Output 3
Partnerships and tools developed and capacity enhanced of all stakeholders for improving the health and fertility of soils

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Rationale

Managing soil fertility for improved livelihoods requires an approach that integrates technical, social, economic, and policy issues at multiple scales. To overcome this complexity, research and extension staff need the capacity to generate and share information that will be relevant to other stakeholders working at different scales (i.e., policy-makers, farmers). Thus the activities of Output 3 are founded on building the human and social capital of all TSBF-CIAT stakeholders for research and management on the sustainable use of tropical soils.

The challenge of building the social capital encompasses both the new and existing networks of scientists and other stakeholders (e.g.: AFNET, MIS, CSM-BGBD project). Within these networks, as within the individual project activities where TSBF-CIAT works in partnership with others (NARES, ARI's, NGO's), building social capital means ensuring that communication and co-learning support effective institutional collaboration and build confidence in the collaborative advantage afforded by partnerships. Networks run best with diligent coordination that responds to internal and external challenges. However, partnerships become truly empowering when stakeholders themselves recognize and exploit research and development opportunities. The activities prescribed here envisage tapping the potential of South-South collaboration and establishing strategic partnerships that can build learning strategies that to institutionalize ISFM approaches.

The second challenge, of building human capacity, is particularly acute in sub-Saharan Africa and Central America, where the lack of strong tertiary education systems and the chronic under-funding of NARES hamper the professional development of many of our partners. Since ISFM approaches are inherently holistic, effective training demands interdisciplinary cooperation to instill both a specialized knowledge and a competent understanding of the context(s) in which to apply it (the so-called "T-shaped" skill set). Again, working through new and existing networks and partnerships, TSBF-CIAT will continue to support training that offers cutting-edge bio-physical science, laboratory techniques, and also embraces holistic understanding of social, cultural, economic, and policy issues related to soil fertility management.

Building human capacity also applies to the relationship land users have with the products of research. At present, many ISFM technologies remain little used by farmers. This is commonly conceived of as a failure to disseminate the results of research, but can also be seen as indicating a fundamental failure of research to recognize, value, and address farmers' conditions and knowledge. Greater involvement of farmers in the technology design process (to adapt solutions to actual conditions) will not only generate more relevant and adoptable ISFM technologies but is also expected to facilitate the potential dissemination and up-scaling of these technologies through the better interaction and integration of indigenous and formal knowledge systems.

Finally, the lack of an enabling policy environment is made manifest by the often-contradictory policies relating to farm, village, or regional-level conditions. The poor functioning of local input and output markets distorts the incentives for resource conservation. Coherent policy options are needed to address the low added value of farmers' products, the general lack of marketing opportunities on the one hand, and the lack of appropriate infrastructure and mechanisms for input delivery on the other.

Key research questions

1. What are the mechanisms and information required for institutionalization of ISFM approaches with partners for scaling-up and increased impact?

2. Who are the key stakeholders and partners for SLM?
3. What are the relevant learning processes and approaches to improve stakeholders' skills to make improved decisions?
4. How can South-South integration facilitate the development of global products?

Milestones 2005

- ***AfNet, MIS, SARNET and BGBD Networks restructured and strengthened***

AFNET: Following the Yaoundé Symposium in 2004 and in view of continuing growth in membership across sub-Saharan Africa, the network has implemented a structure based on multidisciplinary, regional teams. These teams are now actively involved in proposal development and research implementation

MIS: The network remains focused on the poorest and most degraded environments of Central America (Honduras, Nicaragua) with special emphasis on the Quesungual agroforestry system. It was agreed at the Scientific Advisory Committee meeting (June 2005) that there was no advantage to moving forward with expanding MIS into a "Latin America network" (LATNET) along the lines of AFNET.

BGBD and ***SARNET:*** The successful completion of Phase 1 of the BGBD project culminated in preliminary results being presented at the Annual meeting in Manaus, Brazil (April 2005). At this meeting, and with the input of the Phase 1 evaluation team, mechanisms and communication pathways were prepared to improve information sharing and publication. SARNET (South Asia network) remains the umbrella affiliation that links the Indian country team members in implementing the BGBD work. Major achievements included the participation of seventy four participants of the project from across all the countries in the project and the participation of the project advisory and steering committees in the same meeting. Suggestions were made by both the project advisory committee (PAC), the Technical Advisory group (TAG) and the project steering committee (PSC) on matters that will strengthen the project as a way forward in addressing the expected outcomes of the project. Some of the suggested action lines included:

1. *Actions to ensure that there is a consistent quality and quantity of inventory data across the sites:* The extent of completion of the agreed inventory was observed to be different between sites – in some cases due to lack of expertise. It was observed that the project needed to provide the appropriate advice and capacity building to ensure consistency in methods and data quality and quantity across the sites.
2. *Application of consistent analyses and hypothesis testing to the inventory data in all countries:* It was observed that by the time of the annual meeting in Brazil (April, 2005), most analyses of results had been confined to testing the relationship between diversity and land use type or intensity. The scope of analysis and synthesis needed to be widened and the statistical rigour improved. Many suggestions in these respects were provided.
3. *Establishment of a meta-database and across-site synthesis of the data:* An observation on data was that once data are synthesized at a national level, an exciting opportunity emerges to conduct cross-site and country analyses and syntheses to achieve the 'global' products contracted by UNEP and GEF. The project needed to put in place the mechanisms for doing this which will take into account the intellectual property rights of all participants. A discussion paper on data sharing, publishing and intellectual property rights was presented and discussed during the meeting and a way forward agreed upon.
4. *Restructuring and strengthening of the BGBD project:* On restructuring of the BGBD project, it was agreed the current project implementation set up having working four groups be re-structured and a new strategy adopted that would achieve better results. This was part of the outcome of the project mid-term evaluation team. Another recommendation by the mid-term evaluation consultants was that TSBF takes up more responsibility in the scientific leadership of the project

to give it the edge in ensuring outcomes of the project are achieved during the second phase of the project. The coordination of the project in the countries was also addressed. It was agreed that the country project coordinators should be able to spend at least 50% of their time in project activities, otherwise they step aside and somebody able to spend that kind of time appointed coordinator. There was also a recommendation that quantifiable verifiable indicators be included in the project log-frames to provide the basis for monitoring and evaluating the project in the future. The global coordinating office (GCO) is in the process of restructuring and reorganizing the project according to the recommendations of the mid-term evaluation and according to the recommendations of the PAC in consultation with UNEP.

Highlights

- Commercial farms implemented with conservation farming practices in Fuquene watershed have been at the threshold level to enhance farmer to farmer and technician to farmer knowledge sharing in the Andean region.
- Partners during the BGBD annual meeting produced a total of 71 papers and four discussion papers in ecosystems services, land use intensity quantification, economic valuation of BGBD and data sharing and intellectual property rights.
- AFNET researchers prepared a total of 6 journal articles, 3 book chapters and 11 other publications.
- Results from the use of the NuMaSS (nutrient management expert system) to improve N management in maize-based systems in Nicaragua and Honduras indicated that improved fertilizer N recommendations require knowledge of both the intended crop cultivar and field site characteristics.
- The intensive exchange of ideas and experiences between farmers from Honduras and Nicaragua has accelerated the dissemination of the Quesungual system in drought-prone regions of Nicaragua.
- BGBD scientists participated in three global training workshops. Two in Nairobi (ants and termites characterization) and one in India on mycorrhizal fungi.
- Individual countries organized workshops and training courses for their country partners and project executioners.

Output target 2006

- ***At least two capacity building courses on ISFM held***

Completed work

Africa Network (AfNet)
Two intensive short-term trainings courses for AfNet scientists were conducted in 2005. Also, a third conference was jointly organized between AfNet and IAEA on land degradation.

1. **Participatory Approaches to Research and Scaling Up, an AfNet Training Workshop funded by CTA and held at the World Agroforestry Centre, Nairobi,**

This was the second training of AfNet scientists in farmer participatory research (FPR) methods and scaling up (SU). The 37 participants (in the two week training were AfNet Natural Resource Management scientists from West Africa (Nigeria, Burkina-Faso, Ghana, Niger and Senegal), Central (DRC) East Africa (Kenya, Uganda and Tanzania) and Southern Africa (Malawi, Zimbabwe,) as well as Madagascar (Table 24). There were scientists both first language Anglophones as well as Franco-phones, and the individual disciplines included rangeland ecologists, soil scientists, anthropologists, agro-foresters, sociologists, and one economist. The training covered key concepts and tools for applying farmer participatory methods and approaches to natural resource management research. With the use of one field trip at the end of the first week, participants applied the learning of participatory approaches directly with Farmers in the Meru District of Kenya.

The workshop was opened by the AfNet Program Coordinator, Andre Batiano, who also made presentations on behalf of R Tabo Deputy Director – Western and Central Africa, ICRISAT and Nteranya Sanginga Director, TSBF-CIAT. The workshop was organized and facilitated in terms of content by Ritu Verma, a social scientist and anthropologist at TSBF-CIAT. It was also assisted by other content facilitator, including Michael Misiko, also an anthropologist at TSBF-CIAT, and five invited presenters:- Sandra J. Velarde , Programme Officer, ASB, Regina Karega, Kenyatta University, Elly Kaganzi, Regional Agroenterprise Specialist, CIAT, Jonas Chianu Economist, TSBF-CIAT, Pascal Sanginga, Sociologist, ERI-CIAT. The workshop had three facilitators who mainly focussed on process, and these included Sue Canney Davison, (Pipal ltd Nairobi) and Twalib Ebrahim and Ezekiel Nguyo form the Depot (an NGO based in Nairobi).

Table 24. List of participants trained in the Participatory Approaches to Research and Scaling Up, Nairobi Kenya 2005.

Name	Country	Name	Country
Abdoulaye Moussa	South Africa	Linus Wekesa	Kenya
Amadou Fofana	Senegal	Loraine van den Berg	South Africa
Anthony Esilaba	Kenya	Luke Abatania	Ghana
Benedict Kayombo	Botswana	Mamadou Gandah	Niger
Boaz waswa	Kenya	Mary Baaru	Kenya
Daniele Ramiaramanana	Madagascar	Mathias Fosu	Ghana
Dougbedji Fatondji	Niger	Millogo Sorgho-Claire	Burkina Faso
Dr. Christogonus K. Daudu	Nigeria	Moses Munthali	Malawi
Elizabeth Barirwa	Uganda	Moussa Bonzi	Burkina Faso
Fresiah Mwebia	Kenya	Mr. Ado A. Yusuf	Nigeria
David Muchiri	Kenya	Nancy Mungai	Kenya
Hamade Sigue	Burkina Faso	Njingulula Mumbeya	DRC

Hassane Ousmane	Niger	Rebecca Zengeni	Zimbabwe
Joseph Mudiopo	Uganda	Rodger Kanton	Ghana
Justin P Muriuki	Kenya	Seraphine Kabore	Burkina Faso
Khumoetsile B Mmolawa	Botswana	Victor	Madagascar
Lawarnou	Niger	Zaid Mkangwa	Tanzania
Lee Simons	South Africa	Zivayi Magadzire	Zimbabwe
		Isaac Ekise	Kenya

2. Advanced DSSAT4 Training Workshop: Assessing Crop Production, Nutrient Management, Climatic Risk and Environmental Sustainability with Simulation Models, M Plaza Hotel, Accra, Ghana, Oct. 21 – 29, 2005

This training, Jointly organized by Project 5 of the Challenge Program on Water for Food (ICRISAT), the African Soil Biology and Fertility Network (TSBF-CIAT), and the Desert Margins Program (CGIAR) was presented by the International Consortium for Agricultural Systems Applications (ICASA). This training was a follow-up of one held in 2004, in Arusha, Tanzania where a team of 30 sceintists was to familiarized with DSSAT, a comprehensive computer model for the simulation of crop growth and yield, soil and plant water, nutrient and carbon dynamics and their application to real world problems. The specific focus of the follow-up training was to advance the target scientists' knowledge of the full capabilities of DSSAT through own data simulations and interpretations. The workshop aimed at:

- Refreshing participants on minimum data requirements for DSSAT version 4 and the procedures for collecting and managing weather, soil, crop and management data for model evaluation.
- Giving participants the opportunity to work with their own datasets and determine the accuracy of the models for application to specific problems.
- Participants using own data to analyze management alternatives for single or multiple seasons, or over long-term crop rotations.
- Participants assessing economic risks and environmental impacts associated with agricultural production.

Training participants on how to use DSSAT with socio economic analysis to link on-farm information with biophysical models: The training was done at personal levels with participants being assisted individually whenever one had a hands-on problem. For the issues that cut across the whole group, short lectures, demonstrations were used. Group sessions were conducted where participants reported to the whole group about their progress on given model issues. The workshop brought together 28 participants from 10 different countries namely; Niger, Senegal, Burkina Faso, Kenya, Uganda, Togo, Ghana, Japan, France and Mozambique (Table 25), 11 of whom attended the training for the first time. There were six trainers namely professor James W. Jones from University of Florida (USA), Professor Gerrit Hoogenboom from University of Georgia (USA), Dr Paul Wilkens from IFDC-Alabama (USA), Dr Ken Boote, Professor from University of Florida (USA), Pierre C. Sibiry Traore from ICRISAT-Mali and Dr Jetse Stoorvogel from Wageningen, the Netherlands.

Table 25. List of participants of the Advanced DSSAT4 Training Workshop, M Plaza Hotel, Accra, Ghana, Oct. 21 – 29, 2005.

Name	Institution	Country	Name	Institution	Country
Adamou Abdou	ICRISAT	Niger	Nyambane Nyanga'u	Kenyatta University	Kenya
Cheich Lô	ISRA/ CDH	Senegal	Michiel De Vries	WARDA	
Ousmane Hassane	ICRISAT	Niger	Stephen Kimani	KARI	Kenya
Sigue Hamade	INERA	BF	Boaz Waswa	TSBF	Kenya
Korodjouma Ouattara	INERA	BF	Jules Bayala	INERA	BF
Boubie Bado	WARDA	BF	Anthony Esilaba	KARI	Kenya
Dr. Roger Kanton	SARI	Ghana	Joseph Miriti	KARI	Kenya
Dr. Saaka Buah.	SARI	Ghana	Jacinta Kimiti	KARI	Kenya
Wilson A Agyare	SARI	Ghana	Dougbedji Fatondji	ICRISAT	Niger
Seraphine Kabore	INERA	BF	Akira Kamidohzono	JIRCAS	Japan
Moussa Bonzi	INERA	BF	Joy Tumuhairwe	PLEC/ MUK	Uganda
Karim Traore	INERA	BF	Marc Corbeels	CIRAD	France
Ms. Dilys S. KPongor	ZEF	Ghana	Hellen Wangechi	TSBF	Kenya
Mathias Fosu	SARI	Ghana	Job Kihara	TSBF	Kenya

3. Combating soil degradation to enhance food security in Africa: The role of nuclear techniques in developing improved soil, water and nutrient management practices, 10-12 October 2005, Nairobi, Kenya

This international conference was jointly organized by FAO/IAEA Division, AfNet and Kenyatta University. Conference, attended by 20 participants, focused on the use of isotopic tracers and soil moisture neutron probes to quantify stocks and flows of nutrients, water and soil in cropping systems. The objectives of the meeting were (1) to review recent advances in the use of nuclear and related techniques for developing integrated soil, water and nutrient management practices to combat land degradation an desertification; (2) to enhance knowledge and awareness of the potential of nuclear and related techniques to obtain unique information to enable formulation of integrated strategies to combat land degradation at national and regional scales and (3) to provide a forum for participants to exchange ideas and experiences and establish linkages for future collaboration. The specific issues addressed were desertification, nutrient mining and replacement, carbon sequestration, soil acidity, soil salinization, water management soil erosion and sedimentation. Its approach was mainly presentation of technical papers on these issues and group discussions.

Network research sites in 2005

In Africa, trials were continued at representative benchmark sites in some important agro-ecological zones. Table 26 below shows a list of Network collaborative trials in Africa, giving the type of trial and sites located.

Table 26. Network collaborative trials in 2005.

Type of Trials	Site	Country
Long-term operational scale research	5 sites	Niger, Burkina Faso, Nigeria, Togo and Kenya
Long-term cropping system	Sadore	Niger
Long-term crop residue management	Sadore	Niger
On-farm evaluation of cropping systems technologies	3 sites	Niger, Tanzania, Kenya
On-farm evaluation of soil fertility restoration technologies	Karabedji, Gaya	Niger
Methods of P and manure application	Karabedji	Niger
Comparative effect of mineral fertilizers on degraded and non degraded soils	Karabedji	Niger
Fertilizer equivalency and optimum combination of low quality organic and inorganic plant nutrients	Banizoumbou, Karabedji, Gaya	Niger
Optimum combination of phosphate rock and inorganic plant nutrients	Banizoumbou, Gaya, Karabedji, Sadore	Niger
Biological nitrogen fixation	Several sites	Niger, Uganda
Corral experiment (demonstration)	Sadore	Niger
Conservation agriculture trials	8 sites in Africa	Kenya, Ghana, Burkina Faso
Rock phosphate	10 sites	Burkina Faso, Niger, Senegal
Water and nutrient interactions	5 sites	Mali, Niger, Ghana, Burkina Faso, Zimbabwe, Kenya
Fertilizar microdose	Several sites	Burkina Faso, Níger and Senegal

MIS Network

Members of MIS consortium

During 2005 the MIS Consortium continued strengthening the capacity of its members to improve N and P fertilizer recommendations for maize-based systems using the Nutrient expert System (NuMaSS). Two workshops were organized. Seven researchers from Nicaragua and eight from Honduras attended the first workshop. Participants compared results generated by the software using default values with those generated in the field experiments. The second workshop was given to extension agents from eight NGOs in Honduras willing to compare NuMaSS fertilizer recommendations with those currently used by farmers in different regions of Honduras.

A recent agreement between AridNet and MIS consortium allowed MIS partners to get familiar with the Dahlem Conceptual framework for degradation/desertification processes. A workshop was carried out in

the Lempira region in Honduras with the participation of 17 researchers from Honduras, Nicaragua, Mexico, Colombia and US. The National Science Foundation of USA financed the meeting. Participants visited two field sites (degraded and improved) and validated the nine assertions proposed by the Dahlem Framework to describe degradation and reclamation processes.

Farmers' capacities enhanced through field trips and courses on Conservation Agriculture

W. Otero[1] and A. Moreno[2]

[1] GTZ - EPC Environmental Program for Colombia. A.A.89836 Bogotá, Colombia; [2]Andean Watersheds Project (GTZ). International Potato Center (CIP) P.O. Box 1558, Lima 12, Peru.

Ex- ante evaluation of land use alternatives had demonstrated that conservation agriculture is an SLM alternative for improving environmental services and rural livelihoods. Based on Fuquene (Colombia) experience, the special project "Payment for Environmental Services" of the WFCP is promoting a capacity building strategy for enhancing other pilot sites farmers' capacities in conservation agriculture. The strategy has started with training courses held in the conservation agriculture pilot site (Fuquene) and subsequent courses held directly at the extrapolation sites. The participants of the courses were selected according to their previous commitment to apply the learned practices in their own farms. The project, through the extension partners (GTZ-EPC), will provide continuous technical assistance for a year in order to ensure that the technology is properly applied during planting of green manures and commercial crops.

Four extension courses were conducted:

- Conservation Agriculture for Jequetepeque watershed (Cajamarca, Peru) farmers held in Zipaquira (Colombia).
- Conservation Agriculture for Jequetepeque watershed (Cajamarca, Peru) farmers held in Chilete (Peru).
- Conservation Agriculture for Ambato watershed (Peru) farmers held in Zipaquira (Colombia).
- Conservation Agriculture for Ambato watershed (Cajamarca, Peru) farmers held in Patate Canton (Ecuador).

Output target 2006

- ***At least five capacity building courses on below-ground biodiversity (BGBD) held at the global level and more at participating country level***

Completed work

During 2005 two international training courses were organized by the GEF-funded BGBD project. One training course was on the ecology and taxonomy of termites and ants.

The termites training course covered several topics on termites and ants. Topics covered included termite and ants' biology, taxonomies and functional groups with the facilitators distributing literature on the ecology of termites and ants, their evolution, assemblages and distribution in forests and other ecosystems, field sampling methods, sample preservation, identification and classification among others. The feeding characteristics, gut content and humification of the feeding substrate were also covered providing characteristics of the feeding groups based on order of humification of the feeding substrate. Discussions were also held between the countries on minimum datasets that would be common to all the countries.

The Workshop was held in the National Museums of Kenya, which provided a well appointed laboratory, with all necessary equipment and daytime catering. Five countries, Kenya, Uganda, Cote d'Ivoire, India and Indonesia were represented directly and a Powerpoint presentation of the Mexican experience sent over and shared by the rest of the participants. Mexico and Brazil had in the previous year held similar training in Brazil. During the training session, published Taxonomic Keys were requested by the participating countries and the following keys supplied: (i) Detailed Key to Termite Genera and Species in Borneo and SE Asia (Thapa, 1981), (ii) Main Key to Termite Genera of SE Asia (Tho, 1992), Detailed Key to Genera and Species of Soldierless African Tremites (Sands, 1972), Detailed Key to Gerea and Species of African Termites by the Worker Caste (Sands, 1998), Most Recent Review Volume on termite Biology, Main Key to Ant Genera Worldwide (Bolton, 1994), Taxonomic Synopsis of the Formicidae (Bolton, 2003), Standard Method for Sampling of Ants (Agosti et al., 2000) and Most Recent Review Volume on Ant Biology (Holdobler and Wilson, 1990). The training course was organized by the Global Coordinating Office of the BGBD project in conjunction with the Kenya BGBD Team. The training was facilitated by Professor David Bignell (Termites), and Dr. Gary Alpert (Ants). A total of 18 participants attended the training course (Table 27).

The second training course was on Arbuscular Mycorrhizal Fungi (AMF) and Ectomycorrhiza (ecology, taxonomy and methods of inventory). The training course was conducted in Bangalore, India, again with participants form each of the BGBD countries. In total 20 persons participated, including the resource persons.

In earlier years training course were conducted on the ecology and taxonomy of earthworms, on nematodes and a training course on molecular techniques for BGBD, which brings the total to 5 and by which the target has been met.

Table 27. List of participants for the Termites and Ants Taxonomy and Identification Training in Nairobi.

Name	Institution	Country	Name	Institution	Country
Prof. David E. Bignell	Queen Mary University of London	United Kingdom	Mr. Shaban Okurut	Makerere University	Uganda
Dr. Gary Alpert	Havard University	United States of America	Mr. Rajab Ogogol	Makerere University	Uganda
Dr. Souleymanne Konate	Université d'Abobo - Adjamé	Côte d'Ivoire	Dr. Anne Akol	Makerere University	Uganda
Mr. Mouhamadoue Kone	Université d'Abobo - Adjamé	Côte d'Ivoire	Mr. Allan Lugoolobi	Makerere University	Uganda
Mr. Sylvain Crolaud TRA-Bi	Université d'Abobo - Adjamé	Côte d'Ivoire	Dr. Christine Bakuneeta	Makerere University	Uganda
Mr. H. Guruprasad	University of Agricultural Sciences	India	Mr. Daniel Karanja	National Museums of Kenya	Kenya
Dr. F.X. Susilo	Universitas Lampung	Indonesia	Ms. Martha Sila	University of Nairobi	Kenya
Mr. Fredrick Ayuke.	Methodist University, Meru	Kenya	Mr. Reuben Mwakoli	National Museum of Kenya	Kenya
Ms. Mary Lucy Oronje	University of Nairobi	Kenya	Mr. Joseph Mugambi	National Museums of Kenya	Kenya

The AMF training course included a review of the mandatory and optional methods for studying AMF for the BGBD project, the taxonomy of AMF based on morphology, new terminologies used in the taxonomy of AM fungi and the importance of the number of layers in the spore wall and germinal walls, and the pregermination structures. The theories were followed by practicals where the participants had the opportunity to microscopically observe the spore structures as and when the same was projected on a screen and explained. The participants were allowed to take some of the slides for their future reference. Molecular approaches for the identification of AMF were also taught (Table 28). Protocols for the extraction of DNA and amplification of 18S rRNA and ITS region by PCR were presented. Gel electrophoresis of DNA was also presented. The theories were followed by practicals in which DNA from the spores of 4 AMF. A detailed account on the taxonomy of ectomycorrhizal fungi was also presented. Manuals and Powerpoint presentations were given to the participants for use in the own countries. The training course was organized by the Global Coordinating Office of the BGBD project in conjunction with the Indian BGBD Team. The training was facilitated by Professor David Joseph Bagyraj, Dr. Sidney Sturmer, Dr. G.S. Prasad, Prof. K. Natarajan and Dr. Joyce Jefwa.

Table 28. List of participants for the Mycorrhizal Fungi Training in India

Name	Institution	Country	Name	Institution	Country
Dr. Sidney Liz Stummer	Univesidada Regiona de Blumenau (FURB)	Brazil	Dr. Gerad Mutumba	Makerre University	Uganda
Prof. Joseph Bagyaraj	University of Agricultural Sciences	India	Ms. Susan Serani	Makerere University	Uganda
Dr. Adolphe Zeze	Institut National Polytechnique Laboratoire de Microbiologie de sols	Côte d'Ivoire	Mr. Henry Kiryose	Makerere University	Uganda
Mr. Zabouo Armand	Institut National Polytechnique	Côte d'Ivoire	Dr. Joyce Mnyazi Jefwa	National Museums of Kenya	Kenya
Dr. T. Prasad	University of Agricultural Sciences	India	Mr. Peter M. Wachira	University of Nairobi	Kenya
Dr. G.S. Prasad	University of Agricultural Sciences	India	Dr. Dora Trejo Aguilar	Instituto de Ecologia A.C.	Mexico
Dr. Maria Viva Rini	Universitas Lampung	Indonesia	Dr. Lucia Varela Fregoso	Instituto de Ecologia A.C.	Mexico
Mr. Joko Prasetyo	Universitas Lampung	Indonesia	Dr. Javier Alvarez	Instituto de Ecologia A.C.	Mexico

Apart from the training courses, the BGBD project held its annual meeting in April, 2005 in Manaus, Brazil. A total of 71 participants participated in the annual meeting. Participants were drawn from Brazil, Cote d'Ivoire, India, Indonesia, Kenya, Mexico, and Uganda as the core participants. Other participants who were mainly the Technical Advisors and Project Advisory Committee members were drawn from the United Kingdom, United States of America, France, and from Colombia, the location of CIAT headquarters. Also participating during the annual meeting were Professor Eric Smaling and Professor Maatete Bekunda who had been contracted by UNEP to carry out the mid-term review of the BGBD project.

The annual meeting presented a good opportunity where the participating countries presented the results of their work and were able to compare results and experience between countries through oral transactions and interactions. A total of 71 papers were presented in six technical sessions. The technical sessions included: (i) Benchmark area description and socio-economic characterization, (ii) Results of the inventory of macro-fauna, (iii) Inventory of nematodes and mesofauna, (iv) Inventory of legume nodulating bacteria and arbuscular mycorrhizal fungi (AMF) (v) Inventory of pathogenic and antagonistic fungi and insect pests and (vi) Standard methods for the inventory of BGBD. In addition to these there were Task Force reports on Ecosystem Services, Land Use Intensity and Economic Valuation of BGBD. There was also a report of the technical committee and four planning sessions. The output from the annual meeting are two reports one on the Standard Methods for the Assessment of Soil Biodiversity in the

Context of Land Use Practices and the other is the Technical Report of the Project Annual Meeting, April, 2005 all existing as separate volumes of the CSM-BGBD reports. Following is a list of papers presented during the annual meeting.

Benchmark area descriptions and socio-economic characterization

1. Characterization of Benchmark sites in India
   Balakrishna Gowda, U.M. Chandrashekara, M.P. Sujatha and R.K. Maikhuri
2. Benchmark description: Lampung, Indonesia
   Afandi, M. Utomo and D. Mizwar
   Land use & Socio-economic Characteristics of the Sumberjaya BA
   Rusdi Evizal, S. Bududarsono and H. Ismono
3. Los Tuxtlas Benchmark area description and sampling approach
   José Antonio Garcia, Simoneta Negrete-Yankelevitch
   Socio-economic characterization of three communities of the Los Tuxtlas area
   Isabelle Barois
4. Characterisatin of land use types in the Mabira Forest ecosystem, Uganda
   G. Lamtoo and M. J. N. Okwakol
   Socio-economic characteristics and indicators of below-ground biodiversity in Mabira Forest ecosystem, Uganda
   E. Balirwa, B. Mugonola and G. Byandala
5. Land use land cover mapping using high resolution images of The Upper Solimões River, Benjamin Constant Municipality, Am, Brazil
   Elaine Cristina Cardoso Fidalgo (1), Maurício Rizzato Coelho (1), Fátima M. S. Moreira (2), Fabiano de Oliveira Araújo (1), Humberto Gonçalves dos Santos (1), Maria de Lourdes Mendonça S. Brefin (1).
6. The Physical Environment With Emphasis in Upland Soils of The Upper Solimões River, Benjamin Constant Municipality, Am, Brazil.
   Maurício Rizzato Coelho, Elaine Cristina Fidalgo, Fabiano of Oliveira Araújo, Humberto Gonçalves dos Santos, Maria of Lourdes Mendonça Santos Brefin EMBRAPA Solos, RJ.
7. Flora survey in Upland Soils Of The Upper Solimões River, Benjamin Constant Municipality, Am, Brazil
   Hiroshi Noda(1), Ieda Amaral(1), Ayrton Urizzi(2), Danilo Fernades da Silva Filho(1), Francisco Manoares Machado(1), Jucélia Oliveira Vidal. (1)
8. Land-use mapping and typology in Oumé benchmark site (Centre-West Côte d'Ivoire)
   N'DoumE C1, GnessougoU N1, Tondoh J E2, TANO Y3.
9. Demographic and socio-economical characterisation of the Oumé benchmark area (Centre-West Côte-d'Ivoire)
   Ogni K. B1, Ibo J2, Agnissan A A1
10. Morphological and physical characteristics of soils along a gradient of land use intensity in Center-West Côte-d'Ivoire
    Angui P.K.T.11 Tie B.T2., Tamia J.A1., Assie K. H1., Danho D. M1
11. Impact of human activities on floral diversity in the Oumé Region (Centre-West Côte d'Ivoire)
    N'Guessan K. E; Ake-assi L; Kouassi K. E; Assi Y. J; Sagne C.
12. Land use and biophysical characterization of below-ground biodiversity (bgbd) benchmark site in kenya
    E.M. Muya, N. Karanja, H.Roimen, and B. Mutosotso

Result of the inventory of soil macro fauna

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94. Land Use Intensity of CSM-BGBD Sumberjaya Window, Lampung Benchmark, Indonesia Rusdi Evizal1, Suseno Budidarsono2, F. Erry Prasmatiwi3
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104. Plans for the second phase of the Brazilian BGBD programme
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J.H.P. Kahindi, N. Karanja, E. Muya, S. Okoth, J. Kimenju, B. Mutsoso, J. Jefwa, D. Odee, and J. Ramisch
109. Plans for the second phase of the Uganda BGBD programme
Mary Okwakol
110. Data sharing and intellectual property rights
Peter Okoth

To strengthen the CSM-BGBD project network and linkages the project continues to maintain a website and mailing lists to all its members. The project also has an FTP transfer mechanism for documents that

are too large to thread through the email. This has made it easy to exchange documents and reports between the global coordinating office and the country projects. The project also maintains a server repository with ICRAF as a stop gap measure against machine breakdown or loss. The BGBD project partners with about eighty institutions spread across the countries and works with well over 150 scientists. The Table 29 below shows the categories of partnerships that the BGBD project has.

Table 29. Categories of partnerships within the BGBD project.

Programme	**Year start-ed**	**TOTAL**	**Extent of partnerships**								**Govern-ance structure**	**Coordin-ation mechanism**
			International (including regional)				**National and local**					
			IARCs	Uni-versi-ties*	NGOs	OTHER**	NARs	Universities*	NGOs	OTHER		
BGBD	2002	79	7	7	0	0	37	21	5	2	Yes	Yes

Output target 2007

- ***Strategy for building capacity for SLM is developed with partners***

Work in progress

Social capital and adoption of soil fertility management technologies in Uganda

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A range of soil fertility management technologies have been promoted through research and extension to ensure adequate replenishment of soil fertility and increase crop production. However, despite these many efforts, the rates of adoption remain low. Social capital is crucial for adoption of soil fertility management technologies, as it provides social networks, relationships and linkages that enable people to co-operate, co-ordinate, access and share information and resources, and act collectively. This was investigated through a study conducted with 106 female and male farmers in eastern Uganda, looking at the levels and dimensions of social capital and their influence on adoption of soil fertility management technologies. Results show that although still limited, adoption rates of legume cover crops were higher for group members compared to farmers who do not belong to a group. Farmer' groups had higher levels of social capital, as measured by, co-operation, extent of trust, information sharing and participation in collective activities. On the other hand, indicators of weak social capital, such as selfishness, individualism and conflict were found to be higher in the general community than in farmer' groups. The frequency of visits by extension workers, extent of cooperation and information sharing positively correlated with adoption of legume cover crops whereas the extent of conflict and education was negatively related to adoption. There was higher adoption of technologies by farmers who were in a group, implying that social capital influences adoption of technologies. The paper argues that strengthening local organizations through farmer groups would increase adoption of soil fertility management technologies.

Sustainable promotion and development of soybeans in the farming systems of Kenya: The working of strategic alliances

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Soybean was introduced in the farming systems of Kenya many decades ago. However, the crop has remained a minor crop despite its great potentials for improving household food and nutrition security (through quality food supply), household cash income (through the sales of soybean and soybean products), household health (through the provision of high quality protein-rich food), and soil fertility improvement (through its atmospheric nitrogen-fixing ability). Literature indicates that low yield, lack of knowledge on its utilization, and lack of market are among the key factors that have contributed to lack of widespread adoption of soybeans in the farming systems of Kenya. A recent effort based on improved dual-purpose promiscuous soybeans varieties sourced from IITA, Ibadan, Nigeria has been commenced by TSBF-CIAT and aims at solving the different problems that forestalled the take-off of this crop in the past by engendering strategic alliances of all the stakeholders that can contribute in one way or another in sustainable promotion and development of soybean in the farming systems of Kenya.

The objectives of this study are: (1) to understand the missing links that prevented widespread adoption and production of soybean in the farming systems of Kenya despite great efforts to promote the crop in the past, (2) to search for, contact, discuss with, and prioritize among different stakeholders or partners that can contribute towards alleviating missing links that have prevented widespread adoption and production of soybean in the farming systems of Kenya, (3) to develop the strategies for all the partners in the strategic alliance to work on defined and complementary roles in the new initiative for the promotion

and development of soybean in Kenya, and (4) make recommendations on plausible strategic alliances for future development and promotion of a crop or livestock sub-sector in Kenya.

This study is being carried out in Nairobi. Literature review and interactions with various stakeholders (individual soybean farmers; producer groups; food processing industries; livestock feed industries; supermarket operators; farm input suppliers; staff of the Ministries of Agriculture, Trade and Industry, Finance, and Planning and Economic Development; staff of the National Agricultural Research Systems including research institutes and the Universities; Key informants, etc.) were used to identify the missing links that prevented widespread adoption and production of soybean in the farming systems of Kenya despite great efforts to promote the crop in the past. Following this, some brainstorming sessions were organized and are used to list the potential partners that could be approached for their cooperation in the new initiative for sustainable development and promotion of soybeans in the farming systems of Kenya. Appointments to discuss the strategy were made with each of the listed partners and decisions taken were documented in minutes of related meetings shared with all in attendance at the meetings.

For the different functions, the following partners (see Table 30) have agreed to work with TSBF-CIAT (discussions are still going on with other partners) in the strategic alliance for the development and promotion of soybean in the farming systems.

Table 30. Partners to TSBF-CIAT in the strategic alliance for the development and promotion of soybeans in the farming systems of Kenya.

Function	Partners	Type of Organization
Research to develop technologies	Kenya Agricultural Research Institute, Kenyatta University, Jomo Kenyetta University of Agriculture	Research institutes and Universities
Producer groups	Ebubala Self-Help Group, Tushiauriane Self Help Group, Nabongo Panga Self-Help Group, Jitolee Women Group, Etako Women Group, Bushe Women Group, Shishebu Women Group, Masaa Men and Women Group, Eluche Mwangaza Community Development Organization,	Farmer organization
Inorganic fertilizer supply	FIPS-Africa	Private business organizattion
Micro-credit supply	K-Rep Development Agency	Micro-credit institution
Seed supply	Western Seed Company, Kenya Seed Company	Private and Public Companies
Seed/grains bank development	SACRED-Africa	NGO
Food processing industries for the marketing of output	Bidco, NUTRO EPZ	Private companies
Transportation of output	Farmers' Own Trading Company, Kenya Agricultural Commodity Exchange (KACE)	NGO
Information development and dissemination	AfriAfya	NGO
Scaling out and scaling up	Ministry of Agriculture, Ministry of Trade and Industry; Ministry of Finance; Ministry of Planning and Economic Development; Poverty Eradication Commission	Public institutions and Commission
Research funding	The Rockefeller Foundation	Donor organization

Facilitation of improved decision making of farmers, extension agents and policy makers for improved land management in crop-livestock systems of Ethiopian Highlands

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Most of the land in Ethiopian highlands that was classified as very suitable for cultivation is already under cultivation (FAO, 1986). Farmers are attempting to intensify their agricultural production by utilising marginal lands and converting communal grazing lands to arable land but with limited integration of improved innovations. In these highlands systems where land degradation is the major threatening factor, the resource base in terms of nutrients, water, organic matter and soil are deteriorating causing a decline in agricultural productivity and environmental stress (Amede et al., 2001). Moreover, the extensive livestock management that has been traditionally practiced over years became an apparent challenge not only for technology integration, like agroforestry systems, but also to capture and concentrate nutrients in the form of quality manures.

A considerable amount of information could be available in the various project sites on crop and livestock enterprises, yet predictions and recommendation are difficult due to the variable nature of biological and socio-economic variables and the trade-offs between production and management of resources and inputs. Linking these data with models that simulate livestock productivity, increased marketable enterprises, intensify nutrient cycling and improve market response could provide a means of making initial recommendations for promoting farmers' livelihoods. Incorporation of market needs, farmer production objectives, risk assessment and farmer decision making into this approach will allow the development of decision making tools towards more accurate targeting that will improve the management of crop-livestock systems, improved rural livelihoods and increased household food security. Moreover, resource-poor farmers, particularly those far away from markets, face difficult decisions over the use of scarce resources of land, labour, nutrients and water in their respective production systems. Often the decisions taken on the allocation of resources are taken without an assessment or appreciation of the impact of the traditional wisdom on financial gains and food security with out considering its potential effect on other system components of feed production, soil fertility management, soil erosion and related issues.

This work is attempting to identify, synthesize, simplify and validate tools, methods and approaches in improved land management, with emphasis on integrated soil fertility management by considering biophysical and socio-economic driving forces behind farmers' decision making. This project will utilise a combination of trade-off analysis, partial budgeting of new technologies and farmer knowledge to identify, introduce, validate and disseminate new crop-livestock interventions. It has been developed as response to the invitation of the ILRI-CIDA (IPMS project) to provide tools and methods to improve the decision making of farmers, communities and policy maker operating in IPMS pilot sites and beyond. We anticipate the use of decision support tools will the serve the extension system for achieving high household income, food security and improved system integration. It has started in late 2005 and will be implemented in 2 districts of southern Ethiopia, where about 100,000 people are farming in each district, with further potential to scale-up the approach to other 10 districts in 2007 and beyond.

After screening proven methods and approaches together with partners we will integrate and transfer our experience to the extension system of Ethiopia in 2006 and beyond, particularly in integrated land management.

Output target 2007

- ***At least three capacity building courses on ISFM held by AfNet , MIS and CONDESAN***

Work in progress

Use of the Nutrient Management Expert System NuMaSS to improve management of nitrogen in maize-based systems in hillsides of Honduras and Nicaragua

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In 2004 partners of the MIS Consortium and researchers from the CRSP-USAID Consortium initiated 2-year trials in Honduras and Nicaragua to acquire corn cultivar and soil coefficients for developing improved N fertilizer recommendations using the Nutrient Management Support System (NuMaSS) software. Table 31 shows the main chemical properties of several sites included in the experiment. The amount of fertilizer N recommended by NuMaSS is the balance between the total amount of N needed by the crop and the N acquired from the soil, plant residues and cover crops, with a subsequent adjustment for the fertilizer N use efficiency by the crop. Although the software provides default values derived from reviews of existing publications for many of these plant factors it is possible to generate specific N recommendations the prevailing cultivars and soils cropped in the region.

Forty to seventy days prior to planting corn in 2004, three replicates with ten 4 m x 4 m plots were established at four locations in Honduras: Catacamas, La Ceiba, Talgua, and Yorito. Three different varieties of legume cover crops were planted in three plots within each replicate. Prior to planting corn, cover crops were cut by hand and residues uniformly distributed in their respective plots. Corn was planted in all plots using a spacing of 80 cm between rows and 40 cm within rows. A total of ten treatments were applied in each block: three cover crop treatments and seven urea-N treatments. Urea-N was applied at rates of 0, 20, 40, 80, 120, 160 or 200 kg N ha^{-1} in a split application of two equal amounts at 25 and 40 days after corn planting. Cover crop treatments did not receive urea-N. To avoid soil P limitation, 100 kg P ha^{-1} was applied to all treatments at all locations. In areas where rainfall was insufficient corn was planted without cover crops with seven urea-N rates (0, 20, 40, 80, 120, 160 or 200 kg N ha^{-1}). Treatments were replicated in three blocks at each of these locations using the same split-application procedure described above. At each trial site, data for nutrient content of soils and plants, and stover and grain yield were collected.

Table 31.. Routine soil test data prior to fertilization and planting at some of the fertilizer N and legume cover crop trial sites in Honduras and Nicaragua.

Location	Exchangeable					Al	Olsen-Extractable			
	pH	Ca	Mg	K	ECEC[a]	Sat.[b]	P	Cu	Mn	Zn
		--------- $cmol_c\ kg^{-1}$ ---------				%	---------- mg kg^{-1} ----------			
Candelaria	4.8	9.7	2.2	0.3	13.2	9	17.1	3	21	0.8
Comayagua	7.1	17.7	2.4	0.3	20.4	0	32.5	4	1	2.1
Catacamas	6.8	17.2	2.7	0.9	20.8	0	23.2	4	49	4.9
San Dionisio	5.8	13.8	2.9	0.2	17.0	1	12.2	4	4	1.4
San Rafael	6.0	14.2	2.5	0.2	17.0	1	21.4	4	14	2.0

[a] Effective cation exchange capacity (Ca+Mg+K+Al).
[b] %Al saturation of ECEC.

Results obtained in the Talgua site in Catacamas, Honduras are presented in Figure 32 and are used here to demonstrate the statistical analyses performed on field and lab data, and applications of the derived values in NuMaSS recommendations for N.

In the absence of other values for grain, stover, or soil N content, the derived yield without N application may be input as the previous corn crop yield to estimate native soil N contribution (N_{soil}) to the intended corn crop. The current default value in NuMaSS for this factor is 2.5 Mg ha^{-1}, which is considerably lower than the experimental value of 5.2 Mg ha^{-1}. Using the experimental value in place of the default value would reduce the final N recommendation made by NuMaSS for the Talgua site. In addition, the maximum yield derived through this trial provides a reliable estimate of target crop yield, another value required by NuMaSS. The current default value for intended yield is 3.3 Mg ha^{-1}, less than half of the maximum yield (7.4 Mg ha^{-1}).

Grain yield in the cover crop treatments was similar or inferior to that of the zero-N treatment at the Talgua site (Figure 32). The poor fertilizer N equivalency of the legume cover crops was attributed to the limited growth period (< 30 days) for biomass production and N accumulation prior to their cutting and planting corn, as evidenced by legume aboveground dry biomass of 0.2, 2.1 and 2.6 t ha^{-1}, respectively, for *Dolichos*, *Mucuna*, and *Cannavalia.*

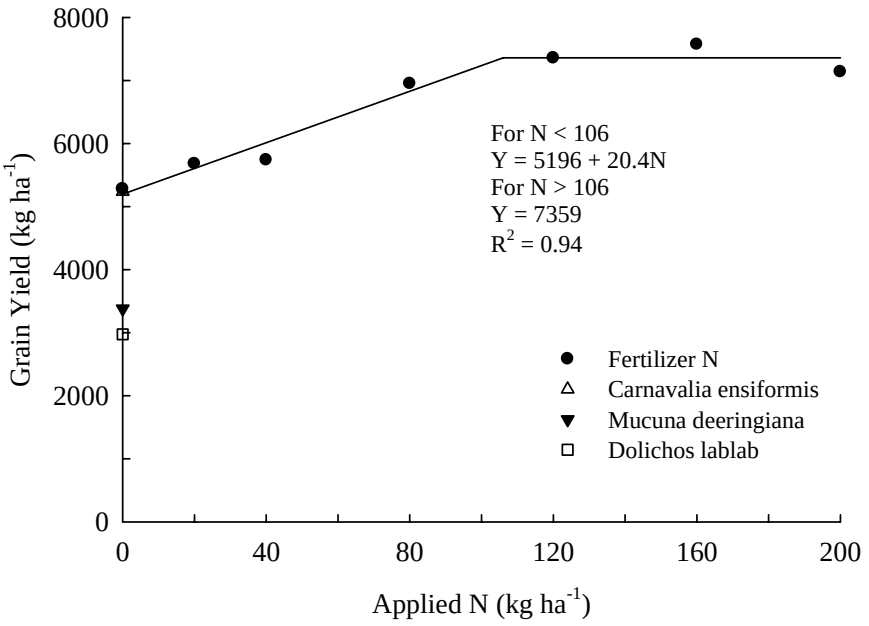

Figure 32. Corn grain yield at Talgua, Honduras as a function of fertilizer N and antecedent legume cover crops.

In the absence of a grain: stover ratio value for a given variety, NuMaSS recommends a default value of 0.84, based on an average of existing coefficients for corn in the software database. At Talgua, the quantity of total crop N uptake estimated by NuMaSS to realize an intended yield of 7.4 Mg ha^{-1}, using the default grain: stover ratio value is 128 kg ha^{-1}. When the experimental value (1.11) is used, NuMaSS estimates total crop N uptake as 116 kg ha^{-1}, less N than with the default software value.

Total N uptake (Y_r*N_{cr}) for each N fertilizer treatment was determined using the equation: [Grain dry weight * (% N grain/100)] + [stover dry weight * (% N stover/100)] = total N uptake. The quantity of

native soil N uptake (N_{soil}) was represented by total N uptake when no N was applied (75 kg N ha^{-1}). The quantity of fertilizer N uptake in each treatment was derived using the equation: Total N uptake – native soil N uptake = apparent fertilizer N recovery, which assumes that N_{soil} is constant for all N fertilizer treatments. The slope of the relation between apparent fertilizer N recovery and applied fertilizer N in represents the fertilizer N use efficiency (Ef), which is estimated as 49% at the Talgua site.

Fertilizer N recommendation with cultivar- and soil-specific variables - Data regarding N content of grain and stover, native soil N, and fertilizer N recovery for a specific cultivar and soil can be applied to NuMaSS to improve local N recommendations. When compared to the yield response data in Figure 1, the N recommendation with default NuMaSS values under-estimated fertilizer N needs by 28 kg ha^{-1}, whereas use of crop and soil coefficients developed through the experiment at Talgua over-estimated fertilizer N needs by 14 kg ha^{-1}.

Conclusions: There was a 2.5-fold difference in grain: stover ratios among the predominant corn cultivars cropped in Honduras and Nicaragua. Maximum yields among 6 trial sites differed by over 5 t ha^{-1} and optimum fertilizer N rates ranged from 0 to 113 kg ha^{-1}. These differences in cultivar characteristics along with differences in yield potential and native soil N supply among the trial sites indicate that improved fertilizer N recommendations require knowledge of both the intended crop cultivar and site characteristics.

Output target 2007

- ***Books, web content and papers produced by partners in BGBD project both north and south in seven tropical countries***

Completed work

In 2005 the BGBD project produced below-ground biodiversity reviews carried out by three countries viz.: India, Indonesia and Kenya. India published a book titled "Soil Biodiversity, Ecological Processes and Landscape Management: P.S. Ramakrishnan, K.G. Saxena, M.J. Swift, K.S. Rao and R.K. Maikhuri (Editors); ISBN 81-204-1617-1 published by Oxford and IBH Publishing Co Pvt. Ltd., New Delhi, India.

Indonesia also published a book titled " Conservation and Sustainable of Below-Ground Biodiversity in Indonesia: F.X. Susilo, Abdul Gafur, Muhajir Utomo, Rusdi Evizal, Sri Murwani and I. gede Swibawa (Editors); ISBN 979-8287-69-X copyright by Universitas Lampung, Indonesia. Kenya also published their review in the Journal of Tropical Microbiology. This was a special issue with selected topics on below-ground biodiversity in Kenya: ISSN 1607-4106 Volume 3 Number 1, October 2004; copyright the Kenya Society of Microbiology.

In addition Indonesia published three brochures and posters for distribution to members of the Indonesian public and to be shared among scientists. Likewise, partners during the BGBD annual meeting produced a total of 71 papers and four discussion papers in ecosystems services, land use intensity quantification, economic valuation of BGBD and data sharing and intellectual property rights.

Books and papers produced by AFNET partners throughout Africa

The following is a list of publications that have been developed in the last one year within AfNet with direct involvement of the coordination office. Most of these papers have been presented in various workshops and are under peer review for publishing while others have been published in refereed journals.

Refereed Journal Articles

Schlecht, E., Buerkert, A., Tielkes, E: and Bationo, A. 2006. A critical analysis of challenges and opportunities for soil fertility restoration in Sudano-Sahelian West Africa (Nutrient cycling in agroecosystems, in press).

Ouattara, B., Ouattara, K. and Serpantié, G., Mando, A., Sédogo, M.. Peters. M. and Bationo, A. 2006. Intensity cultivation induced-effects on Soil Organic Carbon Dynamic in the western cotton area of Burkina Faso. Nutrient cycling in agroecosystems (in press).

Okalebo, J.R,, Othieno, C.O., Karanja, N.K,, Semoka, J.R.M., Bekunda, M.A., Mugendi, D.N., Woomer P.L. and Bationo, A. 2006. Appropriate available technologies to replenish soil fertility in eastern and central Africa (Nutrient cycling in agroecosystems, in press)

Odendo, M., Ojiem, J., Bationo, A. and Mudeheri, M. 2006. On-Farm Economic Evaluation and Scaling-up of Soil Fertility Management Technologies in Western Kenya (Nutrient cycling in agroecosystems, in press)

Kimetu, J.M., Mugendi, D.N., Bationo, A., Palm, C.A., Mutuo, P.K., Kihara, J., Nandwa, S. and. Giller, K, 2006. Tracing the fate of nitrogen in a humic nitisol under different management practices in Kenya (Nutrient cycling in agroecosystems, in press)

Mafongoya, P.L. and Bationo, A. 2006. Appropriate available technologies to replenish soil fertility in southern Africa. Submitted to Nutrient cycling in agroecosystems (Nutrient cycling in agroecosystems, in review)

Book Chapters:

Swift, M.J., Stroud, A., Shepherd, K., Albrecht, A., Bationo, A., Mafongoya, P., Place, F., Tomich, T.P., Vanlauwe, B., Verchot, L. and Walsh, M. 2005 Confronting land degradation in Africa: Challenges for the next decade. ICRAF 25th Anniversary proceedings, Nairobi, Kenya, in press.

Bationo, A., Kihara, J., Vanlauwe, B., Kimetu, J. and Sahrawat, K.L. Integrated nutrient management – Concepts and experience from SSA, in press.

Tabo, R., Bationo, A., Kandji, S., Waswa, B.S., and Kihara, J. Global Change and Food Systems in Africa, in press.

Other Publications:

Bationo, A., Kihara, J,, Waswa, B., Ouattara, B. and Vanlauwe, B 2005 Integrated Soil Fertility Management Technologies for Sustainable Management of Sandy Sahelian Soils. Proceedings of the International Symposium on 'The management of tropical sandy soils for sustainable agriculture- a holistic approach for sustainable development of problem soils in the tropics', November 2005, Khon Kaen, Thailand.

Bado, B., Bationo, A,, Lompo, F., Cescas, M.P. and Sedoso, M.P. Mineral fertilizers, organic amendments and crop rotation managements for soil fertility maintenance in the Guinean zone of Burkina Faso (West Africa). In Press (Springer).

Tabu, I.M., Bationo, A., Obura, R.K. and Khaemba, J.M. Effect of rock phosphate, lime and green manure on growth and yield of maize in a non productive niche of a rhodic ferralsol in farmer's fields In Press (Springer).

Baaru, M.W., Mugendi, D.N., Batiano, A., Louis, V. and Waceke, W. Soil Microbial Biomass Carbon and Nitrogen as Influenced by Organic and Inorganic Fertilisation in Kenya In Press (Springer).

Kimiti, J.M,, Esilaba, A.O., Vanlauwe, B. and Bationo, A. Participatory Diagnosis in the Eastern Drylands of Kenya: Are Farmers aware of Their Soil Fertility Status? In Press (Springer).

Miriti, J.M., Esilaba, A.O., Kihumba, J. and Bationo A. Tied-ridging and integrated nutrient management options for sustainable crop production in semi-arid eastern Kenya. In Press (Springer).

Kihara, J., Kimetu, J.M., Vanlauwe, B., Bationo, A.and Mukalama, J. Increasing land productivity and optimising benefits through nitrogen and phosphorus management in legume-cereal rotations in western Kenya. In Press (Springer).

Kimani, S.K., Esilaba, A.O., Odera, M.M., Kimenye, L., Vanlauwe, B, and Bationo, A. Effects of organic and mineral sources of nutrients on maize yields in three districts of central Kenya. In Press (Springer)

Tabo, R., Bationo, A., Bruno, G., Ndjeunga, J., Marcha, D., Amadou, B., Annou, M.G., Sogodogo, D., Jean Baptiste Sibiry Taonda, Ousmane, H., Maimouna, K.. Diallo and Koala, S. Improving the productivity of sorghum and millet and farmers income using a strategic application of fertilizers in West Africa. In Press (Springer).

Adamou, A., Bationo, A., Tabo, R. and Koala, S. Improving soil fertility through the use of organic and inorganic plant nutrient and crop rotation in Niger. In Press (Springer).

Kaya, B., Nang, A., Tabo, R. and Bationo, A. Performance de diverses espèces agroforestières en jachère améliorée de courte durée et leurs effets sur la fertilité des sols et les rendements du sorgho au Mali. In Press (Springer).

Oral/Poster presentations at conferences:

Bationo, A., Sanginga, N., Kimetu, J., Kihara, J. From Knowledge to implementation: The challenge of the African Network for Soil Biology and Fertility (AfNet).

Bationo, A. Available Technologies for soil fertility Replenishment in East, West and Southern Africa: presentation made during an IAEA workshop on Combating drought held in Nairobi, October 2005.

Bationo, A. Progress Report of TSBF Activities in West Africa.

Bationo, A. Promoting use of Indigenous Phosphate Rock for Soil Fertility "Recapitalization" in the Sahel. Presentation made during the launch of CORAF Funded projects in West Africa.

Bationo, A. The Collaboration between Jordforsk and the African Network for Soil Biology and Fertility (AfNet) of TSBF institute of CIAT. Presentation made in Norway during a visit to enhance TSBF-JORDFORSK collaboration

Sanginga, N., Vanlauwe, B. and Bationo, A. Evaluation of long term agroforestry: Nitrogen and phosphorus use efficiency in the derived savanna in West Africa. Presentation given in Vienna, April 2005, during an Agro-forestry workshop

Bationo, A. Combining rainwater and nutrient management strategies to increase crop production and prevent soil degradation in the Desert Margins of Africa. Presentation given during DMP evaluation meeting in South Africa in May 2005.

Bationo, A., Kihara, J., Kimetu, J. and Waswa, B. The role of the African Network for Soil Biology and Fertility (AfNet) in training and capacity development of young researchers in Africa. Presentation given in Rwanda in February 2005 during a training needs assessment for Rwanda workshop.

Sanginga, N., Bationo, A. TSBFI-CIAT: The New Challenge: Strategy Direction (presented at AfNet FPR-SU training workshop held in Nairobi, Kenya, 19-30th September 2005. Made for a second time during an IAEA workshop on Combating drought held in Nairobi, October 2005.

Output target 2008

- ***Farmer-to-farmer knowledge sharing and extension through organized field trips and research activities result practices in at least two sites***

Work in progress

Strengthening the dissemination process of improved soil management practices of the Quesungual through farmer to farmer exchange

O. Menocal [1], J. Pavón [1], J.L. Olivares [1], M. Ayarza [2], E. Amézquita [2] and M.T. Trejo[2]

[1] Instituto Nicaragüense de Tecnología Agropecuaria, INTA, Nicaragua; [2]Tropical Soil Biology and Fertility Institute of CIAT

One of the main goals of the CPWF- Quesungual project is to extend the benefits of the QSMAS to other hillside regions of Mesoamerica. The Quesungual agroforestry system is now under test for the first time outside Honduras, in neighbouring Nicaragua. During 2005 MIS partners from Nicaragua selected four potential regions for the extrapolation of the Quesungual based on agroecological similarities with respect to the Quesungual site in Honduras. Among these sites, the Rio Dantas watershed in Somotillo was selected as the pilot site for the validation activities of the project.

The process continued with the visit of a group of 20 farmers from Nicaragua to the Candelaria region in Honduras in order to observe the system and talk to farmers practicing the system. During the visit farmers from both countries had an intensive exchange of ideas about the management of the system and the main benefits derived from its use. This was completed by a visit of two Honduran farmers to the pilot site in Nicaragua to demonstrate farmers how to manage trees and plant residues in order to establish the system. This resulted in the establishment of three plots in each of six farms of the watershed. In these plots farmers are comparing the performance of their traditional maize-based management system against the Quesungual system and an intermediate system considering the management of permanent cover crop without burning. These plots have been visited by numerous groups of farmers from neighbouring regions that are interested in the results of the evaluation. So far the system has met the widespread interest and appreciation of participating farmers. Plans to scale up the system to other regions in Nicaragua with the support of INTA and FAO-PESA are under discussion.

Farmer to farmer knowledge sharing and extension of the Quesungual slash mulch agroforestry system (QSMAS)

J. Pavón[1,2], J. L. Olivares[2], G. Bonilla[3], A. C. Calero[3], M. Ayarza[1] and E. Amézquita[1]

TSBF-CIAT; INTA, Nicaragua; UNA, Nicaragua

For the establishment of Quesungual Agro-forestry System in Nicaragua, the first activity was the exchange tour to the community of Candelaria (Honduras), April 04-08 (2005), with producers of La Danta microbasin, the municipality of Somotillo, and producers of Granada, San Dionisio, San Francisco Libre, and young environmentalists from Nicaragua. The pursuable goals in the activity were: the INTA technicians and Nicaraguan producers visited Lempira Sur, to get acquainted of the experiences on the Quesungual Slash Mulch Agro-forestry System (QSMAS), and to begin the validation, the promotion and the diffusion of Quesungual in Nicaragua. A tour was done visiting the different farms and the producers of Honduras. They explained how they established Quesungual and what benefits they have achieved from the system.

For the selection of the QSMAS validation farms (Figure 33), some approaches were considered:

- The importance of the basin
- The access from roads to the farms for data collection
- Suitability of the location for farmer demonstration

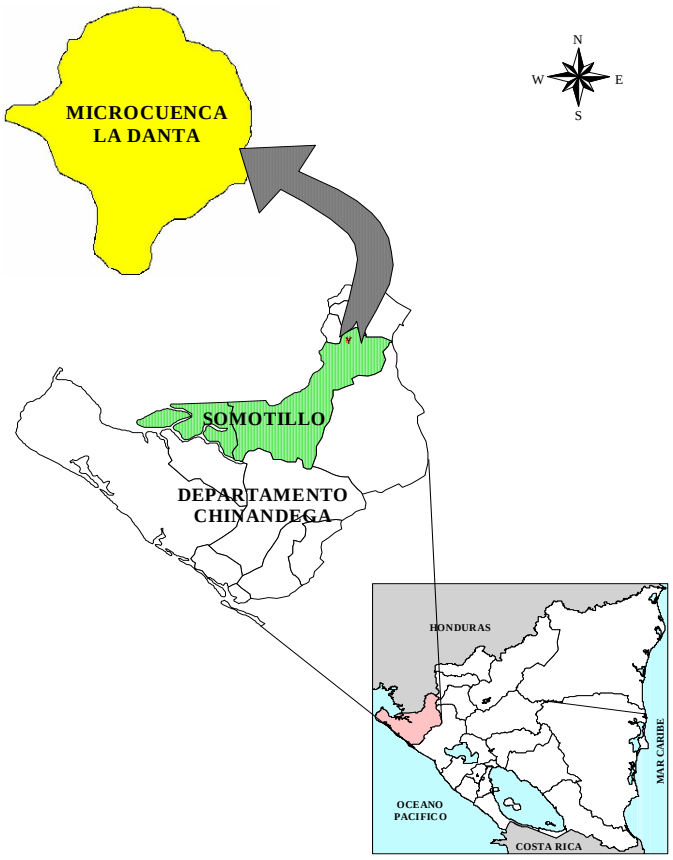

Figure 33. Map of Nicaragua with the general location of La Danta micro basin, Somotillo (Chinandega), Nicaragua. 2005.

- The commitment of the farmer to work in the validation (it implies that he/she should not burn, must manage the tree component, the stubble of the cultivation and have the record of the activities).
- The person must have the tenure of the land (owner).
- Plots that were under at least six years of rest.
- Farm is part of the hillsides agroecosystem.

Sampling of soil in each of the treatments to measure soil physical parameters: This activity was carried out in August 2005 with the collaboration of the Eng. Jeremías Martínez from Honduras; the objective was to evaluate the physical parameters and indicators in the management of the soil.

Field measurement

- Readings of penetrability at different levels of soil depth (0-5; 5-10; 10-20 and 20-40cm)
- Presence of horizons
- Percentage of rockiness
- Compacted layers
- Presence of colors
- Dominant vegetation
- Distribution of roots
- Biological activity
- Percentage of dominant slope

- Description of the soil profile

Sampling for laboratory determinations: Soil cores of 50×50×50cm were opened in each of the treatments (four treatments in total), 12 pits per producer, 500g of soil were collected in plastic bags for chemical analysis, also samples were taken in 5cm × 5cm cylindrical metallic rings for bulk density, 2.5 cm × 5 cm height for humidity retention curves at different soil depths (0-5; 5-10; 10-20 and 20-40 cm).

Vegetation study of La Danta Somotillo microbasin: Regarding the performance of the Vegetation Study of La Danta Somotillo Chinandega microbasin, the following activities were accomplished. Mr. Lester Martin Talle and Mr. Tomás Gutiérrez Vílchez completed the field stage and the cabinet work. The date for the pre-defense of the diploma work was programmed for February 1, 2006. Later on, it will be the defense of the thesis, considering that the vice-dean office gives 15 working days to make corrections to the document.

Activities carried out for the establishment of the treatments:

- An inventory of the tree species within the area selected for the treatment.
- Measure of the treatment areas, according to the specified 900 m^2 for each treatment/producer (4/producter).
- Cleaning of the area in the lower part of the trees (QSMAS) and total cleaning in the treatments of stubble management, and burning of the area and cleaning in the control treatment.
- Selection of the trees that are in the treatments, according to the approach of the farmers
- Elimination of the unwanted trees, and aerial pruning of those that are in the treatment
- Establishment of the annual crop
- Agronomic management (Fertilization with 18-46-0, urea and overgrowth control, samplings of soil, pests, etc.)
- Management of forestry species (pruning)
- Sampling of pests in the soil
- Sampling of soil fertility

Selected plots: By May, the establishment of plots began, also the establishment of the system and the sowing of the first the annual crop (corn). (Table 32).

Table 32. Producers that established validation plots of QAS

Nº	Producer Name	Establishment date	Sowing Date	Crop
1	Jerónimo Herrera	19/05/05	19/05/05/	Corn
2	Santos A Zúñiga	19/05/05	23/05/05/	Corn
3	Ismael Olivas	20/05/05	24/05/05/	Corn
4	Ernesto Pineda	19/05/05	26/05/05/	Corn
5	Roberto Pineda	19/05/05	21/05/05/	Corn
6	Felipe Álvarez	18/05/05	20/05/05/	Corn

Output target 2008

- ***Web content in the BGBD website enhanced to contain data and information on BGBD taxonomy and species identification***

Work in progress

The CSM-BGBD project website was launched at the Annual Meeting in Manaus, Brazil (April 2005) and can be accessed at http://www.bgbd.net/. The bgbd website has a Home page from where there is an electronic newsletter, and announcement board and a board that shows upcoming events. Other links include: information about the project, information on the activities of the working groups, the project mailing links and links with other biodiversity sites. Information such as the project structure, the project directory, project governance, project progress reports are all included. The projects publication list is also included on the site.
Brazil also launched its website during the same annual meeting. The site can be accessed at http://www.biosbrasil.ufla.br/. The Biosbrasil site has information presented in Portuguese on the soils and soil biodiversityof the Amazonia Forest. The site also has weather data and announcements targeting the Brazilian community as the main beneficiaries and other would be interested audiences. To see more of what is in the sites anyone is free to click on the links and visit the sites.

Progress towards achieving output level outcome

- *Strengthened and expanded partnerships for ISFM facilitate south-south exchange of knowledge and technologies*

Strengthening partnerships is at the core of TSBF-CIAT strategy to promote ISFM and SLM in the tropics. This year we have restructured AFNET to include regional multidisciplinary teams in Eastern, Southern, and West and Central Africa to better coordinate and interact with the growing membership. The BGBD project completed its first phase with a successful conference in Manaus where 71 southern scientists were able, for the first time, to share results of pioneering inventory work on belowground biodiversity. We have also consolidated the MIS and CONDESAN Consortia in Latin America and have started a new partnership initially in Colombia aimed at restoring degraded pastureland.

AFNET remains the most dynamic and widespread network for linking scientists working on ISFM in Africa. The more than 350 members now benefit from participation in networked long-term experimental trials, degree-related training and capacity building activities (such as the two short courses and land degradation conference organized in 2005), as well as more general information dissemination (such as on training opportunities and scholarships for young scientists, as well as scientific findings and progress in ISFM). South-south exchange of expertise and findings within the network has been visible in the prominent involvement of many AFNET members in the preparation of successful proposals for the sub-Saharan African Challenge Program.

The 3rd annual symposium of the BGBD project, held in Manaus Brazil, provided a forum for the exchange of preliminary data on (i) Benchmark area description and socio-economic characterization, (ii) Results of the inventory of macro-fauna, (iii) Inventory of nematodes and mesofauna, (iv) Inventory of legume nodulating bacteria and arbuscular mycorrhizal fungi (AMF) (v) Inventory of pathogenic and antagonistic fungi and insect pests and (vi) Standard methods for the inventory of BGBD. The innovative pan-tropical research activities of this project were evaluated by a team of external reviewers in 2005, which has translated into a successful restructuring of the project for the launch of a second phase in 2006.

The MIS consortium is very active in advancing the research agenda for the agriculture in Honduras and Nicaragua. The most important achievement has been the strong commitment from partners in Nicaragua to disseminate the Quesungual System into the Country. This is generating very positive synergies between the NARS, the academia, regional and national authorities and of course farmers. Partners of MIS were involved in 4 regional workshops during 2005 and many students have benefited from training that is associated with MIS activities.

The CONDESAN Consortia continues to be a strong partner in the Andes and will be a major vehicle to transfer research outputs, particularly related to implementation of schemes for payment of environmental services. In 2005, a new partnership was initiated with the regional environmental agency in the Caribbean savannas of Colombia, (CVS), the National Research Institution (CORPOICA) and regional Universities (U. Cordoba and U. Sucre) as well as organizations of indigenous communities, to concentrate efforts in the rehabilitation of degraded pastureland in the region. Pasture degradation is perceived as a major problem in the region. This partnership will greatly strengthen the capacity of partners to focus on land rehabilitation and will also include a large number of students from the region at different project phases.

Progress towards achieving output level impact

- *Improved institutional capacity in aspects related to ISFM and SLM in the tropics contribute to agricultural and environmental sustainability*

By involving the principles of ISFM and SLM in the implementation of the activities of the partnerships, we are advancing in reinforcing local and regional capacity to use and disseminate such strategies. Large involvement of students from different disciplines will warrant the continuation of these efforts beyond those of the current partnerships.

In particular, AFNET has been highly effective in placing young scientists and building the capacity of mid-career scientists in advancing ISFM and SLM within African NARES. In preparation for the upcoming 2006 Symposium, a study will be conducted of the disciplinary and career impacts of AFNET members since the network's inception in the early 1990s. The impact of the network is already visible in the regular successes of AFNET members in securing funding for ISFM and SLM work from major donors and initiatives, such as the sub-Saharan African Challenge Program. The networking of leading scientists in various, African agro-ecoregions has already led to significant advances in understanding the dynamics of combining organic and inorganic resources, the interaction of water and nutrients in dryland conditions, and in conservation agriculture.