PART TWO

Case Studies
Burkina Faso, in the West African Sahel, has a serious problem of environmental degradation. However there are now many projects designed to conserve or rehabilitate land for agricultural production.

The Central Plateau of Burkina Faso has a high population density and suffered badly from the serious droughts of the 1970s and 1980s. Much of the land is eroded or degraded, and it is hard for the people who live there to produce sufficient food.

We have chosen two projects from Burkina to illustrate some of the ways in which these serious problems are being tackled.

These are:
• the Agroforestry Project (PAF) based at Ouahigouya, Yatenga Province
• the PATECORE Project based at Kongoussi, Bam Province

While there are a number of similarities between the two projects – for example they both promote techniques based on stone, and try to involve local people as much as possible – there are also differences. Both are successful projects, yet in each case there are still problems to be overcome.
1. THE AGROFORESTRY PROJECT (PAF) – YATENGA PROVINCE

SUMMARY

The Agroforestry Project (PAF) of Yatenga Province, Burkina Faso, has built up the reputation of being one of the most successful soil and water conservation projects in sub-Saharan Africa. PAF promotes contour stone bunding and planting pits as its main conservation techniques. Stone bunding is based on a traditional technique for water harvesting. It is a method by which degraded land can be rehabilitated, and it leads to rapid improvements in crop yields. In its extension work, PAF collaborates with various Government services. Participation of the farmers in planning and implementation is a central objective of the programme. PAF has a remarkably successful training programme for field staff and villagers.

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Status: Non-Government Organisation
Sponsor/Donor: OXFAM (Oxford, UK)
Date of Start: 1979

BACKGROUND

Yatenga Province lies on the Central Plateau of Burkina Faso, and has the double problem of high population density (70-100 people per square kilometre) and severely degraded land. Over 50% of the land is under cultivation these days and little or no fallowing is practiced. Much of the remaining land is eroded and encrusted with a hard cap. It cannot be cropped without being improved. Overgrazing adds to the problem. Locally these barren expanses of land are known as zipeela.

To make matters worse, the rainfall has decreased significantly from the long-term average of 720mm/annum to 440 mm within the last twenty years. Not only is the rainfall low, but it is also very unreliable.

Early efforts to improve land and increase cereal production were generally unsuccessful. In the 1960s, under a large scale, internationally funded project called GERES, heavy machinery was used to construct earth bunds over entire catchments – whether the land was used for agriculture or not. Work was carried out without any active participation by the local people.

The bunds were designed to drain rainfall runoff away from the fields to protect the soil from erosion. However, in subsequent years, when the rainfall diminished, this was the opposite of what the people wanted. They wanted the runoff on their fields to increase the moisture for their crops. The people didn’t bother to maintain the GERES structures, and the bunds quickly lost their effectiveness.
GERES failed because the people were not adequately consulted about their needs.

Environmental problems increased, and as the population grew and rainfall decreased in the 1970s and 1980s, the people were faced with a simple choice – to improve the land or to migrate.

In Summary:
• the population density is very high
• there are large expanses of barren land
• rainfall has diminished significantly over the last 20 years
• rainwater harvesting is required to grow crops well
• the people have to improve the land – or migrate

PAF’S APPROACH AND OBJECTIVES

When the Agroforestry project (PAF) began in 1979, it was, as its name suggests, an agroforestry project. It aimed to improve tree planting using “micro-catchment” techniques which collect rainfall runoff and concentrate it around tree seedlings. However it quickly became apparent that the people were not interested in planting trees. Their most urgent need was food production. As Mathieu Ouedraogo, the Project Manager, says:

“If you have a thorn in your foot and a thorn in your backside, which do you take out first? The thorn in your backside! Then you can sit down and remove the thorn in your foot!”

The moral of the story is “First things first!” PAF was flexible enough to change direction according to people’s priorities.

Traditionally simple stone lines had been used to help reduce erosion in fields, but this practice had largely been forgotten. However through discussions with the people, PAF saw this as the basis for improved food production. The technique was resurrected and improved by building the stone lines along the contour. Contour stone bunds became the focus of the project’s attention from 1982.

A contour is an imaginary line which runs along land of equal height above sea level. By building stone lines along the contour, rainfall runoff is spread behind the stone line and allowed to seep into the soil. This improves the amount of moisture for crops.

Having developed an effective technique, PAF’s main role has been to motivate villagers, and then to provide appropriate training for them.

ACTIVITIES AND TECHNIQUES

1. Water Harvesting

PAF’s main recommendation for the rehabilitation of degraded land, and improvement of existing cultivated land, is contour stone bunding. PAF took the rather crudely made traditional stone bunds and built on them with the traditional technique to create contour stone bunds: an improvement on the traditional technique.
lines and improved the design by aligning the bunds along the contour and building them more carefully. The contour is laid out by the use of a simple water-tube level (see technical section).

The new design allows the rainfall runoff to spread evenly through the field. When runoff reaches a stone bund, it spreads out and slowly trickles through the small holes between the stones. In addition, organic matter from the catchment area, such as eroded soil, bits of dead plants and manure, is filtered out of the runoff. This rich sediment builds up behind the bunds and this improves the soil.

In combination with stone bunds, another traditional technique called zai was reintroduced. Zai is the name in the local Moore language for wide and deep planting holes. The zai collect and concentrate runoff water for improved plant growth. Placing manure or compost in each zai further improves crop yields. Once again a traditional technique has been proved to have real value.

The combination of contour stone bunding and zai leads to rapid benefits for farmers. Yields are improved in the first season after the land has been treated, and even in very dry years these techniques ensure some yield. For these reasons the techniques have proved very popular, and by the end of 1989 some 8,000 hectares in over 400 villages had been treated with stone bunds.

2. Village Land-Use Management

Recently PAF has broadened its outlook and has begun to promote the integrated approach of village land-use management. This approach gives the responsibility for conservation and development of village land to the villagers themselves. In certain villages special committees called “Village Land-Use Management Committees” have been set up. These committees look at the village land, decide what needs to be done to improve the whole area, and then coordinate the various conservation activities required, such as:

- Stone bunding on a large scale.
- Compost pits.
- Enclosure of sheep and goats in the homestead.
- Village fodder plots.
THE PROJECT LORRY IS LOANED TO GROUPS WHEN TRANSPORT OF STONES IS A PROBLEM.

- Protection of communal land from overgrazing.
- Sowing Andropogon grass alongside stone bunds to form a vegetative barrier.
- Tree nurseries.
- Planting multi-purpose trees within the fields.

Although a number of the new techniques are not yet widely used, PAF is helping the people to see their potential by trying them out. From starting with two villages in 1989, by late 1990 the programme of village land-use management had spread to include eighteen villages.

PROJECT MANAGEMENT AND ORGANISATION OF WORK

1. Management of the Project

PAF has a small central office at Ouahigouya, with a total of 12 paid staff. Five of these staff are field extension agents, but PAF also works through the extension agents of three Government Services in Yatenga.

2. Organisation of the Conservation Work

The planning and coordination of conservation activities is carried out through village committees.

These committees are central to the programme. Before a village is allowed to join the programme, a committee must be set up. PAF's philosophy is that villages must develop their land resources themselves, through planning and coordination of self-help activities.

Conservation work is normally carried out by groups on a voluntary basis in fields belonging to members of the group. Food is provided for the group by the individual whose land is being treated. The type of group differs from village to village - some are more formal than others - but by and large PAF's experience has shown that groups work in Yatenga Province!

3. Incentives

PAF's philosophy is to use the minimum of incentives. The project believes that incentives should be used only where there is a specific need - a shortage of tools for example.

Incentives given to villagers to implement conservation measures include:
- pickaxes, shovels and wheelbarrows;
- donkey carts - for groups who buy their own donkeys;
- the loan of the project's lorry where the supply of stones is very limited and a large area has to be treated. In these instances the lorry is loaned free of charge to groups, but individuals are charged a small amount.

Additional help for the poorest farmers comes in the form of a food loan from the village committee, so that they can feed the group when work is done on their fields.

4. Participation

Full participation of the local people in all stages of planning and implementation is one of the strongest features of the project. Participation in the planning and organisation of activities takes place through the committees, and the work is carried out voluntarily by the people themselves.
TRAINING AND EXTENSION

PAF's training and extension system is the cornerstone of the programme's success.

PAF avoids the temptation to carry out its extension work independently, and joins hands with three Government services operating in the province. These are:

- the Regional Centre for Agropastoral Development (Centre Regional de Promotion Agropastoral – CRPA)
- the Provincial Office for the Environment (Direction Provinciale de l'Environnement Eaux et Forêts – DPET)
- the Provincial Livestock Service (Service Provincial de l'Elevage – SPE)

PAF helps train the extension agents of these three services, who then collaborate in extension work.

Collaboration has led to more widespread achievements, and means that the activities should continue after the project comes to an end.

The project has developed a very effective training programme for farmers. PAF has trained thousands of farmers to use simple surveying equipment to lay out contours in the fields and to build improved bunds. Simple technology is within the reach of the villagers.

Training for villagers usually follows this sequence:

Stage 1: Extension agents from PAF and the other services (see above) meet villagers, and after a general discussion about conservation and development, a group of willing participants is selected for training.

Stage 2: Inter-village meetings and visits take place.

Stage 3: Training courses are held in the village.

The training courses consist of discussions about the need for conservation and land improvement. The main features of the courses are:

- using a model to demonstrate the effect of contour bunds (in the beginning, this was used a great deal, but is rarely needed now);
- training in the use of the water-tube level for surveying contours;
- construction of improved stone bunds.

A MODEL IS USED TO DEMONSTRATE HOW CONTOUR STONE BUNDS WORK.

By 1989 over 5000 people in more than 400 villages had been trained in this way, resulting in almost 8000 hectares of land being treated with stone bunds.

VILLAGERS ARE TRAINED HOW TO USE A WATER TUBE LEVEL.

In recent years PAF has helped to train people from other regions of Burkina Faso, and also other countries. Visits to PAF by outsiders have become very common. During the first eight months of 1990 alone, fifteen groups from six countries visited the project.
YIELDS AND BENEFITS

The combination of contour stone bunds and zai can lead to significant yield increases – in the range of 40-60% – in the first season, and there is some evidence that yields may continue to increase for several seasons as fertile deposits are built up on the fields.

Most importantly, even in very dry years, treated fields yield some harvest. A survey in 1986 – a year of good rain – showed that whereas plots treated with stone bunds and zai yielded an average of 972 kg/ha, plots left untreated yielded an average of only 612 kg/ha.

However, as PAF admits, there is not yet enough accurate yield data to compare different areas or different years.

There is some concern that the benefits of PAF’s interventions have not reached the very poorest farmers who are unable to provide food for group labour. It is for this reason that PAF has made food grain available to village committees, who can loan it to poor families to feed groups working on their fields.

PROBLEMS OUTSTANDING: WHERE NOW?

Degradation of Village Land

Improvements to private fields are not enough on their own, and each village must now take responsibility for halting degradation on all its land. Grazing areas pose a particular problem in this respect. The introduction of a village land-use management policy is intended to address this problem, and the first signs are that it is being accepted. However more motivation and training will be needed before the integrated approach can be fully effective.

Lack of Stone

The basic technique of stone bunding is excellent – as long as enough stone is available! But this is not always the case. PAF has recently bought a lorry to help transport stone long distances. The project also makes donkey carts available to those farmers who own or have access to donkeys. It is now faced with the dilemma of whether to buy more lorries or continue to promote the slower, but more appropriate, donkey transport.

Maintenance

The problem of what to do when the stone bunds become silted up – as they do after several seasons – is not yet satisfactorily answered. Where stone is plentiful, the bunds can be raised in height. But where stones are not available, one answer is to plant a grass (for example Andropogon guvanus) alongside the bund to act as a barrier hedge. However, it is difficult to grow these hedges thick enough to act effectively, and they take at least two seasons to develop well.

ANDROPOGON GRASS AND TREES ARE PLANTED ALONGSIDE STONE BUNDS TO ACT AS A BARRIER HEDGE.

Monitoring

Not enough is known about the effect of the techniques on crop yields and the reliability of harvests. The figures available show significant yield increases when stone bunding and zai are used together, but the data are not always of an acceptable scientific standard. PAF realises this, and is in the process of improving its monitoring system.

The Poorest Farmers

Is the project effectively helping the poorest of the poor? The achievements in terms of land treated are very impressive, but the majority of the farmers in
Yatenga have not yet bunded their fields. Why not? Is it just a question of time, or are there specific constraints, of labour for example? PAF is currently (1990) undergoing an evaluation, and this is one of the points which is being studied.

Withdrawal

Projects cannot last forever! Is it possible that activities could continue without PAF’s help in some regions? Perhaps both inputs and training could be handled by experienced village committees with assistance from the Government development organisations. Should PAF be expanding, staying the same size or contracting?

LESSONS AND CONCLUSIONS

1. PAF is an internationally known success story. This is because of its impressive achievements and use of appropriate techniques. However the special combination of factors which make PAF so successful is not found everywhere in sub-Saharan Africa. PAF’s techniques are rather site-specific.

2. Participation of villagers in decision making and in the implementation of soil and water conservation measures is central to PAF’s philosophy and to its success.

3. Training and extension are among PAF’s greatest strengths. PAF has a well developed training scheme for villagers during which they are taught how to lay out and build the bunds.

4. Flexibility in allowing the programme to evolve and change is a feature of the project. Having started as an agro-forestry project, PAF achieved considerable success with stone bunding techniques, and is now moving towards village land-use management.

5. The main technique, contour stone bunds with zai or planting pits, is simple, relatively cheap to implement and based on traditional techniques.

6. The techniques are particularly popular because they give farmers a rapid increase in crop yields, and allow at least some harvest in very dry years.

7. PAF is a small NGO project which is able to have an important impact on soil and water conservation by acting together with both government agencies and other NGOs.

EVERYONE PARTICIPATES IN CONSTRUCTING THE STONE BUNDS
SUMMARY

PATECORE is a conservation and land development project, based at Kongoussi on the Central Plateau of Burkina Faso. One of the project's first activities was to set up a provincial committee for the coordination of development activities. PATECORE promotes self-help by local communities and encourages discussion about development at all levels. Communities are encouraged to develop village land-use management plans, and are trained to use aerial photographs for this purpose. Permeable rock dams, which the local people feel to be a priority, are the project's most important conservation activity. Lorries have been introduced by the project free of charge to help farmers to carry stones for the construction of these rock dams.

BACKGROUND

As with the Agroforestry project – PAF – in Yatenga, PATECORE is situated on the Central Plateau of Burkina Faso. The problems in Bam Province are similar to those of Yatenga. A growing population has caused increasing pressure on agricultural and grazing land, leading to abandonment of the fallow period in the fields and overgrazing of the common land. The result is land degradation due to over-use.

These problems have been made worse by the reduction in rainfall over the last 20 years. The annual average for the early part of the 1980s was as low as 500 mm – a very marked decline from the 1960s' when the average was nearly 700 mm.

A particular problem around Kongoussi is the formation of gullies in the productive valleys where floodwaters previously used to spread naturally. Villagers rely on these valleys for crop production because the soil has been eroded away from the hillsides which they used to cultivate. The farmers have followed the soil, and the water, down from the hills!

Two national conservation projects, the "GERES" project of the 1960s and the "FEER" project of the 1970s/80s had programmes to combat land degradation. However their effect was limited by the lack of consultation or collaboration with the villagers.
The problems:
- a growing population leading to increased pressure on land and other resources and consequent land degradation;
- marked decline of rainfall over the past twenty years;
- formation of gullies;
- lack of consultation with villagers by previous soil conservation projects.

The people’s urgent priority now is to control the gullies in these valleys. One solution is permeable rock dams. These long, low structures rehabilitate the gullies and spread the floodwater. They improve plant production by:

- making more moisture available in a generally dry climate;
- improving the soil with fertile deposits of top soil and plant debris.

In 1981/82 a small project was set up under the French Volunteer Service (AFVP) in the Rissiam region, near Kongoussi. This project developed the technique of permeable rock dams. These became so popular that between 1982 and 1987, 148 permeable rock dams were built with the assistance of AFVP. The technical model of AFVP was the starting point for PATECORE’s permeable rock dams.

PATECORE’S APPROACH AND OBJECTIVES

PATECORE began in 1988 with the aim of introducing an integrated, approach to conservation of village resources. This was to be achieved through discussion between villagers, project staff and other organisations working in the same village.

The Programme Allemand CILSS (the German Programme for the Sahelian Countries) had already successfully tested this type of approach in Burkina Faso.

Specific objectives were that:

- Land use planning should be carried out by villagers, according to their traditional methods of classifying land.
- Conservation structures – such as permeable rock dams – should be built as carefully as possible to reduce maintenance requirements.
- No techniques should be used which were too difficult for the people to construct and look after.
- Assistance by the project would be limited to:
  - transport
  - technology development
  - training
  - support for the process of collaboration.

ACTIVITIES AND TECHNIQUES

We will look closely at one of PATECORE’s main conservation activities – the technique of permeable rock dams.
Permeable rock dams (PRD) are the most important conservation technique in the area, and the project views these as the “backbone” of its activities.

During the rainy season, large quantities of rainwater runoff are produced on the barren hillsides, where overgrazing has removed most of the vegetation. This runoff collects in small gullies and then flows down towards the valleys. This is no longer a gentle flow which spreads and waters the crops. These days it has become a torrent which cuts channels in the centre of the fertile valleys.

Permeable rock dams help to control the runoff and stabilise the valleys. At the same time water is spread, and crop performance is improved.

PATECORE has taken the design developed by the nearby AFVP project and modified it to make the dams more durable and to reduce the amount of maintenance required. The permeable rock dams constructed under PATECORE are long, low dams made of loose stone, which stretch across valley floors, spreading floodwater and healing gullies. Usually the height of the dams is only 50 cm, but they can be up to 800 metres in length. Water doesn’t stand behind the dam for long, because it filters through the loose stone wall. (See technical section.)

PROJECT MANAGEMENT AND ORGANISATION OF WORK

Management of the Project:
PATECORE has up to ten local and expatriate staff at the project headquarters in Kongoussi. They see their role as facilitating development, rather than “managing” activities directly.

Coordination of Development Activities in the Province:
PATECORE has helped set up the Provincial Land Development Coordinating Committee. This committee is made up of government officials at the provincial level, and all the development agencies which are active in the province. The committee can plan activities in a coordinated way which will enable them to work out a common overall strategy for development in the area. By working in this way, they can ensure that there is no unnecessary duplication of activities, that they agree on technical solutions, that there is no “competition” between them, and that the villagers do not become confused because of different approaches and incentives.

Organisation of Work:

When a village requests assistance with planning and implementing conservation measures, this is what happens.

1. Village requests for assistance are screened by the Provincial Land Development Coordinating Committee (see above).

2. If approved, extension agents visit the village and discuss what must be done to overcome the problems the villagers face.

3. A Village Land Resource Management Committee is formed.

4. In cooperation with extension agents from various organisations, planning of the village land use takes place using aerial photographs. The villagers draw outlines on the aerial photographs of the different categories of their land which follow the traditional system of classification. This mixture of the traditional and the modern works well, and it does not take long to train villagers to interpret aerial photographs.
5. A village land-use management plan is then drawn up by the Village Land Resource Management Committee. This plan outlines the improved management of each of the land categories, with a timetable for action.

6. Villagers are trained in techniques such as surveying with water-tube levels and siting of permeable rock dams. Guidance is also given on organisational aspects.

7. Some hand tools are supplied to the village committee.

8. The villagers stake out the alignment of the permeable rock dams in the field.

9. Stones and rocks are collected voluntarily on a group basis, and then transported, free of charge, by the project’s lorries.

10. Construction is supervised by a project extensionist in the first year, then by a locally trained technician in the second year, and after that by the villagers themselves. Usually families carry out the construction on their own.

Incentives:

PATECORE has a very clear policy on incentives. It believes that the people should be given significant support in carrying out this type of activity and not have to rely entirely on their own resources.

For this reason PATECORE provides lorries free of charge to transport stone for the villagers. Availability of stone is of course the major problem with the construction of permeable rock dams. The argument in favour of the lorries is as follows:

1. Donkey carts are too slow to cope with the size and urgency of the problem ("erosion is faster than a donkey cart").

2. Lorries are only required in the construction stage, so no dependence on them will be created for other activities.

3. The people are so poor that they cannot be expected to contribute a significant amount to the running costs of the lorries.

However it is in this last respect that PATECORE differs most from the earlier established AFVP project. The belief of AFVP is that villagers should contribute a proportion (approximately a half) of the running cost for transport by lorries. AFVP believe that transport should eventually be taken over and managed by the village committees themselves.

In addition to the lorries, PATECORE supplies hand tools on a revolving-fund basis. Food-for-work is not used by PATECORE.

Participation

There is a clear division of work and responsibilities between the project and the people. In summary the people’s participation is required in:

- the original request for assistance
- setting up village committees
- developing a village land-use management plan
• supplying volunteers for training
• contributing the labour, voluntarily, for all activities
• monitoring
• future planning and supervision of development activities.

The project concentrates on providing training, technological guidance and transport – as well as helping to coordinate development activities.

A TRAINING SESSION USING AERIAL PHOTOS

TRAINING AND EXTENSION

Training is one of PATECORE’s main priorities. PATECORE trains villagers in planning the use of their land and in various conservation techniques.

Staff from government agencies and other projects are trained as well. This helps to ensure that techniques and approaches are the same for all the organisations in the area.

Training courses are held at the project headquarters near Kongoussi, where there are purpose-built classrooms.

YIELDS AND BENEFITS

Permeable rock dams improve crop yields very considerably – by between approximately 50% and 130%. Yields of sorghum can be increased to as high as 2,000 kg/ha. Because rich sediment builds up behind the dams each season, crop yields improve over the first few years.

A summary of the main benefits expected from permeable rock dams:
• harvesting and spreading of floodwaters for better crops
• a reduction in the speed and erosive force of runoff
• silting up of gullies with fertile deposits
• prevention of further erosion
• rehabilitation of abandoned land (in some cases)
• raising the water table.

Gombraogo Ouedragogo, a farmer whose land has been improved by a permeable rock dam.

"This area was so dry and degraded, I abandoned it for seven long years. I was farming elsewhere when I heard about the project. So I came back here last year and we built this dam. It has worked very well and I'm very happy with it."

PROBLEMS OUTSTANDING: WHERE NOW?

Limitations of Permeable Rock Dams

Permeable rock dams are a very effective technique, but their impact is limited. This is for two reasons.
1. Permeable rock dams use a large amount of stone and labour, and therefore only a small number can be built during one season.

2. Since they are particularly suited to valley bottoms, their main benefits are concentrated on those who live there rather than being spread among the whole community.

TECHNICAL PROBLEMS

PATECORE has developed the design of PRDs, but there are some technical problems which sometimes occur. These include:

- waterlogging on heavy soils
- siltation with sand rather than soil
- tunnelling of runoff below dams in some soils.

Lorries for Transport of Stone

The project considers that people are too poor to pay anything towards the cost of the lorries. However this makes it very difficult for other projects which believe that beneficiaries should contribute something.

Keeping up with Demand

The popularity of permeable rock dams is so great that it is difficult for PATECORE to keep up with demand! The project is trying to emphasise other techniques which are quicker and cheaper to implement.

LESSONS AND CONCLUSIONS

1. Coordination of development organisations working within the same area is extremely important. The establishment of the Provincial Coordinating Committee is a positive step towards achieving this in Bam Province.

2. The responsibility for overall planning and management of village resources has been given to the villagers themselves. Planning of land use by the village committees ensures that local priorities and development efforts are matched.

3. Requiring voluntary labour for construction of conservation works ensures that villagers are committed to what they do. Participation by the "beneficiaries" is essential for long-term development.

4. Using traditional systems of land classification together with aerial photographs is a mixture of the very old and the very new - but it has been shown to work effectively as a basis for planning.

5. Training of extension workers from Government departments and other projects leads to improved cooperation, and helps make sure that extension messages and techniques are similar.

6. The design of the permeable rock dam is based on systems tried originally by other projects – learning from others’ experience where possible is always useful.

7. The question of mechanisation must be approached very carefully to ensure that dependence and expectations are not created. There is also the danger of projects having conflicting approaches.

8. Permeable rock dams are successful here, but this is a technique which can be used only in certain specific situations.

9. There is a need to develop cheaper techniques which can be applied more widely.
Kenya is favoured by having high-altitude areas of good agricultural potential where most of the population lives. Nevertheless Kenya suffers occasional food shortages. One of the reasons for this is that over three quarters of the country is, in fact, arid or semi-arid. These areas are home to an increasing number of people as the country’s population rises at about 4% per year – one of the fastest growth rates in Africa.

Agricultural production is threatened in many parts of the country by soil erosion. Soil conservation techniques for the highland areas are well developed and the conservation activities of self-help groups in Machakos District in eastern Kenya are particularly effective. In the more arid areas, such as Turkana district in the far north-west, water harvesting is needed for dryland cropping to be possible. There are several projects testing systems of water harvesting, which is a new technique for Kenya.

We have taken one project from each of these two contrasting districts and looked at their different approaches to soil and water conservation. They are:

• the National Soil and Water Conservation Project in Machakos District
• the Lokitaung Pastoral Development Project, based at Lokitaung in Turkana District
I. THE NATIONAL SOIL AND WATER CONSERVATION PROJECT - MACKAKOS DISTRICT

SUMMARY

Machakos has the reputation for being the District with the best soil and water conservation record in Kenya. Over 70% of the arable land has been terraced. However during colonial days there was strong resistance to soil conservation within Machakos. The change in attitude has been the result of campaigns and support from the National Soil and Water Conservation Project. Success has also depended on the strength of the groups which implement much of the conservation. The farmers, many of whom are women, have recognised the benefits of terracing.

Conservation of moisture and also soil has led to better and more reliable crop yields.

Name: National Soil and Water Conservation Project (Machakos District)
Contact: The District Soil Conservation Officer, Machakos
Address: The District Agricultural Office, Machakos, Kenya
Status: Government Project
Sponsor/Donor: Swedish International Development Agency (SIDA)
Date of Start: 1974 project initiated; 1979 field work began in Machakos District; 1989 expanded to whole country

BACKGROUND

Machakos District in eastern Kenya has a large and growing population, which has to support itself on limited agricultural land. With an average of 72 people per square kilometre (census of 1979), most land which can be cropped is already in use. Much of the district has a marginal or semi-arid climate, and crop yields are commonly affected by lack of rainfall.

Machakos is hilly, and erosion has become increasingly widespread over the last twenty years as more land is cleared for cultivation. Much newly cultivated land is to be found on the hill-sides, where erosion rates are higher. Pressure for more agricultural land has meant that livestock are steadily being squeezed on to smaller and smaller areas of land, which are then overgrazed and more prone to erosion.

Over most of the District, families depend on home-grown food for their daily diet. Maize has become the most popular cereal during this century, replacing the more drought-resistant crops of sorghum and millet. Though the average rainfall figures for Machakos are quite high, there are regular periods of drought during the rainfall seasons. Lack of adequate rainfall for maize, and an ever decreasing supply of productive land has made the farmers appreciate the need for soil and water conservation.
Soil conservation was first introduced to the District by the colonial government in the 1940s. Some of the techniques developed during this period were effective, but the fact that they were based on enforced communal work meant that soil conservation was bitterly resented by the people, and it developed a bad name.

Little happened immediately after Independence in 1963, until a new soil and water conservation campaign began in the 1970s. This campaign started up just at the time when the people were becoming increasingly concerned about the future of their farm land. People were now anxious to listen to advice, and were ready to participate in conservation activities.

In summary:
- Slopes are steep in Machakos, and erosion rates high.
- Erosion is getting worse due to the expanding cropped area.
- Drought spells regularly affect yields, especially of maize.
- Enforced conservation in colonial times didn't work.
- By the 1970s people were ready to respond to a new campaign.

NSWCP’S APPROACH AND OBJECTIVES

The National Soil and Water Conservation Project (NSWCP), supported by the Swedish International Development Agency (SIDA), began in 1974. Machakos was chosen to be a pilot district, and a full soil and water conservation campaign was launched there in 1979. This became a national campaign with support from local government as well as the Ministry of Agriculture.

The overall objective of NSWCP is:
“to contribute to food security and to raise the standard of living of the rural population - through suitable conservation practices.”

In the early days, some of the work was paid, but the policy quickly became one of voluntary participation, supported by:
- technical advice
- tools.

Machakos was an excellent choice of district to begin operations. This was because:

1. Erosion was a serious problem, and as we have seen, the people themselves were concerned about the effect on their crop yields.
2. A suitable soil and water conservation technique – *fanya-juu* terracing – was already well established in the district.
3. Strong and active self-help *mwethya* groups already existed and they were ready and willing to work on conservation projects.

**ACTIVITIES AND TECHNIQUES**

“Fanya-juu” terracing

The focus of the soil and water conservation project has been on improving arable land. It is in the cropped fields where erosion has had the most damaging effect on productivity and farmers’ income.

MWETHYA GROUP CREATING FANYA-JUU TERRACES

The basis of the system is the development of bench terraces over a period of time. The main technique used is *fanya-juu* terracing. This means, in Kiswahili, “do-up” and it refers to the way that soil is thrown up the slope from a ditch to form an earth embankment or bund. Several of these terrace banks are made across a field, on the contour, and over time the land between the bunds levels off. The field then develops the characteristic “steps” of bench terraces (see technical section). Soil and rainwater are conserved between the *fanya-juu* bunds.
The technical objective is two-fold:
• to keep rainfall where it falls;
• to keep soil in the field.

The end result is better growing conditions for the crop, both immediately, because of an increase in the amount of moisture available, and in the long term, because the soil is conserved.

Each farm is surveyed to see whether it requires a cutoff drain to protect it from surplus rainfall runoff. The cutoff drain is usually designed to hold all the runoff which flows into it, and therefore it is sometimes known as an “infiltration ditch”.

The alignment of the terraces is surveyed along the contour using a simple line level. The spacing between the terraces depends on the slope of the land. (For details see technical section.)

Since the mid-1980s the District has achieved an average of 1,000 kilometres of new *fanya-juu* terraces constructed each year, as well as several hundred kilometres of cutoff drains. The campaign has been so effective that it is estimated that 70% of all the cultivated land has now been terraced. From a hillside above Machakos town it is easy to believe these figures! The remaining unterraced plots are mainly in the lower, drier areas.

Fodder grasses can be planted on the top of the terrace bank to hold the earth together. The farmer benefits from this source of valuable cattle feed, and land which might otherwise be wasted is put to good use. Likewise, the trenches are often used for growing bananas, which do well because of the extra water which collects there.

*Fanya-juu* terracing uses a considerable amount of labour but it is well understood by the people in eastern Kenya, and has been proved to be effective.

Terracing is not the only technical component of the project in Machakos. Also recommended and used, though on a smaller scale, are:
• grass strips along the contour
• contour ploughing
• simple gully control measures
• tree planting
• protection of riverbanks
• grazing control

**PROJECT MANAGEMENT AND ORGANISATION OF WORK**

Management of the Project:

NSWCP falls under the Ministry of Agriculture’s Soil and Water Conservation Branch. In Machakos it is supervised by the District Soil Conservation Officer. Representatives of local farmers participate in planning through the District Agricultural Committee.
Organisation of Conservation Work:

The Ministry of Agriculture in Machakos holds soil conservation campaigns each year, but everyday conservation activities are organised and carried out by the people themselves.

Soil conservation work is normally undertaken by self-help mwethya groups. A group decides which member's land is to be terraced on which day, and then the members meet and work collectively.

Some individuals, who are wage earners, sometimes decide to employ people to carry out the work for them since family labour on its own is not enough.

Incentives:

Farmers are not paid for any soil conservation work on their own land in Machakos. Some incentives however are given to assist them with the work. This help is in the form of hand tools, which wear out very quickly in the hard soils of the District. During 1988 over 4,000 tools were distributed for soil conservation work - these included shovels, hoes, pangas (machetes), mattocks, pickaxes, crowbars and wheelbarrows.

Tools are allocated according to availability, and the demand for tools is far greater than the number available. Most of the conservation work is done with the farmer's own tools.

Participation:

The people of Machakos participate fully in the whole conservation programme. This participation is largely through the self-help mwethya groups. Mwethya groups are traditional in the area, though nowadays the majority are registered with the Ministry of Culture and Social Services. There are over 3,000 registered groups in Machakos District, with group membership ranging between 20 and 150. The vast majority of the members are women.

These well organised groups count soil conservation as one of their main activities. Mwethya groups have been the backbone of the soil conservation success story in Machakos. The sight of a hundred or so people digging a terrace together and singing at the same time is impressive!
The Kyungu Mwethya Group is active in an area some 5 kilometres to the south of Machakos town. There are 78 members of this group, which was founded in 1986. All the members are women. Very few are unmarried or younger than 25 years old. Some of their menfolk are away in Machakos or Nairobi earning wages, others are unemployed.

The chairperson, Munyira Maleve, explains how the membership fee is KSh 100 (about $5) and if anyone misses the weekly afternoon work-meeting on Wednesdays they pay a fine of KSh 10. The funds raised are used for a variety of purposes, including buying tools.

Each week the group meets on someone’s farm to carry out soil conservation work or other related activities. Each member is given a fixed amount of work to do. For digging a fanya-juu terrace this is normally “two shovels length” of terracing. Each member brings her own tools. Group tools used to be shared, but that didn’t prove a good system, as the tools were not looked after well. Now they are allocated to individuals.

By 1990 each member has had at least a portion of her farm terraced. This group also has a communal one-acre plot of onions and beans. Other groups in the area undertake income-generating activities such as shopkeeping, operating maize mills, or poultry keeping.

Munyira Maleve tells how the mwethya group acts as a kind of insurance – helping out when a member falls sick. The group can decide to allocate one of its work days to planting, weeding or harvesting a member’s plot for example. No wonder most married women in Machakos are members of mwethya groups!

TRAINING AND EXTENSION

Extension work is carried out in the same way as for crop and animal production. The Ministry of Agriculture has a well-organised system of advising farmers called the “training and visit” system. This consists of regular visits by extension agents to “contact farmers”, carrying specific recommendations each time. The contact farmers then relay the recommendations to the rest of the community. Although the system is rather inflexible, it generally works well.

Before delivering messages, the Ministry’s extension staff are trained through a system of monthly workshops. These workshops cover all aspects of agricultural production, and concentrate on soil conservation during certain periods of the year – for example after crops have been harvested in January. The soil and water conservation programme fits neatly into the extension workers’ calendar. The main seasonal campaign takes place after the crops have been harvested, when there are no other “crop production messages” to give out.

In Machakos District the contact farmers for extension visits are groups rather than individuals since self-help groups in Machakos meet on a regular basis.

YIELDS AND BENEFITS

The main reason that terracing has been so successful in Machakos is the effect it has had on crop yields. Farmers can clearly see that terraced land produces better crops year after year than neglected land. The reasons for this are many, but the most important one is that rainfall is kept where it falls.

Only a few detailed studies have been carried out to measure the effect of terracing on crop yields in Machakos, but a recent report shows that on average terraced fields yield 400kg more maize per hectare than unterrated ones. This is an increase of 50% or more.

There are other important benefits of terracing:

- Where a whole catchment area has been conserved, there is an improvement in stream flow – very important for village water supply.
- Terracing is sometimes viewed as a “proof of occupancy” or a claim of ownership.
- Some farmers take great pride in the appearance of a well-terraced “sham-
ba” (farm) and this leads to an overall improvement in the standard of farming.

Not everyone, however, has benefited, and there is still a significant proportion of crop land unterraced. There are a number of very poor, female-headed households where the women cannot find the time or the money to join in mwethya activities. Their land will remain prone to erosion and the poor crop yields which result.

**PROBLEMS OUTSTANDING:**

**WHERE NOW?**

**ERODED GRAZING LAND**

Erosion of Grazing Land: Although most of the cropped land is well conserved, there is a serious problem with erosion of grazing land. An appropriate approach to this problem needs to be developed.

**Alternative Techniques:** Fanya-juu terracing is costly in terms of the considerable labour it requires. The project recognises this and has recently begun to work with cheaper alternatives such as vegetative strips and agro-forestry techniques. In drier areas, some sort of water harvesting system would be more appropriate.

**Vegetation of Terrace Banks:** The Ministry recommends that terrace banks should be planted with fodder species, such as bana grass. So far this has been poorly adopted by farmers, with the result that the banks are prone to erosion. Part of the problem is an inadequate supply of planting material and a lack of transport.

**Shortage of Tools:** There is a shortage of hand tools in Machakos. Tools wear out quickly in the hard soil, and some groups are hindered by a lack of implements to work with.

**Monitoring:** Although this is one of the best examples of soil conservation in sub-Saharan Africa, there is little information on the effect of conservation on crop yields or farm incomes. The project accepts that monitoring needs to be improved.

**The Poorest Households:** The poorest households, which are often headed by women, frequently miss out on the benefits of soil conservation. A way of assisting poorer households in the community needs to be found.

**Other Districts:** Machakos and neighbouring Kitui have an especially good record for soil conservation. But the programme has not yet been as effective elsewhere in Kenya. Where self-help groups are not part of the local tradition, and where returns from conservation are not so immediate, the techniques and approach need to be modified.

**LESSONS AND CONCLUSIONS**

1. Machakos has a serious problem of soil erosion because of the steep slopes and the expanding area under cultivation.

2. Terracing in Machakos is popular due largely to the rapid benefits it gives in terms of improved crop performance.

3. The existence of well developed self-help groups is one of the main reasons for the success of conservation activi-
ties in Machakos. Elsewhere experience has shown that it is very difficult to form effective groups if they do not already exist.

4. The conservation technique used is not new to the area. It is technically sound, and because people have had experience of it for a number of years they accept it more readily. New ideas are much more difficult to introduce.

5. In Machakos, where the level of participation from the people is good, the most important support on offer from NSWCP is in the form of technical guidance and tools, which are an effective and suitable incentive.

6. The project has benefited from being integrated into the Ministry of Agriculture’s well-established extension system.

7. Another factor in the success of the programme in Machakos has been the well-publicised campaigns for conservation.

8. Machakos is an example of a site-specific success story where a combination of factors has created favourable conditions for the programme. Reproducing the results in districts where conditions differ is not proving easy.

9. There are still problems to overcome. These include the lack of an effective conservation approach for the grazing areas, the need for suitable techniques in the driest zones, and the difficulty of involving the poorest households in community conservation activities.

Mukethe Mbithi is a member of the Kyungu Mwethya group.

"Before making the terraces we didn't have good harvests because the soil was eroded. When we put fertilizer on, the water washed it into the river and the maize grew short. But when we made terraces the soil erosion stopped and we got good crops."
2. LOKITAUNG PASTORAL DEVELOPMENT PROJECT – TURKANA DISTRICT

SUMMARY

The Lokitaung Pastoral Development Project in Turkana District helps semi-nomadic Turkana people. LPDP is working in an arid and difficult region where there is a history of hardship and relief food aid. The programme began as the "Turkana Water Harvesting Project", helping to develop systems of water harvesting for crop production, while also introducing animal ploughing. The project has trained local people – many of them women – to become water harvesting technicians. The most interesting aspect of the project is its evolution into a long-term development programme, mostly concerned with pastoral production – the main occupation of the local people. LPDP is largely managed by the local people themselves. In the context of the problems faced, LPDP has made significant progress.

BACKGROUND

The vast majority of the Turkana people in Kenya's arid north-west are pastoralists. They herd camels, cattle, sheep and goats. The climate of Turkana is hot and dry, and when the rains do come, they are short and unreliable. The average rainfall is 360mm, with as little as 115mm in some years, and as much as 650mm in others. Pastoralism is the most viable subsistence system. The balance can, however, be upset by disease or drought. Crop production is not possible without irrigation or some form of water harvesting. In some areas, the Turkana carry out a little sorghum cropping, especially where flooding of rivers leaves some moisture in the ground.

Name: Lokitaung Pastoral Development Project
Contact: Pius Chuchu, Project Secretary
Address: P.O. Lokitaung, via Lodwar, Turkana District
Status: Self-help Project
Sponsor/ Donor: Oxfam (Oxford, UK) supported by the Intermediate Technology Development Group (Rugby, UK)
Date of Start:
• 1984 started as the Turkana Water Harvesting Project
• 1990 became the Lokitaung Pastoral Development project
Development projects have rarely succeeded in Turkana. Often projects have been based on food relief, and have been introduced hurriedly without proper planning. When the need for food relief ends, the “development” process also stops. Irrigation and fishery schemes have both been tried in Turkana, but with little success. In most of these cases the technology was inappropriate, and the social issues not properly considered.

Turkana District has always suffered from natural hardships – in 1979/80 livestock deaths and food shortages led to severe hunger, and the creation of relief camps. Food-for-work schemes were based around these camps, and one of the activities under this programme was water harvesting. The aim was to construct earth bunds to “harvest” rainwater runoff for growing crops and fodder. But most of the structures were poorly designed, and no thought was given to how the community would use the water harvesting systems afterwards. The people were more interested in the food than the activity! The result was that most of the structures were abandoned after being built.

**LPDP’S APPROACH AND OBJECTIVES**

The Lokitaung Pastoral Development Project began in 1984 as the “Turkana Water Harvesting Project” with the two objectives of:

- demonstrating appropriate rainwater harvesting systems;
- introducing animal draught for ploughing and earth moving.

This was at a time when food-for-work was still widely used by projects in Turkana. LPDP had little choice but to use food-for-work also, for the construction of rainwater harvesting systems. However the aim was to reduce food rations gradually and to put the people in charge of food distribution.

It was decided to organise management of the project under a local Management Board drawn from members of committees in each of the three project centres. The committees themselves would be based on existing local institutions. Management would be by the people themselves – with a minimum of outside help.

Activities at the start were centred around improved rainwater harvesting for sorghum production. The idea was that crops would help to supplement income from livestock, and by bartering surplus grain, families could rebuild their herds. The policy was to help families who only had a few animals remaining to “get back on their feet” as pastoralists.

Rainwater harvesting can make sorghum production a little more reliable in this area – and it was believed that improvement could be made to some of the bunding techniques used by earlier relief programmes. There was also much traditional agricultural knowledge to build on – an excellent starting point!

**ACTIVITIES AND TECHNIQUES**

**Water harvesting:**

LPDP helps to improve existing sorghum gardens, and to establish some new ones. Traditionally some Turkana plant sorghum where rainwater runoff accumulates in natural depressions.
making growing conditions favourable. The local sorghum variety requires very little water and can be harvested after two months. LPDP aimed to improve the collection of rainwater runoff to give the crop more moisture to survive the arid conditions.

LPDP had a number of problems with early design of water harvesting systems. However much was learnt from the experiences of other projects in the area. The technique has been developed over the years, and the locally trained technicians have helped to design improvements – such as a new spillway system, locally called “irimeto” (see technical section).

The rainwater harvesting system consists of earth bunds on three sides of individual plots. These plots range in size from half an hectare to two hectares. The plots are sited where small channels bring runoff during storms – and the runoff is held by the earth bunds. Surplus runoff runs away around the tips of the two “arms” which extend up the slope.

The earth bunds are built to a maximum of a metre in height, and are up to eight metres in base width. Although the earth is carried in metal basins by the workers, oxen have been trained to pull a scoop to bring heaps of soil closer. The scoops are also used to level the plots, so that the water will spread better, and the crops grow more evenly.

**Animal Draught:**

In addition to introducing oxen scoops, LPDP has trained oxen and donkeys to plough. Traditionally land is prepared by hand. The project brought in an animal draught trainer from another part of Kenya, who in turn trained one local Turkana in each of the three centres. A new and appropriate type of plough has been introduced – based on the Ethiopian ard. The ploughshares are made by local blacksmiths, and the frames of the ploughs are made from local wood.

**Activities at the Community Stores:**

Each of the three project centres has a community store which operates with a revolving fund. The two main activities are:

- Trading of skins (of sheep and goats). Families deliver skins to the stores.
These are bought at a fair price and then sold to a mobile trader.

- Sales of food grain to assist food security. Each store keeps a supply of grain for sale. This guards against shortages in food supply.

FAMILIES DELIVER SKINS TO THE COMMUNITY STORE

PROJECT MANAGEMENT AND ORGANISATION OF WORK

Management of the Project:

LPDP is managed by a local Management Board. Members of the Management Board are drawn from the local committees, which are based at the three centres of activity – Loarengak, Kachoda and Kaaling. These three committees are based on traditional institutions.

LPDP receives financial and technical support from OXFAM and the Intermediate Technology Development Group respectively. A small number of local project staff are employed, including the Project Secretary, and the following staff at each of the three centres:

- an elder ("Ekarabon")
- a monitoring/store person
- a water harvesting technician
- an animal draught trainer.

Several of the project staff are women, as are the majority of the members of the local committees.

Organisation of the Water Harvesting Work:

When assistance is requested by a land user, the process is as follows:

1. The plot is visited by the local water harvesting technician, who recommends the work to be done if:
   - the site is suitable
   - the applicant has at least 15 sheep/goats
   - a workforce can be organised
   - the family has traditional land rights.

2. If approved, the technician designs the structures in cooperation with the land user.

3. A food-for-work contract is drawn up. This states how many bags of grain will be given to the family when the work is finished. In early 1989, this averaged 6 sacks (90kg each) per plot.

4. The work force is organised by the land user, and is usually composed of family members and friends. An oxen scoop may be borrowed from the local committee, but most of the construction is carried out by hand with simple tools such as hoes and basins.

5. The land user then contributes a goat to the village committee to build up community funds.

The contract system has worked very well, and very few families have failed to complete work on their gardens.

Incentives:

Food-for-work has been the main incentive to assist families in construction of water harvesting systems. There is a long history of food-for-work in the area, and when the project began, it would not have been possible to start such a programme without some food aid. The project has a clear policy on food-for-work:

1. to use food aid only when necessary, and to reduce rations gradually – thereby reducing dependence.

2. to put the people in charge of the distribution of their food.

One of the first moves by the project was to put elders in charge of the distri-
bution of food rations. This delegated responsibility to the local people. A steady reduction in food rations has been achieved, and by 1989, the ration had been reduced to a quarter of that first given out.

Participation:

One of the most positive aspects of the project is the way it has achieved local participation in management and the organisation of activities.

Voluntary participation in construction of water harvesting systems is growing all the time. In 1990 there was a shortage of food-for-work supplies, and yet construction continued. Maintenance of structures, almost everywhere, is voluntary.

TRAINING

YIELDS AND BENEFITS

By June 1990 over 200 families had received assistance to improve their sorghum plots. There are no exact figures on yield improvements, but the people say that yields have increased. More importantly the harvest is more reliable. It is said that a good harvest can be expected about three years out of five.

PEOPLE ARE TRAINED TO USE A “LINE LEVEL” FOR SURVEYING

There are regular training courses when staff are trained in a variety of skills. These include:

- water harvesting technology – design of systems;
- animal draught – how to use oxen to plough and scoop earth;
- monitoring – recording of data such as work rates and yields;
- general leadership and management skills.
PROBLEMS OUTSTANDING: WHERE NOW?

Change in Emphasis:

There are limits to what water harvesting for crop production can do for the Turkana. Many of the families in the area have already improved their plots. The Management Board has now decided to change the emphasis of the project from water harvesting to include livestock and food security.

Outside Assistance:

The project hopes to become self-reliant in the future. Already food-for-work is being phased out. But it remains to be seen how truly independent of outside assistance the project can become.

Costs:

The water harvesting system is quite expensive – especially in relation to the unreliable yields in the arid conditions of Turkana. However costs have been reduced by the use of the oxen scoops. There may be a possibility of developing new ideas, such as using brushwood or planted shrubs to catch wind-blown sand and form bunds in a “natural” way.

Animal Draught:

Oxen/donkey ploughing has not been adopted as quickly as was hoped – it takes time to train people and their animals. However ploughing has been made quicker and easier now with the introduction of the Ethiopian ard-type plough.

Crop Husbandry:

Crop husbandry could be improved. This is one of the objectives of the future programme. A wider variety of crops and varieties could be planted, better pest control introduced, and more use made of “take-a-chance” planting of crops like cowpeas.

Monitoring:

Improved monitoring systems are needed. These are indeed being developed in order to measure yields, the rate of restocking which has taken place, and other important effects of the project.

LESSONS AND CONCLUSIONS

1. LPDP has been successful, despite its limited achievements, in the context of the very difficult environment of northwest Turkana.

2. The project has managed to develop into a community-based programme, with a reduced dependence on support from outside.

3. The project has also evolved from a simple water harvesting project to a long-term programme focusing particularly on the people’s main priority, pastoralism.

4. Existing local institutions have made a very good base for the development of local management committees.

5. Food-for-work often leads to poor development projects, which do not last after the food relief ends. LPDP has managed to reduce the amounts of food allocated, and put its distribution into the hands of local people. The project is well on the way to phasing the food out of its programme.

6. Training of local people in the technical skills of water harvesting and animal draught has worked well.

7. The water harvesting system used by the project, although quite costly, works well. LPDP has taken models from other projects, and used its own experience to develop a system over a period of time. Locally trained staff have made an important contribution in this process.

8. Problems which are being faced by LPDP include the relatively high cost of its water harvesting system, the need to improve monitoring, a variable standard of crop husbandry and a rather uncertain future.
Much of northern Mali is arid and barren, land where only pastoralists can make a living. Although the population of Mali is quite low overall, the majority of the people are concentrated in the wetter south, where the agricultural land is becoming scarce.

There is land degradation in parts of the arid north, and this has been made worse by the droughts of recent years. There is erosion also in southern Mali, with its higher rainfall and better land. Cotton is the most important cash crop in the south.

There are some very interesting traditional techniques of conservation in Mali – which are not widely known about. However Mali has not had much experience of soil conservation programmes and it is only in the last few years that a significant number of projects have started up.

First, we visit an area where there is a wide range of conservation techniques, all entirely traditional – the Dogon Plateau.

Second, we look at one of the longest established soil conservation projects, situated in the cotton growing zone of southern Mali – the “Projet Lutte Anti-Erosive” (Anti-Erosion Project) of the “Compagnie Malienne de Developpement des Textiles” (Malian Textile Development Company).
I. TRADITIONAL SOIL AND WATER CONSERVATION ON THE DOGON PLATEAU

INTRODUCTION

The Dogon Plateau is home to a wide variety of traditional soil and water conservation measures. There can be few other areas in sub-Saharan Africa where the local people have devised such a range of conservation techniques including hillside terracing, stone lines, earth basins, planting pits and earth mounds. These traditional methods of conservation have been developed mainly to cope with the acute shortage of soil – and rain – on the plateau. Some of the techniques could be improved, and the people urgently need support to reduce erosion further. Nevertheless the main lesson from the Dogon Plateau is that there is much to learn from traditional ways of doing things which have often been ignored. Soil and water conservation projects should always begin by looking at what the people are doing for themselves.

BACKGROUND

Situated in the eastern part of central Mali, the Dogon Plateau is well known to outsiders for its picturesque villages and spectacular cliffs and escarpments. The plateau is hilly and covered with rocky outcrops. But for the agricultural Dogon, the shortage of land to cultivate has always been a problem. Less than a quarter of the plateau’s surface can be planted with crops, and much of the soil is just a thin cover over the rock.

The population density of about 25 people/ km² is very high for an area with such little soil and such low rainfall. Strangely, the population is most concentrated on the rocky hillsides where there is the least cultivable land! In common with several other regions in Africa, one of the reasons that the people originally moved to the escarpments, was for security from raiders. Many families have chosen to stay there.

The large population simply cannot feed itself in times of drought. In low rainfall years many young men go to the towns and the better agricultural areas in search of seasonal work. Some families have even migrated from the area, settling in the south of Mali where there is better soil and more reliable rainfall.

The Dogon plateau is a low rainfall area and lack of rainfall has become an even more severe problem over the last 20 years. The annual average rainfall has diminished from 555mm to as little as 465mm during this period. Not only have crop yields suffered, but drinking water has become more scarce. Streams dry up earlier in the season, and the water tables have gradually fallen – which means that wells and boreholes have to be dug ever deeper and deeper.

As well as being low, the overall rainfall is also unreliable and individual rainstorms can be very intense. Naturally there is considerable runoff from the rocky surfaces. This leads to erosion of soil on the fields below – if the land is not well protected by soil conservation measures. Wind erosion is also a serious problem here during the dry season.

Much of the erosion caused by rainfall occurs on land which is too rocky to be cultivated. This is grazing land, and erosion here means that less vegetation grows for the cattle, sheep and goats. At the same time, money which is sent back to the villages by those working away is often used to buy livestock...and the problem of the grazing lands increases.
The Dogon however depend principally on their subsistence food crops. Most of the land cultivated is planted with sorghum and millet. Groundnuts are also common. In addition to rainfed farming, irrigated vegetable production is important close to the watercourses. The most common vegetable here is onions.

In summary, the problems on the Dogon Plateau are:

- a shortage of land to cultivate and thin soils
- a high population density
- low rainfall which has diminished over the last 20 years
- high rates of rainfall runoff from stony surfaces
- high rates of erosion — both by water and by wind
- overgrazing by livestock.

Because of their historical dependence on their food crops, the Dogon have simply had to develop methods to conserve their soil and water! Without these, they could not have survived.

**ACTIVITIES AND TECHNIQUES**

**Hillside terraces**

The hillside terraces of the Dogon consist of small stone walls which hold pockets of earth in place. Where there is quite a good supply of soil, the terraces may be more or less continuous along the hillside. Elsewhere they may be scattered, with individual terraces constructed between stone outcrops. Soil is normally levelled by hand within each terrace. Where the earth is not deep enough, extra soil may be added from nearby. Some terraces are built on bare rock — and all the soil is brought from outside! (See the section on onion gardens below.)

This technique now less important than it was for three reasons.

1. People are gradually moving down from the hillsides now that there is no longer a security problem.
2. Construction and maintenance use a great deal of labour.
3. Recently, the lack of rainfall on the shallow soil has resulted in poor crops within the terraces.

**Stone lines**

Throughout the flatter areas of cultivation, wherever there is any loose stone, the Dogon construct stone lines. These lines are placed across the slope, in
order to slow runoff and reduce erosion. Often the lines are just a string of individual stones – resembling crocodiles’ teeth!

These lines could be improved. The stones could be placed more carefully to avoid small rills forming between them, and the lines would be more effective if they followed the contour.

Stone bunds

These are larger structures than the stone lines, and less common. More labour is involved. They are preferred to stone lines where the land is more sloping, where erosion is worse and where there is a good supply of stone. As with stone lines, these bunds are built across the slope, and the idea is again to slow runoff and reduce erosion. But again they would be more effective if they were built more carefully, and if they followed the contour.

Earth Mounds

The technique of making small earth mounds between plants while weeding is very widespread on the Dogon plateau. These mounds are seen elsewhere in Mali. It is possible that the technique has only been adopted by the Dogon in the last half century. It is certainly growing in importance now.

When the young cereal crop is first weeded in July, the weeds are scraped together and covered by earth in the form of mounds between the plants. Each mound is about 20-30cm high. The mounds last throughout the season and have two useful effects. First they tend to slow down runoff as it flows through the field. Secondly the mounds act as “mini-compost heaps”, and help maintain soil fertility.

Earth Basins

Some Dogon make small earth basins in places where the soil is deeper. The idea is to catch and hold every drop of rainwater where it falls – and of course this stops soil being lost also. This is one of the most effective techniques of all but it is quite labour intensive.

Each basin (of between one and four square metres) is made by building an earth ridge in the form of a square. Construction takes place in the dry season, before planting. The ridges are built-up during weeding.

Planting Pits

As with earth mounds, this is a technique which is also found outside the

Boukary Yebeize

“When we make the basins and pits the water which would have left the field stays put, and so in the dry weather there is less crop damage. The yield is now higher. When we have enough rain the crops ripen well. By harvest time when we haven’t used the techniques the millet can dry out, but everywhere we do use the techniques, the millet stays green”.

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Dogon plateau – even as far away as Yatenga in Burkina Faso where it is known as zai. Planting pits are quite small – only 15-20cm deep and 30cm or so in diameter. These pits are dug about a metre apart. Manure is added, and then several cereal seeds are sown into the centre of each pit.

The benefits are a concentration of rainfall around the plant roots, and a concentration of the effect of the manure/compost.

Planting pits can be used together with most other techniques. This is a popular technique although it is not as widespread as earth mounds.

Trash Lines

One measure which is becoming less commonly used is trash lines. These are narrow strips, made from cereal stems or even cut bush, which are aligned across the slope. They have the effect of slowing and filtering runoff and soil fertility is built up when the vegetative material decomposes. However, the problems are that the trash can easily be blown away before the rains come and cutting of foliage has recently been made illegal.

Onion gardens made with “transported earth”

The Dogon have an extraordinary tradition of creating onion gardens on bare rock! This is not a conservation measure in the same sense as the techniques already described, but it does show the skill with which the Dogon manage the little soil and water that they have.

Market gardening has been practiced for a long time on the Dogon plateau. Vegetables, and particularly onions, are grown close to seasonal watercourses, from which they are irrigated. However there is not enough land on the riverbanks, and in some areas there is bare rock on both sides of the watercourses. It is precisely here that the Dogon create new land for cultivation.

The “transported earth gardens” are started by building a network of small stone squares on the rock surface. Each square has sides of about one or one and a half metres. Silt is then dug from the riverbed, or earth collected from cracks in the rock nearby, and carried to the site. The squares are filled to an initial depth of about 15-20cm. Manure or compost is added to improve the fertility of the transported earth.

Vegetables are planted in these gardens during the dry season. Regular and careful watering is then carried out, by hand, from the riverbed. Onions mature quickly in the shallow soil. After harvesting the bulbs are crushed into pulp, squeezed into balls, and dried on the bare rock close to the gardens, ready for marketing.
ORGANISATION OF WORK

Dogon society is still strongly traditional in all aspects, including agriculture and soil and water conservation. Agricultural land is divided into common fields, family fields and small plots belonging to the women. The main fields are used for sorghum and millet, but the women prefer to grow groundnuts, voandzeia ("Bambara groundnuts"), and various vegetables on their plots.

For most cropping activities the women join the men in the fields after they have prepared the midday meal. However women are traditionally not involved in building soil and water conservation structures except in the construction of onion gardens when they carry soil.

There is no strong tradition of group labour in soil conservation on the Dogon plateau. Normally the male members of the household work alone, though in some cases friends and neighbours may join together in informal working groups.

However a new agricultural development project on the plateau – the "Projet Vulgarisation Agricole" is attempting to involve village groups, which include young women, in soil conservation activities. The idea is that village working groups can speed up construction on an individual's field. Some payments are made to the groups for their labour.

YIELDS AND BENEFITS

There are no figures available for the benefits of the various techniques, either in terms of improved plant performance, or soil conserved. There is simply not enough known about the traditional systems of conservation. But what is certain is that the Dogon could not have continued as agriculturalists without these systems and would not continue to use them if they didn't think it was worthwhile, given the huge amount of labour which they take.

PROBLEMS OUTSTANDING: WHERE NOW?

The future of cropping on the Dogon plateau

Despite all the techniques which are used by the Dogon, erosion is still a menace on the plateau. Overpopulation has lead to over-use of the land. The amount of cultivable land is growing smaller each year, and families are having to migrate. Help is urgently required to improve the conservation techniques, and to assist the people to carry out the work.

Improving the technology

The stone lines and stone bunds are the techniques which are in most need of improvement. Better placement of stone, the introduction of a foundation trench, and alignment on the contour are all improvements which PVA is trying to introduce. But this is only a first step – there is a great deal to do, and the work is urgent.

Tool supply

The Dogon are desperately short of appropriate hand tools to work with. This again is an area where some projects have begun to help.
LESSONS AND CONCLUSIONS

1. The Dogon plateau has a rich variety of soil and water conservation techniques which have been developed by the local people and implemented without outside assistance.

2. The combination of limited land, low rainfall and a growing population have forced people to look after their land. Without conservation of soil and water, cultivation could not have continued.

3. There is very little knowledge about the traditional techniques here – and there is much to be learnt. This is also true of other parts of sub-Saharan Africa. Such systems are usually ignored by soil conservation "experts".

4. Several of the measures could be applied in other parts of sub-Saharan Africa although most of them cannot be used in places where animal traction is used.

5. After careful study, these traditional techniques should be used as the starting point for conservation projects on the plateau.

6. Improvements could be made to some techniques – particularly the stone lines and stone bunds.

7. In spite of their efforts the Dogon need urgent assistance in the field of soil and water conservation because of the natural rate of erosion on the plateau. They need both help to improve their own techniques, and in the provision of tools.

Sana Nantoume

"I learnt these techniques from any parents. If my children learn to use these techniques I think they will benefit in the future. They should do as I do. We are not here on earth for ever, and if you don't work you won't profit. There really are advantages to using these traditional techniques"
2. PROJET LUTTE ANTI-EROSIVE (PLAE)

SUMMARY

PLAE is the largest and longest established conservation project in Mali. The project was set up under the Malian Textile Development Company in 1986 to combat the increasing problem of erosion on fields and village land. Cotton sales had increased farmers' incomes and surplus cash was used to buy more cattle. Overgrazing then caused decreased vegetative cover and therefore more runoff. An increase in erosion followed, and this finally led to poorer crop yields. PLAE introduced the concept of "village land-use management", planned and coordinated by village associations. Several erosion control techniques have been introduced - some more successfully than others. For example, live fences and tree planting on an individual basis have been very popular, whereas grazing control has been very difficult to put into practice.

BACKGROUND

Unlike most of Mali, the area where PLAE operates is not arid. There is usually enough rainfall for food crops - and also for growing cotton.

But just like elsewhere in the Sahel, there has been a reduction in rainfall over the last twenty years. The annual average in the Koutiala area has fallen from 1020mm (1931-1971) to 820mm (1972-1987).

Farmers now have two main problems. With the lower rainfall, short drought spells during the growing season have become more common. But of more concern is the violence of the rain when it does fall. During the months of July and August there is often just too much rainfall - and it is concentrated into intense showers.

The result is runoff and erosion. A single rainstorm is enough to cause severe erosion if the land is not adequately protected by a good cover of grass or crops.

The land in the area has become degraded by water and wind erosion and the problem has got much worse in recent years. Several factors have helped to accelerate the rate of degradation:

1. The human population has increased in recent years - by more than 40% between 1976 and 1987.

2. There is a growing shortage of good agricultural land. The amount of land farmed has increased enormously, partly because of the needs of the growing population, and partly as a result of the popularity of the cash crop - cotton. There is rarely a chance now to rest fields under the traditional fallow system. The soil becomes exhausted and erodes more easily.

More people need more wood for cooking... and as a result the demand for fuel wood has slipped out of balance with the supply. Only 60 years ago this area used to be a forest. Now it only produces about half of the wood that is required. Villagers have even started to cut the protected fruit and nut trees "Nere" (Parkia biglobosa) and "Karite" (Butyrospermum parkii) which grow within the fields.

Name: Projet Lutte Anti-Erosive.
Compagnie Malienne de Developpement des Textiles (CMDT)
Contact: The Chief of Project, PLAE
Address: B.P. 01 Koutiala, Mali
Status: PLAE is a sub-unit of an Agro-Industry
Sponsor/Donor: Dutch and Malian Governments
Date of Start: 1986
Poor husbandry practices, like burning crop residues and ploughing downslope, have helped to make the erosion problem worse.

One unusual factor in the land management problem here is the success of the cotton production in the area, which has indirectly led to erosion. What has happened is as follows:

Cotton production is promoted by CMDT and the families who plant cotton can make a good income from it which is very often invested in livestock. According to PLAE there are now many more livestock in the area than the land can support. The result is severe overgrazing, leading to increased runoff from the plateaux. The runoff has in turn caused erosion on the agricultural fields, and the yield of the cotton crop has decreased.

The erosion in the cotton fields and the expressed concern of the villagers themselves convinced CMDT that action needed to be taken.

Some recommendations for better resource management had been developed by a research project [the Division of Research on Rural Production Systems (DRSPR)], which had been working on erosion control for a number of years. These were used as the basis of a programme, and PLAE – the “project which struggles against erosion” was born.

PLAE’s Approach and Objectives

PLAE began operations in May, 1986. The twin objectives were:
• to halt land degradation
• to improve conditions for crop production

DRSPR had formulated the concept of village land-use management using a “global approach” to conservation. It had been concluded that bits and pieces of isolated activity such as earth bunding, for example, would not answer the overall problem.

The recommendation was to introduce a programme of conservation measures designed to protect the whole watershed from the plateaux at the top, to the valleys at the bottom. The programme would be introduced in phases, starting with communal work at the top of the watershed and ending with conservation on the actual fields. This was the approach which PLAE adopted.

After studying the profile of a typical watershed (see technical section) the village land was divided into three zones, each requiring different management systems. These were called:

1. Sylvo-pastoral zone (firewood and grazing);
2. Cultivated zone (cropped fields);
3. “Protection zone” (grazing land which is degraded).

In summary the problems are:
• a large, and growing population
• a greatly expanded farmed area under the cash crop, cotton
• a shortage now of good land
• heavy, intense rainfall in certain months
• a fuelwood shortage leading to deforestation
• overstocking of cattle and consequent overgrazing
• poor traditional cultivation practices making erosion worse
• decreasing crop yields due to reduced soil fertility.
Suitable techniques were designed for each.

**ACTIVITIES AND TECHNIQUES**

The main function of PLAE is to provide training for the staff of CMDT and the villagers.

Once the process of motivation and training is well underway in the villages, the Village Associations take responsibility for coordinating the programme and putting the various techniques into practice.

During its first three year phase, PLAE has helped more than 20 villages, but has concentrated on the typical cotton-growing village of Kaniko. Here the full range of conservation techniques has been tested. Some of the techniques, like stone bunds, have a direct effect on conservation, while others have an indirect effect – for example improved cooking stoves.

Some of the measures could be used in the drier areas of sub-Saharan Africa, for example improved cattle pens. Others are particularly suited to the climatic and economic conditions of this part of southern Mali, for example tied ridging.

The measures are as follows:

**Protection of the Plateaux**

Grazing control on the plateaux is essential to give the vegetation a chance to recover. However this requires communal agreement, and has so far met with little success – partly because the law allows anyone to graze livestock on the common land, and anyone can cut wood if a fee is paid to the government.

**Earth Bunds/Waterways**

The original plan was to build earth bunds to lead runoff from the plateaux into waterways between fields. But in practice bunds broke and the waterways led to gullying. The technique was soon replaced in most places by...

**Stone Bunds**

Stone bunds sited just above the fields slow and filter the runoff. There is no need then for a waterway, and this has proved a better way of protecting fields. Stones are transported by the farmers' donkey carts – which have proved cheaper than transport by lorries and just as efficient. Work is carried out by village groups.

**Live Fences**

Live fences around farmers' fields only give a limited amount of protection against erosion – mainly by filtering out sediment from runoff. Their main purpose is keeping out livestock and they are popular!

**Grass Strips**

Broad strips of grass across the slope in farmers' fields act as living barriers to runoff. These have been reduced in size and spaced further apart since the original design because farmers felt they took up too much space. Lack of suitable grass seed has been another problem.

**Check Dams**

Gullies in fields are stabilised by small check dams of stone or branches. When built carefully, these can be made a difference very quickly.

**Tree Planting**

Communal tree planting in the form of village woodlots has not been as popular
or as easy to organise as tree planting by individuals. The project has now changed its emphasis towards planting at the farm or household level by individuals.

Cultivation Practices/Tied Ridging

Conservation farming techniques have not been fully adopted. However most farmers now plough across the slope as recommended. A special ox-drawn implement which makes tied ridges is being introduced. But most farmers still have to make earth ties in the furrows by hand – which is time consuming and therefore not very popular.

Improved Cattle Pens

The traditional cattle pens have been increased in size. Stems and leaves from crops are thrown in to be trampled and mixed with manure to form a rich and bulky compost. This is spread on the fields and helps to maintain fertility.

Improved Stoves

Improved low cost cooking stoves are 30% more efficient in terms of fuelwood usage than conventional stoves. Stoves are made locally from earth, and save women some of the time and labour involved in collecting firewood. This programme began in 1987, and up to 1989 more than 6,000 stoves have been made.

PROJECT MANAGEMENT AND ORGANISATION OF WORK

Management of the Project:

PLAE has its headquarters at Koutiala, where a small team of specialist trainers are based. These trainers run technical courses for CMDT’s extension staff. The village associations are motivated and trained in better conservation methods by PLAE and by the CMDT staff. However, since 1983 the number of extension staff has been reduced in this area and because they have several other duties related to cotton growing, it is not always easy for them to give enough time to PLAE activities.

Organisation of Conservation Work:

CMDT is handing over increasing responsibility to the village associations for the management of cotton production and general development. Village associations were set up by CMDT several years ago to assist with activities such as cotton marketing. In Kanikó, the village where PLAE concentrated its early interventions, the village association was set up in 1979.

Village associations are responsible for conservation of all land within each village and it is PLAE’s hope is that they will eventually accept full responsibility for the management and development of their own territory. Within each village association, there is a development committee which controls technical teams, each of which is responsible for a particular task. For example, one team is responsible for surveying and lays out contours with a water tube level. Technical teams also direct group work and record achievements.

The village association helps organise working groups: it has been found that, for communal work, large groups are very difficult to organise on a regular basis. Small groups of people who know each other work better than large units!
**IMPROVED STOVE**

**Incentives:**

PLAE does not, at present, use incentives to encourage conservation work. They are considered to be unnecessary because the people in this region are relatively well-off. Also, people are given credit for farm inputs under CMDT, the amount owed being deducted from payments for cotton.

**Participation:**

Because the village associations are the focus for conservation activities, local participation in planning and implementation has been assured. PLAE's objective is to help the associations to take control of their own development. However experience shows that it will take a number of years to achieve this fully, particularly with the more complicated issues such as grazing management.

**Extension and Training:**

PLAE sees itself as a training programme. Specific technical training is given to CMDT extension staff during intensive in-service training courses. Villagers are motivated and trained in better conservation methods by means of the "GRAAP" method. This is an interactive system of training based on the use of "flannelgraphs", where cut out pieces of cloth are stuck on a felt screen. Stories can be built up on the screen by the villagers - the process of erosion, for example, can be illustrated.

This process is combined with a tour of village land by a delegation of extension agents in the company of the villagers. This has proved to be a very effective system in teaching the villagers about land use planning.

Slide shows are also used. There are two sequences of slides - one for staff training, and one for the villagers. The sequences show the whole cycle of erosion and degradation, followed by the planning process and then conservation measures put into practice.

Written material for training villagers is in the local language, Bambara. Demonstration and experimental plots are also used for extension.

**YIELDS AND BENEFITS**

There are no precise figures yet for the benefits of the different conservation measures in terms of yield improvements.

However, it is estimated that cotton yields can be raised from the current average of about 1,300 kg/ha to 2,000 kg/ha if a programme of conservation measures is adopted. Likewise, sorghum and millet yields would probably rise from the current 800-900 kg/ha to 1,000 kg/ha or above.
Women's Role

Women still only occupy a background role in the village associations. For example, only two out of 17 members in Kaniko's Development Committee are women. Women need to be brought more into the process of decision making.

Monitoring and Evaluation

PLAE does not yet have as much information as it would like to be able to measure the effect of each conservation technique. This is essential to be able to show which techniques work best!

PROBLEMS OUTSTANDING: WHERE NOW?

Popularity of Measures

The best accepted of the measures have been ones which can be carried out on an individual basis. Examples are the live fences around private fields and tree planting near the homestead. Several techniques - especially those which require communal action - have not gone further than the pilot phase. It is proving much more difficult to organise group work on communal land than individual work on private land.

Workload

There is already a heavy work load on the villagers for whom cotton is a six-month activity. There is a need to develop and emphasise less labour intensive techniques.

Village Land Use Management

Physical conservation measures are the framework for the programme. But until there is a change in attitude by the villagers to the use of fuelwood and grazing land there will still be a major challenge for the project. However a change in attitude is difficult to foresee with the present laws on the use of communal land.

LESSONS AND CONCLUSIONS

1. Land degradation is not only a problem in the drier, poorer areas of the Sahel! Even in this relatively prosperous zone where there is a profitable cash crop, there are serious problems of over-grazing, fuelwood supply and erosion.

2. The technical answers to conservation in a relatively wet area may be different from the drier zones, but the basic approach by a conservation project should be similar.

3. Village land-use management is a new idea in Mali. Village land-use management looks for solutions for each of the land use categories - and the village as a whole is responsible for putting them into practice. PLAE's experience will be of interest for all of Mali.

4. The project may have been over-optimistic. Several of the technical research recommendations have not proved workable in the reality of village life.

5. Flexibility is very important! PLAE has been prepared to alter techniques where necessary. For example earth bunds with waterways, which was an unpopular and unsound technique has been replaced by a much more appropriate system of stone bunding.
6. A change of attitude by villagers towards more responsibility for the environment may take years to achieve – especially with the current legislation on use of common land. Strong local institutions like the village associations supported by PLAE are needed to take the lead in communal resource management.

7. The measures which have been adopted most quickly are those which are cheap, do not take up productive land, and are implemented on an individual basis. Groups can work here – but only small informal groups of family and friends!

8. Mechanised transport of stone is not always more efficient than donkey carts – as PLAE's experience has shown.

9. The “GRAAP” system of motivation and training combined with the slide sequences have proved very effective.

10. Remaining problems include the need to improve monitoring and to increase the representation of women in decision making.