

Policy pointers

- **REDD+ delivery models for** Mozambique must be developed to encompass many stakeholders, but especially smallholder farmers, charcoal producers (and consumers) and the logging industry. This will be complex, but all must change their practices if emissions are to be reduced.
- **Understanding land rights** through mapping can help explain carbon losses, leading to better REDD+ interventions.
- **Priority interventions should** include: smallholder extension services to raise productivity; efficiency measures for charcoal production and consumption (and provision of alternative energy sources); and strong efforts to make logging concessions sustainable (including improved governance and support for companies that self regulate).
- **Combining remote sensing** images like ALOS PALSAR with targeted fieldwork can estimate rates of forest loss. Uncertainty is high over short periods, but more research may allow comparisons with older images, and thus a robust estimate of 'business as usual', and projections against which to judge future interventions.

Understanding carbon loss and potential interventions in Manica, Mozambique

Understanding how land use and its changes affect forest cover and carbon stocks is fundamental to developing sound REDD+ delivery options. A study in Manica Province, a REDD+ pilot area for Mozambique, suggests biomass and forest carbon fell substantially between 2007 and 2010. The study combined radar remote sensing information (to measure changes in biomass and carbon stocks) with field investigations (to establish land use and land cover changes, and their causes). Small-scale agriculture is responsible for nearly half of the loss. Charcoal production and logging account for around a quarter. Large-scale commercial agriculture's small role (around 3 per cent) will increase as allocated land is cleared. The remaining carbon loss comes from diverse smaller causes. Recording and mapping land use rights is crucial for identifying the underlying causes of deforestation and forest degradation, who is involved in those causes, and potential interventions.

Manica province: a REDD+ pilot area

Mozambique's REDD+ readiness preparation plan identifies Manica Province as a REDD+ pilot site where emissions from land use activities might be cut. In Manica, conservation is already competing with other land uses. Commercial uses (small and large scale) include extraction of timber poles and firewood, growing biofuels, bananas and other commercial crops, and cattle ranching. Charcoal may be produced when land is cleared for agriculture, or may follow high-value timber extraction on logging concessions. Charcoal production is also licensed elsewhere, particularly in multiple use forest areas.

Subsistence activities include harvesting non-timber products and using fire for hunting, to clear land for agriculture and to harvest honey. Both domestic and international demands for agriculture and

forest products are driving deforestation and forest degradation. Manica is home to 1,438,386 people, of whom 55 per cent live below the poverty line. The province covers 6,166,100 hectares (ha).

Losing carbon fast

Mozambique's 2007 national inventory estimated deforestation in Manica at 0.75 per cent of the province's total area, or 45,245 ha of forest, per year. The national average deforestation rate is 0.58 per cent (corresponding to 219,000 ha).

This briefing draws on a study of changes in biomass and carbon stocks between 2007 and 2010 in a relatively small area (750,000 ha – 12 per cent) in the west of the Province. It included the forest reserves of Maronga, Moribane, and Zomba in the buffer zone of Chimanimani. Researchers used ALOS PALSAR remote sensing imagery of Gondola, Sussendenga and Chibabava Districts, and Chimoio city to assess changes

Understanding land use is key to unlocking potential solutions through REDD+

in forest cover, forest biomass and forest carbon loss. Field visits established the explanation for changes and attributed them to specific drivers and players, revealing

interactions between land uses and links with Chimoio — the city that uses and processes much of the forest harvest, particularly timber.

Despite significant variation between years, and substantial error margins around the estimates, remote sensing suggested a worrying downward trend in above ground biomass during the four year analysis. Biomass and forest carbon stocks decreased from 19.4 ± 0.9 teragrams of carbon (TgC) in 2007 to 17.6 ± 0.9 TgC in 2010 — a drop of around 9 per cent — attributable equally to deforestation and forest degradation.

Mozambique urgently needs to implement its forest policy aim of ensuring that private sector and communities use sustainable management practices. Investing in enforcing this legislation, together with improved government management of forest reserves, would produce a more sustainable outcome, including reduced emissions. The rest of this briefing discusses the causes of carbon loss, and suggests priority policy actions to tackle them.

Causes of carbon loss

In the Figure, the first pie chart shows land uses in Manica, as recorded by the Provincial Services of Geography and Cadastre. The second shows the relative contribution of land uses to the carbon loss detected in the remote sensing study. Despite inherent limitations in such a comparison, a clear picture emerges.

Logging concessions, which cover 16 per cent of Manica, accounted for about 9 per cent of lost carbon. Charcoal production, which the government licenses by production weight, volume of wood extracted or bags of charcoal produced — but not by land area — accounted for 18 per cent of lost carbon. That loss is potentially spread across logged areas, land being cleared for agriculture and other land uses.

However, small-scale agriculture, which takes up around 9 per cent of land in Manica, accounted for nearly half of lost carbon in the study. Clearly, the main threat to forests is encroaching farming. For example, small-scale commercial banana plantations have been carving away the Moribane forest reserve. Mozambique urgently needs to invest in improved land use practices. Technologies that produce sustainable yield increases, in particular, could relieve pressure to clear more forest. The main target for REDD+ interventions should be smallholder farmers.

The study also suggests that commercial agriculture plays only a small part (about 3 per cent) in loss of

carbon stocks. But this is falsely reassuring. A large area is allocated for commercial agriculture (livestock and fruit tree plantations) and biofuels, and will be cleared in the coming years.

Scaling up the study, and taking account of both recent large-scale land acquisitions — over 153,000 ha (2.5 per cent of the province) were allocated between 2000 and 2010 — and as yet unallocated demand for biofuels (130,600 ha — 2 per cent), it is clear that forest cover, and the associated carbon stocks in Manica Province, face an imminent threat as existing land use plans are implemented. REDD+ implementation must also include large-scale commercial sector interventions to mitigate carbon and biomass losses.

The Beira corridor transport infrastructure project runs through Chimoio and Gondola districts, and facilitates market access for agriculture and forest products. The study found proximity to Chimoio strongly influenced biomass stocks, which fell near the city. There was also an east to west gradient associated with the topography, where carbon stocks are higher in the higher slopes, largely influenced by moisture and accessibility.

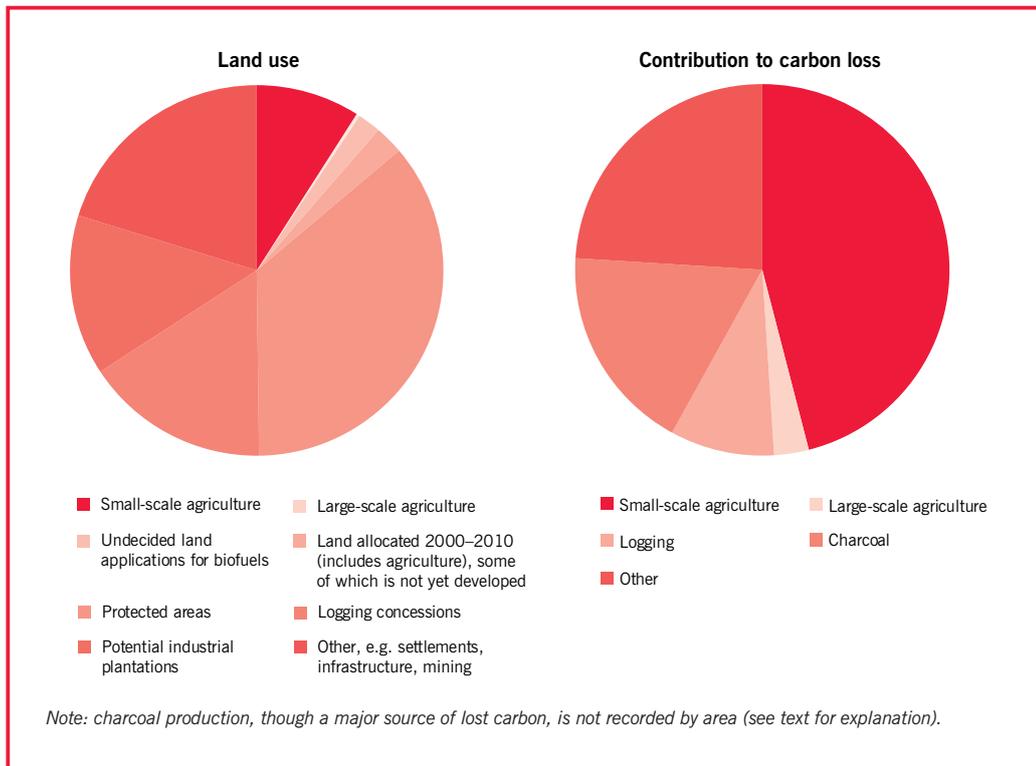
Harvesting biomass energy (in particular charcoal) and logging depends significantly on this infrastructure and on the demand in urban areas of Chimoio as well as Beira in the neighbouring Province of Sofala. Biomass energy and logging together account for about a quarter of carbon losses. REDD+ activities should include interventions to make biomass energy more sustainable, both in its production and in the growing demand from urban areas. Mozambique must also strive to implement its sustainability policies for the logging industry.

Approximately a further quarter of biomass and carbon loss came from myriad small-scale land use activities, including infrastructure, fire used to harvest honey and for hunting, as well as extraction of poles for construction. The study could not disaggregate these.

Understanding land use and land rights is crucial

Understanding who holds land rights in Manica is crucial to analysing how land allocation policies affect carbon loss, and also to identifying who might justly claim compensation for changes in land use practices. With that in mind, the MICAIA Foundation has mapped known land use rights for the entire province of Manica. Small logging operators, forest concessions and areas where land use rights have been formally allocated (under the government's DUAT system) are of particular interest for REDD+. These are likely to explain most of the observed changes in carbon stocks. However, there is also a large area where rights are not mapped and these certainly include scattered communities and individuals who have occupancy rights that are not registered.

Figure. Land use in Manica Province (per cent) and contribution of land uses to carbon loss in the remote sensing study (per cent).



Understanding all the rights, and mapping likely land use changes on to them, is likely to offer a robust prediction of carbon stocks and shed light on where interventions to reduce emissions can have the greatest impact. IIED and partners plan to extend this analysis for the Landscape Corridor of Beira (encompassing Manica, Sofala and Zambezia) starting in November 2012.

Policy priorities for cutting emissions

Identifying land use and land use changes is the key to understanding what drives deforestation and forest degradation, and to unlocking potential solutions through REDD+. Indeed, proposing REDD+ as a mechanism to tackle emissions implicitly acknowledges that land use and land use changes contribute to nearly 20 per cent of global greenhouse gas emissions.

REDD delivery models must encompass many stakeholders, including: the smallholders involved in subsistence and small-scale commercial agriculture; the small-scale logging companies (with licences for harvesting up to 500 m³ per year) and those with large concessions; companies in afforestation and reforestation; charcoal producers; and large-scale agriculture companies involved in food production as well as biofuels. This will be a complex situation to work with, but effective interventions to reduce emissions will need all users to change their practices.

Policymakers and land users must work together to establish interventions that are robust and reflect development priorities. Mozambique needs to demonstrate it is enforcing a set of policies and interventions to reduce emissions from land use and land use change, and that these are widely supported. The outcome should be verifiable reductions in emissions.

This study in Manica, though based on a relatively small area, sheds lights on the options that might be available more widely, and their implications.

The most needed policies and interventions are:

Improved smallholder extension services that share production techniques, fostering higher yields per hectare. There are several opportunities for changing the current practices through:

- fire management (for example, building firebreaks or making cold fires) to reduce the area burnt during land preparation, particularly during August and September;
- better management of rainfall water, including water harvesting for irrigating cropland;
- conservation agriculture practices such as zero tillage, mulching and terracing;
- introduction of various agroforestry systems and tree planting for restoring or enhancing soil fertility and for wood production.

More efficient and more sustainable charcoal production.

Issues to tackle include:

- improving kiln designs to increase the proportion of wood converted to useful charcoal;
- introducing concessions for biomass energy that include sustainable forest management obligations;
- making biomass energy more sustainable through policies and interventions that address the growing demand in urban areas. Ensuring electricity, gas and other renewables are available and accessible is a priority.

Sustainable management of logging concessions.

Mozambique's government has been making efforts to require both small and large logging companies to conduct their operations responsibly, but it faces many challenging tasks:

- better law enforcement against illegal logging and other infringements;
- forest concessions that include sustainable forest management obligations;
- improved forest governance; and

- support for companies that self-regulate and do 'the right thing'.

All these policies are crucial priorities if Mozambique is to reduce its emissions, nearly half of which come from forest degradation.

The study reported here shows how remote sensing combined with targeted field work can estimate forest loss. Extended back over longer periods, remote sensing images could be used to build scenarios for 'business as usual' and for development policies and investments.

Combined with land rights analysis, these techniques can also identify who is driving the changes, who should be involved in interventions, and who might have just claims for compensation when land use practices change in order to cut emissions. It will be vital to assess the viability of REDD+ delivery models in this way to ensure they generate net benefits for land users, as well as effective reductions in emissions.

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Further reading

- Neha, J., Ryan, C. 2012. *Forest Loss in Manica Province, Mozambique: Recent Trends and Future Prospects. A contribution to South-South REDD – a Brazilian Mozambique initiative for zero deforestation with Pan-African relevance.* University of Edinburgh/ IIED.
- Government of Mozambique. 2012. *Readiness Preparation Proposal Mozambique, revised March 2012.* Forest Carbon Partnership Facility (FCPF).
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