

Diversity: A New Strategic Direction for Soil Conservation

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Abstract: ‘Diversity’ is advanced as the new strategic direction for soil conservation. It not only offers ways of correcting for problems in previous approaches, such as engineering solutions, but also advances an array of techniques that better meets the needs of individual land users. The potential of diversity is explored through the ‘agrodiversity’ framework, which brings together a variety of elements of the natural and the managed environment, along with important current issues of global concern, such as food security, land degradation and loss of biodiversity. Researched examples from two major international projects (UNU/UNEP/PLEC and DFID/NRSP Hillsides) involving resource-poor small-scale farmers who are demonstrating excellent practice are briefly described. While it may be difficult for individuals wedded to simple ‘transfer-of-technology’ approaches to accept there may be many ways to achieve the same goal of secure soil conservation, a diverse approach will surely appeal to farmers who have many different needs, constraints, opportunities, skills and knowledge. Their lives are diverse; so too should be the assistance to their soil management and production problems.

Keywords: soil conservation, biological diversity, agrodiversity, conservation strategy, sustainability

1 Introduction

Diversity is literally the condition of being different or of unlikeness. Its first recorded use in the English language is by the explorer Sir Walter Raleigh in the 16th Century: “*Diversitie of circumstance may alter the case.*” (quoted in Onions, 1983, p.585). Diversity may have altered Raleigh’s choices and caused him to rethink his strategy. However, today it is a guiding principle behind ecology. It is the source of resilience of natural systems (Brookfield, 2001), and the unifying component of complex cultures as they interact with their natural resources (UNEP, 1999). It supports processes of adaptation to changing circumstances in many societies (Prain *et al.*, 1999). In the context of agricultural biodiversity, diversity has now been recognised as a possible solution to global environmental problems (GEF, 2001). Though modernisation has sought to impose uniformity of crops and rural landscapes, diversity in agriculture underpins the functioning of small farm practices. This paper will explore how this diversity, called ‘agrodiversity’, has the potential for being a new strategic direction in soil conservation.¹

In its 80 years as a field of knowledge, soil conservation has undergone a number of strategic shifts in direction and emphasis. From the 1930s, it was clearly a response to the perceived environmental degradation of the Dustbowl era in the USA; it addressed some of the needs of the economic depression between the two World Wars by focusing on techniques that would increase production and using methods to subsidise rural producers. Led by agricultural engineers, soil conservation turned into a prescriptive regime of technical interventions, usually as structures, earthworks and methods to control runoff. Even biologically based techniques such as strip cropping, popular in the 1950s and 1960s, had to be ‘engineered’ into the landscape. Right up to the 1980s, soil conservation was an interventionist strategy of earth-works and plantings, a costly addition to normal farming practice. Textbooks of that era

¹ This paper is a contribution from two major international initiatives. (1) The Natural Resources Systems Programme (NRSP) of the UK Department for International Development, which is funding policy-oriented and livelihood-focused research into hillside agricultural systems. (2) The Global Environment Facility funded project, *People, Land Management and Environmental Change (PLEC)*, executed by the United Nations University in 12 developing countries to demonstrate the key role of ‘agrodiversity’. Examples are drawn from both throughout the paper.

featured the essential, costly and differential nature of the package of practices that added up to safe and productive land use (e.g. Troeh *et al*, 1980). Soil conservation was a discipline and subject in its own right and for its own sake.

The 1990s ushered in a new strategic direction, not just for soil conservation but also for rural development: it was ‘sustainable development’ (Hurni *et al*, 1996). From its public inception at the *Earth Summit* in Rio de Janeiro in 1992, the whole sustainability process embraced notions of empowering local communities, ensuring the equitable share of benefits and exploiting the environment with a view to future needs and generations. As part of sustainability, sustainable agriculture developed a longer term vision that included notions such as self-reliance (Pretty, 1995) and started to explore some of the long-ignored features of local (indigenous) knowledge in order to inform development policy (Reij *et al*, 1996). In soil conservation, the sustainability process was encompassed by ‘land husbandry’, an attempt to develop a more holistic and integrative approach to dealing with soil management and land problems. An understanding of the role of local knowledge as a development resource was also added as vital (Blaikie *et al*, 1997). The pre-eminent feature of that knowledge is its variety, complexity and diversity.

So, we come to the 21st Century with a wealth of experience of approaches to soil conservation, from the strictly technical ‘transfer of technology’ to farming systems analysis, from engineering structures to agroforestry. None has met fully their initial promise; none has been embraced properly by soil conservation’s ultimate clients, the land users. This paper is about where we go now, about a new strategic direction that is emerging, and about celebrating diversity as a good in its own right with the potential to inform and to guide approaches to soil conservation.

2 The potential of diversity

So, how can diversity provide a new strategic direction for soil conservation? Brookfield (2001, p.21) gives us some clues where in this quote he summarises the landscapes of two-thirds of the world’s farmland:

“The farming landscape of these many millions of small farmers is very different from the wide, uniform fields of most developed countries. Theirs is a landscape of great diversity. Small farmers ... use ...small local variations in soil, microclimate and water conditions, ... produce a great variety of crops. Commonly described as traditional, this farming landscape is very dynamic; in it the results of learning and experiment are expressed in ways that are constantly new. ...Centrally important is the internal dynamism of so many small-farming systems, yielding a constantly changing patchwork of relationships between people, plants and the environment.”

Key to understanding the potential of diversity, then, are the attributes of complexity, dynamism, experimentation and relationships. Box 1 illustrates two examples: first, the intricate combinations of plant and soil surface management on a small farm in Uganda. Here, bananas are a keystone species, providing many productive components to the household (food, fodder, roofing materials and so on) and protective components to the natural resource system (rooting structures, surface organic matter, cover to other species). In the second example, the Sri Lankan small-scale rice paddies are intimately dependent on the slopes above where home-gardens and other cultivation activities are undertaken. The paddies trap water and sediment more effectively than deliberate soil conservation structures because they are so highly valued by farmers and well maintained in the production system. The rest of this paper will explore these ideas within the context of the goals of soil conservation.

For some, however, it is counter-intuitive that diversity could be the theme for a sustainable future with land degradation controlled and land-use continuously productive. Diversity runs opposite to the idea that there are technologies that, if promoted properly, will solve the major global environmental and developmental problems: food security, climate change, loss of biodiversity, land degradation. Diversity is something that cannot easily be dissected, explained and understood in the normal process of scientific examination. The interconnections and relationships are complicated and its ever-changing nature is not amenable to nice textbook examples to be promoted and implemented. Instead, diversity is asking us to believe that there are many solutions and varieties of options. Diversity means that the most appropriate approach to soil conservation may vary not only between place to place, but household to household and individual to individual. How could this be?

First, diversity directs us away from universalist and blue-print solutions. The history of soil conservation has seen a procession of 'recommended' and favoured practices, each with its disciples and proponents. The singular promotion of the grass, *Vetiveria zizanoides* – the so-called "thin green line against erosion" (National Research Council, 1993) – is a case in point. Individual technologies are not in themselves wrong, but their widespread promotion to different societies, cultures and natural environments invites rejection because of the vast heterogeneity of land use conditions and circumstances. A good example of diversity of solutions is the 220 agroforestry associations documented by Guo and Padoch (1995) amongst ethnic minority communities in eight prefectures of Yunnan, SW China.

Secondly, diversity captures the vast knowledge and experience of farmers who have coped and continue to cope with environmental degradation. Local knowledge is extremely diverse. An example is the local knowledge in development of plant genetic resources (Almekinders and De Boef, 2000). The knowledge is a product of many influences that have adapted and changed actual practice in agriculture, and it has been continually tried and tested. In the *PLEC* demonstration site in northern Ghana, women farmers have protected at least twelve varieties of the African indigenous rice, *Oryza glaberrima*. They manage the varieties subtly and sensitively in different parts of the landscape with boundary bunds and water control that can cope with extreme rainfall variability, erosive soils and a sensitive environment (Anane-Sakyi and Dittoh, 2001). The benefits for soil conservation are well evident in the intricate pattern of fields and sediment traps. Environmental change may then not only be an outcome of change in land use, but also a forcing factor to encourage further change such as the adoption of soil conserving and improving practices. To ignore this diverse knowledge and experience is to reject the most relevant eco-social experimentation available.

Thirdly, there is an array of technologies and solutions that can potentially be brought into modern soil conservation. Just as there are many explanations for soil erosion as embodied in political ecological constructions of causes of environmental degradation, there are many solutions. Indigenous techniques of soil and water conservation are diverse (Critchley *et al.*, 1994). Interventions may be addressed to the farmer, the household, local communities, district councils, and onto national and international policy makers. There are many types of intervention, at different scales and both spatially and temporally, that are appropriate for different circumstances and problems. Yam farmers in the *PLEC* demonstration site in southern Ghana have developed a local system of training yams up trees under a semi-managed forest canopy. They use different trees for the 17 different yam varieties documented by *PLEC* scientists; employ fallen leaves for mulching; and have different pitting and harvesting techniques that create minimum disturbance but maximum water retention. There is no measurable erosion from these forest plots.

Fourthly, diversity has greater potential for offering resilience to land use systems, and hence sustainability. Diversity provides a broader body of land use solutions in order to cope with external forces such as climate change, population increase, and economic recession. The drylands, in particular, are environments of uncertainty (Mortimore, 1998). The *PLEC* demonstration site at Kiserian, Arusha District, in semi-arid Tanzania offers examples of farmers opting for diversity in crops, trees (many with medicinal uses) and management approaches (Kaihura *et al.*, 2000). In that the forces for change are also diverse, land users need many available solutions, and they get this by diversifying, not by specialising. This gives resilience to local society and empowers farmers to deal with complex but often transitory situations.

Finally, a plurality or diversity of approaches to conservation offers a far more practical and accessible means of handling soil conservation. The NRSP project in Tarija, southern Bolivia is working with local professionals to develop tools to assist extremely poor farmers in local communities. One of the principal lessons has been to allow farmers to set the intervention agenda, thereby immediately determining land users' priorities and engaging their willing interest. Priorities have ranged from rehabilitating old irrigated terrace systems, improved access to and capability in administering veterinary drugs, alluvial terrace salinity and coping with *El niño* effects. All of these in either direct or indirect ways impact on farmers' production and hence contribute to soil conservation. Indeed, it is the indirect ways that appear most successful (Beck *et al.*, 2001).

3 Handling diversity in soil conservation

These aspects of diversity have been captured in the term ‘agrodiversity’, employed increasingly now to describe all aspects of the diversity of small-scale agriculture systems in the tropics (Brookfield 2001). Agrodiversity has been defined as “the many ways in which farmers use the natural diversity of the environment for production, including their choice of crops and their management of land, water and biota as a whole.” A framework has been developed, which is now used throughout the *PLEC* project for codifying and organising the many aspects of diversity within a farming system (Brookfield and Stocking, 1999). Along with the Sustainable Rural Livelihoods framework (Ellis 2000), it is also a useful way of identifying land degradation issues with farmers and planning for soil management and conservation (Stocking and Murnaghan, 2001).

Diversity at farm and field level can be divided into four principal elements, all of which overlap but each of which constitute distinctive components that have their own rationale and application to more singular themes, such as soil conservation. These elements are presented in Table 1, showing how they might relate to current soil conservation practices and interventions.

Table 1 Diversity at farm level and relation to soil conservation (Adapted from Brookfield and Stocking, 1999)

Agrodiversity categories	Description	Application to soil conservation (examples only)
Biophysical diversity	The diversity of the natural environment including the intrinsic quality of the natural resource base that is used for production. It includes the natural resilience of the biophysical environment; soil characteristics, plant life, other biota. It takes in physical and chemical aspects of the soil, hydrology, climate, and the variability and variation in all these elements.	The immediate natural resource base aspects of soil conservation, including soil quality, erodibility, fertility.
Management diversity	All methods of managing the land, water and biota for crop and livestock production, and the maintenance of soil fertility and structure. Included are biological, chemical and physical methods of management.	All soil and crop management aspects, with the aim of building resilience in the natural system.
Agro-biodiversity	This is all species and varieties used by or useful to people, with a particular emphasis on crop, plant and animal combinations. It may include biota that are indirectly useful, and emphasises the manner in which they are used to sustain or increase production, reduce risk and enhance conservation.	Biologically-based approaches to soil conservation – such as, multiple cropping, cereal-legume mixes, organic mulches, composting. Also below-ground biodiversity and its functions in structuring soils and reducing erodibility.
Organizational diversity	This is the diversity in the manner in which farms are operated, owned and managed, and the use of resource endowments from different sources. Explanatory elements include labour, household size, capital assets, reliance on off-farm employment, and so on.	The organization of conserving practices, and the allocation of resources for specific activities. Also included is conservation at a landscape level, and the way that different elements and resources are traded off

These agrodiversity categories are fundamental to understanding the interface between natural biological diversity and human land use. They operate through a variety of spatial scales – fields, farms, communities and landscapes. Soil conservation, similarly, is conducted at different spatial scales –

specific soil management techniques for single fields and watershed planning for landscapes, for example. In addition, agrobiodiversity is dynamic, changing both in the short-term and longer term. Farmers make decisions on land use, allocation of resources, and managing risk for single months through to a run of years. In response to environmental, demographic, social, economic or political change, farmers make longer term decisions to invest in land ('landesque capital'), change cropping strategies, undertake major soil management investments such as terracing and irrigation, for example. This long term change is fundamental to the development process, but needs to be captured effectively in order to promote benefits such as sustainable soil conservation practices.

4 Strategic directions

Soil conservation does need a new strategic direction. It needs to re-create itself from time to time and to experiment with new approaches that engage with land users and enable them to invest in techniques that conserve soil resources for the benefit of society and themselves. 'Diversity' is proposed as a new linking theme for a strategic direction that recognises that we have a large armoury of techniques of soil conservation. Technologies are now rarely limiting; it is their appropriate application and recognition of local knowledge that are deficient. A major challenge is to match specific techniques to individual people. Because individuals and households and communities, as well as the environments in which they live, are all very different, it is clear that suitable techniques will also vary from person to person and place to place. While it is probably difficult for professionals trained in technology development to accept that their techniques may match only a few individuals, a diverse approach will definitely appeal to farmers who have many different needs, constraints, opportunities, skills and knowledge. The enthusiasm of local people to the two projects (NRSP and PLEC) mentioned in this paper are evidence of desire by local people to engage with professionals to build better futures on the basis of improved soil, crop and farm management. Diversity is also dynamic, and an approach built upon it will enable land users to continue to experiment and adapt, as they have done for centuries without professional scientific help. A strategic direction that embraces complexity and dynamism and celebrates diversity will not only match the characteristics of farmers but will also blend with an ever-changing natural environment and the challenges that face human society – global warming, food insecurity, loss of biodiversity and greater pressures on land resources.

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