

Dryland Networks Programme

ISSUES PAPER

**Traditional soil and water
conservation on the
Dogon Plateau, Mali**

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The diagrams in this paper were drawn by Tim Critchley.

Traditional soil and water conservation on the Dogon Plateau, Mali

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1. THE DOGON PLATEAU

1.1 NATURAL ASPECTS

The Dogon plateau of eastern Mali has an area of 10,000 km² and lies between 3° and 4° west longitude and 14° and 15° north latitude. The area is covered mostly in almost bare sandstone broken up by valleys or temporary streams. It has a Sahelian climate, with an average annual temperature of over 20°C. Hot, dry Saharan anticyclones blow from east to west. Starting in May or June, this wind is replaced by the rain-bearing westerly monsoon.

Levels of rainfall vary considerably from year to year. In 1981, for instance, 532 mm of rain fell, compared with only 265 mm in 1982. Average rainfall between 1921 and 1968 was 556 mm. Between 1969 and 1989, the average had dropped to 465 mm. In the latter period, the rainy season began later than before, and ended before the crops were fully ripened. Droughts are common.

Poor harvests of food crops are one consequence of this phenomenon. 1988 and 1989 saw satisfactory levels and frequency of rainfall. Normally, rainfall is heavy, and accompanied by high winds. This leads to severe erosion of the soil and the development of hard pans which limits percolation.

1.2 HUMAN ASPECTS

The population of the Dogon plateau is between 200,000 and 350,000, and demographically, it is similar to other areas of the Sahel: high birth and mortality rates, and a relatively young population, with a natural increase of 2 to 3%.

Goundaka and Ouo are the most sparsely populated areas, with 13 and 16 persons per square kilometre respectively, while Sangha (85 persons per km²) and Dourou (65 persons per km²) are extremely densely populated. The average population density is around 25 persons per km².

One very curious thing about the Dogon plateau is the fact that whereas those areas with relatively more arable land (Ouo and Goundaka) are the least densely populated, the very precipitous areas with only around 2 to 3% of arable land, are very densely populated. This phenomenon has a historical explanation: in the eighteenth and nineteenth centuries, the Dogon people found refuge in hillside caves as they fled from invaders, and here they began farming. Although the danger is past, these steep hillsides continue to be very populated.

A rural exodus estimated to be about 20% is the most significant population movement. Numbers vary from region to region and also depend on the success of harvests. After a bad harvest, young people flock to the towns, and in places like Ningari, Kani-gougouna, Kendie, and Goundaka, where there are fewer opportunities for market gardening, the exodus is even more marked. The building of dams is one way of stabilising the population.

Even if the young people who go away to the towns help to maintain their families by sending them money, the overall effect of this rural exodus is clearly negative, since it means a drop in overall income for the families concerned.

More permanent migration is also quite common. During the colonial period, and in the early years of independence, there was a movement of people from the steep mountain areas to the plains; the 1980s saw a definitive migration towards the south of the country. Although it has not been a question of whole villages moving, this migration has involved more than a hundred families from different villages.

1.3 ECONOMIC ASPECTS

The economy of the Dogon plateau is essentially agricultural, and is based on the cultivation of cereals and market gardening. These activities are not without problems. Both land and water are insufficient, there is severe erosion, droughts are frequent, and the soil generally skeletal. The terrain does not lend itself easily to mechanisation, since only 10 to 15% of the plateau is arable land.

The main crops are - in order of importance:¹ millet and sorghum, which occupy 82% of all cultivated land; fonio (a wild grass), 12%; peanuts, 5%. 4,000 to 8,000 tonnes of millet and sorghum, 900 to 1500 tonnes of fonio, and 400 to 600 tonnes of peanuts are produced annually.

Onions are the most common market garden crop, and are cultivated in 61% of plots, followed by tomatoes (11%), sweet potatoes (6%), tobacco (6%), and peppers (3%). The 1990 market garden production was as follows: onions, 23,480.75 tonnes; tomatoes, 3,904.4 tonnes, and potatoes, 365 tonnes.

The area planted in onions increases each year. Whereas in 1989, 515.25 hectares were planted in onions, and produced 15,464.4 tonnes, in 1990 this had risen to 566.25 hectares giving 23,480.75 tonnes. Yield per hectare stands at about 30 to 40 tonnes. Individual family plots (and each household has its own plot) are a maximum of 3,000 m². Men have plots of 400 to 500 m², and women, 100 to 150 m².

Besides agriculture, the people of the plateau engage in handicrafts, and petty trade and animal husbandry are supplementary activities.

The Dogon people have developed totally original, traditional water and soil conservation (and even soil creation) techniques through which they continue to 'manage their fields in ways unequalled anywhere else in the Sahel'. Various factors have contributed to the invention of these techniques:

¹ All statistics are taken from the PRODUCTIONS section of the PVA (Projet de Vulgarisation Agricole: project for popularizing agricultural methods).

- Having fled to the area to escape capture, the Dogon were forced to cultivate the skeletal soil of the steep hillsides around them. These hillsides are very precipitous, and erosion severe. They had to learn to take care of the hills if they were to survive.
- Later, as the population took off and the climate got worse, the Dogon invented other techniques aimed at making better use of available land, or transporting land to places where previously there had been none.

The many traditional soil and water conservation techniques employed by the Dogon are still largely unknown to the outside world.

2. TRADITIONAL SOIL AND WATER CONSERVATION TECHNIQUES.

The best-known are: mounds, terraces, stone lines, bunds or low walls, square basins, and planting-holes.

2.1 CONES or THE TECHNIQUE OF MOUND-MAKING.

Cone-shaped mounds of earth are constructed by farmers during the hoeing or weeding of their millet and sorghum fields (see diagram 1). The first weeding is done in July, while the crops are still young, and second weeding and mound-making from the end of August to September, as the ears of grain begin to develop. Mounds are set among the millet plants, and vary in size. An average mound would be 35 cm high and have a base measuring 60 cm. The size of a mound is partly determined by the person who makes it (a mound made by a woman, or a child of ten to twelve years old, is smaller than one made by a young or adult man), and partly by the nature of the soil. Mounds built on dry clayey or skeletal soil, are smaller than those on damp, deep, sandy or clayey soils. A man of 20 to 45 years old may be able to build mounds over an area of about 800 m². A woman of the same age group would probably be able to do only half as much. Persons above or below this age group would do even less.

Mound making remains the most common soil and water conservation technique. It is popular throughout the plateau, and is well-known in other parts of Mali.

Mounds slow down the runoff of rainwater and facilitate percolation. They also help to cover weeds, and thus function as mini-compost heaps. The buried weeds turn into organic fertilizer for future crops, since the mounds are designed to carry the next season's seedlings whose growth will be encouraged by the nutritive elements in them. Mounds also help to protect seedlings from winds and storms, and aid aeration.

Mound making has become increasingly popular over the years. Up to about 1950, the Dogon only hoed their fields. Nowadays they also weed them, as a result of which they have gone back to making mounds during each season's weeding.

Diagram 1: Mound-making in fields

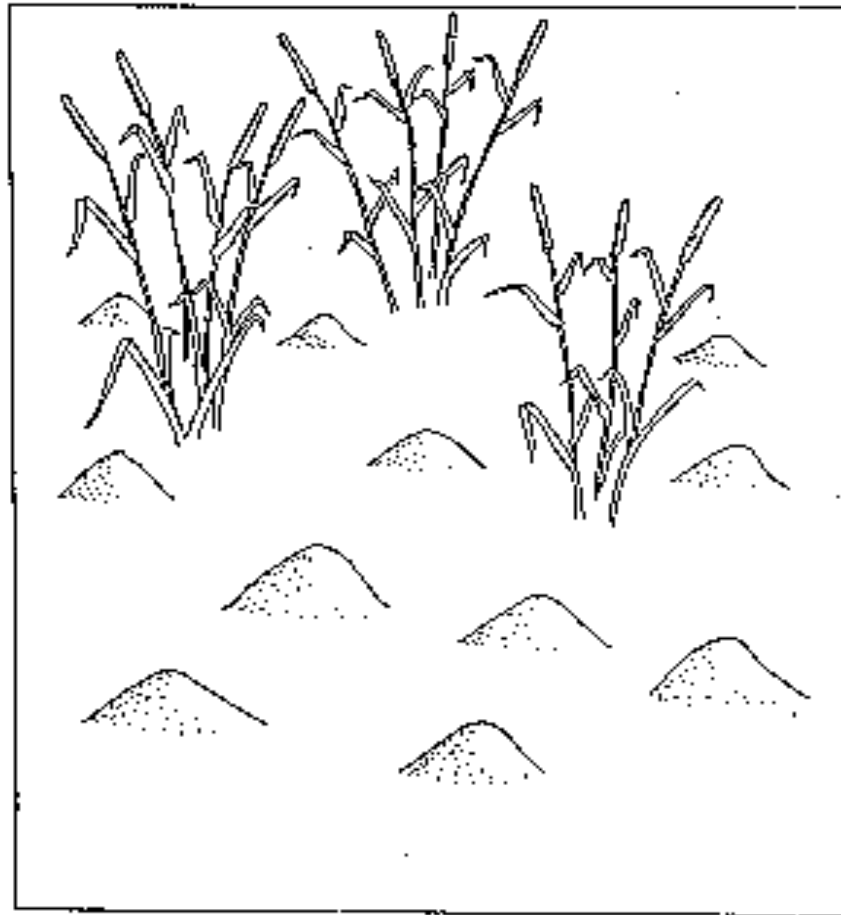
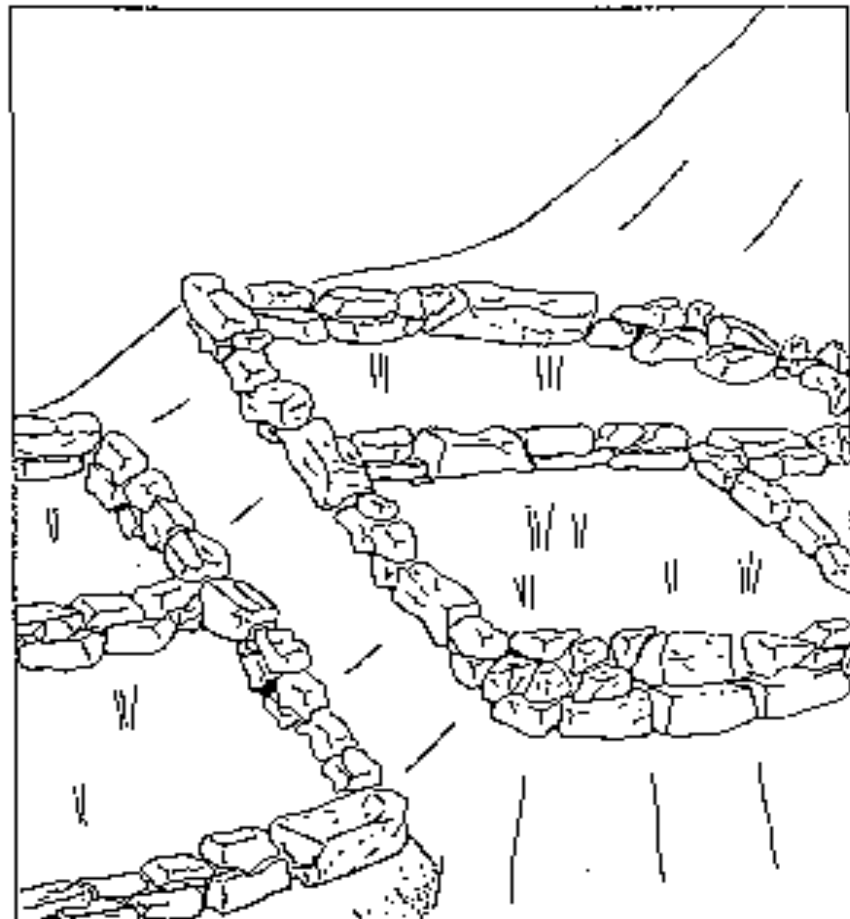


Diagram 2: Hillside terraces



2.2 THE TERRACING OF FIELDS AND HILLSIDES

For the Dogon, managing hillsides means building low stone terraces on cultivable areas (see diagram 2). These terraces follow the contours of the land and are intersected by secondary terraces, and together these form a pocket. In each pocket, the earth is levelled, and this reduces runoff considerably. Viewed from the side, a field constructed this way looks like a flight of steps.

At one time, Dogon agriculture benefited considerably from the practice of terracing. In very precipitous areas, or in the high plateaux, all the old fields were covered with terraces, and today, eloquent testimonies to their existence can still be found. They are much less common in the interior of the plateau where the terrain is less hilly.

Terraces slow down or may prevent runoff, and this can make a tremendous difference on steep slopes. The levelness of the soil in the pockets helps the rainwater to settle, and then percolate. The soil is thus retained and it remains damp longer.

The terracing of hillsides is a fast-declining technique. Certain historical events (the decline of the invading kingdoms that had made the Dogon retreat, and renewed freedom of movement under colonial rule), reduced rainfall, and population growth, pushed the Dogon to occupy land (valleys, plains, sandy or semi-sandy land in the interior of the plateau) that needed very little or no terracing and which was very productive.

2.3 THE STONE LINE TECHNIQUE

This consists of arrangements of continuous lines of stones in a field (note that stones are not placed on top of each other or in any way jointed) (see diagram 3). The construction is perpendicular to the line of the runoff. This work is done by men. Stone lines are used in fields where the slope is not very steep. In some cases stone lines intersect each other, thus improving their effectiveness.

Stone lines are widely used in the whole Dogon plateau. Apart from some fields in villages around Bandiagara, Quo and Goundaka, fields without stone lines are very rare. Stone lines slow down the flow of rainwater; they also facilitate to a certain extent the depositing of vegetable debris and allow percolation. They are also useful for the recovery of what are referred to as aérodromes - totally degraded, denuded land where trees and grass find it difficult to grow.

However, unless stone lines are skilfully built, they are in fact very ineffective, because the runoff rips out the stones and breaks up the lines. Because of persistent erosion, the Dogon continue to use stone lines intensively.

Diagram 3: Traditional stone line

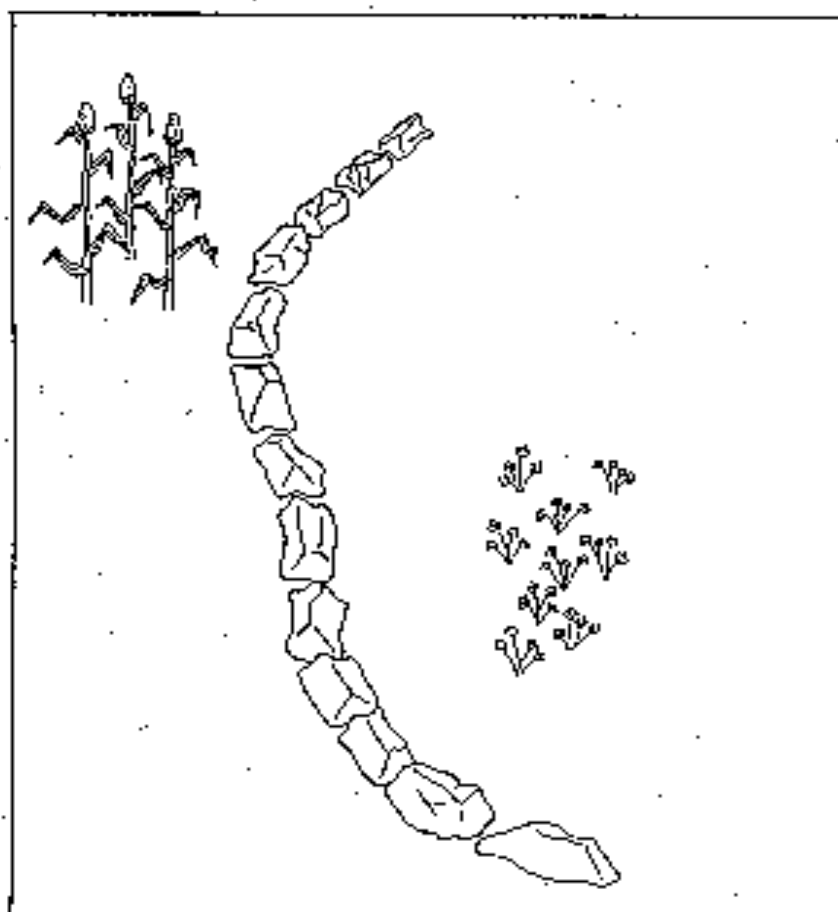
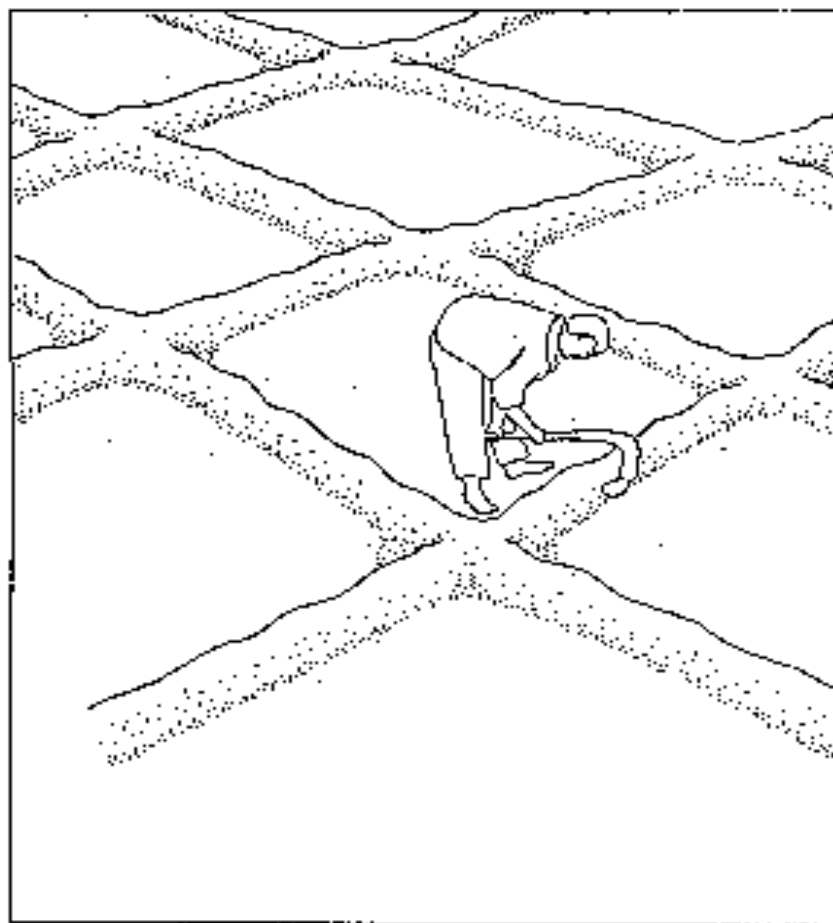


Diagram 4: Square basins



2.4 BUNDS or LOW STONE WALLS

Bunds are like stone lines, but thicker and more solid. They are built in areas where the gulleys created by runoff are so wide that stone lines would be ineffective.

Bunds are less common than stone lines. Constructing a bund is hard work: one man can do less than about 10 metres in a day. If gulleys are very deep, the farmer may calculate that constructing an adequate bund requires too much effort, and therefore permanently abandons certain parts of his field to erosion and degradation. In such cases, the farmer gives up land to the gully, for lack of the necessary human or material means to meet the challenge. The practice of bund-building is not associated with any particular area, but rather is found here and there throughout the plateau.

Bunds are more effective than stone lines. They are better at slowing down runoff, and facilitate the depositing of silt. Crops situated on the upper side of a bund suffer less from drought than those downhill of it. Silt deposits aid the growth and development of crops. On the other hand, weeds grow rapidly next to bunds, and hinder the work of hoeing and weeding.

2.5 SQUARE BASINS.

These are watertight furrows that the farmer takes in his field with a long pick-axe (see diagram 4). Intersecting ridges are used to form a basin on relatively hard clayey or sandy-clayey land, or hard pan soils where there is little percolation. Certain ridges are constructed perpendicularly, following the slope of the land or the flow of runoff. The main ridges are generally long. They are set 1.5 to 3 metres apart, and the space between them varies according to the steepness of the incline.

Basins are seldom made by women. A man may cover an area of 250 to 300 m² in ridges in a day. In some cases the ridges do not intersect but are single, and look like parallel strips of land.

Basins are built on relatively deep soil (40 to 100 cm). That is why they are not at all common in precipitous areas or in the high plateaux where the soil is skeletal. Moreover, the porosity of sandy soils makes them ill-suited to the use of basins. They work well in the *Bandiagara, Goundake, Kendia and Ouc* areas.

Unless there is a break at some point along them, basins are usually watertight. They therefore store practically all the rainwater that fall onto the fields. Water containment means no runoff or erosion, and the soil remains moist for a long time.

Basins are a valued method of conserving water and soil. However, heavy downpours (e.g. 60 to 70 mm within 30 to 40 minutes) can damage them, breaking them at several points. One other disadvantage is that the farmer gradually destroys them himself when he hoes and weeds the land.

cleared, they are left scattered haphazardly. They serve to prevent the soil from being washed away by the rain. This technique also reduces evaporation: the stalks reflect some of the sunlight, and prevent it from reaching the soil.

When stalks are laid out in bands, they decompose within two to three seasons and thus act as a fertilising agent. From the time they are made, and for about a year after that, these bands of stalks slow down runoff and facilitate the deposit of organic material and soil particles. They are often reinforced with stones to make them more effective, since the stalks would otherwise be easily dislodged by high winds and runoff.

In the case of newly-cleared land, rather than burning or throwing away trees that have been cut down, the farmer prefers to make bands of branches. When reinforced with stones, bands of leaves limit erosion, aid percolation, and limit the impact of the wind. Fallen leaves help to soften the soil, and as they decompose, they create an area rich in organic material.

The use of bands of leaves is in decline throughout the plateau for the following reasons:

- The degradation of vegetation
- The limitation of land-clearing
- The struggle against desertification on the part of the relevant national agencies which penalise actions such as the felling of trees without official permission, and the lighting of bush fires.

3. A FEW OBSERVATIONS ON THE VARIOUS TRADITIONAL SOIL AND WATER CONSERVATION TECHNIQUES.

Mounds, hill terracing and stone lines are the oldest techniques. Their use dates from the earliest agricultural activity on the Dogon plateau.

The other techniques have been devised and used more recently. Gradually, as the plateaux of the interior became habitable, techniques were devised that adapted to, and created a balance between environmental conditions and agriculture. This explains why some techniques are only found in certain areas - they are not suitable elsewhere.

Mounds, planting holes, basins, stone lines and terraces tend to be found in the same places. These techniques may complement each other in any one field, or else they are used as circumstances demand. Mounds are the most frequently used in combination with other techniques.

The aims of the different techniques overlap: a reduction of the effects of erosion, and the facilitation of percolation and alluvial deposits. These techniques are not all equally efficient. Basins are better for storing rainwater and preventing runoff, but they work best on gently sloping land. Stone bunds

are the most effective means of limiting runoff on steep inclines, and in areas where gulleying is already advanced. Altogether, the traditional techniques for conserving soil and water have added many years to the arable life of certain fields.

Over the years, the practice of these techniques in the plateau has had its ups and downs. If rainfall was high for a few years, these techniques tended to decline, but when rainfall was low for several consecutive years, thus making every drop of rain vital, they were used more intensively. Whereas in periods of low rainfall farmers apply water conservation techniques to help their crops, in periods of high rainfall, farmers cultivating skeletal land make openings to allow the outflow of excess water which might otherwise harm their crops. The economic use of water is thus well-known.

The Dogon are well acquainted with biological techniques for combatting erosion, but they apply them very little. If *Andropogon* (a perennial grass) springs up spontaneously on the edges of a ravine, the farmer does not destroy it; on the contrary, he combines it with stone lines and walls. However, he rarely plants grass or trees in his fields with the express aim of conserving water or soil. *Andropogon* is rarely combined with cereal crops, because they are incompatible - it causes a drop in yield.

A field cultivated with the aid of conservation techniques gives a higher yield than one cultivated without them. Basins and planting holes have the greatest impact on yield. The use of basins, in particular, can push up the yield of a field by 25 to 30%.

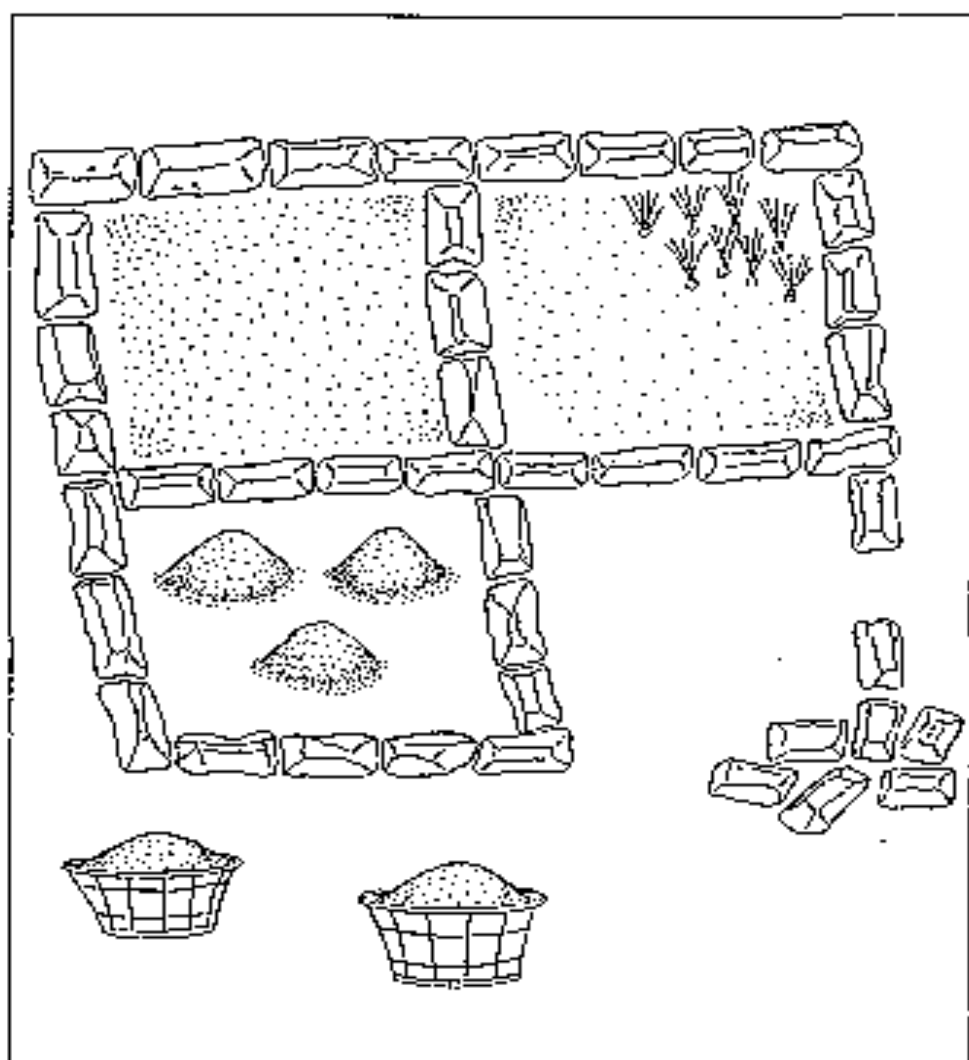
In a normal year the fields that give a higher yield are:

- Those where agriculture and livestock are combined.
- Those with clayey alluvial soil in the valleys.
- Land on which onions or other vegetables are grown.
- Those where a combination of basins and organic manure is used.

The Dogon struggle to conserve water and soil in order to pursue what is barely subsistence agriculture. But the plateau is a region where slopes are generally very steep. Shallow soil and heavy downpours combine with sharp inclines to exacerbate erosion. Each year, large quantities of soil are washed away by runoff and gulleying. Every year, farmers abandon fields that are no longer productive because the fertile areas have been washed away, leaving behind a layer of hard pan soil that is difficult to work with their simple tools. The presence of scattered stone lines on uncultivated land testifies to the fact they were once cultivated but have been abandoned.

The use of traditional techniques needs to be encouraged; errors must be corrected and weaknesses overcome. Two or three years ago, national agencies recognised the need and began to get involved.

Diagram 7: Onion gardens



For the moment, food aid contributes very little to the application of water and soil conservation techniques. In years when there is a bad harvest, some official agencies encourage the construction of these conservation methods by giving the people some basic food supplies: canned fish and chicken, emergency powdered milk, oil, and sometimes millet.

4. TRADITIONAL TECHNIQUES FOR CONSERVING SOIL AND WATER IN THE CULTIVATION OF ONIONS AND OTHER VEGETABLES.

4.1 GARDEN TERRACING TECHNIQUES: "MAN-MADE GARDENS" or "GARDENS MADE FROM TRANSPORTED SOIL".

It would seem that the technique of terracing began in Sangha. Garden terracing is an application of hill terracing to gardening. Unlike the terracing of hillsides, garden terraces are made with intersecting low stone walls (see diagram 7). These are constructed on rocky land that is almost or totally denuded, and located near a temporary or permanent source of water. 'Man-made gardens' entail the creation of arable land: earth is brought from elsewhere to cover a rocky slope. This technique goes beyond the simple conservation of the land in situ, and involves several stages:

- The location or quarrying of stones: traditionally, these are obtained either by hitting one stone with the other, or else, by setting fire to large rocks so that they crumble or explode producing a large number of smaller stones.
- The transportation of stones, these being carried to the place where the walls are to be built.
- Construction of the walls: this is done by one or more relatively skilled persons. First the main walls, then the secondary walls are built, creating small empty pockets. The area of each pocket varies from about 1 to 2 m². The height of the wall depends on the slope of the land, and may vary from 30 cm to 1.5 m.
- The transportation of soil and filling of the pockets: the soil is taken from ponds where water has deposited soil particles along with debris. Soil is also obtained from uncultivated land adjoining the gardens. The pockets are filled so that the level of the earth is slightly lower than that of the walls. The soil is transported in baskets or large bowls. The rocky surface is covered with anything from 10 to 100 cm of earth and stalks.

The different stages of construction may be carried out simultaneously if they are done collectively - that is, by members of a family, people of the same age group, residents of a neighbourhood, or the young people of the village, whom the farmer invites to work for pay. If the work is done individually (i.e. by the owner of the terraces), the stages are done consecutively.

The terracing of a garden may be done in the course of a collective day's work, over several days, weeks, months or even years. The time taken to construct terraces depends either on how urgently the new arable land is needed, or on the human and/or material means available to the market gardener. A single individual working on their own may construct 10 to 12 m² of terraces per day using traditional methods. If the work is done collectively, then 15 to 20 m² of terracing per person per day may be achieved. These days, the use of shovels, hammers, wheelbarrows, jumper bars etc., has led to the reported completion of 1,115 m² of terracing by 40 persons - an average of 27.8 m² per person for half a day. In the construction of terraces, the only physical contribution by women consists of carrying the soil with which the pockets are filled.

These 'man-made gardens' are planted in a variety of vegetables and cereals: onions for the most part, as well as tobacco, peppers, and tomatoes, as dry season crops, and aubergines, millet, maize and okra in the rainy season.

5. SOCIO-ECONOMIC ASPECTS OF SOIL AND WATER CONSERVATION

Work in the fields is done by the family. Healthy individuals - children over ten years old, men, women, or old people still able to walk to the fields - all participate in farming.

The division of labour for working the land parallels the allocation of property. Each extended family has a share of the village land. Each individual household within the extended household also has a number of fields. Women and girls preparing for marriage also work small plots. Household fields and women's plots are either sections of family fields that have been allocated to them, or the fields of other families who have given permission for them to be cultivated. We must not forget that the exodus of people from the countryside leaves a gap. Families that have lost some of their members in this way may allow other families, households or women to cultivate a part of their land.

Work in the various fields is carried out following a well-established organisation of time. Very early every morning, the heads of households and their children go to work in the fields belonging to their own household. Then, at around seven o'clock, they meet in the collective family field. At around ten or eleven o'clock, the young women of the family bring breakfast - which usually consists of milky gruel. At around one o'clock, the whole family shares the meal brought by the older women. The whole family then continues to work in the field until sunset. One day a week, *dama-nân* day, as it is called, working in the family field is forbidden, and households cultivate their own field.

Millet and sorghum are the main crops grown in the family and household fields. They are always grown with haricot beans and *dah* (*Hibiscus* species). Fonio is grown with *dah*.

Women are not under any social obligation to have a plot of land, but their family duties make it an economic necessity. The men allow their wives two to four days for sowing and cultivating their plots. The women also take advantage of the absence of the men (for administrative reasons, or collective village work) to cultivate their plots. The women grow a variety of crops in their plots: peanuts, earth nuts, sesame, okra, among other things, and even millet and sorghum.

Fields vary a great deal in size and are usually scattered over a wide area, because it is not possible to have all the fields in the same place. The total area of family fields may be more than 10 hectares, while the women's plots are seldom more than 1,500 m².

Produce from the family's fields is used to feed the whole extended family at specific times of the year: during the hoeing, weeding, harvesting and preparation of family fields. Family produce is also used to provide meals for family members during the public festivals and cultural events that take place throughout the year. Apart from such times, only the head of the extended family, his wife (or wives) and the children for whom they are directly responsible eat the produce of family fields. When the season for field work comes to an end (end of November to December), the various households are responsible for feeding themselves. Thus, until May, they eat the produce of their respective household fields. In years when the harvest is not big enough to meet the needs of the families and individual households, the shortfall is made up from the market.

By right, the produce from women's own plots belongs to them alone. But in fact, the harvest of the wife (or wives) of the head of the extended family is primarily used to cover the basic food necessities of the family, and that of the other women covers the food needs of their individual households.

Traditionally, women are responsible for providing all condiments. The peanuts, sesame and okra they grow are processed (as peanut and sesame oil in the case of the first two) and used in sauces. Women may sell part of their produce in order to buy salt, fish, pepper, etc., when necessary. The sale of produce also provides women with money towards buying clothes for themselves and their daughters. They also buy household utensils and pay for their daughters' wedding preparations. Dogon women also raise small stock which they fatten for sale.

Produce from their plots does not cover all the needs and responsibilities of women. They also gather fruit (*Lannea microcarpa*, *Butyrospermum parkii*, *Saba senegalensis globiflora*, *Hexalobus monopetalus*, *Zizyphus mauritania*, *Detarium senegalense*, *Balanites aegyptiaca*, *Parkia biglobosa*) and sell it, along with chickens, goats and sheep, dolo (local beer) and cotton cloth. More recently, market gardening is increasingly becoming another source of revenue for women.

Apart from their participation in terracing, the contribution of women to the construction of traditional soil and water conservation techniques is limited to carrying water and meals to the work site. Women help in market gardening by working with their husbands to cultivate household or private plots. The cultivation of private or individual plots is more common. Limited by domestic duties and lesser physical strength, women cultivate smaller areas than do men (see section 1.3 for the plot sizes worked by men and women). The plots of young unmarried women are larger than those of married women.

Women derive a much smaller income from their plots than do men. Onions have become the main source of cash income for women, far surpassing the income earned from their grain plots. But women from the many localities where market gardening does not exist do not have recourse to this source of income. They continue to meet their needs more or less adequately through traditional means. Certain traditional options, such as the sale of dolo, are closed to Muslim women, who supplement their income through petty trade.

Increased onion cultivation has greatly benefited women, improving their ability to meet the expenses for which they are responsible. The management of money is done either by the women themselves, or by the men. In monogamous households where husband and wife agree, the wife may entrust her money to her husband so that he may see to paying for the needs of the family - especially the purchase of cereals.

6. TRADITIONAL SOIL AND WATER CONSERVATION TECHNIQUES, AND DEVELOPMENT PROJECTS IN THE DOGON REGION.

Soil and water conservation projects on the Dogon area include PVA (Projet de Vulgarisation Agricole: project for popularising agricultural methods), the sectioning of forest areas, and work by Peace Corps volunteers. The Catholic Mission's rural water project (Projet Hydraulique Rural) operates through MOLIBEMO (United We Stand), a federation of village groups from 80 Dogon villages.

Traditionally, the construction of conservation structures precedes the rainy season. Projects are therefore organised so that they are scheduled for the months of March, April and May. The terracing of gardens is strongly influenced by the location of certain dam building projects. Technicians are aware that if they provide a given area with water, the local people are capable of transporting soil to the spot. Although traditionally these things were already more or less understood, certain projects have helped to raise public consciousness regarding issues such as the importance of conserving the soil on the plateau, and the dangers of land degradation. The following is a project case study.

6.1 THE PROJECT FOR POPULARISING AGRICULTURAL METHODS (PVA) ON THE DOGON PLATEAU

6.1.1 Work in the area of Soil and Water Conservation

The PVA aims at improving the techniques for soil and water conservation, above all improving techniques for constructing low stone bunds. Action is partly based on identification of some of the weaknesses of traditional stone bunds.

The following weak points have been noted:

- Inaccurate determination of contour lines.
- Haphazard arrangement of stones: there are sometimes gaps between them that create small gulleys in the long run.
- The distance between stone walls is not carefully thought out.
- Weakness of the foundations: the first stones are placed on the ground, rather than being dug in.

Improvements introduced or to be introduced by the PVA:

- The construction of stone walls following contour lines. Determination of contour lines with the help of a spirit level, better building techniques, and use of the "A"-shaped frame.
- A better arrangement of stones, as well as joining them with smaller stones. This has the advantage of limiting runoff, and encouraging deposits of organic debris and soil.
- Rationalisation of the distance between stone bunds: varying it according to the steepness of the land which dictates runoff.
- Stabilisation of the foundation if necessary. The first stones are laid in a sort of trench.
- Thickening stone walls with the aim of reinforcing them.

The PVA sees to it that villagers are trained to use new tools.

6.1.2 Possible influence of the PVA on the traditional division of labour.

This influence is perceptible at three levels:

- The active participation of women in soil and water conservation: the PVA hopes to raise the consciousness of the rural masses regarding the need to integrate women into conservation work. Because of the exodus of men, some fields either lack such techniques, or where they do exist, they are falling into disrepair. If women were included, they could maintain at least some of their fields, even if their husbands or children were away.
- Most of the techniques constructed in the fields are the work of individuals or families. The PVA, which relies on village groups, favours collective work, and the interaction of families and individuals.
- In the case of market gardening, the project is encouraging greater independence for women, as well as their integration into group projects. It does this by giving them grants for

purchasing onion seeds. The women of certain villages (notably Kokolo and Dobolo) do the work of cutting the onion bulbs collectively. The onions are no longer made into balls, but are cut mechanically and dried. Thanks to the PVA, women are beginning to learn new onion-drying techniques.

CONCLUSION

Traditional soil and water conservation techniques have prolonged the arable life of fields by many years. Were it not for these techniques, the steep mountainsides and plateaux would experience a serious shortage of land to farm, and even those areas with gentler slopes would have lost more soil than they have. Without these techniques, many crops would have suffered more greatly from drought.

Traditional techniques are certainly helpful, but their effectiveness is limited, and many fields that have been cultivated for years are now abandoned because of erosion which threatens to destroy the Dogon plateau. We are also aware that traditional techniques on their own will not be able to cope with the erosion that threatens the very survival of the inhabitants of the plateau.

In addition to all the many different problems (demographic growth, drought, rural exodus, illiteracy), the phenomenon of erosion has become more serious. Indeed, it poses such a threat, that traditional techniques alone cannot provide adequate solutions.

The people of the region involved, the government agencies and local NGOs must act urgently and energetically before it is too late. In our opinion, they need to make significant improvements to existing traditional techniques, combining them with new techniques that could help contain the existing problem.

The intensification of soil and water conservation techniques is very much requested by rural people who need the necessary material means to achieve this. The improvement of traditional techniques is essential, because they suffer from a number of weaknesses, given the gravity of the problem. Soil and water conservation projects need to have a strong grass roots base - that is to say, that the views of local people must be taken into account. The awareness of local people of the importance of soil and water conservation is a factor vital to the success of such projects.

We do not wish to be alarmist, but the extent of erosion is very worrying, and unless action is taken promptly, and energetically, it will soon be too late. If the problem of erosion is not tackled properly, all the other development projects (well digging, dam building, cereal banks and savings banks) will be utterly pointless in the long term. If an agricultural community does not have access to arable land in a given area, people will soon abandon it.