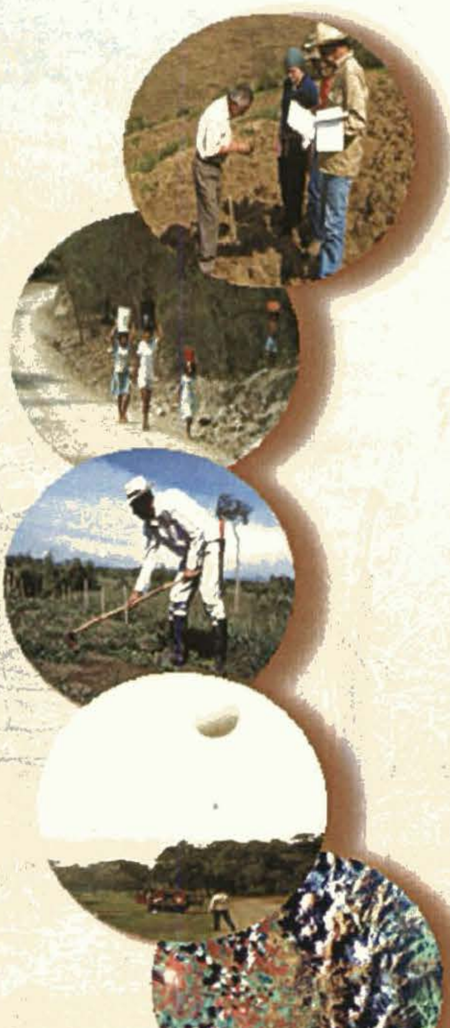
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

Land Use Project Summary Annual Report 2003

11 DIC. 2003
CIAT
UNIDAD DE INFORMACION Y DOCUMENTACION



SUMMARY ANNUAL REPORT

2003

PROJECT PE-4

Land Use in Latin America

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SUMMARY ANNUAL REPORT 2003

PE-4 PROJECT

Site-specific development: Specific information for specific decisions

The success of research for development can only be measured in terms of improved livelihoods. Generation, analyses, and delivery of geographic information have huge potential to support rural communities improving their livelihoods by reducing the uncertainties that are associated with the changes necessary to achieve this goal. However, this potential can be realized only if geographic information is embedded in a practical context to support specific decisions. The Land Use Project has therefore devised over the last year the strategy of *Site Specific Development* that it will deploy to contribute most efficiently to the improvement of rural livelihoods.

Rationale: What is site-specific development?

Site-specific development is the use of geographic information to solve practical decision problems typified by questions such as: "Where can I grow this?" or "What can I grow here?" The basic argument is: Farmers and their advisors need *specific* information to support *specific* decisions. Failure to provide specific information burdens decision makers with errors of generalization that are potentially extremely costly. The value of specific information is proportional to the errors it removes.

How will site-specific development contribute to CIAT goals of poverty alleviation? When people think of site-specific agriculture, they frequently associate it with precision agriculture, and normally picture rich farmers using high-tech equipment to control fertilizer inputs. This type of application of site-specific agriculture is probably irrelevant to CIAT's research to support poor farmers. However, we postulate the opposite, namely that the *central* purpose of site-specific agriculture—to use geographic information to support site-specific decisions—far from being an irrelevance, could be essential to efforts to underpin agricultural development. Here we clarify the concept of *site-specific development*, and outline our plan to deliver practical outcomes that do indeed provide new opportunities for poor farmers to improve their well-being.

Methods: Applying site-specific development to agricultural development

The idea of site-specific development is explained through the following 4-stage approach:

Step 1: Define the value of site-specific development.
Step 2: Develop a range of applications that use site-specific information that assist farmers and others to make rational, knowledge-based decisions.
Step 3: Establish a network of participants – information providers and users.
Step 4: Through application, develop methods and tools to ease the processing of information.

The aim is to establish a cyclical process of learning. Following the initial assessment, research should be stimulated by applications, developed in consultation with users; methods and tools are reviewed and applications refined for the next application.

Step 1: Defining the value of site-specific information

The potential value of site-specific information

Poor farmers and their advisors need information to help them advance in an uncertain world. Uncertainty, from factors such as climate, pests, markets, or simple preference, prevents good decision making. It is reduced by information. General information is helpful, specific information is much better. Farmers respond quickly to information that is specific about their area, farm, or field, because it is perceived as relevant to their particular circumstances. Empirical evidence suggests that perceived relevance is more important to decision makers than scientific accuracy. This aspect of the problem can be paraphrased as: Scientists focus on statements that are generally true, decision makers prefer statements that are relevant to their specific situation.

The value of information is proportional to the improved decisions that are enabled by a reduction of uncertainty. Two errors are common, which we call here Type I and Type II. A Type I error occurs when a farmer fails to act in a way that would have been beneficial. A Type II error occurs when a farmer does something that is harmful, or at least non-beneficial. Many examples have been cited of Type II errors, such as deforestation, adverse crop selection, or marketing failure. But, despite new evidence to the contrary, the prevailing sense is that poor farmers appear risk averse, hence more prone to Type I errors. In short, poor farmers tend to change too slowly to get ahead in a world that is changing around them. Our goal is to deliver information to reduce both types of error.

Uncertainty can be described in relation to its two components of ignorance and variability (Ferson and Ginzburg, 1996). Ignorance is addressed through research that explains, through general truths, the underlying nature of things that vary. Site-specific development addresses the uncertainty introduced by variable expression of those truths at a given place and time. For example, a plant breeder may develop a new bean variety that resists drought. While the variation of resistance in the field is rarely specified, in practice, field data normally reveal surprisingly large variance, even over short distances, that results in persistent uncertainty. This affects the farmer. Before adoption, a farmer is likely to want to know whether drought is likely in *this* site, *this* year. If the variation between sites is significant, specific information can help significantly reduce this source of uncertainty.

Quantitative analysis of the value of site-specific information is possible, but it requires an estimate of the "ideal" decision that would be made, given perfect foresight of the outcome. Such methods exist in economics. For now, quantitative analysis is deemed unworkable. In the interim, we adopt a pragmatic approach to identify the variation according to the following simple concept that:

total variation = manageable variation + unmanageable variation + noise

An interim goal of providing site-specific information is to identify manageable site variation by (a) reducing noise (unexplained variation), and (b) resolving (known) manageable from (known) unmanageable variation.

How is site-specific information used?

The value of site-specific information is related to the degree of variation that is managed. This becomes apparent to a farmer once a situation is clarified (i.e., noise-reduced, "drought situation is likely"), and the controllable component resolved ("drought controlled by changing planting date"). Site-specific information has two practical modes of use:

- Site-specific information can be pushed "forwards" into a problem, to answer questions about what might be, such as: "Where is drought likely?" "Where can I grow forage species *x*?" Or "What can I grow at this location?"[1]
- Site-specific information can be pulled "backwards" out of field observation, to explain why, for example, a given variety of beans always does poorly in certain specific parts of a hillside.

In reality, the process is cyclic. Forward predictions are compared with what actually happens and used to improve the model for subsequent prediction (Figure 1).

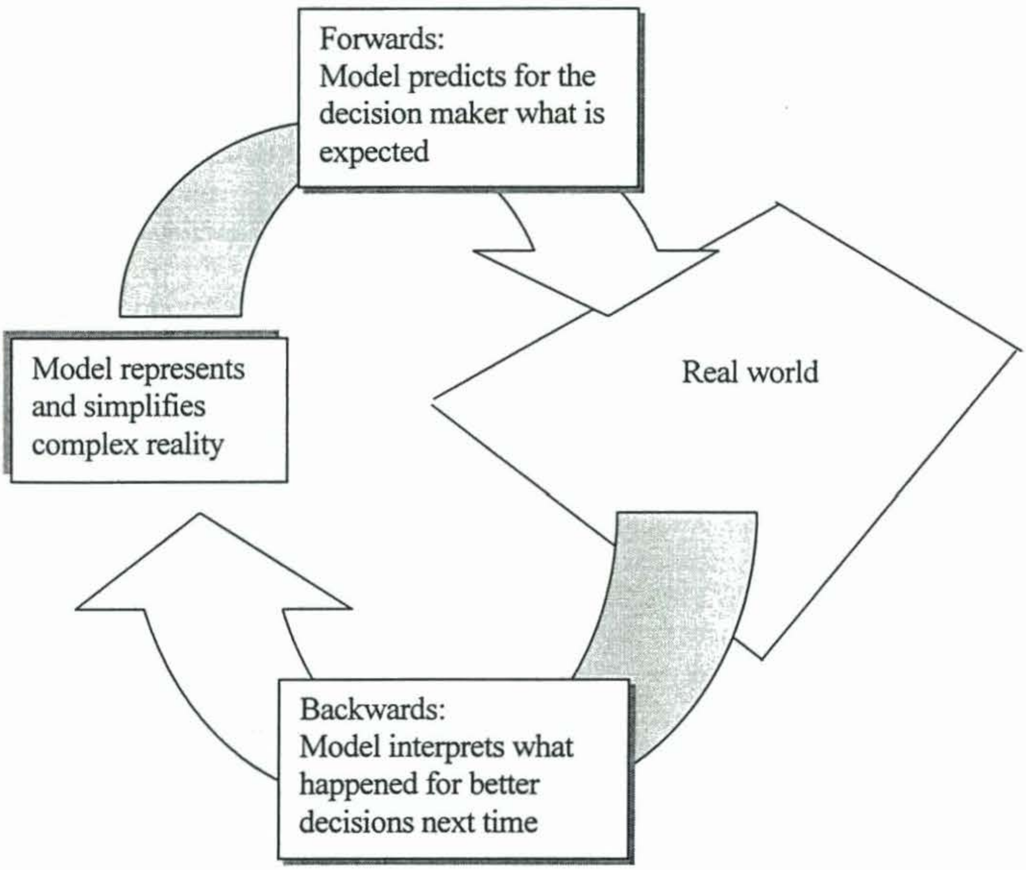

Figure 1. Cyclic process of obtaining site-specific information.

Forward application of site-specific information

Forward application of site-specific information is simplified by prior judgment that the site-specific information is likely to be useful, following which it is offered to the decision maker to assist him/her to divert resources in space or time. The classic example is the use of suitability mapping, which offers information that can help decide where to grow certain crops, under certain management assumptions.

[1] Note that in standard GIS usage, the sense is reversed, i.e., forward chaining starts with evidence and searches for a reason for variation, backward chaining starts with a hypothesis and searches for evidence.

The direct users of such information are rarely farmers. Based on predefined models, this information has a high scientific content. It tends to be valued most by researchers or other specialists who know how to reinterpret the information for strategic decisions. It tends to be most successful when used to reduce "noise" for global or regional scale definition of spatial variation.

Backwards interpretation of site-specific information

While forward application has been highly successful at identifying broad-scale variation in site condition, its ability to resolve decision uncertainty tends to weaken as it approaches the locus of physical change. This weakness is introduced by the prior judgment about the information that is required, which tends to overlook other sources of decision uncertainty—such as short-range variation and farmer preferences—that also strongly influence decisions (see Rowe [1994] for a full description of the range of sources of uncertainty in decisions). Forward prediction is a valuable (and often the major) step towards the final definition of what types of variation are manageable.

A complementary approach is to work *backwards* from site-specific information, which characterizes the variation that has already occurred, and infer, with the farmers, how much of this is manageable. Several options exist to determine how much of this variation is manageable. In decreasing proportion of use these are:

- Intuition: Farmers intuitively recognize many major features of variation. While eschewed by scientists, intuition on the basis of partial information is widely accepted by farmers (and others) as the principal means of arriving at a decision.
- Analysis of variance with respect to known factors, such as fertilizer or crop variety.
- Comparison of actual observations with expectations derived from forward prediction expert knowledge or simulation modeling.
- Compiled data from many sites can be used to determine the "best" practices for sites with specific conditions.

Step 2: Application development

This year's full annual report describes nearly 30 separate activities aimed at providing site-specific information for land use decisions. The decision makers in these examples are mainly policymakers and researchers.

While we have no intention of ignoring these "high-level" decision makers, we now want to focus more effort on providing relevant information to farmers and other local decision makers. Experience shows that the general ideas must be converted as quickly as possible into specific applications that deliver practical outcomes, such as changing land management or accessing new market opportunities, and for these we have chosen high-value fruits and niche coffee, since these match CIAT's mandate for work in hillsides and development of competitive agriculture. Concept notes are being prepared with the Tropical Fruits and Agro-Enterprises projects for submission to donors.

Methods are being developed through collaboration with the Centro Nacional de Investigaciones de Banano (CENIBANANO) and with the Centro Nacional de Investigaciones de Caña (CENICANA).

Step 3: Establish a network of info providers and users

Experience also shows that a spectrum of participants is required to adopt the information within a vertically integrated chain. The network includes researchers, private and public sector organizations, and grower organizations.

A keynote presentation at the 4th European Conference on Precision Agriculture attracted interest from international scientists from the University of Illinois, University of Florida, Silsoe University (UK), and University of São Paolo (Brazil), all of whom have significant experience in both precision agriculture and tropical agriculture, following which a special session on Site-Specific Development has been invited by the President of the 7th International Conference on Precision Agriculture, in Minneapolis.

The applications below for high-value fruits, specialty coffee, and forages all involve information chains that include growers' organizations and extension agencies.

In the hillsides of much of Central America and the northern part of South America, coffee has been the traditional cash crop, and its cultivation has brought wealth to regions such as the coffee zone in Colombia. However, coffee sold as a commodity faces the same problem as most agricultural commodities: real prices are declining year after year, and hence coffee farmers' incomes are inexorably decreasing. On the other hand, certain areas or sites that have suitable characteristics can produce specialty coffees, for which there is a buoyant demand, and prices are good. The solution to the dilemma of the coffee growers would seem to be to produce specialty coffees in those sites that possess the particular conditions required for the production of high-quality specialty coffees, and to diversify into new high-value crops, such as fruits, in those areas that are not apt for specialty coffees.

Within this context, spatial analysis will be used to determine which sites are appropriate for specialty coffee production, utilizing the information available on coffee quality and production on existing coffee farms. For those sites not suitable for specialty coffee, site characteristics will be used to determine what alternatives might be grown there, and this information would be coupled with market analysis to determine which of these products could readily be marketed.

Step 4: Develop methods and tools for specific applications

This approach is in its first year of development. Methods and software tools include:

- Homologue
- CropIdent
- Expector_clone
- IntelAgro
- Participatory 3D mapping
- Kite aerial photography

Discussion: A comprehensive approach to using geographic information

These principals of applying spatial information to problems of rural development are not new to PE-4. However, site-specific development signals a significant shift of emphasis that complements previous research, and is intended to provide a more comprehensive framework for both the regional, and detailed participatory resource mapping:

- Bottom-up and top-down: The ultimate target of site-specific information is individual decisions made by farmers at specific locations, on the basis of local or foreign information that is relevant to the particular local circumstances. Thus regional or global information may be redefined and complement local information.
- Demand-driven: Objectives are defined principally from the viewpoint of the decision maker. The purpose is to remove uncertainty that obstructs good decision making. Decision makers include farmers, community or industry organizations, policymakers and researchers.
- Decision specific: Site information targets specific decisions by participants in an information and value chain. We track the use of spatial information through the decision process by means of dialogue with the users.

References

Ferson, S.; Ginzburg, L.R. 1996. Different methods are needed to propagate ignorance and variability. Reliability Engineer. Syst. Safety 54:133-144.

Rowe, W.D. 1994. Understanding uncertainty. Risk Anal 14:743-750.

Project Overview

Project Description

Objective: By providing relevant information about land use change, the project aims to help decision makers, ranging from farmers to World Bank investors, reduce the uncertainties of development.

Outputs:
1. Baseline and time-series data for subsequent analysis performed.
2. Information and insight of biological limitations and drivers of land use change developed.
3. Analysis and prediction of socioeconomic factors influencing land use development performed.
4. Analysis and prediction of vulnerability of land use systems to significant external events performed.
5. Methods of capturing farmers' knowledge in land use decision support developed.

Gains: Detailed georeferenced databases on land use, ecological, and socioeconomic factors. Environmental and sustainability indicators of land use, networking on the environment, land use, sustainable agriculture, and indicators. A blend of theoretical, methodological, and field-based inquiry for decisions on sustainable agriculture. Upscaling and extrapolation tools available for a variety of uses.

Milestones:

2004 Germplasm targeting tool completed (Beta version). World climate surfaces upgraded to 1-km grid. Data, analyses, and tools for natural resource management disseminated throughout tropical America and other tropical areas of the world.

2005 Delivery of second-order information products (e.g., policy guidelines, analytical methods, or information exchange networks) that will reduce the risks associated with specific land use changes that might otherwise threaten the well-being of significant numbers of rural people in the tropics. These will address specific issues such as water productivity, climate change, and application of new germplasm.

Collaborators: ICRAF, CIP, ILRI, ECLAC, Univ. Guelph (Canada), IICA (Costa Rica), IILA (Italy), IIASA (Austria), WRI (USA), RIVM (Netherlands), TCA (Amazonian Cooperation Treaty), Earth Council (Costa Rica), World Bank; NARS, GOs, and NGOs in Latin America: DNP, IGAC, MinAmbiente, IDEAM, CARDER (Colombia); Ministry of the Environment, EMBRAPA (Brazil); IVITA, INIAA (Peru); INIAP (Ecuador).

CGIAR system linkages: Protecting the Environment (60%); Improving Policies (20%); Enhancement and Breeding (10%); Saving Biodiversity (10%). Contributes to the Ecoregional Program for Tropical Latin America.

CIAT project linkages: GIS studies assist SB-1, SB-2, IP-1, and PE-2; model development with PE-3, PE-5, and BP-1.

Project Logframe - Workplan 2004-2006

PROJECT: LAND USE IN LATIN AMERICA
PROJECT MANAGER: SIMON COOK

Narrative Summary	Measurable Indicators	Means of Verification	Important Assumptions
Goal To reduce the risk of agricultural development in the tropics by providing spatial information about significant opportunities and threats of natural resource management.	Risk recognized as a reducible factor. Information adopted by decision makers. CIAT, CGIAR, or other collaborating research institutional activities enhanced by the ability to target activities.	Policy, projects, or funding strategies modified identifiably to include spatial information. Research portfolios modified identifiably by targeting or pre-selection. Risk management strategies, based on spatial information, included in development projects.	
Purpose To enable decision makers, ranging from farmers to World Bank investors, to reduce the uncertainties of development by providing relevant information about land use change.	Decision makers use spatial information to reduce risk.	Documented case studies at farm, national, and regional scales. Published methods of generalizing improved decision making, using spatial information of land use.	That uncertainty significantly obstructs land use decisions at a range of scales. That spatial variation introduces significant uncertainty to these problems. That relevant spatial information can be generated in a cost-effective manner.
Output 1 Baseline and time-series data for subsequent analysis performed.	Population, crop, and selected databases generated. Detailed climate data sets developed for modelers. Detailed future climatic data sets used to predict climate change effects.	Information available at CIAT. Selected information downloadable at CIAT Web site.	Information can be delivered to analysts and decision makers.
Output 2 Information and insight of biological limitations and drivers of land use change developed.	Threats of global climate change (GCC) to regional crop production defined for entire regions. Threats of climate change to plant genetic resources defined. Models developed for defining the impact of GCC on the potential productivity of a range of crops developed.	Maps and databases completed. Models developed, calibrated, verified, and published. Projects developed to apply models.	Sufficient data are available to generate insights.

Narrative Summary	Measurable Indicators	Means of Verification	Important Assumptions
Output 3 Analyses and predictions of socioeconomic factors influencing land use development performed.	Spatial processes driving land use change identified. Distribution of poverty and its causes identified more accurately, using spatial information.	Published explanations of the improved accuracy of explaining land use change. Spatial drivers of poverty explained in published case studies by June 2004. Information used to direct poverty alleviation policy.	Sufficient data are available to generate insights. Links exist with governmental and NGO partners to enable implementation of poverty alleviation policies.
Output 4 Analyses and predictions of vulnerability of land use systems to significant external events performed.	Indicators of vulnerability adopted by policy agencies. Spatial information on vulnerability used to reduce investment risks in at least one country case study.	Methods of vulnerability assessment published with case study at national or regional scale by June 2004. *Ex ante* analysis of the benefits of risk reduction published.	Sufficient data are available to generate insights.
Output 5 Methods of capturing farmers' knowledge in land use decision support developed.	Strengths and weaknesses, overlaps and gaps identified between farmer and scientist knowledge with respect to locally (e.g., declining soil fertility) and globally rooted resource-base management problems (e.g., climate change). Respective roles of farmers and scientists identified in local decision problems about locally and globally rooted resource-base problems. Farmer-to-farmer decision-support network established that tackle selected locally and globally rooted resource-base problems.	Case study documented of farmers generating information and merging with "hard" data on natural land resources. Network of farmer support initiated, including a minimum of 200 users at second-order organization level. Generated methods and tools documented and disseminated.	Sufficient data are available to generate insights. Local structures enable network establishment.

Investigators:

Simon E Cook	PhD, Crop Biology	Project Manager
Glenn G Hyman	PhD, Geography	Senior Staff
Manuel Winograd	PhD, Ecology	Senior Staff (Outposted)
Thomas Oberthür	PhD, Geography	Senior Research Fellow
Douglas White	PhD, Agric. and Environ. Economics	Senior Research Fellow
Andrew Farrow	MSc, GIS	Research Fellow
Kristina Marquardt	MSc, Agriculture	Research Fellow (Outposted)
Arjan Gisman	PhD, Soil Science/Crop Modeling	Associate Member Senior Staff
Andrew Jarvis (50%)	MPhil., Geography	Research Fellow
Jorge Rubiano✓	PhD, Geography	Postdoctoral Fellow
Peter G. Jones	PhD, Crop Physiology	Consultant
Rachel O'Brien	MSc, Computer Science	Postgraduate Student

✓ Arrived during 2003

Cooperators:

Within CIAT: See under CIAT project linkages of the Project Description on page 7.

Outside CIAT: See under Collaborators and CGIAR Systems Linkages of the Project Description on page 7.

Financial Resources:

Source	Amount (US$)	Proportion (%)
Unrestricted core	705,934	52
Restricted core	0	0
Carryover from 2002	26,990	2
Subtotal	**732,923**	**54**
Special projects	634,632	46
Total Project	**1,367,556**	**100**

Research Highlights in 2003

1. Homologue

Homologue is a new climate application being developed for the Tropical Fruit Project, which is deploying two major software tools to assist its goal of long-range transfer of tropical fruit germplasm. CropIdent will use a large database of information on crop characteristics to match fruit crops to potential environments. However, this database does not exist at present, and must be built up as new information becomes available. Homologue will provide a complementary function, and assist in the production of the CropIdent database. The basic concept is that a farmer's field (target area) will have homologues somewhere in the tropics. Once these are known, the local crops in these areas can be investigated with the view to introduction in the target area. In this process, information will be gathered that will provide input to the CropIdent database. We also envisage Homologue being used to extrapolate from a small number of characteristic sites where fruit crops are known to do well. By combining Homologue probability estimates from these sites into a "cloud" of estimates, we hope to overcome the minimum accession set restrictions of FloraMap.

Homologue is based on the software structure of MarkSim, and uses an algorithm based on that of FloraMap. We have designed a generic version of the FloraMap algorithm. This takes the overall characteristics of species typical of a range of climate types, and applies a user-stipulated basic variance typical of an adaptation range. The algorithm now produces Environmental Systems Research Institute (ESRI) shapefiles of the climate probability coverage. We have determined a method of storing and retrieving probability integrals of soil characteristics, and are now creating the coverages for the tropics. Work has begun on the user interface in Delphi to interact with the Fortran dynamic link libraries that will do the analyses. A demonstration version of Homologue will be ready within this year for demonstration to donors for support for a full system.

2. Poverty analysis

Ecuador: Much effort has been put into obtaining values for food consumption per person at the 4th administrative level. There are a number of potential users of this information, not least CIAT itself. This information must be analyzed and communicated in ways that suit the purpose of each potential user. A multi-scale spatial cluster analysis of the headcount ratio was undertaken to derive hotspots of significantly high concentrations of undernourished people. Weighted centroids were entered into the Geographical Analysis Machine using the headcount ratio for each district. These hotspots have been published on an Internet Map Server, which allows CIAT and our partners to query the strength of these hotspots in combination with location of participatory agricultural research projects. We provide an information product that will aid the targeting of participatory agricultural research in traditional food security crops by providing hotspots of undernutrition.

All the maps produced by this country case study are being published on an interactive map server that is accessible to a wide range of users, and easy to update and to add information. Our map server is being updated, and we are currently experimenting with ESRI ArcIMS software, which will allow partners to add information and comments to the published maps. We are also trying to incorporate near-real time indices of vegetation status similar to many Famine Early Warning Systems (FEWS) to make our Web site more dynamic.

Peru: CIAT's Peruvian Amazon benchmark site has been the focus of several poverty mapping exercises to better understand pathways to improved livelihoods. This report summarizes some of those analyses, and adds insight on land cover and land use patterns. We started our poverty research in Peru by looking at basic unmet needs, since this information is available in the national census. These indicators work less well in the Amazon, which led us to search for other ways to measure poverty. We used multivariate statistical analysis to construct indices for different well-being categories—education, household assets, and agricultural resources. The indices were compared with land cover maps to investigate the relationship between agricultural intensification, deforestation, and poverty.

Our results show two predominant spatial patterns related to poverty in the Peruvian Amazon study area. First, proximity to the city of Pucallpa and the principal roads of the study area is related to well-being levels. The closer a village is to the city or major road infrastructure, the more likely that village will be relatively better off. This effect is most clearly evident with respect to education. In villages nearer to the city and main roads, literacy, number of years of formal instruction received, and net rates of school attendance are all higher. The agricultural resources index also shows spatial concentration related to roads and the city. A second pattern that is evident is lower levels of well-being on the floodplain compared to the uplands. This pattern needs to be investigated in more detail. The presence of indigenous groups on the floodplain may bias our indices. Since many floodplain dwellers leave their farms during the rainy season, they may be less likely to accumulate household goods, which were part of the index. Our results confirm earlier CIAT work at the household level that shows the pathways from initial slash-and-burn systems to more intensified systems over time.

3. Applying low altitude imagery to improve genetic resource management

For some years, the value of spatial information, much of it remotely sensed, has been recognized. It provides information about three dimensions that is important for implementing sustainable local land management. The goals of local management include increasing farm income, reducing environmental risks, and the conservation and sustainable use of biodiversity. Local land managers usually know about variation in genetic resources associated with natural resources, but management rarely accounts for this variation. Without complementary information it is difficult for local land managers to control variation precisely. If presented in an accessible form, small-scale, high-resolution information could be of potentially high value for local managers, for a range of problems that are more or less unique to the site where the information is applied. Recently, the potential of low aerial photography captured from kite and balloon platforms has been identified to overcome some of the constraints of spatial information acquisition at local level. We make use of this early research to further improve the approach by benefiting from now easily available components, such as micro video transmitters, and lightweight construction materials.

The study illustrates the use of spatial information with high spatial resolution in local management of genetic resources. The bean experiment was located in Darien, in the Valle del Cauca department of Colombia. Images were acquired using a developed robust technique. Information contained in the images was shown to be related to various bean growth characteristics. The information can therefore be used in early prediction of bean yields, which is potentially valuable for (participatory) plant breeding experiments. Because of its easily understandable information content and content presentation, and the robustness of the technology at a budget price, the methodology is a potentially powerful way of generating and providing information to local managers of genetic and natural resources. Information derived from these images has the potential to replace destructive field sampling; generate parameters for crop growth simulation models; and serve as decision aid in plant breeding experiments, but particularly so in participatory plant breeding.

4. Role of spatial environmental heterogeneity in the generation and maintenance of genetic diversity

In this study, we attempt to understand the role that spatial environmental heterogeneity plays in generating and maintaining genetic diversity through micro-evolutionary processes. Greater understanding of these processes may lead us to be able to predict the distribution of genetic diversity using minimal amounts of environmental data, and without the need for lengthy and costly field and laboratory studies of genetic diversity. We are using the case of *Araucaria araucana* (Molina) in Argentina and Chile to develop these ideas. We have developed models that measure spatial environmental heterogeneity from a biological standpoint, through the modeling of pollen exchange between populations of *A. araucana* in different environmental surroundings. We have developed these models based on ecological and biological theories, and then compared their results with field-based measures of genetic diversity to assess their validity. Preliminary findings indicate that we can predict the genetic diversity very accurately (R^2 0.83 between our model and delta C-13 carbon measures of genetic diversity), providing strong evidence that environmental heterogeneity is a major influencing factor in micro-evolutionary processes in *A. araucana*, and likely in other species. This model is now being applied to manage and conserve the genetic diversity in wild populations of *A. araucana* in Argentina.

Problems encountered and their solutions:

1. Need for stronger integration of spatial analysis with other projects

A perennial problem for PE-4, which specializes in the provision of spatial information, is the lack of interaction with "conventional" agricultural research in CIAT. The potential for synergies between process research and GIS are obvious, and some significant success stories are apparent (e.g., Homologue, and Kite-based aerial photography). However, more collaborative projects are required. A major source of this problem has been that, in the absence of a clear conceptual framework for the policy-oriented research in CIAT, applications of GIS in this area have tended to draw PE-4 away from agricultural research towards broader sociological or economic issues, such as poverty and vulnerability. These, while of indisputable significance, provide relatively weak opportunities for analyzing agricultural interventions. The solution is to identify specific collaborative goals, not simply as a "mapping service"—this will not develop the analytical power required—but as true mutual learning exercises. Examples such as our collaboration with the Tropical Fruits Program, the Bean Project, the Soils Project, and the Biofortification Challenge Program provide illustrations of the way forward.

2. Need to clarify practical outcomes of spatial analyses to attract special project funding

The problem of funding for strategic research on spatial analysis has become critical. In 2003, PE-4 reduced its demand on core by US$400k, largely through core substitution from the Challenge Program on Water and Food (CPWF), for work unrelated to spatial analysis. There is no scope for further reduction in core this year, yet prospects for better special project funding looks weak: The poverty mapping project ceases with no immediate prospects of a replacement; the World Bank funding for vulnerability in Central America has dried up; the Climate Change program—of great promise to PE-4—has been delayed for at least another year; the Canadian International Development Agency (CIDA) proposal on land degradation was not approved; proposals in the CPWF have not materialized. The problem appears to be two-fold. First, more clarity is required on the effect of risk/uncertainty, and how spatial information can be a significant part of the solution. Second, an obvious preference is shown for bottom-up, local outcome-oriented research that does not favor the top-down broad strategic work in which PE-4 has excelled. The solution for us is to clarify how spatial information, at all scales, can impact on the ground. This could be exemplified through the linkages of global and local information within the Tropical Fruits Program.

3. Need to integrate research top-to-bottom
While in recent years there has been some clarification of what PE-4 does, there is now a need to integrate disparate research themes towards practical development goals. This we will do through the concept of site-specific development, the goals of which can be explained in three sentences:

(1) The role of information is to reduce the uncertainty that causes bad decisions.
(2) Spatial information reduces the uncertainty caused by spatial variation.
(3) If spatial variation is significant (and it nearly always is), the decision uncertainty that can be removed by spatial information is also significant.

This reasoning can be applied to all of our applications, and is especially appealing in that it leads towards site-specific decisions that describe the development process.

4. Need to focus
Finally, there is a continued need to focus. The CPWF represents a huge opportunity for impact. But is it for us? Clearer articulation of CIAT strategic goals through a comprehensive planning process would assist in the allocation of strategic funds, and the clarification of achievable goals for individual projects.

Proposed plans for next year:

- Develop applications for site-specific development in fruits and specialty coffee
- Clarify and separate roles for the CPWF
- Clarify CIAT's likely future involvement in global poverty mapping and impact assessment initiatives
- Insurance: Develop practical applications for spatial information, e.g., index-based drought risk insurance

Project Performance Indicators: Land Use in Latin America 2003

1. TECHNOLOGIES, METHODS, AND TOOLS

1.1. Methodologies

- Stochastic algorithm for automated crop distribution mapping within census tracts
- *Ex situ* conservation prioritization based on species and habitat distribution and accessibility
- Predicting genetic diversity using spatial environmental variability models
- Estimating water productivity as a function of improved / decreased livelihoods
- Estimating the impacts and effectiveness of geographic information systems (GIS) research
- Estimating soil water parameters with a dynamic nearest neighbor method (contribution A. Gijsman)
- New stopping algorithms that increase utility of Morton key indexed database structures

1.2. Rural Development Methods

- The site-specific development approach
- Framework to determine the relevance of different information for agronomic management
- Participatory systems approach to rural planning
- Low altitude imagery system for monitoring of on-farm experiments
- Framework to determine household vulnerability
- Framework of how to define and use vulnerability indicators for policymaking
- Framework to monitor impacts of risk and stability on technology adoption (contribution D. White)

1.3. Decision Guides/Support Tools (models/software)

- Computerized land use allocation tool based on soil and topography
- Decision support tool to target forage germplasm
- IntelAgro prototype: Identifying crop niches and providing market data
- Homologue prototype fruit habitat identification software

1.4. Databases or Maps

- New version of the CUFRUCOL database
- Database structure for soil profiles GEOSOIL
- Thematic online fruit network and information database
- Updated online database with population information for Latin America
- Online production database on wheat, maize, cassava, sweet potato, beans, and rice
- Land cover and land use change database Central Peruvian Amazon and San Dionisio, Nicaragua
- Tropical forest tree biodiversity database

1.5. Innovative applications of established methods

- Multivariate statistical models to estimate food consumption per person and poverty hotspots
- Multivariate statistical models to estimate indices of well-being
- Participatory research to understand the impact of cross-scale institutional processes on vulnerability
- Participatory research to understand farmers' knowledge and preferences of land management strategies
- Spatial analyses to understand biogeography patterns and conservation status of *Vigna spp.*

2. Publications

2.1. Refereed Journals

Published	2
In Press	3
Accepted	1
Submitted	2

2.2. Book Chapters

Published	1
In Press	3
Accepted	3

2.3. CD-ROM with Manual 1

2.4. Published Proceedings

Published	2
In Press	2
Accepted	1

2.6. Scientific Meeting Presentations

Presentations 7

2.7. Working Papers, Technical Reports, or other Publications

6

(See attached Appendix I for full list by categories)

3. STRENGTHENING NARS

3.1. Training Courses

- Monitoring of land use/cover and land degradation with temporal series of satellite imagery, 10-13 May 2003, Geography Department of the University of Uberlândia, Brazil (25 students)
- Course given at the Corporación Colombiana de Investigación Agropecuária (CORPOICA): Aplicación de modelos de simulación para la evaluación de la producción y las practices de manejo en sistemas agrícolas bajo DSSAT version 4, 7-11 July 2003, Mosquera, Colombia. 50 participants from CORPOICA, CENICAÑA, various universities, and a few other institutions.
- Training on basic concepts of remote sensing, 21-25 Oct 2003, Universidad de los llanos, Colombia. (15 participants from national institutions)

3.2. Individualized Training

- N. Sivaraj, National Bureau of Plant Genetic Resources, Regional Station, Rajendranagar, Hyderabad, India. Post doc training in GIS related to plant genetic resources. May 2003.

3.3. PhD, MSc, postgraduate, and pregraduate thesis students

- **PhD**

Andrew Farrow	Jan 2003-Jan 2006
Andrew Jarvis	Dec 2000-Dec 2003
Rachel O'Brien	March 2001-March 2004

- **MSc**

Andres Javier Peña	Dec 2002-Nov 2003

- **Postgrad**

Samuel Jonathon de Blassi	Sept 2003-Jan 2004
Fernando Sevilla	Oct 2002-Sept 2003
Carlos González	Sept 2002-Sept 2003
Dario A. Castañeda	Sept 2003-Nov 2003

- **Pregrad**

Juan Carlos Barona	March 2002-Nov 2003
Lix Danny Mosquera	March 2002-May 2003
Rosa Nohelia Naranjo	March 2003-May 2003
Norbert Niederhauser	Aug 2003-Jan 2004
Thomas Seibold	Aug 2003-Nov 2003
Sabine Rühmland	Aug 2003-Nov 2003
Susan Schmid	Aug 2003-Jan 2004

3.4. Workshops and Meetings

- Distance learning on indicators and information for sustainable development for Central America, transmitted from the World Bank, Washington, D.C. to Central American countries Global Development Learning Network (GDLN) centers (65 participants from El Salvador, Guatemala, Nicaragua, and Costa Rica), 2-7 November 2002.
- Research Project Meeting, Stockholm Environmental Institute, 29 Jan-1 Feb 2003, Stockholm, Sweden.
- Management Team meeting, CPWF, 5-7 Feb 2003, Cairo, Egypt.
- CIDA meeting, 6 March 2003, Ottawa, Canada.
- Limpopo River Basin Kickoff workshop, CPWF, 6-7 March 2003, Pretoria, South Africa.
- Workshop on global poverty mapping: Strategies for moving forward, 11-12 March 2003, Colombia University, USA.
- Second plenary meeting of the Global Forum for Agricultural Research (GFAR), 22-24 May, Dakar, Senegal.
- Mekong River Basin Kickoff workshop, CPWF, 26-27 March 2003, Phnom Penh, Cambodia.
- Data Management meeting, CPWF, 19-23 May, Colombo, Sri Lanka.
- CIAT- Centre de coopération internationale en recherche agronomique pour le développement (CIRAD) - Institut national de recherche agronomique (INRA) - Institut français de recherche scientifique pour le développement en coopération (ORSTOM) meeting, 26-28 May, Montpellier, France.
- Steering Committee and Management Team meeting, CPWF, 2-6 June 2003, Paris, France.
- Workshop on sustainability indicators for Latin America and the Caribbean, 2-6 June 2003, World Bank Institute- Economic Commission for Latin America and the Caribbean (ECLAC), Santiago, Chile. Manuel Winograd invited professor. (55 participants from Mexico, Haiti, Puerto Rico, Dominican Republic, Cuba, Costa Rica, Panama, Chile, Bolivia, Brazil, Colombia, Venezuela, Argentina, El Salvador, and Peru).
- Fourth European Conference on Precision Agriculture, 15-19 June 2003, Berlin, Germany.
- Taller latinoamericano Territorio y desarrollo sostenible, 17-20 June 2003, CIAT-headquarters. (53 participants)
- Course-Workshop on sustainability indicators for Latin America and the Caribbean, held in ECLAC headquarters in Santiago, Chile, in the context of the World Bank Institute/ECLAC / Swiss Development Cooperation (SDC) regional training project, June 2004.
- ESRI International Users Conference, 7-11 July 2003, San Diego, CA, USA.
- 51st International Congress of Americanists, 14-18 July, Santiago de Chile.
- Planning Workshop for Impact Assessment and Policy Analysis Under the Biofortification Challenge Program on the 2nd and 3rd of September 2003 at the International Food Policy Research Institute (IFPRI) Headquarters in Washington DC.
- Planning workshop for impact assessment and policy analysis under the Biofortification Program, 2-3 Sept 2003, IFPRI headquarters, Washington, USA.
- Management Team meeting, CPWF, 2-4 Sept 2003, Washington, USA.
- Plant Genetics Resources Forum, 8-10 Sept 2003, Prague, Czech Republic.
- Bases para la formulación de planes de Ordenamiento Territorial, 8-14 Sept 2003, Arequipa, Peru.
- Planes de Ordenamiento Territorial como herramienta de gestión del espacio en Arequipa, 16 Sept 2003, Arequipa, Peru.

- Metodologías para la Identificación y Priorización de Demandas para la Innovación Tecnológica en Bolivia, FOCAM project – CIAT, Cochabamba, 8-9 October 2003.
- Conference on tropical and subtropical agricultural and natural resource management-Deutscher Tropentag 2003, 8-10 Oct 2003, Göttingen, Germany.
- Workshop on the socialization of methods and decision support tools for land use planning developed during the last 5 years of the agreement between CIAT and Ministerio de Agricultura y Desarrollo Rural (MADR), 16-17 October 2003, Villavicencio, Colombia. (43 participants from 22 institutions)
- Steering Committee and Management Team meetings, CPWF, 9-17 Nov 2002, Penang, Malaysia.
- Workshop on sustainable development indicators and environmental assessment, 10-14 November 2003, World Bank Institute, Moscow, Russia. Manuel Winograd invited professor.

3.5. Technical Assistance

- Exploring opportunities for cross-fertilization on aspects of site-specific development with Colombian national research institutions (the Centro Nacional de Investigación [CENI] network)
- El encuentro nacional de usarios de herramientas SIG para la toma de decisions en planificación rural y Ordenamiento Territorial, 13-15 Nov 2002, CIAT headquarters. Fifty participants from Colombian national institutions.

3.6. ARO Research Partnerships

- Developing new links with Curtin University, Australia

4. RESOURCE MOBILIZATION

4.1. Proposals funded

7

4.2. Proposals and concept notes submitted

11 submitted still pending; 9 in preparation. (See Appendix II)

Appendix I – PE-4 Publications

Papers in Refereed Journals

Jagtap, S.S., Lal, U., Jones, J.W., Gijsman, A.J., Ritchie, J.T. 2003. A dynamic nearest neighbor method for estimating soil water parameters. Trans. ASAE (Submitted)

Jarvis, A.; Ferguson, M.E.; Williams, D.E.; Guarino, L.; Jones, P.G.; Stalker, H.T.; Valls, J.F.M.; Pittman, R.N.; Simpson, C.E.; Bramel, P. 2003. Biogeography of *Arachis*. Crop Sci. 43:1100-1108. Available in: http://crop.scijournals.org/cgi/content/abstract/43/3/1100 [Accessed May 2003]

Jarvis, A.; Williams, K.; Williams, D.; Guarino, L.; Caballero, P.; Mottram, G. 2003. Use of GIS for optimizing a collecting mission for a rare wild pepper (*Capsicum flexuosum* Sentn.) in Paraguay. Genet. Resour. Crop Evol. (In Press)

Jones, P. G.; Thornton, P.K. 2003 The potential impacts of climate change on maize production in Africa and Latin America in 2055. Global Environ. Change 13:51-59.

Morales, F.J.; Jones, P.G. 2003. The ecology and epidemiology of whitefly-transmitted viruses in Latin America. Virus Res. (Accepted)

Oberthür, T.; Barrios, E.; Cook, S.; Usma, H.; Escobar, G. 2003. Increasing the relevance of scientific information in hillside environments through understanding of local soil management in a small watershed of the Colombian Andes. Soil Use Manage (In Press)

O'Brien, R.; Peters, M.; Schmidt, A.; Cook, S.; Corner, R. 2003. Helping farmers select forage species in Central America: The case for a decision support system. Agric. Syst. (Submitted)

Reid, R.S.; Thornton, P.K.; McCrabb, G.J.; Kruska, R.L.; Atieno, F.; Jones, P. 2003. Is it possible to mitigate greenhouse gas emissions in pastoral ecosystems of the tropics? Environ. Dev. Sust. (In Press)

Book Chapters

Beaulieu, N.; Jaramillo, J.; Fajardo, A.; Rubiano, Y.; Munoz, O.; Quintero, M.; Pineda, R.; Rodriguez, M.; León, J.G.; Jiménez, M.F. 2003. Planning of territorial organizations as an entry point for agricultural research towards rural development and innovation. *In*: Pachico, D. (ed.). Scaling up and out: Achieving widespread impact through agricultural research. Centro Internacional de Agricultura Tropical (CIAT), Cali, CO. (Accepted)

Beaulieu, N.; Jaramillo, J.; Restrepo, J.L.; Diaz, J.M. 2004. A systems approach to planning as a mechanism for rural development in Colombia. *In*: Hall, C.; Leclerc, G. (ed.). Making development work. New Mexico University Press, NM, USA. (In Press)

Cook, S. 2003. Spatial dimension of scale. *In*: Pachico, D. (ed.). Scaling up and out: Achieving widespread impact through agricultural research. Centro Internacional de Agricultura Tropical (CIAT), Cali, CO. (Accepted)

Mazurek, H. 2003. Actores y dinámicas territoriales en Bolivia: El rol de la dualidad global-local. *In*: Antezana, F.; Mazurek, H.; Uzeda, A. (eds.). Actores, territorio y desarrollo local. Universidad Mayor de San Símon, Centro Internacional de Agricultura Tropical (CIAT) – Integrated Rural Development Program (IRD), Cochabamba, BO. (In Press)

Mazurek, H. 2003. Desarrollo; territorio y desarrollo local: Replantear la relación global – local. *In*: Parra, C.G.; Downing, T. (eds.). Desarrollo global versus desarrollo local. Universidad de la Concepción, CL. (In Press)

White, D. 2003. Estimating impacts of GIS research: Using rubbery scales and fuzzy criteria. *In*: Pachico, D. (ed.). Scaling up and out: Achieving widespread impact through agricultural research. Centro Internacional de Agricultura Tropical (CIAT), Cali, CO. (Accepted)

Ziervogel, G.; Cabot, C.; Winograd, M.; Segnestam, L.; Wilson, K.; Downing, T. 2003. Vulnerability assessments and risk maps: Do they help to protect the vulnerable? A case study of Honduras. Chapter 8. *In:* Stephen, L.; Downing, T.; Rahman, A. Approaches to vulnerability: Food systems and environments in crisis. Earthscan, London, GB.

Workshop and Conference Papers/Presentations

Amede, T.; Amézquita, E.; Ashby, J.; Ayarza, M.; Barrios, E.; Bationo, A.; Beebe, S.; Bellotti, A.; Blair, M.; Delve, R.; Fujisaka, S.; Howeler, R.; Johnson, N.; Kaaria, S.; Kelemu, S.; Kerridge, P.; Kirkby, R.; Lascano, C.; Lefroy, R.; Mahuku, G.; Murwira, H.; Oberthür, T.; Pachico, D.; Peters, M.; Ramisch, J.; Rao, I.; Rondon, M.; Sanginga, P.; Swift, M.; Vanlauwe, B. 2003. Biological nitrogen fixation: A key input to integrated soil fertility management in the tropics. Position paper presented at the International Workshop on Biological Nitrogen Fixation for Increased Crop Productivity, Enhanced Human Health and Sustained Soil Fertility, 10-14 June 2002, Ecole nationale supérieure agronomique (ENSA)-Institut national de recherche agronomique (INRA), Montpellier, France. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, IN. (In Press)

Cook, S.E.; O'Brien, R.; Corner, R.J.; Oberthür, T. 2003. Is precision agriculture relevant to developing countries? *In*: Proceedings of the 4th European Conference on Precision Agriculture, 15-19 June 2003, Berlin, DE. (In Press)

Hyman, G. 2003. Incorporating breeder opinion. Oral presentation at Planning Workshop for Impact Assessment and Policy Analysis under the Biofortification Challenge Program, 2-3 September 2003, International Food Policy Research Institute (IFPRI) headquarters, WA, USA.

Hyman, G. 2003. Survey of national spatial data infrastructures in Latin America and the Caribbean. Paper presented at the Environmental Systems Research Institute (ESRI) International Users Conference, 7-11 July 2003, San Diego, CA, USA.

Hyman, G.; Larrea, C. 2003. Basic needs mapping and beyond. Paper presented at the Workshop on Global Poverty Mapping: Strategies for Moving Forward, 11-12 March 2003, Colombia University, NY, USA.

Hyman, G.; Rey, D.I.; Perea, C.; Lance, K. 2003. Survey of national spatial data infrastructures in Latin America and the Caribbean. Paper presented at the Environmental Systems Research Institute (ESRI) International Users Conference, 7-11 July 2003, San Diego, CA, USA. Available in: <http://www.procig.org/downloads/ESRIpaper.pdf.

Jarvis, A. 2003. Tools for spatial analysis of PGR distribution – State of the art and future needs. Paper presented at the Plant Genetic Resources Forum, 8-10 Sept 2003, Prague, CZ.

Jones, P.G. 2003. Adaptation of agriculture to climate change for Africa. Presented at Canadian International Development Agency (CIDA), 6 March 2003, Ottawa, CA.

O'Brien, R.; Corner, R.; Peters, M.; Cook, S. 2002a. A GIS-based decision support tool for targeting biophysical and socioeconomic niches in tropical agriculture. *In*:Whigham, P.A. (ed.).The 14^{th} Annual Colloquium of the Spatial Information Research Centre, 3-5 Dec 2002, University of Otago, Dunedin, NZ. p. 111-120.

O'Brien, R.; Cook, S.; Corner, R.; Peters, M. 2002b. Targeting forages to farming systems at farm scale using GIS, socioeconomic data and expert knowledge. Paper presented at the 6^{th} International Conference on Precision Agriculture, 14-17 Jly 2002, Minneapolis, USA. Published on CD-ROM. p. 1671-1682.

Walther, S.; Oberthür, T.; Rubiano, J.; Schultze-Kraft, R. 2003. Evaluation of two GIS-based models for landslide prediction. *In*: Proceedings of the Conference on Tropical and Subtropical Agricultural and Natural Resource Management - Deutscher Tropentag 2003, 8-10 October 2003, Göttingen, DE. (Accepted)

Technical Reports and Information Products

Beaulieu, N. y grupo de planificación para el desarrollo rural. 2003. Guía para la planificación, el seguimiento y el aprendizaje orientado al desarrollo comunitario. Centro Internacional de Agricultura Tropical (CIAT), Cali, CO. 16 p. (Internal report)

Downing T.; Patwardhan, A.; Klien, R.; Mukhala, E.; Stephen, L.; Winograd, M.; Ziervogel, G. 2003. Vulnerability assessment for climate adaptation, Adaptation Planning Framework. United Nations Development Programme (UNDP), NY, USA. (Technical Paper no. 3)

Hyman, G. 2003. Review of book: The Lerma Chapala Watershed: Evaluation and Management. Water International 28(2):281-282.

Jones, P.G.; Gladkov, A. 2003. FloraMap Versión 1.02. Una herramienta para computadora que permite predecir la distribución de plantas y de otras organismos en estado silvestre. Centro Internacional de Agricultura Tropical (CIAT) CD-ROM series, Cali, CO. 1 CD-ROM (in English with Help in Spanish)+ Guide (in Spanish, 127 p.)

Labelle, R.; Wild, K.; Hyman, G.; Zomer, R.; Porcari, E.; Restrepo, P. 2003. Ad-hoc advisory panel on data and information: Final report. Consultative Group on International Agricultural Research (CGIAR) Water and Food Challenge Program, WA, USA.

Winograd M. 2002. Natural disasters in Honduras. TIEMPO 43 (2):11-14.

Winograd, M.; Ruta, G.; Gallopin, G. 2003. Indicadores de desarrollo sostenible para la toma de decisiones. CD-ROM para la capacitación y entrenamiento, The World Bank Institute, Centro Internacional de Agricultura Tropical (CIAT), Economic Commission for Latin America and the Caribbean (ECLAC), WA, USA. 1 CD-ROM.

Appendix II. PE-4 Project Proposals 2003

Project Proposal	Person/s responsible	Donor approached	Duration	Total budget required (US$)	Total budget for PE-4 (US$)
Projects in Execution:					
Improving methods for poverty and food insecurity mapping and its use at country level (SLJ62)	G. Hyman	FAO	1 year	220,000	106,000
SEI (SLL42)	J. Rubiano	SEI	1 year 8 months	24,410	20,342
CPWF (SLK50)	S. Cook	IWMI	1 year	100,000	100,000
Spatial insights: Aerial imagery for site-specific agronomic management (SLP70)	T. Oberthür	GTZ	1 year 7 months	39,000	39,000
SIDA-Kristina Marquardt (SLD40)	S. Cook	SIDA	1 year	73,243	65,985
Projects Accepted					
Challenge Program on Water and Food (CPWF)	S. Cook	IWMI	5 years	1,800,660	200,660
Training on indicators for sustainable development	M. Winograd	World Bank Institute	Not defined	15,500	15,500
Projects Submitted:					
Latin America subnational production database	G. Hyman	IFPRI	1 year 8 months	9,000	9,000
Land systems analysis tool for tropical lowland South America	G. Hyman	CGIAR ICT/KM	4 months	25,000	25,000
Geographic information and breeder survey for Biofortification Challenge Program	G. Hyman	CGIAR BCP	2 months	10,000	10,000
Intensificación inteligente de banano y plama: Aumentando la rentabilidad agricola y los beneficios ambientales por utilizar la agricultura de precision	T. Oberthür	COLCIENCIAS	2 years	316,373	233,280

Continued.

PE-4 Project Proposals 2003 (Continued)

Project Proposal	Person/s responsible	Donor approached	Duration	Total budget required (US$)	Total budget for PE-4 (US$)
Projects Submitted:					
Increased food security and income in the Limpopo Basin through integrated crop, water, and soil fertility options and public-private partnership[a]	P. Jones	IWMI	5 years	2,900,000	91,500
Payment for environmental services as a mechanism for promoting rural development in the upper watersheds of the tropics[b]	J. Rubiano	IWMI	3 years	2,000,000	150,000
Sustaining inclusive collective action that links across economic and ecological scales in upper watersheds (SCALES)[c]	J. Rubiano	IWMI	3 years	2,000,000	30,000
Bringing science to stakeholder dialogues	J. Rubiano/S.Cook/SEI/ CIAT	IWMI	4 years	2,000,000	120,000
Facilitating sustainable community-based management of forest genetic diversity through the use of environmental and socioeconomic decision support models	A. Jarvis	ITTO	3 years	750,000	100,000
Habitat Mapper – Spatial prediction of agroclimatic zones for crop introduction and biodiversity conservation (IPGRI/University of Berkeley/CIAT)	A. Jarvis	CGIAR ICT/KM	3 years	30,000	10,000
Developing rapid responses to combat desertification – RAPIDES	S. Cook	European Commission	4 years	5,142,154 EUROS	578,958 EUROS
Projects Prepared for Submission:					
Sustainable development of coffee-based hillside farming systems through consumer-oriented production and marketing of high-value crops	T. Oberthür/J. Cock/ S. Cook/ D. White/ M. Lundy/ M. Ayarza	Not defined	3 years	1,300,00 EUROS	450,000 EUROS
Natural resource management and reducing risk for agricultural enterprises on the floodplains of the Central Peruvian Amazon	G. Hyman/N. Beaulieu/ D. White	Not defined	-	-	-

Continued.

PE-4 Project Proposals 2003 (Continued)

Project Proposal	Person/s responsible	Donor approached	Duration	Total budget required (US$)	Total budget for PE-4 (US$)
Projects Prepared for Submission:					
Hotspots of climatic change in the tropics: Impacts on agricultural systems and poor people in the tropics	P. Jones/P.Thornton	Included in CGIAR Global Challenge Program on Climate Change Proposal	5 years	2,600,000	Not defined, but about half
Climate change and biodiversity: The effects of climatic instability on plant diversity and food production	P. Jones/A. Jarvis/L. Guarino	CGIAR	3 years	3,000,000	500,000
Amazon land use systems to reduce global and local environmental threats. A concept note.	P. Jones	Not defined	-	-	-
Targeting comprehensive rural poverty reduction campaigns for Mesoamerica that integrate agricultural research and technology	R. Hertford/S. Cook	World Bank	1 year	270,000	90,000
Cost-sharing agreement between CIAT and the InterAmerican Biodiversity Information Network (IABIN)	G. Hyman	OAS	5 years	250,000	208,400
Agro-ecological characterization of water harvesting systems in India: Application of remote sensing and geographical information systems techniques	J. Rubiano/R.D. Estrada	Comprehensive Assessment Competitive Research Grant Scheme	9 months to 1 year	Not defined	Not defined
Isotope tracing of nitrate and phosphorus water sources in Fuquene Lake	J. Rubiano/R.D. Estrada	CONDESAN, GTZ, CAR	6 to 12 months	To be defined	To be defined

a. This is a joint project with ICRISAT and CIMMYT.
b. Together with CONDESAN, GTZ, CIP, and many others.
c. Together with ICRAF, IFPRI, WWF, and Universidad Javeriana.