



Convention on Biological Diversity

Distr.
GENERAL

UNEP/CBD/SBSTTA/14/INF/35
28 April 2010

ENGLISH ONLY

SUBSIDIARY BODY ON SCIENTIFIC, TECHNICAL AND TECHNOLOGICAL ADVICE

Fourteenth meeting

Nairobi, 10-21 May 2010

Item 4.2 of the provisional agenda *

COMPILATION OF EXPERIENCES IN THE FIELD OF CLIMATE CHANGE MITIGATION AND ADAPTATION, SOIL MANAGEMENT AND PASTORALISM IN DRY AND SUB-HUMID LANDS

Note by the Executive Secretary

INTRODUCTION

1. Paragraph 8 (c) of decision IX/17 on the biodiversity of dry and sub-humid lands requests the Executive Secretary, in cooperation with the Food and Agriculture Organization of the United Nations, the United Nations Convention to Combat Desertification and other relevant organizations and collaborators to prepare a compilation of experiences in the field of climate-change mitigation and adaptation, soil management and pastoralism in dry and sub-humid lands.
2. Accordingly, the Executive Secretary is pleased to circulate herewith, for the information of participants to the fourteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, a compilation of experiences in the field of climate change mitigation and adaptation, soil management and pastoralism in dry and sub-humid lands, which has been prepared by IUCN and peer reviewed by FAO and the UNCCD.
3. The document is circulated in the form and language in which it was received by the Secretariat of the Convention on Biological Diversity.

* UNEP/CBD/SBSTTA/14/1.



Compilation of experiences in the field of climate change mitigation and adaptation, soil management and pastoralism in dry and sub-humid lands¹



¹ Jonathan Davies and Guyo Roba, IUCN, the International Union for Conservation of Nature, Eastern and Southern Africa Regional Office, Nairobi, Kenya; Jonathan.Davies@iucn.org
World Initiative for Sustainable Pastoralism: <http://www.iucn.org/wisp>

Table of Contents

Introduction.....	4
Pastoralism and Biodiversity.....	4
High Nature Value Pastoralism.....	5
Climate change and pastoralism	6
Climate change and biodiversity.....	7
The links between pastoralism, climate change and biodiversity	9
Environmental service of pastoralism.....	10
Impact of Climate change.....	10
Possible biodiversity outcome.....	10
Environmental disservices of pastoralism.....	10
Grasslands Potential to Contribute to Climate Change Mitigation.....	12
Current Experiences and Lessons on Adaptation and Mitigation among Pastoral Communities.....	13
Upgrading the knowledge base	14
Re-evaluating and sustaining ecosystem services	16
Promoting public and private investment.....	17
Improving access to profitable markets	18
Rights, reform, risk and resilience.....	18
Conclusions from Recent Experiences on Adaptation and Mitigation.....	21
Conclusions and Recommendations.....	21
References.....	23

Introduction

Pastoralism² has been described as “the finely-honed symbiotic relationship between local ecology, domesticated livestock and people in resource-scarce, climatically marginal and often highly variable conditions” (Davies and Nori 2008). In dry and sub-humid lands, pastoral livelihoods continuously adapt to a limited, highly variable and often unpredictable resource endowment, and depend on a wide range of biodiversity, not simply for livestock production but for a wide range of goods and services that enable household survival and development. The capacity to adapt is crucial to sustainable livelihoods and where this adaptive capacity has been weakened it has led directly to failed pastoral livelihoods and degraded rangeland environments.

Perceptions of the relationship between pastoralism and biodiversity are highly divergent, but there is extensive evidence of a positive relationship between pastoralists and their environment. Extensive land use by pastoralists in Eastern African is associated with the creation of the most biologically diverse savannah ecosystems in the world (Little 1996). In Europe, mountain pasture ecosystems are highly valued and many pastoralists are strengthening their livelihoods by optimising the ‘High Nature Value’ (HNV) of their production system, for example through re-opening of traditional transhumance corridors. Increasingly it is understood that not only over-grazing threatens biodiversity, but undergrazing also leads to degradation and the loss of pastoralism-related HNV (Davies *et al.* 2010).

Pastoralism can have both positive and negative impacts on biodiversity, but globally there are a growing number of initiatives which apply incentives to either promote the most environmentally healthy practices of pastoralism or to reduce disincentives that promote harmful management practices. In recent years an improved understanding of the risks associated with climate change has begun to influence thinking on pastoralist development, but since understanding on development good practice was already divergent, not all mitigation and adaptation activities in response to climate change can be considered constructive and in some cases, such activities may amplify the inconsistencies. For example, food insecurity in some of Africa’s drylands has undermined donor and government confidence in pastoralism as a viable livelihood, leading many agencies to attempt to introduce crop production or livestock intensification as alternatives. Such alternatives continue to be advocated in some quarters, despite the risks to the environment and to livelihoods, and the impacts of climate change may be to make such alternatives all the less viable.

This report examines the relationship between pastoralism, land management and biodiversity and the impact of climate change on that relationship. The report also presents a number of examples of good practice in addressing the likely or actual impacts of climate change related hazards. The report also stresses the importance of an array of changes that threaten or may enhance pastoral livelihoods: changes to which pastoralists were struggling to adapt before the threat of climate change became apparent. The report proposes that adaptive capacity is the central pillar of pastoral livelihoods, and pastoral poverty and many related environmental stresses can be traced to loss of this adaptive capacity and the associated increased vulnerability. Restoring and building on this adaptive capacity does not require a change in development direction, but requires adaptation to be taken seriously as the central indicator of sustainable pastoral livelihoods.

Pastoralism and Biodiversity

Pastoralism and the culture of pastoralists, plays a significant role in protecting biodiversity, including flora and fauna, ecosystems and livestock breeds. Pastoralists employ elaborate land-use strategies for conserving resources, including grazing regimes, stocking regulations and pasture conservation within many pastoral societies (Ruttan and Borgerhoff Mulder 1999). Pastoral land management strategies

² In this report, pastoralism refers to extensive livestock production in the rangelands in which livestock (herd) mobility is a central management tool.

are based on the understanding that opportunism, flexibility and mobility are the key strategies for sustainable dryland management (Scoones 1994). Although pastoralism is often considered to be synonymous with land degradation and biodiversity loss through over-grazing these claims are often exaggerated and many of the assumptions behind this thinking have been successfully challenged (Behnke and Scoones 1992, Behnke and Abel 1996).

Although pastoralism is a relatively recent phenomenon in evolutionary terms, natural resource management and herding strategies of pastoralists have modified many ecosystems to the extent that their removal is often detrimental to grazing ungulates and rangeland diversity (Lamprey and Waller 1990). Many rangelands are managed agroecosystems in which pastoralists have employed a range of management tools for millennia, including the use of fire and intensive grazing to promote the growth of palatable grasses and reduce the encroachment of bushes. Such strategies often create conditions favourable for wildlife, a fact supported by the presence of higher diversities and populations of wildlife in some pastoral areas adjacent to national parks, than in the parks themselves (ILRI 2006).

Many of the attributes of pastoralism that enable pastoralists to withstand environmental risks also contribute to conservation goals, including herd mobility, species diversity, herd splitting (particularly in African pastoral systems), communal resource management and reliance on multiple natural resources. Herd mobility and communal resource management enables pastoralists efficiently to manage highly variable and uncertain resources, providing intensive but periodic impacts on vegetation that favour certain rangeland plant species. Pastoral livestock are extremely well adapted to their natural environments, and are important to the sustainable management of those environments, and they represent important harbours of animal genetic diversity in their own right. By maintaining diversity of livestock types and by splitting their herds (or their claims over livestock) between different locations pastoralists are able to manage a greater variety of ecosystems and “mosaic landscapes”, providing greater diversity in the production base and greater resilience in highly dynamic “non-equilibrium” rangeland ecosystems. The impact of pastoralism is therefore important at all three levels of biodiversity: genetic, species and ecosystems.

In spite of a plethora of studies illustrating a sustainable relationship between pastoralists and rangeland flora and fauna, pastoralism is continuously blamed for loss of biodiversity, and not without evidence. Where constraints are imposed on pastoralism, particularly through restriction of the attributes described above, for example through restriction of mobility or fragmentation of landscapes (Niamir Fuller 1999), pastoralists are often observed to compromise the environment. Some conservation policies have, in the past, contributed to such constraints, particularly through the annexation of pastoral lands to create wildlife sanctuaries. Environmental degradation is also prevalent where natural resource management has been undermined as a result of weakening of local governance. Other drivers of biodiversity loss through pastoralism can be observed where livestock development interventions have removed seasonal constraints to livestock systems, for example by introducing new water sources or disease control measures, without taking into consideration the need for high fluctuation in livestock population numbers according to the highly variable natural resource base.

Another driver of habitat destruction in pastoral areas is population pressure. While population growth of pastoral peoples has been slow (Pratt et al. 1997), growth of non-pastoral groups in dry and sub-humid lands have been among the highest in the world. Flexibility of animal movement can be hampered by increased population pressure and loss of corridors between wet and dry season grazing areas. There, stock is increasingly concentrated the entire year on the same lands, breaking the cycle of alternating use of wet and dry season grazing areas, potentially leading to over-use of dry season grazing land (de Haan et al. 1997).

High Nature Value Pastoralism

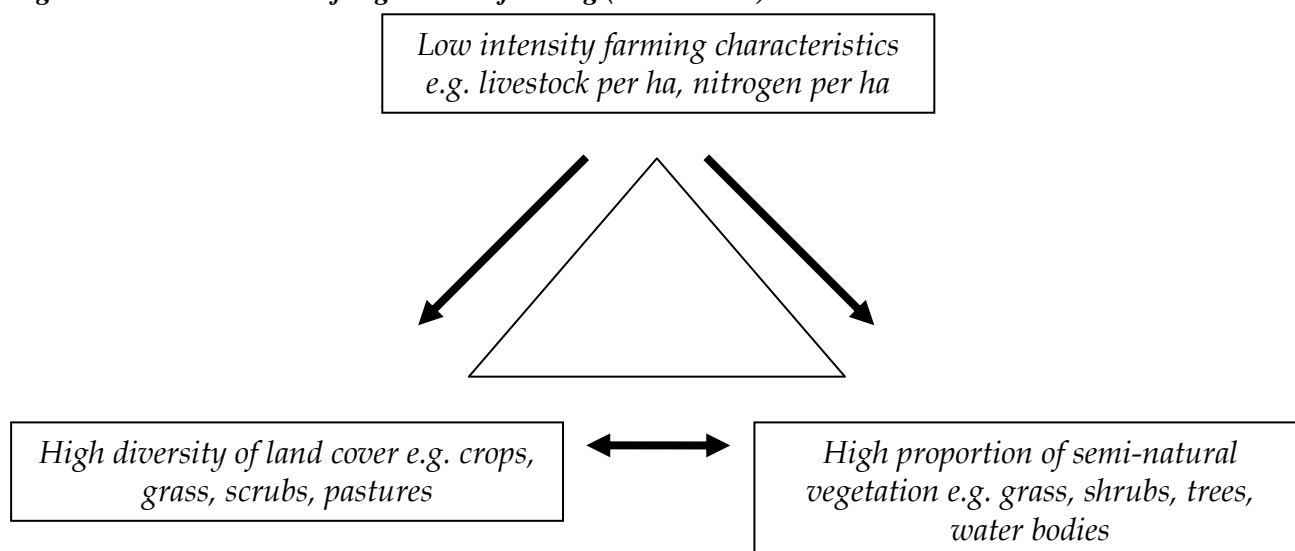
In many industrialized countries of Europe, the role of pastoralism in creating and protecting biodiversity is increasingly recognized and a variety of incentives have been used to enable pastoralists to capitalise on the environmental benefits of their production system, and thereby

increase the economic importance of biodiversity conservation in relation to livestock productivity. Mountain pastoralists in Europe derive important secondary incomes from tourism, and in some areas pastoralists have begun to target niche markets for products (such as cheese) that have attractive environmental and cultural credentials.

In addition to maintaining species diversity, where pastoralism is practiced effectively, livestock grazing can contribute to maintaining biomass production, reducing erosion, maintaining soils, improving nutrient and water cycling and improving carbon sequestration, not to mention protecting rangelands from tillage which would release huge quantities of greenhouse gasses (WISP 2008). The floristic diversity of rangelands varies markedly but the key factor in determining this diversity is the morphology of grazing impact. If the grazing is excluded, biodiversity may increase in the short term but may decline in the long run mainly because the system itself changes and in future may not withstand external disturbances like drought and fire (West 1993).

High Nature Value (HNV) farming systems are production systems with unique characteristics that lead to creation and protection of biodiversity: whether of species diversity or of particular endangered species. They are systems in which land cover with a high proportion and diversity of semi-natural vegetation is managed with low intensity for production. Such systems are usually low-intensity livestock farms, such as those managed by pastoralists, and they harbour unique habitats, many of which depend on continued HNV farming for their conservation (Figure 1).

Figure 1. Characteristics of high nature farming (Bartel 2009)



In a nutshell, pastoral systems are often high in nature value because pastoralism has over the years created and maintained vast areas of natural habitat including grasslands and wood pastures. More importantly, within these habitats, pastoral practices such as periodic (short-term) high-density grazing have created diversity in structure and composition of the vegetation, consequently providing niches for wide range of species to exist. Pastoral practices that are well integrated with environment are therefore often fundamental to the conservation of large proportion of drylands.

Climate Change, Pastoralism and Biodiversity Interactions in Drylands

“Mobile pastoralists are amongst those most at risk to climate change, yet they are amongst those with the greatest potential to adapt to climate change, and they may also offer one of the greatest hopes for mitigating climate change” (Davies and Nori 2008).

Climate change and pastoralism

Archaeological evidence from the Sahel suggests that pastoralism in Africa may have evolved as an adaptation to climate changes, and particularly increased aridity, some 6000 years ago and spread in parallel with the increasingly unpredictable and arid climate³. However, the world was very different 6000 years ago and adaptation strategies of the past may no longer be practical or adequate to address the current and future impacts of climate change. There are other reasons why current climate changes are of such great concern: the unprecedented pace of climate change compromises adaptation strategies; climate change is occurring at a time of major changes in resource availability and increased environmental degradation at the global scale and; the poorest and least resilient countries are those projected to bear the biggest burden. Drylands are particularly prevalent in the world's poorest countries, where people are most reliant on the natural resource base and on environmental goods and services, but where their capacity to invest in adaptive technologies is low.

The Millennium Ecosystem Assessment ranks climate change among the main drivers affecting ecosystems and biodiversity, and by the same token, change to biodiversity is likely to have a profound influence on the global climate. For instance, the consequences of climate change on the species component of biodiversity include changes in distribution, increased extinction rates, changes in reproduction timings and changes in length of growing season for plants among others (SCBD 2007). Drylands are vulnerable to climate change because a small variation in temperature and rainfall patterns can have major consequences for biodiversity, and because many drylands are already under stress from agricultural expansion, invasive alien species and pollution.

In most drylands climate change implies increased temperatures, higher evaporation rates, sporadic rainfall patterns and increased seasonal aridity, all of which are major determinants of drylands ecological processes. Climate change will thus induce a shift in drylands species distribution and reduced productivity of many pastoral lands (Edward 2000). Biodiversity loss in the drylands leads to the loss of productive inputs to pastoral systems, but it also leads to increased hazards for pastoral livelihoods, including higher prevalence of both drought and flood through disruption of ecosystem functions such as water cycling. There is an obvious feedback loop, with climate change leading to loss of biodiversity, leading in turn to greater impoverishment, which feeds back as less sustainable exploitation of the natural environment and reduced adaptive capacity. This may eventually feedback negatively into climate change by compromising carbon sequestration in the rangelands.

Although climate change affects pastoralists differently in different parts of the world, in general climate change jeopardizes the livelihoods of pastoral and agro-pastoral communities living in drylands as their livelihoods depend on natural resources such as pasture and water (Njoya, 2009). Studies indicate that climate variability will severely affect pastoralism through its effect on both the quantity and the quality of natural resources, reducing the carrying capacity of rangelands and the availability of water for livestock as well as changing plant species compositions in a manner that may favour less palatable species. The gross adverse effects of these events will be decreased production of crops and fodder for livestock, shortage of water and decrease in other natural inputs to local livelihoods.

The impacts of climate change on livestock disease are uncertain, with both positive and negative outcomes projected. Certain pathologies may be reduced by heat and drought, such as Trypanosomiasis and worms, although the same circumstances will lead to congregation of animals around water holes, increasing transmission of diseases. Climate change will influence livestock diseases through the effect on life cycles and transmission of pathogens, through the impact on vectors and on vector habitat, and through the impact on host immunity, which can for example be suppressed by exposure to ultra violet radiation.

Climate change and biodiversity

³ Climate Change, Adaptation and Pastoralism, available on the WISP website: www.iucn.org/wisp/wisp-publications

Climate change will impact negatively on biodiversity from the ecosystem to the species level. As weather patterns change, the boundaries of some habitats and ecosystems will shift, with some ecosystems expanding to new areas whilst others become smaller, contributing to a sharp acceleration in extinction rates. In other cases ecosystems may remain spatially intact, but climate change will disrupt their functioning for example by changing species composition or influencing water and nutrient cycling. The outcome will be significant shifts in the areas suitable for different species with large geographical changes in species composition and in some cases projected total loss of suitable climate for some species (McClellan et al. 2005).

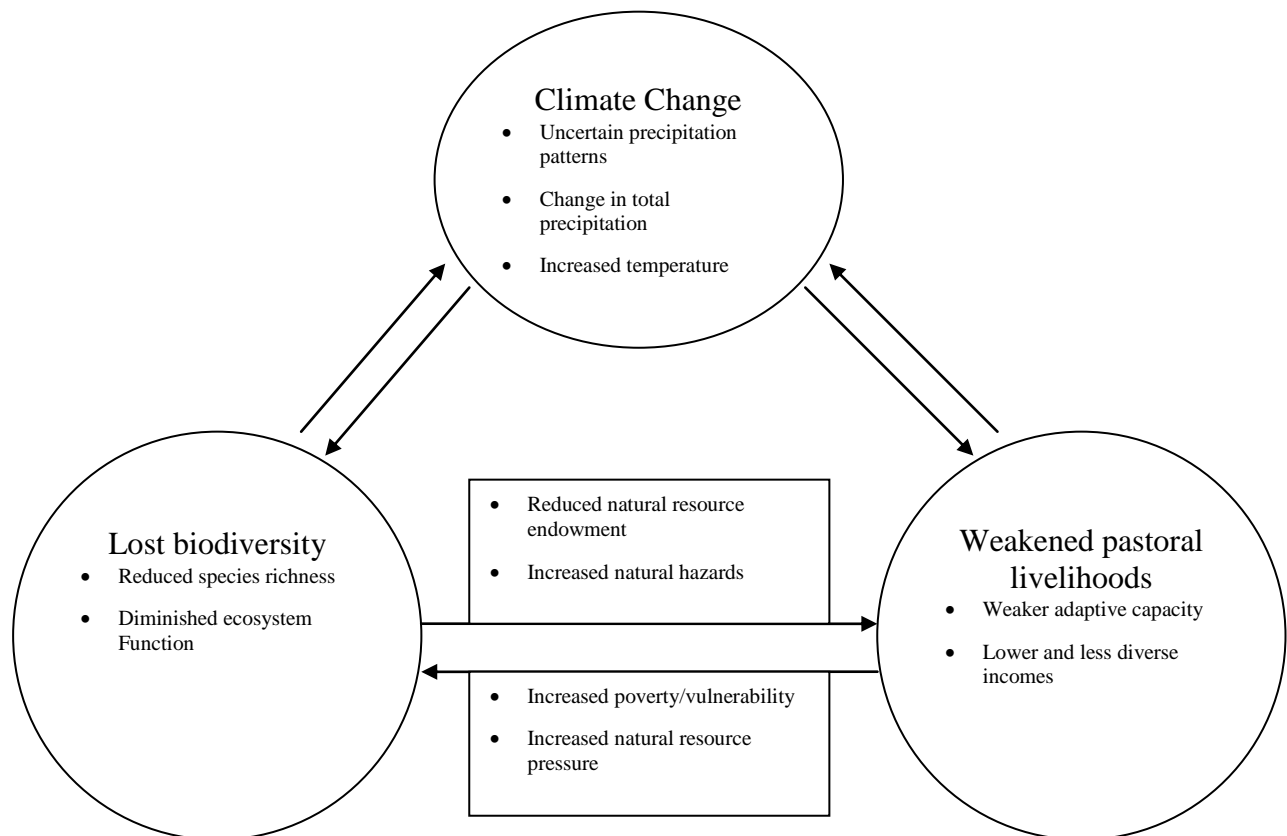
The projected changes in ecosystems and local climate has profound consequences for the adaptation of biodiversity and the rate and scale of change may present too great an obstacle for effective adaptation. The implications are equally profound when planning conservation strategies, since traditional approaches to protecting biodiversity in parks and reserves may contribute to the fragmentation of landscapes unless connectivity is fully considered. A much more dynamic approach to conservation is required that enables species to move with climate gradients and geographic range (Hannah *et al.* 2002a, Hannah, Midgley & Millar 2002).

One of the most efficient ways to address climate change impacts on biodiversity is to facilitate natural adaptation. Some obvious measures can be taken to facilitate natural changes across fragmented landscapes, and conservation strategies need to take into account “mobility”. Scientists advocate networks of conservation areas and “landscape connectivity” but this has to be on an adequate scale to avoid large numbers of extinctions. Movements of species will not respect international borders and landscape connectivity must therefore be Transboundary (Noss et al 1999).

There is strong resonance here with the arguments put forward for enhancing pastoral adaptation strategies by re-enabling mobility, managing at the landscape scale and managing across frontiers (Davies and Nori 2008, Davies et al. 2010). Indeed, the two issues have been dealt with simultaneously and to good effect in Spain, where an Act of Parliament passed in 1995 legitimizes the country’s 120,000 kilometers of cañadas, or transhumance corridors, to ensure that pastoral flocks continue their transhumance and in so doing, continue to preserve the country’s biodiversity (Jefatura del Estado, 1995). Transhumant pastoralism in Spain, particularly between mountain regions, connects ecosystems with a network of biological corridors in which livestock play the role of vector for native plants, improve the fertility of soil through manuring, and assist germination through gut scarification, thereby improving biodiversity in the country’s rangelands (Casas Nogales and Manzano Baena 2007). Plant seeds are transported through these corridors for distances in excess of 400 km, and the loss of transhumance would have profound consequences for plant biodiversity (Manzano and Malo 2006).

Biodiversity loss feedbacks on climate change, although not necessarily only negatively. A net loss in the rate of biomass production would lead to a reduction in the rate at which carbon is sequestered in drylands (both above ground and in the soil), but much more information is needed on the relationship between biomass production and permanent carbon sequestration. However, reduction in biomass is not the universal prognosis. Other factors that need to be better understood are the albedo effects of degraded soils, with more degraded soils reflecting more solar radiation, and the fertilising effects of increasing dust storms on ocean plankton (Zeng 2003). Outcomes of climate change are highly varied in different regions, for example the greening of the Sahel over the past 20 years is projected to increase (Brooks 2006), implying less severe dust storms with both positive and negative feedbacks on climate change, but also implying more potential cultivation of land which in turn will release huge amounts of NO₂.

Figure 1: negative feedback between climate change, biodiversity and pastoralism



The links between pastoralism, climate change and biodiversity

The effect of climate change on pastoral livelihoods is complex and not necessarily only negative. Higher temperatures will induce negative impacts through increased evapotranspiration and possibly through change in species composition. In some areas however, more rainfall is predicted and this could improve the natural resources available to pastoralists. Elsewhere rainfall is predicted to decline, which could render some rangeland resources less productive, but could equally render marginal areas less suitable for crop production and more suited to livestock keeping. In both rainfall scenarios, the determining factor for pastoralists may not be the amount of rainfall *per se* so much as the security of tenure (or lack of it) which in either scenario is likely to mean that non-pastoral communities (with more secure tenure) adapt more effectively than pastoralists.

Regardless of whether precipitation increases or decreases, it is almost universally projected to become more variable, which means greater unpredictability for land managers. Unpredictability presents less of a threat to pastoralists than it does to crop farmers, provided pastoralists retain the capacity to move and to manage far-flung resources communally. This impact has already been observed in Kenya during 2008 to early 2009 when crop farmers were lamenting early unexpected rains followed by a prolonged dry season, whereas pastoralists were able to benefit from the rains by making a-typical seasonal migrations⁴.

⁴ Later in 2009, continued prolongation of the drought in Kenya led to more serious stress for pastoralists and large scale migrations to drought contingency reserves where they were still available, as well as encroachment into national parks.

Table 1: synopsis of how climate change impacts on the environmental services and costs of pastoralism

Environmental service of pastoralism	Impact of climate change	Possible biodiversity outcome
Maintenance of pasture productivity & biodiversity through grazing and hoof action	Changes in transhumance patterns due to change in patterns of water availability or cultivation	Changes in distribution and balance of species, with potential pockets of over and under grazing both leading to land degradation
Distribution of seeds	Changes in transhumance patterns due to change in patterns of water availability or cultivation	Changes in distribution and balance of species
Increasing seed fecundity through rumen action	Reduction in total livestock numbers supported by the rangelands (where rainfall declines)	Reduction in rangeland natural regeneration may lead to land degradation and species loss
Nutrient cycling and accelerated biomass decomposition	Reduction in total livestock numbers supported by the rangelands (where rainfall declines)	Lower rate of nutrient cycling leading to rangeland degradation
Carbon sequestration through improved biomass production as a result of herbivore management	Reduction in total livestock numbers supported by the rangelands (where rainfall declines)	Lower rate of nutrient cycling leading to rangeland degradation
Maintenance of trees (reliance on diverse products)	Increased reliance on natural products and less sustainable harvesting as a result of impoverishment	Deforestation and over harvesting of seeds and other products
Protection of rangelands from tillage	Some crop areas may revert to rangelands, leading to net carbon capture Areas with increasing rainfall may be at risk of cultivation	Increase in rangeland biodiversity in some cases Some loss of biodiversity due to cultivation
Development and protection of animal genetic resources	Climate change will make locally-adapted species more desirable and more likely to survive	Possible increase in population size of indigenous breeds
Environmental disservices of pastoralism		
Overgrazing	Change in distribution of key resources (e.g. surface water) may disrupt transhumance patterns	In many rangelands, climate will continue to regulate overall livestock numbers, but patterns of localised over-grazing may change Changing access to water points may render some areas out of reach, leading to under-grazing
Distribution of invasive species, promoting competition of invasive species	Greater pressure on indigenous and non-invasive species	Invasive species more adaptable and competitive and therefore likely to become more competitive
Emissions of rumen methane	Change in pasture quality Change in stock numbers (carrying capacity) Temperature induced change in metabolic rates	Uncertain whether net effect will be positive or negative change in biodiversity
Competition with wildlife	Changes in resource distribution and availability leading to increased or decreased resource competition depending on	Outcome uncertain, but in many areas, increased competition with wildlife is likely

	climate outcome	
--	-----------------	--

Potential of Dry and Sub-Humid Lands to Contribute to Climate Change Mitigation

Dry and sub-humid lands, as defined under the Convention on Biological Diversity, include dryland, Mediterranean, arid, semi-arid, grassland and savannah ecosystems. Each of these ecosystems have a different carbon storage potential, but globally, dry and sub-humid lands represent an important reservoir of soil carbon and provide a significant opportunity to mitigate climate change. However, degradation of the dry and sub-humid lands, or desertification, is currently a globally important contributor to climate change. Improving the sustainable management of the dry and sub-humid lands is one of the most viable options for simultaneously reducing poverty, protecting biodiversity and mitigating climate change.

Carbon sequestration in soils is a major component of the global carbon cycle, with soil carbon accounting for two thirds of global organic carbon pools: enhancing sequestration can make a major contribution to climate change mitigation. Global stocks of carbon in the soil are approximately 3-4 times greater than in vegetation and more than double that in the atmosphere. Most global attention is focused on forests as a terrestrial Carbon sink, but whilst forests may add only about 10 per cent to their total weight each year, savannas can reproduce 150 per cent of their weight annually, and tropical savannas have a greater potential to store carbon below ground (in roots and soils) than any other ecosystem. Since effective herd management has been shown to increase primary productivity of the rangelands (Briske et al. 2008), and given the scale of pastoralism globally, it is evident that pastoralism has an important role to play in mitigation of climate change.

Drylands have lower mitigation potential per hectare than humid lands, but since dry and sub-humid lands cover 47% of the earth's land surface their overall contribution could be highly significant. The gross mitigation potential in the drylands is amplified by the fact that many dryland regions are affected by degradation and sub-optimally managed and can respond swiftly to management improvements (Farage et al, 2003). Globally, 36% of carbon stored in terrestrial ecosystems is stored in drylands. However, a significant amount of carbon is lost continuously from drylands due to poor management and conversion of rangeland to arable land. In many countries drylands are associated with higher than average levels of poverty and environmental degradation, with these features strongly linked to socio-political marginalisation, under investment, weaknesses in tenure, and a general poor understanding of how to effectively promote sustainable drylands development. Global awareness of these factors in drylands degradation is steadily growing and this opens up new avenues for improving drylands management, reversing land degradation and thereby both capture carbon and averting harmful cultivation of drylands.

Declines in carbon stocks are observed when drylands are converted from pasture to either plantation or to arable land and increases in carbon stocks are seen with a shift from native forest to pasture and from crop to pasture. Meta analysis has shown that carbon capture is increased with improved grazing management of rangelands, and high-diversity perennial grassland species have 5-6 times greater soil carbon and nitrogen than monocultures. The added advantage of improving carbon capture through improved rangelands management is that such practices also contribute significantly to improving the local and household economy. The challenge is that the factors which constrain the spontaneous adoption (or continuation) of such improved management are often at the societal level, requiring both political will, and the patience to build capacity and provide resources over time to ensure results on the necessary scale.

Mitigating climate change through improved drylands management can be achieved through three interrelated channels, firstly through enhancing carbon sequestration (by increasing carbon inputs to soil and above ground woody vegetation and reducing losses), secondly through improving resilience of the ecosystems and drylands populations to climate change and thirdly through the restored vegetative cover of rangeland contributing to sequestration of soil carbon. However, determining actual changes in carbon storage on grassland soils is complex because carbon fluxes in grasslands are driven by a number of interacting factors including the level of precipitation, average

/...

temperature and inherent soil and vegetation properties (FAO, 2009). At the same time, it is important to understand the feedbacks from climate change on the capacity of drylands to sequester carbon, through greater scarcity of water and higher temperature. Water scarcity constrains plant productivity and hence soil carbon whilst high temperature decreases pools of soil organic matters (FAO, 2004). However drier soils are less likely to lose carbon and consequently the residence time for carbon in drylands soils is relatively much longer (Farage et al, 2003).

Measuring carbon stocks and changes in drylands is hampered by a generally poor understanding of biogeochemical mechanisms controlling carbon flux and storage, or genetics and physiology underpinning key processes and of the structure and dynamics of below ground carbon stocks. Considering the scale of potential mitigation and reduction of emissions through sustainable drylands management, there is a pressing need for simplified systems of verification and measurement. New policies and institutional arrangements are required to monitor performance and ensure equity, to understand additionality, leakage and permanence, to link land managers with registered carbon traders, and to set standards and certification. However, such an investment in research and institution building is justified by the multiple interrelated benefits including reduced land degradation, protected biodiversity, reduced poverty and mitigated climate change.

Current Experiences and Lessons on Adaptation and Mitigation among Pastoral Communities

In ecological terms, adaptation is the process of an organism becoming better suited to its habitat, and it is normally a slow inter-generational process, and therefore of particular concern given the current rate of climate change. However, in current climate change debates, adaptation does not only refer to the biological adaptation of species or the biophysical adaptation of ecosystems, but frequently refers to the behavioural and economic adaptation of people. This interpretation takes precedence in this section of the report.

Pastoralism has sometimes been defined in terms of adaptive capacity, and pastoralism is unlikely to have become such a global phenomenon if adaptability was not a fundamental characteristic of pastoral societies (Davies and Nori 2008). Dryland environments are highly unpredictable, with major fluctuations around the mean precipitation both between years and between locations. Under such circumstances the capacity to adapt continuously is a pre-requisite for survival, and sustainable pastoral development must be founded on the understanding that adaptive capacity is what makes pastoralism work: the key indicator of sustainable pastoral development should be the strength of local adaptive capacities. These adaptive capacities allow pastoralists to adapt to new climatic conditions and changes in availability of natural resources associated with climate change.

Adaptive capacities are closely linked to the capacity to make informed management decisions over natural and other resources. Households adapt by moving livestock to alternative grazing zones, or by selecting pastures within access of functioning markets. Pastoralists traditionally adapt by shifting from one type of livestock to another – for example investing in camels that are more resilient, or in sheep that are more marketable. Pastoralists adapt by sending household members to school in order to diversify income sources and perhaps to strengthen links to government administration and other “urban services”. Although no thorough studies have been carried out into this phenomenon worldwide, it is clear that “adaptation” covers the gamut of pastoral livelihood strategies and as a concept is difficult to define or quantify.

Rather than itemise adaptive measures, it is more helpful to consider the underpinnings of adaptability: the factors that determine the degree to which pastoralists make informed (and free) decisions over how they allocate resources. This capacity depends on knowledge, both endogenous

and exogenous^v, and the ability to apply that knowledge. This in turn relies on protection of indigenous knowledge and access to new sources of knowledge, it relies on functioning institutions for governance of communal or common pool resources to ensure that an adaptive strategy does not impinge on or become undermined by the strategies of co-users, and it requires the necessary public resources and infrastructure to afford households the freedom to allocate resources according to their priorities.

Strengthening adaptive capacity for pastoralists and other drylands communities means strengthening rights, enabling reform, managing risk and increasing resilience and this requires greater partnership between communities, governments and Civil Society and an appropriately regulated private sector. As institutions are strengthened or created this creates demand for policy frameworks, which necessitates further empowerment, participation, and ownership. Strengthening adaptive capacity goes hand in hand with enhancing the economic and social well-being of pastoralists and enabling them to sustain ecosystem services and this in turn requires at least five key building blocks^{vi}:

1. Upgrading the knowledge base
2. Re-evaluating and sustaining ecosystem services
3. Promoting public and private investment
4. Improving access to profitable markets
5. Rights, reform, risk and resilience

Upgrading the knowledge base

Building on indigenous knowledge

Research has illustrated the strength and relevance of indigenous pastoralist knowledge in monitoring and managing rangelands and this knowledge provides the strongest platform on which to improve rangelands management (Oba 2009). Support to customary institutions to apply indigenous rangelands knowledge has shown that these institutions can be re-invigorated and their knowledge of the rangelands can be successfully harnessed for development purposes, that traditional leaders are able to re-assert customary rights over natural resources and to mediate over disputes and, with appropriate assistance, local government can engage meaningfully with customary leaders.

Based on this understanding, work with Arsi, Borena and Gujji communities in Liben District (Ethiopia) has led to resumption of regular meetings by formerly abandoned elders' councils (jaarsa dheeda) which has in turn led to significant changes in herd management (including greater herd mobility) and improved rangeland productivity. The jaarsa dheeda used participatory mapping methodologies to map resources and to develop community action plans which resulted in improvements in water resources, dismantling of inappropriate private enclosures, re-opening of former stock routes and rangeland pastures, improved use of fire to control invasive woody plants, restoration of degraded communal rangelands, and increased mobility of more than 160,000 livestock to former wet season grazing areas, resulting in the resting of dry season grazing and associated water points^{vii}.

^v This is not the place for an in depth discussion of knowledge systems, but the terms Endogenous and Exogenous are used tentatively here as it is understood that there are many ways to classify the difference between locally generated ("traditional", "indigenous") knowledge and non-local ("modern", "scientific") knowledge.

^{vi} Adapted from Mortimore *et al.* 2009

^{vii} Save the Children and SoS Sahel 2007. Report for the World Initiative for Sustainable Pastoralism by Solomon Wagkari, Save the Children USA (www.iucn.org/wisp)

Enabling local institutions for decision making and control

The Shinyanga region in northern Tanzania is occupied mainly by the agropastoral Sukuma people. The Hifadhi Ardhi Shinyanga (HASHI) project, which means “soil conservation” in Kiswahili, is a government initiative under the Ministry of Natural Resources and Tourism. It has been instrumental in reviving the Sukuma people's traditional practice of conservation. Using indigenous knowledge, they are practising a natural resource management system called *ngitili* – a Sukuma word meaning enclosure. Traditionally *ngitili* were used to provide animal fodder for very young, old or sick animals unable to follow other animals to grazing lands. Involving the conservation of grazing and fodder lands by encouraging vegetation regeneration and tree planting, *ngitili* has proven to help protect the environment and improve the livelihoods of communities in the region.

The Shinyanga region used to be extensively forested with dense woodland and bushland species. The traditional practice of *ngitili* was used by people in response to serious fodder shortages caused by the frequent droughts typical in semi-arid areas. The government relocation scheme, together with drought, over-grazing, cash crop cultivation, destruction of forests to wipe out tsetse fly and increased demand for fuel wood, began to reduce land productivity and increase deforestation and soil erosion. This has changed the Shinyanga landscape, thanks to farmers' enthusiasm for agroforestry^{viii}.

Supporting indigenous forecasting

The Maasai alternate the use of their natural grassland according to seasons. This requires a timely decision on when and where to move next. They predict droughts as well as weather related diseases by watching the movements of celestial bodies in combination with observing the date of emergence of certain plant species (e.g. Ole Kitolya). Such 'early warning signals' of an approaching environmental disaster are used to determine any preventive measures, mitigate negative impacts and decide on the course of the community in using the natural resources.

Similarly, pastoralist Maasai practice everyday monitoring of their resource base to determine the trend of range condition and to detect early signs of deterioration. To ensure reliability of evaluation they have developed various sampling and surveying techniques. They observe forage types, quality, quantity and condition as used by livestock and wildlife. Common indicators used are: daily milk yield, animal coat texture and colour, consistence of cow and wildlife dung, and the extent of bush encroachment. None of these indicators is used in isolation; rather a combination of all of them provides the experienced pastoralist with early indications of the condition of the range land and its likely changes. Based on the observations, the herders decide how to manage the situation or to apply coping strategies in case of an impending drought. The knowledge of the Maasai is little researched so far. Traditional expertise in astronomy and weather forecasting in combination with conventional agricultural meteorology could enhance local forecasts on harvests and food security^{ix}.

Introducing new relevant knowledge

Although traditional adaptation mechanisms have been used and transmitted over generations, they may not always be sufficient to address climate change. Therefore, there may be a need to design new adaptive mechanisms that are built on traditional practices and knowledge as well as appropriate technology transfer to strengthen the capacity of local people to address the issue of climate change through imparting new knowledge and blending of traditional and modern adaptation measures. In a situation where pastoralist group have adequate access to the marketplace, market-based adaptation practices can be utilized. A prominent example of market based adaptation is weather related insurance schemes designed for farmers or pastoralists group in Mongolia. The market oriented insurance instruments offer significant capacity to spread weather-related risks. As

^{viii} UNFCCC database on local coping strategies. <http://maindb.unfccc.int/public/adaptation>

^{ix} UNFCCC database on local coping strategies. <http://maindb.unfccc.int/public/adaptation>

climate change erodes the insurability of some risks, proactive insurance responses with complementary roles by donors, governments, and local communities can address the needs of highly vulnerable pastoralists groups and populations (Agrawal, 2008). However, using market-based insurance to address climate risks will require strong partnerships between public, private, and community actors. Other institutional based adaptations could include early warning systems, extension and education, micro-credit and commercial cooperative mechanism.

Enabling knowledge development through education

Access to basic education has long been a challenge for pastoralists yet it is increasingly crucial to their capacity to adapt, by strengthening pastoral management practices, enabling pastoralists to diversify into other sectors of the economy, and enabling pastoralists to engage effectively with new systems of governance and with State institutions. Examples of successfully improving pastoral education have included changes to make curricula more relevant, adjusting academic calendars to fit the pastoral production cycle, overcoming the challenges of mobility, and ensuring that teachers have the relevant language and cultural sensitivity to be effective.

Some examples of improved pastoral education can be seen in Iran, Sudan and Mongolia. In Iran, a Tent School system has now operated for Qashqa'i pastoralists for over 50 years, and has successfully educated several generations of nomadic children, to the extent that teachers are increasingly drawn from local communities and the programme now includes a Teacher Training School. In Sudan, the focus is on keeping children, particularly girls, in school and ensuring a supply of qualified and motivated teachers and revolves around appropriate incentives to teachers, reliable supply of teaching materials, and community-wide awareness raising of the rights of women and girls. In Mongolia, the challenge of motivating teachers to work in remote and challenging regions has been overcome through investment in distance (radio) learning, which has been facilitated by the already high level of education in rural areas^x.

Re-evaluating and sustaining ecosystem services

Capitalising on High Nature Value

Promoting sustainable pastoral natural resource management and pastoral adaptive capacity requires greater awareness of the contribution that pastoralism makes to protecting and enhancing ecosystem services and novel incentives are needed to promote these environmental services. In the pastoral Alpine regions of Switzerland, conservation goals are integrated with social and economic goals through the Federal Act on Aid to Investment in Mountain Regions (901.1 of 1997). Swiss pastoralists increasingly capitalise on the High Nature Value of their farming system by targeting niche markets that pay a premium for 'green' produce, and by diversifying into ecotourism^{xi}.

Carbon sequestration in pastoral lands

More directly related to climate change is the role of rangelands in sequestering carbon. Research in the Tibetan Plateau has demonstrated the cost in Carbon stocks of long-term continuous heavy grazing and proposals have been made to use carbon finance as an incentive to reduce stocking pressures. It is estimated that, in a place where average incomes are below US\$1 per day, if management practices could increase soil C sequestration by just 0.5 tC/ha/year, then even at a price half of current carbon prices a herder household might be able to receive payments of over \$3700 per year, more than their current annual income, while also preventing the loss of important

^x Swiss Tropical Institute 2009. Learning from the delivery of social services to pastoralists: elements of good practice. Report for the World Initiative for Sustainable Pastoralism (WISP), IUCN Nairobi

^{xi} Jean-Pierre Biber 2007. The SAMI project – a project for the marketing of mountain agriculture products in Switzerland. European Forum on Nature Conservation and Pastoralism (EFNCP). Case Study for the World Initiative for Sustainable Pastoralism.

ecosystem services in this critical region (Wilkes 2008). Progress on this important ecosystem service has been slow, partly due to disagreements over what constitutes improved rangelands management and particularly over regional differences in perception of over grazing and the relevance of the concept of carrying capacity.

Promoting public and private investment

Investment in infrastructure

Public investments can be linked to adaptive capacity in many ways, including through strengthened local administrative systems and legal services, through infrastructure and services, through social safety nets and through private sector incentives. A simple example of an unintended consequence of infrastructure development on pastoral adaptive capacity was shown in Pakistan with the opening of the Karakoram highway to China. The new road link has permitted easy transport of cereals from the plains and pastoral lands that were formerly used for subsistence cultivation of cereal are now used to cultivate winter fodder, thereby increasing investment in pastoralism and leading to introduction of new fodder technologies and cultivars (Ehlers and Kreutzman 2000).

Investment in service delivery

Veterinary services are critical to sustainable pastoral livelihoods and have been widely promoted in the private sector through training of local service providers and creation of supply chains. Training of Community Animal Health Workers (CAHWs or paravets) has become a widespread practice in Eastern Africa, in most countries exploiting the opportunity created by privatisation of veterinary drug supply. Many diverse and innovative approaches have been used and increasingly they are based on a partnership between services providers operating in the private sector, and public sector veterinary departments, joining forces for example on disease surveillance and response, training and quality control.

The approach to private sector supply of veterinary services, and the rapid local acceptance of this approach, has inspired innovative approaches to the supply of human health services in some countries. In the year 2000 the prevalence of fully immunized children and women in some pastoral areas of Chad was zero, yet in the same areas, livestock were compulsorily vaccinated by circulating veterinary teams. In light of this, Chadian public health professionals agreed to implement joint human and animal health campaigns with 14 vaccination campaigns carried out between 2000 and 2005, leading to significant reduction in diseases such as measles and whooping-cough. Although the link between health, adaptation and biodiversity conservation have not been explicitly made, it is easy to postulate a strong connection based on reduced household expenditures, reduced morbidity of the workforce and lower dependency on family members.

Financial services

Boosting private investment in pastoral regions is facilitated by access to appropriate financial services, which is another area where innovations are beginning to have an impact. Mongolia has experimented successfully with index-based livestock insurance as a risk spreading measure. Herders pay a market premium rate for the base insurance product, which pays out to individual herders whenever the livestock mortality rates in a given location exceed a defined threshold, with payments made on basis of a local average rather than an individual herders' livestock losses. In Tibet, greater emphasis has been placed on making credit available to pastoralists and a revolving "sheep bank" has been set up to lend fertile adult female sheep to poor families with fixed repayment terms (Miller 2008).

Improving access to profitable markets

Strengthening household resilience through market penetration

Resilience of pastoral communities can also be strengthened through greater marketing of the diverse range of products that are found in their rangelands environment. Some of these products are already consumed by pastoral households, and many of these products have global as well as local markets, although some products with potential global appeal have never reached Western markets. Products include fruits, oils, herbal remedies and nutritional supplements. In Eastern Africa, Gum Arabic produced from *Acacia senegal* is in major demand and provides significant export earnings for Sudan. *A. senegal* grows naturally in the drylands and is an integral component of sustainably managed rangelands. Local entrepreneurs have identified marketing opportunities for products such as incense, henna, and aloes although there is plenty of scope to improve the scale at which these products are sustainably extracted. In Southern Africa a company called PhytoTrade is an example of a private sector initiative to promote sustainable and equitable management of natural products. This non-profit Trade Association focuses on industry development, product development and market development. The association plays a role in linking clients and suppliers, assuring quality control, profiling ecological products, and assisting with import/export regulations and contracts, as well as providing a clearinghouse for research and development information on African natural products^{xii}.

Ecotourism

A number of community conservancies have been created in northern Kenya, exploiting the high tourism potential of the country and the natural complementarity between extensive livestock keeping and wildlife conservation. The Naibunga Conservancy Trust for example is a community initiative collectively owned and managed by nine group ranches in Laikipia North district, with 43,000 acres set aside as a conservation area. As a result of creating this conservancy the Naibunga community has improved biodiversity, including wildlife and medicinal plants, and has developed lucrative Eco Lodges that provide tourist revenues and employment opportunities. Income from the conservancy is managed by a Community Trust and has been used for school bursaries, investing in water projects, and improving communication and transport facilities.

The Kalama Community Wildlife Conservancy is a similar initiative, covering 32,945 hectares of land and 5000-6000 people in Samburu East district. The conservancy was established in 2001 in order to derive alternative sources of income for livestock keepers, with 16,000 hectares set aside as a buffer zone, of which 6,000 hectares are designated as a core conservation area. Members of the conservancy graze livestock in the buffer zone during the dry season but access to the core conservation area is restricted except in the worst drought years. The conservancy is managed by an elected board which draws its membership from different parts of the group ranch. Benefits to the community include secure land tenure, new employment opportunities, greater security, better water facilities, improved grazing management, and improved transport and communication networks. These alternative incomes give households greater resilience during periods of drought, they effectively act as a counter-incentive to policies that drive less sustainable forms of production oriented around meat marketing, and they deliver a range of other benefits^{xiii}.

Rights, reform, risk and resilience

^{xii} <http://www.phytotradafrica.com/default.htm>

^{xiii} Rodriguez 2008. A Global Perspective on the Total Economic Value of Pastoralism: global synthesis report based on six country valuations. Report for the World Initiative for Sustainable Pastoralism.

Land reform and pastoral land tenure^{xiv}

Many countries that are home to pastoralists, particularly in the developing world, have seen land reforms in the recent past. These are taken in the context of decolonisation, as for example in many Sub Saharan African countries, or de-nationalisation as in the case of the former Soviet States. In Bolivia, Agrarian Reform was the consequence of a continued “colonialist” order and led to abolishment of the large Latifundia estates in 1953 against the background of a serious social and political upheaval. In China, land reforms were a consequence of the democracy reformation in the late 1950s where all land formerly owned by tribes, nobles and monasteries was nationalized. At a later stage, in the process of the opening up since 1978, the liberalization has led to privatisation of livestock and land. Similar processes took place in the central Asian republics of Kazakhstan and Kyrgyzstan.

In many African States constitutional reforms introduced guarantees of basic human rights and political freedoms such as the right to organize and the right of liberty of opinion leading to multi-party politics. At the same time processes of land-reform were initiated. An exception to these processes is Chitral in Pakistan’s North, where until the accession to Pakistan in 1969, a feudal system existed and rights to pastures are still in a transition from customary law to formal provincial law.

Land reforms have led to different systems of allocating rights over grassland resources, with different strengths and weaknesses for sustainable rangelands management:

- Rights given to the communities: for instance in Nepal the communities have the right to use and manage the State land. The same is true for the grassland surrounding the communes in Kyrgyzstan and Kazakhstan. In these three cases the land remains in common use.
- Communes become the owners of the communal land: this has been the case in India, where communes have the right to sell parcels to private parties. Non-communal land remains in State ownership, where the policy appears to be to distribute and privatise land, particularly in the interest of landless farmers.
- Customary use of State land by pastoralists: for example, in Argentina transhumant pastoralists have, since time immemorial, used land that is now State land. As they are a small minority, there is no formal regulation, and no explicit recognition of their customary rights.
- Rent of State land: in Kyrgyzstan and in Kazakhstan, pastures can be rented for a certain time. Kazakhstan also provides the option to buy pastures, up to a limited maximum size in order to prevent land grabbing.
- Private property of pasture land: found for example in China and Kenya. In China there is an ongoing process of privatising all farmland, whereas in Kenya one of several parallel tenure systems provides for group owned ranches, which in some areas has led to sub-division and individualisation of ownership.
- Common property systems: in Ethiopia, communal rural land holdings can be privatised, but only if there is a tribe-based communal landholding system in place. Similarly in Uganda, customary rights to land ownership and management can be formalized by registration of the respective communities as “Communal Land Associations”.

Property regimes in Mongolia and their Impacts on the pastoral environment

Since 1990, Mongolia has transitioned from a centrally planned to a market-oriented economy. During the process of Structural Adjustment prescribed by the World Bank in the 1990s, all collective properties including livestock, livestock shelters at winter and spring camp sites as well

^{xiv} Biber-Klemm 2009. Organization of Pastoralists to defend their Land Rights. Report for the World Initiative for Sustainable Pastoralism (WISP). IUCN Nairobi

as collective machinery and buildings were privatized. Grazing lands, however, remained under the control of the state. Although privatization improved individual property ownership, the absence of formalized land rights for pastoralists together with the absence of customary institutions and arrangements to manage land led to land grabbing by the wealthy, conversion of land to non-pastoral uses such as mining, and widespread overgrazing and environmental degradation.

The 2003 “Law on Land” and the 2006 “New Amendments to the Law of Nature and the Environment” reversed this situation by placing greater control of natural resources in the hands of customary institutions. Subsequent efforts to organize herders in community groups and restore customary institutions and common property management regimes have resulted in significant improvements in environmental quality and the economic status of group members. Herders are reverting to traditional risk management strategies, developing multi-species herds and returning to customary and more localized levels of cooperation for the management of labour and the production of hay and other inputs. This has led to numerous benefits for both livelihoods and the environment. Incomes have risen, poverty has fallen, and environmental condition has improved as a result of the resurrection of community pasture use rules, increased seasonal movement, improved access to pastures, and increased control over productive resources such as water points. The conservation benefits have been directly felt by pastoral households through tourism and improved livestock and products marketing. Extensive areas of rangeland have been rehabilitated through the application of effective grazing regimes, the use of alternative fuels, and through improved community efforts to monitor and protect against illegal use of resources.

Improving rangelands through co-management

Co-management approaches to grassland management are becoming increasingly popular around the world. In Xiao Zhongdian, China, participatory approaches that implemented the usual approaches to fodder and animal husbandry had proven unsuccessful, so from 2006 co-management was introduced. Training was carried out for villagers, village committee members, township and prefecture technicians and township officials who together developed a locally-appropriate approach to co-management.

Evaluation in 2007 showed that the activities implemented have made a considerable contribution to the rehabilitation of degrading grasslands. The most important activity was not the introduction of new technology, but the enforcement of new grassland management regulations by the community. Improving institutions for the management of grasslands is the core of the co-management approach^{xv}.

Pastoral women's empowerment

Empowerment is the process by which the powerless gain greater control over different aspects of their life, including control over resources (physical, human, intellectual, financial) and ideology (beliefs, values, attitudes). Empowerment implies “greater self-confidence, and an inner transformation of one's consciousness that enables one to overcome external barriers to accessing resources or changing traditional ideologies”^{xvi}. Group formation can be a way for poor communities to empower themselves, generate social capital and create new income opportunities.

In the Republic of Lebanon, women's food cooperatives were created as part of a wider livestock development programme. By pooling resources and sharing risk, women were able to access loans from the project, and through the work of the cooperatives, women were able to find employment. Women cooperative members found that this cooperative effort led to improvements in their social

^{xv} Wilkes A., Jiguang M., and Ye L. 2007. Community Co-management of Grasslands in Xiao Zhongdian, Yunnan, China. The Mountain Institute, China.

^{xvi} Sen and Batliwala 2000 (check quotation###)

standing, a greater sense of empowerment, and strengthening of social capital through dismantling of socio-economic barriers (Flintan 2009).

Similar outcomes have been observed through other approaches to building women's solidarity and strengthening social capital networks. In Uganda NGO support for communal grain banking in Karamoja has been carefully developed to work with existing community group, often based on extended family lines. Small groups of 4-5 women construct a communal grain bank, which is a traditional practice, and NGOs provide stock during periods of food insecurity. Different women's groups then form larger units with an additional communal grain store, which can operate on commercial lines but is also restocked during periods of hardship by supporting NGOs. In this way the NGO meets its objectives whilst ceding management control of resources to the local beneficiaries, who determine when to use the stored food and who should benefit.

Conclusions from Recent Experiences on Adaptation and Mitigation

The adaptive capacity of pastoralists is what has made them so resilient throughout history and has enabled them to sustainably exploit their natural environment. Their adaptive management skills have enabled pastoralists to create and maintain biodiversity in many environments of extraordinary natural beauty, which are enjoyed by consumers worldwide. Yet pastoral development over the past century has, in many cases, been characterised by the loss of this adaptive capacity, and the outcome has been a vicious cycle of impoverishment, resource depletion and environmental degradation, which further erodes adaptation (Davies and Nori 2008).

Restoring adaptive capacities through the implementation of activities such as those highlighted above, is crucial for sustainable pastoral development, and the new challenges of climate change add another argument for building resilience rather than a new argument or a push in a new direction. Adaptive capacity is not about new technology or new skills *per se*, although introducing new knowledge may be part of the solution. Knowledge is one of many resources to be allocated by pastoralists to improving their resilience and key to building adaptive capacity is strengthening governance and respecting the rights of pastoralists as citizens. This is easier said than done in poor countries with particularly scarce budgets and strong demands from competing sectors, but experiences illustrate what is possible and a stronger case has to be made for sustainable and equitable investment in pastoral lands as a priority to build adaptive capacity and ensure that biodiversity conservation is central to pastoral livelihoods.

Conclusions and Recommendations

Pastoral lands are too diverse to make sweeping predication of how they will be affected by climate change. Some lands will get wetter, others will get drier, some will get significantly hotter, and most will find the climate more unpredictable leading to more frequent climatic events such as blizzards, droughts and floods. This increasing unpredictability in regions that are marked by their levels of poverty is cause for immediate concern. Impoverishment of pastoral communities contributes to break down in natural resource governance and leads directly to over dependence on the least sustainable natural resource extraction practices. Strengthening the livelihoods adaptations of pastoralists is therefore the most obvious route to ensure that the impact of climate change on biodiversity is not amplified by its impact on pastoralism and vice versa.

The five foundations of adaptive capacity and economic and social well-being of pastoralists presented in this document have obvious policy implications, but these implications are far reaching and go beyond any one sector. Policy support is needed for more effective education and other social services, for appropriate investments and financial services, for local governance and security, and for greater emphasis on the societal underpinnings of adaptive capacities. It is difficult to prioritise amongst these different sectors and what is perhaps needed more than anything is for an over-riding political will to support pastoralism as a crucial tool for sustainable natural resource

management, biodiversity conservation and poverty reduction in the world's drylands. In some countries such political will seems a long way off.

It is important to challenge pre-conceived notions of what constitutes adaptive capacity, and it is important to put the goals of pastoralists centre stage of adaptation debates. The drive to find new technologies and new management strategies needs to be tempered with a new drive to apply good knowledge and to respect the existing knowledge of pastoral communities. These arguments do not differ from the core arguments in favour of sustainable livelihoods development, but the arguments remain unheeded and the spectre of climate change may be useful in raising the urgency to act. Above all it is crucial to understand that the only way to ensure sustainability in pastoral livelihoods – possibly in all rural livelihoods – is to address the societal constraints to sustainable development. This means acknowledging the political dimensions of impoverishment and vulnerability and working with government and civil society to address them.

Early warning systems will be critical given that advance knowledge about potential disasters may enable communities to establish safeguards at household level. However, such warning systems must go in tandem with building the capacity of pastoralists to make informed choices using the information they receive, and raising their capabilities to implement their preferred adaptation strategy. This includes ensuring that pastoralists have the necessary capital at their disposal (including human and financial capital) which in turn means a much more resilient and productive livelihood platform. The role of adaptation funds has to be considered within this light, so that funds are used to strengthen pastoral livelihoods and adaptive capacity, rather than support alternatives that constrain pastoral livelihoods in the long term.

Achieving sustainable land management at scale in pastoral areas remains a major barrier, and one that is frequently reinforced through perpetuation of failed development policies and misguided investments. Pastoralists remain left behind in development terms, and are frequently poorer than average even in the poorest countries – particularly when poverty is measured in human development terms rather than simply in terms of assets and income. Pastoralist development needs major upheaval and the general attitude towards, and understanding of, pastoralism continuously needs to be challenged, otherwise the same failed policies that have stripped adaptive capacity over the past century will continue to be pursued at the expense of pastoralism, biodiversity and ultimately climate change.

References

- Agrawal Arun (2008). *The Role of Local Institutions in Adaptation to Climate Change, Social Dimensions of Climate Change*, Social Development Department, The World Bank, Washington DC, March 5-6, 2008.
- Bartel, A. (2009). High nature farmland as an European evaluation indicator – definition, function and status quo, international workshop of the Salvère project. Agricultural research and educational center, Raumberg, Gumpenstein.
- Behnke, R. and Abel, N. (1996) .The overstocking controversy in semi-arid Africa. *World Animal Review* 87:4–27.
- Behnke R. and Scoones.I (1992) Rethinking range ecology: implications for rangeland management in Africa Env. Work Paper 53, Washington DC, World Bank
- Bonkougou E. (2000) biodiversity in drylands: challenges and opportunities for conservation and sustainable use, the global drylands partnership (CIDA, UNSO, UNDP/GEF, IIED, IUCN, WWF AND NEF)
- Briske, D.D., J.D. Derner, J.R. Brown, S.D. Fuhlendorf, W.R. Teague, K.M. Havstad, R.L. Gillen, A.J. Ash and W.D. Willms (2008). Rotational grazing on rangelands: Reconciliation of perception and experimental evidence. *Rangeland Ecology and Management* 61:3-17.
- Brooks, N. (2006). Climate change, drought and pastoralism in the Sahel. Discussion note for the World Initiative on Sustainable Pastoralism, IUCN.
- Casas Nogales, R. y Manzano Baena, P. (2007). Valoración Económica del Pastoralismo en España. Report for the World Initiative for Sustainable Pastoralism. www.iucn.org/wisp/
- Davies, J. and Nori, M. (2008) managing and mitigating climate change through pastoralism, Climate change, energy change and conservation, policy matters 16
- Davies, J., Niamir-Fuller, M., Kerven, K. and Bauer, K. (2010). Extensive livestock production in transition: the future of sustainable pastoralism. In *Livestock in a Changing Landscape, Volume 1, Drivers, Consequences, and Responses*. Steinfeld, H., H. A. Mooney, F. Schneider, and L. E. Neville, eds. 2010. Washington, DC: Island Press.
- de Haan C., Steinfeld H. and Blackburn H. 1997. *Livestock and the environment: Finding a balance*. WRENmedia, Fressingfield, UK. 115 pp.
- Ehlers, E., and Kreutzman, H. (2000). *High mountain pastoralism in northern Pakistan*. Stuttgart, Germany: Franz Steiner Verlag.
- FAO (2004) carbon sequestration in dryland soils, world soil reports 102, Rome
- FAO (2009) Grasslands: enabling their potential to contribute to greenhouse gas mitigation, workshop proceeding, Rome.
- Farage P, Pretty J and Ball A (2003) Biophysical aspects of carbon sequestration in drylands, University of Sussex, UK.
- Flintan, F. (2009). Good practice in Pastoralist Women’s Empowerment. Report for the World Initiative on Sustainable Pastoralism, IUCN Nairobi.

- Hannah, L., Midgley, G.F. & Millar, D. (2002). Climate change-integrated conservation strategies. *Global. Ecol. Biogeogr.* 11, 485–495.
- Hannah, L., Midgley, G.F., Lovejoy, T., Bond, W.J., Bush, M., Lovett, J.C., Scott, D. & Woodward, F.I. (2002). Conservation of biodiversity in a changing climate. *Conserv. Biol.* 16, 264–268.
- ILRI (International Livestock Research Institute) (2006). Pastoralism: The surest way out of poverty in East African drylands. Fact sheet. Nairobi: International Livestock Research Institute.
- Jefatura del Estado (1995). Ley 3/95, de 23 de marzo, de Vías Pecuarias. Official State Gazette No. 71, 24 March.
- Lamprey RH, Waller R (1990) The Loita-Mara region in historical times: patterns of subsistence, settlement and ecological change. In *Early pastoralists of south-western Kenya.*, British Institute in Eastern Africa, Nairobi; 1990:16-35.
- Little, D. P (1996) Pastoralism, biodiversity, and the shape of savannah landscapes in East Africa; *Africa*, 66 (1)
- Manzano, P. and Malo, J. E. (2006). Extreme long-distance seed dispersal via sheep. *Frontiers in Ecology and the Environment* 4 (5): 244–248.
- McClellan, C.J., Lovett, J.J., Ku, W., Hannah, L., Henning Sommer, J., Barthlott, W., Termansen, M., Smith, G.F., Tokumine, S. and Taplin, J.R.D. (2005). African Plant Diversity and Climate Change. *Annals of the Missouri Botanical Garden*, 92 (2).
- Miller, D. (2008). Livestock Insurance and Credit. In *People and Policy in rangeland Management: a glossary of key concepts*. The International Rangelands Congress 2008, Hohhot, China.
- Mworia and Kinyamario, (2007). Traditional strategies used by pastoralists to cope with La nina induced drought in Kajiado, Kenya, *African Journal of Environmental Science and Technology* Vol. 2 (1), pp. 010-014,
- Mortimore, M. with contributions from S. Anderson, L. Cotula, J. Davies, K. Facer, C. Hesse, J. Morton, W. Nyangena, J. Skinner, and C. Wolfangel (2009). *Dryland Opportunities: A new paradigm for people, ecosystems and development*, IUCN, Gland, Switzerland; IIED, London, UK and UNDP/DDC, Nairobi, Kenya. x + 86p.
- Nassef M, Aderson S and Hesse C (2009). Pastoralism and climate change: enabling adaptive capacity, Oversea Development Institute, Westminster, London
- Niamir-Fuller, M. 1999. *Managing mobility in African rangelands: The legitimization of transhumance*. London: Intermediate Technology Publications Ltd.
- Njoya, Aboubakar (2009). Building climate change resilience for African livestock west and central Africa region, Institute of Agricultural Research for Development, Yound'e, Cameroon
- Nori Michele and Davies Jonathan (2007) change of wind and wind of change? Climate change, adaptation and pastoralism, WISP, Nairobi
- Noss, R.F., Dinerstein, B. Gilbert, M., Gilpin, B. Miller, J. Terborgh, and S. Trombulak. (1999). Core areas: Where nature reigns. Pages 99-128 in M.E. Soulé and J. Terborgh (eds.). *Continental Conservation: Scientific Foundations of Regional Reserve Networks*. Island Press, Washington, DC.

Oba Gufu (2009). Harnessing Pastoralists' Indigenous Range Management Knowledge for Drought-Resilient Livelihood Systems in the Horn of Africa, Noragric, Department of International Environment and Development Studies, Norwegian University of Life Sciences, Norway

Osbahr Henny (2007). Building resilience: Adaptation mechanisms and mainstreaming for the poor, background paper for Human Development Report (HDR)

Pratt, D. J., F. Le Gall and C. De Haan 1997. Investing in Pastoralism: Sustainable natural resource use in arid Africa and the Middle East. World Bank Technical Paper 365. Washington DC: World Bank

Reid H and Swiderska (2008). Biodiversity, climate change and poverty: exploring the links, an IIED briefing www.iied.org

Ruttan L. M. and M. Borgerhoff Mulder (1999). Are East African pastoralists truly conservationists? *Current Anthropology* 40(5):621-652.

SCBD, (2007). Biodiversity and climate change, IBD 2007 Booklet, Secretariat of the Convention on Biological Diversity. <http://www.cbd.int/doc/bioday/2007/ibd-2007-booklet-01-en.pdf>

Scoones. I (ed) (1994). *Living with certainty: new directions in pastoral development in Africa*, intermediate technology publication, London.

Swiderska & Reid, (2008), Biodiversity, climate change and poverty: exploring the links

UNCCD (2009). Land a tool for climate change adaptation, policy brief No. 1

West, N.E. (1993). Biodiversity of Rangelands. *J. Range Management* 44 (1) 2-13

Wilkes, A. and Tenninkeit, T. (2008). Carbon Finance in Rangelands- An Assessment of Potential in Communal Rangelands

WISP (2007). Pastoralism as conservation in the horn of Africa, WISP policy brief note No. 3

WISP (2007). Pastoralists as Shrewd Managers of Risk and Resilience in the Horn of Africa. World Initiative for Sustainable Pastoralism (WISP) Policy Note No. 04, 2007.

WISP (2008). Biodiversity of rangelands, *journal of range management* 46 PP. 2-13.

WISP (2008). Forgotten services, diminished goods: understanding the ecosystem services, policy brief note no. 8

WISP, (2008). Policies that work for pastoral environments: a six country review of positive policy impacts on pastoral environments

Zeng, N. (2003) Drought in the Sahel. *Science* 302, 999–1000.