Mitigating Climate Change in Drylands – The Case for Financing Carbon Sequestration

Drylands have the potential to play a big role in climate mitigation and, in doing so, to deliver significant co-benefits

A. Carbon storage, emissions and sequestration in drylands

Changes in dryland management practices can lead to greater carbon sequestration. Although, on per unit area basis, the carbon storage potential of dryland ecosystems is lower than for moist tropical systems, but the large area of drylands means that overall they have significant scope for sequestration. However, significant gaps in knowledge remain on drylands carbon sequestration potential.

In Africa, 59% of the carbon stored in terrestrial ecosystems is stored in drylands. Globally, 36% of the carbon stored is terrestrial ecosystems is stored in drylands, mostly in dryland soils. A significant amount of carbon is lost continuously from dryland soils due to poor management. The largely degraded soils of dryland are, for this reason, currently far from saturated with carbon and their potential to sequester carbon may be very high.[1] At the global scale, estimates show that dryland ecosystems contribute 0.23 – 0.29 Gt of carbon a year to the atmosphere, which is about 4% of global emissions from all sources combined.[2] This will be exacerbated by climate change impacts. However, significant gaps in knowledge remain on drylands carbon sequestration potential, acceptable methodologies and cost-benefit ratio of carbon sequestering practices for small scale rural farmers.

Options for Action

1. Further research is required to demonstrate the feasibility of large area measurement schemes: There are technical and statistical challenges of measuring changes in above and belowground carbon stocks over large areas in drylands with the required accuracy.
2. Further research is required on the cost-benefit ratio of soil improvement and carbon sequestration practices for small landholders and subsistence farmers in dryland ecosystems.

B. Strategies for improving sequestration in drylands

There is a wide range of strategies to increase the stock of carbon in the soil

Strategies to increase the stock of carbon in the soil include: enhancing soil quality; erosion control; afforestation and woodland regeneration; no-till farming; cover crops; nutrient management; manuring and sludge application; optimal livestock densities; water conservation and harvesting; efficient irrigation; land-use change (crops to grass/trees); set-aside, agroforestry; and the use of legumes.[3] Models using soil organic matter for Nigeria, Sudan and Argentina, showed that modifying agricultural practices to increase soil carbon stocks in dryland farming systems could result in annual rates of carbon sequestration of 0.08-0.17 tonnes per ha per year averaged over the next 50 years, without increasing farmers' energy demand.[4]

---

1 Farage P., Pretty J., and Ball, A., 2003. Biophysical Aspects of Carbon Sequestration in Drylands. University of Essex.

2 MA 2005. Millennium Ecosystem Assessment. Ecosystems and Human Well-being: Desertification Synthesis. World Resources Institute, Washington, DC.

3 FAO 2004. Carbon Sequestration in Dryland Soils, World Soils Resources Reports 102. Food And Agriculture Organization Of The United Nations, Rome; Lal, R. 2004. Soil Carbon Sequestration Impacts on Global Climate Change and Food Security. *Science* vol. 304. no. 5677, pp. 1623 – 1627; Smith, Pete, Fang, C., Dawson, J. and Moncrieff, J. 2008. Impact of Global Warming on Soil Organic Carbon. *Advances in Agronomy*, vol 97, pp 1-43.

4 IBID 1

Option for action

1. There are several proven strategies for improving drylands soil carbon stocks. Governments, bilateral and multilateral donor agencies need to enhance investment in such land management practices

C. Sequestration in drylands delivers co-benefits

Actions for soil improvement through carbon sequestration are a win - win situation where increases in agronomic productivity may help mitigate global warming, at least in the coming decades, until other alternative energy sources are developed"[5]

Dryland carbon sequestration, particularly in soils, can provide other ecosystem and social benefits such as the rebuilding of the biophysical foundations of a sustainable natural environment – biodiversity, forests, livestock, soils, water, natural ecosystems - thus increasing productivity, improving water quality, and restoring degraded soils and ecosystems. Increasing carbon stocks in the soil increases: soil fertility; workability; water holding capacity; and reduces erosion risk and can thus reduce the vulnerability of managed soils to future global warming.[6] However, hidden costs in intervention strategies need to be considered.

Options for Action

1. Creation of a knowledge base and sharing of data and information on ecosystems and social and economic benefits of drylands carbon sequestration is necessary in enhancing soil improvement practices and reducing the vulnerability to climate change
2. Further research is required to address into hidden costs of increasing carbon stocks in the soil, e.g. mineral or organic fertilizer and water, which would need significant capital investment

D. Financing carbon sequestration in drylands

Unless dryland carbon credits can be used to meet compliance targets, demand will remain limited

At present drylands, including rangelands, activities (except afforestation and reforestation) are not eligible under the CDM and most pre-compliance systems. Currently, the only purchasers of rangeland carbon credits are in the voluntary market. Delivering certified emissions reductions from drylands management activities will require the development of agreed standards and methodologies. The main current constraints on entry of land use ERs into compliance markets are the risks that land-use based carbon sequestration may not be permanent and methodological constraints.[7]

Options for Action

1. Building effective partnerships between national and international actors will be necessary in encouraging national and international carbon markets to consider co-benefits in terms of ecosystem services as well as carbon
2. The pros and cons of carbon accounting at different scales (e.g. individual land user, watershed, national level) and the associated transaction costs in administering compliance market schemes need to be evaluated.
3. Strengthening of weak institutions, enhancing limited infrastructure and resource-poor agricultural systems will be necessary to effectively address soil carbon and DLDD.

Conclusion

---

[5] IBID 3

[6] Smith, Pete, Fang, C., Dawson, J. and Moncrieff, J. 2008. Impact of Global Warming on Soil Organic Carbon. *Advances in Agronomy*, vol 97, pp 1-43.

[7] Tenninkeit, T.and Wilkes, A. 2008. Carbon Finance in Rangelands- An Assessment of Potential in Communal Rangelands.

Soil carbon sequestration has much to offer climate change mitigation, land and livelihood protection and resilience to climate change, but actions to enhance it may be hampered by lack of finance, lack of data and perhaps capacity to implement changes. Policies and institutions addressing these issues will need to work co-operatively.