



## Climate Change in Drylands:

### Mitigation and 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 drylands management practices can lead to greater carbon sequestration. Generally, on per unit area basis, the carbon storage potential of dryland ecosystems is lower than for moist tropical systems. However, because of the spatial extent of drylands they have, overall, significant scope for sequestration.*

36% of the carbon stored in terrestrial ecosystems globally, and 59% in Africa, is stored in drylands, mostly in drylands soils. A significant amount of carbon is lost continuously from dryland soils due to poor management. The largely degraded soils of drylands are, for this reason, currently far from saturated with carbon and their potential to sequester carbon may be very high.<sup>1</sup> At the global scale, estimates show that drylands ecosystems contribute 0.23 – 0.29 Gt of carbon per a year to the atmosphere, which is about 4% of global emissions from all sources combined.<sup>2</sup> This will likely 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.

#### Recommendations 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.

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

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

2. Further research is required on the cost-benefit ratio of soil improvement and carbon sequestration practices for small landholders and subsistence farmers in drylands ecosystems.

#### B. Methods for improving sequestration in drylands

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

Methods 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.<sup>3</sup> Models using soil organic matter for Nigeria, Sudan and Argentina, showed that modifying agricultural practices to increase soil carbon stocks in drylands 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.<sup>4</sup>

#### Recommendations for action

1. Governments, bilateral and multilateral donor agencies need to enhance investment in carbon sequestering land management.
2. Governments, bilateral and multilateral donor agencies need to promote related information-sharing mechanisms, including knowledge bases and networks.

<sup>3</sup> FAO 2004. Carbon Sequestration in Drylands 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.

<sup>4</sup> IBID 1

### 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*<sup>5</sup>

Drylands 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.<sup>6</sup> 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 drylands carbon credits can be used to meet compliance targets, demand will remain limited*

At present, drylands and rangeland 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.<sup>7</sup>

#### Recommendations 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 Desertification Land Degradation and Drought (DLDD).

#### Conclusion

Soil carbon sequestration has much to offer climate change mitigation, land and livelihood protection and resilience to climate change. However, for it to make sense and elicit action from the largely rural drylands communities, it will be imperative for governments to show strong commitment through creating conducive policy and financial frameworks, institutions and related capacity. Cooperation between governments and bilateral and multilateral donors, investors, relevant Multilateral Environment Agreements (MEAs), international and national research institutes will be crucial in making a reality the co-benefits of financing carbon sequestration to mitigate global climate change and its likely impacts on livelihoods for drylands communities.

This brief is meant to inform development practitioners and policy dialogue. The perspectives presented in this brief do not necessarily represent a UNEP position. The Brief is one of a two part set of UNDP –UNEP-UNCCD briefs for CSD 17. The other paper addresses climate change in African Drylands: Adaptive Livelihood Options.

The full paper from which this Brief is derived is available on the CSD-17 website. For more information, please contact: [elizabeth.migongo-bake@unep.org](mailto:elizabeth.migongo-bake@unep.org)

<sup>5</sup> IBID 3

<sup>6</sup> 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.

<sup>7</sup> Tennenkeit, T. and Wilkes, A. 2008. Carbon Finance in Rangelands- An Assessment of Potential in Communal Rangelands.