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Soil and Water Conservation, Global Change, and the Millennium Development Goals – An Evaluation by WOCAT

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Résumé
42 études de cas sur des technologies de conservation de l'eau et des sols (CES) ainsi que 29 approches correspondantes ont été sélectionnées de la banque de données de WOCAT. Le choix couvre ainsi différents types d'utilisation des sols et différentes zones agro-climatiques. L'article démontre que la mise en œuvre de CES apporte une contribution significative à l'atténuation des impacts négatifs du changement global et aux Objectifs du Millénaire pour le Développement (OMD). L'article présente également l'impact sur la productivité des sols, sur les aspects liés à l'eau, ainsi que sur les questions touchant à la séquestration de carbone, la désertification, la biodiversité et la lutte contre la pauvreté. Finalement, l'article insiste sur la nécessité d'investir au niveau du monitoring et de l'évaluation des impacts de CES par rapport aux OMD sur la base des expériences faites dans le cadre du programme WOCAT.

Introduction

Over the past 13 years the WOCAT programme (World Overview of Conservation Approaches and Technologies) has been active in over 45 countries worldwide. It has identified many sustainable land management practices - Soil and Water Conservation (SWC) technologies and approaches - and documented, evaluated and disseminated them. Over 130 technologies and over 72 approaches in the WOCAT database have been made available on the Internet and CD-ROMs (WOCAT 2004). This paper presents the impacts of SWC activities on soil productivity and water issues, and also touches on carbon sequestration, desertification, biodiversity and poverty alleviation. All of these issues are part of the discussion concerning global change and MDGs.

Materials and methods

42 case studies on SWC technologies and 29 corresponding SWC Approaches from all over the world have been selected from the WOCAT database (www.wocat.net): They cover representative land use and agro-ecological zones, address important types of degradation and conservation measures, and thus represent a wide range of SWC technologies and approaches. The information was collected using standardized questionnaires (WOCAT 2005a,b). Most of this information is based on the participative assessments by SWC specialists together with land users, hence very few of the reported impacts have been measured and proved. The results are compiled in a standardized and attractive summary format, and evaluated in a book entitled, *Where the Land is Greener* (Liniger and Critchley 2006). These case studies have been analyzed for purposes of interpretation, additional experience from the WOCAT network has been included. (Schwilch and Liniger 2006)

Results and discussion

Soil productivity: Yield increase (crops, fodder, wood production) is important in almost all SWC measures applied (39 out of 42). Medium to high increases were reported for crops in 60% of the cases (25), for fodder in almost half (20), and for wood in 20% of the cases (8). This means that some SWC technologies have resulted in an increase in more than one of the

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categories listed above. Medium to high soil fertility improvement was mentioned in three-quarters of the cases. Thus improvement of soil fertility and productivity is a main recognized achievement of SWC.

Carbon sink: In the global discussion about climate change, the potential of carbon sequestration in the soil needs to be examined. More than half of the technologies (22 out of 42) led to increased soil organic matter. Given the vast areas of degraded land and the potential of SWC to increase soil organic matter in the topsoil, SWC offers a long-lasting and substantial sink for carbon. But this is only valid as long as organic matter can be increased on degraded soils. Once the soils are rehabilitated and have reached their climax in terms of organic matter content, no more additional carbon can be sequestrated. Nevertheless, a substantial potential can be inferred. A proper assessment of the potential to sequestrate carbon in degraded soils is thus needed. An increase in soil organic matter also has additional benefits such as reduced nutrients loss, improved soil structure and water infiltration, and reduced erosion risk.

Water storage: Concerning water issues, the most important on-site benefit mentioned in 88% of the SWC technologies was an increase in soil moisture. In 71% of all cases, improvement was rated as medium to high. A second water-related issue is that in one-third of the cases water drainage was improved. The functioning of SWC technologies is related to control of dispersed (in 60%) and concentrated (40%) runoff, increase of infiltration (60%), and as a result an increase in water stored in soil. One-fifth of the cases were explicitly declared as water harvesting technologies. Interestingly, reduced water loss from runoff and the importance of increasing water infiltration and storage in the soil were strongly perceived as leading to greater water use efficiency. The potential of reducing soil evaporation loss, especially in drier environments - where 40-70% of the rainfall can be lost - has been described in examples of conservation agriculture working with improved soil cover or minimum to no tillage practice.

The most striking water-related off- site benefits of SWC are that three-quarters of the case studies reported reduced downstream flooding and siltation, of which around half indicated a high to medium impact. 43% indicated reduced river pollution, and about one third indicated increased stream flow in the dry season. Given the growing water-related problems, all impacts mentioned are important for local as well as global discussions of how land use affects water resources. However, there are also a few off-site disadvantages; there was reduced river flow in 4 cases, although the impact was assessed as medium only in one case, and in the others it was low. The cases referred to a situation where terracing and additional irrigation and water harvesting structure reduced the flows (see also Hurni et al., 2005).

Desertification mitigation: Water and soil issues and the discussion about desertification are closely linked. Thus all of the reported cases address natural resource degradation. 45% are situated in semi-humid to arid environments, and contribute towards mitigation of desertification. Improvement of infiltration and reduction of runoff and evaporation are closely related to ground cover improvement, which was indicated in 70% of the cases. Soil cover, be it by vegetation or by dead material (e.g. crop residues, leaves), plays a key role in SLM, especially in the tropics and subtropics (Liniger and Thomas 1998).

Biodiversity conservation: Although biodiversity has not been a main focus of the WOCAT programme, 60% of the cases reported biodiversity enhancement. On cropland this is related

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to agro-biodiversity, and on grazing land it is linked with improvement of the vegetation (species composition). Again, ground cover improvement plays a key role. Additional modules related to biodiversity could be added to the WOCAT database.

Poverty alleviation: Medium to high increase in farm income was listed in 88% of the cases, showing the potential of increasing farm income. Two-thirds reported a medium to high increase. Most important was the cost/benefit analysis. For each technology described, the costs and benefits have been assessed, along with the judgement of the land users about whether the technology was beneficial in the short and long term. This allows detailed analysis and interpretation. In terms of poverty alleviation, SWC technologies with low investment and maintenance costs and short as well as long-term benefits might help small-scale subsistence land users. Several mainly agronomic and vegetative measures fulfil these criteria. For development projects, those SWC technologies with "high" initial investments and low maintenance costs but short-term benefits are also possible options. Through external inputs and investment, improvements in SWC could be made and maintained by the local community without additional external support.

Conclusions and outlook

WOCAT emphasizes the documentation, monitoring, evaluation and dissemination of SWC experiences that have potential value in other situations. Thus the WOCAT database is mainly derived from examples of sustainable land management (bright spots). This analysis suggests that issues of global relevance such as land degradation (including soil, water and vegetation) and climate change, and the achievements of the Millennium Development Goals (MDGs) are closely related to local conservation activities and achievements. The cases analysed show that improvements related to water quality, water availability and reservoir siltation, carbon sequestration, and mitigation of desertification and poverty, have been achieved. This paper presents only selected aspects, while much more can be derived from the WOCAT case studies.

In addition, the present analysis detected knowledge gaps, especially concerning quantification of the impacts of SWC and cost-benefit assessments, where most of the information is based on judgments and not on measurements. Research must help to address identified knowledge gaps. WOCAT experience shows that far too few efforts are being made in monitoring and evaluating the impacts of SWC with respect to the MDGs and sustainable development. Thus achievements, as well as the wealth of knowledge, are not being tapped and used as a basis for present and future SWC activities. The conclusion is that monitoring and evaluation, and dissemination of SWC, must be given a higher priority and conscious investments need to be made. This also relates to assessment of the spread of SWC activities and monitoring of the effectiveness of SWC as proposed by WOCAT mapping (van Lynden et al. 2002, WOCAT 2003).

In this context, there are two different aspects to strengthen. First is self-evaluation, which emanates simply from the process of collecting and analyzing the data required to complete a WOCAT questionnaire. The process actually enhances the capacity of individuals and institutions in both SWC technologies and approaches. What happens is that users find themselves challenged by various questions in QT and QA. What often starts out as a frustrating and time-consuming exercise develops into a learning process. The second element of evaluation, namely learning by comparing experiences, is a more straightforward concept. A

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large and growing global database can be compared with other experience, using WOCAT's database facilities (WOCAT CD-ROM and on-line at http://www.wocat.net).

There are basically three advantages of using the WOCAT tools. First, there is a comprehensive array of questions covering the most important aspects of SWC initiatives. Second, WOCAT provides a consistent methodology, which has been developed to fit the widest range of situations across the globe. Thirdly, this consistency means that SWC programmes have a platform not only to put their achievements in the "marketplace" that the databases provide, but to make comparative assessments at the same time. However, an identified bottleneck is the fact that sustainable land management is complex, involving all natural resources - water, soil, vegetation, animals, as well as the socio-economic environment. Not all factors can be monitored and evaluated: only a selection of indicators can be addressed.

The WOCAT national and regional initiatives, and the database, show the importance of SWC in mitigation of natural resource degradation worldwide and moving towards achievement of the MDGs. Further documentation, monitoring, evaluation and dissemination of SWC "bright spots," and the compilation of a global overview map, showing the major SWC achievements, have been initiated. Tools and methods have been developed and made available for use in national, regional and global programmes. WOCAT offers three levels (levels of detail) for the evaluation of SWC, from "Professional" (the most comprehensive) to "Basic" to "Light" (the simplest). More efforts and investments are needed in order to raise awareness, spread SWC technologies and approaches, and demonstrate the global impacts..

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