Understanding traditional terracing

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Terracing land for rainfed agriculture has long been the basic response of farmers to the problems of cropping in hilly and erosion-prone conditions. A comparative study of conservation strategies amongst traditional, small-scale terrace farmers in Uganda, South Africa, the Indian Himalayas and upland Java has demonstrated striking similarities in their approach and techniques. The main objective of the survey was to understand how different groups of farmers perceived erosion and countered its negative effects. The reasons given by farmers for their conservation practices did not always coincide with conventional "scientific" thinking on hillside conservation, but their local practices were based on a keen understanding of land degradation processes and the need to protect soil fertility.

The survey involved farmers from areas with strong terracing traditions. It was carried out over a number of years as the opportunity arose in areas with terracing traditions in four different countries.

Four terracing systems

The most ancient terraces in the survey – well over a thousand years old – are in the foothills of the Himalayas in the State of Uttaranchal in India. Here, all cultivated land is terraced. True bench terraces, with flat beds to encourage rainwater infiltration, make it possible to use oxen to cultivate the steep slopes. Average annual precipitation is around 1750 mm, although this is erratic and highly seasonal. The terrace walls or "risers" are sometimes stone faced – when stone is available - but more often they are earth structures. The most common crops in the area are finger millet, sorghum and soya bean. On the valley floors there are irrigated terraces, but rainfed agriculture dominates the landscape and the economy.

Kabale District, in south-west Uganda has a gentle hilly landscape checkered with small plots at various stages of cultivation and divided by terrace bunds that cover every hillside. These are not old terraces, but a local 'interpretation' of a compulsory colonial ordinance passed in the 1940s requiring farmers to plant strips of napier grass (*Pennisetum purpureum)* across the slope at intervals of 15 metres to control soil erosion. What has evolved since are a series of forward sloping terraces. In 1949, an official Ugandan publication boasted that the area had reached 'a standard of soil conservation perhaps unsurpassed anywhere in Africa'. These terraces tend to have a highly fertile strip of deep soil held back by the grass barrier. This is a result not only of water erosion (rainfall is between 1000 and 1500 mm per annum), but also of the practice of hand hoeing while facing upslope, which drags the soil progressively down the slope through 'tillage erosion'.

During the cropping season the healthy crop in the rich soil behind the barriers stands out in stark contrast to the poor crop growth in the shallow soil at the top of the fields. The variation in fertility – the so-called 'fertility gradient' – is obvious. Declining soil fertility and landslides continue to be problems in Kabale.

By contrast, upland Java has relatively fertile volcanic soils. In the region around the city of Yogyakarta in south-central Java, for example, agriculture has steadily climbed up the hillsides, using terraces like stepping-stones. During the nineteenth century, under the pressure of rapid population growth, farmers began to encroach rapidly onto previously forested hillsides.

As in India, farmers have traditionally terraced their rainfed holdings. In some areas government programmes have transformed what were forward-sloping terraces into benches, but in most places farmers have completed this transition themselves. The result is a landscape of bench terraces that have a slight backslope, allowing excess runoff to drain away. The rainfall is about 2000 mm per year. A wide variety of annual upland (*palawija*) crops are grown and all livestock is stall-fed, with the manure being returned to the land.

Venda is part of Limpopo province and is home to one of the very few examples of traditional small-scale terracing in South Africa. Visually it is dramatic. Most of the terraces have stone-faced walls (*mitsheto*) that have been constructed with pride and considerable masonry skill. During apartheid, Venda was designated as one of the "homelands" into which the country's black population was crowded by the government. Because these areas were generally isolated and resource poor, agriculture was marginal and land quickly became severely degraded. However, this was less noticeable in Venda, where a tradition of building houses and terrace walls with stone has existed for generations. Local farmers continue to invest enormous amounts of voluntary labour in building stonewall terraces for their main crop – maize and it is not uncommon for farmers to spend as much as 500 days per hectare creating terraces on the steeper slopes.

These four terracing systems are thousands of kilometres apart and involve different peoples, origins and problems. Over a period of eight years, the same basic questions – with some location-specific additions – were asked to farmers in these areas. Table 1 shows the responses that these four groups gave to five key questions.

The first four sets of questions were answered with remarkable consistency. Practically all farmers interviewed recognised that erosion processes were happening in their own fields, despite the terraces, and the majority in each country sample believed the problem was becoming less serious. Perhaps the most significant finding of the survey was the consistent ranking of 'soil fertility decrease' as the most important negative effect of erosion. Not the loss of kilograms of soil, but the consistent decline of its productive potential was what mattered to farmers. There was also, not surprisingly, a clear appreciation of the need to maintain terraces and to build up the terrace 'lips' (the bund or ridge directly above the riser) each season. Human activities, including overgrazing and lack of maintenance, as well as natural causes (heavy rainfall) were given as the main causes of erosion.
The main differences between the farmers in the four areas emerged in their answers to the question "What are the main sources of erosion in the landscape?" and to some of the other questions not included in the summary provided in Table 1. In Java the farmers agreed with an on-going scientific investigation in which one of the authors was involved that indicated that terrace risers were the main source of sediment in the agricultural landscape. In Venda, local people noticed and suffered from the fact that the roads had been badly designed and poor drainage was causing gully erosion. The Venda also provided an example of how local spiritual and ritual practices can influence approaches to soil conservation. The local lake – *Fundudzi* – is considered sacred. During the 1960s it 'turned red', apparently as a result of increasing sedimentation. This led the elders to intervene and mount a campaign to get people to conserve their soil better in order to maintain the integrity of the lake.

Table 1: Perceptions of erosion and conservation strategies: Surveys of small-scale upland terrace farmers in four countries

	Indonesia Gunung Kidul, S-Central Java	**South Africa** Thohoyandou District, Limpopo Province	**Uganda** Kabale District, S-W Uganda	**India** Pauri & Almora Districts, Uttaranchal
Date of survey	1994	1997	1999	2002
Number of farmers interviewed	24	20	24	15
Is erosion taking place in your (terraced) fields?	Yes: 100%	Yes: 100%	Yes: 95%	Yes: 100%
If so is it a little, moderate, a lot; increasing, the same or decreasing?	A little: 65% Decreasing: 70%	Moderate: 55% Decreasing: 80%	A little: 60% (of the 95%) Decreasing: 60% (of the 95%)	Moderate: 60% Decreasing: 70%
Main negative impacts?	1 Soil fertility decrease 2 Terrace collapse 3 Loss of soil	1 Soil fertility decrease 2 Terrace collapse 2 Gullying	1 Soil fertility decrease 2 Destroys crops	1 Soil fertility decrease 2 Gullying
Conservation strategies?	1 Terraces 2 Toe-drain upkeep 3 Riser 'lip' upkeep 3 Tree planting	1 Terraces 2 Grass strips 2 Various (including. Controlling grazing/ gully checks)	1 Trash lines 2 Tree planting 3 Terraces	1 Terrace upkeep (building up riser 'lip')
Perceived causes of erosion?	1 Heavy rainfall 2 Sloping land 2 Soil type	1 Heavy rainfall 2 Ploughing up/down 2 Overgrazing 2 Burning grassland	1 Overgrazing 2 Overcultivation and no fallowing	1 Heavy rainfall 2 Some people unconcerned
Main source of erosion in landscape?	1 Terrace risers 2 Terrace beds	1 Roads 1 Hillside grazing land	1 Crop fields 2 Grazing land	1 Degraded forest 2 Barren land / roads 3 Gullies

In Uganda, crop fields were considered to be the main source of erosion. Indeed a characteristic of the area is that terrace bunds tend to collapse when the soil becomes saturated, leading to a 'domino effect' as a whole series of terraces gradually slip down the hillside. Ugandan farmers pointed out the importance of terrace bunds as boundary markers. Field-end bunds are those that are most keenly protected: if these collapse, then the down-slope neighbour receives a free gift of rich soil. In Uttaranchal, India, the farmers look after their terraces following centuries old traditions and clearly understand their purpose and value. More interestingly they perceived that degraded forest land was the cause of the dry season 'low flow' problem because it leads to reduced rainfall infiltration opportunities. They also voiced their concern about the invasion of thirsty pine trees (*Pinus roxbughii*) which had replaced the original 'moisture conserving' oak (*Quercus leucotrichopora*).

Conclusions

Despite the difficulties of making comparisons across very different cultures, using a basically common questionnaire, it is possible to draw some conclusions. For example, in these areas which all have traditions of rainfed terracing, there is a remarkable degree of consistency in indigenous knowledge and local practice. However, there are clear differences that inevitably arise from variations in production systems, landscapes, and socio-cultural traditions. Various lessons emerged from comparing the results from the four groups who took part in this survey.

First, traditions of terracing are strong in each of the locations. People are aware of the importance of their terraces for agricultural production. They appreciate the problems associated with terraces and the need for continuous maintenance. Second, while their environmental knowledge systems do not exactly match 'scientific knowledge' they generally do not clash. In fact, they can add value to the observations and measurements of outsiders, as some of the results here show. Third, there are clearly possibilities for 'cross learning' through sharing indigenous knowledge, whether this comes from long established traditions or recent innovations.

This survey was not done in a structured, pre-determined pattern. However, by taking the opportunity – when it arose over the years – and by looking at the same factors in different places, it was possible to document people's approaches to more or less common problems using similar criteria. The results show that these farmers have a clear understanding of their problems and their own ideas of how to deal with them. Such information and experiences can further encourage changes in the way soil conservation technologies are perceived and promoted by 'specialists' in different parts of the world. It is not the prevention of soil loss as such that should be the focus of soil conservation efforts – but rather the optimisation of the agricultural production on the land available to the farmer. Production and conservation go hand in hand.

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Acknowledgments for their role in the original surveys to:
- **Escort Netshikovhela**, Department of Agriculture, Limpopo Province, South Africa
- **Sakariza Qori**, Universitas Gadjah Mada, Yogyakarta, Indonesia
- **Henry Dan Miiro**, Ministry of Agriculture, Animal Industry and Fisheries, Entebbe, Uganda
- **Girish Negi**, G B Pant Institute of Himalayan Environment and Development, Uttaranchal, India

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