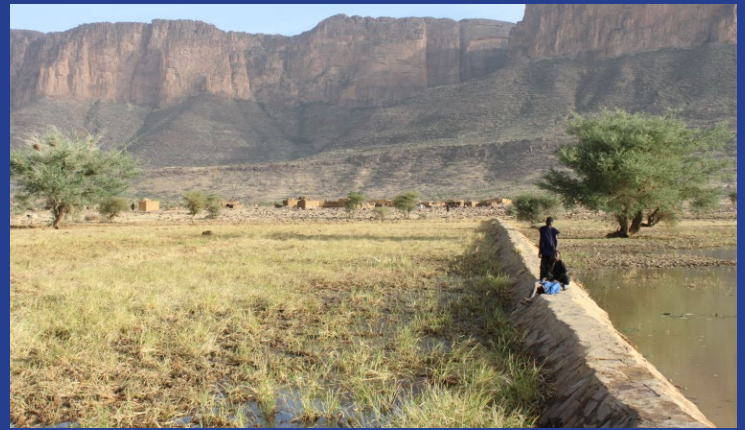




Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED)

Program Development Report #5 Knowledge on Adaptation and the Reduction of Climate Risks and Disasters in Mali and Senegal – A Summary Report



Prepared by the NEF/IIED/IED-Afrique Consortium
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Title: Knowledge on Adaptation and the Reduction of Climate Risks and Disasters in Mali and Senegal

A Summary Report

Based on Full Reports by the Near East Foundation and IED-Afrique (Full French-language reports are available separately)

Connaissances sur la Réduction des Catastrophes et Risques Climatiques, Mali, NEF Mali

Etat des lieux des stratégies d'adaptation aux changements climatiques au Sahel, IED-Afrique

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Introduction

It is no longer feasible to operate as if climate variability is unexpected and plan development programming around the mean. Instead, we need to plan for climate variability in order to deliver timely information to affected people thereby enabling them to deploy a suite of responses to enhance resilience and decrease vulnerability. The Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) programme is poised to incorporate climate variability in development planning in Mali and Senegal, and once the concept is tested and proven, expand elsewhere.

Communities in Mali and Senegal have significant experience with climate variability and change, and have gained important local knowledge to plan and manage changes. Harnessing this knowledge is key to developing successful approaches through the BRACED programme. It is anticipated that these approaches will be grounded in local realities, build on local knowledge and experience, and foster long-term resilience.

The Near East Foundation, IED-Afrique, and IIED consortium undertook detailed studies in Mali and Senegal to inventory responses to climate risk among local communities and institutions, analyse approaches that build resilience to shocks, and develop the importance of programming for long term resilience.

This report summarises key information and findings from these reports in Mali (focused on the cercle of Mopti) and Senegal (focused on the region of Kaffrine), which will influence the proposed BRACED programming.

Overview of Findings

The two country studies illustrate three important conceptual challenges in promoting adaptation, resilience, and disaster risk reduction.

First, climate in the Sahel is highly variable. We can think of this as the coefficient of variation being relatively high in this broader ecosystem; there is a relatively high standard deviation of annual rainfall relative to mean annual rainfall. This longstanding feature of the environment has brought about a system of adaptations over time. These adaptations include: herd mobility and adoption of multi-species herds; utilisation of the toposequence for planting different crops, with different planting schedules; field-scattering; irrigation; recessional cultivation and other various responses.

Programme responses in Mopti and Kaffrine often endeavour to foster and support such tried and tested responses to climate variability, and to attempt reconciliation where these might come into conflict. For instance, whilst expansion of cultivation can cut off transhumance corridors, this can be managed by developing local conventions that regulate both herding and cropping production systems. A second category of programmes encourages the adoption and implementation of practices that have been tested in similar environments to maximize the use of the little rain that does fall and existing soil fertility: the Zai system and anti-soil erosion bunds, for example. A common feature of these responses is that they tend to be labour intense, not reliant on high degrees of capital, and build on what is already in place.

Second, variability can lead to drought. It is advisable to focus on the impacts of drought rather than the technical definitions of drought: crop failure, livestock losses due to animal death, decreased livestock value due to animal emaciation, and most critically, human suffering through food insecurity. The findings propose (and this is indicative of a wider trend in the development field) that the current approach to drought as an unanticipated stochastic shock requiring humanitarian assistance after the occurrence of drought is critically flawed. This is also costlier: it is far more difficult and expensive to get funding for food and goods, than to plan ahead for challenges. Evidence suggests that feeding and keeping livestock alive costs one-third of replacing livestock.

Although the specific timing and intensity of droughts in the Sahel are to some extent stochastic, we know with certainty that they are going to occur. Advanced planning, sometimes called Drought Cycle Management, is imperative. Drought Cycle Management involves defining drought indicators along with thresholds and triggers, counter-actions to respond to indicators and financial planning to ensure availability of funds for implementation of required actions.

By both focusing on the impacts of drought and advanced planning, programmes can build resilience in collaboration with communities. The development of feasible action plans for implementation in drought conditions can help to break the link between drought – a climate driven event, and food insecurity – which can be avoided during drought through better planning and programming.

Third, plans we are making now respond to existing climate variability. Recent research has established that there is evidence to suggest climate change is a feature of the Sahel. This leads to two conclusions. One, it is critical to understand what has happened in the Sahel over the past 50 years as it illustrates what can be done in response to changing climate. Two, plans to deal with climate variability and drought cycle management will need to be adaptive to the reality that planned responses may be ‘overtaken by events’ because climate and climate variability is prone to change. Therefore, plans must be changeable. To deal with such possibilities, ‘scenario planning’ has been proposed and recently tried in the Sahel; the Near East Foundation (NEF) is one of the pioneers in this field in Mopti. The purpose of scenario planning is to encourage communities to articulate how their plans would change if the climate should change in certain specified directions. Although it is clear from that we do not know what will happen with the climate of the Sahel over the next 50 years, the contributions of this report illustrates that this is no excuse for failing to plan. Thus, we need to foster the abilities of communities to develop state contingent plans that deal with variability and drought, with tangible actions and plausible financial plans for a variety of potential climate change scenarios.

Climate Change, Risks, and Adaptation in Mali

Mali is particularly sensitive to climate change due to its reliance on primary products, notably cultivation, livestock production, and fishing. Although the agricultural sector contributes 35 per cent of GDP on average, it is very vulnerable to shocks such as droughts, floods and pest attacks. As a result, agricultural contribution can vary greatly from one year to the next.

The region of Mopti has a distinct hydrological profile. Although the watershed of the Niger River covers most of the region, a small part of the southern zone falls in the Black Volta watershed. The different branches of the river create areas of high potential for exploitation with numerous ponds, lakes, and lowland areas that hold water. Further, this watershed leads to the existence of numerous areas of subterranean water that can be accessed and used, which are renewed by the rains and the rivers that flow through the region.

The availability of water to future generations is threatened by: declining levels of rainfall; the ensuing decline in the seasonal flood and extent of the flood plain; and increasing human and animal pressure on existing resources. These changes result in the silting of fields, erosion of banks where water flows, denuded vegetation, declining productivity, and conflicts between groups who jointly use these natural resources.

Climate Risks, Drought and Desertification in Mopti¹

Climate risks can be slow evolving adverse trends or sudden adverse shocks. Examples of slow evolving conditions in Mali include an increase in the average temperature, an increase in the daily maximum temperature, changes in how rain is distributed spatially and temporally, and increasing water temperature in rivers and lakes. Examples of shocks identified by the study include drought, desertification, heat waves, landslides, and wildfires.

1 The definition of 'desertification' has been subject to much debate. For the purposes of this study, the authors use the definition proposed in the United National Convention to Combat Desertification—"land degradation in arid, semi-arid, and dry sub-humid zones resulting from various factors, including climatic variations and human activities (UNCDD, 1994).

'Drought' is also a term that is subject to some debate. Here, the term is used to represent a natural phenomenon that occurs when rainfall is perceptibly below the long-term average for an area. The reports distinguish between a meteorological drought (rainfall deficit), an agronomic drought (the timing and amount of the rain is poor for plant development), and a hydrologic drought (the flow of the water through the watershed is in deficit).

Climate changes are further aggravated by irrational practices of exploiting natural resources that lead to soil exhaustion, deforestation, erosion, pasture degradation, drying up of water points, and loss of biodiversity. This increases the risks people are exposed to, and the vulnerability expresses itself as a connection between the probability of a shock and the capabilities developed by households.

Droughts have been a long-term challenge in the area of Mopti. The years 1974–1984 were particularly notable, with a series of droughts, floods, and locust invasions. The effect of these events was particularly acute in the north of Mali, impacting the mean and variation about that mean for annual rainfall.

Humid Zones

The Inland Niger Delta is generally considered a humid zone. The lakes, rivers, and ponds of the area interact with the flood plains to make this a critical resource. Further, this zone has a critical ecological and economic importance: it enables the international migration of birds and provides for the existence of densely populated human communities.

In the humid zone commune² of Korombana, residents are experiencing a decline in the flood level, degradation of the aquatic animal fodder *bourgou* (*Echinoloa stagnima*), reduction of natural habitats for wildlife (notably waterfowl), and the chemical and organic contamination of surface waters. Korombana serves as an example of a commune that is a critical resource, which is facing pressures that are only expected to increase as the population grows.

The key question for such areas is whether communities will be able to plan and manage resources to capitalise on the natural resource abundance of humid zones, or whether an unplanned process of overexploitation, in-migration, and conflict will lead to an undesirable alternative.

Arid Zones

In the arid zone commune of Dangol Boré in the cercle³ of Douentza, residents are even more exposed to climate risk. The land is characterized by bush-covered savannahs, rocky soils, and sandy soils. There are high temperatures and high rainfall variability. A large forest is used by around ten villages in the area, where the population harvests fuelwood and uses timbers and animal fodder from *Pterocarpus* trees to sell in markets in Mopti and Sévaré. The villages also have some small temporary ponds, plains watered by runoff from higher elevations, transhumance corridors for livestock, and a local land use management plan implemented by a multi village association (Kelka).

This area is exposed to climate change risk in terms of slow regeneration of ligneous material, soil exhaustion, silting and early drying of ponds, soil erosion (by water and air), and a lack of extension of seed varieties that are better suited to local growing conditions. Management of rangelands and forest resources remains a daunting challenge.

2 A commune is the third level administrative unit in Mali. Cercles are divided into Communes, Rural Communes, and Urban Communes.

3 A cercle is the second level administrative unit in Mali; regions are divided into 49 cercles.

Semi-humid Zone

The semi-humid zone commune of N'Diaptodji in the cercle of Douentza, has the distinction of being astride two distinctive types of geographic reliefs. In the north, the zone is marked by a riverine system of lakes, ponds, flood plains, and the Niger river itself; parts of the peripheries are dominated by massive doum palm trees (*Hyphaena thebaica*). In the south, there are dune formations, sandy and rocky soils and vegetation that is adapted to these kinds of soils (*Pennisetum pedicellatum*, *Panicum laetum*, *Andropogon gayanus*, *Leptadenia pyrotechnica*).

Rainfall in these areas is characterized by irregularity, specifically in terms of the distribution of rainfall over space and time. This leads to a weak recharge of aquifers, drying up of ponds, lower water levels in flowing rivers, silting of fields, and a decline in vegetation, notably pastures.

A significant problem in this area is the expansion of cultivation, leading to fields encroaching on transhumance corridors and areas formerly used as rangelands. This is a source of conflict between herders and cultivators. In addition, the loss of vegetation is a problem not only for the herders, but for the overall biodiversity.

Existing Knowledge and Frameworks on Climate Change in Mali

It is important to understand current knowledge of climate change and existing estimates of future impacts of climate change.

The African Monsoon Multidisciplinary Analysis (AMMA) is analysing the impacts of climate change. The Permanent Interstates Committee for Drought Control in the Sahel and partners are preparing a regional strategy for West Africa. The next critical step is how to implement elements of this strategy in terms of finances and institutions. It is also important to understand how this regional plan complements the Plan d'Action Nationaux pour l'Adaptation (PANA).

The Law of Agricultural Orientation adopted in 2006 is the legal framework for agricultural development in Mali. The principle orientations of the law are: the critical importance of food security; poverty reduction; modernisation of household agricultural producers; and environmental protection and management of natural resources.

The modernisation reforms, especially those led by the Office du Niger, have privileged large investments that are capital intense and tend to displace local producers. These efforts are unwise in the face of climate unpredictability and have not always met their production objectives, often due to variability in floods and rainfall. In addition, these kinds of efforts do not place sufficient emphasis on the roles of females in agriculture, where production and marketing often follow a gender-based division of labour.

Local Knowledge in Mali

Within this context, indigenous technical knowledge is not being valorised at present. However, the current effort of decentralisation makes it possible to tap into this knowledge. Local communities know the gaps inherent in the land management systems they face. The political context is largely positive for local communities to develop plans for durable management of their natural resources, with the adoption of the PANA noted above.

Indigenous technical knowledge, known and practiced in the region, provides an important base for addressing climate change and adaptation.

Climate Predictions

Communities use a variety of signals to predict climate: the presence of migratory birds, the appearance of particular caterpillars in the fields, the way nests are built by birds, the changing wind direction, how rainbows manifest, flowering and fruiting of tree species, outbreaks of animal diseases, herbivory changes, and the presence of particular fish species in the waters of the area.

For livestock keepers, actions taken in response to such signals are primarily tied to mobility. They will decide where to go and when to go based on these and other signals. For cultivators, answers to questions such as what variety to plant, when to plant, and where in the toposequence are all potentially influenced by such information.

Land Use and Disaster Management Planning – Local Level

Mali has had a variety of shocks post-independence, and has learned from a process of decentralization and land use and disaster management planning at the community level. A variety of activities have been undertaken, often with the assistance of donors.

Reforestation. This involves organising the population and building their capacity to put in place a program of rehabilitation and sustainable management.

Soil conservation. Construction of anti-erosion barriers, planting soil and nitrogen fixing bushes, and other varied soil and water conserving techniques.

Natural regeneration, assisted by seed scarring and planting. This takes tree and bush varieties known to be adapted to the ecosystem and fosters their growth by deliberately planting them and protecting them. The seed scarring refers to the fact that many of the indigenous seeds need processing to simulate the experience of passing through an animal's digestive system in order to be ready to germinate, often involving physical scratching of some kind.

Restoring vegetative cover. A variety of techniques can be used to support vegetative regeneration, including stone anti-erosion barriers, the Zai technique of digging small holes and applying manure to the holes before planting, and the construction of living fences.

Protection of pasture by controlling brush fires. This can involve better community monitoring and response, training in fire combatting techniques, and establishing fire breaks to prevent the spread of fires.

Rainwater harvesting. This can largely focus on the small seasonal ponds that form during the rainy season. Better management and conservation can be realised both by better organisation and by technical measures such as deepening and building small dams to prevent outflow. In the more arid plains, digging small holes is possible in soils with more clay, and small dikes, barriers and other structures can better control the flow of rainwater and reduce runoff.



Simple dams capture rainwater runoff to support agriculture and livestock while improving infiltration and groundwater levels. (Photo: NEF)

Gravity fed water systems. In the village of Ganah, NEF has had success with introducing a gravity fed water system. Springs in the cliffs above were tapped to provide a flow of water to the village below. The flow was directed to different areas where it has different uses: a garden, a watering trough, a laundry area, and human consumption.

Market gardening. This is a way of using subterranean water and the relative labour abundance that is realised during dry season. With assistance on the water point and the fencing, much has been accomplished to increase revenues through market gardening. Often oriented towards the weekly markets, market gardening provides a regular source of income to producers. Frequently, it is a task undertaken by women and women's groups. They can often benefit from help by programmes in both the agronomy of production and in developing marketing, accounting, and management plans.



Market gardens help communities increase revenues (Photo: NEF).

Securing pastoral mobility. As part of the development of local conventions – legally binding agreements that govern use of shared natural resources, a key element is to identify transhumance corridors and ensure they remain viable and are not impeded by fields with crops.

Restoring bourgou fields. Bourgou mismanagement has been a major issue in the Inner Niger Delta. This natural resource has been subject to too many claimants, and as a result has produced less animal fodder than is potentially possible. In addition, many bourgou fields have been replaced by rice fields. NEF has found great success in training people in the restoration of bourgou fields and developing management systems of these fields. The benefits can show up in the form of higher revenues from livestock sales as animals can be fattened before sale, higher milk sales revenue, more revenue from fishing as bourgou fields foster fish reproduction, and a drought fodder reserve.

Changing cultivation practices. Changing seeding dates, using different varieties, agroforestry techniques, soil and water management all play a part in adapting to climate change and variability.

Reducing wood use. Some positive experiences have been realised through the use of improved cook stoves, introduction of butane as a cooking fuel, and fuelwood management systems.

Early Warning Systems

Early Warning Systems have been developed in Mali and provide up to date information on: zones experiencing food security/nutritional crises; the likely onset and duration of these crises; and the needs that will result from these crises.

Drought Cycle Management. Acting as if drought is an unexpected event is not reasonable based on the experience to date. Programming for drought is critical.

At a larger scale, the Agricultural Orientation Law of 2006 noted above includes a chapter on the prevention of risks and management of major risks and agriculture crises. It notes, “The State and the local administration are responsible for the prevention and management of major risks and natural disasters impacting agricultural production. In light of this, they are putting in place a system of monitoring and prevention that implicates all actors in this sector.” This is matched by a National Fund for Disasters and Crop Failure that allow funding for such plans.

Past Responses

Past responses to drought have included: food security through food distribution, post-drought herd reconstruction, construction of animal shelters, distribution of seeds following the drought, tools and production equipment, and infrastructure rehabilitation.

Climate Risk and Adaptation in Senegal

Precipitation variability has been a pronounced challenge in Senegal since the 1970s. The hydrologic deficit combined with poor natural resource management, notably in land use, has led to poor agricultural productivity. Adapting to this reality is the key challenge faced in reducing the vulnerability of rural communities in the Sahel.

In Senegal, the battle to confront soil erosion is traced to the colonial era. The post-colonial government of Senegal has continued this battle, and has developed a research agenda to minimise the negative impacts of climate change on the ecosystem and the population.

Notable in this effort has been the project to reforest Senegal (Projet de Reboisement du Senegal-PRS). This accomplished an annual reforestation rate of 14,000 hectares a year between 1993 and 1998, although this stands in disappointing contrast to estimates of the deforestation rate of 80,000 hectares per year for the same period. This contrast, and a growing awareness that reforestation alone was not up to the challenge of combating desertification, has given rise to a more multidimensional approach to the challenge of climate change we see today in Senegal.

Senegal from independence to the 1990s had a centralised, top down approach to forest management. Since the 1990s, the forest policy in Senegal has been modifying from the centralised, rules and fine based approach of the “Eaux et Forêts” model to adopt a more community based, participatory approach. There is growing appreciation that communities must be central to defining and implementing responses to mitigate and adapt to climate change. A series of projects have been based on the concept of community definition of the management of natural resources that has accompanied a larger process of decentralization of politics in Senegal. These experiences will influence programming of the proposed BRACED project in the Kaffrine region of Senegal, as well as its work in Mali.

History of Activities to Combat Desertification in Senegal

The report provides a conceptual timeline of activities to combat desertification in Senegal. From 1970 to the mid 1980s, approaches were dominated by reforestation, which was generally top down, centralized, operated from government-managed tree nurseries that were run with hired workers, and had minimal involvement of the local population. This was a relatively costly approach to the problem, and was not effective in combating deforestation.

From the mid 1980's to the start of the 1990s, community based forestry was introduced. This was centered on the community forest, where there was some opening for profits to be made by the

community by managing and selling forest resources. There was still a large focus on reforestation, and a continued emphasis on the planting of exotic species (Neem and Eucalyptus were prominent). Community based forestry was supported by the forestry department through the provision of technical support, in how to operate community tree nurseries.

In the 1990s, there was a shift from 'forestry' to a more holistic sense of territory management. Natural resource management in the context of agro-pastoral production systems shifted the understanding of management from protecting classified forests to managing natural resources in the context of sustaining agro-pastoral livelihoods. Land use and land management plans were increasingly put in the hands of local communities, though often without technical and financial support. Handing over decision-making to 'the community' proved problematic in the context of marginalising women in community decision-making unless adequate precautionary steps were taken, given the gender roles in place.

This led in the following decade to an emphasis on governance. The 'local convention' approach came to dominate natural resource management in Senegal, often with the assistance of NGOs. More attention was given to gender roles and gendered aspects of land use management. All this was taking place in the context of growing decentralisation of land use authority from the top down. Eaux et Forêts model of protecting natural resources from the population gave way to a new approach of having the community define natural resource management.

Outcomes were mixed. In some cases, local conventions brokered by NGOs were transformative. In others, the convention never had any impact beyond a document produced in a donor-funded workshop. In a recent study of local conventions in Senegal, a telling quote describes the devolution of authority to local levels by the state as akin to 'an empty envelope', with all the pomp of the centralised state mailing notification of the transfer of responsibility to the local level only to find there are no resources in the envelope to actually implement the devolved mandate.

In the recent past, the battle against desertification/effort to reforest Senegal has been modified to meet the donor focus on adaptation and mitigation of climate change. There is a growing emphasis on resilience in programming, acknowledging that variability is a feature of this environment and programming to embrace this reality. In addition, there is growing emphasis on planning for how to adapt to climate change, with new approaches such as scenario planning. These go beyond 'local conventions' to explore community perceptions of how the plan would change in response to long-term changes in climate. BRACED will be a strong voice in this new era, and will play a prominent role ensuring the voices of women and children are heard in the definition of these long-term scenarios as it continues to be a challenge to have their voices heard in community based approaches.

An Overview of the Kaffrine Region

Kaffrine only became a region in 2008, having been formerly part of the region of Kaolack. Kaffrine has 4 departments, 5 communes, 9 arrondissements, and 28 *communautes rurales* (which are in the process of becoming communes). The rainfall level is in the 500mm to 800mm annual range, and rainfall comes in the June to October months.

Cultivation in Kaffrine has expanded in line with a population shift out of the peanut basin and to the north, and also along a zone that is crossed by transhumant herders who are based farther to the north. There is a seasonal flow of animals from the northwest to the southeast of Senegal that traverses the region, and a longer-term shift in human population in the same direction. The people of Kaffrine are working to respond to both movements in the context of climate change. Notably, there is evidence that

the intensity of rainfall may be increasing. In one day last year, Kaffrine experienced a rainfall level of 160 mm. At the other extreme, brush fires continue to be a problem; 12 cases were recorded in 2013. The removal of vegetation due to brush fires and the sudden inundation of intense rainfall combine to remove critical topsoil, undermining the effort to improve resilience and calling for additional support.

Community Level Models to Foster Resilience in Kaffrine

Communities in Kaffrine have demonstrated experience in working, often with partners, to improve human and natural systems. These offer model for what is possible in the region, and for what could be undertaken through the BRACED project.

Natural Regeneration

This is largely based on working with communities to protect plants that grow in the environment and ensure they grow through natural regeneration. In some cases, economically valuable natural plants are selected, allowing the effort of protecting to be rewarded in the future with economic returns. World Vision has been conducting efforts along these lines in Kaffrine since 2009.

Fire Breaks

Another method that has been developed by communities in collaboration with partners is fire breaks. These can be either clearings that do not allow fire to pass from one area to another or live fire breaks, where a succulent species is planted to form a 'green wall' to a fire. These can also lead to climate change mitigation, as the planted species sequester carbon.

Zai

A method of planting adopted from Burkina Faso, called "Zai" has been growing in the region. This involves digging holes of about 15 centimetres in depth and 24cm diameter and filling them with manure. These are spaced around 40cm from each other. The holes help trap rainwater, the manure improves soil fertility, and the combined effects can reduce soil erosion and improve yields.



IED-Afrique

Half-moon cultivation

A variant of the "Zai" is the half moon cultivation technique. Here, a larger hole is dug, still to a depth of about 15 centimetres to 20cm, but with a radius of between 2 and 4 meter and spaced about 8m apart. The holes provide mini-catchment zones for water, and can improve yields while reducing erosion.

Small dikes

A different method that is seen in Kaffrine is the building of stone walls in fields. The rainwater, which contributes to sheet erosion, is combatted by building small dikes in fields that block the natural flow of water and allow it to infiltrate rather than run off. Since 2002 projects have been introducing this technique in Kaffrine.

Micro irrigation

Projects have recently introduced micro irrigation in areas where there is water available for pumping. Small motopumps are introduced with systems of tubing to deliver water to plants in a more regular fashion than can be provided by irregular rainfall. This can deliver high yields and profits, though the large financial capital costs make widespread adoption a challenge.

Composting

Composting has been promoted as a means to enhance soil fertility in the region. This takes manure and organic matter and mixes them before applying them to fields. A recent United States Department of Agriculture (USDA) project introduced the method to a village in the region of Kaffrine in an effort to increase the value of millet yields.

Fallowing

Another, long known, method for enhancing soil fertility is fallowing. Fallowing, and placing grazing animals on fallowed fields, is a low cost, well known approach to maintaining and enhancing soil fertility.

Local Conventions

The concept of Local Conventions is revisited, noting that it has been prominent in Kaffrine, particularly with regards to forest management. They are noted as being one of the most prominent approaches currently under use in much of West Africa and will certainly be an area of opportunity for the BRACED program.

Early Warning Systems

Early Warning Systems are playing an increasingly important role, and are being integrated into development programming. The National Agency of Civil Aircraft and Meteorology (ANACIM) under the action research project CCAFS (Climatic Change and Agroforestry in Senegal), implemented early warning systems in the region to improve responses to climate-related disasters such as bushfires and floods. These systems also enable farmers to better plan planting dates, to prevent delays and respond to other possible risks.