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INDIGENOUS SOIL AND WATER CONSERVATION IN SOUTHERN ZIMBABWE

A study of techniques, historical changes and recent developments under participatory research and extension

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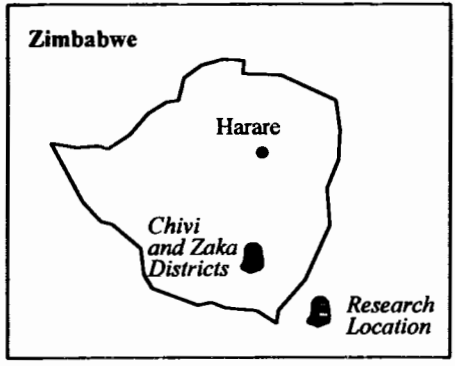

Soil and water conservation (SWC) have played an important role in the development of smallholder agriculture in Zimbabwe. The introduction of the plough early this century triggered a drastic change in the farming system and in practices, virtually eradicating indigenous technical knowledge in soil and water conservation. As a consequence, degradation became so severe that from the 1940s the colonial administration forced smallholders to implement externally developed conservation works.

At present, there is growing concern about continuing degradation and alternative SWC systems are being studied (Norton, 1987; Elwell, 1993). This

paper analyses indigenous soil and water conservation with a view to promoting appropriate SWC techniques in smallholder agriculture in semi-arid Zimbabwe. The study was carried out in Chivi and Zaka districts in southern Zimbabwe. The area is marginal for cropping with poor sandy soils and erratic rainfall. Soil and water conservation activities have been carried out by two projects since 1991: The Intermediate Technology Development Group (ITDG, a UK-based NGO) Food Security Project with its main emphasis on the extension of SWC techniques and the Agritex/German Technical Development Agency (GTZ) Conservation Tillage Project which is more research orientated.

For an assessment of techniques and the historical development of the farming systems, semi-structured interviews guided by a questionnaire were carried out, covering changes to the traditional farming system. Results of these surveys were discussed in workshops, with farmers paying particular attention to the role of local institutions with regard to SWC.

A HISTORY OF INTERVENTION AND CHANGE

Agriculture before the introduction of the plough (*c* 1920) was based on livestock and shifting cultivation. Livestock provided food, clothing, transport and manure but not draught power, and had a major role in the social system.

Finger millet was the main crop, together with sorghum, pearl millet, groundnuts and other minor crops. Land was cleared from the bush with hand axes and cultivated for three to ten years. A fallow period which allowed soil fertility to be restored followed and a new piece of land was cleared after shifting. Wetlands were also cultivated and provided a major source of food during drought years. The collection of wild fruits and the hunting of wild animals contributed considerably to food security.

Traditional rules ensured the sustainable use of natural resources. The burning of trees without a good reason was prohibited. Water sources were mostly sacred and therefore protected from pollution. The permission to cultivate a new piece of land came from the traditional authorities, who enforced these rules together with the spirit mediums.

With low population density and limited tools, traditional soil management prevented severe soil degradation. For example, when bushland was cleared with hand axes and hoes, tree stumps were left in the field and ash spread on the field, while soil disturbance was minimised through shallow hoe cultivation. A considerable area of the drylands was planted on hand-made ridges. Intercropping developed a dense soil cover so that erosion hazard after crop establishment was minimal, and the high percentage of ground cover reduced soil evaporation and therefore drought vulnerability. Further measures included mulching with weeds or burnt crop residues, construction of soil bunds, stone bunds and ridges, and management of wetlands for rice production in the wet season and maize on big ridges in the dry season.

Changing towards the plough and maize with the emerging extension service

The introduction of the plough and maize as a food crop came with the arrival of white settlers at the end of the last century and became adopted on a large scale by indigenous farmers between 1920 and 1940. Improved weed control allowed an expansion of the cultivated area and attractive producer prices for maize were an incentive for the expansion of maize production, triggering the market production of maize.

With the introduction of the plough and maize, agricultural extension started in the 1930s. A package of cropping practices was developed by an American missionary (Alvord, 1958; Page and Page, 1991) and is still promoted today. This included the utilization of manure, crop rotation (cereal crops with legumes), row planting and mono-cropping, autumn and pre-plant ploughing, as well as the uprooting of trees in the field to provide for easy tillage and straight planting lines. Alvord was convinced that the best way to improve farming and conservation was to consolidate arable holdings, to separate these from grazing lands by perimeter fencing and to locate villages along the margins of the cultivated areas.

The expansion of the area under cultivation and increasing population pressure resulted in longer cultivation periods. The shifting of fields was reduced and later abandoned completely. The recovery of fields during the bush fallow period took longer after the complete clearance of woody vegetation.

Two-thirds of the respondents noted an increase in soil erosion after the introduction of the plough. Rill and gully formation increased particularly. However, all still consider the system positive as it increased work rates and efficiency.

Imposition of externally developed contour ridges to fight accelerated erosion

By 1930 erosion and degradation had become so severe that the then colonial government promoted conservation works and enforced by law highly unpopular measures, such as the digging of contour ridges and destocking (Native Land Husbandry Act, 1951). It also prohibited stream bank cultivation (mostly gardens in wetlands), which was a major threat to food security in drought years.

Contour ridges are part of a conservation layout designed for commercial farming areas. These are normally sited in high rainfall areas and on heavier soils, aimed at stopping erosion by draining excess water off the fields. Despite different climatic conditions, these structures were imposed in semi-arid areas as well, where water retention would have been appropriate.

The introduction of contour ridges meant the end of shifting cultivation and bush fallow. Permanent cultivation under the plough and the adoption of the Alvord extension package increased considerably, partly as a result of the

incentives promised. The package was also partly adopted as a result of land use intensification necessitated by the increasing population. The technical design of contour drains which drained excess water led to many farmers rejecting the measure. Farmers were punished in an attempt to make them willing to implement the measures, resulting in poorly constructed ridges, which can increase gully erosion.

Relaxation of the enforcement of SWC and commercialization of smallholder agriculture

During the liberation struggle (1976–80), farmers were encouraged by the freedom fighters to destroy or stop maintaining contour ridges as a symbol of white oppression. After independence in 1980, it became very difficult for the new government to enforce the conservation objectives. The major focus of agricultural policy and extension became the commercialization of smallholder agriculture using high-input technology (hybrid seeds, inorganic fertilizers and chemicals for pest control) which was previously available only to the large-scale commercial farms. The focus on conservation in extension lost out to the drive towards yield maximization, and the maintenance of conservation works was neglected (Whitlow, 1988). The traditional soil and water conservation methods such as intercropping were discouraged. The productivity decline due to severe erosion was buffered by the application of manure and inorganic nutrients. However, several severe droughts between 1980 and 1993 have reduced the number of cattle to a minimum, implying that now negligible amounts of manure are available and it is doubtful whether it will be possible to sustain the present levels of production with inorganic fertilizer.

The changes in the farming system have almost eradicated traditional conservation measures. Conservation is understood by farmers and extension workers to be a synonym for contour ridges (Hagmann, 1996).

In workshops, farmers' perception of degradation and the need for conservation was analysed with regard to the change in the state of their natural resources during the last 20 years. The results were identical in both areas. There is a common perception that the natural resource base has dwindled drastically over the last two decades and that the situation will continue worsening unless stringent measures of resource management are put in place. But traditional leaders who used to enforce laws on SWC have been stripped of their powers in favour of rather weak village development committees (VIDCOs). All the respondents now emphasize the importance of soil and water conservation, based on the fact that 'there is no place where we are going to move to after the final degradation of our land', or 'we wish we could be taught ways of maintaining those small fields we are left with'. Most people realize the need for resource management, including soil and water conservation, but feel helpless to organize themselves properly to define and implement appropriate conservation measures.

The role of indigenous SWC in the present environment

The plough and Alvord's package for permanent agriculture (Alvord, 1958) provided a technology which, at least on a short- and medium-term basis, addressed the requirements well and was therefore very successful. The major mistake, however, was the contempt for traditional knowledge in favour of modern Western technology. The new technology was not based on traditional, sustainable soil management systems which could have been improved by integrating new components, but on the superiority of a completely new system imported from the temperate climates of Europe and North America. In a relatively short time, this approach managed to wipe out indigenous soil and water conservation systems and farmers' confidence in indigenous agriculture in general (Page and Page, 1991). Today, three generations later, the plough is considered 'traditional' practice by most people in Zimbabwe and the Shona word for cultivation even means 'ploughing'.

Techniques used in the last century are largely inappropriate to the present population pressures on land. Nevertheless, the principles which were effective in the traditional system, such as soil cover, minimum tillage, planting on ridges, intercropping, soil bunds and stone bunds, would be taken as the basis for developing improved techniques. A synthesis of traditional techniques and new methods for SWC could be adapted to specific sites, situations and farmer needs.

The role of local institutions and government authorities in SWC

The major changes in the farming system described above were accompanied by a drastic change in social organization. Before the establishment of the colonial system at the end of the 19th century, few local institutions existed. The major institutions at that time were spirit mediums (considered as messengers of God), traditional healers and the chiefs, the last of whom were responsible for land allocation and management.

Removal of power from the traditional leaders after independence made them feel that they were no longer responsible for soil and water conservation, and thus many of the conservation laws were diluted and no longer executed. The latest trend, after chiefs and traditional leaders have regained power for land allocation, is a monetarization of traditional rights and laws which is corrupting the traditional leadership. Cases in which kraal heads sell land which is highly vulnerable to soil erosion to immigrants are on the increase. The result is increasing land degradation, the opposite of the objectives they pursued previously.

Present functions and the capacities of local institutions and of government authorities in SWC

The importance of different institutions varies in each location. Traditional leaders (kraal heads and chiefs) are considered most important in the man-

agement of natural resources and SWC. The involvement of VIDCOs, Village Community Workers (VCWs) and agricultural extension workers ranks far behind them.

Farmers' expectations of their institutions concern their role in preventing the burning of vegetation, the cutting of trees and the cultivation of stream banks. Traditional laws on resource management are perceived as rather contradictory: a third of those interviewed still hold by them, while others said that many of these laws no longer exist. The position of the chiefs today is much weaker, with 40 per cent of respondents pointing out that they do not take any steps if traditional laws are broken, while 60 per cent claimed that although they are still active, their power has been overshadowed by modern institutions like VIDCOs.

Implications of the local institutional set-up for interventions in ISWC

The institutional set-up at local level is highly complex, the social and generational conflicts being reflected in the generally weak leadership and co-operation found within rural society. Traditional leaders and structures are at odds with those who are in favour of modern democratic institutions. In such a complex and tense situation, the major condition for success with indigenous soil and water conservation (ISWC) is to work with local institutions and to strengthen them.

RECENT DEVELOPMENT UNDER PARTICIPATORY RESEARCH AND EXTENSION

Participatory approaches to SWC

The ITDG Food Security Project and the Agritex/GTZ Conservation Tillage Project have both been following participatory approaches to their work from 1991 onwards, with an emphasis on the strengthening of local institutions as vehicles for any developmental activities.

Using a community awareness raising approach, 'Training for Transformation', TFT, the importance of participation and co-operation are emphasized in organizational development in order to build institutions which enable people to become self-reliant. It manages to integrate and unite often conflicting interests under one umbrella. As described earlier, change within Shona society has weakened the social coherence and security which was based on traditional rules and regulations. A new 'umbrella' could provide a means to resolve and promote innovation. This is particularly important for SWC where all land users in a watershed must agree to implement certain measures if they are to succeed.

In both projects, several options for SWC have been developed by farmers. Others were developed on station and were offered to farmers for testing. Most of the options have their origin in traditional farming practices, but are adapted to the present farming system (see photos 16 and 17).

Mechanical conservation options

- Stone bunds as check-dams in rills and small gullies along the contour line.
- Infiltration pits in the contour drain to retain water and soil from flowing out.
- *Fanya-juu* terraces for maximum water and soil retention in the field.

Agronomic conservation

- Weeding systems to enable a reduction in ploughing.
- Conservation tillage: tied ridging and mulch ripping.
- Intercropping.

Biological conservation

- Compost.
- Vetiver grass for rill reclamation and grass strips.

Water-saving irrigation methods for gardens

- Sub surface irrigation with homemade clay pipes (Murata *et al*, 1993).
- Underground plastic sheets to prevent deep percolation.
- Inverted bottles directed to roots to reduce water loss due to evaporation.

Other less widespread options which are being tested include agroforestry and wetland management. As problems and needs differ from area to area, not all the options are being promoted for testing in all areas.

Impact of the participatory approach

The impact of the approaches taken in the two projects has been evaluated in terms of the technological achievements and the effects on local institutions and social organization. In both cases, the results are very encouraging and should be further monitored during the coming years.

Farmers were asked about their perception of the old extension approach, compared with the new participatory approach to developing soil and water conservation techniques. Three major differences need to be highlighted. First, farmers now feel that everybody can participate in soil and water conservation, rather than being limited to Master Farmers. The second major difference is the process of dialogue which is now encouraged, involving the explanation of soil processes rather than the imposition of solutions on farmers. Farmers also noted that they were now encouraged to co-operate and to share knowledge between themselves and the researchers (see the table on next page).

The participatory process seems to have initiated a major drive towards improving the leadership of local institutions. With leadership and co-operation being one of the major problems often mentioned by farmers, these results indicate that institutional strengthening has had a positive effect on farmers' capacity to organize themselves and to increase participation in agricultural development through club membership. In one ward, membership of farmers'

Farmers' perception of the old and the new approach and the most important aspects of the participatory approach

Characteristics of approaches

Old approach
Forceful methods were used.
Only few people could benefit (eg, literate).
Intercropping was forbidden.
Failed to address SWC convincingly.
We were told to do things without questioning.
Usefulness of conservation works never explained.
No dialogue between farmers and extensionists.
Little co-operation among farmers.
Extension agents treated our fields as theirs.

New/participatory approach
Everyone to benefit as all are free to attend meetings now.
There is dialogue.
Process is well explained (teaching by example).
Farmers are the drivers now.
Intercropping is encouraged to boost yields.
Farmers are being treated as partners and equals.
No discrimination against poor or rich, educated or uneducated.
We are given a choice of options.
They pay attention to us and take time to find solutions to farmers' problems.
We are being encouraged to try out new things.
It helps farmers to work co-operatively.
Farmers practise SWC with enough knowledge of why they should do it.
Learning from others through exchange visits/learning through sharing.
It helped farmers to develop the ability to encourage each other in farm activities.
Encouragement to practise SWC through various options.
It is capable of mobilizing large numbers of people.
The approach brings about desirable SWC techniques through participation.
Farmers are free to ask for advice.
Yields have increased through SWC techniques.
The dedication of modern extension agents/researchers.
It has brought development in the area.
It is very effective in the conservation of trees, soil, water.

clubs, which are the organizations that carry out SWC, has increased from 120 in 1991 to more than 800 in 1994. This was mainly due to changes in the club leadership as a result of the process of the strengthening of local organizations. The villagers managed to choose and elect leaders who were popular and had the potential to motivate people.

Impact on development and the spreading of SWC techniques

Within Chivi, with a total of 1136 households, at least 80 per cent are practising

SWC in one form or another. The range of technologies currently in practice include mulching, tied ridges, the use of clay pipes, plastic sheets and inverted bottles for the irrigation of gardens, infiltration pits, intercropping and rock-catchment water harvesting. The adoption of the different techniques during the first three cropping seasons is shown in the table below:

The adoption of SWC techniques in Chivi (Ward 21)

Technique	Adopted by number of farmers 1992–93	1993–94	1994–95	Source of technique
Cropped fields				
Tied ridges/furrows	28	> 100	> 500	ConTill Project/ Chiredzi Research Station
Infiltration pits	20	289	> 800	Farmer innovation (Mr Phiri)
Fanya-juu bunds	0	4	nd	ConTill Project
Mulching	2	3	nd	ConTill Project
Intercropping	~50	> 450	nd	Indigenous farmer knowledge
Spreading of termitaria	78	> 128	nd	Indigenous farmer knowledge
Tillage implements	0	96	nd	ConTill Project
Gardens				
Sub-surface irrigation/ garden	~50	68	nd	Chiredzi Research Station
Plastics/inverted bottles	10	> 200	nd	Unknown farmer
Compost in gardens	4	14*	nd	Farmer/ConTill Project
Mulching in gardens	85	> 300	nd	Farmer

* Groups out of a total of 37 practising this technique.

Because of very limited animal draught power, tied ridges continue to be constructed by farmers by hand through labour parties. Infiltration pits have become very popular and have spread beyond the ward through farmer to farmer sharing, whereas *fanya-juu* bunds have only recently been introduced. Mulching is particularly popular in gardens where 60 per cent of the group members are practising it for water-saving purposes. Spreading of anthill material is a traditional technique which has been revived. Testing of tillage implements only started in the 1993–94 season. The focus is on draught power-saving implements and the use of donkey power. In general, SWC techniques for gardens are most popular as they contribute directly to a reduction of labour

and increased production through the prolongation of water availability in the wells. As gardening is a major source of income generation in the area, these techniques are particularly important.

In the ConTill Project experimentation among farmers has spread to include other subjects linked to SWC, creating numerous ideas and farmer trials. Trials on topics such as mechanical conservation works, rill reclamation, live hedges, fodder plots, new varieties, planting techniques, plant spacings, intercropping, strip cropping, mulching, wetland cultivation and composting have been thought out in detail by farmers and are being carried out.

An interactive process between researchers and farmers has been established which has led to increased self-confidence and the building up of knowledge based on experience. This is manifest in farmer-organized field days to share knowledge with their neighbours. Researchers and extensionists are invited as guests, not as experts.

CONCLUSION

The introduction of the plough more than 70 years ago brought about major changes to the agricultural system and the abandonment of many ISWC techniques. An extension policy which assumes the superiority of Western technology over African agriculture has reduced farmers' confidence in their own solutions. Social organization has been weakened as traditional and modern institutions have been juxtaposed, while conflicts between generations have worsened as a result of socio-cultural changes.

Participatory processes have been used to revive and combine indigenous knowledge and research capacities of the local farming communities with that of research and development institutions in an interactive way. By working with and strengthening local institutions, farmers' confidence in their own capacity for experimentation has created a new generation of soil and water conservation techniques which builds on traditional knowledge but is adapted to current conditions.