

Farmers' strategies for adapting to climate change in Niger

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Urban farming in the green belt of Niamey. Photo: Soulé Moussa



"With limited external aid, farmers themselves have developed a range of ways to increase their resilience."

Introduction

The West African Sahel is very vulnerable to the effects of climate change, due to land degradation, dependence on rainfed farming, political instability, poor governance, food insecurity, terrorism, poor infrastructure, and limited technical capacity. This has particular impacts on the agricultural sector (Sissoko et al. 2011; Zougmore et al. 2016).

High levels of poverty and illiteracy also challenge agriculture, alongside a lack of adequate agricultural policies and agricultural investment, and limited mechanization. Conflict also affects agricultural societies and pastoral activities (Snorek et al. 2014). In addition, there is population pressure. Niger has the world highest population growth (INS 2016), which leads to agricultural saturation, the now total absence of fallowing land and increased land-use conflicts.

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Climate change impacts on agriculture

At the national level, the government estimates the agricultural population at 15,665,750: 7,917,439 male and 7,748,311 female (Ministère de l'Agriculture du Niger 2019). Agrosilvopastoral production systems dominate, with millet and sorghum the main rainfed crops, and beans and groundnut the main cash crops (Ministère de l'Agriculture du Niger 2019). There is also some oasis agriculture (rainfed and irrigated), and limited urban and peri-urban farming and orchards. Agriculture in Niger suffers from intrinsic challenges such as low soil fertility and unsustainable agricultural practices, which are worsened by the collection of almost all crop residues for other uses and the use of fire to clear land.

In Niger, climate change has direct negative effects on agricultural production through increased variation in rainfall, recurrent droughts, flash flooding, higher temperatures and strong winds (Aghrhyet 2015; République du Niger 2020), with notable impacts on millet, the main subsistence crop in the country (Ben Mohamed et al. 2002). The frequency of bush fires and incidences of crop and livestock pests and diseases are also increasing, as is the invasion of farmland and pastures by weeds (Habou et al. 2016; Ministère de l'Agriculture du Niger 2019). Indirect effects include increases in climate-related malaria and diarrheal diseases that negatively affect agricultural societies. Climate change also amplifies conflicts and migration.

Adaptation strategies and their implications

Land restoration

Nigerien farmers use many different land restoration techniques to adapt to the effects of climate change on their land. A wide range of techniques are used, including *zai* pits (*tassa* in the local Hausa language), stone bunds, half-moons, micro-dams, grass strips, filtering dykes, mulching, multiple cropping systems, crop rotations, fallows, zero tillage, agroforestry, farmer managed natural regeneration (FMNR), use of firebreaks, planting wind breaks, stabilizing sand dunes, applying manure or compost, micro-doses of chemical fertilizers, early sowing, and developing contracts with pastoralists to have their animals stay in the fields to provide additional manure (Nouhou Koutcha 2016; Oumarou 2007). The technique that the farmers choose varies according to the problems they face and the knowledge they have, but the overriding purpose of all techniques is to improve water retention and soil fertility to maintain or increase yields in response to land degradation. And adoption of some has been widespread, with *zai* pits, half-moons and FMNR along with more intensive rice cultivation reported to have been implemented on more than 310,000 hectares in Niger (Botomi et al. 2015).

Another adaptation is planting species such as *Andropogon gayanus*, *Euphorbia balsamifera*, *Leptadenia hastata* and *Leptadenia pyrotechnica* to stabilize sand dunes. These species also have socio-economic and food security benefits. For example, the seeds and mulch of *Andropogon gayanus* are harvested and used by farmers or sold for animal feed, and the grass from the species is harvested for use in preparing building materials. The leaves of *Leptadenia hastata* are consumed or sold for food. These species are also planted as a land restoration technique over large areas where male, female and youth farmers benefit from cash-for-work arrangements in many private and public projects. This strategy helps to reduce rural poverty and migration, as well as the risks of youth joining terrorist groups. In addition, restored lands have improved productivity and increased resilience to the uncertainties of climate change.

Cropping systems

Farmers have also developed cropping techniques to mitigate the negative effects of climate change. They practise multiple cropping systems and crop diversification to reduce climate-driven crop failure, reductions in yields and loss of soil fertility. For example, they grow cereals such as millet or sorghum with tigernut (*Cyperus esculentus*) or other crops for home consumption or sale, with nitrogen-fixing legumes such as groundnut or different varieties of beans such as cowpea (*Vigna unguiculata*). This crop diversification reduces crop failures and yield losses, which has positive impacts on nutritional, pastoral, economic and land restoration considerations and enhances farmers' resilience.

A key adaptation strategy is combining crops with livestock and forestry. This agrosilvopastoral land use enhances soil fertility, reduces poverty, and leads to biodiversity conservation, all of which further enhance resilience. The use of drought-tolerant and early maturing crop varieties is another important measure to reduce the impacts of climate shocks (Ministère de l'Agriculture du Niger 2019).

In addition, irrigation is a key adaptation strategy to boost crop production where water is available (CNEDD 2020). Examples include agricultural crops in oases in Agadez Region, and crops, mainly fodder, in interdunal depressions (*cuvettes*) in Zinder and Diffa regions. The most important irrigated cropping system is found near dams and alongside wetlands such as along the Niger River in Niamey and in Tillabéri Region (République du Niger 2020).

Non-timber forest products

Agroforestry with multipurpose tree species is a key adaptation measure. Farmers plant woody species in croplands or encourage natural regeneration. This ensures varied ecosystem services that reduce the effects of climate change on agricultural production and allows farmers to harvest non-timber forest products. The sale or home consumption of these products helps people cope with household food shortages during drought years (Lawali et al. 2018; Sendzimir et al. 2011). Farmers harvest flowers, fruit, fibres, fodder and medicines from a wide variety of trees for domestic use and for sale. Species include *Adansonia digitata*, *Acacia raddiana*, *Balanites aegyptiaca*, *Boscia senegalensis*, *Faidherbia albida*, *Leptadenia hastata*, *Maerua crassifolia*, *Neocarya macrophylla*, *Parkia biglobosa*, *Prosopis africana*, *Piliostigma reticulatum*, *Sclerocarya birrea*, *Tamarindus indica*, *Tapinanthus* species, *Vitellaria paradoxa* and *Ziziphus* species.

In the wet season, farmers also harvest wild herbaceous species such as *Ceratotheca sesamoides*, *Cleome gynandra* and *Corchorus tridens* on their farmland for household food and for sale, and some store them until the dry season. Some farmers have gone so far as to domesticate some wild plants for food and commercial purposes, such as *Cassia tora* (*tafasa* in Hausa) in the department of Aguié in Maradi Region



Women harvesting *Balanites aegyptiaca* flowers for human consumption in Koygolo village, Dosso. Photo: Manzo Farouk



Millet fields in the green belt of Niamey. Photo: Soulé Moussa

(Moussa et al. 2017). Farmers harvest and store cowpea tops (*takunka* in Hausa) for human consumption as a dry-season strategy (Moussa 2013); they also eat immature cowpea pods (*hansari*) in salads in the face of food insecurity in the lean period before the millet harvest is ready. Furthermore, the minor millet *Digitaria exilis* (*fonio blanc*) is also cultivated for food and for sale. In addition to plants, farmers also collect crickets, which are eaten as a protein source or sold in local markets.

Cultural adaptations

National planting programmes such as national tree-planting day on 3 August, play a crucial role in climate change adaptation related to agriculture. This encourages the planting of a range of trees species along roads, in towns and schools compounds, and in croplands. Programmes also include cultural gatherings of farmers such as national and regional agricultural fairs (e.g. *le salon de l'agriculture Sahel, la cure salée*). These gatherings support farmer exchanges, capacity building, awareness raising, and provide incentives such as prizes for farmers in various categories, including the most inspiring innovations. Such gatherings are thus important ways to strengthen the adaptive capacity of farmers. They also help to reduce conflicts between farmers and pastoralists, and promote the use of climate smart agricultural technologies.

At the local level, another adaptation strategy is the use of small-scale rainfed farming systems, specifically by youth and women. Youth farmland is usually worked in the evenings or at the close of the family cropland working period, during holidays, and on Fridays, when many do not work due to its being the Islamic day of prayer. Women's farmland is usually located within their husbands' farmlands; women generally cultivate the cash crop.



Peri-urban rainfed agriculture in Maradi. Photo: Soulé Moussa

At the national level, adaptation is supported by a number of laws that aim to build the resilience of farmers, including the rural code, pastoral law, forest law and biodiversity law, all of which help to regulate the balanced use of agricultural land and natural resources in the context of climate change and expansion of agricultural land.

Institutional and individual capacity building

Understanding the role of the many private and public institutions in Niger in enhancing farmers' climate change adaptation is critical. These organizations assist farmers with basic education in literacy and numeracy, and provide weather and climate information and technical advisory services. There is also the national 3N policy – *Nigériens Nourissent Nigériens* – which aims to reduce the effects of climate change on key sectors such as agriculture. The adaptive capacity of farmers is strengthened through workshops, village gatherings, rural radio programmes and similar initiatives, and through the provision of improved rural infrastructure (such as roads, marketplaces and storage facilities) and better access to agricultural loans and inputs such as seeds and fertilizers.

Government responses

In 2015 the government provided 8,516,435 tree seedlings for general distribution with 23,501 hectares planted, and an additional 5,937 hectares of sand dunes were fixed through planting (INS 2016). There were 164 bush fires (*fuex de brousse*) reported that year, similar to previous years, and so an additional 17,205 km of fire breaks were also prepared.

For the 2019 agricultural production season, the government — through its *Programme de la Renaissance Acte II* — distributed significant quantities of diverse agricultural inputs to farmers to help them cope with the effects of climate change. These included 5,063 tonnes of certified seeds, 12,875



Urban farming and honey production in an urban orchard in Maradi. Photo: Soulé Moussa

tonnes of fertilizer, 61,538 litres of pesticide (to treat 70,280 ha), 19,853 packets of fungicide powder, 370 chemical applicators, 49 cattle and donkey carts and 46 ploughs (Ministère de l'Agriculture du Niger 2019). The implication of such assistance from the government is that the use of agricultural inputs enhances agriculture production, reduces crop failure, restores land and reduces poverty. It indicates the importance that the government places on assisting the agricultural sector in order to support food security.

General recommendations

- Raise awareness among farmers, local leaders, civil servants, academic institution staff, the private sector and the general public of climate change and its impacts.
- Include climate change in the curricula on national universities, to ensure graduates can act as ambassadors for climate change adaptation.
- Take account of climate change adaptation strategies in agricultural policies, and develop national, regional and commune-level adaptation plans, including public finance and encouraging private investments for climate actions.
- Increase the number and coverage of weather stations for more timely and accurate forecasting.
- Construct more dams and promote water harvesting methods to increase water availability for small-scale horticulture and larger-scale irrigation of agricultural crops.
- Improve agricultural insurance services for farmers from the private and public sector to help them cope with crop failure, damage to infrastructure, loss of human life and loss of livestock from climate shocks.

- Improve access to agricultural loans, including for storage facilities for rainfed and irrigated crops to reduce post-harvest losses.
- Increase the production and distribution of more tree seedlings, and of a more diverse range of species that produce food for human consumption to improve nutritional security.
- Develop urban and peri-urban agriculture and urban forestry for food production.
- Encourage the cultivation of fodder species and improve storage to support supplies especially in the dry season.
- Promote programmes that increase the engagement of youth and women in the agricultural sector and in large-scale farming in particular.

Conclusions

Agricultural systems in the West African Sahel are vulnerable to climate change. Farmers in Niger have developed many adaptation strategies, which provide myriad services with socioeconomic and ecological benefits. These include *zai pits*, stone bunds, mulching, crop rotation, multiple cropping systems, half-moons, filtering dikes, fertilizer micro-doses, use of manure, and farmer managed natural regeneration. Strategies also include pest control measures, use of drought-tolerant and early maturing crops varieties, improved crop storage facilities, and use of timely and accurate weather forecasting. Some adaptation measures involve the use of land law and environmental law to regulate the use of resources. In addition, farmers reduce risks through loans from agricultural banks to invest in irrigation infrastructure and agricultural inputs. These measures are being considered at the highest level, such as in the national strategy and plan for climate change adaption in the agricultural sector 2020 (République du Niger 2020). Now it is hoped that these strategies can be adequately financed and effectively implemented so farmers and pastoralists alike can have the support they require to adopt more climate-smart practices and improve their livelihoods.

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