BIOCHAR IN NAMIBIA

Opportunities to convert bush encroachment into carbon offsets

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Executive Summary

Considerable proportions of Namibia's natural rangelands are encroached by invader bush. This phenomenon, called bush encroachment, is recognised as a form of land degradation. It reduces the livestock carrying capacity of rangelands, leads to a loss of biodiversity, reduces the penetration of rain water into the soil and thereby reduces the recharge of underground water resources, and indirectly causes a decline of jobs and business opportunities in rural Namibia. Yet, the bush resource sequesters significant amounts of carbon dioxide, which renders Namibia a net carbon sink.

Most farmers consider bush encroachment undesirable. Yet, bush is vital for the country's browsers, which constitute a significant source of income for the tourism industry, game farmers and conservancies. The bush resource also offers business opportunities for fire wood producers and the charcoal industry, and holds significant additional expansion potentials. In addition, new but as yet undeveloped opportunities lie in the creation of carbon sequestering and offset projects in the country's agricultural and forestry sectors, as well as bush encroached farmlands.

Under the Kyoto Protocol, Namibia is a non-Annex I country, which implies that it does not have greenhouse gas reduction commitments. It can, however, actively participate in and derive benefits from the trade in certified emission reduction certificates for carbon-saving and/or carbon-sequestering activities. Namibia's various land uses could offer new prospects for additional revenues from carbon credits: while many farmers equate bush to an expensive nuisance factor that needs to be eradicated, projects using bush and its derivative products could potentially earn carbon credits, and thereby introduce new economic value chains.

Namibia's rural areas do not offer many formal job opportunities. This is despite the fact that almost one-half of the country's population depends on subsistence farming and associated activities. Innovative projects are needed to create jobs and additional economic activities using the country's many natural resources without undermining the environmental sustainability of the land. Here, the production of biochar could one day offer perspectives for local job creation, while creating new opportunities for value addition from invader bush and rangeland rehabilitation.

Presently, carbon sequestering and associated trading mechanisms from improved rangeland and soil management practices, including the use of biochar, are discussed at a variety of international forums. However, numerous research and procedural gaps remain before carbon revenues from biochar can be generated. The promise that Namibia's bush encroachment can be turned into biofuels and biochar, while also earning carbon credits, is a proposition that deserves prominent attention, targeted support and ongoing research and development.

There is no Namibian policy or guideline that incentivises or regulates the development of carbon offsets or carbon sequestering through rangeland management. While baseline and methodological guidance is currently available for select project types in the field of agriculture and forestry through the Clean Development Mechanism, none is as yet available for biochar. It is expected that an internationally binding post-2012 carbon trade agreement will be developed within the coming months, and ratified at Copenhagen in December 2009. It is likely that additional mechanisms from the formal and informal trade in carbon from the land-use, land-use change and forestry sectors will be agreed upon in the coming months. Biochar may be included in such future arrangements too.

Namibia is well-advised to develop the required institutional capacities, and actively participate in international negotiations, to benefit from the many as yet undeveloped opportunities that its bush resource offers, both as a carbon offset and a source of future carbon revenues. This paper explores these issues in more detail, and develops policy recommendations to address the key questions.

1. Purpose

In March 2009, the first meeting of the National Advisory Expert Panel (NEAP) on trade and environment linkages signalled the start of Namibia's Rapid Trade and Environment Assessment (RTEA). The RTEA process is designed to identify the issues and opportunities for environmental sustainability in Namibia's trade and investment policy-making, and to prioritise those trade policies, sectors and sub-sectors that have an impact on the country's natural environment.

The RTEA assessment is to highlight those areas in the country's environmental sector in which Namibia could have "first mover advantages", and develop associated recommendations on policy options. As such, the assessment is geared to provide information to better prepare Namibia's international negotiation position while also benefitting the continued development of the domestic policy framework. As the RTEA considers new initiatives, it also provides a basis for recommendations on additional research and analysis requirements, and identifies capacity development needs. The NEAP guides the RTEA process to ensure value-addition within Namibia's ongoing policy development and implementation processes.

The NEAP prioritised four indicative sectors for further study within the RTEA process, and commissioned the following sector papers highlighting key policy issues:

1. Red meat traceability policy implications for integrated sustainable land management
2. Opportunities to convert bush encroachment into carbon offsets
3. Threats and opportunities of green labelling, eco-certification and fair trade schemes
4. Opportunities for eco-tourism presented by the informal carbon market

This paper explores the issues and opportunities presented by Namibia's bush encroachment, specifically highlighting the requirements to benefit from future carbon offset schemes and carbon finance mechanisms.

2. Background

In 2006, agriculture and forestry contributed N$ 2.53bn or almost 6.3% to Namibia's gross domestic product (GDP), while contributions from mining and fishing were 9.2% and 2.7% respectively [CBS, 2008]. The agriculture sector encompasses both commercial and communal farming systems [Werner, 2003]. Despite contributing less to GDP than for example mining, agriculture remains a most important sector in Namibia's economy because some 48% of the country's rural population consider farming activities in general, and subsistence farming in particular, their main source of income [GRN, 2002]. This implies that investments and value addition in the country's agriculture and forestry sectors stand to reach a substantial number of households, and therefore have an important impact on rural livelihoods and poverty alleviation. Table 1 below illustrates the respective growth rates and contributions of various sectors to GDP in the period 2001 to 2006.

Sector	Average growth rate between 2001 and 2006	Average share to GDP between 2001 and 2006
Agriculture and Forestry	2.2%	5.3%
Fishing	– 1.3%	4.8%
Mining	7.7%	10.4%

Table 1: Percentage growth and share of GDP of select sectors between 2001 and 2006 [CBS, 2008]

Namibia's National Development Plan 3 – NDP 3 – identifies the productive use of natural resources, and environmental sustainability, as key result areas [NDP 3, 2008]. This also corresponds to Namibia's Vision 2030 objectives [Vision 2030]. NDP 3 states that a land and agricultural production goal is that "land is used appropriately and equitably, significantly contributing towards food security at household and national levels, and supporting the sustainable and equitable growth of Namibia's economy, whilst maintaining and improving land capability". As part of the forestry goals, NDP 3 states that "Namibia's diverse natural woodlands, savannahs and the many resources they provide are managed in a participatory and sustainable manner to help support rural livelihoods, enhance socio-economic development, and ensure environmental stability" [NDP 3, 2008]. Because Namibia's economy is largely based on the use of primary resources, the efficient extraction, sustainable harvest and use of such resources is of key importance [GRN, 1998].

The agriculture sector is particularly vulnerable to the natural volatility of the prevailing seasonal weather patterns. Climate variability is expected to increase as a result of global climate change [IPCC, 2007; DRFN, 2008]. At the same time, pressure to allocate land to those who have previously been excluded from it remains a political issue [GRN, 2002]. Increased economic pressures will make the prudent management of the land resource base even more important in future [Zeidler, 2008]. Specifically, increased demand for high-yielding rangelands and a greater pressure to enhance their yields is likely to drive the over-exploitation of an already marginal resource in a brittle environment. The encroachment of rangelands by invader bush is an indicator of land degradation and desertification. Against this background, a better use of invader bush is particularly attractive, mainly because it could

- rehabilitate encroached rangelands by improving the yield of non-bushy biomass, and in this way increase the per hectare return of activities that depend on the availability of cellulosic biomass
- create jobs in areas that have shown declining job numbers in the past years
- introduce new economic opportunities and associated investments in rural areas
- enhance the uptake of water and associated recharge of the groundwater resources
- reinvigorate opportunity-poor rural areas by introducing both low-technology and possibly high-tech enterprises, and
- re-establish and strengthen biodiversity, and increase value addition from and through it.

Most of the present day value chains relying on Namibian bush as feedstock do not require substantial water resources. At the same time, enhancing the soil's water absorbing ability by way of removing invader bush increases the recharge of Namibia's groundwater resources. This is of particular importance as the country's water limitations are well-known [4], and are expected to become even more critical in years to come [DRFN, 2008]. A significant number of Namibians are either directly or indirectly dependent on the yields of natural rangelands. The social, environmental and economic impacts that the creation of water-conserving land use activities in general and the increased use of the bush resource in particular would bring to rural Namibia are most considerable.

To date, there are a variety of ways in which wood resources from Namibian invader bush are used. Of note is the charcoal industry, which produced some 60,000 t of charcoal in 2008, mostly for export to South Africa and Europe [Groenewald, 2009]. In addition, a manufacturing plant producing compressed woodblocks from shredded invader bush – the so-called Bushblok – has been established in Otjiwarongo, producing some 6,000 t of wood-fuel briquettes in 2008 [Brewer, 2008]. Numerous efforts have been undertaken to use shredded bush to produce furniture, and a Windhoek-based company is currently manufacturing some pressed-wood furniture using invader bush material [Brewer, 2008]. An Interim Woodlands Management Council exists, and has commissioned a cost-benefit study to analyse the various uses of invader bush [IWMC, 2009]. Also, efforts are currently under way to establish a bush-to-electricity plant, which will use invader bush to generate electricity [DRFN, 2009].

It is not only Namibia's agricultural sector that could benefit from an increased use of the country's bush resource: the forestry sector is important for jobs and community livelihoods, and a significant proportion of the country's population depends directly on forest resources, including for fuel wood, charcoal production, building materials, fodder, food and medicinal plants [5]. NDP 3 estimates the value of forest products to be N$10.2bn for fuel wood, N$2.0bn for poles, N$634m for sawn timber, and some N$5.9bn for non-timber products [NDP 3, 2008]. In addition, bush lands and forests offer many ecological services that remain mostly undervalued. Such "free" services include their role as a reservoir of biodiversity, their water catchment and filtration functions, their ability to contribute to soil conservation and maintenance, being an important sink for carbon dioxide, and offering cultural, spiritual and heritage values.

3. Context and Introduction

Namibia has significant indigenous bush resources. These offer as yet untapped development and value addition opportunities. Today, Namibia's bush is an important food source for browsing animals, and is also used for the production of fuel wood, charcoal, wood chips and wood briquettes. Many other value adding bush utilisation opportunities exist, some of which would most likely be initiated if additional revenues were available.

The international Kyoto Protocol specifies the framework of activities that aim to reduce emissions of greenhouse gases (GHG), and/or enhance GHG sinks. Of particular relevance to

Namibia is the Clean Development Mechanism (CDM), by which industrialised countries can invest in projects that promote sustainable development in developing nations. Certified emission reduction certificates (CERs) earned through such projects – by way of carbon saving and/or sequestration activities – are used by the investing country to fulfil its emissions obligations under the Protocol, while at the same time infusing much-needed project and development capital into the developing beneficiary country.

Under the Kyoto Protocol, Namibia is a so-called non-Annex I country. This implies that Namibia does not have any GHG reduction commitments, but can actively participate and derive benefits from the trade in CERs. Presently, Namibia's bush is the country's major GHG sink. Bush could be more than a sink for carbon dioxide: while many farmers equate invader bush to an expensive nuisance factor that needs to be reduced or even eradicated, there is scope that projects using bush and derivative products could earn carbon credits, thereby creating much-needed jobs and creating new economic values in rural Namibia.

The United Nations Framework Convention on Climate Change, UNFCCC, defines the Land Use, Land Use Change and Forestry (LULUCF) sectors to include six main areas, namely: forests and forested land, grassland, cropland, wetlands, settlements, and other land [1]. This paper focuses primarily on those Namibian areas that are encroached by invader bush – under existing UNFCCC guidelines such areas are considered "forested land".

As the most arid country south of the Sahara, many of Namibia's land uses have adapted to the country's highly variable and arid climatic conditions. Past land management practices are believed to have been an important contributor to the explosive proliferation of indigenous bush species [Bester, 1998; NAU, 2000]. This paper takes a pragmatic approach, based on the realisation that Namibia is now faced with considerable bush encroachment, and asks whether this "bush problem" could offer opportunities for value creation, specifically by way of carbon sequestration and to offset carbon emissions.

Carbon sinks in the LULUCF sectors are non-trivial, and remain controversial. Concerns about carbon sinks in these sectors include

- the permanence of the carbon sequestered in soils and forests
- how CERs earned from LULUCF activities will drive additional deforestation and increase GHG emissions from land use changes
- what the impacts of large-scale afforestation and reforestation are, including the social and food security repercussions of such activities
- how biodiversity will be affected by soil carbon sequestration incentives, and
- how soil and soil-enhancing carbon sinks can be effectively monitored over time.

Under the Kyoto Protocol commitment period, which ends in 2012, accredited carbon sinks are only available for afforestation, reforestation, and land-use changes in areas that have been deforested before 1990 [2]. However, new opportunities in LULUCF sectors may arise in the post-2012 period, especially those that permit the use of agricultural soils as carbon sinks, and those that target forest-like areas such as Namibia's bush-encroached lands. But, while new opportunities could arise for LULUCF-related carbon sinks in the post-2012

commitment period, their associated implications and repercussions remain both poorly understood and are hotly debated [16, 17, 18, 19].

Today, several sectors (e.g. the renewable energy sector [von Oertzen 2008, 2009]) benefit from an active trade in carbon credits. For a carbon sink to be considered effective, questions of additionality, permanence, and leakage have to be addressed satisfactorily. It is critical that carbon sinks and the associated trade in carbon do not create incentives or promote activities that counteract the benefit of carbon sequestration. To illustrate, carbon saving or sequestering mechanisms in the LULUCF sectors should not trigger large-scale changes in land use or forestry practices. This implies that the scientific basis for such carbon sinks needs to be well-established, and the monitoring of any such efforts feasible. Past disagreements about carbon accounting have often taken years before they could be resolved and translated into legitimate and actionable trading mechanisms. This serves to caution the reader that bush encroachment, and/or biochar sequestration opportunities, may take some time before they really benefit Namibia through any new carbon trading and/or offsetting activities.

4. Bush Encroachment in Namibia

Bush encroachment in Namibia is a phenomenon whereby certain thorny bush and shrub species found on natural rangelands grow to such abundance that they significantly reduce the growth of grasses, decrease biodiversity, and reduce the recharge of underground water resources. It has been the topic of several in-depth investigations and studies [see for example Bester, 1998; de Klerk, 2004; and NAU, 2000].

Bush encroachment affects some 26 million hectares of farm- and rangeland in Namibia, and is responsible for an annual loss in agricultural output estimated to exceed N$ 700 million [de Klerk, 2004]. It has a direct impact on the livelihoods of both communal and commercial farmers and their employees, and amongst other factors, is responsible for the reduction of the total number of livestock in Namibia from 2.5 million in 1958, to some 800,000 in 2001.

Indirectly, bush encroachment causes a reduction of rural livelihood opportunities, especially on commercial farms that experience reduced carrying capacities, thereby reducing much-needed job opportunities in rural Namibia in general, and the agricultural sector specifically.

Namibian achievements to effectively address bush encroachment and create practical, economically viable and sustainable uses for invader bush remain unspectacular. Most methods for removing invader bush are expensive, and many focus exclusively on increasing the land's livestock carrying capacity [NAU 2000; de Klerk 2004]. However, returns from increased livestock production alone will often not offset the costs of removing bush permanently. Only a few of the present-day bush-clearing efforts view invader bush as an economic resource. Of note is Namibia's fledgling charcoal industry. The impact that this industry has – harvesting some 60,000 tons of charcoal per annum – is insignificant compared to the sheer volume of invasive biomass found on Namibian rangelands [Groenewald, 2009].

5. Namibia as a Sink of Greenhouse Gases

The Namibian greenhouse gas inventory for 2000 [MET, 2008] shows that the country's agriculture and energy sectors are the most important GHG emitters, while the forest sector constitutes the country's main sink. The report states that "the uncertainty of data ... would appear to be greatest for the LULUCF sector", and "...the supporting data for the LULUCF sector removal calculation is less definite. The large removal value is based on a rough estimate of the annual increase in mass of invader bush biomass. It has been estimated that approximately 26 million hectares of land are affected by the bush encroachment problem. A rough estimate of the annual amount of biomass growth for such a large area is clearly subject to some uncertainty". Furthermore, "more scientific data supported by new field tests and remote sensing is needed to reduce the uncertainty underlying the CO_2 removal calculations for bush encroachment" [MET, 2008].

The significance of Namibia's bush resource as a sink of carbon dioxide is based on the carbon-utilising effect during vegetation growth phases, which binds atmospheric carbon dioxide into organic matter. Because Namibia's bush encroached areas are substantial, they serve as a highly significant greenhouse gas sink. Table 2 below summarises the woody biomass stocks per region in Namibia.

Volume and growth estimates for woody biomass in bush encroached areas (2004)

Region	Density m^3 / ha	Volume million m^3	Area (calculated) km^2	Resource mass Tg	Contained C Tg	Growth / y Tg
Caprivi	21.37	30.92	14,467	21.64	10.82	1.62
Erongo	0.10	0.64	63,590	0.45	0.22	0.03
Hardap	0.10	1.10	109,660	0.77	0.38	0.06
Karas	0.05	0.81	161,080	0.56	0.28	0.04
Kavango	18.00	87.27	48,483	61.09	30.54	4.56
Khomas	0.25	0.92	36,860	0.65	0.32	0.05
Kunene	0.20	2.30	115,155	1.61	0.81	0.12
Ohangwena	20.00	21.39	10,694	14.97	7.49	1.12
Omaheke	2.00	16.89	84,440	11.82	5.91	0.88
Omusati	3.22	8.54	26,517	5.98	2.99	0.45
Oshana	0.90	0.78	8,682	0.55	0.27	0.04
Oshikoto	11.44	44.24	38,669	30.97	15.48	2.31
Otjozondjupa	3.90	41.08	105,334	28.76	14.38	2.15
Total	**3.12**	**256.86**	**823,631**	**179.80**	**89.90**	**13.4**

Table 2: Woody biomass and woody biomass growth in Namibia [MET, 2008, amended]

The GHG inventory finds that the total carbon dioxide uptake in 2000 – in bush-encroached areas alone – was 10,960 kilotons. Taking emissions from biomass consumption into account, the report arrives at annual emission removals of 10,566 Gigagrams [MET, 2008]. This makes Namibia's bush resource the country's most significant carbon dioxide sink. It also implies that large-scale bush clearing, or reducing or eliminating such vegetation, would decrease this agent's ability for carbon sequestration and by implication reduce the country's ability bind atmospheric carbon.

6. Carbon Credits in Namibia

The Clean Development Mechanism (CDM) principle is simple: because it does not matter where emissions of greenhouse gases occur, investments in emission-reductions are most sensible where they are most cost-effective. As emission reductions are often cheaper in the developing world, CDM-accredited projects that lead to emission reductions in these parts of the world may issue so-called "certified emission reductions", or CERs. These certificates can be bought and sold – often facilitated by international carbon brokerage firms – by governments, investment and insurance companies, banks and companies in industrialised countries to help them reach their country-specific emission targets. Such trade is meant to assist developing nations in funding their own development projects while creating opportunities for industrialised countries to meet national emission commitments without having to make costly carbon-reducing investments in their own industrial processes. In May 2009, one CER for a ton of carbon dioxide or equivalent sequestered was worth some N$ 120 [PointCarbon, 2009].

To qualify, CDM projects need to conform to a set of selection criteria; adherence to these has to be demonstrated by the project developer and verified by an independent verification agent before any carbon credit revenues can be earned. Potential projects have to apply a project methodology approved by the CDM Executive Board, which specifies how emission reductions are calculated. It is of particular importance to show that project activities and associated carbon offsets would not have been achieved without benefitting from CER revenues, a criterion called additionality. Also, emission reductions achieved in projects benefitting from carbon revenues have to be real, have to be measurable against a historical emission baseline, and remain permanent and sustainable. Furthermore, emission reductions made in one area should not lead to an increase of emissions elsewhere, a criterion called leakage. Benefitting from carbon credits therefore requires rigorous preparation, registration, verification and validation processes, all of which come at a cost. Projects that save only a few tons, or tens of tons of carbon per year, are therefore not suitable under CDM. In some cases the voluntary carbon market – VCM – offers opportunities for small-scale projects.

Namibia, as a non-Annex I party to the United Nations Framework Convention on Climate Change, is eligible to host greenhouse gas mitigation projects to earn CERs. In August 2007, the Namibian Cabinet approved the establishment of an office for the Designated National Authority (DNA) at the Ministry of Environment and Tourism, and the country's CDM office at the Ministry of Trade and Industry. In May 2009, the DNA is established and operational, and is supported by the Namibia Climate Change Committee. A position of Deputy Director to coordinate Namibia's DNA activities is about to be advertised. The establishment of the CDM office, however, experiences delays. Project proponents wishing to benefit from CERs are required to work through the national CDM and DNA offices to identify, prepare and ultimately launch and undertake their projects. A number of Project Identification Notes, which constitute the very first step in developing a project that is to benefit from CERs in future, have been assessed to date. These include a proposal for the development of geothermal sources, the use of invader bush in cement production, a wind farm and biogas digester using slurry from a dairy. While Namibia has made some progress to participate in

CDM-related activities, further institutional and project development support is required to ensure that the country can fully benefit from the many opportunities presenting themselves through the CDM.

The voluntary carbon market, or VCM, exists in parallel with the CDM. Unlike the regulated CDM, VCM has no regulatory body and relies on various voluntary standards. These standards specify how projects can benefit from greenhouse gas emission reductions without having to fulfil the CDM's many bureaucratic and administrative requirements. VCMs generally provide greater flexibility to parties offering carbon credits, and to those wishing to purchase such certificates. A host of special-purpose carbon credit vehicles exist. Some VCM schemes are set up to specifically benefit projects offering more than just carbon reductions. For example, projects promoting development initiatives while at the same time reducing the carbon signature of such activities are popular. The VCM also caters for individuals who wish to reduce their carbon footprint, such as airline passengers, as well as companies and institutions. The main rationale motivating buyers participating in the VCM seems to be their desire to offset their own carbon footprint while supporting projects in a developing nation.

7. Biochar

Biochar, in the context of this paper, is understood to be fine-grained charcoal with high organic carbon content [6]. It is claimed that biochar is largely resistant to decomposition when buried in the soil [Lehmann, 2006]. Biochar is produced during pyrolysis [9], i.e. the chemical decomposition of organic material by heat in the absence of oxygen [6]. Plant and waste biomass can be used as a feedstock in the pyrolysis process [Lal, 2007a, 2007b]. When used as a soil amendment, biochar is said to increases the soil's carbon pool [Sanchez, 2002; Tiessen, 1994]. Because of its reported longevity in the soil, some consider biochar as an important carbon sequestering agent [Steiner, 2007; Sauerbeck 2001a and 2001b].

The current interest in biochar is based on the following features:

a) that it is produced during biomass conversion processes which release volatile substances in the form of biofuels, such as oils and gases (depending on the temperature and speed of the process), and heat (which has an economic value) [Kim, 2004]
b) that the biofuels produced in this way can displace conventional fossil fuels [Lal, 2005]
c) that the biomass conversion process also results in a solid substance containing considerable carbon residues, i.e. biochar, that is firmly embedded into the organic biomass matrix, which is said to prevent the rapid disintegration and release of carbon dioxide into the atmosphere when buried in the soil [Lal, 2003, Steiner, 2007]
d) that biochar has soil-enhancing properties and its addition to soils can reduce the requirements for fertilizers and water, which in turn improves arable land and agricultural yields [Blanco-Canqui, 2007].

The conversion of biomass to biochar is therefore seen to offer a mechanism to effectively remove carbon dioxide from the atmosphere, while producing biofuel and biochar that have beneficial carbon-reducing features [Baker, 2007]. Soils that benefit from biochar enrichment are said to have an increased capacity to absorb and retain water and nutrients, which

promotes the establishment of micro-organisms for pro-biotic soil processes, while also reducing the soil's fertilizer requirements [Goudriaan, 1995]. Enhanced and stimulated plant growth in turn consumes more atmospheric carbon dioxide. Also, soils treated with biochar have shown reductions in nitrous oxide emissions (which are of importance in GHG accounting), sometimes between 50 and 80%, while also reducing the runoff of phosphorus into surface waters. Nitrogen leaching into the groundwater is also reduced [Glaser, 2001].

Because many fertilizers are either directly based on fossil-fuel feedstock or require considerable energy to be produced, any net reduction in such fertilizer requirements also reduces the carbon footprint of the crops produced on such land [Lehmann, 2006]. This implies that a reduction of the embedded fossil-fuel energy required to produce crops has a net beneficial effect on the global climate, and by implication, the environmental impact of croplands [Sauerbeck, 2001a and 2001b]. Producing a combination of carbon-neutral biofuels as well as carbon-sequestering fertilizer, by using surplus biomass from agricultural waste products, is said to lead to a net reduction of carbon dioxide in the atmosphere. By implication, the overall production and use of biochar is therefore considered carbon-negative. There is, however, as yet no scientific consensus on the many positive aspects that the generation and use of biochar is said to have [17].

8. Developing the Namibian Bush Resource

8.1 Framing Namibia's Bush Resource Opportunities

Namibia's dependency on agriculture – even if it only contributes 6.3% to the country's GDP – is well-established [GRN, 1995; CBS, 2007]. Many significant development opportunities – supported by the participation in global carbon markets and the CDM – could be created through afforestation, reforestation, agro-forestry, enhanced natural regeneration, re-vegetation of degraded lands, reduced soil tillage, and sustainable agricultural practices. Such initiatives would also introduce revenues that have previously been unavailable in rural Namibia. Carbon markets could transform the way that the Namibian agriculture and forestry sectors produce their products, and create new opportunities for both commercial and communal farmers. Here, biochar [6] could become a new frontier: reducing bush encroachment while generating carbon-neutral fuels as well as a soil fertiliser could become Namibia's entry point to contribute to international efforts to mitigate the effects of climate change, while simultaneously creating local jobs using a plentiful indigenous resource. If this does not sound like a promising value proposition for rural Namibia, what ever will?

The Directorate of Forestry in the Ministry of Agriculture, Water and Forestry classifies Namibia's invader bush as low-density forest [5]. The large-scale use thereof resorts under its jurisdiction. Entities wishing to harvest forest resources and/or products have to apply for a permit at the district forestry office responsible for the area in which wood is to be harvested [22]. Presently, operators active in the charcoal and fire-wood sector seem to consider the necessary harvesting and transport permits easy to comply with [Groenewald, 2009].

Internationally, it is accepted that forest resources and associated lands should be managed in a way to meet the social, economic, ecological, cultural and spiritual needs of people. The Forest Stewardship Council (FSC) is an international body which accredits certification organisations to guarantee the authenticity of their harvesting and sustainability claims. The FSC promotes the environmentally responsible, socially beneficial and economically viable management of the world's forests, by establishing and applying a worldwide standard of recognised and respected Principles of Forest Stewardship. Products carrying the FSC label are independently certified to assure consumers that they come from forests that are managed to meet the social, economic and ecological needs of present and future generations [Schumann, 2008]. The process of certification is voluntarily initiated by forest owners and managers, who request the services of a certification organisation to certify their operations.

Using existing agricultural and forest value chains may present one of the most promising and appropriate methods to sequester carbon from the atmosphere. If Namibia is to benefit from carbon credits from its bush resource, bush has to be managed like a resource. Future monitoring and verification requirements will demand that strict land management practices – going beyond the more traditional methods presently applied in Namibia – are introduced.

The viability and sustainability of any value adding activity using Namibia's invader bush resource has to be established on a case-by-case basis. Some 26 million hectares of rangeland are currently infested by invader bush and on average yield more than 10 tons of harvestable wood per hectare [Groenewald, 2009]. This implies that current uses of invader bush barely make a dent into this significant resource. Also, efforts to combat bush encroachment have yet to find a cost-effective and acceptable method that does not undermine Namibia's other agricultural sectors, such as the red meat industry. Although not an issue presently, Namibia should ensure the sustainability and availability of bush for different future uses. In this regard, a national feasibility and strategic impact assessment would clarify how public and private funds could be spent most sensibly to control bush encroachment on the one hand, while creating new bush-use and bush beneficiation ventures.

8.2 The International Debate

Namibia has not yet benefited from the global market and exchange of carbon certificates. This is not due to a lack of opportunities, and those waiting to be developed in the agriculture and forestry sectors are plentiful. In December 2008, during the COP 14 meeting at Poznan, Poland, a coalition of 26 African countries – the so-called African Climate Solution – called for the inclusion of carbon credits generated from agriculture and forestry in future climate agreements [3]. This initiative towards climate mitigation, adaptation and improved rural livelihoods for the continent envisages the reduction of GHG emissions by forest resources, and carbon sequestration through agriculture, forestry and land use. The call entailed carbon sequestration by way of activities such as re- and afforestation, agro-forestry, reduced tillage and biochar. The initiative aims to become a movement comprising all countries from the South where many people still make a living from agriculture and related sectors [3].

The African Climate Solution initiative is of particular importance as – according to the United Nations' panel of climate experts – Africa is "highly vulnerable" to the impacts of

climate change [IPCC, 2007]. Indeed, predictions for climate change in Namibia do not read comfortably: amongst others, increasing temperatures, increasing climate volatility in an already highly variable climatic regime, increased wind speed and an increase in the average wind regime, higher evaporation rates, and increased river run-off are predicted [IPCC, 2007; DRFN, 2008]. Climate volatility increases the probability of severe climatic events, including droughts and floods, increases land degradation, decreases biodiversity, and is expected to lead to declining agricultural productivity. Poverty, declining rural job opportunities and low-wage agricultural jobs are already a reality in Namibia. Climate change will exacerbate these outcomes [Lal, 2007], with serious implications for the economic development, growth, and the sustainable development of Namibia and its people [DRFN, 2008].

Developing and using LULUCF as accredited carbon sinks, especially biochar [13], remains controversial. Critical and remaining issues that are debated internationally include:

- the question whether opening biosphere sinks for carbon trade would delay other emission reduction activities, for example replacing fossil fuels with renewable energies
- the concern that carbon revenues could drive large-scale land-use changes and deforestation, particularly in developing nations
- the actual quantities of carbon that would remain permanently sequestered in the soil, especially in semi-arid and arid regions
- that carbon from biochar may incentivise the large-scale removal and/or conversion of forests and semi-forested lands
- the total energy and carbon balance of industrial-scale biochar production, and its application to soils
- the required monitoring and verification of soil carbon sinks and associated costs, which could be considerable because of the potential extent of the application (unlike, for example, the verification of carbon emissions from centralised power stations).

International opinion about biochar as an effective carbon sink remains divided. On the one hand, at the COP 14 meeting at Poznan in December 2008 [7; 8], it was decided to consider biomass as a possible tool to reduce emissions. Specifically, the UNCCD stated: "According to the IPCC, biochar management would be a valid carbon sink in the current and post-2012 LULUCF guidelines. However, the following policy action is urgently required:

a. Raising awareness on the role of the land on mitigation and adaptation to climate change and in particular the importance of biochar in enhancing the sequestration of carbon in the soils.

b. Inclusion of biochar in the CDM mechanism along with currently already included afforestation and reforestation.

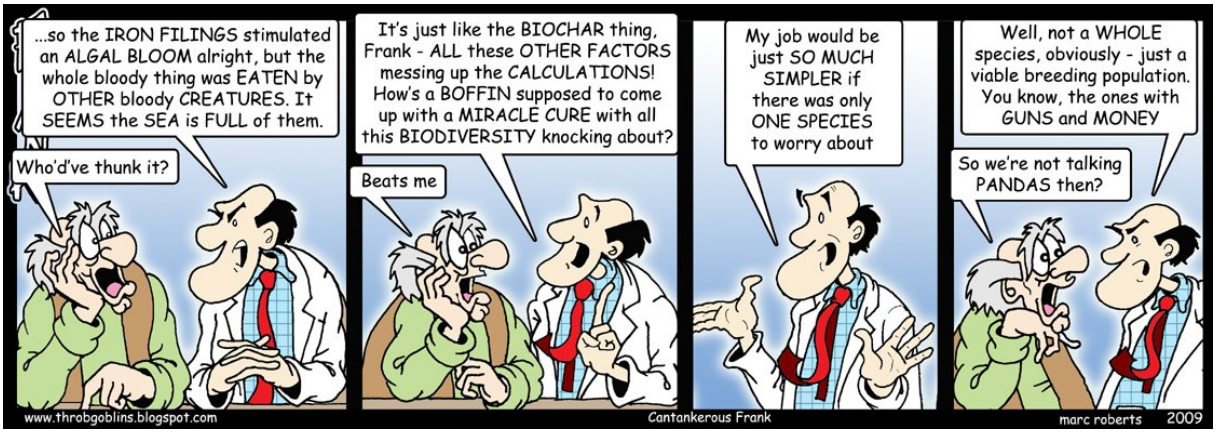
c. Revision of the additionally and permanence rules in order to take into account the fact that biochar is a permanent means of carbon capture that has more value than the potentially reversible afforestation and reforestation..." [6]

At the UN climate meeting in Bonn in April 2009, several countries have called for the inclusion of biochar projects in the CDM post-2012, which will be negotiated in Copenhagen in December 2009. This requires that a UN climate agreement would have to back the

inclusion of biochar in the CDM. Because biochar and forestry are closely related, and the rules on earning CERs from the forestry sector are stringent, earning CERs from biochar will have to be harmonised with the existing ones. It also implies that specific biochar methodologies would have to be developed before the first project design documents are accepted by the CDM Executive Board. In addition to these requirements, which are usually time-consuming, it remains uncertain to what extent the CDM will play a role in any global climate deal for post-2012. It also remains uncertain how many credits could be generated by biochar, should it be included in any potential climate pact that succeeds the Kyoto protocol.

However, several international environmental groups remain most critical about biochar. For example, Biofuelwatch has the following to say about biochar: "...it is imperative that we do not repeat the errors by embracing yet another technology that is poorly understood, inherently risky and will likely encourage further land conversion and expansion of industrial monocultures" [10]. Others, including the pro-biochar IBI state that "...we know that there are bad ways to make biochar, that crop monoculture for producing feedstock is not a good idea, and that biochar does not affect all soils equally. None of this should rule biochar out of court, however." [PointCarbon, 2009].

Environmental activist George Monbiot states that "the great green miracle works like this: we turn the planet's surface into charcoal. ... Sorry, not charcoal. We don't call it that any more. Now we say biochar. " [11] In contrast, James Lovelock says that "...what we need is a charcoal maker on every farm so the farmer can turn his waste into carbon" [12]. The following cartoon frames the wider debate in more humoristic terms [15]:



At the most recent Climate Change Talks in Bonn in June 2009, scepticism about the suitability of biochar as a carbon sequestering agent was met by exuberance from the pro-biochar lobby [16, 17]. The continuing uncertainty on how biochar will interact with existing soil organic carbon, the suitability of biochar as a soil fertilizer, actual emission rates from soils enhanced with biochar (i.e. permanence and conversion rates), and the implications of possible carbon funding for land use and land use changes, are still unresolved. Also, LULUCF rules and accounting procedures remain uncertain, and parties to the Talks were encouraged "to submit, before August 2009, views on the need for information and data to facilitate parties' understanding of the implications of the options for treatment of LULUCF" [18]. A presentation by Biofuelwatch states that a declaration signed by 156 organisations expresses opposition to the inclusion of soils in future carbon trading schemes [19].

8.3 LULUCF Opportunities in Namibia

Presently, the UNFCCC lists the following approved CDM baseline and monitoring methodologies that are of interest to the Namibian LULUCF sector [14]:

- 10 large-scale, 5 approved small-scale and 2 consolidated methodologies for afforestation and reforestation, and
- 1 large-scale, 3 small-scale and 1 consolidated methodology for agriculture.

The specific titles of these methodologies are listed in Annex 1. Closer inspection of these methodologies shows that the following topics could be of interest for the development of LULUCF opportunities in Namibia:

- Restoration of degraded lands through afforestation/reforestation
- Afforestation / reforestation with trees supported by shrubs on degraded land
- Afforestation / reforestation on degraded land for sustainable wood production
- Methane recovery in animal manure management systems
- Methane recovery in agricultural activities at household/small farm level, and
- GHG emission reductions from manure management systems.

It is premature to comment on the viability of any of the above activities before specific projects are not conceptualised, and Project Identification Notes are drafted. To benefit from biochar opportunities, baselines and methodologies have to be available. Presently, they remain unavailable, and while they could be developed locally and submitted for discussion, assessment and possible approval by the CDM Executive Board, such activities cost money. If Namibia is to participate in biochar-related carbon trade, it is advisable that exploratory funds for specialised studies be made available; to investigate, identify and quantify the country's most significant LULUCF-related carbon sequestration opportunities, including those offered by biochar.

Of greater concern is Namibia's role in supporting LULUCF-related motions, submissions and discussion points at the forthcoming COP and other international forums. In order to effectively contribute to such deliberations, and promote the opportunities that are of interest to Namibia's development, the capacity of our Namibian representatives needs additional strengthening. Here, both the Ministry of Trade and Industry, and the to-be-established CDM office there, and the Ministry of Environment and Tourism with its DNA office, should initiate the necessary capacity building processes as a matter of urgency. Broad-based support from the agricultural unions and various agricultural, forestry and agronomic institutions will be necessary to ensure that Namibia's potential LULUCF benefits are well understood and communicated at international forums. Seed funds are required to investigate the most promising LULUCF opportunities, and initiate the most pertinent research initiatives. As yet, Namibia does not have an institutional CDM or carbon credit champion. This is of concern, and is one of the reasons for the lacklustre approach to developing national CDM opportunities. It is time that this vacuum is filled, and it is recommended that a Government ministry takes the lead to drive the goal-oriented development of our national carbon credit opportunities.

8.4 Risks Associated with LULUCF Opportunities

As long as LULUCF-related baseline and project methodologies applicable to the use of biochar remain unavailable, all biochar projects remain at risk of making investments that cannot be recovered through the sale of CERs. This could have a significant impact on any project's viability, and it is not as yet advisable to launch projects that significantly depend on revenues from biochar-related CERs.

Any post-2012 carbon trade arrangements will to a most significant degree determine the scope and potential of LULUCF-related certificate trading activities. It is therefore essential that Namibia actively participates at the forthcoming COP in Copenhagen, and that officials from both MTI and MET keep up to date with the latest issues and developments. An often-cited excuse, namely that the required human resources are unavailable, should not prevent Namibia from participation. It should be recognised that some private-sector capacity exists that could and should be called upon to support Government in framing and communicating the most important climate change and carbon issues presently under discussion.

8.5 Research Needs and Requirements

The following issues – which are preliminary in nature – require further investigations:

- sustainable land use criteria for bush-encroached areas in Namibia
- cost-benefit analyses of the various LULUCF options, with a focus on those areas that have established baseline procedures and methodologies
- field trials to investigate the recommended dose, longevity and method of application of biochar, and associated costs and benefits under Namibia's climatic conditions
- quantification of benefits of value chains related to the biochar production process
- opportunities for synergies in the production of biochar, especially from related sectors and existing or new agricultural and/or forestry products
- business models for private-sector and institutional biochar production
- local, regional and international market opportunities for Namibian-produced biochar
- biochar production chains, using existing agricultural and/or forestry practices
- value-adding processes that could benefit from biochar production in Namibia
- institutional support mechanisms to establish and sustain a biochar sector in Namibia
- technology requirements for the establishment of a biochar sector
- human resource requirements to initiate and sustain a biochar market in Namibia

8.6 Policy Options and Implications

The following policy options promoting value addition through the use of Namibia's bush resources are focused mostly on areas that are either not yet well established and/or require more direct future policy interventions. Table 3 below summarises the policy options and their implications, which are designed to enhance and invigorate the use of Namibia's bush resources and promote LULUCF-related carbon trading opportunities in the country.

Policy Option	Implication(s)
assess the development needs of LULUCF opportunities identified in NDP 3	NDP 3 spells out national targets for the period 2007/2008 until 2011/2012 – yet many of the LULUCF-related opportunities that could be derived from such targets remain insufficiently described and necessitate further investigation and assessment so as to ensure their timely support and implementation
identify sector-specific and cross-sectoral requirements of LULUCF-related carbon opportunities	institutional and financial support across sectors has to be made available to explore and assess non-traditional LULUCF opportunities
stimulate LULUCF-related sectoral developments by promoting carbon trading opportunities	studies will first have to be undertaken to identify those areas within the LULUCF sectors that show the greatest promise of yielding benefits from incentives and development assistance
promote LULUCF-related research and development	a process to identify the most promising areas of research will have to be initiated, and funding will be required to initiate and sustain such research and development. As in many development approaches, the possibility of a negative research results should be kept in mind.
incentive LULUCF-related activities	project specific incentives may fail to promote sector-wide developments and therefore require a sector-specific and cross-sector approach to identify and incentivise new LULUCF-related opportunities
set national targets for LULUCF-related sectors	NDP 3 targets and their realism in the face of climate variability and cost/benefit have to be weighed up and contrasted with those new opportunities offered by LULUCF-related developments and carbon trade
introduce incubation support for new LULUCF-related activities	section 8.5 lists open research and development questions that require the financial support – over and above those that would merely enable investors to set up shop and spend their own development funds
introduce LULUCF-related small-and-medium enterprise (SME) development support	targeted SME development is required to allow operators to tap into new LULUCF-related opportunities
incentivise the productive use of invader bush for value-adding activities	Namibia's charcoal industry is established but remains vulnerable. Entry into the sector could be improved by way of providing incentives. Emphasis on quality standards (e.g. through FSC accreditation), and the wider promotion and development of trade relations and niche markets would strengthen established and newly established industry participants.
provide opportunity-focused LULUCF-related information to interested and affected parties	a focus on carbon opportunities in the LULUCF sector requires well-informed decisions, which would be easier if the relevant information was effectively shared across institutions and organisations – this will necessitate the activities of a carbon champion that is influential across sectors and institutions

Table 3: Proposed Policy Options and their Implications

The above policy options remain broad, and require further detailed elaboration before they become fully actionable. This however goes beyond the scope of the present paper and is left as a follow-up activity for NEAP and the line ministries participating in the RTEA process.

8.7 Policy Recommendations

This section draws together the various recommendations emanating from this paper, and summarises them as key policy messages.

Key Message 1: strengthen institutional capacity
Local institutions dealing with carbon projects, including the to-be-established CDM office at the Ministry of Trade and Industry (MTI), and the existing DNA office at the Ministry of Environment and Tourism (MET), need to be adequately staffed and resourced to become fully operational. It is of prime importance that Namibia establishes sufficient institutional competence that is able to deal with the rapidly developing opportunities as well as the associated risks introduced through international carbon trade.

Key Message 2: prepare and train Namibian negotiators attending international forums
Institutional representatives that attend international forums, such as the COP and related UN climate meetings, require adequate training and preparation to meaningfully contribute to such gatherings and ensure that Namibia derives the maximum benefits from them. Of particular importance will be the upcoming UNFCCC COP 15 in Copenhagen in December 2009. It is essential that Namibian representatives and negotiators attending this and the preparatory meetings are knowledgeable about the issues at stake, and can effectively communicate Namibia's position and preferences. The required preparation and training of such representatives requires a commitment of resources.

Key Message 3: enhance feedback from international forums
Improved feedback mechanisms are require to spread the insights gained from attendance at international forums to interested and affected parties, irrespective whether they are from Government or the private sector. This makes it necessary to improve communications between Government ministries on the one hand, and Government and the multitude of private sector stakeholders. To this end, regular press releases, providing up-to-date information on the web, compiling information brochures and specialist publications, and calling for and participating in regular public information exchange activities are all highly recommended.

Key Message 4: involve private-sector specialists and stakeholders
Local specialists and specialist organisations exist in Namibia, and can significantly contribute to existing and new Government functions. In order for such parties to show greater involvement they need to have a mandate to do so, for example by way of short-term appointments and contracts. In this way local specialists and non-state stakeholders can cost-effectively render specialist services and assistance, for example in the field of capacity development, concept and project development, and project implementation. Greater involvement of private-sector specialists also broadens the national pool of expertise, and is often more cost-effective than training existing Government employees.

Key Message 5: support research and specialist studies
Specialist studies, such as identified in section 8.6 above, need to be commissioned to identify the most viable options for Namibia's future participation in LULUCF-related carbon trade activities. Such studies should include both techno-economic and socio-

economic assessments, and aim to quantify the opportunities arising from Namibia's future participation in carbon trade in LULUCF-related sectors. In addition, further research is required to assess the viability and sustainability of different bush utilisation methods, including the large-scale production and use of biochar. To this end, the national farmers unions, agricultural boards and interested and affected private-sector participants should convene to agree on the most important research requirements, and public funds should be made available to undertake such assignments. Identifying a dedicated national bush-promotion champion, for example the Ministry of Agriculture, Water and Forestry, or the MET, would support the goal-oriented identification of sustainable bush utilisation measures. It is advisable that private-sector specialists are recruited to participate in this important national debate and associated research activities.

Key Message 6: devise a bush utilisation and beneficiation framework
Specific LULUCF-related targets, as put forward in the NDP 3, are to be comprehensively assessed to highlight those areas that may benefit from the development of carbon trade activities. It is recommended that a cross-sectoral assessment is undertaken to draw up a *Namibian bush utilisation and beneficiation framework,* which identifies and quantifies the business and carbon reducing / sequestering opportunities, as well as the carbon offset opportunities in the country's LULUCF sectors.

Key Message 7: provide seed funds to stimulate carbon project development
Seed funds are required to scope, investigate, identify and draft Project Identification Notes and Project Development Documents, which are to be submitted to the CDM Executive Board for Namibia's participation in future carbon-related trade activities. It is recommended that public funds are made available – on a competitive basis – with the aim to foster and promote innovation and sustainable development through such endeavours.

Key Message 8: assess costs and benefits of charcoal use in Namibia
The potential of charcoal production and the use of biochar need to be further assessed. In regard to charcoal production, investigations are required to identify how existing and new market entrants could be strengthened, if and how mechanisation would improve the sector's viability, and which mechanisms should be introduced to promote bush harvesting, beneficiation and export. In regard to biochar and its role as soil additive, further research has to be undertaken, for example to quantify its suggested soil-improving features and characteristics, and assess the costs, benefits and implications of using biochar in areas with poor soils, such as the northern communal farming areas.

Many LULUCF-related development opportunities exist in Namibia. Some of them could benefit from future carbon revenues if Namibia further developed the necessary business models and expertise to tap into international carbon funding opportunities. However, potential opportunities require development support. Fledgling LULUCF businesses require access to seed funding and development funds, tax incentives, and institutional assistance and support. It is at this juncture that policy can be most effective: establishing and fully operationalising the CDM and DNA offices at the MTI and MET respectively is essential. Incentivising private sector participation will add momentum and rigour. Developing smart

and goal-oriented public-private partnerships to develop the potential carbon trade opportunities in Namibia's LULUCF sectors is feasible. And an institutional champion driving such development could make it happen. In this spirit, waiting for things to (miraculously?) happen on their own cannot be considered a value adding option.

9. Conclusions

Namibia's LULUCF sectors in general, and bush resources in particular, offer numerous development opportunities. There is some promise that additional carbon finance for LULUCF-related sectors and activities will become available in the coming years, and that biochar may be formally recognised and become eligible to benefit from carbon certificate revenues. It is imperative that Namibia is well-prepared to benefit from such development opportunities if and when they arise.

Presently, Namibia's forestry and agriculture sectors are dominated by the more traditional activities and approaches, although some innovation has taken place in the past years. Of note are various community-based natural resource management initiatives, and the establishment of conservancies that allow rural communities to benefit from natural resource use. However, new business models tapping into international carbon markets and offering formal (i.e. through CDM) or informal (i.e. through the VCM) carbon trading and offset opportunities are yet to be established. It is not a lack of opportunities that prevents Namibia from benefitting from such additional revenues.

For Namibia to attract investors – both local and international – greater emphasis on establishing support mechanisms for fledgling LULUCF businesses is necessary. Such support must include access to seed and development funds, tax incentives, and non-bureaucratic and capacitated institutional assistance and support. It will be of particular importance to have the CDM and DNA offices, at the MTI and MET respectively, become fully established, and have sufficient competent and capable staff as well as access to operating funds. Also, the private sector could be involved more meaningfully, most notably to provide expertise for the establishment of carbon-reducing projects that could benefit from a trade in CERs and/or VERs. A partnership model – between Government institutions and ministries on the one hand and interested and capable private sector participants on the other – is likely to more readily unlock the carbon trade opportunities existing in Namibia.

As with many other investment opportunities, access to seed funds and incentives, and an institutional champion promoting the development of carbon trading and offsetting opportunities in Namibia, may quickly lead to tangible results. The questions remain: who will take the first steps to more deliberately develop the plentiful LULUCF opportunities that Namibia offers? And how will Namibia more deliberately unlock the opportunities that the country's bush resource offers, both as a carbon offset mechanism and future source of carbon revenues?

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Annex 1 [14]

AFFORESTATION AND REFORESTATION – LARGE-SCALE

AM0042: Grid-connected electricity generation using biomass from newly developed dedicated plantations

AR-AM0001: Reforestation of degraded land

AR-AM0002: Restoration of degraded lands through afforestation/reforestation

AR-AM0004: Reforestation or afforestation of land currently under agricultural use

AR-AM0005: Afforestation and reforestation project activities implemented for industrial and/or commercial uses

AR-AM0006: Afforestation/Reforestation with Trees Supported by Shrubs on Degraded Land

AR-AM0007: Afforestation and Reforestation of Land Currently Under Agricultural or Pastoral Use

AR-AM0008: Afforestation or reforestation on degraded land for sustainable wood production

AR-AM0009: Afforestation or reforestation on degraded land allowing for silvo-pastoral activities

AR-AM0010: Afforestation and reforestation project activities implemented on unmanaged grassland in reserve/protected areas

AFFORESTATION AND REFORESTATION – SMALL-SCALE

AR-AMS0001: Simplified baseline and monitoring methodologies for small-scale afforestation and reforestation project activities under the clean development mechanism implemented on grasslands or croplands

AR-AMS0002: Simplified baseline and monitoring methodologies for small-scale afforestation and reforestation project activities under the CDM implemented on settlements

AR-AMS0003: Simplified baseline and monitoring methodology for small scale CDM afforestation and reforestation project activities implemented on wetlands

AR-AMS0004: Simplified baseline and monitoring methodology for small-scale agroforestry - afforestation and reforestation project activities under the clean development mechanism

AR-AMS0005: Simplified baseline and monitoring methodology for small-scale afforestation and reforestation project activities under the clean development mechanism implemented on lands having low inherent potential to support living biomass

AFFORESTATION AND REFORESTATION – CONSOLIDATED

AR-ACM0001: Afforestation and reforestation of degraded land

AR-ACM0002: Afforestation or reforestation of degraded land without displacement of pre-project activities

AGRICULTURE – LARGE-SCALE

AM0073: GHG emission reductions through multi-site manure collection and treatment in a central plant

AGRICULTURE – SMALL-SCALE

AMS III A: Urea offset by inoculant application in soybean-corn rotations on acidic soils on existing cropland,

AMS III D: Methane recovery in animal manure management systems, and

AMS III R: Methane recovery in agricultural activities at household/small farm level

AGRICULTURE –CONSOLIDATED

ACM0010: Consolidated methodology for GHG emission reductions from manure management systems