The Cirrus Group

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Exploring the relationship between land-use based climate change mitigation and ecological infrastructure

National Climate Change Response Dialogue 2014

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Today's discussion

National Climate Change Response Dialogue

Carbon sinks and sequestration session

Three key questions –

1. What is our understanding of opportunities to sequester carbon and the incentives required to drive this?
2. How do we approach restoration given the competing demands for land-use?
3. What are the implications for the restoration of South Africa's ecological infrastructure?

Essential definitions

What is land-use based climate change mitigation?

- Additional activities within the land-use sector that lead to a net reduction in greenhouse gasses in the atmosphere. There are two principle types:
- Interventions that reduce GHG emissions – e.g. reducing deforestation and forest degradation (REDD), anaerobic biogas digestion, biomass to energy.
- Activities that sequestrate atmospheric carbon dioxide in plant matter or soils – e.g. reforestation and grassland restoration.

What is ecological infrastructure?

- Working definition: “A landscape of functioning ecosystems that preserve biological processes that are crucial to maintaining natural capital and resilient ecosystem services”
- Important in terms of the ecosystem services it generates – water flow and sedimentation regulation for local and downstream economies, fertile soils for agriculture, sustainable rangelands for commercial and small-scale livestock production
- Often assessed relative to built infrastructure e.g. does one build a flood management infrastructure or rather restore a watershed?

How did we identify land-use based CC mitigation opportunities?

The second component of the national assessment had two primary objectives:

- To **identify** the principal land-use based climate change mitigation opportunities in South Africa
- To **understand the nature** of each opportunity in terms of:
  - scope
  - implementation models
  - costs and finance
  - required capacity and support
  - employment and skill development
  - as well as further social and ecological benefits and trade-offs

- The intention was to move from the general to the particular through extensive engagement with national, district and local Government as well as established field practitioners
- 18 structured interviews were held with stakeholders in the Eastern Cape, Western Cape, Kwa-Zulu Natal and Gauteng, in an attempt to better understand the nuance details of implementation and the socio-economic context in which implementation is likely to occur.

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South Africa's eight principle land-use based mitigation opportunities

Activity	Sub-class	Spatial extent (ha)	Reduction per ha per yr (tC)	Emission reduction per yr (tCO2e)	Reduction over 20yr (tCO2e)	Percentage contribution
Restoration of sub-tropical thicket, forests and woodlands	Sub-tropical thicket	500 000	1,2	2 200 000	44 000 000	25,1
	Coastal and scarp forests	8 570	1,8	56 562	1 131 240	
	Broadleaf woodland	300 000	1,1	1 210 000	24 200 000	
Restoration and management of grasslands	Restoration - Erosion Mesic	270 000	0,7	693 000	13 860 000	17,7
	Restoration - Erosion Dry	320 000	0,5	586 667	11 733 333	
	Restoration - Grasslands Mesic	600 000	0,5	1 100 000	22 000 000	
	Avoided degradation mesic	15 000	1,0	55 000	1 100 000	
Commercial small-grower afforestation	Eastern Cape	60 000	1,5	330 000	2 750 000	1,7
	KwaZulu-Natal	40 000	1,5	220 000	1 833 333	
Biomass energy (IAPs & bush encroachment)	Country-wide			1 990 316	39 806 316	14,4
Biomass energy (bagasse)	Country-wide			328 955	6 579 099	2,4
Anaerobic biogas digesters	Country-wide			3 642 408	72 848 160	26,4
Biochar		700 000	0,3	641 667	12 833 333	4,7
Reduced tillage		2 878 960	0,1	1 055 619	21 112 373	7,7
Reducing deforestation and degradation	Through planning					
	Through regulation					
Total				**14 110 193**	**275 787 189**	**100,0**

Restoring sub-tropical thicket and forests

A considerable amount of work has been done on the science, implementation, financial, and monitoring, reporting and verification aspects of sub-tropical thicket and forest restoration:

- **Sub-tropical thicket***:* 500,000-1,000,000ha could be restored. Carbon sequestration rate of 1.2-2.4 $tC.ha^{-1}.yr^{-1}$
- **Coastal and scarp forests***:* A potential of 8500ha, carbon sequestration rate of 1.8 $tC.ha^{-1}.yr^{-1}$
- **Woodland:** 300,000ha potential, carbon sequestration rate of 1.1 $tC.ha^{-1}.yr^{-1}$

Ecological infrastructure -

- Close alignment – essentially the restoration of ecological infrastructure and associated water, soil and forage related services

Restoration and management of grasslands

Two primary mitigation activities are considered within the grassland biome:

- **Carbon sequestration through grassland restoration and long-term management** – there is opportunity to restore at least **1,2 Million ha** of severely degraded grassland in the Eastern Cape, Western Cape and Kwa-Zulu Natal. Carbon sequestration rate of 0.7-1.0 $tC.ha^{-1}.yr^{-1}$ is reasonable.
- **Reducing the degradation of grasslands** and release of soil carbon into the atmosphere – a conservative area of 15,000ha. The reduction in GHG emissions is estimated to be 1,0 $tC.ha^{-1}.yr^{-1}$

Ecological infrastructure -

- Due to the water and soil benefits of grassland restoration and management, both activities would form the foundation of ecological infrastructure initiatives in the grassland dominated catchments of the escarpment – e.g. the proposed 19th Strategic Integrated Project (SIP 19).

Anaerobic biogas digesters

- Possibly the largest land-use based climate change mitigation opportunity in the country in terms of pure GHG emission reductions (a conservative estimate of 3,6 Million tCO2e per year)
- Good opportunity to manage the substantial agricultural, municipal biomass and food waste generated across the country.
- The pending national South African Waste Management Act effectively bans organic waste from landfills from 2015 onwards. Such regulation will result in a significant amount of waste that needs to be processed
- The units are relatively easy manage and monitor. Existing CDM methodologies exist.

Ecological infrastructure -

- Anaerobic biogas digesters are seen as a key intervention is the management of water quality in areas with substantial livestock feedlots, piggeries or chicken production e.g. the uMgungundlovu District.
- Essential to the management of Midmar Dam and the Umgeni Catchment

The adoption of no- or zero till

No- and zero- till:

- It is conservatively assumed that reduced tillage practices could be adopted on 20% of South Africa's arable land in future. Carbon sequestration rate of 0.1tC.ha^{-1}.yr^{-1}
- There is already substantial implementation in the Western Cape (60%) and even 'low-till clubs' in certain parts of the country
- The key climatic benefit may be the reduction in diesel usage (-66%)

Ecological infrastructure -

- The primary driver are the significant erosion, soil health and water retention benefits
- It restores the ecosystem services provided by the land

Biomass to energy

Two principle implementation options:

Energy generated through the combustion of bagasse

- A (very) well known opportunity in terms of scope, required technology, logistics financial considerations and GHG emissions
- Initial implementation is already underway within the sugar industry, supplying electricity to industry
- Expansion is dependent of purchase agreements with the national electricity supplier
- There is good opportunity to expand operations to include further emerging farmers

Electricity generated through the combustion of woody biomass

- Initial studies and implementation in the Eastern Cape have indicated opportunity to generate electricity using biomass sourced from alien invasive species.
- The commercial forestry industry is already generated electricity using waste biomass for internal use
- Purchase agreements with the national electricity supplier and a sustainable source of carbon finance would result in extensive expansion of the practice.
- Strongly reliant on existing transport networks.

Ecological infrastructure -

- The benefits are not as clear or significant as in the case of other land-use based mitigation opportunities

Commercial small-grower afforestation

- Implementation would occur through partnerships between established commercial forestry companies and local communities. The partnership allows industry to access new areas, while providing local communities with the opportunity to leverage the extensive knowledge and capacity of industry.
- Industry has already completed extensive feasibility assessments that identified 60,000ha in Eastern Cape and 40,000ha in KwaZulu-Natal that meet water and biodiversity regulations and where the resident community is willing to partner in implementation.
- As a climate change mitigation activities, the opportunity is well known in terms of monitoring, reporting and verification requirements as well as risk and feasibility considerations.

Key considerations

- There are substantial water and biodiversity concerns that need to be considered
- The rate at which water licenses are considered by local Government needs to be addressed
- The provision of a favorable interests rates or loans or carbon finance could unlock extensive implementation in the short-term

Ecological infrastructure -

- May decrease the provision water to downstream economies but this is considered in the water use licenses

Remaining opportunities

Biochar production and application

- Conservatively, biochar use could be applied to approximately 700,000 ha (penetration fraction of 5% of agricultural lands), with an annual emissions reductions of approximately 0.3 $tC.ha^{-1}.yr^{-1}$.
- Few comprehensive assessments of the production, transport or application of biochar in South Africa exist.
- Initial research on climatic, financial, implementation model and MRV aspects is required

REDD through regulation and planning

- Numerous Government officials and field practitioners identified that a new progressive form of reducing landscape degradation in South Africa is required
- It would need to be done through planning and regulation at a local scale (IDPs) and possibly form part of SIP19
- New forms of MRV and payment mechanisms would need to be developed

Ecological infrastructure -

- REDD through regulation and planning may be one of the primary mechanisms through which ecological infrastructure could be governed at a national scale

The cost of implementation

Project Activity	Cost		NPV over 30 years	CO2 over 30 years	R/tCO2
	CapEx/ha	OpEx/ha			
Restoration of sub-tropical thicket and forests	6 000	500	9 215 155 158	87 530 691	105
Restoration and management of grasslands	250	200	3 080 847 399	57 190 320	54
Commercial small-grower afforestation	10 000	550	1 681 090 327	15 015 000	112
	Levelised R/MWh (2020)	**MWh**	**Annualised Rmill**	**tCO2/a**	**R/tCO2**
Biomass energy (IAPs & bush encroachment)	779	2 365 200	1 842	1 990 316	926
Biomass energy (Bagasse)	869	390 915	340	328 955	1 033
Biogas (farm manures)	730	5 256 000	3 838	3 642 408	1 054

Summary

Revisiting our three key questions –

1. What is our understanding of opportunities to sequester carbon and the incentives required to drive this?
2. How do we approach restoration given the competing demands for land-use?
3. What are the implications for the restoration of South Africa's ecological infrastructure?

- *The restoration of grasslands, thicket, woodlands and forests as well as the adoption of zero-till, leads to the restoration of ecological infrastructure and may even be viewed as "creating land"*
- *Anaerobic biogas digestion has clear water and soil health benefits and may be crucial to the management of important watersheds*
- *The ecological infrastructure benefits of commercial afforestation and biomass to energy are less clear but both opportunities could provide substantial employment opportunities in rural areas.*

Important next steps:

- Clear long-term financial incentives for climate change mitigation activities – either a carbon offset mechanism or alternative payment for implementation
- A national or provincial facilitation unit is required to unlock opportunities, especially on land owned by communities and emerging farmers

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