

**CENTER COMMISSIONED EXTERNAL REVIEW OF SOIL AND
PLANT NUTRITION AND AGRICULTURAL SYSTEMS
RESEARCH AT CIAT
(CCER 1999)**

by

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Summary

The CCER team have reviewed the work of the soils (PE-2) and production systems (PE 5) projects, which fall within the area of natural resource management research at CIAT. These projects serve central functions within CIAT's overall natural resources management strategy. As such, the review team used the NRM strategy to frame the review of these two project areas.

It is useful to go beyond project purpose and objectives to identify the functions of these two projects within CIAT's overall research and development program. Within CIAT's NRM strategy, soil and water are the principal resource areas where there is a dedicated research program/project—this complements the biodiversity resource embodied in CIAT's germplasm development program area. The soils project thus embodies most of the strategic and applied research done on resource management and thus frames most of CIAT's biophysical research on resource management. The research agenda developed within the soils project is thus critical to CIAT's development of improved land management options.

The production systems project (PE-5) serves a very different function within CIAT's program/project structure. The project coordinates the integration of NRM research—both soils research and decision support tools and information—with germplasm research, potentially complemented by post harvest and IPM research. This integration focuses on integration of technology components within the farming or production system and application of decision support tools and organizational models at the landscape/watershed scale. This is done within a farmer participatory adaptive research mode within either commodity based adaptive research networks or in reference or benchmark sites. PE 5 thus coordinates the field research done by CIAT, tests the tools and technology components arising from CIAT's research projects, and contributes to methods development from its action-oriented research.

The quality and quantity of work outputs from these projects is most impressive although each generates a very different type of research product. In PE 5 the team notes the impacts of the cassava and forage networks within Asia on both introducing improved soil and germplasm technologies and introducing farmer participatory research methods. In PE 2 the team notes the research on management of savanna soils and the recent synthesis of this body of research.

The team notes that the integrative adaptive research function is spread across three projects, namely PE-2, PE-3, and PE-5. The team's main concern is that the present project structure and organization is not conducive to the efficient conduct and integration of research across the three ecoregional zones—forest margins, hillsides, and savannas, recognising that this is a product of the recent restructuring of CIAT into projects. The team believes that a more integrated structure will not only increase efficiency but also increase the relevancy and responsiveness of the research teams by addressing research needs across levels of ecosystem organization (eg Soils – production – land use management). An early response to these organizational concerns will help CIAT to maintain and enhance its comparative advantage in natural resource management research, which is directed at land use intensification.

The team recommends that this exercise should involve all project managers and key team members in an open, participatory manner in order to develop an effective new structure and organizational interaction between scientists and partners

The team also feel there should be continuing efforts to integrate the strategic, scientific research endeavor with adaptive, participatory resource management systems and perspectives which address the continuing problems faced by small and poorer farmers in the humid tropical regions

1 Introduction

This report represents the outcome of a Centre Commissioned External Review of the Overcoming Soil Degradation (PE-2) and Sustainable Systems (PE-5) projects. The review has been carried out by Maria Cristina P. Neves, John K. Lynam, Michael H. Beare and David P. Gibbon, over the period November 13th to 20th 1999. Two of the team visited the Pucallpa site in Peru (CN and DG)¹ and two visited the San Dionisio site Nicaragua (JL and MB). The team were given access to a large amount of published material and also discussed the project activities with project staff (and collaborating partners) in the field and during seminars and individual discussions held at CIAT headquarters in Cali.

It is evident that there are many linkages and interdependences with other CIAT projects which need to be evaluated if one wished to understand the full significance of the contribution that these projects are making.

The terms of reference for the CCER covered the research plan and objectives, the research process and resources and partnerships.²

2 CIAT's Natural Resource Management Research Strategy

The soils and systems projects reside within CIAT's NRM area of interest, and their strategies and log frames are nested within this larger program or area structure (NRM at CIAT 1995-1999). Since the overall NRM strategy puts boundaries on the two project areas under review, some overview of the NRM area is necessary to set the context for review.

2.1 Mandate

CIAT's mandate within the CGIAR system has historically been defined as worldwide mandates for cassava, bean and tropical forage germplasm, a LAC mandate for rice germplasm, and an ecoregional mandate for tropical Latin America. CIAT has therefore tended to focus its germplasm work on LAC, Africa, and Asia and its NRM work mainly on LAC. Within LAC itself, CIAT has used an agroecology zonation to define relative priorities for NRM research, namely between hillsides, forest margins, and savannas, with responsibility for the high Andes being under the CODESAN ecoregional program coordinated by CIP and with the semi arid areas having no priority.

The team makes two observations related to the currently perceived mandate (which provides the principal boundaries on the current and very broad mission statement). First, the agroecological zones (hillsides, savannas and forest margins) in LAC provide a reasonable framework for prioritizing CIAT's work on NRM in LAC. We

¹ Some field notes and comments on the components of this project are given in Appendix 2.

² The full terms are presented in Appendix 1.

are aware that activities in these three zones involve several other projects, and in the case of hillsides in LAC, the Hillsides Management Project (PE -3) plays a significant role. However, the priorities between these three agroecological zones are not clearly articulated, even in a qualitative sense. The team accepts that some presence in each zone is needed, but agreement on the relative priorities is essential in relation to decisions on how new research is taken up and to how overall strategies in the two project areas are defined.

Second, we note that activities in Asia draw on NRM research in LAC. The team is aware that guidelines for this work are contained in the Asia Strategy Paper which has recently been completed and that it will now be necessary to refer to this in any relation to any new initiatives in these regions.

2.2 Research Strategy

The research strategy is encapsulated in the term improved land management options. Such options are defined across levels of system organization from plot soil/crop management to field to production system, farm catchment and landscapes. Research focuses on two principal areas: 1) tools and process development to identify management and production system options and to support land use planning and 2) technology components and management options that support sustainable production systems. Tool development in turn focuses on decision support tools for decision making at different levels including indicators of environmental health and sustainability and organizational models both for community based organization and for institutions facilitating improved NRM. The outputs in the two projects are framed in terms of the development of either these tools or the technology components.

We have two main observations on this. The efficacy of the research strategy rests heavily on the notion of community based planning and assessment of land use. Much of the focus is on developing effective tools for the planning process. However, NRM impacts rest on whether there are mechanisms or instruments by which current land use can be changed to correspond more closely to that planned. For this reason, a key component of NRM research within such a strategy should be on the "change instrument" effecting land use change rather than on the assessment tool. The projects that were reviewed by the team tend to rely principally on the technology and management components to contribute to land use change, but this principally addresses farm level. Such mechanisms as land tenure, resource pricing or taxing, or land use regulations (either formal or informal i.e. collective action) all come principally at the policy level. CIAT has made a decision not to develop a capacity in policy research nor to focus on interventions at this level, and that these two projects should rather focus on interventions at the level of the production system. However, without a mechanism to influence policy change at the landscape level (and the research necessary to understand it), the tool development work would seem to lack the necessary overarching structure for successful application.

2.3 Operational Strategy

The operational strategy includes the development of -
 Organizational models for community based natural resource management
 Decision support tools

Component technologies

These are tested, when appropriate, in the framework of reference or benchmark sites. The development of production systems is principally the function of the systems project. According to the NRM strategy paper, this is done through two principal means, namely crop and forage system experiments and the farmer participatory research processes. CIAT operates one ecoregional reference site in the forest margins at Pucallpa, Peru, one in the savannas at Puerto Lopes, Colombia and two in the hillsides in Honduras and Nicaragua. Not all the reference sites have systems experiments and there are systems experiments outside these sites. There is one system experiment in Carimagua, CULTICORE, no system experiments in the forest margins, and system 'demonstrations' in the two Central American hillside sites SOL. Farmer participatory development of production systems is done within the hillsides sites and the forest margin site but not in the savanna site.

The team has several observations on the operational strategy:

- not all reference sites have systems trials
- there are systems trials in Carimagua and Cauca, Colombia, outside the ecoregional reference sites for historical reasons
- not all reference sites involve participatory development of production systems
- responsibility for systems research is in the system project (PE 5) but operationally each reference site is coordinated by a different project which is a source of inefficiency

3 Review of project PE-5 Sustainable Systems for Smallholders

3.1 Project Function and Operation

The function of Project PE-5 is to develop production systems that underlie the development of land management options from farm to landscape-level, the central component of the NRM strategy. As such, the systems project provides the integration of system components drawn from across the centre as a whole and in particular the integration of germplasm, management options and NRM strategies. To date this has consisted principally of germplasm components especially rice, cassava and forages and soil management components although there is potential to include IPM components as well. The project works almost purely within an adaptive research mode, utilising a range of farmer participatory approaches, with some complements of applied research within project sites. Most of the research work is executed through national collaborating institutions. The project works within two principal operational modes, namely germplasm based networks and benchmark sites. The project implements CIAT's programs in Asia and interacts with the bean project (IP 2) in Africa. PE-5 plays a key role in the implementation of CIAT's NRM strategy, managing as it does the field based research, one benchmark site and the production systems research.

The review team has several observations on the function of the systems project. First, the team feels that the function of the systems research is relatively clear and is central to the execution of CIAT's mission. Nevertheless, this function is currently spread across the systems, soils, and hillsides projects. The team appreciates the historical underpinnings of the current structure, but notes that the current set of overlapping responsibilities limits closer interaction between PE-2, PE-3 and PE-5 and results in loss of clarity on priorities and strategies. Second, within PE-5 the NRM component of the production systems work consists almost solely of soils management options—apart that is from the selection of crop options such as bananas or upland rice. The team notes little flow of soil management options from PE-2 to PE-5 nor the elucidation of other NRM research areas of relevance to production systems (eg IPM). Given the location of the field research areas, soils are in most respects the key resource management issue. Some clarity on what the NRM research agenda is in each of the field research sites would better help to focus both the site level research strategies as well as the project level research strategies. Third, the systems project understands the relative strengths and weaknesses of the two operational modes in the development of production systems. The systems group expressed some uncertainty as to which path to emphasise in its future work. The team sees no problem with deepening each mode of operation. Given the clear impacts that have been achieved in Asia and Africa with the commodity-based networks and CIAT's historical mandates over those crops, these are the logical operational modes and entry points in those two continents. They provide a valuable framework around which to deepen NRM research. The benchmark sites serve as the obvious operational mode in Latin America, allowing the addition of other commodities to the development of land management options.

3 2 Research objectives, outputs and milestones

Since 1997, PE 5 has undergone continual revision and redefinition of project purpose and goals due to a variety of changes within CIAT, the NRM focus and the need to integrate with other projects

The project has brought together a range of sub-projects and activities which fall within the 4 principal intended outputs of the project, namely

- Alternative land use options for agricultural systems
- Component technologies for sustainable production development through farmer participatory research
- Models and frameworks developed to target research integrate results, assess impact and extrapolate results
- Increased effectiveness of CIAT and partners to conduct appropriate research for developing productive and sustainable land use practices

In relation to each of these planned outputs are between 5 and 7 activities all of which involve a high degree of interaction with other projects, and each of which are now generating some highly significant outputs, both of a specific and strategic nature

The milestones, and many other outputs, indicate that the project has, within a very short period of time established its identity and justification within CIAT NRM research. The quality of the research, arising from the competence, commitment and energy of the staff team members, colleagues and their support staff, is of a high standard and has impressed the review team. We feel that in general the work is responding in the affirmative to question 1 in the terms of reference (See appendix 1)

3 3 Research Process and Strategies

PE 5 is the vehicle through which CIAT's NRM strategy is tested and implemented in the field. It both develops the production systems that underlie improved land management options and it integrates the decision support methods and tools within project-based action research. PE 5 is thus the locus for the testing of the tools and approaches as well as the source of feedback from the field to other project elements within CIAT as a whole. Again the review team notes the critical function that this project serves within the centre and reviews below three elements that are central to the research strategy pursued by the systems project

Community Based Resource Management This theme has evolved over the last four to five years within CIAT's NRM research. It is the focus of much of the research work on tool development (eg Decision Making for Sustainable Natural Resource Management Nine Tools that Help). Moreover community organisational models are the principal entry point for implementing change at a landscape level. This is an emergent line of research for CIAT and the review team notes the high quality of the decision support tools that have been developed. Moreover the benchmark sites provide an ideal laboratory to test the efficacy of these tools within an action oriented research mode

Nevertheless while the review team considers decision tools and production systems to be necessary to improved community-based resource management, they are not sufficient to achieve effective changes in land use and resource conservation within a landscape. Within an essentially privately based system of land holdings and land tenure, policy instruments, however defined, are required to effect the community's collective land use plan. While the work on diagnostic tools has been essential the project now needs to consider how communities move from diagnosis to implementation and the efficacy of alternative instruments. Setting a research agenda and research priorities for the social scientists working within the benchmark sites is essential to the rounding out of the community-based resource management concept. There is a tendency for the social scientists to be heavily involved in the day to-day diagnostic work, losing a clearer vision of research priorities across the benchmark sites and within the more generic area of community based resource management.

There is as well uncertainty as to what biophysical research is carried out at a landscape scale. The team notes the concept of water quality as an integrator /indicator of resource management at a landscape scale including issues related to soil erosion control, nutrient management and agrochemical pollution. Hydrological flow and periodicity forest cover and extraction rates or field fragmentation can be other indicators. The review team would suggest some consideration of whether such an agenda exists at the landscape level for biophysical research, followed by the difficult question of whether CIAT has any capacity to undertake it—for example a hydrological gauging system in watersheds.

Sustainable Production Systems PE-5's principal strategy for the development of sustainable land management options is through the development of resource conserving production systems. These are developed in-situ through the integration of crop germplasm crop and soil management options and livestock production systems. The project uses a combination of participatory farmer experimentation and system experiments to develop these systems. The review team considers this to be a critical area of work and that the overall approach is sound. However the team feels that more consideration should be given to first how this system integration is most effectively accomplished and second to how system sustainability and longer-term investment in the soil resource is accomplished.

Participatory learning methods The team notes that the following areas remain underdeveloped and they might be included in future research work:

- How farmers move from experimentation with components to integrating them into first the cropping system and secondly into the farming system
- The role and function of such system experiments as the SOL both in terms of evaluating system sustainability and as an input into farmer knowledge
- The use of participatory methods with difficult experimental options such as animal feeding trials and animal production systems
- Methods to evaluate farmer decision making for longer term investments such as soil conservation measures. The Asia cassava work has gone some way in developing methods in this area, but the difficulty remains of how farmers evaluate technologies with distant future outcomes

All of this is fertile ground for continued deepening of the systems research methodologies and a vehicle is needed for how learning across the very different projects and sites is synthesised, assessed and new approaches and needs conceptualised

3 4 Overall conclusions on the research process in PE-5

The project maintains a strong emphasis on combining germplasm development with natural resource management, as far as possible with the involvement of communities and appropriate user groups. It also has a focus on exploring integrated land management system options both at the farm and watershed or landscape levels. In addition, the project has an overall user-participatory learning approach to technology development and works closely, at each site, in partnership with other IARC's, NARS NGOs and other collaborators.

The benefits of the juxtaposition of these elements is immediately obvious, certainly at the Forest Margin site, and from the evidence presented by the commodity focused project staff operating from other sites. It was generally agreed that all germplasm development should have a strong connection with the different contexts in which the new materials were to perform.

The general conclusion from our analysis of the activities and methods used was that they were appropriate to achieve the expected outputs. However, the conditions for the achievement of these outputs were different in each of the three sites (the Colombian site could not be visited) and there was a need for a reorganisation and reallocation of human resources to balance the activities at each site and to maintain the focus on smallholder farmers and cultivators.

At the forest margin site there had been some excellent diagnostic work and an impressive start has been made on a range of activities: participatory training, collaborative institutional initiatives, on farm trials, dynamic study of health, biodiversity and natural resource use, alternative land use options, economic models for decision support and several others. At the Central American Hillsides site there was clearly a need for a wider systems perspective in which PE-5 is more integrally involved.

A reasonable proportion of the research in hand is original and strategic in nature. The forest margin site has great significance in the broader regional context of the Amazonian and Asian rainforests and in the context of global concerns for the environment also. The team feels that the Pucallpa site would benefit from a collaborative program with a reference site which has gone through a longer history of natural resource exploitation, settlement and more secure land tenure arrangements. The site at Acre across the near border in Brazil has been suggested, with EMBRAPA acting as a partner in this work.

The quality of the written outputs from this project is high and much has been published in internationally refereed journals. More can be expected as the project becomes more established and the outputs from the current field work activities are written up. There are all kinds of research in progress, much of it is adaptive in nature.

relying on qualitative rather than quantitative indicators of change. The research outputs are being used by a variety of clients, from poorer farmers to Government decision-makers.

So far the progress of the research project is satisfactory as evidenced by the wide range of outputs from many activities.

The research is linked to other CIAT projects but more could be done to develop this further. In particular there needs to be closer links with PE - 2 and clearer areas of responsibility need to be agreed both in the hillsides and in the forest margin sites.

The review team has discussed the concept of community natural resource management, watersheds and landscapes and accepts that although this is an overall approach, it might vary in application under different circumstances. For example, at the Hue site there is a strong and established community who have been farming for many years and who have strong social capital, whereas the people in the lowlands of Pucallpa come from different origins and cannot yet be regarded as a coherent community. The situation will be investigated by a social scientist attached to the team.

The timing of this evaluation is appropriate but it should be borne in mind that several activities studied are at a very early stage of development and cannot be expected to have delivered substantial outputs by this time.

4 Review of Project PE-2 Overcoming soil degradation through productivity enhancement and natural resource conservation

4.1 Research goals/priorities in terms of CIAT's mission/comparative advantage

The goal of the PE 2 project is overcoming soil degradation through productivity enhancement and resource conservation. It was established with the purpose of developing strategic principles, concepts, and methods for protecting and improving soil quality through the efficient and sustainable use of soil, water, and nutrient resources. PE-2 emerged out of CIAT's Savanna and Tropical Lowlands Programs as a key component of CIAT's new natural resource management thrust and with a strong CGIAR mandate to address issues of water scarcity, soil, and nutrient management and aquatic resources.

The CCER99 team believes that PE 2's goal and purpose are consistent with and indeed central to CIAT's overall mission. Nevertheless, we would make one comment on the current goal and purpose statements that may be of strategic relevance: Protecting and improving soil quality *for* (to achieve) rather than *through* efficient and sustainable use of soil, water, and nutrient resources more directly addresses CIAT's mission of reducing hunger and poverty by improving agricultural productivity and natural resource management. That is, efficient and sustainable use of soil, water, and nutrient resources may be achieved without necessarily improving agricultural productivity or reducing hunger and poverty. While this may be regarded as a purely semantic argument, it is probably of strategic importance to the development and implementation of PE 2 research. Alternatively, the term *through* may be intentional, though this would seem to place a strong emphasis on soil restoration rather than the avoidance of degradation. Both are clearly important issues to address.

The research priorities address productivity and natural resource management issues in savanna and hillside ecoregions. The PE 2 project has focused much of its past research on savanna ecosystems. There are important historical reasons for this focus, in particular the opening up of the cerrados in Brazil in an effort to reduce pressures on the Amazonian rainforests. Given the advances in agricultural development in the Brazilian savannas, the research needs there now extend beyond those of CIAT's overall research mission (i.e., research no longer addresses directly issues of poverty). While there remains a donor-driven demand for research on the Colombian llanos, it is clear that CIAT's PE 2 research must be much more heavily focused in Hillside and Forest Margin ecoregions. In these regions, demand for improving agricultural productivity and natural resource management is central to addressing issues of food security and poverty.

However, there appear to be at least two areas of further research need in the savanna ecoregion:

pasture decline (e.g., grazing management, INM, IPM) and

soil conservation practices for small holders at the savanna margin (e.g. appropriate tillage technology)

While soils research will make an important contribution to both areas, many of the key issues in each case require solutions at the production systems level. This observation argues for greater participation of the PE-5 project team and continuing collaboration with EMBRAPA in future savanna research.

The 1996/99 PE-2 summary document states (pg 4) that the project's objective represents a *shift towards soil-water processes with less consideration of production systems and their components*. However, the summary also states (pg 9) that the *main focus of the project's activities on soil plant processes is the production system*. There are some strong similarities to the purpose of the PE-5 project (Summary pg 5) namely *developing integrated crop livestock and arboreal technologies and information that leads to more productive and sustainable production systems*. While we believe that research in PE-2 (Soils) is essential to identifying the need for and underpinning the development of sustainable production systems, there is a need for greater integration with systems researchers in PE-5 to achieve that goal. This may be particularly important in the Hillside ecoregion where there is a concentration of smallholder farms and where complex issues of land use management require production system solutions that differ within and between watersheds.

4.2 Objectives, Milestones, and Outputs

The project objective is feasible. The overall project milestones (pg 3, 99 Annual Report) are appropriate, but very broadly defined. It is therefore difficult to monitor their achievement.

While the project outputs are ambitious they are clearly consistent with the overall goal and purpose of the project. Although it is difficult to determine the indicative time frames for all of the output activities, the project has documented a high level of achievement in each of the output areas, gives us some confidence in the PE-2 teams' ability to meet the objectives.

The project outputs are very well defined, however, there are some potentially important gaps in the proposed activities for key output areas.

- Output 1 - includes no explicit activities that address *water constraints* (e.g. soil water holding capacity, porosity, hydraulic conductivity) and constraints on and improvements of soil structural integrity.
- Output 2 - includes no activities that contribute strategies for improved water management. While strategies to maximize C sequestration are addressed, improved organic matter management is not explicitly addressed. Yet the strategies that achieve these objectives may not necessarily be the same. Soil organic matter is also an important integrating property in soils having influences right across a range of soil quality issues.
- Output 3 - the importance of identifying optimum ranges for the soil quality indicators based on relationships between soil quality indicators and productivity or environmental degradation needs to be highlighted. Developing decision

support tools for improved water management will be difficult to achieve without the relevant underpinning research on water constraints and management strategies

4.3 Regional Priorities

The project outputs respond to regional priorities in hillside and savanna ecoregions though the relative importance of some output activities differs between ecoregions (e.g. native plants as biofertilizers strategies for soil erosion control). Greater clarification of these issues might help the project team to define strategic priorities including the staffing allocation and the disciplinary skills required in each ecoregion.

4.4 The Research Process

PE 2 has to date combined several research functions, namely process-based studies on the biological, chemical and physical determinants of productivity in the oxisols and ultisols of the savanna ecosystem and participatory research on soil management options in the hillsides. Virtually all the strategic research has in the past focused on managing soils in the savanna ecosystem. Over the last year there has been a shift in focus from the savanna (MAS) to the hillside ecosystem (MIS). The research priorities for the hillsides benchmark sites remain to be defined. The team notes that little emphasis is being given to the forest margin reference site though we understand that efforts have been made to collaborate with ICRAF in this area. Given the extensive nature of those systems and the uncertain land tenure this probably reflects a correct assessment of current priorities for soils research across the three ecosystems. PE 2 is thus in transition and this provides significant opportunity for reflection on both the mandate of the project and the research strategies that will be pursued over the next three to five years. The team would note several areas that might be considered by the project in this transition period.

Strategic to Adaptive Research The soils project now combines a set of activities that run from strategic, process based research to adaptive on-farm research. The strategic research has focused on the savanna systems and the more applied and adaptive work has focused on the hillsides. The team would expect the development of a more strategic research agenda for the hillsides and a move toward greater integration in their adaptive research activities with PE 3 and PE-5. The development of this research agenda will not be straightforward given the more complex and variable nature of soils constraints in this ecosystem particularly as compared to the savanna ecosystem. It may be argued that the real constraint in hillsides and forest margin research is the development of applied and adaptive research based on process-level research and technologies developed elsewhere. There is a need for and indeed an opportunity to develop a soils research strategy that uses participatory research tools to identify key soil management issues that will help to focus the process level research which then feeds back into practical tools and solutions. The team recognises that this process will be enhanced by close integration with the PE 5 team. The team would only note that this is a complex but fundamental issue that PE-2 will need to address in a systematic way in the coming year. The team would also note the area of bioeconomic modelling where biophysical models are integrated with

economic modelling as being both particularly relevant to smallholder agricultural systems as well as building on some existing capacity in CIAT

The team notes the use of the arable layer as a conceptual model for what might be termed integrated soils management. Such a conceptual model can be easily linked to a modelling framework such as APSIM, which integrates soil water tillage and organic resources in the arable layer. The project, however, should note the existence of alternative conceptual models such as resource and nutrient budgets (whether static or dynamic) or soil capital, which integrates farmer management and investment decisions. For complex, smallholder systems, the project might consider which heuristic device best integrates the soil management issue and the research strategies which underlie it.

The research activities and outputs over the period from 1996 to present have been of a very high standard and have had some important ecoregional impacts. First, the scientific research outputs are rigorous and of a high international standard. This is demonstrated by the exceptionally large number of peer reviewed journal publications and the publication of synthesis volumes on savanna Oxisols and agropastoral systems in LA savanna (edited by PE 2 staff). Second, PE-2's basic research has been developed with an eye to its relevance for underpinning the applied and farmer participatory research and technology uptake. The continuum from basic to applied to farmer participatory research is evidenced by PE-2 contributions to the Soil Quality guide (Guia 1), one of the nine tools developed by the PE-3 project.

At this stage of development the Soil Quality Guide (Guia 1) is primarily an educational tool directed at farmers and extensionists. This is an important first step, however to meet the aim of output 3 - improved decision making for combating soil degradation and greater agricultural productivity, there is a need to develop an integrated on-farm diagnostic/decision support tool through a process of participatory research. The concept of the on-farm Soil Quality Monitoring Systems (SQMS) was developed as a decision support system to assist farmers in diagnosing and managing changes in soil properties to sustain/improve productivity or minimise the risk of environment degradation. The SQMS would include guidelines on establishing a monitoring program, practical tools for monitoring relevant soil properties (indicators) guidelines for interpreting indicator results and recommendations for reversing soil quality decline, all developed through participatory research. To achieve this the project team will need to define optimum ranges (quantitative or qualitative) by establishing relationships between the indicators and productivity of natural resource degradation or improvement.

A Hillside Research Agenda The research agenda for the MIS is being developed within a participatory research process. Nevertheless the results of this process need to overlay with CIAT competencies. Much of the work on resource quality and the work on improved fallows and crop rotations have legumes as their central component. CIAT has some obvious comparative advantage in this area, but needs to combine their legume collection with the potential of others such as ICRAF and ILRI. As with the resource quality database there is real need for a germplasm and ecophysiological database for legumes to better inform the utilisation of broad-based legume germplasm. Developing a research agenda that complements the resource

quality work is an issue as it would need to complement ongoing work in other institutions on BNF/ecology, SOM synchrony and dynamics root turnover etc

The experience generated by the alternative cropping systems work in the Columbian hillsides has been important to the establishment of the SOL network in the hillside reference sites of Nicaragua and Honduras. Their goal is to use participatory techniques to evaluate the merits and weaknesses of proposed management solutions on "experimental" farms where the supermarket of options (SOLs) can be demonstrated. While the goals and objectives of the SOLs are generally defined, the specific pathways by which the germplasm and management ingredients will be developed and integrated into recipes for production systems and ultimately the SOL menu remains somewhat less clear. Although the PE-2 team has indicated that there may be more than one pathway, clearly defining these pathways will be important to defining the relationships between scientists, farmers and the community and to identifying the participatory tools and techniques required to meet the objectives.

Erosion and soil conservation is an obvious constraint in the hillside ecosystem but there is a similar issue of CIAT's comparative advantage in this area, given the large amount of existing and ongoing research in this area. The work on erosion risk assessment is innovative and helps to support the farmer participatory research. An evaluation of existing models for Latin American conditions might be another option linked to the current work being done by GCTE in the evaluation of erosion models. The work on development of live barriers in both Asia and Latin America is best done in an adaptive research mode within PE 5. Again how CIAT assesses its comparative advantage in doing versus accessing soil erosion research will be an issue in the development of the MIS research agenda.

There has been a recent flurry of activity around the integration of INM and IPM for soil borne pests and diseases. The work on beans, roots, rots and bean stem maggot in East Africa provides some insight into this area of research. This is a possible area to explore but is obviously dependent on the particular crop and disease complex. The work on nematodes in legume rotations would be another aspect of such work on integrated soil biology. There may also be a need for research on biological regulation of soil borne diseases through improved residue management strategies that conserve soil organic matter. The team would only note in going through these examples that development of a research agenda in PE-2 for MIS will not be straightforward but some systematic determination of such an agenda is crucial to defining the work of the project over the foreseeable future.

PE 2 and SWNM The team would note that given the transition in research within PE 2 toward soil management constraints for small farms in hillsides, that issues arise as to how PE 2 participates in SWNM. First, does PE 2 continue with its MAS agenda within the context of SWNM or shift its focus to the MIS agenda? How are limited resources best allocated between the two activities? Second, if the focus shifts to MIS issues, then there becomes a significant commonality between the activities of SWNM in both Asia and East Africa where the focus is also on small farmer agriculture on hillsides, rather than a division of labor. Optimally this would allow a two way flow of research products such as is occurring with the TSBF/CIAT joint position on resource quality in Uganda. However, PE 2 has the option of either

linking through the SWMN partners or the CIAT crop based networks in PE-5 In East Africa, there is an overlay through AHI that integrates all parties In Asia that is not the case Third, it is not inconceivable that PE-2 could define its research agenda for the hillsides not only in relation to MIS but also in relation to the work of both SWMN and the CIAT crop networks in Asia and Africa. If such a route is taken, some clarity is needed about the respective roles of PE-2 and PE-5 in overseeing field based research in Asia and Africa.

5 Resources and partnerships Combined comments with respect to the two projects

5 1 Research organization and resources

From our comments above it should be clear that the review team feels that there is a need for further clarification in the structure and organization of the projects under review in relation to other complimentary projects which are active in the Forest Margins, Savannas and Hillsides

We suggest that a participatory planning exercise involving project managers and key staff is organized to completely rethink the structure, organization and allocation of roles and responsibilities across these ecozones There is a particular need to examine the distribution of human resources across the three zones and when and for how long staff are operation within each site and with a center based role across sites and regions This particularly applied to social scientists who are still a scarce resource at the Center

The Center should be giving a serious commitment to community participatory systems research approaches at these key sites through which germplasm, soils, crop protection and livestock components inputs are integrated in the search for more sustainable natural resource management systems The learning experiences from the older, commodity based systems work from other continents should feed into and compliment this endeavor

5 2 Strategic partnerships

The benefits of multi institution partnerships at the international level are evident from the linkages that PE 2 has developed However, the establishment of these partnerships often comes with a high cost in terms of staff time and the cost/benefit of these exercises needs constant review

More local and regional linkages are of crucial importance to CIAT s activities DEPAM at the Pucallpa site is an example of a framework in which CIAT might continue to take a lead role Other partnerships with NGOs, Universities EMBRAPA Centers and others in the region and in the North could be explored further

There are many opportunities amply demonstrated by the PE-2 project, for synergy arising from the integration of Masters and PhD students that need further attention, and there are new initiatives for some donors (eg Sida) to support scientist and research student secondment to CG Centers

The team recognizes that importance of giving support to young scientists who are operating in the field and to ensure that they maintain active linkages with other institutions and individuals. Visiting scientist programs should be also explored more fully

Partnerships with other CG Centers are worth reviewing to see whether it is really necessary for more than one Center to have a presence at each site, or whether some economies might be possible when a single Center takes responsibility for integrating inputs from other Center Programs

6 Issues and recommendations

- 1 The research carried out within these two projects is of a high standard and represents some of the key areas of research at CIAT for the foreseeable future. Basic and applied research in soil science and management, participatory research methods development, decision support methods adaptive technology development within an action or learning context with resource users, and a community natural resource management perspective at appropriate production systems and higher scales, are all crucial areas of activity which should remain high on the research agenda
- 2 The projectisation of research at CIAT has had some negative effects on research efficiency and on transaction costs. In the case of the three ecoregions – hillsides forest margins and savannas – there is a need to restructure and organize activities in a more integrative manner which makes better use of scarce resources both at the three sites and at the Center. There needs to be clearer understanding of roles, functions and responsibilities between actors and research groups who participate in this research in the future. It is suggested that this replanning exercise be conducted in a participatory manner with management project leaders and key staff present
- 3 The review team considers that it is important to maintain a critical mass of scientists at each of the reference sites and there is a need to establish effective back up support from appropriate institutions and individuals in the rest of the World. Good academic linkages are essential for any young scientist working under these conditions and attention should be paid by managers to ensure that field scientists are supported effectively with access to communication and information search services and dialogue partners in particular
- 4 *Systemwide Program on Soil Water Nutrient Management (SWNM)*
The panel reviewer considers that future activities should aim at producing generic products for inclusion in a SWNM toolbox for use by ecoregional programs and other stakeholders. All consortia must contribute to the development of a logframe which should be integrative in nature and realistic

focusing on generic outputs. The panel reviewer recommends that a program meeting of participating scientists be convened in the first half of 2000. Exchange of personnel should be stimulated among consortium members and between consortia. In addition, the panel reviewer considers it essential to make every effort to obtain 3-year core funding to each consortium, perhaps through World Bank funding. A full-time co-ordinator should be appointed for the programme (alternatively a 50% scientific co-ordinator plus administrative support) to strengthen the currently existing and excellent work at CIAT HQ.

Appendix 1 Terms of reference for CCER 1999

The CCER 1999 review concerns Soil and Plant Nutrition and Agricultural Systems which is concentrated in Projects PE2 and PE5

The review will be conducted on or before November 16 20 1999 This date was chosen as it follows completion of annual reports and out posted staff can participate in conjunction to the Annual Review This date will allow for sufficient time to prepare the responses to the recommendations for the December BOT meeting

A review panel of up to 4 external consultants will conduct the review led by the review chair and provide a report

The proposed Terms of Reference for the review are

1) Research plan and project objectives

- 1 1 Are the research goals and priorities appropriate in terms CIAT s mission and comparative advantage for supply of international public goods regional priorities?
- 1 2 Are milestones appropriate and well indicated and can their achievement be monitored?
- 1 3 Are project outputs and impact well defined and feasible
- 1 4 Are the project objectives feasible within the indicated time frame?
- 1 5 Do the proposed research outputs respond to regional priorities?

2) The research process

- 2 1 Are the research activities and methodologies used appropriate to achieve the expected output?
- 2 2 Is the research original and of a strategic nature?
- 2 3 Is the proposed science rigorous of international standards and is the peer review process in place to assure those standards including research publications?
- 2 4 Is research progress satisfactory?
- 2 5 Is the research linked appropriately with other projects in CIAT?
- 2 6 How is the research continuum from strategic to applied to adaptive managed?
- 2 7 How are the research outputs being used and by whom? Are the stakeholders and the uptake paths identified, and mechanisms for uptake in place?
- 2 8 Is there an appropriate and timely impact assessment plan being carried out?

3) Resources and partnerships

- 3 1 Is the right research organization in place and can the expected outputs be delivered with the available resources (budget, facilities and staff)?
- 3 2 Are suitable strategic partnerships with NARSs Universities NGOs and the private sector in place? Are there other possibilities?

These terms of reference form the outline for review panel s report which should be prepared during the panel s visit to CIAT The report should not exceed 10 pages

Appendix 2 Field visits and discussions on individual component activities on the research process Systems research in the Forest margins, Pucallpa

Following a period of minimal activity in the mid to late 90s there has been a renewed focus on this site. The initial diagnostic work has provided an excellent basis for the team to develop a systems approach to addressing poverty and livelihood sustainability issues for small farmers at a landscape level. It is important to recognise that diagnostic work needs to be incorporated into on going monitoring process and that diagnostic skills need to be transferred to new staff members.

The additional study on health, biodiversity and natural resource use should provide valuable additional information, not only on the importance of the diverse natural resource base on which people living in these areas depend, but also may provide suitable entry points for future intervention which can lead to more sustainable food and income supply for these emerging communities.

There is recognition of the importance of labor and market availability which influences decision making in relation to the introduction of alternative crops. The area has been through a period in which inappropriate introductions of crops have been made. The team has been justifiably cautious with respect to making early interventions with exotic materials and has started field activities with crops and problems which arise from farmers' expressed needs. The work on rice and banana germplasm introductions is appropriately low key and should provide platforms for discussion with farmers and agricultural staff in working with more complex resource management options in the future. One possibility might be a focus on evolving home gardens which in some cases are already sources of valuable fruits and medicinal plants which have importance particularly for women and children. In addition, there are enormous opportunities for increasing the role of legume use in production systems. Many people are already familiar with some species but are not exploring their potential yet.

An important organizational initiative has been the development of the multi institutional team approach to participatory action learning and development activity (DEPAM). The effort required to establish and maintain such a group should not be underestimated, but the current progress has been impressive. There are obviously many institutions involved in parallel and potentially complimentary research activities that need coordination and a coherent approach. In the longer term there is a need for the CIAT staff to take a lower profile, but for the moment this activity is crucial to the rationalization of efforts to address key issues in food security and income generation for poorer farmers. Within this arrangement, participatory methods training is taking place for both managers, middle level staff and field staff. The operations of the consortium are funded through 11 small projects which form from collaborative initiatives between partners. After some experience, these activities need to be prioritised and discussed and reviewed in an appropriate forum.

Through this device, the team is developing a vitally important relationship with the Ministry of Agriculture that is clearly appreciated. There is a danger that this relationship is strained as a consequence of the growing demands that will be generated, but provided the interaction is handled with tact, it should develop in a mutually beneficial manner.

The approach to farm level modeling using accessible software (Microsoft Excel) is refreshing. This should enable the project team to engage national and regional agricultural staff and policy makers in an ex ante analysis of future technology options and perhaps prevent some of the very negative consequences which have arisen from past crop and technology interventions. The simplicity and accessibility of the approach also allows the possibility of engaging farmers in a dialogue about their choices for the future. This might be aided by the use of additional graphics or animation when discussing 'what if?' scenarios. This parallels many initiatives that are taking place in which devices or techniques or analytical tools are made more accessible and thus enable a common understanding and learning process between scientist and farmers.

The presence of so many external agencies at this site, including three international agricultural research centers, needs careful review on a regular basis. It ought to be possible to investigate what the comparative advantages of these kinds of arrangements are and whether there is true synergy between institutions and activities. This is not to suggest that the review of this situation is primarily a CIAT responsibility, but with ever tighter accountability and the search for complimentary, all the institutions

involved need to examine the true value of their continued presence CIAT is currently playing an important facilitating role in planning and coordinating several joint activities

Collaboration in the system wide participatory research and gender analysis programs is clearly important for the team and the outputs from the project will contribute to the alternatives to slash and burn program of ICRAF

Appendix 3 Systemwide Program on Soil, Water, Nutrient Management (SWNM)

Preamble

CIAT has commissioned an external review (CCER 1999) concerning Soil and Plant Nutrition (PE 2) and Agricultural Systems (PE 5). This report (section 1) provides an input to this review focusing on CIAT's overall co-ordination of the SWNM. The contribution to one of the four consortia on Managing Acid Soils (MAS) is covered by the CCER of PE 2.

In addition, CIAT has also asked for an internal review to be made available to CIAT and the SWNM consortia focusing on the SWNM research plan and progress to date (section 2). The terms of reference are annexed (Annex 1).

The review was conducted during visits to TSBF/ICRAF Nairobi on 14-15 November and CIAT Cali on 18-19 November 1999. It is anticipated that section 2 will be expanded to include more detailed considerations of the roles of ICARDA/ICRISAT and IBSRAM to SWNM through visits to Aleppo and Bangkok in early 2000.

The review in Nairobi focused on the components of SWNM conducted in Africa. Representatives of TSBF, KARI, IFDC, IBSRAM, ICARDA and ICRISAT participated in the meeting (participants and the overall program of the review Annex 2).

The review in Cali focused on MAS and the overall role of CIAT in the co-ordination of the program.

CIAT's coordinating role in SWNM

In 1996, a proposal was submitted to TAC69 concerning a system wide program on Soil, Water and Nutrient Management. The plan, which was agreed upon, focused on four consortia dealing with:
 Managing Acid Soils (MAS) (CIAT, EMBRAPA)
 Combating Nutrient Depletion Consortium (CNDC) (IFDC, ARI, TSBF, KARI, IBSRAM)
 Managing Soil Erosion Consortium (MSEC) (IBSRAM, CSAR)
 Optimizing Soil Water Use Consortium (OSWU) (ICARDA, ICRISAT, IER)

The reasons for proposing a new systems wide program was the fragmentation of research and the need to develop stronger links to socio-economic and policy factors. It was expected that generic results would be provided (models, databases, GIS applications, decision support systems, etc.). It was also stressed that all stakeholders should be involved.

It is clear that SWNM has been successful during the early stages, but the program is still far from achieving the expected synergies. However, there is considerable scope for addressing some of the weaker aspects of the program. Participants realize the shortcomings and are willing to address these in a constructive manner. The next year is going to be crucial if the program is to give expected added benefits and be more than the sum of the individual parts.

Although collaboration among consortia is not very evident, collaboration with the ecoregional initiatives seems in most cases to be excellent. A further considerable strength of the program is the central involvement of both CGIAR centers and non CGIAR centers (IBSRAM, TSBF, IFDC, etc.). This strengthens the program, but it also provides an excellent platform for strengthened collaboration between CGIAR and other partners interested in the overall aims of the CGIAR.

Participants are very pleased with the role of CIAT and IBSRAM as co-convenors. The overall governance structure of system wide programs should, however, be considered. It is essential that subsidiarity is a key concept when developing governance.

In order to achieve further synergies between consortia and the production of common goods more effort needs to be put on central co-ordination. In particular the need for a full or half-time scientific coordinator is necessary to provide scientific leadership. Additional attention must be given to the question of what value added products can be expected from SWNM. Thus it must be made clear why either individual centers or the ecoregional programs cannot just as well handle the SWNM consortia activities.

It is suggested that special emphasis will be given to the production of generic products such as simulation models (crop models etc), common data bases, methodological packages (e.g. participatory approaches) and decision support systems. If such generic tools could be assembled in a SWNM toolbox, these should be used and tested within the ecoregions. Various stakeholders can then also use different components of the package.

The logframe provides an excellent prioritization tool and a statement against which success can be measured. The logframe should be used both for priority setting as well as for outlining milestones and synthesis products from individual consortia and the program as a whole. The importance of socio-economic outputs and activities related to policy development should be stressed in the logframe.

Participatory approaches have been used with CIAT playing a major role in developing methodologies. However participatory approaches should not only involve farmers but also decision makers.

Joint positions (e.g. the PhD student working jointly for CIAT and TSBF) or exchange of scientists between institutions would provide opportunities for strengthening collaboration within SWNM. However a priority for overcoming communication gaps would be to convene a SWNM scientists meeting to review and develop the logframe and for discussion on inter- and intra-consortium synthesis.

It is necessary that basic funding on a 3 year basis be provided through core support. Current financial support is far less than was anticipated in the original plan approved by TAC. If the CGIAR is serious about the importance of systems wide programs urgent attention should be given to the need for a realistic basic funding.