On- and Off-site Effectiveness of Soil and Water Conservation in Switzerland – Steps Towards the Integration of Farmers', Experts' and Scientific Knowledge

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Abstract
In recent decades, soil degradation research has focused on degradation processes and in particular on the on-site impacts of soil and water conservation (SWC) technologies on soil erosion and soil fertility. In contrast, little is known about the social and economic dimension on the one hand, and the off-site effects of soil erosion and SWC, respectively, on the other hand. Therefore, the research project investigates the effects of soil protection, both on-site and off-site, i.e. taking into account ecological soundness, economic viability, practicability and social acceptance. It explores social processes and seeks to determine farmers' rationales for implementing, adapting, innovating or rejecting SWC. The project is based on a transdisciplinary approach, appreciating that optimal implementation of SWC needs to combine different knowledge systems as part of a social learning process involving farmers, researchers, public administration, and other relevant representatives of civil society.

Introduction
In Switzerland about 20 % of the cultivated land is affected by soil erosion (Mosimann et al. 1990). Long-term average soil loss rates are low (< 1 t/ha a), whereas tolerable threshold values can easily be exceeded on single farm plots.


Photo: Thomas Ledermann

Therefore, Switzerland has established a broad legal framework to enhance implementation of soil and water conservation (SWC) technologies on a large scale (Prasuhn and Weisskopf 2004). However, cantonal extension services have different ideas about how to enforce these laws. Currently, experts from public administration are developing systems and incentives for promoting soil conservation.

The starting point of the project was the significant contributions by its three Swiss partners "CDE", "FAL" and the private firm "Knowledge Management Environment" (see authors reference). The study is embedded in the EU COST action 634. It is split into two separate PhD theses with a common concept, in order to give due emphasis to both natural and social sciences on the one hand, and to research, policy making and agricultural practice on the other hand. Furthermore, the project is accompanied by a steering committee consisting of scientists, experts of public administration, agricultural contractors and farmers. This permits identification and discussion of the main dimensions and indicators to be considered in a comprehensive appraisal of sustainable land use, reflecting and integrating the perceptions

and concerns of farmers, experts, and researchers. Preliminary research results are regularly discussed.

PhD Thesis I: Ecological, economic and social impacts of SWC activities on arable farm land in the Swiss Midlands

Research background

With the revision of the regulation relating to impacts on the soil in 1998 (VBBo – establishment of reference values for soil erosion: 2 and 4 t/ha a, resp. depending on soil depth), farmers have been addressed directly by the Swiss authorities with respect to avoiding soil degradation. In order to maintain soil quality in the long term, soil protection agencies must communicate scientific knowledge in a way that farmers can incorporate it into their daily activities.

Recent assessments of the existing knowledge on soil degradation phenomena, in particular soil erosion (Leser et al. 1998, Leser et al. 2002) and on technologies that help reduce soil loss (Mosimann et al. 1991) show that a lot of information has been generated and extended catalogues of SWC technologies were created. Nonetheless, potentials and limitations of these technologies are often evaluated only regarding the ecological effectiveness neglecting considerations of their economic and social impacts. Furthermore, local variations and modifications in SWC technologies are often unknown or not well documented.

Off-site damages caused by soil erosion are largely known, but have not been examined with the same intensity as on-site effects. For example, past investigations mostly focused on the phosphorus issue and nothing has been documented so far about externalities (e.g. damage on infrastructures) and its potential future conflicts (e.g. between farmers and insurances).

Research tasks and methodology

1. identify main actors in the field of soil protection / investigate their role and interaction;
2. clearly attribute off-site effects (positive & negative) to on-site erosion / damage and SWC on cultivated land;
3. list indicators of (un-)sustainable agriculture, find basic principles for an agro-environmental indicator on “erosion risk”;
4. assess the potentials and limitations of SWC technologies regarding economic efficiency, ecological effectiveness and social compatibility;
5. analyse costs / benefits of SWC for all actors involved;
6. evaluate potential social conflicts related to off-site impacts;
7. outline meaningful strategies of supporting soil protection on the administrative level.

The main focus of this thesis lies on a comprehensive assessment of the costs and benefits of soil protection. Emphasising on consideration of all actors of the Swiss agricultural system brings along a great challenge. Normally, a cost-benefit analysis (CBA) is applied for such purposes, but given the fact that neither the multiple effects, nor the beneficiaries can be easily detected, quantified and valued, cost-benefit analysis may not be the most appropriate tool for the evaluation of such a broad context. Since many effects cannot be expressed in monetary terms and many different groups of actors are involved, each having different sets of objectives, a combination of CBA with multi-criteria analysis (MCA) may offer better possibilities for applying various evaluation criteria and different weight sets for these criteria (de Graaff 1996).

Therefore, the particular methods used will be adapted to suit the MCA without limiting their outputs. These methods are: Erosion Damage Mapping; WOCAT (WOCAT 2006); Impact Monitoring and Assessment (IMA) (Herweg and Steiner 2002); interviews, group

discussions, workshops; photo-/ videomonitoring; participatory transect walks and observations.

PhD Thesis II: Implementation of soil protection as social learning process

Research background

The starting point of the present PhD-study is the considerable gap between research results on soil degradation processes/SWC technologies on the one hand, and implementation of this knowledge in agricultural practice, on the other hand. Traditionally, implementation of innovation is seen as linear process, where technologies are developed by research and transferred by extension services to the farmers (Carr and Wilkinson 2005). However, in practice the knowledge system of agriculture is much more complex. Knowledge is exchanged and co-produced - rather than transferred - between several actors on different levels, especially farmer to farmer interactions, and the knowledge backflow from farmers to research should be mentioned. In addition, other elements such as agricultural policy, medias etc. play an important role (Blum 1994).

The social learning approach is much more appropriate to describe the process of innovation properly and thus to develop strategies for a more sustainable soil management. Social learning processes recognise that solutions to complex resource management problems can only be developed on the basis of an integration of farmers, experts and scientific knowledge. Social learning processes can be understood as the simultaneous transformation of cognitive, social and emotional competences as well as of attitudes and values related to collective or individual social actors, emerging from the joint search for more sustainable management of natural resources at the interface between the world of rural actors, experts and public administration (Rist et al. 2006).

Research fields

The PhD-study focus on these learning processes taking place in the context of soil protection in Switzerland, taking into account different institutional policy settings and intervention strategies (subsidies, incentives, regulations, contracts, inspections etc.). Three different cantonal implementation strategies are compared related to their contribution to social learning and their effect on sustainable agriculture. The canton Solothurn embarks on a strategy based on a soil erosion risk map (independent from visual damages). Farmers in high risk areas must prove that they prevent soil erosion sufficiently (Top down risk oriented approach). The canton Fribourg pursues a policy where the person in charge of agricultural issues in the community reports recent soil erosion damages. Farmers must adopt soil conservation measures after two notified damages (Top down damage oriented approach). Both cantons count on regular inspections and a corresponding sanction system. By contrast, the implementation strategy of the canton Bern is based on participatory proceedings such as management contracts, personal relations and counselling interviews rather than inspections (Bottom-up participatory oriented approach). In the course of the revision of the national soil protection decree the canton Bern will have to adopt its strategy to the new national policy, which stipulates that in case of soil erosion damages a package of measures must be implemented and sanctions to be taken by non-compliance. All three cantons believe that training of farmers and collaborating with the agricultural departments are key factors to achieve soil conservation.

Beside the official implementation strategies an innovative non-governmental project named "from farmer - to farmer" is evaluated. The project seeks to enhance motivation for the implementation of soil protection measures by means of knowledge management methods

(Davenport and Prusak 1998, see also evaluation of similar approaches in South America Holt-Gimenez 2002). Farmers who have already introduced soil protection measures successfully possess valuable know-how which they have developed over years in collaboration with scientists and the authorities. In the project "from farmer - to farmer" this know-how is made explicit and thus communicationable by means of qualitative interviews and videos, and then passed on to local farmers at informal assemblies and by personal interactions (knowledge exchange by farmer networks) (Fry 2004).

Photo: Flurina Schneider

The role of different actors, their perception of soil erosion, their reasoning and their motivation for adapting or rejecting SWC technologies are investigated with special attention. Public and scientific discussion is dominated by cost/benefit oriented models of reasoning and action. Financial considerations are undoubtedly important for decision making on soil protection measures; however, they are not sufficient to understand reasoning of farmers (Van Weperen et al. 1998). Normative-prescriptive and communicative elements such as professional ethics (to be a "good" farmer) and neighbourhoods relation play a crucial role, too. These elements are explored within the present study.

Research design

The methods used within this study are designed to generate qualitative data with a focus on depth and detail of information. The study comprises mainly qualitative research methods according Flick (2005). Data is collected through document review, literature review, participatory observation, group discussions, semi-structured interviews and evaluation of existing interview and video material. According to the transdisciplinary approach, the preliminary findings, results and/or difficulties are discussed with all relevant actors involved at all stages during the research process.

References

Blum, A (1994): Das Landwirtschaftliche Wissenssystem der Schweiz. Agrarforschung 1. 507-510.

Carr, A. & Wilkinson R. (2005): Beyond Participation: Boundary Organizations as a New Space for Farmers and Scientists to Interact. Society and Natural Resources. 18, 255-265.

Davenport, T. H. and Prusak L. (1998): Working Knowledge: How Organisations manage what they know. Boston.

De Graaff, J. (1996): The price of soil erosion. An economic evaluation of soil conservation and watershed development. Mansholt Studies 3, Agricultural University of Wageningen, The Netherlands.

Flick, U.(2005): Qualitative Forschung. Eine Einführung. Hamburg.

Fry, P. (2004): «Von Bauern - für Bauern»: Ein neuer Ansatz fördert den mechanischen Bodenschutz in der Landwirtschaft. BGS- Bulletin.

Herweg, K. & Steiner, K. (2002): Impact Monitoring & Assessment. Instruments for use in rural development projects with a focus on sustainable land management. Volume 1: Procedure (48 p.) & Volume 2: Toolbox (44 p.). Bern.

Holt-Gimenez, E. (2002): Measuring farmers agroecological resistance after Hurricane Mitch in Nicaragua: a case study in participatory, sustainable land management impact monitoring. Agriculture, Ecosystems and Environment. 93, 87-105.

Leser H., Prasuhn V. & Schaub D. (1998): Bodenerosion und Landschaftshaushalt. In: Richter G. (Ed).: Bodenerosion - Analyse und Bilanz eines Umweltproblems. Wissenschaftliche Buchgesellschaft, Darmstadt. 97-109.

Leser, H., Meier-Zielinski, S., Prasuhn, V. & Seiberth, C. (2002): Soil erosion in catchment areas of Northwestern Switzerland. Methodological conclusions from a 25-year research programme. – Z. Geomorph. N.F. 46/1, 35-60.

Mosimann, T., Crole-Rees, A., Maillard, A., Neyroud, J.-A., Thöni, M., Musy, A. & W. Rohr (1990): Bodenerosion im Schweizerischen Mittelland. Ausmass und Gegenmassnahmen. - NFP-Bericht Nr. 51, Liebefeld-Bern, S. 262.

Prasuhn, V. & Weisskopf, P. (2004): Current approaches and methods to measure, monitor and model agricultural soil erosion in Switzerland. p. 217-228 – In: Francaviglia (Ed.): Agricultural Impacts on Soil Erosion and Soil Biodiversity: Developing Indicators for Policy Analysis. Proceedings from an OECD Expert Meeting – Rome, Italy, March 2003, 654 pp.

Rist, S., Chiddambaranathan, M., Escobar, & C., Wiesmann, U. (2006): "It was hard to come to mutual understanding…" – The multidimensionality of social learning processes concerned with sustainable natural resource use in India, Africa and Latin America. Journal of Systemic Practice and Action Research (forthcoming).

Van Weperen, W., Proost, J. & Röling, N.G. (1998): Integrated arable farming in the netzerlands. In Facilitating sustainable Agriculture. Participatory learning and adaptive management in times of environmental uncertainty, N.G. Röling & M.A.E. Wagemakers. 102-121.

WOCAT (2006): www.wocat .net