PRACTICAL ACTION
Technology challenging poverty

BUILDING ON A TRADITION OF RAINWATER HARVESTING

technical brief

Pastoralists in sub-Saharan Africa are often part-time cultivators as well, and they manage to make the most of irregular rainfall by harvesting rainwater, using traditional techniques. Will Critchley argues that these methods can sustain a delicate balance between cropping and pastoralism which is both environmentally and socially appropriate.

Development jargon is constantly changing, and new terms can quickly become fashionable. The actual processes described may not be new - 'agroforestry' and 'rapid rural appraisal' are examples of basic techniques which have been around for a good long time - but the very naming draws popular attention to the concept, and gives it respectability. 'Rainwater harvesting' is a term which only became widely talked about in the early 1980s, despite the fact that, according to one well-known (and nameless!) proponent, it is the world's second oldest profession. But as is so often the case, it is much easier putting a name on a technique than putting that system into practice.

The basic concept of rainwater harvesting for plant production is very attractive: instead of allowing run-off to cause erosion, it is collected and concentrated in the fields for better crops. It is, in effect, productive soil-and-water conservation. This makes very good sense for the semi-arid areas of sub-Saharan Africa, where a third or more of the meagre rainfall is lost through runoff. In the field, however, things are not so straightforward.

Traditional techniques

Part of the problem is that much of the well-publicized work on rainwater harvesting in the 1970s and 1980s was carried out in Israel where conditions are very different to sub-Saharan Africa (SSA). Not only are the soils and climate dissimilar, but so, of course, are the social and economic settings. Briefly, the direct transportation of techniques from the Negev Desert in Israel to SSA in the heady days of the early 1980s just did not work out. Engineering structures were commonly inappropriate, and costs often too high. A number of fingers were burned, and rainwater harvesting lost some of its initial shine when trials did not give the results hoped for.

What was not recognized, however, until very recently, is the wide usage of simple traditional techniques in SSA: systems which have been used quietly to harvest rainwater for as long as local inhabitants recall. These systems are not perfect, nor could they be automatically replicated elsewhere, but they do represent a very useful source of information and ideas for people with an interest in rainwater harvesting in SSA. Three examples illustrate the point.

The central rangelands of Somalia, stretching north from Mogadishu, are noted for their rich bush which supports the largest population of camels in Africa. Scattered through this apparently pastoral zone, however, are pockets of cultivation. In some areas, where the average annual rainfall is less than 300mm, up to half of the families are actually growing crops as well as herding livestock. In Hiraan District, some 200km north of Mogadishu, the soils are mainly clayey and here the agro pastoralists make use of rainwater harvesting to magnify the effect of the scanty rains.

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An informal chat with a group of elders in the small town of Bula Burti goes something like this: 'How long have you been using rainwater harvesting techniques?' 'Our fathers used them ... before that, our grandfathers also.' 'Why do you use such techniques?' He gives a look of mild astonishment. 'Well, how could you grow crops here without harvesting the runoff?' ... and so on. Rainwater harvesting is obviously well appreciated here!

The caag system of Somalia

Two types of small-scale rainwater-harvesting systems can be distinguished. The *gawan* system makes use of a grid of ridges to trap rainfall, and hold some overland flow, whereas the *caag* (pronounced 'aag') consists of larger earthern bunds which impound runoff from small gullies. The bunds arc commonly made by a 'Kawawa' (see photograph), a simple, but efficient, two-man push-pull shovel.

In the *caag* system, the main earth bund is made approximately on the contour. This bund is then extended up the slope at both ends into a 'U' shape, but with one tip shorter than the other, allowing excess runoff to flow around it. This then automatically controls the depth of flooding, which is usually not more than 25cm at its deepest. One ingenious alternative 'spillway' sometimes used in Somalia is simply a piece of 30mm-diameter plastic pipe set in the contour bund, which is unplugged to allow excess water to drain away.

Earthbunds

Sudan has probably the richest tradition of rainwater harvesting of any country in SSA.

In many parts of the north, crops just cannot survive unless they are planted where *wadis* spread and saturate the earth. Near Kassala, in eastern Sudan, there is a fascinating system - practically unknown outside the area - of small-scale rainwater harvesting called *teras.* The arabic word *teras* (from which the word 'terrace' originates) refers to the earth bund which forms three sides of each plot. There are many similarities with the *caag* system in Somalia.

From the air, the 'teras' appear as a checkerboard design of green rectangles on the barren plains. Each *teras,* of about two hectares in size, has a catchment of at least double this area. Here, perhaps 30 per cent of the rainfall runs off from the plain and thus a plot with a catchment twice its own size can effectively increase the rainfall available for the crops by over 50 per cent.

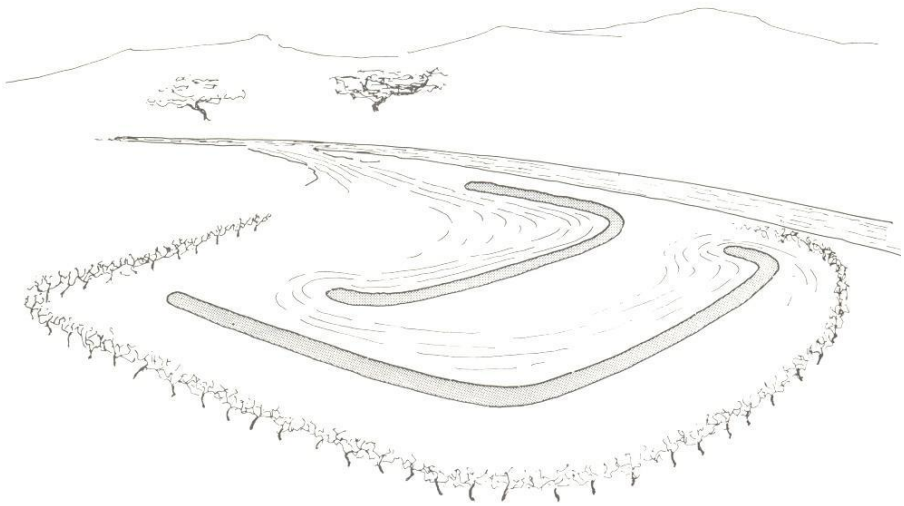

Figure 1: The caag system, showing the live thorn fence surrounding the earth bunds.

Once again, the system uses earth bunds. The main bund, about 40cm in height, is sited across the slope, approximately on the contour, which ensures an even spread of water behind it. Side bunds then extend up the slope, and sometimes extra bunds divide the *teras* into sub-

units. Runoff flows into the 'open end' of the plot and the excess finds its way around the tips of the arms, higher up the slope. In the case of prolonged standing water, the farmer - or, more correctly, the agropastoralist merely breaches the bund.

Stonebunds

As yet neither of these traditional techniques, from Somalia and Sudan have attracted the attention they deserve. The same, however, is not true of the stone-bunding technique in Yatenga Province of Burkina Faso. Here, the traditional system is to use stone lines, or sometimes stone bunds, across the fields. The Oxfam-supported 'Projet Agro-Forestier' (PAF), began by attempting to introduce rainwater harvesting for tree planting - but with little success. The project then realized some years ago that what the villagers really wanted was at their doorstep. The farmers were interested in improved systems of stone bunding to harvest water for their crops, and simultaneously to capture sediment for their degraded fields.

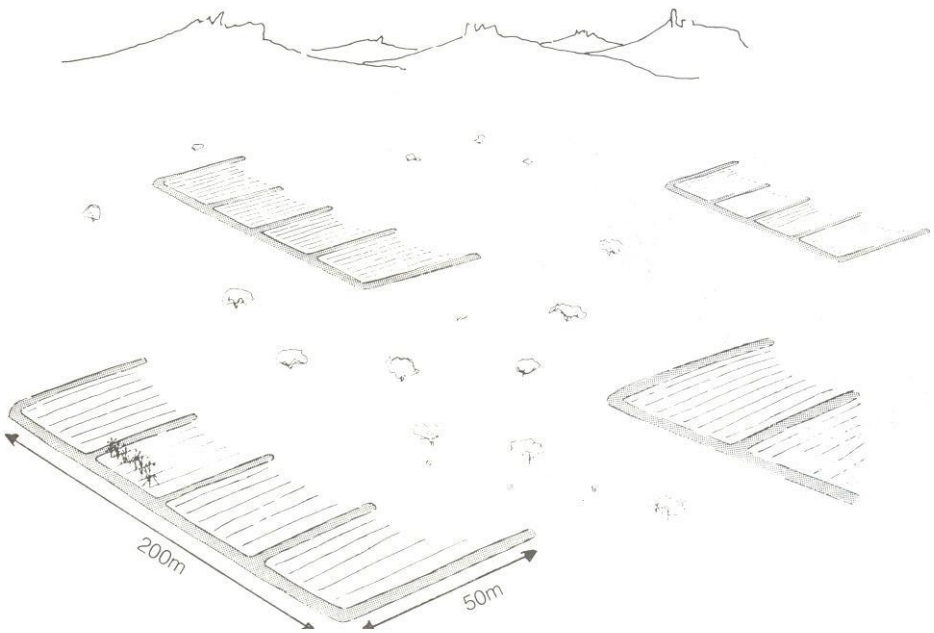

Figure 2: The teras system of the Sudan.

PAF showed farmers how to build better bunds. One improvement was to dig a trench of a few centimetres depth in which the larger 'foundation' stones were sited, then to place smaller stones in front of this framework. An efficient filter is thus formed. Another technical innovation was the introduction of the 'contour concept'. Stone bunds work much more efficiently when aligned along the contour. PAF taught farmers to use simple water levels to determine the contours for themselves.

The development of appropriate rainwater-harvesting systems depends, however, not only on the promotion of suitable techniques but also on the way in which community organization is handled. This successful example from Burkina Faso provides several useful lessons of how to approach the social as well as the technical issues. Farmer training, for example, - of women as well as men, has proved to a vital factor in the rapid expansion of stone bunding in the region.

Environmental benefits

Traditional rainwater-harvesting systems are, of course, only found in certain areas of semi-arid Africa. Such systems are limited, for example, to areas where the soils are clayey and where therefore, significant run-off occurs. The systems are normally environmentally sound: by definition, rainwater harvesting is moisture, and therefore soil, conserving. Wind erosion can cause havoc where fields are cleared in semi-arid areas, but this problem of erosion is limited to sandy soils, where rainwater harvesting is not practised. The cultivators practising rainwater harvesting tend usually to preserve useful species of tree when they clear land.

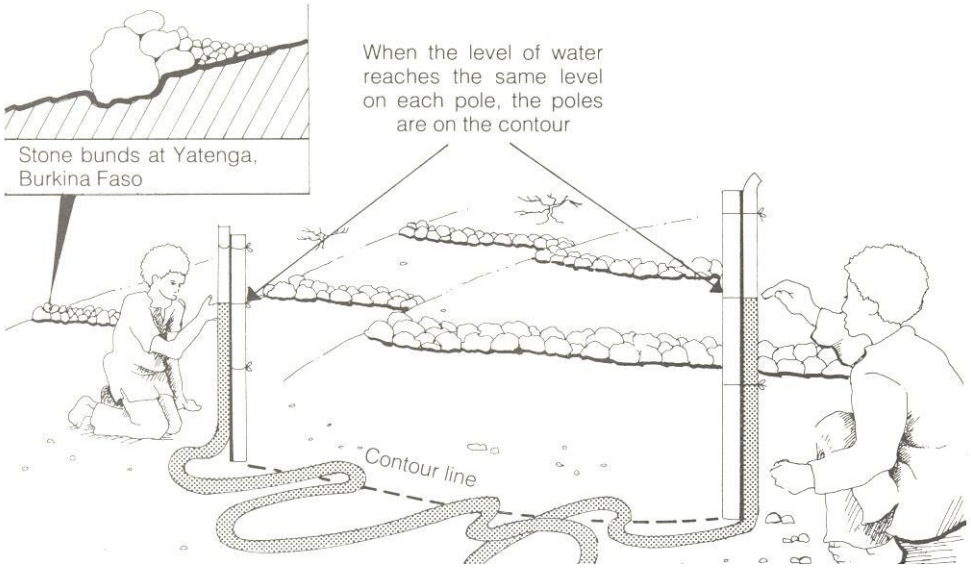

Figure 3: Finding the contour line using a water level, and building a stone bund.

Rainwater harvesting projects need, nevertheless, to beware of the possible dangers to the environment, especially when earth bunds are used. The concentration of water can often lead to bund breaches in the first season after construction, before the bunds have become consolidated. There are plenty of examples of gully erosion caused by projects whose techniques have not always been appropriate. A common mistake is to assume that the bigger the bund, the less likely it is to break. It only takes a small crack, or a tunnel caused by a rodent, to lead to disaster, if it is not spotted in time.

One question often asked is, what is the role of cropping (with or without rainwater harvesting) in what are essentially pastoral areas? Indeed, the very thought of growing fields of grain in rangelands horrifies traditional range-management specialists. The bald fact, however, is that many pastoralists in sub-Saharan Africa are, in fact, agropastoralists, and their small plots of food crops can contribute significantly to their diet. Why not indeed use up the spare labour available in the slack period of wet-season herding? And the by-product of straw, even when the crop fails, often provides more fodder for the livestock than the rangeland which the field replaces.

Guiding principles

So what are the guiding principles for projects about to embark on rainwater- harvesting systems? The following points are worthy of consideration: some may seem obvious, but they are often overlooked in the field.

Find out what the people are doing themselves: to build on a traditional technique is better than creating something new.

- Ignore socio-economic factors at your peril! Talk to the people, establish their felt needs, encourage participation.
- Avoid systems which the people cannot replicate or maintain themselves. Hand tools and donkey carts beat tractors and bulldozers nine times out of ten.
- Consider the cost. Even where subsidies (such as food-for-work) are available, costs

should be related to the benefits.
- Develop techniques slowly and be prepared to admit mistakes and make modifications. A flexible approach pays.
- Where stone is readily available, use it. Stone bunds may not hold so much water, but they are durable and simple to build.
- Where earth bunds are the choice, small structures with small catchment areas are the easiest to manage.
- Always compact earth bunds (by ramming with sticks/jumping on them) and establish vegetation on the bunds to improve durability.
- Do not forget husbandry. There is little point increasing water availability if the production system is poor. Soil fertility is especially important.

Rainwater harvesting only forms part of the solution to production in just a section of the semi-arid areas, but it does have an important role to play. It is much more than a passing development fashion. Learning from the experience of projects and particularly from the traditions of the people, will point the way to better systems and better approaches.

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