The ASIALAND Network on Sloping Land Management: Evolution from Plot-scale Experiments to a Community-based Development Program

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Abstract

In addressing soil erosion and its adverse effects, the ASIALAND sloping land network has implemented research and development activities in seven Asian countries since 1988. Starting with plot-scale experiments to generate and validate soil conservation practices, the network progressed to conducting research at the farmers' field level and eventually moved on to technology promotion in targeted upland farming communities. The network's step-wise approach in finding solutions to land degradation produced promising conservation practices and valuable lessons in transferring these technologies for adoption by farmers.

Among the technologies validated, the alley cropping system showed great potential in preventing soil erosion and providing farmers with economic benefits. Lessons learned from the on-farm research of the network identified issues and constraints of farmers in adopting technologies and proposed a number of strategies to enhance farmers' awareness and participation. The network has also developed and advocated the Conservation Farming Village (CFV) approach to disseminating practices and technologies on sustainable land management.

Hinged on its research outputs, the network widens its coverage in promoting conservation practices and technologies by scaling up activities in sloping land communities through the establishment of linkages with government agencies and non-government organizations and conducting joint on-farm trials with farmers. The ASIALAND network has likewise embarked on upgrading its methodology of assessing soil erosion by shifting its research paradigm from plot-scale to catchment-based studies. This innovative approach to sloping land management will definitely complement the network's thrust of moving upland farming communities towards sustainable agriculture.

The ASIALAND Network

The Management of Sloping Lands for Sustainable Agriculture in Asia Network, or the ASIALAND sloping land network, as it is commonly known, was the pioneering network of the International Board for Soil Research and Management (IBSRAM). It was established in late 1988 with the aim of conserving soil resources in the region through the research and

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application of appropriate land management technologies to achieve sustainable agriculture on sloping lands. The network is now under the auspices of the International Water Management Institute (IWMI) and its Southeast Asia Regional Office in Bangkok, Thailand.

To fulfill its objective, the ASIALAND network established plot-scale experiments on soil conservation technologies in partnership with national agencies in seven Asian countries, namely China, Indonesia, Lao PDR, Malaysia, the Philippines, Thailand, and Vietnam. The network has gone through four major phases – technology validation, revalidation, on–farm research, and technology promotion. During the initial years of Phase I, funding support for the network was provided by the Asian Development Bank (ADB), the International Development Research Center (IDRC), and the Swiss Agency for Development Cooperation (SDC). From then until the present phase, SDC has continued to support the operations of the network. The governments of network member-countries have also provided local counterpart resources for the project.

While different levels and nature of accomplishment characterize each of the four phases of the network, the general sentiment of the participating countries is that the project's impact could be more visibly and substantially felt if efforts and activities are scaled up to reach not only individual farmers but also entire upland farming communities. The fifth and current phase of the network has thus been implemented. This paper presents a general outlook on the results of the first four phases and relates them to the network's current development thrust. The network, incidentally, is working out an arrangement to interface with another IWMI network, the Management of Soil Erosion Consortium (MSEC). MSEC focuses on soil erosion management at the catchment scale. Lessons learned from both networks could provide the needed catalyst to effect this collaboration.

Overview of Network Phases

Phase I: Technology Validation

Phase I of the network was implemented from 1988 to 1991 with the aim of identifying appropriate technologies for sloping land agriculture. Different soil conservation technologies were tested against the farmers' practice, which is characterized by up-and-down the slope tillage and no conservation measures (Table 1). Comparison of these technologies with the farmers' practice, in terms of soil and nutrient loss and crop yield, was carried out in plot experiments with varying slopes and plot sizes (Figure 1).

Phase II. Technology Revalidation

In Phase II, the network moved on to revalidating the promising results of Phase I. Two main activities were included in this phase – the continuation of the research activities of Phase I (long-term research) and the establishment of development research sites. The development research sites were essentially larger scales of the experimental plots designed for technology demonstration and training (Figure 2). Activities for this phase were carried out from 1992 to 1994.

Table 1. Different soil conservation technologies validated by network-member-countries

China	Alley cropping using *Tephrosia candida* and *Coronilla varia* hedgerows; hHillside ditches and aAgroforestry using *Eucalyptus*
Indonesia	Alley cropping using *Flemingia congesta* hedgerows; cCover cropping using *Mucuna munaneae*; and cCrop residue management
Lao PDR	Agroforestry using teak; sStrip cropping with upland rice and soybean; aAlley cropping using vetiver and mango as hedgerows; and hHillside ditches
Malaysia	Legume cover; rRubber intercropped with annual and perennial crops
Philippines	Alley cropping using *Gliricidia*, napier, banana, sapodilla, cashew as hedgerow crops
Thailand	Alley cropping using pigeon pea, *Leucaena*, congo grass, Bahia grass, and coffee as hedgerow species; hHillside ditches; and aAgroforestry with coffee and mango
Vietnam	Alley cropping using *Tephrosia candida*, aAcacia and pineapples as hedgerows

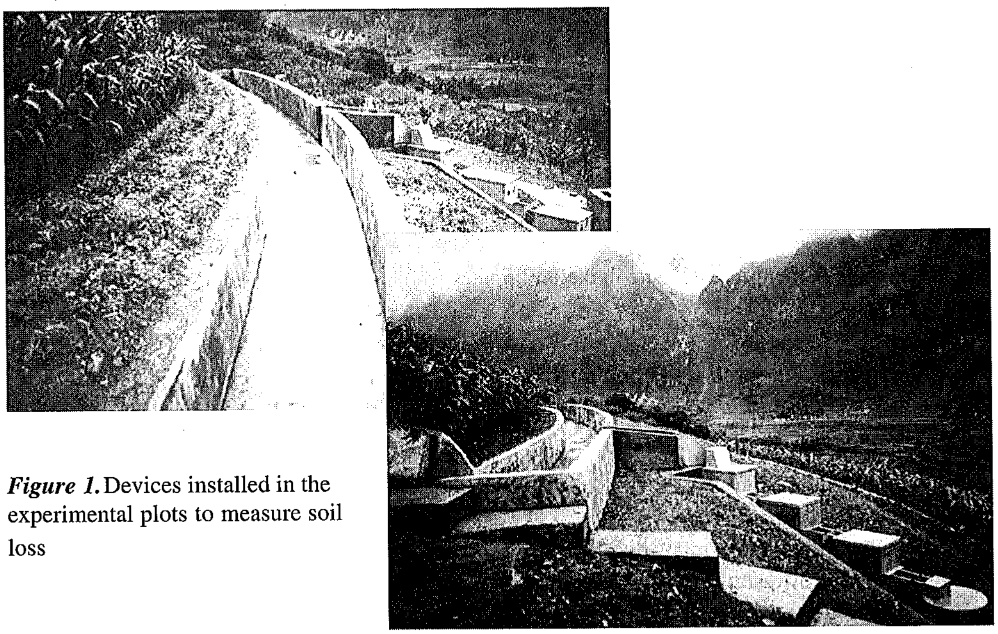

Figure 1. Devices installed in the experimental plots to measure soil loss

Phase III: On-farm Research

Phase III, which was implemented from 1995 to 1997, focused on on-farm research. This served as a transition stage from research to extension or from technology validation to technology promotion. Validated technologies in the two earlier phases, which showed sustainability and economic potential, were introduced and tested in the farmers' fields. However, instead of researchers doing the experiments, they acted as facilitators while farmers conducted the research. In the on-farm research, socio-economic information took precedence over biophysical data so that farmers' attitudes, perceptions, and feedback were used to assess reasons for the adoption or non-adoption of technologies. Long-term research sites were discontinued in some countries, while others continued them for sustainability studies.

Figure 2. Development research site in the Philippines which serves as a venue for training and demonstration

The on-farm research was conducted with the following general guidelines:

1. Principles and procedures for farming-systems research were followed, focusing on land management practices for sustainable land use.
2. Implementation was carried out at new sites following the network's guidelines for site selection.
3. Each member-country had at least 10 farmer-cooperators per site. Each farmer-cooperator tested a set of technologies according to his choice with a plot size of at least 1,000 m^2. Farms of non-cooperating farmers served as control plots.
4. The research team included extension personnel and social scientists or farming systems research specialists.

Phase IV. Technology Promotion

In its fourth phase (1998-2001), the ASIALAND network shifted to technology dissemination from its purely research activities. While notable observations and important lessons were obtained from the on-farm research phase, the adoption of soil conservation technologies among farmers still remained low, with the number of adopters being limited to the farmer-cooperators.

Phase IV therefore was implemented with three objectives: (1) to develop appropriate approaches for technology promotion, (2) to ensure technical soundness of the technologies in line with farmers' needs and preferences, and (3) to make sure that necessary support and policies from governments were instituted.

Results and Lessons Learned

Research Findings from Phases I and II

In general, the results of the experimental plots showed that the soil conservation technologies were advantageous over the farmers' practices (IBSRAM, 1993, 1995, 1995a). Soil and nutrient losses decreased with the application of conservation measures, while crop yields were enhanced through soil conservation, crop residue management, and soil fertility management. Simple cost and return analysis likewise proved the viability and productivity of soil conservation technologies.

Although, soil loss is affected by slope, rainfall, soil type, vegetation, and human activities, plot experiments show that soil conservation practices (i.e. alley cropping, hillside ditches, and grass barriers) reduced the amount of soil loss significantly when compared with the farmers' practices. Cumulative soil loss under farmers' practices reached amounts up to as much as 536.7 t ha^{-1}. Soil loss in plots with conservation measures was reduced to as low as 0.3 t ha^{-1}. As a direct consequence, nutrient losses were also higher under farmers' practices.

Crop yields in soil conservation technology plots were comparable, if not higher than those obtained from farmers' practice plots, particularly when nutritional deficiency and soil acidity were corrected. Yields in farmers' practice plots are expected to decline over time as the organic-rich surface soil is continuously eroded.

Simple cost and return analysis showed that farmers can gain favorable economic returns if soil conservation technologies are practiced. This is especially true if alley cropping is used. Fruit-bearing plants like banana as part of the hedgerow system give very high economic returns and are a source of steady and regular income for farmers.

Based on the results of six years of testing and verification, soil conservation technologies validated by the network member-countries appear to be ready for dissemination. Technology-wise, however, there is a need to look into the sustainability of these technologies from the agronomic, environmental, and economic standpoints. Another ingredient that is missing is the farmers' input. If these technologies are to be extensively promoted, farmers' responses should be taken well into consideration.

Lessons Learned from Phases III and IV

During Phase III, farmers tested soil conservation technologies that were validated in the two earlier phases. Highlights of the on-farm research include:

- More farmers have become aware of soil erosion problems and have become quite receptive towards soil conservation technologies.
- Alley cropping received more attention from farmers, compared to other technologies, in all network member-countries, mainly because of the high economic returns and steady income obtained from fruit tree components of the system.
- Distance between hedgerows has become quite an issue for farmers since hedgerows take up considerable space for planting. Widening the alleyway was considered, depending on the slope of the farm.
- In some member-countries, farmers have formed cooperatives to address marketing problems.

- Subsidies for farmers, in terms of the provision of planting materials, were seen as important and necessary in technology transfer activities, especially when working with resource-poor farmers. However, subsidies should be properly managed to avoid farmers' dependency.
- In long-term research sites, under the alley cropping system, the slope strength of experimental plots has been weakened due to the formation of terraces. Economic analysis also continued to show the advantage of soil conservation technologies over the farmers' practices.

In Phase IV, with the encouraging results of Phase III, the network commenced a full-blown extension program, focusing on appropriate approaches, technologies, and support services. The following highlights relate to the outputs *vis à vis* the identified objectives.

The primary approach that was used to enhance the adoption of sustainable land management (SLM) technologies was the establishment and development of conservation farming villages (CFVs) or upland farming communities. In most member-countries, the on-farm research sites were continued and farmer-cooperators were mobilized through the conduct of various training events, field days, and cross-farm visits. Embedded in the CFV approach was the setting up of information centers and training shelters at the village level. Information packages on sloping land technologies were made available to various users, but particularly to farmers in these information centers. At the same time, formal workshops and seminars on the participatory approach, communication skills, and related topics were held to build up the capacity of extension workers and researchers.

The CFV, as a modality for technology promotion, has increased farmers' awareness and appreciation of SLM technologies. This approach has produced a sense of belonging among farmers, which in turn has given farmers a high level of confidence and trust in their own capabilities to manage their natural resources. Likewise at the village level, the CFV has given more prominent roles to local government units in handling issues related to SLM.

In addressing the second objective, the network wanted to know how to make the technologies more attractive to the farmers with due consideration to local situations and conditions. Informal meetings with farmers and farmer groups were conducted to obtain responses and feedback. A socio-economic survey was also employed to evaluate the key constraints and opportunities of farmers. The decision support system for sustainable land management (DSS-SLM) of IBSRAM was likewise used to assess the technologies using sustainable agricultural indicators. In some countries, short-term, collaborative studies were carried out to identify other knowledge and technology gaps. When necessary, changes or modifications to the technologies were made.

The results of these activities showed that farmers recognized soil erosion as a factor that negatively affects crop production and sustainability. However, they were more concerned with the other pressing needs of their households. In some countries, there was a predicament where younger members of farming families were no longer interested in farming because they were more attracted to off-farm opportunities. Farmers with smaller farms and who lack security of land tenure were less likely to invest in soil conservation. Addressing the immediate needs of farmers through the introduction of short-term cash crops was a plus factor in adoption. Farmers' crop preferences varied depending on the needs and availability of marketing infrastructures. Sustainability-wise, technology adopters were better off than non-adopters.

The third objective focused on harnessing the support of government agencies, planning organizations, and policy-makers to actively support soil conservation. It was shown that in all countries, senior and mid-level policy-makers were adequately informed, which resulted in various concrete actions. Policy recommendations related to SLM have been proposed and collaborative projects with various national programs have been initiated. The support of local government units and related institutions has been formalized.

Overall, hundreds of people in member-countries have been reached and they have become actively involved in promoting SLM on sloping lands. In most countries, there has been a strong and successful emphasis on farmers but the impact of the SLM technologies on the community as a whole is still undetermined. The integration of livelihood and natural resources conservation may well be the link to produce a tangible impact at the community level.

Cross-country Studies

Several studies on various topics related to the research activities of the network were conducted using data obtained from the plot-scale experiments. Results of these studies were valuable in focusing and redirecting the network's research activities. Major findings were also used as a basis for technology adjustments and support for technology dissemination (Francisco, 1998; IBSRAM, 1999; Penning de Vries, 2002). Some of the results are given below:

- In a study on the economics of soil conservation in selected network countries, data showed that the adoption of soil conservation measures effectively reduced soil loss. However, there were differences in effectiveness among soil conservation measures in reducing soil loss. The study also showed that profitability of the validated technologies depended on the kinds of hedgerows and labor cost requirements. The on-site cost of soil erosion is the negative impact on crop productivity, while off-site cost constitutes high estimates in repairing damages due to sedimentation.
- In investment analysis, findings confirmed that alley cropping is beneficial for farmers because of the returns from alley and hedgerow crops and the reduction of nutrient losses due to erosion. Investment in establishing alley cropping has also been found to be financially viable in most network countries.
- The erosion model, GUEST, or Griffith University Erosion System Template, which was used to predict soil loss showed that soil erodibility in selected sites decreased over time. This indicates the positive effects of conservation practices on soil conditions.
- Results of the analysis on residue management, as a component of the alley cropping system, point to its positive effect on soil conservation by enhancing and maintaining soil organic matter content. Crop residue management is highly recommended as soils are heavily depleted of organic matter through soil erosion.

Impact of the Network

One of the objectives of the ASIALAND network is to strengthen the capability and competence of the National Agricultural Research and Extension System (NARES) in member-countries with regard to their ability to conduct adaptive research. This was accomplished mainly via training events, workshops, and national and international meetings. Network annual meetings provided participants with venues for information exchange on research results and country situations. Network partners have likewise received training on various topics such as socio-economic survey, information services and dissemination, modelling and GIS, and economic valuation, among others.

The network's impact on its partner organizations and countries is most evident in the way these partners have reoriented their research priorities and funding allocation towards SLM. Most member-countries have also integrated SLM in national policies and guidelines. The network has given its partners more opportunities to participate in regional and global research (Maglinao, 1998).

Through the outputs of the network, other international centers have adopted the Framework for the Evaluation of Sustainable Land Management (FESLM) and the soil, water, and nutrient management (SWNM) concepts through a participatory research paradigm and network and consortium approaches. Donor awareness and support for SLM has likewise increased.

The adoption of SLM technologies among farmers has also increased. Benefits from the technologies, in turn, have given farmers greater incentives to sustain their adoption.

Through the networking arrangement, a closer partnership among developing countries has been established. The development of concepts and tools provides a wider application of SLM technologies. The network has enabled the NARES not only to tackle major soil constraints to food production but also to undertake and strengthen their own research, utilizing operating funds from donors.

Reaching More Upland Farming Communities

Recommendations of the External Panel

During the latter part of Phase IV, SDC commissioned a panel of evaluators to review the accomplishments of the network and make recommendations for the implementation of Phase V. The panel gave the following recommendations:

- Strengthen the existing research-extension cooperation to include partners from non-government organizations.
- Move towards training of trainers rather than direct training of extension workers.
- Conduct a complete policy research and socio-economic study on the use of incentives.
- Assist the NARES in analyzing scientific results including their publication in view of individual scientific papers.

Goal, Objectives, and Strategies of Phase V

The goal of Phase V is to promote the widespread adoption of SLM technologies and practices in sloping areas in participating countries. With the lessons gained from Phases I to IV, the network intends to target communities in sloping lands, thereby reaching more farmers. The network-members have agreed to accomplish this through: (1) enhancing collaboration with other national agencies with emphasis on research and extension linkages, (2) strengthening the role of local government units and forging partnership with non-government organizations, (3) increasing farmers' involvement through joint on-farm experimentation, and (4) strengthening the NARES capacity in undertaking participatory research and information dissemination.

In the current phase, the network highlights the following:

- Emphasis on modalities and approaches to technology dissemination.
- Adoption of multi-sectoral and multi-disciplinary methodologies in research, development, and extension.
- Focusing on integrated farming systems rather than on soil conservation alone.
- Addressing the economic constraints of farmers through entrepreneurship and livelihoods.

Initial Results (January to October 2002)

Since the start of Phase V at the beginning of 2002, the network members have already learned a number of valuable lessons (NSC, 2002). These include:

- Site selection of pilot sites in establishing CFVs for the introduction of improved sloping/upland conservation and management technologies is very important. The pilot CFV has to represent the farming systems, physio-biological, and socio-economic conditions in the local areas. It could serve as a core or nucleus village for learning and disseminating identified and verified technologies to the surrounding villages.
- The target group of farmers in the pilot CFV is also very important. To better promote the widespread adoption of sloping/upland conservation measures by the farmers, they should form an integral part of their farming systems. This is achieved using participatory and community-based approaches. Farmers' groups or farmers' organizations, not individual farmers as in the previous phases, are addressed. The volunteer farmers should represent diversified farmers in the village to enhance wide acceptance.
- If the introduced sloping/upland conservation practices fit the farmers' circumstances and conditions, resulting in farmers' acceptance of these technologies, then the pilot CFV should be sustained as a learning base in the long run.
- There appear to be two types of farmers being targeted by the network – the subsistence farmer and the agribusiness or commercial farmer. In dealing with the first group, the aim is to increase crop yields and income for food security. In the second group, the activities are directed towards income generation and land improvement.
- The ASIALAND project is in line with the national agricultural development plans and local government programs in partner countries. Nevertheless, the research-extension linkages' system at the national level is considered to be too complicated to make national networking possible at the moment. At present, the linkage system is progressing well at the local level (province, district, and village). Formalization of linkages through agreements and protocols is encouraged for them to become operational and functional.
- Though farmers mentioned economic returns to be a motivating factor for greater acceptance of SLM technologies, it was also concurred that there should be research on what factors affect the farmers' adoption and non-adoption of the introduced sloping/upland conservation practices in partner countries. Both qualitative research and quantitative research are required. Process documentation should be emphasized. This will be useful in conducting impact assessment.
- People's empowerment is recognized as a prerequisite to sustainable development. Therefore, networking among farmers is encouraged for joint learning and sharing

(knowledge, ideas, experiences, and materials); this allows them to become more self-reliant and have mutual assistance for increased agricultural production and sustainable development.

- The active involvement of community leaders, local government units, non-government and government organizations in the planning, implementation, and evaluation process is very important in accomplishing the objectives of the project.
- Capacity building must be sustained to enhance the technical and management skills of various stakeholders.
- Micro-credit has been identified as a possible intervention in addressing the financial constraints of farmers but this should be coupled with responsibility and accountability.
- Feedback is crucial in soliciting responses between and among stakeholders. Regular meetings and dialogues should be conducted for this purpose.

Paradigm Shift in Sustainable Land Management

Catchment-scale Research

The inadequacies of earlier research on soil erosion led the former IBSRAM to adopt a new research paradigm, which resulted in the establishment of the Management of Soil Erosion Consortium or MSEC. This new paradigm provides an organizational arrangement that engages scientists and research institutions to tackle a common goal through a participatory, interdisciplinary, community- and catchment-based framework (Maglinao, 2001).

Research on soil erosion conducted on a catchment scale is a new innovation in managing the on- and off-site effects of soil erosion. This is done by quantifying and evaluating the effects of soil erosion in the biophysical, environmental, and socio-economic standpoints in one setting. All stakeholder groups in the catchment area affected by soil erosion, including farmers and policy-makers, will benefit from the knowledge generated. By recognizing the scope and severity of the problem, stakeholders are enabled to make appropriate decisions about investments and land use policy in the sloping land areas.

MSEC-ASIALAND Linkage

MSEC and the ASIALAND network share a common goal and IWMI has encouraged closer linkage and complementation between the two projects. At the moment, both projects employ people's participation and community-based approaches as key elements of natural resource management. While they differ in methodology, focus, and location, the projects target the same goal – the sustainable management of sloping lands and watershed areas.

A proposed linkage between MSEC and ASIALAND is presented in Figure 3. The technologies that have been developed and recommended by the ASIALAND network are valuable inputs to MSEC in terms of identifying the options that can be presented to the farmers at the catchment site. These technologies are expected to be technically feasible after many years of evaluation. The CFV approach or other modalities of technology promotion will also be useful for MSEC in designing the development aspect of its work.

On the other hand, MSEC can contribute its experiences in conducting catchment research, which has become relevant in the community-based approach of ASIALAND in further promoting its developed technologies. It can also complement the on-site focus of the ASIALAND project with the off-site considerations of MSEC.

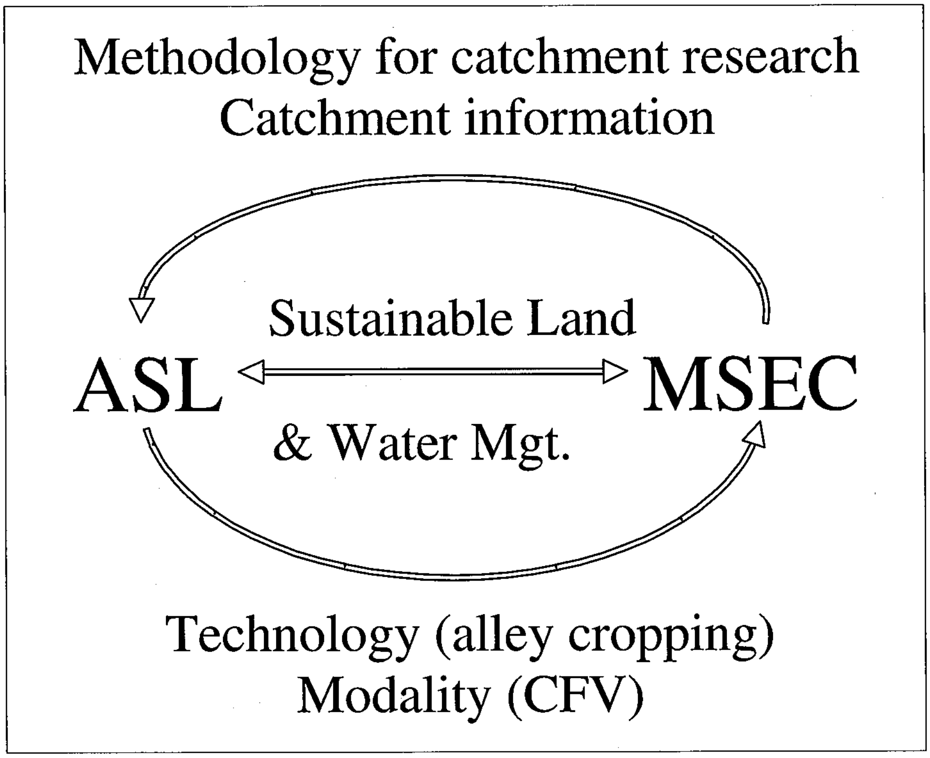

Figure 3. Proposed MSEC-ASIALAND linkage

Summary

The step-wise approach of the ASIALAND network in accomplishing its goal of assisting national agencies from its member-countries in conserving soil resources has covered activities from technology validation to on-farm research and extension. The network has progressed from plot-scale experiments to trials in farmers' fields and now development work in entire communities. Banking on the solid base of research findings and lessons gained in working with farmers, the network pursues a more dynamic and proactive approach to extending conservation farming technologies for sustainable land management. While the strength of the ASIALAND network is in its experience of more than 10 years of research, MSEC's approach opens a new dimension in soil erosion research; charting new ground for community-level development work on sloping lands.

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