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FAMINE MITIGATION INTERVENTION OPTIONS MANUAL: NIGER

USAID/NIGER DISASTER PREPAREDNESS AND MITIGATION PROGRAM

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INTRODUCTION

This manual describes interventions to mitigate famine, particularly drought-related famine, in Niger. They are presented in a series of design papers, each one outlining implementation guidelines, the circumstances under which the intervention is appropriate, and its potential impacts. The interventions were identified through a literature review and a field survey that included project site visits and interviews with villagers, government officials, NGOs, donors, international research institutes, and technical specialists. The manual is intended to facilitate the development of famine mitigation proposals for funding under the USAID/Niger Disaster Preparedness and Mitigation (DPM) Program.

THE DISASTER PREPAREDNESS AND MITIGATION PROGRAM

The DPM Program recognizes the recurrence of famines in Niger and seeks to strengthen the ability of the Government of Niger (GON) to respond. On the preparedness side, the Program establishes a GON famine early warning system, the *Système d'Alerte Précoce (SAP)*, to provide information on the causes and geographical distribution of famines. On the response side, the DPM Program establishes an Emergency Fund for rapid implementation of mitigation interventions. The Fund is designed so that other international donors can contribute to it as the GON's institutional capacity to cope with disasters improves.

The DPM Program creates opportunities for a wide range of agencies and organizations to participate in designing and implementing famine mitigation interventions. These may be private sector enterprises, national or international NGOs, village associations, or government agencies at the national, departmental, or *arrondissement* (county) levels. Any group that wants to implement an intervention will be required to submit a formal proposal to the *SAP Cellule de Prévention, Secours et Atténuation des Catastrophes (PSAC)*. Funding requests will be made using a concise form designed by the DPM Program management and *SAP*. Funding awards will be based on a review committee's assessments of the disaster's severity, the proposal's technical and social soundness, the organization's ability to implement it, the expected impact on the beneficiaries, and the extent to which the beneficiaries are willing to participate in and contribute to the proposed activity.

Program resources from the Emergency Fund will be awarded to implementing agencies and organizations through a contract with the GON. Funds can be applied to the <u>non-recurrent costs</u> of inputs, management, technical assistance, and transport. The mitigation interventions may be implemented through Food- or Cash-for-Work (FFW/CFW) or provision of credit. They may require large-scale labor organization (FFW public infrastructure construction) and considerable inter-agency coordination, or they may be small-scale, such as wells for dry-season gardening. Interventions will be implemented where needed, at the village or regional level, primarily in food deficit areas. Most will be short-term, operating for six months to a year. Designs must be site-specific, taking full account of local social and environmental conditions, in order for the interventions to be effective.

FAMINE MITIGATION

Mitigation connects disaster relief and development. The ideal mitigation intervention provides immediate, short-term benefits while promoting long-term food security. It builds upon and enhances local coping strategies. Other desirable characteristics are quick implementation time, low cost, sustainability, replicability and a measurable impact on a large number of beneficiaries. Famine mitigation interventions may:

- Provide employment using cash- or food-aid to achieve long-term infrastructural or environmental benefits;
- Prevent the loss of or restore households' productive assets;
- Increase food production;
- Increase peoples' and households' access to food; and
- Increase peoples' productivity through improved health and sanitation or by alleviating conditions requiring large labor expenditures.

The intervention design papers in this manual address all of the above objectives as well as disaster preparedness. They provide examples of the kinds of activities that can be undertaken using DPM resources. Specific mitigation goals are given for each intervention. Some design papers reference others as complementary components or for additional information. Although the design papers constitute off-the-shelf project ideas, they do not contain sufficient detail to be submitted as proposals. Costs, materials, management requirements, and impacts will vary according to site, project scale, and currency value.

The fact that an intervention is in the manual does not guarantee that as a proposal it will automatically qualify for funding under the DPM Program. Nor are interventions eligible for funding limited to those contained in this manual. DPM/*SAP* is the final authority for setting funding priorities and guidelines, and for approving interventions for implementation.

IMPLEMENTATION: MATCHING INTERVENTIONS WITH PEOPLES' PRIORITIES THROUGH COMMUNITY PARTICIPATION

Knowledge of the local cultural and socio-economic context is essential for implementing successful famine mitigation interventions. While the technical aspects of the proposed interventions may be relatively easy to modify, the socio-economic context is not. The design papers are generic but proposals for implementing them require participatory, site-specific field research to identify villagers' priorities and the local socio-economic and technical factors that may affect implementation of the chosen interventions.

People in different areas of rural Niger report the same basic needs succinctly: more food, water, and cash. Increasing the availability of food and water is the objective of their economic activities, particularly in the dry season. Villagers' and pastoralists' priorities for donor interventions therefore focus closely on activities directly related to food and water production or on those which generate cash to buy them. The needs that outsiders might

identify -- education, sanitation, nonagricultural employment -- are rarely reported.

People's fundamental short-term needs deflect their attention from long-term needs such as sustainable Natural Resource Management (NRM). Participatory field research can help implementors identify interventions that match local priorities, which contributes to greater impact and sustainability. A participatory approach also helps expand the villagers' understanding of the range of alternatives available for addressing their basic needs.

The rural population currently uses few traditional or project-designed NRM techniques. The traditional techniques they reported for improving soil fertility are fallowing, using manure, and making a type of water catchment in the grain fields using lines of stones that follow the contour. Several groups reported that they cannot fallow their fields due to lack of sufficient farm land. One group reported using chemical fertilizer on cash crops (Galmi onions) and others want to use it on their grain crops but cannot afford it. *Zais*, small water-harvesting catchments, have been introduced to Nigerien farmers and seem to be the technique most readily adopted because it matches their labor capacity. *Demi-lunes*, another type of catchment, apparently are not adopted because, as designed by current projects, they require more labor than farmers are willing to invest.

People consistently report that the quality of the rains determines the quality of their harvests, and this fundamental truth certainly influences their attitude toward allocating scarce resources (land, labor, capital) to NRM techniques. From the farmers' point of view, especially those who have been exposed to inappropriate or badly designed technology requiring too much labor compared to the returns, it is not worth investing in modern NRM techniques unless they are compensated for doing so because the potential gains are small or long-term. Interventions that include labor-intensive public works or NRM projects probably will have to compensate participants with food or cash, a strategy that can provide employment during food shortages while contributing to long-term public benefits.

Requiring villagers to contribute local materials, labor, or cash is one way of helping to ensure that interventions match village priorities, because it is a concrete statement of investment and project ownership. This approach helps avoid creating dependency and a "gift" mentality. It also avoids undermining other self-help projects operating in the area. The character of village leadership and social cohesion also affect the complexity of the interventions which can be undertaken and their likelihood of success.

CURRENT COPING STRATEGIES

Men's migration to work outside Niger during the dry-season is a structural part of the rural economy in most areas. Households need to generate cash to buy what they cannot produce, including staple grains. During our limited fieldwork farmers stated that they harvested 0-5 months of subsistence grain this year and therefore need to generate income to meet their food requirements for the rest of the year. One of men's primary coping strategies is seasonal migration to neighboring countries to send home remittances to help support their families.

Other dry-season economic activities are limited. Men may travel to Niger's urban centers to do commerce, or stay at home and engage in petty trade in commodities. They may sell some of their harvests (peanuts, sesame, hibiscus) or buy livestock and fatten them up for resale. Traditional dry-season activities such as building and repairing houses, cutting straw, and doing agricultural wage labor (such as making *zais*) are reported to generate little income.

Women generally remain in the village during the dry season; in crisis years when the men migrate they are responsible for supporting the household with local resources. Their food- and income-generating activities also are limited. Dry-season gardens are one activity, even when wells are over 35 meters deep, because they produce both food and income. Women also weave mats, make pottery, gather wild foods, engage in petty trade, sell food, transform agricultural products (i.e. dry vegetables, make peanut oil), and fatten small livestock for the market to earn money. Cutting wood to sell is another activity done by both women and men.

Men and women reported that their priority is to improve their agricultural production. Both want credit in order to buy livestock for resale or to engage in commerce. Men want access to short-cycle seed for their staple grain crops and carts to transport their inputs and harvests. Women want to establish dry-season gardens or expand the ones they have, mainly by acquiring motor pumps (that may be unsustainable due to maintenance costs). Women also want access to credit in order to buy livestock and do commerce. A few women's groups reported that they wanted education and to learn income-generating skills such as sewing.

OTHER IMPLEMENTATION ISSUES

Resource tenure and the forthcoming new Rural Code are factors that must be taken into account with many interventions. The development of the Rural Code leaves resource tenure issues in flux. Agencies implementing interventions must investigate and understand resource tenure issues in each village where NRM interventions are planned.

Droughts are critical times in which to implement interventions. Even in good years food security in Niger is marginal. During droughts the land is stripped of vegetation, especially through overgrazing by livestock, and by wind and water erosion. Interventions are needed that convert livestock to other forms of income and do not encourage overstocking.

Table 1 (below) shows the interventions organized by sector and by a summary of their characteristics. They are rated in terms of cost and complexity. These ratings are general; the actual cost and complexity depend on the scale and scope of the intervention, and the circumstances under which it is implemented. For example, an intervention to improve one well obviously will increase in cost and complexity if it is expanded to include 100 wells. In cases where the costs and complexity can vary in this fashion, the rating applies to a small-scale, limited-scope implementation. Factors affecting an intervention's cost and complexity

include:

- Is it necessarily geographically widely distributed?
- Does it require cooperation between multiple organizations?
- Does it involve Food for Work?
- Does it require other expensive inputs?
- Does it employ or require the participation of large numbers of people?
- Does it have multiple components?
- Does it attempt to relieve a particularly intractable constraint?

Some of the interventions are time-sensitive and must be implemented at a certain time during the agricultural season in order to achieve the desired result. Some provide immediate benefits, primarily cash or food, as soon as they are implemented, in the form of contributions by the donor or immediate results. The impacts of some accrue within a single agricultural season while the benefits of others do not materialize until a year or more later. The options attempt to fit as wide a range of needs and circumstances as possible. The cross-cutting issues at the bottom of Table 1 are particularly important because they apply to many of or all of the interventions.

Table 1 Intervention summary

INTERVENTION	COST/COMP-LEXITY	WHEN TO INITIATE	IMMEDIATE BENEFIT	LONG-TERM RESULT
Irrigated agriculture				
WOMEN'S COMMUNAL DRY-SEASON GARDENS	Medium	Dry season	FFW (optional)	Food (potentially within a single season)
VEGETABLE TRENCHES FOR GARDEN PRODUCTION	Low	Dry season		Increased garden productivity
Water resources				
MODERN WELLS	Medium	Finish by June	Water	Health, livestock, agricultural production
GRAY WATER FOR TREES AND DUCKS	Low	Anytime		Food (potentially within a single season)
Economic diversification				
SMALL CREDIT PROGRAM	Medium-High	Anytime	Cash	Household economic security
WOMEN'S SAVINGS AND LOAN PROGRAM	Low	Anytime		Household economic security
FOOD FOR THOUGHT: VILLAGE TRAINING CENTERS	Low	Dry season	FFW	Household economic security
Livestock				
ANIMAL DESTOCKING AND MEAT PROCESSING	High	On early warning (July)	Cash/Food	Income, food, reduced environmental stress
COMMUNITY VETERINARY AIDE TRAINING	Medium	Dry season		Livestock health
Rainfed agriculture				
PHOSPHATE FERTILIZER	Low	Prior to growing season		Food (potentially within a single season)
ON-FARM APPLIED RESEARCH	Low	Depends on technique	FFW (optional)	Food, NRM (depends on technique)
MICRO-CATCHMENT WATER-HARVESTING FOR AGRICULTURE	Low-Medium	Dry season	FFW	Food, NRM
Natural resource management				
NATIVE SEED COLLECTION FOR REVEGETATION	Medium-High	All year	FFW	NRM (most impacts take several years)
WATER-HARVESTING ON RANGELANDS	Medium-High	Dry season	FFW	NRM (most impacts take several years)
Seeds and grain				
SEED DISTRIBUTION AND GRAIN REPURCHASING	High	Prior to growing season		Food, income (within a single year)
VILLAGE CEREAL BANKS	Medium-High	Dry season		Food security
Public works				
GABION CHANNEL PLUGS	High	Dry season	FFW	NRM
ROAD IMPROVEMENTS	High	Dry season	FFW	Market access
Cross-cutting				
EXPANDED EXTENSION SUPPORT	Medium	Depends on technique		Food, water (depends on technique)
FOOD FOR WORK	High	Mainly dry season	Food	Intervention-dependent
INTERVENTION MONITORING		All interventions		Improved intervention management
APPENDIX A: RESOURCE TENURE AND THE RURAL CODE	Cases involving land improvements		Decreased conflict over resources	

LIST OF ACRONYMS

AD	After Devaluation of the *CFA* (January 1994)
AFVP	*Association Française des Volontaires du Progrès*
AGRHYMET	Agricultural/Hydrological/Meteorological Program
AIDS	Acquired Immune Deficiency Syndrome
API	Assessment of Program Impact
BALD	*Bureau d'Animation et de Liaison pour le Développement*
BD	Before Devaluation of the *CFA* (January 1994)
CCIC	Canadian Council for International Cooperation
CFW	Cash for Work
CFA	*Correspondant Franc African*
CILSS	*Comité Interétats de Lutte Contre la Sécheresse au Sahel*
CLUSA	Cooperative League of the United States of America
CORRA	*Comité Régionale de la Recherche Agronomique*
DDH	*Direction Départementale d'Hydraulique*
EERN	*Eglise Evangélique de la République du Niger*
FAO	United Nations Food and Agriculture Office
FEWS	Famine Early Warning Systems
FFW	Food for Work
FFT	Food for Thought
GON	Government of Niger
IBPGR	International Board for Plant Genetic Resources
ICRAF	International Center for Research in Agro-Forestry
ICRISAT	International Crops Research Institute for Semi-Arid Tropics
IIMI	*Institut International du Management de l'Irrigation*
ILO	International Labor Organization
INRAN	*Institut National de Recherche Agronomique de Niger*
NGO	Non-governmental Organization
NRM	Natural Resource Management
NRMS	Natural Resource Management/Sahel
OFEDES	*Office d'Exploitation des Eaux du Sous-Sol*
ONAHA	*Organisation Nigerien de l'Aménagement Hydro Agricole*
ONVPE	*Organisation Nigerienne des Volontaires pour la Préservation de l'Environment*

OPVN	*Office des Produits Vivriers du Niger*
PRA	Participatory Rural Assessment
SAP	*Système d'Alerte Précoce*
SWC	Soil and Water Conservation
TA	Technical Assistance
UNC	*Union Nationale des Coopératives*
USAID	United States Agency for International Development
UNDP	United Nations Development Program
UNICEF	United Nations International Children's Education Fund
WFP	World Food Program
WID	Women in Development
WOCCU	World Council of Credit Unions

WOMEN'S COMMUNAL DRY-SEASON GARDENS

DESCRIPTION

Cultivating dry-season household gardens is a preferred economic activity for Nigerien women of both agro-pastoral and sedentary agricultural ethnic groups. Women report that the produce is consumed by the household, which contributes to dietary diversity and to the food supply in the dry season. The produce also is sold, which contributes to household income. Women can cultivate individual plots independently or work in a communal parcel given to a women's group by the village authorities. Essential inputs consist of a fence and wells. Pulleys are required to raise water from deep wells. Buckets, tools, seeds, and technical assistance are optional inputs, depending on village needs. Women's traditional garden crops include: sesame, okra, Bambara groundnuts (*vouandzou*), sorrel, peanuts, sedge/tiger nut, *fonio*, manioc, and sweet potatoes. They also cultivate a variety of vegetable crops when the seeds are available, including: lettuce, eggplant, carrot, parsley, squash, hot pepper, onion, tomato, and mint. Fruit trees (mango, lemon, guava, mandarin, and grapefruit) also can be grown in the fenced gardens. Food for Work (FFW) can be used to support village labor to build fences and the wells, prepare the earth, and plant the trees.

SELECTION CRITERIA

Dry-season gardens contribute to household food supply and dietary diversity and can generate cash income. Gardens with wells can be established and potentially begin producing within a single dry-season. Given some technical assistance for development, they can be a short-term intervention with long-term, sustainable benefits. Thus they make a direct, albeit limited, contribution to increased resilience during food deficits, and can provide limited, short-term relief through FFW. FFW may not be a necessary input in all cases. The possibility of obtaining a well may be a main attraction of this intervention for the beneficiaries.

Dry-season communal gardens are appropriate where:

- women are interested in establishing or expanding them;
- a women's association exists or can be formed to negotiate access to land for the communal garden and to pay for structural maintenance costs;
- women are responsible for producing food and/or generating income for the household during the dry season, when the men are likely to be absent;
- village authorities will give a women's group a parcel of land (1-5 hectares); and
- the water table is sufficiently close to the surface that women will be willing to invest the labor required to lift it.

Lack of major markets for produce does not discourage women's desire for gardens because the production is mainly for household consumption. Surplus produce is sold in local markets.

Dry-season gardens have become an important activity for women during the past decade and women may benefit from technical assistance to improve efficiency of labor and other inputs. Extension assistance may also be useful in the management of wells and irrigation systems (see **Expanded Extension Support**, p. 41).

The site-specific technical and marketing feasibility of dry-season gardening must be discussed by the villagers and the implementing agency. Factors such as deep water tables may pose technical and economic constraints that the villagers do not recognize. Site-specific technical assessments and participatory village decision-making are necessary to determine when gardens are a viable intervention.

IMPLEMENTATION

Women's time: women generally have more time available for income-generating activities -- including FFW labor and gardening -- in the dry season. A communal garden can be built when their harvest responsibilities are completed, early in the dry season. However, the garden might not be completed (i.e. fenced, functioning wells) in time to be sown that same dry season. In this case the garden may not be cultivated until the following dry season because women help cultivate the staple cereal crops during the rainy season.

Inputs: construction materials for building a metal fence with gates, or a temporary metal fence and seedlings to plant live fencing; well/s with pulleys to raise the water. The need to provide hand- or gasoline-powered pumps, buckets, tools, and seeds is site-specific. The implementing agency can establish a credit fund in order to provide women access to seeds not locally available, or they can use local seeds.

Technical assistance (TA): local NGO/extension agents can provide TA, if necessary. TA for pest control and well maintenance are likely to be recurrent needs. Training in integrated pest management will decrease crop losses caused by infestations. On-going, periodic assistance from extension agents may be beneficial for introducing new techniques and crops (see **Vegetable Trenches for Garden Production**, p. 14).

Maintenance: maintaining machines such as pumps (manual or motor) is a male responsibility. Women may lose control of the pumps unless they have an association that can fund the purchase and maintenance of their pumps. Pumps can be difficult to maintain in working order.

Monitoring: monitoring the performance and impact of this intervention includes collection of both pre-intervention baseline data and follow-up. Indicators include:

- number of women cultivating dry-season gardens;
- crops cultivated in women's dry-season gardens;
- number of fruit trees on household land;
- number of fruit trees in the communal garden;
- area actually cultivated in dry-season garden sites;

- quantity and variety of garden produce consumed by participating households; and
- quantity and variety of garden produce available in local markets.

Management requirement: low. Mainly procurement of construction materials, FFW resources, and construction supervision. Agricultural TA initially necessary, along with some on-going maintenance.

IMPACT

Dry-season gardens are particularly appropriate as a woman-oriented project and have a positive impact on women because:

- they traditionally are women's work;
- they provide essential products; and
- women can market the products and control the income (men control staple and cash crops).

Gardens' impacts on households include:

- increased food security and dietary diversity from producing fruits and vegetables that otherwise would not be available;
- increased cash income, a priority in the dry season;
- productive use of women's and girl's labor in the dry season; and
- increased quantity and diversity of useful plants, such as multipurpose trees and traditional medicinal plants.

Impacts on the environment are:

- possible salinization of the soil if irrigation water has a high salt content and unsustainable irrigation techniques are used;
- reduced environmental degradation through an alternative productive activity to those that are extractive and degrade the natural environment (i.e. firewood collection);
- increased vegetative cover; and
- increased biodiversity by providing sites for seed multiplication of valuable native species.

REFERENCES

See also: **Food for Work**, p. 70. Africare currently provides TA for women's dry-season gardens in Loga, in Dosso Department; one garden has been operating for three years. Other agencies that work with this intervention include: CCIC in Birni and N'Gaoure; Peace Corps in Ouallam area; Caritas in Tillaberi; SwissAid in Tahoua; and ONVPE in Kollo.

VEGETABLE TRENCHES FOR GARDEN PRODUCTION

DESCRIPTION

A vegetable trench lined with locally available materials and layered with sand and manure provides a water-conserving growing medium. Vegetable trenches can use 80% less water while producing up to 300% better yields than traditional gardens. They can be constructed as demonstration plots in individual or communal gardens (see **Women's Communal Dry-Season Gardens,** p. 11). Because of their water retention capacity, vegetable trenches are appropriate in women's dry-season gardens especially where wells are deep and water hand-pulled. Vegetable trenches increase the diversity of vegetables and nutrients available to households.

SELECTION CRITERIA

Criteria for selecting vegetable trenches as a famine mitigation intervention include:

- deep water tables where reduced water availability justifies the high initial labor required to construct the trenches;
- community participants have identified dry-season gardens or crop diversification as a priority; and
- an organization or GON extension agent is providing technical assistance to the community group.

Vegetable trenches can be constructed with minimal outside materials and technical expertise. They can be adapted for use in communal gardens that are already receiving technical assistance from NGOs and GON extension agents. Vegetable trenches also are appropriate for urban areas with little garden space. In urban locations above-ground troughs can be constructed out of cement and stone or other locally available materials. These structures would require more technical assistance, labor and materials. Africare in Ethiopia established above-ground, cement vegetable troughs as a pilot famine mitigation activity in 1991-92. They found that most people who previously were not gardeners preferred using the vegetable troughs to produce cash crops. Farmers were quick to adapt the design of the troughs to better fit their needs and the space available.

Although vegetable trenches require much less water than traditional garden plots they must be irrigated regularly. Vegetable trenches are appropriate for women's communal gardens where irrigation water is available.

IMPLEMENTATION

Initial Labor: high
Cost: low
Management: low
Project Duration: three months to plan and construct initial demonstration trenches; on-going extension service.

A vegetable trench is 40 cm wide and deep. Excavated soil is placed around the edges of the trench to build up the sides to approximately 20 cm. The length of the trench is determined by the space and labor available. The bottom of the trench should have a convex shape to promote drainage towards the edges. The sides and bottoms of the trench are lined with a mixture of locally available materials such as wet cow manure and straw, millet stubble, black plastic bags, and other wastes to promote water retention. Drainage holes may be punched along the edges of the trench.

The trench is then layered in order with:

- a thin layer of gravel lining the bottom to permit drainage;
- a layer of sand to allow water to filter through.
- a layer of manure mixed with ashes, crushed bone, hair or feathers;
- cover the manure with another layer of sand; and
- top with a layer of sand, fine soil and sifted dry animal manure.

The trench is soaked through and planted with a variety of vegetables including lettuce, tomatoes, peppers, garlic, onions, cabbage, beans, peas, spinach, beets, potatoes, turnips, carrots, mint, or eggplant.

The trench retains water while allowing heavy rains to drain through the layers. The trenches can withstand continuous, intensive farming with proper crop rotation and replenishment of manure and last two to three years before requiring rejuvenation. To increase productivity, the trenches can be watered with a "manure tea" -- manure mixed in water. Let the manure dissolve thoroughly before irrigating.

Vegetable trenches can be constructed by volunteers or extension agents as a demonstration activity. Other farmers may become interested in adapting the trenches as they witness increased yields with less water. The implementing agency can then provide extension training to farmers who elect to build small trenches beside their regular plots to further test their productivity. If the test trenches are successful, farmers can increase the numbers and size of the trenches on their own. Extension training should continue by trying various building materials, designs, mixtures of manure and sand, and new vegetable types. Trenches also can be built for tree and vegetable seedling production.

Inputs: technical assistance to construct the first vegetable trenches and to experiment with optimal designs; local materials for construction; shovels and hoes; water; labor; and seeds. Almost all of the inputs should be provided by farmers. The intervention should be

implemented where wells and agricultural extension services are already being provided and should not require additional funding. The implementing agency may need to supply seeds in some areas.

An indicator of project adaptation and impact is the number of trenches constructed following demonstration. Data should be collected comparing yields of trenches with standard plots and water use of trenches compared with standard plots.

IMPACTS

Short term impacts include:

- increased production of vegetables leading to a more diverse diet and improved nutrition; and
- improved household economic status due to sales of surplus crops.

In the long term, vegetable trenches should not put additional stress on the environment as the construction materials are mostly bio-degradable and improve soil quality.

REFERENCES

Currently, there are no known programs in Niger with experience using this technique. James Williams, Africare Ethiopia Representative, adapted above-ground, cement vegetable troughs for use in Ethiopia after seeing them in use in South Africa (Africare, 1992). Lynn Uttal, Water Resource Specialist, redesigned the troughs for construction in-ground, thus eliminating the need for cement, which can be costly (Dilley *et al.*, 1993).

SMALL CREDIT PROGRAM

DESCRIPTION

Agriculture and animal husbandry are the principal components of Niger's rural economy, but the rural population engages in a variety of other economic activities in order to survive. Risk avoidance through diversification is necessary in Niger, where agricultural/pastoral resources and income are limited and unstable. Access to capital through a rural credit program strengthens people's ability to diversify their economic activities and thus makes them more resilient to economic crises resulting from natural disasters and agricultural failures. A credit program allows the beneficiaries to invest resources they control in whatever activities they feel are most advantageous. A successful model exists in CARE International's rural credit program in Maradi. CARE has refined its program during the past three years and currently has a capital fund of 15 million *CFA* before devaluation (BD), makes average loans of 50,000 *CFA* (BD) per client, has funded about 15,000 clients, and has a reimbursement rate of about 80%. The loans are non-targeted; they go to both men and women and there are no restrictions on what the credit is used for. The Cooperative League of the United States of America (CLUSA) and the World Council of Credit Unions (WOCCU) also have credit programs in Niger.

SELECTION CRITERIA

Access to capital through credit enables rural people to broaden the range of their income generating activities which reduces their vulnerability to economic crises in any one sector. Credit programs can be established relatively quickly and provide a good means of rapidly injecting cash into areas affected by drought or agricultural shortages. Rural people consistently report a need for credit to invest in small business activities: purchasing livestock for resale, petty trade, transformation of agricultural products, and purchase of raw materials for weaving, and construction. CARE reports that many of their clients loan a portion of their loans to other people.

IMPLEMENTATION

CARE operates its credit program with eleven field offices and agents in the areas of Maradi, Dakoro, and Tessoua. They provide untargeted credit to both men and women; the average loan is 50,000 *CFA* but groups can receive as much as 1-2 million *CFA*. Eighteen percent interest is charged. Collateral is required; sewing machines, mills, cars for small loans, and deeds to houses or property for large loans. There are no restrictions on what the credit is used for, including providing credit to other people. CARE reports that giving credit to groups works well because social pressure helps ensure reimbursement. Groups are required to provide collateral but "moral guarantees" or personal promises also are effective.

Any agency that plans to set up a rural credit program can benefit from CARE's model and experience. They should consult CARE about establishing accounting and monitoring systems, and training of administrative staff and field agents. The target population also must be educated about credit programs and their rights and responsibilities as borrowers.

Implementation steps are:

- identification of the target population or region;
- collaboration with them to design the lending program;
- selection and training of administrative staff and field agents;
- provision of a capital fund;
- establishment of an evaluation system; and
- provision of on-going managerial, financial, and administrative support.

Management requirements for this intervention are moderate to high. Project supervision and monitoring must be continuous during the life of the project.

Indicators include:

- number of clients;
- distribution of capital fund by amount of the loans, and amount of average loan;
- reimbursement rate;
- number of unfulfilled loans due to lack of funds;
- amount of capital fund; and
- number of field agents employed.

IMPACTS

Impacts include reduction of economic vulnerability through:

- increased nonagricultural income-generating activities;
- diversification of household economic activities; and
- increased and stabilized household cash income.

REFERENCES

Mr. Colin Beckwith, Regional Director, CARE International,
Maradi, Tel: 410-562, 437-466

UNDP/ILO has a women's credit program in the Zinder Department

WOMEN'S SAVINGS AND LOAN PROGRAM

DESCRIPTION

Nigerien women are responsible for contributing to household income but their access to and control of resources is restricted, including access to credit. Rural women consistently report a need for credit in order to generate income, particularly during the dry season when they have more time for nonagricultural activities and imminent needs to provide food for the household. Traditional means exist for women to cooperate and generate small sums of credit through *tontines*. A *tontine* is a group of women who have a rotating fund. Each week the members contribute a fixed amount to the fund and one woman receives the money to invest as she likes. Using a similar model, CARE International has built a successful Women's Savings and Loan Program that gives rural women access to credit. CARE's experience in Niger supports the conventional wisdom that women are excellent credit risks. Increasing the resources available to women through this type of program increases households' resilience to disaster. Rural women can use the credit to buy livestock, agricultural products, and raw materials which can be transformed into cash to buy food and for other household needs.

SELECTION CRITERIA

Women are especially economically vulnerable when agricultural production is poor, men migrate, and women are responsible for supporting the household with local resources. Credit is generally a scarce local resource, especially during crisis years when it is most needed. The Women's Savings and Loan intervention creates of a cash fund but introduces no food or cash from outside sources. It is therefore best implemented as a preventive measure, prior to the sale of productive assets that may occur during droughts and other food-related emergencies.

An agency that plans to implement this intervention should consult with CARE International. CARE developed its program through a participatory approach and found that the women's groups should develop at their own pace. Field staff should act as observers, sharing their previous experiences. Self-selection by women and the agency's role as facilitator are key elements in this approach.

IMPLEMENTATION

CARE's experience can be used as implementation guidelines for savings and loans programs. CARE's program is explained fully in Eknes (1993b). Their women's savings and loan program is exclusively demand-driven, so the women's groups are self-selected for participation. It was designed and modified by rural women themselves, using a participatory approach, and, as it is based on the traditional *tontine*, it is a familiar form of organization. The women capitalize the fund initially and make all the organizational decisions (i.e. number of members in the group, amounts of weekly payments and interest rates, how to use the loan funds and the group's savings). The implementing agency

provides field agents who help the women form a management committee, train the management committee, help the group develop internal rules and regulations, and encourage independence. The project provides neither financial assistance to capitalize the group nor materials (such as security cash boxes, locks, notebooks).

A field agent can work with five groups of women. Groups should have a maximum of 35 members. They should form a management committee and establish their own internal rules and regulations early in order to develop independence. In order to avoid social pressure from men for loans, the group's cashbox should have three locks on it so that three women are responsible for the funds, rather than just one.

Management requirements are low, as the implementing agency's role is to facilitate the women's initial organization into groups and provide minimal on-going counseling. The implementing agency's inputs include supervising the project, and providing administrative support and trained field agents. The implementing agency should consult with CARE on training its administrative staff and field agents.

Indicators include:

- number of women's savings and loan groups established;
- total number of women who are members of a savings and loan group;
- total amount of funds per group; distribution and average;
- number of women's groups requesting assistance to begin a group; and
- number of field agents.

IMPACTS

According to an external evaluation of CARE's program, project impacts should be measured in terms of qualitative as well as quantitative impacts. Qualitative indicators include:

- regularity in income-generating activities;
- participation in traditional *tontines*;
- speculation capacity (i.e. ability to buy and sell commodities); and
- in-kind forms of savings such as livestock.

Impacts also can be assessed in terms of men's acceptance of their wives participation, on-loans to husbands, and economic conditions in the household (Eknes, 1993b).

Other potential impacts include:

- stabilization of women's annual income;
- women's increased ability to fulfill the social obligations of gift-giving;
- increased women's income; and
- increased control over cash income by women.

REFERENCES

Eknes, 1993b.

FOOD FOR THOUGHT: VILLAGE TRAINING CENTERS

DESCRIPTION

Rural Nigeriens have reported that they want education in areas ranging from literacy and numeracy to practical skills like sewing and mechanics. Village training centers are a Food for Work (FFW) activity designed to apply food-aid during food shortages towards enhancing long-term household food security. Training centers provide skills identified by both men and women as ones that will increase their income-earning potential. Students are reimbursed in food for attending classes. For some, particularly women, this allows them to spend time learning new skills that they would not be able to afford without some immediate compensation. The classes can be taught by local people and expatriate volunteers who have the appropriate skills. Education in literacy, numeracy, French, and English makes villagers more competitive in the job market as men compete for jobs in urban centers and women engage in commerce. People also report the need for women, youths, and the handicapped to learn practical skills or trades to earn their livelihoods. Outsiders report the need for village-level health education, including education about AIDS, child nutrition, and household hygiene.

SELECTION CRITERIA

The rural population already generates part of its income outside the agricultural sector. Education that improves nonagricultural skills broadens the range of their potential economic activities. A broader economic base -- the ability to generate income in nonagricultural activities -- increases people's resilience to natural disasters. Training in subjects such as health and literacy will contribute to both adults' and children's overall well-being.

Villages or village associations in which education is reported as a felt need are candidates for this intervention. Women often report needs for basic literacy or income-generating skills. Local demand should determine the classes that are taught. The implementing agency can negotiate with villagers how many classes to offer and the minimum number of people necessary to justify a class. A training center in one village could serve other nearby villages as well.

IMPLEMENTATION

Local materials and labor are contributed by the village to build the education center, or an existing building is used. The implementing agency can provide the technical assistance and construction materials if necessary. The center can be constructed simply with mats to protect participants from the sun. An agency such as Peace Corps or the *Eglise Evangélique de la République du Niger* can provide a volunteer as a teacher, or local people can be hired to teach classes, full- or part-time, as appropriate.

Management requirements are low when the villagers and teachers are responsible for operating the education center. Additional funding might be desirable to support the teachers after Food for Thought funding ends.

Indicators include:

- type and number of classes taught in the village;
- number of people attending classes;
- number of people who have attended more than one class;
- number of villages using the training center;
- number of people graduated successfully from classes; and
- villagers' evaluation of the center.

IMPACTS

Appropriate training imparts nonagricultural skills, improves people's competitiveness in the nonagricultural job market, broadens the range of villagers' potential economic activities, and improves health status of villagers, particularly that of children through women's education.

REFERENCES

Tony Rinaudo, who has worked with the Sudan Interior Mission in the Maradi area for 11 years, uses FFW for training.

The Catholic NGO BALD supports teaching and literacy projects.

VILLAGE CEREAL BANKS

DESCRIPTION

Village cereal banks are seed and grain storage cooperatives. Their goal is to promote members' access to grain by safely storing and, ideally, increasing local grain stocks by charging interest on withdrawals and through strategic buying and selling on the market. Their ability to lend to members at lower-than-market prices reduces farmers' dependency on merchants and vulnerability to seasonal price fluctuations.

The most common benefit reported by villagers is that cereal banks provide food during the hungry season prior to harvest when household grain stores and/or seed for sowing are depleted. Cereal banks free farmers' time and energy for agricultural production during these months by reducing the necessity to make trips to the market to buy grain. They may also contribute to villagers' management and decision-making capabilities, improving their capacity to cope with future crises. Cereal banks also provide a sustainable channel for food-aid donations during emergencies.

There are mixed opinions on the success and sustainability of cereal banks in Niger. Rietsche (1993) reported that none of the cereal banks implemented by the Haroun project in the early 1990's survived more than three years after the project ended. Current data from the United Nations Development Program International Labor Office (UNDP/ILO) project in Zinder shows that cereal bank stocks increased about 130% during 1988-1993. The ILO data also indicate that poor money management and lack of credit reimbursement are the major constraints on sustainability and growth. In spite of these problems, villagers are willing to invest time and resources in building and maintaining cereal banks and express satisfaction even when returns on their efforts appear to outsiders to be low (i.e. cereal banks supply 1-2 weeks of grain per year per household, usually withdrawn around planting time).

SELECTION CRITERIA

The fact that donors subsidize most of the cost of creating and stocking cereal banks makes them an attractive intervention for the beneficiaries. Cereal banks are indicated in deficit zones and in regions that are isolated or have poor transportation services. Their sustainability depends on several factors. Villages exposed to recurring drought or those isolated from markets are difficult locations because the former can quickly deplete a bank's stores and cause failure, and the latter limits the potential for increasing the bank's stocks through competitive buying and selling. However, UNDP/ILO in Zinder reports that villages most at risk from drought have more incentive to manage their cereal banks well and that they have a relatively high rate of success. Good village leadership and organization are commonly associated with successful cereal bank management. Banks tend to be more successful when they refuse credit to poor credit risks and require payment in cash rather than in kind.

Cereal banks are complex interventions relative to their immediate benefits. The egalitarian organization required to establish and manage a cereal bank is incongruent with the traditional hierarchical social structure of Niger's villages. The management committee is subject to strong pressure from both the poor and the powerful, which can lead to poor business decisions and bank failure. Poor harvests and bad faith make credit repayment a major problem; the UNDP/ILO project reports that about half of their cereal banks have poor money management and recuperate 60% or less of their credit. Costs to members rise when the bank begins to operate independently, and the costs of buying, transporting, and storing cereals are no longer subsidized by the donor. Good weather and favorable trade relations with Nigeria can stabilize grain prices and eliminate the banks' commercial advantage.

IMPLEMENTATION

Implementation requires:

- participatory interaction with the village to choose the management committee and bank manager, and to organize the bank's structure and operation;
- training for the management committee in bank management, accounting, planning, and grain storage techniques;
- training for the bank manager in stock management, credit systems and accounting, building maintenance and pest control;
- permanent technical assistance to support bank management, commercialization, and the credit system;
- follow-up visits to monitor progress;
- a specialist to review the construction plans to ensure that building and storage requirements are met;
- materials to construct the grain storage building or renovate an existing building, including cement, tin roofing, and metal doors;
- equipment: wooden pallets, sacks, a 50-100 kilo scale;
- village labor to construct the building and manage the stored grain; and
- all or part of the initial grain stocks (usually provided by the implementing organization).

Funding:

Costs of grain banks are moderate: materials and labor for the construction of the storage building, funds to buy grain, management training.

Donors often provide construction funds (either gifts or loans) as well as the first year's stock. Villagers should be required to contribute a portion of the stock if possible. A reasonable estimate for the initial stock is 15 kilos of grain per member.

A typical interest rate on loans to members is 15 percent. Loans and repayments can be in either grain or cash. Surplus capital generated through interest payments in theory can

support a variety of activities: 1) purchase of additional grain from markets where and when the price is low; 2) transportation of the bank's stores to markets where and when the price is high; 3) a "solidarity fund" used as village aid for villagers who cannot pay for the grain; 4) other activities not connected with the grain bank such as village schools, pharmacies, and well improvements. Enforcement of reimbursement can be a problem. Some village grain banks have assigned neighborhood agents to remind borrowers to reimburse the bank.

Management training:

Management requirements of grain banks are moderate to high. Training in management skills is imperative. The implementing organization needs to provide orientation sessions and training for the accountants and controllers as well as periodic refresher courses. Management committees should be established to supervise the functioning of the bank, monitor accounts, purchases, sales, and loans, and to conduct meetings of the members. A manager is usually selected to operate the grain bank and is responsible for stock management, accounting and maintenance.

Construction:

The goal of grain storage is to reduce losses to pests and moisture. Pooled resources through a village grain bank will allow villagers to construct a building that protects the grain from heat, humidity, and pests better than individual household storage.

To achieve cool and dry storage, the buildings need watertight roofs, water-repellent walls, doors and vents, drainage away from the exterior walls, sealed floors to keep out ground moisture, shaded roofs, walls and windows, and smooth, easy-to-clean surfaces. Tight joints between roof and walls, windows, vents, and doors are needed to keep out rodents; fine screen closures for windows and vents are needed to keep out insects.

A cement or mud-brick storage facility with a tin roof, solid doors and screened windows fulfills these needs and is within the means of most villages.

Storage considerations:

Cereals and legumes are the most suitable staple foodstuffs for this type of storage because of their nutritive value, low water content, and resistance to spoilage by bacteria and fungi. In general, threshed grain is easier to store than bulky cereal heads, but the loose grain is more susceptible to pest and humidity damage.

Contamination of legume grains by mycotoxins can be prevented by quick-drying the grain and storing it under cool, dry conditions. If leguminous grains are stored communally it should be the responsibility of the grain bank manager to ensure that the grain has been properly dried and that the risk of contaminated grain is low.

Pest management:

In general, lower temperature and moisture levels prevent insect development. Traditional methods of protecting stored grain from insects are to mix sand, ashes or other small grained, non-toxic material to fill the pores between the individual seeds. This inhibits movement of the insects, air exchange, and condensation problems.

Rodent preventative measures include: constructing a well-sealed building; keeping grain sacks in easily monitored small piles on pallets; keeping the area around the storage building clean of spilled grain and rubbish; and setting rodent traps.

Establishing regular inventory control procedures also will help facilitate timely inspection for rodent, insect, and moisture damage so that corrective measure can be taken. Villagers generally compensate bank managers in some way, such as helping in their fields and/or a salary.

Monitoring and Evaluation:

The implementing agency periodically should monitor cereal bank accounts and assess the need to recapitalize stocks. They should make quality checks of grain in storage and of the facilities. UNDP/ILO monitors its banks using indicators with values of 0 = bad, 1 = passable, and 2 = good, to evaluate the interior and exterior condition of the building, the condition and storage of the stock, the management of credit funds, record keeping, rate of stock increase, recuperation of loans, membership records, and frequency of organizational meetings. The criteria for assigning a 0, 1 or 2 are spelled out in an annex to a questionnaire that is used during monitoring visits (ILO, 1993).

IMPACT

Initial impacts include:

- improved food security by establishing a mechanism for distributing emergency relief food; and
- increased amount of time and energy farmers can spend on fieldwork in the rainy season by establishing a convenient village grain supply.

Long term impacts include:

- surplus funds from the bank to be invested in other village needs;
- incentives for members to become functionally literate and numerate;
- improved villagers' organizational abilities, enabling them to undertake other long-term development activities.

A health-related impact is that improved grain preparation and storage techniques ensure that grain stocks will be free of mycotoxins or insect infestations.

REFERENCES

The UNDP/ILO office in Zinder has helped to establish over 100 cereal banks in the Zinder Department. Their effective data collection system includes indicators for measuring baseline conditions and for on-going monitoring. Contact person is Joao de Azevedo, BP 232, Zinder; Telephone 510-677; Fax 510-079.

FAO, 1983; GTZ, 1980; ILO, 1993; Rietsch, 1993; and Woodrow, 1989.

SEED DISTRIBUTION AND GRAIN REPURCHASING PROGRAM

DESCRIPTION

The seed distribution and repurchasing program provides essential inputs (seeds and tools) to farmers in surplus grain-producing areas, and guarantees repurchase of the surplus at market price. The grain is redistributed either on the market or as food assistance during the dry season. There are two groups of beneficiaries: surplus-producing farmers who benefit from increased sales at a guaranteed price, and the groups in food-deficit areas who benefit from relief food, Food or Cash for Work (FFW/CFW).

SELECTION CRITERIA

The purpose of this intervention is to increase food security and hasten recovery from disasters. It is implemented in three stages and provides assistance to several sectors of the population. It is therefore expensive and has a high management requirement. The first stage requires provision of essential agricultural inputs to grain producers. The second requires traders and transporters for distributing the surplus production to deficit areas or vulnerable groups. The third stage requires FFW/CFW activities that target vulnerable populations. The activities implemented by FFW and CFW can target agricultural production, health, or natural resource management to promote food security. This intervention requires funding, monitoring, and logistics management as well as input distribution, but has a wide impact: it affects both agricultural production and markets, and reaches a range of target beneficiaries.
The seed distribution and grain repurchasing intervention is designed primarily to assist farmers who normally produce surpluses in the year following crop failure. A major assumption is that there will be enough rainfall in the following year to produce surplus crops in these areas. For this reason, the intervention may be more appropriate when crop failure is the result of pest infestations, population displacement, or localized droughts rather than when it is from prolonged, widespread drought. Purchase of the initial agricultural inputs uses only a small portion of the total required funding. If the crops fail during the intervention year, funds programmed for redistributing grain are available for alternative activities such as purchasing grains from other sources for distribution.

Criteria for selecting this intervention include:

- a major crop failure that requires large-scale response;
- grain producers who lack basic agricultural inputs;
- traders and transporters who lack capital to engage in commerce; and
- food is not readily available from reserves or from outside relief assistance.

IMPLEMENTATION

The seed distribution and repurchasing program provides essential agricultural inputs (seeds and tools) to surplus grain-producing regions following a year of poor yields or total crop failure due to any type of disaster. Farmers in a disaster area receive enough seed to produce maximum yields. The project guarantees the repurchase of all surplus grain produced, at market price. This grain is redistributed to more vulnerable populations.

Rather than being distributed as relief, surplus grain may be sold to traders in deficit areas to stimulate a normal market. The sales may be made directly between producers and traders (thereby saving project funds allocated for this use) or through the implementing agency. Intervention implementors must be knowledgeable of the standard trading and marketing practices in Niger. Large traders usually have their own vehicles for transportation, while smaller traders may move the grain by carts to larger towns for resale to transporters. The traders may have lost capital in the disaster so the implementing agency could purchase the grain and sell it wholesale to traders for payment upon resale. Grain sales to Nigeria or other countries should be avoided if people in Niger are suffering.

The grain or the cash from sales can be used in FFW or CFW activities in food deficit areas during the dry season. A portion of the grain may be sold to traders and the remainder distributed as relief assistance or FFW. Repurchasing of surplus grain may be undesirable if yields are not significantly higher than normal, because it could damage the functioning of the normal market. Market distortions caused by large influxes of external resources should be minimized. Cash collected from traders, or funding saved through farmers' direct sales, is used for CFW activities. Grain can be provided as direct food relief to those unable to work (pregnant/lactating women, the elderly, and children) and cash from grain sales as CFW for those who are able to work.

Inputs:

Agricultural inputs to generate a grain surplus include:

- seed (quantities depend on cultivars and land area);
- hoes, shovels, machetes, and other tools;
- irrigation maintenance materials and fuel for pumps; and
- organic fertilizer.

Fertilizer use may increase yields but it also affects crop water requirements and is not sustainable without a local supply (see **Introduction of Phosphate Fertilizer**, p. 44). Implementors must weigh the economic and environmental sustainability of providing external technologies like chemical fertilizer and pumps.

Redistribution of surplus grain requires:

- storage facilities; and
- transportation.

These should be procured locally through the private sector if available.

In the third stage of the intervention, redistribution of the surplus production, FFW/CFW activity inputs vary according to the chosen activities.

Technical assistance and management requirements:

The implementing organization must have the management experience and capacity to implement this long-term, three-stage intervention. The first stage of seed and tool distribution requires an assessment to determine potential surplus producing areas, and farmers and traders interested in participating. The implementing organization works with the participants to develop a repurchasing plan including agreement on amounts of grain and the prices to be paid. A facility for storing the grain after repurchasing is needed. If construction or repairs are necessary, they should be done during the dry season prior to planting. Appropriate inputs and their sources are identified, and the inputs purchased and distributed. Rainfall and production are monitored throughout the growing season until harvest.

Assessments, planning, and input procurement and distribution must be completed before the first rains (by May). Earlier distribution of seeds will encourage farmers to begin land preparation but may also lead to consumption of seed if no other food is available.

Local extension agents may assist in selecting participating farmers, distributing inputs, providing technical advice, and monitoring the growing season and yields. They can help determine if local traders and transporters have the interest, capital and other resources necessary to purchase and market the surplus grains.

The second stage of repurchasing the surplus grain requires a high level of logistical support. Cash must be available and an accounting system established to pay farmers for the grain. The implementor must organize transportation from farms to the storage facility or a system for monitoring the transfer of grain from farmers to traders.

During the rainy season, the implementing organization should conduct community needs assessments in food deficit areas to determine appropriate project sites and activities for the third stage of grain redistribution. Rainfall and crop assessments provided by SAP, FEWS, AGRHYMET or ICRISAT (see **List of Acronyms**, p. 9) can be used to identify regions of probable production deficits. Interventions should be identified which require FFW/CFW and are appropriate for these areas. Other agencies may need to be located that are capable of implementing them. Systems for distributing and accounting for grain or cash should be developed, including daily or by-piece pay rates. Materials for the selected project are procured. Good planning at this time for the FFW activities will alleviate the need for long-term grain storage and decrease losses. Projects implemented soon after harvest will decrease the villagers' need to migrate for work.

The final stage of food or cash distribution requires transporting the grain from the storage facility to the FFW project sites and additional project management. See the section on **Food for Work**, p. 70, for additional information.

IMPACTS

Short term impacts of this project are:

- increased food production in major grain production areas;
- increased food security in deficit areas; and
- decreased migration for work.

Long term impacts of this project are:

- strengthened economic activity in markets;
- potential for improving participants nutritional status and natural resource base through FFW/CFW projects with long-lasting, sustainable impacts;
- potential for improved village infrastructure through FFW/CFW; and
- reduced need for migration.

REFERENCES

The Government of Niger or organizations such as CARE International or Africare may be prepared to manage a program of this scope. Smaller organizations could collaborate with them by implementing the input distribution and the FFW/CFW projects. The section on **Food for Work**, p. 70, in this manual gives recommendations for using it with other

MICRO-CATCHMENT WATER-HARVESTING FOR AGRICULTURE

DESCRIPTION

Improved yields of millet, sorghum and other crops can be achieved in the Sahel with micro-catchment water-harvesting. Techniques such as *zais*, small pits for individual pockets of cereals, plants or trees, and *demi-lunes*, v-shaped earth ridges which collect runoff, are suited for land-poor farmers, areas of high population density, and areas of recurrent drought where conventional practices produce relatively low yields. *Zais'* modest labor requirements make them a form of water-harvesting that is easily adopted by Nigerien farmers.

The profit from water-harvesting agriculture can be substantial, especially during drought years when grain prices soar and even stalks become marketable. Millet yields in properly designed water-harvesting micro-catchments can be six times greater than yields produced by conventional techniques. High yields can be achieved even on abandoned, crusty soils with the addition of animal manure. The yields are small on a per-area basis, but only a small percentage of the area receives inputs of labor and fertilizer.

The yield per unit-labor for micro-catchment water-harvesting is similar to that of conventional agriculture in Niger. Obviously, farmers with sufficient land to achieve adequate yields using conventional low-input agriculture are unlikely to shift to more labor- and capital-intensive water-harvesting. Micro-catchment water-harvesting is therefore most applicable in areas where the demand for agricultural land is high or yields are low, as in the dry northern fringe of the rainfed agriculture zone.

SELECTION CRITERIA

The management requirements of providing technical assistance (TA) to teach water-harvesting techniques are low. However, the intervention also requires the participants to provide considerable labor to construct the catchments. Food or Cash for Work (FFW/CFW) can be used to pay farmers to work on demonstration plots that they can replicate on their own. It is desirable that the participants contribute uncompensated labor as part of their own investment in the intervention. They may be unable to continue constructing micro-catchments when not compensated for it because of competing demands for their labor. Consequently FFW or CFW may continue to be needed for construction of catchments even on the fields that the participants intend to farm. Due to the high initial labor demand and fertilizer requirements of water-harvesting, implementation efforts should be directed to landless or land-poor people with livestock or access to sufficient amounts of animal manure.

The best return-on-investment for water-harvesting agriculture comes when the cultivated area consists of deep, productive soils that have relatively high water-holding capacities. This allows crops, trees and forage plants to survive longer periods of drought, to endure shorter periods of water stress, and as a result, to produce higher, more stable yields (see

also **Water-Harvesting on Rangelands**, p. 46). Farmers can ensure that their catchments are on good soils by selecting those crusted sites that once were productive agricultural land. Erosion of the sandy surface common to many Sahelian soils exposes their slightly more clayey subsurface, which can form a crust. This crust greatly reduces the ability of the soil to absorb moisture from the intense, short-duration rainstorms. The crusted surface increases rainfall runoff and reduces the amount of water stored in the soil to the extent that established trees, forbs, and grasses may die from lack of water, causing desertification. These unproductive crusty patches (*gangani* in Zarma; *farara* in Hausa) are common across the Sahel from Senegal to Sudan. They occur on old dunes, sandy plains, colluvial slopes, and alluvial terraces. These areas of abandoned land with high water-runoff still retain high agricultural capability and potentially provide a subsistence resource for the landless through water-harvesting agriculture.

Limitations on access to eroded land, such as rental contracts that must be renewed annually, may discourage catchment construction. Successful targeting of poor farmers may require that intervention implementors or the Government assure land owners that longer term (five to ten years) rental of fields to landless farmers will not affect their tenure claims.

Water-harvesting can be integrated into many development activities. For example, micro-catchments can provide an incentive for local inhabitants to rehabilitate commonly held bushland or protected areas that have good soils by using a *taungya* cropping system, in which crops are grown with trees near the catchment area. After a set period of time, the farmer abandons the catchment, leaving the young trees above grazing height. The immediate, striking results of water-harvesting can demonstrate to farmers the benefits of other soil and water conservation activities. However, the numerous successes reported are mirrored by many failures. Poor design is one common reason. Failure to be realistic about farmer's ability and willingness to devote labor to sustaining them is another.

IMPLEMENTATION

Inputs: The implementing agency can assist each participating farmer to construct a variety of water-harvesting catchments on crusty soils to which they have access. The agency may want to compensate the participants for constructing demonstration catchments with FFW or CFW. Continued FFW/CFW for construction of catchments in farmers' fields is negotiable (see "labor costs" below). A generalized list of inputs and expected outputs is given in Table 2.

Table 2 Estimated inputs and outputs of micro-catchment agriculture with millet occupying 15% of the area (Tabor, in press).

Major inputs:	
Catchment construction labor	75 person-days ha^{-1}
Recurrent maintenance, cultivation, and harvest labor	113 person-days ha^{-1}
Ordinary superphosphate fertilizer	188 kg ha^{-1}
Urea fertilizer	120 kg ha^{-1}
Minor inputs: Seeds, tools	
Outputs:	
Grain yield	240 - 690 kg ha^{-1}
Stalk yield	1,500 - 3,300 kg ha^{-1}

Labor costs: Micro-catchment construction costs are incurred only once, during the dry season, a time when wages are low and labor is scarce owing to seasonal migration. The need to generate income during the dry season is the principal reason men migrate. The opportunity cost of foregoing migration to stay home and dig micro-catchments may necessitate compensating farmers with FFW or CFW so that they need not migrate. Recurrent labor costs occur during the rainy season when wages are highest due to competition with conventional agriculture. The higher yields associated with micro-catchments should, however, provide incentive for farmers to tend them during this time. The benefits of fertilizing water-harvested crops are probably sufficient to induce farmers to collect limited quantities of animal manure. The ultimate cost of constructing catchments depends on soil characteristics, size and shape of catchment, height of dike, and maintenance requirements.

Construction: Farmers seem most interested in *zais*, small catchments for individual pockets of millet or sorghum. They generally are not interested in large *demi-lunes* and contour dikes, such as those used in the Keita Project. Smaller dikes that can be constructed at reduced labor costs may be more attractive. Dike height can be progressively increased during yearly maintenance of the dikes during preparation for planting. Many *zais* and *demi-lunes* constructed in Niger are too densely spaced, which limits the amount of runoff water available to the cultivated areas and diminishes their effectiveness. Stability of the earthen dike is an important consideration when selecting sites and designing catchments. Catchment dikes can blow away in the wind or melt during first rains if the clay content of the soil's crusty surface is not enough to form stable clods. Under these conditions, rock or vegetation can help stabilize the dikes. Depending on soil tilth and worker incentives, two to eight cubic meters of earth can be picked-and-shoveled per person-day under project conditions in the Sahel. Labor constraints dictate two basic approaches: the project approach and the farmer approach. The immediate, project-oriented approach results in catchment

designs constrained by the time limitations of the project and by the expense of managing work crews. Also, the resulting structures tend to be larger than those constructed under the farmer approach because of probable lack of future maintenance.

Land tenure: There are essentially no opportunity costs associated with cultivating degraded land through water-harvesting but access to degraded land may be limited by tenure laws and usufruct rights. As water-harvesting agriculture spreads, the perceived value of "abandoned" land will change and landowners may refuse to transfer ownership of their crusty areas (or have their ownership threatened through renting) even though they are unable or unwilling to invest the labor required to convert these areas to productive agriculture. Therefore, resource tenure and usufruct need consideration when extending water-harvesting techniques. Including water-harvesting activities in government-supported projects can help break through local power structures that inhibit the transfer of control of "abandoned" land to farmers who are willing to bring the land back into production. It may be necessary to set up agreements with landowners or village chiefs before those farmers who are willing to construct catchments can have access to the abandoned land.

Cultivation: Plant spacing within micro-catchments (i.e. *demi-lunes*, "V"s, and contour dikes) for millet, sorghum and other crops can be much denser than conventional rainfed agriculture (three and seven pockets per square meter versus one pocket every two steps). *Zais* on the other hand can maintain tradition spacings with one seeded pocket per *zay*. Soil infiltration and permeability characteristics will improve with the addition of organic matter such as roots and animal manure during successive years of cultivation. Organic matter or other fertilizer should be applied several times during the growing season.

Crop selection: Although flooding stress on millet in micro-catchments should become less and less likely with improvement of the soil's surface characteristics, millet always will be at risk in exceptionally wet years. Under conditions where a thick surface layer of windblown sand collects in the catchment basins, groundnuts and bambara nuts can produce good yields.

IMPACT

Water-harvesting reduces the risk of crop loss from drought and maximizes the benefits of applying fertilizer to a crop. It extends the growing season, increases water availability and as a result, allows a wider selection of crops to grow. It spreads the workload over a longer period and allows previously abandoned land to be cultivated.

Water-harvesting reduces rainfall runoff and resulting downstream erosion. The captured runoff helps recharge aquifers that makes surface water, ponds and stream pools, available for livestock longer into the dry season.

Impact indicators include:

- number and type of water-harvesting catchments constructed by farmers after seeing the technique demonstrated;

- catchments built by renters of land and by owners of land;
- land tenure disputes caused by this intervention;
- types of crops grown in catchments;
- yields in catchments versus those on fields without catchments;
- number of months of household grain stored by participants versus non-participating households.

REFERENCES

Rochette, 1989; Tabor, 1986; and Tabor, in press.

ON-FARM APPLIED RESEARCH

DESCRIPTION

Insufficient or highly variable moisture availability and low soil fertility make rainfed agriculture difficult in large sections of Niger's southern agricultural zone. Farmers seek to ensure a minimal level of agricultural production rather than to maximize yields. This strategy, while appropriate and rational under the circumstances, is risk averse and does not lend itself to experimentation with untried techniques. Research organizations and some NGOs, on the other hand, have developed a variety of innovative agricultural techniques with potential benefits for farmers. These include introduction of new or formerly cultivated plant species, natural resource management, and agronomic techniques. The true test of these is how well they fare under actual on-farm conditions. The DPM Program offers an opportunity to field-test agricultural innovations at minimal risk to farmers, by guaranteeing them a minimum return in exchange for experimenting with a new agricultural idea. At the same time, the arrangement offers a chance for researchers to test the feasibility of innovations under actual farm conditions.

SELECTION CRITERIA

Experience has shown that if researchers treat farmers as hired hands in a field trial, the experiment has little benefit. This intervention tests whether techniques which work under controlled conditions are viable under on-farm conditions. Because most trials are designed to be implemented during the growing season, they generally do not have an immediate impact on food supplies in the months following a bad harvest. On-farm trials are intended to diversify food production techniques and contribute to higher overall levels of food production so that food deficit periods in the future will be shorter and less frequent.

Criteria for selecting this type of intervention are that:

- farmers or gardeners demonstrate interest in the demonstration technique by agreeing to commit labor and other resources to it;
- students, volunteers, GON agents, research institute scientists, or NGO agricultural experts are available to work with farmers to adapt a particular innovation to their needs, and to provide extension services throughout its implementation and follow-up;
- required material inputs are available; and
- environmental conditions are suitable for the intervention.

IMPLEMENTATION

A number of techniques with potential agricultural benefits have been proposed and/or implemented in Niger. The following list, which is not exhaustive, includes ideas from Rinaudo and Rinaudo (unpublished) and Sivakumar (in press).

Inputs include technical assistance and extension, plus whatever agricultural inputs (i.e. seeds, tools) are required by the intervention.

Cassava:

Cassava once was widespread in Niger but the 1970s drought and deforestation, which reduced the availability of fencing materials, caused its virtual disappearance. Cassava is drought-tolerant and has no critical period when lack of rain will cause crop failure (Cock 1985). In low rainfall years growth will be stunted, but if left in the field, cassava will continue to produce the following season. It rebounds after pest and disease attacks and can serve as a reserve food crop in poor millet-yield years and as a cash crop in others (Hahn and Keyser, no date). Cassava can be reestablished using *Commifora africana* live fencing and by planting it close to *Bauhinia reticulata* and *Faidherbia albida* trees, where it seems to do well, perhaps owing to lower soil surface temperatures.

Cassava root depletes the body of iodine which may increase the incidence of goiters. Farmers should be encouraged to eat iodized salt or sardines to counter cassava's negative effects. Cassava leaves are nutritious and are often added to sauces.

Australian acacias as a human food crop:

Acacia seeds are a traditional food crop of Australian aborigines and three species in the section *A. juliflorae*, *A. colei*, *A. cowleana*, and *A. tumida* appear to have outstanding potential for production of human food in the Sahel (Thomson, 1992). They grow fast on poor soils and require little water. The leaves are not palatable, giving them resistance to livestock. Prior on-farm research has resulted in successful adoption of Acacia seeds as a cash crop (for making "acacia coffee"). *A. holosericea* seeds have been used in making traditional dishes. Additional on-farm research is needed on Acacia species' effects on crop and grass production, species selection and seeding techniques.

Farmer-managed natural tree regeneration:

Farmer-managed natural tree regeneration increases the availability of fuel and construction wood as well as organic matter and fodder. Other benefits include reduced soil temperatures and wind speeds. Farmers implement natural tree regeneration by leaving 40 tree stumps per hectare in their fields and at least one stem (but preferably five) per stump when harvesting wood. When five stems are left, one can be harvested every year indefinitely. During field trials in Maradi farmers were initially skeptical of leaving trees in their fields but this practice is becoming more accepted as its benefits become apparent.

Calotropis procera:

Calotropis procera is extremely fast growing and provides marketable, termite-resistant wood. It grows and thrives on crusty soils, rock out-crops, in heavy clays, and in infertile sands.

Native live mulch and fodder plants:

Chorozophora brocchiana and *C. senegalensis* grow actively throughout the dry season providing shade and wind protection. Fine silt and organic matter are trapped at their base and soil temperatures average 8°C cooler than on surrounding bare soils. *Alysicarpus* spp. fixes nitrogen, provides fodder, and forms a soil-hugging mat, while *Tephrosia uniflora* also grows rapidly and is sought out by livestock.

Relay cropping of millet and cowpea:

Cowpea traditionally is intercropped with millet, on the assumption that during dry years when millet yields are low or non-existent the cowpea will provide hay for livestock, and grain. Research by Sivakumar (1993) has shown that in years with early rains, planting cowpea three weeks prior to harvesting the millet (relay cropping) results in reduced competition between the species, which benefits both crops.

Hay cutting and curing for livestock survival rations:

Many species of plants grow during the rainy season that livestock do not eat because of taste preferences. When these plants die, drop their seeds, and are bleached by the sun, they lose most of their nutritional value. Yet these same plants are survival food for livestock during the dry season because they achieve their highest protein content and nutritional value during flowering. Species that are relatively unpalatable during the rainy season can provide acceptable, nutritious feed during the dry season if harvested at the right time and stored properly. The hay that can be harvested depends on species' availability and palatability. One plant that becomes palatable during the dry season is *Cassia tora* (*tafasa* in Hausa; *ula*, *karham*, or *lalaha* in Zarma; *ulo* or *ubulo* in Peul; and *abaezzey* in Tamacheq). It is a plentiful legume that is eaten by donkeys and humans when it is young. Flowering occurs in mid-September when the quality of pastures can be estimated and there is time to harvest the plant at its peak nutritional value. Livestock avoid the plant at this time but willingness to eat it may increase later in the dry season when it is one of the few species to forage. Hay should be cut just before flowering when the protein content is high, and left to dry for one to two days before baling or stacking, and then stored in a dry place. This intervention is most appropriate for farmers and semi-sedentary pastoralists who have a secure place to store hay. The hay can provide nutritious survival rations for breeding livestock, allowing farmer and herders to recover more quickly from severe droughts.

The above techniques are best tried under the sponsorship of an established agency or NGO who can combine them with other programs. They require considerable interaction with farmers to sensitize them to the techniques and their possibilities. The *Institut National de Recherche Agronomique de Niger* (*INRAN*) *Comité Régional de la Recherche Agronomique* (*CORRA*) program establishes regional research centers concerned with identifying and removing constraints on agricultural production in each Department in Niger through local participation and agricultural research extension.

The objective of monitoring these applied agricultural research projects is to substantiate their impacts on the beneficiaries through increased food production, reduced risk, or sustainability. The experimental character of these techniques provides an opportunity to test their performance through a comparison of indicators affected by the intervention against a baseline or by comparing a treatment group versus a control group. More importantly, sponsored on-farm demonstrations of these techniques give farmers an opportunity to experiment with them without the threat of negative consequences.

Indicators vary by technique but may include:

- number of participants trying the technique (disaggregated by gender);
- number of hectares treated;
- number of participants who continue using the technique one or more years later; and
- yields compared with baselines or control groups.

IMPACTS

Impacts include:

- new techniques introduced with food production potential;
- increased options available to farmers to diversify risk;
- demonstrations provided for other farmers to observe and perhaps adopt; and
- opportunities to field-test experimental ideas for researchers.

REFERENCES

Cock, 1985; Peyre de Fabregues, 1979; Hahn and Keyser, no date; Rinaudo and Rinaudo, unpublished; Sivakumar, in press; Thomson, 1992.

EXPANDED EXTENSION SUPPORT

DESCRIPTION

This intervention provides funds for training, materials, and transportation to GON and NGO extension agents so that they can expand their assistance in rainfed and irrigated agriculture. The increased presence and effectiveness of field level extension agents also allows for better information collection and dissemination, targeting of interventions, and monitoring of crises.

SELECTION CRITERIA

This intervention is designed to assist farmers to improve their current farming practices in order to increase crop production. It is appropriate as a mitigation activity because it targets farmers in food deficit areas who wish to reduce their vulnerability to drought and other threats to food security. Assistance is provided through local extension agents willing to attend training sessions if necessary and provide additional extension services.

IMPLEMENTATION

Under this intervention a GON or private organization in a food deficit area provides management for and training to agricultural agents who in turn provide extension services to farmers. Direct emergency support to the field agents allows them to visit more sites and to provide DPM/*SAP* with more accurate field-based data on the severity of food security and drought problems.

Participatory Rural Assessments (PRA) are conducted with both farmers and extension agents to help farmers identify areas for improvement in their farming systems, and extension agents to identify areas for additional training. Training agents in the targeted areas may include refresher courses in agronomy, irrigation management, integrated pest management, and forestry, as well as guidelines in project management and proposal preparation for interventions. Based on field visits, training, and criteria set by DPM/*SAP*, agents submit intervention proposals to the implementing organization. Proposals should be site specific and based on farmers' and pastoralists' expressed needs.

Interventions can target both rainfed and irrigated agriculture. For example, improving small-scale irrigation systems can reduce labor requirements and improve production in dry-season gardens. Irrigation specialists can choose from a variety of improvements such as: 1) deepening, an activity usually undertaken at the end of the dry season; 2) repairing cracked walls; and 3) hiring *plongeurs* (professional well technicians) to remove sand and other debris that has collected in the well.

Irrigation agents also can help farmers improve their water pumping or pulling systems by introducing: 1) pulleys and tripods to facilitate pulling; 2) animal traction systems which are

used in northern Niger; 3) *chadoufs* (water collection device); 4) hand pumps installation or repair (this intervention may require credit or subsidized purchase); and 5) gasoline/diesel power pumps (this intervention would require credit for purchase and special attention to sustainability issues).

Irrigation delivery systems also can be improved by: 1) collection basins with hoses for siphoning; 2) pipes or lined canals for gravity flow; and 3) pulse delivery systems to reduce losses along delivery canals.

Irrigation agents can help farmers improve their application methods so that the water applied to crops is used most efficiently (i.e. sprinkler, flood, or trickle application systems). Other management improvements to counter specific problems such as salinity, fertility, and pests also may be addressed.

Improvements that can be extended to farmers for rainfed agriculture include those in such areas as soil fertility (see **Introduction of Phosphate Fertilizer**, p. 44), agricultural productivity (see **On-Farm Applied Research**, p. 37), agroforestry (see **Native Seed Collection for Revegetation**, p. 49) and soil and water conservation (see **Micro-Catchment Water-Harvesting for Agriculture**, p. 32). Other areas of agricultural support include integrated pest management and livestock related activities.

The management capability required by this intervention depends on its scope. It can involve coordination among multiple GON Ministries and their field agents as well as extension agents from other organizations and projects. Inputs include management responsibility and training provided by the implementing organization, and the resources required by each of the selected interventions (i.e. labor, materials and transportation).

Possible indicators include:

- number of extension agents receiving training and implementing activities;
- number of farmers participating in extension activities;
- numbers and types of new activities implemented; and
- specific outputs and impacts of activities implemented through expanded extension services.

IMPACTS

Funding devoted to more effective coordination of GON and donor activities in food deficit areas will allow more efficient utilization of resources. Impacts will vary according to interventions actually implemented but should include:

- increased access to or production of food; and
- improved availability and use of water resources.

REFERENCES

Institut International du Management de l'Irrigation (*IIMI*) is a research organization that focuses on large perimeters but may become involved in small perimeter/garden research. Contact person is Kurt Lonsway, B.P. 10883 Niamey, Telephone 73.29.58.

The World Bank is considering a project that will help development of small scale irrigation and may provide opportunities for collaborative work with other organizations.

INRAN and ICRISAT should be consulted for information, training, and other assistance.

Norman, 1992; and Beniest, 1987.

INTRODUCTION OF PHOSPHATE FERTILIZER

DESCRIPTION

The two major physical constraints on agricultural production in many parts of Niger are rainfall and soil fertility. Introducing phosphate fertilizer to farmers' fields in drought-affected areas improves soil fertility and increases yields, with benefits potentially spanning several years. Phosphate encourages plant root development and remains in the soil if it is not taken up by plants. Some farmers in drought-prone areas of Niger have observed the benefits of phosphate fertilizer during low rainfall years and expressed it as a priority need.

ICRISAT research has shown that grain yields on phosphate fertilized fields are higher than those on unfertilized fields, given equal rainfall. When rainfall is insufficient to allow plants to take up the phosphate, it remains in the soil and can increase yields the following year. However, most Sahelian farmers are reluctant to invest in chemical fertilizer because of their experience with manured fields. They know the benefits of using manure in good rainfall years but they also know that using it is "inviting drought," as nitrogen-rich manure produces a crop with a high demand for water. The farmers' widespread perception is that fertilizer use increases the risk of "burning" the crop. Phosphate fertilizer therefore will probably require subsidization in order to demonstrate its benefits.

Phosphate fertilization causes millet to mature faster. Farmers can exploit this effect and reduce the chance of a complete crop failure owing to lack of rainfall during the flowering and grain-filling stage of growth. Fertilized and unfertilized fields will mature at different times, reducing the risk that the entire crop will be adversely affected to the same degree during dry spells.

SELECTION CRITERIA

This intervention will increase farmers' food security and resiliency to drought. It has minimal management requirements as long as phosphate fertilizer is readily available. Fertilizer can be offered to farmers on a subsidized basis or in small amounts for demonstration plots. The sustainability of continued use depends on farmers' ability to generate enough agricultural surplus to justify the expense of the fertilizer. Rock phosphate is a natural, but under utilized resource mined in Niger. Implementors should encourage the use of local rock phosphate fertilizer over more expensive imported varieties. Implementation of this intervention may be easier in areas near sources of rock phosphate. Two areas where rock phosphate deposits have been exploited in the past are near Tahoua and in Tapoa, near *Parc National de "W"*. Fertilizer use can produce benefits within a single season since it can be applied to rainy- or dry-season crops. No Food or Cash for Work is required because farmers should contribute labor as an investment in the intervention.

IMPLEMENTATION

Simple Super Phosphate, Triple Super Phosphate, or rock phosphate fertilizer should be applied at a rate of 13 kg of elemental phosphate per hectare. It can be applied by broadcasting over the field or side-dressed by each sown pocket of millet. Side-dressing ensures phosphate availability for individual plants but does not provide benefits over the entire field in the following year the way broadcasting does. Application rates for other rainfed and irrigated crops vary according to crop and soil type, pH and degree of phosphate deficiency. Initially, enough fertilizer for one hectare can be distributed to create a demonstration plot. Technical assistance is necessary initially in order to teach farmers application rates for broadcasting and side-dressing.

Since phosphate fertilizer has a residual effect that lasts over several years, its use could benefit farmers that rent land if the implementing agency helps persuade land owners to grant three to four year leases.

Farmers should spread fertilizer on their fields while under supervision. This also ensures that farmers are applying and using the fertilizer correctly and are not selling the fertilizer for cash.

Impact indicators include:

- number of farmers who use phosphate fertilizer on rainy-season crops;
- number of farmers who use phosphate fertilizer on dry-season crops;
- total number of sacks/kilos of phosphate purchased by individual farmers in the rainy season;
- total number of sacks/kilos of phosphate purchased by individual farmers in the dry season; and
- farmers' evaluation of the benefits and problems of fertilizer use.

IMPACTS

Improved grain yields from phosphate fertilization will increase food production and contribute to household food security. Increased demand for phosphate fertilizer could stimulate exploitation of Niger's rock phosphate deposits. Improved harvests from fertilizer use also may promote farmers' confidence in extension services.

Phosphate is a relatively safe agricultural input, in terms of its environmental impact, but it could collect in water (lakes, streams, rivers) as the result of erosion. Farmers can prevent erosion and pollution with appropriate land management techniques, with assistance from agricultural extension services.

REFERENCES

Research by ICRISAT scientists has shown that phosphate fertilization can increase crop yields and reduce vulnerability to drought.

WATER-HARVESTING ON RANGELANDS

DESCRIPTION

Water-harvesting catchments on open-access rangelands can rehabilitate degraded areas. Their construction provides public-works employment. There are different types of water-harvesting catchments such as *zais* (small pits for individual pockets of grasses, plants and trees), *demi-lunes* (V-shaped earth ridges which collect runoff), and contour dikes, which are rock or earthen ridges constructed along contours to collect runoff. These types of water-harvesting catchments are appropriate in areas with eroded, crusty soils such as those on lateritic plateaus. On rangelands, these catchments increase water infiltration and provide a better environment for vegetation to establish and survive even under intense grazing pressure. Water retention and reduced runoff decreases erosion and recharges aquifers. Ultimately these catchments contribute to food security by increasing the availability of wild foods and improving pasture for livestock. **Micro-catchment Water-harvesting for Agriculture**, p. 32 and **Native Seed Collection for Revegetation**, p. 49 are complementary interventions that provide additional information about these techniques.

SELECTION CRITERIA

Micro-catchments can be constructed any time during the dry season. They contribute to long-term food security and natural resource management (NRM) and provide direct relief when implemented through Food or Cash for Work (FFW/CFW).

The major criteria for selecting this intervention are:

- villagers have identified soil and water conservation as a priority and an appropriate use of land, labor and capital;
- donors want to invest in NRM using FFW/CFW on public-work projects; and
- environmental conditions are such that selected areas would benefit from soil and water conservation measures.

Project experience in Niger shows that techniques that require heavy manual labor must be supported by FFW/CFW. Catchments attempted without external support must be adapted to farmers' labor capacity. This may require designing two types of dikes: larger dikes requiring heavy manual labor to be constructed using FFW/CFW, and smaller dikes suitable for construction by individual farmers. Conflict over the use of and rights to open-access land (between villagers or between villagers and pastoralists) is an important factor to consider with this intervention.

The implementing agency must have technicians or engineers with field experience and knowledge of how to adapt micro-catchment designs to local socio-economic and environmental conditions. If such technicians are not available, the implementing agency should collaborate with a qualified sponsor to train them in the techniques appropriate for the

intervention site. Proposal budgets should allow for this added expense.

IMPLEMENTATION

The primary purpose of micro-catchment construction is improving the vegetation on rangelands. Implementation should be discussed with farmers and pastoralists, both men and women. Three methods of vegetation improvement are: 1) improving the environment around existing preferred plants, 2) direct seeding, and 3) planting seedlings (refer to **Native Seed Collection for Revegetation**, p. 49 and **Village Cereal Banks**, p. 23 [for seed storage]). Farmers and pastoralists should be encouraged to protect the young plants from livestock for at least two years until they are established. Without this step the long-term impact of the intervention is likely to be minimal.

Site-specific participatory research concerning land use rights is a key prerequisite to implementation. Farmer-to-farmer visits and training can be effective ways to communicate water-harvesting catchment techniques. Technical assistance (TA) should include training local people as trainers in construction techniques.

Several types of catchments can be used. *Zais* are appropriate for establishing grasses and trees, and *demi-lunes* can be constructed around existing vegetation. Contour catchments are more labor efficient since more surface area is treated per length of dike constructed but have the added technical complication of following the land contour. When constructing contour dikes, the ratio of the length of dike along the contour to the length of the containment arms at either end should be 10 or 20 to 1.

Inputs are:

- FFW/CFW for the manual labor;
- picks and shovels;
- seeds and seedlings of preferred grasses and trees (if revegetation is to be included as part of the intervention);
- trained local extension agents to teach catchment construction techniques to participants, direct operations and control quality.

Technical assistance:

Local technicians are easily taught correct micro-catchment placement. Farmer-to-farmer visits and training has been documented as an effective way to spread the technique throughout regions (Erdmann, 1992) and may help motivate people. The required TA consists mainly of training trainers--extension agents and villagers--in this relatively simple but labor-intensive technique.

Management:

Discussions between the villagers and the implementing agency will be necessary to confirm that the intervention is a local priority and within the villagers' labor capacity. While

FFW/CFW can support heavy labor to construct large dikes, post-intervention maintenance and villagers' independent use of the technique depends on its adaptation to individual needs and labor and time resources. This again underscores the need to work interactively with the participants to design and build catchments suitable and sustainable under local conditions. Follow-up TA is necessary to ensure maintenance and promote improvements and expansion of the water-harvested surface area.

Indicators include:

- number of meters of contour dikes in open-access land completed by the intervention;
- number of micro-catchments (*demi-lunes*, *zais*, and dikes) completed by the intervention;
- condition of the catchments one year after the intervention is completed;
- number of micro-catchments constructed after the intervention;
- villagers' evaluation of the benefits of and problems with the contour dikes; and
- tenure disputes caused by the intervention.

IMPACT

Potential effects on farmers and pastoralists are:

- improved livestock health through improved grazing conditions;
- increased livestock production;
- increased food security and income from livestock and livestock products;
- improved access to wild foods and fuelwood.
- improved nutrition and increased income for farmers and pastoralists from wild food collection; and
- reduced migration from rural villages for work (because of the FFW used in implementation).

Potential effects on the environment are:

- increased water infiltration and retention;
- regeneration of rangeland brush and grasses;
- regeneration of wild foods and seeds;
- reforestation, if trees are planted;
- increased capacity of rangeland to withstand drought;
- decreased erosion; and
- improved soil fertility and conservation.

REFERENCES

Erdmann, 1992; Rochette, 1989; Tabor, 1986; and Tabor, in press.

NATIVE SEED COLLECTION FOR REVEGETATION

DESCRIPTION

A readily available source of native vegetation seeds will greatly improve the ability of small projects to rehabilitate degraded lands through direct seeding and seedling plantings. Valuable plants can be reintroduced into degraded open-access land as well as agricultural fields as part of soil and water conservation (SWC) activities. This intervention involves collection and storage of native seeds which can be used for direct seeding and seedling nurseries for revegetation. Revegetation can help improve land productivity, increase biodiversity, and provide income for farmers and herders over the long-term through increased production. This is not an intervention likely to rank high among village priorities but it can be implemented through Food or Cash for Work (FFW/CFW) to provide an additional source of income during emergencies.

Plant communities change because of overgrazing, especially during droughts. Valuable and palatable species disappear -- consumed by livestock before they can reseed -- giving a competitive advantage to low-value species and reducing land productivity. Integrating revegetation of valuable grasses, forbs, shrubs, and trees with SWC activities improves land productivity and stabilizes SWC earthworks (see **Water-Harvesting on Rangelands**, p. 46). Seed collection must be conducted year-round to obtain a wide enough variety of seeds for revegetation. The seeds can be stored in a seed or cereal bank to assure that the full range of plant species is available for revegetation projects. The *Lexique des Plantes du Niger* (1979) provides a basis for communication about what farmers and pastoralists want planted on their land.

Seeds collected and stored can be provided to other existing revegetation, SWC, and biodiversity projects. International environmental and research organizations may help subsidize particular species collection and distribution. The International Board for Plant Genetic Resources (IBPGR) and International Center for Research in Agro-Forestry (ICRAF) and International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) could play advisory roles in this and related interventions.

SELECTION CRITERIA

This intervention provides FFW/CFW to areas experiencing food shortages in return for the labor of collecting and planting seeds. It can be implemented in combination with a SWC project or provide seed to other independent projects.

The required management and funding level is low for seed collection but increases if storage and revegetation activities are included. The financial and management costs also depend on the scale at which the intervention is implemented. Seed banks and seedling nurseries can be incorporated into existing **Village Cereal Banks** (p. 23). The assistance of specialists such as agronomists, botanists, and foresters may be needed to manage certification and seed treatments.

NGOs, Government agencies or research institutes can coordinate the collection and distribution of seeds -- determining type and quantity -- between banks and other projects.

IMPLEMENTATION

Seed Collection:

Seed collection of native plants for extra income can be integrated into many activities in the daily lives of rural people. For example, women can collect seeds when they are searching for firewood; men can collect grass seeds while they are collecting grass for making *seco* (straw) mats; pastoralists can collect seeds while they are herding their animals. Implementing agencies can contract with farmers and pastoralists to collect seeds, compensating them in grain or cash. As in all FFW/CFW activities, care should be taken to ensure that by compensating laborers the project is not undercutting the efforts of any other self-help projects in the vicinity who may be requiring beneficiaries to contribute uncompensated labor.

Seed quantities and species types for revegetation should be directed by farmers' and herders' preferences for plants with high value for grazing, medicines, food, and construction materials. Collection of high-priority plants will increase the perceived utility of this intervention to the beneficiaries and contribute to its sustainability.

One technique for identifying plant preferences is by drawing up a list of 4-6 key species identified as important by male and female participants. The list is then written down the rows and across the columns of a matrix. Each cell of the matrix cross-references one pair of species, the row species and the column species. The relative merits of each pair of species are discussed by the participants and the name of the more valuable species of the pair is entered in each cell. After all combinations have been considered, the species can be prioritized simply by ranking them according to the number of times their names appear in the matrix.

The collected seed can be used for revegetation in SWC and revegetation activities or sold/given to other organizations or farmers that need seeds. Possible end uses of the seeds are village seedling nurseries, direct seeding of hay/fallow fields, paddock for livestock fattening or nursing weakened animals, and direct seeding in water-harvesting catchments on rangelands. Human uses include wild food and medicinal plants.

Indicators include:

- number of people (men, women, children, farmers, pastoralists) collecting seeds;
- number of varieties collected;
- amount of seeds collected;
- viability of seeds;
- number of village nurseries established; and
- number of hectares planted.

Seed Banks:

Local seed banks are needed to store the collected seeds. Ideally, to keep transportation costs low and convenience high, banks should be established in each Department (obviously implementing the intervention on a national scale like this would raise the costs considerably). Seed banks can function as brokers, assuring that seeds for a wide variety of species are available in sufficient quantities to projects for revegetation efforts. Their other functions would include storage, germination testing, seed treatment, packaging, certification, and distribution to other organizations.

The seed banks will need storage facilities (see **Village Cereal Banks**, p. 23 for storage requirements), laboratory space to process and treat seeds, packing materials, and capitalization to pay for collected seeds and transportation.

Some level of seed purity standards, percentage of leaves, stems, and other acceptable matter, should be established for the different types of seeds to be purchased from farmers and pastoralists. The bank may need to clean the seed further. Seeds need some form of certification. They should be tested for viability and some will need treatment (scarification) to improve germination. Initial standards and procedures could be established by INRAN, IBPGR, or International Center for Research in Agro-Forestry (ICRAF). Package labeling should include an appropriate seal of certification and origin.

Seeds can be packaged in vacuum packed plastic bags using a bicycle pump with a reversed valve. The seeds can be mixed with freshly toasted cereal grain to help absorb moisture.

If there is large enough demand from projects or farmers willing to pay for some of the "certified" seeds, banks can develop funds to purchase collected seeds and for seedling distribution, thereby decreasing the need for FFW inputs. It is unlikely that farmer demand will be enough to sustain the costs of storage and certification. Maintenance of these functions past the life of the intervention would require a continued demand for a supply of high quality wild seeds by donors or other implementors of SWC and revegetation projects.

Besides convenience and quality assurance, banks can guarantee the availability of seeds even after severe, widespread drought. Areas that have received sufficient rainfall are good sources of seed. Information on the distribution of rainfall is available from AGRHYMET and can be used to direct seed collection during droughts.

Donor/Government-supported native vegetation seed banks can be converted to agricultural seed banks after widespread droughts in order to help meet demands for agricultural seeds.

Indicators include:

- types and amounts of seeds stored in banks;
- number of requests for seeds;
- types of seeds requested; and
- amount of seed distributed by banks (to groups and individuals).

Seedling Nurseries:

Seed banks can provide seeds to village-based seedling nurseries. These nurseries allow villagers easy access to trees and other kinds of plants at minimal cost. The seedlings produced are based on local demand and availability of seed. Seedlings commonly provided by village-based nurseries are fruit trees, trees for woodlot plantations, medicinal plants, and trees grown for community anti-desertification efforts.

Government forestry or agricultural agents and NGO personnel can train village volunteers to manage the nurseries. Training should include techniques for producing seedlings, such as how to mix the potting soil, fill bags, treat seeds to improve germination, and planning so that the seedlings are ready to plant when both the rain and labor are available.

Plastic bags can be difficult to obtain and the implementing organization may be required to find suppliers. Villagers and outsiders could pay a small fee (generally less than 100 *CFA*) to cover the costs of bags and other inputs.

Indicators include:

- number of seedlings produced;
- number of survivors over time;
- list of species introduced in an area;
- location where seedlings are planted (i.e. communal areas within village, agricultural fields, and open access land);
- number and percentage of people with surviving trees;
- number of people using nursery; and
- villagers' evaluation of project.

Direct Seeding:

Revegetation and rehabilitation costs can be greatly reduced if direct seeding, rather than planting of seedlings, is integrated into SWC activities such as water-harvesting catchment construction. Soil and water conservation structures commonly need vegetative protection. Implementing organizations should be encouraged to broadcast seeds on and around these structures during construction.

Through direct seeding, farmers can convert their fallow lands into more productive hay fields by broadcasting the grass seeds of preferred species. This intervention is one in which pastoralists can take an active role in improving their environment. Significant improvements in range production can be achieved if high-value species are nurtured. When rainfall is good, vegetation quickly returns to the Sahel, and most Nigeriens would prefer a field of *Ziziphus mauritiana* (*jujubier*) and *Diheteropogon hagerupii* (*shamréy* in Hausa; *haramdam* in Zarma) to one of *Calotropis procera* (*tumfafia* in Hausa; *sageye* in Zarma).

After years of very poor survival rates of planted tree seedlings, direct seeding of grasses, forbs, and trees is a technique which is receiving more attention. Direct seeding is easier to manage, reaches a wider audience, and provides a larger selection of plant species from which to choose.

There is a wealth of information throughout Niger about site selection, seed treatment requirements, and success rates for different species. Implementing agencies can play a pivotal role in helping collect and disseminate this information as well as encouraging further research on how to improve germination and survival rates. Experimentation by farmers and pastoralists should be encouraged (see **On-farm Applied Research**, p. 37). For example, Sahelian farmers grow nutritious grasses in small enclosures that are used to fatten animals or strengthen weakened ones. In the Maradi Department, Tony Rinaudo of the Sudan Interior Mission has been encouraging farmers to plant useful species in fallow fields and the practice is spreading. Direct seeding of fallow hay fields near farmers' compounds may allow hay cutting, curing and storage to be a more convenient family labor operation.

Revegetated areas must be protected from over-harvesting by both people and animals in order to be sustainable. Unsustainable harvesting and failure to protect vegetation from livestock are common downfalls of revegetation efforts.

Indicators include:

- amount of seeds distributed;
- number of SWC activities requesting seeds;
- types of seeds requested; and
- plant survival rates in revegetated areas.

IMPACTS

This intervention increases the availability of native seeds to farmers and pastoralists and increases their agro-forestry options. In addition, poor people can directly receive cash or food in exchange for collecting and redistributing seeds without unduly interfering with other daily labor demands.

The impact of collecting seeds of productive plants for revegetation activities helps reduce soil erosion and improves rangeland and vegetative resources including famine foods, and traditional medicines.

Biodiversity can be improved through this activity by making available seeds of species that have disappeared from drought, over-grazing, and over-exploitation. Plants that are considered threatened or endangered such as *Prosopis africana*, and *Borassus aethiopum* could be preserved through seed collection funded by conservation organizations.

In addition to improving the environment, native species improve villagers' quality of life by providing shade, wind erosion protection, fodder, fire and construction wood, food, and traditional medicine.

REFERENCES

Peyre de Fabregues, 1979; Gueye and Freudenberger, 1991; Maydell, 1983; and Shaikh et al., 1988.

COMMUNITY VETERINARY AIDE TRAINING

DESCRIPTION

Community veterinary aide training assists communities to establish their own sustainable veterinary health care programs. The intervention involves training in basic livestock veterinary care and herd management practices to community-selected participants. Villagers/pastoralists are required to pay for vaccines, medicines and other supplies.

This intervention is designed to improve livestock health conditions and increase livestock output production levels. Improved livestock management will produce an increase in food security for the transhumants and pastoralists whose staple foods are meat and milk. It will increase income for those who sell livestock to purchase grain. Thus it helps to mitigate the negative effects of seasonal and environmental changes on food security. It is important, however, that this intervention promote herd management that includes culling to prevent environmental degradation from overgrazing as herd health and size increase (see **Animal Destocking and Meat Processing**, p. 58).

A similar Veterinary Aide (Vetscout) program was implemented in Niger by Tufts University in the 1980s. "A post-project evaluation shows that a majority of the Vetscouts continued to operate without supervision as long as they could obtain animal health commodities [supplies and medicines] to sell in the field" (Stem and Sollod 1991, p. 98).

CARE International in Ethiopia is currently implementing a Rangelands Vet Scout Program in Borana.

SELECTION CRITERIA

Community veterinary aide training can be implemented throughout Niger. It is targeted at pastoralists and transhumants who identify a community member to participate in the training to become their Veterinary Aide. The community then provides for his/her maintenance and reimburses for medicines and supplies for their livestock. For transhumant herders, training must be conducted when they are stationary.

Aspects of other potential livestock interventions such as destocking, marketing, rangeland management are incorporated into the training. Interventions such as restocking are more suitable for periods following high environmental stress and loss of livestock.

Criteria for selecting this project include:

- pastoralists and transhumants are target groups;
- livestock are vital to their food and economic security;
- livestock health and herd management are identified by the community as primary needs;

- GON or NGO has the technical staff to provide training and on-going monitoring; and
- a reliable and continuous source exists for veterinary medicines and supplies.

By training locally selected participants in identifying livestock diseases and treatments, range management techniques, destocking, and marketing, all aspects of livestock herd and health are addressed. Fifteen to twenty Aides are trained during each session, thereby assisting an equal number of communities. Community selection and support of the Veterinary Aides increases the communities' acceptance of their advice and diagnoses.

Pastoralists and transhumants must be willing to participate and remain stationary long enough for training to be conducted and for the veterinary medicines and supplies to be distributed to the Veterinary Aides. The implementing agency must have access to laboratory and extension services in the region.

IMPLEMENTATION

Fifteen to twenty trainees, experienced with livestock, are selected by pastoral and transhumant groups within a *arrondissement* (county) to become their "Community Veterinary Aide." Experience shows that communities usually select traditional veterinary specialists or their apprentices. The selected participants receive training focused on disease diagnosis, administration of drugs, and methods of disease prevention. The training is conducted by regional veterinarians and extension staff, thereby developing working relationships. Upon completion of training the Veterinary Aides return to their communities to identify diseases, and prescribe and administer appropriate drugs. They also introduce cattle management techniques to the pastoralists and transhumants to help prevent diseases, pest problems, and over-stocking. Community participants reimburse the Veterinary Aides for services received, including a small salary, thereby establishing a revolving or sustainable source of medicines and supplies.

The Veterinary Aides work closely with and under the supervision of local veterinarians and extension agents. They alert them to any major problems or potential epidemics so appropriate responses such as vaccination programs can be implemented. Veterinary Aides also maintain daily records of their activities, medicines and supplies disbursement, market prices, and changes in the community, herd, or environment -- information which can be useful for famine early warning.

Training the Aides provides an opportunity for veterinarians and extension agents to reach local groups. Extension agents may benefit from training in participatory development, data collection and maintenance, and additional technical training.

Technical assistance may be required from GON Ministry of Agriculture and Livestock or research organizations to provide laboratory and immunization services, medicine, and supplies. For example, the Pan-African Rinderpest Program may be a source of collaboration for rinderpest diagnosis and vaccinations.

Training of Veterinary Aides will last approximately 30 days (five weeks) and include sessions on:

- animal production;
- infectious and non-infectious diseases;
- wounds and infections;
- drugs and equipment;
- diagnosis and treatments;
- vaccinations;
- marketing (data collection, and best time to sell);
- rangeland conservation; and
- herd management (culling, destocking, and diversification).

Kits should be supplied with appropriate and readily available medicines including anthelmentics, antibiotics, acaricides and narcotics; and supplies such as syringe and surgical materials, forceps, scissors, stethoscopes, ice boxes, and first aid kits.

Additional materials such as laboratory equipment and supplies may be required to accommodate analysis of data and cultures collected by the Veterinary Aides and to facilitate medicine and supply distribution. Trainees (and possibly veterinarians and extension agents) will require per diem during training. Enough funds must be available to supply needed medicines and supplies for at least one full year.

Planning, procurement and training for this project will take three months. Follow-up to ensure proper diagnosis and treatments and reliability of the medicines and supplies distribution is on-going.

Community participation must be initiated from the beginning. Participatory Rural Assessments to solicit community needs and opinions on possible options should be conducted in potential villages. If a Veterinary Aides Training intervention is identified as a community priority then committees can be created to begin planning for the project and selecting potential participants. It is essential that the trainee candidates be literate.

Once the number of potential trainees has been established the procurement of necessary medicines, supplies and equipment should be initiated. A reliable and continuous source of medicines and supplies is required. Training should not begin until these materials are in stock. Both the Tufts and CARE projects reported that the lack of a reliable source for medicines and supplies as the largest problem in their programs. Training design and selection of Veterinary Aides can be conducted during this time.

At least two veterinarians are needed to conduct technical training, manage laboratory analysis, immunize cattle, direct the medicine and supplies distribution system, and to provide on-going technical assistance to the Veterinary Aides. Extension agents can assist in distributing supplies and providing technical assistance. A professional trainer could assist in designing and facilitating the training.

Following training, Veterinary Aides are provided with their veterinary kits and return to their villages or communities. The veterinarians and extension agents should monitor the Veterinary Aides' activities closely and be prepared to respond quickly to their requests for assistance for vaccinations and treatment. This requires dependable transportation.

Detailed records should be kept on supply disbursements, immunizations and treatments, occurrence of disease, and market prices and quantities. This information is collected from the community, by the Veterinary Aides, veterinarians and extension agents. They also are responsible for collecting data on immunizations supplied by other sources (NGOs, other programs and donors) to livestock in the region. These records establish accountability, and serve as guides for procurement. The collected data should be provided to the Government monthly for inclusion in its early warning system. It should also be collected prior to implementation as a baseline.

Monitoring indicators include:

- number of Veterinary Aides trained;
- requests from other communities for Veterinary Aides;
- change in quantity of diseases reported; and
- change in number of livestock vaccinated.

IMPACTS

The initial impacts will be improved livestock herd and health conditions, and increased livestock production levels, that never have fully recovered from the droughts of the 1980s. Improved production will provide more m and milk to participants, improving their nutritional status and food security. Increased livestock production can increase livestock sales for the purchase of grain for consumption.

Increased livestock production will generate income for pastoralists as animal husbandry is their primary strategy for generating cash and savings. Training in marketing and data collection can improve local knowledge and increase participants' incomes from sales.

Rangeland and herd management techniques (i.e. diversification, smaller herd size) should decrease degradation of the environment, although this impact may be minimal and difficult to measure. Conversely, if destocking and rangeland management are not implemented, increased animal population pressure may cause environmental degradation from over-grazing.

Livestock immunization projects can be used to encourage child immunizations. Veterinary Aides Training might be followed by training of trainers in literacy, numeracy, and health and nutrition. A USAID funded health sector project in the early 1980s trained village level health workers, *secouristes* and *matrones*, which included transhumants who travelled with their family groups (Lukas, 1982).

REFERENCES

CARE, 1992; Lukas, 1982; Stem, 1993; Stem, 1994; Stem and Sollod, 1991.

ANIMAL DESTOCKING AND MEAT PROCESSING

DESCRIPTION

Poor pasture, rising grain prices, and falling livestock prices during droughts result in distress sales of livestock, usually in poor condition. This causes a loss of income, particularly for pastoralists, and the livestock that die represent loss of potential food. In this intervention, cattle unfit for sale on the hoof are converted into dried beef for resale or relief distribution. Sun-drying and meat curing to make jerky is done in Niger on a small scale. This intervention entails purchasing large numbers of vulnerable cattle and processing large quantities of meat. The process for preserving meat described is appropriate in rural areas because it requires a minimal amount of equipment, uses solar energy, and the dried meat can be transported without refrigeration.

Due to market competition from preferred and/or donated protein (such as dried milk), the implementing agency initially must assure producers of a market in order to initiate the intervention. That is how a similar project was started in 1983 in Tanout. In that case, however, the quality of the dried meat did not meet retail standards so it was used as part of food rations for famine relief. Livestock purchase by the implementing agency also provides an immediate source of cash to pastoralists during emergencies.

SELECTION CRITERIA

This intervention will: 1) allow pastoralists to sell their livestock for grain or cash and reduce their financial losses during emergencies; 2) help reduce range degradation through reduction in herd sizes; 3) provide locally-produced food for famine relief; and 4) support the development of private enterprise. It is appropriate for pastoralists as well as agriculturalists with sizeable herds. It is possible that the intervention could become sustainable given sufficient and prolonged funding and management commitment, but at a high cost.

IMPLEMENTATION

A precedent for this activity exists: dried meat was produced and marketed in Niger from the 1940's until the early 1970's. The industry was centered in Nguru, about 200 kilometers southeast of Zinder, and the smoked meat was shipped to Ibadan for distribution (Cook, 1989).

When early-warning data indicate that pasture will be insufficient for the national herd, agencies can encourage pastoralists to destock by setting an initially high, but declining price for cull animals. Both current and the lower, future prices for cull animals should be announced on the radio weekly, along with other market information. The initial price could vary across the country as a function of estimates of regional pasture shortages from local reports and satellite data. There would be no restrictions on who brought in livestock to sell (pastoralists or traders). The GON and private traders then would sell the dried meat, based on prior agreements with buyers in southern Nigeria, as was done previously (Cook, 1989).

Interventions involving buying and selling livestock must be tailored to local situations. Needs assessments must establish set prices for animal offtake and identify food deficit areas for meat sales or donations. These interventions can be initiated by NGOs and Governmental organizations and implemented by farmers and pastoralists with the aid of the private sector.

This project requires capitalization in cash and grain. Storage and purchasing centers operated by the GON or donors will be required to initiate the project until the private sector takes over. This will require a high degree of inter-organizational cooperation. After a drought, implementing organizations can establish livestock purchasing and meat processing stations in areas where destocking is necessary. Then they can transport the meat to storage facilities for inspection and purchase.

Dried meat such as jerky is a concentrated protein that is nutritious, palatable, and storable. In Niger, it is traditionally called *kalichi* and is made by air-drying meat or drying meat over an open fire. Three kilograms of raw meat produce one kilogram of dried meat. One thin bovine produces about 25 kilograms of dried meat.

Equipment and ingredients required to make jerked beef are:

- beef;
- a system for hanging meat strips (wire or barbed wire);
- brine or marinating solution (optional); and
- a smoker (optional).

Preparation:

The beef is cut into 3 by 15 centimeter strips, along the grain of the meat. The meat should be only 3-6 mm thick to allow quick drying and ensure good quality. Fatty cuts and the muscle membrane are removed for other uses. A large bull can be processed by a skilled team of four people in less than two hours.

Lightly curing the strips in a cold or boiling salt brine or marinating them for about three hours are optional steps that help preserve and season the meat. The meat is sufficiently cured in a cold brine when it is lighter in color; in a boiling brine it is cured by dipping the strips until the meat is no longer red (about 15 seconds). Or meat can be marinated in a mixture of *Maggi cubes* (a flavor bouillon readily available in West Africa), hot peppers, and water.

The strips are air-dried in the sun without touching each other or the ground for 1-3 days. Solar dryers can greatly reduce drying times. Smoking the meat as it drys keeps off flies and gives the jerky/*kalichi* an agreeable flavor, especially using trimmings from the mesquite tree (*Prosopis juliflora*). Cooking the jerky over low heat for about ten minutes will kill any pathogens that may have contaminated the meat during drying and storage.

In addition to drying, curing meat (Ashbrook, 1955) and fish (Rawson, 1966) using dry salt, brine submersion, corning, or vinegar pickling offers simple alternative preservation techniques

for fatty meats or other cuts that are not appropriate for drying.

Technical assistance and training requirements include:

- economic analysis to determine anticipated market demand for meat and to set prices for dried meat;
- the assistance of a specialist to conduct training in appropriate drying methods;
- training implementing organizations in meat preparation that meets government standards; and
- training GON personnel how to inspect dried meat for resale and food relief.

Financial costs may involve:

- capital for purchasing cull animals;
- construction or rehabilitation of storage centers;
- training in livestock purchasing, appropriate drying methods and meat inspection; and
- transportation for processed meat.

Monitoring and evaluation:

Indicators include total offtake in number of head, price per head, quantity of dried meat inspected, and quantity sold. Monitoring data should be kept from each phase of the intervention in order to guide the management of each consequent phase: destocking, processing, inspection, storage, and distribution.

IMPACTS

This intervention can have a positive impact on pastoralists and villagers with livestock. It can help establish new private enterprise activities. Destocking also reduces range degradation during droughts. Proper processing and storage techniques increase the amount of high quality protein that is locally available.

REFERENCES

Ashbrook, 1955; Cook, 1989; Ferguson, 1967; Greenleaf, no date; and Rawson, 1966.

GABION CHANNEL IN ENTRENCHED CHANNELS

DESCRIPTION

Gabion channel plugs are wire cages filled with rock and placed in channels to prevent further erosion. Channel erosion is caused by the overgrazing of grasses and over-harvesting of trees which increases rainfall runoff in watersheds. The increased runoff cuts the stream channels deeper to accommodate peak flows. Entrenched channels cause extensive gully erosion and reduce flooding over the plains which normally provides supplemental irrigation for crops. Nigerien farmers with fields in the floodplain are acutely aware of their loss of agricultural productivity when the channel entrenches itself. The degradation of the surrounding resource base through gully erosion and reduced aquifer recharge causes long-term environmental problems.

The immediate benefits of gabion channel plugs (*barrage seuils*) in the Sahel are well documented (Shaikh et al., 1988; Rochette, 1989) and Niger's Rural Engineering Service (*Génie Rural*) has experience constructing them. If the channels are relatively small, organizations can provide total support for their construction. For larger channels and structures, organizations can provide additional support to on-going projects such as the *Seuil d'Epandage de Safo* in the Department of Maradi (in this particular case the reduced flooding was caused by the construction of a dam for an irrigation reservoir in Nigeria). Channel plug interventions have the twin benefits of providing employment through Food or Cash for Work (FFW/CFW) while promoting agricultural productivity through soil conservation.

SELECTION CRITERIA

This labor intensive intervention requires a high level of management capability on the part of the implementing organization. Site selection should be the responsibility of *Génie Rural* or other organizations with sufficient engineering capabilities. Priority should be placed on sites with agricultural fields located on a floodplain. The intervention proposal should account for the total number of gabion drop structures needed in order to treat the entire entrenched channel. Agreements with land owners and farmers should be made to protect erodible areas with permanent vegetation (i.e. grasses and trees). Even with the structures in place the floodplain will remain threatened by excessive runoff from the watershed. Secondary interventions such as seeding and construction of contours should be implemented to initiate the rehabilitation of the degraded watershed (see **Native Seed Collection for Revegetation**, p. 49, and **Water-Harvesting on Rangelands**, p. 46).

It is appropriate to incorporate FFW as a resource for gabions and channel plugs interventions because they are labor intensive and the channels often are situated on public access lands. The types of work required by these interventions employ large numbers of men (rocks are usually collected by women and children and the gabions are filled and placed by men). The work usually is done during the dry season so it does not compete for labor and time with agricultural

activities. Treatment of the entire watershed provides on-going activities and, as the work progresses to new areas, additional villages can be included in the Food for Work activity. This is the type of intervention that farmers normally would not have time to pursue without outside assistance and compensation (see **Food for Work**, p. 70). It is important to ensure that the land improvement benefits resulting from the FFW activities accrue to the most vulnerable households (Jackson and Eade, 1982).

IMPLEMENTATION

Organizations can collect information on potential sites from GON agencies. Intervention proposals should include information on the depth, width, and length of the entrenched channel, area of floodplain affected, population affected, and estimated number of structures needed. Inputs include labor, materials (such as wire for gabions and tools), and transportation (trucks and fuel to haul rocks to the site).

Possible project indicators are:

- amount of agricultural land restored to use;
- water-table levels at nearby wells, before and after the intervention;
- villagers' perception of the intervention's effect on them; and
- amount of revegetation on the channels.

IMPACTS

Many of the impacts of this intervention are immediate. Impacts of particular interest to those that have benefitted from these structures are:

- increased flooding and supplemental irrigation provided to crops;
- increased groundwater recharge and, potentially, higher water levels in nearby wells; and
- increased resilience of the affected communities to withstand recurrent drought.

The longer that channel plug interventions are delayed the greater the inevitable long-term environmental damage and lost agricultural capability.

REFERENCES

Jackson and Eade, 1982; Rochette, 1989; and Shaikh et al., 1988.

ROAD IMPROVEMENTS

DESCRIPTION

Road construction projects can provide employment for vulnerable populations during times of crisis. Road construction projects can be part of a long-term famine mitigation strategy, as roads increase access to markets and facilitate the circulation of goods. Existing road projects can be expanded to employ more labor compensated by Food or Cash for Work (FFW/CFW) (see **Food for Work**, p. 70). As road work is extremely expensive, the intervention presented here pertains only to emergency employment of people to work on pre-existing road projects which will increase their access to markets or otherwise contribute to their long-term food security.

SELECTION CRITERIA

As this intervention targets men, who often migrate in search of work immediately after the harvest, it should be implemented as quickly as possible after harvest time, particularly if the harvest was bad. Sites chosen for this intervention should have high population densities to minimize the logistical problems of getting work crews to and from the work site. This criteria may result in targeting higher rainfall areas with higher agricultural potential.

IMPLEMENTATION

When a crisis has been identified, on-going road projects in the affected areas that can be expanded to improve roads and employ people from food-deficit villages are identified. The agency sponsoring the road improvement intervention reimburses the organization implementing the existing road project for additional costs and is responsible for any additional logistics related to FFW/CFW.

Inputs will include labor, materials, equipment, tools, transportation, technical services of engineers, and FFW/CFW.

This intervention has a high management requirement including supervision of labor, and logistics for food or cash payments, materials, and equipment. Road improvement activities are expensive (i.e. labor, materials and equipment) and require the expertise of skilled engineers to ensure a quality product. These should be provided by the agency implementing the existing road project. Badly engineered roads can result in rapid degradation of the road structure and the environment.

IMPACTS

This intervention provides employment opportunities for men who otherwise may leave their villages in search of employment during the dry season. Improved roads provide better access to markets.

REFERENCES

Génie Rural and Nigertip are the GON organizations responsible for road construction and improvement. Nigertip currently has a grant from the World Bank for urban road improvements and is expanding to rural areas.

MODERN WELLS

DESCRIPTION

Access to water for household use, food production, and livestock is a stated priority for rural Nigeriens. In many areas people want wells so they can have dry-season gardens. Modern, cement-lined wells with manual pumps or pulley systems can replace or supplement traditional wells and improve local water supplies and sanitation. Increasing the number of wells in the rangeland-agriculture transition zone will allow pastoralists to keep their livestock outside agricultural areas until the harvest is finished, especially after a drought or poor pasture conditions in the northern rangelands. This will help reduce conflict between pastoralists and farmers.

There are several domestic and foreign agencies working on hydrology projects capable of executing this intervention (see references below). Artisanal technicians (*plongeurs*) trained by the *Association Française des Volontaires du Progrès* (*AFVP*) provide low-cost maintenance services to rural communities. Modern village wells can be implemented in conjunction with **Expanded Extension Support** (p. 41).

SELECTION CRITERIA

Wells provide year-round water and contribute to peoples' disaster resilience. Wells with manual pumps or pulleys located in or near villages/rangelands conserve the time and energy that women and children spend on the daily chore of collecting water for household use and watering livestock. Improving access to water contributes to human and animal health by improving sanitation and contributing to food production in dry-season gardens.

Both technical and social analyses must be done before this intervention is implemented. Well sites may require some compromise between what is technically feasible (such as the depth of the water table in relation to where the people want the well located) and what is socially viable. Conflict (actual or potential) between farmers and pastoralists over passage and water rights is a chronic issue that must be taken into consideration. Participatory discussions will help people understand the amount of labor required to pull/pump water from the well, and the limits that imposes on its use. Wells need to be located and designed to minimize overgrazing around the well. Bore-hole wells (*forages*) are infamous in causing desertification because their high yield of water encourages large herds of livestock to remain nearby, resulting in overgrazing. Smaller wells generally cannot support large herds and the labor required to pull water discourages pastoralists and their herds from remaining too long around the wells. Nevertheless some overgrazing is inevitable around the wells and revegetation and range improvement activities should be integrated with this activity (see **Water-harvesting on Rangelands**, p. 46 and **Native Seed Collection for Revegetation**, p. 49).

The village or pastoralist group must be willing to contribute labor and materials to the construction of its well. Maintenance will be their responsibility; they can establish a fund by

charging a fee per bucket of water, per head of livestock, or by collecting money from users when maintenance or repairs are necessary.

The cost of wells varies, depending on their depth, the type of material that must be excavated, and the type of well that is constructed. Costs in the Maradi area are 70,000 to 110,000 *CFA* (before devaluation) per meter (*Direction Départementale d'Hydraulique*). One hundred meters is a practical limit for digging wells, which limits where this intervention can be used.

IMPLEMENTATION

Inputs:

The villagers or pastoralists must contribute some resources such as labor or local materials to constructing the well. The implementing agency needs both social and technical expertise. Participatory social assessments and resource tenure investigations must to be conducted before well construction. The agency will have to provide imported construction materials (cement, re-bar, forms, sling and hoist, mining bars, a water-lifting device, and possibly dynamite). Participants may provide local materials such as sand, gravel, shovels, and picks.

Management requirements:

The management requirements for digging wells in villages is low. Follow-up technical assistance includes ensuring that the community has the means and technical training for maintenance of the well. The management requirements for constructing wells in the pastoralist rangelands may be higher, if they are a potential source of conflict among and between pastoralist groups.

Indicators include:

- physical condition of the well and water-lifting system one year after implementation;
- amount of funds accumulated from water fees paid by villagers or others who use the well;
- number and type of gardens, trees, or other innovations resulting from the well;
- villagers' and pastoralists' evaluation of the well's impact;
- frequency of tenure or usufruct conflicts; and
- plant species around the well site.

IMPACTS

The impacts of wells include:

- conservation of women's and children's energy through easier access to water;
- improved human and livestock health status by providing a source of water in which

contamination by diseases and parasites can be prevented;
- contributions to nutrition and income by allowing dry-season gardening and animal husbandry;
- accumulate village funds from outsiders through water sales; and
- potentially reduce conflict between pastoralists and farmers.

REFERENCES

The following agencies are engaged in hydrology projects, including well rehabilitation and maintenance:

Mr. Amadou Mahamane, *Directeur Adjoint*
Direction Départementale d'Hydraulique
Projet Hydraulique Rural de Tessoua
B.P. 477, Telephone 410-526
Maradi

NGOs:
Association Brigade Hydraulique de Mayahi
Association Française des Volontaires du Progrès
Africare
Association des Puisatiers de la République du Niger
Eglise Evangélique de la République du Niger

GRAY WATER FOR TREES AND DUCKS

DESCRIPTION

Water is a valuable resource in Niger and simple, inexpensive interventions that increase water accessibility and promote conservation should be encouraged. Gray water, such as bath and dish water, can be collected and used for duck ponds or to irrigate trees or household gardens. Construction of a small collection basin connected to a gray-water source is an easy intervention that has a positive, household-level impact. Gray-water basins provide a good environment for ducks, which in turn are a source of food or cash for people. Hand-filled gray-water cisterns can provide nutrient-rich water for valuable trees such as the baobab or fruit trees.

SELECTION CRITERIA

Gray-water catchments are inexpensive to construct and therefore affordable for most rural and urban households. They are low input and management interventions that can be implemented by Peace Corps volunteers or as self-help projects.

IMPLEMENTATION

Gray-water cistern:

A perforated, bottomless, and topless oil barrel (approximately 1,500 *CFA*, before devaluation) buried in a sandy soil serves as a reservoir for gray water. Water percolation into the ground is increased by excavating a hole larger than the barrel. This is especially important for clayey soils that have slower water percolation rates. The hole is filled with gravel so that the top of the barrel rests at a convenient height above the ground surface when it is placed in the hole. Holes should be punctured in the sides of the barrel in the part that will be underground. Gravel is packed around the outside of the barrel, filling the hole up to about 10 cm below the ground surface. Plastic or plastic bags should be placed over the gravel to prevent soil from filling into the spaces in it. Soil is placed on top of the bags to fill up the rest of the area around the barrel. Tree seedlings can be planted near (three meters) the barrel or the barrel can be placed near an established tree. The roots of the tree will find the gray water that is discarded into the barrel. A cover should be used to keep children and animals from falling into the barrel.

Duck ponds:

Ducks already enjoy puddles of discarded gray-water, however the environment for ducks can be improved by digging a small basin (ten liter capacity) lined with plastic bags that collects bath water run-off or other gray water. Covering the basin with a small overhang gives the ducks a cool, shady spot to rest and feed on the insects that are attracted by the water. The ducks also can forage on wild plants (i.e. Morning Glories, *Ipomoea*) which other livestock do not eat.

IMPACTS

Gray water has productive uses, with a small initial investment. It can be used to irrigate trees that provide leaves and fruit for food, and to provide a productive environment for ducks. Both of these products can contribute to household income and nutrition.

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Peace Corps
Niamey, Tel: 734-686

Tabor, 1986.

FOOD FOR WORK

DESCRIPTION

Most experts agree that short-term food aid is beneficial in emergencies involving food shortages. Food provided in exchange for work is a resource which can be utilized to implement many of the interventions in this manual. Food for work (FFW) projects, when carefully designed and implemented, can contribute to long-term development objectives and have a impact lasting beyond meeting immediate food needs. As much as 90% of the male work force in rural Niger leaves their villages during the dry season to seek work. FFW can provide alternative employment for these men, and for women and children, while simultaneously improving the environment, agricultural production, and local infrastructure. FFW does not constitute an intervention in and of itself. It is a resource contributing to producing an output or set of outputs that have a long-term benefit.

SELECTION CRITERIA

The objectives of FFW activities are to improve the rural infrastructure and environment while providing employment to people who cannot find other work in the area. FFW activities also can contribute to increasing agricultural or economic production.

The criteria for implementing a FFW activity are:

- the Government of Niger (GON) has requested relief assistance for a region due to food deficits;
- the community has identified the need for an intervention that requires labor;
- there are people able and willing to provide labor in exchange for food;
- the FFW is offered only for a limited time, and the length of the FFW arrangement is understood and accepted by the beneficiaries;
- the supply of food can be sustained without interruption throughout the duration of the agreed-upon time period;
- a cooperating GON agency or NGO has the experience and capacity to manage and monitor the distribution of food;
- the long-term benefits of the project are equitably distributed and do not accrue only to the wealthier members of the community; and
- the activity is coordinated with other development projects in the area so that the FFW does not undercut existing uncompensated self-help interventions.

FFW can be a resource for implementing labor-intensive projects. It can be used to pay participants to work on communal land on public works projects (i.e. soil and water conservation and infrastructure projects) that will provide long-term benefits. FFW also can pay farmers for their labor to try new Natural Resource Management techniques such as *zais* and contour dikes in their fields (see **Micro-Catchment Water-Harvesting for Agriculture**, p. 32). And it can be used as compensation for people's participation in education and training programs (see **Food For Thought**, p. 21) or on-farm agricultural research (see **On-Farm Applied Research**, p. 37).

In the participatory philosophy of this manual, the question of whether people should remain in their villages or migrate is best resolved by the beneficiaries; FFW simply provides an alternative employment option for both men and women. FFW activities provide men with an alternative to migrating during a crisis, which is a principal coping strategy for families even in non-crisis years. During a crisis, this seasonal migration leaves their families alone to survive off scarce local resources without the assurance that sufficient remittances will arrive before those resources are depleted. Some household resources are saved if men do not migrate, as livestock and grain usually are sold to finance travel expenses. Men who remain at home can also devote labor to long-term land and household improvements. However, there are also advantages to men's seasonal migration. It decreases the potential stress on the local natural resource base by providing income from exterior sources, and reducing dependency on extraction of local resources (i.e. reduced firewood collection and destocking of livestock to pay for travel costs).

IMPLEMENTATION

FFW activities require a high level of expertise in logistics and management in order to acquire commodities for distribution, transport them to the project site, determine and distribute the ration amount, and monitor the process. It may be preferable for a more experienced organization to assume responsibility for implementing the FFW aspects of the activity while another organization or agency implements the technical components.

With this division of tasks, a local NGO would assist a village or village group to identify an appropriate intervention by conducting a participatory rural assessment (PRA). Community discussions should evolve into an implementation plan which identifies resources required for the project. If the village is unable to muster all the necessary resources but the other criteria listed in the previous section are met, the implementing organization may request FFW.

The World Food Program (WFP) provides commodities for FFW activities. Project implementors complete a request for food assistance through a Department representative, but allocations are approved by government officials in Niamey.

Additional planning is required for an NGO or other agency to undertake FFW distribution. An assessment should be conducted to define the target beneficiaries and their food and nutritional requirements. Ration type and size, and a distribution plan must be developed. Types of commodities usually are determined by what is available from WFP, GON and donors but rations should take into consideration local dietary preferences, nutritional value, and potential impacts on local production and prices. Rations may be provided at a set daily rate, usually enough to feed five people per day, or participants may be paid by the unit of work completed. This will be determined by the type of work being done and by participants' needs. If participants have no food reserves, they will require daily rations. One purpose of FFW is to assist the people who have the fewest employment opportunities. Therefore, ration size must meet the nutritional needs of the population but not be large enough to attract people who have other, more productive options. Rations should be equal to or lower than the value of the standard minimum wage rate. Setting low FFW wages is a mechanism for self-selection of the neediest segment of the population.

Once commodity needs are determined, logistics for transportation and storage must be arranged. This must be completed before requesting commodities for distribution. The commodities must be on-site prior to beginning the intervention to ensure an uninterrupted supply. An information management system must be in place to monitor commodity logistics.

Impact indicators for the FFW activity should be separate from the indicators for monitoring the technical intervention for which the FFW is an input. Impact indicators should be selected and the data collected as a baseline prior to intervention implementation. Indicators may include:

- number of village men on seasonal migration during the dry season;
- number of people employed by the activity (men, women, elderly, children); and
- household consumption of staple grains before and during activity implementation.

Other considerations for implementing FFW activities include:

- Mixed rations are more difficult to distribute because commodities' storage requirements vary and appropriate ration sizes are difficult to determine and distribute.

- An assessment of other interventions in the area should be conducted to determine how and if other projects are using FFW. Care must be taken not to undermine other activities by introducing FFW in an area where communities are willing to provide free labor, in order to avoid promoting a "gift" mentality.

- Beneficiaries should be aware that the FFW is temporary and not permanent welfare. Otherwise they may alter their traditional agricultural and economic strategies. Conversely, FFW can be used expressly to encourage participants to alter these practices, such as to leave fields fallow for a season.

- The technical intervention for which the FFW is an input must be identified by the participants as a priority among their felt needs. Because it is receiving FFW, the community should contribute locally available resources (such as labor, sand, bricks) so that they have a sense of ownership in the project. Care must be taken that the people participating in the FFW activity are the direct beneficiaries of the long-term effects of the project. Projects that employ poor people in the community to work for the benefit of wealthier people should be avoided.

- Experience shows that mainly women, the elderly, and teenagers work on FFW projects, as these age-groups generally have fewer employment options and are the most vulnerable segments of the population. The FFW activity should provide transportation to and from the work site, prepared food and water at the site, and child care for women so that their participation does not create additional stress on household well-being.

- The intervention should begin soon after the harvest (November) to provide men with the option of working in the area as an alternative to seasonal migration. The project should include work that traditionally is done by men in order to encourage their participation.

- The intervention should be planned so as not to compete with other agricultural and income-generating activities for peoples' time and labor.

- Care must be taken that commodity choice, transportation, and storage does not compete with local products, further undermining local food security and economic stability.

- FFW can be provided in exchange for livestock to promote destocking on fragile lands or for the collection of native seeds (see **Animal Destocking and Meat Processing**, p. 58 and **Native Seed Collection for Revegetation**, p. 49).

- FFW can be provided for training and skills development. Participants may receive rations for attending literacy, numeracy, health, or technical training sessions. If large numbers of children are applying for participation, a school feeding program or literacy training might be incorporated into the activity.

IMPACTS

Short term impacts are:

- improved nutritional status of vulnerable people through the provision of food; and
- additional local employment options during the dry-season.

Long term impacts depend on the intervention implemented using the FFW resources, but should include improvement in agricultural production, economic production, local infrastructure, and the local environment.

REFERENCES

The following documents provide useful insights into implementing FFW activities. The Catherson document provides the best information on previous and existing FFW activities in Niger:

Bryson, et al., 1990; Bryson and Hansch, 1993; Bryson and Joyce, 1991; Catherson, et al., 1993; Von Braun, et al., 1991; and Jackson and Eade, 1982.

INTERVENTION MONITORING

DESCRIPTION

Monitoring is the on-going collection and use of information about intervention operations and conditions affecting its outcome. It is part of good record keeping and should make intervention management easier rather than imposing a burden. Monitoring data concerns baseline conditions, the status of inputs and outputs, and the impacts on beneficiaries. Information collected in these four areas (baseline, inputs, outputs, and impacts) enables managers to measure progress throughout implementation, and the extent to which the intervention is accomplishing its purpose. Monitoring also helps to detect problems and take corrective actions.

Famine mitigation interventions that are funded and implemented are part of a larger program, the Disaster Preparedness and Mitigation (DPM) Program. The goal of DPM is to promote greater well-being among Nigeriens by minimizing the negative impacts of disasters, particularly famine, on economic development. The Program managers and *Système d'Alerte Précoce* (*SAP*) members are required to measure the DPM's success toward achieving this goal. This requirement provides two other important uses for information collected before and during mitigation intervention implementation. First, intervention monitoring information reported to the DPM Program managers will enable them to account for commodities and funds committed to famine mitigation interventions from the DPM Emergency Fund. Second, information about baseline conditions and intervention impacts can be used in intervention evaluations.

SELECTION CRITERIA

All interventions implemented under the DPM will be expected to collect and report monitoring information. Formally, the process of deciding which information to collect is known as the selection of indicators. Indicators are quantifiable, material, and change as implementation proceeds. Indicators should be few in number, easy to collect, and simple to interpret. DPM/*SAP* may specify certain standardized indicators to be monitored as part of the funding contract. Of particular interest is the participation of women and their perceptions of intervention benefits, which requires indicators disaggregated by gender. Other indicators will depend on individual intervention design. A few carefully selected indicators should be sufficient to monitor inputs, outputs, and progress relative to the intervention's purpose. Indicators should be specified in each famine mitigation intervention proposal. They will be agreed upon by DPM/*SAP* and the implementing agency as part of the proposal approval process.

IMPLEMENTATION

Indicator selection is part of intervention design. Proposals for implementing famine mitigation interventions through the DPM Program will specify the purpose of the intervention (i.e. to reduce the time and effort required of village women to obtain water or to increase the number

of wild plant species growing within a specified radius of a village), the required inputs (such as fencing, cement, labor, technical assistance, food for work, seedlings), and the outputs (i.e. wells, irrigation systems, village seedling nurseries, gardens). The purpose should be achievable given project resources. It should be stated in such a way that whether or not it has been accomplished can be verified. A few (1-3) clear, quantifiable, and easy-to-collect indicators should be specified in the proposal for measuring progress at each of the input, output, and purpose levels. Examples of suggested indicators are included in many of the intervention design papers. Proposals should specify who is responsible for collecting and reporting the information to the intervention manager.

Monitoring begins prior to implementation with the collection of baseline data. The baseline reflects the initial status of the indicators, particularly at the output and purpose levels, and provides a benchmark against which progress can be measured. Examples include the number of women involved in village gardening or the average number of buckets of water used daily by a household. This data can be collected during Participatory Rural Assessments (PRAs) conducted during pre-intervention planning. As the intervention progresses or finishes, its effects on the beneficiaries are reflected by changes in the values of the indicators.

Throughout implementation and during follow-up visits, monitoring requires the regular collection and recording of indicators on the status of inputs, outputs, and effects on the beneficiaries. In addition to field notebooks the information can be recorded on computer spreadsheets or word processors, or on maps. These records are summarized periodically and reported to the intervention manager as a basis for decision-making. Tables, charts, graphs and maps can be helpful for organizing and summarizing monitoring information. In addition to their management applications, these reports can be given to DPM/*SAP* for accounting, monitoring and evaluation purposes. Monitoring data should be submitted as part of the required reporting.

IMPACTS

Monitoring has no direct impact on the beneficiaries; its immediate benefit is the basis it provides for management decisions and improving intervention performance. Monitoring information provides accountability to DPM/*SAP* and background for intervention and Program impact evaluations, and will contribute to improved performance in the DPM Program. The long-term cumulative impact of monitoring efforts will be demonstrated by the extent to which the DPM Program becomes attractive to other donors and therefore sustainable beyond its currently allotted five years.

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The United Nations Development Program, International Labor Organization in Zinder Department has developed a data system for collecting and updating information on selected indicators for their cereal banks, pharmacies, and credit programs that could be used as a model for other activities.

APPENDIX A

RESOURCE TENURE AND NIGER'S RURAL CODE[1]

Organizations that are involved in public works activities such as soil and water conservation may provoke resource tenure disputes by changing the perceived value of land or by supporting an individual's claim to the land. To avoid this, implementing organizations should consult with local government officials and authorities about resource tenure issues when planning such activities. Local officials and village authorities can help encourage local populations to participate in public works projects, and defuse potential conflicts.

The Nigerien Government has been developing the Rural Code since 1986. Its goal is to establish a legal framework for appropriation, tenure, and management of natural resources that are vital to agricultural and livestock production. The Government's understandably cautious approach has resulted in some social groups positioning themselves (often farmers vs pastoralists) so that when the new laws are enacted they will be in legal control of more resources than they currently are entitled (Lund, 1993).

The current ambiguity of Nigerien tenure systems is the product of the combination of traditional, Islamic, colonial, and post-colonial laws. The result is a profusion of contradictory policies, laws, decrees, ordinances, and circulars (see Harouna, 1986; Ngaido, 1992; and Lund, 1993). These inconsistencies make it imperative that projects contact local Government officials and traditional leaders for their approval before public works projects are initiated.

There are three categories of right holders: the State, land owners, and land borrowers. The State is considered the formal administrator of land. Land owners generally are the first families to settle in an area and their descendants. The colonial government also gave village chiefs the right to allocate land, which they still retain. The majority of farmers belong to the last group, land borrowers (Lund, 1993). They generally pay cash for rent and give land owners a portion of their harvest as a tithe.

Organizations implementing interventions must be particularly sensitive to tenure and usufruct issues between land owners and land borrowers. Under the Islamic system of tenure, a person who makes an improvement on the land (i.e. planting trees, clearing) has rights over the resource. This has serious implications if farmers are given aid by an organization to rehabilitate land traditionally claimed by pastoralists. Pockets of open-access pasture land within the agricultural zone are important resources for pastoralists, especially during droughts. The existence of these areas allows them to bring livestock into the south before the crops are harvested without causing conflict with agriculturalists. Farmer encroachment onto or elimination of these open-access areas will produce conflicts.

Three social institutions are used to resolve disputes over resources: the State, the traditional community structure, and Islam. The resolution of tenure conflicts by these organizations is unpredictable. The State representatives include *Préfets*, *Sous-Préfets*, and *Chefs de Poste*. The traditional community structure is headed by a sultan. The farming communities' structure

(primarily Hausa) includes *Chefs de Canton* and *Chefs de Village*. The community structure of pastoralists and sedentarised Peul, Touareg, and Bouzou includes *Chefs de Groupement* and *Chefs de Tribu*. The *Alkali* heads the Islamic structure. All three of these groups may become involved in land disputes so organizations should be aware of who holds these positions prior to implementing interventions with potential land use implications.

There are recognized boundaries separating village and pastoralist territories. These territories are established management units that implementing organizations should consider when designing activities. In order to encourage sustainable resource management, public works projects must be sensitive to the tenure issues of these areas and conduct their activities as equitably and transparently as possible.

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[1] Much of this discussion is taken directly from Lund (1993).

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APPENDIX B

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