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Rotational Grazing for Soil Carbon Sequestration

Soil carbon sequestration has the potential to provide significant economic and environmental benefits to communities in semi-arid regions around the world. Increased levels of carbon enhance soil fertility and water retention capacity, leading to higher agricultural productivity. Communities also can obtain financial incentives through carbon trading programs. However, the realization of these benefits and incentives requires more than technical capacity. It calls for communities to organize themselves to implement land use practices at a scale broad enough to participate in such trading programs. Participating communities must demonstrate continuity and consistency with program rules and must account precisely for effects on the environment. They must also negotiate effectively with outsiders and allocate revenues equitably within their boundaries. These challenges are particularly daunting to communities in the West African Sahel, where natural resources are subject to multiple claims by diverse users, such as farmers and herders. Conflicts among overlapping land tenure systems and administrative jurisdictions further complicate the picture.

SANREM addressed these challenges in a rural commune on the edge of the inner delta of the Niger River in Mali, West Africa. Researchers worked closely with community leaders and other local stakeholders to develop a pilot project to test a community-based pasture management system inspired by Holistic Management ™ (HM) principles (http://www.holisticmanagement.org/). This model differs from other technical approaches to sustainable pasture management in that it integrates institutional capacity building as a key component. Attention to local customs is particularly important for the management of common-property resources and multi-functional landscapes such as those that prevail in the Sahelian region.

Holistic Management of pasturelands

HM understands overgrazing to be a function of the amount of time livestock spend in a pasture, rather than the number of animals in a grazing herd. The approach aims to exploit fully the beneficial effects of animals on pastures, including deposition of manure and urine, and the disturbance of the soil surface by animal hooves, which may improve aeration and water absorption. Thus, the HM model centers on the segmentation of pastures into grazing units and the development of a schedule based on the time needed for vegetative regeneration in each unit. Such a schedule is then used to rotate herds among grazing units so that each area is able to regenerate its grass cover before being grazed again.

The process

The HM pasture management experiment was established in 2002 on two village pastures within the Madiama commune in Mali. Volunteers were recruited to monitor pasture conditions, coordinate the rotations, and ensure compliance by resident and itinerant herders. Also, community leaders were

Photos courtesy of Carla Roncoli.

Left: An environmental monitors takes notes on the state of pasture quality at the experiment site. His observations will be used to decide when and where to move herds to allow optimal recorvery of vegetative cover. Right: Transient herds replenish soil fertility in open access grazing sites.

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trained in conflict management techniques to help resolve tensions among multiple users.

The pasture management experiment in Madiama resulted in:

- improved vegetative cover and soil structure;
- re-emergence of useful plant species that had previously disappeared;
- reductions in unwanted species due to renewed competition; and
- enhanced understanding of the relationship between improved pasture quality and soil carbon sequestration.

Lessons learned in Madiama can inform the development of a framework for community-based grazing and carbon sequestration programs.

Despite these improvements, unanticipated constraints limited the extent to which the potential benefits of HM were realized. The selected pastures, which measured about 100 hectares each, were highly degraded and could not support large numbers of animals. During the dry season, there was little grass to graze; and nearby streams and ponds dried up, forcing animals to travel long distances for water. During the rainy season, the proximity of the pastures to cultivated areas increased the risk of social conflict if animals trespassed into fields and damaged crops.

The project also met several institutional challenges, which exemplify the complexities of carbon sequestration efforts centered on management of common property resources. Leaders in some villages opposed participation, fearing that the project would limit field expansion and exacerbate disputes over territorial boundaries. Further, resident and itinerant herders were involved only marginally in the design and management of the rotational grazing system because the two villages that agreed to participate were mostly populated by farmers. As a result, regulations were not consistent with local livestock management practices, so monitors had little clout in pressuring herders to abide by them.

Uncertainties stemming from the broader political and institutional context also undermined the viability of the system. These uncertainties revolved around:

- lack of clarity about the project's primary objective (whether it was environmental conservation, community development, or scientific research)
- monitors not feeling empowered to change the rotational grazing schedule based on their observations of pasture quality, without approval from SANREM researchers.
- inconsistencies among resource tenure regimes and overlapping jurisdictions among levels of governance (e.g., village, commune, province, and central state).

This ambiguity resulted from the superimposition of colonial codes and post-colonial policies, including the recent decentralization of local governance, on established natural resource management systems.

Lessons learned

Despite these difficulties, the Madiama findings can inform the development of a framework for community-based grazing and carbon sequestration programs that integrate HM principles for sustainable pasture managements. Such a framework would include:

- solid understanding of seasonal variation in quality and quantity of forages and livestock movements before implementation within individual pastures;
- system design and management that integrates herders' knowledge of pastoral resources and livestock behavior;
- ensured effective participation of herder groups (e.g., transients, residents, etc.) and organizations in the management system;
- a flexible management system and clear decision making structure that allows for adjustments to rotations according to changes in the quantity and quality of pasture resources;
- strengthened capacity for consensus building, coalition formation, conflict resolution, contractual negotiation, environmental legislation, and financial accounting and management; and
- secured support of supra-local citizens and networks to bolster community bargaining power, ensure non-resident commitment, leverage additional resources, and scale up successful practices.

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For more information, see:

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