The climate-smart village approach: putting communities at the heart of restoration

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"Only the appropriation and governance of sustainable land management by local communities can regreen the Sahel"

Introduction

Land degradation affects 24% of the world's land surface and 1.5 billion of its people. It is the result of human activities, exacerbated by natural processes, and is closely linked to climate change and loss of biodiversity. In Africa two-thirds of arable land is degraded. In Senegal, 2.5 million hectares are degraded (CSE 2011); the central "groundnut basin" is particularly affected (Wezel and Lykke 2006).

Increasing the capacity of smallholders to address land degradation and adapt to climate variation is paramount, which is why the Senegalese Institute for Agricultural Research (ISRA) and its partners adopted the holistic and participatory "climate-smart village" approach. Based on innovative local governance, this approach includes seven components: (1) climate forecasts and information; (2) resilient crop varieties and good agricultural practices; (3) agroforestry with fruit and fodder species; (4) farmer managed natural regeneration; (5) inter-village silvopastoral areas; (6) planting of native fruit trees; and (7) small forestry and farm businesses (Sanogo et al. 2019).

An integrated participatory approach beyond the fields

The climate-smart village approach promotes the participatory development of context-specific land management practices, taking into account environmental (sustainable management of resources, ecosystem resilience) and socio-economic (institutional organization, empowerment, food security) aspects. It guides the actions needed to transform agricultural systems so they effectively ensure food security and support livelihoods in a changing climate (Sanogo 2018). This requires assessing site-specific social, economic and environmental conditions to identify appropriate farming practices (Sanogo et al. 2016).

The aim is to sustainably increase agricultural productivity and income, build community and ecosystem resilience, and reduce greenhouse gas emissions.

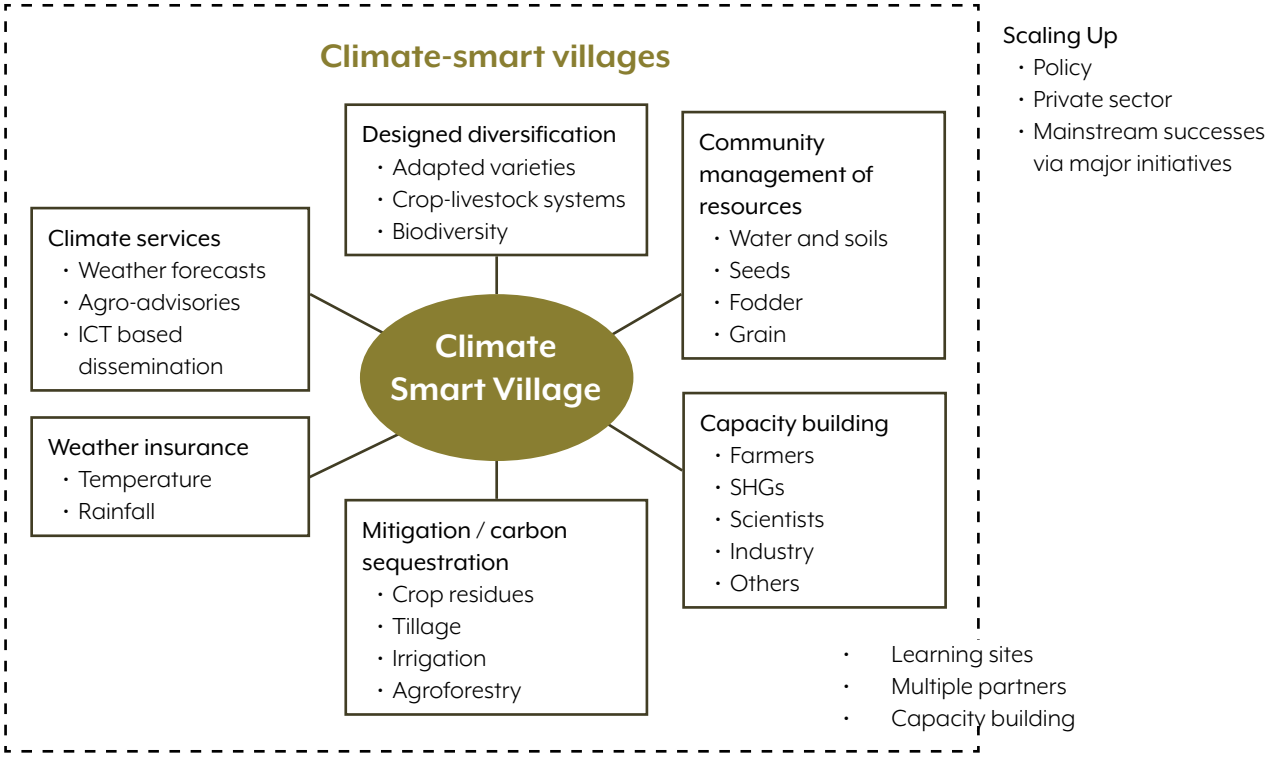
The approach was piloted in Daga Birame, Kaffrine Region. An initial assessment of existing capacities for climate change adaptation was carried out using the TOP-SECAC Toolkit (Somda et al. 2011), which included participatory mapping of livelihood and climate hazards. The next steps involved creating a vulnerability matrix to analyze community perceptions, and an adaptation strategy matrix to identify and analyze current and future adaptation strategies. The resulting measures were structured around different components (Figure 1).

An innovative platform and governance model

In applying the climate-smart village approach, an innovation platform was created as a driving force (Sanogo et al. 2017; Raile et al. 2019). This included 194 farmers (including 110 women) from all social levels of the community, plus technicians, administrative staff, elected officials, researchers and association representatives. The platform is coordinated by a committee of 17 members, including 6 women, with groups for specific purposes, such as the transformation commission for promoting non-timber forest products (especially the processing of baobab fruit and marketing of the fruit powder). There are also groups for market gardening, agroforestry, farmer managed natural regeneration, tree nurseries, and protecting inter-village silvopastoral areas.

The innovation platform is recognized as the village's decision-making body. It facilitates information exchange and sharing, and identifies and conducts capacity building for producers. It also relays climate information to farmers, and

Figure 1: Conceptual framework for the climate-smart village approach (Bayala et al. 2016)



facilitates access to research results, particularly those related to improved seeds and cultivars. The innovation platform has also contributed to the development of income-generating activities and to access to finance.

Building adaptive capacity

Each year since 2014, training has been provided in the use of climate services by a Multidisciplinary Working Group in Kaffrine. During the rainy season, climate information is sent via text messages to 11 members of the platform, who then relay it to all 194 members, allowing them to choose the best suited varieties and reduce the need to reseed. In addition, farmers believe that taking this information into account allows them to reduce weed density and the time needed to control weeds.

Smallholder farmers have also benefitted from capacity building through the participatory integrated climate services for agriculture approach, carried out by ISRA, ICRAF and the National Agency for Civil Aviation and Meteorology. This allowed 21 men and 21 women farmers from Ngouye and Daga Birame villages to plan their production and other livelihood activities through a better understanding of local climate characteristics and a joint analysis of their resources and personal circumstances (Sanogo et al. 2016; Dayamba et al. 2018). Following the training, farmers said that they now keep track of all the money they spend on production activities.

Protecting baobabs

A study trip organized as part of the 'Farms of the Future' approach allowed farmers of Daga Birame to visit Dahra commune in Linguère Department, where they saw the value of fruit trees, and found that the baobab fruit juice they were served came from their own region. On their return, they decided to plant appropriate fruit tree cultivars, and to ban the cutting and excessive pruning of baobab trees. Baobabs in Daga Birame have always been overexploited for animal and human food, which resulted in a lack of regeneration. To address this, each baobab tree in the village was marked and its use was prohibited. This has led producers to use other plant resources for livestock feed, including crop residues and cereal byproducts, yielding convincing results. As a result, communities and especially women, now have an ample supply of baobab fruit for generating income.

Training of producers in the Participatory Integrated Climate Services for Agriculture (PICSA) approach. Photo: Baba Ansoumana Camara

Inter-village silvopastoral areas

This initiative resulted from the initial assessment exercise, which identified the progressive degradation of vegetation as a major cause of increased risks from strong winds, floods, soil erosion and drought. The community of Daga Birame established participatory management over 128 hectares of communal land as inter-village silvopastoral areas, with a further 47 hectares around Katre Sy village. These areas provide fodder for local livestock and for the livestock of pastoralists who pass through, also providing additional income, and sustainable ecological, socioeconomic and cultural benefits. A committee of about ten people (men and women), officially recognized and appointed by local authorities (municipalities, Water and Forests and the Prefect), enforce the rules for managing these areas. Cultivation and wood cutting are prohibited in these areas, but grazing is permitted. The success of this approach is based on the will to act together, self-discipline, the involvement of technical partners, and the commitment of elected officials. Significant regeneration was seen after only four years (2014–17), revealing the potential of this strategy to rehabilitate degraded lands in the Sahel. Species that regenerated naturally included trees of economic and nutritional value, such as *Adansonia digitata*, *Albizia chevaleri*, *Bombax costatum*, *Cassia sieberiana*, *Cordyla pinnata*, *Detarium microcarpum*, *Diospiros mespiliformis*, *Parkia biglobosa* and *Tamarindus indica*.

Promoting agroforestry

Agroforestry was promoted by farmer field schools. The goal was to improve productivity while also producing biomass for environmental benefits and carbon sequestration. Demonstrations and trials included farmer managed natural regeneration (FMNR), good agricultural practices (mulching, application of organic manure, ploughing, mineral fertilization by micro-dosing) and the use of climate forecasts and information (choice of varieties, technical management). In 2014, a rain-deficit year, this combination of climate-smart agricultural technologies reduced the amount of mineral fertilizer required by 51%, reduced the need to have to sow crops a second time, and increased production by 60%. The approach also allowed farmers to better understand how such integrated agroecosystems function. In addition, the community was made aware of FMNR, leading to a more than doubling of adopters between 2014 and 2020, from 25 to 60 smallholders. This in turn led to an increase in on-farm tree densities over 93

Protected baobab (*Adansonia digitata*) trees. Photo: Baba Ansoumana Camara

hectares, with a further 182 hectares now under assisted natural regeneration.

Developing value chains and diversifying incomes

Fruit trees diversify sources of food and income. Five species were identified that match local needs and context: baobab (*Adansonia digitata*), guava (*Psidium guajava*), jujube (*Ziziphus mauritiana*), soursop (*Annona muricata*) and tamarind (*Tamarindus indica*). The species also include grafted varieties of baobab, jujube and tamarind. In 2016, group members also decided to combine trees with groundnut cultivation.

Income from the sale of jujube fruit increased from an insignificant amount in 2014 to €95 in 2018, along with a gain of €390 in association with groundnut. An economic evaluation showed that domestication is a profitable practice, with a net present value (NPV) of CFA 118,078 (€191) and an internal rate of return (IRR) of 27% (Sanogo et al. 2019). In addition, an initiative in 2014 called "One woman, one fruit tree" became "One woman, one agroforestry garden." The initiative drew inspiration from experiences acquired in demonstration plots: 22 women learned how to graft trees, and 300 fruit trees were provided for planting on their own land.

Women advocated for the protection of baobab trees in 2014. They obtained fruit for processing a year later, and took out a loan from the Daga-Birame Innovation Platform, which they later repaid. The income generated goes into savings accounts; this amounted to CFA 112,170 (€171) in 2015, CFA 192,500 (€294) in 2016 and CFA 458,000 (€699) in 2017. Women are still uncertain as to how to use the income, but have stated a desire to benefit from capacity building for managing community revenues in a way that avoids conflicts.

Impacts

Satellite images taken in 2004 and 2018 show the impacts on land use and vegetation cover from the implementation of new practices (Figure 2). As shown in Table 1, there were decreases in farm land, without natural regeneration (–7.3%); village woodland (–0.5%), medium-density savannah zones (–2.4%), and bare land (–0.6%). There were increases in urban areas (+0.1%), low-density savannah zones (+0.8%), high-density savanna zones (+1.6%), and cultivated land with FMNR (+7.8%).

Overall, practices initiated a process of regeneration on 151 ha, and stabilization on 867 ha , but 150 ha (13%) of the land still faces degradation. There

Results of natural regeneration. Photo: Baba Ansoumana Camara

was a significant increase in tree density and a reappearance of wild animals such as guinea fowl, partridges, monkeys and warthogs. Areas with regeneration also led to an increase in fodder availability (from 50 to 100 carts), and in fruit production (from 10 kg to 500 kg of jujube, and from 150 kg to 3,000 kg of baobab). An economic assessment confirmed the economic viability of these new protected areas (NPV = CFA325,612 > 0, and IRR = 33% > 8%).

Table 1: Assessment of spatial changes in Daga Birame, 2004–18

	Area (hectares)		Average annual change in tree cover (%)
	2004	2018	
Farm land with FMNR	193	302	+7.8
Low-density savannah zones	18	29	+0.8
High-density svannah zones	11	34	+1.6
Managed areas	0	6	+
Farmland without FMNR	736	634	–7.3
Medium-density savannah zones	145	112	–2.4
Village woodland	7	0	–0.5
Bare land	44	36	–0.6
Urban areas/habitations	13	15	+0.1
Water bodies	1	1	0

Conclusions

The climate-smart village approach created enthusiasm and commitment from farmers in seeking solutions to the problems and constraints that they themselves identified. The approach also involved strengthening the capacity of technical staff to use new tools, and to understand and support the new methods, with complementary finance to support the changes.

However, the success of regreening actions such as these requires a combination of legal, institutional, organizational, sociocultural, economic

A young baobab tree and a sign explaining the protection of an area of regeneration.
Photo: Baba Ansoumana Camara

and ecological factors. A failure to consider any of these factors will hamper progress.

The remaining challenges include the limited involvement of local elected officials in environmental and state-owned commissions, and their lack of knowledge of decentralization laws. In addition, there are issues at the organizational and sociocultural level. These include the exclusion of women, youth and pastoralists; the limited involvement of monitoring organizations; interference by religious leaders (*marabouts*), inconsistent sectoral policies, and lack of synergy between projects and programmes.

Involving local communities in the identification of problems and in the planning, implementation and governance of sustainable land management must be the basis of all interventions aimed at reversing the process of land degradation in the Sahel. Equally crucial is awareness-raising among communities and strengthening their capacity through farmer-to-farmer exchange visits, farmer field schools, and specific training that promotes wide-scale adoption of best practices. Finally, supporting restoration through the development of agroforestry resource value chains helps to empower communities and sustain interventions.

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