2003-4 BASIS CRSP Project Annual Activity Report
October 1, 2003 – September 30, 2004

I. **Research Project Title:** Rural Markets, Natural Capital and Dynamic Poverty Traps in East Africa

II. **Collaborating Institutions and Researchers:** **Cornell University** (Ithaca, NY): Dr. Chris Barrett(principal investigator), Mr. Marc Bellemare, Dr. Larry Blume, Dr. Douglas R. Brown, Ms. Heidi Hogset, Mr. Paswel Phiri Marenya, Dr. Bart Minten, Ms. Christine M. Moser, Mr. Andrew Mude, Mr. Felix Naschold, Dr. Ben Okumu, Dr. Alice Pell, Mr. Jean Claude Randrianarisoa; **FOFIFA** (Antananarivo, Madagascar): Mr. Jean-Fidele Randrianjatovo (researcher), Dr. Jhon Rasambainarivo (co-principal investigator); **International Centre for Research in Agroforestry** (ICRAF, Nairobi, Kenya): Dr. Nelson Mango, Dr. Frank Place (co-principal investigator), Mr. Dennis Simiyu, Mr. Justine Wangila; **Kenya Agricultural Research Institute** (KARI, Nairobi, Kenya): Mr. Gatarwa Kariuki, Dr. David M. Mbugua, Mr. Josephat Cheng'ole Mulindo, Dr. Festus Murithi (co-principal investigator), Ms. Elizabeth Nambiro, Mr. Collins Obonyo, Mr. Martins Odendo, Mr. James Ouma; **Syracuse University**: Dr. John McPeak; **University of Nairobi (Department of Agricultural Economics, Kabete Campus)**: Dr. Willis Oluoch-Kosura.

III. **Project Dates:** October 1, 2001 – March 30, 2005

IV. **Support:** Core BASIS CRSP funding with matching funds from Cornell University and the Rockefeller Foundation. Supplemental funding (about $35,000) was provided by the Rockefeller Foundation and by IDRC (Canada) to the University of Nairobi and by USAID-Madagascar's Ilo project with Cornell (about $7,500) for qualitative research and training. We also received $1.688 million over five years from the National Science Foundation's Biocomplexity in the Environment special competition on the Dynamics of Coupled Natural and Human Systems to Cornell University and ICRAF for biophysical research in three of the Kenya sites and more in depth bioeconomic systems modeling. The National Science Foundation's Economics Program also provided a ($17,662) doctoral dissertation improvement grant for a project on "The Theory and Practice of Reverse Share Tenancy" that wound up covering all the field research costs for the work led by Marc Bellemare on understanding land contracts in rural Madagascar (see point VI A 4). Grants from the Social Science Research Council's Program in Applied Economics ($10,000) and from the Rockefeller Foundation ($150,371) wound up supporting the BASIS-related research done by Hogset, Marenya and Mude in Kenya.

V. **Program Overview:** One fifth of the world's population lives on less than a dollar a day, and most of those ultra-poor live in rural areas and work in agriculture. So the poorest populations in the world rely disproportionately on the natural resource base on which agricultural productivity depends. Recent empirical studies using longitudinal data find

that a disturbingly large share of these people suffers chronic rather than transitory poverty. Many appear trapped in a state of perpetual food insecurity and vulnerability because their poverty and poor market access preclude efficient investment in or use of productive assets.

Furthermore, those caught in a poverty trap may have strong incentives to degrade natural resources, particularly the lands they cultivate and graze, in the course of their ongoing struggle to survive. Partly as a consequence, nearly two-fifths of the world's agricultural land is seriously degraded and the figure is highest and growing in poor areas such as Central America and Sub-Saharan Africa. Such degradation exacerbates pre-existing poverty traps, by discouraging capital-strapped smallholders from investing in maintaining, much less improving, the natural resource base on which their and their children's future livelihoods depend. The resulting degradation of the local agroecosystem further lowers agricultural labor productivity, aggravating the structural poverty trap from which smallholders cannot easily escape. These problems feature prominently today in Kenya and Madagascar and in discussions among policy makers, donors, and NGOs as to how best to design poverty reduction strategies.

The project "Rural Markets, Natural Capital and Dynamic Poverty Traps in East Africa," is being undertaken in collaboration with FOFIFA in Madagascar and with KARI, ICRAF and the University of Nairobi in Kenya with the goal of identifying best-bet strategies to help smallholders escape the interrelated problems of dynamic poverty traps and on-farm natural resource depletion. Degradation of soils and access to factor and product markets are the primary foci. Empirical analysis, based on panel data collection and follow-on qualitative (oral history and ethnographic) field work in seven sites, five in Kenya and two in Madagascar, is being undertaken to determine the incidence, severity and causal linkages behind poverty traps, as well as to identify the most promising approaches to reducing the incidence and severity of chronic poverty, especially in ways that support agricultural productivity growth and repletion of degraded soils.

The project is engaging in active discussions with policy makers involved in the Poverty Reduction Strategy Program (PRSP) processes in each country, with the most senior levels of the agricultural research communities in each country, and with local communities about practical, science-based strategies for improving access to productive inputs (including soil nutrients) and markets necessary for poor people to be able to improve their livelihoods over time.

VI. Discussion of Annual Activities:

A. Specific Activities Undertaken and Related Accomplishments (lead team member):

Data Collection:

1. **Panel Data Collection in Embu, Kenya (Murithi):** KARI directed much of its time in 2003-2004 to data entry and cleaning for the first two sets of data. Much time

and effort was also spent finding locations and plots for the final round. They began the last round of surveys in August-September 2004.

2. **Soils Samples Data Collection in Madagascar (Rasambainarivo):** Data from the soil samples were collected in September-October 2003 (using NSF project funds) from nearly every rice plot in the Madagascar sample. The soil samples were prepared and had to wait clearance for international shipment to ICRAF's labs in Nairobi, where they were analyzed in September 2004 to produce plot-specific characteristics reports to be returned to the sample farmers. These sample provide the first profiles of spectral imagery of soils from highland Madagascar, thus providing valuable data and calibration for the agricultural research community working on improving agricultural productivity in this region. They also create a baseline of matched economic and soils data to enable future construction of an unprecedented matched panel of socioeconomic and biophysical measurements of agricultural productivity and resource conditions.

3. **Rice Production Data Collection in Madagascar (Minten):** The Cornell-FOFIFA team re-surveyed households in the BASIS panel (about 1400 plot-level observations) in order to allow for panel data analysis at the rice plot level, to study productivity dynamics controlling for spatial and biophysical factors specific to plot level. The data have all been entered and cleaned and are now being analyzed at Cornell by Randrianarisoa.

4. **Land Contracts and Productivity Survey in Madagascar (Bellemare):** The purpose of this survey was to collect household-level data on land sharecropping contracts. Data collection took place between March and August 2004, with data entry ending in September. Team members hope to be able to study the institution of reverse share tenancy, i.e., sharecropping contracts wherein a poorer landlord rents out land to a richer tenant, over the coming year. Please see Appendix A for a brief article (in French) published in Antananarivo's "Le Quotidien", profiling this study for the Malagasy public.

5. **Collection of Data on Social Networks, Informal Finance and Technology Adoption in Highlands Kenya (Hogset):** As part of her Cornell dissertation research, Hogset undertook original survey work in Embu and Vihiga Districts, Kenya, from August 2003 – September 2004, reconstructing social networks as they relate to information flow and informal lending and insurance transactions within households in our BASIS panel in those locations. Using snowball sampling methods to collect data from first- and second-order networks, Hogset has established far greater density of networks in the better-off region of Embu – in spite of greater household-level access to formal financial services – and significantly higher rates of adoption of improved natural resources management practices.

6. **Collection of data on smallholder product marketing, producer co-operatives and meso-level impediments to accumulation in central Kenya (Mude):** As part of his Cornell dissertation research, Mude undertook original survey work in Mur'anga District, Kenya, from September 2003 – February 2004. He did sub-sector studies of the coffee, dairy and tea industries, coupling household-level survey data with qualitative and quantitative data collection at the level of producer co-ops and local processing facilities to explore why farmers are able to effectively use commercialization of certain products (e.g., dairy and tea) to accumulate assets and improve standards of living but not other products. This study looks at the political economy of local groups as well as the organization of smallholder production and product marketing.

Data Analysis:

7. **Analysis of determinants of adoption and disadoption of improved natural resources management practices in western Kenya (Marenya):** As part of his MS thesis at Cornell University, Marenya is using the BASIS panel data from Vihiga District, Kenya, to identify the determinants of investment and disinvestment in natural capital through improved natural resources management practices.

8. **Analysis of Intercropping Productivity in Highlands Kenya (Brown, Nambiro, Wangila):** Intercropping of various crops is commonplace on the farms in our sample, especially in the highlands sites in central and western Kenya. There are differing opinions as to whether this affects productivity and thus welfare dynamics for small farming households. We have therefore been doing novel ray production function estimation of mixed crop production systems, both for calibration of the bioeconomic simulation model and to establish why farmers intercrop and with what productivity effects.

9. Qualitative Studies of Poverty Dynamics (Mango, Mulindo, Kariuki, Ongadi and Randrianjatovo): We followed up quantitative panel data collection by doing intensive household-level qualitative research on a sub-sample of households selected randomly from the income transition matrices constructed from the panel data. The objective of this research was to uncover subjects' perception of the reasons for poverty transitions so as to complement and help shape the quantitative analysis.

10. **Public Goods and Services Provision and Markets Performance in Madagascar (Moser):** We used the national commune census collected under the separate Ilo project (see section VII) to study meso-level issues related to potential geographic poverty traps. As part of her Cornell dissertation research, Moser analyzed the commune-level provision of public goods and services (e.g., education, health) and how these are shaped by the political economy of democratic election that leads to

significant, predictable deviations of actual allocations from those that would minimize poverty in the nation. She likewise studied how well markets transmit prices across space, time and transformed commodities (e.g., paddy into milled rice) using the commune census data so as to identify whether market failures were primarily local, regional or national phenomena and whether these were attributable to high costs of market intermediation or to the exercise of market power by traders.

11. Integrated study of welfare dynamics in rural Kenya and Madagascar (Barrett): Using the panel data collected in each of the project sites and the qualitative data collected in follow-up visits to a sub-sample of panel households, we undertook empirical analysis of household-level welfare dynamics to explore the core hypotheses of the project: are there really poverty traps? If so, are these related to locally increasing returns to particular key assets, to wealth-dependent risk management, and/or to site-specific conditions (e.g., access to markets, agroecological conditions) that create geographic poverty traps. This involved descriptive statistics, econometric work and contextual analysis of qualitative (oral history and participatory appraisal) data.

12. **Development of CLASSES model and initial application to western Kenya (Okumu):** We continued to develop the bioeconomic simulation Crop, Livestock and Soils in Smallholder Economic Systems (CLASSES) model, calibrating it to the western Kenya BASIS site and working through various simulation scenarios. This work will result in at least one academic paper explaining how the interaction in the nonlinear dynamics of the underlying natural resource stock, fixed and sunk costs of changing livelihoods and barriers to financing adverse shocks and de novo investment combine to yield divergence in economic growth paths followed by reasonably similar households in rural Kenya.

Stakeholder Consultations:

13. **Community Feedback Workshops in Embu, Kenya (Murithi, Ouma, Hogset):** KARI held three community feedback workshops in Embu (July 6-8, 2004) to share highlights of the first round of their survey with the participating farmers and extension staff. There was a high turn out among farmers (67%). The farmers confessed they did not initially fully understand the purpose of the project but now after those presentations, they were very happy and saw the value of the study. Attendants unanimously agreed to participate in the second round of the survey starting in August/September as they could now see the benefits of the study. Ms. Hogset also highlighted some of the findings of her social networks study. Also during this session, the farmers requested visit the KARI Embu station, preferably before the start of the second round of the survey. Please see Appendix B for a summary of this workshop.

James Ouma organized the subsequent visit to KARI Embu in August 2004. 120 farmers (70 female, 50 male) participated in the tour. Although the farmers live in the area, the majority of them had never been to the station and were impressed by the range of activities taking place. Many expressed an intention to try some of the technologies they saw that day on their own their farms. Please see Appendix C for a summary of the day.

Community feedback workshops were also planned for the fourth quarter for the Baringo and Vihiga districts in Kenya, as well as in Madagascar. These three workshops have been postponed to January or February, 2005.

14. **Policy Research Strategy Group and Stakeholders' Workshop on Linking Research to Policy (Murithi, Oluoch-Kosura, Place):** The informal Policy Research Strategy Group (PRSG), initially begun under the BASIS CRSP, has been active intermittently for about two years. Coordinated by the Department of Agricultural Economics (University of Nairobi), its purpose is to strengthen linkages between research institutions and policy makers in Kenya by encouraging exchange of recent research findings, ongoing research efforts and research questions on which policy makers could use current, precise findings. On January 27, 2004, the Department of Agricultural Economics at the University of Nairobi organized a stakeholders' meeting at KARI headquarters for policy researchers and policy makers to review the status of the links of research findings to policy making in the country. We identified constraints, opportunities and suggestions on what can be done to improve the communication and linkages related to research findings and policy. Mr. David Nalo, the Permanent Secretary of the Ministry of Planning and National Development, gave the opening speech and Dr. Romano Kiome, Director of the Kenya Agricultural Research Institute, also spoke. The meeting was supported by the British Department for International Development but other key donors such as the World Bank, USAID and the Rockefeller Foundation were represented. Please see Appendix D for letter of invitation and program (note that the letter of invitation is for January 23 but the meeting was subsequently rescheduled to the 27th). Also of note, the World Bank held another, related, meeting on January 28. (Please see Section VII for "Collaboration With Other Projects".)

15. **Cognitive Mapping Introductory Farmers' Focused Group Discussions, western Kenya (Wangila):** Justine Wangila, David Amudavi, Heidi Hogset and Clement Lenachuru were discussants and Japheth Bulali, Godfrey Lomosi and Manoah Obwayo assisted in taking notes for this meeting held at the Salvation Army Church in Madzuu, Vihiga District on January 29, 2004. The objective of the meeting was to introduce the planned "cognitive mapping" survey under the related NSF project (see section VII) and to discuss farmers' perceptions of soil fertility, crop changes and risk assessment, and actual actions and investments farmers undertake. Please see Appendix E for notes from this meeting.

16. **Meetings with USAID Mission Staff (Barrett, Minten, Murithi):** Barrett met with USAID mission staff in Kenya in March 2004 and Murithi met with them again in September 2004 to update them on the activities of the BASIS CRSP project. Minten met with USAID mission staff in Madagascar regularly throughout the past year to update them on BASIS and related activities.

17. **Project Team Meeting** (Barrett, Murithi, Place): The Fourth Annual BASIS CRSP Project Team Meeting took place March 15-16, 2004, in Nyeri, Kenya, including team members from Kenya, Madagascar and the United States as well as stakeholders from multiple institutions in Kenya. The purpose of the meeting was for researchers to present their findings for discussion and to plan the final months' workplan under the project. Please see Appendix F for the agenda and summary.

18. **Cognitive Mapping Introductory Farmers' Focused Group Discussions, central Kenya (Mbugua):** A farmers focused group discussion was held in Embu with selected farmers coming from Manyatta, Mukangu, Kianjuki and Kavutiri extension focal areas. The meetings were facilitated by David Amudavi, David Mbugua and Clement Lenachuru. James Thuranira and James Njeru assisted in taking notes during the proceedings. The objective of the meeting was to introduce the planned "cognitive mapping" survey under the related NSF project (see section VII) and to discuss farmers' perceptions of soil fertility, crop changes and risk assessment, and actual actions and investments farmers undertake. Please see Appendix G for notes from this meeting.

Training:

19. **Degree Training (Barrett, Bellemare, Hogset, Marenya, Moser, Mude, Naschold, Randrianarisoa):** The BASIS project supported one graduate student and partially funded six other students last year, all at Cornell University under Christopher Barrett's supervision, and most in the Department of Applied Economics and Management (AEM). Jean Claude Randrianarisoa (Madagascar, AEM Ph.D. candidate) entered his second year of training in September 2004 and was fully funded by the BASIS CRSP. Marc Bellemare (Canada, AEM Ph.D. candidate) conducted field research in Madagascar, partially funded by BASIS and partially funded by a grant he was awarded by the NSF. Heidi Hogset (from Norway, AEM Ph.D. candidate) was partially funded by BASIS for work in Kenya (with co-funding from Cornell). Paswel Phiri (Kenya, AEM M.S. candidate) received funding from the Rockefeller Foundation. Christine Moser (USA, AEM, Ph.D. candidate) completed her Ph.D. Andrew Mude (Kenya, Dept. of Economics, Ph.D. candidate) was mostly funded by BASIS (with co-funding from Cornell). The workplan had also anticipated partial funding for Sharon Osterloh (USA, AEM, M.S. candidate) but wee later found that her work contributed more directly to another project under Chris Barrett's supervision and so her funding was transferred off the

BASIS project. This left room in our budget to fund Felix Naschold (Germany, AEM, Ph.D. candidate) who's work is a much better fit with our research. The workplan also called for Justine Wangila to do Ph.D. dissertation research at the University of Nairobi but he did not officially register as a student this year and so his work is not captured under "training" in this report. Mr. Wangila is still heavily involved in the BASIS project as a researcher at ICRAF. The student training reports have been submitted to the ME under separate cover.

20. **Université d'Antananarivo Lecture Series (Minten):** In early 2004, BASIS CRSP - collaborator Bart Minten gave a series of lectures at the University of Antananarivo to masters students that are enrolled in the DEA (Degree d'Etudes Approfondies) program on rural development that ESSA (Ecole Superieure des Sciences Agronomiques) is offering. He taught the students principles of agricultural supply and demand, agricultural policy analysis and the linkages between agriculture and poverty. Around 25 students of this program attended this series of lectures.

21. **Post doctoral training (Okumu, Barrett):** Dr. Ben Okumu, the post-doctoral researcher on the BASIS project, trained in empirical methods while playing the lead role in the bioeconomic modeling component of the project. Barrett supervised Okumu's training, which included field visits to Kenya, presentations of seminars, and leading the development of the CLASSES bioeconomic modeling tool. Dr. Okumu finished his post-doctoral assignment in October 2004.

22. **On-going maintenance of the "Bioeconomic Modeling for Smallholder Systems" course website (Okumu):** This restricted-access course website, developed in 2002, continues to stir interest beyond our project. We have received a number of requests from people all over the world wanting to learn more about bioeconomic modeling. We most recently granted access to Dr. Jeffrey Sachs, Director of the Earth Institute at Columbia University, at his request. We continue to devote time to helping researchers understand the site, for example, Dr. Okumu has devoted much time to explaining integrated bioeconomic modeling simulation methods to students at Cornell and other institutions, many of whom are now applying these methods in their own research. On-line activity from former class participants has dropped, as expected, as the course ended. Others continue to use that web site (http://aem.cornell.edu/special_programs/AFSNRM/Bioecon/) regularly.

B. Additional Activities Not Anticipated in the Work Plan:

None

C. Problems and Issues: The main problem faced in FY2002 concerned delays in development and release of the CLASSES bioeconomic model due to modeling challenges and the fact that the NSF Biocomplexity modeling effort effectively superceded the CLASSES effort. This was discussed with the BASIS CRSP ME and with the USAID/Washington BASIS CTO who each concurred that contributing the socio-economic component to a more sophisticated and useful modeling tool would suffice in meeting the simulation modeling objectives originally set out for this project. BASIS CRSP will be duly acknowledged in all resulting materials and publications as the source of the socio-economic data and much of the empirical calibration of those modules of the model being developed under the NSF project.

VII. Collaboration With Other Projects:

a. The World Bank followed KARI's January 2004 stakeholders workshop with their own, related, meeting coordinated by Dr. Christine Cornelius. The meeting was attended by senior World Bank officials from Washington such as Karen Brooks, James Bond, among others. One of the issues agreed upon was that there is a need to take stock and synthesize the various research efforts which have taken place in the agricultural sector in the recent past, identify the gaps and the policy implications. This work was contracted to Prof. Chris Ackello-Ogutu of the UoN, Dr. John Omiti of IPAR and Mr. James Nyoro of Tegemeo through the support of the World Bank.

The Bank then organized a 2-day workshop (June 24-25, 2004) in which the consultants presented their findings. The meeting was attended by, among others, Mr. Makhtar Diop, the Country Director, Dr. Kiome, Director of KARI, several donors and senior officials especially from the Ministry of Agriculture and Ministry of Livestock and Fisheries Development, and about six MPS belonging to the Parliamentary committee on Agriculture (responsible for agricultural sector issues in parliament). One of the major challenges highlighted during the presentations was the lack of a clear process of collecting, storing and using primary data for policy making processes in Kenya. There is a feeling that much of the policy research conducted is based on secondary data and without a clear indication of the methodology used in the data collection. The group also feels that policy recommendations are often based on outdated data or published reports. While neither of these World Bank workshops were directly related to the BASIS project but build on and intersect with our work.

b. The World Bank is undertaking study in Eastern Africa on the linkages between poverty and agriculture. Madagascar is one of the case studies in this analysis. This study is being done in collaboration with local researchers in FOFIFA and INSTAT. The BASIS CRSP project is closely aligned with this project and it is planned that research findings of this project will be presented at the final BASIS CRSP meeting. Minten is leading the World Bank study and Barrett is contributing to it.

c. In Kenya, we have strong links to two other USAID-funded projects and to a major National Science Foundation research project. We share our Baringo and Marsabit sites with the USAID Global Livestock CRSP Pastoral Risk Management (PARIMA) project. PARIMA has enabled us to leverage data collection in our northern Kenya sites significantly, to our mutual benefit, as BASIS funding enabled expanded thematic coverage of the households being surveyed under PARIMA. The USAID Strategies and Analyses for Growth with Access (SAGA) cooperative agreement includes Kenya as a core country in exploring "bottom-up" approaches to growth with access. The consortium of Kenyan collaborators under SAGA includes each of the major economic research institutes in the country (IPAR, KIPPRA and Tegemeo)) and are heavily represented in the KRDS and PRSP advisory processes in the government. The SAGA program in Kenya is pursuing two interrelated projects that link nicely to our BASIS project, "Reducing Risk and Vulnerability in Rural Kenya" and "Empowering the Rural Poor", and coordination has been explicit between BASIS and SAGA. Our project is most closely linked in Kenya with our team's 5-year $1.7 million National Science Foundation biocomplexity grant entitled "Homeostasis and Degradation in Fragile Tropical Agroecosystems." The NSF project augments the BASIS social science research with in depth biophysical field research and modeling in our Baringo, Embu, and Vihiga sites to pursue frontier modeling of complex dynamic systems. This project began in January 2003, and involves extensive biophysical field research over four-plus years with involvement of leading animal, atmospheric and soil scientists in addition to sociologists and economists. The NSF project also involves four Kenyan Ph.D. candidates – a GIS specialist, two soil scientists and a rural sociologist - whose programs at Cornell are funded under the Rockefeller Foundation's African Food Security and Natural Resources Management program at Cornell and complement the BASIS project, especially in our Baringo and Vihiga sites. This adds considerable capacity in understanding processes of ecological degradation and will ultimately improve the quality of the bioeconomic modeling product from this project. The NSF modeling effort has, however, superceded the CLASSES modeling venture programmed under the BASIS project because it affords us the opportunity to go into greater depth in modeling the biophysical processes that mediate productivity and resource changes over time among smallholder farmers in Kenya.

Our project is also closely linked with two other projects directed by ICRAF. One is a DFID funded project on assessing the impact of agricultural research on the poor, coordinated by IFPRI, with ICRAF directing the case study work in western Kenya, in our Siaya and Vihiga sites. ICRAF has another related DFID-funded project, on Voices of Poor Livestock Farmers in the greater Lake Victoria basin, which likewise includes our western Kenya sites.

Linkages to other projects are likewise extremely strong in Madagascar. Cornell recently completed a substantial, multi-year policy analysis and capacity building project (the Ilo project) funded by USAID-Madagascar. BASIS team member Bart Minten was the Ilo project chief of party in Antananarivo and Barrett, Moser and

Randrianarisoa were actively involved in the research under that project. Cornell is also a part of USAID-Madagascar's Landscapes Development Initiative (LDI) project run by Chemonics International, and Madagascar is (like Kenya) one of the seven core countries under the USAID/Washington SAGA cooperative agreement. These projects share complementary interests, in the case of Ilo and SAGA, in welfare dynamics and public policy and in the case of LDI in sustainable agricultural systems for smallholder producers. Ilo has helped fund the social analysis component of BASIS' data collection, while LDI and Ilo have both contributed background data to BASIS analysis of poverty traps and rice technology adoption. SAGA will help integrate BASIS findings into a broader policy dialogue about Madagascar's poverty reduction strategies and into training of economic researchers in the country.

VIII. Outputs

1. BASIS Publications Series: We fell behind our anticipated production scheduled for BASIS policy briefs. We drafted two policy briefs but have not yet submitted them to the ME. The first, by Place and Murithi, offers a comparative analysis of central and western Kenya, explaining how labor and product market access drive opportunities for diversification, leading to measurable differences in investment and poverty patterns. The second brief, by Barrett, responds to a request by the USAID/Washington BASIS CTO to explain how financial market failures lead to displaced distortions in other factor and product markets.

2. Other Print Outputs: In FY2004, the project produced a number of chapters, articles, workshop presentations, trip reports, proposals, etc.

    1) Prospects for Integrated Soil fertility Management Using Organic and Inorganic Inputs: Evidence from Smallholder African Agricultural Systems
    Food Policy, vol. 8, no. 4 (August 2003): pp. 365-378: by Frank Place, Christopher B. Barrett, H. Ade Freeman, Joshua J. Ramisch and Bernard Vanlauwe.

    2) Fractal Poverty Traps
    September 2003, under revision for resubmission to *World Development* in September 2004; by Christopher B. Barrett and Brent M. Swallow.

    3) An Asset Risk Model of Reverse Tenancy
    December 2003 revision; by Marc F. Bellemare and Christopher B. Barrett.

    4) *Social Aspects of Dynamic Poverty Traps: The Case of Madzuu Location, Vihiga District, Kenya*

SADPT Document 4, December 2003, by Wesley Ongadi and Nelson Mango

5) ***Social Aspects of Dynamic Poverty Traps: The Case of Ng'ambo Location, Baringo District, Kenya***
SADPT Document 5, December 2003, by Josephat Chengole and Nelson Mango

6) ***Social Aspects of Dynamic Poverty Traps: The Case of Dirib Gombo Location of Marsabit District, Kenya***
SADPT Document 6, December 2003, by Gatarwa Kariuki and Nelson Mango

7) ***Poverty Traps and Safety Nets***
December 2003 revision, by Christopher Barrett and John McPeak, in Alain de Janvry and Ravi Kanbur, editors, *Poverty, Inequality and Development: Essays in Honor of Erik Thorbecke* (Amsterdam: Kluwer, forthcoming).

8) ***Dynamic Poverty Traps and Rural Livelihoods***
December 2003 revision, by Christopher Barrett and Brent M. Swallow, in Frank Ellis and H. Ade Freeman, editors, *Rural Livelihoods and Poverty Reduction Policies* (London: Routledge), forthcoming.

9) ***The Interplay Between Smallholder Farmers and Fragile Tropical Agroecosystems in the Kenyan Highlands***
February 2004; by Alice N. Pell, David M. Mbugua, Louis V. Verchot, Christopher B. Barrett, Lawrence E. Blume, Javier G. Gamara, James M. Kinyangi, C. Johannes Lehmann, Agnes O. Odenyo, Solomon O. Ngoze, Bernard N. Okumu, Max J. Pfeffer, Paswel P. Marenya, Susan J. Riha and Justine Wangila.

10) ***Estimation of a Ray Production Function for the Maize-bean Mixed Crop Production System in Madzuu, Vihiga District.***
Draft manuscript, March 2004, by Douglas R. Brown and Christopher Barrett.

11) ***Mixing Qualitative and Quantitative Methods of Analyzing Poverty Dynamics***
March 2004; by Christopher B. Barrett.

12) ***International Trip Report: Kenya***
March 2004, by Christopher B. Barrett

13) ***Baseline Study Report: Embu Site***
June 2004; by Justine Wangila, Elizabeth Nambiro, James Ouma, Dennis Simiyu and Festus Murithi.

14) ***An Ordered Tobit Model of Market Participation: Evidence from Kenya and Ethiopia***
June 2004; by Marc Bellemare and Christopher B. Barrett.

15) ***Social Aspects of Dynamic Poverty Traps: Cases from Vihiga, Baringo and Marsabit Districts, Kenya***
SADPT Cases, July 2004, by Nelson Mango, Josephat Cheng'ole, Gatarwa Kariuki and Wesley Ongadi

16) ***Social Aspects of Dynamic Poverty Traps: Cases from Vihiga, Baringo and Marsabit Districts, Kenya***
SADPT Document 7, July 2004, by Nelson Mango, Josephat Cheng'ole, Gatarwa Kariuki and Wesley Ongadi

17) ***Missed Opportunities and Missing Markets: Spatio-temporal Arbitrage of Rice in Madagascar***
August 2004; by Christine M. Moser, Christopher B. Barrett and Bart Minten.

18) ***Welfare Dynamics in Rural Kenya and Madagascar***
Working paper by Christopher B. Barrett, Paswel Phiri Marenya, John McPeak, Bart Minten, Festus Murithi, Willis Oluoch-Kosura, Frank Place, Jean Claude Randrianarisoa, Jhon Rasambainarivo and Justine Wangila, September 2004.

19) ***Educational Investments in a Dual Economy***
September 2004 revision; by Andrew G. Mude, Christopher B. Barrett, John G. McPeak and Cheryl Doss.

20) ***The Complex Dynamics of Smallholder Technology Adoption: The Case of SRI in Madagascar***
September 2004 revision; by Christine Moser and Christopher B. Barrett.

21) ***Analyse descriptive de l'aspect qualitative de la dynamique de pauvreté.***
Jean-Fidele Randrianjatovo, FOFIFA, 2004

22) ***Explaining High Variability in Within Country Outcomes: Three Essays Using Spatially Explicit Data from Madagascar***
2004 Cornell AEM dissertation; by Christine M. Moser.

23) ***International Trip Report: Madagascar***
September, 2004, By Marc Bellemare

24) ***Better Technology, Better Plots or Better Farmers? Identifying Changes In Productivity And Risk Among Malagasy Rice Farmers***
American Journal of Agricultural Economics, vol. 86, no.4 (November 2004): pp. 869-888 (lead article): by Christopher B. Barrett , Christine M. Moser, Oloro V. McHugh and Joeli Barison.

25) ***Heterogeneous Constraints, Incentives and Income Diversification Strategies in Rural Africa***
Quarterly Journal of International Agriculture, vol. 44, no. 1 (2005): in press ; by Christopher B. Barrett, Mesfin Bezuneh, Daniel C. Clay, and Thomas Reardon.

26) ***Rural Poverty Dynamics: Development Policy Implications***
Agricultural Economics, forthcoming; by Christopher B. Barrett.

27) ***Poverty Traps and Natural Resources Management***
Forthcoming in Richard T. Wright, Environmental Science, Ninth Edition (Upper Saddle River, NJ: Pearson Prentice Hall, 2005); by Christopher B. Barrett.

Team materials are regularly posted on the project website at: http://aem.cornell.edu/special_programs/AFSNRM/Basis/papersreports.htm.

3. Non-Print Outputs: The project continues to maintain a substantial web site and to make presentations at conferences and seminars outside the BASIS CRSP. A partial enumeration includes the following

a. ***Poverty Traps and Safety Nets***
Presentation by Christopher Barrett and John McPeak, October 10, 2003

b. ***Welfare Dynamics in Rural Kenya and Madagascar***
Presentation by Christopher B. Barrett, Paswel P. Marenya, John McPeak, Bart Minten, Festus Murithi, Willis Oluoch-Kosura, Frank Place, Jean Claude Randrianarisoa, Jhon Rasambainarivo and Justine Wangila, Delivered at the USAID BASIS CRSP Pre-conference Workshop on "Combatting Persistent Poverty in Africa" , November 14-15, 2003, Cornell University, Ithaca, NY

c. ***Bayesian Herders: Optimistic Updating of Rainfall Beliefs in Response to External Forecasts***
Presentation by Travis J. Lybbert (Cornell), Christopher B. Barrett (Cornell), John G. McPeak (Syracuse/Cornell) and Winnie K. Luseno (Cornell); Delivered February 16, 2004 at the Development Economics Seminar, University of California, Berkeley, Berkeley, CA

d. ***Presentations from the Fourth Annual USAID BASIS CRSP Team Meeting:***
The following presentations were made on March 15, 2004 at the Fourth Annual USAID BASIS CRSP Team Meeting (Outspan Hotel, Nyeri, Kenya). Slides from these presentations are online at:
http://aem.cornell.edu/special_programs/AFSNRM/Basis/presentations.htm

Linking Institutional Partnerships, Community Groups and Rural Livelihood Improvement in Kenya
Presentation by David M. Amudavi (Cornell)

Welfare Dynamics in Rural Kenya and Madagascar: Preliminary Quantitative Findings
Presentation by Christopher B. Barrett (Cornell)

Some Results of Qualitative Research from Madagascar
Presentation by Jean Fidele, Bart and John Rasambainarivo (FOFIFA)

Soils Collection for Analysis
Presentation by John Rasambainarivo (FOFIFA)

Ray Production Function Estimates for the Maize-Bean Mixed Crop System in Madzuu
Presentation by Doug Brown (Cornell) and Chris Barrett (Cornell)

Social Networks and Technology Adoption
Presentation by Heidi Hogset (Cornell)

The Interplay Between Smallholder Farmers and Fragile Tropical Agroecosystems in the Kenyan Highlands
Presentation by A.N. Pell (Cornell) and D.M. Mbugua (Cornell, ICRAF)

Social Aspects of Dynamic Poverty Traps: Cases from Vihiga, Baringo and Marsabit Districts
Presentation by Nelson Mango (ILRI), Festus Murithi (KARI, HQ) and Frank Place (ICRAF)

Mixing Qualitative and Quantitative Methods of Analyzing Poverty Dynamics
Presentation by Christopher B. Barrett (Cornell)

IX. **Key Findings and Results:** The project has generated a range of empirical results that are informing researchers and policy analysts and policy makers on rural markets, natural resources management and poverty reduction strategies.

a. Although economic mobility appears significant in the short-run as a share of income, the structural component of income – that which is predictable based on household ownership of productive assets – appears far less mobile. Since assets and their productivity are the ultimate determinant of long-term poverty status, we have focused most of our energies on studying the **dynamics of assets and asset productivity**, broadly defined. This enables us to test empirically among several **competing hypotheses of economic growth**, each carrying quite different implications for policy. The convergence hypothesis holds that, given universal access to finance and markets, poverty is only transitory and getting prices right will suffice to induce accumulation and growth out of poverty. The conditional convergence hypothesis holds that barriers hold certain groups back, but if those barriers can be overcome, even the poor from such groups will enjoy growth out of poverty. This logic underpins, for example, efforts to break down legal restrictions based on race, religion or gender that handicap members of certain groups, and initiatives to redouble infrastructure and technology development for remote rural areas that might represent geographic poverty traps. The poverty traps hypothesis, by contrast, posits that there exist not only group-specific barriers that impede growth, but wealth-conditional barriers based largely on access to the finance necessary to adopt new technologies or to acquire a critical mass of productive assets. The poverty traps hypothesis implies not only a need for targeted interventions to break down exclusionary barriers and to create assets for the poor, but also a need for safety nets to prevent shocks from thrusting households irreversibly into long-term poverty as their asset losses shift them into a new, lower-level equilibrium. Our research repeatedly rejects the first (convergence) hypothesis in favor of the second and third hypotheses, each of which demands a more activist profile for government and NGO actors than has prevailed over most of the past twenty years in development practice. This body of research yields several important results that we now describe.

b. In quite different environments – from the semi-arid rangelands of southern Ethiopia to the arid lands of northern Kenya to the highlands of western Kenya – we find asset dynamics that exhibit multiple stable equilibria, meaning a low level at which some households appear stuck – **a poverty trap**

– and a higher level to which a small population ascends and remains safely above the poverty line. Households appear to understand this, even though researchers have been slow to recognize the existence of nonlinear asset dynamics in poor communities. For example, pastoralists in northern Kenya and southern Ethiopia have long been criticized for what seems mindless devotion to building up their herds. Yet in an environment prone to severe asset shocks associated with climate and disease and in the presence of multiple asset equilibria, herd accumulation is a perfectly rational economic growth strategy. While many observers have been puzzled and frustrated by pastoralists' general reluctance to market their livestock in response to the onset of drought or a rise in prices due to new export opportunities, our work has shown how household-level livestock marketing and risk management behavior both reflect rational adherence to a herd accumulation strategy necessary to minimize the risk of falling into a poverty trap in a place where non-pastoral livelihood options are essentially non-existent.

c. This phenomenon does not appear universal, however. For example, we find no evidence of such effects in the most prosperous rural region of Madagascar, the Vakinankaratra highlands around the city of Antsirabe. This raises key questions of why poverty traps associated with multiple equilibria might emerge in some places but not in others.

d. One important issue seems to be **access to finance**. Those who can borrow and insurance themselves reliably can afford to undertake new investments, while those without access to financial services typically cannot either afford an investment and simply cannot take the chance. This seems to describe, for example, patterns of adoption of an extremely promising new rice production method – **the system of rice instensification (SRI)** – in Madagascar. Our research has demonstrated through careful econometric methods that SRI increases farmer productivity more than 80%, controlling for farmer- and plot-specific characteristics and variation in input levels. Put differently, a farmer who uses SRI methods instead of other methods to plant the same plot with the same other inputs should enjoy more than 80 greater harvest. Yet a minority of farmers use SRI and the poor in particular hardly ever adopt the method. Why? The answer seems twofold. First, SRI is initially labor intensive during the *soudure* (hungry season) when poor households must work off-farm as casual day laborers for wages necessary to buy food to meet their families' immediate consumption needs. In the absence of seasonal consumption credit to enable them to reallocate their time to their own plots, they cannot afford to practice SRI. Second, we have also documented that yield risk is greater with SRI, with estimated risk coefficients that imply uninsured poorer households will typically opt not to take a chance on SRI while wealthier households that can afford to self-insure might. As a result,

poor households follow a safer, less remunerative strategy while wealthier households follow a somewhat riskier but far more rewarding rice production strategy. The outcome is a bimodal distribution, with the ex ante poor stuck in a low-productivity poverty trap and the ex ante rich enjoying productivity and income growth that pushes them further above the poverty line.

e. Similar financial liquidity barriers appear to impede both entry into more remunerative activites in the **non-farm rural economy** and **intensification of agricultural production** through use of inorganic fertilizers, adoption of improved breeds of dairy cattle, and uptake of improved natural resources management practices such as tree planting for erosion control and use of improved fallows for soil nutrient replenishment. The most attractive agricultural sub-sectors – e.g., commercial dairy or tea production – lie beyond the reach of those without some independent source of cash income or credit. As a consequence, we find smaller, poorer households cultivating less well-diversified farms on soils that are degrading – while wealthier neighbors' soils commonly commonly exhibit stable or improving quality – with the predictable consequence that one subpopulation's situation is deteriorating while their wealthier neighbors enjoy economic growth.

f. **Meso-level barriers to poverty reduction**: Poverty traps may arise due to phenomena at more aggregate levels as well, as our team has pointed out in its work on "fractal poverty traps". Consider the case of coordination failures arise from the complex political economy of producer groups. Preliminary results from Mude's dissertation research in Muranga District, Kenya, show for example, that coffee cooperatives severely underperform their potential as coop leadership bribes voters in order to have access to collective resources they can divert for personal gain. The failure of coffee marketing then discourages farmers from investing in chemical pesticides necessary to maintain yields, so output falls. This limits farmers' cash incomes, constraining their capacity to invest in even non-agricultural activities or assets requiring up-front cash outlay.

g. **Informal networks** do not necessarily fill in the blanks left by access to formal financial services. Preliminary results from Hogset's dissertation research show that in Embu District, where most sample households have access to bank credit and savings services, social networks for informal credit and insurance are far denser than they are in Vihiga District, where very few households enjoy access to formal financial services. This greater access to financial services is strongly and positively associated with increased likelihood of adoption of improved natural resources management practices (e.g., improved fallows or *tumbukiza*) that sustain soil quality and thus long-term productivity on farm.

h. Similarly, in Madagascar, we have similarly found important **market-level obstacles** to growth among poor households. Basic food markets that appear to operate quite efficiently at the local, commune level (within *fivondronana*), appear vulnerable to non-competitive manipulation by traders at regional levels (within provinces but between *fivondronana*) and largely segmented from one another at national scale by poor infrastructure that drives transportation costs so high as to effectively preclude profitable trade across the whole island. The consequence is an economy *enclavé*, one segmented into distinct sub-markets, some of which lack market-level competition necessary for farmers to enjoy incentives to invest in productive new technologies. The predictable consequence is geographic poverty traps of the sort we see in our survey data for Fianarantsoa, the poorest province in the nation.

i. These regional-scale markets problems are compounded by electoral politics that similarly complicates the **distribution of essential public goods and services** (e.g., health and education). Moser's dissertation research shows that because the provision of public goods and services attracts votes, incumbent politicians have an incentive to distribute such goods and services so as to maximize their chance of re-election, leading to deviation from the allocation appropriate to poverty reduction goals. Data from our 2001 commune census and the 2001 national presidential election in Madagascar, combined with the national poverty map, suggest that the foregone poverty reduction effects due to electoral pressures are quite substantial.

j. In theoretical work motivated by our observations in rural Kenya, we model the educational disincentives created by **spatial differences in public goods and services** that affect labor productivity (e.g., workers are more productive where electricity allows them to use advanced machinery and where reliable police protection means they do not have to dedicate time to security-related activities). When poor children and their parents do not have access to loans to pay for the costs of secondary or tertiary education, informal loans and gifts can, in principle, enable children blessed with talent to continue in school regardless of their household's wealth. Oral history suggests this used to occur in rural Kenya, as elaborate gift and loan networks provided for the education of talented rural children. But as spatial disparities in labor productivity have grown due to striking differences in institutional and physical infrastructure between rural and urban areas, educated children become more likely to outmigrate and not return, making collection of past debts and reciprocity more difficult. The predictable result is that only families able to self-finance their children's education can afford the secondary and tertiary education necessary to enter higher-return segments of the non-

farm labor markets and the informal financing of poor rural children's education has been effectively choked off.

X. Photos, Illustrations, or Other Graphics:

Fourth Annual Team Meeting participants. March 15-16, 2004
Outspan Hotel, Nyeri, Kenya

Front row (L-R): David Amudavi, Justine Wangila, Nelson Mango, George Keya, Festus Murithi, J.K. Moi, Francis Kihanda, Gatarwa Kariuki

Back row (L-R): Chris Barrett, Jhon Rasambainarivo, Frank Place, Josephat Cheng'ole Mulindo, Collins Obonyo, David Mbugua, Alice Pell, Heidi Hogset, Martins Odendo, James Ouma, J.T. Muchoki, Dennis Simiyu, Elizabeth Nambiro (not shown: Ben Okumu)

Appendix A

La production rizicole de Madagascar continue toujours d'intéresser Cornell university

Les paysans représentent 80 % de la population malgache et 95 % d'entre eux sont des riziculteurs. Pourtant, leurs productions n'arrivent pas à satisfaire les besoins annuels du pays. La situation rend perplexe plus d'un observateur.

L'université de Cornell, quant à elle, ne cesse de porter une attention particulière à notre système de production rizicole. En 1992 et 1993, par exemple, le Professeur Chris Barret a mené de fructueuses recherches sur la riziculture malgache.

FOFIFA et l'université de Cornell

La FOFIFA, partenaire stratégique de la FAO et du MAEP dans le cadre de la célébration de l'Année internationale du Riz (AIR), travaille étroitement avec l'université de Cornell. En effet, Bart Minten, chercheur américain est un proche collaborateur de l'équipe de François Rasolo, Directeur Général de la FOFIFA.

Mais sur la base des études publiées par Joseph E. Stiglitz, prix Nobel d'économie en 2001, l'université de Cornell a émis trois thèses principales sur la théorie des contrats agraires pour expliquer l'échec de la riziculture à Madagascar. Ces trois thèses correspondent chacune à trois pratiques toujours d'actualité non seulement à Madagascar mais dans bien des pays tels que le Mexique, les Philippines, l'Ethiopie...

Les études menées par Marc F. Bellemare sont cofinancées par deux importants organismes américains.

Des contrats agraires au métayage inverse

Le premier modèle relève du fermage ou de la location contre argent ou quantité fixe de la récolte. Le contrat de salariat constitue le deuxième modèle, c'est-à-dire l'exploitant est le propriétaire même de sa terre. Il peut donc embaucher des salariés.

Le troisième type de contrat est du domaine du métayage, c'est-à-dire que le propriétaire de la terre demande à l'exploitant une fraction de sa récolte. Cette pratique est très répandue à Madagascar malgré les interdictions des textes publiés à cet effet d'autant plus que le "*métayage inverse*" existe partout.

- Appauvrissement des paysans

Avec le "*métayage inverse*", beaucoup de pauvres paysans, propriétaires de terre, laissent en location leurs parcelles à des locataires riches. Ce système renversé renforce leur appauvrissement. C'est donc un blocage majeur pour une grande partie de nos "riziculteurs".

Pour expliquer ce phénomène, le Canadien, boursier de l'université de l'université de Cornell, Marc F. Bellemare du "*Departement of Applied Economics and Management*" est dans nos murs actuellement en vue d'une thèse de doctorat en Economie. Pour ce faire, il va effectuer 300 observations auprès des 6 communes rurales de la région d'Alaotra.

Son directeur de thèse, le Professeur Chris Barret, lui a suggéré comme choix Madagascar.

Rivonala R
032 05 377 34

Appendix B

Embu Feedback Workshops

Introduction

Over the week of 6th to 8th July 2004, three community feedback workshops were held in the 4 extension units studied under the BASIS CRSP Poverty Traps Project in Embu. The first meeting was in Mukangu on the 6th of July 2004, second in Manyatta on the 7th and the last in Kavutiri on the 8th of July 2004. The workshop in Kavutiri was attended by farmers from Kavutiri and Kianjuki.

The main aim of the workshops was to share key findings or highlights from the first round of the survey and preliminary analyses thereof (Wangila et al 2004) with the participating farmers and extension staff.

The project staff participating were Festus Murithi and Elizabeth Nambiro (KARI Headquarters); Justine Wangila (ICRAF Headquarters); James Ouma, James Thuranira, Madrine Nthiga, Alice Omokamba and P. Mucheru Karichu (KARI Embu); and Heidi Hogset (Cornell University). Dennis Simiyu and Frank Place could not attend as were they sitting exams (University of Nairobi) and home on leave, respectively.

Presentations

The presentations were structured around:

- **Extension staff** - Welcome and introductions
- **Project staff**
  - Workshop Objectives
  - BASIS CRSP and NSF Projects and activities inter-linkages and intra-linkages
  - Sampling to explain why only a few farmers were chosen
  - Household access to land and allocation to annual and perennial crops in both the long and short rains
  - **Gross margins (GM) for selected food and crops**
  - **Input and output marketing problems**
  - Financial Markets - Money Lending Institutions and Collaterals for loans
  - Institution and social networks presented by Heidi who though a student, her research work fit in the overall BASIS CRSP Project and specifically be important in informing microfinance policy.
  - Dairy Production
  - Incomes
  - Contribution of different enterprises overall and in different extension units

    - Categorization of farmers by income classes in different extension units
- **Farmers** - Feed back from the farmers.

Highlights

Farmers change amount of land different crops between the long and short rains because: of amount of rainfall which is lower during the short rains.

- It was way of hedging against vulnerability and risk associated with the climate/weather.
- This is more so for tomatoes whose acreage in the short rains season is increased beyond the long rains season acreage of perceived decrease of risk of blight infestation.
- More Irish potatoes are grown or more land is put to Irish potatoes in the short rains season because of their shorter maturing period compared to maize.
- Maize and beans do well in the long rains season while Irish potatoes do better in short rains season.

Gross margins short that beans have higher margins than maize and tea has higher margins than tea. Farmers pointed out that this could only be true because of problems with coffee marketing and poor coffee prices. Lower gross margins for coffee are also due to poor management of coffee cooperatives. It was agreed that the key to increased margins is reduction in input costs and increased yields (central to the workshop objectives). This can be achieved through early planting, purchasing of inputs early enough and proper crop planting spacing. Will farmers achieve same gross margins from monocrops compared to inter-crops?

Credit in the groups and merry-go-rounds is limited by the local economic conditions.
Farmers stressed that apart from tea and coffee, Macadamia nuts are an important cash crop whose price has recently increased to Kshs 25 – 35 per kg. Indeed, in Kavutiri representatives of Farm Nut Limited attended our workshop as observers. They pointed out that there are now about 8 companies dealing in the nuts in the region and that processing is done for the local market but raw nut are exported.
In response to merry-go-rounds and modes of sharing the pot, farmers pointed out that merry-go-round are mainly for women and men mostly participate in share-dividend based groups.

Most of the land rented out in Kavutiri is hired by farmers from Kianjuki though there are some cases of farmers in Kavutiri renting land in Kianjuki, implying an active land rental market.

Maize-beans intercrops are most prevalent; and though not all output is sold, what is consumed is valued for inclusion in the computation of gross margins and incomes.
Though initially farmers confessed to not fully understanding the purpose of the project/study, after presentations, they were very happy and saw the value of the study; and the concept of poverty traps and dynamics is now well understood.

Farmers agreed with the inter-extension unit assessment of poverty levels or income categories; pointing out that it is lower in Kavutiri because of earnings from tea and micro-finance assistance available using cash crops as collateral. Some farmers in Kavutiri/Kianjuki do grow pyrethrum.

Poverty in Kianjuki is higher than in Kavutiri because low micro-finance, less tea in most cases and poor returns to coffee.

Questions

1. What are the chemicals are suitable for treatment of potato blight, how are they applied and in what quantities?
2. How can KARI help avail superior varieties of Irish Potatoes (multiplied at Tigoni, Kiambu district) to farmers?

   Farmers who accessed these seeds in the last season were encouraged to start local (on-farm multiplication) for supply to neighbors as a livelihood strategy and source of income.

   The seeds are currently not available at KARI Embu and farmers will be informed if they become available through the extension staff or BASIS Project staff on the ground.
3. Can KARI introduce fertilizer trees in the area as promised by the team dealing with soil sampling?

   It was explained that because most of the tree species were based on the concept of improved fallows yet farmers in Embu hardly and rarely leave land under fallow because of small land sizes, these species from western Kenya can only be introduced on trial or demonstration basis. Farmers readily volunteered plots for demonstrations.
4. What are the world (international) prices of tea and coffee?
5. Is it possible to select farmer in the study area for demonstration of researched technologies, extension and to act as farmer field school?
6. Since provision of artificial insemination services is problematic what can KARI do to assist?
7. The following questions were raised on gross margins.
   a. Farmers wondered if they or their literate sons can be taught how to compute gross margins?
   b. Why are gross margins computed separately yet most farmers intercrop maize and beans, and other grow maize as a monocrop?
   c. Why the costs for planting and weeding of beans are zero?

      This is because beans are planted as an intercrop with maize.
8. Is it possible to provide farmers with abridged versions of the reports/results both from the soil analyses and poverty traps study?
9. Why it is that tissue cultured bananas do well when planted 1st time but start dying out during the second time? I thought bananas were perennials!!!!!!!!!!!
10. Where are soils sampling results for individual farmers?

    The initial results were passed to extension officers and other results will be availed when ready.

11. How will farmers benefit or what feedback do they expect from participation in the research activities? Will government assist in one way or another?
12. How can farmers get financial assistance from the government like in the day gone by when the Agricultural Finance Corporation was functional?
13. How can farmers solve the problem of poor seed germination especially Irish potatoes on which a chemical is used for 'cheating potatoes'?

Comments by farmers

- A farmer commended that per kilogram earnings from tea appeared lower than what they actually receive. It was however explained that the calculation were based on net earning as reported by farmers and gross payable at the factory and were also average across tea farmers.
- Need to access more improved goats.
- Farmers were grateful for the Irish Potato and maize seeds that were provided by BASIS CRSP and NSF projects during the long rains 2004. However, the rains in this season are below normal.
- Farmers requested for assistance with the acquisition of irrigation equipments or systems.

Farmers' stated Problems

- Fertilizer is not delivered on time and is sold at very high prices deteriorating terms of trade be crop outputs and fertilizers.
- The price of fertilizer is very high.
- Seeds are mostly fake, expensive or adulterated, therefore to the Appointed Stockists
- Pests are many and a big problem to many crops on the farms.

Some Responses from the BASIS CRSP team

- The KARI managed ATIRI grant making project is an opportunity for addressing problems facing farmers in a locality. Similarly, the recently launched Kenya Agricultural Productivity Programme (KAPP) that was put together by the Ministries of Agriculture and Livestock and which will cover Embu among other select districts opens up opportunities for addressing these problems.
- The newly launched Strategy for Agriculture further emphasizes agriculture as a major source of growth of Kenya's economy.
- A trip will be organized (Mr. James Ouma) in collaboration with the local extension staff for each extension unit possibly before the start of the second round of the survey for farmers visit the KARI Embu station to see what is done there especially more information on the new varieties which are resistant to diseases and quick maturing.
- The extension policy of demand-driven extension approaches should enable farmers have individual problems addressed.
- The attendance was 79% in Manyatta, 59% in Kavutiri, 61% in Kianjuki and 69% in Kianjuki with a combined attendance rate of 67% which is quite high. All those who turned up unanimously agreed to participate in the second round of the survey starting from August/September as they could now see the benefits of the study.

Participants by Extension Unit

	MUKANGU		
1	Akisha Muthoni	F	
2	Rose Muthanje	F	
3	Michael Munyi	M	
4	Joseph Mwaniki	M	
5	Simon Njeru	M	
6	Ephantus Kariuki Mbeca	M	
7	David Kariuki	M	
8	Dominic Mbogo	M	
9	Kariuki Katharane	M	
10	Mrs Njeru	F	Representing deceased husband
11	Nathan Njuki	M	
12	Jeremiah Gakonyo	M	
13	John Njue	M	
14	Reuben Mugo	M	
15	Bidan Kimwandao	M	Rep
16	Gichovi Kimotho	M	Rep
17	Dancan Munyi	M	
18	Kiura Waithanje	M	Rep
19	David Njiru	M	
20	Eustace Kariuki	M	
	MANYATTA		
1	Preston Ndwiga	M	
2	Njoka Ms'imba lMrs	F	
3	Kiura Msimba	M	
4	Peter Nyaga Samwel	M	
5	Elisha Njeru Samwel	M	
6	Godfrey Kariuki	M	
7	Fredrick Njiru Nthiga	M	
8	Gichovi	M	
9	Isaiah Nyaga	M	
10	Beth Muthoni - (rep son)	M	
11	Nicasio Kariuki	M	
12	Joseph Muthumbi	M	
13	Grace Mwaniki Wilson Mrs	F	
14	Rucina Njoki	F	
15	Elisha Njeru Ms'imba	M	
16	Peter Msimba	M	
17	Johnson Gatemauviu Mrs	F	
18	Albert Mwaniki Mrs	F	

19	Catherine Wanja	F	
20	Milka Mugo	F	
21	Benson Njagi Mathenge Mrs	F	
22	Joel Njagi Kagane Mrs	F	
23	Nyaga Kinanda Mrs	F	
		KAVUTIRI	
1	John Ndereva	M	
2	James Kamaitha	M	
3	Hosea Njagi	M	
4	Alice Kuguru	F	
5	Wangui (Ali Stanley Ndwiga)	F	
6	Kithinji	M	
7	Esbon Njiru	M	
8	Peter Mugo	M	
9	Wanjira	F	Jeniffer accompanied her neighbor Wanjira
10	Venus Njuguna Mrs	F	
11	Jane Gatavi	F	
12	Rebecca Wambogo	F	Neighbour to p.post
13	Triza Mairani	F	
14	Keren Rwamba	F	
15	James Njagi Nyagi	M	
16	Jacinda Murangi	F	
		KIANJUKI	
1	Consolata Wanjuki	F	
2	Njura Anjira	F	
3	Kirigi Margaret	F	
4	Joseph Ndwiga Njeru	M	
5	Ndwiga	M	James Nguli accompanied neighbor Ndwiga
6	Eliveret Njeru	M	
7	Nguu Daniel	M	
8	Kiarago Bernard	M	
9	Mbeere Sarah	F	Rep
10	Njagi Jacob Njue	M	
11	Katharanjau Njeru	M	
12	Catherina Runji	F	
13	Wambetti	M	
14	Alice Kanyi	F	
15	Joseph Kagundu	M	
16	John Njeru (Nancy) Mrs	F	
17	Joel Njiru	M	

Appendix C

REPORT OF FARMERS TOURS TO REGIONAL RESEARCH CENTRE EMBU

The idea of BASIS farmers visiting Regional Research Centre - Embu came up during 3 day workshops held in early July 2004 to present results of the first round of survey to farmers. A total of 120 farmers (70 female, 50 male) visited the station on 26th and 27th August 2004. In some cases, both husband and wife were in the group. The farmers were taken around various research plots by technicians and appreciated the wealth of knowledge that they acquired. Their comments are captured in the table below. Most of the farmers confessed that they were visiting the center for the first time despite the close proximity of the Centre to their farms.

Table 1: Research plots visited by farmers and their comments

Research plots/activities	Farmers comments	Remarks
Maize breeding	1. Requested for seeds of some of the newly released Quality Protein maize (QPM) 2. Each farmer was given 250 gm of QPM (104 seeds) for on-farming testing during the short rains 2004. The seeds were donated by Western Seed Company	Farmers participated in the evaluation of the newly released Quality Protein Maize and singled out OPV WSQPM 104 and QPM 3 as the most promising varieties based on flintness, good roasting qualities, medium height, big cobs and tolerance to Maize Streak Virus
Zero grazing unit	1. Requested for Calliandra seedlings and were advised that these were available at the commercial unit (technoshop) of RRC-Embu 2. Farmers are ready to produce more milk since the nearby KCC at Runyenjes is now operational	The dairy unit is used as standard farm model and has various fodders such as Calliandra, Mulberry and Napier grass plus biogas
Tissue Culture (TC) bananas	1. Farmers noted that the TC bananas produce bigger bunches compared to the traditional varieties and are free of diseases. They however said that the market for bananas was still a problem.	
Root and Tubers	1. Noted that the cassava variety, *Muchericheri,* is good food security because of its high production 2. Some farmers collected cuttings of the cassava and vines of sweet potatoes	Cassava variety*, Muchericheri*, has always attracted a lot of attention at agricultural shows due to its high production
Agroforestry (Nursery and techno-shop)	1. Were interested in buying seedling of mangoes and promised to come back at the close of the short rains	The commercial unit sells seedlings to farmers at a reasonable price

Appendix D

UNIVERSITY OF NAIROBI
COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES
FACULTY OF AGRICULTURE
DEPARTMENT OF AGRICULTURAL ECONOMICS

Tel: 631340/631354 Ext 27002
Fax 631815 or 632121

P.O. BOX 29053
NAIROBI, KENYA

15/12/2003

Dr. Festus M. Murithi
KARI, P.O. Box 57811
Nairobi

Dear Sir,

RE: INVITATION TO PARTICIPATE IN A STAKEHOLDERS' WORKSHOP ON LINKING RESEARCH TO POLICY.

I am writing to invite you to participate in the above stakeholders' workshop which will be held on **Friday 23rd January, 2004** at the **Kenya Agricultural Research Institute (KARI) Headquarters at Loresho, Nairobi.**

The objective of the initiative is to explore ways of strengthening linkages, with long term perspective, between research institutions and policy makers in emerging policy processes related to rural growth and poverty reduction. The workshop participants will discuss and develop outlines of Terms of Reference for Studies on "***Deriving Lessons from Outputs of Agricultural and Natural Resources Research to Inform Policy and Institutional Reform Processes in Kenya".***

Most of the participants will be drawn from the Policy Research Strategy Group (PRSG). The membership of this informal group includes policy researchers from Kenya Agricultural Research Institute (KARI), Universities (Nairobi, Kenyatta, Moi), Public/Private National Research Institutions (Tegemeo, IPAR, KIPPRA), International Research Institutes (ACTS, ICRAF, ILRI, ICRISAT, AU/IBAR, CIAT, CIP, and CIMMYT), and International Development Bodies (World Bank, Rockefeller Foundation).

It will be an opportunity for the Policy Research Strategy Group (PRSG) and other stakeholders to give direction to the much needed study. Your participation and contributions will be highly appreciated. The workshop programme will be sent to you in due course.

I would be grateful if you would confirm your participation to Susan/Catherine on 020-632150 or 020-631815 or e-mail agecon@insightkenya.com

Thank you.

Yours Sincerely,
Dr. Joseph T. Karugia
Acting Chairman, Department of Agricultural Economics

WORKSHOP ON DERIVING LESSONS FROM OUTPUTS OF AGRICULTURAL AND NATURAL RESOURCES RESEARCH TO INFORM POLICY AND INSTITUTIONAL REFORM PROCESSES IN KENYA

Kenya Agricultural Research Institute (KARI) Headquarters at Loresho, Nairobi: Tuesday 27th January, 2004

TENTATIVE PROGRAMME

8.30 -9.00 Registration of Participants

9.00-9.30 **SESSION I –** Opening

- Introductions *(Rose Nyikal)*
- Opening Remarks by Ag. Principal CAVS *(Prof. Peter Mbithi)*
- Objectives of the Workshop *(Dan Kisauzi)*

9.30-10.00 **SESSION II**

- Opening Speech: - Director KARI *(DR. Romano Kiome)*
- Keynote Address: - Permanent Secretary - (*Ministry of Planning and National Development)*

10.00-10.30 **Tea/Coffee Break**

10.30-13.00 **SESSION III**
(10 MINUTES PRESENTATIONS FOLLOWED BY 10 MINUTES DISCUSSION)

- Present and Future Research – Policy Linkages: from a Trainer and Policy Analyst's perspective *(Dr. Kang'ethe W. Gitu)*
- Present and Future Research-Policy Linkages: Successful cases from around the world *(Rachel Lambert)*
- Present and Future Research-Policy Linkages: from a Development Agency's Perspective *(Andrew Karanja)*
- The Role of Policy in Kenya's Agricultural Growth Path (*Director of Agriculture*)
- Recent Livestock Policies that have emerged from research (*Director of Livestock Production*)
- Recent Environment and Natural Resources Polices that have emerged from research (*Director of Environment*)
- How Research and Policy have benefited or stifled the growth of the Kenyan a Agricultural Producer (*KENFAP – Hon Nduati Kariuki*).

13.00 - 14.15 **LUNCH BREAK**

14.15 - 15.30 **SESSION IV**
Reflections on Morning Sessions with respect to extracting research output for policy.

15.30 – 16.00 Summary of Proceedings by Facilitator
Way Forward and Wrap-up

16.00 – 16.30 Tea/Coffee and Departure

Appendix E

KARI / ICRAF / CORNELL UNIVERSITY
BASIS CRSP/NSF BIOCOMPLEXITY PROJECTS
MADZUU SITE

COGNITIVE MAPPING INTRODUCTORY FARMERS FOCUSED GROUP DISCUSSIONS HELD AT THE SALVATION ARMY CHURCH, MADZUU

29/01/2004

Compiled by Justine Wangila

World Agroforestry Centre

A. Introduction

The discussants were David Amudavi, Justine Wangila, Heidi Hogset and Lenachuru, while Japheth Bulali, Godfrey Lomosi and Manoah Obwayo jointly assisted in taking notes in the plenary meetings and group discussions.

The meeting had 2 objectives:

1. Introduce the planned on cognitive mapping survey, and
2. Discuss farmers' perceptions of soil fertility, crop changes and risk assessment, and actual actions and investments that they undertake.

The meeting started with a word of prayer by one of female farmers, followed by self introduction of all those present.

B. Agenda and Objectives

The next item on the schedule was to set the agenda and objectives of meeting, emphasizing the linkages between the BASIS 1989 and 2002 Surveys, Soil Sampling work, individual work by students – David, Heidi and Jane, and the planned Cognitive Mapping exercises. It was stressed that the various research projects aim at poverty reduction.

While the key issues for discussions for the day were soil fertility, crop changes and risk assessment particularly linking scientists' measures to farmer indicators.

I. Soil fertility

The main question was:

- What do farmers consider important in assessing soil fertility?

Subsidiary questions were:

- What are the differences between a good soil and a bad soil?
- How do you know if a soil is excellent, fairly good or bad for production?

- Do you think there are different types of soils on your farm?
- Can you indicate limits of the soil types in your farms?
- Can you mention a few properties of the soil farm that can be modified?
- Do you know properties of soils that cannot be modified?

II. Crop changes

What do farmers consider in making crop changes?

III. Risk assessment

How do farmers view and deal with risk?

C. GROUP DISCUSSIONS

Farmers were divided into 4 groups so as to address the 3 key issues and subsidiary ones comprehensively. Since only 3 enumerators were present to act as group secretaries, one group chose a farmer (an ex-teacher) to notes. The discussions are reported below by group.

1. GROUP 1

Members of this group were Oripa Mudimwa, Tereza Obeni and Jane Murera with Godfrey Lomosi (enumerator) taking notes in this group.

A. SOIL FERTILITY

What are the differences between a good soil and a bad soil?

Fairly good or **fertile** soils 1) are judged by the appearance or behavior of the crop grown, 2) rate at which the crop grows, 3) if the harvest is good or the amount of the big, 4) yield crops that are not very good but medium, and 5) dark in color.

Whereas a bad or infertile soil is evidenced by 1) bad harvest, 2) color of the crop is yellow, 3) the crop if maize is short in size, 4) no harvest at all, and 5) red in color.

How do you know if a soil is excellent, fairly good or bad for production?

Soils are excellent if 1) they produce good crop harvests, 2) the maize cobs are strong (thick?), and 3) the leaves of the crop are very green.

Do you think there are different types of soils on your farm?

Yes there are different soil types.

- Black soil – good harvests
- Red-black - intermediate or medium fertility
- Red – poor harvests.
- The poorest quality is sandy.

Can you indicate limits of the soil types in your farms?

Continuously require addition of fertilizers.

Can you mention a few properties of the soil farm that can be modified?

Red soils can be modified through application of a lot of fertilizers (manure) to turn them into black.

Do you know properties of soils that cannot be modified?

Black soils can not be modified (improved as they are at their best).

B. CROP CHANGES

What do farmers consider in making crop changes?

Farmers change crops on the farms for a number of reasons which include:

- To get higher yields.
- To get or see different responses by crops on particular soils.
- Based on the initial or first crops harvests on particular plots.

C. RISK ASSESSMENT

How do farmers view and deal with risk?

View

- Apply animal manure on hybrid maize to see if it is effective in soil fertility improvement (in some cases the situation may be beyond salvation or redemption).

Dealing with risk

- Rearing of dual purpose cattle
- Planting major food crops

2. GROUP 2

Members of the group were Grace Katziga, Nancy and Jane, and Manoah Obwayo was the secretary.

A. SOIL FERTILITY

What are the differences between a good soil and a bad soil?

A good soil is 1) black in color, 2) produces a good harvest, 3) helps water sink quickly after raining, 4) helps inn quick germination of seeds, 5) no complication in seed germination, 6) the crops root well and grow with strength, and 7) crops reach to maturity earlier.

Whereas a **bad soil** is 1) red in color, 2) produces poor harvests, 3) water does not infiltrate but erodes the soils, and 4) difficult for seed germination.

How do you know if a soil is excellent, fairly good or bad for production?

Excellent soils 1) makes maize grow tall and healthier, 2) beans respond well, and 3) crops generally thrive to a good harvest. **Fairly bad soils** lead 1) medium (standard) growth of crops and 2) crops thrive or respond differently - others tall others medium. **Bad soils** are evidenced 1) by unhealthy crops, 2) crops withering before maturity, 3) at times some planted seeds do not germinate, and 4) these soils do not allow roots to penetrate the easily.

Do you think there are different types of soils on your farm?

This group came up with 4 soil types: black, red, loam and sandy.

Can you indicate limits of the soil types in your farms?

None was mentioned.

Can you mention a few properties of the soil farm that can be modified?

- Soil yielding capacity.
- Changing crops to suit different crops, e.g., from maize to cassava.

Do you know properties of soils that cannot be modified?

- Soil color.
- Crop yield
- One farmer did not know or did not have information.

What do farmers consider in making crop changes?

- Poor responses of some crops.
- Variability in soils suitability for different crops on different plots.
- Good production shown by increased yields.
- Risk from theft as some crops are more prone to stealing.
- Shifts to commercial crops, e.g., from maize to tea.

How do farmers view and deal with risk?

Views of risk

- Fear to diverse to unknown crops or on whose husbandry they lack know-how.
- Pure (exotic) breeds of livestock are expensive (medicine and feeding) to maintain and the environment is unsuitable.
- Small farms leading to inadequate pasture/feeds.
- Loss of farm implements
- Livestock disease prevalence.

Dealing with risk

- Loans for investments.
- Diversification to dairy cows to smooth income streams.
- Planting pasture.

3. GROUP 3

The members in this Group were Mr. Jacob Kinyangi, Mrs. Callan Amadi, Mrs. Edith Mwigai and Mr. Joseph Akello with Japheth Bulali as the Secretary.

What are the differences between a good soil and a bad soil?

Good soils give good harvests and one can tell from the level of harvests. **Bad soil**s 1) give poor harvests, 2) are clay or sandy, 3) and can be detected by crop rotations on different plot, e.g., maize to beans and millet, or from beans or millet to Napier grass, maize to beans, millet to potatoes, cassava to cabbages.

How do you know if a soil is excellent, fairly good or bad for production?

You can know productive soils from harvests of different crops, e.g., maize, millet or beans.

Do you think there are different types of soils on your farm?

Mentioned 3 types of soils but did not specify which ones.

Can you indicate limits of the soil types in your farms?

Stated that soils or farms have bad limits (implying poor yields).

Can you mention a few properties of the soil farm that can be modified?

- Acidity which can be neutralized through digging of terraces, and or planting trees and Napier grass
- Nitrogen – add chicken manure and animal urine.
- Alkalinity – mix branches of grass or trees.

This group stated ways of improving soils such as through digging of terraces, manuring and planting of trees.

Do you know properties of soils that cannot be modified?

Where there is a rock cannot be modified whatsoever, i.e. naturally formed.

What do farmers consider in making crop changes?

Lack of sales or market.

Poor or no harvests.

For crop rotation.

How do farmers view and deal with risk?

Views of risk

- Different losses
- Planting wrong crops or fake seeds.
- Plant different plants.
- Lack of or no money to buy fertilizers, cow, goats etc.
- Rain failures.
- Heavy stones.
- Hail stones.
- Disturbance from locusts.

Dealing with risk

Different losses

- Use manure
- Use terraces
- Plant trees
- Napier grass to feed cows

Wrong crops or seeds

- Look for certified seeds
- Use suitable crops

Lack of capital

- Seek loans from cooperative societies.
- However, hail stones, failure of rains and locusts are natural hazards that are unavoidable.

4. GROUP 4

The members were Musazi (Secretary), Oshiago, Mugenya and Gimwei.

What are the differences between a good soil and a bad soil?

The characteristics of a **good soil** are 1) sustaining crops like bananas and groundnuts, 2) supporting crops like sugarcane and cabbages/ kales, 3) deep, and 4) dark in color. Those a **bad soil** include 1) inability to sustain crops like maize, 2) yellowing of crops especially beans, 3) a bit stony, i.e. large particles, and 4) reddish in color.

How do you know if a soil is excellent, fairly good or bad for production?

This can be capture through the use of manure, quantities of harvests, and soil color e.g. red is poor

Do you think there are different types of soils on your farm?

There are 3 different types of soils on the farms, which are 1) black soil mostly on home gardens, 2) red on upper parts of the farms, and 3) murram soil also in upper parts of the farms.

Can you mention a few properties of the soil farm that can be modified?

- Soil fertility – nutrient level through mulching.
- Soil color – use of ashes and cow dung.

Do you know properties of soils that cannot be modified?

- Soil texture e.g. murram soil
- Stony soils.
- Hard pans – "oluhanda."

What do farmers consider in making crop changes?

- Harvest quality
- Fertility of the farm with respect to crop being crop.
- Marketability of the crops being grown.
- Family food requirement.
- Farm labor input.
- Crop input requirements e.g. seeds.

How do farmers view and deal with risk?

- Rainfall pattern (irregular) leading to late planting e.g. in March where one is sure of April long rains.
- Pricing i.e. poor prices of products e.g. coffee – cannot cope – discard some crops e.g. coffee.
- Rodents especially mole (root crop) – trapping the rodent using wired bows- kills or use of animal/ cattle urine to repel the rodent i.e. pouring urine in mole holes.
- Dairy farming (inputs) – rearing of dual purpose cattle
- Poultry farming – rearing a small stock/ maintaining a small stock of about two birds to prevent losses.
- Disease outbreaks.

GROUPS PRESENTATIONS TO PLENARY AND SUMMARY OF SOIL FERTILITY INDICATORS

A farmer from each group presented to the plenary in a language of choice, ranging from Kiluhya, Kiswahili through English or mixtures, assisted by the secretaries to clarify issues and other members to answer questions.

Based on these presentations, the meeting initially came with 16 soil fertility indicators were identified in no order of importance as

1. Type of crop being grown.
2. Crop health – crop color, height.
3. Soil color
4. Black is best
5. Red is poor
6. Yield of the crop.
7. Crop residue quality.
8. Water retention capacity.
9. Soil texture.
10. Rate of growth (Quick growth)
11. Water logging – poor soils.
12. Wilting level
13. Crop range/variety
14. Soil Depth
15. Support to both cash crops and food crops
16. Soil structure.

Further deliberations reduced the number of indicators from 16 to 14 as numbers 4 and 5 above were re-grouped under the broad indicator of soil color.

The next stage was to ask farmers to score each indicator against all the others using a simple methodology that ensures pair-wise rating of all indicators.

The cross-tabulation of the indicators is as in Table 1 below.

Table 1

CROSS TABULATION OF FARMERS PERCEIVED INDICATORS

Indicator

Indicator	CT	CH	SC	CY	CRQ	WR	STex	CGR	WL	W	RC	SD	CFC	SST
CT		CH	CT	CY	CRQ	WR	STex	CGR	CT	W	RC	SD	CFC	SST
CH			CH	CY	CRQ	CH	STex	CH	CH	CH	RC	SD	CFC	SST
SC				CY	CRQ	WR	STex	CGR	SC	W	RC	SD	CFC	SST
CY					CRQ	WR	STex	CGR	CY	W	CY	SD	CFC	SST
CRQ						WR	CRQ	CRQ	CRQ	W	RC	SD	CFC	CRQ
WR							WR	CGR	WR	W	RC	SD	CFC	WR
STex								CGR	STex	W	RC	SD	STex	STex
CGR									CGR	W	RC	SD	CFC	SST
WL										W	RC	SD	CFC	SST
W											RC	W	CFC	SST
RC												SD	CFC	SST
SD													SD	SD
CFC														CFC
SST														

Key							
CT	Crop type	CH	Crop health	SC	Soil color	CY	Crop yield
CRQ	Crop residue quality	WR	Water retention	STex	Soil texture	CGR	Crop growth rate
WL	Water logging	W	Wilting	RC	Range of crops	SD	Soil depth
CFC	Cash and food crops	SS	Soil structure				

Then next step is a count of how many times an indicator was mentioned so as to arrive at a ranking or prioritization of the soil fertility indicators. The results of this exercise are as indicated below in Table 2.

Table 2

Indicator	Abbreviation	Score	% score	Rank
Soil depth	SD	12	13.2	1
Support cash and food crops	CFC	11	12.1	2
Wilting	W	9	9.9	3
Range of crops	RC	9	9.9	4
Crop residue quality	CRQ	8	8.8	5
Soil structure	SST	8	8.8	6
Water retention	WR	7	7.7	7
Soil texture	STex	7	7.7	8
Crop growth rate	CGR	6	6.6	9
Crop health	CH	5	5.5	10
Crop yield	CY	5	5.5	11
Crop type	CT	2	2.2	12
Soil color	SC	2	2.2	13
Water logging	WL	0	0.0	14
All indicators		**91**	**100**	

From the above table, the most important indicator is the soil depth. However, a deeper look shows that ability to grow a wide array of crops as evidenced by the scores for 1) support of cash and food crops, and 2) range of crops which total to 20% is the most important. This shows farmers concern for food security and livelihood security.

Particpants

Discussants
- David Amudavi
- Justine Wangila
- Heidi Hogset
- Lenachuru

Secretaries/enumerators
- Japheth Bulali
- Godfrey Lomosi
- Manoah Obwayo

Farmers
1. Tereza Oben
2. Oripa Vudimwo
3. Jane Murera
4. Grace Katziga
5. Resba Mayende
6. Jacob Kinyangi
7. Jane Arekwa
8. Edith Mwigai
9. Kellan Amadi
10. Jimwei Imbaya
11. Joseph Akelo
12. Mugunya Mbaya
13. Fanuel Muzazi
14. Francis Oshiago

Appendix F

"Rural Markets, Natural Capital and Dynamic Poverty Traps in East Africa"
Fourth Annual BASIS CRSP Project Team Meeting
March 15-16, 2004
Outspan Hotel, Nyeri, Kenya

Meeting Objectives:

1. Brief team on results of qualitative research from Madagascar and Kenya under the Social Aspects of Dynamic Poverty Traps sub-project.
2. Present results of quantitative analysis of data from the project sites.
3. Present CLASSES model calibrated to Madzuu site in western Kenya.
4. Present related graduate student research.
5. Discuss related work on soils analysis and natural capital – poverty dynamics relationship.
6. Pin down FY2004 (Oct. 1, 2003 – Mar. 31, 2005) workplan details: who takes responsibility for which remaining activities (see calendar and listing of anticipated published outputs after meeting agenda)?
7. Help with team building by providing more opportunity for team members from different institutions to interact with one another.

2004 Team Meeting Agenda
Sunday, March 14
Participants arrive at Outspan Hotel, Nyeri

Monday, March 15 Discussion Leader
At Outspan Hotel, Nyeri
08:00 Welcome to 2003 team meeting Representative of KARI
08:15 Participant introductions All team members and guests
08:30 Review of project overall, FY03-04 objectives Chris Barrett and promised project outputs
09:15 Findings of qualitative research in Madagascar Jhon Rasambainarivo
10:00 Coffee/tea break
10:30 Findings of qualitative research in Kenya Nelson Mango/Festus Murithi/Frank Place
11:15 Findings of comparative quantitative research Barrett
12:00 Lunch
13:30 Graduate student preliminary research findings Heidi Hogset
14:00 Graduate student preliminary research findings David Amudavi
14:30 Group discussion of results and synthesis Team
15:30 Coffee/tea break
16:00 Presentation of results from soils work in Madagascar Rasambainarivo

16:30 Presentation of findings from NSF project David Mbugua/Alice Pell
17:00 Closing group discussion and comments Team
19:30 Group dinner

Tuesday, March 16 Discussion Leader
08:00 Presentation/discussion of CLASSES model for Madzuu Ben Okumu
10:00 Coffee/tea break
10:30 Coordination of remaining project research: Barrett/Place/Murithi/who does what and when? Rasambainarivo
12:30 Lunch
14:00 Coordination of remaining project outreach: Murithi/Rasambainarivo community/national stakeholder meetings
15:30 Coffee/tea break
16:00 Final group discussion of BASIS outreach, research, Team and training activities … potential extensions
17:00 Close of team meeting
Team members depart Tuesday evening or Wednesday morning

Participants

From Kenya:
David Amudavi
Dr. Gethi
Heidi Hogset
Gatarwa Kariuki
George Keya
Francis Kihanda
Nelson Mango
David Mbugua
Josephat Mulindo
Festus Murithi
Elizabeth Nambiro
Collins Obonyo
Martins Odendo
James Ouma
Alice Pell
Frank Place
Justine Wangila

From Madagascar:
Jhon Rasambainarivo

From US:
Chris Barrett
Ben Okumu

Meeting Notes
Chris Barrett and Festus Murithi opened the meeting with some preliminary remarks explaining the nature of the project for all participants. Each participant then briefly introduced him/herself.

The Eastern Provincial Deputy Director of Agriculture then formally opened the meeting with a welcome to Nyeri.

Nelson Mango, a development sociologist, gave a presentation on the qualitative findings of the Social Aspects of Dynamic Poverty Traps study in Kenya. See the accompanying Powerpoint file (similarly for each of the other presentations over the two days). Across all three sites, education and connections necessary to get a good off-farm, salaried job is key to escaping poverty. Diversification into higher-return off-farm and on-farm activities (e.g., higher-value horticultural products) and a wider social network are likewise strongly correlated with likelihood of escaping poverty. A stable family life,
self-discipline and work ethic are key to avoiding collapse into poverty, as is capacity to safeguard your assets against claims from poor relatives.

Not everyone can access these strategies. They haven't extensive social networks to be able to borrow, to find jobs for educated family members, and to learn about promising agricultural products and technologies. They lack the education necessary to get a good off-farm job. They haven't livestock enough nor cash to move into higher return niches.

Those who fall into poverty tend to have experienced a death of a key adult worker in the household. Health care and funeral expenses force households to liquidate productive assets and the household loses valuable labor. Loss of stable, salaried/wage employment is likewise a key factor. Natural shocks (drought/flood) often associated with collapse into poverty (through health shocks, loss of farm employment and loss of livestock).

Finally, shrinking land sizes (plots for cultivation shrinking due to farm partitioning for adult children, or reduced grazing area due to increased competition, encroachment by crop cultivation or insecurity) and decreasing land quality due to nutrient depletion and erosion (in cropping areas) or localized overgrazing or introduction of invasive species (in grazing areas) are likewise associated with households' collapse into poverty when they cannot come up with non-farm employment.

The nonpoor tended to be more actively engaged in conserving natural resources. The poor are understandably preoccupied with taking care of themselves, in some cases even overharvesting resources (e.g., firewood/charcoal) in their struggle to survive.

Gatarwa Kariuki, the social anthropologist at KARI-Marsabit who led the fieldwork in Dirib Gombo, emphasized the importance of social networks in helping people . In the lower potential areas of Baringo and Marsabit, respondents placed relatively greater emphasis on natural shocks – livestock disease, drought, etc. – as an explanation for collapse into poverty. Markets are increasingly important in all sites, especially for facilitating peoples' escape from poverty. Josephat Cheng'ole Mulindo, the KARIPekerra agricultural economist who led the fieldwork in Baringo, then discussed the importance of choice of families into which one marries off one's daughters, livestock lending and hiring herders, etc. A variety of questions and comments emerged from the group, from David Amudavi, Chris Barrett, George Keya, Francis Kihanda, David Mbugua, Festus Murithi, Collins

Obonyo , Martins Odendo, Ben Okumu, Alice Pell and Frank Place, asking for clarification of what sorts of social networks help and hinder, for a bit more precision as to what strategies prove most important/effective in helping people escape/avoid poverty, and for clarification on the relation between poverty and mining of natural resources (e.g., through brickmaking). Nelson responded that people commonly construct multiple, intersecting networks to serve their objectives, that success in deflecting damaging social claims on one's resources requires a certain level of cleverness and creativity. George Keya challenged the importance of social networks,
emphasizing that increasing individualism has caused significant deterioration of the use and effectiveness of clan-based networks in all of these places. Frank Place emphasized that creating new productivity in crucial ... social networks may be effective as individual strategies but they don't work at larger scale since networking for a job doesn't create any new goods or services or productivity, so while it can be a good strategy at household scale it's not at national scale. Frank also emphasized the time scales involved.

Education might be a good long-term strategy, but few poor people can now invest with such long-term payoffs. Alice pointed out that depleting soils can be a short-term strategy that helps conserve human capital short-term but has a big long-term cost.

Jhon Rasambainarivo, the FOFIFA PI under BASIS, then presented findings from the qualitative ("social aspects of dynamic poverty traps") study in our two Madagascar sites.

They find that the dynamics of escape from poverty are closely linked to diversification within agriculture into higher value enterprises (fruits, dairy, vegetables) and into remunerative non-farm activities (e.g., owning a restaurant or a store or a construction business, salaried employment). The key ingredient is really stable cash flow from offseason cash crops, dairy, wages, etc. as a complement to annual crop income from rice and maize. People get poorer due to shocks: illness or death in the family, biophysical shocks that kill livestock (e.g., disease, drought) or destroys crop (e.g., hail, drought).

Children's education is a high priority because it is almost necessary for long-term escape from poverty through non-agricultural employment. Land inheritance is a key correlate to being nonpoor, suggesting much intergenerational propagation of poverty. Josephat Cheng'ole Mulindo and Alice Pell asked about education and cost. In Madagascar, the cost of education is much lower at secondary level than it is in Kenya, so education is more accessible. Josephat mentioned that in Baringo (Kenya) some households blame education for their poverty, because they spent lots of money on school expenses and lost their children's labor while they're in school. Justine Wangila asked about those who remain nonpoor. Jhon emphasized their inheritance and the diversification of their activities on-farm and supplementation with decent off-farm employment. Those who remain poor have very little land, too little to be self-sufficient, and they haven't education enough to get salaried employment, so they depend on casual, unskilled wage labor to earn enough money to buy their rice. George Keya asked about definitions of poverty lines and food security. Frank Place asked about off-farm diversification.

Jhon explained that this is primarily in off-season, in the dry period, when people engage in construction, seasonal migration, etc. Some people have year-round sources, but most use seasonal cash supplementation of household rice production. Heidi Hogset asked about differences in NRM and improved technology adoption between the poor and nonpoor.

Jhon remarked that there seem to be relatively modest differences in NRM but significant correlation between technology adoption and initial wealth/income, e.g., with SRI. Ben Okumu asked about farmers' perceptions of the link between health and food consumption. David Amudavi asked about importance of land to welfare dynamics.

Jhon emphasized that in the highlands, greater population density makes land that much more important, in particular lowland rice fields (not rainfed hillsides). Adult children need either a decent sized plot to be able to make it as a farmer or a good education to be able to make it in the non-farm sector. In Kenya, land is relatively less important, in contrast to nonfarm employment, than in Madagascar because there's a more vibrant nonfarm rural economy. David Mbugua asked about maintaining soil fertility in continuous rice cultivation. Jhon responded that manure from cattle is central to maintaining yields. Those households that are too poor to have cattle get lower yields and then wind up dependent on the wage labor market. So livestock boost labor productivity, in part through effects on soil fertility and crop production.

Chris Barrett then presented preliminary results from the quantitative analysis of survey data. (Sorry, I can't take notes on a discussion when I'm presenting.) A key thread of the conversation was the importance of integrated development strategies, for example, introduction of zero grazing, improved livestock keeping requires development of milk markets and disease prevention.

Heidi Hogset presented early, descriptive results from her ongoing dissertation field research in Embu and Vihiga Districts on social networks and the adoption of improved natural resources management techniques. She has 114 and 128 respondents in Embu and Vihiga, respectively, for her broad survey. She has surveyed a subset of these households (28 and 24, respectively) to reconstruct social networks to second order through snowball sampling. She finds that Embu has much denser social networks, especially exchange networks (in which people give gifts, lend/borrow or exchange labor), than does Vihiga. Density of social networks is positively correlated with incomes. Adoption of organic fertilizers and terracing is widespread in both sites.

Adoption of tumbukiza (deep incorporation of organics through double digging) is relatively widespread in Embu but not in Vihiga; same for use of fallows/improved fallows. Conflicts over weed or water spillovers are more common in Embu. In Vihiga, people are more likely to have an unmet emergency but less likely to ask for help. Nelson Mango and Martins Odendo asked about the problem of network endogeneity and how one can establish whether a larger network causes technology adoption or if

technology adoption causes one's network to expand or to change. Heidi emphasized that she can trace the sequencing of adoption and what she's after mainly is the direction of information flow. Justine Wangila asked about the spatial spread of respondents' networks. Heidi observed that the vast majority of contacts are very close, mostly one kilometer between homes or less. Very few direct network members in urban centers.

David Amudavi presented early, descriptive results from his ongoing dissertation field research in Baringo, Embu and Vihiga Districts on community groups and partnerships. He's trying to establish which sorts of groups can help build wealth and reduce food insecurity among the poor and which are ineffective at this, as well as which partnerships between community groups and external agencies (what sorts of transfers – info, money, technologies, etc.) prove helpful with which sorts of groups. He presented a long battery of characteristics of groups that he has found, the shortcomings of these groups and their partnerships with external agencies, etc. Collins Obonyo asked about inter-institutional coordination and the role of government District Development Committees (DDCs), which have formal responsibility for this. David observed that DDC coordination is theoretical/rhetorical, but not functioning in reality. Agencies, at most, pay a courtesy call on the DDC or the District Development Office (DDO), and then proceed to the field to do what they want. The Deputy DPA remarked that external donors direct different terms (what they provide, where, to whom, etc.) for group formation, but these efforts are all driven from above, based on a donor's vision of optimal design irrespective of local conditions. This crowds out much prospective group activity and causes disconnects between local needs and resource availability. Coordination problems are significant.

George Keya observed that groups may be formed for one reason and then subsequently shift toward or acquire another purpose as they evolve. Also, sometimes, groups don't need to be sustainable. Some activities necessarily have a fixed term of relevance and thus they should emerge, work and then dissolve. That's not a problem. David replied that he's focusing on groups for which there remains an ongoing need and thus dissolution is an undesirable thing (relative to the continuation of a successful group).

Alice Pell and David Mbugua presented preliminary findings from the closely affiliated NSF Biocomplexity project based on a paper prepared for the recent AAAS meetings in Seattle. Need to understand how farmer decisions affect agroecological system functioning and how they understand (i) their environment and (ii) how their actions affect the agroecology. Then need to understand how agroecosystem state affects farmer choice, thereby creating a feedback loop. Key questions about the agroecosystem concern how long it takes for soils to become degraded and what is required for soils to be replenished? Chronosequence data underscore that soils deplete relatively rapidly. P appears to become limiting after about 15 years' continuous maize cultivation. Maize quality and quantity in harvest fall off markedly in old conversion plots. Percent soil carbon falls from 11-12% at newly converted lands to around 2% at 20-30 years, at which

point it stabilizes thereafter. The same sort of hyperbolic relation emerges when one studies soil enzyme activity ... fertility falls off quickly, bottoming out after 15-30 years' continuous cultivation. There's a strong correspondence between soil fertility indices based on spectral data on soils and farmers' perception of soil change. In Embu, SFI are much higher and farmers commonly perceive that soil quality is improving, while in Madzuu farmers typically indicate that their soils are degrading and SFI measures indeed bear out that soil quality is strikingly lower than in Embu. Current soil repletion trials are exploring how treatment efficacy (manure, inorganic fertilizer, etc.) varies with time since conversion. We are simultaneously trying to understand farmers' perceptions of this through a "cognitive mapping" exercise. There is also field research on animal performance in Embu and Vihiga and how livestock management and performance is related to nutrient intake and manure output (and its resulting contribution to soil fertility). High quality manure seems to degrade quite quickly while lower quality manure degrades more slowly. Francis Kihanda observed that there already exist some studies of farmer perceptions of soil quality and manure management in Kenya and that it would be wise to draw on these. Typically, scientists' measures of soil quality and farmers' perceptions of soil quality correspond reasonably well. He asked about the level at which soil organic carbon becomes problematic ... isn't there much difference across soil types, altitude, etc. that matter? Alice and David replied that we're now studying soil organic matter fractions, the stable/labile fractions we're presently computing (as well as N and P) probably will give us a more robust measure of soil quality and resilience.

Frank Place observed that Embu farms were not converted more recently than Vihiga farms. So why the difference in SFI and farmer perceptions when the chronosequence suggests all should degrade? And to what extent are the concepts of thresholds and traps relevant in soils and animals? Alice replied that our trials are trying to look explicitly for multiple equiliibria and threshold effects in soils (the break between labile and stable SOM fractions) and in animals (e.g., adequate nutrient intake in early lactation due to basal metabolic rates). Ben Okumu and Chris Barrett both remarked on the prospective persistence of farmer soil perceptions, i.e., farmer assessments might not evolve at the same rate as soil biophysical characteristics. Alice remarked that this is an issue with the chronosequence ... mismatches may be greatest in recently converted lands, where rates of change in soil status are especially high. Farmers might not replenish nutrients because their average level (and thus yields) are high, yet rates of decline (and thus the marginal response to nutrient application) are very high. George Keya remarked on the importance of manure availability on farm and the methods of manure application, that these matter a great deal to rates of soil nutrient repletion, perhaps especially due to soil micronutrient content (perhaps especially in western Kenya where deficiency of potassium and other micronutrients is of growing importance). Festus Murithi asked about returning information and analytical results (e.g., soil fertility test results) to farmers, for both instrumental reasons (i.e., to keep farmers willing to participate) and for intrinsic reasons (i.e., an ethical obligation to contribute directly to addressing local problems and to compensate farmers for their significant contributions of time). David Mbugua and Justine Wangila reported on methods that are being used, e.g., providing improved maize seed (which was farmers'

preferred non-cash compensation method ... had to be careful not give fertilizer which could distort soil fertility measures). George Keya called for making these massive data sets publicly available so as to reduce future researchers' demands on farmers' time and so as to be able to build on good longitudinal data.

Jhon Rasambainarivo then discussed the new soils analysis being done on the BASIS CRSP survey households. We collected samples from all samples on plots less than 15 minutes' walk from each of the 337 households. This includes all irrigated rice fields as well as many rainfed fields. Samples were all GPS'd, so we have plot-specific data on soil fertility. This generated more than 1120 samples of 400 grams each. The samples have just arrived at ICRAF in Nairobi for spectral analysis (with about 20% undergoing wet chemistry for calibrating the spectral data) in collaboration with FOFIFA. Francis Kihanda emphasized that spectral analysis can only predict well on certain elements (e.g., soil organic carbon) and need to be careful about not attributing false precision to the components of the soil fertility measures.

Chris Barrett then presented preliminary results on estimating multi-output production functions in intercropped maize-bean plots in Vihiga District. David Amudavi and Francis Kihanda pointed out the SAGRET is extending new maize-bean intercropping spacing recommendations. Collins Obonyo remarked that households may have minimum maize yield targets that create a lower bound on the maize share in crop mix.

Alice Pell and Francis Kihanda remarked that beans may be higher risk crops and thus that what appears as suboptimal crop mixes (too heavy on maize) may in fact be optimal. We closed the day's proceedings with logistical/administrative announcements by Justine Wangila and Dennis Simuyu, who did a terrific job with all the local organizational details of the team meeting.

The second day of the meeting began with a presentation by Ben Okumu of the first partially calibrated prototype of the CLASSES model, to Madzuu in Vihiga District (western Kenya). The emphasis in the talk was on resource degradation poverty traps.

Ben's presentation aimed to demonstrate how a complex model might capture feedback effects in this sort of system. Alice Pell asked about incorporation of soil nutrient depletion processes, which are absent from this model. Ben responded that erosion should be understood as a composite of soil quality loss by whatever mechanism. Frank Place asked about the relevance of the top layer of 15-20 cm of high quality top soils in a place where plots have been cultivated continuously for decades. Is this relevant any longer? Chris Barrett replied that soil erosion in CLASSES is merely shorthand for land quality decline and should not be understood as modeling a specific process of change in soils. Justine Wangila emphasized that CLASSES is not a predictive model, it's meant to trace out how complex interrelationships and how particular changes lead to perhaps

unanticipated results and why might pathways diverge between different farmers starting from pretty similar initial conditions. He also queried about household illness and the difference between idiosyncratic and covariate disease risk. Justine also emphasized that KTDA has a minimum size for registered tea farmers. Ben replied that this has been incorporated within the CLASSES model. David Amudavi asked about the empirical basis for initial assumptions of the model. He is especially puzzled by the marked divergence in trajectories between two farms starting at similar initial conditions. Alice Pell pointed out that the land size difference is considerable (the bigger farmer has 40% more land). Chris Barrett emphasized that the point of these models is to be able to trace out the complex interactions between different aspects of the system through feedback effects. Some small movements (e.g., in land or livestock space) will have big effects.

Others (e.g., relief food supplementation, reduced school costs, higher tea or maize prices) have negligible effects. David Mbugua asked about persistence in farmer behavior, that western Kenyan farmers might persist in maize cultivation regardless of soil conditions. Millet and sorghum are far preferable once soils are highly degraded.

Collins Obonyo asks about setting a minimum amount of land in maize. Alice Pell remarked that in Embu people are less wedded to maize cultivation and are more willing to go buy their own maize. She wanted to know if CLASSES would accommodate those sorts of inter-site differences. Ben replied that it could indeed do this by changing the preference parameter that affects land use. George Keya asked about economies of scale in tea production. Ben explained that this was due to the sunk costs of joining the tea system since there's a minimum entry cost. Gatarwa Kariuki and George Keya emphasized that the KTDA minimum entry costs are a big issue and that we should look explicitly at how changing the minimum entry costs will change tea cultivation. Those rules are old and have not evolved in response to changes in technologies (e.g., moving from planting tea seed to more current vegetative propagation methods). Chris Barrett replied that this tool probably cannot be used for identifying precise levels, but could be used effectively for identifying subgroups of farmers for whom particular rules or assets are limiting. Festus Murithi asked whether there will be different models or a core model that can be tweaked to adjust to different settings and different initial conditions. Alice Pell emphasized that one needs to be careful to calibrate the model appropriately to a site before using it there, else one is extrapolating out of sample. Frank Place asked why consumption falls over the latter part of the period in this model and asked as well about other investments (e.g., in dairy, in nonfarm). In a follow up question, he asked about endogenous change in activities as wealthier folks take on more risk and get higher returns. Jhon Rasambainarivo and Elizabeth Nambiro asked about livestock, which are notably absent from the current run. Ben responded that the households in the model started with one cow but the animal was sold off in the model. The model might not yet be properly calibrated since it seems to fail to capture patterns of observed investments in livestock. Festus Murithi asked about when and how the CLASSES model will be made available with a users manual and a clear interface for users to be able to operate it. Ben suggested this can/will all be made available on a web site at Cornell. Alice suggested a one day CLASSES users model workshop at the very end of the project. In her experience with

CNCPS, those sorts of sessions have proved very valuable in getting more users of the system and to help them use it more effectively.

The conversation then turned to the workplan and next steps in the final year of the project. We discussed the core hypotheses we had originally proposed to explain the existence of poverty traps.

One hypothesis was that interhousehold and intersite variation in market access can cause poverty traps and bifurcated welfare dynamics. David Mbugua emphasized that Madzuu hasn't significantly worse market access than Embu does. Indeed, parts of Embu are far more difficult to access during the rainy season. A discussion ensued over how to define "market access". Francis Kihanda remarked that it may have to do with the existence of a reliable buying outlet for product and supplier for inputs (e.g., fertilizer). Products and distance both matter. There isn't bulking in Madzuu as there is in Embu (tea, milk, avocados, macadamia, etc.). Can we get at "market access". Frank Place remarked that we had more of a "commercialization" concept in our minds. We can study market participation activity explicitly from the baseline and subsequent surveys and look at Tegemeo's index of commercialization. We agreed to use relative prices for commodities (maize, milk, beans, perhaps vegetables), for inputs (maize seed, wage rates, DAP) and assets (cows) as a measure of differences in returns to sales/purchases and then correlate change in welfare with relative input and relative output prices. Then we will tell stories of why these differences exist (e.g., timing issues, quantity-dependent pricing, transactions costs differences, organization of markets – coops and bulking or market power by intermediaries) to try to flesh out the results.

Another hypothesis concerned risk exposure and poverty traps. Justine Wangila and David Mbugua and Nelson Mango suggested using qualitative data from the cognitive mapping and SADPT studies to help flesh out the quantitative results from northern Kenya. Frank Place also suggested modeling production functions with structural heteroskedasticity to get at risk over enterprises or even just getting qualitative rankings. For example beans and tomatoes are higher risk. Beth Medvecky's data on bean disadoption due to disease might be helpful.

The third core hypothesis was the existence of entry barriers that impede joining high return strategies. For example, KTDA sets minima volumes for being a tea farmer in the KTDA system. In milk marketing, there's a minimum at cooperative scale and thus capacity to organize farmers is important. Andrew Mude's work will speak to this directly. Florence Nherera's work will give us some insights on milk marketing in Embu before and after the reopening of the co-op. Francis Kihanda has the data on this, having tracked the explosion of milk marketing in Embu once KCC started paying for milk. This established a proper floor price for milk with effectively perfectly elastic demand. Without KCC in the market, the market's capacity to absorb milk without the price falling to zero was limited. This has driven up cow prices, which then blocks those who didn't already have cattle. We can tell similar stories from Madagascar, e.g., the opening

up of the road to Faratsiho (which Jhon, Jean Fidele and Bart will look into) or the explosion of the Ambohibary market and Antsirabe with the rise of barley and fruit contracts with size minima. Justine Wangila, Elizabeth Nambiro and Frank Place will tackle this topic for the group.

The fourth hypothesis relates to access to finance to enable people to make lumpy investments. We can study this using the survey data to study credit access.

On the relationship between wealth and natural capital, Justine Wangila suggested looking at thresholds in soils and livestock. Chris observed that this falls more within NSF than within BASIS. Alice Pell suggested looking at the soils spectral data by transition matrix cells used for the qualitative study. David Amudavi suggested studying investments in natural resources management techniques. Heidi Hogset and Paswel Phiri will be studying adoption of improved fallows, terracing, double digging, etc. in these sites. Alice Pell suggested we look at crop rotation as well, since that's relatively low barrier to entry but can matter a lot to maintaining soils. Paswel can/should do this in the BASIS data set and we can also draw on the cognitive maps data.

Frank emphasized that we'll need to do some integrative work at each site to establish which constraints are most important in a given spot and what one needs to do there, including identifying successful pathways out of poverty people have identified and feasible. This will be especially important for discussion for policy fora and should be pursued as separate papers.

On Tuesday afternoon, we discussed research dissemination and outreach. Our team is committed to briefing each of the survey communities on basic descriptive statistics and findings as to what we see taking place in their communities. It was proposed that we hold briefings at two distinct levels subnationally, one at KARI RRCs (Embu, Marsabit, Maseno, Pekerra) to KARI scientists and local institutional partners (e.g., NGOs, ALRMP and extensionists) and a second to local farmers and community residents. These meetings should include a 1-2 page handout for each attendee. These meetings should be integrated with partner projects (e.g., NSF in Embu and Vihiga, GL CRSP in Baringo and Marsabit, Ilo in Madagascar). At local level, where we can (e.g., with soils data) we should have a farmer-specific sheet with that farmer's results and a paragraph prescription as to what they ought to do in response. At the all levels, invite the local politicians (e.g., councilor at community level, MP at RRC level). George Keya suggests it would be best to present these findings at CRAC (Centre Research Advisory Committee) meetings at KARI RRCs. Francis Kihanda disagreed, suggesting that CRAC programmes are too crowded. These workshops ought to be sequenced, first at community level, then at RRC/CRAC, then at national level. The community work ought to include soils results and be specific to that location. The RRC level ought to include local results but also put it into broader comparative context. Then national level ought to focus on the big picture.

The group emphasized the following policy brief topics for the national policy workshops:

- Central/Western Kenya Highlands Comparison (Frank/Festus)
- SRI in Madagascar (Chris/Chris Moser)
- Are There Poverty Traps? Why? So What? (Chris/Larry: conceptual/empirical)
- Chutes and Ladders: Poverty Transitions in Rural Kenya (Nelson/Frank/Chris/etc.: 4 pager national with 3 2-page District-specific inserts)
- Chutes and Ladders: Poverty Transitions in Rural Madagascar (Jean Fidele/Jhon/Bart/Chris: 4 pager national with 2 2-page Province-specific inserts)
- Extension, Improved Natural Resources Management and Technology Adoption and Rural Poverty Reduction (David A./Heidi/Chris)
- Markets and the Rural Poor (Chris/Emma/Justine/Frank)
- Perhaps social networks

Next steps in research/outreach:

- April-June: Descriptive statistics and basic inferences to be done in April-May for community group briefings and briefings at the KARI and FOFIFA regional research centers. Complete Madzuu CLASSES model and CLASSES documentation.
- Complete and publish qualitative studies.
- June-August: Econometric work on finance use, relative prices, entry barriers, NRMwealth relationships.
- August-October: prepare the Embu survey revisit, including a new one page module on effects of reopening KCC distribution on dairy in Embu. Prepare remaining policy briefs for the national policy workshops.
- January-February: national policy and technical workshops.
- Need to run a separate two-day workshop to introduce and train people on CLASSES and write a technical brief on using CLASSES. Keep this separate from the policy workshop and policy briefs. After getting the Vihiga model completed, get the CLASSES documentation finished up and then switch the model over to one of the Madagascar sites.

Appendix G

NSF Biocomplexity/BASIS CRSP Projects

Farmers focused group discussions on cognitive mapping of soils in Central Kenya (Embu)

23/01/2004

Compiled: David M. Mbugua

1. INTRODUCTION

A farmers focused group discussion was held in Embu with selected farmers coming from Manyatta, Mukangu, Kianjuki and Kavutiri extension focal areas. The farmers were selected to represent the broad spectrum of farmers found in the region ranging from resource-poor to well-off farmers. A total of sixteen farmers participated, 8 men and 8 women. The main objective of the discussions was to elicit farmers' views on the various criteria that they use to assess soil fertility status on their farms. The meeting was also meant to provide a forum for input to improve on a cognitive mapping questionnaire that was to be fielded in the same area but to a large group of farmers. A third objective was to introduce the farmers to the planned cognitive mapping exercise that was to follow. The meetings were facilitated by David Amudavi, David Mbugua and Clement Lenachuru. James Thuranira and James Njeru assisted in taking notes during the proceedings.

2. APPROACH

The participating farmers were divided into four fairly homogenous groups of four according to age and gender. The two characteristics were found appropriate to use to disaggregate the groups to facilitate rich discussion. The number of participating farmers was kept low to ensure maximum engagement and productive discussion among those present. It was also meant to avoid problems that may emanate from large groups, such as greater information-processing demands resulting from more complex pattern of preferences that decrease the chances of successful coordination. Each group wrote their summarized points on manila papers. The information was then presented to a plenary session through which the main local indicators of soil fertility were discussed. The participants developed a cognitive consensus, which is how key factors are defined and conceptualized, on most issues that were considered important.

Key questions and issues

The discussions covered three key questions:

1. **Soil fertility:** What do farmers consider in assessing or identifying indicators of soil fertility? Additional questions on soil fertility were: (a) How farmers identified differences between good and bad soils? How they distinguished a soil as excellent or fairly good or bad for production? Whether in their opinion they thought they have different soil types on their farms. Other questions related to whether they could indicate limits of the soil types in their farms? Whether they could identify some properties of the soils on their farms that can be modified and those that cannot be modified?
2. **Crop changes:** What decision processes do farmers go through before making crop changes?
3. **Risk assessment:** How do farmers view and deal with risk?

3. GROUP DISCUSSIONS

The following section combines the summaries of the different groups on the various questions of interest.

D. SOIL FERTILITY

What are the differences between a good soil and a bad soil?

Farmers identified the attributes of a good soil as the following:
(a) They are black in color (b) they have good water holding capacity (c) they are associated with better crop performance (d) they are usually heavy (d) they readily form clumps/clods. On the other hand attributes associated with bad soils were identified as the following: (a) Brown or red color (b) failure to form soil clumps (c) poor water holding capacity (d) poor crop performance (e) they are light and (f) crops growing on such soils readily dry/wilt quickly when exposed to dry weather conditions.

How do you know if a soil is excellent, fairly good or bad for production?

The farmers identified the characteristics of excellent soils as being associated with the following conditions:

- High crop yield
- Crops growing on excellent soils have deep green color on their leaves.
- They have excellent water holding capacity
- Weeds grow very fast on such soils. Weeds commonly found growing in fertile soils include *Amaranthus* sp. and black nightshade.
- They are usually found on flat land
- Percentage of sand is very low
- Virtually every crop will do well on the soils
- Crops on excellent soils will not wilt easily even when exposed to direct sunlight
- Excellent soils are not eroded easily

Characteristics of fairly good soils were identified as:

- Fairly good soils are neither black nor red in color
- They give average crop yield
- Crop growth on these soils is uneven
- They have fair water retention capacity
- These soils are also characterized by quick growth and re-growth of weeds

Characteristics of bad soils

- Bad soils are very light,
- They have tiny particles,
- They have poor water holding capacity,
- No humus / crop residue is found on these soils,
- Virtually every crop does very poorly including weeds,
- Crops on these soils are stunted and develop yellowish leaves,
- There is high percentage of sand and gravels,
- Weeds such as poverty grass (Muguku), Mwaraciau, Ruthiru (scientific names to be confirmed) are found on these soils.

Do you think there are different types of soils on your farm?

Farmers in all the groups were agreed on the fact that they have different soil types on their farms. The following points were noted:

- There are different types of soils on the farm depending on farm management practices and topography of the farm.
- There is variation in crop performance on different plots. Soil types bring this variation.

- Some sections of the farm have light soils while others heavy soils.
- Soils near homestead and away from homestead are usually different.
- Soils on flat land and on slopes are usually different.
- Some farm sections have muram and gravels depicting differences in soil type.
- Soils on valley bottoms, hills and on hilltops are usually different.

Can you identify the different types of soils on your farms?

- Loam soil
- Clay soil
- Sandy soil
- Light soil
- Heavy soil
- Good soil
- Fairly good soil
- Bad soil

Can you indicate limits of the soil types in your farms?

"There are limits of soil types on our farms depending on land management and contouring".

Can you mention a few properties of the soil in your farm that can be modified?

- Soil pH
- Soil color
- Soil structure
- Water holding capacity
- Soil fertility

The above properties of soils can be modified through:

- Addition of manure
- Leaving land under fallow
- Planting trees (Agro-forestry)
- Practicing organic farming

Do you know properties of soils that cannot be modified?

- Soil Texture
- Soil particles (granules)

E. CROP CHANGES

What do farmers consider in making crop changes?

Farmers consider the following when making crop changes

- Crop rotation

Farmers plant different crops in different during different seasons to avoid continuous cropping. This helps in soil conservation and in pest and disease control.

- Weather/climate

Farmers consider the prevailing weather /climate when making crop changes. For instant, a farmer will plant different crops during short and long rains.

- Food production

When a certain crop performs poorly on a certain plot, a farmer may consider changing the crop. Also the farmer may decide to change the crop depending on the market demand and prevailing prices.

- Soil fertility

Crops such as maize, beans, Irish potatoes, coffee etc. that perform very well on fertile soils are biased to fertile plots while crops such as sweet potatoes, cassava, yams are grown on poor soils where they perform well.

- Soil erosion

When soil erosion is persistent on some sections of the farm, a farmer may shift to crops that will help check soil erosion.

F. RISK ASSESSMENT

How do farmers view and deal with risk?

(i) View of risk.

- Risk is the "fear" to engage in a farming activity due, say, to bad weather and poor food production. For example, during the dry season some farmers fear to plant crops on their farm plots because, even if the soil is fertile, there is no water in the soil and that may lead to crop failure.

- Some farmers noted taking risk may be a way to success and not failure.

(ii) Dealing with risk

To deal with risk, farmers diversify to other income sources such as:

- Planting different crops. In this case the gave the example of some farmers opting to maintain their coffee farming with hope that the market (read payments) will improve while others have decided to intercrop with beans, kales etc.
- Livestock keeping
- Bee-keeping
- Horticulture
- Business etc.

The farmers noted the following points.

- A farmer should be creative and innovative (entrepreneurship). For example, practicing irrigation farming during dry season, organic farming etc.
- A farmer should plan for any risk and adopt proper management.
- Farmers should concentrate on capacity building than relying on external borrowing.

4. SOIL FERTILITY INDICATORS AND RANKING

After group presentations, the farmers identified the common agreeable soil fertility indicators that they considered important in assessing the status of their soils. The following is a least of the key indicators that they agreed on:

1. Soil color (SC)

2. Water retention (WR)
3. Soil weight (SW)
4. Soil structure (SS)
5. Soil texture (ST)
6. Weed re-growth (WRG)
7. Water drainage (WD)
8. Humus contents (HC)
9. Slope of the land (SLP)
10. Uneven growth /performance (UG)
11. Range of crops (RC)
12. Weight of residue (WCR)
13. Closeness to homestead (CH)
14. Site of plot (SP)
15. Kinds of weeds (KW)

The farmers then scored the identified soil fertility indicators using pair-wise ratings (Table 1) that were later used to rank the different indicators based on the frequency of their preference by farmers over other indicators (Table 2).

Table 1. Pair-wise ranking of different soil fertility indicators by farmers in Embu

	Indicator														
Indicator	**SC**	**WR**	**SW**	**SS**	**ST**	**WRG**	**WD**	**HC**	**SLP**	**UG**	**RC**	**WCR**	**CH**	**SP**	**KW**
SC		WR	SW	SS	ST	WRG	WD	HC	SLP	UG	RC	WCR	CH	SP	KW
WR			SW	SS	ST	WRG	WR	HC	WR	WR	WR	WCR	WR	SP	KW
SW				SS	ST	WRG	WD	HC	SW	SW	RC	WCR	SW	SW	SW
SS					ST	WRG	WD	HC	SS	SS	RC	WCR	SS	SS	KW
ST						WRG	WD	HC	ST	ST	RC	WCR	ST	ST	KW
WRG							WRG	WRG	WRG	WRG	RC	WCR	WRG	WRG	WRG
WD								WD	WD	WD	WD	WCR	WD	WD	WD
HC									HC	HC	HC	WCR	HC	HC	KW
SLP										UG	RC	WCR	CH	SP	KW
UG											RC	WCR	CH	SP	KW
RC												WCR	CH	SP	RC
WCR													WCR	WCR	WCR
CH														CH	CH
SP															KW
KW															

NB. The code for each soil fertility indicator is shown on the above list (in brackets).

Table 2. Ranking of soil fertility indicators

Indicator	Abbreviation	Score	% Score	Rank
Weight of residue	WR	14	13.33	1
Weed re-growth	WRG	12	11.43	2
Water drainage	WD	11	10.48	3
Humus content	HC	10	9.52	4
Soil texture	ST	8	7.62	5
Range of crops	RC	8	7.62	6
Kinds of weeds	KW	8	7.62	7
Soil weight	SW	7	6.67	8
Soil structure	SS	7	6.67	9
Water retention	WR	6	5.71	10
Closeness to homestead	CH	6	5.71	11
Site of plot	SP	5	4.76	12
Uneven growth	UG	2	1.90	13
Slope of the land	SLP	1	0.95	14
Soil color	SC	0	0	15
All Indicators		**105**	**100%**	

Farmers in Embu agreed that weight of crop residue is the most important soil fertility indicator followed closely by weed re-growth rate. It was, however, noted that farmers use a combination of factors to gauge the quality of their soils. Soil color, even though often cited as an important soil fertility indicator, was ranked as the least important indicator. It was clear from the discussions that farmers in Embu have clear and unambiguous methods of differentiating poor from rich soils. The

Participants

Discussants

David Amudavi

David Mbugua

Lenachuru

Secretaries

James Thuranira

James Njeru

Farmers

15. Kiura Waithanji
16. Joseph Mwaniki
17. David Kariuki
18. Njoka M'Simba
19. Madrin Njoki
20. Michael Munyi
21. James Kamaitha
22. Reuben Mugo
23. Joseph Ndwiga Njeru
24. Ann Njura Mbogo
25. Mercy Njoki Ndwiga
26. Janet Nginda Njagi
27. Lucia Njoki Njagi
28. Faith Njura Kagundu
29. Triza Kinyua Mairani
30. Milka Wanjira Mugo