HOMING IN ON THE RANGE: Enabling Investments for Sustainable Land Management

Technical Brief 29/01/2015

IUCN Global Drylands Initiative

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Jonathan Davies*, Claire Ogali*, Peter Laban** and Graciela Metternicht***

* Global Drylands Initiative, IUCN
** Drylands Working Group, IUCN Commission on Ecosystem Management
*** UNSW Australia, Institute of Environmental Studies.

Citation: Davies J., Ogali C., Laban P. and Metternicht G., 2015. *HOMING IN ON THE RANGE: Enabling Investments for Sustainable Land Management.* Technical Brief 29/01/2015. Nairobi: IUCN and CEM. vi+23p

ISBN:

Cover photo: Agdal in Morocco - Credit: Pablo Dominguez

Design & layout: Gordon Arara (IUCN Publications Unit, Nairobi)

Available from: IUCN, the International Union for Conservation of Nature
Global Drylands Initiative (GDI)
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For more information, please visit: http://www.iucn.org/about/union/commissions/cem/

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Acknowledgements

The authors would like to acknowledge the inputs and insights shared by numerous organisations and individuals from the WISP global network that were consulted during this study. Particular thanks to Andreas Wilkes, Fawn Jackson, Guy Beaufoy, Jean-Pierre Biber and Jabier Ruiz Mirazo for taking the time to share detailed information regarding particular case studies or national contexts. We are also thankful for considerable insights shared by pastoralist leaders and civil society organisations at a global pastoralist gathering entitled "Pastoralism for a Sustainable Future: From representation to action", held in Kiserian, Kenya, 9th – 15th December 2013. We thank the following experts and colleagues who invested significant time and effort in reviewing and commenting on drafts of this report: Pablo Manzano (IUCN-WISP); Edmund Barrow (IUCN); Ced Hesse (IIED); Antonio Rota (IFAD); Caterina Batello (FAO) and from UNEP: Elizabeth Migongo-Bake, Maryam Niamir-Fuller, Magda Nassef, Salma Hussain, Edoardo Zandri, and Laetitia Zobel. The work nevertheless reflects the views of the authors and is not the official position of the supporting institutions.

Acronyms

CBNRM .... Community Based Natural Resource Management
CEM..... IUCN Commission on Ecosystem Management
DLDD..... Desertification, Land Degradation and Drought
GDI ..... IUCN Global Drylands Initiative
IUCN..... The International Union for Conservation of Nature
LDN ..... Land Degradation Neutrality
PES..... Payment for Ecosystem Services
SLM ..... Sustainable Land Management
SRM..... Sustainable Rangeland Management
UNCCD..... United Nations Conventions to Combat Desertification
UN ..... United Nations

Summary

Rangelands are places of important biodiversity and ecosystem services that occupy up to half of all land and up to three quarters of the world's drylands, providing benefits to local communities, to economies and to global society. Desertification, or land degradation in the drylands, significantly affects rangelands, but in many countries measures to address rangeland degradation are weak or absent. Furthermore, evidence on the current health of rangelands is absent in most countries and this is contributing to inappropriate investments and policies that in turn can lead to desertification and poverty.

Sustainably managed rangelands provide a wide range of goods and services and sustainable rangeland development must be based on harnessing this diversity rather than intensive investment in single goods. Economic valuations demonstrate the high value of rangeland ecosystem services like water cycling, carbon sequestration and sedimentation control, and indicate where investments are likely to have the greatest aggregate return.

Sustainable management of rangelands requires innovative solutions both to manage the high levels of climatic risk that are experienced there and to address the many other unique features of dryland ecology. Such innovations are often found in customary management practices, but often these practices have been undermined by development and policy interventions. Re-enabling customary practices and supporting them to develop in a modern economy is central to sustainable rangeland management. Local institutions are vital for rangeland development and effective solutions tend to be grounded in improvements in local governance and communal resource rights.

This approach to Sustainable Rangeland Management requires a rethinking of orthodox investment paradigms, and the role of the private sector. Rangeland managers already invest heavily in terms of labour and social capital to produce a wide array of environmental and economic benefits; new investments should be responsive to these existing investments and the risk-management strategies of rangeland managers. More insight is needed into investment options and investor groups to determine where appropriate solutions are likely to come from, what enabling conditions are needed for improved investment, and safeguards that need to be in place.

Priorities for intervention include:

- Strengthening communal management of rangeland resources;
- Improving local decision making in the rangelands;
- Improving the use of science-based evidence in targeting policy and investment;
- Generating willingness to address sustainable development concerns in the rangelands;
- Leveraging appropriate investments in sustainable rangelands management;
- Emphasising policy implementation and monitoring and evaluating policy effectiveness.

Considering the importance of rangelands within the drylands, progress towards a Land Degradation Neutral world will only be possible if major attention is now given to this globally important biome, and if investments and policies are oriented towards supporting locally generated solutions.

SUSTAINABLE DRYLAND MANAGEMENT: The Case of the World's Rangelands

Throughout the history of humanity rangelands have inspired and sustained great societies. Rangelands are challenging and often highly unpredictable environments in which both nature and human societies have evolved, leading to unique biological and cultural diversity. This diversity in the rangelands is part of our global heritage and contributes to a variety of goods, services and knowledge that are of benefit to the rest of the world. Yet in recent history rangelands have suffered from poor understanding of these adaptations and many efforts have been made to develop rangelands as if they were like other regions, leading in many cases to degradation, poverty and conflict.

Land Degradation in the Drylands, otherwise known as Desertification, is a major global environmental and developmental concern; yet in current discourse on combatting desertification many countries pay minimal attention to the rangelands. The majority of rangelands—some three quarters—are drylands and the majority of drylands—some two thirds—are rangelands. In this Technical Brief we focus on the intersection of drylands and rangelands to examine major knowledge, investment and policy gaps in achieving the objectives of the United Nations Convention to Combat Desertification. This Technical Brief examines the current discourse on desertification, the shortcomings in relation to rangelands, drivers of degradation in the rangelands, and proven options for more sustainable rangelands development. This Brief in particular demonstrates the potential synergy between Sustainable Land Management practices and the halting of land degradation, conservation of biodiversity and ecosystem services, and climate change adaptation and mitigation.

THE WORLD'S DRYLANDS: A Unique Natural Capital

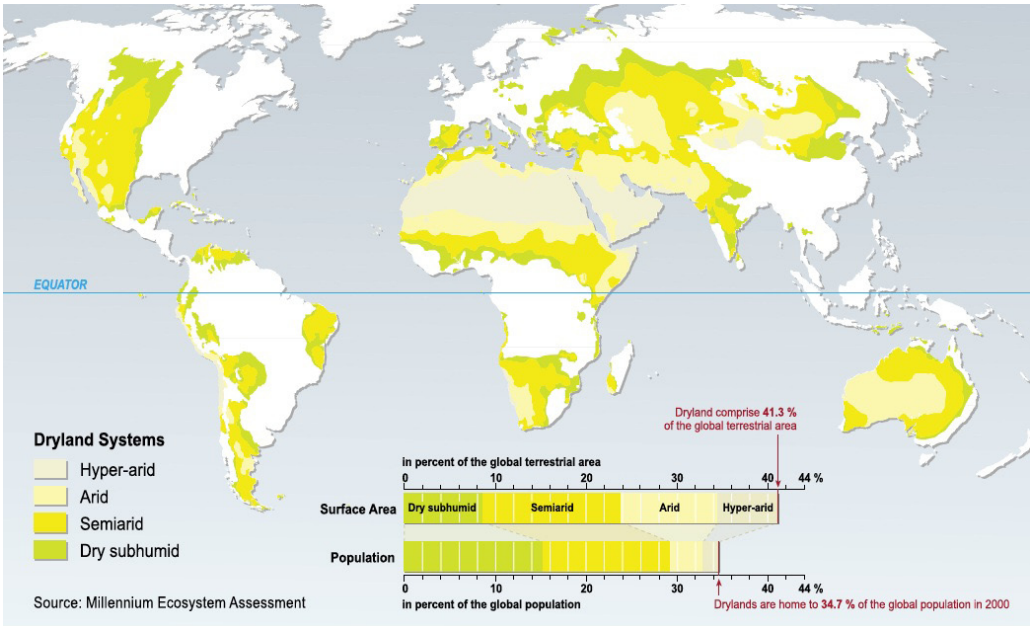

Figure 1: Map of the World's Drylands.

Drylands encompass some of the world's most important land use systems and a significant proportion of biodiversity. They provide 44% of the world's cultivated systems, 50% of the world's livestock[1], and contain a variety of important habitats for vegetable species, fruit trees and micro-organisms[2]. They host some of the most unique biologically and culturally diverse habitats on the planet and feature high levels of species endemism. Drylands contain 28% of all surface cover of Alliance for Zero Extinction sites; these are sites supporting the last remaining populations of Endangered or Critically Endangered species, as listed on the IUCN Red List. They hold 30% of the total area of sites of important biodiversity, 35% of the global Biodiversity Hotspot Area and 28% of the total area of World Heritage Sites (Davies *et al*., 2012). Drylands include many unique ecosystems, like East Africa's mist oases and cloud forests, the Californian Chaparral, the Cape Floristic Kingdom, Madagascar's spiny desert, and the Brazilian Cerrado: ecosystems that are home to some of the world's most iconic species and most treasured natural heritage.

Drylands are tropical and temperate areas with an aridity index of less than 0.65 that collectively comprise nearly half of the land mass: 41.3% of the earth surface. About 72% of drylands occur in developing countries and this proportion increases with aridity: almost 100% of all hyper-arid lands are in the developing world (Safriel *et al* 2005). Drylands can be classified into four categories based on precipitation: dry sub-humid, semi-arid, arid, and hyper-arid lands (Figure 1). Within these four subtypes land use is significantly influenced by rainfall, with crop production declining rapidly with increasing aridity (Figure 2).

1 http://www.unccd.int/Lists/SiteDocumentLibrary/WDCD/DLDD%20Facts.pdf
2 http://www.fao.org/fileadmin/user_upload/newsroom/docs/i0372e01.pdf

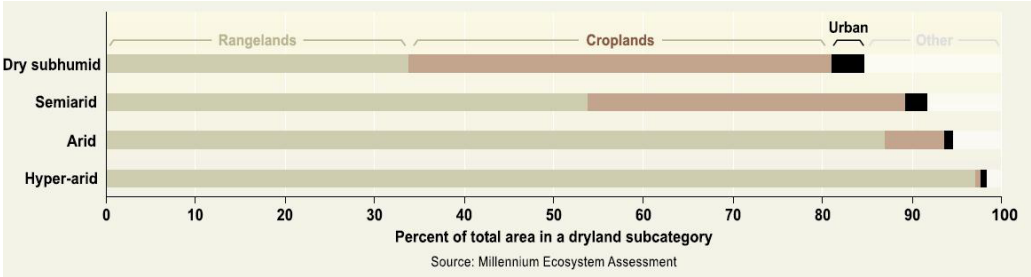

Figure 2: Land uses by dryland category (MEA, 2005).

Moreover, drylands are home to a third of all humanity (about 2.5 billion people) with the majority of these people living in developing countries. Many drylands are therefore associated with poverty, for example having high levels of adult female illiteracy and child mortality (Middleton *et al*., 2011). Dryland inhabitants are often marginalised from development and policy processes, as well as political discourses, and in many countries dryland peoples have for long been denied sustainable development and related appropriate investments. This has contributed to entrenching a profound misunderstanding of drylands environments, leading to inappropriate and even detrimental interventions (Mortimore *et al*. 2009).

Rangelands

As Figure 2 shows, rangelands dominate the drylands covering between two thirds and three quarters of all the area (MEA 2005; Neely *et al*. 2009). There is considerable disagreement over how rangelands should be defined which leads to divergent estimates of their extent, but according to the World Resources Institute (1986) rangelands cover 51% of the total land area of the world[i]. This shows that rangelands are not confined only to drylands, but the majority of rangelands are in drylands and the majority of drylands are rangelands.

The term rangeland can be confusing as it is both an ecological and social construct. As an ecological construct the term relates to rangeland ecosystems which can be defined as "land on which the indigenous vegetation (climax or sub-climax) is predominantly grasses, grass-like plants, forbs or shrubs that are grazed or have the potential to be grazed, and which is used as a natural ecosystem for the production of grazing livestock and wildlife" (Allen *et al*., 2011). Rangelands can also be more broadly defined as "land carrying nature or semi-natural vegetation which provides habitat suitable for herds of wild or domestic ungulates (Pratt, Greenway and Gwynne, 1966). Rangelands can include annual and perennial grasslands, shrub and dry woodlands, savannah, tundra, and desert: also here the term rangeland is an ecological construct. The Society for Range Management has produced a world map of rangelands (Figure 3) based on major forms of plant growth, assigning eco-regions to the

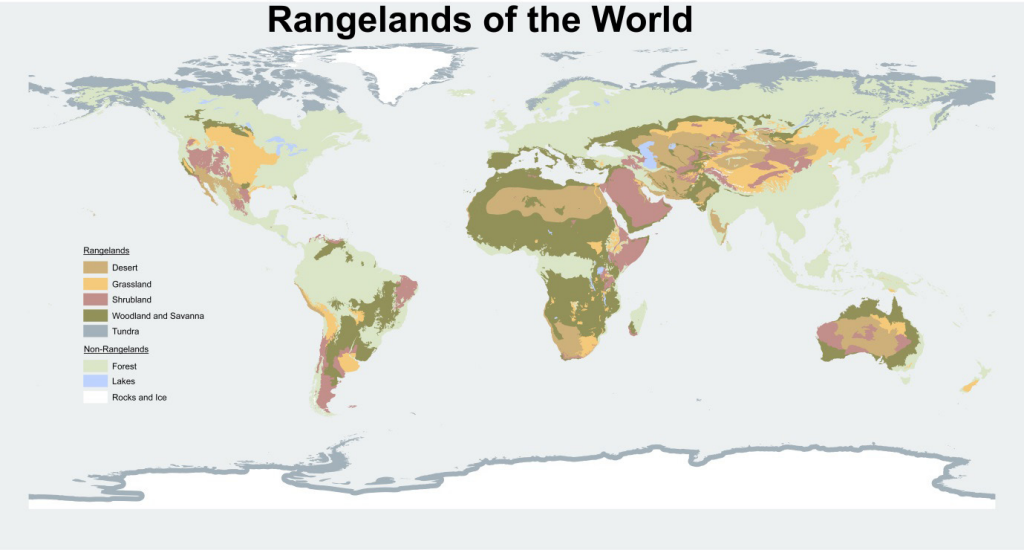

Figure 3: Map of the world's rangelands (Society for Range Management[ii])

following **rangeland categories**: Desert; Grassland; Shrubland; Woodland and Savannah; and Tundra.

At another level the term rangeland refers to the management unit – a socio-political construct, which may contain a great diversity of other ecosystem elements and areas suitable for other uses like cultivation. Some of these elements may not be classified as rangeland ecosystems; for example oasis ecosystems, wetlands, riparian forests, woodland patches, areas of "rich patch" vegetation, and higher altitude forests (e.g. mist or alpine forests). Yet these resources within rangeland landscapes are often critical—sometimes seasonally essential—to the functioning of the rangeland management units and the associated livelihoods.

Land Degradation in the Rangelands

Desertification is defined as land degradation in drylands[iii] (and hence in the dry rangelands) and has been described as "the greatest environmental challenge of our time" and "a threat to global wellbeing"[iv]. A growing number of countries are voicing concerns about the combined challenges of Desertification, Land Degradation and Drought (DLDD), particularly in Africa where food security challenges may be greatest and therefore land degradation represents a particularly alarming risk[v].

Land degradation translates into *a persistent reduction of biological and economic productivity*, making it a global challenge that affects millions of citizens in both developed and less developed countries (Adeel *et al*., 2005, p. 4-5). Land degradation decreases global food yields, contributes to climate change and natural hazards like droughts and floods, and causes losses of biodiversity and ecosystem services like water provision. An estimated 20 million hectares of fertile land become degraded each year and in the next quarter of a century global food production could fall by up to 12%, pushing up food prices by up to a third[vi]. Rising food prices have been identified as a significant trigger of conflict in the Middle East and North Africa and are likely to increasingly result in social unrest globally (Lagi *et al*., 2011). Globally the cost of deforestation and land degradation is estimated at up to €1.5-3.4 trillion or 3.3 % –7.5 % of the global GDP in 2008 (TEEB, 2008).

Land degradation processes in rangelands however are poorly understood and the shortcomings in knowledge have contributed to poorly-informed interventions: policies and investments that have targeted sustainable management but have instead contributed to degradation (Davies *et al*., 2010). The bedrock of ecological science has long been the Clementsian model of plant succession, in which an ecological community progresses inexorably towards a climax equilibrium state, or is held back from that state through human intervention (such as ploughing or grazing) and maintained at a lower state of equilibrium (Clements, 1916). A counter theory emerged in the 1980s that portrayed rangelands as in a state of non-equilibrium. Rangeland vegetation and ecological communities respond in complex ways to different pressures, including grazing, drought and fire. The responses are not always linear or reversible and rangelands can exist in distinct ecological states, transitioning between states according to different pressures. This is known as the state-and-transition model and has been posited as an alternative to the rangeland succession model (Westoby *et al*., 1989).

Land degradation and land scarcity

As land becomes scarcer its value rises, leading to speculation and accumulation of land assets in fewer hands, often with negative consequences for the poorest people and the poorest countries. This is a major reason for the land acquisitions and "land grabbing" by richer and more powerful countries and people, and the food industry: following the 2008 food crisis between 15 and 20 million hectares of farmland in developing countries are reported to have changed hands. With growing global wealth and demand for food, land degradation is contributing to food insecurity, with a global population of 842 million people who are currently undernourished. Land degradation is not only a problem for the poorest countries; many of the world's industrialised or rapidly emerging economies face major land degradation problems and increasing constraints to feed their people. Indeed, these are also the countries that have responded by acquiring productive land in Africa, effectively outsourcing food production to countries with lower purchasing power and weaker property rights and hence putting here sustainability of land use and livelihoods at stake (von Braun and Meinzen-Dick, 2009).

The Global Extent of Land Degradation

Measurement of the actual extent of land degradation is notoriously uncertain, with estimates ranging from 15% to 63% of all land (Safriel, 2007). Some of the differences in estimates can be explained by the divergent perceptions of what constitutes degraded land and how it can be measured. For example, deforestation can be considered as land degradation when including the forest vegetation mass and ecosystem as part of the land. Yet the cleared land, often used for crop farming, can, in specific cases, be managed sustainably and maintained in a new steady state, albeit with lost hydrological functions, biodiversity and carbon sequestration capacity.

A global analysis of the period 1981-2003 using remotely-sensed data showed that 24% of the land area has been degrading. However, this analysis only showed vegetation changes during the monitored period and makes no assessments of what the authors call "the legacy of thousands of years of mismanagement in some long-settled areas". The analysis revealed that cropland and forest land were overly represented: 19% of degrading land is cropland even though cropland only accounts for 12% of the land area and a further 4% in mosaics; 43% of degrading land is forest even though forest occupies only 28% of the land. The analysis found that drylands did not feature strongly in on-going land degradation: 78% of degradation by area is in humid regions whereas 22% was in drylands (Bai *et al*., 2008).

Although rangelands can be stable in different states, those states are not necessarily desirable, but they can be highly resilient to change. Bush encroachment for example often represents a loss in livestock productivity as well as disruption of water cycles and other ecosystem services and can be irreversible in the short-term, requiring heavy intervention to restore productivity. However, changes in rangeland vegetation cover and abundance can also have profound effects on soil erosion and exchanges of energy and water between the land surface and the atmosphere and these bottom-up effects can intensify stresses associated with climate and act to initiate self-reinforcing changes in vegetation (Peters *et al* 2013), making arid and semi-arid grasslands particularly susceptible to some forms of land degradation.

Globally land quality is declining; croplands are being lost through loss of soil fertility, range and forest lands continue being converted to croplands, and land under crop cultivation is losing fertility and productivity (Bruinsma, 2003). Twelve million hectares of land where 20 million tons of grain could have been grown are reported to disappear every year due to pressure from human activities, and it is estimated that 50 million people may be displaced within this decade as a result of land degradation in the world's drylands (UNCCD, 2012). Approximately 2,000 hectares of land is reported to be lost daily due to salinization caused by irrigation in drylands (Qadir *et al*, 2014).

In addition to local impacts, land degradation produces major externalities that are felt regionally and globally, including dust storms, floods, disruption of hydrological cycles, and emission of greenhouse gasses. Soils store more than double the carbon (2,700 Gigatonnes) of the combined total of atmosphere (780 Gt) and biomass (575 Gt) (Lal, 2008), which makes land degradation a major contributor to climate change.

Land degradation has significant impacts on biodiversity: desertification is estimated to lead to a loss of about 27,000 species annually[3]. Drylands support many unique plant groups such as the cacti and succulents, and are home to large number of endemic fauna: one third of all Endemic Bird Areas are found in the drylands. Overall an estimated 10,000 mammals, birds and amphibian species can be found in the drylands worldwide. Drylands are also home to 35% of the global hotspot area: areas with high numbers of endemic species, extreme threats and with over 70% of original natural vegetation already lost (Davies *et al*., 2012).

3 http://www.unccd.int/Lists/SiteDocumentLibrary/WDCD/DLDD%20Facts.pdf

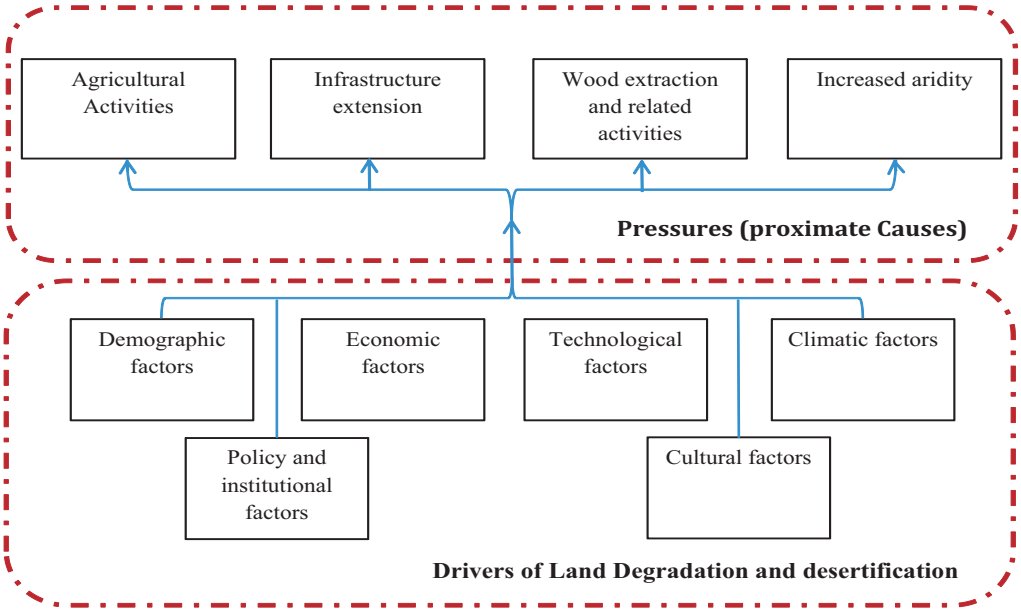

Figure 4: Proximate and underlying driving forces of land degradation.[vii]

Drivers of Land Degradation in Rangelands

With increasing population growth and associated food demand, it is projected that globally we need at least 70-100% greater food production from existing land in order to feed the current and future generations (FAO, 2009). This is likely to place more pressure on existing resources, leading to conversion of forest and rangeland to crop land, and consequent risk of land degradation. Conversion of land and land use change were identified by the Millennium Ecosystem Assessment as the leading factors in desertification (MEA, 2005). As Figure 4 illustrates, the most obvious drivers of land degradation, like over exploitation for agriculture, are usually proximate causes that have a number of common roots.

Policy and institutional factors are important underlying driving forces of DLDD (Figure 4). Policy failures can in turn be attributed to a combination of weak resource rights and governance, weak influencing capacity of rangeland stakeholders, and insufficient or inaccurate data, information and knowledge on drylands (Mortimore *et al*., 2009) and by implication on rangelands.

In many countries there is an investment bias towards crop production over rangeland production systems. This is manifested through greater investments in research, extension and policies for crop production, particularly at ecological thresholds where crop production becomes unviable and hence promoting crop production at the expense of rangeland production systems bears the risks of land degradation. Evidence shows the value of rangelands in most countries is greatly underestimated, and conversion of critical rangeland resources can have greater costs than benefits when measured across the entire system (Davies and Hatfield, 2008; Behnke and Kerven, 2013). This is particularly true when irrigation is used in rangelands risking both exhausting intrinsic fertility levels and depleting ground water resources. Yet despite evidence that converting rangeland to cropland is one of the most significant drivers of land degradation in drylands, many countries still focus overwhelming attention to crop farming to the detriment of rangelands status.

Although assessments of rangeland degradation continue to be weak, there is widespread (though not universal) belief that over-grazing is one of the principal causes of desertification. In practice over-grazing is poorly understood and frequently misrepresented and in a number of cases under-grazing is as great a problem. Many rangeland ecosystems depend on herbivore action to maintain specific plant communities and when herbivore action is removed, or is sustained even at a low level, degradation processes can occur. Such “over-grazing” would be better labelled as grazing mismanagement and is a common outcome when herd management and seasonal herd movements are restricted: for example through policies of sedenterisation, loss of transhumance corridors, or inappropriate location of water points. Mismanagement can be an outcome across a rangeland landscape when small but critical resource patches are rendered inaccessible, for example when dry season grazing areas are converted to crop cultivation or when forest patches are fenced off to create protected areas (McGahey *et al*., 2008; Davies *et al*., 2010; Behnke *et al*., 1993).

OPTIONS FOR ACTION: Sustainable Range Management

There are options for indirectly reducing land degradation in the rangelands that will not be addressed in this Technical Brief, such as increasing the efficiency of production on crop lands through more efficient farming practices, or reducing post-harvest losses and food wastage. These approaches could reduce the pressure to convert rangelands for crop production by reducing actual food shortages. However, specific actions to promote sustainable management of rangelands still need to be given much greater support.

Sustainable Land Management (SLM) has been defined as "the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions" (UN Earth Summit, 1992). SLM plays a vital role in halting land degradation and in rehabilitating degraded lands. In many countries the SLM challenge is to maintain long-term productivity of ecosystem functions whilst increasing productivity of food and other goods and services. This also applies to Sustainable Range Management (SRM), a term we adopt to cater for the specific conditions of rangelands.

SLM can include practices such as agroforestry, Low-External-Input and Sustainable Agriculture (Reijntjes *et al*, 1992), and pastoralism (Davies *et al*., 2010; McGahey *et al*., 2014). SLM practices typically provide both on-site benefits, in the form of productivity increases, as well as off-site benefits related to improved ecosystem services, such as mitigating climate change through soil carbon sequestration and regulation of hydrological flows. SLM can therefore provide options for alternative income that can be used as additional incentives,

Land Degradation Neutrality: current status, challenges and opportunities (LDN)

The notion of a 'zero net loss' goal for action against land degradation was raised in the Rio+20 report The Future We Want, where the international community agreed to strive for "a land-degradation neutral world in the context of sustainable development" (2012, para. 206). This has been encapsulated in a global aspiration to halt and reverse land degradation by 2030 (Sustainable Development Goals, target 15.3), although there is a lack of consensus about the specific meaning of the goal as it now stands. The UNCCD Intergovernmental Working Group's current working definition of Land Degradation Neutrality is "a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales, and ecosystems" (IWG, 2015). LDN has a dual focus on two complementary approaches, pursuing both sustainable land management practices and the ecological restoration of degraded lands.

Sustainable land management (SLM) is promoted as a core aspect of LDN. By using land resources to meet human needs while at the same time ensuring the long-term productivity of those resources, SLM considers the range of ecosystem services provided by land: provisioning, supporting, regulating and cultural. Traditional and localised knowledge has much to offer in regards to SLM and SRM, although often major socio-economic changes are also required (Welton et al, 2014). SLM improves land value primarily through the empowerment of land managers, using community-based approaches that account for environmental variability (Grainger, 2015). The prevention of land degradation through the implementation of SLM is cost-effective, offering promising investment opportunities (ELD Initiative, 2013).

The second pathway to LDN – restoration at a greater rate than that of continued degradation – is intended to account for developments, human encroachment, land uses and industries which degrade land due to their nature. These factors need to be accounted given the expanding needs of the world's growing population and increasing land scarcity. According to the principles of LDN, the ideal sites for restoration would be the same ecosystem type and serve the same community that would be affected by the degradation in question (Stavi & Lal, 2015). Determining appropriate arrangements for such efforts will therefore require careful planning, consultation and valuation methods, especially if any compromises must be made.

LDN faces significant operational challenges though; because LDN can be used as a managerial tool at different spatial and temporal scales, particular attention will be needed for setting, monitoring and evaluating chosen limits. This involves calculating for asymmetrical shifts in land quality, noting that restoration takes time whereas ecological losses can be immediate (Tal, 2015), and future climatic conditions need to be anticipated. Similarly, determining appropriate geographical restrictions poses difficulties because of complex, changing ecological and socio-economic environments. Overarching monitoring programs, consistent measurement and indicators of land degradation, valuations considering total land value and effective financing remain important steps to be addressed before operationalization of the LDN concept.

Prepared by G Metternicht and E Berry, Institute of Environmental Studies, UNSW, Australia.

particularly when there are significant costs associated with adoption. For example, where management practices contribute to conservation of biodiversity land managers can generate additional revenues through ecotourism, or through payments for protection of wildlife dispersal areas. Where land managers are protecting watersheds they can receive payments from down-stream beneficiaries in order to incentivise and safeguard their stewardship. Contributions by land managers to climate change mitigation and adaptation could also be translated in revenue for land managers in the form of payments for ecosystem services (PES). Conservation approaches like the Indigenous Community Conserved Areas (ICCAs) model (Borrini-Feyerabend, 2014) and Community Based Natural Resource Management approaches (CBNRM) (Nelson, 2010) can play a role in legitimising and popularising such land management practices.

SLM is essential in meeting the objectives of the three UN Rio conventions on Climate Change, Biological Diversity and Desertification; it helps advancing these objectives by addressing or avoiding land degradation while simultaneously reducing greenhouse emissions and conserving biodiversity with environmental benefits and improved livelihoods as a result (Cowie *et al*. 2011; Thomas, 2008). Whilst 24% of all land is estimated to be currently degrading we are less clear on what percentage of land remains un-degraded, although we assume the figure is substantial. It makes economic sense to ensure that this vast area of land is maintained in the best condition possible, through widespread adoption of SLM. The cost of investing now in SLM will most probably be much less than restoration costs of already degraded lands. Recognising and incentivising the wider benefits of sustainably managed lands, such as through Payments for Ecosystem Services, could be instrumental in enabling greater SLM adoption.

Within the broad subject of SLM, Sustainable Rangeland Management gets limited attention. This can be attributed partly to the relatively recent wider recognition of Rangeland Ecology as a discipline, but in many countries it is also attributable to the poor social status of rangeland users (mainly pastoralists – a term we use in this report interchangeably with rangeland user/manager[4]) and persistent government efforts to either forcibly change the management systems of these rangeland users or to appropriate their land for other use (Scoones, 1995; Niamir-Fuller, 1999). There are still important gaps in our understanding of rangeland ecology and there is a tendency to pursue SLM approaches in rangelands that may be valid for cropping systems in more humid regions, but not necessarily valid in dry rangelands.

4 Pastoralism has been defined as "extensive livestock production in the rangelands" (IUCN, 2010) and therefore we use the term pastoralist to refer to managers of livestock in the rangelands. This is different from other uses where the term pastoralist denotes an Indigenous People.

In addition to weak understanding of rangeland ecology there are important knowledge gaps around good land use practices in rangelands. These include knowledge of customary governance, resource tenure, grazing patterns, dependency of rangelands on herbivores, the positive roles of fire, indigenous knowledge, local practice and institutions, and the extent and kind of risks of rangeland degradation (McGahey *et al*., 2014). Resource mismanagement is often a consequence of moving away from traditional practices, and coupled with poor policy has, in some regions, driven rangelands biodiversity loss, decreasing soil health and losses of stored soil carbon (Singh, 2013).

Sustainable Rangeland Management (SRM) should give particular importance to enhancing resilience of rangeland ecosystems in view of the high variability and unpredictability of precipitation, which is likely to be exacerbated by climate change. Much can be learned from local practices that have developed indigenous crop and livestock breeds, which demonstrate remarkable adaptation and tolerance and are often critical to the efficiency of the system. Indeed, a frequent feature of indigenous SRM technologies is their orientation towards ensuring productivity in the worst years rather than maximising on the good years. In lands where drought is the norm rather than the exception this is a logical adaptation and is central to resilient rangeland livelihoods. However, this ecological insight can easily be jeopardized by a myopic focus on maximizing production in the short-term, and especially through use of unsuitable land use and cropping strategies.

Strengthening Local Governance for Sustainable Range Management

Many of the most successful SLM stories are built on existing land management practices that have been revived after a period during which, for a number reasons, they had been neglected. An example is agroforestry that has been used for centuries in the Sahel and is now the heart of the "Farmer Managed Natural Regeneration" approach (Garrity *et al*., 2010). The same applies to Sustainable Rangelands Management which has been enabled through revival and adaptation of customary herding strategies in cases that span all continents (Herrera *et al*., 2014).

A common factor in the revival of traditional SLM and SRM practices is the establishment of institutions and rules that allow local knowledge to be applied; for example local rules over cutting of trees, access to water, or grazing of seasonal pastures. Revival

of Al Hima systems for management of communal pastures in Jordan and Lebanon was made possible by establishment of local management committees and through granting of de facto management rights by the relevant authorities (Haddad, 2014; Sattout, 2014). Revival of pasture management practices in Kenya and Mongolia have similarly been enabled through creation of local user committees (Roba, 2014; Hannam, 2014). In all these cases the role of government is evident, whether it is through direct support as in the Jordanian case, or indirectly through establishment of enabling policy conditions for local resource governance, as in Mongolia, Kenya and elsewhere. Whilst local resource management arrangements may be struggling to adapt to the modern context, there is a body of practice showing how existing governance systems can be supported to adapt, evolve and transition into a modern political-economy (Herrera *et al*., 2014).

SRM is influenced by a number of factors including respect for local knowledge and institutions, building consensus and ensuring equity through participatory approaches, policy and institutional support, and secure resource and land tenure. At its basics, local governance of rangelands refers to the set of systems that control and mediate decision making by local actors in consultation with concerned external stakeholders with regard to rangeland resource development and management. Central to enhancement of local rangeland governance systems is the support and strengthening of local institutions, in particular building on existing community institutions in order to strengthen the social fabric of pastoral societies. Many countries have policies that support such approaches, but which are poorly implemented in rangeland areas (Herrera *et al*., 2014).

At the heart of SRM is the identification of the full range of stakeholders involved in use and management of rangeland resources, to ensure their participation in decision making processes. This principally should include local institutions but also influential external actors. Participatory approaches such as Participatory Technology Development (Van Veenhuizen *et al*, 1997) are instrumental in building bridges between indigenous and external scientific knowledge where appropriate. Encompassing local knowledge fosters better conditions for innovation, in which local knowledge holders make the decisions over how to deploy new science and technologies (Herrera *et al*., 2014).

There is growing global appreciation of the economic efficiency of managing common property in general and communal rangelands in particular, as illustrated by the award of the Nobel Prize for Economics in 2009 to Elinor Ostrom "for her analysis of economic governance, especially the commons"[viii]. Pastoral rangeland management frequently refutes the widespread belief that secure private ownership rights are necessary to allow economic actors to develop production and markets. Increased private ownership of some rangelands can lead to intensification, encroachment, abandonment and improper uses that end in degrading those lands (Herrera *et al*., 2014). Rather than to think about outright ownership of land it is better to think of rights along a continuum, from simple right of access to right of use, right of management, right of exclusion and right of alienation. Sustainable rangeland management is often made possible when users have the right of management and the right, at least periodically, of exclusion.

Strengthening Communal Governance in Kenya's Rangelands

Garba Tula District of Isiolo County lies in northern Kenya and is inhabited by Boran pastoralists using long-established herding practices. Rangeland management is governed through traditional grazing units called ***Dhedas***, which govern the location and timing of communal grazing. The area is also rich in wildlife and connects a number of major protected areas, including the Meru National park complex and the reserves of Shaba and Buffalo Springs. In recent decades the ***Dheda*** system has come under strain due to changes in local power balances and the misappropriation of key resources. The outcome is that rangeland management practices have weakened, infrastructure has been developed inappropriately, grazing routes have been disrupted and seasonal resources have been lost.

In response IUCN worked with the local community, through a Community Based Organization, and the County Government, to revive pastoralist rangeland planning through the use of participatory tools, and to establish by-laws that combine customary rules with statutory law. The result has been a strengthening of grazing management, improved planning of water infrastructure, significant improvements in drought management and food security, and increased supplementary income through cultural and wildlife tourism. It has been observed that the outcomes are the result of long-term engagement and highly skilled facilitation, but at relatively low overall cost. The critical factor in success was the strong leadership shown by the community, the devolution of decision making power to the community, and the subordination of individual project-funded activities to the overall process.

Figure5: Multiple benefits of sustainably managed rangelands (adapted from McGahey et al., 2014)

Multiple Benefits from Sustainably Managed Rangelands

There is growing evidence that sustainable land management can reduce poverty and generate economic growth (UNCCD 2012). Rangelands provide a wide range of benefits for local users and for society at large, including contributions to food security, biodiversity conservation, and provision of a number of ecosystem services. Livestock products sustain large populations in the rangelands but are also valued externally by consumers who often consider them to have superior health or environmental qualities. Livestock products are often much more diverse than is appreciated and often markets are not available for the full range of goods: milk, fibre, meat, hides, and manure (McGahey *et al*., 2014).

Rangeland degradation contributes to greater exposure to risk in an already highly risk-prone environment. Rangeland communities have over the years developed adaptive mechanisms for the climatic conditions in which they live and these depend on flexible and often opportunistic management of rangeland resources (Scoones, 1995). Pastoralists employ low-intensity and low-external-input strategies to harness high value products provided by these ecosystems and rely heavily on established customs of resource sharing and risk spreading. Reinforcing such tried-and-tested practices in sustainable range management can be seen as an ecosystem-based solution for adapting to climate change and hence avoiding some of the potential costs of climate change and land degradation (Davies and Nori, 2008).

In addition to a wide range of livestock products, benefits can also include biodiversity conservation, production of high value natural products (such as Arabic gum, shea butter, myrrh, honey, saffron etc.), protecting hydrological cycles, and carbon sequestration. These goods and services contribute to poverty reduction, economic growth and disaster risk reduction. Undervaluation of these many

benefits is a factor in the continuing association of drylands as "wastelands" and in the pursuit of poorly designed policies and unsustainable investment strategies (Davies and Hatfield, 2008).

Rangelands are of global conservation significance as they support large wildlife populations outside of protected areas (Fuller *et al*. 2012), provide essential connectivity between more exclusionary protected areas, and are also essential for long range bird migrations. Most rangelands are effectively Community Conserved Areas and could potentially qualify under Protected Area Categories 5 and 6 (Dudley, 2008). Many rangelands would however be excluded from this system of categorisation since conservation is a major outcome rather than the primary purpose. Nevertheless they contribute to Aichi Target 11 "other effective area-based conservation measures".

Research shows that many rangelands only exist through the actions of large herds of ungulates: like antelopes and wildebeest in the wild, and cattle, sheep, goats and camels in domestic herds. Pasture production can be actively encouraged through the impacts of ungulates in transporting seeds, trampling dead vegetation, recycling nutrients, scarifying soil, and suppressing growth of shrubs (Frank *et al*., 1998; Behnke and Abel, 1996; Savory, 1999). The result is that effective rangeland management by pastoralists lead not only to greater pasture (and therefore livestock) productivity, but can also lead to higher levels of biodiversity. It is critically important to understand that these environmental benefits cannot be secured by abandoning pastoralism or by minimising either herd sizes or mobility.

Sustainably managed rangelands can also deliver important benefits through ecosystem services—such as water cycling or climate regulation—which have knock on effects on populations locally and externally. Improved rangeland hydrological cycles lead to improved infiltration of water and reduced surface flow, which contribute to fewer floods and lower risk of drought. Indeed each action that takes place in the rangelands has an impact on surface and ground water (Barchiesi *et al*. 2014). The hydrological cycle in rangelands can be characterized as providing irregular water inputs that are dependent on irregular rainfall patterns and, in general, regular water outputs in the form of regular flows of surface and especially ground water. On the basis of these water outputs other ecosystem services can be provided as a function of the health of a rangeland ecosystem (Agnew and Anderson, 1992). These can include higher biodiversity, soil fertility, carbon sequestration, quality of drinking water and its health benefits, and maintenance of rangeland products like fodder that are the basis of the pastoral economy.

Recent studies have suggested that soil carbon management presents the most cost-effective climate change mitigation option (McKinsey, 2009). Rangelands (including grasslands, shrublands, deserts, and tundra) contain more than a third of all the terrestrial above and below-ground carbon reserves (Allen-Diaz 1996). With improved rangeland management they could potentially sequester a further 1300-2000 $MtCO_2e$ by 2030 (Tennigkeit and Wilkes, 2008).

Good practices in rangeland management thus offer win-win situations for simultaneous economic, social and environmental benefits. Where pastoralism is practiced sustainably, conversion of rangelands to crop production bears the multiple costs of land degradation, degradation of water sheds, reduced biodiversity, increased poverty, social inequity, and release of greenhouse gasses, as well as concomitant costs of land and biodiversity restoration.

Valuing the Benefits from Rangelands

Although there is abundant evidence that sustainably managed rangelands provide multiple economic, social and environmental benefits, many governments still consider them to be low-potential areas that are in need of improvement through land use change, for example through conversion to crop farming. Stronger evidence is therefore frequently required to demonstrate the relative merits of different land use options. However, valuation can be carried out incompletely, overlooking important costs or benefits, and is not always adequate for decision making. More comprehensive economic valuation is required to examine the multiple costs and benefits of alternative land use options.

Decision making usually involves a mismatch between values and interests and therefore a common measure of value can be useful to examine the gains, losses and trade-offs between options. In rangelands however this frequently raises a challenge of scale, since a land use change in one location can have far-reaching consequences across a rangeland landscape. For example, decision making over scarce water resources often fails to capture the landscape value of that water and irrigation of small pockets of land can render vast areas of rangeland less productive and more risk-prone as a result of lost seasonal pasture (Davies and Hatfield, 2008).

To get a full understanding of the economics of sustainable range management and rangeland degradation it is necessary to examine both the direct and indirect benefits and costs, and to compare the cost-benefit analysis with those for alternative rangeland management options. Direct costs may be experienced by the land user who degrades the land, or by other users who use the land subsequently, while indirect economic costs relate to off-site impacts, often some distance from the source of degradation, which are generally suffered by people other than those who cause degradation. This includes the impacts of flooding, siltation, dust storms, deterioration of water quality and so on.

Economic Valuation of rangeland restoration in the Zarqa River Basin, Jordan (Myint & Westerberg 2015)

IUCN has worked with Bedouin communities in the Zarqa Basin, the Jordanian Ministry of Agriculture and the Arab Women's Organisation for a number of years to revive the Al Hima system: a traditional means of protecting rangelands for sustainable use. There was evidence that the system could be revived through a low-cost approach based on multi-stakeholder dialogue and participatory planning, and that this could generate a number of environmental and economic benefits. An Economic Valuation was conducted to provide a comparison of the cost-benefit of scaling up al Hima throughout the Basin with the status quo.

The economic valuation took advantage of high-resolution remote sensing and ArcSWAT (Soil and Water Assessment Tool) integrated with economic analyses of key regulating and provisioning ecosystem services to estimate costs and benefits of scaling up Hima. An estimate of rangeland restoration potential was made through the study and biophysical models were used to predict impacts of adopting Hima on key ecosystem services including fodder production, water infiltration, soil protection (measured as reduced sedimentation of dams) and carbon sequestration over a 25 year time horizon.

Large-scale adoption of Al Hima within the Zarqa River Basin may deliver between 203 and 408 million USD worth of net-benefits to Jordanian society over a 25 year period (depending on the discount rate used). This includes up to USD34.6 million in value of avoided fodder purchase, USD369m in present value of additional groundwater infiltration, and USD14.7m in present value benefit of avoided reservoir sedimentation. Direct benefit to rangeland managers in the Zarqa Basin are also net positive at USD26.5m over 25 years based on a 2.5% discount rate, assuming that the communities themselves bear the management costs of the Himas.

Net present value of large-scale Hima restoration over a 25-year time horizon (in Million USD dollars)

	Discount rates		
	r=2.5%	r=5%	r=8%
To pastoral communities in the Zarqa River Basin if they bear the management costs	**18.7**	**11.8**	**6.7**
To the Jordanian society	289.0	207.1	143.9
To the global society	326.7	214.0	143.9

Investing in Management of Rangeland Ecosystems

Many of the benefits of the rangelands can be considered as outputs of ecosystem services: the intrinsic services the ecosystem can provide to people and society. The benefits of these services are higher when the ecosystem is in good health, and maintaining a rangeland ecosystem in good health requires good management, stewardship and investment. These benefits of rangelands are mostly undervalued and not compensated for.

A lot has been written about the need for 'supportive policies' for the rangelands, but recommendations are often lacking in detail. Numerous efforts have been made to raise awareness of the multiple benefits of rangelands, but insufficient thought has been put into what kinds of investment need to be mobilised. In some cases investors are attracted to the rangelands by the weak land rights and therefore relative ease of access and they are less concerned with sustainability or equity. Mitigating such risks should consider four key questions: (i) who are the investors; (ii) what are the drivers of investment (why are investments made); (iii) what kind of investments are required; (iv) and what safeguards are required?

Who Are the Investors?

In general, among the investors three distinct groups can be recognized: Community investors, central and local government and private investors (from outside the community). Additionally it may help to consider down-stream beneficiaries as a distinct investor group in relation to some specific ecosystem services.

Central and local governments essentially invest in public goods, for instance infrastructure and education, through sectoral budgeting, and project interventions. Whilst governments are the primary investor in creating an enabling environment, they also provide asset investments, such as water resources. Investments are largely made by technical departments or line ministries, often guided by locally-developed plans. The nature of development of those plans can be critical for the effectiveness of investments and there are many risks of mal-investment, particularly where conflicting interests leads to the favouring of one user group over another.

Decentralisation of government planning has been shown in many cases to create favourable conditions for improved public investments, particularly by strengthening accountability at the local level. This is assisted by increasing civic awareness of communities and improvements in political representation and voice. Participatory approaches can contribute to this increased accountability and are increasingly used to channel local priorities into government planning, including at the national level (Herrera *et al*., 2014). However, public resources are finite and inevitably trade-offs have to be made between competing priorities.

Community investors include primary land users as well as those who invest in local value chains. Land users in the rangelands have traditionally invested natural, human and social capital with limited use of financial capital, although the steady increase in the investment of financial capital is almost universal. Rangeland managers have traditionally invested heavily in collective action to build up social capital: for example to create debts and obligations that can be drawn upon in times of need. They also invest social capital in maintaining institutions that govern resource use (Davies and Bennett, 2007; Homewood, 2008).

Pastoralists invest labour in herding and watering livestock and in breeding locally-adapted stock. Financial capital is also invested in veterinary medicine, in basic milk and fibre processing equipment, and in weapons for herd protection. With increasing wealth pastoralists also invest outside of the rangeland economy, for example in property (IUCN, 2013). Although research reveals that even the poorest communities are willing to sustain small-scale investments in natural resource-based livelihoods, the nature of their investments is usually incremental and encompasses long term strategies often overlooked by outsiders (Mortimore and Tiffen, 2003). These strategies are often holistic with sustainability at the core while deriving social, economic and environmental benefits from rangelands. This justifies targeting them, as the principle investors, with improved social and economic infrastructures.

The **private sector** dominates the economy and is responsible for allocation of the majority of financial resources. However, the private sector is not only the corporate sector (i.e. companies or businesses) but also includes individuals. In this sense it encompasses communities that we discussed previously. Whilst community members themselves are often the most significant investors in sustainable range management, private investors from outside the community can also find investment opportunities depending on changing markets and conditions established by the government. Significant opportunities can be found in livestock sector services such as veterinary pharmaceuticals, in processing of livestock products (dairy, meat, fibre

and hides), in financial services, and in marketing of natural resources (e.g. medicinal plants) and tourism. Private investors include small and large enterprises, including in some cases multi-national firms.

The interests of private investors however, cannot be assumed to be always sympathetic with the community or ecosystem interests. Some may be looking for markets for selling products or may be looking to purchase local produce, whilst others may be in search of natural resources to exploit. Some of the key investors for sustainable rangelands management, like banks and food processing or marketing companies, have often shied away from the dry rangelands due to stereotypes associated with these areas, such as fear of insecurity or poor infrastructure. In fact some of the stereotypes are directly related to the low investment, and where private sector investments rise there can be noticeable changes in the favourable environment for further investment. This is particularly noticeable with investments in banking, transport and communications (e.g. cell-phone networks) (Mortimore *et al*., 2009).

Sustainable Rangelands Management, as we have illustrated earlier in this report, provides both internal and external benefits. Whilst the internal benefits are captured by the rangeland managers and act as incentives for sustainable management, externalities are enjoyed by others who are not directly responsible for rangelands management. There is growing interest in establishing how these downstream and external beneficiaries can pay for such services, and how their payments can ensure improved supply of the services.

Beneficiaries of these "externalities" can include downstream consumers of water or hydroelectric power, the wildlife tourism sector, and populations that are protected from flooding or erosion. They also include global beneficiaries of climate change mitigation and those who derive value purely from the existence of wildlife. As a result there is growing interest in Payment for Ecosystem Services (PES) as a mechanism through which beneficiaries reward land managers for good practice.

What Are the Drivers of Investment

Investments can be driven by both the inherent opportunities of the drylands and by the obligation of authorities to invest in meeting basic rights. It has been reported that a major factor in underinvestment in the drylands is the perceived lack of opportunity; the association of drylands as wastelands (Mortimore *et al*., 2009). Abundant evidence has been published to refute this perception and data on the dryland livestock sector alone shows the major contributions made to national economies, and the huge opportunities for investment growth. Pastoralism makes a strong contribution to many developing country economies; an estimated 80% of agricultural GDP in Sudan and Niger and 90% in Mongolia (Davies and Hatfield, 2006). A study by IIED and Reconcile of the contribution of pastoralist cattle to the nyama choma (roast meat) industry in Arusha, Tanzania, demonstrates an annual turnover of US$86million, and each head of cattle slaughtered contributes 0.24 full time jobs, supports 1.07 dependents, and provides US$172 in value added to the Tanzanian economy (Letara *et al*., 2006.)

Drylands harbour a great wealth that is largely underexploited, while global markets are booming as a result of overall population growth and the increasing proportion of urban to rural population. Growing global wealth and demand for livestock products, combined with a growing awareness of environmental issues, suggests there could be an increasing willingness to pay for rangeland livestock products and environmental services. There are already a growing number of markets for pastoralist products that have higher human health or environmental credentials and these niche markets create major investment opportunities that investors are beginning to examine more closely.

Whilst there are many untapped opportunities for investment in the rangelands, governments also have a responsibility to raise investments for sustainable development, and are increasingly under international pressure not to neglect impoverished regions. The responsibility may emanate from the fact that rangeland and dryland populations lag far behind in development terms, as we have seen earlier in this report. However, governments also face a responsibility to reduce the inordinately high costs of natural disasters in drylands, by ensuring resilience through sustainable development.

Disasters like floods, droughts, landslides and natural resource conflict are often aggravated by rangeland degradation and provide a powerful argument for investment in SRM. Similarly SRM contributes to Ecosystem and Land-Based Adaptation and could be a low cost option for offsetting much higher future costs of climate change. The Post-2015 development agenda is likely to be dominated by a set of Sustainable Development Goals that include targets on Sustainable Land Management. Such targets will call on governments to address the long-term systemic underdevelopment of rangeland areas and provide an opportunity to galvanise action.

In 2013 the Second UNCCD Science Conference concluded that the cost of land degradation and restoring degraded land was much higher than the cost of prevention through sustainable land management. It makes good economic sense to invest in SRM before it is too late, particularly given the potential economic returns from the rangelands. Governments from developing countries are balancing multiple demands against limited resources but more effort is needed to demonstrate the value of prioritising rangelands in order to make a stronger contribution to overall national growth and development.

What Kinds of Investment Are Required?

Often investments in rangelands are required in more fundamental areas like securing rights and boosting security; areas that have traditionally been seen as the role of the state. In many cases existing policies are adequate for improvements in these areas, but those policies are poorly implemented in the rangelands. Thus the priority is to demonstrate the value/benefit of appropriate investments, particularly with regards to implementation of supportive policies for sustainable rangeland development.

Enabling Investments

Many rangelands are under-developed due to long-term underinvestment in basic services and infrastructure; reversing this trend is the priority for progress towards sustainable management of rangelands. It is though important to disaggregate these "enabling investments" from "asset investments" in order to better identify prospective investors. Many, although not all, enabling investments will be made by the public sector and often the greatest challenge is in leveraging such basic amenities. Articulating the role and the value of such investments to government is often a prerequisite, and supporting citizens from the rangelands to pressurize their local leaders into action remains a priority.

IUCN's experience has shown that investments in communal tenure and natural resource governance are among the most effective in delivering SRM at scale, and that in the long run these investments are low cost. These investments can initially be highly demanding in both time and facilitation skills and depend on governments and development partners making the right kinds of investments: prioritising long-term change in attitudes and practices over short term delivery of physical investments. Many interventions fall into the trap of assuming that material investments are needed to solve development problems. Yet there are numerous examples of investment in rangeland water facilities that have led to rangeland degradation and reduced productivity.

Enabling investments create the social and institutional environment for sustainable range management, such as community range management associations and inter-sectoral working groups in local government, or building capacities to enable land titling (World Bank, 2006; Pagiola and Bosquet, 2009). The World Bank considers explicit recognition of property rights as crucial to achieve SLM. Property rights may help by enabling the enforcement of rules, as for example in Niger where farmers began actively protecting or planting trees once they were given the freedom to own the trees and the land (Botoni and Reij, 2009). In other cases Property rights may improve access to credit, help extend the planning horizon for the poor, and enable the individual investor to benefit directly from investments in land improvement and conservation (Panayotou, 1993).

However, securing property rights does not necessarily mean promoting private property, and where land and resource management is governed by customary law, privatising land does not necessarily lead to increased investment. In the Sahel/Sudan zone of West Africa privatization efforts have often been a failure as maintaining soil fertility in rainfed farming needs long periods of fallow and this was best managed by customary law rotating land use over different families in the community (Gueye and Laban, 1994). Neither does securing rights mean granting the legal right to alienate land (i.e. title that allows land to be bought and sold). Private ownership and the right of alienation are not considered essential for sustainable rangeland management and in many cases may be detrimental.

Asset investments for sustainable rangeland management

It can be useful to separate asset investments in the livestock sector from non-livestock sector investments. Livestock sector investments in veterinary drugs and vaccines are often least controversial, particularly since they often tackle zoonotic diseases and therefore have direct human impacts. Models of Community Animal Health Workers (paravets, barefoot vets etc.) have proven popular with pastoralists, even if they are sometimes less popular with government vets, and they operate well in the private sector as long as government does not over regulate the sector. Such investments can reduce both mortality and morbidity, with the latter being particularly important for ensuring optimal production from a finite rangeland resource.

Breed improvement has more ambiguous implications and there are examples of both good and bad practice. Government programmes to "improve" breeds, usually using imported breeds from very different environments, have frequently been disastrous. They have generated breeds that are highly dependent on high-cost inputs and are poorly adapted to the heat, aridity and diseases of their new environment (Davies *et al*., 2010). On the other hand, efforts to improve endogenous breeds through selective breeding and building on indigenous knowledge and locally-determined breed characteristics could offer practical options for investment that could be much more widely adopted.

Fodder supplements have frequently proven to be harmful to sustainable rangelands management, by encouraging excessively high stocking and removing the need for livestock to move seasonally to new pastures. Throughout North Africa and West Asia for example fodder subsidies are blamed for widespread rangeland de-vegetation (Hatfield and Davies, 2006). Improving access to fodder without safeguarding underlying rangeland management systems can be very risky and more work is required to understand the appropriate safeguards.

Investments in water infrastructure have been discussed above as enabling assets, but they are also asset investments that are increasingly made by pastoralists themselves. Again, these investments can be either beneficial or highly detrimental depending on how they are planned and how their use is governed. Where water sources are planned to optimise use of pasture resources, and where their use is managed for seasonal access, they can contribute to significant improvements in efficiency of rangeland use. Often less care is taken in their placement, or they are explicitly used to "settle" pastoralists, leading almost invariably to environmental degradation and economic decline.

Investments in food processing and storage may be made at both the household and the private company scale, although it is more often associated with the latter. Pastoralism produces goods of high value that are often poorly connected to markets and there is potential for major investment in value chains. Most pastoral systems have been shown to be "live product" systems, in which milk or fibre are of greater value than meat or hides. However, value chain development for these products, particularly the more perishable milk, has often proven challenging.

Non-livestock sector investments can include investments into markets for high value rangeland products including medicinal plants, wildlife, wood products and more. These products are often found naturally in the rangelands, although pastoralist management practices are often designed to promote their production: for example protecting forest and wetland patches and wildlife habitat. Natural rangeland products may include cosmetics like Henna (*Lawsonia inermis*), medicinal plants like Hoodia (*Hoodia gordonii*), gums and resins like Gum Arabic (from *Acacia Ssenegal* and *A. seyal*), and fruits such as Baobab (*Adansonia digitata*) and the Desert Date (*Balanites aegyptiaca*). They also include animal products such as honey and bush meat. Investments in rangeland products can be through developing value chains and through accessing tools for improved harvesting. As with any investments, safeguards are often needed to guard against overharvesting.

Appropriate investments in harvesting of natural products will ideally be developed in conjunction with rangeland development to avoid trade-offs between this sub-sector and livestock production. Where an individual product attains a high market value there is sometimes a temptation to set rangelands aside for exclusive production of this resource to the detriment of the wider economy and to rangeland biodiversity more generally.

Non-consumptive use of wildlife is increasingly popular in many rangeland environments, particularly through tourism and ecotourism. Ecotourism is a form of tourism in areas of relatively undisturbed natural areas, often with high levels of wildlife or particularly aesthetically pleasing landscapes, in which tourism itself has minimal impact on the environment. Rangelands are particularly well suited to ecotourism, despite being managed environments that have been influenced by human involvement over centuries. They nevertheless provide habitat for large amounts of wildlife, including many highly 'iconic' and sought after species, and provide wide-open spaces and dramatic scenery that visitors are willing to pay highly for.

Rangelands by their nature are low-external input systems and as a result they are perceived to be healthy environments that produce healthy foods. The nutritive value of pastoralist goods has been shown to be higher than industrially produced livestock products and in addition it has been shown that pastoralism plays a major role in protecting these important areas. The result is that many consumers are willing to pay significantly more for pastoralist products and this is driving a number of major niche markets worldwide (WISP, 2011). Well known pastoralist products that attract premium prices in the market place include Swiss Cheese, Argentinian Criollo Goat, Mongolian Camel wool, and Cashmere Fibre.

Safeguards

In the preceding sections we have strongly argued for investment in enabling conditions for sustainable rangelands management, including basic services and improved local natural resource governance. Such investments not only make rangelands more attractive to external investors but also enable local investors and stimulate economic growth. However, as Figure 4 shows, Indirect Investments in SRM, such as investments in infrastructure, may open up rangeland areas for market access but may also lead to over-exploitation or disrupt migrations of wild or domestic animals if strategic environmental assessments are lacking, thereby contributing to further land degradation. All rangeland development

needs to be embedded in development planning at the appropriate scale in order to make informed choices and trade-offs over the complex costs and benefits of investment.

Government investment is crucial in ensuring economic stimulation in rangelands. Whilst it is attractive to think that investment will help to capitalise on the many values outlined above, much better understanding is needed to identify and guide appropriate investments. Perhaps in some cases neglect of the rangelands has protected them from harm. History shows that investments can pose risks for herders and others. Major investments were made to intensify the rangeland livestock sector in Africa, particularly during the 1970s and 1980s, which contributed not only to land degradation but also to economic decline and impoverishment (Behnke *et al*., 1993; Scoones, 1995). Irrigation projects have led to land degradation, through waterlogging and salinization and through lowering of water tables (FAO, 1994).

The governance of local resources in sustainable range land management assigns an important role to local pastoralist communities; it is therefore important to ensure that these local communities can assume ownership and a sense of accountability with regard to use and management of the natural resources within their community domain. From work done in dryland environments in the Sahel and in the Middle East, it appears that if essential pre-conditions for such ownership and accountability for management practices are not fulfilled this will form almost insurmountable constraints for local rangeland users to make the necessary investments to sustain the management of their rangelands. In many cases local people will not assume such ownership because they do not feel that the activity, investment and/or its results are really theirs (ownership). Important preconditions for them to assume such ownership and accountability are assured benefits, resource rights, appropriate knowledge and claim-making power (Laban, 1994; Laban *et al*, 2009; Laban and Haddad, 2015). Investment interventions in the rangelands need to take this into account to be valid and sustainable.

The growing demand for food combined with the declining availability of land is driving land speculation and “land grabbing”, often leading to the kind of investments that accelerate land degradation. Investments hence are not a panacea on their own, and care must be taken to ensure appropriate investments and suitable safeguards. Many of the safeguards relate to rights and informed decision making, which provides further justification for the governance approaches outlined earlier. However, much deeper knowledge and more comprehensive data are required to enable informed choices and to monitor development and environmental outcomes.

Conclusion

Sustainable land management in rangelands has the potential to provide multiple benefits not only to communities that directly depend on rangelands but also to others: neighbouring rural communities, urban centres, and global society. Emphasis on land use intensification is distorting investments away from the multiplicity of benefits towards a narrower focus on single benefit streams. An alternative approach is needed that focuses on optimisation of returns to investment in a diversity of ecosystem services through greater local benefit capture and reward for positive externalities. Achieving this investment approach requires improved local governance, stronger consultation with rangeland users, and better-informed decision making. Progress towards these targets requires greater motivation amongst government agencies in particular to establish the enabling investments for sustainable growth, and also amongst the private sector to strengthen value chains and to target appropriate asset investments.

Priorities for intervention include the following:

1. Strengthen communal management of rangeland resources:
   a. Rangeland resource management can be strengthened through revival and strengthening of local institutions, adaptation of traditional governance practices according to the changing environmental and political context, and more secure communal resource management rights.

2. Improve local decision making in the rangelands:
   a. Better-informed decision making can be achieved through stronger participation of rangeland managers in public planning, improved coordination between public sectors for more integrated, responsive and sustainable development, and through participatory technology development and innovation.

3. Improve the use of science-based evidence in targeting policy and investment:
   a. Evidence of rangeland health and development opportunities, for better targeting of policy and investment, can be strengthened through the use of scalable assessment tools that are adapted to non-equilibrium dryland ecology. Evidence-based decision making can be boosted by supporting enhanced knowledge management, communications, capacity building, and advocacy.

4. Generate willingness to address sustainable development concerns in the rangelands:
   a. Motivation amongst government agencies to implement policies in the rangelands and to prioritise rangeland investment can be stimulated through greater, more informed engagement of rangeland managers in public consultations and greater representation through political processes.

5. Leverage appropriate investments in sustainable rangelands management:
   a. Greater investments can be generated through awareness-raising based on economic valuation of ecosystem services and communication of the multiple values of rangelands; in many countries enabling investments in appropriate public services and infrastructure are a priority, but investments are also needed in multiple ecosystem goods and services and to mobilise innovative marketing options such as payments for ecosystem services.

6. Emphasise policy implementation:
   a. Policy barriers may impede sustainable rangelands management in some cases, but in most countries supportive policies already exist and priority should be given to raising awareness and capacity and mobilising resources to implement these policies.

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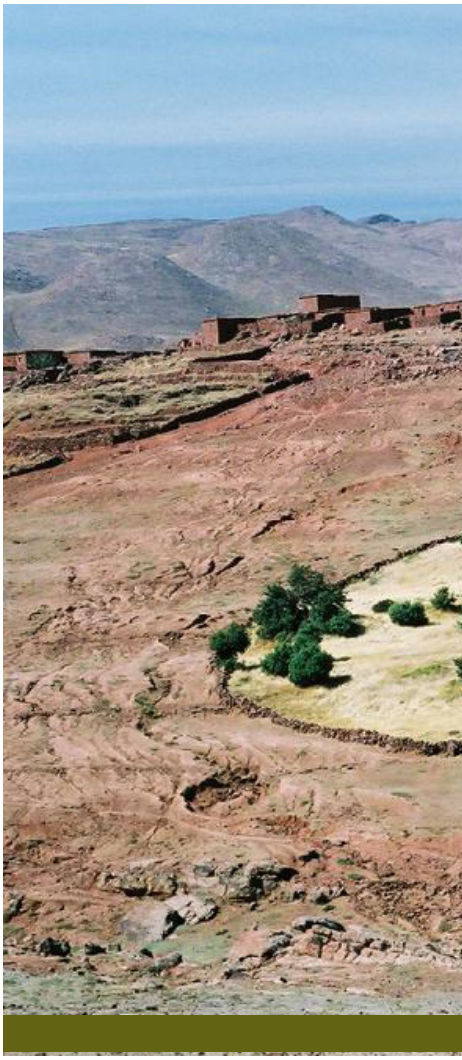

INTERNATIONAL UNION
FOR CONSERVATION OF NATURE

Global Drylands Initiative

Mukoma Road (off Magadi Rd)
P. O. Box 68200 - 00200
NAIROBI, Kenya
Tel: +254 20 249 3561/65
+254 724 256 804
+254 734 768 770

www.iucn.org/wisp