



Developing all AFOLU climate change mitigation activities at a national scale –
The South African National Terrestrial Carbon Sink Assessment as an example

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- Initially, our understanding of the opportunity to mitigate climate change through land-use sector activities was severely limited.
- Good, substantial work had been done on certain activities (REDD+) in particular locations (e.g. coastal forests), but there was little comprehensive understanding of the sector at a national scale.

This was highlighted in **South Africa's Second National Communication to the UNFCCC**

- Poor understanding of the relative importance of southern Africa's biomes in terms of their influence on climate and on carbon storage
- Inadequate understanding of the relations between bushfires and greenhouse gases and carbon storage



The broad scope of work was distilled into a three-part framework:

1. Understanding the status and dynamics of terrestrial carbon stocks across the country

- Mapping of carbon stocks across the entire country and for all land-use types
- Estimation of the effect of climate- and land-use- change on carbon stocks over the next 20-30 years.

2. Understanding potential climate change mitigation opportunities

- The identification all climate change mitigation activities with the AFOLU sector
- An initial exploration of the nature of implementation in each case – implementation models, co-ordination, finance, MRV and required institutional support.

3. Supporting policy: Current status and future needs

- An assessment of all existing national policy that may effect the extent or nature of carbon stocks.
- A review of required supporting policy for identified mitigation measures.

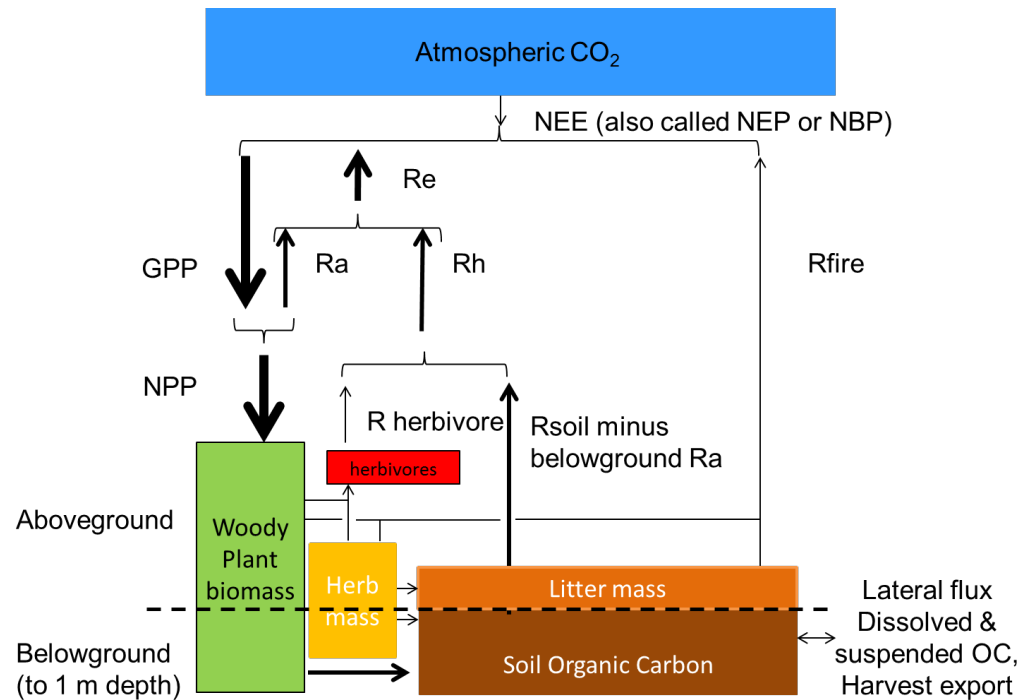


Section 1: The distribution of carbon stocks and fluxes across South Africa

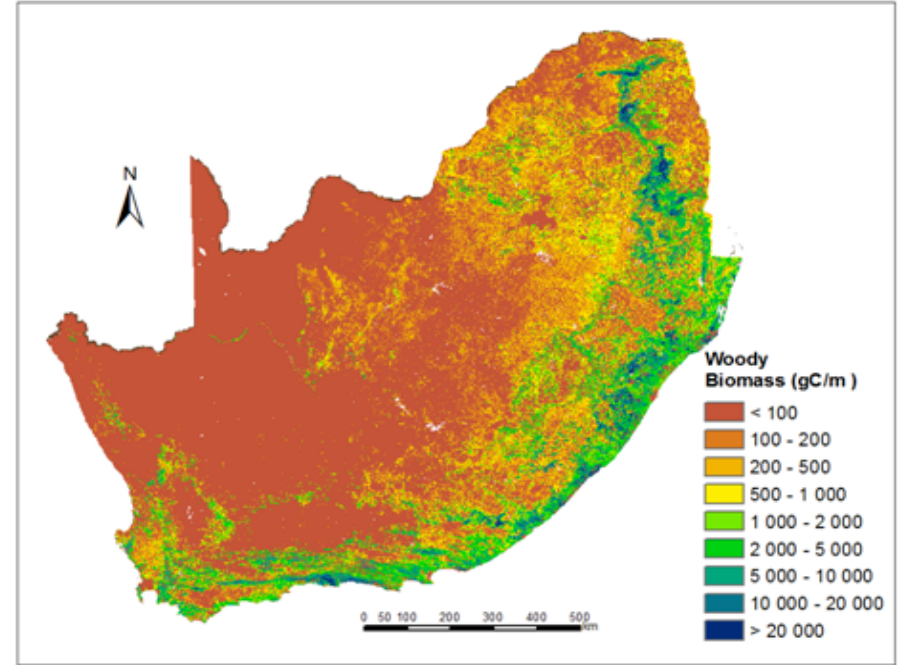
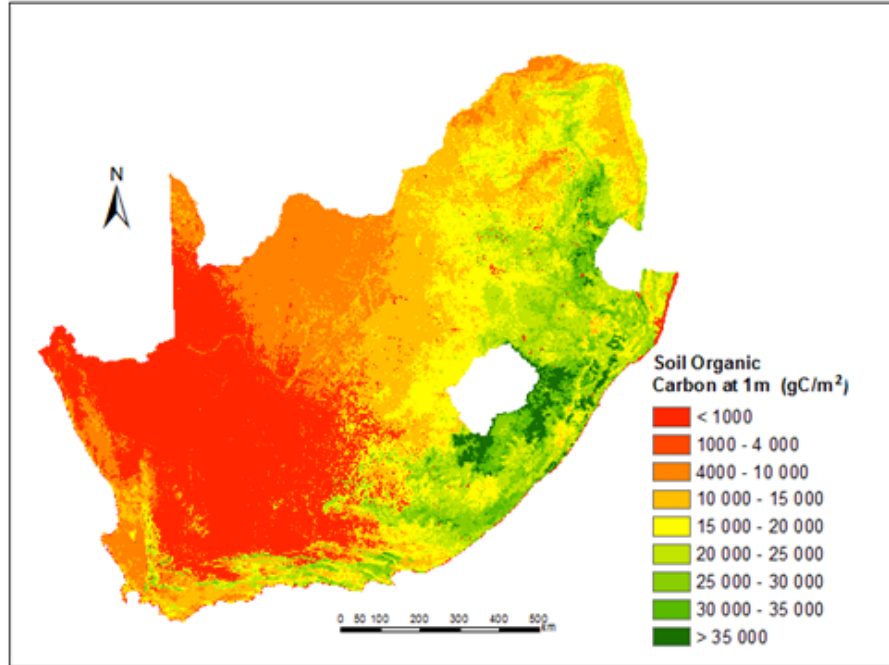
- 1.1. Geographic Distribution of Carbon Stocks
- 1.2 Principle fluxes: NPP, NEP and fire
- 1.3 Effect of climate change on terrestrial carbon stocks over time
- 1.4 Direct Human-Drivers: Historical and current analysis.



- A continuous variable approach was used to map carbon stocks and fluxes at a national scale.
- Each carbon pool was modeled individually and then aggregated – woody biomass, herbaceous, litter and soil organic.
- The soil organic carbon layer was obtained from the AfSIS database
- The herbaceous and litter pools were estimated using production models
- And, the woody plant biomass pool was estimated using area-based allometry
- Agricultural lands, built environments and other forms of converted lands were considered separately.



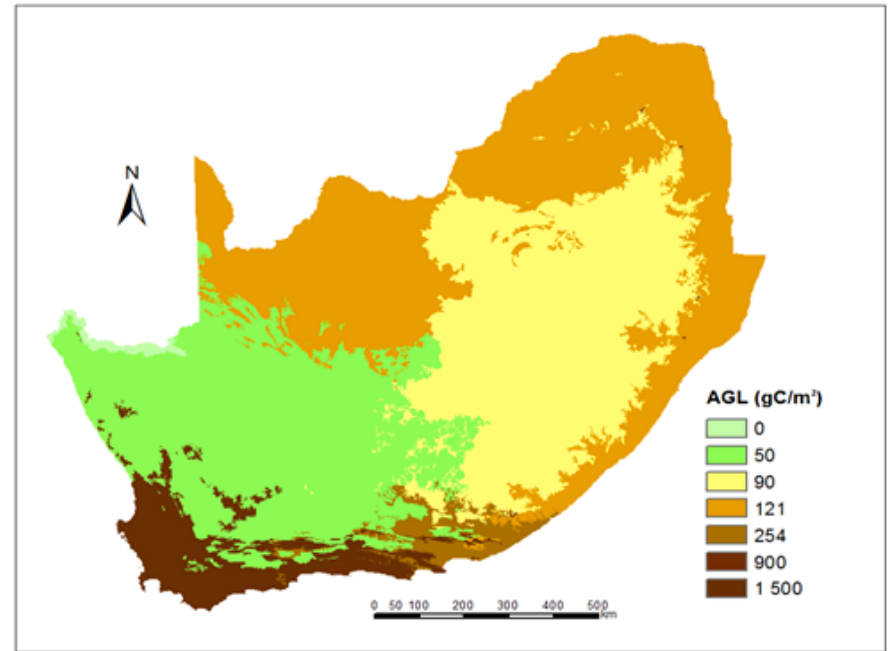
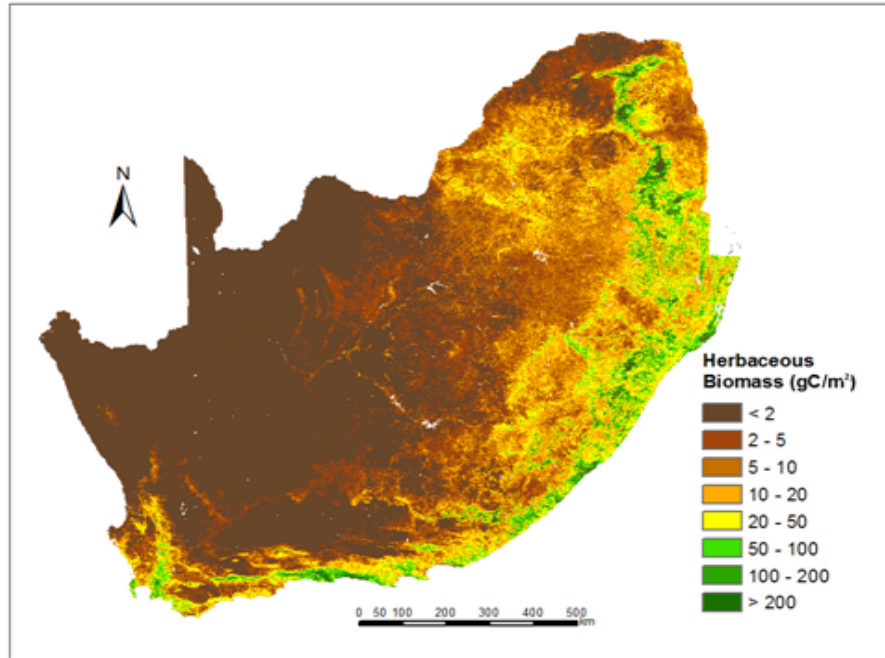
Source: Scholes et al. 2013



Components of the terrestrial carbon stock of South Africa

Left: Soil organic carbon to 1m in depth.

Right: The above-ground woody plant biomass pool



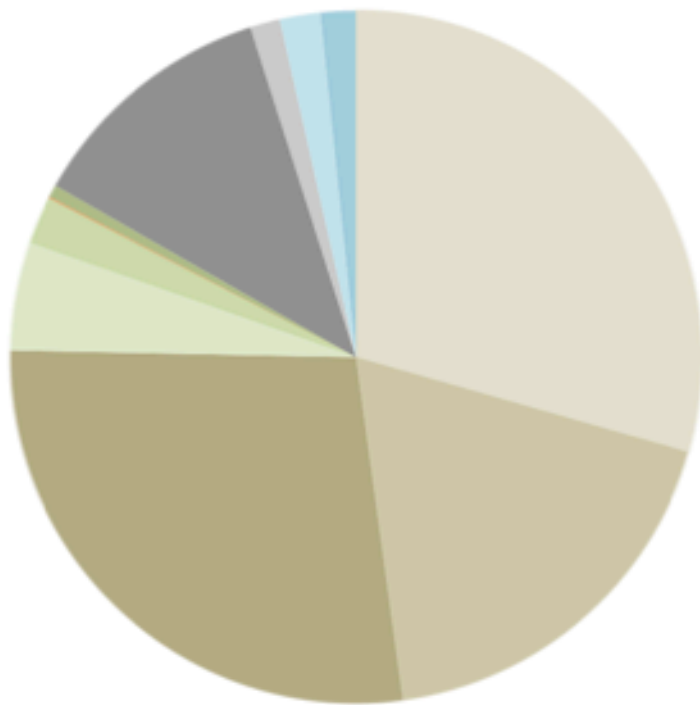
Components of the terrestrial carbon stock of South Africa

Left: The herbaceous plant biomass pool

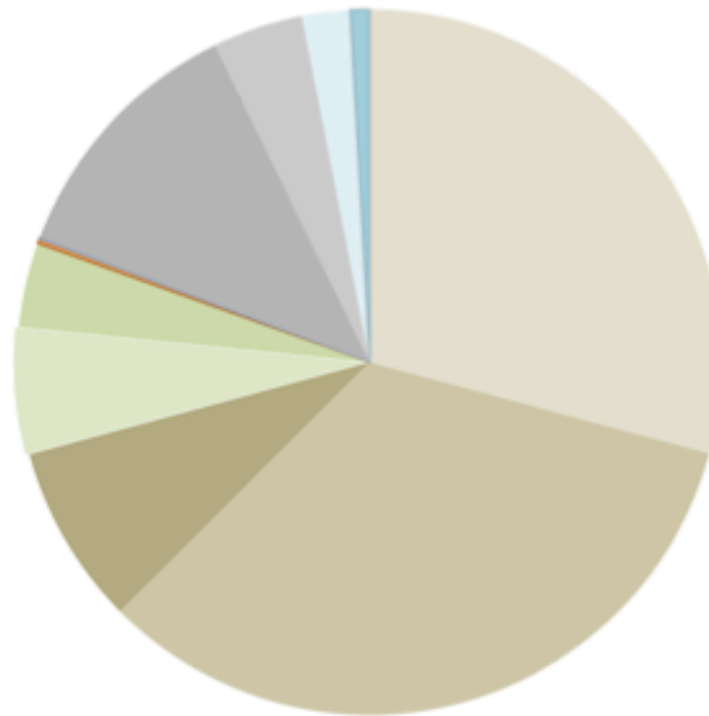
Right: The litter carbon pool



- Over 60% of the country's terrestrial carbon stocks are located in open savanna and grassland ecosystems.



a. The relative spatial area of each land-cover type

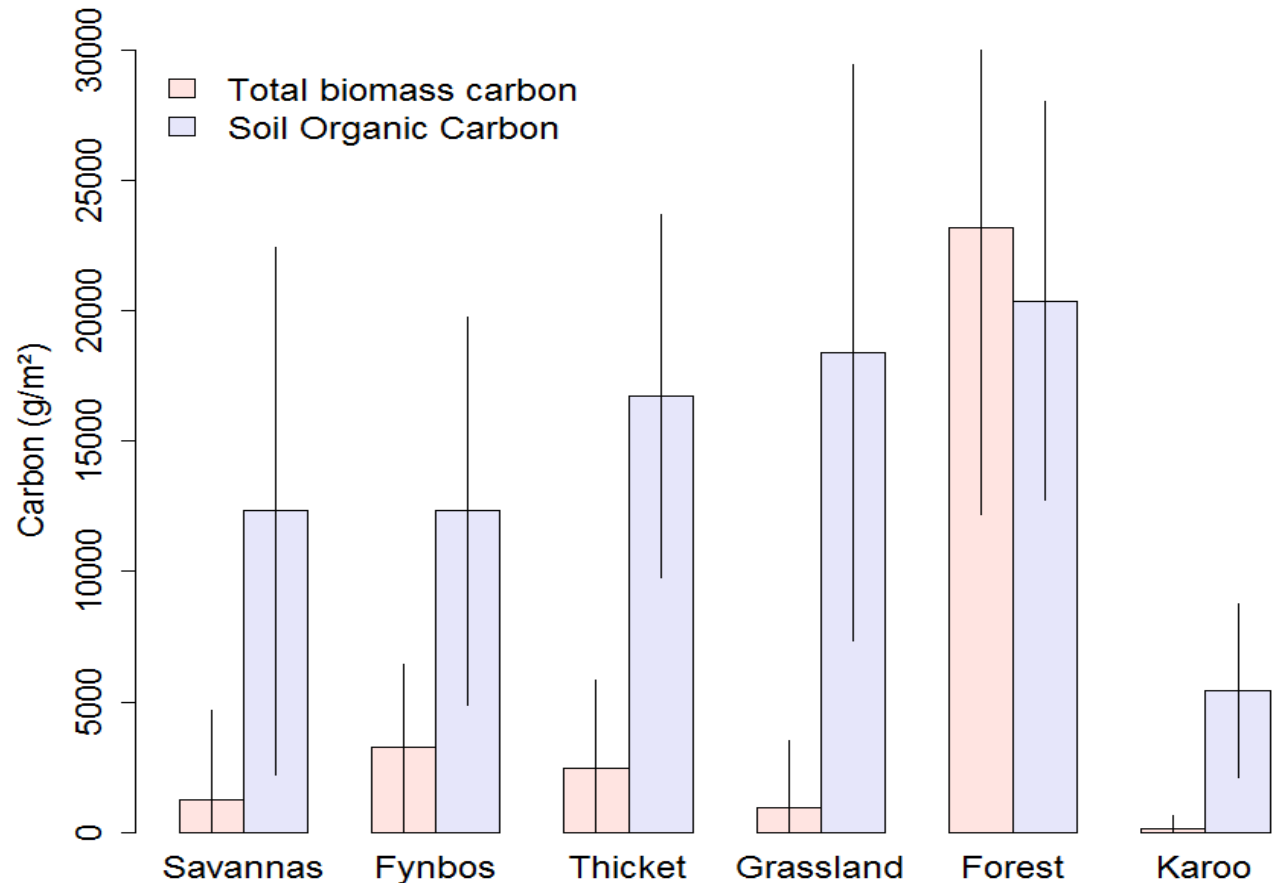


b. The relative percentage of the national terrestrial carbon stock within each land-cover type





- Over 80% of South Africa's terrestrial carbon stock is located below ground in the form of soil organic carbon.





This analysis aimed to answer two of the principal questions:

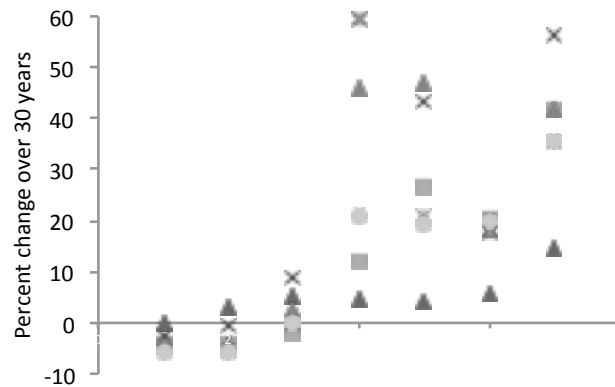
1. The need to understand the potential effect of projected climate change and elevated [CO₂] on terrestrial carbon stocks in important South African biomes
2. The need to understand the potential effect of projected climate change and elevated [CO₂] on the outcome of land-use based climate change mitigation activities located in South Africa

Two principle scenarios were modeled:

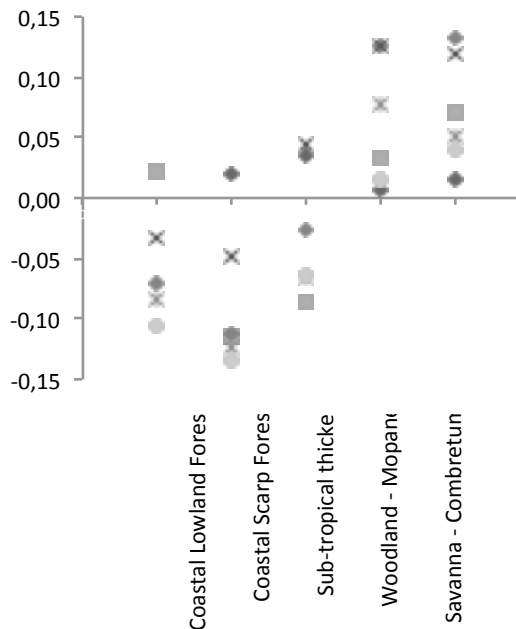
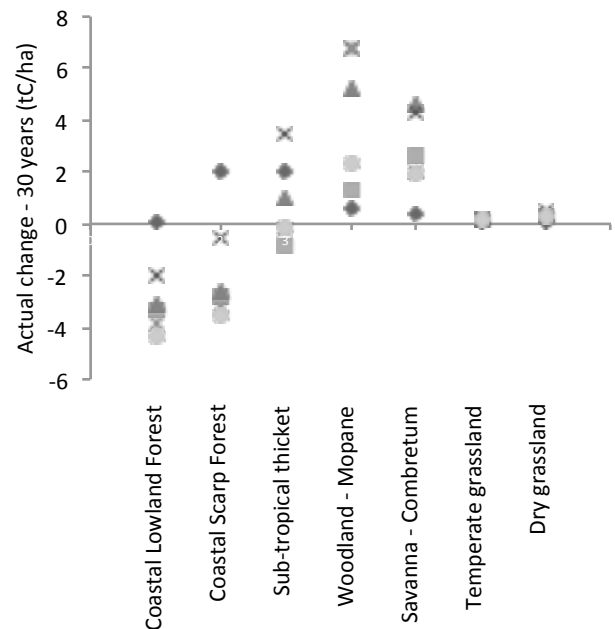
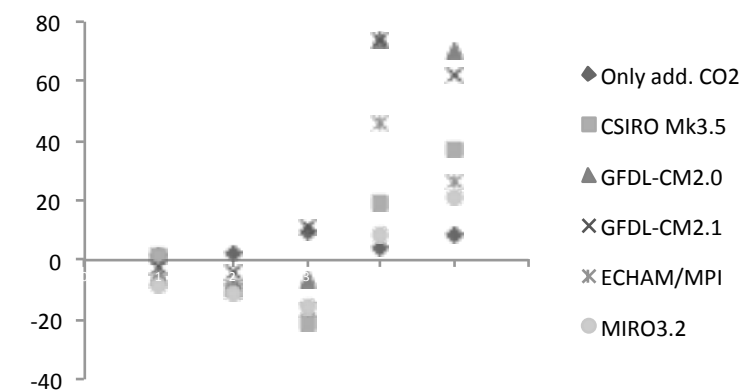
- The effect of climate change and elevated [CO₂] on **existing carbon stocks** in each vegetation type
- And, the effect of climate change and elevated [CO₂] on **the rate of carbon sequestration** during the restoration of degraded ecosystems.



Effect on carbon stocks



Effect on carbon sequestration rates



- The magnitude of predicted changes on both carbon stocks and sequestration rates is anticipated to be less than 5 percent over 30 years.
- The effect of changes in rainfall, temperature and atmospheric CO₂ may therefore present little risk to land-use sector initiatives.



- The Assessment forms part of a larger suite of activities implemented under the National Climate Change Response Policy (NCCRP) with the purpose of: *“...assessing the current national carbon sinks related to afforestation, forest restoration, wetlands, agricultural practice, bio-fuels, urban greening and all significant changes in land use and to quantify the potential future carbon sinks under varying climate change scenarios and land use change.”*
- Mapped and modeled land-use change over the period 2000 – 2020
- The modeled ‘2020’ land-cover dataset is not strictly linked to that specific year, but is rather an interpretation of a likely scenario in approximately 10 – 15 years time. The future changes are based on potential landscape changes arising from either planned or highly likely land-use changes, associated developments, and resultant land-cover changes, linked if possible to current or proposed legislation.

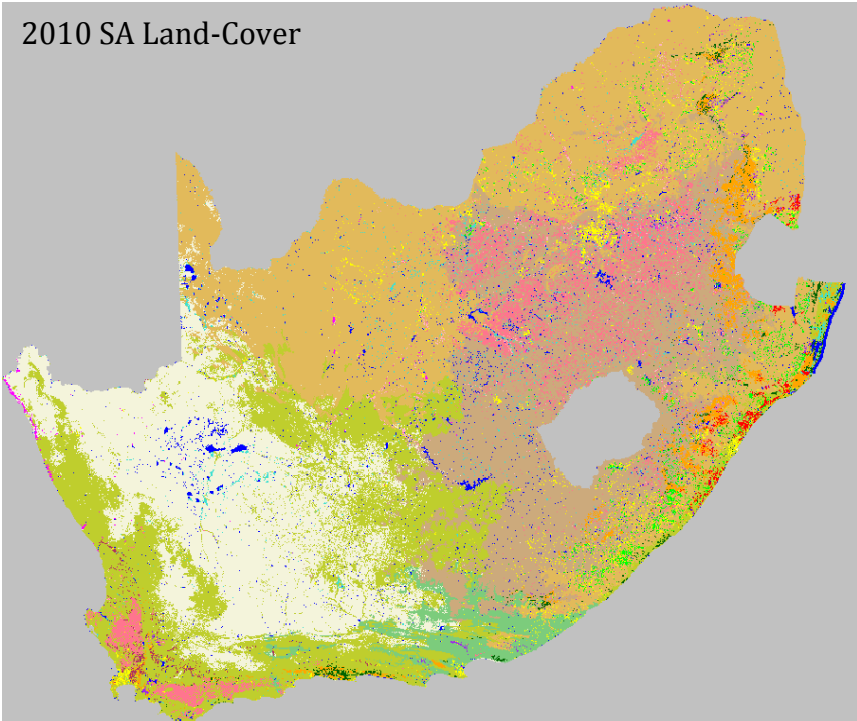


Sources of data -

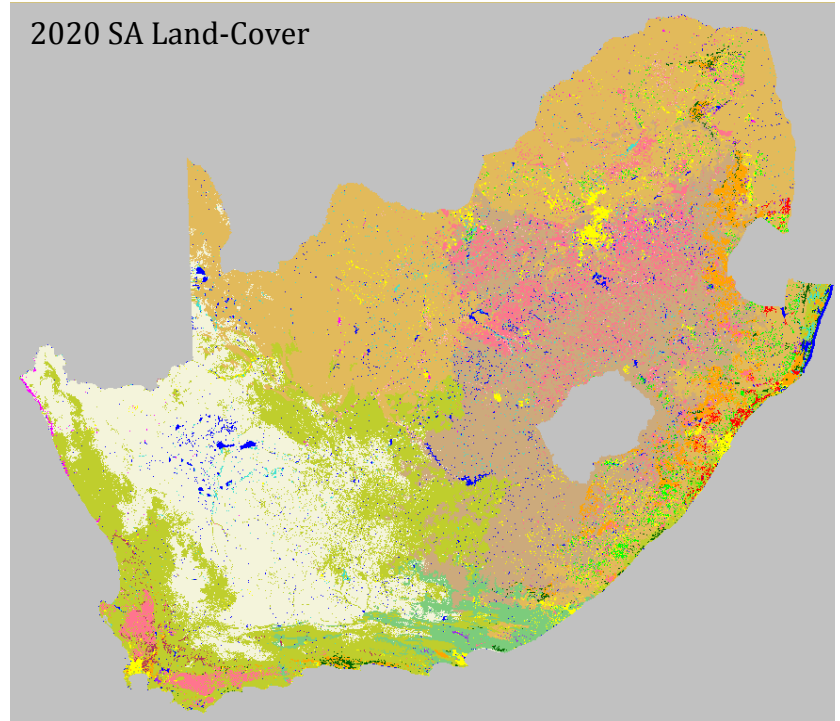
- Department of Rural Development and Land Affairs (DRDLR), Chief Directorate National GeoSpatial Information (CDNGI),
- Department of Rural Development and Land Affairs (DRDLR), Spatial Planning and Information (SPI)
- Endangered Wildlife Trust (EWT)
- i@consult (commercial Town and Country Planners, Pretoria)
- CSIR Built Environment (CSIR-BE), (Pretoria)
- CSIR Natural Resources and Environment (CSIR-NRE), (Stellenbosch)
- SA National Biodiversity Institute (SANBI) (via BGIS website)
- Gauteng City-Region Observatory (GCRO)
- NW Provincial Government (NWPG), Dept of Economic Development, Environment, Conservation and Tourism (DEDECT)
- Department of Water Affairs (DWA), Directorate of Planning
- Department of Environmental Affairs (DEA), Directorate of Planning
- Department of Environmental Affairs (DEA), Atmospheric Carbon Mitigation
- Department of Environmental Affairs (DEA), EIM Systems and Tools
- Department of Agriculture, Forestry and Fisheries (DAFF), Directorate Land Use and Soil Management
- Department of Agriculture, Forestry and Fisheries (DAFF), Directorate: Forestry Regulation and Oversight
- MetroGIS (commercial GIS-Environmental Planning company)
- Council for GeoScience (CGS)
- STATS SA
- ESKOM (GIS Technology, Midrand).

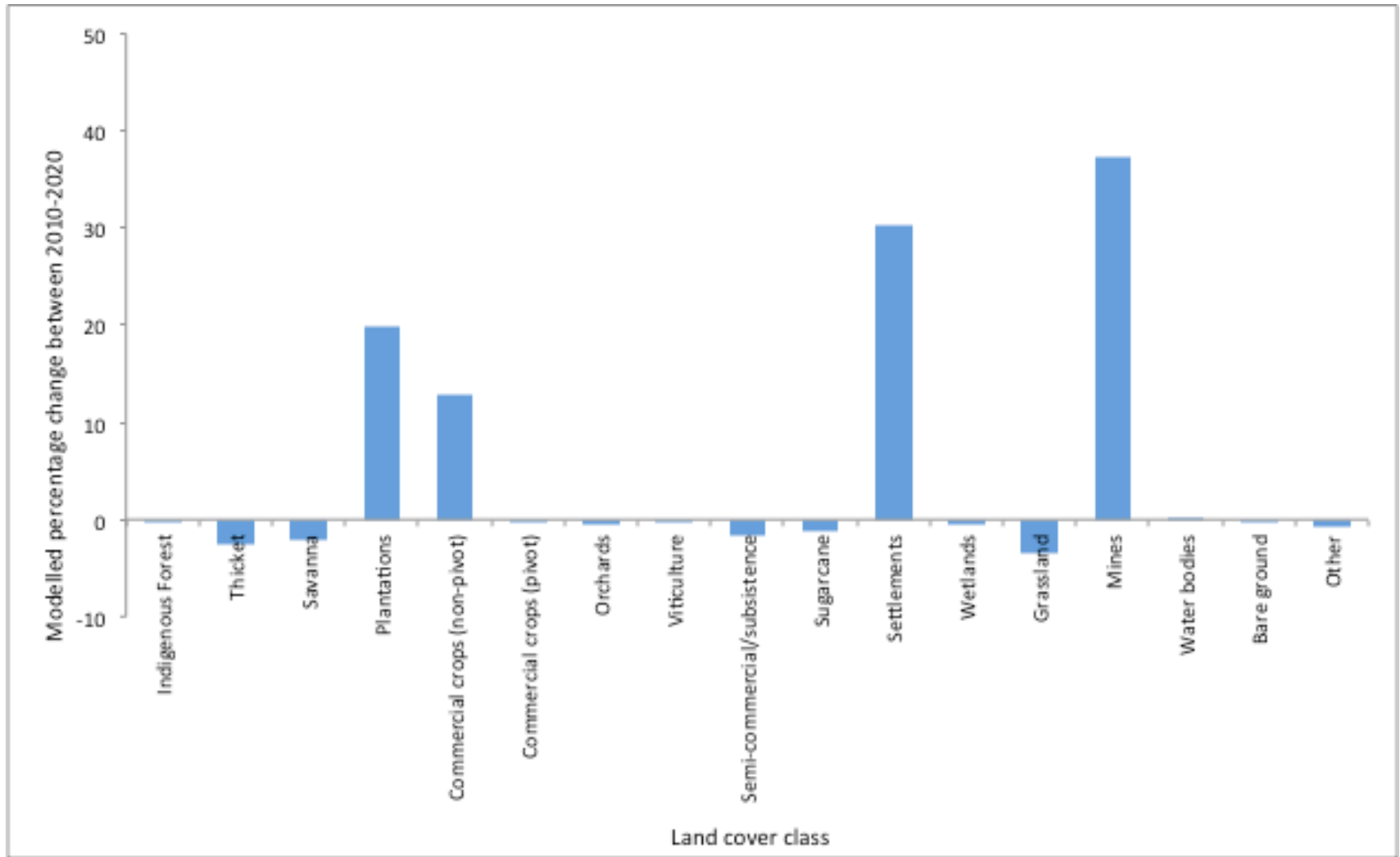


2010 SA Land-Cover



2020 SA Land-Cover





Modeled percentage change in each land-cover class between **2010 – 2020**



Section 2: Understanding potential climate change mitigation opportunities

2.1 To identify the principal land-use based climate change mitigation opportunities in South Africa

2.2 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

2.3 To understand opportunities to scale-up implementation

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



Activity	Sub-class	Spatial extent (ha)*	Per unit area per yr (tC)	Emission reduction per yr (tCO2e)	Percentage contribution
Restoration of sub-tropical thicket, forests and woodlands	Sub-tropical thicket	500,000	1.2	2,200,000	25.1
	Coastal and scarp forests	8,570	1.8	56,562	
	Broadleaf woodland	300,000	1.1	1,210,000	
Restoration and management of grasslands	Restoration	1,190,000		2,379,667	17.7
	Avoided degradation	15,000	1.0	55,000	
Commercial small-grower afforestation		100,000		550,000	1.7
Biomass energy	Country-wide			2,319,271	16.8
Anaerobic biogas digesters	Country-wide			3,642,408	26.4
Biochar		700,000	0.3	641,667	4.7
Reduced tillage		2,878,960	0.1	1,055,619	7.7
Reducing deforestation and degradation	Planning and regulation				
Total				14,110,193	100.0



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



Interviewed members of Government and field practitioners continually raise the need for an 'entity' that fulfills the following requirements (among others):

- Awareness and support services
- A cost efficient national monitoring, reporting and verification system
- Research and development
- Strategy development
- Income creation and management
- Incentive mechanisms and disbursements
- Integration with policy and regional planning
- The need for a champion and substantial operation capacity



Objectives of the study:

3.1 Review of existing policy

- To map out the existing policy environment, with a focus on land-use and associated carbon stocks
- To understand which policies may have the greatest impact on the size of carbon stocks,

3.2 Suggested future amendments to policy

- To provide policy recommendations that would establish an enabling environment for formal climate change mitigation activities, and which would improve the planning and regulatory functions which contribute to conserving and enhancing existing terrestrial carbon stocks
- To provide greater depth of understanding of the barriers and opportunities for implementation that policy can help address



Policy Review methodology

Policy catalogue populated through extensive review of existing policies, input from the DEA and leading to finalization of a long-list of policies (116 policies total)

Each policy systematically read and reviewed against thirteen pre-defined categories, used to gauge each policy's potential impact on terrestrial carbon stocks

Some policies removed from the catalogue due to negligible perceived impacts on terrestrial carbon stocks (final list of 78 total policies)

Catalogue results analyzed to identify trends, impacts, themes, gaps and conflicts in policy, as well as overarching potential impacts on different AFOLU sub-sectors





Three categories of policies

- **Those that promote sustainable natural resource management**, notably captured in the National Environmental Management Act and its subsidiary Acts
- **Those that lay the framework for economic growth**: these are referred to as “Presidential Policies” (the *National Development Plan*, the *Medium-Term Strategic Framework*, the *New Growth Path*). They make little to no mention of existing environmental legislation.
- **Those that seek to mediate land-use and land-use change through improved planning**: From NEMA (including bioregional planning tools and EIA processes) to the newly approved Spatial Planning and Land Use Management Act.



Broad findings and conclusions

- There is a strong legislative framework that supports the responsible management of natural resources.
- The number of different political objectives highlighted in policy demonstrates that a number of future land-use trajectories is possible
- There often seems to be little cross-reference or “communication” between policies
- A consistent lack of targets in policy – notably strategies and plans – made it difficult to assess the potential impact of a number of policies



Broad areas of focus

Opportunities to address the most common barriers limiting roll-out of the eight principal mitigation opportunities



- High costs burdens of monitoring, reporting and verification
- Weak to no demand for carbon offsets or other incentives to drive activity development

Creating an enabling environment for each of the eight principal opportunities



- Policy recommendations to address activity-specific barriers

Policy changes that would impact on land-use change generally, outside of the “formal” CC mitigation activities identified in phase II



- Policy changes that would strengthen planning and regulatory functions



- In general, the policy environment is favorable to the pursuit of the eight principal activities, and in most instances directly supports their implementation.
- Despite the broad base of policy alignment with the eight activities, stakeholders noted their difficulty in accessing and covering costs of carbon market participation.
- It is imperative to address the issue of *demand* for land-based climate change mitigation activities. A first point of departure will be engagement with the South African Carbon Tax.



- Based on the guidance provided by the assessment, Government is pursuing the Top 4 mitigation opportunities as well as addressing the principal road-blocks to implementation.
- During the course of 2015-2016, DFID and GIZ funded a series of analyses focused on the creation of a cost-efficient national MRV system, certification standards as well as more in-depth assessments of REDD+, biofuel and biochar opportunities.
- Substantial demand for the generated maps has since led to the commissioning and completion of the “South African Carbon Sink Atlas” located within a web-based portal.
- The policy “catalogue” is being widely used and surprisingly in demand.
- National Carbon Sink Assessment Reports [**www.environment.gov.za/documents/research**](http://www.environment.gov.za/documents/research)
- South African Carbon Sink Atlas [**www.environment.gov.za/links**](http://www.environment.gov.za/links)



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