Consolidation and Application of Ecoregional Methods

A Funding Request for the Ecoregional Fund
to Support Methodological Initiatives

Submitted to the Directorate General for International Cooperation (DGIS)

Ecoregional Fund

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Summary

The Ecoregional Fund to support methodological initiatives has achieved much in the past 4 years. Ten projects have contributed to the development of innovative methodologies for ecoregional research and new approaches to natural resource management and rural development in ecoregions. The projects were positively reviewed in recent evaluations (Henzell, 2000). However, there is a need to bank on the success of these projects.

The proposed extension of the Fund therefore focuses on consolidation and application of the developed ecoregional methods. While the emphasis will be on methods developed by projects supported by the Fund, methods developed elsewhere will also be exploited. The proposed extension for the Ecoregional Fund aims at the development of a framework and an operational toolkit of ecoregional methods that can be applied to a range of decision problems. The framework and methods will be tested and fine-tuned in regional case studies in Latin America, Africa, and Asia addressing real-world ecoregional problems.

The main focus of the activities supported by the Ecoregional Fund is and will be to improve decision making within research organizations and within local, provincial and national governments. It seeks to improve the use of ecoregional analysis to support decision-making in applied research and policy making. Hence, the principle "intended users" of ecoregional methods are (a) researchers and research managers who need to design and implement applied research studies and (b) groups that support decision making at various levels, ranging from the farm level to local and provincial governments to national governments and supra-national levels.

Based on the analysis of the Fund's results to date and the opportunities to achieve impact in the future, five program areas are proposed for the extension phase. These five program areas are highly complementary and their activities will be designed and implemented jointly. The intended results of the proposed five programs can be summarized as follows:

Program 1. Consolidation of frameworks and methods for ecoregional research and development:
- A general framework for ecoregional research and development
- A tool box with a set of applicable tools for operationalizing the framework

Program 2. Testing and application of ecoregional methods in regional case studies:
- An account of the ways in which the NRM problems were identified, characterized and evaluated in each of the three cases
- Feedback to Programs 1 and 4 for improvement of the ecoregional frameworks and methods and the strategies for institutionalization

Program 3. Development of user-oriented software for ecoregional analysis:
- An operational web-based software system that includes a complete range of methods and tools of varying complexity

Program 4. Strategies for institutionalizing ecoregional analysis:
- Reports on the reviews of experiences with the institutional use of ecoregional methods and related types of decision-support tools
- A set of guidelines for those working in ecoregional methods, to ensure the use of the methods developed

Program 5. Communication of results of activities supported by the Ecoregional Fund
- A set of printed publications on activities supported by the Fund
- Training materials
- A Web site
- Public awareness materials

Overall an independent Scientific Board will formulate goals, priorities and strategies for the Fund. ISNAR continues to serve as the management agent for the Fund. Three consortia of research groups have been selected to build on prior and existing research activities. The proposals are based on on-going research activities funded by a range of donors and stakeholders. Each of the consortia leverages the funding of the Ecoregional Fund Phase 2 with funds from other donors to reach a common goal: the consolidation and application of ecoregional methodologies. The three research consortia have been selected in such a way that they 1) build on tools developed in the first phase of the fund, 2) cover all 5 programs identified by ISAC, and 3) provide the required leverage funding.

- A project headed by the International Potato Centre (CIP) will work primarily on a framework for eco-regional research in which stakeholders are informed about the toolbox of methodologies, select tools through an interactive process, receive appropriate training, and develop an application.
- A project headed by the International Livestock Research Institute (ILRI) focuses on the usage of ecoregional methods in a large smallholder dairy project. Key element is to determine whether observed changes in land use are desired and where specific problems do occur. In addition, it is stressed to determine the driving factors behind these changes as an indication how to tackle the problem.
- Finally, there is a project headed by Wageningen University (WU) dealing with the application of the Tradeoff Analysis Model that succeeded in the first phase to integrate Bio-physical, socio-economic and health indicators.

Each of those existing projects identified an amount of restricted project funding that was allocated to serve the ecoregional objectives. The Soil Management CRSP project identified, for example, 254,000US$ out of a total of 2,745,477US$. Time commitments to the joint projects are not used as for leverage funding.

The Ecoregional Fund will provide additional funding to specifically target the fund's objectives. The proposed future activities for the extension phase will require that the management agent continues to provide technical inputs for project preparation and supervision. These inputs may be provided by ISNAR staff members and/or by external specialists contracted for this purpose. On behalf of ISAC and the Management Agent, the Directorate General for International Cooperation is requested to consider an extension and enlargement of the original Fund as follows:

- To allow for budget-neutral extensions of six on-going projects until the end of 2002, which will then have exhausted the original US$ 5,000,000.
- To provide an additional sum of US$ 800,000 to carry out five new programs as summarized above.

1. Introduction

1.1 Background and Rationale

Until recently, most research done by centres affiliated with the Consultative Group on International Agricultural Research (CGIAR) and in developing countries has focussed on increasing crop and livestock yields. Major achievements were recorded and food supplies in most developing countries kept pace with or exceeded population growth. However, by the mid-1980s, there was increasing concern for environmental protection and conservation of natural resources.

In 1987, the World Commission Report on Environment and Development (*Our Common Future*) was published. In 1992, a number of global environment and development agreements were reached at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro (*The Rio Declaration* and *Agenda 21*). Since then, the research approach to food security shifted from an emphasis on productivity increases with single crops and livestock to integrated approaches with particular emphasis on ecological issues, sustainable use of natural resources, and associated developmental consequences.

The members and stakeholders of the CGIAR, both in the north and the south, now wish to use their contributions to the CGIAR to support sustainable development goals. The CGIAR centres and most of the NARS they work with have been ill-equipped to make the shift from commodity-based to resource-based research. Staffing has reflected the expertise required for the old research paradigm, as did the structure and research agendas of these organizations. Few resources have been available to tackle the challenges of resource-based research and development. Methods to tackle new research questions related to ecoregional research were conspicuously absent

1.2 Activities supported by the Ecoregional Fund

In 1995 and 1996, the Dutch and Swiss governments established the Ecoregional Fund to Support Methodological Initiatives. The purpose of this Fund was to support the development of methodologies for research that is ecoregional in scope and for enhancing the implementation of new approaches to natural resource management and rural development in ecoregions. Advanced research communities in the north were encouraged to take part in activities supported by the Fund.

Guided by a distinguished international scientific advisory committee (ISAC, see Annex 1), the Fund set up a competitive grants facility managed by International Service for National Agricultural Research (ISNAR). In its first three years of operation (1996-1999), the Fund identified ten methodological topics for which it made research grants of approximately US $500,000 each. The topics were carefully chosen from among the numerous proposals submitted to the Fund.

The ten projects supported by the fund started at different times from 1996 to 1999, and each had a three-year time horizon. Some were completed within this time frame; others were granted budget-neutral extensions. The first four projects have been completed; the rest are scheduled for completion during 2001 and 2002. All ten projects have been completed, or are operating, within the budgets assigned by the Fund. Many of the projects have benefited from substantial amounts of complementary funding from the participating organizations and other donors.

All the resources available to the Fund have been spent or committed to ongoing projects, except for a small amount reserved for final evaluation of completed projects. No further projects can be undertaken within the current financial framework. Unspent funds, transferred from the two donors, are maintained by ISNAR in a separate account for the Fund.

In 1999 and 2000, an internationally renowned Australian scientist reviewed the ten projects supported by the Fund (Henzell, 2000). The projects generally received favourable reviews. The reviewer stressed that the projects were making significant methodological contributions to ecoregional research. In the context of other ecoregional research efforts in the CGIAR (TAC, 1999), the Fund's projects scored by and large well.

The four projects completed to date have been externally reviewed (*cf* Goldsworthy & Horton, 1999; Berdegue & Horton, 2000; Horton & Berdegue, 2000; Veldkamp, Berdegue & Horton, 2000). The following general conclusions can be drawn from these reviews:

- Need for more systematic application of modelling results in planning or policy-making
- Need to adapt developed methods and tools for use in other settings to be able to tackle real-world, pressing NRM issues.
- More interaction with (possible) stakeholders, to facilitate institutionalisation of methodology developed.

1.3   Priorities for the future

The desk review of the ten projects supported by the Fund and the external evaluation of the four completed projects identified a number of promising areas for future activities of the Fund. These areas, discussed by ISAC in its meeting in The Hague October 2-3, 2000, can be summarized in the following points:

- Development of a general framework to guide ecoregional research and development
- Evaluation of the various ecoregional methods developed or under development, so as to better understand their potential application to different types of problems and situations
- Testing of methods developed in new areas to address real problems, in collaboration with local stakeholders
- Development of computer software that would facilitate the use of the methods by different stakeholder groups
- Development of approaches for institutionalizing the use of ecoregional methods in research organizations and policy-support groups
- More effective communication of results (methods, data sets and policy implications) to various stakeholder groups

ISAC has also become aware of the desire of its original contributors – the Dutch and Swiss governments – to use the results of projects supported by the Fund to inform decision-making on the future organization of the CGIAR. Ecoregional approaches are likely to play increasingly important roles in future CGIAR activities.

It is the view of ISAC and the management agent that a structured set of well formulated and implemented projects addressing the priorities set out above would add significant value to the methodological results achieved to date, and to the anticipated impact of the on-going projects supported by the Fund.

1.4   Objectives

The purpose of the Ecoregional Fund is to support the development of methodologies for research that is ecoregional in scope and for enhancing the implementation of new approaches to natural resource management and rural development in ecoregions. To this end, the Fund's objective in the period 2001 – 2004 is to provide researchers and development workers with a general framework to guide ecoregional research and development and a set of consistent, operational methods for carrying out such work. The framework and methods are intended for use by applied researchers as well as by groups supporting policy making in developing countries.

1.5   Principles for the Fund's Operations and Activities

In the proposed extension phase, the operation of the Fund will be guided by the following principles:
- Local scientists and policy makers in developing countries must be involved with the planning, implementation and review of all activities, to ensure that the areas worked on and the approaches employed are relevant for their needs and interests, and to ensure their commitment to the results obtained.
- Future activities should build on expertise and knowledge generated in the projects supported to date.
- Future activities should focus on consolidating the results and expanding the use of methods developed to date, in order to address practical problems in developing countries.
- Concerted action across the activities supported and frequent interactions among participants are essential for the achievement of the Fund's objectives.

On the basis of the above the criteria three research consortia have been established that indeed do cover the priorities set for the future, build on the knowledge developed in the first phase 1 of the Fund, and provide for adequate leverage funding. The three research consortia will focus on specific elements of the 5 programs:
- A project headed by the International Potato Centre (CIP) will work primarily on a framework for eco-regional research in which stakeholders are informed about the toolbox of methodologies, select tools through an interactive process, receive appropriate training, and develop an application. The project will emphasize on three different application in which the framework will be tested.
- A project headed by the International Livestock Research Institute (ILRI) focuses on the usage of ecoregional methods in a large smallholder dairy project. The broad character of the smallholder dairy project makes it specifically challenging to determine what are the key problems now, and where are they likely to occur. In addition, it is stressed to determine the driving factors behind these changes as an indication how to tackle the problem.
- Finally, there is a project headed by Wageningen University (WU) dealing with the application of the Tradeoff Analysis Model that succeeded in the first phase to integrate Bio-physical, socio-economic and health indicators. The project aims to move away from the Andean highlands (where the methodology was developed) and test the methodology in the east-African highlands.

This proposal first explains the overall research priorities and how they are structured in 5 different programs (Chapter 2). Subsequently, the 3 research proposals by the research consortia are given in Chapters 3-5. Finally, an overview of the overall program, the role of the three projects in the 5 programs, and the summary budget are given in Chapter 6.

# 2.	Proposed Work

## 2.1	Overview

In the proposed extension, the Fund focuses on consolidation and application of ecoregional methods. While the emphasis will be on methods developed by projects supported by the Fund, methods developed elsewhere will also be exploited, where appropriate. The strengths and weaknesses of existing methods for ecoregional research and development will be assessed. A general framework will be developed to guide the selection and application of ecoregional methods, to address different problems in different settings. User-oriented software will be developed to facilitate the use of a menu of methods for ecoregional analysis. Strategies will be developed to encourage and facilitate the use of ecoregional analysis in support of policy decision-making.

The proposed extension of the Ecoregional Fund aims at the development of a framework and an operational toolkit of ecoregional methods that can be applied to a range of decision problems. The framework and methods will be tested and fine tuned in regional case studies in Latin America, Asia and Africa, which address real-world ecoregional problems.

The main focus of the activities supported by the Ecoregional Fund is to improve decision making within research organizations and within local, provincial and national government. Ecoregional research and development involves a multi-step approach, which requires different methods for defining, analyzing and exploring problems perceived by various stakeholders. The Ecoregional Fund seeks to improve the use of ecoregional analysis to support decision-making in applied research and policy making. Hence, the principle "intended users" of ecoregional methods are (a) researchers and research managers who need to design and implement applied research studies and (b) groups that support decision making at various levels, ranging from the farm level to local and provincial governments to national governments and supra-national levels.

Based on the foregoing analysis of the Fund's results to date and the opportunities to achieve impact in the future, five program areas have been defined for the extension phase:

- *Program 1*. Consolidation of frameworks and methods for ecoregional research and development
- *Program 2*. Testing and application of ecoregional methods in regional case studies
- *Program 3*. Development of user-oriented software for ecoregional analysis
- *Program 4*. Strategies for institutionalizing ecoregional analysis
- *Program 5*. Communication of results of activities supported by the Ecoregional Fund

These five program areas are highly complementary and their activities will be designed and implemented jointly. Program 1 will be responsible for consolidating and integrating ecoregional methods. Emphasis will be on methods developed up to date within the methodology program but attention will also be paid to other issues, as needed. This program will develop an overarching framework for ecoregional research and development and toolkit with a set of ecoregional methods. It will monitor the progress of three regional case studies to be carried out under the umbrella of Program 2. It will also guide the development of the computer software, which is the responsibility of Program 3.

Program 4 will develop strategies for institutionalizing ecoregional analysis. This program will provide guidance for the institutional strategies applied in Program 2. It will also provide orientation for the software development effort in Program 3, to ensure that user needs and interests are adequately taken into account.

Program 5 will be responsible for ensuring adequate dissemination of the experiences and results of all the activities supported by the Fund.
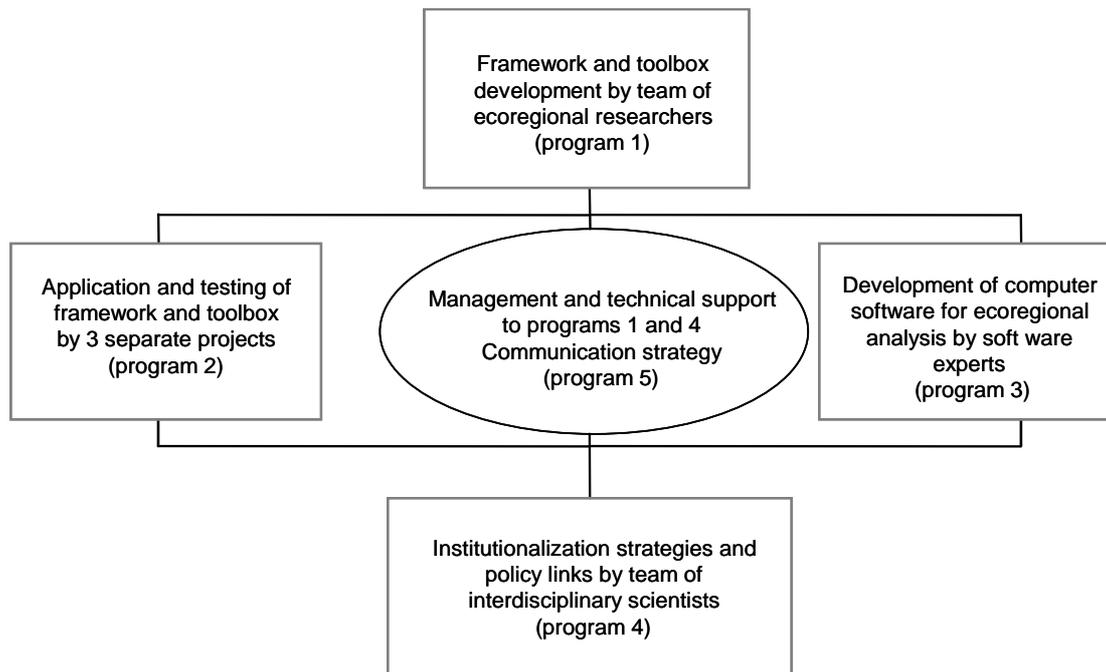
Figure 1: Proposed programs for the extension phase of the Ecoregional Fund.

2.2 Program 1. Consolidation of frameworks and methods for ecoregional research and development

Rationale and objectives

Considerable progress has been made in developing ecoregional methods that address specific questions in specific locations. Much less progress has been made integrating the various methods into a general approach for ecoregional research and development. And few methods have been standardized or documented adequately so as to facilitate their use by other research teams working in other areas.

Consolidation, standardization and integration of existing methods for ecoregional research and development are among the main goal of the extension phase. A consistent working methodology needs to be developed, including a framework for selecting methods and a toolkit with operational tools that can be used to respond to practical NRM questions in different settings.

Tools for ecoregional research and development fall into four main categories, which form a sequence (adapted from van Ittersum et al, 1998; Bouma et al., 2000):

- *Descriptive tools.* Permit description of the current system at various scales by means of multidisciplinary exercises
- *Projective tools.* Permit the projection of possible future system states at various scales, based on empirical evidence and 'what-if" scenarios.
- *Explorative tools.* For exploring alternative system conditions/states for selected scales based on disciplinary process knowledge. This includes the systematic generation of alternative systems

- *Predictive tools*. For exploring what types of policy measures could be used to achieve desired goals, as defined in explorative and projective procedures.
- G*enerative or prototyping tools.* For designing possible future systems, based on predetermined requirements and scales and on expert and empirical knowledge.

Stakeholder interactions can be classified similarly, in the following sequence:
- *Problem definition* (description)
- *Assessment of the stakes involved* (projection)
- *Negotiation of alternatives* (exploration)
- *Defining desirable solutions* (generation/prototyping).

A general review procedure should produce a first general framework that describes the methods including an assessment of their strengths, weaknesses and complementarities.

Activities to be supported

This program will support the following types of activities:
- Review and synthesis of the methods developed or used by projects supported by the Ecoregional Fund projects, and or relevant recent developments in the broader ecoregional research field
- Development of an initial framework and set of tools for ecoregional analysis
- Periodic workshops with scientists and stakeholders in Programs 2 – 4, to provide guidance to them, and to gain information and insights that will allow improvement of the framework and toolkit

Expected outputs

- A general framework for ecoregional research and development
- A tool box with a set of applicable tools for operationalizing the framework

2.3   Program 2. Testing and application of ecoregional methods in regional case studies

Rationale and objectives

The Ecoregional framework and toolbox developed in Program 1 need to be field-tested and their value needs to be demonstrated. Given the unique settings and problems of the sites where the Fund has supported projects so far, we propose test cases for the extension phase in Latin America, Asia and Africa. Each test case should follow the framework and use the toolbox developed by Program 1. Each should test and improve the framework and toolbox by addressing problems of significance to local stakeholders.

Each of the test cases will need to address the following types of issues:
- Selection of new study areas
- Definition and description of NRM problems to be studied, through close interaction with local stakeholders
- Assessment of data and modeling requirements
- Data gathering and analysis
- Use of results of systems analysis and geographical information systems (GIS) to facilitate discussion and joint learning, involving a range of local stakeholders
- Exploration of land-use scenarios in a participatory manner
- Communication processes, within the research team and with outsiders
- Assessment of future developments

The research questions will seldom be clear to all participants in the outset; they have to be formulated by researchers, policy makers and other stakeholders, in group processes. What we aim for is three projects where this interaction is occurring and producing results. The processes that occur and the results obtained need to be documented.

Activities to be supported

The following types of activity may be supported in each case:
- Workshops for researchers and stakeholders to define the research questions
- Data gathering at relevant scales and from available sources. (Methods should be based on available data and not rely on primary data collection.)
- Development or use of tools for ecoregional description, analysis and projections
- Feedback workshops with stakeholders, to present results, assess the stakes involved and reformulate research aims and question.
- Development or use of scenario tools to support projections and explorations of alternative stakeholder defined scenarios.
- Negotiation of stakeholders about desirable solutions and pathways.
- Development of generic (prototyping) tools.
- Interactive negotiation of stakeholders about new prototypes.

Expected outputs

A detailed account and improved manner in which the NRM problem has been identified, characterized and evaluated by the multidisciplinary team, focusing on (but not restricting attention to) methodologies developed up to date within the Fund. The team will initially use the framework and toolbox as determined in Program 1. There will be regular feedback sessions (workshops) with the specialists in Programs 1 and 4, to improve the frameworks, methods and strategies for institutionalization.

2.4 Program 3. Development of user-oriented software for ecoregional analysis

Rationale and objectives

The frameworks and methods developed in Program 1 and tested in Program 2 could be made much more accessible to potential users if they were made available in a user-friendly software designed to guide and facilitate

Such software should be of use both to seasoned ecoregional analysts and to interested professionals who are new to this field. Hence, an important aspect of the computer software is that it should be user-friendly. This will require that, initially, highly simplified models and methods will have to be used. Over time, based on feedback from the test cases in Program 2, the models may become somewhat more complicated and realistic.

This activity should build on existing expertise assembled by teams implementing projects in the current phase of the Fund and also in the International Consortium for Agricultural Systems Applications (ICASA). Professional programmers should be involved to ensure a high technical quality of the outputs. The software should be tested in the three test cases and improved on the basis of feedback.

Activities to be supported

- Development of simplified versions of the methods/tools
- Construction and management of essential databases
- Development of an appropriate "user shell" for operationalizing the framework and set of tools
- Development of a web-based applications to facilitate broad access to the frameworks and tools development and the data assembled

Expected outputs

The main expected output is an operational web-based software system that includes a complete range of methods and tools of varying complexity.

2.5 Program 4. Strategies for institutionalizing ecoregional analysis

Rationale/objective

To date, there has been more progress in developing methods for ecoregional analysis than in applying them to solve practical problems in real-world settings. This is partly because most specialists in ecoregional programs are biophysical scientists or agricultural economists who are ill-prepared to promote the use of research results. Another reason is that there are numerous personal, social and political barriers to the use of decision-making support tools in research and development organizations.

Since the Ecoregional Fund wishes to promote the use of ecoregional methods to support policy decision-making, more attention needs to be given to the factors that influence the use of decision-support tools.

The objective of this program is to develop and test effective strategies for enhancing the use of ecoregional methods to support decision making in research and development organizations.

Activities to be supported

The main activities of this program include:
- A review of experiences to date with the use of decision-support tools in research and development organizations
- Development of strategies to enhance the use of ecoregional methods by research decision makers and policy support groups, for testing in Program 2
- Interaction with professionals in Program 2, to provide guidance on institutional issues
- Interaction with professionals in Program 3, to guide development and testing of the software
- Based on interactions with professionals in the other programs, to improve the institutional strategies under development

Expected outputs

- Reports on the reviews of experiences with the institutional use of ecoregional methods and related types of decision-support tools
- A set of guidelines for those working in ecoregional methods, to ensure the use of the methods developed

2.6 Program 5. Communication of results of activities supported by the Ecoregional Fund

Rationale and objectives

Ecoregional research is new and dynamic, field in which the Ecoregional Fund is making significant methodological contributions. To date, the results of projects supported by the fund have not been widely disseminated. The objective of this program is to ensure that the experiences gained by project teams supported by the Fund and the results obtained are accessible to a wide audience. This audience will consist of researchers, research managers and development workers in national research organizations, Governmental Organizations, NGOs and the CGIAR. The CGIAR is moving increasingly towards working in an ecoregional mode and use of the methodology developed in the Fund should be promoted. Another important target group consists of policy makers and planners in (semi) national organizations. The type and amount of information will differ according to different target groups.

Activities to be supported

This program would support four main groups of activity:
- Printed publications on work supported by the Fund. Such publications could include final reports and evaluations of completed projects and policy briefs on key topics
- Training materials embodying the general framework and the menu of ecoregional methods
- Web site. This would include key documents of the fund and its projects, links to project web sites, a newsletter on the activities supported by the Fund, a help facility for project collaborators and a discussion facility for exchange of information on methodological issues
- Public awareness activities for the Fund and the activities it supports

Expected outputs

- A set of printed publications on activities supported by the Fund
- Training materials
- A Web site
- Public awareness materials

2.7   Expected Results and Benefits

The results of the proposed five programs can be summarized as follows:
Program 1. Consolidation of frameworks and methods for ecoregional research and development
- A general framework for ecoregional research and development
- A tool box with a set of applicable tools for operationalizing the framework

Program 2. Testing and application of ecoregional methods in regional case studies
- An account of the ways in which the NRM problems were identified, characterized and evaluated in each of the three cases
- Feedback to Programs 1 and 4 for improvement of the ecoregional frameworks and methods and the strategies for institutionalization

Program 3. Development of user-oriented software for ecoregional analysis
- Operational software systems that include a range of methods and tools of varying complexity

Program 4. Strategies for institutionalizing ecoregional analysis
- Reports on the reviews of experiences with the institutional use of ecoregional methods and related types of decision-support tools
- A set of guidelines for those working in ecoregional methods, to ensure the use of the methods developed

Program 5. Communication of results of activities supported by the Ecoregional Fund
- A set of printed publications on activities supported by the Fund
- Training materials
- A Web site
- Public awareness materials

3. Project 1: Prototyping Ecoregional Analyses Tools to Improve Science-Based Decision Making in Research and Development

3.1 Research team

Principal Investigator:

Roberto A. Quiroz   Head, Department of Production Systems
and Natural Resources Management
International Potato Center (CIP)
PO Box 1558 Lima 12, Peru
E-mail: r.quiroz@cgiar.org
Phone: (511) 317-5312 Fax: (511) 317-5326

Co-Investigators

Abel Rojas   Principal technical advisor PDLA- Oruro, Bolivia

César Sotomayor   Executive Director MARENASS, Abancay, Peru

Rodrigo Morales   Head, Research Station in Cerro Punta, Panamanian Agricultural Research Institute (IDIAP)

Carlos León-Velarde   Animal Scientist & Agricultural Systems Analyst International Livestock research Institute and CIP

Walter Bowen   Soil Scientist & Agricultural Systems Analyst, International Fertilizer Development Center and CIP

David Yanggen   Economist, Montana State University and CIP

3.2　Problem statement and objectives

CIP/CONDESAN and its partners successfully implemented two projects funded by the Ecoregional Fund in the Andean Region. New concepts, tools and methods in ecoregional research were tested in data scarce environments. Given the nature of the research conducted during the first phase, the level of involvement of decision-makers was limited. Due to the need for in-depth discussion of the scientific principles behind the concepts, tools and methods it was too early in the process to have full involvement of decision-makers. It was also argued that in order to get buy-in from most decision-makers in developing countries, a user-friendly product - at least a prototype- had to be previously developed.

The tools and methods developed are now in a stage where decision-makers at different scale levels or institutions – research, development, and policies – can make use of them. It is crucial at this stage to make a leap forward from the research context where the tools and methods were developed and tested to problem solving in real-life cases.

The objectives of this project are:
- To assemble tailor-made decision-making systems for research, extension, and development adapting the tools and methods developed by different projects (principally those financed by the Ecoregional Fund) in three case studies.
- To test a strategy of stakeholder engagement and diffusion of ecoregional analysis tools using hypermedia CD-ROMS and Internet.
- To refine critical aspects of existing tools and methods.

3.3　Project Strategy

Case studies

Real-life case studies covering three key aspects of sustainable rural development - participatory NRM research, extension, and government managed development projects - will be included. The pre-condition for participation as a case study is a written commitment to co-invest in the implementation of the project. All the tools developed for ecoregional research will be made available. The users will select and co-finance the implementation of the ones they find useful for their needs. Letters from the different groups of stakeholders are given in Annex 2.

Case 1 – Panama: Upper watershed management

One of the most vulnerable watersheds in Panama is located in the eastern part of the country. Most of the vegetables and the milk consumed in the country are produced in the upper Chiriquí river watershed. Pesticides and fertilizers are heavily used, given the high value of the crops. This conflicts with downstream water use for drinking and pollution that affects environmental quality for tourism. A large portion of the upper watershed is within a bi-national (Panama-Costa Rica) natural reserve. The only two native potatoes of the country were collected within this park. Current farming practices threatens wildlife biodiversity. Pesticide contamination of the drinking water is an issue being raised by the press at this moment.

In addition, given the high rainfall and the steep slopes cropped without conservation practices, large amounts of the region's deep volcanic soils are being lost. Land degradation threatens the

livelihoods and food security of the small holder farmers and other residents of the zone. Local researchers in conjunction with IRD (ex-ORSTOM) have conducted soil erosion studies in the area. Our expected access to this data will facilitate rapid progress of this research.

Case 2 – Bolivia: Managing salinity-prone soils for maximizing productivity

This case study is located in the poorest region of Bolivia, the Department of Oruro. This is a semi-arid area inhabited by some of the poorest farmers of Latin America. Farmers have mixed crop-livestock systems, producing potato, quinoa, and barley and oats as forage. The local government is managing a Danish funded project (PDLA) aimed at enhancing dairy productivity. Alfalfa is being heavily promoted along with irrigation in strategic areas. The problem is that most water sources are saline and drainage is very poor.

The project provides technical assistance to farmers. The project's technicians could benefit from the use of the tools developed by the Ecoregional Fund to improve the quality and targeting of their assistance. The newly formed research foundation for the highlands of Bolivia, based in Oruro, has expressed interest in implementing ecoregional analyses tools in their decision making process. PDLA-Oruro is also interested in zoning the areas according to their production and market potential as well as for their vulnerability to salinity, frost and drought.

Continuous involvement of local farmers is envisioned throughout the research and development process. The local farmers association – FEDEPLO – co-manages the funds of the PDLA-Oruro program. This will add an additional participatory dimension to the discussions on ecoregional analysis.

Case 3 – Peru: Participatory NRM

MARENASS – Natural Resource Management in the Southern Sierra of Peru- is an innovative NRM project of the Peruvian Ministry of Agriculture. It is funded through a loan to the Peruvian Government from the International Fund for Agricultural Development (IFAD).

This project is highly participatory. Farmers define the priorities for NRM through contests on their vision for the future of their communities. This constitutes the prioritization exercise. Once the master plan is agreed upon, MARENASS facilitates its implementation through strengthening the farmer-to-farmer transfer of knowledge and through the assessment of the effectiveness of the process using contests as the approach for evaluation. The project is currently working with 280 peasant communities in three departments of the Southern Sierra. Given the project emphasis on strengthening the local institutional capacity and the valuation of the local culture, the acceptance and success of the project have exceeded expectations. This can be attested by the dramatic change in the quality of life of participating farmers.

 This is probably one of the few projects ever designed using systems analysis tools. Some of the scenarios analyzed and then used to justify the project were described by Quiroz et al. (1995). MARENASS' coordination council will be a primary user of ecoregional tools and will provide a strong showcase to influence the Ministry of Agriculture of Peru in the use of tools and methods for making science-based policy decisions.

Since negotiating NRM strategies is a key aspect of the project, the innovative tools of 3-D visualization being developed by CIP and partners will be tested in this case. Farmers' sketches

of their expectations on how they want the landscape to look like in 20 years from now may be translated into a 3-D format. Scenarios with and without changes can be simulated and the results presented using virtual reality technologies. CIP and MARENASS will provide matching funds to test the usefulness of 3-D visualization in decision-making at different levels.

3.4   Activities

The activities to be implemented in each site include:

1. Formation of a strategic alliance with stakeholders sharing common interests. Potential partners for the alliance have been listed for two of the cases. (1) Panama - the National Agricultural Research Institute (IDIAP), the extension office of the Ministry of Agriculture (MIDA), the agricultural bank (BDA), the national authority for the environment (ANAM), the marketing institute (IMA), and the agricultural insurance institute (ISA), the farmers' cooperative, and the local chamber of commerce. (2) Bolivia - the farmers (FEDEPLO), the local authorities, the coordination of the Danish-funded project (PDLA-Oruro), CARE-Bolivia, and the research foundation
2. Problem assessment and definition of scenarios to be tested and the indicators needed. Tools and methods will be selected at this stage.
3. Data collection. Partners will be responsible for their own data collection. The project will provide technical support and co-finance critical data gathering, but it will not carry the full burden as in phase one. The key to success here is to have a minimum data requirement well defined and agreed upon by everyone in the alliance
4. Scenario analyses. The project coordinators in the alliance must show the usefulness of available tools and methods to make science-based decisions and guide – but not impose - the selection of the tools required for each case. The tools include process-based models (soils, crop, livestock, erosion, climate, etc.), GIS, remote sensing, Interactive Multiple Goal Linear Programming, and Tradeoff Analysis
5. Definition of action plans
6. Documentation and feedback

3.5   Engagement and diffusion

Strategies for institutionalizing ecoregional analysis are needed. There are two crucial elements of these strategies that ought to be tested in real-life cases: stakeholder engagement and diffusion of results. In any strategic alliance it is normal for stakeholders to ask "what is in it for me" or "what do I gain by joining this alliance". Since science-based decision-making is a relatively new area for most of our potential users, it is difficult to get buy-in at the beginning. We are thus proposing to utilize our experience in developing hypermedia CD-ROMS in the process of forming the alliances. This experience shows that the visual representation of problems and possibilities with the CD-ROM media is an outstanding way to bring different stakeholders to the table.

The first exercise will include a rapid appraisal of the problems, mapping of the contributions from each partner in the alliance, and the definition of the issues the alliance should address. The tasks will be assigned and results of the first exercise documented in the first version of the CD-ROM.

Extensive hands-on training on the concepts, limitations and use of the tools selected will be emphasized. The training will start from the onset with the appraisal and the definition of the scenarios to be assessed.

The hypermedia CD-ROMS will document the whole process. Some of the tools (mainly simulation models) will be incorporated in the CDs. This will increase the friendliness of the products to other users since they will see the context and have access to some examples and the interactive tools. The different versions of the CD-ROMS will be shared among groups. The coordinators will facilitate the exchange and the analyses of the experiences. The experiences will also be shared through Infoandina, the electronic network of CONDESAN and the hub for the Mountain Forum-LAC. CIPWORLDS, an Internet-based virtual environment to implement collaborative research will also be used to share tools, methods, and lessons learned.

A face to face workshop will be conducted to allow for a more direct exchange of experiences and to evaluate the process. An early involvement of key decision-makers will help promote a feeling of ownership of the process and thus facilitate the negotiation phase.

3.6   Refining tools and methods

New methods are being added to the "toolbox" of analytical techniques with additional grants obtained by CIP and partners. The Ecoregional Fund will partially contribute to the financing of these activities. In addition to the TOA, already explained by the Wageningen-led proposal, there are three areas of active research we are proposing to co-finance with the funds from this project:

1. *Simplification of existing tools* – (a) Simplifying models and data requirements to predict yields at different spatial scales using low cost field RS cameras and other sensor e.g. electromagnetic induction sensors for soil salinity. Yield prediction is an area of concern of policy-makers. Existing process-based models are too data demanding for predictions at large scales. Preliminary results show that it is feasible to make simpler models that are less data demanding with the use of remote sensing. Ongoing research at the University of Campinhas, Brasil is focusing on the subject. With minor complimentary investments the Fund can benefit from the results. The research is being conducted with sugar cane as a model having access to field and RS data from over 17,000 ha. Our contribution will consist of the adaptation of DSSAT to the conditions of the site and the development of a simpler model, using field, air-borne and space-borne remotely sensed data. The project will only finance a few trips to Brazil. (b) In addition, we propose to use artificial intelligence (AI) to facilitate the communication of some of the complex concepts behind the tools and methods. The objective here is to create an intelligent shell capable of guiding users in the selection of the appropriate tools for their needs and also guide them in the data gathering processes. The lessons learned in the tools and methods selection process will be used to assess the usefulness of AI in ecoregional development and the transferability of the framework and the toolboxes. This activity will be co-financed by the System-wide Livestock Program (SLP) project on virtual labs.

2. *Fractal scaling*. In the first phase we developed software that includes analysis of fractal dimension. In highly heterogeneous environments, particularly at high resolution, the self-similarity concept does not hold true. Multi-fractal parameters are required. We have initiated the development of the software to estimate the parameters for both biophysical and socio-economic data. The project will provide part-time support for the software developer and the applications. CIP and ILRI have supported the preliminary work.

3. *Visualization*. This is a project with financial support from the CGIAR System-wide Livestock Program and CIP. Some of the visualization techniques will be used on the case studies. Marginal costs for the implementation in the case studies will be charged to this project.

3.7   Work plan

Item	Quarter											
	1	2	3	4	5	6	7	8	9	10	11	12
Formation of the strategic alliance	■											
Problem assessment and definition of scenarios and indicators	▬	▬										
Data collection		▬	▬	▬	▬	▬	▬	▬				
Scenario analyses				■			■			■		
Definition of action plans					■						▬	▬
Hands-on training		■					■			■		
Hypermedia CD-ROMS			▬	▬	▬	▬	▬	▬	▬			
Internet-based sharing				▬	▬	▬	▬	▬	▬	▬	▬	▬
Models simplification			▬	▬	▬	▬	▬	▬	▬	▬	▬	▬
Artificial intelligence						▬	▬	▬	▬	▬		
Fractal scaling			▬	▬	▬	▬	▬	▬	▬	▬	▬	▬
Visualization			▬	▬	▬	▬	▬	▬	▬	▬	▬	▬
Workshop											■	
Documentation and feedback				■				■				▬

3.8   Budget

Amount requested from the Ecoregional Fund   US$ 247,500
Leverage funding from partner institutions   US$ 817,045

	Eco-regional	CIP	IDIAP	PDLA	MARENASS	TOTAL
Local stakeholders meetings	$5,000		$5,000	$10,000	$5,000	$25,000
Data collection	$20,000	$25,000	$50,000	$20,000	$30,000	$145,000
Development of cd-rom's	$15,000	$20,000	$10,000	$10,000	$10,000	$65,000
Development of website	$5,000	$15,000				$20,000
In-site training	$10,000		$20,000	$25,000	$10,000	$65,000
Models simplificaton – Research assistant	$25,000	$75,000				$100,000
Articficial Intelligence		$16,000				$16,000
Fractal scaling - Post Doctoral	$90,000	$20,000				$110,000
Visualization - programming		$100,000				$100,000
Visualization - case studies	$10,000	$10,000				$20,000
Expert consultancy	$15,000					$15,000
Documentation and feedback	$5,000		$5,000	$5,000	$5,000	$20,000
Project coordination/Co-PI's		$120,000	$20,000	$20,000	$20,000	$180,000
International travel	$15,000	$10,000				$25,000
Workshop	$10,000		$3,000	$2,000	$500	$15,500
Sub-total	$225,000	$411,000	$113,000	$92,000	$80,500	$921,500
Indirect costs @ 10%	$22,500	$53,430	$14,690	$11,960	$10,465	$113,045
Equipment			$15,000	$10,000	$5,000	$30,000
Total	**$247,500**	**$464,430**	**$142,690**	**$113,960**	**$95,965**	**$1,064,545**

Note: The matching funds of collaborating institutions are indicative of the ballpark amount they are willing to co-invest. The exact amount will be given during the first stakeholders meetings. CIP's co-investment comes from core funds and two restricted projects funded by the System-wide Livestock Program and INIA-Spain.

4. Project 2: Transregional Analysis of Crop-Livestock Systems: Understanding Intensification and Evolution across Three Continents

4.1 Research team

Principal Investigator:
Steven Staal   Agricultural Economist
ILRI
PO Box 30709
Nairobi, Kenya
E-mail: S.Staal@cgiar.org
Phone: (254) 2 630743 ; Fax: (254) 2 631499

Co-investigators:
Federico Holman   Economist, ILRI-CIAT, AA 6713, Cali, Colombia

Tom Veldkamp   Laboratory of Soil Science and Geology, Wageningen University, The Netherlands

Victor Manyong   Economist, IITA, Ibadan, Nigeria

Jetse Stoorvogel   Laboratory of Soil Science and Geology, Wageningen University, The Netherlands

M N M Ibrahim   University of Peradeniya, Sri Lanka

B R Patil   BAIF, India

P K Thornton   Systems Analyst, ILRI, Nairobi

M Herrero   Crop-livestock modeller, ILRI-University of Edinburgh

4.2   Problem statement

To improve opportunities for smallholder producers to participate in the increasing global demand for livestock products, by developing and applying new tools and understanding to target policies, planning and technologies.

Demand for livestock products in developing countries is projected to expand very rapidly to 2020 (Delgado et al., 1999). This demand-led expansion offers considerable opportunities for poverty alleviation through income generation if smallholder mixed crop-livestock producers can effectively compete in these new markets. It may also create conditions that favour large-scale and industrial production to the detriment of small resource-poor producers.

While the increased industrialization of monogastric production seems inevitable, the future for large ruminant production, on which smallholders tend to depend, is less clear. The wide variety of ruminant production systems observed globally, differing in both scale and level of intensity, point to the importance of many factors in determining production choices. Those factors may include not only agro-climatic conditions and animal disease challenge, but also infrastructure, access to markets, capital and services, nature of local demand, the opportunity cost of labour, but critically the potential for interaction with crop production and other uses of land. Unlike monogastric systems, there are no clearly apparent "pathways of development" of mixed crop-ruminant systems (Pender et al., 1999).

Further, crop-ruminant systems offer important opportunities to relieve the problems of soil fertility that still plague much of the poorest developing countries. Nutrient balances are complex and depend on the efficiency of preserving and making best use of nutrients as well as balancing inputs and outputs. Changes in land use and the consequent changes in nutrient flows both within and between households may result in fragile systems where negative nutrient balances make long-term sustainability tenuous.

Added to this, the latest information from the Intergovernmental Panel on Climate Change (IPCC, 2001[a,b]) shows that many regions of the developing world, particularly Sub-Saharan Africa, are vulnerable to predicted changes in climate (temperature increases and changes in rainfall distributions and amounts).

Given this complexity of outcomes, and the certainty of coming demand-driven livestock production intensification, researchers, planners and policy makers are currently not well equipped to predict where and how changes will occur. This research will address this problem by providing new analytical methods to conduct systematic comparisons of crop-ruminant systems across three continents.   Some of this research has begun under a System-Wide Livestock Programme project. This phase will complete that process and focus on delivery of tools.

4.3   Objectives

To apply new methods developed to predict changes in crop-livestock intensity and evolution, and develop tools for their use by planners, policy-makers and researchers.   The method development and initial analyses (objectives 1-3 below) are being conducted with complementary funds from the System wide Livestock Programme. This phase and funding will focus on application and dissemination, objectives 4-7 below.

Specific objectives include:
1. Identify patterns of systems evolution and land-use change in crop-ruminant systems in Central and South America, sub-Saharan Africa and Asia, and elucidate the main driving forces of change.
2. Model the common (transregional) relationships between driving factors and change in targeted sites, including nutrient balances and land use, and predict system evolution by means of dynamic modelling.
3. Identify planning and policy interventions that enhance opportunities for, and sustainability of, smallholder producers.
4. Implementation of new analytical methods that combine GIS, survey techniques and models to predict system evolution and nutrient status, and produce various decision-support tools that apply them.
5. Make these tools and methods available through websites and on CD-ROMS to a wide variety of users.
6. Assess demand for information, and identify institutional mechanisms for supporting the sustained delivery of these tools.
7. Strengthen capacity among national partners for crop-livestock systems analysis.

4.4   Outputs

- Strategic understanding of patterns of evolution of crop-ruminant systems in developing countries, and new methods to study them.
- Identification of specific planning, policy and technological interventions that best enhance opportunities for, and nutrient sustainability of, smallholder crop-livestock producers.
- Strengthened capacity among national partners for crop-livestock systems analysis.
- Information outputs, including CD-ROMs, data sets available from the Internet, spatial decision support tools, a book on strategic lessons for crop-livestock intensification and related methodologies, and policy briefs and reports.
- Pilot institutional mechanisms established for output delivery.

4.5   Research Methodology

Because results of the analysis of crop-livestock intensification and evolution will differ greatly according to scale, three parallel efforts are proposed:

- Participatory Rapid Appraisals (PRAs) in 15 countries on three continents to identify broad patterns of intensification, as well as nutrient balances and flows in the most common combinations of crop-livestock technologies, and where smallholder development needs are greatest. Analysis will consist of tabular and simple regression analyses.
- Detailed landscape-level analysis of crop-livestock intensification and changes in nutrient balances in contrasting selected sites using existing cross-sectional household survey data and regional geographic data-sets. Data are available from Sri Lanka, Kenya, Nigeria, Colombia, and India. Two approaches will be undertaken:
- spatial econometric analysis using combined GIS and household data, a method already being developed in ILRI (Staal et al., 1999) and used in land use/cover change research (Verburg & Chen, 2000; Veldkamp & Fresco, 1997).

- Dynamic land-use modelling based on improved and regionally adapted tools developed in earlier projects (CLUE (see Veldkamp et al., 2001; Verburg and Van Keulen, 1999) and a model developed at ILRI and CIAT (Jones and Thornton, 2001).
- Farm/household models combining simulation and optimisation approaches constructed for representative farms in several countries across three continents, to allow better understanding of individual household behaviour leading to intensification of livestock systems (Herrero et al., 1999). These will be linked to detailed nutrient balance models, to both determine the impact of farmers' choices on sustainability and to capture farmer nutrient management objectives in intensification decisions.

At each of these three levels, case studies from different continents are jointly evaluated by pooling multi-site data, using appropriate models of interaction and intensification. This will allow the identification and quantification of common relationships between driving forces, modifying factors, and outcomes. The continental level analysis can identify areas or regions of particular general characteristics worthy of more detailed analysis. Analysis can then be targeted to the local system level, particularly at systems that represent common structures of production and combinations of crop-livestock technologies, and where smallholder development needs are greatest. Finally, representative crop-livestock farm types can be selected from each system for direct farm-level comparison. However, there is also a crucial link back to higher levels of analysis, so that the lessons learned at the farm level can ultimately be tied back to the region/country/continental level, for much wider applicability. This last link allows the identification of recommendation domains, which define target areas for planning and strategies. At all levels, robust models will be employed along a gradient of intensification, in order to deliver reliable predictions at varying levels of intensification.

4.6 Activities supported by the SLP

Some of this work is already in progress. In 2001, PRAs were completed at over 50 sites in Thailand, Nepal, Bangladesh, India, Sri Lanka, Ethiopia, Kenya, Tanzania, Madagascar, Nigeria, Niger, Colombia, Peru, Bolivia, and Costa Rica. Preliminary analysis shows consistent patterns of changes in herd sizes, land holding and opportunity costs of labour linked to factor values driving intensification. For the landscape-level analysis, detailed spatially-referenced household data sets are being assembled for sites in Sri Lanka, Kenya, Nigeria, and Colombia, and further data are being gathered in India. These comprise over 10,000 individual household observations, and preliminary analysis shows the ability of the spatial econometric model to differentiate household from spatial effects on intensification choices. For the farm-level modelling, a protocol for data collection has been developed, and work started on collecting the necessary information from five countries.

4.7 Activities supported by the Ecoregional Fund

Funds are requested from the Ecoregional Fund to fill gaps in current research activities and further integrate data and tools developed by SLP and other eco-regional projects. These activities relate mostly to the application and accessibility of tools and databases, the landscape-level modelling, and activities to assess demand for information to assist in decision making concerning natural resource management and crop-livestock systems evolution.

Development and application of tools:
- Apply and implement existing up-to-date dynamic land-use change models.
- Complete development and application of the household model.
- Apply the models to new, independent case study sites for rigorous validation purposes.

Accessibility of tools and databases:
- Assemble all the data sets and make these available to others on CD-ROM and via the internet. This will include the farming systems database currently under development at ILRI.
- Decision-support tools and models made available to partners and others.
- Studies on how to effectively translate results into information that can be used by decision makers and other stakeholders (researchers, extension workers, and planners and policy makers), including information demand studies.

4.8   Expected impacts

The key users of project outputs will be researchers, planners, and policy makers concerned with the mixed farming systems in the developing world. Researchers investigating the evaluation and potential of these mixed systems will be better equipped to target existing technologies and to develop appropriate alternative. Planners and policy makes will also be able to use the research outputs to design appropriate policies and infrastructure, and developers will be able to assist smallholder producers to improve their livelihoods in a sustainable manner.

4.9   Project duration and timetable

Project duration will be 3 years, from January 2002 to December 2004. Project activities include the following:
- PRAs in 15 countries completed.
- Landscape spatial analysis and modelling in 3 to 5 countries (spread over three continents to allow comparison). The modelling work will be a PhD project, with backstopping by partners at ILRI, CIAT and Wageningen University.
- Farm-level modelling in 5 countries.
- Information demand studies.
- Development of decision-support tools, CD-ROMs, and web-based applications.
- Production of research reports and policy briefs, and policy-maker and stakeholder workshops.

4.10 Budget

Amount requested from the Ecoregional Fund   US$ 247,500
Leverage funding from partner institutions   US$ 367,000

	Eco-regional	SLP	Total
Human resources			
Post-doc (spatial statistics)	$30,000	$130,000	$160,000
Post-doc (landscape modeling)	$105,000		$105,000
Software development	$25,000		$25,000
Website development (including web-based tool)	$15,000		$15,000
General project costs			
Training and workshops	$15,000	$55,000	$70,000
International travel	$20,000	$30,000	$50,000
Publication and policy briefs	$5,000	$5,000	$10,000
Data collection and analysis	$5,000	$108,000	$113,000
Other operating, including consultants	$5,000	$39,000	$44,000
Sub-total	$225,000		
Indirect costs @ 10%	$22,500		$22,500
Total	**$247,500**	**$367,000**	**$635,400**

Budget does not include matching funds from ILRI, CIAT and IITA, for scientist time and technical support from other sources, to a total of $200,000 over three years (4 months IRS per year plus 12 months technical per year).

5. Project 3: Tradeoff Analysis as an Operational and Accepted Tool for Policy Analysis

5.1   Research team

Principal investigator

Jetse J. Stoorvogel   Associate Professor, Department of Environmental Sciences
Wageningen University
P.O. Box 37
6700 AA Wageningen
The Netherlands
E-mail*:* jetse.stoorvogel@bodlan.beng.wau.nl
Phone: (31) 317-484043; Fax: (31) 317-482419

Co-Investigators

Charles Crissman   Economist, International Potato Center, Nairobi

John M. Antle   Professor, Department of Agricultural Economics and
Economics, Montana State University, Bozeman, USA

Andre de Jager   Agricultural Economics Research Institute (LEI-DLO)

Franck Place, Brent Swallow   International Center for Research in Agroforestry (ICRAF)

Philip Thornton   International Livestock Research Institute, Kenya

David Bigman   International Service for National Agricultural
Research/Wageningen University

5.2   Problem statement and objectives

The Ecoregional Fund to Support Methodological Initiatives supported the development of the Tradeoff Analysis Model[©]. The basic concepts originated in a project funded by the Rockefeller Foundation. The Ecoregional Fund and the Soil Management Collaborative Research Program (SM-CRSP) of US-AID provided subsequent funding. This joint funding led to the development of an operational tool for tradeoffs analysis. Although the tool is operational and has proven its usefulness in applications in Ecuador and Peru, the tool is not yet available for other projects. This is due to a number of reasons:

- The tool was developed for the Andean highlands and has not been applied outside this region.
- Training material and manuals are required for the distribution of a tool like the Tradeoffs Analysis Model.
- The software should be adapted to make it more generic.
- The application of the Tradeoff Analysis Model is currently constrained by the data requirements of the model.
- The Tradeoffs Analysis Model was developed in the context of a research project. For a wide distribution and application of the model, the tool needs to be institutionalized.

The research team that developed the Tradeoff Analysis Model is aware of these constraints and applied for an extension of the Tradeoff Analysis Project in the second phase of the SM-CRSP. The proposal entitled "The Tradeoff Analysis Project Phase 2: Scaling Up and Technology Transfer to Address Poverty, Food Security and Sustainability of the Agro-Environment" (2001) was approved by US-AID and tackles a number of the issues listed above. The new SM-CRSP proposal funds applications of the Tradeoff Model in different environments and focuses on a number of methods issues related to scaling up the analysis to larger region that may have a higher policy interest. Finally, the project will deal with the development of protocols and materials to transfer the TOA method and the TOA Model software to existing and future users groups.

Although the new SM-CRSP project deals with a variety of aspects that are essential for a further consolidation and application of the TOA method, a number of key elements cannot be dealt with in the program. The eco-regional methodology fund proposal Phase II includes 5 different programs that are required for a proper consolidation and application:

Program 1. Consolidation of the Tradeoff Analysis Model
Program 2. Testing and application of ecoregional methods in regional case studies
Program 3. Development of user-oriented, generic software for TOA Model
Program 4. Strategies for institutionalizing the TOA Model
Program 5. Communication of research results.

We propose to create a jointly managed project similar to the one that external reviewers rated as successful in the DME-nor project in the first phase of the Tradeoff Analysis Program (External Evaluation Panel, 1999). The joint project aims to consolidate and apply the TOA model. It is clear that this cannot be done with a single contribution from the Ecoregional fund. We therefore propose closely linked projects in which US-AID funding is used to compliment the funding from the Ecoregional Methodology Fund. Only in such a way, it is possible to consolidate and apply the Tradeoff Analysis Model in a proper manner.

5.3   Specific activities that will be financed by US-AID

Although the project funded by US-AID goes beyond the objectives of the Eco-regional Methodology Fund, a number of specific activities directly deal with the further consolidation and application of the Tradeoff Analysis Model. More specifically this includes 1) a further development and refinement of the existing Tradeoff Analysis Method and Tradeoff Analysis Model software, 2) the development of protocols and materials to transfer the Tradeoff Analysis Method and the corresponding software to existing and future user groups 3) applications of the model in Central America and -jointly with another SM-CRSP project- in West Africa.

5.4   Specific activities that will be financed using Ecoregional Fund

Phase 2 of the SM-CRSP program leaves a number of gaps in research activities that are essential for the Tradeoff Analysis Model to function as an operational tool:
- How easy or complex is the application of the tradeoff model using data from previously conducted surveys?
- There are a large number of cases where the policy or technology options for long run soil nutrient management are unknown. The TOA Model should be linked to relevant models for monitoring nutrient depletion such as the NUTMON toolbox (Vlaming *et al.*,2001).
- How do we effectively translate tradeoff analysis results into policy recommendations?
- How do we institutionalize the tradeoff analysis method?

The joint venture between the two projects (SM-CRSP and this phase 2 of the ecoregional program) will tackle all five programs proposed in the ecoregional fund. We view activities within the Tradeoff Analysis Program as a contribution in kind to the ecoregional project.

5.5   Project strategy

In the past, dynamic surveys of farm household activities and farm management have often been used as an important technique to adequately model agricultural decision-making. The applicability of the TOA Model would be significantly increased if we could show that the model can be run using this type of previously collected data. Wageningen UR has extensive experience in nutrient monitoring in its NUTMON program (www.nutmon.org). NUTMON is an integrated, multi-disciplinary methodology that targets different actors in the process of managing natural resources in general and plant nutrient in particular. Using the NUTMON method farmers and researchers jointly analyze the environmental and economic sustainability of tropical farming systems. Participatory research techniques such as resource flow mapping, matrix ranking and trend analysis are used to obtain the farmers' perspective. Among with the participatory analysis, NUTMON guides a quantitative analysis to generate important economic and soil management indicators such as nutrient flows, nutrient balances, cash flows, gross margins and farm income. Both the qualitative and quantitative analyses are then used to improve or design new technologies which tackle soil fertility decline can help to increase the economic performance of the farm.

However, despite the fact that many applications of NUTMON showed the mining of soil fertility to be a major threat in East African cropping systems, the projects were unable to guide changes in policy to reduce this threat. In contrast, the aim of the Tradeoff Analysis method is to answer the questions: What will be the effect of technology changes or policy interventions on the decline of soil fertility?

An application of the TOA method in East Africa, building on existing research from the NUTMON program makes a number of contributions to the funds objectives:

1. It demonstrates the applicability of the TOA method outside of the Andean conditions.
2. It links the TOA method to an existing research network with a well developed toolbox for nutrient monitoring and allows a range of research groups throughout Africa to further analyze their research findings at the policy level.
3. It illustrates how the TOA method can be applied on the basis of existing survey data.
4. A range of adaptations to the TOA Model will be necessary to make it applicable under these new conditions and in combination with the NUTMON toolbox. This will make the model more generic and easier applicable under new conditions.
5. We propose to use an African PhD student to lead the application as part of his thesis work. This will build local capacity in the TOA method.

New research activities require new partners. The current research group includes a range of CGIAR institutes (CIP, CIAT and ILRI), universities (Montana State University, Wageningen University) and national agricultural research centers in South and Central America. This diversity make the modeling group an increasingly interesting partner in global and regional initiatives that are currently underway.

A regionally-based process is underway to promote greater integration of the activities of the CG system and its partners in Eastern and Southern Africa (ESA). The process of integration is to respond to global and regional challenge programs. Challenge programs are proposed as new methods of financing research in the CG and their aim is to promote integration. The sub-Saharan Africa group has proposed an Africa regional challenge program on integrated natural resource management and policies. The objectives of these regional challenge programmes are clearly consistent with the objectives of proposed joint Ecoregional Fund and SM-CRSP projects for applications of the TOA Model. This consistency is illustrated with the following output developed by the sub-Saharan Africa group for a proposed regional challenge program on Policies.

> *[There is a need for…] instruments to address trade–offs between private and social costs and benefits, including policy instruments to guide food security decision making on appropriate agricultural inputs, those to guide fair trade decision making for the removal of trade barriers at national, regional and international levels, and appropriate policy options, norms and standards for sustainable land use.(Final report ESA working group 2001)*

The above example together with, for example, the African Highlands Initiative illustrates that there is a basis in East Africa to further institutionalize the TOA method. Active lobbying and participation in these activities will be needed for an effective implementation of the Analysis in these initiatives.

Although the concept of tradeoffs is clearly appealing to policy makers, an important step towards the design of effective policies still has to be made. Applications in Latin America as well as the proposed new application based on the existing NUTMON research provide a range of examples. In Ecuador our application of the TOA method stimulated an active discussion between researchers and policy makers related to pesticide use and its effects on human health and the environment. In Peru, the national soil conservation service is struggling to identify the best set of incentives to promote terracing on hillside farms. Our application of the TOA method with them provided an excellent basis for spatially explicit policies. Geographical targeting of agricultural policies is receiving increased attention. The geographically explicit tradeoff results make an important link to this type of policies.

5.6   Workplan

- Different applications of the TOA Model require a range of adaptations. These adaptations involve new interfaces with environmental process models and more generic user interfaces. Together with software developments, team members will develop data standards for model interfaces.
- A PhD student will work on an application of the TOA Model using the NUTMON survey data. His work will be supervised by members from the Tradeoff and NUTMON teams.
- The TOA method is an interactive process with those that apply the TOA Model and those that use the results of the model. We will develop manuals and other materials for use in training courses that will be a part of the implementation process. Continued interaction with user groups will take place through the (to be developed) interactive website.
- Team members will actively participate in regional and global initiatives related to ecoregional research put the TOA method on the policy analysis agenda.
- Specific attention in the applications will be paid to the question on how to effectively translate tradeoff results in policies.

The consortium proposes the following workplan:

Year	Month	Activity
2002	Jan-Jun	Setting up research network, Participate in stakeholder meetings, Contact policy groups, Presentations on TOA
		Development of research team, Recruit research assistants (soil science and ag. econ. background)
	Jul-Dec	Training multidisciplinary research team, Team workshop
		Site selection and data assembly, Development of GIS database, Analysis of survey database
		Linkage between NUTMON and TOA, Linkage between IMPACT and TOA, Adaptations to the TOA software.
		Linkage between IMPACT and TOA
2003	Jan-Dec	Application of the TOA process
		• Research priority setting in stakeholder meetings
		• Project design and implementation
		• Disseminate findings in stakeholder workshops and publications
		• Wrap up of application
		• Project evaluation
		• Reporting
2004	Jan-Dec	Disseminate results to other potential users
		CD hyper-text
		Post results on project web site
		Develop linkages with the BASIS model
		Analyze the use of aggregated data
		Census data
		National household expenditure/welfare monitoring surveys
		BASIS CRSP regional economic data.
		Adapt the TOA model to deal with other scale levels

5.7 Budget

Amount requested:

Ecoregional Fund	US$ 247,500
Leverage funding from partner institutions	US$ 367,000

WAU	Eco-regional	SM-CRSP	Total
Kenya case study			
Research assistant (bio-physical)	$70,000		$70,000
Research assistant (socio-economic)	$20,000	$25,000	$45,000
Programming	$15,000		$15,000
LEI-DLO	$30,000		$30,000
ISNAR	$15,000		$15,000
International travel			
JJ Stoorvogel	$10,000		$10,000
A de Jager	$7,500		$7,500
D. Bigman	$5,000		$5,000
C. Crissman	$10,000		$10,000
ICRAF	$10,000		$10,000
Domestic travel (100 days à US$50)	$10,000	$20,000	$30,000
Field supplies	$6,250	$6,250	$12,500
Samples	$6,250	$6,250	$12,500
Data collection	$6,250	$6,250	$12,500
Vehicle maintenance & Insurance		$6,000	$6,000
Stakeholder workshops		$20,000	$20,000
Computer		$5,000	$5,000
Software		$3,000	$3,000
TOA global program			
Software development/ support		$100,000	$100,000
TOA website		$20,000	$20,000
Data standards		$20,000	$20,000
Training material		$40,000	$40,000
Total direct cost	$221,250	$277,750	$499,000
Indirect costs (@ 10%)	$22,125		
Total	**$243,375**	**$277,750**	**$521,125**

6.   Overview

The current proposal draws heavily on the results of he first phase of the Ecoregional Methodology fund. A number of ecoregional tools developed in the first phase are the basis for the applications:

- process-based models for soils, crop, livestock, erosion and climate developed in the DME-nor, DME-sur and the ARC projects as well as the integrated crop-livestock models developed in the prototyping project.
- GIS and remote sensing tools developed in the two DME projects and the CIAT project
- Multiple Goal Linear programming models
- Tradeoff Analysis
- Farm household model developed in the prototyping project
- the CLUE methodology developed outside the ecoregional methodology fund but applied in the CIAT project.

Key elements in this proposal include: i development of tools that enable stakeholders dealing with ecoregional problems to make the proper selection of tools (see especially project 1); ii determination of key problems and the location where their impact is most severe (project 2), and iii an analysis in how ecoregional methods can properly be implemented in an institutional setting. These elements are studied in an operational setting where different ecoregional methods are being applied.

The three research consortia will deal with five different programs to consolidate and apply ecoregional methods:

- *Program 1*. Consolidation of frameworks and methods for ecoregional research and development
- *Program 2*. Testing and application of ecoregional methods in regional case studies
- *Program 3*. Development of user-oriented software for ecoregional analysis
- *Program 4*. Strategies for institutionalizing ecoregional analysis
- *Program 5*. Communication of results of activities supported by the Ecoregional Fund

Although all three research consortia deal with the different research programs the focus of the projects is rather different. The CIP consortium deals mainly with the consolidation of ecoregional methodology and tries to develop tools that allows users to make the proper selection of the appropriate tools from the toolbox. The ILRI headed program focuses on the determination when and where to apply ecoregional tools through an analysis of land use dynamics. Finally the Wageningen headed program focuses on the consolidation and application of a single tool and tries to put that tool in the proper institutional context. All programs, however, do so in the context of actual applications with intensive contacts with stakeholders.

Program	1	2	3	4	5
CIP	XXX	XXX	XX	X	X
ILRI	XX	XX	XX	XX	XX
WAU	X	XX	XX	XXX	XXX

6.2   Management of the Fund

As in the current phase, overall goals, priorities and strategies for the Fund will be formulated by its International Scientific Advisory Committee (ISAC). ISNAR will continue to serve as the management agent for the Fund. In this capacity, ISNAR will develop specific guidelines for the development of project documents and for monitoring the progress of on-going projects. The guidelines for external evaluation of completed projects, developed in 1999, will be reviewed to ensure their compatibility with the guidelines to be developed for project preparation and monitoring.

Rather than calling for proposals, specific groups to formulate proposals for program activities are invited. Experts and research groups from completed and ongoing projects of the Fund are expected to have a specific role here.
Up to now, ISNAR has been responsible for the administration of the Fund, with technical issues being handled by ISAC. However, the proposed future activities for the extension phase will require that the management agent provide additional technical inputs for project preparation and supervision. These inputs may be provided by ISNAR staff members and/or by external specialists contracted for this purpose.

6.3   Budget and Implementation Schedule

On behalf of ISAC and the Management Agent, we request the original contributors to consider an extension and enlargement of the original Fund as follows:
- To allow for budget-neutral extensions of six on-going projects until the end of 2002, which will then have exhausted the original US$ 5,000,000.
- To provide an additional sum of US$ 800,000 to carry out three research projects carried out by consortia headed by CIP, ILRI and Wageningen University as summarized below:

	Eco-regional	Other donors	Total
CIP	$247,500	$817,045	$1,064,545
ILRI	$247,500	$367,000	$635,400
WAU	$243,375	$277,750	$521,125
Total	$738,375	$1,461,795	$2,221,070

Other donors that will fund specific activities within the projects include:
- CGIAR through the system-wide livestock initiative,
- IFAD through MARENASS
- PDLA
- INIA-Spain
- US-AID through its soil management collaborative research support program

Specific activities that are funded through the other projects are listed in the table below (All figures in US$).

Activity	CIP	ILRI	WAU	Total
Data collection	125,000	108,000	32,750	265,750
Methodology development	46,000	130,000	45,000	221,000
Software and web-site development	165,000		120,000	285,000
Documentation	15,000	5,000	40,000	60,000
Travel	10,000	30,000	20,000	60,000
Workshops, training, meetings	25,500	55,000	20,000	100,000

These activities play a specific role in the 5 different research programs as they are identified within this program.

Indicative sub-division of funds over the different research programs:

Program	Budget (US dollars)
Program 1. Consolidation of ecoregional frameworks and methods	200,000
Program 2. Testing and application of ecoregional methodologies	1,200,000
Program 3. Development of user-oriented software	400,000
Program 4. Strategies for institutionalizing ecoregional analysis	200,000
Program 5. Communication of results of the Fund	200,000
Total	2,200,000

It should be noted that the research programs specifically allocated restricted funding to this collaboration. This means that only part of the total funding available goes into this project. Researchers' time has not been accounted for in the budgets (except for a few cases where consultants are specifically contracted for activities within the projects). As a result the actual contributions of the different institutions is larger than shown in the various budgets.

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Annex 1 Members of ISAC

Dr. Stein W. **Bie**, Director General, International Services for National Agriculture Research (ISNAR), The Netherlands.

Dr. Christian **Bonte-Friedheim,** Humboldt University, Germany.

Prof. Johan **Bouma**, **ISAC Chairperson,** Professor of Soil Science, Wageningen University and Research Centre (WUR)/ Member, Scientific Council for Government Policy (WRR), The Netherlands.

Dr. Gelia T. **Castillo**, Professor Emiritus University of the Philippines.

Dr. Masa **Iwanaga**, Director, Biological Resources División, Japan International Center for Agricultural Research (JIRCAS), Japan.

Prof. Geoffrey C. **Mrema**, Executive Secretary, Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), Uganda.

Dr. R.S. **Paroda**, Secretary & Director General Indian Council of Agricultural Research, India.

Prof. G.E. **Schuh**, Regents Professor, Humphrey Institute for Public Affairs University of Minnesota, USA.

Dr. Filemon **Torres**, Director, Strengthening of the Social and Economic Organization in Management (FORGES), Argentina.

Dr. Hubert **Zandstra**, Director General, International Potato Center (CIP), Peru.

Annex 2 Letters from project leaders

In this annex, 3 letters can be found that confirm the leverage funding from the different projects.

Annex 3 Letters of interest from CIP collaborators (Project 2)