1997 Annual Report
Tradeoffs in Sustainable Agriculture and the Environment in the Andes: A Decision Support System for Policy Makers

Introduction

The principal objective of the project is to develop a decision support system for assessing *tradeoff s*between agricultural production and the environmental impacts of agriculture, for different economic, agricultural and environmental policies, and agricultural research. The decision support system will be developed and tested in the potato/pasture production system of the Andean region. This decision support system has the following key features:

• Provides decision makers with information on tradeoffs between key sustainability indicators under alternative policy and technology scenarios
• Links disciplinary data and models in a GIS framework
• Utilizes minimum data necessary for decision support and policy analysis
• Generalizable: results can be extrapolated to larger geographic regions in a GIS framework
• Transportable: the generic structure of the system can be adapted to other geographic settings and applications.

Specific objectives of the project are to:

1. Link bio-physical models that describe soil processes (pesticide leaching, erosion and soil fertility decrease) with the tradeoffs model of Crissman, Antle and Capalbo, 1997.
2. Modify the economic components of the tradeoffs model to facilitate linkages with crop growth models to facilitate the correction for soil productivities and thus the extrapolation of the tradeoff model to other regions.
3. Develop a decision support system (DSS) that can be used to quantify impacts of existing and proposed agricultural practices and policies on the sustainablity of selected Andean agro-ecosystems.
4. Utilize the DSS to screen proposed agricultural technologies such as integrated pest management and various types of soil husbandry for their potential impact on the sustainability of selected Andean agro-ecosystems.
5. Assess the usefulness of the methods developed for the DSS to extrapolate results to a regional basis.
6. Based on the DSS, develop recommendations for research priorities for national and international research systems in the Andean region.
7. Provide training to individuals and groups in interdisciplinary research tools, including the DSS and the use and interpretation of integrated economic and bio-physical modeling.
8. To communicate the empirical results of the Ecuadorian and Peruvian studies to the appropriate sets of users in the Andean region.

The first section of this report provides a summary of the activities that were planned for the year in the grant proposal (defined as February 11, 1997 through February 10, 1998), and then summarizes the actual activities and accomplishments, following the format that was specified in the original RFP. The second section describes expected and potential impacts of

the project according to the criteria set out by the Soil Management CRSP Management Entity in the December 29, 1997 Memorandum to project PIs. The remainder of the report pertains to the project's budget, personnel, and publications.

At the outset several important facts about this project should be noted.

First, the original grant proposal described two sites in Ecuador for project implementation. After the grant was awarded, the Director General of CIP suggested that the project consider working at one site in Ecuador (San Gabriel, in Carchi Province) and at the La Encanada research site near Cajamarca, Peru. This change was approved by the SM-CRSP Management Entity.

Second, after the SM-CRSP grant was awarded, a 3-year, $499,944 grant was awarded to CIP by the Dutch Government's Ecoregional Research Program to be coordinated with the SM-CRSP project. This grant supports the involvement of Dutch scientists and students to collaborate with the research being carried out in the SM-CRSP project in Ecuador and Peru.

1. Year 1 Activities and Accomplishments

According to the project proposal, section D.5., " Schedule of program activities and measurable indicators of progress", activities planned for year 1 and indicators of accomplishment are listed below in bold type. Actual activities are listed in regular type. Notable in this section is the work in site development, the search for and systematization of existing data, and new data collection activities.

• Visits by all participants to the benchmark sites for orientation visit and selection of the micro-catchments to be studied. June.
• Coordination meetings to focus inter-project collaboration on the important agricultural/environmental factors for each site. Identify possible students for thesis research. All participants, June.
• Inventory of available primary and secondary information relevant to the research watersheds by CIP, INIAP, PUCE, PROMUSTA, Fundación Pastaza. Feb.-June., computer data bases.
Indicators: research sites selected, five year and annual research plans written.

The project is working in two field sites, La Encañada near Cajamarca in Peru and San Gabriel in Carchi Province in Ecuador. The sites are CONDESAN pilot sites and as such enjoy a level of documentation and research infrastructure from previous CONDESAN-related research. (CONDESAN is a consortium of governmental and non-governmental organizations established for research on sustainable development in the Andean region). In year 1 the Tradeoffs project took maximum advantage of this history and incorporated collaborators with experience in these sites.

• A planning meeting was held in November 1996, and field trips were made by PIs to study areas in Ecuador and Peru. Preliminary identification of working groups (economics, soils, crops), and task assignments were made for the 1st year. Plans were made for graduate student participation from Wageningen A.U., Universidad Nacional de Cajamarca (Peru), Escuela Politecnica de Chimborazo (Ecuador), Universidad Catolica (Ecuador), Utah State University,

and Montana State University. A research plan for year 1 was prepared (see below).
• A planning meeting was held in October 1997 in Cajamarca, Peru, to review work to date and plan completion of year 1 and year 2 work (see Appendix B for a report based on this activity).
• Inventories of data and related scientific literature were initiated in Ecuador and Peru, with Dr. Robert Hijmans, CIP-Lima, responsible for coordinating a computer-based data and reference library for the project accessible on the Internet.
• Students for bachelor, masters and doctoral level studies were identified. See the list below for details.
• Three courses and a workshop were organized. One course was on advances in soil physical analytical techniques and the other two introduced crop models in the DSSAT system. The workshop offered a forum for comparing different types of models, from land use models to crop growth models. (see more details below)

• Characterization of watershed sites. WAU-Cornell-MSU-CIP-INIAP-Fundación Pastaza-PROMUSTA, June.
Indicators: development of decision trees, characterization report, selection of priority research topics for model development.

Since the sites have a research history, their economic, agricultural and environmental characteristics are fairly well established. This plus the number of collaborators with experience in the sites greatly facilitated the prioritization of research topics for model development. Work in this area concentrated on recovering existing information, making contacts with informants and systematizing existing information.
• WAU students made a quantitative description of soil physical and chemical characteristics, described field variability and on the basis of the 1:50,000 and a detailed digital elevation model created a detailed 1:10,000soil map for which a novel procedure has been developed.
• Economic data collection in Ecuador consisted of the compilation of existing economic survey data from previous projects conducted by CIP and INIAP in the research area supplemented by.
• Soils, elevation and climate data were collected and digitized for Ecuador by INIAP and a non-governmental organization (EcoCiencias), erosion data were collected from Fundación Pastaza.
• Economic data collection in Peru was collated from existing studies in the La Encañada site. New data collection was started as detailed below.
• Peru soils and climate data assembled from existing ADEFOR and CONDESAN sites in La Encañada. Erosion data also collected from Universidad Agraria in Lima.
• Indicators for tradeoff assessment were selected and scenarios for simulation analysis were identified (see Oct. 1997 planning meeting report in Appendix B).

• Contract field assistants, purchase vehicles and equipment, and establish field offices. CIP, January-June.
Indicators: Contracts, purchase orders, rental agreements

The logistical aspects of the project were directed at establishing field support based on existing physical installations and institutional arrangements. The project is hosted in the San Gabriel site by INIAP (Ecuador's national agricultural research organization) and in the La

Encanada site by ASPAREDUC (a non-governmental organization active in the region). In both cases the project has contributed towards improvements in these sites.

• Requisite vehicle and equipment purchases were made as per project budget
• WAU students were identified to conduct a downscaling study in collaboration with INIAP in Ecuador (see publications below)
• Cecilia Ortiz, Ph.D. candidate at Utah State, was identified to conduct additional economic data collection in Ecuador
• Dr. Mario Tapia was appointed as supervisor of the field work in La Encañada, Peru; Roberto Valdivia was hired to conduct farm production data collection. Collaborating institutions are CIP/CONDESAN, Instituto Nacional de Investigacion Agropercuaria, Universidad Nacional de Cajamarca.
• Phone, fax and email were added to INIAP field office in Carchi. A field office was added to the existing CONDESAN office in La Encañada.

• **Select sample farmers in micro-catchment sites. CIP-MSU-PROMUSTA-Fundación Pastaza, July-August.**
Indicators: Report of sample frame and sample selection procedure, register of farmer participants.

In year 1 the project reinitiated contact with the farmers from the previous pesticides study in Carchi. These farmers participated in a single visit survey and will be participating in collaborating CONDESAN integrated pest management and health research from which information for scenarios will be drawn. In Cajamarca, a new sample was drawn from representative zones of the pilot watershed.

• Because the site in La Encañada, Peru, replaced one of the Ecuador research sites, the sample selection took place in Peru with assistance of CONDEAN and ASAPAREDUC. The sample was designed and farmers were recruited into the study in December 1997 and January 1998.
• In the Carchi, Ecuador site, the data from the previous pesticides study are being utilized, supplemented with additional collection of soils, climate and economic data.

• Commence baseline economic, environmental, and farming system data collection. CIP-Fundacisn Pastaza-PROMUSTA. August.
Indicators: Documentation of data collection instruments, data base documentation, data entry.

Scenario testing in the tradeoffs model requires specific economic production agriculture data. Work focused on complimenting the existing Carchi data set and initiating collection in the La Encañada site.
• Cecilia Ortiz data survey in Ecuador
• Other data obtained from surveys in Ecuador (Victor Barrera)
• Survey instrument for field-level production data designed for La Encañada site in Peru, based on earlier survey done in Carchi site in Ecuador

• **Establish bio-physical trials. INIAP-PUCE-Cornell-WAU, June.**
Indicators: Reports of soil, water and residuals sampling methods and design, logs of samples taken and processed.

• Several experiments were started and/or continued using project resources:
    • Mario Caceres : the use of organic matter
    • Erosion experiments were set up by the project (Peru) and supported by the project (Ecuador)
    • Experimentation started to calibrate/validate the pesticide leaching models.
• Scenario testing also requires primary data from biological and physical disciplines. These data are being collected in both sites.
    • Pasture, organic matter management, and erosion trials in Peru.
    • Digitized soil maps for Carchi, Ecuador
    • Soil and erosion data for Peru – Robert Hijmans

In addition to the above activities, the following activities were conducted during the first year:
• Tools Workshop
Co-sponsored by the SM-CRSP project, CIP, ICASA, and the C.T. de Wit Graduate School for Production Ecology, 25 researchers from 11 countries participated in a workshop in which eight models were presented for hands-on testing and criticism. The course proceedings are in preparation for publication.
• A preliminary version of TRADEOFF, the decision support system software, was developed by Stoorvogel and Antle. This version was presented at the Tools Workshop.
• DSSAT Courses
In Lima and Quito, Walter Bowen conducted week-long introductory courses to DSSAT. The Lima course, attended by 21 persons from four countries was in collaboration with a second Dutch Ecoregional Fund project managed by CIP. The Quito course was attended by 22 participants from three countries. These courses were run with computers for hands-on practice. There are currently six students in Ecuador and Peru testing and validating selected crop models under supervision of various course participants.
• Soil Physical Properties Course
The project objectives require extensive use of soil physical models for leaching and erosion. It is therefore crucial to obtain reliable data on the soil physical properties for the two project sites. To determine the water retention and hydraulic conductivity curves, multi step outflow equipment has been installed in the INIAP laboratory in Quito. To train people in the use of this equipment and to strengthen the capabilities of the INIAP soil science group, a week-long course on pragmatic means and methods for soil physical properties analysis was given by WAU for 24 participants mostly from INIAP. The course manual is available in English and Spanish.

• Economics group:
    • Econometric models from the Carchi pesticide study were redesigned, and incorporated into the Carchi simulation model for linkage with crop growth models (linkage of economic models with GIS data through crop growth models)

• The economic simulation model was incorporated into the preliminary version of the DSS
• Livestock/dairy simulation models/data were developed for linkage with the existing economic simulation model

• Soils group:
• Procedures were developed to down-scale soil map information to field level, field data were collected to test the procedures
• Multi-step outflow equipment to measure soil hydraulic properties was installed in the INIAP laboratory. A course on its use was conducted by Bouma and Stoorvogel in February 1998 in Quito with INIAP, the National Agricultural Research Institute.
• Previous leaching simulation models were refined for Carchi, including assessment of lateral flows
• Screening of the WEPP erosion models for validity in Ecuador and Peru
• Analysis of slow terrace formation in Peru (UNC)

• Crops group:
• Testing of soil and crop/pasture models for their ability to simulate under conditions in the study sites (collaborators trained in use of DSSAT in a 1-week workshop by W. Bowen in Lima)
• historical field experiment data collected in Peru and Ecuador

2. Potential Project Impacts

The central focus of this project is the development of a decision support system that can provide information to policy makers that improves their ability to assess tradeoffs among competing goals and how those tradeoffs might be changed through policy and technology interventions. The purpose of this project is not to produce technologies such as new seed varieties or to devise new conservation methods, but rather to provide decision makers with a tool to assess the potential impacts of such technologies and methods.

Based on the indicators being developed for the decision support system, the following is a list of the impacts that the project will be able to quantify upon the completion of the research. Following this list, we provide some estimates of potential impacts from the research that has already been carried out in the Carchi site.

2.1 Quantifiable Potential Impacts

Impacts on People
• improved farm household income, short term and long term
• reduced farm household income risk
• improved rural nutrition
• improved human health (reduced exposure to pesticides)
Impacts on Food Production

• increased potato, crop, and livestock production
• potential shifts between crops, livestock associated with resource degradation
• long-term sustainability of crop, livestock production
• impacts on production of potato technology innovations (late blight resistant varieties, IPM)

Trade and Growth

• impacts of trade policies and agreements on competitiveness of domestic crop and livestock production
• improved information to support trade negotiations

Environment

• early identification of impacts of crop and livestock production on long-term soil quality, water quality
• impacts of pesticide use on environmental quality
• reduced encroachment of crop and livestock production into fragile or protected areas
• early knowledge of impacts of climate variability on crop and livestock production

2.2 Potential Impacts of Research Completed in Ecuador

The previous research completed in Ecuador examined the tradeoffs between the value of agricultural production (potato production and dairy production), environmental quality (leaching of pesticides to groundwater), and impacts of pesticide exposure on the health of the rural population. Based on the findings of this previous research, and based on the current project's efforts to extrapolate these findings to other potato producing regions of Ecuador, we can make some preliminary estimates of potential impact. ***We stress that at this early stage of the project, research on the potential impacts of these production systems on long-term soil productivity has not been completed, and these potential impacts cannot be quantified at this time for either Ecuador or Peru.*** Thus, the estimates of impact presented here are only a part of the potential impacts of the project. The potential impacts of improvements in long-term soil productivity will be presented at a later date when that component of the research has been completed.

Estimated Potential Impact

The potato producing zones of Ecuador comprise some 40,000 farms cultivating about 30,000 ha of potatoes. Although potatoes are produced throughout the country, the northern region of potato production in Carchi province supplies about 40 percent of national production. The impacts reported here are from the case study conducted in watersheds in Carchi province.

According to the results of the previous research, published in the Crissman, Antle, Capalbo (1998) book, *Economic, Environmental and Health Tradeoffs in Agriculture: Pesticides and the Sustainability of Andean Potato Productio* (Kluwer Academic Publishers, Boston), Chapter 11, the adoption of Integrated Pest Management for control of the major insect pest (the Andean weevil) would allow production to be increased by about 25% without increasing leaching of the insecticide Carbofuran into groundwater. Likewise, adoption of late blight resistant cultivars was estimated to provide at least a 25% increase in production without an increase in the use of fungicides. (Measured in terms of production losses, late blight is the world's most costly plant disease). Using this 25% figure, a yield of 15 mt/ha, and a price of $150/mt, this 25% increase in production would be valued at $16.9 million/yr. Assuming that

increase was maintained over a period of 20 years, using a 10% discount rate this increase would have a present value of $144 million.

In addition to these potential benefits, the previous research showed that the use of pesticides was associated with significant health consequences for the rural population of Ecuador. To the extent that the adoption of IPM and disease-resistant varieties allows production to increase without increasing these adverse health effects, additional benefits are associated with these technologies. We do not have data available that allow us to put a dollar value on these health benefits. However, our research shows that to generate comparable benefits by restricting pesticide use, it would be necessary to reduce production by at least 25%. Using this value as a lower-bound estimate of the health benefits, it could be concluded that the potential health and environmental benefits of improved pest management could be on the order of $288 million over a 20 year period. To obtain an estimate of the net benefits of these improvements, one would have to estimate the costs associated with adoption of these improved practices. Such cost estimates are not available at this time, but in our judgement the costs are not likely to amount to more than a small fraction of these benefits.

It must be emphasized that the research conducted in this project can not lay claim to producing all of the benefits described above. Rather, by contributing to the knowledge required by decision makers managing research and extension programs at the national and international levels, this research would contribute to the creation of those benefits.

Linkages to IPM and Safe-Use Farmer Training

The health findings of the research provide linkages between this project and the CIP-INIAP IPM and Safe Use Farmer Training Pilot Project. This project will develop explicit links to NGOs operating in the Andean sierra. The IPM-Safe Use project is a component of the Integrated Crop Management Program in Ecuador. This project will start later this year and run for a minimum of four years. Through linkages with this program, the SM-CRSP project will be able to further assess the impact of reduced pesticide use on potato production and obtain estimates of coverage. Some 400-500 villages are expected to be impacted by the program with a population of 30,000-40,000 starting in 1999. The CIP-INIAP project will have funds for monitoring adoption.

A similar IPM and Safe Use Pilot Project is being initiated in Peru by CIP researchers with one pilot site in La Encanada. This project will provide the opportunity to link the SM-CRSP research in La Encanada to assess potential impacts of adoption of improved crop management and soil conservation practices.

3. Budget

Attached as Appendix A is a summary of the project's expenditures during the first year and to April 30, 1998. The grant funds allotted for this period will have been largely expended by that time, and all cost-sharing commitments listed in the grant proposal have been met.

Leveraged funding from the Dutch Ecoregional Research project was $183,045 through December, 1997.

4. Project Participants

Principal Investigators:

Dr. John M. Antle, Dept of Ag Econ and Econ, Montana State University
Dr. Charles Crissman, International Potato Center, Quito, Ecuador
Dr. Johan Bouma, Laboratory of Soil Science and Geology, Wageningen Ag University

Key Personnel and Collaborating Institutions:

Dr. Walter Bowen, International Potato Center and International Fertilizer Development Center, Lima, Peru
Prof. Ramiro Merino, Head, Toxicology Laboratory, Universidad Catolica, Quito, Ecuador
Dr. Ruben Dario Estrada, CIP and CIAT, Cali, Colombia
Dr. Jetse Stoorvogel, Laboratory of Soil Science and Geology, Wageningen Ag University
Dr. Anton Haverkort, Res. Inst. for Agrobiology and Soil Fertility (AB-DLO), Wageningen
Dr. Robert van Haren, AB-DLO, Wageningen, The Netherlands
Ing. Agr. Juan Cordova, Head, Soil Science Department, Instituto Nacional de Investigaciones Agro-Pecuarias (INIAP), Quito, Ecuador
Ing. Agr.Victor Barrera, Head, Technology Transfer Unit, INIAP, Quito, Ecuador
Dr. Robert Hijmans, CIP, Lima, Peru
Dr. Mario Tapia, CIP/CONDESAN, Lima, Peru
Ing. Roberto Valdivia, CIP, Lima, Peru
Ing. Hector Cabrera, Instituto Nacional de Investigacion Agropecuaria (INIA), Cajamarca, Peru

Ing. Guillermo Baigorria, Dept of Agrometerology, Universidad Nacional Agraria (UNA), La Molina, Lima, Peru
Ing. Fernando Rodriguez, EcoCiencia, Quito, Ecuador
Dr. Leo McGilvary CARE- PROMUSTA (Ecuador)
Dr. Peter Muck, Escuela de Post-Grados, Universidad Nacional de Cajamarca (UNC), Peru
Dr. Edevaly de la Peña, Escuela de Post-Grados, UNC, Peru
Ing. Agr. Flavio Flores, Asociacion Civil para la Investigacion y Desarrollo Forestal (ADEFOR), Cajamarca, Peru

Graduate Students:

José Negrete, Ing. Agr.,Escuela Politecnica de Chimborazo, (ESPOCH), Riobamba, Ecuador
Neidy Clavijo, Ing. Agr., ESPOCH, Riobamba, Ecuador
Miguel Flores, Ing. Agr. ESPOCH, Riobamba, Ecuador
Cecilia Ortíz, Ph.D. Dept of Ag. Econ, Utah State University, Logan, Utah
Genaro Carrión, M.Sc., Escuela de Post-Grados, U. Nacional de Cajamarca (UNC), Cajamarca, Peru
Sara García, M.Sc., Escuela de Post-Grados, UNC, Cajamarca, Peru
Ernesto Rodriguez, M.Sc., Escuela de Post-Grados, UNC, Cajamarca, Peru

Mario Cáceres, M.Sc., Escuela de Post-Grados, UNC, Cajamarca, Peru
Ramiro Merino, Ph.D., Wageningen Agriculture University (WAU), The Netherlands
Guillermo Baigorría, Ph.D., WAU, The Netherlands
David Meerbach, Ir., C.T. deWit Graduate School for Production Ecology, WAU
Francien van Soest, Ir., C.T. deWit Graduate School for Production Ecology, WAU
Erik Meyles, Ir., C.T. deWit Graduate School for Production Ecology, WAU
Lammert Kooistra, Ir., C.T. deWit Graduate School for Production Ecology, WAU

5. First-Year Project Publications

Antle, J.M., Stoorvogel J.J. & Crissman, C.C., 1998. Tradeoff assessment as a quantitative approach to analysis of the sustainability of agricultural production systems. In: Stoorvogel, J.J., Bouma J. & Bowen, W.T., 1998. *Information technology as a tool to assess land use options in space and time. Proceedings of an international workshop Lima, September 28- October 4, 1997* Quantitative Approaches in Systems Analysis No. 16. DLO Research Institute for Agrobiology and Soil Fertility, The C.T. de Wit Graduate School for Production Ecology. Wageningen, The Netherlands: 63-76.

Antle, J., and C. Crissman. "Linking Economic and Crop Growth Models for Environmental Impact Assessment." Research Discussion Paper, in preparation.

Antle, J., J. Stoorvogel and C. Crissman. "TRADEOFF: A Decision Support System for Policy Decision Makers." Version 1, September 1997.

anon. "Las propiedades físicas del suelo en análisis de use de la tierra desde datos de estudios de suelos hasta retencion de agua y conductividad hidráulica: Curso sobre análisis de las propiedades físicas del suelo y su aplicación en análisis del uso de la tierra." (Quito: CIP-WAU-INIAP) February 9-13, 1998. (Soils Physical Properties Course Manual)

Kooistra, L. and E.W. Meyles. " A novel method to describe spatial soil variability: A case study for a potato-pasture area in the northern Andes of Ecuador. M.Sc. Report, Wageningen Agriculture University, The Netherlands and International Potato Center, Quito, Ecuador. 1997.

Stoorvogel, J.J., Bouma J. & Bowen, W.T., 1998. *Information technology as a tool to assess land use options in space and time. Proceedings of an international workshop Lima, September 28- October 4, 1997* Quantitative Approaches in Systems Analysis No. 16. DLO Research Institute for Agrobiology and Soil Fertility, The C.T. de Wit Graduate School for Production Ecology. Wageningen, The Netherlands.

van Soest, Francien. "A method for downscaling soil information from regional to catena level. M.Sc. Report, Wageningen Agriculture University, The Netherlands and International Potato Center. 60 p + annex. 1997.

Appendix A. Budget Summary

SOIL MANAGEMENT - CRSP
MONTANA STATE UNIVERSITY; GRANT #291488
ANNUAL EXPENDITURE REPORT; FEBRUARY 11, 1997 TO FEBRUARY 10, 1998

Salaries	$ 1,800.00
Benefits	30.27
Travel	3,595.35
IDC (Overhead)	4,259.60
Sub Contract (International Potato Center)	165,128.00
Total	$174,813.22

Estimated Expenditures to April 30, 1998

Salaries	$ 6,357.00
Benefits	1,589.00
Travel	3,000.00
Computer Equipment	5,064.06
Subcontract (International Potato Center)	85,026.00
Total	$275,849.00

Cost Sharing Obligations have been met.

Appendix B. 1998 Work Plan CRSP/DME-Nor

Prepared during the Annual Planning Meeting October 5-8, 1997, Cajamarca, Peru

CARCHI SITE (Ecuador)

Indicators:
- attainable yield
- water quality
- economic - value of production, income, risk

Scenarios:
- climate - mean and variance in temperature and precipitation
- economic - dairy production, trade policy
- mechanical soil displacement - soil conservation
- feed pasture improvement
- potato production technological change (Late Blight resistant varieties, Andean Weevil IPM)
- improved pasture management

Documentation

All tasks will include working paper documenting data, procedures, etc. to standard of replication.

Soils
- Final EcoCiencia Soils Map for entire Carchi AEZ. To Stoorvogel and Hijmans by Crissman, Nov. 1, 1997
- Soil data from FUNDAGRO Encuesta Dinamica parcels in El Angel to Stoorvogel and Hijmans by Barrera, Nov. 1, 1997
- Downscaling the 1:50,000 soil map towards the field level and the development of a soil information system that will be implemented in the field sector, Stoorvogel, March 1998
- Course on soil physical measurements at INIAP, Quito, by Kooistra and Stoorvogel February, 1998

Climate
- Data and coordinates from 50 stations for 30 years to Hijmans and Stoorvogel by Crissman, mid October, 1997
- Data from stations surrounding Carchi AEZ to Stoorvogel and Peter Jones of CIAT by Hijmans, late October 1997.
- Peter Jones interpolation due to Stoorvogel by Hijmans, January 1, 1998.
- Stoorvogel interpolation due by February 1.

GIS

- Ecociencia digitization to Hijmans and Estrada, mid October, 1997
- Peter Jones correction of coordinates to Hijmans by Estrada, early December 1997

Field Map
- GPS register of FUNDAGRO Encuesta Dinamica fields to Stoorvogel by Barrera, December, 1997

Pesticide Leaching model
- Measurement of pesticide behavior in soil to Stoorvogel by Ramiro Merino, October, 1997
- Initial runs of two dimensional leaching model to Stoorvogel by David Meerbach, April, 1998
- Continued development of two dimensional leaching model to Stoorvogel by Ramiro Merino starting early 1998, continuing through year.

Erosion/ Displacement models
- Aerial photograph series of site to Stoorvogel by Crissman, November, 1997
- Field colonization history, to Hijmans by Crissman, April, 1998
- INIAP Agricultural Engineering displacement studies review to Hijmans by Barrera, December, 1997
- Literature search on mechanical displacement to Hijmans by Stoorvogel, April, 1998
- Email meeting on planning for erosion/displacement field work, April, 1998
- Livestock compaction sampling and analysis by Juan Cordova, April 1998.

Potato growth models
- Data needs:
  - soil - proportion soil with depth to A horizon
    water holding capacity (wilting point, field capacity)
    nitrogen content per soil type
  - climate- daily values of radiation, min and max. temperature vapor pressure wind speed and rain.
  - crop - data from Jukka Korva obtained by v. Haren, December 1997
    Ecuador potato trials data from Barrera to v. Haren as processed
    Peru potato trials data from Bowen to v. Haren as processed
- calibrated potential and water limited model is available by March 1998, results in Xfiles format
- calibrated potato-late-blight-weevil model for one cultivar available by January 1999

Pasture-Milk model
- Dairy models put into DSSAT format by Barrera to Bowen, April 1998

User Shell
- Development of loss function, inclusion in user shell, by Antle, Feb 1998
- Complete user shell, by Antle/Stoorvogel, Feb. 1998

- Develop K3 Economic model - Antle/Diehl, May 1998
- Model Execution/Analysis - Antle/Crissman/Stoorvogel, May-July, 1998

CAJAMARCA (Peru)

Indicators:
(same as Carchi...)

Scenarios:
- Soil Management (via soil conservation and soil fertility management)
- Indicator: Soil erosion impact on productivity
- Pest Management (Andean weevil, late blight)
- Dairy production (pasture productivity...)
- Climate (mean and variance of temp and precip)
- Economic (domestic dairy and other policy...)

Soil:
- Downscaling of soil map to functional horizon approach:
  Form work team: Led by Jetse, Mario Tapia, Walter Bowen, Wilfredo Poma, Edelvaly de la Peña. Preliminary proposal by Stoorvogel and Poma to work group after course in February. Final proposal by work group by March.
- Soil conservation
  Mario Tapia oversees the incorporation of proper physical data on parcels into economic survey. He also oversees the literature review on soil conservation related to La Encañada and Cajamarca
  Roberto Vadivia to do economic analysis of soil conservation (?)
- Erosion:
  C. Felipe Morales erosion data digitized by December 31, 1997
  WEPP model validation by May 1998 by Bowen
  Potential use of WEPP mechanistic model (data demands) by Lafite thesis December 1998.
- Soil fertility management:
  Nutrient management and sources nutrient flows by Aart Osman to Walter Bowen November 1998
  Corral system study by Mario Caceres to Walter Bowen, February,1998

Climate
- ADEFOR climate data to Bowen by November, 1997
- Quality checked ADEFOR weather data by Bowen to Hijmans, Jan 1, 1998
- Weebauer SENAMI station data digitized by Walter Bowen, by March, 1998
- ADEFOR climate data interpolated by Peter Jones to Robert Hijmans by December 1998
- La Encañada weather station data with SENAMI radiation data assembled by Mario to Hijmans and v. Haren, July 1998

GIS

- No work for 1998.

Fields

- Economic survey fields georeferenced by field assistant to Stoorvogel June 1998.
- GTZ survey fields georeferenced by field assistant to Stoorvogel, June 1998.
- Aerial photos of La Encañada by M. Tapia to Stoorvogel, November 1997.

Crop Production Models

- Cereals models
  - INIA and INIA-CIMMYT crop experiment data for validating DSSAT barley and wheat models by INIA-Cajamarca researchers to Bowen, May 1998
  - DSSAT cereals models validated by Bowen, June 1998.
  - Economic survey data included, late 1998
- Potato models
  - INIA delivery of all potato experiments from 1988 in GTC format
  - INIA potato experiments in FILEX format by Bowen to van Haren, February, 1998
  - Other CIP experiments (J. Landeo Porcon trials) by Hijmans to van Haren report by February
  - GTZ data set (43 potato fields) with weather by Tapia/Bowen to van Haren, April, 1998
  - Nutritional balance study (Aart Osman) experimental data by Bowen to v. Haren, November 1998
  - Validated potato model by van Haren to Stoorvogel, early 1999.
- Pasture-milk models
  - Pasture-Milk model validation plan facilitated by Mario Tapia with Carlos Leon Velarde in coordination with Carchi group
  - UNC pasture thesis by Sara Garcia to M. Tapia, July 1998
- Economic Survey
  - M. Tapia and C. Crissman will coordinate initiation of the economic survey.
  - Sample selection - Nov 97
  - Survey instrument design Crissman/Antle Oct 97, circulated to other P.I.s to be finalized by end November 1997
  - Hire field assistant, November 1998
  - Farmer recruitment, November 1998