The Management of Soil Erosion Consortium (MSEC):
participatory and interdisciplinary approach to
research at a catchment scale

Le Consortium de Gestion de l'Erosion des Sols
(MSEC): une approche participative et
interdisciplinaire utilisant l'échelle du bassin versant

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Introduction
Several land degradation processes, of which soil erosion is one of the most important
(FAO 1990), threaten Asian soil resources. It has been estimated that some 35% of the
land in Asia is severely to moderately affected by water erosion. At the same time
growing population pressure will lead to an increased use of sloping lands in 2020
(Scherr and Yadav 1996). This situation was recognized many years ago. National
agricultural research systems (NARS), international agricultural research centers
(IARCs) and advanced research organizations (AROs) have conducted experimentation
and development work to conserve and improve the quality of land resources; these
include SANREM, FAO-ASOCON, ISRIC (GLASOD), WOCAT, as well as NGOs.
IBSRAM, through its ASIALAND-slopingland network was the first organization to
conduct adaptive soil-conservation research on a regional basis. Through a network of
seven countries in Southeast Asia, it tested soil conservation techniques such as mixed
cropping, alley cropping with shrubs or tree hedgerows, grass strips or agroforestry. But
although most of these technologies proved to be efficient in terms of soil conservation,
few were accepted by farmers, and hence really sustainable. The impact of farmers on
this research was limited.

The question of the management and conservation of the soil resource came
under scrutiny at the Rio Conference. During this gathering, it was first claimed that
natural resources were limited in quantity and fragile in quality. This led the CGIAR to
reconsider its commodity oriented programme to include elements of natural resource
management in its mandate, and resulted in the CGIAR soil, water, and nutrient
management programme: SWNM (Craswell and Latham 1998), that includes the
management of soil erosion consortium (MSEC) led by IBSRAM.

The need
The green revolution of the 1960s and 1970s was successful in increasing food
production to meet the demands of a rapidly growing population, and scientific
technological ability to modify the environment to create more optimal conditions for crops and livestock, than nature alone could offer (FAO 1996). However farming practices employed in many areas of Asia have become environmentally unsustainable, especially in the uplands where the rural poor have been by-passed by the green revolution. Soil erosion is a widespread problem. Coupled with continuing deforestation and urbanization, land degradation reduces the area of land suitable for cultivation and the quantity of water available for rural, industrial, and urban use. Ecologically effective erosion control techniques have not yet found widespread adoption because socio-economic factors were addressed insufficiently.

While significant amounts of soil loss on sloping lands were demonstrated in many cases, the resilience of the soils has been often strong enough to maintain crop yields for several years. As a result, it is sometimes difficult to convince farmers to invest in soil conservation (Latham 1995). At the same time, soil and nutrients lost in one place are trapped a little lower in the landscape (lowland rice farmers benefited for centuries from nutrients and organic matter generated by erosion), so that the economic balance at a catchment level is not necessarily negative (or positive). Under such contradictory evidence, it is understandable that some economists reject investments in soil conservation (Crosson 1994) while others demand more attention (Enters 1998) as extreme events may cause high economic off-site losses, and continuing erosion leads to irreversible loss of natural resources that are indispensable for agricultural production.

The establishment of the consortium
To address these concerns, the International Board for Soil Research and Management (IBSRAM) spearheaded the formation of the Management of Soil Erosion Consortium (MSEC) with institutions in and outside Asia to pool their resources, to adopt a common strategy to erosion and to provide practical recommendations to all stakeholders. Consortium members agreed on a project outline and phasing of activities that address the erosion problem in Asia through a series of catchment studies in China, Laos, Vietnam, Philippines, Indonesia, Nepal and Thailand (IBSRAM 1996). A meeting with ARO's was held to review specialist current methods (Penning de Vries et al. 1998).

Methodology
In previous erosion research, processes were studied without sufficient attention to the total system. Particularly, the facts that erosion and deposition may occur simultaneously in a catchment, and that erosion control should find its place within the context of the entire farming system, were often ignored, so that ineffective conservation recommendations were made. Historical and socioeconomic evidence suggests that farmers often respond to degradation by modifying their farming systems or practices through independent innovation or adoption of practices known elsewhere. But since conditions for farmers in upland parts of a catchment are unlike those in lowlands, their options for conservation measures are different (Turkelboom and Trebuil 1998). The most successful farmers may use high levels of chemical inputs, causing environmental problems (Scherr and Yadav 1996).

The approach taken by MSEC is to analyze the farming system first and to discuss farming options with farmers (Greenland 1998). Indigenous knowledge of soil conservation technology in each country must firstly be considered carefully. Secondly, off-site effects do not derive directly from on-site effects, so that soil gains and losses are
measured at 3-4 scales: plots (a few square meters), micro-catchments (a few hectares), meso-catchments (a few hundred hectares), and micro-watersheds (30-50 km²). Thirdly, working at the catchment level and in the farming-systems context means undertaking interdisciplinary, integrated research to solve a practical problem and not disciplinary issues (Latham 1998). No single discipline alone can undertake the research needed to understand these systems fully, and they need to be studied in an integrated manner with a problem-oriented approach. However, specific problems do arise in the systems context that are best solved through advanced (mono-disciplinary) research groups.

MSEC has ARO-members from France, Germany, Switzerland, Australia and the USA, and also members from other IARCs (IRRI, CIAT, ISRIC) that contribute their expertise. In this way, the consortium manages, in a unique manner, a range of disciplines and research from applied to fundamental research level, all directed towards understanding practical issues.

The purpose of MSEC is to explore how farmers and other land users can adopt sustainable land management practices. New technology will be useless unless one can convince them of the usefulness of a change of practice. A participatory approach with all stakeholders is therefore paramount for planning, development, implementation, and evaluation.

Because projects of this complexity cannot be designed from beginning to end, a project cycle of needs and resource assessment, research, implementation, monitoring, and evaluation (Figure 1) is anticipated to be followed during each phase of several years; different catchments may be in different stages at the same time.

Figure 1. The project development cycle
Socioeconomic and institutional aspects

Participatory rural appraisal techniques are used to learn about indigenous knowledge on land utilization and farming systems, to establish dialogue for collaboration with different stakeholders, and for development planning. These activities will strengthen the resource-use planning capacity of all stakeholders. This implies the following activities:

- Baseline socioeconomic studies of different groups of people in catchments (completed);
- Identify stakeholders: people, as well as GO/NGO agencies, and encourage their collaborative input;
- Acquire indigenous knowledge on cultivation practices, division of labour between men and women as well as between different ethnic groups (completed);
- Study the impacts on men and women of different ethnic groups, and attitudes of people towards change, for past catchment developments;
- Identify extension workers and organize training sessions or workshops on participatory methodologies for all stakeholders and involved agencies;
- Organize activities to obtain inputs of stakeholders into planning, implementation, monitoring and evaluation;
- Evaluate institutional and policy arrangements on resource-use management.

Biophysics

Our catchment approach considers fast and slow biophysical and socioeconomic processes and their interactions. This implies that mid to long-term (5-15 years) trials and monitoring are needed (IBSRAM 1997). Some of the catchments will be studied at a low level of detail (quantifying only output: water discharge, dissolved and suspended elements, bedload, that give information on on- and off-site effects), medium level (monitoring water and element inputs and outputs at the weirs of meso- and/or micro-catchments), and high level (also spatial variability in inputs and outputs, using micro-catchments and plot experiments). Activities include:

- Reviewing local knowledge of conservation methods (completed);
- Making a detailed biophysical inventory (GIS supported) of the catchments;
- Upgrading or establishing the equipment for monitoring water and element balances at meso-catchment, micro-catchment and plot levels, establishing meteorological stations, rain gauges, weirs with automatic water level recorder (WLR) and water sampler (AWS), suction cups and tensiometers, and time domain reflectometry (TDR);
- Quantifying the fate of biocides, where frequently used, and other pollutants (nitrate);
- After a two-year period of establishment of baseline knowledge, implementation of alternative land management practices within the catchments (one remains untouched as a control); and quantification of the on- and off-site effects observed;
- Establishing new models, or calibrating existing ones, for extrapolation to larger areas and in time, to develop specific management options to farmers and other decision-makers, and for training.
Implementation
A set of political, socioeconomic, and biophysical criteria for selection of catchments was developed in 1996, with all NARS involved. The methodology to be used was adopted at a consortium assembly in 1997. Selected catchment sites are found in natural forests, degraded forests, and under intensive agriculture using high levels of fertilizers and other chemical inputs, mixed farming systems, and degraded land covered with alang-alang. An international interdisciplinary team, complemented with national scientists, visited China, Indonesia, Philippines, Nepal, India, Thailand, and Vietnam, and reviewed the problems, the needs, and abilities in these countries. In another consultative meeting of the 16 NARS, final selection of the sites took place.

The case of Vietnam may serve as an example. The selected sites are in the Ngoc Thanh watershed in Ngoc Thanh village, Melinh District, Vinh Phuc Province, 70 km north of Hanoi. The watershed covers 35 km². More than half of the watershed belongs to the Forestry Department. There are five catchments in the watershed, two were selected by MSEC (I, II). Catchment I, of 400 ha, has two subcatchments on northeasterly exposed slopes that are relatively homogeneous. In the lower parts, farmers cultivate rice. There are permanent streams, and long-term meteorological data; the sites are close to the forest station. A specific objective is to investigate the environmental and socioeconomic consequences of forest management practices in comparison to more farmer-oriented land-use activities. The activities comprise:

- Identification of the boundaries of the catchment, and subcatchments
- Making biophysical and socioeconomic inventories of selected sites;
- Upgrading of the soil laboratory in Hanoi;
- Installation of equipment (automatic weather station near subcatchments, two rain gauges per subcatchment, rainwater collectors in the lower, middle, and upper slope positions, weirs on each tributary with sediment traps, WLR, AWS, etc.);
- Construction of a weir (at S1, Figure 1; 5-10 m cemented channel, >2 m wide); installation of a complete system (at S2) with three rain gauges, WLR at the bridge;
- Calibration of selected models (input/output) with 2 years of baseline knowledge;
- Introduction of improved land-use practices according to the participatory approach; quantification of the on-/off- site effects;
- Socioeconomic evaluation of alternative practices, cost/benefit analysis;
- Training in different disciplines for uses at different scales;
- Evaluation of the touristic potential and socioeconomic and biophysical effects
- Remote sensing for interpretation of land use.
Input/output is measured at weirs, as well as water quality and quantity at S1 and S2 (Figure 2). Catchment II, with two subcatchments, was re-forested 10 years ago from *Eucalyptus* to *Pinus caribacea*. The Forest Department planned to cut all pines in the year 2000 and to replant with *Pinus caribacea* again but agreed with MSEC to leave one subcatchment with pines, (which then will serve as the control treatment) and to replant another subcatchment with *Tectona grandis*. Additional activities in this catchment include:

- After two years, replacing half of the *Pinus* by *Tectona*;
- Quantification of on- and off-site effects of clear cutting, with emphasis on water quality;
- Socioeconomic evaluation and cost benefit analysis.

**Conclusion**

MSEC, part of a CGIAR system-wide ecoregional program and linked to the IRRI-led ecoregional program in Asia, comprises the first catchment-based research consortium and implementation program on land management in erosion-prone lands of the humid tropics. It integrates biophysical and socioeconomic sciences in an endeavour to find hard data on soil erosion in the humid tropics, and to identify practical solutions that are acceptable to the various users of the land. The purpose is not to stop soil erosion at all costs, but to find compromise solutions that will allow farmers to develop profitable farming opportunities while keeping the environment healthy. The studies allow MSEC to quantify the real economic cost of soil erosion and hence to indicate where it is prohibitive to any development and where it can be accommodated with a sustainable development approach. Together with all of the stakeholders, it will then be possible to look at more appropriate and implementable land-use policies. MSEC will serve the community if it can maintain the balance between creating a profitable agriculture sector in the hills and mountains and keeping a clean and friendly environment.
References
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Keywords: Asia, soil erosion, long-term experimentation, on and off site, catchment research, participatory approach, interdisciplinary approach
Mots clés: Asie, érosion du sol, expérimentation de longue durée, recherche par bassin versant, approche participative, approche interdisciplinaire