



The material that follows has been provided by [Overseas Development Institute](#)

BETTER LAND HUSBANDRY: RE-THINKING APPROACHES TO LAND IMPROVEMENT AND THE CONSERVATION OF WATER AND SOIL

Francis Shaxson, Mary Tiffen, Adrian Wood and Cate Turton

Soil erosion has conventionally been perceived as the chief cause of land degradation, yet the limited effectiveness and poor uptake of widely promoted physical and biological anti-erosion methods challenges this logic. An alternative perception focusing on prior land damage - notably to soil cover, architecture and fertility - permits an holistic, farmer-centred approach which has generated positive response to date.

Policy conclusions

- Investment in physical structures to prevent erosion is unlikely to be sustainably effective in the absence of improvements in land husbandry.
- A land husbandry approach focusing on higher yields and improved vegetative cover, reduced raindrop impact and runoff, and improved soil architecture can reduce erosion and improve fertility, and enhance farm livelihoods.
- Different types of agency (NGOs; government research and extension) can each bring their strengths to bear in collaborative efforts which are interdisciplinary, supportive of farmers' aspirations, and based on joint learning.

Rethinking natural resource issues in sub-Saharan Africa

Over the past 50 years, public policy and investment have been oriented primarily to better endowed agro-ecological areas with high agricultural potential. In the last decade, however, investment funds have begun to shift towards more arid areas primarily due to poverty-focused donor programmes, national government concerns to increase food sufficiency, attempts to stem migration and concerns over environmental degradation. This last factor has been a powerful force. Until recently, the driving forces behind environmental policy were powerful, widely perceived images such as erosion, degradation and deforestation.

Farmers were seen as agents and victims of degradation and many proposed solutions were based on the premise that stewardship over natural resources was properly the

responsibility of the state (Leach and Mearns, 1996). Many policies sought to enforce soil conservation, but to little effect.

The range of farmers' strategies for dealing with degradation has only recently been recognised. Recent research in Kenya has sought an explanation of why in some areas environmental recovery has succeeded, population growth being accompanied by specialisation, diversification of the economy, rising living standards and an increasing rate of technological change (Tiffen et al., 1994). There is also increasing evidence from some areas that degradation may be only a passing phase in the transition to different land uses under higher populations and new technology (Leach and Mearns, 1996).

Such findings urge a shift away from coercion and towards policies which support farmers' strategies and are responsive to diverse needs at the local level. Within this context, there is a growing awareness at the technical level of the need to move away from a narrow focus on soil conservation per se and support farmers' responses to a changing resource base. A strategy of managing and improving the present use of land for productive purposes on a sustainable basis is now beginning to emerge from the more holistic approaches to land husbandry which are the subject of this paper.

Damaged land: concerns and uncertainties

Under population pressure, rotational bush-fallow periods, which formerly had been adequate to allow recuperation of soils, are being shortened almost to vanishing-point. The physical response to erosion spearheaded in the 1930s by the USA, and comprising conservation banks, terraces, silt-traps, and checkdams have been widely introduced - often under coercion - in developing countries, but with little lasting effect. Erosion still occurs widely, and the productivity of land in many places continues to decline.

The unsustainable adoption of these measures is attributable to several factors:

- the gradual nature of degradation, making it difficult for farmers to detect without clear comparative markers';
- pressure on farmers to secure food production in the short-term, to the possible detriment of longer-term fertility;
- the physical measures which most commonly have been proposed do not, in practice, stop all soil movement;
- physical structures do not necessarily raise yields: terracing, for instance, may expose infertile subsoil;
- a proportion of the surface area will be taken out of preferred crop production, as in the case of bench-terracing.

In response to the unpopularity among small farmers of earthen cross-slope structures for minimising runoff, two modifications are now being promoted widely.

Firstly, a close-stemmed deep-rooted grass such as Vetiver can slow down runoff and allow accumulation of filtered-out soil into self-forming mini-terraces. Secondly, to

make up for lost production of the preferred crop, other (often perennial) species are being introduced as Sloping Agriculture Land Technology' - SALT - as in the Philippines. Live barriers may soon prove futile unless improvements in soil and water management are also achieved simultaneously in the upslope areas.

Shifting the paradigm: an ecological view of land damage

This paper argues that more emphasis on helping farmers to improve their care - husbandry' - of their lands, and less on efforts to combat erosion alone, provides a more effective response to an old problem. It specifically recognises farmers' desire to raise yields and incomes as they stabilise or reverse resource depletion. It also provides opportunities for governments to harmonise certain national objectives - notably, better management of natural resources and development of sustainable agriculture - with major objectives of farm families - notably, secure livelihoods based on stable and productive land uses. However, by seeking both improvements in land and increased production, this approach requires many reversals in common modes of thought (Hinchcliffe et al., 1995).

The onset of soil erosion is a foreseeable ecological consequence of decreased cover over the soil (allowing high-energy rainfall to impact the soil surface directly) and of reduced porosity, particularly in the surface layers, which causes more run off. Rainfall-impact effects initiate the erosion process, and runoff subsequently acts to scour and transport soil. Loss of nutrient-rich clay particles and organic matter in raindrop-splash impoverishes the upper topsoil; subsequent erosion peels-off' upper soil layers and exposes lower layers. These are often - though not always - of poorer quality as a rooting environment because they contain less airspace, a lower nutrient content, and/or less available water-holding capacity than the layers which have been removed.

Yields after erosion are related less to the quantities of soil removed than to the fertility of the soil that remains behind. Soil fertility, as productive potential, lies in the combination of physical, biological, chemical and hydrological components of the soil and in their spatial arrangement, not just in the contents of nutrients and water alone.

Land's potential for production may have become degraded without erosion occurring at all - such as by leaching-down and net removal of nutrients, by loss of pore-space through various means, by oxidation of organic matter, by acidification, by waterlogging. Developing and maintaining the soil's fertility involves managing these conditions together over time, so as to keep the soil in optimum condition for its stability and as a rooting environment.

Erosion may occur as a consequence of diminished cover over the soil associated with declining yields and with reduced ability of the soil to absorb incident rainwater. While erosion control is about stopping soil once it has begun to move, the conservation of soil ought, in most situations, to be about maintaining or improving soil quality, keeping it in place, and - if unavoidable erosion has occurred - building the recently-exposed subsurface back into a good quality rooting environment. If

erosion is a consequence of poor land husbandry, then conversely water and soil will be conserved through improvements in its husbandry, including denser plant cover.

The implications of this ecological viewpoint are: that initial attention should focus on maintaining or improving all aspects of soil quality and decreasing its erodibility; that the damaging effects of rainfall should be mitigated via improved vegetative cover; and that ways of achieving this should be consistent with farmers' objectives and systems of land use. Physical structures against runoff then become complementary to, not substitutes for, improvements in farmers' management of soils, crops and animals. They provide back-up assurance against the damaging effects of infrequent large volumes of runoff water.

In some areas, wide fluctuations in plant yields occur around a long-term trend and are often attributable to shortage or excess of soil moisture.

Pore-spaces in the soil architecture are important for: the infiltration, absorption, transmission, retention and supply of soil water; for providing an optimum balance between air and moisture in the rooting zone of the soil; for gas-exchange in relation to root growth and nutrient absorption; and thus for the growth and functioning of roots. Loss of effective pore-spaces within the soil architecture may have a much more detrimental long-term effect on plant growth than erosional loss of soil particles (FAO, 1995:5). Soil porosity also affects what proportion of rainfall enters the root zone and what proportion becomes potential runoff. When cover and soil porosity are adequate for soak-in and for plant production, the size and/or number of physical structures against runoff can be kept to a minimum.

Organic materials and soil regeneration

Organic materials and processes in the soil are important in maintaining soil fertility by providing some nutrients and mediating the availability of others.

They also provide humic gums which stick together soil particles to form the complex of solids and spaces that make up the soil's architecture.

The effects of woody perennials in long-period bush-fallows have been particularly: to bring up plant-available nutrients from deep in the soil profile; and to deposit them at the surface as parts of organic materials such as leaf- and branch-litter.

On and in the immediate surface layers of the soil such materials provide cover, regulate temperature, improve soil architecture, facilitate rainfall infiltration, enrich the nutrient status, and provide the substrates for meso- and micro-organic transformations.

Porosity can be lost not only by compaction and pulverisation but also by a decline in organic matter content of the soil and a weakening of humic bonds between soil particles.

Additions of organic matter - both as roots and residues and as applications of manure and compost - can have positive effects on soil-moisture content, retention and release of nutrient ions, physical resistance to root growth, respiration by roots and the soil's erodibility.

Box 1. Responses to land husbandry suggestions in Kenya

With technical assistance from the Association for Better Land Husbandry, and working with Kenya Government staff and several Kenyan NGOs interested in better land management, a programme to promote conservation-effective farming was launched in Kakamega. It began with participatory discussions in which farmers identified their concern for higher cash incomes and with problems of soil fertility. The programme worked with ten self-help groups, several of them associated with local churches. Training was offered in several technologies, including the making of four types of compost, liquid manures, double-digging to break hardpans, and two types of terraces.

Farmers experimented with these on small areas of their holdings, and within a few months found that improved fertility and water retention enabled them to grow a new range of crops with good market prospects, such as tomatoes, kale, cabbages, pineapples, carrots, spinach and parsley.

More farmers are joining the groups, and many intend to expand the size of the areas they have treated. Farmers find the advantages of joining a group include economies in marketing, the exchange of ideas, and the better ability to call in specialist advice when needed.

A recent review of this and similar approaches in high, medium and low potential areas (Hamilton, 1997), noted limitations of some techniques such as natural pesticides, and constraints in some areas such as access to water and markets. Overall, however, improvements in food security, nutrition and cash income have encouraged steady spontaneous spread of the approaches.

Box 2. Effects of better husbandry in Brazil

In the decades 1940-1979, the development of commercial small-farm agriculture from dense native forest in the State of Paran in Southern Brazil was accompanied by accelerating runoff and erosion. Increasing quantities of inorganic fertilisers were being applied in attempts to maintain yields, but with declining success. Ever-larger physical conservation works were constructed along contours to trap the water and soil, but in some cases even banks two metres high were insufficient to hold runoff from the largest storms. At the same time, flooding of river valleys increased during the rains, while dry-season flows of the same rivers decreased.

In the 1980s, staff in the State's research and advisory services began to pool results from disparate research programmes - in particular those on soil physics; agronomy of wheat, soyabeans, coffee and other crops; tillage systems; forage legumes; soil erosion; winter cover-crops - with in-field observations and experiences by the advisory staff. It became clear that widespread use of disc-tillage equipment had led to severe sub-surface compaction problems resulting in much unnecessary runoff.

Furthermore, the practice of burning-off straw was depriving the soils both of protective cover and of replenishment of organic matter.

Major campaigns were mounted to demonstrate the benefits of changing from disc to tined equipment in reduced-tillage systems, and of retaining wheat straw as a partial or complete mulch. Results over tens of thousands of hectares have been dramatic: infiltration of rainwater has markedly increased; the hydrographs of rivers are more suave than before; and crops are less affected by drought than previously. Erosion and associated removal of applied nutrients diminished almost immediately, such that less fertiliser has been needed to maintain yield levels. There have been increases in organic activity by soil-inhabiting fauna, the organic-matter content of soils and the value of agricultural land. Reductions have been noted in gully formation and in migration to urban areas.

Without improved productivity they may even be unable to afford add-on conservation-specific practices which provide little if any immediate benefit.

Better land husbandry

Good land husbandry' can be defined as: the active process of implementing and managing preferred systems of land use in such ways that there will be an increase - or, at worse, no loss - of productivity, stability, and usefulness for the chosen purpose (after Downes, in Shaxson, 1993:105). It involves the active management primarily of rainwater, vegetation, slopes and soils, with regard to the technical aspects mentioned above. This management takes place at a variety of scales, from the field to the landscape, and embraces land under planted crops, pastures and plantations, and under native vegetation of every sort.

Farmers are integral to the concept of husbandry: men and women assume centre stage as the husbanders of the land, who also consider, select or reject, integrate and adapt advice tendered by specialists. Their perspectives must be understood and taken into full account if programmes to assist them are to succeed.

In managing land to meet family livelihood requirements, farmers have to consider a wide range of influences including risks, opportunities for profit, the opportunity costs of their resources, maintenance costs, and the like. Better understanding of the significance of farmers' needs in husbandry decisions must be central to efforts to improve land.

Neglect of farmers' priorities can lead to a significant dissonance between government agencies and rural communities, as in the past when governments have insisted on soil conservation measures' before addressing the need for increased and more stable yields. Farmers generally insist on meeting livelihood requirements first.

The better land husbandry approach', by emphasising the two way interaction between sustainable increased vegetative output and land improvement, specifically embraces farmers' priorities and respects their goals. If initiatives to improve the land do not come to terms with farmers' conditions, aspirations, needs and priorities, programmes may (as all too often in the past) be based on flawed assumptions about their nature, relevance and worth; not address the issues which are of prime concern to farmers; and in consequence severely limit the credibility of field staff and programmes.

Enabling farmers to improve their husbandry

As outsiders', our own perceptions and assumptions are derived from specific contexts of knowledge, culture, training and experience, and do not necessarily accord closely with the experiences and realities faced by farmers. To a very large extent farmers' traditional approaches to sustaining their land have been unseen or ignored, and technical staff have focused solely on what they have seen as technically desirable to solve problems of erosion and runoff.

The better land husbandry approach requires that technical staff should participate with farmers in defining, prioritising and solving problems; that farmers' perspectives should be understood; and that action should be built on local knowledge and experience for addressing issues of inadequate husbandry. The credibility of staff who listen to what farmers have to say increases, information and ideas flow in both directions, and the prospects of positive reaction by farmers are enhanced (Box 1).

However, all too often mono-disciplinary recommendations continue to be made to deal with what are in fact multi-faceted on-farm problems. In other cases, there is a dearth of relevant research on low-cost solutions to specific problems. Empowerment of farmers to solve their own problems is achieved not only through training but also by introducing ideas and information from which farmers can make their own choices.

Examples

Where farmers have found it feasible and worthwhile to improve the texture, organic matter content, porosity and nutrient levels of the soil, natural fertility has

Box 3. Effects of leguminous green-manure cover crops

Recent studies of the velvet-bean maize intercropping system on farms of 2-5ha in the very steep

Cantarranas area of Honduras have established its positive impact on the soil, its ability to maintain very high levels of organic matter in the humid tropics, and its ability to produce maize at approximately 30% less cost per unit of grain produced than nearby 'modern' systems employing tractors, hybrid maize and agro-chemicals' (Bunch and Lopez, 1994:3).

In Albay Province of the Philippines, Farmers used indigenous indicators for determining reduction in soil erosion [following implementation of improved land husbandry methods, again using high-bulk legumes and recycling of organic matter]. Some indicators included: soil becoming softer over the years; plants growing uniformly; changing colours of soils from dull brown to darker colours; contour walls becoming smoother without slumpage during the rainy season; ... water flowing out of the field and water in nearby creeks are fairly clear in contrast to muddy conditions in the past; stone pebbles in the soil not visible any more; decreased frequency of landslides and contour wall slumpages; sticky soils becoming loam thereby absorbing much of the rainwater thus reducing the speed of rainwater flow on the surface; the increase in the depth of top soils on the farm; lesser and lesser deposits in the contour canals, soil traps and check dams and the like.' (Bhuktan et al., 1994).

'In the village of Pacayas [Honduras], we talked with Elias Zalaya, a farmer-extensionist, about the improvements on his farm and in the village. The land had been abandoned as virtually worthless when he took it on some ten years ago: We planted maize here, but it just wouldn't grow'. The unimproved soils are barely a few centimetres thick, and beneath them is hard bedrock. The soil on his farm is now remarkable [from using green manures and high-bulk cover crops such as *Mucuna* sp.]: where he has contour grass strips, the soil had formed terraces 1.3m high. The terraces are almost flat, and the soil thick, springy to the step, and covered with a thick layer of decomposing organic matter'. (Pretty, 1994 pers. comm. 95/4/3).

been raised and soils have recuperated. This is permitted by combinations of modifications to tillage systems, incorporation of organic matter, the use of crop residues as protective mulches, mixing with other soils (sands to decrease density, clays to increase density), adding plant nutrients, drainage, and other soil-improving actions (Box 2).

Such measures for actively constructing improved soils have transformed the sandy heaths of East Anglia in the UK into high-yielding grainlands, the salty polders of the Netherlands into productive pastures, the forested hills of Java into irrigated rice-lands, the acid cerrados of the Brazilian Planalto into productive farms, and exposed subsoils and weathered rock in Ecuador and Guatemala into valued cropland.

Where conditions are suitable, increased residues and soil cover resulting from higher yields can generate an upward spiral of improvement in soil productivity. The inclusion of leguminous green-manure/cover crops in small-farm systems have shown such effects dramatically, by contributing not only dense cover over the soil and large quantities of organic matter to the soil, but also significant quantities of microbially-fixed nitrogen as an essential plant nutrient (Box 3).

Conclusions

Acknowledging that farmers are at the centre of improved land husbandry, and that better land husbandry will be more effective and acceptable than merely increasing the size or number of physical conservation works in preventing degradation, has many implications for farmer support arrangements.

- Policies affecting the use and management of land should be coordinated across government departments to facilitate appropriate decision-making by farmers on aspects of land husbandry. Skill levels and reward systems in the public sector need to be adjusted in ways which encourage government staff to provide acceptable conservation-effective advice, and agriculture-related incentives or subsidies should not jeopardise appropriate husbandry.
- Training of professional staff must include developing their capacities in interdisciplinary collaboration and interpersonal relations; it should also include teaching the teaching of good land husbandry on an holistic basis.
- Research programmes and activities need to do more to address the real-life problems of farmers, and to include farmers in the design and implementation of programmes relevant to their needs. Generating new technical knowledge may become less important than discovering inter-linkages and interactions in the elucidation of appropriate solutions to difficulties.
- Government organisations need to serve their farmer clients in more interdisciplinary and participatory ways, jointly focusing on particular groups, problems or areas rather than planning from above and executing technical programmes independently of one another.
- Legislation should be adjusted to facilitate the requirements and initiatives of local groups, moving away from coercive or punitive legal instruments where these still exist on statute-books (as e.g. in a number of Forestry Departments) as means of trying to stabilise land resources.

References

Bhuktan, J.P., Basilio, C.S., Killough, S.A., De Los Reyes, M.F.L., Operio, S., Locaba, R.V. (1994) Participatory upland agro-ecosystem management: an impact study'. Paper presented at Workshop New Horizons: Economic, Social and Environmental Impacts of Participatory Watershed Development, Bangalore, India, Nov. 24/Dec. 2 1994. London: IIED. (Proceedings: in preparation).

Bunch, R. and Lopez, G. (1994). Soil recuperation in Central America: measuring the impact four and forty years after intervention'. In: Proc. IIED New Horizons Workshop (see above). London: IIED.

Food and Agriculture Organisation of the United Nations. (1995) Agricultural investment to promote improved capture and use of rainfall in dryland farming.' FAO Investment Centre Technical Paper 10. Rome: FAO. 46pp.

Hamilton, P. (1997) Goodbye to hunger!
A study of farmers' perceptions of conservation farming. Report to Association for Better Land Husbandry. Aberdeen: Department of Geography, University of Aberdeen.

Hinchcliffe, F., Guijt, I., Pretty, J.N. and Shah, P. (1995) New horizons: the economic, social and environmental impacts of participatory watershed development.' IIED Gatekeeper Series SA50. London: IIED. 22pp.

Leach, M. and Mearns, R. (1996) The lie of the land: challenging received wisdom on the African environment. London: International African Institute, with J. Currey and Heinemann.

Shaxson, T.F. (1993) Conservation-effectiveness of farmers' actions: a criterion of good land husbandry.' In: Baum, E., Wolff, P. and Zobisch, M.A. (eds). Acceptance of soil and water conservation: strategies and technologies. Vol.3 in Topics in applied resource management in the tropics. Witzgenhausen: German Institute for Tropical and Subtropical Agriculture.

Tiffen, M., Mortimore, M. and Gichuki, F. (1994) More people, less erosion: environmental recovery in Kenya. London: ODI.

**Francis Shaxson, Chairman
of the Association for Better
Land Husbandry can be
contacted at:**

**Greensbridge,
Sackville Street
Winterbourne
Kingson
Dorset DT11 9BJ,
UK**

**Fax: +44 (0)1929
471401**

**Overseas Development Institute
Portland House
Stag Place,
London SW1E 5DP, UK**

**Telephone +44 (0)171 393 1600
Fax +44 (0)171 393 1699**

Email: nrp@odi.org.uk



[Overseas Development Institute Home Page](#)
