Land Use Project Summary Annual Report 2004

Uso de la Tierra
Land Use
Project

Land Use Project - PE4

Summary
Annual Report 2004

CIAT
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

Uso de la Tierra
Land Use
Project

SUMMARY ANNUAL REPORT 2004

PE-4 PROJECT

PROJECT: **LAND USE**
PROJECT MANAGER: **S. COOK / T. OBERTHÜR (ASSOC. PROJ. MGR.)**

1. Project description

Objective

The Land Use Project (LUP) provides high-quality spatial information to enable better decision-making about specific agricultural land use change. Information is provided at three broad scales:

- ✓ At global to national scale, spatial information is demanded by policy-makers and researchers to interpret complex biological processes that underpin agriculture and to help target investment in agricultural research.
- ✓ At the regional to catchments scale, information is required by administrators or local institutions to direct policy based on knowledge of land use change processes.
- ✓ At the local scale, detailed information is required to enable individual farmers or community groups to make sound decisions for land use change that can reverse the downward spiral into poverty.

The definition of a 'better' decision is one that improves the well-being of stakeholders through the effective management of agricultural land resources. Such decisions are evident in individual or collective action, policies and investments.

Outputs

1. Baseline and time-series data. These provide 'feed' material for subsequent analysis, methodology development and decision-support tools.
2. Insights on biological limitations and drivers of land use change developed from spatial analyses of agrobiodiversity.
3. Indicators of risk, resilience and vulnerability of tropical agricultural systems to external and internal stresses, determined from analyses of land use dynamics.
4. Local information and information management systems that support specific individual and collective decisions.

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 ***(achievement in italics)***

- High-resolution (90 m) digital terrain models processed from SRTM (Shuttle Radar Topography Mission) for tropical areas of LAC, Africa and SE Asia and made available to collaborators. *Data complete.*
- Canasta software for outscaling forage adoption in LAC available. *Software written for evaluation.*
- Homolog method developed for outscaling tropical fruits. *Method written and under evaluation.*
- Method of modeling continental-scale gene flow demonstrated. *Submitted to journal.*
- Impact analysis for Harvest +; *Proposal accepted.*
- Global Environment Facility (GEF) proposal on indicators of land degradation developed; *Proposal developed, reviewed and under modification.*
- Water research agenda developed for CIAT. *Ongoing.*
- Coordination of Water & Food Challenge Program (WFCP) Theme 2. *Ongoing.*
- Low-cost participatory land-inventory methods. *Ongoing.*
- Concept of site-specific development developed and clarified through reports, publications and conferences. *Reported.*
- Preliminary site-specific drought-insurance products developed. *Ongoing.*

CIAT project linkages

GIS studies assist the following CIAT Projects: Agrobiodiversity and Biotechnology, Saving Agrobiodiversity SB-01/02, Bean Improvement for the Tropics, Integrated Soil Fertility Management in the Tropics, Tropical Grasses and Legumes, Impact Assessment, Rural Agroenterprises Development, CIAT in Asia, CIAT in Africa, CIAT-Central America.

Project logframe 2004-2006

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 institution activities enhanced by the ability to target activities.	Policy, project or funding strategies modified to include spatial information. Research portfolios modified by targeting or preselection. 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.	Case studies at farm, national and regional scales documented. Methods of generalizing improved decision-making using spatial information of land use, published.	That uncertainty significantly obstructs land use decisions on 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 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.
Output 2 Analyses and predictions of socioeconomic factors influencing land use development executed.	Spatial processes driving land use change identified. Distribution of poverty and its causes identified more accurately using spatial information.	Improved accuracy of explaining land use change published. Spatial drivers of poverty explained in case studies published 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.

Narrative Summary	Measurable Indicators	Means of Verification	Important Assumptions
Output 3 Analyses and predictions of vulnerability of land use systems to significant external events executed.	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 with case study at national or regional scale published by June 2004. Ex ante analysis of the benefits of risk reduction published.	Sufficient data are available to generate insights.
Output 4 Methods of capturing farmers' knowledge in land use decision support developed.	Strengths and weaknesses, overlaps and gaps between farmers' and scientists' knowledge identified 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 to address 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.
Output 5 Baseline and time-series data for subsequent analysis executed.	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 from CIAT Web site.	Information can be delivered to analysts and decision-makers.

2. Project Inputs

Staff List (* Left during 2004; ✓ Arrived during 2004)

Simon E. Cook	PhD, Crop Biology	Senior Scientist / Proj. Mgr.
Glenn G. Hyman	PhD, Geography	Senior Scientist
Manuel Winograd	PhD, Ecology	Senior Scientist (outposted)
Douglas White	PhD, Agr. & Environ. Econ.	Senior Research. Fellow (SRF)
Thomas Oberthür	PhD, Geography	SRF / Assoc. Proj. Mgr.
Andrew Farrow	MSc, GIS	Research Fellow
Andrew Jarvis	MPhil., Geography	Research Fellow
Kristina Marquardt*	MSc, Agriculture	Research Fellow (outposted)
Arjan J. Gijsman	PhD, Soil Science/Crop Modeling	Assoc. Senior Scientist
Jorge Rubiano	PhD, Geography	Postdoctoral Fellow
Peter G. Jones	PhD, Crop Physiology	Consultant
William Díaz	MSc, Admin./System Engineer.	Systems Analyst 1
Martha F. Otero	MSc, Hydraulic Engineering	Research Associate 2
Liliana Rojas	MSc, Natural Resources	Research Assistant 1
Germán Lema	BSc, Industrial Engineering	Statistical Consultant 2
Jorge H. Becerra*	BSc, Economics	Research Assistant 1
Luz A. Clavijo	BSc, Geography	Research Assistant 1
Germán Escobar	BSc, Biology	Research Assistant 1
Otoniel Madrid*	BSc, Statistics	Research Assistant 1
Jenny L. Correa	BA, Social Communication	Editorial Assistant 2
Sandra L. Bolaños	BSc, Industrial Engineering	Research Assistant 1
Elizabeth Barona	BSc, Systems Engineer	GIS Analyst 3
Claudia J. Perea	BSc, Systems Engineer	Systems Analyst 3
Lilian P. Torres	BSc, Business Administration	Administrative Assistant 1
Samuel J. de Blassi*	BSc, Biology	Visiting Researcher
Fernando Sevilla*	Agronomist	Visiting Researcher
Silvia E. Castaño	Systems Technology	GIS Coordinator
Jorge A. Cardona	Systems Technology	Systems Technician
Hermann Usma	Agricultural Technology	Expert Research 1
Ligia M. García*	Architectural Drawing	Graphic Artist 1
Marisol Calderón	Architectural Drawing	Office Clerk 1
Ovidio Rivera	Systems Technology	Office Clerk 4
Alexander Cuero	Systems Technology	GIS Expert
Rosalba López	Statistical Technology	GIS Expert
Carlos Nagles	Agricultural Technology	GIS Expert
Víctor M. Soto	Systems Technology	GIS Expert
Yuviza Barona	Bilingual Secretary	Bilingual Secretary
Gloria S. Torres	Bilingual Secretary	Administrative Assistant
Norbert Niederhauser	DI(FH), Inf. & Com. Engineering	Consultant
Jacqueline Diaz-Nieto✓	MSc, Monitoring Modeling	Consultant
Natasha Pauli✓	MSc, Biology & Geography	Visiting Researcher
José M. González✓	MSc, Geological Sciences	Visiting Researcher
Viviana Gonzalías✓	MSc, Sustainable Forestry	Visiting Researcher
Laure D. Collet*	Dipl, Biology	Visiting Researcher
Christof Meyer✓	Inf. & Com. Engineering	Visiting Researcher
Susanne Schmid*	DI(FH), Inf. & Com. Engineering	Visiting Researcher
Yerinthong Restrepo✓	Agronomy Engineering	Undergraduate Student
Edward D. Guevara✓	Environmental Engineering	Undergraduate Student
Diana M. Tangarife✓	Environmental Engineering	Visiting Researcher

List of Partners
Cafi-Cauca Cooperative (Colombia)
CENIBANANO (Colombia)
CENICAÑA (Colombia)
CIESIN - Center for International Earth Science Information Network, Columbia University, NY
CSIRO Land & Water (Australia)
CSIRO Maths and Info Sciences (Australia)
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)
FAO - Food and Agriculture Organization
IFPRI - International Food Policy Research Institute
Stockholm Environmental Institute (SEI)
UNEP GRID ARENDAL - United Nations Environment Program, Arendal, Norway
Universität für Bodenkultur Wien (Austria)
USGS - United States Geological Survey
VIRMAX Specialty Coffees (Colombia)

Poverty Project Partners
CIMMYT, IFPRI, IITA, ILRI, IRRI, IWMI

ATMOS Research & Consulting
CENARGEN, Brasilia, Brazil
ILRI & University of Edinburgh
IPGRI, Rome
IWMI, Sri Lanka
King's College London, United Kingdom
Regional Committee of Hydraulic Resources of the Central American Isthmus
Secretariat of Natural Resources and the Environment, Honduras
South Pacific Commission, Fiji
Swiss Agency for the Environment, Forests and Landscape (SAEFL)
Swiss Federal Institute of Technology Zurich
USDA-FAS, Washington
USDA-PEO, Washington
University of California, Berkeley
University of Costa Rica
University of Leeds, United Kingdom
WWF Washington

Financial Resources:

Source	Amount (US$)	Proportion (%)
Unrestricted Core	639,001	49
Restricted Core	0	0
Carryover from 2003	134,554	10
Subtotal	**773,555**	**59**
Special Projects	385,560	30
Water and Food CP	142,905	11
Total Project	**1,302,020**	**100**

3. Research Highlights 2004

These highlights were selected from the Land Use Project's four strategic lines of engagement including agrobiodiversity, land use change analyses, local adaptation to external stresses, and spatial data generation and management.

LUP Theme "Agrobiodiversity" in close collaboration with the Tropical Fruits Project: Development of the crop-niche identification tool Homologue

Homologue is the result of over two years' collaboration between the Tropical Fruit project and Land Use. Homologue is designed to map the world regions homologous to a target point. The measures of similarity are climate and selected soil characteristics. The system is for using in two cases. A farmer looking for alternatives can ask "Where in the world is there land like my field?" Having the answer, s/he can look at what agriculture is being practiced in those areas for ideas as to what to do with his/her field. A researcher can find a crop doing well and ask, "Where else in the world is it like this crop situation?" By building up several analyses of this sort s/he can construct a "cloud" of probability, showing all the places where that crop or variety could be expected to do well, based on a limited set of site experiences. The Homologue package is a self-contained, user-friendly mapping system. The user selects the target site simply by pointing at a map. At present the climate data are restricted to 10 min pixels, but eventually the user may point directly at a field. The user then selects crop adaptation range. Soil data are entered as ranges of tolerance to one or several soil characteristics. Homologue calculates the joint probability of finding a climate like the target site and a soil within the specified ranges. The user can select which continents to map the homologue probability, and the probability map can be saved as an ESRI shapefile for further analysis in other GIS systems. Homologue goes beyond the simple homologue mapping by including a function to create the "cloud." The user can specify a number of probability maps, and Homologue will amalgamate them to form a joint probability map by selecting the maximum probability for each pixel in the set. Foreign probability maps from other systems such as FloraMap can be used without transformation. Homologue is now in final stages of completion and manual writing. It is hoped to be in production by the end of 2004. *Responsible*: Peter Jones.

LUP Theme "Land use change analyses": Quantifying and measuring nitrate pathways on Fuquene Lake - Colombia

Some of the main pollutants leached from agricultural systems are nitrates and phosphates. When leached in higher concentrations, they contribute to the eutrophication of lakes and surface waters. This is the case in the Fuquene watershed (98,000 ha), Colombia, where different land uses are contributing to the eutrophication process of Fuquene Lake (2200 ha). This lake feeds more than 24 towns downstream, where more than half a million people live. Preliminary studies state that the cattle-production systems are the main source of nitrates from ammonia fertilizers and animal excreta. Nevertheless, other land uses in the region such as potato cultivation and several milk industries located in the area seem to have a shared responsibility in the discharge of

pollutants to the water system. Controversy about the mechanisms and volumes in which nitrates and phosphates are getting into the water system suggested the need for further research, which the current project plans to address using 15N and 18O natural isotopes. It is expected that the isotope signature left by each of the sources can be identified in the system's sink waters. Clearer identification of the pollutant sources will aid in the identification of stakeholders in the region with whom to negotiate the alternative solutions for this problem. *Responsible*: Jorge Rubiano.

LUP Theme "Data generation and management": High resolution topographic data for the globe: A fundamental source of data for spatial research

Topography is basic to many earth surface processes. It is used in analyses including ecology, hydrology, agriculture, climatology, geology, pedology and geomorphology as a means of both explaining processes and predicting them through modeling. Our capacity to understand and model these processes depends on the quality of the topographic data that are available. For these reasons the LUP has invested in acquiring, processing and analyzing SRTM data, which originate from radar imagery and have been processed by the USGS and NASA to produce very high-resolution digital elevation models (cell size of just 92 m at the equator) covering the entire globe. The LUP now has this important resource at its disposal in a cleaned and processed form, permitting immediate extraction of topography data for any area of the world. Indeed several projects have already started using these data in their research. Additionally the LUP has performed detailed analyses of data quality and assessed their potential utility in ecology, agriculture and hydrology, the results of which are published in a 33-page technical report. The data are being offered free of charge to our partners, and the project has processed over 50 requests for data. By the end of 2004 the data will be available for downloading from servers through an alliance with the ICT/KM CSI project and IWMI. Initiatives are also under way with the WWF to provide global datasets on catchments boundaries, stream networks and hydrologically corrected DEMs; and results are expected for 2005. *Responsible*: Andrew Jarvis.

Other highlights

- ✓ A Center-commissioned external review (CCER) of the Land Use Project (PE4) in November 2003 requested a strategic restructuring of the Project, which was initiated successfully in 2004.
- ✓ The conceptual framework and a proposal for research on reversing land degradation in subhumid tropical environments were submitted to GEF. *Responsible*: D. White and S. Fujisaka. PE4 Land use change analyses theme.
- ✓ The beta version of CaNaSTA (Crop Niche Selection in Tropical Agriculture) for forages was delivered to the CIAT Forages group. CaNaSTA is the result of collaborative work between the Land Use and Forages projects and is designed to help answer—for any place within the Central American region—the question: "What forage should be planted here?" *Responsible*: R. O'Brien; PE4 Agrobiodiversity theme.

- ✓ The Challenge Program Water & Food (CPWF) began its implementation phase in 2004, by commissioning 27 projects, of which 14 are coordinated and monitored through the LUP as leader of Theme 2. Special Issue on Scale, commissioned by Agriculture, Ecosystems and Environment. Organizing session at the ASA Conference, Seattle. *Responsible:* S. Cook and M. Otero; PE4 theme Land use change analyses.
- ✓ Gap analysis of CPWF $30 m research portfolio completed. Major calls for future research in Theme 2 identified as the linkage between water and poverty, participatory change in land and water management, upstream-downstream conflicts, and management of floods and drought risks. *Responsible:* S. Cook and M. Otero; PE4 theme: Land use change analyses.
- ✓ A conceptual framework developed and published for sustainable site-specific diversification of hillside environments with high-value crops. *Responsible:* T. Oberthür and S. Cook. PE4 theme: Local adaptation to external stress theme.
- ✓ Public-private partnership research initiated among PE4, specialty coffee exporter VIRMAX and the Cafi-Cauca Cooperative to research the site-specific potential of hillside environments for higher value coffee diversification. *Responsible:* T. Oberthür. PE4 theme: Local adaptation to external stress theme.
- ✓ Completion of a 3-year, Norway-funded project entitled "Improving methods for poverty and food insecurity mapping and its use at country level." Seven CGIAR Centers carried out poverty mapping case studies for Ecuador (CIAT), Mexico (CIMMYT), Nigeria (IITA), Kenya (ILRI), Malawi (IFRPI), Bangladesh (IRRI) and Sri Lanka (IWMI). *Responsible:* G. Hyman and A. Farrow.

4. Problems encountered and their solution

The CCER, commissioned for the LUP in November 2003, identified clearly the need to focus on three areas that are consistent with CIAT's role as an agricultural research center. For reasons outlined below, we warmly welcome this and other recommendations, and we are restructuring accordingly; however, this process has revealed the critical requirements of time and money that we do not have. The LUP's main problems are linked directly to the process of implementing the CCER recommendations, particularly the unavailability of appropriate staff and financial resources to facilitate the change. We analyze below the causes of this problem and present our solutions. Analysis of the problem reveal that most of the last decade of LUP history has been marked by a lack of strategic research planning, which had the following consequences:

- Loss of science direction or focus. Without reference to Project or CIAT goals, scientists pursued individual interests, with no consistent guidance on appropriateness or quality. At one time, scientists were encourage to pursue *any* funding opportunity, regardless of its concordance or otherwise with strategic goals. Furthermore, with the loss of experienced scientists in the late 1990's, research quality tended to slide at the

same time that GIS applications drifted away from the interests of fellow scientists in CIAT. GIS became increasingly viewed as 'fad' science in CIAT.

- Lack of management planning. Unregulated or ad hoc expansion of staff activities in PE4 greatly increased financial liabilities without the equivalent expansion of research competence in strategically important areas. Total costs jumped from $1.4 to almost $2 m in 1999 without a clear plan as to how these would be sustained.

- Unreliable special project funding. Special projects proved unstable without consistent strategic directions. While costs rose, special project income plummeted to less than $200 k in 2001, ending a surplus and initiating a deficit that persisted through 2003.

Most of the solutions to this problem have already been initiated. They are:

- Clarification of science direction. The recommendations from the CCER have proved exceptionally valuable in this respect and have supported preexisting attempts internally to focus project scientists. The recommendations are especially valuable because they encourage consistency with CIAT's Development Challenges.

- Substantial reduction of core costs through core substitution or reduction. Core expenditure has been cut from $1.29 m in 2001 to $873 k in 2004. Core expenditure on international research scientists (IRS) has been reduced by 54%, on national staff by 18% and operating costs by 59%.

- Training and development of junior staff to enable them to assume responsibilities normally expected of IRSs. Some national staff members have proven capable of discharging responsibilities previously assumed by IRSs.

- Additional effort on resource mobilization. Special project earnings increased from $195 k in 2001 (13% of revenue) to $528 k in 2004 (41% of revenue). PE4 has invested substantial core resources in two flagship proposals (to BMZ and GEF) that are consistent with strategic goals.

The above actions have enabled PE4 to achieve twin goals of correcting serious financial imbalance while strengthening its science in accordance with the CCER's recommendations. Despite the foregoing, the LUP faces serious difficulties in moving forward quickly enough without some strategic investment given that available core funds are already committed to special projects. Based on current trends, it is anticipated that project core for 2005 will be sufficient to support only 1.5 senior scientist IRS equivalents (including a project manager) and 2 junior IRSs. This is inadequate to sustain development in all strategic research lines; thus the LUPs ability to implement the strategic directions indicated by the CCER depends on the success of proposals currently with donors or in process. There are three possible solutions to this problem:

- ✓ CIAT can follow the CCER recommendation for a 'call-in' of funds to support strategic investment in flagship projects, to which PE4 would contribute.
- ✓ CIAT can facilitate an alignment of other projects in directions consistent with the CCER-recommended areas so that staff positions could be shared. This might take the form of investment from regional offices in co-funded positions.
- ✓ PE4 could get sufficient special projects funded to support this expansion independently (difficult, given the need to offset special project funds with core funds).
- ✓ Should these options fail, a fourth option would be simply to cut strategic research areas with inadequate special project funding.

5. Project Indicators

Technologies, methods & tools

Botta, A.; Winograd, M. 2003. Model PolLU (Policies and Land Use Systems), Prototype developed with CORMAS, CIRAD-GREEN, Montpellier, France. Model development.

CIESIN (Center for International Earth Science Information Network), Columbia University; CIAT (International Center for Tropical Agriculture), GPW (Gridded Population of the World), Vers. 3. 2004. Columbia University, Palisades, NY, US. Available in:

http://beta.sedac.ciesin.columbia.edu/gpw

CIESIN (Center for International Earth Science Information Network), Columbia University; IPFRI (International Food Policy Research Institute), the World Bank; CIAT (International Center for Tropical Agriculture), GRUMP (Global Rural-Urban Mapping). 2004. Project: Settlement Points. CIESIN, Columbia University, Palisades, NY, US. Available in:

http://beta.sedac.ciesin.columbia.edu/gpw

CIESIN (Center for International Earth Science Information Network), Columbia University; IPFRI (International Food Policy Research Institute), the World Bank; CIAT (International Center for Tropical Agriculture), GRUMP (Global Rural-Urban Mapping). 2004: Urban Extents. CIESIN, Columbia University, Palisades, NY, US. Available in:

http://beta.sedac.ciesin.columbia.edu/gpw

CIESIN (Center for International Earth Science Information Network), Columbia University; IPFRI (International Food Policy Research Institute), the World Bank; CIAT (International Center for Tropical Agriculture), GRUMP (Global Rural-Urban Mapping). 2004: Gridded Population of the World, vers. 3, with Urban Reallocation (GPW-UR). CIESIN, Columbia University, Palisades, NY, US. Available in:

http://beta.sedac.ciesin.columbia.edu/gpw

CIAT (International Center for Tropical Agriculture). 2004. Crop Distributions for Latin America and the Caribbean. CIAT contribution to the FAO AgroMaps database. http://www.fao.org/landandwater/agll/agromaps

DIVA-GIS. Continued involvement in its development, with Vers. 4.2 now available (see Hijmans et al.).

Farrow, A. Ecuador web-mapping software http://www.ecuamapalimentaria.info, site also includes data downloads. Metadata from selected project data can be found on the National Geo-spatial Data Clearinghouse at http://clearinghouse1.fgdc.gov

Hijmans, R.; Guarino, L.; Mathur, P.; Jarvis, A. 2004. DIVA-GIS Version 4.2, freely available from http://www.diva-gis.org/

Niederhauser, N.; Oberthür, T. CINFO. Information management for coffee supply chains. Web page development. http://gisweb.ciat.cgiar.org/cinfo/

O'Brien, R. CaNaSTA for Forages beta version + documentation.

Winograd, M.; Schillinger, S.; Arana, B. 2003. CONDOR version 2.0, Web vers. Web tool. Final vers. Dec. 2003. Available in:

CAF http://www.caf.com/condor

Winograd, M.; Ruta, G. 2003. Capacitación y entrenamiento en indicadores de desarrollo sostenible (IDS) para la toma de decisiones [CD-ROM]. CIAT-ECLAC-The World Bank Institute, Washington, DC.

Publications

Journal papers

Ferguson, M.E.; Jarvis, A; Stalker, H.T.; Valls, J.F.M.; Pittman, R.N.; Simpson, C.E.; Bramel, P.; Williams, D.; Guarino, L. Biogeography of wild *Arachis*: Distribution and environmental characterization. Biodiversity and Conservation. (In Press)

Gonzalez, C.E.; Jarvis, A. Biogeography of the rare Colombian oak *Quercus humboldtii* (Bonpland). Cardasia. (Submitted)

Gonzalez, C.E.; Jarvis, A. Plants of Tambito I. Dicotyledonous. A preliminary list. (Submitted)

Holmann, F.; Argel, P.; Rivas, L.; White, D.; Estrada, R.D.; Burgos, C.; Perez, E.; Ramirez, G.; Medina, A. 2004. Is it worth to recuperate degraded pasturelands? An evaluation of profits and costs from the perspective of livestock producers and extension agents in Honduras. Livestock Research for Rural Development (16)11.

Jarvis, A.; Williams, K.; Williams, D.; Guarino, L.; Caballero, P. & Mottram, G. 2004. Use of GIS for optimizing a collecting mission for a rare wild pepper (*Capsicum flexuosum* Sentn.) in Paraguay. Genetic Resource and Crop Evolution. (In Press)

Labarta, R.; White, D.; Leguía, E. La agricultura en Amazonia ribereña de Río Ucayali. ¿Una zona productiva pero poco rentable? Acta Amazónica. (Under Review)

Marquardt, K. 2004. Without the forest, the field suffers - Land management strategies among small-scale farmers in the western Amazon. Paper presented at the International Symposium on Society and Resource Management (ISSRM), 2-6 June, Colorado, US.

Morales, F.J.; Jones, P. G. 2004. The ecology and epidemiology of whitefly-transmitted viruses in Latin America. Virus Research 100:57-65.

Nelson, A.; Oberthür, T.; Cook, S. 2004. Multi-scale analyses of topography and vegetation in a hillside catchment of Honduras. International Journal Geographical Information Science. (Submitted)

Oberthür, T.; Barrios, E.; Cook, S.; Usma, H.; Escobar, G. 2004. 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 and Management 19:1-9.

Pali, P.; Delve, R.; White, D. 2004. The adoption potential of biomass transfer and improved fallow practices in eastern Uganda: Determining profitable and feasible options from a farmer perspective. Uganda Journal of Agricultural Sciences. (9)11: 379-388.

Peters, M.; Hyman, G.G.; Jones, P.G. 2004. Identifying areas for field conservation of forages in Latin American disturbed environments. Environment and Society. (In Press)

Reid, R.S.; Thornton, P.K.; McCrabb, G.J.; Kruska, R.L.; Atieno, F.; Jones, P.G. 2004. Is it possible to mitigate greenhouse gas emissions in pastoral ecosystems of the tropics? Environment, Development and Sustainability 6: 91-109.

Rubiano, J. 2004. Conflict resolution by means of spatial information use and collective action. IJARGE. (Submitted)

White, D.; Labarta, R.; Leguia, E. 2004. Technology adoption by resource-poor farmers: Considering the implications of peak-season labor costs. Agricultural Systems. (In Press)

Yeaman, S.; Jarvis, A. Evolution in a two-dimensional cline: environmental heterogeneity and gene flow shape diversity. Evolution. (Submitted)

Conference papers and posters

Barona, E.; Hyman, G.G.; White, D.; Lema, G.; Perea, C. 2004. Población y medio ambiente en América Latina. Poster presentation at the Environment Week (Sept. 7-10, Washington DC, US). Inter-American Development Bank, Washington DC, US.

Biringer, J.; Guariguata, M.R.; Jarvis, A.; Locatelli, B.; Pfund, J-F.; Spanger-Springfield, E.; Suarez, A.; Yeaman, S. Biodiversity in a changing climate: A framework for assessing vulnerability and evaluating practical responses. In: Proceedings from the international workshop on adaptation to climate change, sustainable livelihoods and biological diversity. Center for International Forestry Research (CIFOR). (book title to be defined -submitted)

Cook, S.; Oberthür, T.; O'Brien, R; White, D. 2004. Using site-specific information to encourage safe and essential agricultural development. Paper presented at 7th International Conference on Precision Agriculture and other Precision Resources Management (July 25-28, Minneapolis, US).

Farrow, A.; Perea, C.; Barona, E.; Hyman, G.G; Lema, G.; Larrea, C. 2004. Spatial analysis of food poverty in Ecuador. Poster presentation at Environmental Systems Research Institute's International User Conference (Aug. 9-13, San Diego CA, US).

Farrow, A. 2004. Spatial analysis of food poverty in Ecuador. Paper presented at workshop on Poverty Mapping: Spatial Analysis for Poverty Reduction (Aug. 10, San Diego CA, US).

Farrow, A. 2004. Mejoramiento de métodos de análisis espacial de la pobreza y seguridad alimentaria en el Ecuador. Paper presentado en el taller: Seguridad Alimentaria de Niños y Mujeres Embarazadas (Jan. 22, Quito, EC).

Hyman, G.G.; Larrea, C.; Barona, E.; Lema, G.; Perea, C. 2004. Alternative poverty mapping method for the Central Peruvian Amazon. Poster presentation at the Environmental Systems Research Institute's International User Conference (August 9-13, San Diego CA, US).

Hyman, G.G.; Maarten, I. 2004. Review of food security and poverty mapping research. Paper presented at the Environmental Systems Research Institute's International User Conference (Aug. 9-13, San Diego CA, US).

Hyman, G.G.; Fujisaka, S. 2004. Geographic targeting of biofortified crops for addressing micronutrient deficiencies. Paper presented at HarvestPlus Meeting: Reaching End-Users (May 5-7, Rome, IT).

Hyman, G.G; Barona, E.; Perea, C.; Correa, J.; Lema, G.; Tello, F.; Meneses, C. 2004. Foro regional sobre desarrollo sostenible en América Latina: Cambios regionales y comunidades locales. Paper and oral presentation presented at Program Evaluation meeting of the Kellogg Foundation (June 24, Cali, CO).

Hyman, G.G. 2004. LCR rural strategy learning event. Paper presented at International videoconference on spatial aspects of rural development in Latin America and the Caribbean (April 15). Sponsored by the World Bank.

Hyman, G.G. 2004. Population change and protected areas in Central America since 1950. Paper presented at 100th Annual Meeting of the Association of American Geographers (Mar. 19, Philadelphia, PA, US).

Jarvis, A.; Winograd, M. 2004. Desarrollo y uso de indicadores de biodiversidad: Desde los datos a la toma de decisiones. Paper presentado en el seminario internacional sobre "Indicadores de Biodiversidad" (Mar. 2-4, Cartagena de Indias, CO).

Jarvis, A. 2004. Biogeography of wild Arachis. Paper presented at IV Latin American Meeting of Arachis Specialists (May 11-15, Brasilia, BR). Centro Nacional de Recursos Genéticos y Biotecnología (CENARGEN).

Jarvis, A.; Mulligan, M. The climate of cloud forests. Paper presented at Mountains in the Mist – Science of Managing and Conserving Tropical Montane Cloud Forests (July 27-Aug. 2, Kona, Hawaii, US).

Jones, P.G; Thornton, P.K. 2004. How crop production will be affected by climate change in Africa and its repercussions on the continent. In: International Workshop on Adaptation to Climate Change, Sustainable Livelihoods and biological Diversity. Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Turrialba, CR. (In Press)

Jones, P.G. 2004. Modeling local climate change in developing countries: Problems and possible solutions. In: International Workshop on Adaptation to Climate Change, Sustainable Livelihoods and biological Diversity. Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Turrialba, CR. (In Press)

Jones, P.G.; Amador, J.; Campos, M.; Hayhoe, K.; Marin, M.; Romero, J.; Fischlin, A. 2004. Generating climate change scenarios at high resolution for impact studies and adaptation: Focus on developing countries. In: International Workshop on Adaptation to Climate Change, Sustainable Livelihoods and Biological Diversity. Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Turrialba, CR. (In Press)

Jones, P.G.; Thornton, P.K.; Jarvis, A.; Beebe, S. 2005. How the CGIAR should respond to climate change. Paper presented at World Conference on Disaster Reduction (Jan. 18-22, Kobe, Hyogo, JP). UNISDR.

Marquardt, K. 2004. Farming System Research's possibilities and shortcomings -the necessity of learning from and with farmers' knowledge and worldviews. Insights from a case study in Peru. Presentation at the Sixth International Farming Systems Association (IFSA) European Symposium (April 4-7, Vila Real, PT).

Muller, J.P.; Winograd, M. 2004. Linking multiple scales and levels for land use and vulnerability assessment. Paper presented at the Joint International Workshop on Integrated Assessment of the Land System: The future of land use (Oct. 28-30, Amsterdam, The Netherlands). Institute for Environmental Studies.

Mulligan, M.; Torres, E.; Jarvis, A.; Gonzalez, J. Field and laboratory measurement of rates of cloud interception by epiphytes, leaves and fog collectors. Paper presented at Mountains in the Mist – Science of Managing and Conserving Tropical Montane Cloud Forests (July 27-Aug. 2, Kona, Hawaii, US).

Oberthür, T.; Watts, G.; O'Brien, R.; Escobar, G. 2004. Developing a research framework that supports sustainable diversification of coffee-based cropping systems with higher value crops. Paper presented at I International Congress on "Desarrollo de Zonas Cafetaleras" (Oct. 6-8, Tapachula, Chiapas, MX).

O'Brien, R.; Peters, M.; Cook, S.; Corner, R. 2004. CaNaSTA - Crop Niche Selection for Tropical Agriculture: A spatial decision support system. Poster presented at the 7th International Conference on Precision Agriculture and other Precision Resources Management (July 25-28, Minneapolis, US).

O'Brien, R.; Cook, S.; Peters, M.; Corner, R. 2004. A Bayesian modeling approach to site suitability under conditions of uncertainty. Paper presented at the 7th International Conference on Precision Agriculture and other Precision Resource Management (July 25-28, Minneapolis, US).

O'Brien, R.; Peters, M.; Corner, R.; Cook, S. 2004. CaNaSTA - Crop Niche Selection for Tropical Agriculture: A spatial decision support system. Poster presented at XX International Grasslands Conference (June 26-July 1, Dublin).

Rubiano, J. 2004. Environmental conflict resolution in Andean watersheds. Paper presented at World Water Week (Aug., Stockholm, SW).

Rubiano, J. 2004. Environmental conflict resolution in Andean watersheds. Poster presented at World Water Week (Aug., Stockholm, SW).

Rubiano, J. 2004. Water quality and quantity modeling for hydrologic and policy decision-making. 2004. Paper presented at AGU Fall Meeting (Dec. 13-17, San Francisco, CA, US).

Rubiano, J. 2004. Presentation on Payments for Environmental Services. (Sept., CIAT. Cali, CO).

Rubiano, J.; Giron, E.; Quintero, M.; O'Brien, R. Water quality and quantity modeling for hydrologic and policy decision-making. Paper submitted to the 2004 AGU Fall Meeting (Dec. 13-17, San Francisco, CA, US).

Tomich, T.; Timmer, D.; Alegre, J.; Arskoug, V.; Cattaneo, A.; Cornelius, J.; Ericksen, P.; Joshi, L.; Kasyoki, J.; Legg, C.; Locatelli, M.; Murdiyarso, D.; Palm, C.; Porro, R.; Salazar-Vega, A.; Van Noordwijk, M.; Velarde, S.; Weise, S.; White, D. 2004. Insights from integrated natural resource management research in the tropical forest margins by the Alternatives to Slash-and-Burn Programme. In: Millennium Assessment Symposium: Bridging Scales and Epistemologies. Alexandria, EG.

White, D.; Labarta, R.; Leguía, E. 2004. New agricultural technologies: are farmers too busy to adopt them? EcoAgriculture Partners Conference (Sep. 27- Oct 1, Nairobi, KE). ICRAF.

Winograd, M. 2003. The steps from data to indicators to actions: The use of geographical information in decision and policy making for sustainable development. Paper presented at Workshop on Sustainable Development Indicators and Environmental Assessment (Nov. 10-14, 2003, Moscow, RU). World Bank Institute.

Winograd, M. 2004. Hacia una agenda de investigación en tecnología y manejo integrado de recursos naturales en América Latina y el Caribe. Paper presentado en la Reunión de Plan de Mediano Plazo (Aug. 9-10, Costa Rica). FONTAGRO, IICA.

Winograd, M. 2004. Resilience: Examples d'application a différentes échelles et niveaux de décision. Paper presented at Séminaire Permanent de l'UMR SAGERT sur La Gestion Territoriale de la Diversité (Jan. 20, Montpellier, FR). CIRAD-TERA.

Winograd, M. 2004. Vulnerability indicators: From data to policy implications, vulnerability modeling. Paper presented at Workshop SEI-Oxford (July 5-6, Oxford, UK).

Thesis

O'Brien, R. 2004. Spatial decision support for selecting tropical crops and forages in uncertain environments. PhD thesis. Curtin University of Technology, Perth, WA, AU. (Unpublished).

Reports, working papers & manuals

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

Farrow, A. 2004. Mapping Ecuador's vulnerability to El Niño In: CIAT in Perspective. CIAT, Cali, CO.

Jarvis, A.; Rubiano, J.; Nelson, A.; Farrow, A.; Mulligan, M. 2004. Practical use of SRBM data in the tropics – Comparisons with digital elevation models generated from cartographic data. Working Document no. 198. International Center for Tropical Agriculture (CIAT), Cali, CO. 32 p.

O'Brien, R. 2004. CaNaSTA users' manual for CaNaSTA beta version. (Draft)

Rubiano, J. 2004. Vulnerability to natural disasters in Honduras. Stockholm Environmental Institute (SEI), Stockholm, SW. (Project report)

Tomich, T.; Palm, C.; Velarde-Pajares, S.; Geist, H.; Gillison, A; Lebel, L.; Locatelli, M.; Mala, W.; Van Noordwijk, M.; Sebastian, K.; Timmer, D.; White, D. 2004. Forest and agroecosystem tradeoffs in the humid tropics: A crosscutting assessment by the alternatives to Slash-and-Burn Consortium (ASB). ASB Millennium Ecosystem Assessment. ICRAF, Nairobi, KE. 125 pp.

Winograd, M. 2004. Propuesta para una agenda de investigación en tecnología y manejo integrado de recursos naturales. Informe final de consultoría, FONTAGRO-BID-IICA. Washington, D.C., US. Available in: http:www.fontagro.org. (Report)

Ziervogel, G.; Cabot, C.; Winograd, M.; Segnestam, L.; Wilson, K.; Downing, T. 2004. Risk assessments in Honduras before and after Hurricane Mitch. Stockholm Environmental Institute (SEI), Stockholm, SW. (Working paper)

Books and book chapters

Degen, B.; Jarvis, A.; Vinceti, B. Modelling biological processes from genes to ecosystems. In: (editors to be determined). Challenges in managing forest genetic resources: Some examples from Brazil and Argentina. International Plant Genetic Resources Institute (IPGRI), Rome, IT. (In Press)

Jarvis, A.; Mulligan, M. The climate of cloud forests. In: Bruijnzeel, L.A.; Juvik, J.; Scatena, F.N.; Hamilton, L.S; Bubb, P. (eds.). Forests in the mist: Science for conserving and managing tropical montane cloud forests. University of Hawaii Press, Honolulu, US. (In Press)

Jarvis, A.; Yeaman, S.; Guarino, L.; Tohme, J. The role of geographic analysis in locating, understanding and using plant genetic diversity. In: Zimmer, E. (ed.). Molecular evolution: producing the biochemical evidence, Part B. Elsevier, NY, US. (In Press)

Maxted, N.; Mabuza-Dlamini, P.; Moss, H.; Padulosi, S.; Jarvis, A.; Guarino, L. African Vigna: An ecogeographic study. International Plant Genetic Resources Institute (IPGRI), Rome, IT. (In Press)

Mulligan, M.; Torres, E.; Jarvis, A.; Gonzalez, J. Field and laboratory measurement of rates of cloud interception by epiphytes, leaves and fog collectors. In: Bruijnzeel, L.A.; Juvik, J.; Scatena, F.N.; Hamilton, L.S.; Bubb, P. (eds.). Forests in the mist: Science for conserving and managing tropical montane cloud forests. University of Hawaii Press, Honolulu, US. (In Press)

Rafiqpoor, D.; Nowicki, C.; Villarpando, R.; Jarvis, A.; Jones, P.; Sommer, H.; Ibisch, P.L. 2003. El factor abiótico que más influye en la distribución de la biodiversidad: El clima. In: Ibisch, P.L.; Mérida, G. (eds.). Biodiversidad: La riqueza de Bolivia. Editorial FAN, Santa Cruz de la Sierra, BO. pp. 31-47.

White, D. 2004. Estimating impacts of GIS research: Using rubbery scales and fuzzy criteria. In: Scaling up and out: Achieving widespread impact through agricultural research. International Center for Tropical Agriculture (CIAT), Cali, CO.

White, D. 2004. Alternatives to Slash-and-Burn (ASB) in Peru: Challenges, Research and Impact. In: Sanchez, P.; Palm, C.; Vosti, S.; Tomich, T.; Kasyoki, J. (eds.). Alternatives to Slash and Burn: Challenge and approaches of an international consortium. Columbia University, New York, US. (In Press)

White, D.; Velarde, S.; Alegre, J. 2004. Alternatives to Slash-and-Burn (ASB) research consortium in Peru. In: (eds.). Summary Report and Synthesis of Phase II. ICRAF, Nairobi, KE. 150 pp.

Winograd, M.; Farrow, A. 2004. Sustainable development indicators for decision-making: Concepts, methods, definition and uses. In: Encyclopedia of Life Support Systems. EOLSS Publishers Co Ltd., United Nations Educational Scientific and Cultural Organization (UNESCO).

Winograd, M.; Bundschuh, J. Geographical, economic, social and environmental characteristics and developments of Central America. Chapter 1 In: Bundschuh, J.; Alvarado, G.E. (eds.). Central America: Geology, hazards and resources. Balkema Publishers, The Netherlands. (In Press)

Yeaman, S.; Jarvis, A. Environmental heterogeneity shapes genetic diversity through gene flow in *Araucaria araucana* forest ecosystems in Argentina. In: (editors to be determined). Challenges in managing forest genetic resources: Some examples from Brazil and Argentina. International Plant Genetic Resources Institute (IPGRI), Rome, IT. (In Press)

Ziervogel, G.; Cabot, C.; Winograd, M.; Segnestam, L.; Wilson, K.; Downing, T. 2004. Vulnerability assessments and risk maps in Honduras before and after Hurricane Mitch: Progress in protecting the vulnerable. In: Stephen, L.; Downing, T.E.; Rahman, A. (eds.). Approaches to vulnerability: Food systems and environments in crisis. Earthscan, London, UK.

Training

Project interns: 7

Postgraduate higher degree students: 8

Visiting scientists: 25

Project collaborators trained: 3

Jan. 26-Feb. 2, 2004. Barona, E., Cardona, J. and Hyman. G.G. 2004. Introduction to ArcGIS I and II. Training in Geographic Information Systems software for 15 CIAT staff members (Colombians). 15 participants, 5 day course, 75 person-days of training.

June 2-6, 2003, Course-workshop on sustainability indicators for Latin America and the Caribbean, held at CEPAL headquarters in Santiago, Chile, in the context of the World Bank Institute/CEPAL/ASDI regional training project (55 participants from Mexico, Haiti, Puerto Rico, Rep. Dominican, Cuba, Costa Rica, Panama, Chile, Bolivia, Brazil, Colombia, Venezuela, Argentina, Salvador, Peru). *Responsible*: Manuel Winograd.

Oct. 11-14, 2004, Training of trainers workshop on vulnerability assessment and indicators and adaptation to climate change, UNITAR in collaboration with SEI and CIAT, Cape Town, South Africa (25 participants from regional partner centers (ENDA, Dakar in Senegal; ERC, Cape Town in South Africa; and MIND, Colombo in Sri Lanka as well from Africa LDC countries). *Responsible*: Manuel Winograd.

Resource mobilization

Approved

Definition of a research agenda on technology and integrated management of natural resources, consultancy, FONTAGRO-BID-IICA, Washington, D.C. (funded by FONTAGRO, US$12,500).

Responsible: M. Winograd.

Training of trainers workshop on vulnerability assessment and indicators and adaptation to climate change, Cape Town, UNITAR (funded by UNITAR, US$10,000). *Responsible*: M. Winograd.

Sustaining inclusive collective action that links across economic and ecological scales in upper watersheds (SCALES). (US$50,000).

Responsible: J. Rubiano.

Payment for environmental services as a mechanism for promoting rural development in the upper watersheds of the tropics. (US$50,000).

Responsible: J. Rubiano.

Contract for research on nitrogen tracers in Fuquene, Colombia. (GTZ, US$16,000). *Responsible*: J. Rubiano.

Spatial trade-off analyses and south-to-south knowledge transfer for site-sensitive development interventions in upland fallow rotation systems of Southeast Asia and East Africa. (Austrian Ministry of Finance. Total funds requested, 450,000 Euros; approved for 2005: 117,000 Euros.

Responsible: T. Oberthür, E. Hesse.

Facilitating public-private partnerships for site-specific development: Online provision and management of market and product information by smallholder hillside farmers. (USAID Linkage Fund, US$12,000).

Responsible: T. Oberthür.

A system of drought insurance for poverty alleviation in rural areas. (GTZ, 19,000 Euros).

Responsible: S. Cook, T. Oberthür.

Ex ante analyses of farm data in order to determine strategies to implement precision farming in intensive banana systems. (C.I. Probán S.A., Colombia, US$5,000). *Responsible*: T. Oberthür.

HarvestPlus Mapping. (Gates Foundation, US$250,000).

Responsible at PE4: G. Hyman.

South America Land Systems Project. (World Bank-CGIAR ICT-KM Project, US$31,000).
Responsible: G. Hyman.

LAC context project. (Kellogg Foundation, US$43,000).
Responsible: G. Hyman.

Support to Poverty Mapping Conference. (World Bank, US$30,000; USAID US$27,000).
Responsible: G. Hyman.

Spatial insights: Aerial imagery for site-specific agronomic management. (GTZ, US$39,000).
Responsible: T. Oberthür.

Development of SRTM topography data. (IWMI, US$5,000).
Responsible: A. Jarvis.

Pending

Development of a resource book on "Vulnerability indicators and assessments: Frameworks, methodologies and practices." Proposal submitted to the World Bank Disaster Management Facilities, Aug. 2003 (US$75,000).
Responsible: M. Winograd.

Land systems vulnerability and resilience across scales: Understanding socioeconomic and environmental interactions to enhance mitigation options, adapted responses and decision-making process. Project proposal developed by CIAT/CIRAD-GREEN/Wageningen University, Jan. 2004. Proposal not yet submitted.
Responsible: M. Winograd.

Reversing land degradation in the humid and subhumid tropics. Submitted to UNEP for US$600,000.
Responsible in PE4: D. White.

Enabling the conditions to reduce land degradation in the humid and sub-humid tropics. Project concept development preparation (PDF), GEF-UNEP, (C. Lascano, D. White,

S. Fujisaka, M. Winograd et al.). Submitted in Aug. 2004. (new version to be submitted in Dec. 2004) (Phase I, US$600,000).

Responsible: M. Winograd.

Climate change programmed strategy to support the implementation of NAPA in Francophone LDCs of Africa, UNITAR with CIAT and SEI collaboration. Proposal submitted by UNITAR and funded by French government (US$100,000; the CIAT component will be defined in Oct.-Nov.; around US$25,000 is expected).
Responsible: M. Winograd.

Guidebook for vulnerability assessment and indicators. Proposal submitted to UNDP and UNITAR in Sept. 2004. (US$85,000 expected; waiting for final decision in function of the results of the aforementioned CN/training activities).

Responsible: M. Winograd.

Locating and conserving wild crop relatives in Paraguay. (USDA, US$45,000). *Responsible*: A. Jarvis.

New opportunities for hillside farmers: Matching product quality, environments and market demand for high-value agricultural products. Submitted to the German Ministry for Economic Cooperation (BMZ). Requested funds US$1.44 million. *Responsible*: T. Oberthür.

Geographic information and remote sensing for food security systems in Ecuador. Submitted in Sept. 2004. (USAID).

Responsible: G. Hyman.

6. New directions for 2005

In 2005 the LUP will pursue the implementation of the recommendations of the 2003 CCER further:

- ✓ Continued development and implementation of a viable business plan for the project.
- ✓ Depending on the success of resource mobilization, the LUP may focus on a reduced number of strategic research themes.
- ✓ Special attention will be given to developing the support and research capacity in CIAT's regional offices in Africa and Asia. Where funding allows, staff will be deployed to the region, as well as explore funding opportunities with staff in regional offices.
- ✓ Maintain research capacity through training on remote sensing, spatial database management and advanced spatial analyses. The feasibility of these plans is currently being analyzed.
- ✓ The employment system for international staff based on the opportunity of flexible part-time contractual arrangements will be further tested and adjusted.
- ✓ Further consolidation of key internal CIAT partnerships and the development of strategic alliances with external partners, including those from the private industry will be pursued for the efficient implementation of the LUP's research activities.

7. Log frame 2005-07

Narrative Summary	Measurable Indicators	Means of Verification	Important Assumptions
Goal: Support agricultural development by providing spatial information that is *novel, significant* and *actionable*, thereby reducing the risk to agricultural development in the tropics.	Risk recognized as a reducible factor. Information adopted by decision-makers. CIAT, CGIAR or other collaborating research institution activities enhanced by the ability to target activities.	Policy, projects or funding strategies modified to include spatial information. Research portfolios modified by targeting or preselection. Risk management based on spatial information included in development projects.	
Purpose: Our goal is to provide spatial information that enables better decisions about agricultural land use change. Such information is derived from analyses at the local, regional and global scale and provided to individual farmers or the associations and organizations that work with and for them.	Decision-makers use spatial information to reduce risk.	Case studies at farm, national and regional scales documented. Methods of generalizing improved decision-making, using spatial information of land use published.	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 Insights to biological limitations and drivers of land use change developed from spatial analysis of agrobiodiversity.	Threats of global climate change (GCC) to regional crop production defined for regions. Threats of climate change in specific environments to plant genetic resources defined. Opportunities for improved genetic resource management defined for regions. → Homologue, FloraMap and MarkSim user community established. Management decisions based on the use of these tools.	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 2 Indicators of vulnerability and degradation risks of land use systems determined from analysis of land use change in tropical developing countries.	Indicators of vulnerability adopted by policy agencies. Spatial information on vulnerability used to reduce investment risks in at least one country case study. Practical risk management tools produced. → Management decisions in case study catchments guided by the outputs of this research.	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. Risk management tools adopted by users.	Sufficient data are available to generate insights.
Output 3 Information that supports individual land management decisions provided at local and farm-scale.	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). Farmer-to-farmer decision-support network established. → On farm land management changed on the bases of this research's outputs.	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.
Output 4 Baseline and time-series data for subsequent analysis executed.	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.

Cont. Table 7. Milestones

	Output 1. Agro-biodiversity analyses	Output 2. Land use change analyses	Output 3. Local information management systems	Output 4. Baseline data
2005	Canasta software for outscaling forage adoption in LAC available (June 2005) Homolog method developed for out-scaling of tropical fruits. Trialled with collaborators in LA, SE Asia (Dec 2005). Method of modelling continental-scale geneflow demonstrated with *Araucaria sp* and published (Dec 2005) Impact analysis for Harvest+ CP submitted (Dec 2005)	GEF Proposal on high resolution, national scale indicators of land degradation developed (June 2005) Research agenda on analysis of collective water use developed for CIAT (Dec 2005) Coordination of WFCP Theme 2 activities, including management of Phase 2 competitive bids (Dec 2005)	Low-cost participatory methods developed to capture farm-scale information of land productivity (June 2005) Concept of site-specific development developed and clarified through reports, publications and conferences (Dec. 2005). 60 farming families in case studies benefit directly. Concept of weather insurance developed and included in proposal (Dec 2005).	High resolution (90m) digital terrain models processed from SRTM for tropical areas of LAC, Africa and SE Asia, and available to collaborators (June 2005) Data-bases of political divisions, crop types, population compiled/updated for 27 countries in LA (Dec 2005)
2006	Floramap v 1.3 updated to include higher resolution climate database (Dec 2006). Marksim-DSSAT coupled method for scenario analysis (Dec 2006)	GEF phase I project initiated with collaborators in 6 countries (June 2006) Hydrologic models applied by CONDESAN to solve problems of environmental servicing and land degradation in 3 trial catchments in LAC (Dec 2006). Coordination of WFCP Theme 2 activities (Dec 2006)	Methods of analyzing farm product quality in relation to management * environment * genotype developed and validated for coffee (June 2006). Methods to analyze joint bio-physical and social networks developed (Dec 2006). Site-specific production opportunities for non-commodity crops demonstrated with farmer groups in LAC (Dec 2006). 3000 farmers benefit directly.	1 km climate data base generated for pan tropical region (June 2006) Selected crop specie databases compiled for agro-biodiversity and crop diversification research (December 2006)
2007	GxEngine prototype trialled (Dec 2007)	Indicator maps of vulnerability to natural hazards produced at regional, national and sub-national scale in 6 countries as part of GEF Ph I (Dec 2007). Vulnerability framework developed for policy-makers and included in WB methodology (Dec 2007). Coordination of WFCP Theme 2 activities (Dec 2007)	Methods and software to target environmental niches in hillsides made available and upscaled to 100 producer networks (Dec 2007). Natural hazard insurance implemented through 3-5 NGO groups in LA and Africa (Dec 2007).	High resolution, dynamic vegetation change data base compiled from satellite imagery for pan tropical region (Dec 2007)