From soil erosion to soil quality

Farmers' priorities may have nothing to do with agriculture. Lempira, Honduras. Photo: Jon Hellin

Jon Hellin

Throughout the tropics, smallholder farmers are increasingly forced to colonise marginal areas such as steep-lands. The consequence has been increased land degradation, loss of soil quality and accelerated soil erosion. This threat to sustainable agricultural productivity has led to considerable interest in soil conservation technologies that control run-off and erosion. Cross-slope technologies such as live barriers, rock walls, infiltration ditches, terraces, and earth bunds have been widely promoted all over the world.

Farming communities have been encouraged to adopt these technologies, but the response has been poor. Many development organisations have reverted to using direct incentives such as cash payments and food-for-work to encourage farmers to adopt soil conservation technologies. The problem with this approach is that farmers often abandon the technologies when projects end or funds dry up.

Based largely on field experiences from Honduras, this article discusses the case for a different approach to improved land management. Rather than focusing on controlling soil erosion it seeks to improve soil quality. In doing so, it not only takes farmers' concerns about productivity into account but also addresses the growing problem of land degradation.

Controlling soil erosion

The scene is all too familiar. The valley below is criss-crossed with neat green lines of honey melons destined for export to Europe and the United States. Standing on a hillside above the melon farm in Southern Honduras, I am surrounded by a mosaic of maize plots and the remains of the dry forest that used to stretch, unbroken, along the Pacific coast from Mexico to Panama. Inequality in land distribution in countries such as Honduras has meant that resource-poor farmers have few alternatives and have to work on what land is available. This is often in marginal agricultural areas such as hillsides.
Heavy rainfall and steep slopes mean that large parts of Central America are particularly prone to high rates of soil erosion. As land degrades, production falls and farmers are forced either to clear more patches of forest or migrate to the cities in search of work.

In Central America and many parts of the tropics and sub-tropics there is a danger that land degradation caused by farmers' own activities will undermine efforts to increase sustainable agricultural production. One response is investment in soil conservation technologies. In the last 30 years, soil conservation programmes have become commonplace in the developing world. Development practitioners provide farmers with technical advice, assistance and technologies designed to restrict soil loss and actively promote cross-slope technologies such as live barriers (contour hedgerows), rock walls, terraces and earth bunds.

Farmers, however, are often reluctant to adopt these technologies. Sometimes soil conservation programmes use incentives such as cash payments to encourage adoption. The problem, as shown in Figure 1, is that farmers often abandon the technology once the incentive is removed.

When farmers do not adopt recommended technologies, it is often said that this is because they are under-educated, conservative and unwilling to change. Recently, however, there has been a greater appreciation of the farmers' own situation. This has led some to question whether farmers are unwilling to follow recommendations because many of the technologies being promoted do not address their needs and real priorities.

Farmers' perceptions

Those concerned about the severity of soil erosion and the effects it can have on agricultural production are often surprised to learn that smallholder farmers often do not share the same concerns. This lack of concern about soil loss is partly explained by the fact that many farmers do not recognise that soil erosion is taking place. In Honduras it is not uncommon to hear farmers talk about 'rocks growing out of the hillside'. Soil loss rates as high as 20 to 40 tonnes per hectare per year result in an annual lowering of the soil surface by less than 0.3 mm. As farmers cannot see this erosion occurring, the explanation of rocks growing is a logical explanation for rocks becoming exposed.

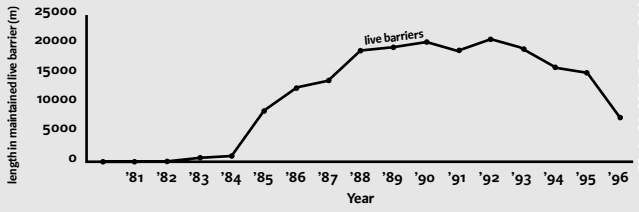

Figure 1: Adoption and abandonment of live barriers on 147 farms in La Paz, Honduras. The project lasted from 1980 to 1991 and direct incentives were provided from 1984 to 1991.

The major worry of farmers in Honduras seems to be the damage caused by pests and diseases, drought and irregular rains (see Table 1). Soil erosion is seldom seen as a threat to their livelihoods.

Deeper questioning reveals that farmers are not worried about pests and diseases or reduced rainfall as such. Their real concern is what these problems will mean to them in terms of reduced productivity. When asked about the effects of the problems identified, reduced productivity (360 responses) and hunger (46 responses) accounted for 91% of the responses.

Soil erosion and productivity

The reason why erosion control has received so much attention is the assumption that there is a direct relationship between soil loss

and crop productivity. Conventional soil conservation technologies, focusing on controlling soil loss, tackle what outsiders consider the main threat to (and from) farming on sloping lands rather than the problems and priorities identified by the farmers themselves.

Yields are actually determined by a complex interaction of factors including soil quality, crop and land management systems, and climate. In countries such as Honduras, the amount and distribution of rainfall has a much more profound impact on yield than the amount of soil eroded. Given such variation in yields, farmers' 'failure' to identify soil erosion as a threat to their livelihoods seems reasonable.

By placing too much emphasis on erosion, we are potentially doing a disservice to farmers because any relationship between productivity and the soil depends more on the quality of the soil remaining on the land rather than the amount of soil removed through erosion.

A soil in good condition is well structured, allows roots to penetrate, exchanges gases and absorb rain easily. The more rainfall that is absorbed, the less erosion takes place. Erosion occurs once the soil is degraded. A degraded soil is less able to absorb rainfall and the result is greater run-off and erosion. Cross-slope technologies, such as live barriers, do little to improve the quality of the soil between the barriers. As a result, farmers seldom witness an improvement in production as a result of such soil conservation efforts. Clearly, there is a need for a new approach to soil conservation. The farmers' concerns – agricultural productivity and its sustainability through the preservation and improvement of soil quality – provides the starting point for this approach and should be given priority.

Improving soil quality

A more effective approach than focusing on cross-slope soil conservation technologies is the use of agronomic, biological and mechanical measures to improve soil quality via soil protection, the incorporation of organic matter and the use of soil organisms. These procedures directly address factors such as surface cover and soil structure, that are within the control of the land user and that can be used to rebuild the soil into a dynamic and living system. Soils that favour root growth also favour better water retention and the conservation of soil and water on the farm itself.

Improving soil structure and infiltration capacity can result in improvements in both production and soil conservation. Improvements in crop management, such as early planting, optimum density, leaving crop residues on the surface and the use of green manures (see LEISA Magazine Vol 13 No 3, p 12-14), reduce erosion, encourage water infiltration and, through improving soil quality, lead to improved crop production. A practical example of this approach is the *Quesungual* system in Western Honduras (see Box and also LEISA Magazine Vol 18 No 3, p 10-11).

Table 1: Farmers' perceptions of threats to agricultural production. Based on a questionnaire administered to 213 smallholder farmers in Honduras.

Threat	Responses	Percentage of responses
Pests and diseases	172	38
Drought and/or irregular rain	136	30
Low productivity	60	13
Quality of land (eroded, waterlogged etc.)	40	9
Availability of land	29	7
Few economic resources	7	2
Others	4	1

The Quesungual System in Honduras

The Quesungual system is an agroforestry system that is characterised by three layers of vegetation: mulch, crops and dispersed shrubs and trees. Farmers in Western Honduras used to practise a slash-and-burn agriculture. Different development organisations encouraged them to stop burning their fields prior to planting their maize crop and instead to cut the weeds, leave them on the soil surface and sow their maize seed through the mat of vegetation.

The three-tiered vegetation canopy affords ample protection to the surface of the soil and as soon as the farmers stopped burning they noticed there was hardly any erosion: the rivers were 'clean' as opposed to 'dirty' when it rained. Soil erosion control is not, however, the reason that farmers are increasingly adopting this system. The issue at stake is improved soil quality.

Having abandoned the practice of burning their fields, there are more beneficial insects and increasing levels of organic matter in the soil. The attraction for farmers is that the soil can now hold moisture much better. The result is improved production. The reduction in soil loss is a 'secondary' benefit of the system. Farmers do not see the Quesungual System as a soil conservation practice. On the contrary, it is viewed as a productivity-enhancing practice that also happens to be effective for soil conservation. This approach to land management is more attuned to the farmers' priority needs and is more readily adopted by them.

The Honduras experience shows that, although there is still a role for cross-slope conservation technologies, these should be combined with technologies and agronomic practices that lead to an improvement of soil quality. If used on their own, they are unlikely to result in improved productivity, which is the farmers main concern.

Recent positive experiences with the rapidly expanding zero tillage systems of Latin America show that when soil quality is improved, agricultural production increases and soil erosion is reduced. Fundamental policy changes are, of course, still needed to alleviate the pressure on the steep lands of Central American. These changes include more equitable land distribution and greater access to markets. However, despite numerous social, economic and agro-ecological constraints to better land management, farmers can improve soil quality through the use of technologies that enhance both productivity and soil conservation. Through such approaches Central America's hillsides can support more smallholder farmers on a more sustainable basis. ■

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References

- Bunch, R., 1982. **Two ears of corn: A guide to people-centred agriculture.** World Neighbors, Oklahoma.
- Hallsworth, E.G., 1987. **Anatomy, physiology and psychology of erosion**. The International Federation of Institutes of Advanced Study. John Wiley & Sons Ltd., Chichester.
- Hellin, J. and M.J. Haigh, 2002. **Better land husbandry in Honduras: towards the new paradigm in conserving soil, water and productivity**. Land Degradation & Development, 13, pp. 233-250.
- Hellin, J. and K. Schrader, 2003. **The case against direct incentives and the search for alternative approaches to better land management in Central America**. Agriculture, Ecosystems & Environment, 99, pp. 61-81.
- Hudson, N.W., 1995. **Soil conservation**. B T Batsford Limited, London.