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INTEGRATED NATURAL RESOURCE MANAGEMENT

The Approach of the Soil, Water and Nutrient
Management Program



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1. Introduction

The 1998 CGIAR System Review has invigorated the debate on how research can become more integrative and encompass a more holistic understanding of agro-ecological systems. At the recent meeting of specialists in Natural Resource Management held in the Netherlands Sept 3-6, 1999, some principles of what should be included in natural resource management projects were developed (the Bilderberg consensus). There is a clear congruence between the conclusions of the Bilderberg group and the guiding principles developed as the basis for the program and approaches adopted by the four consortia of the CGIAR system-wide program on Soil, Water and Nutrient Management (SWNM). These principles are actively being tried and tested by these four consortia.

Here we reproduce for a wider audience, relevant sections, updated where necessary, of the TAC-approved SWNM submission to contribute to the ongoing debate on the role of the CGIAR and other international centers in research on Integrated Natural Resource Management (INRM). The SWNM program already represents a substantive contribution to INRM globally and utilizes a research paradigm and institutional framework on which an expanded INRM effort can be built.

2. Background and rationale of the SWNM program

It is an alarming reality that within 30 years, the world's population will rise to 7-8 billion people, and this will demand a doubling of food production. Agenda 21 and the 2020 Vision Initiative have expressed concern regarding the capacity of available production systems to satisfy the demands of this growing population for food and other agricultural commodities, particularly without accelerating natural resource degradation.

A specific call was made in Agenda 21 to improve the knowledge base for sustainable production, including an ability

to improve long-term predictions and build scientific capacity (Chapter 35). The agenda emphasizes a need to determine research priorities at the national, regional and global levels. Chapter 14 requests a coherent policy framework for sustainable agriculture and rural development (including policy advice).

Land available for expansion of agricultural area is limited to a few parts of South America and Africa, where the production potential has been proven, but current output is marginal due to inherent soil constraints, rapid nutrient depletion and mismanagement. Production increases from fertile lands have been reported to be declining. Both marginal and fertile lands are currently undergoing varying degrees of degradation, including nutrient depletion, soil acidification, soil erosion, and reduction of soil water retention. As a result, water is becoming contaminated and scarce in some areas.

International studies estimate that nearly a quarter of the world's agricultural, pasture and forest land has been degraded since the mid-1900's. The application of fertilizers is generally insufficient to reverse the degradation process. Rather, soil quality, fertility and water supplies need to be managed effectively, conserved through husbandry of natural resources, and through land-improving investments. Effective soil, water and nutrient management (SWNM) requires action not only at the farm level, but also at community, regional and national levels.

Rationale for a SWNM Program

The Greenland Report and the TAC study on Priorities and Strategies for Soil and Water Aspects of Natural Resource Management Research in the CGIAR conclude that to promote more widespread use of sustainable SWNM management systems requires a change in the research approach. In past research, there has often been inadequate understanding of the socioeconomic and policy factors influencing land degradation and improvement. Research on SWNM has been fragmented,

with little coordination at the regional, national and international levels.

The 2020 Initiative international workshop on Land Degradation (April 1995), emphasized the need for new research which would permit the synthesis of critical technical, institutional and policy action to achieve a real impact on land degradation problems in the most critical areas. The workshop participants called for better assessment of the scale and relative importance of degradation problems from production, human welfare and environment perspectives, as well as technology development with farmers and users, institutional innovations, and policy action.

Hence, the present SWNM program is adopting a research approach explicitly designed for impact. Research principles, drawn from the Greenland report, the TAC Soil and Water Report, and the CGIAR ecoregional approaches, include:

- use of participatory, community-based research, involving farm families in project development and evaluation;
- a focus on policy and institutional issues which influence farmer and community decisions;
- explicit consideration of equity concerns in research planning and implementation, including gender analysis and gender-specific approaches;
- interdisciplinary research design, implementation and evaluation, incorporating ecological perspectives;
- a focus on a range of scales from landscape to plot, to achieve a comprehensive understanding of the interaction between people, land and water in the landscape, including on-site and off-site linkages;
- utilization of the full research and development continuum, linking strategic, applied and adaptive research, testing and dissemination, based on identified needs and constraints of farmers;

- reliance on both indigenous and innovative scientific knowledge;
- linkage between production increases and natural resource conservation in land-use system development.

These research principles call for a new organizational approach. This must first ensure that the whole range of stakeholders, including land users, community organizations, development actors, researchers and policy makers, is involved in the generation and promotion of improved land-use practices. Secondly, the approach must generate synergies and efficiencies from the involvement of multiple partners, making use of existing national, regional and international capacities and their comparative advantages.

This approach is being adopted by four consortia working in priority areas of land degradation: managing soil erosion, acid soils, soil nutrients and soil water. The organizational approach and the new research principles have been further developed and refined by the consortia, for eventual application to other important land degradation issues such as salinisation, wind erosion in rangelands, pollution in peri-urban areas and soil fertility and yield decline in intensive agriculture.

Policy issues

As indicated in the objectives and research approach, the SWNM program highlights the importance of a supportive policy environment in achieving widespread use of sustainable land management systems. IFPRI is a partner in the Program, and many other national partners will be tapped to develop policy research activities and to promote national and international policy dialogue about land degradation.

During 1996, specific policy research was initiated by the Nutrient Depletion consortium working in East Africa, on nutrient markets and community resource management decisions, and planning began for policy research by the Soil Erosion consortium in southeast Asia. Inter-consortium policy research and dialogue activities have been initiated via

cooperation between IFPRI and the CNDC consortium in Eastern Africa in March 1999 under two BMZ-funded projects. A methodology was developed during 1996-97 for systematic and comparative assessment of the scale and relative importance of different types of degradation, from a policy perspective, which could be implemented jointly by the SWNM and/or ecoregional programs.

3. Program Evolution

The SWNM program derives from the IBSRAM position paper (Greenland et al 1994), which calls for seven high-priority areas namely:

- land and water management in the:
- mountainous areas and steplands,
 - desert margins,
 - irrigated areas,
 - management of acid soils,
- factor productivity in wetlands,
- integrated inorganic/organic farming methods for savannas, and
- alternatives to shifting cultivation for humid forests.

Considering that this last priority is addressed by the system wide initiative on alternatives to slash and burn, the Zschortau plan (1994) decided that the SWNM activities could initially focus on four themes, namely:

- combating nutrient depletion,
- managing acid soils,
- managing soil erosion, and
- maximizing soil water use.

These priorities were subsequently confirmed by the Center Directors Committee at ICW94 and the development of an implementation plan was assigned to CIAT and IBSRAM at a meeting in Rome (December 1994). An SWNM proposal was prepared in May 1995 at Feldafing. It called for a regional initiation of activity on these four themes through consortia, led by IARC and NARS with relevant mandates and expertise as follows:

- Eastern and Western African subhumid savannas for the nutrient depletion theme (IFDC, TSBF, KARI)
- humid savannas of Latin America for the acid soils theme (CIAT, EMBRAPA)
- stepland and mountainous areas of South East Asia for the soil erosion theme (IBSRAM, CSAR)
- semi arid subsaharan Africa and West Asia and Northern Africa for the soil water use theme (ICARDA, ICRISAT, IER)

The rationale for these choices included the need to start where multi-institutional capacities existed and where the likelihood for success and rapid impact was greatest and then to extend these themes globally. Regional SWNM linkages of these consortia could then be developed according to the needs of the ecoregional programs. Other priority areas such as irrigated and wetland areas could be addressed at a later time. In its July 1995 meeting, TAC67 approved the Feldafing proposal and recommended a budget of \$900,000, mainly for project development and initiation. At the same time TAC stressed the need for close links between the SWNM and the relevant ecoregional programs, further elaboration on the interrelationships amongst the consortia and an in-depth articulation of theme 4 on optimizing soil water use. Since then a meeting of convenors was held in Washington October 31, 1995 during ICW95 to discuss further elaboration of the program. Each consortium has subsequently held further consultation meetings with all participants and especially NARS representatives to develop further the specific themes and workplans which were presented at the Rome Feb 21-23, 1996

meeting. Consortia projects have been running since 1996/97 and progress reports have been made to the CGIAR and investors at the annual Mid-Term meetings in Cairo (1997), Brasilia (1998) and Beijing (1999).

The Consortia of the SWNM program

In the context of the SWNM program, a consortium is understood to be an open collaborative gathering of research groups working on a common program, problem or theme, in line with the agreed CGIAR research agenda. The membership is open to researchers from within and outside the CG system including NARS, IARCs, ARO's and NGO's.

During the Feldafing meeting, four consortia proposals were developed around prioritized themes. They built on prior and existing programs and therefore provide a way to strengthen ongoing activities, adding value to them. At this stage it may be worth pointing out that the establishment of these consortia has followed somewhat different paths according to the subject matter involved and the ecoregional setup. For example the combating nutrient depletion and optimizing soil water use consortia appear more as specific expert groups based on subject matters whereas the consortia on managing soil erosion and managing acid soils address management systems. The four consortia are briefly described below:

i. *Combating Nutrient Depletion*

This theme deals with innovative approaches to arrest nutrient depletion and improve the availability and efficiency of nutrient use, including nutrient replenishment. It is designed to develop integrated nutrient management practices, policy guidelines, and pathways for adoption. This theme will initially focus on two different ecoregions in East and West Africa, working within the framework of the East African Highland ecoregional program convened by ICRAF and the Ecoregional program for Humid and Sub-humid Tropics of Sub-Saharan Africa convened by IITA.

The consortium is convened by TSBF, IFDC, Institute for Agricultural Research (IAR Nigeria) and Kenya Agricultural Research Institute. The consortium addresses the critical problem of nutrient depletion through two innovative approaches: recapitalization of nutrient stocks and the improvement of nutrient use efficiency through the combined management of organic and inorganic nutrient sources.

ii. *Managing acid soils (MAS)/Manejo Integrado de Suelos (MIS)*

This theme dealt initially with the recuperation and replacement of degraded acid soils of the tropics by productivity-enhancing and resource-conserving agropastoral and/or silvoagropastoral systems. The consortium built around this theme was initially convened by CIAT and EMBRAPA (Brazil). It identified the driving forces behind land use change, indicators for the successful transformation of these areas and defined successful prototype systems or components and technologies for the prudent management of acid soils. It operated initially within the Tropical Latin American Lowlands convened by CIAT. The first MAS project was completed in May 1999 and in August 1999 a new consortium named MIS (manejo integrado de suelos) was established for Central America.

iii. *Managing soil erosion*

This theme tackles on-site and off-site effects of soil erosion and nutrient depletion within catchment studies. The consortium built around this theme is convened by IBSRAM and CSAR. The consortium aims to harmonize existing research activities and to develop management practices to minimize soil erosion which are acceptable to land users. It is linked with the IRRI-led ecoregional program on humid and subhumid tropical Asia. The key elements in this consortium are the focus on the off-site impacts, the emphasis on community involvement, and the provision of scientifically sound data for decision making.

iv. *Optimizing soil water use*

This theme aims to maximize crop-available soil moisture derived from rainfall, through integrated soil-crop-water

management strategies. The planned research builds on existing scientific knowledge and indigenous practices of soil and water conservation and management. The consortium is jointly convened by ICARDA, ICRISAT and IER (Mali), and is closely linked with the Desert Margins Initiative in SSA (ICRISAT), the Water Husbandry Initiative in WANA (ICARDA), and the Systemwide Initiative on Water Management (IWMI). A key element in this consortium is the exchange of scientific and indigenous knowledge and technologies between countries and regions (WANA & SSA), in the framework of extrapolation domains defined on the basis of socioeconomic and biophysical factors.

4. Program Overview

The coordinated efforts of the SWNM program contribute to the following, goal, objectives and outputs using a collaborative approach with advantages over the traditional, but somewhat fragmented approach.

Program goal:

The goals of the SWNM program are to:

- increase long term agricultural productivity,
- reduce human poverty,
- conserve and enhance land and water resources.

Program objectives

The program will achieve the following objectives:

- effective, efficient and environmentally sound technologies and systems for land management and conservation developed and made available to farmers and other users;
- community-based new institutional mechanisms developed, tested and promoted, which encourage the use of sustainable SWNM technologies;

- partnerships and capacity of all stakeholders of the ecoregional program (NARS, NGO's, ARC's, and ARO's) enhanced in order to plan and implement research and dissemination programs for sustainable land management systems;
- workable policy options and advice, including issues concerning equity (gender, resource access, tenure) developed and promoted.

Generic outputs:

The corresponding generic outputs linked to program objectives are:

- economically viable, socially acceptable and environmentally sound technologies for SWNM,
- improved methodologies and diagnostic tools for participatory SWNM research,
- improved indicators for sustainable and unsustainable land use systems which monitor environmental and economic impacts,
- easily accessible decision support systems (models, expert systems, GIS, global data bases etc.) for generating, testing, and extrapolating SWNM options,
- better trained human resources capable of implementing SWNM programs and policies,
- effective framework for full cooperation and partnership between stakeholder groups,
- appropriate policy dialogues that promote sustainable SWNM practices in place,
- effective mechanisms for information exchange.

Advantages of the program

By initiating the global SWNM Program, as detailed in this document the following advantages are being added to the ecoregional programs of the IARCs:

- providing a linkage for focused research on SWNM at benchmark sites within the ecoregional programs and regions,
- addressing priority SWNM problems in selected ecoregions, the results of which will have significance for extrapolation and adoption in similar ecoregions,
- increasing the efficiency of the research system through effective collaboration between NARS, IARC's, and ARO's, and through capacity building in NARS,
- avoiding duplication of research and promoting efficiency in technology generation,
- focusing a critical mass of scientists in resource management disciplines by facilitating interaction and communication,
- accelerating the rate of scientific advance through shared experiences, common methods, databases and models across regions,
- utilizing holistic approaches to SWNM issues to strengthen the research projects already in place in the various ecoregions,
- adding activity where there are identified gaps and increasing the global SWNM knowledge for decision making in natural resource management.

Inter-Consortia Collaboration

Benefits of a global program accrue from simultaneous and coordinated work by all consortia on high priority, cross-cutting issues. The consortia are working together on such issues as:

- collection and development of common data sets
- development and use of participatory research methods
- standardization of approaches for site selection, characterization, monitoring and evaluation

- delineation of resource management domains
- improvement and application of analytical models, decision support systems, and sustainability indicators
- appropriate policies and institutional capacity supporting the development and use of improved soil, water, and nutrient management systems
- widespread information dissemination and exchange
- establishment of long-term experiments for resource management studies

5. Integration of SWNM Activities with Ecoregional and Other Global Programs

SWNM consortia and ecoregional programs are collaborating closely through shared benchmark areas and sites, joint activities and linked planning mechanisms. The SWNM consortia will provide thematic leadership and technical support for soil, water and nutrient management research of ecoregional programs operating in African, Asia and Latin America. Decisions on SWNM research program will as far as possible be based on consultation between ecoregional programs and SWNM consortia. Linked planning mechanisms have been established to:

- develop consensus on priorities
- prepare joint proposals for multi- and bilateral funding
- organize joint activities based on comparative advantage of institutions, ecoregional programs and SWNM consortia
- harmonize methodological approaches

Where appropriate, the SWNM consortia have forged planning and implementation linkages with other global programs and initiatives.

6. Program Coordination/Governance

Each of the four consortia operates under a set of common principles of governance.

Participation is open to all interested partners who are currently involved in research and development activities relevant to the goals of the SWNMP and who are willing to commit resources for this purpose. Where appropriate working groups have been formed including all participants at the research study area level. The number of such working groups varies with each consortium. Each NARS may in addition elect an in-country committee and a national coordinator.

- 1) *All consortia have a steering committee consisting of representatives of the participants (NARS, NGO's, user groups, IARC's and ARO's).*

Functions of the Consortia Steering Committee:

- Develops the project workplans and activities
- Allocates responsibilities
- Agrees on resource allocations
- Reviews and monitors activities and results
- Assesses requirements for training and information exchange
- Selects chairperson who will serve on a rotational basis
- Selects consortium secretariat
- Forms working groups (site or theme-based)

The secretariat is responsible for coordination activities:

- Organizing meetings, bulletins/newsletters, literature reviews, budgetary reports
- Ensures evaluation and monitoring of activities/progress of consortium

- Coordinates preparation of reports for the Steering Committee
- Serves as liaison officer between research sites and groups
- Liaises with other relevant research and development organizations

2) *Global coordination*

The global steering committee consists of the consortia convenors and co-convenors and ecoregional program leaders. Donor representatives and specialists from ARO's can participate as observers/resource persons as required.

Functions of the global Steering Committee include:

- Assure harmonization of activities across different consortia and ecoregions through the formation of across theme working groups.
- Evaluate progress of the Program
- Provide central governance for the Program
- Identifies common training and information requirements
- Approves consortia workplans/activities and budgets
- Design focal points for cross cutting initiatives and working groups
- Organize mechanisms for monitoring Program progress including external reviews

7. Conclusions

The SWNN program already fulfills the criteria for INRM projects outlined in the Bilderberg consensus (1999) and is actively seeking further opportunities to link with other institutions and projects. Our experiences and lessons learned to date contribute significantly to the efforts to integrate the work of the

international research community in areas such as remote sensing and spatial modeling, social organization and social capital, analysis tools and decision support systems, knowledge management and indicators of system performance. Benefits flow also from collaboration with other system-wide programs, particularly the program on participatory research and with ecoregional programs. Our main area of focus remains the soil and its interaction with atmosphere, water and people.

Acronyms

ARO	Advanced Research Organization
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung
CGIAR	Consultative Group for International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CSAR	Center for Soil and Agroclimate Research
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária, Brazil
IAR	Institute of Agricultural Research (Nigeria)
IARC	International Agricultural Research Center
IBSRAM	International Board for Soils Research and Management
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IER	Institut d'Économie Rurale, Mali
IFDC	International Fertilizer Development Center
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
INRM	Integrated Natural Resource Management
KARI	Kenya Agricultural Research Institute
MAS	Managing Acid Soils
MIS	Manejo Integrado de Suelos (Integrated Soil Management)
NARS	National Agricultural Research Systems
NGO	Non-Governmental Organization
TAC	Technical Advisory Committee
TSBF	Tropical Soil Biology and Fertility Programme