Final Report

Options for Support to Grassland Restoration in the context of Climate Change Mitigation

Freiburg, Germany, May 2012

UNIQUE forestry and land use.

Options for Support to Grassland Restoration in the context of Climate Change Mitigation

Client: FAO

Authors: Andreas Wilkes, Katalin Solymosi, Timm Tennigkeit

UNIQUE forestry and land use GmbH
Schnewlinstraße 10
79098 Freiburg, Germany
Tel: +49 - 761 - 20 85 34 - 0
Fax: +49 - 761 - 20 85 34 - 10
unique@unique-landuse.de
www.unique-landuse.de

Content

Key messages

This report reviews the options for support to grassland restoration in the context of demand growth for livestock products and climate change mitigation. Key messages are:

Grasslands provide crucial economic, social and environmental outputs

Gasslands cover a total of 52.5 million km^2, or about 40% of the world's ice-free terrestrial surface area. Extensive grasslands contribute about 7% of global beef production, 12% of sheep and goat meat production and 5% of global milk supply. Hence, this land-use type makes a significant contribution to the supply of livestock products, the food security status of livestock keepers and national economic development. Grasslands provide also a range of environmental services, including carbon sequestration, and are critical and highly threatened ecosystems for biodiversity conservation.

Restoring value to grasslands should focus on the sustainable intensification of production and environmental outputs

Despite the provision of multiple services there is widespread underinvestment in grasslands, leading to a situation where based on best but rough estimates 50% of grasslands are degraded. Therefore, there seems to be an overarching consensus to focus efforts on sustainable intensification with the dual focus on production and environmental outputs. The synergies and trade-offs between the two desired outputs are site specific. The condition of the natural resource base, market access and other context-specific factors determine the livelihoods options available to grassland users.

Low carbon development is a co-benefit of sustainable intensification

Soil carbon sequestration and reducing production related emissions will be important co-benefits of sustainable intensification and key elements of a low carbon development strategy in agriculture-dominated countries or regions. Climate finance may add important market-oriented and political resources, and act as a convening force for sustainable intensification. Climate benefit and performance monitoring might improve the efficiency and effectiveness of related investments. However, GHG emission reductions may not always be a suitable indicator of improved environmental and development outcomes in pastoral areas. In non-equilibrial arid and semi-arid rangelands, for example, GHG emissions may be less responsive to change in management than to climatic variability.

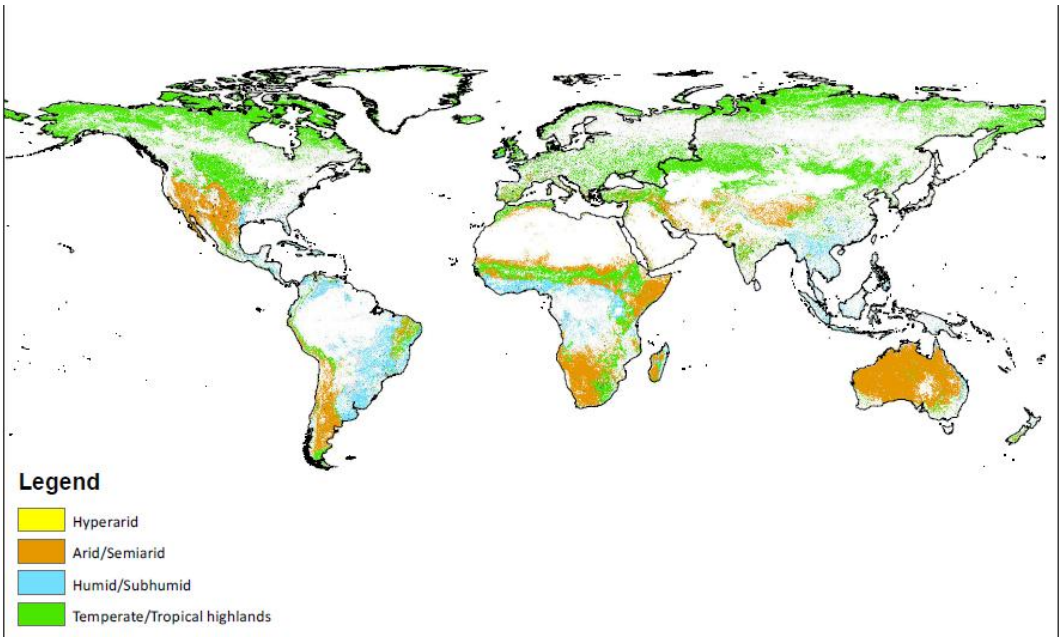
Coalition to restore value to grasslands to support pastoral identities

Pastoral interests are in general not well represented in many countries and the scientific basis for sustainable intensification options and their impacts are variable across grassland types and production systems. Furthermore, framing of issues and solutions with a well-considered climate perspective may be a lengthy process. This highlights the need for broad coalition

building for a grassland valuation strategy, and knowledge sharing combined with pilot actions to establish proof of concept for innovative sustainable intensification pathways.

1 Background and perspectives

Figure 1: Global extent of grasslands[1]



Consideration of options for supporting grassland restoration in the context of climate change mitigation and adaptation must reflect the roles of grassland and grassland-based livestock production in the wider context of the productive, socio-economic and ecological services that grasslands provide. The analysis in this report is based on five broad propositions:

(1) In many countries, extensively grazed grasslands make a significant contribution to the supply of livestock products, the food security status of livestock keepers and national economic development.

(2) In addition to provisioning services (i.e. livestock products), grasslands provide a range of environmental services of local, regional, national and global importance, of which carbon sequestration may be one.

(3) Globally, grasslands are critical ecosystems for biodiversity conservation, but relative to their degree of vulnerability and to the economic costs of conversion or degradation, there is widespread underinvestment in the protection and restoration of grasslands.

(4) Protection and restoration of grasslands can make significant contributions to mitigation of climate change, with different technical options suited to different ecosystem and production systems.

(5) Strong synergies between the climate change mitigation benefits of protection or restoration of grasslands and income generation for livestock keepers and enhanced

[1] Source: GlobCover 2009 (Global Land Cover Map).

provision of other ecosystem services provides justification for further exploring and promoting a role for climate finance in supporting improved management of grasslands.

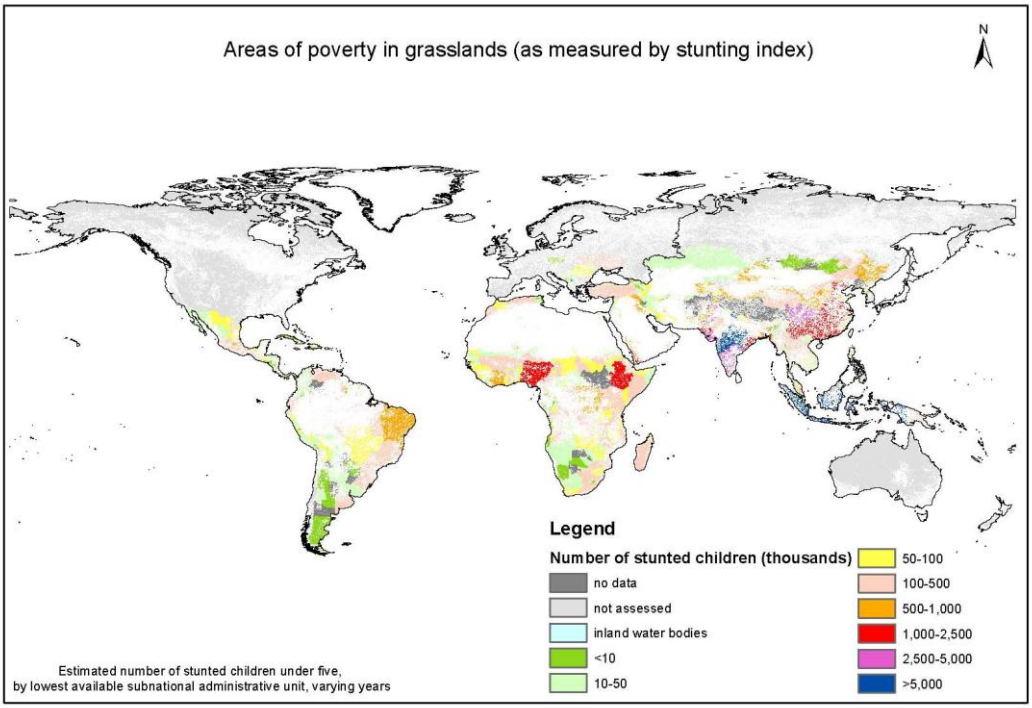
The remainder of this chapter substantiates and elaborates on these 5 propositions. The following chapter outlines a range of existing initiatives and mechanisms for supporting protection and restoration of grasslands. The subsequent chapters explore the potential roles of climate finance in supporting protection and restoration of grasslands, including potential constraints on and limitations of climate change mitigation as an entry point to restoring value to grasslands.

1.1 Economic and food security contributions of grassland-based livestock production

Globally, extensive grazing systems are estimated to contribute about 7% of global beef production, 12% of sheep and goat meat production and 5% of global milk supply.[2] In addition to provision of marketed products, livestock supply draft power and manure, and represent the major asset of many poor households providing a buffer against adverse shocks.[3] Grassland-based livestock production often accounts for a small proportion of national livestock sector output value. But economic valuation of the direct marketed and non-marketed values of livestock in developing countries shows that when a wider range of benefits is considered, extensive livestock production can make substantial contributions to national economies.[4] In particular, hundreds of millions of rural poor are dependent on livestock for their livelihoods.[5] Livestock also make important contributions to nutrition and health.[6] Thus, grazing livestock and the grasslands they are dependent upon are critical in achievement of the MDGs,[7] and a key driver of agriculture sector growth.[8] In semi-arid and arid regions in particular, improved range management can make significant contributions to enhanced resilience of pastoral populations and disaster risk reduction in the context of increasing climate variability.[9]

[2] FAO 2009: 26
[3] Alari et al 2011
[4] e.g. Rodriguez 2008; Benkhe et al 2010; Benhke & Muthami 2011
[5] World Bank 2007
[6] Randolph et al 2007
[7] LivestockNet 2006
[8] Pica et al 2008
[9] E.g. Roberts 2010

Figure 2: Areas of poverty in grassland as measured by stunting index[10]



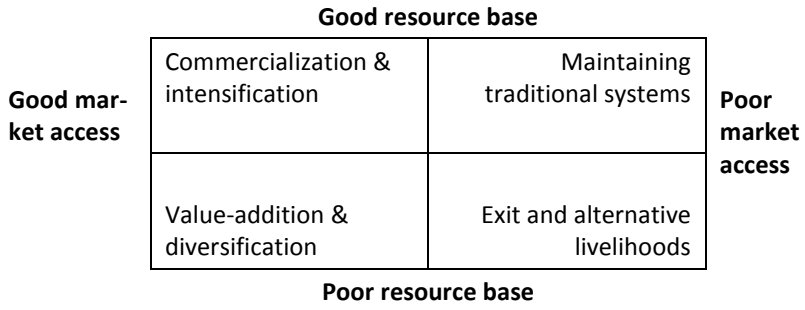
The livestock sector (including intensive production) already represents around a third of agricultural GDP in most countries.[11] In the past three decades, production and consumption of livestock products in developing countries has grown at 3-5% p.a..[12] Global population is expected to reach 8.9 billion by 2050,[13] in addition to which increasing urbanization and rising incomes are expected to further increase demand for livestock products, with both trends particularly affecting demand for livestock products in developing countries.[14] By 2050, total meat and milk consumption in developing countries is expected to at least double.[15] Since most increase in demand is coming from developing countries, some regions (e.g. countries in Asia and the Americas, but also in Africa) are increasing their share of global output of some livestock products (e.g. ruminant meat), while developing country imports of other livestock products are increasing.[16]

These trends present both opportunities and challenges for livestock production in grassland regions. Firstly, much of recent and projected growth in livestock production and trade is being met from more intensive systems and through products in which grassland users do not have

[10] Prevalence of stunting among children under five, from Module 3 "Socio-economics and nutrition indicators" of Food Insecurity, Poverty and Environment Global GIS Database (FGGD).
[11] World Bank 2008
[12] FAO 2009
[13] FAO 2006
[14] FAO 2006, FAO 2009
[15] FAO 2006
[16] ibid.

comparative advantage (e.g. poultry and pork). As concern with food safety for urban consumers and export markets increase, regulatory responses typically favour more intensive and spatially concentrated production options.[17] **For some producers in grazing systems, the key question will be how they can intensify production practices, to increase productivity and take advantage of new marketing opportunities**. On the other hand, increased demand and shifts towards production methods that are more intensive in inputs present risks of adverse environmental impacts. In some contexts awareness of these risks and their impacts is inducing **demand for investment in maintaining the productivity of the natural resource base on which livestock production and wider society depends**. **Protection and restoration of grasslands has relevance to strategies for both intensification and maintenance of extensive production**. This is illustrated in Figure 3, which shows that the condition of the natural resource base may frame the general options available to grassland users for benefiting from wider market opportunities. **Promoting changes in management practice with climate mitigation impacts may be of interest to stakeholders where these practices support them to access and benefit from the more remunerative and more resilient livelihood pathways.**

Figure 3: Grassland resource base and livelihood scenarios



Source: Adapted from Dyer et al (2012)

1.2 Grasslands: an under-prioritized and vulnerable ecosystem

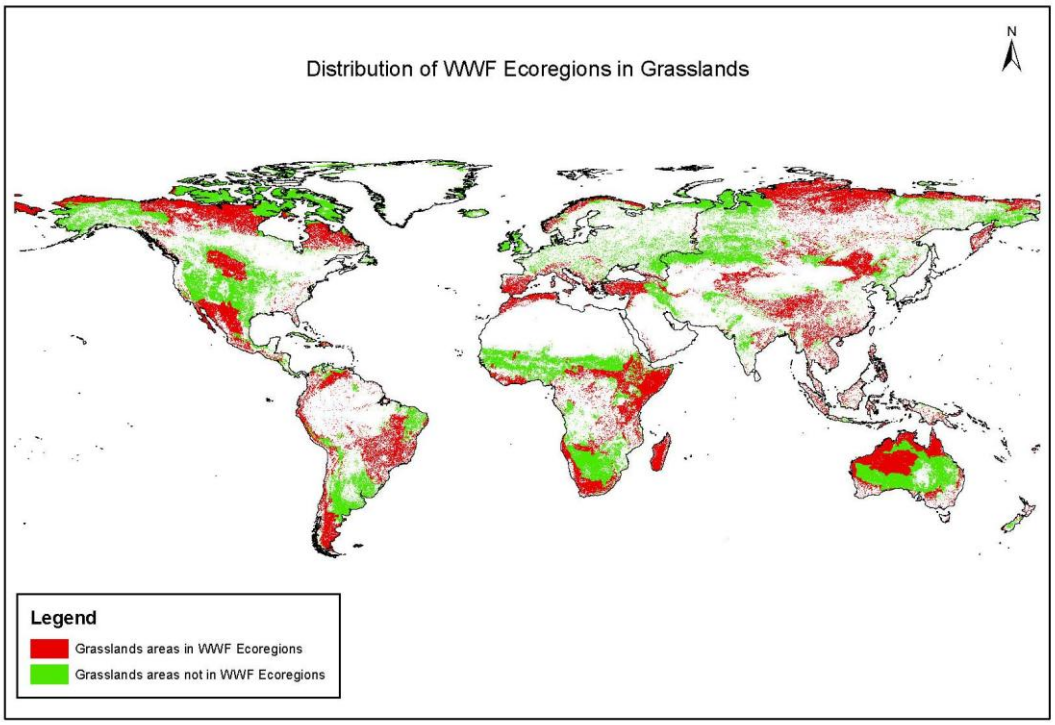
Grasslands cover a total of 52.5 million km^2, or about 40% of the world's ice-free terrestrial surface area.[18] Grasslands can be found in every region, with the largest grassland areas in Sub-Saharan Africa (14.5 million km^2) and Asia (8.9 million km^2).[19] Covering a range of different vegetation types, grasslands are found in semi-arid regions (28% of the world's grasslands), humid regions (23%), cold regions (20%), and arid regions (19%).[20]

A global review of threats to grassland ecosystems,[21] finds that the main threats to grassland ecosystems include:

[17] Gulati et al 2007
[18] White et al 2000
[19] Ibid.
[20] Ibid.
[21] Ibid.

- conversion to other land uses (primarily cropland and urban landuse)
- degradation and desertification
- habitat fragmentation (e.g. due to agricultural expansion in some areas, due to roads in other areas)
- pollution from mining, and
- competition from invasive species.

Figure 4: Grasslands and Global 200 Ecoregions



Source: Olson et al. 2001

A significant proportion of the global historical extent of grasslands has been converted to other uses. This is particularly prominent in North America and some parts of South America and Australia (see Table 1).

Table 1: Conversion of Grassland Ecoregions

	Estimated Conversion:			
Ecoregion	**Current Grassland Extent (%)**	**Cropland Extent (%)**	**Urban Extent (%)**	**Other (%)**
North American Tallgrass Prairie	9.4	71.2	18.7	0.7
South American Cerrado Woodland and Savanna	21.0	71.0	5.0	3.0
Asian/Daurian Steppe	71.7	19.9	1.5	6.9
Central and Eastern Mopane and Miombo Woodlands	73.3	19.1	0.4	7.2
Southwest Australian Shrublands and Woodlands	56.7	37.2	1.8	4.4

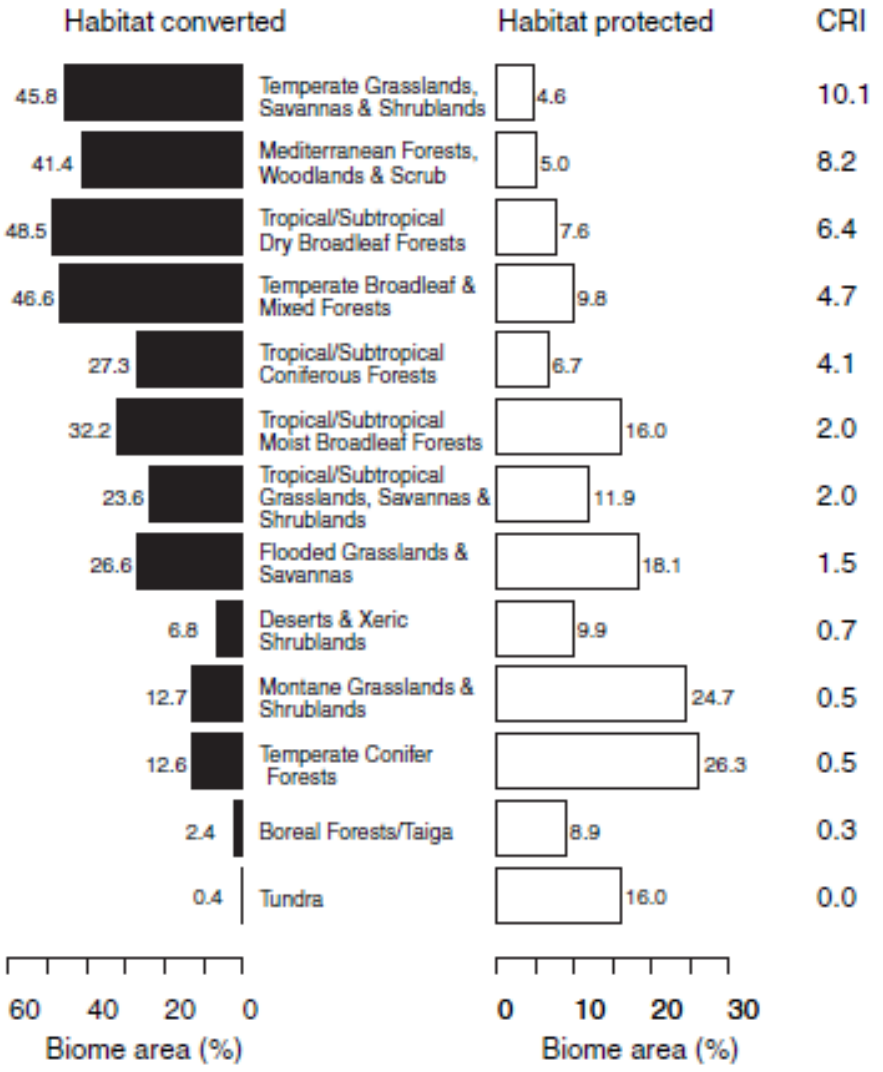
Source: White et al 2000

Nearly 4 million km² of grasslands are included in formal protected areas, but this represents only 7.6% of grassland ecosystems (compared to 8.5% for forest ecosystems globally).[22] Those grasslands that are formally protected are most extensive in Sub-Saharan Africa – 1.3 million km², with less than 1 million km² protected in other regions.[23] Taking percentage of area converted to other land uses as an indicator of habitat vulnerability (which does not therefore cover habitat degradation without change in land use), and calculating an index of conservation risk (CRI) as the ratio of percent area converted to per cent area protected, Hoekstra et al (2005) find that temperate grassland, savannas and shrublands are the globally most at-risk biome. Among the top 13 biomes analyzed, grassland biomes account for 6 (average CRI 2.47) compared to forests (average CRI 3.74) (Figure 5).

Based on GLASOD, White et al (2000) estimate that soil degradation affects more than half of all grasslands worldwide, with nearly 49 percent lightly to moderately degraded and at least 5 percent strongly to extremely degraded. Habitat fragmentation, pollution from mining and invasive species are problems in smaller scale locations across the globe.[24] **Given the threats to grasslands globally, attention should be paid to both avoided conversion of grasslands and to improved management of remaining pastures.**

[22] http://earthtrends.wri.org/text/biodiversity-protected/map-249.html
[23] White et al 2000
[24] Ibid.

Figure 5: Converted and protected biomes



Source: Hoekstra et al 2005

The reasons for the low prioritization and lack of political commitment to grasslands are many and varied between regions. Grasslands are often considered to be economically unproductive in comparison to intensive livestock and cropping sectors.[25] Undervaluation of the services provided by grasslands leads to undervaluation of the services lost and costs of rehabilitation when grasslands are converted or degraded, and to underinvestment in their protection and management. Politically, representation of grassland populations is also often marginalized within political decisions affecting grassland use.[26] Within administrative hierarchies, too, grassland management agencies often have limited influence in agricultural ministries. This is also reflected in the limited budgets allocated to grassland management in many countries. In some cases, where budgets are allocated for interventions in pastoral areas, inappropriate investment in large-scale projects such as large-scale irrigation schemes, may limit the benefits

[25] Rodriguez 2008
[26] Raas 2006

for grassland users,[27] again reflecting misunderstanding and undervaluation of extensive grassland utilization.

1.3 Environmental services of grasslands and grassland restoration

Grasslands and rangelands are valued for a range of services, of which the provisioning services (i.e. provision of livestock products) are just one. Important environmental services of grasslands include:

- Biodiversity conservation
- Regulating quantity and quality of water flows
- Sandstorm abatement
- Erosion / desertification control, and
- Recreational and spiritual values.

Twenty-five of the 145 major watersheds of the world are made up of at least 50 percent grassland,[28] and Sub-Saharan Africa has the most extensive grassland watersheds.[29] Vegetation plays key roles in water cycles. While precipitation and site water balances are key determinants of the distribution and productivity of vegetation, the composition and distribution of plant communities have key influences on evapotranspiration and run-off. Change in vegetation cover at landscape scale has potential to influence river basin hydrology,[30] as well as regional climate,[31] and these effects may be larger than the effects of global climate change.

Grasslands are located in many areas of global biodiversity significance. Almost half of 234 global Centers of Plant Diversity (CPDs), housing important plant gene pools include grassland habitat.[32] Of the WWF "Global 200" ecoregions, 35 are grassland ecoregions.[33] At plot or site level, at small scale (<100 m2), grasslands have higher species richness than forests,[34] and may have a higher number of useful plants than forests in the same climatic zone.[35] While endangered and charismatic species attract much attention, it is crucial to realize that the important roles of biodiversity in maintaining ecosystem functioning.[36]

Degradation of grasslands is associated with changes in ecosystem service provision,[37] and may cause the irrevocable loss of ecosystem functions such as soil and soil moisture retention, regulation of water flows and regulation of carbon and nitrogen cycles.[38]

---

[27] See e.g. Dwyer 2012.
[28] White et al 2000.
[29] ibid.
[30] Wilcox and Thurow 2006
[31] e.g. Stohlgren et al. 1998
[32] White et al 2000
[33] ibid.
[34] Wilson et al 2012
[35] Salick et al 2009
[36] e.g. Hooper et al 2005; Maestre et al 2012
[37] Havstad et al 2007
[38] Schlesinger et al 1990

Restoration of converted grasslands may improve ecosystem functioning,[39] but may not be able to fully restore ecosystem service provision to that of natural grassland.[40] Improved management of degraded grasslands can enhance ecosystem services, in some cases to levels comparable with non-degraded grasslands.[41] However, there are usually trade-offs between the different ecosystem services targeted.[42]

The many ecosystem services from grasslands will be valued variously by different stakeholders in different contexts. Local stakeholders may tend to value productive services and specific ecosystem services such as hydrological services. International valuations may apply to niche products (including livestock and non-livestock grassland products), but international finance is currently most developed for biodiversity conservation services. Since the climate mitigation benefits of grassland management accrue globally, and awareness of the impacts of a changing climate have risen in the international political and economic agenda,[43] there is a prospect that **climate change mitigation services in grasslands may provide an entry-point to the valuation of grasslands for their conservation and restoration.**

1.4 Climate change mitigation potential of grassland protection and restoration

The expansion of cropland and pasture for agricultural use is a major cause of deforestation, and conversion of grassland is also a major supplier of new cropland .[44] Conversion of forest to pasture and conversion of grassland to arable land cause significant emissions of carbon to the atmosphere.[45] Conversion of forests to grassland results in large losses of carbon in both plant biomass and soils. Native tropical forests may store 1-200 tC per hectare in biomass, much of which is lost under conversion to pasture, while around 12% of carbon stored in forest soils is lost in the process of conversion to pasture.[46] Conversion of grassland to cropland is estimated to cause an average loss of 59% of soil carbon, the main carbon pool in many grassland types.[47]

Various methods of improved grassland management can sequester carbon in soils,[48] and in below- and above-ground biomass.[49] For improved management of grasslands, Table 2 2 gives some global estimates of mitigation potential per unit area.

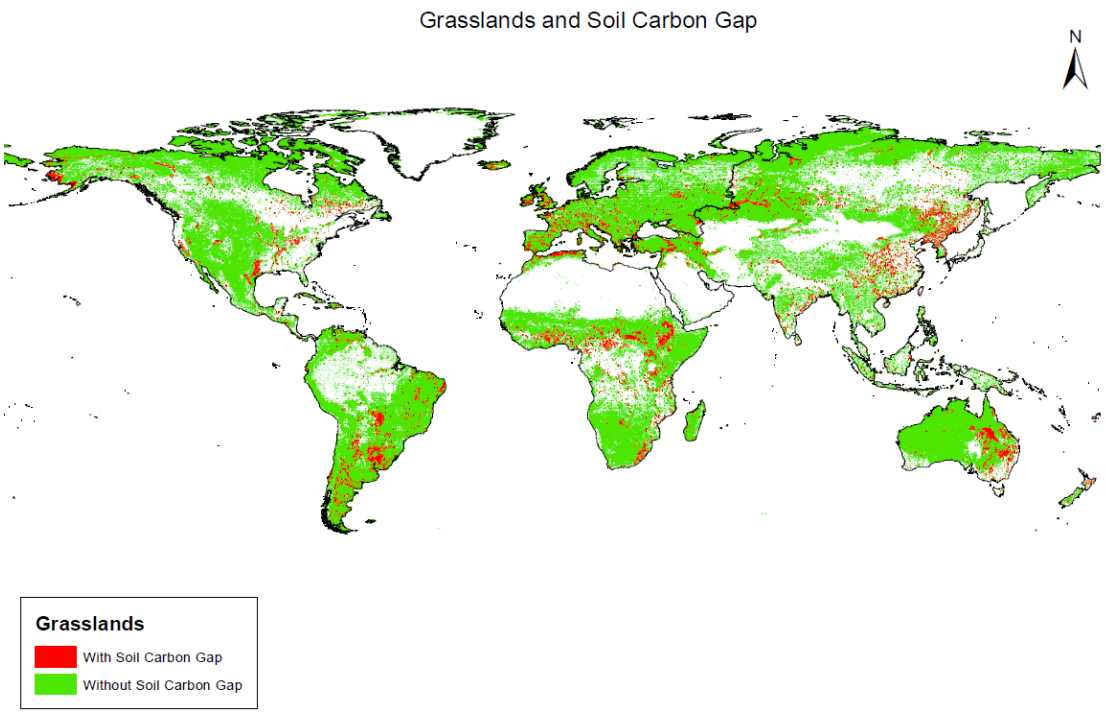
[39] e.g. Martin et al 2005; Pywel et al 2002
[40] e.g. Martin et al 2005, Cao and Long 2009
[41] e.g. Ma 2006
[42] Naidoo et al 2008
[43] Stern 2006
[44] Gibbs et al 2010
[45] Davidson and Ackerman 1993; Guo and Gifford 2002
[46] Don et al 2010
[47] Guo and Gifford 2002
[48] Conant et al 2001
[49] E.g. Kumar and Nair (eds) 2011

Table 2: Carbon sequestration rates and number of data points summarized by type of management change[50]

Management	Data points	C sequestration ($tCO_2/ha^{-1}/year^{-1}$)
Irrigation	2	0.40
Fertilization	42	1.10
Improved grazing	45	1.28
Conversion: native to pasture	42	1.28
Conversion: cultivation to pasture	23	3.70
Introduction of legumes	6	2.75
Earthworm introduction	2	8.62
Improved grass species	5	11.15
All types	167	1.98

Source: Conant et al 2001, tC converted to tCO_2 by multiplying by 3.67.

Figure 6: Soil carbon gap in grasslands



Source: FAO dataset prepared for FAO 2007

Globally, grazing land management has been estimated to have a technical mitigation potential of 1.5Gt CO_2 eq p.a. to 2030, and restoration of degraded croplands has been attributed a technical mitigation potential of 0.6 Gt CO2 eq. Unfortunately, data on the restoration potential of degraded grassland is not available.[51] Figure 6 shows the overlay of

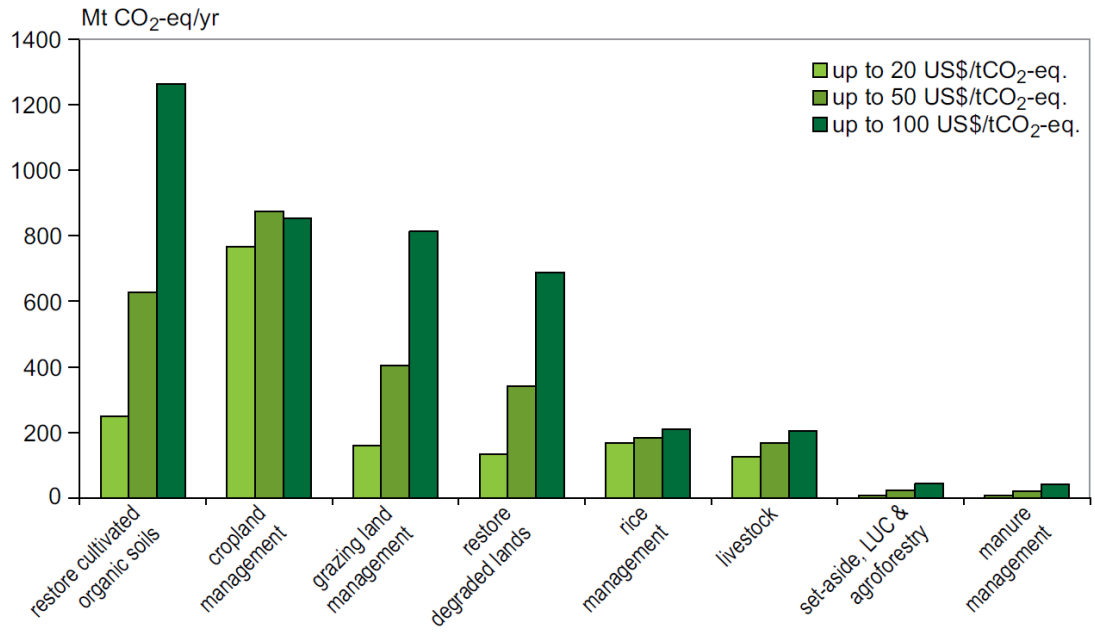
[50] The vast majority of data points reviewed in Conant et al (2001) are from developed countries. A revised database including more datapoints from developing countries is currently under development (R. Conant, pers. comm.)

[51] IPCC 2007

global grasslands with areas in which there estimated to be a gap between current soil carbon stocks and their biophysical potential[52] – an indicator of potential to sequester additional soil carbon. The figure indicates technical potential to sequester carbon across large areas of grassland in all continents. The map indicates, for example, areas in Eastern Africa and Northeastern China with relatively high soil carbon gaps. Eastern Africa is a region with a significant soil carbon sequestration potential, as also highlighted in the IPCC fourth assessment report. However, enabling institutions and incentive structures need to be investigated to understand the economic potential and implementation barriers. In Northeastern China, the government is already supporting policies to close the carbon gap such as intensive feed production systems and area enclosure programmes that reduce degradation pressure and restore soil carbon. In other areas on the map, such as in central Australia, the soil carbon sequestration potential is limited due to limited and variable rainfall (von Wehrden et al 2012). In all regions, improved data is required to better understand the economic sequestration potential.

In Figure 7 the economic mitigation potential of the agricultural sector is presented. This indicates that there are limited low cost options for restoring carbon and value to grasslands. However, considering the very limited number of economic studies related to grazing land management any conclusion is only as strong as the underlying evidence base.

Figure 7: Global economic agricultural mitigation potential by 2030

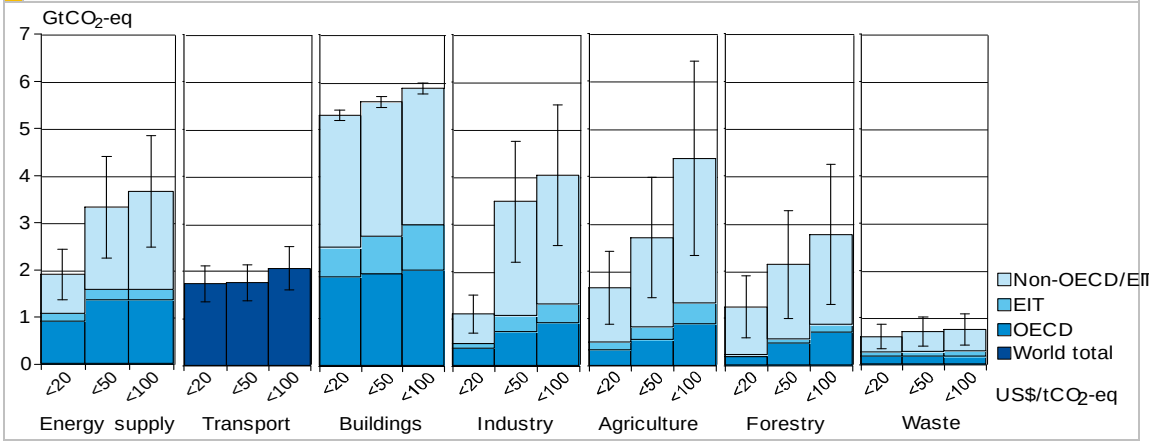


Source: Smith et al 2007

Comparing the economic mitigation options among different sectors (Figure 8) highlights that agriculture provides cost effective mitigation options.

[52] Using FAO metadata prepared using the method outlined in Latham and Cumani 2009.

Figure 8: Global economic agricultural mitigation potential by 2030



Source: IPCC 2009

However, the global analysis in particular for some regions has a high level of uncertainty. Therefore, in Table 3 we summarize various estimates of the technical mitigation potential in selected grassland areas around the world. The estimates presented in Table 3 are subject to a range of assumptions and uncertainties. Primary among these uncertainties are the costs at which carbon sequestration is economically viable. Several studies suggest that compared to other mitigation options, grassland mitigation is cost-competitive,[53] but further work is needed to validate this. There are several types of cost to consider regarding any change in management practice, including initial investment costs, annual operating costs, and opportunity costs of income foregone by undertaking the activities needed for avoiding conversion of or improving management of grasslands.[54] While degraded grasslands may have significant potential for carbon sequestration, initial costs of restoration and the delayed return before grasslands recover their productivity imply that costs will not in all cases be low. [55] For many grassland-based livestock systems around the world, systematic documentation and analysis of costs of protecting and restoring grasslands are still limited.

Table 3: Global, regional and national / sub-national mitigation potential estimates

Source	Subject	Estimated potential
Smith et al 2007	Global (i) Grazing lands (ii) Restoration of degraded lands	 1500 $MtCO_2e$ yr 600 $MtCO_2e$ yr
Thornton & Herrero 2010	Livestock mitigation options in the tropics	241-417 $MtCO_2e$ yr
Follet et al 2001	US rangelands	733 $MtCO_2e$ yr

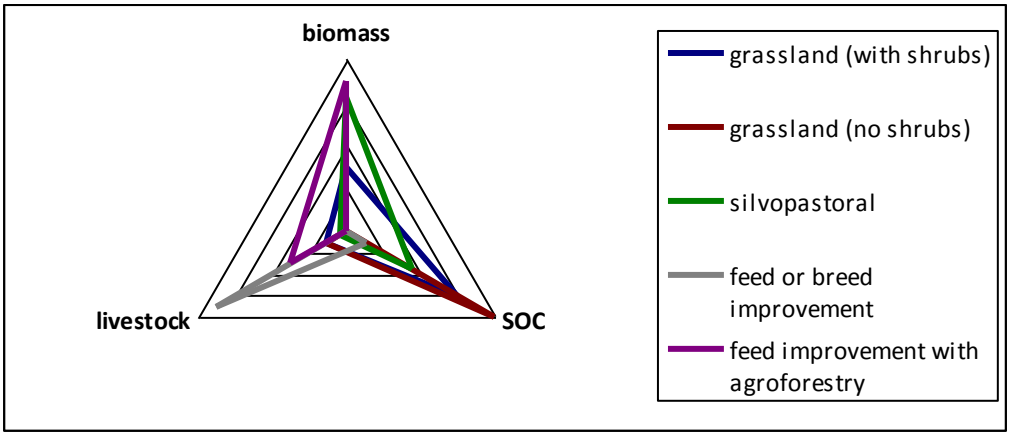
[53] e.g. Smith et al 2008; McKinsey 2009
[54] Lipper et al 2011
[55] Lipper et al 2010, Wilkes et al (in preparation).

Schuman et al 2002	US grazing lands (i) Improved management (ii) Avoided losses	 69.7 Mt CO_2 yr 157.7 Mt CO_2 yr
Witt et al 2011	Herbivore exclosure in Eastern Australian rangelands	11.6 - 14 Mt CO_2e yr−1
Garnaut review	Australia	286 Mt CO_2eq yr-1
Eady et al ed 2009	Australia	10-1000 Mt CO_2eq yr-1
Wang et al 2011	China (exclusion of livestock & planting grass)	880 MtCO_2e yr

Source: compiled by the authors

There are a range of different grassland-based production systems, in each of which different mitigation options will have greater or lesser relevance. Figure 9 presents a general indication of the relative contribution of different potential sources of GHG emission reductions from improved management in different types of grassland-based production system. In extensively grazed grasslands and silvopastoral systems, because of low livestock densities, there is much greater potential from soil carbon sequestration and / or above ground biomass carbon pools (e.g. shrubs and trees) compared to the potential for emission reductions from livestock. Livestock emissions may be of greater potential in mitigation programmes focusing on increasing the efficiency of feed use (e.g. by improving supplementary feed rations and their composition). Where these are combined with agroforestry practices, biomass carbon pools will also be relevant. Biomass carbon and soil carbon will also be relevant where mitigation programmes involving grazing systems aim to reduce deforestation and forest degradation pressures. In many cases, grasslands will be managed for a combination of environmental and productivity objectives, selecting management practices that balance the synergies and tradeoffs between them in site-specific ways. In non-equilibrial arid and semi-arid rangelands, responses of soil and biomass carbon pools to change in management may be less than the response of these pools to climatic variability, presenting a challenge to efforts to predict GHG mitigation effects of management practices. It cannot be assumed that the changes in practice required to meet socio-economic and other environmental management objectives are necessarily practices that mitigate climate change, and the same set of practices will not be relevant in all types of grassland.

Figure 9: Archetypes of mitigation potentials in different types of grassland-livestock system



NB: Axes represent % of total emission reductions, not absolute values.

Source: by the authors.

Since most grasslands are productive landscapes, the valuation of climate change mitigation services may not be the sole source of incentives to protect and improve management of grasslands. However, **where quantifiable GHG emission reductions occur in line with the pursuit of other objectives, valuation of these climate mitigation services may provide a supporting incentive**. Where production systems are moving towards intensification of livestock production, accounting for carbon benefits in terms of GHG emission reductions per unit of product output may assist mitigation programmes in aligning with productivity-enhancing activities. Where the main mitigation impacts come from conservation or restoration of grassland soils or vegetation, land-based accounting may assist in incentivizing improved land management. Specific approaches for quantification of benefits will depend on the requirements of funders. For example, where the value of climate benefits is required to be reflected in national GHG inventories, quantification approaches consistent with IPCC requirements for inventories should be adopted.[56]

1.5 Synergies between grassland protection / restoration and other policy priorities

Protection and restoration of grasslands may have strong synergies with policy objectives of eradicating poverty, meeting needs for food security both in pastoral areas and nationally, and with the provision of a range of ecosystem services. In theory, total economic valuation approaches [57] can provide an indication of the value of protecting grasslands, and also of the relative cost of restoring grassland compared to the total economic costs of inaction.[58] In practice, many ecosystem services remain unremunerated, because of a lack of clear

[56] Meridian Institute (2011), Ch. 6.4
[57] Costanza et al 1997; Nkonya et al 2011
[58] Nkonya et al 2011

beneficiaries, difficulties in quantification of benefits and transaction costs, among other obstacles.[59]

Where protection or restoration of grasslands provides quantifiable climate change mitigation services, payments for climate change mitigation services may be a useful complement to other sources of finance and other policy tools for delivering grassland and livestock sector policy objectives. It should be noted that biodiversity conservation has been a major public justification for investments in forest protection (i.e. REDD).[60] Also, among the many existing PES schemes in grasslands, it is most common for schemes to target multiple ecosystem services,[61] and in many cases, the ecosystem protection and restoration activities promoted may also have climate change mitigation benefits. However, there may also be trade-offs between the ecosystem services pursued.[62]

Early experience from agricultural carbon finance projects suggests that the monetary values of carbon transactions may be much smaller than the values of income achieved from productivity gains of newly adopted agronomic practices.[63] Analysis in extensive grazing contexts also suggests that the productivity benefits of improved grassland management far exceed the monetary values of carbon sequestered.[64] Therefore, **climate finance may be an important game changer to support the transition from current to improved management practices in grasslands that have a reasonable mitigation potential**. However, carbon finance has limited potential in arid and semi-arid regions where increasing soil carbon sequestration is an important adaptation practice, but slow stock changes limit the mitigationrelated financial gains.

The same may also apply to other ecosystem services (e.g. water or biodiversity) whose supply increases positively together with the supply of climate change mitigation services. The potential for synergies between climate change mitigation and other policy objectives provides a key justification for exploring the role of climate finance in the conservation and restoration of grasslands. However, **the design of programmes with climate change mitigation objectives should explicitly consider whether and to what extent other policy objectives are also achieved by promoting mitigation practices**. Since these other policy objectives are likely to have a higher value than the monetary value of the GHG emission reductions, mitigation should be pursued where it is a valued co-benefit.

2 Existing grassland protection and restoration initiatives and incentive mechanisms

2.1 Incentive mechanisms for grassland protection and restoration

Broadly conceived, incentive mechanisms include indirect mechanisms such as laws and regulations, and direct incentives such as cash or non-cash subsidies and other forms of

[59] Wunder 2005
[60] Cerbu et al 2009
[61] Wilkes et al in preparation
[62] Nelson et al
[63] Tennigkeit et al 2011
[64] Wilkes et al forthcoming

support. In many countries there are existing regulatory frameworks governing the use, conversion and management of grasslands, and government budgets that target promotion of specific management practices through technical assistance and grants to land users. Table 4 and Table 5 present illustrative types of incentive mechanisms for the conservation and improved management of grasslands.

Table 4: Incentives for protection of grasslands

Regulatory incentives	• National or sub-national legislation, e.g. land use and agricultural zonation laws, nature protection and environment protection laws • Grassland and grazing laws • Prohibitions on habitat destruction / vegetation conversion • Land use planning
Private law mechanisms	• Easements, covenants • Private contracts for conservation
Financial incentives	• Taxation policies, e.g. related to easements

Table 5: Incentives for improved management of grasslands

Regulatory incentives	• National or sub-national legislation, e.g. land use and agricultural zonation laws, nature protection and environment protection laws • Grassland and grazing laws
Financial aid	• Credit policies
Grant aid	• Government cost-sharing grants (e.g. Landcare grants) • Input subsidies • Technical assistance (extension services)
Conditional payments	• Payments for specified practices • Payments for specified ecosystem services • Input subsidies • Off-take subsidies • One-off grant payments • Recurring payments for ecosystem services
Product market payments	• Labeling for niche products (e.g. Geographical Indications) • Certification of products • Eco-tourism revenues

Payments for ecosystem services (PES) schemes are one potential form of incentive mechanism, and payments for climate change mitigation services can be made through a PES scheme. While many schemes offering land-care grants or cost-sharing investments in grassland management may also be seen as a form of payment for ecosystem services, what distinguishes PES schemes is that payments are **conditional** on either a change in environmental status, change in management as a determinant of environmental status, or conditional in environmental outcomes.[65]

Figure 10: Grassland PES schemes by biome type

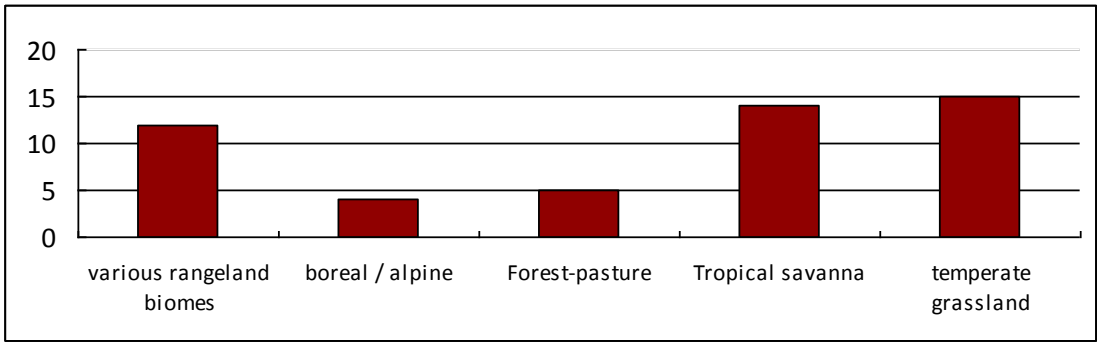
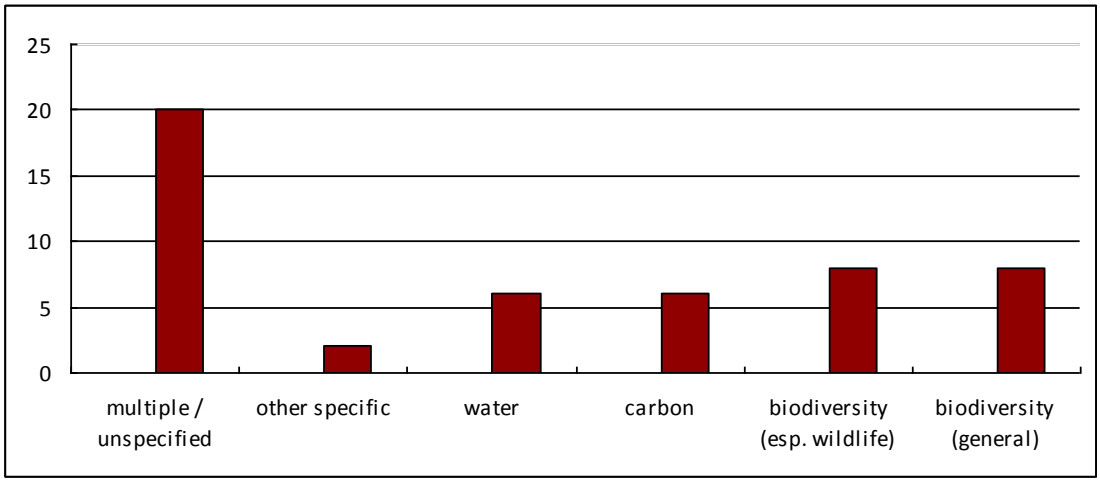


Figure 11: Grassland PES schemes by targeted ecosystem service



A review of 50 PES schemes in grasslands and grazing lands worldwide[66] highlights the following main descriptive findings:

- The review covered 50 PES schemes in grazing lands in 6 continents, covering a variety of rangeland biomes. Out of 34 schemes for which a land area could be identified, 14 were very small (<10,000 ha), and 9 were very large (>1 million ha).

[65] Van Noordwijk and Leimona 2010
[66] Wilkes et al forthcoming; see Annex 1 for list of the schemes reviewed.

- Almost half of the schemes did not specify which ecosystem services were targeted or specified multiple services, while other schemes targeted biodiversity (14), carbon (6), water (6) and salinity (1). While in theory payments are made for ecosystem services, because of the difficulties and costs of quantification, 41 of the 50 schemes reviewed paid land users to perform specific management practices that on the basis of general knowledge or scientific research are expected to increase the supply of ecosystem services, while 9 paid for estimated (6) or measured (3) delivery of ecosystem services. Schemes targeting carbon payments used carbon accounting and monitoring methodologies to estimate GHG emission reductions, often involving some direct measurement (e.g. of biomass).
- Although ecosystem service delivery is mostly not measured, some schemes that paid for performance of practices targeted land plots for enrolment by ex ante estimation of the current or expected change in the environmental values of the land plots. In all but one case, the PES schemes paid land users directly. In 14 cases, the payments were on a flat rate per land area basis, while some schemes (12) paid on the basis of the ex ante assessment of environmental values of the practices adopted or land plots. 8 schemes paid on the basis of ex ante measured or estimated environmental services delivered.
- Although PES schemes are often promoted as a way to leverage private sector finance, about half of the schemes were financed from local or central government budgets. Private funds, international donors and user fees financed more than half of the smaller schemes reviewed. Most of the larger schemes (by area) were financed from central or sub-national government budgets.

Just as PES schemes are designed within the context of existing regulatory and financial incentives, programmes targeting climate mitigation services from grassland conservation and restoration should be positioned relative to existing financial mechanisms.[67]

2.2 Other initiatives for grassland protection and restoration

The full extent of initiatives and interventions impacting on grassland management worldwide is not possible to review. The main multilateral and bilateral institutions all have portfolios of projects supporting economic development, biodiversity conservation and / or grassland management in grassland areas.[68] A large number of NGOs work at local, sub-national and national levels with land users in grassland areas on livestock management and development, economic development and biodiversity conservation. Often, the focus of these organizations and in some cases of their initiatives is not on grasslands, but they address needs and issues that have a direct bearing on grassland management as part of their work. Several large conservation NGOs, including Conservation International, WWF[69] and The Nature Conservancy,[70] for example, all have programmes targeting biodiversity conservation in grasslands. IUCN also has a

[67] Global Mechanism 2008
[68] See e.g. http://www.ifad.org/lrkm/projects/index.htm; http://www.worldbank.org/projects.
[69] http://wwf.panda.org/about_our_earth/ecoregions/about/habitat_types/habitats/grasslands/
[70] http://www.nature.org/ourinitiatives/habitats/grasslands/index.htm

working group on grasslands,[71] with a particular focus on developing strategies for preserving temperate grasslands. Furthermore, other organizations working on issues related to the agenda would be relevant boundary partners for any initiatives to support the agenda, e.g. The Economics of Ecosystems and Biodiversity (TEEB).[72] In the Annex a selection of organizations and initiatives whose work is relevant to the restoring value to grasslands agenda are presented, focusing on initiatives at regional and international levels.

In developing countries and countries in transition, development and deployment of many market and non-market mechanisms relevant to grassland management are promoted through the Global Environment Fund (GEF).[73] The GEF serves as financial mechanism for the CBD, UNFCCC, UNCCD, and the Stockholm Convention on Persistent organic pollutants and supports implementation of the Montreal Protocol on substances that deplete the ozone layer. In relation to UNFCCC, the GEF also manages the Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF). The GEF operates as a partnership between three Implementing Agencies – UNDP, UNEP and the World Bank, and seven Executing Agencies (Asian, African, and Inter-American Development Banks, the European Bank for Reconstruction and Development), FAO, IFAD and UNIDO – to integrate global environmental benefits into county-led development. Since its founding in 1991, the GEF has provided $10.5 billion in grants and leveraged $51 billion in co-financing for over 2,700 projects in over 165 countries.

The GEF has a strong mandate to support actions in countries on global environmental issues. With support from development partners, it addresses problems that have been recognized internationally as urgent, and the countries that receive support are signatories to the conventions and have agreed to take action, thus serving as a mechanism for implementation of multilateral environmental agreements. Countries are eligible for grant funding if they are eligible to borrow from the World Bank [74]or eligible for UNDP technical assistance.[75]

---

[71] http://www.iucn.org/about/union/commissions/wcpa/wcpa_what/wcpa_conservingsd/wcpa_grasslandstf/

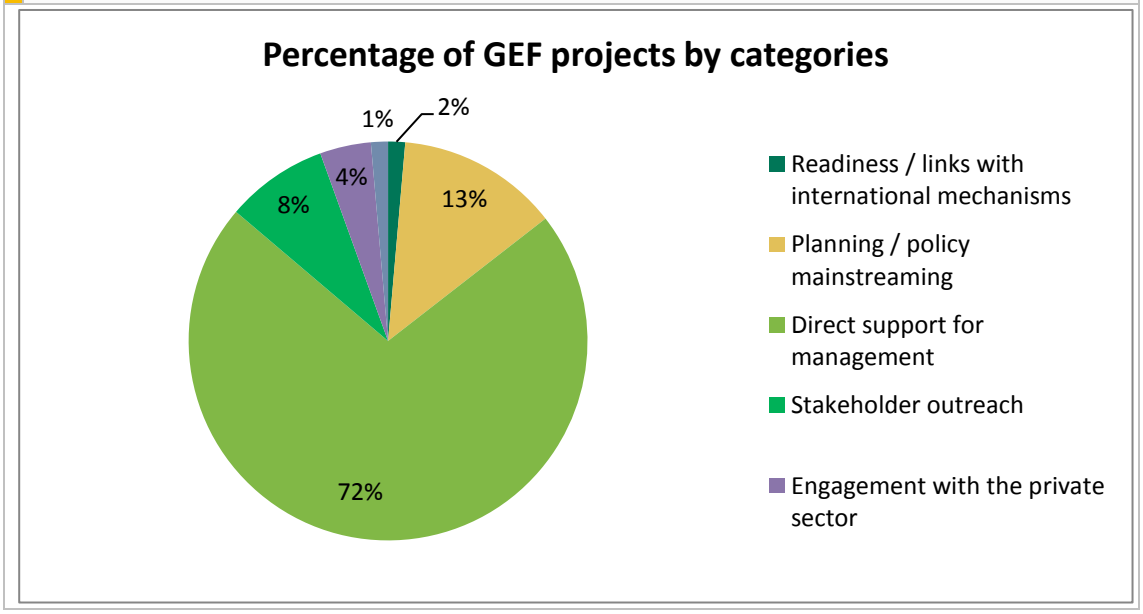
[72] http://www.teebweb.org/

[73] http://www.thegef.org/gef/whatisgef

[74] middle-income and credit-worthy lower income countries are eligible for IBRD loans, and low-income countries are eligible to receive low or no interest loans and grants from IDA

[75] i.e. funding allocated to technical assistance during UNDP programming cycles.

Figure 12: Percentage of GEF funded projects by type of action supported



The GEF's is intended to have a catalytic role in addressing environmental issues.[76] This is performed by funding of **foundational interventions**, such as regulatory frameworks and national plans that create an enabling environment; finance for **demonstration** of new technologies or approaches to environmental management; and **investments** to support national implementation and up-scaling. The GEF provides funding through four basic modalities: full-size projects, medium-size projects, enabling activities, and small grants. Full-size projects account for 87 percent of GEF project funding. **Of the almost 3000 full-sized projects in the GEF database less than 30 are related to grassland activities according to the project title[77].** This indicates either a low funding level for grassland projects, which may be related to low levels of national interest in grassland related activities, or that grassland activities are primarily funded in the framework of larger programmatic activities. Subsequently, we randomly selected 145 projects and categorized them with regard to the main type of action supported (Figure 12). The figure shows that GEF funding has been used to support a range of activity types that would be relevant to an agenda to restore value to grasslands. In its own evaluation of GEF,[78] it is noted that the foundation-demonstration-investment approach has worked well in middle-income countries, but that in small island developing states, least developed countries and fragile states, however, the GEF has generally not moved beyond laying a foundation for future work. Partly, this is attributed to underfunding, and partly due to the fact that global environmental benefits are more appreciated and supported in middle-income countries. The current phase of GEF funding[79] continues the previous strategy, with a focus on the following focal areas:

(a) biological diversity

(b) climate change

[76] GEF 2008b

[77] Searching in the GEF project databases (http://www.gefonline.org/) for "grassland" and " rangeland" and "livestock", only 8 grassland projects, 9 rangeland projects and 9 livestock projects appear. By contrast "forest" comes up with 101 projects

[78] GEF Evaluation Office 2010

[79] GEF 2010

(c) international waters

(d) land degradation, primarily desertification and deforestation

(e) ozone layer depletion and

(f) persistent organic pollutants

Of these, three (biodiversity, climate change, and land degradation) are relevant to the agenda of restoring value to grasslands.

Table 6: GEF funding by focal area

Focal area	Million USD	%
Climate change	2,743	31.9
Biodiversity	2,792	32.5
International waters	1,065	12.4
Ozone layer depletion	180	2.1
Persistent organic pollutants	358	4.2
Land degradation	339	3.9
Multifocal	1,114	13.0
All focal areas	8,591	100.0

Source: GEF PMIS, through June 2009[80]

For GEF funding committed to date, the majority of projects that have been funded from the GEF Trust Fund are in the biodiversity focal area. In dollar terms, however, the biodiversity share similar to that of the climate change focal area, which together account for about two thirds of GEF funding (Table 6).

2.3 Carbon-targeted initiatives in grasslands

Compared to investments in other types of mitigation activity, carbon market initiatives in grasslands are relatively few, and grassland management projects have not yet emerged as a mature project type. Nevertheless, there is an existing basis of operational projects and projects under development. In addition, there have been voluntary contracts for GHG mitigation services in grasslands, as well as government- and multi-lateral funded initiatives targeting carbon sequestration. Types of activity promoted have included afforestation and shrub management, sustainable grazing, grass and legume planting and fire control.

Among the operational initiatives, the most widely known is the rangeland carbon offset programme of the former Chicago Climate Exchange (CCX). Under this programme,[81] individual grassland managers in the USA were required to commit for a period of 5 years to implementing selected grassland management activities (e.g. limiting biomass utilization to 50%, planned

[80] GEF Evaluation Office 2010

[81] https://www.theice.com/publicdocs/ccx/protocols/CCX_Protocol_Sustainably_Managed_Rangeland_Soil.pdf

grazing within available paddocks, and drought response measures), and signed contracts with any one of a number of aggregating organizations (e.g. farmers' unions, companies) that served as a link between the land users and the CCX. 'Best estimates' of carbon sequestered under different management practices were used to provide scheme participants with default values that determined how many credits would be issued. The risk of reversal was addressed by requiring that 20% of offsets be held in an escrow account to be released to the owner at the end of the 5 year period. The programme has been criticized for a number of design shortcomings but as an early pilot initiative has been instrumental in garnering interest and highlighting where further development of scheme design is required.

A number of afforestation projects have been initiated in grasslands. Since carbon market afforestation projects are well documented elsewhere,[82] these projects are not further discussed here. However, shrub management is relevant to many semi-arid rangelands around the world. One such initiative, which used an afforestation methodology to expand the area of thicket in nature reserves and national parks, is the Working for Woodlands initiative of the Department of Water of South Africa.[83] While initial thicket restoration activities were publicly funded, the Department developed a strategy for leveraging additional investment for the sale of carbon credits to enable further expansion of the area of thicket restored. In addition to contributing to maintenance of valuable biodiversity in the targeted protected areas, the initiative provides employment for rural poor.

In addition to improved grassland management initiatives, there are also avoided conversion of grassland initiatives. This is an activity category that is recently made eligible for one of the main international voluntary carbon standards, the Verified Carbon Standard.[84] The work of a US NGO, Ducks Unlimited, to preserve the remaining grasslands of the North Great Plains illustrates how carbon finance can contribute to avoided conversion initiatives. In North Dakota, US government Grassland Easement initiatives which can be used to protect grasslands are underfunded, so grassland owners are not offered payments that are competitive with land market prices. Ducks Unlimited has developed an approach to estimating the likely loss of soil carbon in the region, and uses the valuation of the soil carbon not emitted to pay land owners not to convert grasslands.[85]

Voluntary carbon markets are not the only source of investment in activities to sequester carbon in grasslands (see Box 1). The example of Portugal illustrates how in-country work can be used to derive Tier 2 emission factors for grassland management practices that link with national GHG inventory accounting procedures, and how these actions may be supported with national carbon funds, providing an instructive example also for developing countries interested in supporting programmatic actions in the framework of NAMAs.

[82] See e.g. Merger 2010
[83] Mills et al 2010
[84] www.v-c-s.org
[85] Almack 2010

Box 1: Accounting for mitigation impacts of sown biodiverse pastures in Portugal

Portugal is one of 2 countries that has elected to report grassland management in its national inventory. Within Portugal, mitigation through pasture management has been supported through the Terraprima programme. This programme supports the cultivation of biodiverse pastures on smallholders' lands. The baseline is typically represented by natural grasslands or abandoned croplands with limited soil organic matter content, low fertility and a low carrying capacity. Cultivation of mixed species of highly productive forage grasses and legumes sequesters carbon and increases carrying capacity, giving farmers an incentive to maintain the grasslands for between 10 and 25 years. Inclusion of legumes also reduces the need for nitrogen fertilizers. To account for carbon sequestration benefits, research was conducted in 8 sites nationwide over a 5 year period. Data from sown biodiverse pastures was compared unimproved pastures and fertilized natural pastures in each site, and used to calibrate a model describing the carbon sequestration rates under different management practices. The difference between with-programme and without-programme sequestration rates are then used as a Tier 2 emission factor along with data on the area of adoption to describe the emission reductions due to programme implementation. It is intended to sow a total of 42,000 ha in 2009-10, which will generate an estimated 0.9 Mt CO_2e over 3 years. Contracts for 3 years are signed with participating farmers, and monitoring visits to each farm provide technical support as well as verification functions. But since the management of the improved pastures is economically profitable for farmers, they have an incentive to maintain the pastures over a much longer period. Initial implementation has been funded by the Portuguese Carbon Fund. A framework describing integration of project monitoring with the national inventory is under preparation.

Source: Domingos 2009; Teixeira et al. 2010.

In addition to these existing activities, several grassland carbon initiatives are ongoing. These include the design of a grassland carbon finance project in Qinghai, supported by UN FAO,[86] and an associated carbon accounting methodology that is currently undergoing validation by the VCS standard.[87] The draft methodology is already being used in the design of grassland carbon sequestration projects in other countries, such as Mongolia.[88] A range of other initiatives of UN FAO[89] and the Global Research Alliance on Agricultural GHGs[90] relate to GHG accounting and lifecycle analysis for livestock products which may prove relevant in contexts where intensification is an option.

Overall, these carbon-related initiatives demonstrate through practical action that there is potential for GHG mitigation in grasslands, and that both co-benefits and estimated emission reductions can be sufficiently robust to attract private and public investment. The scope of these early pilot initiatives is limited, but as experience grows, some demand from the voluntary carbon market for replication can be expected where the underlying assets (e.g. environmental or socio-economic benefits) are attractive. Enthusiasm should be tempered, however, with the realization that voluntary markets may not be able to support action to address needs in grassland areas across a large scale. By 2010, the total global area of carbon market afforestation projects, for example, was just over 655,000 ha.[91]

[86] Gerber 2011

[87] http://www.v-c-s.org/methodologies/methodology-sustainable-grassland-management-sgm

[88] see http://www.sdc-climateandenvironment.net/en/Home_Who_we_are/Info_media_center/Files_publications_weblinks/In_thematic_order/Blending_adaptation_mitigation_Carbon_sequestration_in_forests_soils_biomass_in_Land_Use?page=4&action=search&searchCategory=6083&searchCategory=6083

[89] Gerber et al 2010

[90] http://www.globalresearchalliance.org/

[91] Merger 2010

The example of the Terra Prima programme in Portugal indicates also the potential for accounting for the carbon benefits of grassland restoration activities in the context of other sources of climate finance. As discussed in the next chapter, several countries have expressed interest in seeking support for grassland and livestock related activities in the framework of Nationally Appropriate Mitigation Actions (NAMAs), which – like the Portuguese case – may support programmatic adoption of grassland conservation and restoration activities on a larger scale.

3 Grassland protection and restoration in the context of the UNFCCC

Given the likely synergy between climate change mitigation in grasslands and other priority policy goals, the following chapter explores the positioning of grasslands within the UNFCCC processes, and other market and non-market climate finance mechanisms relevant to the preservation and restoration of grasslands.

3.1 Grasslands in the UNFCCC negotiations

Agriculture – including grasslands – are relevant to many aspects of the UNFCCC,[92] which it should be recalled aims to address atmospheric GHG concentrations in a manner "to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."[93] The Convention (Article 4.1 (c and d)) specifically confirms the commitment of all Parties to promote and cooperate in diffusion of practices that mitigate GHG emissions in the agriculture sector and to promote and cooperate in the sustainable management of terrestrial sinks of GHGs. These clauses are relevant to grassland management. Within the ongoing negotiations, grasslands are relevant to several streams under discussion within the Ad-Hoc Working Group on Long-Term Cooperative Action (AWG-LCA), including cooperative sectoral approaches and sector-specific actions in agriculture; REDD+; and NAMAs. There is also potential relevance of discussions relating to the Kyoto Protocol.

3.1.1 AWG-LCA

Cooperative sectoral approaches and sector-specific actions in agriculture

In the context of recent negotiations in the UNFCCC, agriculture more generally has been discussed in the context of the Ad-Hoc Working Group on Long-Term Cooperative Action (AWG-LCA). At COP 16 in Cancun, a draft negotiating text[94] pursuant to Article 4, paragraph 1(c) on cooperative sectoral approaches and sector-specific actions in agriculture was not included in the final text at COP16, due to the linking in the text of agriculture with bunker fuels and to disagreement on trade implications of the issue. However, at COP17 in Durban in 2011, following part of the draft text from COP16, AWG-LCA adopted a decision to request the

[92] Meridian Institute 2011
[93] Article 2, UNFCCC
[94] FCCC/AWGLCA/2010/14, Chapter IX, http://unfccc.int/resource/docs/2010/awglca12/eng/14.pdf

Subsidiary Body for Scientific and Technological Advice to consider issues related to agriculture at its thirty-sixth session (i.e. in May 2012 in Bonn).[95] In response to that decision, a number of Parties have made submissions to the SBSTA on issues to be discussed in an agricultural work programme, including inter alia issues related to grassland restoration. However, at the meeting in Bonn in May 2012 agreement on the content of the work programme was not reached and the topic will be discussed again in Bangkok in September 2012 during the thirty-seventh SBSTA session.

REDD+

Conversion of forest to pasture for livestock production is one of the drivers of deforestation, and where grazing is a cause of forest degradation, or where demand for increased grazing area is a cause of deforestation, grassland restoration may also be considered in relation to REDD+. Within the AWG-LCA discussions on REDD+, drivers of deforestation have been highlighted as an issue requiring methodological guidance[96] and will be discussed under cooperative sectoral approaches and sector-specific actions related to a SBSTA work programme on agriculture. Additionally, agriculture will be part of the REDD+ negotiations in 2012 as a driver of deforestation. Durban has made clear that there is progress in the negotiations, but it is still slow. This reinforces the need for action on the ground.

Nationally Appropriate Mitigation Actions

AWG-LCA has also been the main forum for discussing scaled-up action to mitigate climate change. In 2009, the Copenhagen Accord,[97] which was not officially adopted by the COP, invited non-annex I parties to submit broad descriptions of Nationally Appropriate Mitigation Actions (NAMAs). A number of countries responded and provided information to the UNFCCC Secretariat on their proposed targets and actions. A significant portion of the responding countries stated that they planned to adopt mitigation actions in the agricultural sector, of which four made specific reference to pastoral land management and livestock (FAO 2010[98]).

The Cancun Agreements confirmed country pledges to provide fast-start finance of $30 billion, for the period 2010-2012. Long-term funds for mitigation activities were planned to be committed annually to reach $100 billion per year as of 2020. It became clear that NAMAs bear possibilities to scale-up and finance sectoral emission reduction activities.

While modalities and procedures for NAMAs were still evolving, many developing countries already started to develop NAMAs. These were often at the level of aggregate sectoral or national targets and did not include much detail. At the end of 2011, the number of NAMA of countries in the process of developing NAMAs had risen to 104, and 47 had already submitted NAMA proposals to the UNFCCC. At least 21 out of these involved mitigation actions in the land use sector. Some provided voluntary sector-wide agricultural mitigation targets, while other countries submitted quantitative agricultural reduction targets for specific actions. The

[95] http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf#page=4, paragraphs 74 to 77.
[96] COP15 decision 4/CP15 on methodological guidance for activities relating to REDD
[97] unfccc.int/files/meetings/cop_15/application/pdf/cop15_cph_auv.pdf
[98] FAO 2010

rest tend to identify broad priorities for development of the agricultural sector or a short list of specific actions, including some that are relevant for livestock and grassland management:

- restoration of grasslands;
- fodder crop production;
- methane capture for livestock;
- improved productivity of livestock;
- reduced land conversion.

Post-Durban, in March 2012 three developing country parties and one party on behalf of African States made submissions related to NAMAs. All submissions had a strong agriculture and land use focus, and one refers to livestock and grassland management, mentioning planned activities in areas like supplementary livestock feeds, livestock and crop insurance and weather-based index insurance schemes, as well as enhanced research efforts for improved livestock breeds. Some of the practices proposed are also practices supporting climate change adaptation, indicating that for developing countries adaptation is the priority and that mitigation and adaptation practices overlap and intersect. None of the submissions state estimated mitigation outcomes. In addition, several countries proposed NAMAs relating to reforestation of degraded lands, desertification control and reducing deforestation, some of which are likely to relate to the management of grasslands and other grazing lands.

Table 7: Grassland / livestock related NAMA submissions to UNFCCC

	Proposed activities			
Country	Grassland restoration and conservation	Improved livestock management, including efficiency	Introduction / promotion of fodder crops	Livestock insurance
Brazil	83-104 Mt CO2	18-22 Mt CO2		
Central African Republic			X	
Chad			X	
Jordan	x	x	X	
Madagascar		x	X	
Mongolia		x		
Swaziland		x	X	x

Sources: UNFCCC 2010[3] and 2012[99]

Aside from Parties to the UNFCCC, in 2012 after COP17 in Durban, many UNFCCC approved non-governmental organizations (NGOs) submitted "Views on issues relating to agriculture under the Subsidiary Body for Scientific and Technological Advice", [100] some of which proposed livestock and grassland management related activities to be included or further enhanced under an agriculture work program.

[99] http://unfccc.int/bodies/awg-lca/items/4578.php
[100] http://unfccc.int/parties_observers/ngo/submissions/items/3689.php

3.1.2 Kyoto Protocol

Mitigation of climate change is also a focus of the Kyoto Protocol, under which the CDM and JI mechanisms are established. Under the JI mechanism, countries in transition are supported to implement actions to reduce emissions, where these emissions can be accounted for in the host country's GHG inventory. LULUCF and livestock emissions are covered in all these countries' inventories, but to date, no JI-eligible country has elected to account for grasslands. The CDM has been used to finance a number of agricultural mitigation projects, most notably related to livestock waste management such as biogas and bioenergy projects. However, there have been few agricultural land use projects. Those CDM projects that do relate to land use are mainly afforestation / reforestation projects, some of which are proposed to be conducted on grassland or former grazing land. The reasons for the relatively small share of agricultural land use projects in the CDM has been analyzed elsewhere.[101] In addition to rules affecting all CDM projects, demand for credits from LULUCF projects has been restricted by allowing LULUCF projects to only issue temporary CERs (tCERs) and by limiting the eligibility of tCERs for compliance purposes.

In addition, work programs were initiated under the Kyoto Protocol to consider additional land use activities under the CDM and to explore more comprehensive accounting from land use activities (moving towards landscape accounting approach).

3.1.3 National Adaptation Programmes of Action

In addition to the discussions within UNFCCC on climate change mitigation as described above, adaptation to climate change which is already unavoidable is a focus of the UNFCCC. Pursuant to Article 4.9 of the UNFCCC, which recognizes the special needs of LDCs, a series of COP decisions have led to the institution of National Adaptation Programmes of Action (NAPAs) as a framework for identifying priority actions that reflect urgent needs for adaptation in LCDs. By late 2008, 39 LCDs had submitted NAPAs to the UNFCCC Secretariat, which lists the proposed actions in a database. Many bilateral agencies have a preference for supporting actions that are within the framework of a country's NAPA.

Of the 39 countries' NAPAs in the NAPA database,[102] 21 countries' NAPAs contain prioritized actions relating to grasslands and livestock. Among the prioritized actions, 5 prioritized actions relate explicitly to rangeland management, and 16 to livestock in extensive grazing contexts, including proposals for intensification of inputs. This illustrates the importance of improved rangeland and livestock management to adaptation in the least developed countries.

[101] Larson et al 2011

[102] http://unfccc.int/files/cooperation_support/least_developed_countries_portal/napa_priorities_database/application/pdf/napa_index_by_sector.pdf

4 Potential roles of mitigation finance and complementary incentive mechanisms

There is an opportunity for public climate finance to leverage investments in grassland restoration and intensification. The rising demand for livestock demand helps to remove existing investment barriers and to engage the private sector at scale while strengthening social and environmental safeguards. However, the difficult current macroeconomic circumstances related to the debt crisis in many developed countries will impact on the capability to finance the required action within the next few years.

4.1 Carbon project finance

Climate change mitigation initiatives in grassland areas are already eligible for and engaging with the voluntary carbon market. Such projects will be of interest where carbon revenues can help overcome the barriers to adoption of improved management practices. Carbon revenues alone, however, are unlikely to be a sufficient driver of change, especially if policy uncertainty at international level continues to contribute to low market prices for carbon. In any particular initiative, carbon revenues must be seen as one among many potential sources of finance (see Box 2). Public and private philanthropic finance has been important in funding the development of many of the early pilot actions in grasslands, as is also the case with forestry and agriculture. Non-carbon sources of finance are also important for covering the basic operating costs of the organizations implementing carbon market projects.

Box 2: Financing sources for improved grassland management in Qinghai, China

The Three Rivers Grassland Carbon Sequestration Project, developed with the support of UN FAO, aims to promote sustainable livelihoods of yak and sheep herders on an area of just over 20,000 ha in Qinghai, China. Around half of the project area is heavily or severely degraded. The project proposes to cultivate high yielding grasses on severely degraded lands, reseed heavily degraded lands, and promote sustainable grazing practices on the remaining grasslands. Cultivation of grass for use as winter forage can make significant contributions to livestock productivity since it contributes to reduced weight loss and mortality in winter. An even more significant contribution comes from the higher market price obtained for healthier animals, especially if they can be sold in late winter when prices are higher. Analysis suggests that for most individual households, the direct costs of planting grass far exceed household incomes, even if a proportion of livestock are sold off in order to graze at sustainable stocking rates. Most households also lack access to credit for grass planting. Government programmes exist to finance grass planting, but these programmes currently do not support subsequent investments in the maintenance of cultivated grass plots, and do not provide funds to offset the opportunity costs of reduced grazing numbers that are required to restore less severely degraded lands. Carbon revenues can thus complement existing sources of public finance in addressing grazing land management in a holistic manner. In the long-term, however, it is the enhanced revenues from more productive and higher priced livestock husbandry that will provide herders with the incentives to engage in the project's activities.

Source: the authors

The prospect of carbon project finance is unclear because carbon markets are driven by climate policy, and are therefore highly volatile and unpredictable across the globe. The current situation in the EU and China underlines this.The EU will most likely move away from CDM type carbon project finance. A revised policy is expected in June 2012. In the compliance carbon market, CDM-type projects will most likely only remain to support CDM projects in least developed countries and in the voluntary carbon market. In China, carbon markets are currently being established in a number of provinces that may result in a domestic carbon market by 2015, which may allow offset supply from the land use sector. In 7 provinces, carbon trading have been approved and since 2008 four carbon exchanges have been established. Recent statements indicate that forestry offsets will be definitely part of a domestic carbon market. However, there is less experience with agriculture and grassland related mitigation activities and therefore it is unclear if this sector will be included.

Nevertheless, the EU and other developed countries will most likely support NAMAs (see section above) through multilateral and predominantly bilateral financing mechanisms. Hence standardized baselines and performance crediting mechanisms for grassland restoration and livestock production efficiency activities would have to be developed to trigger performance based payments in the future. Currently, adaptation financing mechanisms are weak, but the development of performance metrics may help to attract financing.

4.2 Underlying incentives complementing mitigation finance

Climate benefits can be achieved with a mix of complementary market-oriented incentives and regulatory reforms. In this context, climate finance requires regulations to underpin agricultural financing instruments and remove regulatory barriers to achieve positive economic, environmental and social impacts. The instruments presented below should be combined and used in the framework of a NAMA.

Market-oriented incentives for direct investments

- Risk management: Designing and supporting financial instruments that reduce or redistribute risks for investments in agriculture
- Monetizing grasland/carbon/ecosystem service revenue streams: Financial instruments (e.g. bonds) monetizing grassland/livestock productivity and/or ecosystem services
- Direct purchase: Purchase or creation of sustained demand for carbon credits, potentially with a quota for credits derived from grassland restoration projects
- Transition cost subsidies: Creation of funds and financial instruments that subsidize up-front costs for transition to improved grassland management practices

Regulatory reforms

- Subsidies or tariffs: Removal or modification of domestic subsidies or tariffs that encourage unsustainable grassland management – or disincentives more efficient production – with international trading partners

- Regulatory mandates: Implementation and enforcement of regulatory mandates for adoption of improved grassland management practices, minimum standards or processes, lowering transaction costs for adoption
- Regulatory infrastructure: Investments in the regulatory infrastructure that lower the transition costs of adopting improved grassland management practices
- Land use planning and tenure reform: Investments in land use planning and tenure reform to support sustainable land management practices, enforcement, monitoring and improved governance
- Sustainability criteria: Creating, recognizing or mandating market-based sustainability criteria and labeling (within the borders of current WTO agreements)

Source: Streck, C. and the authors

The country or jurisdiction specific policy context including evolving domestic low carbon development and green economy strategies and international climate policy under the UNFCCC may define the appropriate mix of market-oriented and regulatory instruments to restore value to grasslands.

5 Existing models for a global grassland protection and restoration programme

5.1 The emergence of REDD+ as an international policy domain

This section briefly reviews the development of REDD+[103] in the international policy domain and considers reasons for its emergence as an international policy domain.

REDD+ can be considered as successful at least in terms of raising international attention and finance. Until today more than $4bn have been earmarked for REDD+ worldwide which is roughly the same amount available for climate change adaptation worldwide.[104] In this section we argue there are three main reasons for the prominent role of forests within the climate change negotiations:

a) Emission reductions from REDD+ are perceived to be low cost while simultaneously providing strong biodiversity benefits. The latter aligned the global biodiversity and in particular the wildlife lobby behind this concept

b) REDD+ targets developing countries only and is less important for the competitiveness of high polluting but strategic industries and related interest groups

c) Considering the slow progress of the international climate change negotiations, many countries supported REDD+ to demonstrate commitment and readiness for action

Political support for REDD+ in the international climate negotiations was built over more than a decade until finally the Coalition of Rainforest Nations requested formation of a working

[103] Reduced Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and carbon stock enhancement in developing countries

[104] http://climatepolicyinitiative.org/publication/the-landscape-of-climate-finance/

group at COP11 in Montreal (2005). In the Bali Action Plan (2007) the scope of REDD was expanded to include the role of conservation, sustainable management of forests and enhancement of targeted efforts.[105] The Bali Action Plan with its strong mandate to implement REDD+ is also positively attributed because according to many countries the plan reflects the principle of common but differentiated responsibilities and indicated a commitment to reach a global legally binding commitment to reduce emissions.

In 2009 the Meridian Institute published the REDD+ Options Assessment report[106] with a phased REDD+ implementation approach as a core proposal. The report highlighted that countries may wish to develop a national REDD+ strategy in phase 1, implement the strategy in phase 2 and would be ready in phase 3 for performance based transactions (see Table 8 below).

Table 8: Phased REDD+ approach

Phase	Scope	International Financial Instrument
Phase 1	National REDD strategy development, capacity building, institutional strengthening. Demonstration activities. Strategy development elements include, *inter alia*, reference level and monitoring, reporting, and verification (MRV) assessments and participation of indigenous peoples and local communities (see Chapters 3, 4, and 5, respectively).	Voluntary contributions. Eligibility: Demonstrated cross-sectoral commitment to REDD strategy development within the national government. Examples: Forest Carbon Partnership Facility of the World Bank (FCPF) and United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD) "readiness" funding.
Phase 2	Implementation of National REDD Strategy PAMs. Strategy implementation elements include, *inter alia*, reference level setting, improvement of MRV, and participation of indigenous peoples and local communities.	Global facility (unitary fund, or clearinghouse that records eligible bilateral and multilateral contributions relative to binding commitments). Eligibility: Demonstrated cross-sectoral commitment to REDD strategy implementation within the national government. Continued access dependent upon performance, including proxy indicators of emission reductions and/or enhanced removals. Example: Brazil's Amazon Fund.
Phase 3	Quantified changes in GHG emissions and/or removals.	Transition from global facility to integration with compliance markets. Eligibility: Compliance-grade MRV and emissions/removals accounting relative to agreed reference levels.

Source: Meridian 2009

REDD+ gained significant importance throughout 2009, which culminated in a COP decision and in the Copenhagen Accord.[107] This decision actually was perceived as being among the few positive outcomes from Copenhagen. In May 2010 the REDD+ Partnership Initiative was established as a global platform for organizing action in order to enable effective, transparent

[105] Negra and Wollenberg 2011
[106] Meridian 2009
[107] Negra, C. and Wollenberg, E. (2011). Lessons from REDD+ for Agriculture. CCAFS Report no. 4. The CGIAR Research Program, Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org

and coordinated fast start action on REDD+.[108] In the absence of a legally binding commitment under the UNFCCC, the initiative also provides a platform for like-minded countries to ensure momentum and support for REDD+. In 2010 at COP-16 in Cancun, countries agreed on REDD+ policy approaches and positive incentives, including guidance on activities and safeguards to be promoted and supported.

UNFCCC continues to explore financing options for the full implementation of the results-based actions. In the meantime, many countries have called for immediate and significantly scaled-up action to build capacity and readiness to address the multiple challenges associated with reducing emissions from deforestation and forest degradation as well as addressing conservation, sustainable management of forests and enhancement of forest carbon stocks.[109]

Decisions on reference emissions levels, safeguards and financing in Durban 2011 made clear that there is still a long way to go for a robustly financed REDD+ mechanism that applies internationally standardized and approved safeguards. The decision on safeguards also highlighted that developing countries will not accept that international standards may conflict with national sovereignty rights.

Thus on the one hand, REDD+ can be seen as a policy domain that has successfully been placed at the center of international negotiations. On the other hand, while discussions continue, deforestation rates, although slower in the last decade, remain high.[110] At the very least, this highlights the complexity of deforestation and forest degradation issues which take different forms in different locations, and also the institutional complexity implied by the objective of reaching a single international solution that is acceptable and implementable across multiple institutional levels. While negotiations continue, voluntary sub-national and national pilot projects to gain practical experience for supporting national REDD processes remain of high importance. In Tanzania with support from the Government of Norway, 9 sub-national REDD+ pilot projects are currently being implemented. However, a new UN-REDD study estimating the economics of REDD+ pilot projects indicates that the cost of addressing the drivers of deforestation, such as agricultural expansion, is likely to exceed any potential revenue generated solely through the sale of carbon credits on the voluntary or future compliance markets .[111]

The positive progress over the past years has been made possible due to various factors:[112]

- strong leadership from powerful parties lobbying for REDD;
- financing from major donors through the World Bank's FCPF and UN-REDD;
- significant motivation within both industrialized and developing countries;
- alignment of diverse stakeholders' interests;
- a long conservation experience that has demonstrated the possibilities and challenges of protecting forests; and
- demonstrated feasibility in numerous REDD pilot projects.

[108] http://reddpluspartnership.org/73855/en/
[109] UN-REDD 2011, The UN-REDD programme strategy 2011-2015. Available online at: http://www.un-redd.org/
[110] FAO 2010b.
[111] ongoing study by the authors for UN-REDD.
[112] Negra and Wollenberg 2011

5.2 Learning from REDD+ for grasslands

Analyzing the implications of the REDD+ process for the agriculture sector in general, Negra and Wollenberg (2011) have identified six main areas required to develop a successful global mechanism:

1. International policy support
2. Implementation mechanisms and governance
3. Tools and technical guidance for monitoring, reporting and verification (MRV)
4. Finance and incentives
5. Capacity for REDD implementation
6. Co-benefits for the environment and poverty alleviation.

Below, for each of these areas, we briefly assess what a restoring value to grasslands agenda could learn from REDD.

International policy support

The REDD+ policy support process for REDD+ started to accelerate from 2005, but had been preceded by at least 10 years of related initiatives. Among the key factors enabling this shift in support for the agenda was that the potential for significant economic benefits was recognized by both developed and developing countries. At the same time a global authority on climate change – the Stern Report – claimed that protecting forests would be the most efficient way to reduce GHGs.[113] Pilot experiences were available to demonstrate the feasibility of the agenda and to aid in highlighting areas in which progress was still required.

Hence, we suggest that the restoring value to grasslands agenda would need to consider:

- A preparation period including
  - Stock-taking of existing instruments and initiatives
  - Coalition building among stakeholders at different institutional levels
  - Capacity building for local, regional, national and international stakeholders to support scientific and financial confidence.
- Pilot initiatives to provide ongoing proof of concept and significance of the agenda, feeding the policy process with field-level experiences.
- Focus on larger strategic policy areas, e.g. mainstreaming grassland and livestock issues in agricultural policy first, rather than on technical, GHG-related details.
- Ensure inclusion and transparency in the participation process for policy stakeholders.

Implementation Mechanisms

Grassland tenure systems vary between countries, including both private and various forms of collective tenure and ownership, making clear land rights and accountability a challenge that might reduce confidence in a global mechanism. In this respect, they are similar to forests, and

[113] Stern 2007

there may be much to learn from the forest sector. Experience from REDD+ suggests that nesting of a grassland agenda within wider governance frameworks will be necessary to avoid the common situation where individuals have incentives both to overexploit and to under-invest in pasture resources. As with REDD+, the development of GHG accounting rules, methods, standards and project design should build on experiences with existing pilot grassland protection and community based rangeland management, and with the emerging grassland projects in voluntary carbon markets. An assessment of such initiatives may enable identification of a phased approach such as was outlined for REDD (see above)[114] to allow countries to prepare and demonstrate feasibility.

Key points for exploring implementation mechanisms for a global grassland agenda might include:

- Mechanisms should build on innovations developed through existing programs, policies and projects.
- Policies should integrate grassland management at multiple scales within the wider policy setting.
- Dissemination of technical information to decision makers.

Monitoring, Reporting and Verification (MRV)

Under the REDD+ umbrella, a well developed pool of monitoring tools, methods and IPCC guidance evolved, enhancing the credibility of the mechanism. The scientific status quo is that existing measurement methods are sufficient to make REDD+ operational (UNFCCC 2006). However, many countries with high REDD+ potentials lack capacities to make use of these tools. Despite the more complex nature of agricultural MRV in general, there are some promising initiatives to develop MRV systems for grassland initiatives.[115]

Lessons learned from the REDD+ process indicate that the following factors are key:

- An accessible and affordable MRV framework that is open to developing countries.
- An integrated landscape approach helping to address leakage, and conversion of range- to cropland and expansion of grassland at the cost of forest.
- Balance between measurement precision and monitoring costs to enable wide uptake and attract investors.
- Integration of MRV into production focused M&E systems to demonstrate economic relevance (in many cases M&E systems need to be strengthened)
- Verification and standards based on internationally approved parameters.

Finance

According to a COP-17 decision, REDD shall be financed through public, private, bi- and multilateral sources, without further specifying the mechanisms. There was opposition from some developing countries to market-based mechanisms and the EU ETS will not allow REDD+

[114] Meridian Institute 2009
[115] Seebauer et al. 2012; Wilkes et al. 2011

credits until 2020. Financing therefore continues to pose a challenge as positive policy signals are lacking, and biocarbon credits have a relatively low market value. Nevertheless, funding provided by foundations and developed country governments in the past has been critical for supporting initial pilots, as well as activities ranging from capacity building to negotiations.

Financing for a grassland agenda means taking into account:

- Early development partner support to demonstrate feasibility and building readiness.
- Winning key development partners to act as champions for moving policy and operations forward.
- Coordination of finance among development partners and private investors.
- Sustainable development investments as a framework for investments in grassland management.
- Transparent benefit sharing, based on free, prior and informed consent.

Ensuring environmental and social benefits

Experience from REDD+ and agricultural carbon projects has shown that from a smallholder perspective, climate change mitigation is a co-benefit, while improved livelihoods and adaptation to climate change are the main benefits resulting from improved management. Ensuring these non-mitigation benefits has attracted attention to safeguards that seek to limit negative social and environmental impacts. REDD+ projects have also demonstrated the importance of distributing benefits through investments in community development rather than payments to individuals. The Climate Change, Community and Biodiversity Alliance (CCBA) has established standards against which REDD+ benefits can be measured.

Since the livestock sector provides numerous opportunities for enhanced food security and livelihood support beyond mitigation benefits, it will be crucial to consider the following aspects in a grassland agenda:

- Independent and robust safeguard policies and standards to ensure land users' rights in decision making processes, and benefits.
- Mechanisms for structured stakeholder participation to ensure free prior and informed consent.
- Capacity building for improvements outside UNFCCC to ensure full benefits (e.g. supporting herder cooperatives through national policies).

5.3 The UN-REDD model for a programme of support

The establishment of a global grassland protection and restoration programme would require an operational platform to provide technical expertise and to build and share knowledge among partner countries. In the paragraph below the UN-REDD programme is presented as a potential learning model.

The UN-REDD Programme was established in 2008 as a collaborative effort of three UN organizations, i.e. FAO, UNDP and UNEP. The programme provides support and technical assistance to currently 47 countries. About 1/3 of the countries receive support to implement

national REDD+ readiness programmes and 2/3 participate in the international knowledge sharing activities. UN-REDD received a total programme budget of $120m, of which $110m was provided by Norway. The program was established to tackle the knowledge gaps in particular related to Measurement, Reporting and Verification (MRV).

The UN-REDD Programme Policy Board is responsible for programme oversight. The 11 members are comprised of three representatives from the participating UN organizations, three development partner representatives, three representatives of pilot program countries (one from each region), one representative of indigenous peoples and one representative of civil society[116]. The structure of the Programme Policy Board is currently being reviewed.

National Programme Documents (NPD) outlining plans for developing national REDD strategies are being developed by each pilot country in conjunction with the UN Country Team and Resident Coordinator. These documents are the foundation to receive financial support.

UN-REDD collaborates closely with the World Bank funded Forest Carbon Partnership Facility (FCPF), which has a budget of $230m for the REDD+ readiness process and $200m for the FCPF Carbon Fund. In a number of countries UN-REDD and FCPF are working together.

In the starting phase UN-REDD was working with nine countries based on two areas of programmatic action: (i) assisting developing countries prepare and implement **national REDD strategies and mechanisms**, and (ii) supporting the development of agreed rules and standardized approaches at **international level** linked with the REDD initiatives under the UNFCCC. [117] Areas of activity the programme identified as within its original scope included:

National level activities:

- Scoping and Alliance Building
- REDD Readiness for Monitoring and Assessment
- REDD Dialogue among stakeholders
- National REDD strategy
- Support for implementing the REDD measures
- REDD Data Management
- REDD Payment structuring
- REDD Payment Distribution

International support functions included:

- Technical and Scientific Support for monitoring systems, including
  - Accounting Methods and Verification of Reduced Emissions,
  - Guidelines, methods and tools for REDD,
  - Co-benefit and Trade-Off Tools,

[116] Daviet et al. 2009. Ready or Not? A Review of the World Bank Forest Carbon Partnership R-Plans and the UN REDD Joint Program Documents. WRI Working Paper. World Resources Institute, Washington DC. Online http://www.wri.org/gfi

[117] http://www.un-redd.org/LinkClick.aspx?fileticket=gDmNyDdmEI0%3d&tabid=587&language=en-US

  - Capacity building in negotiation and

- Knowledge Management for knowledge sharing between countries, including
  - REDD Awareness,
  - Data availability and interpretation,
  - Cutting edge science and policy networks.

In the current (2011-2015) UN-REDD strategy plan, national programmes and global programmes are still the main two modalities for support. Key elements of the UN-REDD Strategy include:

- Definition of six key work areas for focused support through UN-REDD reflecting partner country demand as well as comparative advantages of the UN-REDD agencies. The definition of these six work areas will enable the UN-REDD Programme to provide targeted, in-depth and strategic support to 20-40 individual countries in one or more of the defined work areas.
- Support to up to an additional 20 countries for initial REDD+ readiness, taking account of the lessons learned from the initial Quick Start pilot countries.
- Creation of a new financial modality known as 'Tier 23': This will include REDD+ activities undertaken by UN-REDD Programme agencies that are clearly contributing to the overall UN-REDD Programme Strategy and which are funded through various sources.
- Elaboration of approaches for coordination and collaboration with strategic partners (e.g. Forest Carbon Partnership Facility (FCPF), the Forest Investment Program (FIP), the Global Environment Facility (GEF) and the REDD+ Partnership).

Key lessons:

- The UN-REDD Programme's relatively expeditious access to funds has been critical in allowing countries to rapidly set up their readiness activities and gain internal political support to move forward
- The formulation of REDD+ "roadmaps" has greatly helped to clarify required interventions, and those for which the UN-REDD Programme has a comparative advantage.
- The process of developing a REDD+ strategy is as important as the end product.
- REDD+ readiness requires cross-sectoral coordination within multiple government agencies
- Stakeholder participation and engagement is critical
- REDD+ strategies should include the discussion of tradeoffs and costs-- including opportunity costs-- and benefits at various scales
- Free, Prior and Informed Consent (FPIC) for REDD+ is an on-going process, rather than a single event, and REDD+ needs to build on previous experience.

- The design of national REDD+ strategies needs to build upon previous experiences on forest conservation and restoration, payment for environmental services (PES) and integrated conservation and development projects.
- Technical and institutional capacities are weak in potential REDD+ countries and it will take time to build a critical mass of know-how

5.4 Opportunities and challenges for a grassland agenda

The preceding sections mainly focused on key lessons from the point at which REDD+ was raised into the international negotiations with the specific proposal for support to developing country actions through international mechanisms, through to the design of concerted programmes of support (e.g. UN-REDD) for country-level actions that are unified at the international level.

Where is the issue of restoring value to grasslands currently positioned? The grassland issue currently has multiple existing and potential positionings in relation to other national and international policy issues. On the one hand, this provides the opportunity for broad and widespread coalition building among stakeholders with a range of interests. On the other hand, it indicates that the related issues are diverse and complex, and raises the suggestion that actions on the ground may be addressed through multiple approaches rather than through a single unified international mechanism.

Grasslands and livestock production appear within the REDD+ agenda in some – but not all – countries, since it has long been known that forest clearance for pasture is a major driver of deforestation in some regions. To date, there has been no systematic assessment of initiatives within REDD+ to address grassland and livestock. Grassland and livestock production are both part of the wider agriculture agenda in the climate negotiations, which is just beginning to be formally addressed in the SBSTA. Grasslands and livestock have been highlighted in a number of country priorities for NAMA-type action, and have been explicitly mentioned in a number of observer NGO submissions to UNFCCC. 'Sustainable intensification' is emerging as one overarching consensus in relation to agriculture and climate change.[118] The diverse needs in grassland and livestock management for intensification of inputs in some regions, and for intensification of environmental outputs (i.e. ecosystem services) in other regions, suggests that the sub-issues within the restoring value to grasslands agenda are consistent with this overarching agricultural agenda.

Conservation and restoration of grasslands also relates to agendas in other policy arenas, such as biodiversity conservation, combating desertification and land degradation, rural development and livestock policy. This suggests opportunities for coalition building with key actors in these arenas, but also suggests that identification and framing of issues and solutions are likely to be highly divergent. While there may be consensus on the assumptions that improvement of grasslands and livestock systems are needed, and that valuing ecosystem services can lead to improved grasslands, there may not be consensus on GHG emission reductions as the universal metric for valuation. This paper has posited that there are likely to

[118] Beddinton et al 2011

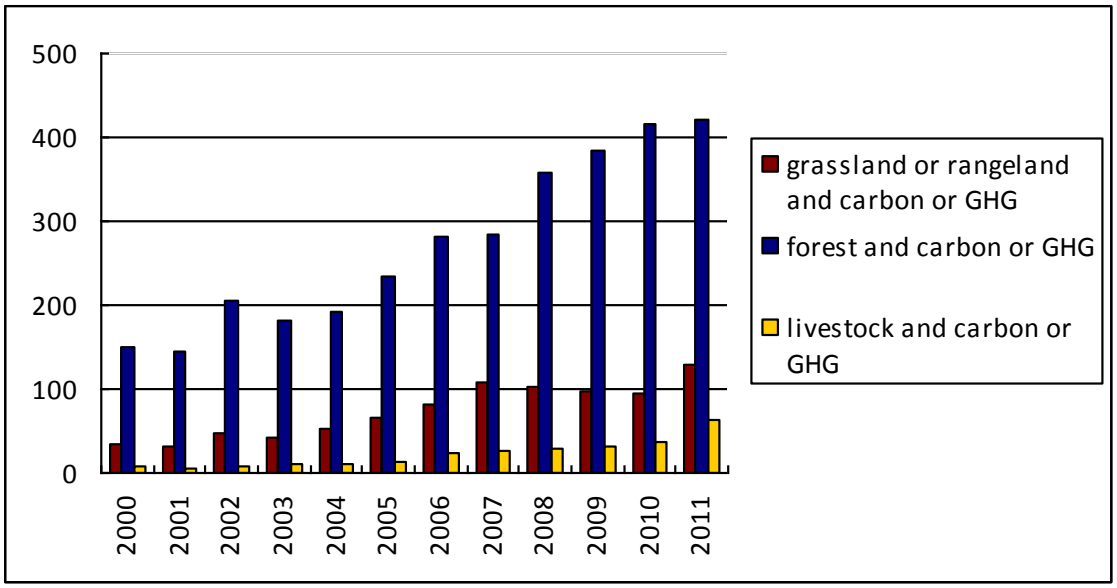
be synergies between GHG emission reductions and other policy objectives, but there are also likely to be trade-offs. These trade-offs can only be assessed in their specific context.

It may also be noted that REDD+ was largely a developing country issue from the outset, with deforestation and forest degradation mainly happening in non-Annex 1 countries. On the one hand this made it easier for Parties to form strategic alliances, as happened with the Coalition for Rainforest Nations. On the other hand, this also created conditions for champions among the industrialized nations (e.g. Norway) to take a clear position and provide strong support for the REDD+ process. Restoring value to grasslands, by contrast, is an issue of relevance to both Annex-1 and non-Annex 1 countries, thus on the one hand potentially uniting very different interests from industrialized and developing countries, while on the other hand suggesting that interests in the issue will be more divergent than in the REDD+ arena, and that some of these interests may relate to other policy issues (e.g. trade) that may complicate the identification of common ground.

Further, it should be considered whether the restoring value to grasslands agenda can be best served by a unified international mechanism. Programmes such as UN-REDD serve to support countries to take part in an internationally agreed mechanism while also supporting the development of the internationally agreed standards. On the one hand such a mechanism poses the potential to unlock major international funding for REDD+ action. On the other hand, finance for REDD+ action is to come from public, private, bi- and multilateral sources (COP17 decision). If finance sources are diversified, and policy and environmental objectives of specific actions to remunerate the values of grasslands are also diversified, a grassland agenda may also do well to retain diversity.

Compared to the deforestation and forest degradation issue, a grassland agenda also faces a number of unique challenges. Firstly, grasslands and extensive livestock production systems have to date been accorded lower political priority in many countries. Agencies charged with grassland management are typically not powerful agencies even within their own agriculture ministries. And the perspectives of grassland users such as pastoralists are often politically marginalized within regional and national policy debates. Secondly, compared to the gradual emergence of a robust scientific basis for quantification of REDD+ actions, a grassland agenda also faces the challenge of a scientific basis that is variable across the many grassland types and production systems that it may address. So far, there has been no harmonized definition for grasslands. Furthermore, while there are a number of initiatives already supportive of a scientific basis for GHG quantification in grasslands, in general there has been less focus in the international scientific community on grasslands. As an illustration of this, Figure 13 shows the number of published articles on grasslands or livestock or forest and carbon or GHGs over the last 11 years. Current levels of scientific publications on grasslands or rangelands and carbon are lower than the annual numbers of publications on forest and carbon before the REDD+ agenda was first formally adopted within the UNFCCC. This may suggest the need for expectations of a longer lead-time, or more focus in concerted international efforts on a targeted range of grassland types and production systems. These issues might indicate a more difficult political starting position for a global grassland agenda modeled on the REDD+ approach.

Figure 13: Frequency of publications containing keywords in title, abstract or keywords in Science Direct



Source: www.sciencedirect.com

Overall, grasslands currently have a weak stand-alone position, and it is unlikely that momentum can be gained in a similar way as occurred with REDD+ almost a decade ago. Some existing climate related policy arenas – e.g. REDD+, NAMAs and more generally agriculture in the climate regime – may provide suitable ground for making progress in restoring value to grasslands. In other contexts, situating grasslands in relation to arenas other than climate change mitigation (e.g. adaptation, biodiversity, water, desertification control) may be more suited to coalition building and support for action. That is, restoring value to grasslands may gain practical traction as an issue that intersects tactically with a range of policy arenas and implementation mechanisms. In the SWOT analysis we summarize the pros and cons of using climate policy and climate finance as an entry point for a global agenda to restore value to grasslands.

Table 9: SWOT analysis to use climate policy and climate finance as an entry point for a global agenda to restore value to grassland

STRENGTHS: • Restoring grasslands can provide food security, climate resilience and mitigation and biodiversity benefits at the same time • Biodiversity value is exceptional, i.e. 35 of the WWF "Global 200" ecoregions are grassland	**WEAKNESSES:** • Low cost economic mitigation is limited according to IPCCC . This estimate is based on a single study and may not reflect true potential • Limited documentation of grassland restoration and its impact on livelihoods and the environment • Economics of grassland restoration unclear for many ecoregions • Many grassland areas are in non-equilibrium ecozones where management will not determine soil carbon stock changes
OPPORTUNITIES: • Low productive and unsustainably managed grasslands are a major driver of deforestation and will receive attention • Value adding through the adoption of sustainable intensification measures, value chain development activities and PES • Climate finance can support the transition to more sustainable grassland management systems	**THREATS:** • Pastoral areas have diverse cultural heritage and indigenous land use rights are complex. • Real potential to close the efficiency gap unclear

6 Conclusions and way forward:

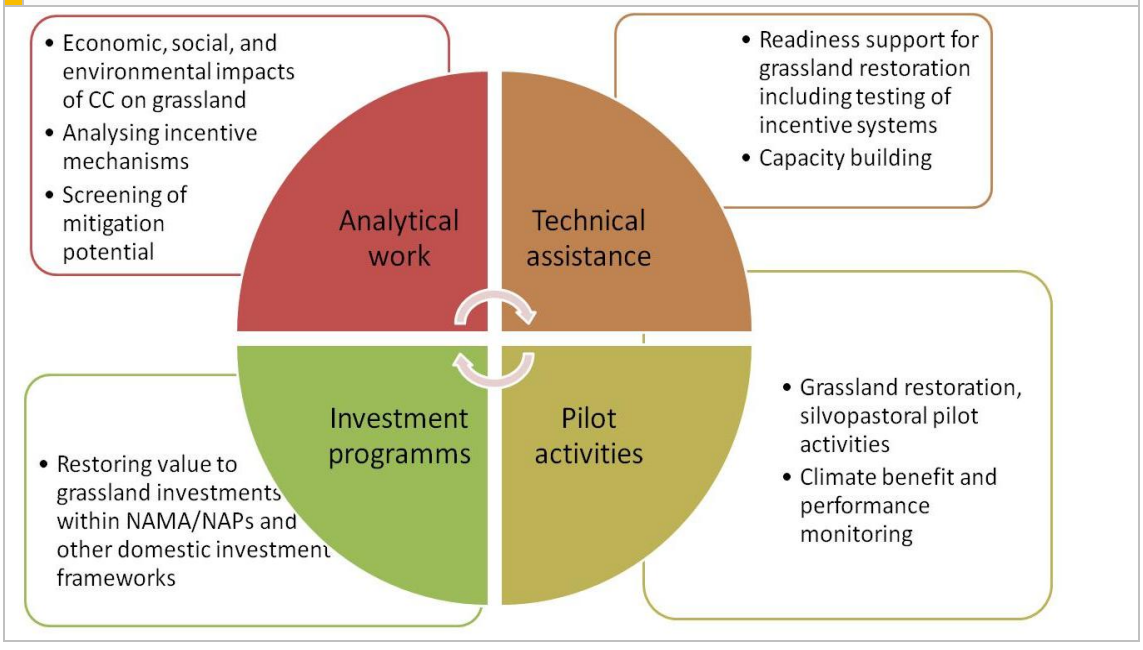
This paper has argued that, given the multiple services of local, national and global importance provided by grasslands, the assumption that climate change mitigation can serve as the single entry point to the valuation of grasslands is unlikely to be upheld in many locations or at the global scale in general. However, the case for climate change mitigation in grasslands has potential in some regions, such as temperate and humid regions where grasslands have a large carbon gap and restoring carbon and rural development objectives are well aligned. Furthermore, the focus of the Global Agenda on Action on "closing the efficiency gap" has an additional mitigation and strong rural development potential by reducing the emissions per product unit. However, given the existing basis in scientific knowledge, pilot actions and related initiatives, substantial readiness work is required before grassland mitigation initiatives are investment-ready and able to absorb significant climate finance and core agricultural investments.

Compared to REDD+, where proof of concept is perceived to be available and different powerful constituencies have build a strong alliance to gain political attention and financial support, there is rather limited policy interest in grassland restoration and pastoral issues compared to the importance of grasslands outlined in this report. Restoring value to grasslands therefore

may well be embedded in a larger agenda – or set of agendas – as proposed by the Global Agenda on Action. For example, the general concept of inclusive green rural development may be defined in the context of restoring value to grasslands in specific local and national contexts, where it may relate, for example, to other areas of policy action such as improving education for pastoralists, provision of rural non-herding employment, and value chain development. In climate-vulnerable regions such as the Horn of Africa, in particular, expanding opportunities to engage in alternative livelihoods is consiered as an important long-term risk mitigation strategy. Within this broader development agenda there is consensus that climate change adaptation is critical for herder's livelihoods and that mitigation – when there are synergies – may be useful to provide additional support through climate finance to achieving adaptation objectives.

Specific to the topic of this paper, we propose targeted support for a grassland climate programme, including analytical work, technical assistance, pilot actions and design of investment programmes. Possible components are outlined in the Figure 14 below. Some of these elements may follow earlier and some later, in a phased approach.

Figure 14: Possible components of a grassland climate programme.



Considering also that valuing grassland climate change mitigation services will only be viable where it is supportive of other environmental management, socio-economic development and climate change adaptation objectives, one approach to making the case for climate change mitigation in grasslands is to pursue the programme in regions with high potential and strong stakeholder support, considering the following generic actions:

(i) pilot actions, in tandem with
(ii) programmes of research on topics relevant to underpinning the basis for the pilot action and relevant to identifying the potential and pathways for upscaling (analytical work);

(iii) Capacity building linked to pilot action, and supporting readiness for upscaled initiatives (technical assistance); and
(iv) Addressing the readiness needs for upscaled climate-smart initiatives, including screening of existing programmes in the pipeline (investment);

Knowledge management and networking activities linking the regions with international level can both support regional actions and regional coalition building, while also providing opportunities for continued engagement of the valuing grasslands agenda with other international policy domains. Engagement at international level will further inform the proposed work programme on agriculture within the international climate negotiations.

the authors suggest that the Global Agenda on Action with its three focal areas (reduced discharge, closing the efficiency gap and restoring value to grasslands) may consider a structure based on two windows, one related to knowledge generation and sharing, including support for investment readiness, and the other focusing on project and programme investments. The two windows could have one steering committee representing governments, civil society and the private sector, but be led by different institutions considering their respective expertise and strengths.

Annex 1: Terms of Reference

In support of the thematic focus area 2 (restoring value to pasture) of the Global Agenda of Action (www.livestockdialogue.org), which is being facilitated by FAO AGA, the consultant will conduct a global review of policies, programs and initiatives for the restoration degraded grasslands. This review will serve as a background document for the focus area 2 workshops to be held in Brazil in the week beginning 7 May 2012. While this document will stand on its own, it will also be subsumed into a larger document FAO is preparing to cover all 3 focus areas of the Agenda. The consultant will also travel to Brazil to participate in this workshop as a resource person.

Tasks

1. Review policies, programs and initiatives for grassland restoration

The consultant will review the following:

a) Grassland restoration in the context of the United Nations Framework Convention on Climate Change (UNFCCC)
   - Its current place within the global policy architecture of the UNFCCC (considering both mitigation and adaptation). And its future, given developments/progress (if any) in the Conference of the Parties (COP) and related negotiations
   - Potential and constraints for its participation in Kyoto-compliant market mechanisms
   - Current uptake, and potential and constraints for integration within NAMAs and NAPAs
   - Review and evaluate the submissions from the Parties to the AWG-LCA on Nationally appropriate mitigation actions or commitments, and related documents.

b) The feasibility, advantages and scope for the UN REDD programme to serve as a template for a programme to support and finance grassland restoration.

c) The current role and future potential of non Kyoto mechanisms to leverage investments needed for grassland restoration
   - The potential and constraints for the voluntary carbon market to fund grassland restoration
   - The potential and constraints for other non Kyoto funding mechanisms (e.g. the Global Environment Facility)
   - Indication of the overall capacity for the current range of market and financing mechanisms to fund grassland restoration

d) Stock take of programmes, initiatives and policies additional to those discussed above, implemented by governments, NGOs, and the private sector to restore grasslands.

The role of mitigation finance, based on soil carbon sequestration, as an entry point for achieving the multiple environmental and socio-economic benefits of grassland restoration.

Annex 2: Selection of PES schemes in grasslands and grazing lands

For information sources on each scheme, see Annex 1 in Wilkes et al (in preparation)

Schemes supporting initial costs of implementing improved land management practices	
Landcare Australia	Organizes groups and individuals to adopt improved land management for which grants can be accessed (now named Caring for our Country)
ICMS Ecológico Brazil	Tax revenue-sharing scheme, designed to provide county governments with incentives for conservation and management of protected areas
National Farm Stewardship Program Canada	Funds 30-50% of cost of adopting provincially-defined 'best management practices' (BMPs) for improved land management
Greencover Canada	Funded provincially-defined BMPs for eligible land types
Swiss Foundation for the Conservation of Cultural Landscapes Switerland	Provides grant funding for improved land management, environmental and cultural-historical preservation
Landscape Auctions Netherlands	Auction scheme enabling buyers to fund conservation actions and easements offered by land owners
Farm and Ranch Lands Protection Program USA	Co-funds purchase of lands at risk of development or land use change to conserve agricultural uses. Federal state funded.
Wildlife Habitat Incentives Program USA	Co-funds management practices set according to state priorities for habitat and species conservation. Land parcels are ranked against set criteria to enable targeting of most valuable plots. Federal, State co-funded.
Environmental Quality Incentive Program USA	Co-funds management practices set according to state priorities that deliver environmental benefits. Ranks applications against benefits index to target most worthy applications. Federal state funded.
Landowner Incentive Program USA	Grant funds support activities on private lands that complement state wildlife conservation strategies.
Schemes providing recurring payments for implementing improved land management practices	
Grassland Retirement Program China	Annual payments for exclosure, seasonal or rotational grazing. Central government funding, minor local government funding
Sloping Farmland Conversion Program China	Annual payments for afforesting or planting grass on degraded lands. Central government funding, minor local government funding
Grassland Conservation Rewards China	Annual payments per ha for not exceeding stocking capacity of grasslands.
Kitengela Wildlife Conservation Lease Programme Kenya	Annual payments to residents in national park for not fencing, not farming, not selling their farms

Integrated Silvo-pastoral Program Columbia, Costa Rica, Nicaragua	Pilot project providing annual payments for improved silvo-pastoral practices. Land plots and practices quantified ex ante using carbon and biodiversity index.
Vittel-Nestlé Water Scheme France	Owner of mineral water factory paid land owners in watershed to change their management practices in favour of extensive livestock and agriculture practices, including funding buy-outs of farms.
CCX Rangeland Offset Program USA	Farmers can generate carbon credits for planned grazing and sell them to companies that are CCX members.
ESPH Costa Rica	Based on site-specific needs, farmers upstream of ESPH water company can receive payments for forest protection and reforestation of underused land or land currently used for livestock farming. Funded from surcharge on water fees.
San Pedro del Norte Water Co. Nicaragua	Based on site-specific needs, farmers receive annual payments for restoration of degraded pastures and other land management practices in critical watershed funded from water fees, municipal budget and donor seed funds.
Pimampiro watershed services scheme Ecuador	Land owners paid to protect native vegetation from deforestation and land conversion based on farm-specific agreements. Funded from trust fund and water fees.
Conservation Reserve Program USA	Rewards farmers / ranchers for conservation practices. Applications are ranked based on an Environmental Benefits Index, and a nationwide reverse auction is used to identify best applications. Annual payments made within 5-year contract. Federal state funded.
PSAH Mexico	Farmers rewarded for forest protection in target watershed areas. Scheme funded from water fee surcharge.
Simanjiro CCA Tanzania	Tour companies make annual payment to community to prevent agricultural encroachment and poaching in wildlife habitat.
West Arnhem Fire Abatement Project Australia	Aboriginal communities paid to revive traditional methods of preventing destructive fires that release GHGs. Federal, state, private funding.
Environmental Stewardship Scheme UK	Annual payments to farmers for performing pre-specified management practices in farmland in environmentally sensitive areas. Management activities ranked by environmental benefits index, need minimum score for farm to be eligible. EU and UK funded.
MEKA Germany	Annual payments for low input agriculture practices. Payments per ha with payment levels based on points assigned to different practices.
Spiti valley predator incentive scheme India	Community receives annual payment from NGO for agreeing not to graze in one wildlife habitat location. 5-year contract.
Snow Leopard program	NGO established company, which agrees to purchase wool from herders in

Mongolia	exchange for a ban on wildlife poaching.
High nature value grasslands programme Romania	Annual payments per ha for low input agriculture practices targeting high biodiversity grassland and land use types.
Alternative Land Use Services Canada	Pilot project supporting demonstration farms to conserve and enhance uplands, wetlands and riparian area. Provides annual incentive payment and variable payment based on costs and foregone income.
Agro-Environmental Grassland Payment (PHAE) France	Annual payments on condition of compliance with specified practices, such as sustainable stocking levels, maintenance of areas as permanent pasture limitations on fertilizer use etc
Meadow Bird Agreements Netherlands	Agreements signed with farmers to delay dates of plowing and mowing to allow time for rare birds to hatch. One option allows for payment per clutch of eggs found. Monitoring by farmers, farmer groups and volunteers.
Traditional meadows and pastureland scheme Sweden	In response to declining pasture land area, annual payments at a set rate per ha made to maintain pastures. Requires a detailed pasture management plan.
Conservation Stewardship Program USA	Rewards for performing pre-defined conservation practices that meet state-set priorities. Payment levels tiered to reflect different levels of conservation benefit.
Bushtender Australia	Reverse auction held to identify land owners for contracts to improve biodiversity, reduced salinity, water health etc. Bidders' proposals are ranked by environmental benefits and most cost-effective proposals accepted. Annual payments made on successful implementation of plan.
South Australian Multiple Ecological Communities project Australia	Targeting endangered vegetation types, the scheme rewards farmers for implementing 3-year management plans over a 15 year period. Farmers enroll through a reverse auction. Land plots assessed against pre-set criteria for eligible lands.
Woodland BushBids Australia	The scheme pays rewards to farmers who submit successful bids in a reverse auction to undertake management practices that meet pre-defined minimum standards which are scored based on their environmental value.
CAMPFIRE Zimbabwe	In the Communal Areas Management Programme for Indigenous Resources programme (CAMPFIRE), tour operators pay local authorities (which pay communities) in return for access to wildlife habitat and bans on poaching etc.
Schemes providing recurring payments for delivery of ecosystem services	
Performance payments for carnivore reproduction Sweden	Indigenous communities paid for new offspring of wolverine and lynx. Each community devises its own use of the funds. Animal populations monitored with field surveys. State funded.

Desert Uplands Committee Landscape Linkage Auction Australia	Reverse auction held to identify land owners for contracts to protect biodiversity by maintaining or improving land condition as measured by an index reflecting biodiversity, land condition and landscape connectivity. Pilot project.
Wetland Banking USA	Wetlands put under long-term easement to offset wetland habitat loss elsewhere.
EcoTender Australia	Reverse auction held to identify land owners for contracts to improve biodiversity, reduced salinity, water health etc. Bidders' proposals are ranked by environmental benefits and most cost-effective proposals accepted. Annual payments made on successful implementation of plan.
BushBroker Australia	Land owners undertake conservation actions as part of 10-year management plan that provide Native Vegetation Credits that can be traded to offset native vegetation lost elsewhere.
New South Wales BioBanking scheme Australia	Land owners offer land for threatened species conservation, and receive payments to maintain the site, creating a species or ecosystem offset for losses due to development.
CDM Reforestation Project Paraguay	Reforestation of croplands and grasslands. JIRCAS and Paraguay forestry institute to get income from sale of CERs; farmers to get income from sale of forest products. Uses CDM-approved carbon accounting methodology
VCS Afforestation project Tanzania	Afforestation in grassland areas. Private company operates carbon sequestration project, will give 10% of revenue to community. Uses VCS-approved carbon accounting methodology.
Project Terraprima Portugal	Pays farmers for 3 years to sequester carbon by cultivating mixed species pastures on degraded or unimproved pasture lands. Funded by Portugal's national carbon fund.
Thicket restoration project S Africa	Aims to sequester carbon by planting saplings of native thicket species in nature reserves. Carbon accounting is done according to Voluntary Carbon Standard. Revenues from sale of carbon credits will go to a new entity established by nature reserve management agencies.
Nordheim Plant Diversity Pilot Germany	Farmers provide competitive bids to provide plant diversity. Plots measured annually and payments made according to bid and performance.
Salinity benefits trading scheme Australia	Land management practices ranked according to salinity benefits. Farmers' actions create credits which can be traded with other farmers. (Pilot scheme)

Annex 3: Selected regional and international initiatives relevant to restoring value to grasslands

Selected regional and international initiatives relevant to restoring value to grasslands

Initiative / organization	Focus	Main activities	Sources
Worldwide Initiative for Sustainable Pastoralism (IUCN-WISP)	"a global initiative that supports the empowerment of pastoralists to sustainably manage drylands resources"	Supporting knowledge management, networking and advocacy by and on behalf of pastoralists	http://www.iucn.org/wisp/
African Union Policy Framework for Pastoralism in Africa	Securing pastoral livelihoods; strengthen pastoral contribution to African economies	Support national pastoral policy development processes	http://au.int/en/dp/rea/sites/default/files/Policy%20Framework%20for%20Pastoralism.pdf
Temperate Grasslands Conservation Initiative	Protected areas in temperate grasslands	Aims to serve as a hub for international communications and collaboration for the improved conservation and protection of the temperate grasslands.	http://www.iucn.org/about/union/commissions/wcpa/wcpa_what/wcpa_conservingsd/wcpa_grasslandstf/
Linking Conservation Initiatives for Grasslands Migratory Species of the South Cone of South America	Cross-scale and transboundary conservation planning	Facilitate the adaptation and application of a methodology that allows a unified planning for the conservation of migratory species at local, regional, and hemispheric levels	http://www.oas.org/DSD/WHMSI/English/FEMCIDI3/GUYRA.htm
North American Grasslands Initiative	Sustainable ranching and agriculture practices	Work with ranching associations to identify and disseminate sustainable ranching, production and biodiversity conservation practices	http://www.cec.org/Page.asp?PageID=924&SiteNodeID=1013&AA_SiteLanguageID=1
EU Financial Instrument for the Environment (LIFE)	Finance for environmental conservation in the EU	Financial support in the EU for a variety of grassland conservation initiatives.	http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/grassland.pdf

Source: Compiled by the authors

References

Alary V, Corniaux C, Gautier D, 2011, Livestock's contribution to poverty alleviation: how to measure it? World Development 39(9): 1638-1648.

Almack K, 2010, Carbon finance for conservation of native prairie, USA. TEEB case study available at: TEEBweb.org.

Benkhe R, 2010, The Contribution of Livestock to the Economies of IGAD Member States, IGAD LPI Working Paper No. 02-10, Addis Ababa.

Benhke R, Muthami D, 2011, The Contribution of livestock to the Kenyan Economy, IGAD LPI Working Paper No. 03-11, Addis Ababa.

Cao G, Long R, 2009, The Bottleneck and its Resolutions to the Natural Recovery of Black Soil Type Degraded Grassland in the Three River Source Region, in Acta Agrestia Sinica.

Beddington J, Asaduzzaman M, Fernandez A, Clark M, Guillou M, Jahn M, Erda L, Mamo T, Van Bo N, Nobre CA, Scholes R, Sharma R, Wakhungu J. 2011. Achieving food security in the face of climate change: Summary for policy makers from the Commission on Sustainable Agriculture and Climate Change. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark.

Cerbu G, Minang PA, Swallow B, Meadu V. 2009. Global survey of REDD projects: What implications for global climate objectives? ASB PolicyBrief No. 12. ASB Partnership for the Tropical Forest Margins, Nairobi, Kenya .

Conant, R, Paustian, K and E Elliott. 2001. Grassland management and conversion into grassland: effects on soil carbon. Ecological Applications. 11(2): 343-355.

Costanza R, d'Arge R, de Groot R, Farberk S, Grasso M, Hannon B, Limburg K, Naeem S, O'Neill R, Paruelo J, Raskin R, Sutton P, van den Belt M, 1997, The value of the world's ecosystem services and natural capital. Nature 387: 253-260.

Davidson, E and I Ackerman. 1993. Changes in soil carbon inventories following cultivation of previously untilled soils. Biogeochemistry 20: 161-193

Domingos T, 2009, Project Terraprima: carbon seqeustration in sown biodiverse pastures. Presentation at EU side-event at UNFCCC COP15, Copenhagen, 10/12/2009. http://www.se2009.eu/polopoly_fs/1.27540!menu/standard/file/10_Dec_Grassland_soil_carbon_management_Project_Terraprima.pdf

Don A, Schumacher J, Freibauer A, 2011, Impact of tropical land use change on soil organic carbon stocks: a meta-analysis. Global Change Biology 17(4): 1658-1670 .

Dyer K, 2012, Pastoralism in the Horn of Africa: Diverse livelihood pathways, Future Agricultures Consortium CAADP Policy Brief No 6, FAC, Brighton.

Eady S, Grundy M, Battaglia M, Keating B (eds), 2009, An analysis of greenhouse gas mitigation and carbon biosequestration opportunities from rural land use. CSIRO,Armidale.

FAO 2006, Prospects for food, nutrition, agriculture and major commodity groups: World Agriculture Towards 2030 / 2050, FAO, Rome.

FAO 2007, State of Food and Agriculture 2007, FAO, Rome

FAO, 2009, State of Food and Agriculture 2009, FAO, Rome

FAO 2010: Agriculture, food security and climate change in the post-Copenhagen process, an FAO information note. FAO, Rome.

FAO 2010b. Global Forest Resources Assessment 2010. Main Report. FAO Forestry Paper 163. FAO, Rome.

Follet R, Kimble J, Lal R, 2001. The potential of U.S. grazing lands to sequester carbon and mitigate the greenhouse effect, CRC Press, Florida.

Garnaut R, 2008, The Garnaut Climate Change Review, http://www.garnautreview.org.au/index.htm.

Gerber P, Vellinga T, Dietze K, Falcucci A, Gianni G, Mounsey J et al, 2010, Greenhouse Gas Emissions from the Dairy Sector: A lifecycle assessment. FAO, Rome.

Gerber P, 2011, Assessing and rewarding environmental services from the livestock sector, presentation at Liflod Rosario workshop, April 2011, available at http://liflod.org/files/workshop_rosario/Gerber-Rosario-3Avril-2.pdf

Gibbs H, Ruesch A, Achard F, Clayton M, Holmgren P, Ramankutty N, Foley A, 2010, Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s. PNAS 107(38): 16732–16737.

Global Environment Facility (GEF), 2010, GEF5 Focal Area Strategies, GEF, Washington D.C.

Global Environment Facility (GEF) Evaluation Office, 2010, Fourth Overall Performance Study of the GEF: Full Report, GEF Evaluation Office, Washington D.C.

Global Mechanism of the UNCCD, 2008, Integrating Financing Strategies for Sustainable Land Management, Global Mechanism, Rome

Gulati A, Minot N, Delgado C, Bora S, 2007, Growth in high value agriculture in Asia and the emergence of vertical links with farmers, http://siteresources.worldbank.org/INTRANETTRADE/Resources/Topics/Standards/paper_minot.pdf

Guo L and R Gifford. 2002. Soil carbon stocks and land use change: a meta analysis. Global Change Biology 8: 345-360

Havstad K, Peters D, Skaggs R, Brown J, Bestelmeyer B, Fredrickson E, Herrick J, Wright J, 2007, Ecological services to and from rangelands of the United States. Ecological Economics 64: 261-268.

Hoekstra J, Boucher T, Ricketts T, Roberts C, 2005, Confronting a biome crisis: global disparities of habitat loss and protection. Ecology Letters 8: 23–29.

Hooper D, Chapin F, Ewel J, Hector A, Inchausti P, Lavorel S, Lawton J, Lodge D, Loreau M, Naeem S, Schmid B, Setala H, Symstad A, Vandermeer J, Wardle D, 2005, Effects of Biodiversity on ecosystem functioning: a consensus of current knowledge. Ecological Monographs 75(1): 3–35.

Kumar B, Nair P (eds), 2011, Carbon Sequestration Potential of Agroforestry Systems: Opportunities and challenges, Springer Verlag, New York.

Larson D, Dinar A, Frisbie J, 2011, Agriculture and the Clean Development Mechanism, World Bank Policy Research Working Paper No. 5621, World Bank, Washington D.C.

Latham J, Cumani R, 2009, Mapping global soil carbon stocks and sequestration potential, presentation available at:

http://www.fao.org/fileadmin/templates/agphome/scpi/cgwg/Latham.pdf

Lipper L, Dutilly-Diane C, McCarthy N, 2010, Supplying Carbon Sequestration From West African Rangelands: Opportunities and Barriers. Rangeland Ecology and Management 63: 155–166.

Lipper L, Wilkes A, McCarthy N, 2011, Crediting soil carbon sequestration in smallholder agricultural systems: what fits and what will fly? In D de Brogniez, P Mayaux and L Montanarella (eds), Monitoring, Reporting and Verification systems for Carbon in Soils and Vegetation in African, Caribbean and Pacific countries, EC JRC Scientific and Technical Reports, EC European Commission Joint Research Centre, Brussels.

LivestockNet 2006 Livestock Production and the Millennium Development Goals: The role of livestock for pro-poor growth. LivestockNet, Zollighofen.

Ma Y, 2006, Impact of cultivated Poa pastures on degraded ‘black beachu, Qinghai Animal Husbandry and Veterinary Journal 36(2).

Maestre F, Quero J, Gotelli N, Escudero A, Ochoa V et al., 2012, Plant Species Richness and Ecosystem Multifunctionality in Global Drylands. Science 335: 214-218.

Martin L, Moloney K, Wilsey B, 2005, An assessment of grassland restoration success using species diversity components. Journal of Applied Ecology 42: 327–336.

McKinsey & Co, 2009, China’s Green Revolution: prioritizing technologies to achieve energy and environmental sustainability. McKinsey & Co, London.

Merger E, 2010, Status and Future of the Afforestation and Reforestation (A/R) Carbon Sector, http://www.carbonfix.info/chameleon/outbox/public/55/AR-Carbon-Projects_CarbonPositive_2010.pdf .

Meridian Institute 2009, Reducing Emissions from Deforestation and Forest Degradation (REDD): An Options Assessment Report

Meridian Institute, 2011, Addressing Agriculture in Climate Negotiations, Meridian Institute, Washington D.C.

Mills A, Blignaut J, Cowling R, Knipe A, Marais C, Marais S, Pierce S, Powell M, Sigwela A, Skowno A, 2010, Investing in sustainability. Restoring degraded thicket, creating jobs, capturing carbon and earning green credit. Climate Action Partnership, Cape Town, and Wilderness Foundation, Port Elizabeth.

Naidoo R, Balmford A, Costanza R, Fisher B, Green R, Lehner B, Malcolm T, Ricketts T, 2008, Global mapping of ecosystem services and conservation priorities. PNAS 105(28): 9495-9500.

Negra C, Wollenberg E, 2011, Lessons from REDD+ for Agriculture. CCAFS Report No. 4. Climate Change, Agriculture and Food Security (CCAFS), Copenhagen, Denmark.

Nelson E, Polasky S, Lewis D, Plantinga A, Lonsdorf E, White D, Bael D, Lawler J, 2008, Efficiency of incentives to jointly increase carbon sequestration and species conservation on a landscape. PNAS 105(28): 9471-9476 .

Nkonya E, Gerber N, Baumgartner P, von Braun J, de Pinto A, Graw V, Kato E, Kloos J, Walter T, 2011, The Economics of Desertification, Land Degradation, and Drought: Toward an Integrated Global Assessment, IFPRI Discussion Paper 1086, IFPRI, Washington D.C.

van Noordwijk M, Leimona B, 2010, Principles for fairness and efficiency in enhancing environmental services in Asia: payments, compensation, or co-investment? Ecology and Society 15(4): 17. [online] URL: http://www.ecologyandsociety.org/vol15/iss4/art17/

Olson D, Dinerstein E, Wikramanayake E, Burgess N, Powell G et al, 2001, Terrestrial Ecoregions of the World: A New Map of Life on Earth. BioScience 51: 933-938.

Pica G, Pica-Ciamarra U, Otte J, 2008, The Livestock Sector in the World Development Report 2008: Re-assessing the Policy Priorities, Pro-Poor Livestock Policy Initiative Research Report No. 08-07, FAO, Rome.

Pywel R, Bullock J, Hopkins A, Walker K, Sparks T, Burke M, Peel S, 2002, Restoration of species-rich grassland on arable land: assessing the limiting processes using a multi-site experiment. Journal of Applied Ecology 39(2): 294-309.

Randolph T, Schelling E, Grace D, Nicholson C, Leroy J, Cole D, Demment M, Aomore A, Zinsstag J, Ruel M, 2007, Role of livestock in human nutrition and health for poverty reduction in developing countries. Journal of Animal Science 85(11): 2788-2800.

Raas N, 2006, Policies and strategies to address the vulnerability of pastoralists in Sub-Saharan Africa, Pro-Poor Livestock Policy Initiative Working Paper No. 37, FAO, Rome.

Roberts R, 2010, Regional Resilience Enhancement Against Drought (RREAD) Phases One and Two: Best Practices & Lessons Learnt:

http://www.disasterriskreduction.net/fileadmin/user_upload/drought/docs/Final%20draft%20RREAD%201%20and%202%20Lessons%20Learnt%202%20.pdf

Rodriguez L, 2008, A global perspective on the total economic value of pastoralism: global synthesis report based on six country valuations, WISP, Nairobi.

Salick J, Fang Z, Byg A, 2009, Eastern Himalayan alpine plant ecology, Tibetan ethnobotany, and climate change. Global Environmental Change, 19(2): 147-155

Schlesinger W, Reynolds J, Cunningham G, Huenneke L, Jarrell W, Virginia R, Whitford W, 1990, Biological feedbacks in global desertification. Science 247(4946): 1043-1048.

Schuman G, Janzen H, Herrick J, 2002, Soil carbon dynamics and potential carbon sequestration by rangelands. Environmental Pollution 116: 391–396.

Seebauer, M., Tennigkeit, T., Bird, N., Zanchi, G. 2012. Carbon accounting for smallholder agricultural carbon credits: a Verified Carbon Standard for agricultural land management projects. In: Wollenberg, E., Nihart, A., Tapio-Biström, M-L., Grieg-Gran, M. (Eds.). Climate change mitigation and agriculture. Earthscan, 274-284.

Smith, P., D. Martino, Z. Cai, D. Gwary, H. Janzen, P. Kumar, B. McCarl, S. Ogle, F. O'Mara, C. Rice, B. Scholes, O. Sirotenko, 2007: Agriculture. In Climate Change 2007: Mitigation. Con-

tribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Smith, P., D. Martino, Z. Cai, D. Gwary, H.H. Janzen, P. Kumar, B. McCarl, S. Ogle, F. O'Mara, C. Rice, R.J. Scholes, O. Sirotenko, M. Howden, T. McAllister, G. Pan, V. Romanenkov, U. Schneider, S. Towprayoon, M. Wattenbach, and J.U. Smith, 2008. Greenhouse gas mitigation in agriculture. Phil. Trans. R. Soc. B (2008) 363, 789–813.

Stern, N. 2007. The Economics of Climate Change. CUP, Cambridge.

Stohlgren T, Chase T, Pielke R, Kittel T, Baron J, Evidence that local land use practices influence regional climate, vegetation, and stream flow patterns in adjacent natural areas. Global Change Biology 4: 495-504

Teixeira R, Domingos T, Costa A, Oliveira R, Farropas L, Calouro F, Brradas A, Carneiro J, 2011, Soil organic matter dynamics in Portuguese natural and sown rainfed grasslands. Ecological Modelling 222(4) 993-1001

Tennigkeit T, Karhl F, Wölcke J, Newcombe K, 2011, Economics of agricultural carbon sequestration in sub-Saharan Africa, in in Wollenberg E, Nihart A, Tapio-Biström and M Grieg-Gran (eds) Climate Change Mitigation and Agriculture, Earthscan: London 144-158.

Tennigkeit, T and Wilkes, A. 2008, An Assessment of the Potential for Carbon Finance in Communal Rangelands, ICRAF Working Paper 68, ICRAF: Beijing.

Thornton P, Herrero M, 2010, Potential for reduced methane and carbon dioxide emissions from livestock and pasture management in the tropics. PNAS 107(46): 19667–19672.

UN-REDD (2011). The UN-REDD programme strategy 2011-2015. Available online at: http://www.un-redd.org/

von Wehrden H, Hanspach J, Kaczensky P, Fischer J, Wesche K. 2012: A global assessment of the non-equilibrium concept in rangelands. Ecological Applications 22:393–399.

Wang, SP, Wilkes, A, Zhang, ZC, Chang, XF, Lang, R, Wang, YF, Niu, HS, 2011, Effects of management and land use change on soil carbon in China's grasslands. Agriculture, Ecosystems & Environment doi:10.1016/j.agee.2011.06.002.

White R, Murray S, Rohweder M, 2000, Pilot Analysis of Global Ecosystems Grassland Ecosystems. World Resources Institute, Washington D.C.

Wilcox B, Thurow T, 2006, Emerging Issues in Rangeland Ecohydrology: Vegetation Change and the Water Cycle. Rangeland Ecology and Management 59(2): 220-224.

Wilkes A, Wang S, Tennigkeit T, Feng J, 2011, Agricultural Monitoring and Evaluation: What can we learn for the MRV of agricultural NAMAs? ICRAF Working Paper 126, ICRAF: Beijing .

Wilkes A, Lipper L, Wang S, Henderson B, et al, in preparation, Estimated climate change abatement costs from improved grassland management in Qinghai, China. FAO ESA Working Paper, FAO, Rome.

Wilkes A, Soloski R, Tennigkeit T, forthcoming, Experiences with Payments for Environmental Services in grazing lands and other rangelands: an international review with analysis of implications for NE Asia, ICRAF Working Paper, ICRAF, Beijing.

Wilson J, Peet R, Dengler J, Partel M, 2012, Plant species richness: the world records. Journal of Vegetation Science Doi: 10.1111/j.1654-1103.2012.01400.x

Witt B, Noel M, Bird M, Beeton R, Menzies N, 2011, Carbon sequestration and biodiversity restoration potential of semi-arid mulga lands of Australia interpreted from long-term grazing exclosures. Agriculture Ecosystems and Environment 141 (1-2): 108-118.

World Bank 2007 World Development Report 2008: Agriculture for Development, World Bank, Washington D.C.

Wunder, S. 2005. Payments for environmental services: some nuts and bolts. CIFOR Occasional Paper 42. Center for International Forestry Research, Bogor, Indonesia. [online] URL: http://www.cifor.cgiar.org/Knowledge/Publications/Detail?pid=1760.