CHAPTER 1: GAINING A FARMER-PERSPECTIVE ON LAND DEGRADATION

1.1 Introduction

Land degradation manifests itself in many ways. Vegetation, which may provide fuel and fodder, becomes increasingly scarce. Water courses dry up. Thorny weeds predominate in once-rich pastures. Footpaths disappear into gullies. Soils become thin and stony. All of these manifestations have potentially severe impacts for land users and for people who rely for their living on the products from a healthy landscape.

Local people, however, may see the degradation in entirely different ways. For example, a woman increasingly engaged in collecting firewood and fetching water will worry about the scarcity of these natural resources and the burden of having to travel long distances to gain them. A male herder of livestock in the same village will have concerns in searching for elusive dry season pastures. So, there are different perspectives within local society, which need to be reflected in any field-level assessment of land degradation.

A further issue in making assessments of land degradation is the perspective of the assessor. Land users prioritise various aspects of degradation quite differently from local professionals or expatriate experts. This contrast in perspectives between that of the scientifically-trained professional versus those of local people is difficult to tackle because it involves ourselves and our own prejudices. Science teaches us that we are right: the setting of hypotheses, the experimental testing of alternatives, analysis of process, all are intended to verify what is actually happening and to prove cause and effect. However, the products of science have not always been 'right'. Developing countries are littered with technologies that have been promoted and have failed, or recommendations that have been rejected by local people. Nowhere is this more evident than in soil and water conservation – the main antidote to soil degradation. Since the 1940s mechanical techniques of soil conservation, such as broad-based terraces, have come and gone; biological techniques such as strip cropping were popular in the USA in the 1960s and are now hardly ever seen. There is clearly a mismatch between the perspectives of the scientists, technology developers and local professionals, and the views of land users who are expected to implement the recommendations.

This publication will try to promote the likely views of land users, not just as a different perspective but as a set of views of land degradation that is much more likely to be relevant to the design and promotion of acceptable technologies.

To explore the differences in perspective further, take erosion-induced loss in soil productivity. This biophysical process, whereby soil erosion reduces the quality of the soil and hence its ability to produce vegetation, is the driving force in current debates on food security. If degradation is reducing current and future yields, the argument goes, future populations will not be able to feed themselves. Erosion-induced loss in soil productivity may occur through a variety of processes, described in partially scientific terms – i.e. the professional perspective:

- loss of nutrients and organic matter in eroded sediments reduce the total stock of nutrients in the remaining soil that will be available to future crops;
- reduction in plant-available water capacity, through the selective depletion of organic matter and clays by erosion, increases the chances of drought stress in future crops;
- increase in bulk density, surface crusting and other physical effects of soil degradation prevent seed germination and disrupt early plant development;
- reduced depth of topsoil and exhumation of subsoil by long term soil erosion decrease the available soil volume for plant roots;
- increasing acidity through selective removal of calcium cations on the exchange complex affects nutrient availability, encourages P-fixation and induces free aluminium causing severe toxic effects;
- reduction in micro-faunal and micro-floral populations affects beneficial processes, such as nitrification;

- and, because of poorer soil properties, loss of seeds and fertilisers, poor germination and in-field variability and other direct process effects of degradation, farming operations become more difficult and less economic.

Figure 1.1: Ploughing with Oxen, Tanzania
Land degradation can make farming more difficult

These processes present a complicated interactive and cumulative picture of how land degradation may translate to an actual decline in farm production. Only some of these individual processes may be recognised by farmers. Reduced soil depth and poor seed germination are often cited, but rarely do farmers relate them directly to erosion. Other processes, such as aluminium toxicity causing massive crop failure, usually go unrecognised. Since this occurs mainly in the humid tropics where farmers have shifted their plots after only a few years of cultivation, the failures will be seen as nothing more than the normal course of events.

A farmer's perspective will usually be different from, and the ascribing of cause and effect quite unrelated to, the scientific explanation. The classic example of this is the explanation of soil formation by the Burungee of Tanzania, as discovered by the anthropologist Wilhelm Östberg. The Burungee see stones on the surface of the soil. To them it is evidence that "the land is coming up" and that soil formation is active. To the scientist, stones are the residual left after erosion, and are clear evidence of the very opposite of soil formation.

Figure 1.2: Stony Soil Surface

Differences in thinking and explanation are not always as stark, but can be every bit as powerful. Take the account of a Sri Lankan farmer explaining what the situation would be like without leguminous contour hedgerows: "Without hedges, yields would decrease to 25% after 4 years. After 10-15 years there would only be stones; the soil would be 'no good' (*nissaru*) and would have 'no fertiliser' [i.e. no natural nutrient content]. Crops could still be grown but, because of insufficient yields, the farmer would then leave the land." Such descriptions give fascinating insights into farmers' explanations and priorities. Soil productivity is articulated principally through the *consequences* of its change, what farmers see going on in their fields, and the effects that this has on farming practice and production.

These *Guidelines* will adopt the evidence of land degradation in the field through what farmers have said they see, the effects that they have described, and how their farming practices have had to change to cope. Obviously, the authors here will have processed these messages, and the result will not be exactly as farmers see land degradation. Nevertheless, the principles of field observability and farmer relevance will be maintained throughout the rest of this publication in deciding what to include and what to exclude.

1.2 Advantages of the Farmer-Perspective Approach

There are three main advantages of adopting a farmer-perspective approach to land degradation assessment. First, measurements are far more **realistic** of actual field level processes. Secondly, assessments utilise the **integrated** view of the ultimate client for the work, the farmer. Thirdly, results provide a far more **practical** view of the types of interventions that might be accepted by land users.

Realism. The problem with most techniques of scientific monitoring of degradation processes is that they intervene in the process itself. Measurements may simply reflect the intervention rather than the process in its real field setting. Runoff plot results, for example, are partly a product of creating rigid boundaries and the changes this induces in the erosion processes. Even a simple erosion pin (a long thin stake forced into the ground, against which lowering of the level of topsoil can be measured) has its problems. The insertion of the stake may crack the soil, altering the local hydrology and resistance to erosion. The stake itself affects runoff around it, possibly causing downslope eddies in the water current. Stakes are also very likely to be interfered with by small boys and inquisitive cattle. Accuracy of measurement of very small changes in ground surface is extremely difficult, especially considering that one tonne of soil loss per hectare is equivalent to much less than 0.1 mm lowering.

Conversely, most of the field techniques in these *Guidelines* rely on the results of processes that have not been altered by the technique of monitoring. So, accumulations of sediment against a barrier such as a boundary wall of a field are 'real' accumulations that would have occurred whether or not an observer were interested in measuring them. In addition, measuring the height of a mound of soil protected by a tree, relative to the general level of the soil surface influenced by erosion since the tree started to grow is a 'real' difference that is impossible to ascribe to inaccuracies introduced by the technique of measurement. There may be other explanations for the tree mound – see 'health warnings' below – but these are no more serious than alternative explanations in other more interventionist techniques.

Realism is also enhanced by simple field techniques in that indicators often used by farmers are being employed. The pedestals under small stones and the existence of coarse sandy and gravelly deposits in fields are both frequently identified by farmers as the result of rainwash.

Integration. The results derived from field assessments tend to integrate a wide variety of processes of land degradation. This is most evident in changes in soil productivity as measured by farmer's assessments of historical yield. Many scientists may see this as a disadvantage, covering up the causative influences on yield reduction. Yields are a product not only of soil erosion, but of past and current management, seed sources, climate, pests and general vagaries of nature. However, land degradation is a very broad concept, including not only attributes of the physical environment but also the way in which the environment is managed and how nature reacts to human land use. So, integration is essential if the researcher is to present the outcome of a set of processes that farmers really face. The scientific method of deconstructing natural processes into their singular elements for study, and then reassembling them to regain complex reality, has dubious validity in ecological systems where it is the interactions between components that are far more influential.

Take the example of how vegetation controls soil degradation. Directly, vegetation introduces organic matter into soil, which renders the soil less erodible. But, indirectly, and of far greater universal importance, is the way that a vegetation cover intercepts raindrops. The energy of the drops is dissipated in the structure of the plant, rather than being used to dislodge soil particles. These interaction effects are vital to capture, if accurate assessment of the severity of degradation is to be made.

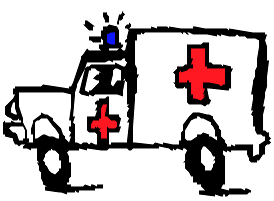
Practicality. Of the greatest importance, however, is that farmer-perspective assessments are more practical. They bring together the long experience of the farmer in using the

field and of noting what happens – experience that could not possibly have been accumulated by the researcher as an occasional visitor. The researcher can also learn much about how farmers respond to the effects of land degradation from in-field experimentation by farmers. Farmers experiment in many areas – they try new varieties, vary planting dates and test different fertility treatments and conservation measures.

Practicality also extends to the application and use of the results. If, for example, the farmer has been involved in collection and processing of field data on land degradation, then ownership of the results and empowerment of the land user is far more clearly identified with the farmer rather than the researcher. This participatory element has been found to be essential in most rural development work. Furthermore, results of land degradation assessments will be much more relevant to the issues facing land users. Change in soil productivity that affects future yields is a constant concern to many marginal land users. So, land degradation assessments which use yield as the indicator variable will much more closely relate to farmers' priorities and be much more likely to develop solutions which combat land degradation through yield-enhancing measures.

A further practical attribute of field-level farmer-perspective assessments is that they are quick and simple. Many more observations can be accomplished in a short time than through the more complex procedures of standard monitoring. Having the possibility of many more data points enables a much better sampling of the enormous number of permutations of field types, management regimes, crops and land uses.

1.3 'Health' Warnings



Farmer-perspective assessment is not without its limitations. Problems relate to **accuracy**, **extrapolation** and **reliability**.

The **accuracy** of individual observations is often compromised. Using a ruler marked in millimetres to measure the effect of a process that is significant at an order level one less (i.e. 0.1mm) inevitably introduces inaccuracies. Inaccuracy also means that results are difficult to replicate from place to place. These problems are partially compensated by undertaking large numbers of such measurements. Triangulation (described below) and combinations of indicators described in Chapters 4 and 5, also serve to reduce the problems of inaccuracy.

Because farmer-perspective assessments tend to integrate the effect of a variety of often-unknown processes, it is very difficult to **extrapolate** the results to unmeasured conditions. If, for example, it were known that aluminium toxicity causes yield declines after a crop that allows high erosion, then these same conditions would likely prevail at another broadly similar geographical location. But farmer-perspective assessments usually contain only limited information on causative relationships. Hence, extrapolation to other places is problematic. Partly, this can be overcome by undertaking parallel investigations into the scientific rationality of farmers' techniques. In one study in semi-arid Kenya, for example, farmers used trashlines (barriers of weeds placed along the contour) as a conservation measure, even though the specialists were not recommending them. At the same time they routinely ignored the advice to build large-scale terraces. Further investigation revealed that the farmers were absolutely right! Terraces would have had a negative effect on their farm economy, while trashlines were far more effective in maintaining soil fertility levels and soil humidity, while being extremely low-cost to construct. In another example, many different conservation strategies (such as compost mounds or deep ditches) can be observed in the sweet potato growing highlands in Papua New Guinea. Investigation has revealed that the main function of each of these diverse strategies is to aerate the soil, since sweet potato is particularly sensitive to wet soil. It is these sorts of insights that enable farmers' knowledge to be extrapolated. Successful, locally-developed agricultural practices, that protect against land degradation, can be identified and disseminated to farmers in similar circumstances.

Finally, it has been claimed that farmer-perspective assessments are less **reliable**. It is true that many means of controlling reliability are unavailable to the researcher. How does one know the farmer is telling the truth, for example? How can such a wide variety of techniques be used from field to field, without more consistent guidance as to applicability and relevance? Part of the answer to such problems lies in the social science technique of 'triangulation'. Triangulation is the use of several different methods or sources of information to gain a consensus view of a situation, such as the status of land degradation. Obviously, the different methods give different representations of absolute levels of land degradation. But their combined message, if in agreement, gives a powerful conclusion; far more powerful than the results of just one measurement technique.

1.4 What is Included Here under 'Land Degradation'?

Land degradation is a composite term, which is explained fully in Chapter 2. However, there is considerable confusion as to what is included within the term and how best to represent it in practical, field terms.

The approach adopted in this publication is to view land degradation as an 'umbrella' term, covering the many ways in which the quality and productivity of land may diminish from the point of view of the land user (and of society at large). It therefore includes changes to soil quality, the reduction in available water, the diminution of vegetation sources and of biological diversity, and the many other ways in which the overall integrity of land is challenged by inappropriate use (see Figure 1.3). Land degradation also includes many urban and industrial problems, such as pollution, mine tailings, smog and waste dumping.

Clearly, to make assessment of land degradation viable, indicators of its process and effect have to be used. These indicators may be drawn from any aspect of how the quality of land degrades. There is much inter-linkage between the various types and manifestations of land degradation, however. For example, a reduction in vegetation cover through deforestation will almost always be accompanied by soil erosion, sedimentation of lower slopes, and increased surface runoff.

These *Guidelines* have, therefore, deliberately concentrated on those indicators of closest relevance to farmers and land users. First, they concentrate on **soil degradation**. This is one

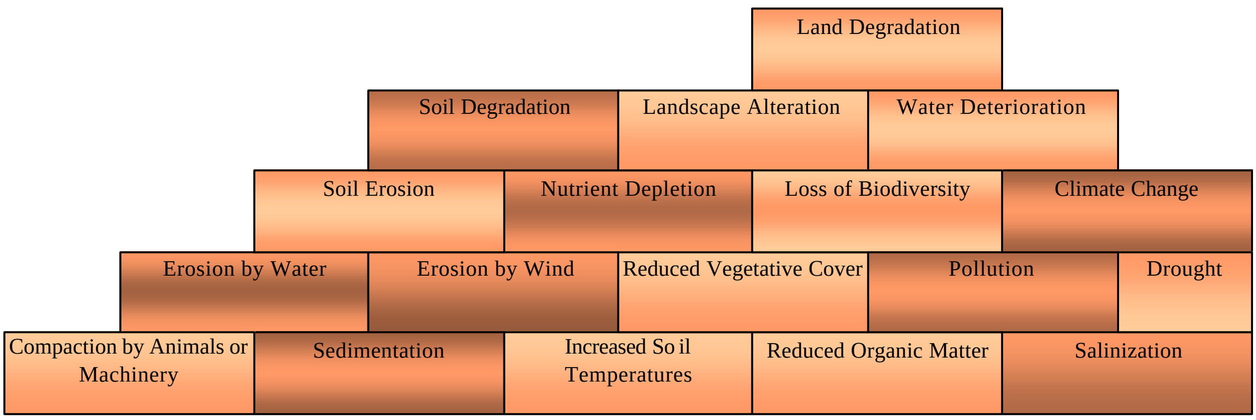


Figure 1.3: "The Land Degradation Wall"

Land Degradation consists of many components, each of which interlocks with many other components.

manifestation of land degradation, concentrating on soil quality and soil productivity. Although soil degradation is only one aspect of land degradation, variables of its progress can be used as indicators of land degradation. Soil degradation, itself, is also conceptually rather wide and difficult to accommodate in a few simple measures. **Soil erosion by water** is, for most landscapes, the commonest way in which soil degradation occurs. Again, there is considerable linkage between erosion and other types of degradation. 'Nutrient mining', or the depletion of soil nutrients through taking more nutrients away in the harvested crops than are returned, is less visible but is a common cause of soil fertility decline. Soil erosion by water often accompanies such depletion of nutrients. An eroded soil will almost always have less organic matter (biological soil degradation), increased bulk density (physical soil degradation) and other problems such as waterlogging. Salinity and sodicity, however, are more restricted, but even they commonly occur along with other aspects of soil degradation. Since soil erosion by water is the most visible way in which soil and land degradation affects the direct production of land users, this publication has deliberately taken evidence of soil erosion as the main set of indicators of the seriousness of land degradation. This is done not to imply that soil erosion is the only (or even the single most important) evidence of land degradation which affects farmers. But there are many experiences to indicate that soil erosion acts as the single best proxy for most of the other aspects of degradation.