Achieving Sustainable Soil Management in Agriculture

Hans Hurni. *World Association of Soil and Water Conservation, and Group for Development and Environment, University of Berne, Hallerstrasse 12, 3012 Berne, Switzerland.*

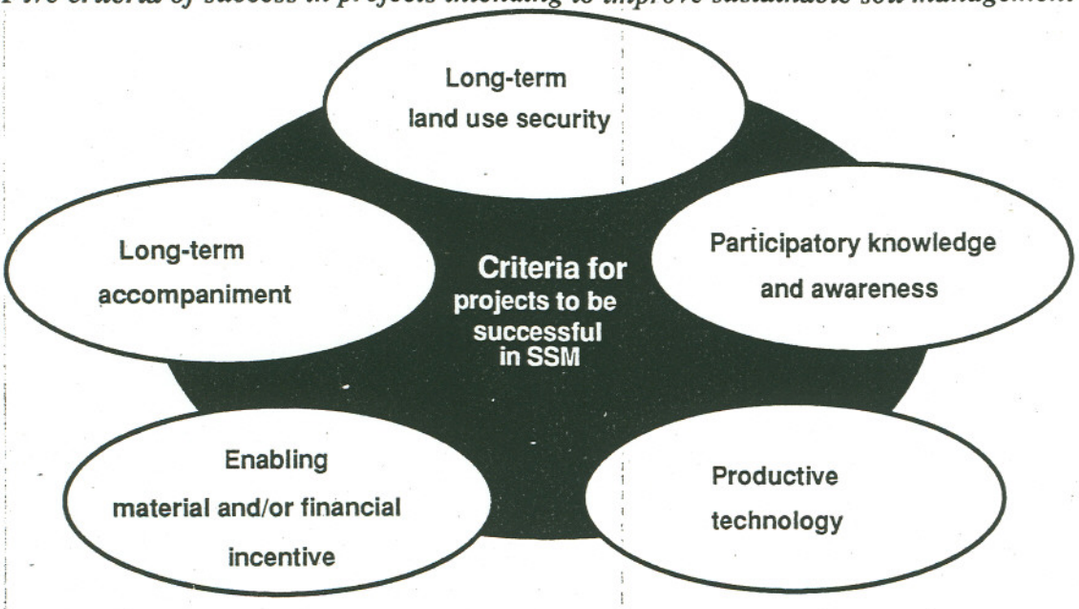
Introduction. Agriculture and soil degradation are closely related. If agriculture managed its soils in a sustainable manner, the problem of land degradation could be reduced to a fraction of its present state. According to a world map (4), 28% of all types of soil degradation at the global level are caused by agriculture, and 35% by overgrazing. A further 29% are related to deforestation, a process which again results in agricultural land uses in most instances. Thus soil degradation is caused in more than 92% of all cases by a variety of agricultural uses. Many types of processes are responsible for soil degradation, such as water erosion, wind erosion, and physical and chemical deterioration. By far the most important is soil erosion by water and wind, which accounts for 84% of all damage (4). When attempting to achieve sustainable soil management in agriculture, soil conservation in its broadest sense constitutes an important component, hence the focus on it in this overview.

Theory. A brief analysis based on the theory of land management (1) shows that land degradation is as old as agriculture itself, although in this century there has been a threefold aggravation: Land degradation has never in history been so widespread, accelerating so rapidly and been so negative in its consequences for the land user. First, farming activities have never been as widespread as at present. Second, the acceleration of the processes is explained by marginalisation, whereby farmers are forced to cultivate their land more frequently and on steeper slopes. Third, consequences are particularly negative because land reserves in developing countries are nearly absorbed, or even exceeded, due to the present number of land users and the restricted alternatives to land use. Sustainable soil management according to (2) is being achieved when (a) a number of soil parameters (volume, fertility) remain unchanged for at least one generation, when (b) all soil degradation processes and toxic inputs are kept below tolerable limits, when (c) soil management does not affect other criteria of sustainable use of natural resources (biodiversity, genetic maintenance of species, and the sustainable development of the human societies), and when (d) soil management does not hinder or reverse the overall sustainable development in the region.

Empirical Experience. Soil conservation, as a major component intended to increase sustainable management of soils, has become an issue of serious concern in the recent past. Most of the introduced conservation technologies were not adopted by land users except when incentives, subsidies or legislation were applied. This particularly concerned developing countries where there were extreme shortcomings in enforcement of legislation and policies, and where the governments could not afford subsidies for additional inputs into soil maintenance and care. Hence, only projects developed through bilateral or international co-operation programmes implemented such activities. In light of these negative experiences, an evaluation of technologies and approaches of sustainable soil management was launched by the WOCAT project of the World Association of Soil and Water Conservation (WASWC) in 1992 (3). Tens of projects are currently being evaluated on the basis of a methodology developed by WOCAT. Criteria of success in this respect are considered central in the evaluation (5), and a concept has been developed from the theory and the empirical experience.

Results. According to the concept of sustainable soil management (SSM), the criteria of success to be evaluated in these projects can be clustered in the five fields given in the figure below. It can be argued that every single cluster must be positive in a programme if it is to achieve sustainability. The presented set of criteria constitutes a very strigent definition of success. This is opposed to project evaluations where much weaker principles are normally applied, and a much shorter-term perspective is taken. Field evidence in projects assessed in the long term calls for such a strict application of all principles to be fulfilled for SSM.

Five criteria of success in projects intending to improve sustainable soil management (SSM):



Knowledge and awareness of problems of sustainable soil management (SSM) and of opportunities for improvements in land use and technology should be created in a participatory manner at all levels, from the land users to the political decision makers. Failing to create such continuous understanding at any single level of interaction means threatening the long-term efficiency of the action. Marginalised land users with scarce land resources in difficult environments, where certain land use types should be even more restricted, will not be willing to adopt technologies that are not by themselves productive in the respective farming system. **Technological innovations** should therefore constitute a **productive asset** in the farming system, at least after an initial installation period. The introduction of the technologies may need a **minimum enabling incentive**, either in material, know-how, or financial investment, or a combination of these, up to a maximum period of five years. The institutional environment at local and regional levels should allow long-term accompaniment of the required **maintenance inputs** and continuous upgrading of the technology. Long-term **land use security**, finally, should guarantee that the investment in sustainable soil management is safeguarded to the benefit of the land user.

Discussion. A "policy" is defined as "a plan of action as pursued by an organisation". Usually, policies are developed at national, regional, or organisational levels. The scientific and technical bases for land use and soil conservation policies have been given above, but need to be further developed according to capability and competence of the concerned institutions. Here, the socio-economic framework for policy development and application will be decisive. For example, national economies must be assessed when deciding on incentives or subsidies to be used to support sustainable land use and soil management. A further important issue for developing countries will be the international solidarity in agreements on trade (NAFTA, GATT), and the international funds which must be mobilised to assure that investments in environmental improvements can be made for small-scale farmers world-wide.

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