A PLATFORM FOR STAKEHOLDERS IN AFRICAN FORESTRY

POLICY BRIEF

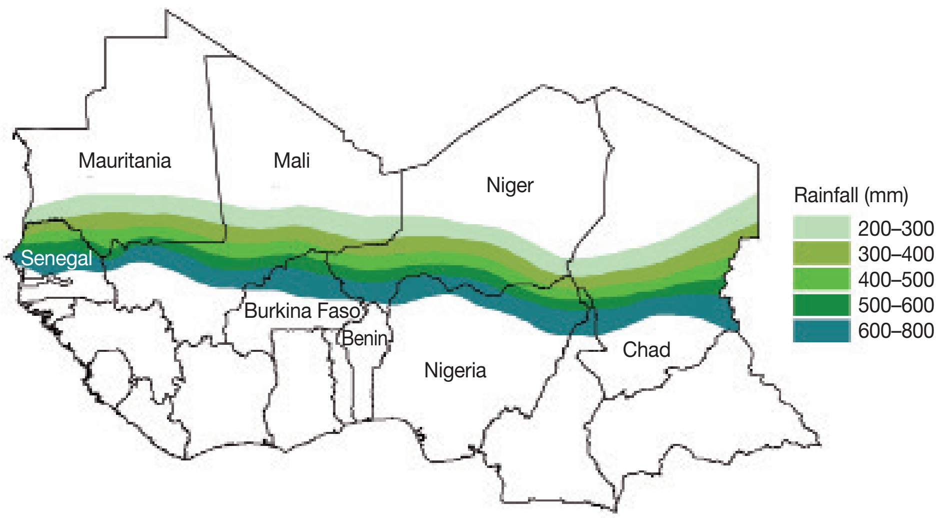
CLIMATE CHANGE, FORESTS AND TREES IN THE SAHEL

The Sahel is a semi-arid climate zone which stretches across Africa south of the Sahara Desert. Only sparsely covered with native shrubs and trees, the Sahel nonetheless sustains the livelihoods of millions of pastoralists and subsistence farmers. But over the past 40 years, variability in the region's annual rainfall has increased, marked by dramatic peaks and troughs. Degradation of land and vegetation is widespread. Understanding the role of trees in Sahelian ecosystems and livelihoods is at the heart of strategies for responding to climate change now and in the future.

Responding to climate change in the Sahel

The Sahel is and has always been a complex and variable environment, characterized by a diversity of people, cultures, soils and vegetation. Rain-fed agriculture is one of the most common livelihood strategies in rural areas, making food security particularly sensitive to changes in climate. Livestock herding, fishing and trading are also important, as well as seasonal migration in search of employment.

Figure 1. The Sudano-Sahelian region showing rainfall bands



Source: Mamby (2007) Climate change and small-scale farming. Public Forum and Policy Seminar, Ottawa.

Trees and climate change in the Sahel

- Deforestation in the Sahel can be seen as both a cause and a consequence of climate change.
- Sahelian trees have multiple uses for local people, and contribute numerous ecosystem services.
- Trees have a key role to play in climate change adaptation and mitigation.
- Learning from successful initiatives to tackle ecosystem degradation through the active regeneration of trees and forests is a crucial strategy for addressing the impacts of climate change.

The driving forces of biophysical, social and economic change in the region are closely interlinked.

Rainfall variability is a distinguishing feature of the Sahel. Annual rainfall ranges from 200 mm to 800 mm per year (Figure 1), with high annual variability that has become more pronounced in the past 50 years. During the three decades from the 1960s to the 1990s, mean annual rainfall fell by as much as 30 per cent, described as "the most dramatic example of multi-decadal climate variability that has been quantitatively and directly measured" (Hulme 2001:19).

This period of climate variability was marked by the very serious and recurrent droughts of the 1970s and 1980s, during which millions of people died. Water tables fell, affecting vegetation cover, and many trees and forest stands were lost.

The interaction between climatic variations and human activities led to vicious cycles of ecosystem degradation. Reduced fallow periods and expansion of farming into marginal areas led to the loss of soil organic matter and fertility, with further reductions of plant cover, especially trees. Severe soil erosion and biodiversity loss resulted. The harvest of many remaining trees for timber and fuel further increased soil instability.

Since this period of dramatic climate variability, widespread efforts have been made both to restore vegetation cover and soil fertility, and to better understand the drivers of climate change. What lessons do these efforts offer for adapting to current and future climate change?

Trees in Sahelian land use systems

The Sahel has three vegetation zones which reflect the shifting bands of annual rainfall. The characteristic Sahelian vegetation types are semi-desert grassland, thorn scrub and wooded grassland. Vegetation cover increases and diversifies towards the wetter south of the zone.

Multiple uses of Sahelian trees

There are more than 100 species of native Sahelian trees with multiple uses. The range of these uses reflects their vital importance in both livelihoods and ecosystems.

Products	Services
Timber and poles	Shade
Fuelwood	Increasing soil organic matter and fertility
Forage for livestock	Protecting soil against water and wind erosion
Fruit	Carbon sequestration
Leaves as a vegetable	Nitrogen fixation
Oils	Religious and spiritual significance
Wax and honey	
Medicine	
Edible insects	

Trees in the Sahel are integral to several land use systems.

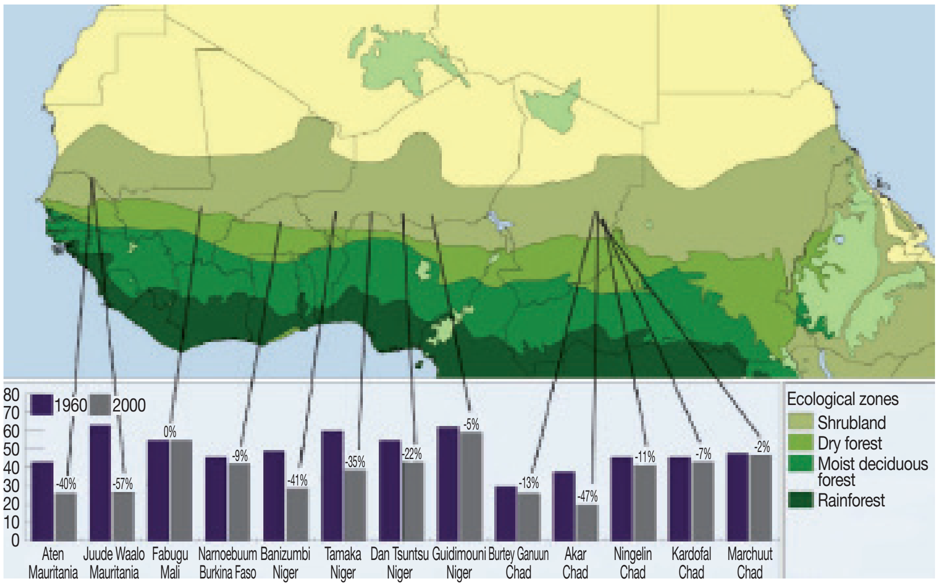
- Some **forests** and **woodlands** remain. Biomass productivity is usually low and levels of extraction are often high. These areas are very important for local communities, but they seldom have resources to invest in them. Sahelian woodlands do not appeal to external investors because their commercial value is low and because of conflicting demands for available resources.
- **Plantations** are rare in the Sahel because of low rainfall. Where they exist, they are mainly for fuel wood and fodder production, desertification control, or windbreaks and shelterbelts to protect agriculture.
- **Trees outside forests** have always been important as sources of tree products and services. Trees in Sahelian farmlands – called **agroforestry parklands** – have been increasingly widely promoted and are becoming more common in some countries. In 2006, it was estimated that Niger had more than 10 million hectares of agroforestry parklands with a mean density of 40 trees/hectare (Larwanou and Saadou 2006).

Sahelian trees in a changing environment

The Sahel has seen an increase in average temperatures since the 1960s. Increasing temperature has an impact on trees at a number of levels including increased transpiration, changes in seed production and regeneration rates, and change in overall species composition and competition. In some places, the result of such changes is decreased biodiversity of tree species and fewer trees in total.

A study of forest inventories conducted in 13 Sahelian villages illustrates this trend of species loss. Figure 2 shows that between 1960 and 2000 there was a negative trend in species loss in all but one village. Across all 13 locations, there was a mean decline of 22 per cent in the number of tree species.

Figure 2. Percentage of forest species loss in 13 villages of the Sahel (1960–2000)



Source: Larwanou (2011)

As well as a loss of species diversity, there are many examples of deforestation and decreasing tree numbers. An analysis of 20 studies of forests in the West African Sahel between 1947 and 2000, for example, showed an average rate of deforestation of 2 per cent per year.

The primary causes of this deforestation were demand for fuelwood and expansion of agriculture. Overgrazing, drought and forest fires were secondary causes. This causality highlights the importance of the complex web of environmental and social processes which shapes both the impact of climate change, and the ways that people adapt to it. Increased rainfall variability and drought clearly had a part to play in tree loss. But the demands of rising human and animal populations for food, fodder and fuel also had an important role. The people of the Sahel are not only responding to social and environmental change, but creating this change through their own actions.

Responsestoclimate-related change

Responses to the dramatic ecosystem degradation of the past 40 years have taken many forms and involved diverse stakeholders. Early initiatives to counter degradation met with little success. Many failed to consult local people in the design of projects and programmes. Efforts at reforestation with exotic species failed to thrive. Dams were built but not supported by farmer training or local infrastructure development.

But gradually a new vision began to emerge for natural resource management strategies that would restore and protect the environment and satisfy energy needs. These included forest management and energy plans, natural forest management plans and land rehabilitation projects.

The example of farmer-led reforestation in Niger, shown in the box below, demonstrates that much can be gained by providing an enabling environmental to support local responses to climate variability and strengthen the capacities of local people. Such enabling environments can be buttressed by external organisations, whether NGOs, aid agencies, national governments or regional bodies.

Farmer-led reforestation in Niger

Source: Sendzimir, Reij and Magnuszewski, 2011

Droughts in the 1970s and 1980s hit Niger hard and many trees were lost. In the early 1980s, farmers began adapting traditional systems of establishing trees, using a method that became known as farmer-managed natural regeneration (FMNR). This model relied on using existing webs of living tree roots. Farmers would choose stumps of useful tree species, then select and protect the best stems on the stump. Regular pruning promoted growth of the selected stems and the production of food, fuel or fodder. Crops were grown between the trees.

The success of FMNR lay in its flexibility, which allowed farmers to adapt the techniques to their own circumstances. The technique spread from farmer to farmer by word of mouth and observation of success. Its use was also promoted and supported by an international missionary organisation, Serving in Mission.

In the area covered by Serving in Mission, 88 per cent of farmers practiced FMNR, adding an estimated 1.25 million trees each year to the landscape. Larwanou and Saadou (2006) have reported an increase in tree cover in Niger from 0.6 per cent in 1975 to 16.5 per cent in 2005. FMNR has had a direct impact on food security through increased productivity of ground and tree crops.

Living in the Sahel requires constant learning and adaptation because it is a highly variable environment at all scales of space and time[1].

Soil erosion, Karimama, northern Benin (Courtesy N'danikou Sognigbe)

Recommendations

The constant variability of the Sahel offers an important lesson about what future initiatives need to take into account. Drawing on and learning from rich local traditions for managing change is an important strategy for adapting to climate change.

If responding to climate change means building greater resilience into systems – both social and ecological – then strengthening the ability of Sahelian people to protect themselves from adverse impacts and recover from damage is essential.

The actions needed to achieve this should:

- be well-defined, inclusive and relevant to local interests;
- draw on systematic analysis to learn from the successes and failures of the numerous initiatives designed to support natural resource management and counter land degradation;
- include better scientific understanding of climate variability.

Advances in climate modelling are improving seasonal and decadal forecasting, and they need to be integrated into initiatives to tackle ecosystem degradation in the region.

Source

Larwanou, M., 2011. Climate change in the West African Sahel and savannas: Impacts on woodlands and tree resources. In Chidumayo, E., Okali, D., Kowero, G., Larwanou, M., eds. *Climate Change and African Forest and Wildlife Resources.* Nairobi: African Forest Forum, p. 102–120.

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Hulme, M., 2001. Climatic perspectives on Sahelian desiccation: 1973–1998. *Global Environmental Change* 11:19–29.

Larwanou, M., Saadou, M., 2006. Evaluation de la flore et de la végétation dans les sites traites et non dans les régions de Tahoua, Maradi et Tillabery. Niamey: Centre Régional d'Enseignement Spécialisé en Agriculture.

Sendzimir, J., Reij, CP., Magnuszewski, P., 2011. Rebuilding resilience in the Sahel: re-greening in the Maradi and Zinder regions of Niger. *Ecology and Society* 16(3):1.

Endnote

1 Sendzimir et al., p.1

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