ongoing assessments of the Intergovernmental Platform on Biodiversity and Ecosystem Services, in order to better understand the implications for sustainable livelihoods, while taking into consideration local and indigenous knowledge and technologies

The full text of the resolution is available at: <https://bit.ly/2LenbXT>

Methodology

The gap analysis on which this report is based was conducted between 2017 and 2018. The report explores what data and information are available on pastoralists and rangelands, as well as how reliable different actors consider these to be. It also analyses types of technical support provided by multilateral organizations and through official development assistance (ODA) of member countries of the Organisation for Economic Co-operation and Development (OECD). The report assesses different information sources, such as assessments, data sets, project information and scientific publications. A

survey on the perspectives of different organizations and pastoralists also informed the gap analysis, concerning issues such as data-collection methods, data usage, perceptions of the reliability of data and information gaps, and the provision of technical support for pastoralism and rangeland management.

This section outlines the scope, data sources and sampling used in the gap analysis. Findings of the study are presented in chapter 4. A more detailed presentation of the methodology is available in the [Methodology Report](#).



Stakeholders' brainstorm at the Arendal working meeting.
Kathrine I. Johnsen/GRID-Arendal

What is a gap analysis?

This report defines 'gaps' as information with a low 'fitness of use' for policymakers, low data confidentiality, usage restrictions, limited accessibility of data sets, poor data integration, and a lack of long-term data (IPBES (2016). FAO (2008, 104) explains that an information gap analysis involves matching the available information to information needs, thereby identifying gaps in available information. Available information refers to existing types of information and its quality. Furthermore, a gap analysis focuses on factors that may explain poor information quality, for example, information that is not timely, not valid or reliable, uninterpretable, poorly managed or not easily accessible. Identifying reasons for poor information quality is important for designing actions to improve the information systems (FAO 2008).

However, this report acknowledges that different actors have different needs for information and

will therefore have different perspectives on the adequacy and availability of the information. For example, for a policymaker, national data might be important for making informed decisions about laws and regulations; non-governmental organizations (NGOs) might need regional data to target activities; and researchers might need access to materials from different locations to analyse and contextualize issues affecting pastoralists and rangelands. Also, pastoralists might require access to local information to make informed decisions about herding strategies or marketing, or might need international information for policy lobbying, knowledge-sharing and networking. Faced with such ambiguity and diverse audiences, the study team spent considerable effort in first defining the information needs by determining the scope or system boundary.

“A gap analysis determines the space between where something is and where it is desired to be. It serves as a means to bridge this space by identifying what has to be done in order to reach this desired state.”

(Borit and Olsen 2016, 2)

The scope of the gap analysis

The scope or system boundary of the gap analysis is determined through three overarching strategic principles.

First and foremost is UNEA resolution 2/24, which discusses a wide range of issues that concern countries regarding pastoralist livelihoods and the health of rangeland ecosystems. Secondly, the study team only considered topics and subjects that fall within the mandate of UN Environment to conduct integrated assessments and analyses. Thirdly, the team sought guidance from the 2030 Agenda for Sustainable Development, which is mentioned as a guiding principle in resolution 2/24, and specifically from the SDGs and their targets and indicators relevant to pastoralism and rangelands.

An adapted version of the IPBES conceptual framework guided the definition of the scope and depth of the gap analysis (see Figure 2). This scope was reviewed and endorsed at a stakeholders' working meeting in Arendal, Norway, in November 2017. It included the following issues as relevant for the gap analysis of information on pastoralist livelihood and rangelands sustainability:

- Pastoralist well-being (including: culture, technical knowledge, population, health, education, participation, conflict, security)
- Nature of rangelands (including: diversity, climate, water, soils, degradation, productivity, condition)
- Rangelands benefit to people (including: grazing animals, biodiversity by using adapted local breeds, energy, wild harvesting/gathering, cultural

value, alternative income, water regulation)

- Pastoral assets (including: indigenous practices, mobility, resilience, income, market, subsidies)
- Direct drivers (including: land-use change, climate change, disaster risk, pollution, management change)
- Indirect drivers (including: policy, law, institutions, political representation, international obligations).

In terms of the gaps in the provision of technical support, the main guidance was obtained from UNEA resolution 2/24 and from feedback provided by the participants of the working meeting. In general, the issues identified as a priority in the provision of technical support for sustainable pastoralism and rangelands cover social and economic services, capacity-building and institutions, livestock health



Burnt boma after farmer-pastoralist clashes, in Karamoja, Uganda. Maryam Niamir-Fuller

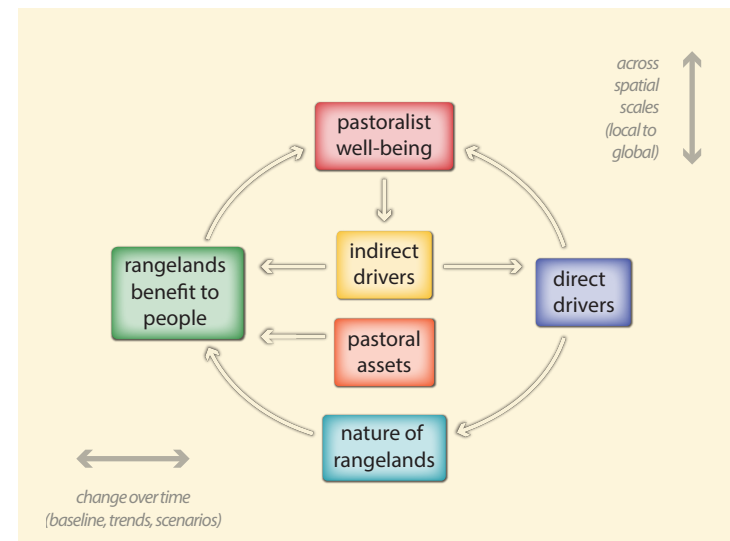


Figure 2: The conceptual framework for the gap analysis

Note: Adapted from the IPBES conceptual framework (Díaz et al. 2015). Solid arrows denote influence between elements. Interactions between elements change over time (bottom-left arrow) and occur at various scales of space (top-right arrow).

and inputs, rangeland health and improvement, and access to information and communication technology (ICT) and energy. Box 3 provides a full list of issues.

As far as possible, the study examined the inclusion of LIKT in the information sources reviewed and the

Box 3: Types of technical support addressed by the gap analysis sorted according to the system boundary (see Figure 2)

Pastoral well-being

- Health
- Education
- Vocational training
- Exchange between communities

Nature of rangelands

- Rangeland improvement
- Biodiversity
- Carbon capture
- Water

Rangelands benefit to people

- Supplemental feed
- Energy
- Watershed management

Pastoral assets

- Capacity-building
- Veterinary services
- Credit/loans
- Market
- ICT

Indirect driver

- Institutional development

opinions of different actors on LIKT were collected through a survey.

Several issues fell outside the system boundary as they did not meet the three strategic principles described at the start of this section and therefore were not included in the gap analysis. However, many of these could be flagged for inclusion in a future global assessment of pastoralists and rangelands (see Box 4).

Box 4: Issues not addressed by the gap analysis

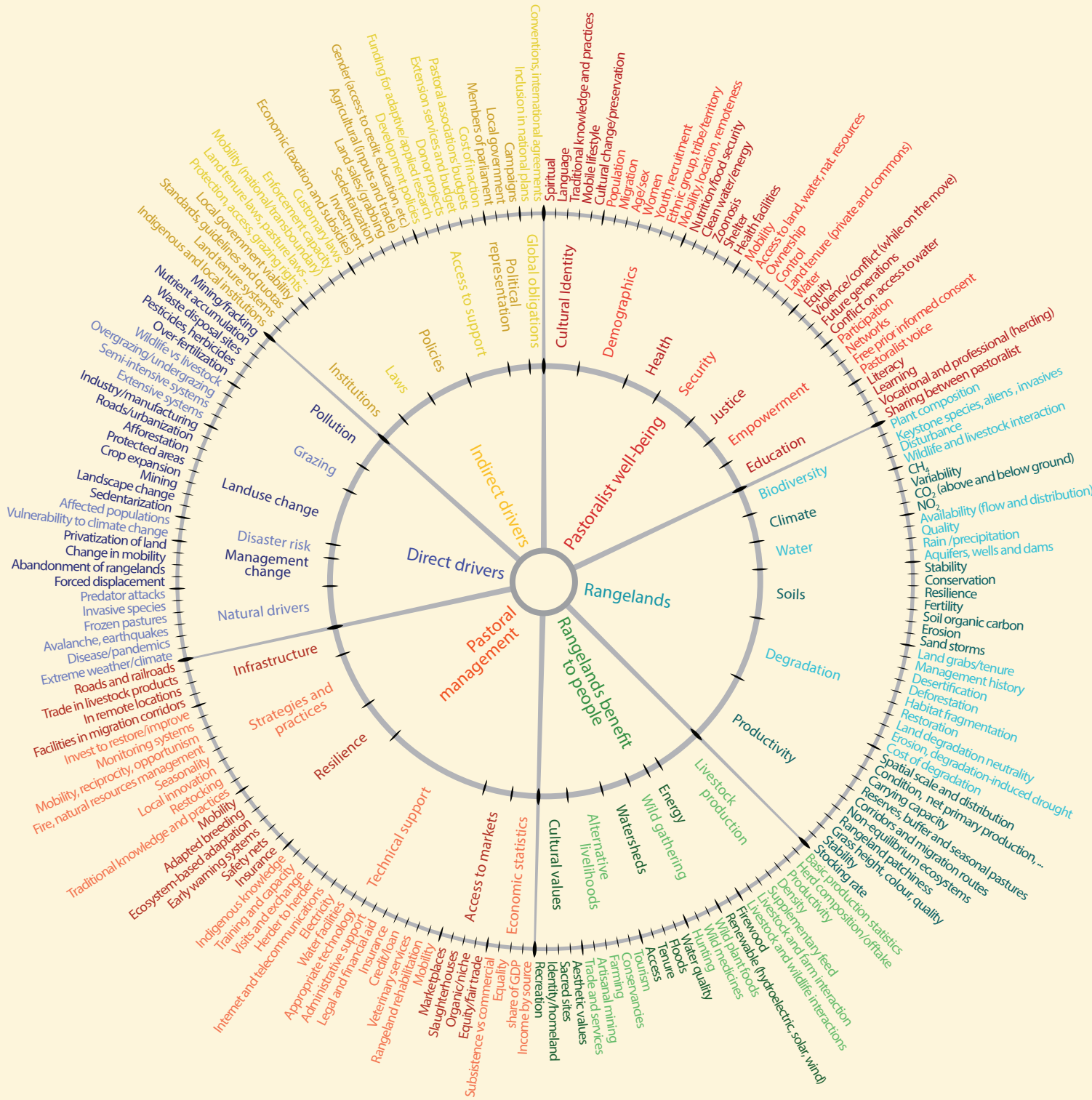
- Spiritual satisfaction of pastoralists
- Rituals and taboos
- Presence/absence of freedom of choice
- Autonomy
- Ecological evolution of rangelands
- Food-webs
- Provision and regulation services of ecosystems in relation to production of oxygen, photosynthesis, atmospheric regulation, etc.
- Some cultural services: totemic species, cultural landscapes
- Production of some consumed goods from rangelands (clothes, building materials)
- Animal welfare
- Reproductive cycles and livestock breeding
- Land-intensive livestock production systems
- Some gender issues (reproductive rights, etc.)
- Disease epidemiology and control
- Biosecurity
- Crime levels and access to the criminal justice system
- Non-pastoral income activities



Rangelands grazier in South West Queensland, Australia. Dana Kelly



Pastoralist women from Fentale, Ethiopia mapping rangelands and rangeland resources. PRIME/Kelley Lynch/flickr (CC BY-NC-SA)



Keywords

In order to identify relevant publications and records in the databases, websites and project portfolios, keywords were used to search the information sources. The keywords were chosen as synonyms and metonyms related to rangelands, pastoralism and the key concepts within the study's system boundary (see Figure 3). A synonym is a word that has the same or nearly the same meaning as another word and a metonym is a word or expression used as a substitute for something else with which it is closely associated.

Keywords related to pastoralists and rangelands (and their metonyms) were categorized as 'first-tier'. Keywords that reflected the conceptual framework were categorized as 'second-tier' and 'third-tier', with second-tier relating to more general terms (for example, health) and third-tier more specific terms (for example, nutrition). If a first-tier keyword was identified within a source, then the search was conducted for second-tier keywords and then for third-tier keywords. If a source did not have any first-tier keywords or their metonyms, then the search through that source stopped.

The choice of keywords and their metonyms is of particular importance in this study, due to the immense variation in definitions and usages across regions of the world and languages. A total of 48 different synonyms and metonyms for pastoralists and rangelands (first-tier) were used in this study. In addition, 38 second-tier keywords and 462 third-tier keywords were identified. The keywords and their metonyms were verified through the Arendal working meeting, the Advisory Committee of the study and the peer review. While the study team recognizes that another set of keywords

may have given a different result, the decision was made to use the same keywords throughout so that generalizations can be made on the findings of the information source searches.⁴ Due to the general disaggregation of information on pastoralists and rangelands in the sources reviewed for this study, the third-tier keywords were of limited use.

A word cloud analysis of the first-tier keywords and their metonyms, as available in Google, is provided in Figure 4. Google is one of many online search engines, all of which provided similar results. Research for this study showed that there is significantly more coverage of woodlands than rangelands. As terms, 'rangelands', and to a greater extent, 'pastoralist', are used far less in academic work than their metonyms (for example,

desert/meadow and livestock/grazing respectively). Any future global assessment will need to be very mindful of the language and definitional challenges.

Using Google Trends shows that there are variations in how metonyms are perceived and used in different regions. For example, over the last five years, the term 'herders' was searched for on Google 46 times per day on average, while 'pastoralists' was searched for 18 times per day. Through Google Trends, it was also possible to identify the top 30 or so countries that searched for these terms (see Figure 5). The term 'pastoralists' was most often used in Google searches by people in

4. An overview of the first-, second-, and third-tier keywords is presented in a separate [Methodology Report](#).



Figure 4: Word cloud of metonyms for pastoralist/pastoralism and rangelands

Note: This word cloud presents the relational difference between the metonyms according to how often they appear in Google. The more often the words appear, the bigger they appear in the word cloud.

Figure 3: The thematic scope of the analysis of the knowledge gaps in sustainability of pastoralism and rangelands



Woman herding sheep in northeastern Turkey. Wolfgang Bayer

Ethiopia, followed by Tanzania, Kenya and Zimbabwe, while 'herders' was most often used in searches by people in Bhutan, followed by the Netherlands. In some countries, such as Australia and the United Arab Emirates, both terms were used equally.

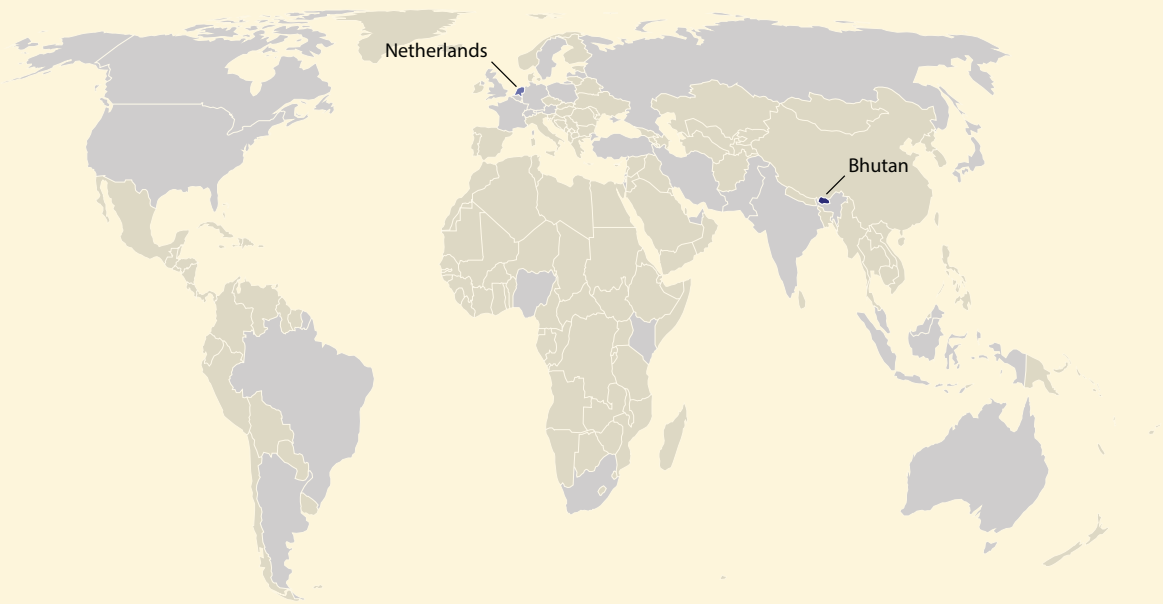
However, Google Trends cannot be used to estimate general interest in the issue of pastoralism, since the tool only synthesizes data from the Google search engine. Data from alternative search engines, in a different timespan and different language, may have given a different result in the popularity of these terms. For example, as one of the reviewers of this report noted, in order to identify information about pastoralists in the Southern Cone of South America, a search should be carried out for the term 'criancero'.

While attempts were made to translate first-tier keywords into French and Spanish, it was difficult to achieve full consensus among stakeholders on the translations and would have required more time to complete. Keyword searches were therefore conducted only in English and as a result, the study is heavily based on English-language sources. During the peer review process, reviewers were asked to read carefully through the report's conclusions to assess whether these resonate with the world's non-English regions. Future global assessments on pastoralism and rangelands should consider completing this exercise in other languages to ensure a better geographical coverage of available data and information.

Figure 5: Top countries that searched the terms 'pastoralists' and 'herders' on Google, 2013–2018

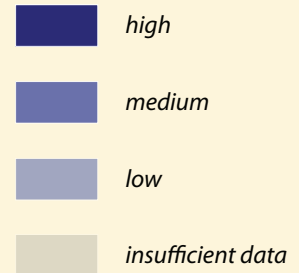
Notes: The maps present the top 32 countries that performed Google searches for the terms *pastoralists* and *herders* in the last five years. A darker shade indicates where the terms have the highest probability of being searched. The popularity of a search term is relative to the total number of Google searches performed at a specific time in a specific location. A higher value therefore means a higher proportion of all queries, not a higher absolute query count.

Source: Google Trends.



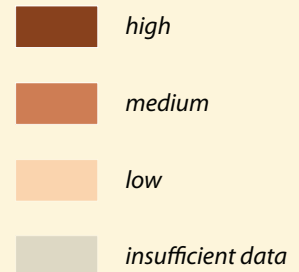
Google search trends
(08/2013 - 08/2018)

herders



Google search trends
(08/2013 - 08/2018)

pastoralists



Time frame for the analysis



Dukha woman milking reindeer, East Taiga, Mongolia.
Lawrence Hislop/GRID-Arendal

The time frame for the analysis was set to information published between 2000 and August 2018. Stakeholders at the Arendal working meeting debated on the best time frame for sampling, using an analysis of the chronology of information available through a Google Scholar search (see Figure 6). It is acknowledged that older publications may not yet be fully digitized and entered into Google Scholar.

It was recognized that, in or around the year 2000, there was a relative increase in research and documentation on pastoralists and rangelands, including a shift in paradigms and theoretical innovations. Participants also noted that the situation of pastoralists and

rangelands has evolved considerably in the past two decades, especially as evidenced from research showing various changes to areas, including major land-use change, desertification, drought and greening. For example, researchers have shown that the Sahel has gone through at least two cycles of drying and greening since 1972 and the so-called “desert boundary” line has shifted considerably (Mueller 2011). Thus, participants felt that any data produced before 2000 would not be immediately relevant for this study, though it was acknowledged that older data would be needed for future assessments in order to analyse trends and patterns where comparable data are available.

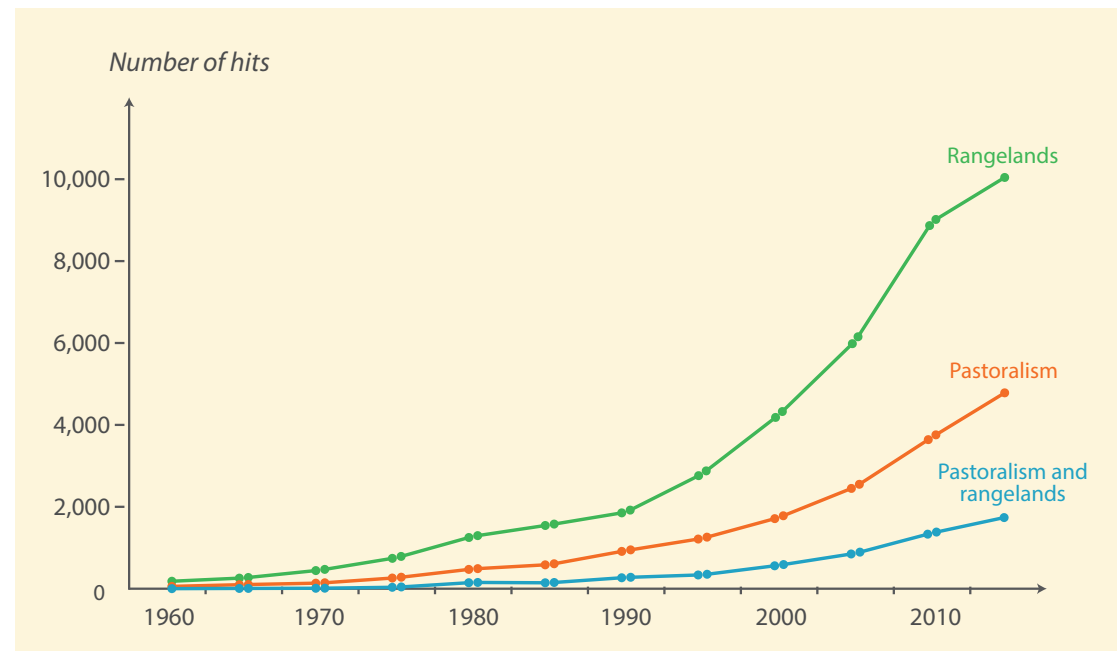


Figure 6: Accumulated hits in Google Scholar for three searches – ‘rangelands’, ‘pastoralism’ and ‘pastoralism and rangelands’ – over 55 years

Source: Google Scholar, 11 September 2017.

Sources and sampling of information

The information sources examined for this report include global assessments and databases, academic publications and project information from multilateral organizations. While the identified global assessments were screened in a more thorough way, the other written sources were – when possible – examined by Boolean⁵ searches of the keywords related to pastoralists and rangelands. The use of keywords helped to search peer-reviewed literature for topics and subject matters, but did not indicate whether quantitative statistics were present or not. Keywords were also helpful when searching databases and websites for thematic coverage of topics. If a database was found to have relevant information, a search for quantitative data was carried out separately as a second step.

In addition to written sources, a survey of pastoralism and rangeland stakeholders informed this report. Through the survey and an assessment of the examined sources, the study team sought to determine the relevance and usefulness of the information available.

Global environmental assessment

A search was conducted to determine whether there have been any global environmental or integrated assessments published since the year 2000 that are relevant to pastoralism and rangelands. Such assessments were identified in three ways: through a simple Google search using keywords, a search on the FAO and UN Environment websites, and questions targeted to survey respondents, participants of the working meeting, the Advisory Board and the International Support Group for the International Year of Rangelands and Pastoralists (IYRP)⁶ – a total of 73 eminent researchers and stakeholders. Furthermore, some assessments were identified through the

database searches. As resources were limited, a sample of 13 global environmental assessments more relevant to pastoralism and rangelands was identified for an in-depth review.⁷ This review was carried out by searching through the assessments for the first-tier keywords, followed by a careful reading of sections with hits. After this, all sections with related information (for example, deserts, dryland forests, croplands etc.) were also reviewed.

Databases and websites

A number of global databases and websites store and maintain statistics and data sets on international, regional and national economic, social or ecological statuses and trends. This study examines the inclusion of information related to pastoralists and rangelands in a set of international and regional online databases accessible to the general public. A list of databases and websites was drawn up using two methods: a Google search using the term database and by consulting certain researchers and stakeholders selected due to their affiliation with the International Rangeland Congress, the Commission on Nomadic Peoples, the World Initiative for Sustainable Pastoralism, the FAO Pastoralist Knowledge Hub and the International Support Group for the IYRP. The researchers and stakeholders – roughly half of which focus on socioeconomic issues and the other half on biophysical issues – were asked to identify international and regional databases they were aware of that may have contained information on pastoralism and rangelands.

Through this process, 100 databases and websites were identified, screened and then categorized according to the format of their information. Overall, 81 were categorized as data sets and statistics, 16 as knowledge repositories and 3 as geographic

information system (GIS) portals. Of the 100 databases and websites, only 33 provided hits for keywords related to pastoralism and/or rangelands, which were then assessed further. Eight sources were inaccessible.

Academic publications

An increasing number of academic papers on pastoralists and rangelands are published online. These were sampled by limiting this study to examine relevant publications available in Scopus, the largest abstract and citation database of peer-reviewed literature. According to the Scopus website, it includes over 71 million records from scientific journals, books and conference proceedings in the fields of life sciences, social sciences, physical sciences and health sciences.

The title, abstract and keywords of publications in Scopus were screened for first- and second-tier keywords to identify the degree to which issues related to pastoralists and rangelands were covered in scientific writing. English keywords were used in these searches. This approach excluded publications in other languages, except those that provided

5. Boolean logic (named after mathematician George Boole) is a system of logic designed to yield optimal search results. The Boolean operators, AND, OR and NOT, help form logical searches. For example, a Boolean search for “pastoralism AND rangelands” would limit search results to documents only containing those two keywords (University of Minnesota, available at: <https://hsl.lib.umn.edu/biomed/help/boolean-operators>)

6. See <https://globalrangelands.org/international-year-rangelands-and-pastoralists-initiative>

7. However, there are many other global assessments that focus on well-being issues that would be relevant to pastoralism, such as the State of the World’s Children reports of the United Nations Children’s Fund (UNICEF) and reports on health matters of the World Health Organization (WHO).

English abstracts or used any words coinciding with the English keywords. Approximately 96,414 records that cover issues related to rangelands or pastoralism were identified, 79,245 records concerned rangelands, 19,133 concerned pastoralism and 1,644 concerned agropastoralism. Only 2,658 publications covered both pastoralism/agropastoralism and rangelands. Given the integrated nature of the system boundary of this gap analysis, it was decided that a further review would be conducted for the 2,658 publications covering both topics. This sample was then screened through Boolean searches for the second-tier keywords.

Project information related to the provision of technical support

Development projects gather information, develop know-how and provide technical support. The study assessed the online project portfolio of 10 multilateral organizations and consulted 585 documents. By searching for first-tier keywords, it was possible to identify projects relevant to pastoralists and rangelands, the thematic focus of these projects and their budgets and target countries. The following multilateral organizations were screened:

- Food and Agriculture Organization of the United Nations (FAO)
- Global Environment Facility (GEF)
- International Fund for Agricultural Development (IFAD)
- United Nations Development Programme (UNDP)
- UN Environment
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
- United Nations Children's Fund (UNICEF)
- World Bank
- World Food Programme (WFP)
- World Health Organization (WHO)

The study also examined project databases of ILRI, the International Council for Research in Agroforestry

(ICRAF), also known as the World Agroforestry Centre, and the International Center for Agricultural Research in the Dry Areas (ICARDA). These sources were included in the analysis on account of their strong focus on supporting smallholder farmer and pastoralist livelihoods and drylands in the Global South.

While the methodology was effective in identifying the use of keywords related to technical support, it was less effective in differentiating between available information and the quality of technical support provided.

Stakeholder survey

In order to include stakeholders' perspectives in the gap analysis, an online survey was developed to explore how different organizations regarded available information on and technical support for pastoralism and rangelands. The survey asked questions about the organizations' use of LIKT and invited respondents to make recommendations on how to address potential data gaps on pastoralism and rangelands, provision of technical support and inclusion of LIKT.

A questionnaire was prepared and distributed to 20 regional pastoralist organizations and 16 members of the International Rangeland Congress Steering Committee. A slightly revised questionnaire was distributed via e-mail to approximately 300 additional individuals (researchers, development experts and staff at NGOs, United Nations organizations and governmental agencies) interested in issues related to pastoralism and rangelands. In total, 58 responses were received, which is 18 per cent coverage.

Sources not included in the study

One initial idea was to approach and interview chief executive officers (CEOs) or Corporate Social Responsibility (CSR) staff of a few multinational

large-scale corporations working on issues related to pastoralists and rangelands. The intention was to find out if, and what type of information these corporations collected on pastoralists and rangelands, and whether they offered any technical support to pastoralists. The rationale for targeting corporations was that they were thought likely to have sustainability agendas and may therefore be collecting data. Recognizing that corporations may consider such information confidential, the review adopted an interview format. Information from the business sector could have complemented information reviewed from other sectors. Unfortunately, it was not possible to identify a sufficient sample of relevant corporate entities to interview and therefore no interviews were conducted with this sector.

Grey literature from civil society organizations (CSOs), unpublished literature and non-peer-reviewed material are vast and thus proved difficult to sample. Moreover, the stakeholders' working meeting in Arendal had a relative low level of confidence in the information coming from these sources. Hard copies of grey, unpublished and non-peer-reviewed literature were difficult to access and were therefore not included in the study. Media sources were also not included, as their information was often lacking detail or not comparable.

Another source of information not included in the study concerned the impact of national and regional policies on pastoralists and rangelands. Many scientific articles and strategic analyses of these impacts were available online, including on multilateral websites. However, these were not used as a separate source due to methodological challenges – the keywords method was not useful for identifying direct impacts of policies (for example, poverty among pastoralists could be a result of policies, but also a result of environmental degradation, lack of access to development, etc.). Such sources should be studied individually and in detail in order to determine any impacts.

Availability, accessibility and confidence level

This study's assessment of the availability and accessibility of and level of confidence in the sources and information identified was based on subjective observations made when they were screened, using a few replicable principles.

For example, the purpose of the review of the global environmental assessments was to ascertain:

- availability – whether the assessment contained quantitative statistics and data on pastoralism and rangelands and, if so, to what level of detail or disaggregation
- accessibility – whether the assessment was easily accessible, including its raw data
- confidence – whether the assessment was based on primary field data collected for the purpose of the assessment, or whether it was a compilation of other assessments and research data.

The three criteria were then rated for each assessment on a scale of 1 to 3. More importance was placed on reviewing the global assessments than the global databases, since these could be examined more in-depth. More details on how these criteria were assessed are available in the [Methodology Report](#).

The accessibility of information and data online depends on whether databases and websites are public or password protected, have functional or broken links, or have been removed. When screening for project information, it became evident that how multilateral organizations share information with the public online and the degree to which they do this varies greatly. Some project portfolios were easily accessible through online searches, while others were only indirectly accessible with the help of staff members. Some project portfolios were not accessible at all. Accessibility was rated from 1 (high)

to 3 (low), depending on how easy it was to access the information and data online without additional effort: 1 – quick, one-step and easy online access, strong and comprehensive search engine, data easily accessed and analysable; 2 – access requires several steps, weak search engine, data do not have global coverage; and 3 – access is difficult, no search engines, search tools or results are incorrect, data are difficult to find. Databases with no relevant information were labelled “no information” and those that were closed, not operable or under construction were labelled “no access”.

If a source was accessible, the next step was to examine the availability of information concerning pastoralism or rangelands and whether the information was disaggregated to a level where it could inform related decision-making. Availability was rated based on the appearance of first-tier keywords and their metonyms on a scale of 1 to 3: 1 – both pastoralists and rangelands keywords present; 2 – presence of keywords for either pastoralists or rangelands; and 3 – no presence of any of these first-tier keywords. It is, however, important to note that scale is also a factor that affects the availability and relevance of data. For example, the relevance of the information available in the databases for decision-making will depend on the type of information provided. Data could lose their relevance at an aggregated level as they become more generalized.

Data, information and knowledge on pastoralism and rangelands are subject to observation and sampling errors that affect their quality. There might be uncertainties related to the data, information and knowledge, which may be limited by scope or inherent biases. All of these issues affect the level of confidence and generality that can be attached to the conclusions they support. Failing to quantify,

document, verify and provide sources for data could lead to false conclusions or unwarranted actions based on trends analysis or prioritization (IPBES 2016). Supporting effective decision- and policymaking relies on careful and clear delineation and communication of these limitations.

The original approach for the analysis was to assess the validity of all data sources, i.e. examining the type, quantity, quality and consistency of information (in the existing peer-reviewed literature and grey literature), and the level of agreement (in the data and literature, and among experts in general) (IPBES 2016, 7). However, this approach became too resource demanding to implement for this report and, therefore, the level of confidence was considered only for databases and assessments. A high level of confidence (rating 1) was given if there was evidence that the information was directly collected from the field (primary data) and/or verified by a third (and neutral) party.

The level of confidence was also a topic discussed during the stakeholders' working meeting in Arendal, which was factored into the choice of sources. In general, the participants had high level of confidence in data from published, peer-reviewed literature and from organizations that were part of or had a consultative status at the United Nations. Although the participants had a medium level of confidence in information from pastoralist organizations, CSOs and development projects, they considered these important sources as they were close to the local realities and were likely to collect disaggregated data relevant for the gap analysis.

Participation and review process

The study draws on advice and support from ongoing discussions within a large community of academics, pastoralists, government officials and other experts, including the international members of the International Rangeland Congress, the United Nations Permanent Forum on Indigenous Issues and the International Support Group for the IYRP.

A total of 48 eminent academics from around the world who are researching pastoralism and rangelands

were contacted individually to obtain information on the availability of databases, assessments and research data sets. Many of these academics in turn canvassed their network of colleagues.

In addition, several partners and experts participated in the stakeholders' working meeting in Arendal, where the methodology and design of the gap analysis were refined, verified and approved.⁸ During four days of debate, participants not only helped

establish the scope and system boundary of the study, but also recorded critical issues and urgent concerns where the perceived lack of information and data was acute. The study team has built upon insight gained from this working meeting as a way to counteract some of the resource limitations it faced.

The questionnaire drew responses from 58 people, including stakeholders such as pastoralists, researchers and development experts. While general observations can be made from the survey respondents' input, the number of respondent was not enough to determine any regional conclusions. The conclusions and recommendations of this gap analysis are based primarily on its findings but have also been enriched by the opinions of workshop participants, survey respondents, peer reviewers and Advisory Committee members.



Stakeholders at Arendal meeting clarifying scope of the study. Kathrine I. Johnsen/GRID-Arendal

8. Those invited to the working meeting represented a broad variety of geographies, organizations and expertise. Individuals who attended the meeting were those who responded to the invitation. Most covered their own costs, but representatives from pastoralist organizations received financial support. Some people that signed up for the meeting did not attend due to issues obtaining a Norwegian visa. Participants represented the following institutions (in alphabetical order): the Association for AgriCulture and Ecology (Agrecol)/Coalition of European Lobbies for Eastern African Pastoralism (CELEP), the Eastern and Southern Africa Pastoralist Network, the European Shepherds Network (Italy), GRID-Arendal, the International Centre for Reindeer Husbandry (Norway), the International Livestock Research Institute (IRLI), the International Rangeland Congress/Coventry University, the Environment and Development Association – JASIL (Mongolia), Princeton University, Red Pastoramérica (Peru), the Soil Conservation Service of Iceland/United Nations University Land Restoration Training Programme, UN Environment and the Yolda Initiative.

Findings of the study (by source)

Global environmental assessment

Observations

The majority of global environmental assessments reviewed were very accessible and in many cases provided access to raw or underlying data sets. Confidence in the data was generally high, though some global assessments were concerned about the data's lack of adequate field verification (see Figure 7). None of the 13 global assessments reviewed had sufficient statistical information regarding pastoralism and rangelands to warrant the highest rating. Most mentioned pastoralism and rangelands only in passing or not at all.

The most recent IPBES report Assessment of land degradation and restoration (2018) collected a large body of existing information and data and used a conceptual framework similar to the one used in this gap analysis. Findings and conclusions were also rated according to the level of confidence (defined as quality and quantity of evidence rather than degree of agreement). In general, the IPBES assessment presents comprehensive information on land degradation and restoration, but does not disaggregate this to a level where it can be used to inform decision makers about pastoralism and rangelands. Land degradation is defined in terms of loss of biodiversity and ecosystem functions and services, as agreed at the third session of the IPBES Plenary. Although this definition covers many of the issues relevant to pastoralism and rangelands, it does not cover all issues. For example, rangelands may show high levels of biological diversity, but if their plant compositions were mostly unpalatable and invasive species, pastoralists would consider them degraded land.

A section on grazing and land degradation provides important conclusions on the effects of land-tenure security, climate change, poverty and conflict on pastoralism and rangelands, as well as other direct and indirect threats. However, the report also notes that due to a lack of information, it is not possible to ascertain whether the estimated 50 per cent loss of global livestock production from rangeland systems is because of a decline in fodder quality or loss of rangelands.

Much of the evidence is based on case studies and research reports, sometimes with differing conclusions. For example, chapter 6 states that overstocking and poor grazing has caused rangelands to deteriorate across the world, before concluding on the importance of introducing good grazing management through adjusting stocking rates and densities, while chapter 3 evidences that land-tenure security, enabled transhumance mobility and rangeland rotation and strong community

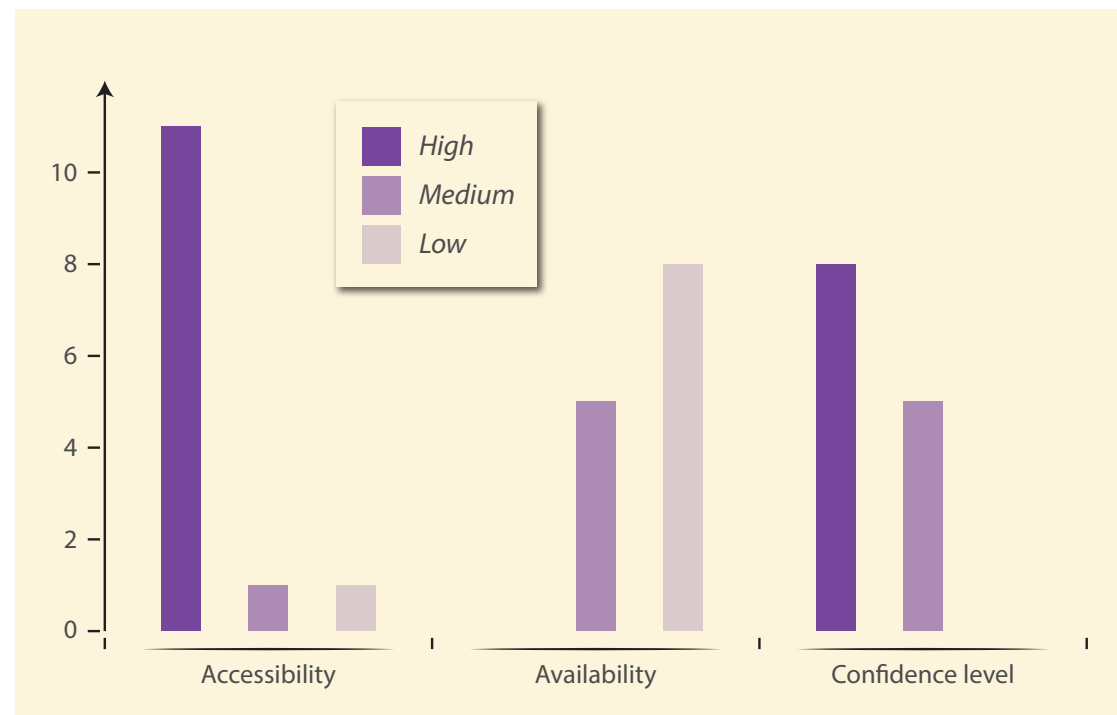


Figure 7: Global assessments rated by accessibility, availability and confidence level

institutions can prevent and have prevented land degradation.

The chapter on definitions points to the challenges of comparing statistics across different research methodologies and conflicting definitions. It also highlights the importance of the data's source, since information collected at the local level may have higher proportions of land degradation than information collected at the global level. Chapter 4 discusses the extent of global rangeland degradation, noting that there is still confusion in literature due to various understandings of the term 'degradation'.

The third edition of the World Atlas of Desertification (Cherlet et al. (2018) has recently been released by the European Union Joint Research Centre. It provides a historical overview of assessments on drylands since the publication of the first World Map of Desertification in 1977. It details many assessment challenges that are also relevant to this study, such as contextualization and collection of field data to complete remotely sensed data, the lack of consensus on the definition of 'land degradation', and different methodologies for estimating land cover (for example, estimates of the world's cropland range from 15 million to 28 million km²). The assessment was based on a comprehensive compilation of existing research and assessments, 'converging' such information to build a global picture. A web-enabled platform will be established that can be used to download specific data sets and statistics.

The atlas reports that there are 29 million km² of rangelands globally and that 15 per cent of all rangelands have some form of biomass reduction. Combined pressures of biomass reductions and other global change issues, such as overgrazing, salinization and high population density, may trigger land degradation, depending on local conditions. Grazing systems that rely on rangelands for more than 90 per cent of production occupy 26 per cent of the

world's ice-free land surface. The atlas also provides statistics on livestock production and consumption sourced mostly from FAO, and on groundwater, soil organic carbon and salinization, nutrient balance, atmospheric dust and fire frequency, among others. These are valuable data that define the ecosystem dynamics impacting on rangelands. However, the atlas does not distinguish between different forms of pastoral production or different types of rangelands and how land degradation affects these.

The atlas describes the contrasting viewpoints of researchers and policymakers on the 'desertification paradigm', with some stressing continuing land degradation and others focusing on resilience and 'regreening'. It highlights the limitations of a global assessment/atlas in providing prescriptive solutions to policymakers due to the contextual and highly variable nature of degradation. It cautions against using a standardized methodological approach to understanding land degradation at the local level.

Trees, forests and land use in drylands – the first global assessment: Preliminary findings (FAO 2016b), better known as the Global Drylands Assessment, was based on interpretations of satellite imagery for 213,795 plots of 0.5 hectares in all continents. While the report provides valuable primary data, its authors have cautioned that they still need to be verified through field checking. Raw data are expected to be available soon for free download.

The assessment focused on forest management, with most statistics presented relating to tree cover. It does not include any disaggregated information on pastoralism or rangelands. It asserts that trees are an important yet underestimated element of drylands, and describes in general terms the benefits of trees for agrosilvopastoral systems.

The assessment reports that 31 per cent of global drylands are grasslands, which are defined as any area

with less than 10 per cent tree cover, but since this also includes recreational areas, it cannot be directly compared with rangelands. Furthermore, some other land-use categories can also be grazed or used by pastoralists. For example, pastoralists use areas of land categorized under "Other land" (which covers 34 per cent of drylands and is defined as bare soil, rock and ice), dryland forests (18 per cent of drylands) and even wetlands (2 per cent). Croplands (14 per cent of drylands) also provide grazing resources for pastoralists. The methodology used for the assessment is, however, an important and innovative one that merits consideration for any future global assessment.

The State of the World's Forests 2018: Forest pathways to sustainable development (FAO 2018) is a short policy-oriented assessment summarizing existing analyses and data that link the state of the world's forests to the achievement of the SDGs. Pastoralism and rangelands is occasionally mentioned, but only in general terms and with no statistics. The assessment mostly associates pastoralism and rangelands with overgrazing and as a cause of deforestation. One case study provides data on the coverage of grassland ecosystems in Italy. The Global Forest Resources Assessment 2015 (FAO 2015) is a comprehensive assessment of available statistics and data related to forest resources. No specific information on drylands, rangelands or pastoralism is available. It mentions grazing only once and in relation to deforestation.

The State of Food Security and Nutrition in the World 2017: Building resilience for peace and food security (FAO et al. 2017) focuses on developing countries. It provides a good coverage of issues related to pastoralism, including loss of mobility, livelihoods and the effects of conflicts on land degradation. However, no particular statistics or data are provided. The state of nutrition and food security among pastoralists and crop farmers is not differentiated. The State of Food and Agriculture 2016: Climate change, agriculture and food

security (FAO 2016a) focuses on the impacts of climate change. Pastoralists (and metonyms such as herders) are mentioned several times as relevant stakeholders, but there is no disaggregation of the many global statistics provided. One case study reports on an innovative analysis of rates of return from rangeland improvements among yak herders in Qinghai, China. Modelling and future-scenario data are also available for rural areas as a whole. Similarly, rangelands are mentioned, but only in general terms and in relation to the impacts of climate change or to the benefits of grazing management and the rehabilitation of rangelands for carbon sequestration. The assessment also provides more detailed national information on net emissions from grasslands and agriculture (which includes grazing and manure left on pastures) for 2014. However, despite overlaps, grasslands and croplands cannot be compared with rangelands. It reports that there are lower enteric emissions from livestock in the Mediterranean region and in the tropics than elsewhere, and that efforts to substantially reduce enteric emissions face challenges, such as use of illegal substances or lack of production gains. There are more references to managed pastures than rangelands, including large emissions from manure left on pastures. Apart from the carbon emissions data, which are sourced from FAO, the assessment relies on existing scientific publications often focused on sample sites or based on modelling.

Food Systems and Natural Resources (UNEP 2016) summarizes information from other global assessments and scientific publications in order to draw conclusions on resource efficiency and decoupling of growth from environmental degradation. While there is some mention of pastoralism, rangeland beef systems and grazing management, the report mostly analyses the efficiency of resources used for particular products (beef, dairy). Statistics provided on feed efficiency do not differentiate rangeland systems from more confined livestock systems. An analysis of research



Training pastoralists on statistical monitoring of rangelands, Uganda. Jonathan Davies/IUCN

results on land use and GHG emissions per protein source shows very large variability in data points and little consensus among researchers. For example, there are two data points for land use per kilogram of protein from rangeland beef and veal systems, one reporting approximately 160 m²/kg and the other 2,100 m²/kg. Similarly, 12 data points on GHG emissions from these systems, measured as CO₂ equivalence per kilogram of protein range from around 60 kg CO₂eq/kg to 640 kg CO₂eq/kg (UNEP 2016, 97). Such widely varying data points can lead to very different conclusions and recommendations.

To complement Agriculture at a Crossroads. International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD): Global Report (McIntyre et al. 2009), a website was developed and is still updated with information on key issues, such as the ecological footprint of confined livestock systems and land grabbing, offering links to institutions working in these areas. The report was instrumental in highlighting major global challenges in agricultural production. Although it notes the importance of traditional pastoralist systems and the challenges these face, it does not provide detailed

statistics or disaggregated data on the many different forms of pastoralism. It states that there is insufficient research, science and technology in certain areas, such as pastoralists' access to animal genetic resources, rangeland management (rather than technology) and the improvement of rangeland resources.

Global Environment Outlook 5: Environment for the future we want (UNEP 2012b) provides insight on agricultural land-use and production systems, highlighting pastoralism as a potentially sustainable form of production. It provides some case studies on pastoralism, including land-tenure security and rangeland restoration through rotation. While the report includes statistics related to confined livestock production (especially in relation to its ecological footprint), it does not for rangeland livestock systems. Rangelands (using the metonym pasturelands) are discussed in relation to land degradation, crop expansion and overgrazing, but there are no detailed statistics.

The Emissions Gap Report 2017: A UN Environment Synthesis Report (UNEP 2017) provides information on GHG emissions and mitigation related to the livestock sector. It includes global statistics obtained from United Nations organizations and research data on carbon sequestration and emissions from grazing lands. However, it does not disaggregate pastoralism and rangelands.

The report Avoiding Future Famines: Strengthening the Ecological Foundation of Food Security through Sustainable Food Systems (UNEP 2012a) draws on a wide array of existing research and peer-reviewed information, but does not provide specific statistics on pastoralism and rangelands. Rangelands are mentioned in a general manner and pastoralism is only discussed in the context of experiences with Holistic Management in Australia.

Energy Access Outlook 2017: From Poverty to Prosperity (IEA 2017) provides valuable information on the differences between rural and urban populations' access to electricity and other energy-related services, highlighting the importance of using renewable energy to reach remote rural areas in developing countries. However, since the report does not disaggregate data on pastoralists, it is not possible to ascertain their level of energy poverty, how this compares with sedentary populations, and whether renewable energy would help improve their access to energy while still practising grazing mobility.

Key messages related to availability of information on pastoralists and rangelands

- There are differences between estimates for total rangeland area and the extent of rangeland degradation is a confusing issue, due to varying interpretations of 'degradation'. For example, the World Atlas of Desertification (2018) states 29 million km², while FAO estimated 34 million km² in 2011. A widely quoted publication, Gabathuler, Hauert, and Giger (2009) estimates that 73 per cent of rangelands are degraded, but the World Atlas of Desertification (2018) shows that 15 per cent of rangelands have some form of degradation. It is not clear whether these figures represent actual statistical reductions over the years or differences in definitions, sampling methodologies and data-collection methods. Without a clear understanding of such large-scale phenomena, it will not be possible to devise appropriate policies for pastoral development and rangeland management as well as wider phenomena, such as increasing sandstorms and dust storms.

- Although relevant to an understanding of overall habitat health and trends, the global health assessments on forest resources do not provide sufficiently detailed and disaggregated data to assess the extent and status of rangelands. Some of the assessments reviewed stress the benefits of trees to agricultural systems, including pastoralism, while others focus on the effects of overgrazing on forest systems.
- The global assessments on agriculture contain useful information on livestock systems, but tend not to disaggregate data on pastoral and rangeland systems.
- Several assessments on drylands (including land degradation and desertification) provide valuable insight on ecosystem changes, threats and opportunities. However, they generally lack sufficient disaggregation of pastoral systems (transhumance, nomadic, ranching, agropastoral, etc.) and their rangelands.
- Existing assessments often provide valuable information on controversial and current topics, though these mostly use scientific research carried out on samples of sites or populations, rather than global data that are collected in a consistent manner.
- Remote sensing methods used by the Global Drylands Assessment and the 'convergence' method used by the third World Atlas of Desertification and IPBES are innovative methodologies, especially considering the advances in satellite imagery and its availability, and should be replicated and verified through field data.

Global environmental and socioeconomic databases and websites

Observations

The 100 identified and publicly accessible databases and websites screened for the study were rated according to disaggregation, accessibility and confidence level. A high rating meant that data were available specifically for both pastoralists and rangelands (or their metonyms), that they could be easily searched and accessed, and that they were verified by a third party or a scientific method. A low rating meant that data were not disaggregated and only provided general information on populations or ecosystems, that they were difficult to access, and that there was no visible attempt of verification. In eight cases labelled “no access”, it was not possible to rate one or more of these indicators due to insufficient information, password protection or the website being under construction. In total, 92 databases were screened, 59 of which had no hits for any metonym keywords and were thus labelled “no information” (see Figure 8).

Most of the databases reviewed were easily accessible, though the ability to search these varied. Boolean searches were not possible for search engines where search paths were limited to single words. Some data sets could be searched only through a specific geographical site, a specific species or according to pre-set subjects. Some databases had sections that were password protected and others required training to understand how to navigate the site. Screening databases and websites for relevant information was therefore a very time-consuming process.

Most of the databases were rated as having only a medium confidence level, as their data were not subject to rigorous verification, with the majority based on some form of self-reporting. These databases may therefore be biased in what they report.

The databases and websites category includes various sources. Within the 33 sources that provided hits for keywords related to pastoralism and/or rangelands, 21 were categorized as data sets and statistics, 11 as knowledge repositories and 1 as a GIS portal. The knowledge repositories contained collections of published and unpublished literature, news and media reports, manuals and guidelines, case studies and other documents.

As was the case with the Google word cloud (Figure 4), searching the databases for pastoralist (or pastoral) and rangeland returned less information from the 92 databases than their metonyms. However, this increased uncertainty in the availability

of information, since many of the metonyms do not necessarily relate to pastoralism or rangelands. For example, the term ‘pasture’ could relate to either natural (rangelands) or cultivated pastures (not rangelands), which are not distinguished in the data. In Eurostat, ‘nomad’ appeared with the terms ‘vagrants’ and ‘homelessness’ and was not related to pastoralism at all. In the World Database of the Key Biodiversity Areas some sites were labelled as ‘ranch’, though information was lacking for these and only concerned biodiversity. The Statistical Data Warehouse of the FAO is a repository holding all of the organization’s digitized maps and statistics in one place. However, its search engine was not sensitive to first-tier keywords and returned no directly relevant

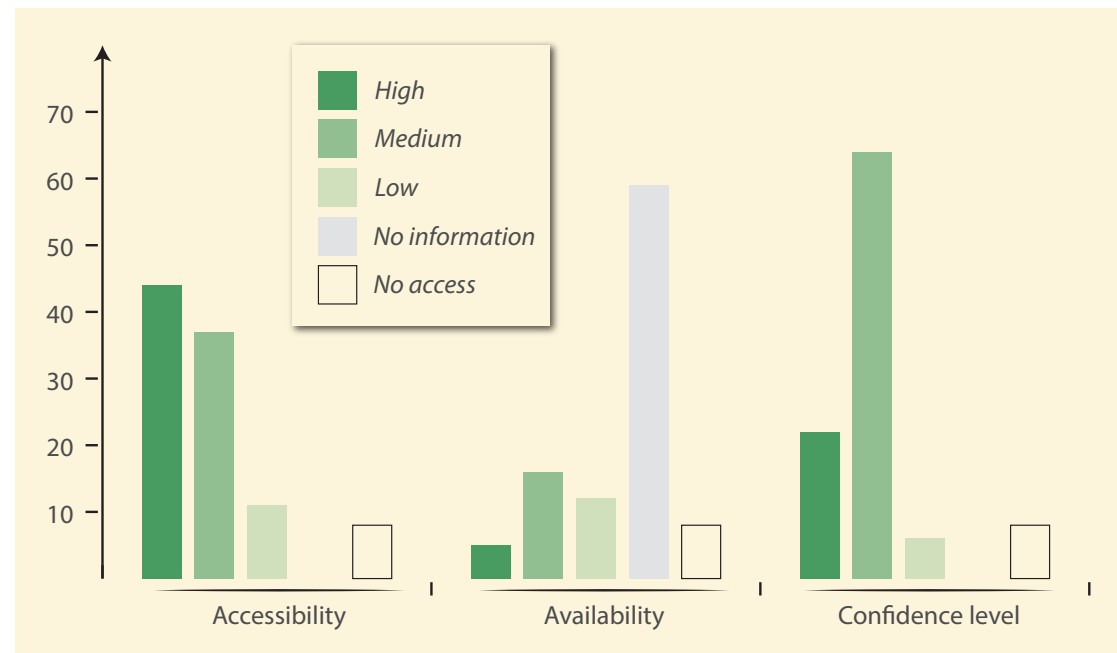


Figure 8: Data sources rated according to accessibility, availability and confidence level

Note: Databases that were under construction or could not be accessed for other reasons are labelled “no access”.

results (the term 'rangeland' provided any type of land cover map, while 'pastoralist' returned information on irrigated pastures).

Only 33 of the 92 screened databases contained information on pastoralists or rangelands. Figure 9 gives an overview of these databases. Of these, only five had information on both pastoralists and rangelands and were therefore rated "high" availability: the Pastoralist Knowledge Hub, the World Initiative for Sustainable Pastoralism (WISP), the Global Livestock Production Systems in Rangelands, the ILRI Data Portal and the Land Portal. The Land Portal provided links to a rich portfolio of land-related downloadable data sets from a wide variety of organizations. However, as was the problem with most of the sites screened, most data were not disaggregated to a level that was relevant for this study. The indicator map of the Global Livestock Production Systems in Rangelands visualized relevant issues, but had no search engine.

The ILRI Data Portal, the Land Portal, WISP, the Pastoralist Knowledge Hub, the Global Rangelands Initiative and ICARDA gave access to several scientific articles and popular reports related to pastoralism and rangelands. For example, the ILRI Data Portal provided information related to livestock, rangelands, soil and livestock insurance, while its GIS portal provided information on rangeland productivity, cover, condition, etc. The African Monsoon Multidisciplinary Analysis – Coupling the Tropical Atmosphere and the Hydrological Cycle (AMMA-CATCH) also had long-term data on pastoralism and/or rangelands. Despite these databases containing some relevant information, they were challenging to search through and in some cases, such as the ILRI map viewer in particular, selected databases were not presented and data could not be downloaded.

Most of the 92 databases were topic specific with little integration of physical and social issues (for example,

savanna carbon emissions, disease epidemiology). Rangeland metonyms appeared more often (on 31 websites) than pastoralist metonyms (on 23 websites), though most databases examined (64 per cent) did not contain any hits for metonyms of either term. Sixteen sources were rated "medium" availability, as they provided some disaggregated information on rangelands or pastoralism. These databases focused primarily on livestock productivity and health, and rangeland conditions. Many databases and knowledge repositories, such as UNESCO, FAOSTAT, the World Database on Protected Areas (WDPA), Globally Important Agricultural Heritage Systems (GIAHS) and the IUCN Red List, contained information that was relevant for understanding the broader context, but did not directly address pastoralism and rangelands or distinguish between different types of pastoralism and rangelands.


As of May 2018, the Global Database on Sustainable Land Management of the World Overview of Conservation Approaches and Technologies (WOCAT) contained 1,810 fact sheets recording the impacts of projects and programmes, though very few seemed related to pastoralism. The database was difficult to search and did not return directly relevant information for searches performed. For example, when searching pastoralism, the search engine returned examples of crop farming. WOCAT is currently developing guidelines on sustainable rangeland management in sub-Saharan Africa, an effort which also includes preparing additional entries for the WOCAT database on rangeland approaches and technologies.

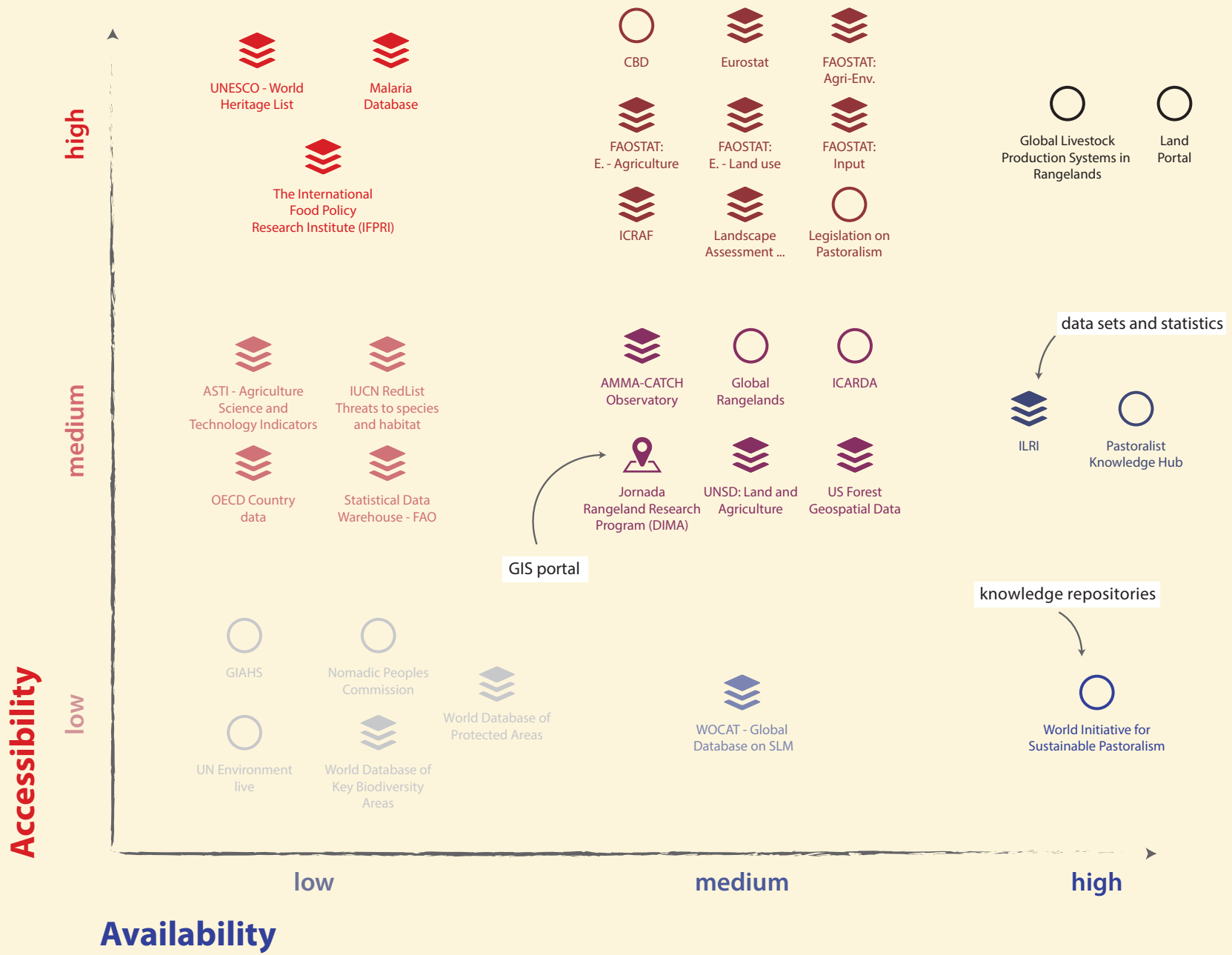
The Global Livestock Production and Health Atlas (GLiPHA) of FAO and its Gridded Livestock of the World, developed in collaboration with the Environmental Research Group Oxford (ERGO), provided in-depth statistics on livestock production, including animal disease, nutrition and trade issues, but did not disaggregate data on pastoral production systems. GIAHS, also developed by FAO, provided site-specific

fact sheets about agricultural systems worldwide, including pastoral systems. While this proved a useful tool, it did not have a search engine, which made identifying relevant cases a very time-consuming process. The FAO toolbox Legislation on Pastoralism within the Pastoralist Knowledge Hub contained copies of an impressive 619 legal documents from around the world directly relevant to pastoralism, including grazing quotas and land-use regulations.

Eurostat held considerable information on the overall livestock sector in Europe, focusing on livestock population and productivity, with some data on open-space grazing, though it did not distinguish between transhumant and sedentary livestock raisers or disaggregate social indices, such as pastoralist education and health. Several of the FAOSTAT sites provided data on types of land cover and land use that fit the definition used for rangelands in this report. However, the statistics did not have a separate category for rangelands, making it unclear whether the data also concerned grazing lands. Eurostat, FAOSTAT sites and OECD Country Data contained information on the geographical distribution and types of livestock, but none of these sources differentiated the type of livestock operation. However, the FAOSTAT guidance on agricultural censuses to be carried out by countries between 2016 and 2025 includes some pastoralism-specific items, such as type of livestock system.

The Convention on Biological Diversity (CBD) site did not have any data sets, but referenced a number of site and topic specific case studies relevant for pastoralism and rangelands, such as the case "Autonomous adaptation to droughts in an agro-silvo-pastoral system in Alentejo" (2016), which examined the livelihood of 20 people in southern Portugal.


Figure 9: Availability of data on pastoralism and rangelands in the 33 databases and websites reviewed





Afar pastoralists selling goats in northern Ethiopia.
Wolfgang Bayer

However, many of the links to the CBD case studies are partly broken and the information available is often not comprehensive enough to inform decision-making on pastoralism and rangelands. Searching for metonyms within UN Environment Live did not return any data sets for pastoralists and rangelands, though a couple of assessment reports describing relevant and integrated information were identified, such as “Pastoralist participation and networking in policy dialogue” and “Changing taiga: challenges to Mongolian reindeer husbandry”. Although the WHO Malaria Database did not provide disaggregated data useful for decision-making on pastoralism, WHO has issued a bulletin highlighting lessons learned and challenges to data collection in highly mobile pastoralist households in Chad (Weibel et al. 2011).

Several country databases had specific data on rangelands (for example, data sets of the United States Bureau of Land Management, the United States Forest Service and the Jornada Rangeland Research Program’s Database for Inventory, Monitoring and

Assessment), which often look only at biophysical data. The accessibility of these last two databases were rated “medium”, since special software and permission is required to download the data.

The Land Degradation Assessment in Drylands (LADA) and the Global Land Degradation Information System (GLADIS) offered detailed information on land degradation in drylands, though the study team was unable to gain access through their websites. Some websites under construction when screened, for example, the Rangelands and Pasture Productivity (RAPP) Map of the Group on Earth Observations Global Agricultural Monitoring (GEOGLAM) and the FAO Land Resource Planning Toolbox, could potentially be very useful sources for data on rangeland trends worldwide. Furthermore, the Pastoralist-Driven Data Management System (P4D), which FAO is developing, could provide an important data source on pastoralism in the future. The Google Dataset engine, launched on 6 September 2018, is yet another tool that could provide useful data on pastoralism and rangelands in the future, as data set publishers enter information that the system can recognize.

Once data sources had been screened, the study examined texts of the following 14 conventions, protocols and targets:

- Aichi Biodiversity Targets
- Basel Convention
- Convention on Biological Diversity (CBD)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS)
- International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)
- Kyoto Protocol
- Paris Agreement
- Ramsar Convention

- Rotterdam Convention
- Stockholm Convention on Persistent Organic Pollutants
- Sustainable Development Goals (SDGs)
- United Nations Convention to Combat Desertification (UNCCD)
- United Nations Framework Convention on Climate Change (UNFCCC)

Only the SDGs indicator text provided hits for first-tier keywords, specifically for the terms ‘pastoral’ and ‘drylands’.

The 12 multilateral environmental agreements (MEAs) (excluding the Aichi Biodiversity Targets and SDGs) regularly collect reports from countries, which are a potential source of information on national status and trends on issues related to pastoralists and rangelands. Using ILRI rangeland statistics collected from a map produced by the University of Idaho (see Figure 1), countries with the highest percentage of rangelands as a share of national land surface were identified for each region. A total of 10 countries⁹ were selected representing all continents with the aim to screen their national reports to the conventions since 2000. However, several obstacles made it challenging to carry out this screening. Regularly submitted national reports were available only for UNCCD, CBD, UNFCCC, CMS and the Ramsar Convention. Furthermore, not all countries reported to each of these conventions, which meant a statistical comparison of results would not be possible. Another obstacle concerned the language in which the reports were written, since not all countries reported in English. Within the sample, some countries reported in Arabic, French, Spanish and Russian, which meant that English keywords and metonyms could not be used in the screening of these reports.

9. The 10 countries sampled were: Argentina, Australia, Burkina Faso, Iceland, Liechtenstein, Senegal, Syria, Turkmenistan, Uruguay and the United States.

Key messages related to availability of information about pastoralists and rangelands

- While there is a wide variety of statistics and data sets for environmental and socioeconomic issues, only a third of the sample reviewed provide some information about pastoralism and rangelands, with only a few providing it in a manner that could inform decision makers on sustainable livelihoods and ecosystem management. For most sources screened, data are not disaggregated in a way that could provide information on the ecosystem's well-being, land use, herding strategies, migration and distribution and ownership of pastures and livestock, as well as other types of information relevant for decision-making.
- Specific assessments and online knowledge repositories often provide more integrated information, but this is most often site and topic specific and does not provide a holistic assessment of pastoralism in a country or worldwide. Furthermore, information is often difficult to access because of broken links, password protection and non-existing or non-intuitive search engines. Quite often, the search engines are not programmed to be sensitive to the first-tier keywords and their metonyms and return information that is not relevant. In addition to the 100 databases and assessments reviewed, some other databases were found that were either closed down (for example, GLADIS) or that were in development.
- Many databases are not available without a password, although they provide direction on how passwords can be obtained. Several relevant databases were also found that are maintained by individual researchers or organizations, but are not publicly accessible. Future assessments should establish partner agreements early on in order to obtain passwords and in some cases appropriate software for such sources.
- Confidence in the accuracy and reliability of existing data and information is generally medium to high, since data are from global or multilateral databases that usually have some form of review and verification process.
- Country statistics that are routinely reported in United Nations portals focus on livestock production only, including animal numbers, types, offtake and export, but not specifically on pastoral livestock production. Statistics on rangelands are rarely disaggregated out of broader land-use types, making it difficult to separate out natural rangelands and grasslands. Socioeconomic statistics on pastoralists are not disaggregated at all, except in a few countries where pastoral production dominates the agricultural sector, though even in these cases there is no distinction between the different categories of pastoralist mobility.
- Due to the limited resources for this study, it was not possible to create an exhaustive list of all potential data sources, which would be a useful practice in the future. Furthermore, it would be practical for one or two global institutions championing pastoralism and rangelands to agree to establish a comprehensive repository of information.
- A future assessment could invest considerable resources to further examine data sets and other knowledge repositories. However, it is likely that the information extracted would still be inadequate for a thorough assessment on account of low disaggregation, outdated information and unverified statistics. For example, anecdotal evidence suggests that, despite a reduction in the size of rangelands due to agricultural expansion, older statistics for rangeland cover are still being used in reports. The collection of science-based and accurate field data is therefore crucial in the subject areas identified to fill gaps in knowledge and update information on systems as these rapidly change.
- There is no standard method, process or structure for the databases, meaning it is not possible to compare statistics and data sets. Some organizations are attempting to develop global comprehensive databases (for example, the Land Resources Planning Toolbox). However, these are sector-specific and do not provide an integrated approach to understanding pastoralism and rangelands.
- Long-term monitoring platforms for rangelands are available in several developed countries, but no publicly available platforms were found for developing countries, with the exception of GEOGLAM, which is a global monitoring site. It is difficult to locate disaggregated information on pastoralists, since most countries do not distinguish between crop farmers and confined livestock raisers.
- The challenge of finding information is largely due to the inconsistency in how terms are used. The terms 'pastoralist' and 'rangelands' are defined in many different ways and are not relevant in all parts of the world, where their metonyms may instead be used. A future assessment could help clarify terminology and definitions, thus making future data collection more efficient, consistent and comparable.
- Most convention texts of the MEAs do not show hits for keywords related to pastoralism and rangelands, except one SDG target that mentions pastoralists.
- Country reports are submitted in different United Nations languages. Future assessments should make available sufficient resources to cover the translation of sources with such data.



Masai Mara conservancy at Eagle View, Kenya. Peter Prokosch

Project information

The accessibility of project information differed significantly between the organizations. Only four – the World Bank, GEF, IFAD and UNESCO – had searchable project portfolios available online. The World Bank and the GEF were the most accessible organizations and provided easy online access to project titles, objectives, status, budgets and target countries. The other organizations were contacted by e-mail to request access to their project archives. FAO provided overviews of relevant projects and UN Environment gave access to abstracts for all current projects, which were searched to identify the number of projects relevant to pastoralism and/or rangelands.

The study also looked at the project portfolio of three international agricultural research centres under the Consultative Group on International Agricultural Research (CGIAR), namely ILRI, ICRAF and ICARDA. Most hits within the ICRAF portfolio were from project titles, indicating that the search engine may not be effective in screening project descriptions. If this is the case, the hits identified would not be representative of the project portfolio. The project databases of the CGIAR agencies were less accessible than those of the World Bank and the GEF in providing information on the funding granted to each project. Table 1 presents the results of the screening of the 13 organizations.

Observations

Not all countries are eligible for funding from multilateral agencies, meaning that this information source is biased against certain parts of the world. However, project documents can be an important source of information of what is happening on the ground and offer recommendations for improving the sustainability of pastoralism and rangelands.

In total, 585 projects were identified (from 2000 until present) that included one or several keywords related to pastoralists and/or rangelands. However, since donor agencies are sometimes project partners, there may have been an overlap in the projects identified, which meant that it was not possible to obtain an accurate figure for the percentage share of projects compared with all projects related to

pastoralism and rangelands. For example, as five of the donor agencies are partners of the GEF, more time was given to further explore the GEF project portfolio.

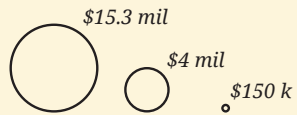
In the GEF project portfolio, 124 projects were identified that were relevant to pastoralism and/or rangelands. These included projects at different stages and some that had not been approved. Thus,

Table 1: Screened project portfolio results

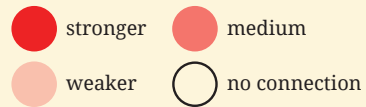
Multilateral organizations	Accessible project portfolio	Total number of projects	Number of relevant projects
FAO	No	Not available	60*
GEF	Yes	10,051	124
ICARDA	No	29*	29*
ICRAF	Yes	185	4
IFAD	Yes	Not available	27
ILRI	Yes	108	5
UNDP	No	Not available	Not available
UN Environment	No	439**	8**
UNESCO	Yes	1,351	4
UNICEF	No	Not available	Not available
WFP	No	Not available	Not available
WHO	No	Not available	Not available
World Bank	Yes	13,190	354

* Not publicly accessible; identified and shared by FAO and ICARDA.
 ** Not publicly accessible; accessed through Uniform Resource Locator (URL) provided by UN Environment.

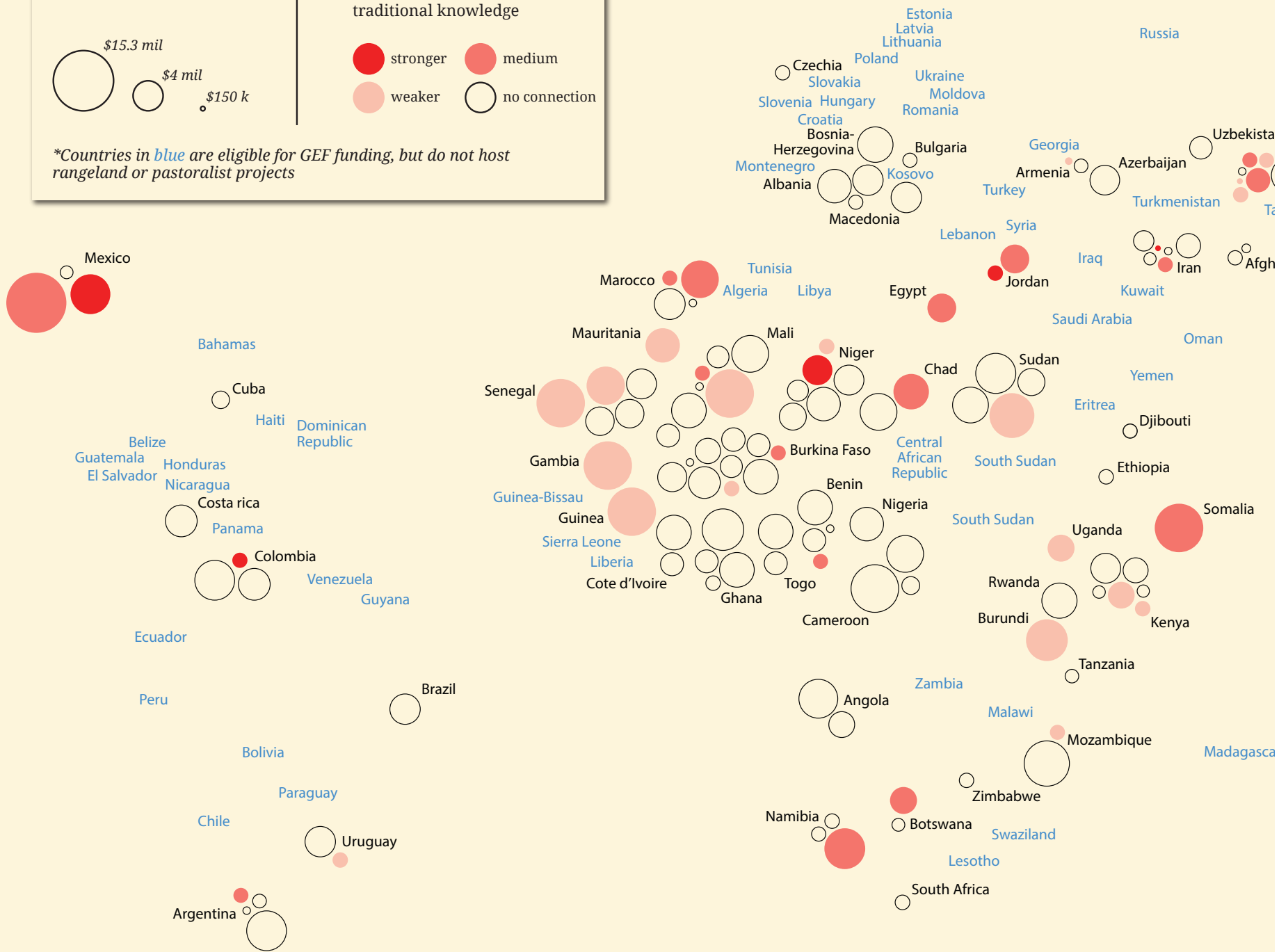
GEF Grant



Connection to traditional knowledge



*Countries in blue are eligible for GEF funding, but do not host rangeland or pastoralist projects



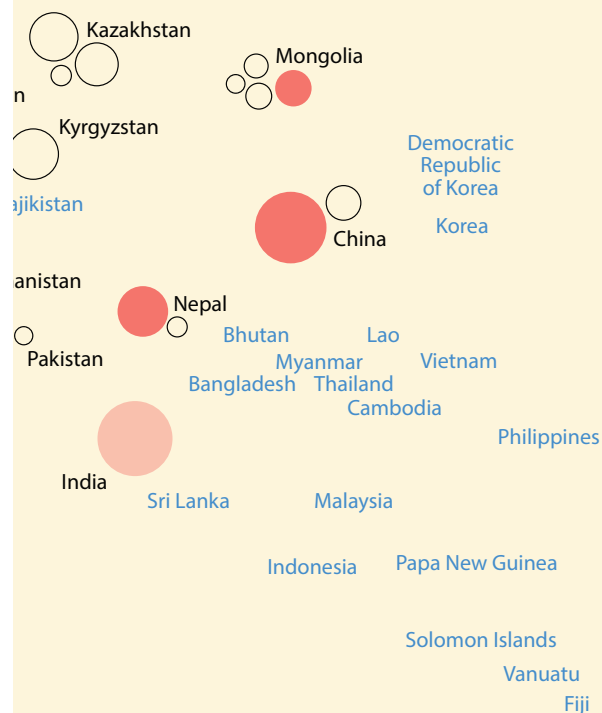


Figure 10: Geographical distribution of GEF projects

Notes: The circles indicate the number and size of project per country. Red circles indicate the inclusion of traditional knowledge.

in its search for activities providing technical support, the study focused on 107 projects with a “completed” or “approved” status. The total GEF grant allocated to the 107 projects was \$406,885,166. On average, each of the identified projects received a grant of \$3.77 million. The total amount of GEF grants for any project in the same period (from 2000 to 2018) was \$17,122,496,329. In short, the GEF projects on pastoralism and rangelands are 1.22 per cent of its project portfolio and receive 2.38 per cent of the total GEF grants. Figure 10 shows the geographical distribution of GEF grants allocated to pastoralism and rangelands projects since 2000.

The 107 relevant GEF projects were categorized according to the type of technical support they provided. Most projects covered more than one of the topics within the scope of this study. More than half included capacity-building activities and more than 40 projects focused on biodiversity conservation (particularly emphasizing mitigation and adaptation to climate change) and institutional development. The latter category was often in combination with capacity-building and knowledge-sharing. Less than five projects focused on health, credit or loans, vocational education, supplemental feed and ICT (see Figure 11).

Table 2: Distribution of OECD-donor aid for MEA goals in 2015 (millions of USD)

	Biological diversity	Combat desertification and drought	Climate change adaptation	Climate change mitigation	Environment*	Total
All aid (principle**)	220	4,160	3,474	9,150	12,634	29,638
All aid (significant**)	1,918	4,625	11,635	10,461	17,558	46,197
All aid total in 2015	2,138	8,785	15,109	19,611	30,192	75,835
Aid for livestock (principle)	0.3	6.9	31.8	0.6	30.3	70
Aid for livestock (significant)	54.1	26.2	38.8	13	30.8	163
Aid for veterinary services (principle)	0	0	0	0	0	0
Aid for veterinary services (significant)	0.02	0.8	4.8	0.6	18	24
All aid for veterinary services total in 2015	54.4	33.9	75.4	14.2	79.1	257

*“Environment” includes capacity-building, governance, national reporting, etc.

** “Principal” and “significant” refer to projects where the “principal” objective was livestock/veterinary, or where this was only a significant part of their objective.

Source: OECD (2018).

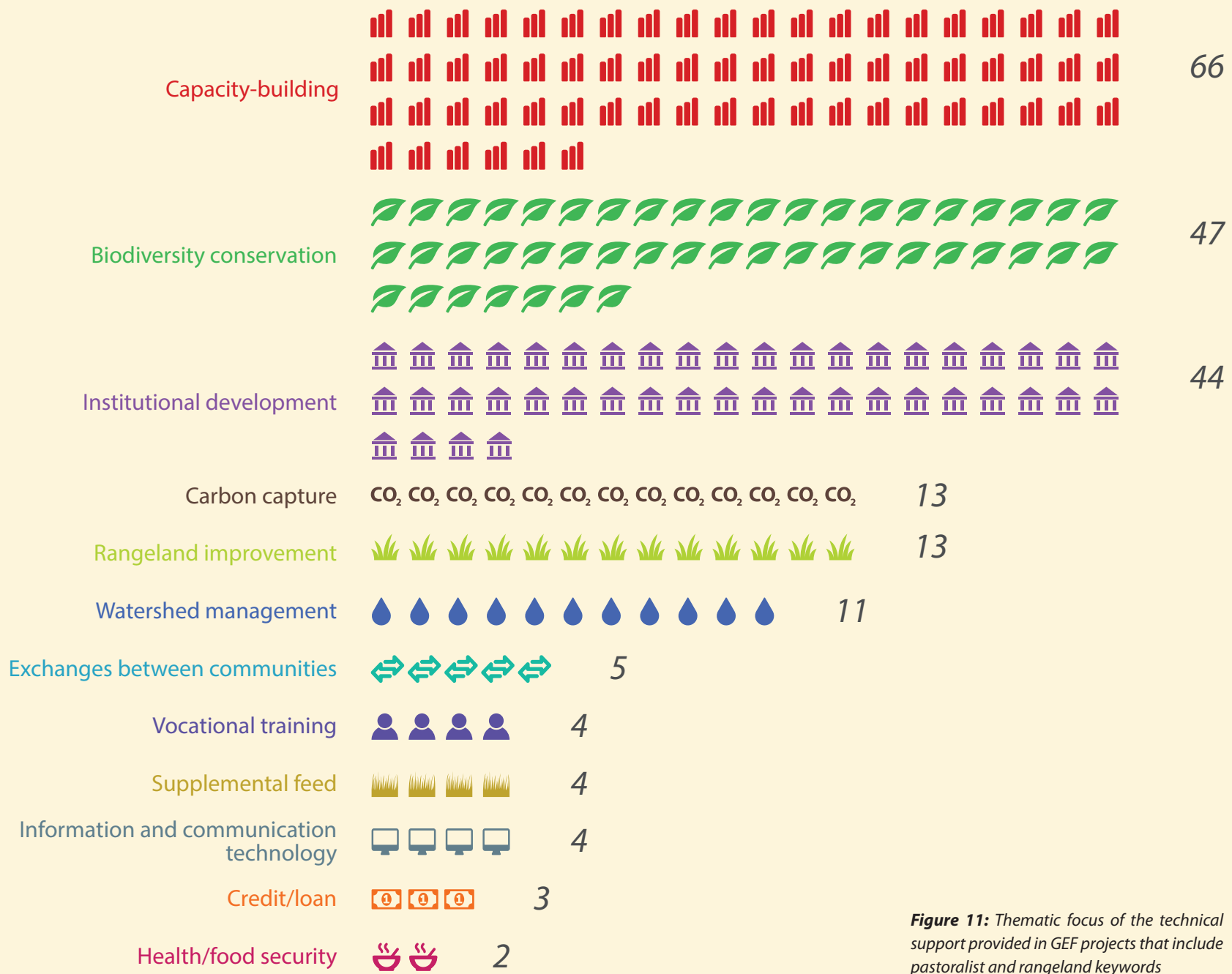


Figure 11: Thematic focus of the technical support provided in GEF projects that include pastoralist and rangeland keywords

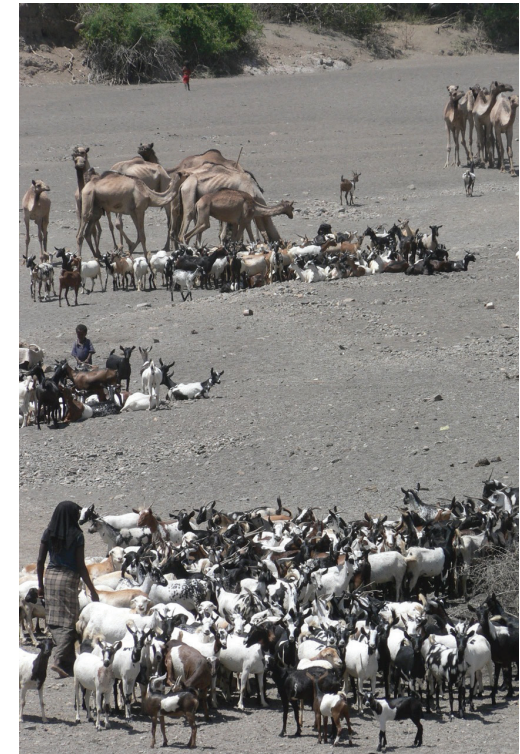
To identify the significance of traditional knowledge (LIKT) within the relevant GEF projects, a further in-depth search was conducted by tracking hits for this metonym within the project documents. Of the 107 approved projects, 52 included the term 'traditional knowledge' or a related keyword (see Figure 10). In most cases, the term is used as a strategic statement to support biodiversity conservation or to improve capacity-building and adaptation management. Specific outputs that reflected LIKT were not found in the project documents, but 2 per cent of the projects were rated as actively engaging in the use or development of LIKT.

The gap analysis also explored the technical support provided by international donors through ODA to help developing countries achieve the MEA goals and action plans. OECD categorizes ODA according to sector. There are two categories directly relevant to pastoralism and rangelands: livestock and livestock/veterinary. However, there is no indication of disaggregation beyond these two sectors, which meant that it was not possible to identify what ODA was allocated specifically to pastoralists and rangelands. OECD cautions against adding figures together across the MEAs due to the risk of double-counting. Nevertheless, Table 2 provides the results of this sampling.

The OECD information suggests that, in 2015, out of approximately \$76 trillion, only \$257 million (0.3 per cent) of ODA was provided for livestock and/or veterinary issues through projects addressing all MEA goals. It is not known what proportion of this was provided for pastoralism and rangelands. Of the portion that covered livestock and/or veterinary issues, 30 per cent (the largest share) was allocated to capacity-building, governance and national reporting, while roughly another 30 per cent was allocated to climate change adaptation issues. Measures to combat desertification received 21 per cent of the funding.

Key messages related to the provision of technical support for pastoralism and rangelands

- There is a large difference in the accessibility of the multilateral organizations' project information and it is difficult to find information on technical support provided for pastoralist and rangeland activities through the organizations' websites.
- Among the GEF projects relevant to pastoralism and/or rangelands, which constituted 1.2 per cent of the entire GEF portfolio, most focused on capacity-building, biodiversity conservation and institutional development.
- Some countries receive substantially more support from the GEF for pastoralism and rangeland issues than others. Sudan received most GEF grants and Africa was the main regional recipient.
- Traditional knowledge is included in half of the relevant GEF projects and is mentioned to a small or medium extent. The term is mostly used in connection with supporting adaptation management to mitigate climate change impacts, improve capacity-building or help conserve biological diversity.
- Development projects typically collect field data, such as population numbers in their target zones, geography and land-use patterns, livestock numbers, etc. However, such data are not readily available on their websites. Future assessments could potentially benefit from such data, especially if they have been vetted and confidence levels are high.
- Participants of the Arendal working meeting noted that there are quite a lot of 'known unknowns'. In other words, long-held biases can influence what information is recorded in project documents. For example, a project to establish or expand



Livestock at watering hole in Afar, Ethiopia. Wolfgang Bayer

a protected area into a rangeland area will not always consider the impact of such an expansion on pastoralists' livelihoods and mobility patterns.

- To fully understand the extent of international development support for pastoralists and rangelands, an exhaustive and complete analysis of all development organizations' project portfolios should be completed, since sampling does not provide a complete picture of the situation.
- Technical support of OECD countries to developing countries for achieving MEA goals appears to have been only 0.3 per cent of total aid in 2015 for livestock and/or veterinary sectors. This figure combines pastoralists and all other livestock raisers.

Academic papers

Observations

The search for pastoralism and rangeland metonyms in Scopus identified only 96,414 records out of a possible 71 million records. There were 79,245 records for rangelands, 19,133 for pastoralism and 1,644 for agropastoralism. A total of 19,626 records included metonyms for pastoralism or agropastoralism, while only 2,658 publications covered both pastoralism and rangelands (see Figure 12).

According to the Scopus search, the publications on pastoralism and rangelands have increased since 1980, with a substantial spike starting in 1995, though it is not clear how much of this is due to a lack of digital publications in the earlier years or a general increase in all academic literature (see Figure 13). For

example, anthropologists have studied pastoralism since the early 1900s. Another interesting trend is the increase in integrated approaches since 2005 (where both pastoralism and rangelands were mentioned in the same publication).

Based on the study's system boundary, an in-depth analysis was carried out on a sample of 2,658 publications covering both pastoralism and rangelands, hereafter referred to as the sample. The number of hits found for different keywords within the sample gives an indication of what subjects are



Sheep on migration along the Conquense Drove Road, Spain. ILC Rangelands Initiative/flickr (CC BY-NC-SA)



Herder boy in Garba Tulla, Kenya. ILRI/Fiona Flintan/flickr (CC BY-NC-SA)

Figure 12: Number of publications in Scopus addressing pastoralism and/or rangelands, published between 2000 and August 2018

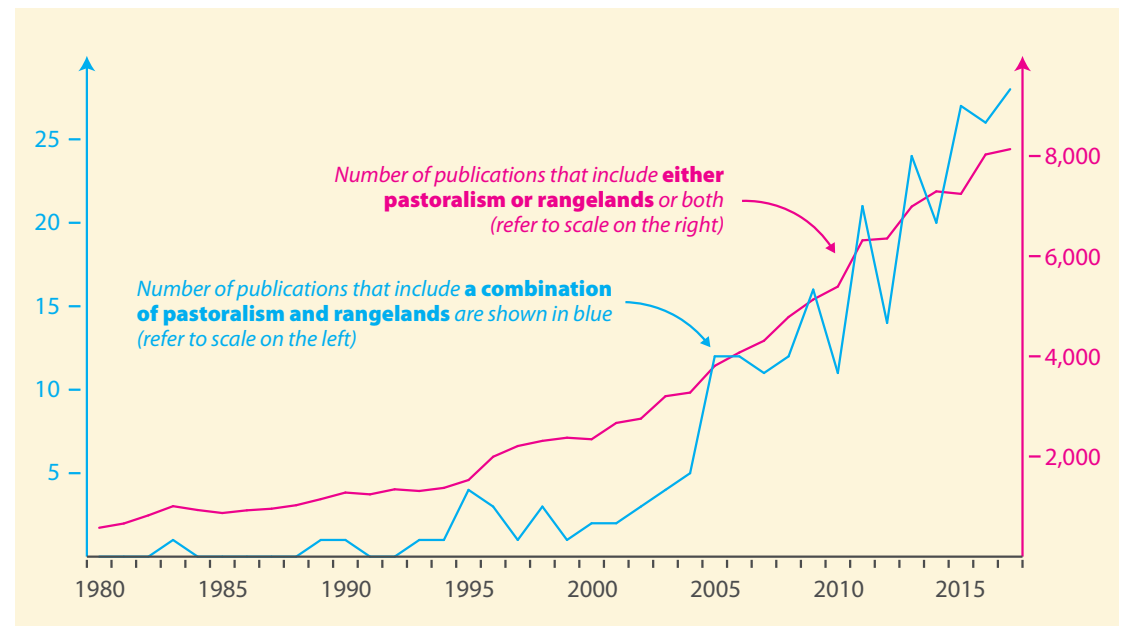


Figure 13: Publications on pastoralism and rangelands in Scopus per year since 1980

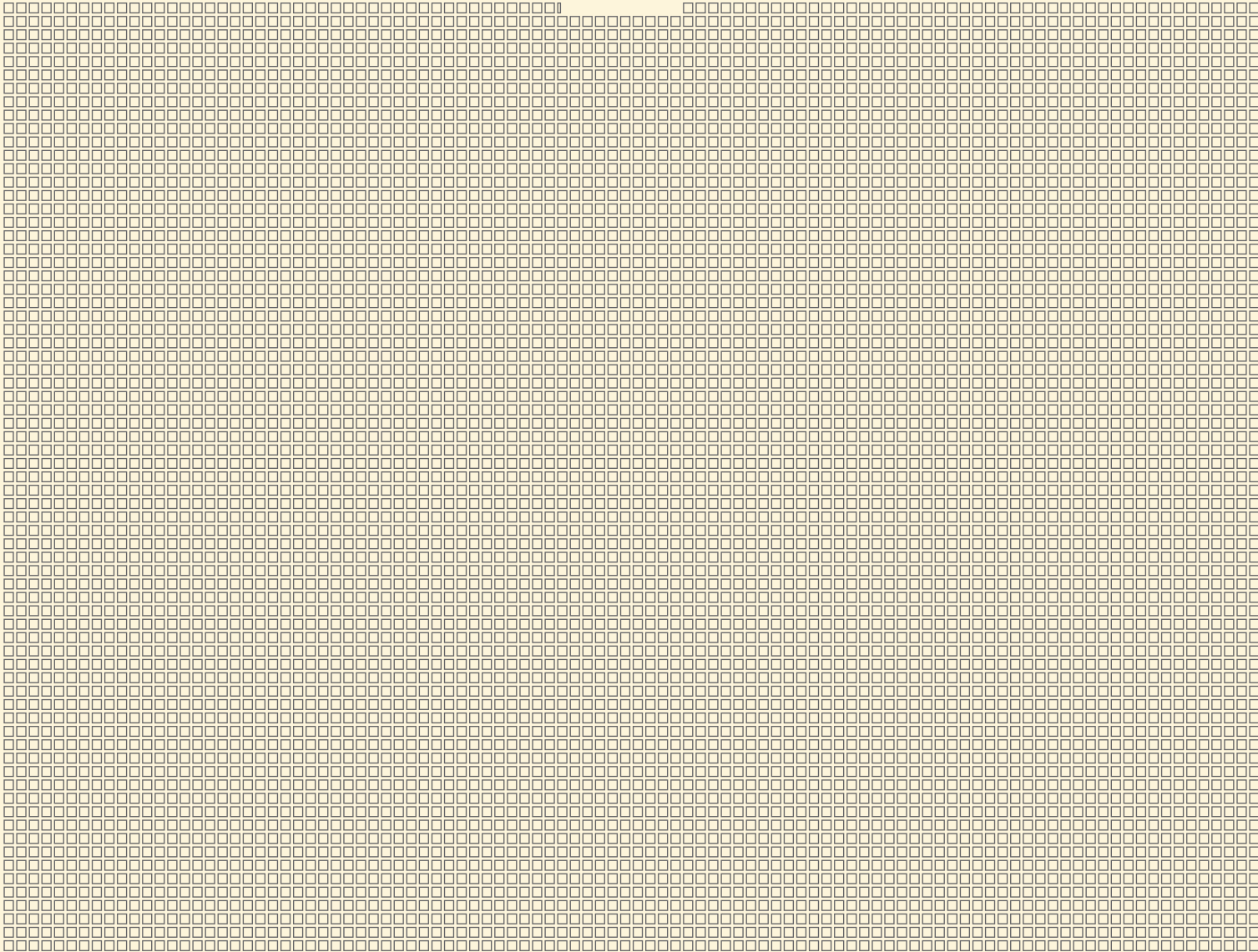
Here are all the academic papers mentioning *rangelands and pastoralism* (2,658)



... here are the papers mentioning *rangelands or pastoralism* (96,414)



... and here are *all the papers* on Scopus with no mention of either rangelands or pastoralism (70,903,586)



given more attention in scientific writing about pastoralism and rangelands (see Figure 14).

When searching for second- and third-tier keywords related to pastoralists' well-being, 'population' was the most popular keyword (610 hits), followed by 'conflict' and 'culture' (166 and 117 hits respectively). The three least popular keywords were 'gender', 'education' and 'participation' (34, 66 and 69 hits respectively).

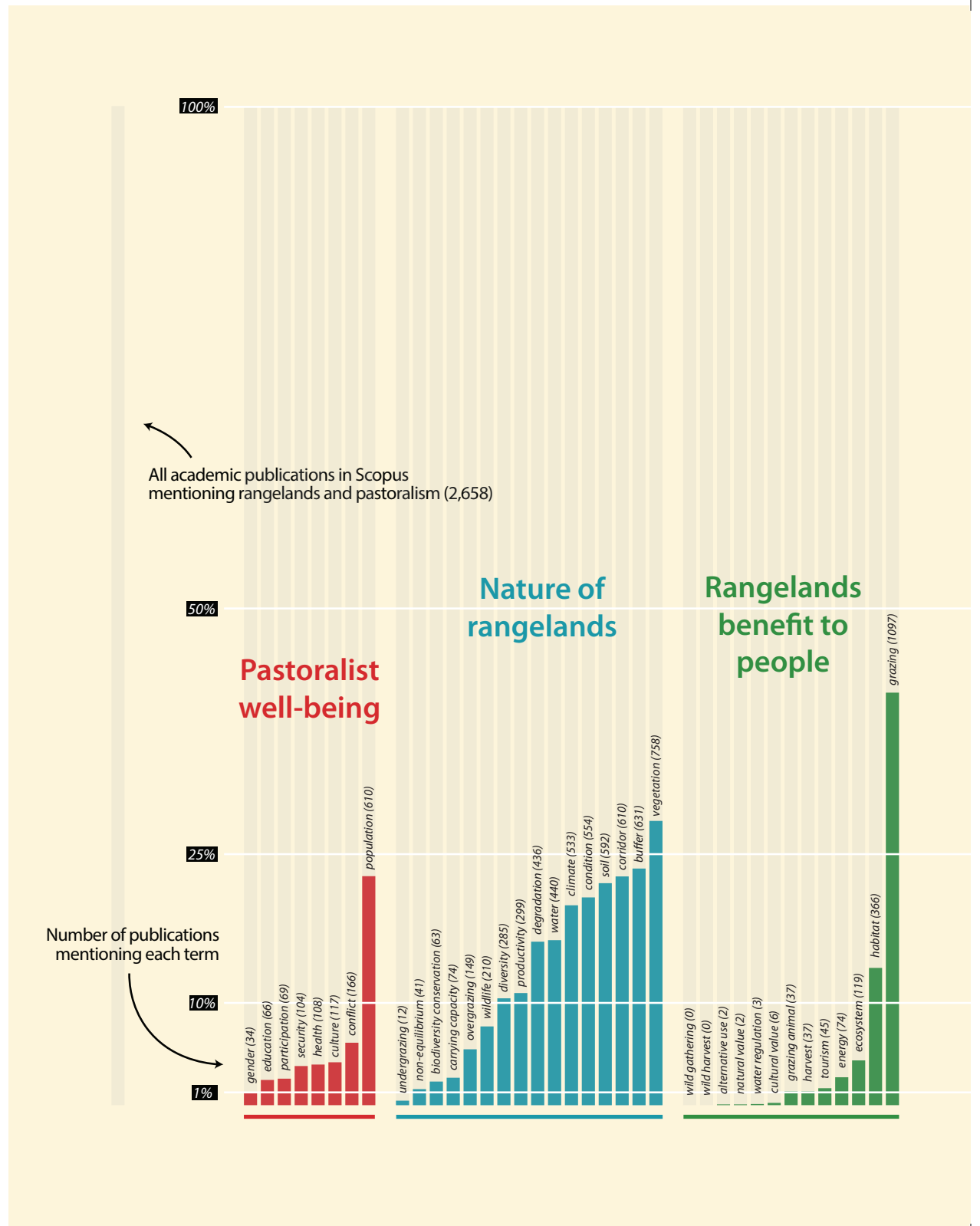
Within the sample, the nature of rangelands was the issue with the highest coverage. The three most popular keywords were 'vegetation', 'buffer' and 'corridor' (758, 631 and 610 hits respectively) and the three least popular keywords were 'undergrazing', 'non-equilibrium/disequilibrium' and 'biodiversity conservation' (12, 41 and 63 hits respectively).

The sample was also examined for terms relating to rangelands benefit to people. Of the keywords searched, 'grazing' (1,097 hits) was the most used independent of subject. Other popular keywords within the sample and related to ecosystem services were 'habitat', 'ecosystem services' and 'energy' (366, 119 and 74 hits respectively). 'Cultural value' had six hits, while 'natural value' had only two hits. There were no hits for 'wild gathering' or 'wild harvest', though 'harvest' had 37 hits.

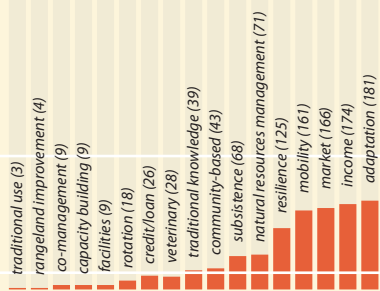
On the subject of pastoralist assets, the most popular keywords were 'adaptation', 'income', 'market' and 'mobility' (181, 174, 166 and 161 hits

Figure 14: Percentage of Scopus publications on pastoralism and rangelands that included second- and third-tier keywords

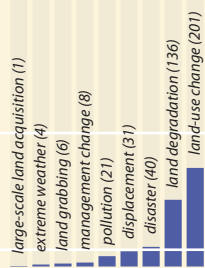
Note: The bars indicate the number of hits found for each keyword and the relative gap between the themes



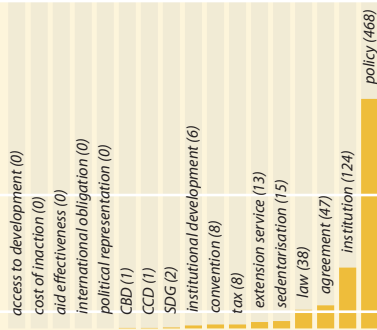
Pastoralist assets



Direct drivers



Indirect drivers



Wind energy for water pumping in Maasailand, Kenya.
Maryam Niamir-Fuller

respectively). 'Resilience' was another popular keyword with 125 hits. Keywords with the least hits on this subject were 'traditional use' and 'rangeland improvement' (three and four hits respectively). 'Co-management', 'capacity-building' and 'facilities' had nine hits each. It should be noted that Scopus searches only indicate the presence of data and not their depth and variety.

Within the sample, the number of publications using terms often associated with the non-equilibrium theory of drylands has generally increased since 2000 (see Figure 15). The terms 'non-equilibrium' or 'disequilibrium' were mentioned 41 times in publications since 2000. The terms 'corridor' (usually associated with livestock movement) and 'buffer' (usually associated with grazing territories between groups of pastoralists) showed a steady increase since 2000. The term 'mobility' also showed an increase albeit a smaller one, while the term 'rotation' showed no significant change over the years.

Searching for the terms 'traditional knowledge' and 'community-based' within the sample returned 39 and 43 publications respectively and revealed an increasing trend in hits since 2000. However, the number of publications was limited to a maximum

of six or seven per year and it seemed that there was poor integration between these notions in academic literature on pastoralism and rangelands. For the terms 'traditional use' and 'co-management', only three and nine publications were identified since 2000.

Keywords related to technical support did not occur often in the sample. Within this subject, 'veterinary', 'credit/loan' and 'extension service' were most frequent (28, 26 and 13 hits respectively). 'Capacity-building', 'institutional development', 'rangeland improvement' and 'technical support' occurred less than 10 times (nine, six, four and four hits respectively), while there were no hits for 'access to development', 'aid effectiveness' or 'cost of inaction'. Except for 'veterinary' and 'credit/loan', most keywords related to provision of technical support

occurred in publications in the later 2000s. Given that the terms 'rangeland productivity', 'rangeland degradation' and 'rangeland condition' had far more hits under the 'nature of rangelands' category (299, 436 and 554 respectively), it can be assumed that earlier publications discussed technical support in some form, but did not label it as such. Furthermore, the topic of credit/loan received much attention in academic publications, though not in the context of technical support in GEF projects. Keyword searches were therefore not the best method for analysing gaps in the provision of technical support. Since technical support forms part of one of the main objectives of this gap analysis, consideration should be given for developing a more suitable analysing methodology in future assessments.

Among the keywords used to examine the topic of direct drivers, the two used most often were 'land-use change' (201 hits) and 'land degradation' (136 hits). 'Disaster', 'displacement' and 'pollution' have 40, 31 and 21 hits, respectively. The least used keywords were 'land grabbing', 'extreme weather' and 'large-scale land acquisition' (six, four and one hits respectively). While the keyword searches in Scopus indicate researchers' level of interest in certain topics, they also indicate how little is known about pastoralism and rangelands. For example, there were 2,363 articles since 2000 on 'land grabbing', an issue that is both new and topical. However, only six of these were about pastoralism and rangelands.

On the subject of indirect drivers, the most used keywords were 'policy' and 'institution' (468 and 124 hits respectively). 'Carrying capacity' (representing the 'old' paradigm of grazing management) had more than twice as many hits as 'non-equilibrium/disequilibrium' (74 and 41 hits). The terms 'agreement' and 'convention' occurred 47 and 8 times respectively, while 'SDG' occurred twice and 'CBD' and 'CCD' only once each. There were no hits for 'international obligation' or 'political representation'.

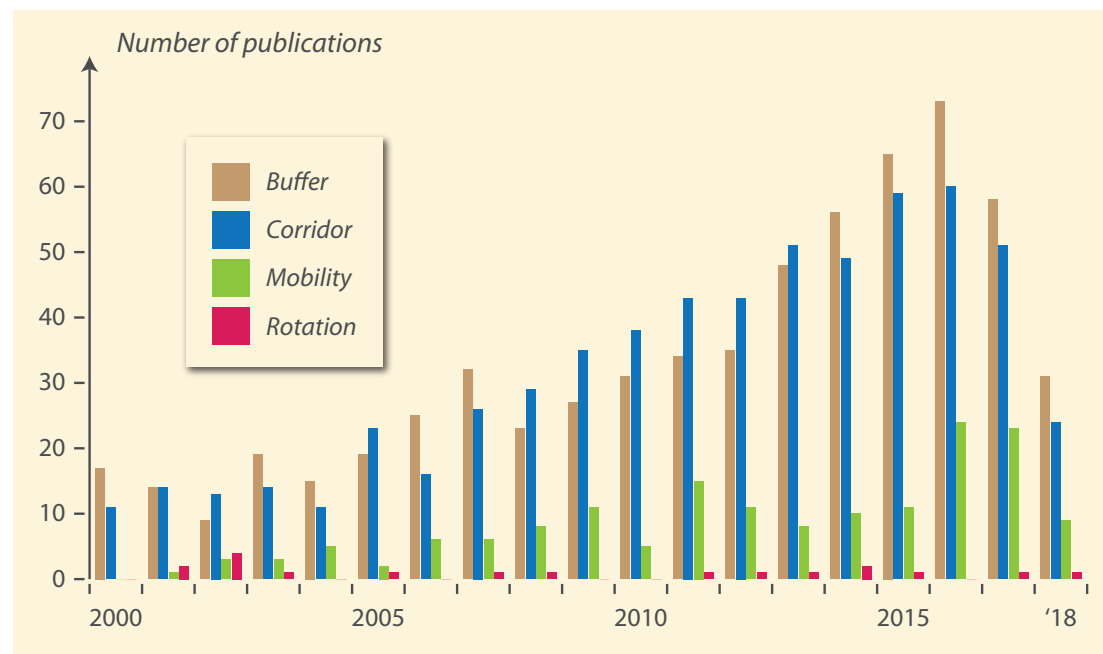


Figure 15: Number of Scopus publications on pastoralism and rangelands with keywords related to non-equilibrium ecology, per publishing year



Masai cattle herding, Masai Mara, Kenya. Peter Prokosch

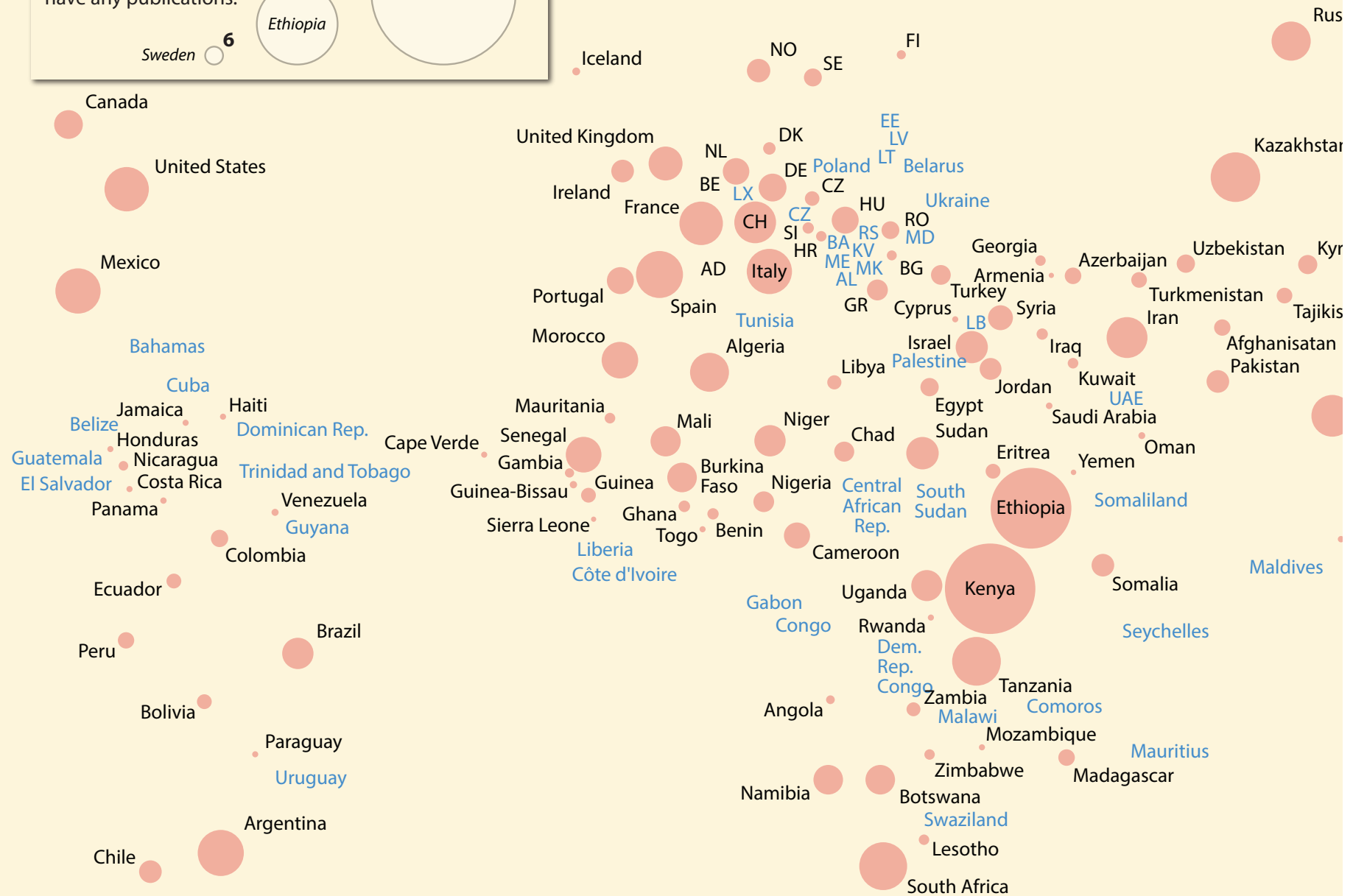
Number of publications on rangelands and pastoralism per country

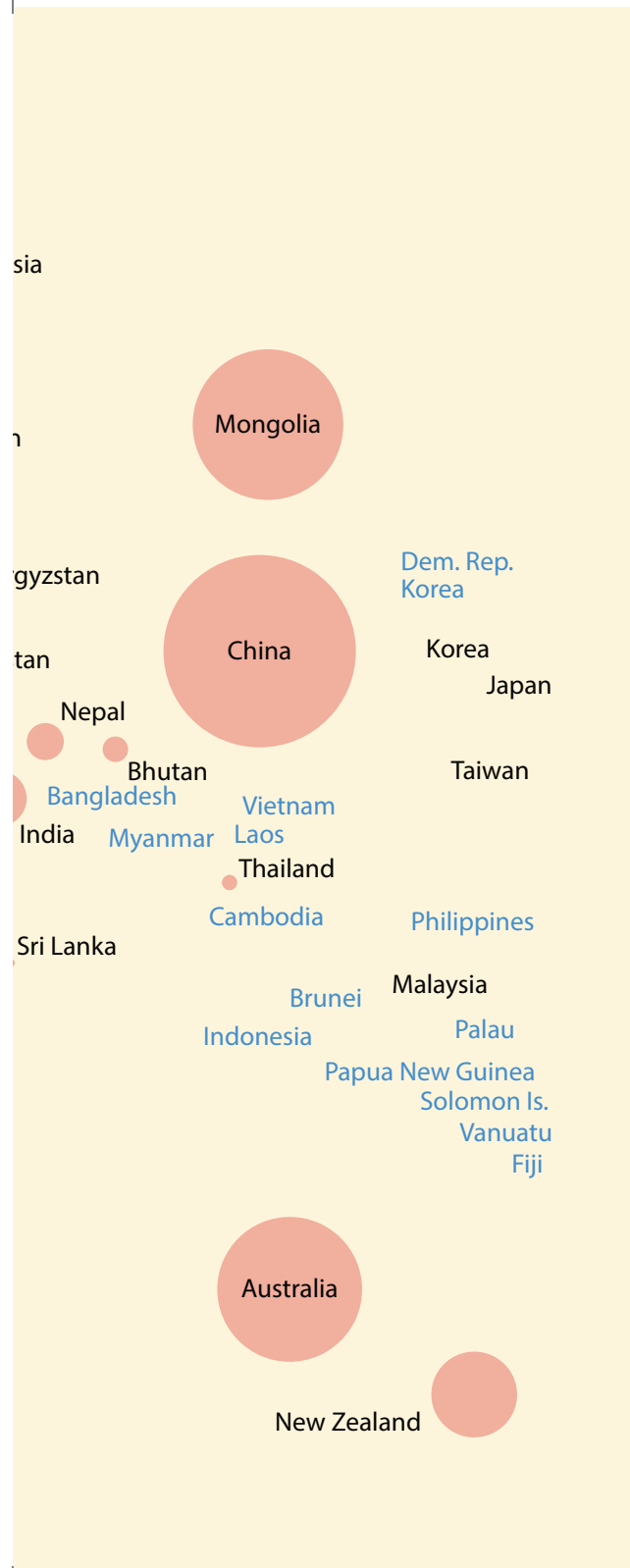
*Countries in blue do not have any publications.

Sweden 6

Ethiopia 128

China 406





The sample was also screened for country names to assess the distribution of geographical focus within the records on pastoralism and rangelands. Most countries were mentioned less than five times, but some countries stood out with more than 100 hits: China (406 hits), Mongolia (246 hits), Australia (224 hits), Kenya (163 hits) and Ethiopia (128 hits) (see Figure 16). A few countries with more than 50 per cent of their land classed as rangelands had no records: the Central African Republic, the Democratic Republic of the Congo, Swaziland (now known as Eswatini), Ivory Coast, Lebanon and Uruguay. The low number of hits for certain countries, such as Canada and the United States, may be due to writing traditions. For example, domestic journals do not always include the name of the country, but refer instead to a state or a region within a state.

Key messages related to the availability of information on pastoralists and rangelands

- More than 96,000 academic peer-reviewed publications have covered pastoralism and/or rangelands since 2000. However, this pales in comparison to the 71 million records published in the same time period.
- There is far more information in academic publications on issues such as grasslands and livestock than specifically on pastoralism and rangelands. Nevertheless, the amount of

information on pastoralism and rangelands has increased considerably since 2000.

- Compared with literature on rangeland issues, there is little coverage of issues related to pastoralism and very few publications cover pastoralism and rangelands in an integrated way. Within all publications about pastoralism and rangelands, the vast majority (82 per cent) include one or several keywords related to rangelands. Only 20 per cent mention keywords related to pastoralism and 3 per cent covered both pastoralism and rangelands issues.
- Keywords that are typically related to natural sciences have more hits than subjects typically related to the social sciences. Furthermore, there appears to be more information regarding basic descriptors (for example, pastoral population, rangeland vegetation, grazing) than there is for more specific issues such as tourism, traditional use or education.
- There were only two hits for SDG (from 2013 and 2017) and one hit each for CBD and CCD (both from 2009).
- There were very few publications related to technical support issues. Of these, most used the terms 'veterinary' and 'credit/loans'. None or very few publications discussed the effectiveness of aid, cost of inaction or rangeland improvements.
- There is a large difference in the coverage of countries in Scopus publications on both pastoralism and rangelands in the few cases where countries were specified. Australia, China, Ethiopia, Kenya and Mongolia had the most coverage, with more than 100 hits in each case. Most countries had only one hit.

Figure 16: Countries mentioned in Scopus publications on pastoralism and rangelands since 2000

Notes: Red circles indicate countries mentioned, with the size reflecting the number of mentions. Blue countries were not mentioned in the sample searched.

Stakeholder survey

Observations

Of the 58 stakeholders that responded to the survey, most (21) were affiliated with a university

or a research institution. Twelve respondents were affiliated with an NGO, eleven were part of a ministry or a government agency and seven were affiliated with a pastoralist organization (see Figure 17).

According to the survey results, the respondents worked with sedentary and semi-nomadic pastoralists more than fully nomadic pastoralists. Most respondents stated that they worked within a single country (30

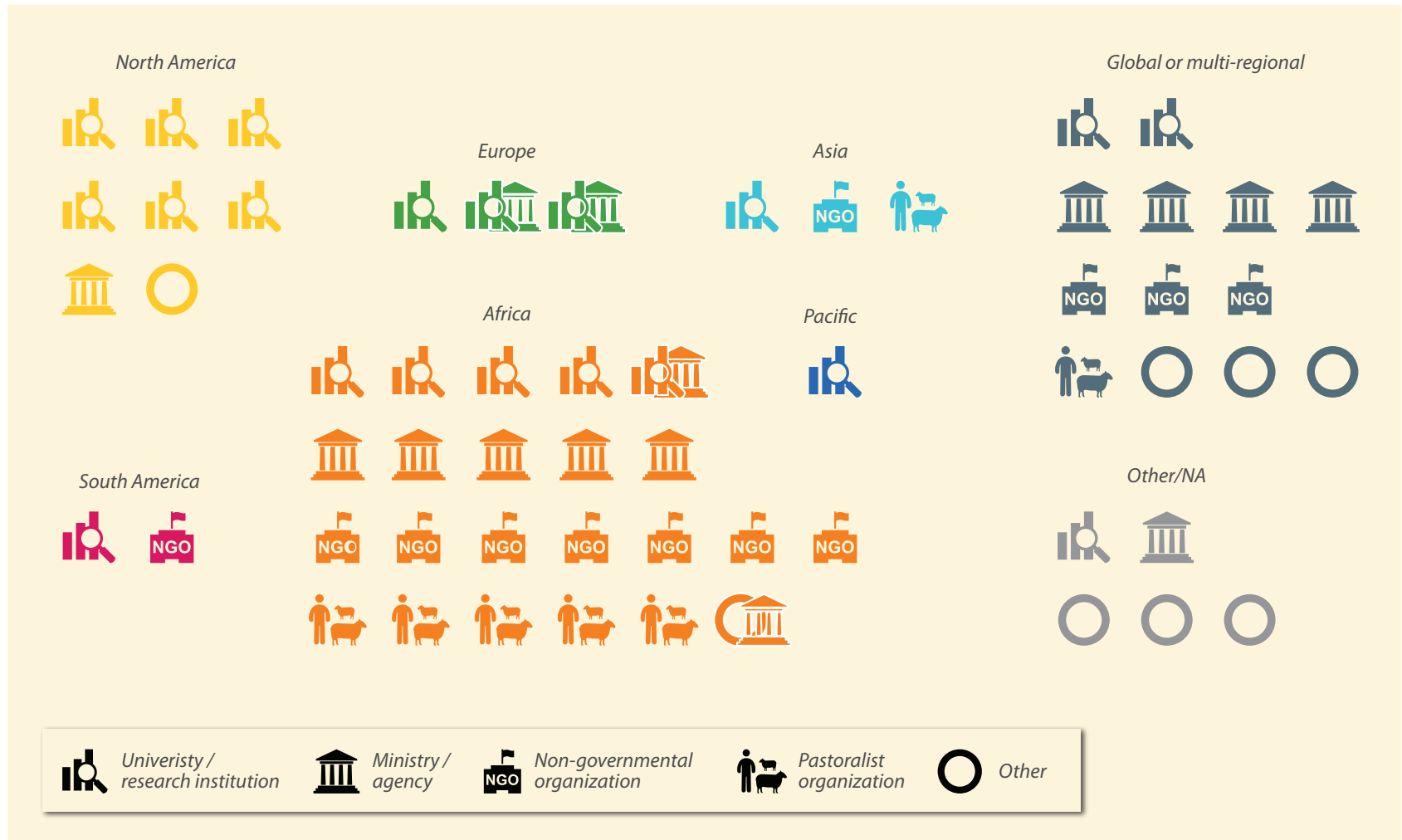


Figure 17: Overview of respondents' affiliation and geographic focus of their work

respondents), with only seven working globally. Most respondents (32) worked in Africa, followed by Asia (14), North America (13) and South America (11). In their work, the respondents noted that they give less attention to Europe (4), the Pacific (4) and the Arctic (1).

Twenty-two respondents collected information on pastoralism and rangelands annually and 10 respondents collected information every two to five years. Only four respondents reported that they never collect such information. The type of information collected is broad, with most respondents collecting information related to pastoral herd structure, livestock numbers and production (see Table 3). Respondents also tended to collect data on issues related to livestock owners, herd structures, livestock production and herding practices. Other popular topics included education, rangeland improvement, the health of rangeland ecosystems and water management.

Many respondents also collected information related to LIKT, markets and livestock health. Less attention was given to the issues of mobility, technical support for pastoralism, participation, gender, youth and elders and pastoralists' health and well-being. Very few collected information related to rights, identity and cultural aspects of pastoralism. However, different results may have been obtained if each respondent had been asked to list the types of information collected themselves, without any prompting from a list included in the questionnaire.

The respondents reported (without any prompting) that they make their information available through different means, such as leaflets, scientific papers, annual reports, online newsletters, websites, public gatherings, radio, television, emails to participants and networks, statistical departments, social media and upon request.

Table 3: Information collected by the survey respondents

Type of information collected	Number of respondents who collects the information
Number of livestock owners, distribution of livestock	40
Education	40
Herd structure and number of animals	38
Rangeland improvement	32
Land-use conflicts	30
Livestock production	30
Health of ecosystems, ecosystem services	28
Herding practices	25
Water management	25
Local and indigenous knowledge and technologies (LIKT)	23
Markets	23
Livestock health	22
Mobility	19
Access to technical support	18
Decision-making, co-management and representation	16
Gender, youth and elders	16
Pastoralists' health and well-being	12
Identity and cultural aspects of pastoralism	8
Rights and Free Prior Informed Consent (FPIC)	7

Note: The topics collected by less than 5 have not been included in the table.

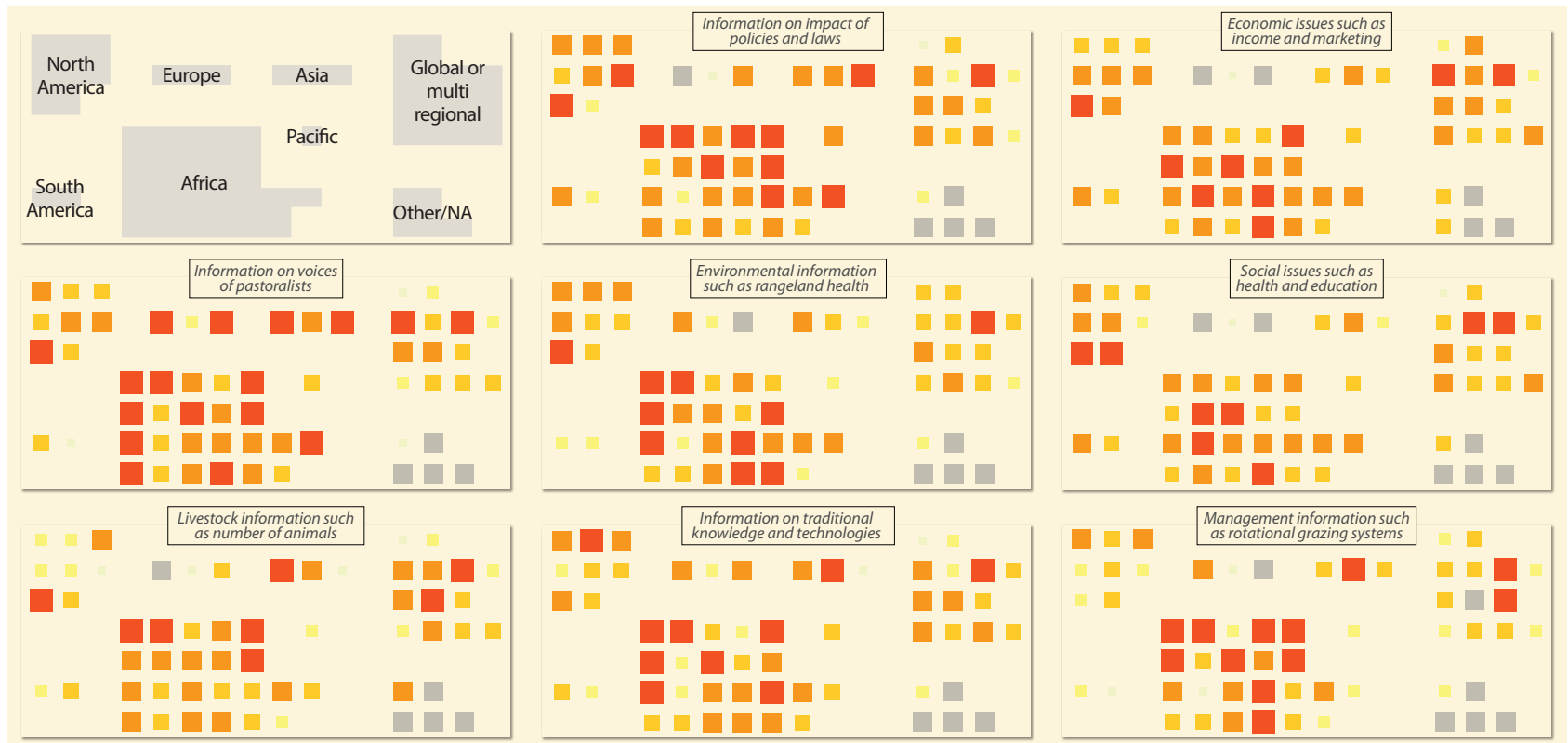
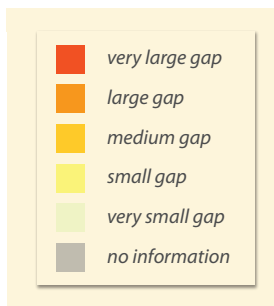


Figure 18: Respondents' assessment of knowledge gaps for given topics



In addition to collecting their own information, 42 respondents also used information of other organizations. The respondents regarded information provided by pastoralist organizations as most relevant and were most confident in the quality of information from this source. Regarding information from community-based organizations and NGOs, the respondents regarded this as highly or very highly relevant and its quality as medium-high. They perceived government and donor information as somewhat relevant, but had less confidence in its quality. The respondents regarded information from the business sector of medium relevance and had medium-low confidence in its quality.

The respondents shared information they had on upcoming assessments, almost all of which were either national (for example, India's Pastoral and Forest Inventory, Lesotho's national rangeland baseline assessment, the United States survey of range and forestry extension personnel) or subnational (for example, annual surveys on rangeland conditions, household wealth and livestock numbers in the South Gobi region of Mongolia). They also noted that some globally relevant tools were being developed, such as the Land Portal and the Pastoral Development Toolkit. Furthermore, they reported that three global integrated assessments were under way: an assessment

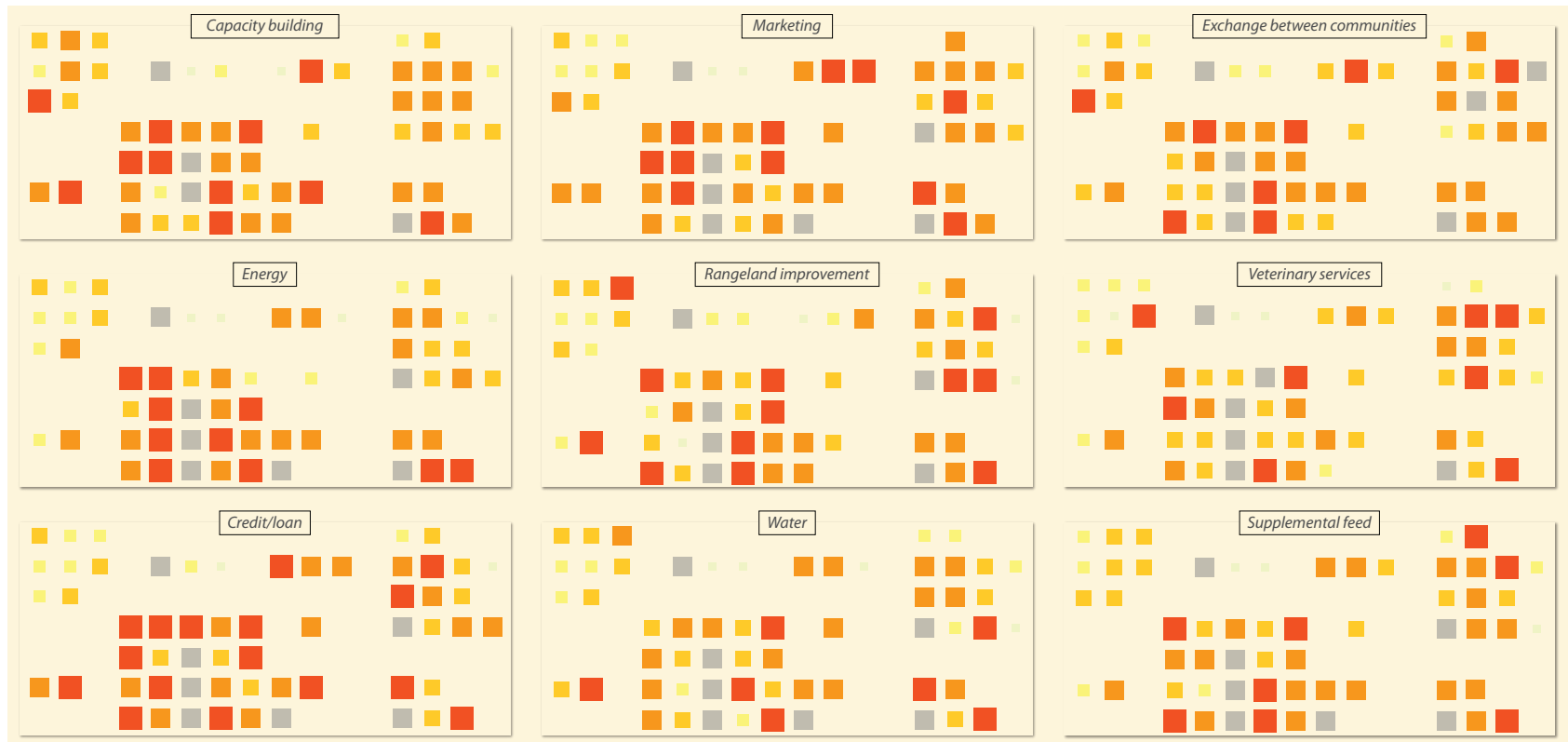
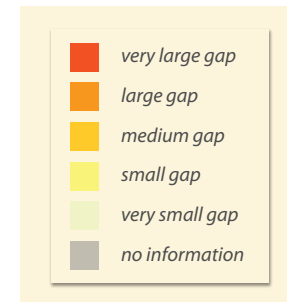


Figure 19: Respondents' assessment of knowledge gaps in the provision of technical support by topic

of conflicts through the International Institute for Environment and Development (IIED), mapping of land-tenure and land-use change in rangelands by the International Land Coalition (ILC) Rangelands Initiative, and a review of transboundary livestock movement agreements and legislations by IUCN.

Respondents were asked to share their perspectives on gaps in information on technical support provided for pastoralism and rangelands. The results showed that there are gaps in all information and support subjects. Many respondents also thought that there were major gaps in the availability of information on

the impact of policies and laws and information on voices of pastoralists (see Figure 18). Interestingly, the latter topic was also rated as having the smallest information gap. There seemed to be consensus that the smallest information gap was for the topic livestock information, such as number of animals. Regarding technical support, the largest gaps were identified within capacity-building and marketing. Large gaps were also identified for rangeland improvement and vocational training. The smallest gaps in technical support were related to the topics of water and exchanges between communities (see Figure 19).



Although certain trends were identified in the survey responses, respondents perceived the information gaps and gaps in technical support very differently. For example, credit/loan was rated as a technical support measure with both the smallest and largest gap, while information on voices of pastoralists was rated as having the smallest and largest information

gap. One reason for this discrepancy may be that the respondents interpreted the questionnaire differently, though it is also likely that they have very different experiences with information and technical support. Since most respondents had a country focus, their responses are most likely based on their local experiences.

The respondents made a number of recommendations, all of which are presented in the [Methodology Report](#). A selection of the recommendations that are most relevant to the gap analysis is available in Box 5.

Box 5: Highlights of the respondents' recommendations most relevant to the gap analysis

The conclusions and recommendations of this gap analysis have been enriched by the opinions of the workshop participants, survey respondents, peer reviewers and Advisory Committee members. Below is an overview of the survey respondents' recommendations.

Recommendations for filling the gaps in information on pastoralists and rangelands:

- Enhance the availability of existing information and increase the awareness of decision makers and the general public on pastoralism and rangeland challenges by encouraging governments to better disaggregate information on pastoralists and rangelands, and requiring all publicly funded projects, research and workshops to make information easily accessible.
- Use the Internet as a means of facilitating information-sharing for all actors through, for example, open-access platforms or mobile phones, or by producing regular information booklets and brochures, and using media (such as social media).

- Broaden the understanding of the natural and cultural value of pastoralism and rangelands, and the effects of environmental change on pastoralist livelihoods to enhance sustainability and resilience, through conducting accurate and up-to-date assessments on rangeland health/conditions and regular targeted surveys on pastoral system diversity, integrating indigenous knowledge, facilitating exchanges of good practices in land use and natural resource management and providing support for postgraduate research.
- Enhance pastoralists' voices by building the capacity of pastoralist communities and organizations to collect, analyse, store and package information on pastoralism and rangeland management.

Recommendations for filling the gaps in the provision of technical support to pastoralists:

- Support all forms of education and capacity-building for pastoralists, including post-secondary education and extension programmes, informal sessions and small practical workshops, exchange programmes, demonstration sites and household demonstrations, inspirational programmes for pastoralist youth, and develop guidelines relevant to pastoralism and livestock mobility.

- Empower pastoralists and ensure their participation through supporting local autonomous institutions run by pastoralists to engage in making laws, policies, programmes and projects relevant to pastoralism.
- Obtain recognition from authorities that positive discrimination is good for achieving real equality – i.e. that extra measures benefiting pastoralists are needed. Provide more long-term support, including donor support, as well as a national helpline or knowledge hub and develop mobile information resource centres. Provide pro bono assistance for managing legal issues, including land titles, make more credit and resources available and raise investments for pastoral livelihoods and rangeland improvements.
- Enhance communication to facilitate development by conducting surveys in villages and in native languages, not online and in English, establish country focal points responsible for translating reports and recommended actions into local languages and facilitating a two-way flow of information, and publish information in magazines, on the radio, and on websites targeting pastoralists.



Micro catchments for watering pastoral livestock in northern Kenya. Maryam Niamir-Fuller

Key messages related to the provision of technical support for and the availability of information on pastoralism and rangelands

The key messages below reflect the perspectives of the 58 respondents to the survey.

- The respondents collect large amounts of data and information, which could be made more available to external users for future use.
- In general, the respondents have the most confidence in information provided by pastoralist organizations.
- There is a general gap in information on technical support.
- The inconsistency in how issues are rated indicates that individuals in different locations experience different gaps and that there are different needs for reducing gaps in information and support. A future assessment could provide local and contextualized information alongside global issues relating to pastoralism and rangelands to present their diversity.
- Judging by the response rate to the questionnaire, an online survey might not be the most efficient way of engaging pastoralist organizations. Any follow-up work to this study should seek to engage pastoralists more directly throughout planning, implementation and evaluation phases, following the example of the Arenal working meeting.



The Amazon burns and cattle graze. Maryam Niamir-Fuller

Conclusion

Availability, accessibility and confidence level of information and data on pastoralism and rangelands

There are far more assessments of forests and croplands than rangelands. In fact, the study team was unable to locate a specific global assessment of rangelands or pastoralism. Almost all of the assessments reviewed use the same sources of information, thus reiterating the same conclusions. Recognizing the need for new data, some of the more recent global assessments have taken innovative approaches and used satellite imagery. However, due to a lack of field verification, confidence in the results of such assessments and their conclusions is relatively low.

The assessments reviewed in this report tend not to provide sufficient detail and disaggregation that could give insight on specific issues related to pastoralists and rangelands. It is important not to aggregate such systems due to the different needs of livestock keepers from those of farmers or forest dwellers, the difference in how land is used and livestock mobility is practised among pastoralist groups, and the different ways in which natural resources are managed and utilized. These assessments often provide valuable information on controversial and current topics, such as enteric carbon emissions from livestock, carbon sequestration from rangelands, the extent of rangeland degradation and its causes, and costs of inaction, though such data are mostly based on scientific research conducted on samples of sites or populations. As the analysis of scientific publications in Scopus confirmed, there are knowledge gaps in geographical and thematic coverage of pastoralists and rangelands. As a result, data, conclusions and recommendations from available information are often very conflicting. This lack of comprehensive

coverage should be addressed at the international level through concerted efforts to collect primary data in order to resolve such confusions and support effective policy decision-making.

In addition to identifying gaps, the reviewed global assessments uncovered the degree to which there is (or is not) agreement among data sets and research results. In many cases, agreement is quite low due to differences in definitions, methodologies and standards used.

Due to resource limitations, the study team was not able to collect and archive an exhaustive list of relevant global assessments. Such an exercise would be important when carrying out a full assessment.

There are indications that some assessments and research at the national or subnational levels on pastoralism and rangelands are being planned or are under way. Three global-scale assessments are also under way: one on conflicts, one on land-tenure and land-use change in rangelands, and one on transboundary livestock movement agreements and legislations. Future assessments will therefore be able to rely on some newly generated information.

The study was unable to find credible and publicly available data on most pastoral and rangeland systems around the world in the sampled assessments, data sets, websites, project documents and academic publications. Data on the number of pastoralist populations worldwide and comparable geospatial information, including global maps, are

severely lacking, especially when compared with similar information on forests or croplands. The study identified several global maps of pastoralism and rangelands, mostly produced by scientific and academic researchers. However, according to their authors, there is a low level of confidence in the information these provide due to a lack of sufficient field data and differences in terminology. Disaggregation of data is very poor, with data generally available for livestock production but no other socioeconomic and ecological issues related to pastoralism and rangelands. There are 'known unknowns' and biases that influence the type of information and data recorded and stored in project documents, databases and assessments. Developed countries are able to benefit from long-established monitoring platforms on rangelands (for example, the Bureau of Land Management in the United States), but similar disaggregated information on pastoralists and rangelands developing countries is more difficult to locate.

Information from academic studies and projects is available but is not very comprehensive, and some developing countries are far more informed than others. Only around half of the multilateral organizations surveyed provide an open project database with a range of information, such as objectives, budget, targeted countries or regions of their projects.

Overall, the level of confidence in the data of the sources reviewed for this study is medium, with a few notable exceptions that have protocols and



Ranchers herd cattle on healthy rangeland next to overgrazed land, Colorado, USA. Natural Resources Conservation Service (NRCS), United States Department of Agriculture

procedures in place for verifying information. In most cases, however, information on pastoralism and rangelands may be grossly inaccurate, which could lead to poor decisions or panic about the severity of a crisis. For example, inaccurate data on rangeland degradation could cause governments to blame and dismantle traditionally sustainable pastoral systems, or in other words, 'fix' something that is not broken.

This low level of confidence is due to a lack of verification and disaggregation of data. In contrast, survey respondents had more confidence in information provided by pastoralists and their organizations than most other data sources, though this information is not readily accessible.

While the methodology adopted for this study allowed for an understanding of the extent to which pastoralism and rangelands are covered in assessments, databases and academic publications, it was only about to provide some indications as to what the thematic gaps might be for these topics. These can be summarized as follows:

- There is far less information on pastoralists and rangelands than crop farmers or woodlands. Of the information that is available, most is descriptive (such as number of livestock and area under permanent pasture). There are even larger gaps on deeper issues, such as access to education, participation, livestock mobility, rangeland health and livestock insurance, among others, that would be needed to inform decision-making.
- In general, there are more information gaps in socioeconomic issues related to pastoralism than in biophysical issues related to rangelands. Very little reliable information exists on the number of pastoralists. Information on rangeland area is mostly collected through satellite or remote sensing methods.
- There are large information gaps in thematic topics that are considered specifically challenging for remote and mobile populations, such as the provision of education and health services, participation in local representation and national politics, alternative livelihoods, access to development, the provision of facilities and infrastructure, and livestock mobility within a country or across borders, among others.
- Recent topics important to pastoralism and rangelands are covered less than 'conventional' topics. For example, as the Scopus search shows, the undergrazing (thought to be one cause of rangeland degradation) is covered much less than overgrazing. Although much attention is being paid to land-use change (especially conversion of rangelands to crop farming or protected areas), less attention is focused on land grabbing or large-scale land acquisitions that dispossess pastoralists. There is relatively little coverage of non-equilibrium solutions for grazing management, though this appears to be increasing.
- Two recent topics – namely conflict and adaptation to climate change – are covered relatively more than other topics as they are issues of global interest. These could therefore serve as a vehicle to better mainstream information and data on pastoralists and rangelands into government data and decision-making.

- There are large information gaps in the understanding or cataloguing of LIKT among pastoralists. Gender issues are covered relatively less than other issues.
- While there is considerable focus on land degradation, rangeland conditions and productivity, there is less coverage of specific issues such as pollution, disasters, displacements and management change.
- Academic publications provide more coverage of policies that affect pastoralists and rangelands than other topics. However, some specific policy issues, such as taxation and sedentarization, are covered less (the latter may have been covered more in the pre-2000 period).

Some countries have important information on pastoralism and rangelands, even if it is substantially less than information on forests or croplands. However, it is impossible to ascertain whether there are countries with absolutely no information. The Scopus search suggests that there may be some countries that have not benefited from peer-reviewed publications, but this may indicate a lack of accessibility (language, grey literature) rather than availability. Furthermore, there are at least some forms of data available for every rangeland country, even if they are not fully disaggregated. For example, even if FAO data on livestock are not disaggregated fully among pastoralists and non-pastoralists, it is fair to assume that for countries where pastoralism contributes 70–80 per cent of agricultural GDP (such as Mongolia and Sudan), livestock data will largely be about pastoralism. The importance of adequate disaggregation and increasing accessibility to information should not be understated.

Current innovations and paradigm changes are generally not reflected in the information available in databases, assessments and project



Summer camp of the Dukha reindeer herders, East Taiga, Mongolia. Lawrence Hislop/GRID-Arendal

documents. For example, recent scientific research on non-equilibrium ecosystems, benefits of livestock mobility to ecosystems, economic valuation of environmental benefits, and impacts of the Internet and telecommunications on pastoral systems are not reflected or captured. However, these have been increasingly covered in scientific publications since 2000 and could be addressed in policy briefs and grey literature. However, the fact that these issues are primarily covered in academic publications and less in global assessments, databases and development projects means that such concepts may have a reduced impact on decision- and policymaking. Future assessments should design a strategic approach that bridges the old and new paradigms.

There are some opportunities where existing information could be enhanced. For example, the level of disaggregation of multilateral organizations' data sets directly relates to the level of disaggregation of statistics at the national level. At present, such disaggregation seems to be very low for pastoralists and rangelands. To enhance data availability, governments could improve their data collection by disaggregating using targeted indicators. Similarly, the review of project documents indicates that a development project infrastructure is a potentially important means for data collection (for example, through their baseline studies and monitoring/evaluation exercises) and that this information could be made more accessible to the public.

Information on the provision of technical support

Information on what type of technical support is provided to pastoralists was difficult to obtain. The main tool for collecting this information was the survey, supplemented by a screening of keywords in Scopus and within GEF projects, an analysis of OECD Development Assistance Committee data and discussions during the Arendal working meeting. There was a relatively low level of response to the questionnaire (58 respondents), which focused on international donor support. However, national governments and local organizations also give considerable technical support through projects, programmes, subsidies, extension services and more. Any future assessment should include such sources in its methodology.

The coverage of technical support to pastoralists and rangelands in scientific publications is low compared with other topics in publications on pastoralists and rangelands in the same period. Although the study was not able to conduct an exhaustive survey of

all donor support to pastoralism, the results of the GEF portfolio sampling show that direct support to pastoralists and rangelands is only 2 per cent of available funding, with most of this focused on capacity-building and governance issues. ODA sampling shows that the portion provided for the livestock sector is marginal compared with other sectors and is not commensurate with the estimated importance of the sector in the world economy (see Table 2). It is difficult to determine what portion of this ODA reaches pastoralists and rangelands due to a lack of disaggregated data.

Much of the technical support provided through GEF projects focuses on capacity-building and institutional development, with biodiversity conservation, rangeland improvements and watershed management moderately covered. Gaps were found in less conventional areas, for example, in community exchanges or the provision of credit and

loans to pastoralists. It is interesting to note, however, that the issue of credit/loan receives moderately high attention in academic publications.

Survey respondents had largely differing views on what should be priority topics for technical support. However, in general, their recommendations focused on: capacity-building and pastoralist education, empowerment and pastoralist participation, provision of mobile services, financial and legal support, and rangeland improvements. Some survey respondents from developing countries recommended a positive discrimination approach so that pastoralists (and rangelands), which have long been neglected, would receive a much fairer share of development assistance. Respondents from developed countries did not think that the provision of technical support to pastoralists was a priority for their countries.

Crop farmers and pastoralists face many similar challenges in developing countries and programmes for technical support should therefore be continued. However, the needs of mobile pastoralists are often different and the challenges they face in engaging with the modern world, such as obtaining a niche in export markets or having the collateral for credit and loans for investment purposes, could be daunting (McGahey et al. 2014).

Analysing gaps in technical support requires a different methodology than that used for analysing gaps in information and knowledge. The two issues should therefore be decoupled in the future. The results of this study show that there is a large difference in how the respondents perceive gaps in the provision of technical support for pastoralism and rangelands. A full assessment should consider the vast diversity of challenges faced by pastoralists and rangelands worldwide.



Reindeer herding, Finnmark, Norway. Lawrence Hislop/GRID-Arendal

Challenges and opportunities for filling information gaps

The gap analysis selected a large number of keywords that best described the scope of issues to be reviewed, totalling 48 different first-tier synonyms and metonyms for pastoralists and rangelands, 38 second-tier keywords and 462 third-tier keywords.¹⁰ Although such a large number of keywords was a useful method for conducting fast online, automated searches in assessments and databases, it would not be suitable for other means of data collection, such as field data or country statistics. Any future assessment should therefore be more selective in how it defines its system boundary and scope, though this may reduce the integrative, holistic nature of the assessment.

The majority of online, publicly available databases and assessments screened used secondary sources of information, thus reiterating what had already been published. The collection of science-based and accurate field data is crucial in the subject areas identified, in order to fill knowledge gaps and update information as socioeconomic and environmental systems rapidly change. Few data sets were found that had relevant, verified, primary data and statistics on pastoralism and rangelands. Such data sets may not be available to the public, may be held by individual researchers and organizations or may be accessible only through partnerships. While the study team is confident in the methodology used for identifying first-tier keywords in different data sources (that is, the pastoralism and rangeland metonyms), it is less so for the more specific second- and third-tier keywords.

The immense diversity in methodology, data storage, terms and definitions means that information from different sources (and over time) is barely comparable.

10. Due to the general disaggregation of information on pastoralists and rangelands in the sources reviewed for this study, third-tier keywords were of limited use.

Language differences, ambiguity of terms used and a lack of disaggregated data pose challenges for any assessment. The subject matter (pastoralists and rangelands) is far less studied than other subjects (for example, forests) and has been discussed much less in international environmental arenas (for example, among the multilateral conventions, protocols and targets screened, only the SDGs specifically mention pastoralists). Due to the high diversity of definitions and linguistic nuances, the task of building global consensus on terms and definitions and fitting this to existing information may not be achievable in the near future. However, it should be possible to build a lexicon of related and comparable terms (semantic ontology), thus allowing for improved communication and data comparisons.

Key reviewers from developed countries note the de-emphasis of the value of rangelands (sometimes called the “forgotten rangelands”) as a further gap,

resulting in a loss of resources to study, protect or even monitor rangelands at a time when climate change is increasing the need to understand this. This is shown by the closure of research facilities, reduction or loss of university departments and faculties, and non-replacement of experts as retirements occur.

Stakeholders expressed highly diverse opinions in the survey, with some holding extreme and opposing views on gaps in information and technical support for sustainable pastoralism and rangelands. This is not surprising given the geographical differences, diversity and ambiguity in terminology, general lack of data availability and insufficient national or international dialogue space on pastoralists and rangelands. While this diversity can be seen as a challenge in communicating future needs for filling information gaps, it should also be seen as an opportunity for engaging a diverse set of stakeholders into the process.



Kudu and cattle co-existing on the outskirts of Nairobi National Park, Kenya. Maryam Niamir-Fuller

Local, indigenous and traditional knowledge and technology

The study found that there was a lack of documentation on LIKT in the databases, assessments, academic papers and projects screened. However, there is high recognition of the value of such knowledge to development work, investments and empowerment activities, as evidenced by the survey respondents and to a lesser degree the project analysis. Thus, any future assessment should ensure the full participation of pastoralists and their member organizations so that local, indigenous and tradition knowledge, information and technology are available to the assessment.

The study sought the views and participation of pastoralists in the design, data-collection and final review stages of the report. Through the assistance of the Advisory Board and the International Support Group for the IYRP, the study was able to develop the most comprehensive list of regional pastoralist organizations to date.¹¹ However, the study faced some challenges in achieving full participation of pastoralists, including: inadequate representation of pastoralists and their own organizations in international platforms; young and developing

pastoralist organizations struggling to achieve full legitimacy and internal cohesion were unable to furnish the required information or data; language difficulties; and non-responsiveness of some pastoralist organizations, likely due to a lack of understanding of the study's objectives, or a lack of time and resources. The study was not able to seek out national and local pastoralist organizations, due to a lack of resources to overcome language and communication challenges. However, this should be an important aspect of any future assessment.

11. An overview of the regional pastoralist organizations is presented in a separate [Methodology Report](#).



*Goats, Turkey.
Engin Yilmaz/Yolda Initiative*

Recommendations

Conduct an intergovernmental, integrated global assessment

Provide sufficient funding and resources to address information gaps on pastoralists and rangelands through an intergovernmental, multi-year, integrated global assessment, which is participatory and addresses terminology for a common understanding on pastoralism and rangelands.

- Provide sufficient funding and resources for an intergovernmental, science-based, multi-year, holistic, participatory, integrated global assessment of pastoralism and rangelands that covers socioeconomic and biophysical issues, how the pastoral systems interact with other parts of society, as well as past trends and future scenarios. Update the global assessment regularly.
- Ensure that the integrated global assessment covers all the descriptive and thematic gaps identified in this study. In particular, descriptive information on the extent of land considered rangelands and on populations and communities considered pastoralist is a vital first step, as is the trend in these figures over time.
- Ensure that the integrated global assessment can collect verifiable and high-quality new and existing data and information (including primary field data) on the gaps identified, such as gender issues, incorporating new paradigms, traditional knowledge and innovative thinking. It is recommended that the gaps in information be closed through a combination of remotely sensed data and local-level data collection. Furthermore, the data collected should respond to indicators used by pastoralists when assessing the land.
- Ensure that the integrated global assessment is consistent and comparable in terms of definitions, methodologies and mapping protocols, by being sensitive to the ambiguity and regional and geographical differences in terminology, and using a semantic ontology. In this way, the global assessment can lay the basis for harmonizing data-collection and monitoring on pastoralism and rangelands worldwide.
- Ensure that governments provide direct access to existing local and national statistics and primary data on pastoralists and rangelands to the integrated global assessment in order to help disaggregate existing data wherever possible.
- Provide sufficient funding, time and resources for the integrated global assessment to address the methodological and preparatory challenges identified in the gap analysis, such as the inclusion of indigenous and local pastoralists in a participatory international process for developing a lexicon of related and comparable terms (semantic ontology), the participatory selection of the most appropriate system boundary, scope and methodology, and the establishment of bilateral partnerships for accessing data not freely available online.
- Provide sufficient funding, time and resources for the integrated global assessment to directly access local and national government statistics (including translation), to access grey literature and local and traditional knowledge and technology (LIKT), to collect new primary field data on areas and themes with gaps as identified in this report, and to analyse the impact of national government policies and subsidies on pastoralists and rangelands.

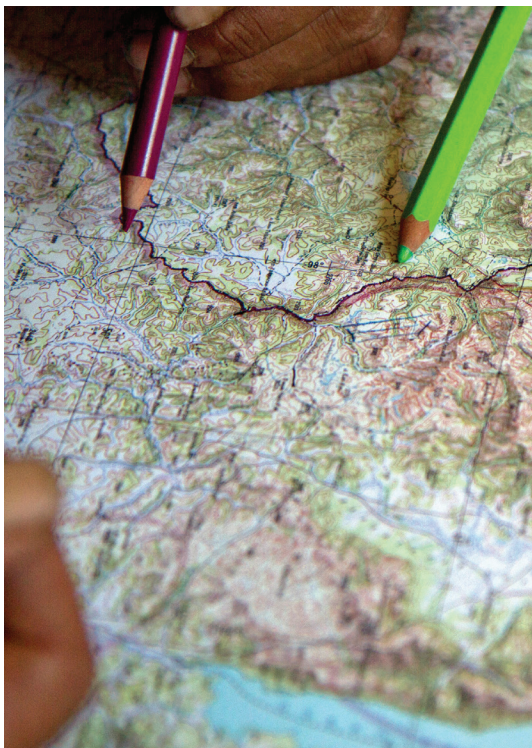


Herders drawing water for livestock in Niger. Wolfgang Bayer

Enhance the availability and quality of existing information

Develop national and international information systems to enhance the availability and quality of existing information on pastoralists and rangelands, and include pastoralists' knowledge to understand the specifics of and dynamics between pastoralism and rangelands.

- Ensure that consistent efforts are made to disaggregate government data on pastoralists and rangelands and that governments, all publicly funded projects, NGOs and research institutions



Participatory mapping session with reindeer herders in Tsagaanuur, Mongolia. Riccardo Pravettoni/GRID-Arendal

provide access to verifiable, disaggregated data and information on pastoralists and rangelands, including data obtained through baseline and monitoring/evaluation studies from development projects and pastoral knowledge of indigenous species and changes in rangeland ecosystems.

- Encourage the development of accurate maps of rangelands and pastoral land use that are regularly updated to better assist decision-making.
- Regularly conduct assessments on the impact of government policies, laws and regulations on pastoralism and rangelands, especially those that are new or have been.
- Ensure that government statistics on pastoralists and rangelands cover issues of global concern, such as conflict and human security, adaptation to climate change and large-scale land acquisition. New technologies, such as satellite imagery, will facilitate future monitoring of rangelands.
- Encourage pastoralist organizations and NGOs that work with them to document data and information on pastoralists and rangelands, including population size, land area in use and LIKT, and make these available.
- Encourage one or two global institutions to establish a comprehensive information repository on pastoralism and rangelands with an agreed set of global indicators, ensuring that the information included is based on the common definitions and is highly accessible, available, comparable and reliable.



Participatory mapping session with reindeer herders in Tsagaanuur, Mongolia. Lawrence Hislop/GRID-Arendal



Broaden the understanding of pastoralism and the value of rangelands

Increase funding and resources for participatory research on pastoralism and rangelands, and ensure that 'non-typical' topics are addressed.

- Increase funding and resources for participatory research on pastoralism and rangelands, especially in developing countries and areas where data and information are lacking, through regular surveys and statistical collection, in-depth research studies, frequent analysis of remotely sensed data, and interregional exchanges.
- Ensure that parties collect and share data and information on non-typical topics, such as rangeland mobility, vocational and practical education, investments, pastoralist women and youth, covering both developing and developed countries.
- Encourage researchers to visit and engage directly in discussions with pastoralist communities on issues related to pastoralism and rangelands. Convene events that bring together pastoralists, researchers, governments and NGOs to broaden understanding and develop a consensus on strategic approaches, priority strategies and policies for data collection and management, comparable and consistent methodologies for sharing information and data. Consider follow-up activities or action plans and appropriate international protocols where relevant.
- Encourage all relevant international environmental agreements, protocols and conventions, as well as other relevant international agreements, to explicitly address the issues of sustainable pastoralism and rangeland health as relevant to their goals and obligations.



Wildlife-rich rangelands in Kenya. LRI/Dave Elsworth/flickr (CC BY-NC-SA)



Prescribed burning for natural regeneration of fodder and reduction of forest fires, Ferlo, Senegal. Maryam Niamir-Fuller

Conduct a detailed assessment of the provision of technical support to pastoralists

Develop a suitable methodology and assess the extent to which technical support provided to pastoralists is based on identified needs and interests.

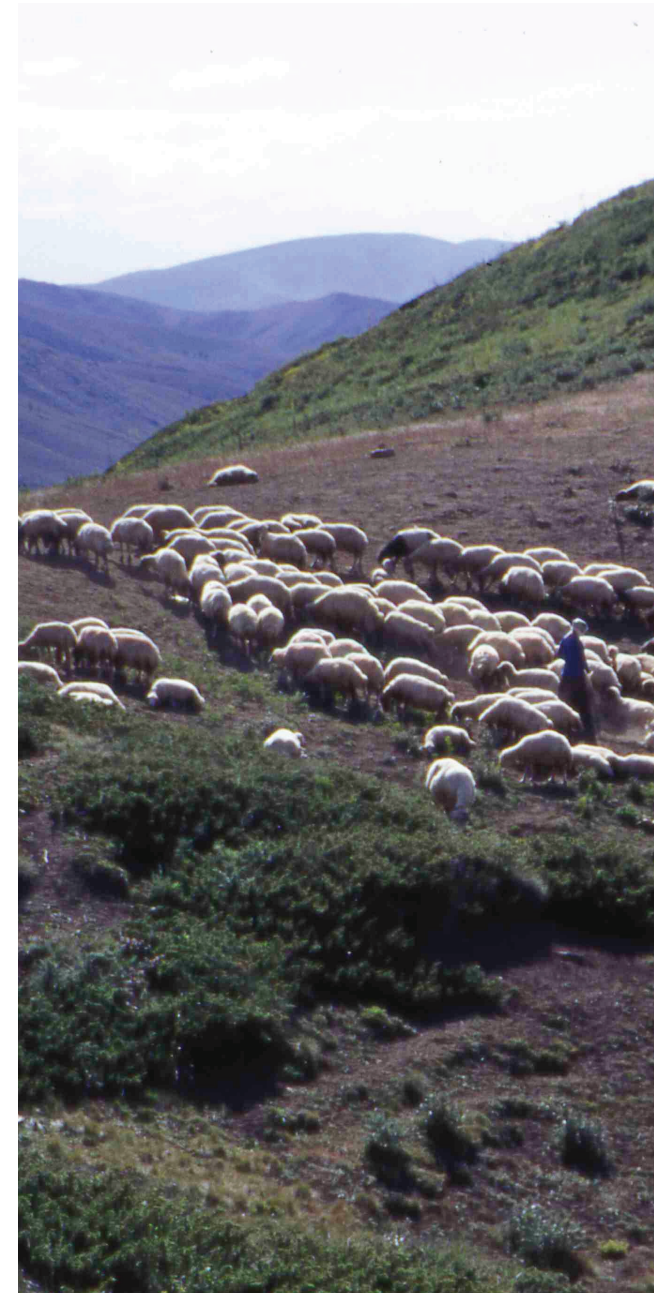
- Establish the system boundary (thematic scope) for a gap analysis on the technical support provided by Member States before beginning the assessment, drawing on stakeholders' views expressed in the survey for this study.

- Ensure that the assessment of technical support includes both developed and developing countries, by extending the scope to include national universities, research institutions and government extension agencies focusing on community development.

- In its methodology, an assessment of technical support to pastoralists should cover financial support not only from international donors, but also from national governments and local organizations.



Nomadic pastoralists winter range, Turkey. Engin Yilmaz/Yolda Initiative



Transhumant sheep flock of Kurds in Turkey. Wolfgang Bayer



Involve pastoralists in all assessments and information gathering

Engage pastoralists and pastoralist CSOs in global assessments to ensure the appropriate inclusion of LIKT and effective representation of different pastoralist constituencies.

- Strengthen LIKT and the capacity of existing pastoralist organizations (that have access to the Internet) and NGOs working with pastoralists throughout the assessment process, and focus on empowering pastoralist communities to speak and act for themselves, taking gender, youth and traditional knowledge into account.
- Build on the list of regional pastoralist organizations to develop a comprehensive global list including national and local organizations, and create constituencies through these networks that can be closely involved in the global assessment.
- Conduct new peer-reviewed scientific research in collaboration with pastoralists, local extension agents, livestock organizations and other pastoralism- and rangeland-related actors.



Nomadic pastoralists women, Turkey. Engin Yilmaz/Yolda Initiative



Reindeer herding, Finnmark, Norway. Lawrence Hislop/GRID-Arendal

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Pastoralism is practiced by millions of people worldwide. It has roots in every part of the world and back thousands of years to the beginning of agriculture. But while pastoral societies have existed for millennia, we still don't know that much about the interlinkages between pastoral practices and the rangelands these depend upon. It's as if they are invisible in a lot of research about the global environment. There are many questions we cannot answer today with confidence because of widespread gaps in understanding rangelands and pastoralists. Yet, the answers to these questions have profound implications for national and global policy – and influence on how we will deal with climate change.

