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Swedish University of Agricultural Sciences

SLU Global

The SLU Global Food Security Research and Capacity Development Programme 2012-2014

A Swedish Government Initiative

SLU-Global Report 2014:6

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Swedish University of Agricultural Sciences

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Introduction

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Meeting the demand for sustainable production in agriculture is a major challenge for countries in Sub-Saharan Africa, both as a driver for economic development and to sustain growing urban populations. The African Union has emphasised this in its Comprehensive Africa Agriculture Development Programme (CAADP) for food security and national progress. Agriculture is a knowledge-based operation and therefore support for higher education and independent research in these fields is paramount.

The Swedish University of Agricultural Sciences (SLU) is the only Swedish university that has a specific government mission to conduct research and education to support the agricultural sector in its broadest sense and to perform national environmental monitoring and assessment. Apart from this national role, the global perspective is an integral part of most of SLU's activities, and participation in international collaboration and capacity-development projects together with partners in low-income countries has always been vital for our university. In 2014 it is 60 years since the first capacity development project began at one of the preceding colleges; former Royal College of Veterinary Science. More recently SLU's programme Agricultural Sciences for Global Development (SLU Global) has since 2012, been creating a university-wide platform for international development cooperation in research and higher education. The mission is to facilitate wider multidisciplinary cooperation and communication potential for many disciplinary groups throughout SLU. The coordination and reporting of this project is one example of efforts within this mission.

In 2011 the Swedish Ministry for Foreign Affairs made an allocation to SLU of SEK 15 million (approx. USD 2.2 million) to be utilized in 2012 and 2013 with the aim to strengthen Sweden's cooperation with African universities, research institutes and organizations in the area of food security. The twenty-seven main activities within the programme have mainly focused on eastern and southern Africa and have involved Swedish and African universities as well as African and international organizations such as AGRA and CGIAR. Examples of quantification of the outputs of the programme reported on in this report include:

Seventy-five academic institutions and 65 organizsations in 77 countries were involved in collaborative activities as partners (not counting additional diversity of course and workshop participants).
Fifty-five articles (published and in preparation) were produced for peer reviewed scientific publication.
Thirty-one research students (MSc and PhD) and post-docs received support.
Fifty-five courses, workshops and seminars were organised.
Thirty-eight applications for future funding were written.

As an additional outcome of this programme, 35 research fund applications for future onward cooperation have been submitted to various national and international councils and donors. So far 6 have been granted, 7 not granted and 22 are pending decision at the time of this report.

The work has partly been channelled through SLU Global's five multidisciplinary themes aimed at framing some of the desired foci for broader development research. The themes are Efficiency in farming systems, Land-use and climate change, Restoration of degraded rural landscapes, Scale issues in relation to food security and poverty alleviation, and Urban and peri-urban farming. Within each of these thematic areas, funds have been used to augment initiatives that enable Swedish researchers and teachers to become partners in ongoing international collaboration to strengthen global food security, but also to contribute to the formation of long-term research collaborations with this purpose.

Apart from the activities within the thematic frames, another 17 projects (or parts of projects) with research, educator and staff exchange and capacity development with Sub-Saharan partners have been supported. The initiatives supported by the Ministry's initiative at large include gender aspects in the management of natural resources, sustainable water and land use, bioinformatics, plant and animal breeding, aquaculture, agroforestry and agri-business. The activities carried out include international workshops, compilations of knowledge, graduate and doctoral exchanges, 'write-shops' for applications to international research initiatives, and doctorate and post-doctoral studies. The funds have also contributed to African colleagues having had the opportunity to attend workshops within the Global Challenges University Network initiated by SLU, and to participate in a world conference for agricultural journalists held in Sweden.

On behalf of SLU and our partners we wish to express our thanks to the Swedish Ministry for Foreign Affairs for its foresight and generous support of this programme. This support has contributed strongly to consolidate an extensive network and a platform for continued investments in collaborative agricultural research and capacity development activities between SLU and its partners, in particular in Sub-Saharan Africa. The platform that has been created is an integral component in the maintenance of a Swedish, internationally competitive resource base in the fields of agricultural and environmental sciences, and has the commitment and capacity to participate in future efforts to contribute to sustainable global food security.

SLU-Global thematic areas

Hillside in Rwanda.
Photo: Anders Malmer

Efficiency in farming systems

Project leaders: Sigrun Dahlin and Håkan Marstorp

Summary

The overall objective of the project was to contribute to sustainable intensification of small scale farming systems in Africa. The project consisted of two parts of which the first concerns agricultural productivity and yield gaps within African farming systems. In this context, an international post-graduate training course was organised at SLU in collaboration with Wageningen University. The course addressed the on-farm reality by using a modelling tool (NUANCES-FARMSIM) that integrates biophysical and social environments. Further, a guest researcher from Ghana carried out a desk study with a focus on determinants of yield gaps at the household level, and the extent to which yield differences explain economic wealth gaps. The experience gained in the desk study led to a pilot study in the field where information on farming systems was collected through interviews, transect walks on the farms and the use of unmanned aerial systems (UAS) and satellite imaging.

The second part of the project was a broad effort to enhance the cooperation between SLU and IITA (International Institute of Tropical Agriculture) within the area of sustainable intensification, including identification of major research areas of cooperation resulting in synergies between the two institutions. Two workshops were organised jointly by IITA and SLU. A variety of disciplines were represented such as plant breeding, bioinformatics, plant production ecology, pest management, soil science, economics and sociology. A number of interdisciplinary research proposals or concept notes for joint projects have been written based on the workshops. Representatives from SLU have also participated in workshops within the 'Humidtropics' research programme where a common scientific framework for the programme was laid down.

Summary in Swedish

Det övergripande målet med projektet var att bidra till en hållbar intensifiering av småskaliga jordbrukssystem i Afrika. Projektet består av två delar, varav den första rör jordbrukets produktivitet och avkastningsskillnader inom afrikanska jordbrukssystem. Som en del av detta genomfördes en internationell forskarutbildningskurs vid SLU i samarbete med universitetet i Wageningen. Kursen var inriktad på förhållandena på hushållsnivå och modellen NUANCES-FARMSIM användes för att analysera systemen med hänsyn tagen till både den biofysiska och sociala miljön. Vidare genomförde en gästforskare från Ghana (Fred Dzanku), en skrivbordsstudie med fokus på faktorer som bestämmer skillnader i avkastning på hushållsnivå, och i vilken utsträckning sådana skillnader i avkastning kan förklara skillnaderna i välstånd. Lärdomarna från denna studie ledde till en fältstudie av pilotkaraktär i Uganda där information om jordbrukssystemen samlades in genom intervjuer, transektpromenader på gårdar och användning av flygfotografering (UAS) och satellitbilder.

Den andra delen av projektet var en bred insats för att stärka samarbetet mellan SLU och IITA (International Institute of Tropical Agriculture) inom forskningsområdet hållbar intensifiering. Ett särskilt syfte var att identifiera forskningsområden där synergieffekter mellan de två institutionerna kunde erhållas. Två workshops anordnades gemensamt av IITA och SLU. En mängd olika discipliner var representerade såsom växtförädling, bioinformatik, växtodling, ekologi, markvetenskap, växtskydd, nationalekonomi och sociologi. Ett antal tvärvetenskapliga och gemensamma projektansökningar och "concept notes" har skrivits baserat på workshoparna. Representanter från SLU har också deltagit i olika workshops inom forskningsprogramet "Humidtropics" där en gemensam vetenskaplig ram för Humidtropics-programmet fastställts.

Background

The project concerns sustainable intensification of agriculture with a focus on small-scale farming in Africa. It is made up of two parts, of which the first concerns agricultural productivity and yield gaps within African farming systems. The second part is a broad effort to enhance the cooperation between SLU and IITA (International Institute of Tropical Agriculture) and especially their research programme, "Humidtropics". IITA is one of the CGIAR's (Consultative Group on International Agricultural Research) research centres with headquarter in Ibadan, Nigeria but active throughout Africa. Activities include visiting scientists and research-promoting activities in the form of planning meetings and workshops.

Productivity and yield gaps

To cope with projected population and income growth globally and specifically in Sub-Saharan Africa (SSA) the agricultural sector needs to increase production and productivity dramatically, without compromising environmental sustainability. An important activity has become to identify underperforming regions and identify key causes of poor productivity. The general assumption is that regions where the so-called yield gaps (the difference between best possible output per area and what is actually achieved) are large, holds promise for productivity gains and greater food security. However, success relies heavily upon the type of identified causes and, ultimately, the prospect and cost of alleviating them.

To address the on-farm reality, an integrated modelling tool, NUANCES-FARMSIM (www.africanuances.nl), has been developed to facilitate synthesis of existing information at the farm level. The model includes both the biophysical and social environments as well as potential technologies for intervention and farmer adaptation. This model framework was used in an international post-graduate course organised within the project.

Towards an enhanced cooperation between IITA and Swedish Universities

IITA has as major goal to improve the livelihoods of rural populations in SSA. The research is focused on four thematic areas: (i) crop improvement, (ii) improved agronomy and pest management, (iii) natural resource management, and (iv) agri-business development and social sciences.

The IITA led Research Program on Integrated Systems for the Humid Tro-

Photo: Håkan Marstorp

Interviewing farmers in Uganda.

pics (Humidtropics) seeks to improve the lives of the rural poor in the humid and sub-humid tropics. The work is centred on agricultural systems' productivity, natural resource management and market and other institutional development. The programme implementation is based on partnerships that include local and national partners as well as other CGIAR Centres and advanced research institutes. More information about the "Humidtropics" programme can be found at www.humidtropics.org. With complementary capacities within SLU and IITA/Humidtropics the collaboration is expected to give synergies.

Aims/Objectives

The overall objective of the project was to contribute to sustainable intensification of small-scale SSA farming systems. A specific aim was to increase the understanding of factors controlling productivity gaps and to integrate biophysical and socio-economic explanations for these. Another specific aim was to enhance the research cooperation between SLU and IITA within the area of sustainable intensification, including identification of major research areas of cooperation enhancing synergies between the two institutions.

Description of the activity and how it was conducted

Productivity and yield gaps - guest researcher

Fred Dzanku, Legon University, Ghana, had a position as a visiting scientist for six months (March-August, 2013) at the Department of Soil and Environment, SLU, Uppsala as part of an interdisciplinary collaborative effort between SLU and the De-

Photo: Håkan Marstorp

Dr Kwesi Atta Krah, Director, CGIAR Research Program on Integrated Systems for the Humid Tropics ("Humidtropics").

partment of Human Geography, Lund University. The idea behind the exchange was to combine econometric methods with farming system analysis to further advance the understanding of factors underlying yield gaps in SSA. The data used in the study had previously been collected by the Department of Human Geography and was mainly derived from recurrent household surveys in nine African countries over a ten-year period.

Field testing of new methods for yield gap studies

The experience gained in the above-described collaboration led to a pilot study where representatives of socio-economic and natural science disciplines as well as agricultural extension services and village development workers participated. Information on farming systems was collected through interviews, transect walks on the farms and the use of UAS and satellite imaging. The approach thus combined tools and information derived from socio-economic sciences, natural sciences and remote sensing technology. A post-workshop section included further data processing to link the high-resolution imagery with satellite imagery and the potential of this approach to link investigations on different geographical scales was evaluated.

Post-graduate course

The course "Exploring tradeoffs around farming livelihoods and the environment - using farming systems modelling" was organised in August, 2012 (3 ETCS) at SLU´s Ultuna campus in Uppsala in collaboration with Pablo Tittonell, Mark T. van Wijk and Mink Zijlstra of Wageningen University, Netherlands. The course included: basic principles of systems analysis as applied to research on and design of farming systems and analysis of short and long-term consequences and tradeoffs between alternative objectives. Scenarios for future sustainable development of the farming were developed using the dynamic farm-scale simulation model NUANCES-FARMSIM. The use of the NUANCES framework as a tool to analyse farming systems at household level was further explored in a review and scenario study (see project report Reviews and meta-analysis within the SLU Global Thematic area "Efficiency in farming systems" http://www.slu.se/sv/internationellt/slu-global/temaomraden/efficiency-in-farming-systems/).

IITA workshops

In September 2012, a survey was conducted to determine the interest of SLU researchers in collaboration with IITA and the Humidtropics research program. About 60 scientists over a wide range of themes and disciplines responded positively. A second step was the organisation of joint IITA-SLU workshops at the IITA headquarters in Ibadan, and at the SLU campus in Alnarp in April 2013 and August 2013, respectively. Twelve researchers from SLU and one from the Lund University attended the workshop in Ibadan together with some 15 researchers from IITA. A variety of disciplines were represented such as plant breeding, bioinformatics, plant production ecology, pest management, economics and sociology. In the second workshop more than 20 researchers from SLU and 15 from IITA came together to formulate interdisciplinary 'concept notes' for joint projects, mainly in the context of the CGIAR research programme "Humidtropics" but also within the research programme "Roots, Tubers, and Bananas."

The CGIAR Research Program "Humidtropics"

SLU participated in the introductory workshop in Ibadan in November 2012 and in a second workshop in Nairobi in February, 2013. The aim of the meetings was to consolidate the overall themes of the research programme. SLU participated by invi-

tation in four of five working groups, viz. Systems Analysis and Synthesis, Increasing System Productivity, Natural Resource and Biodiversity Management, and Scaling and Institutional Innovation. In December 2013, SLU held a follow up discussions with the Director for Humidtropics, Dr Kwesi Atta-Krah, on SLU´s further engagement in the research programme.

"A number of interdisciplinary research proposals or concept notes for joint projects have been written based on the workshops."

Collaborators

SLU
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Wageningen University, The Netherlands
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A summary of the statistics for this project on p. 154

Reviews and meta-analysis within Efficiency in farming systems

Project leaders: Sigrun Dahlin and Håkan Marstorp

Summary

A decline in ecosystem services such as soil fertility and pest control is having a negative backlash on agricultural productivity in Sub-Saharan Africa (SSA), whilst population growth and changed consumption patterns are increasing demand for agricultural products. There is thus a need for sustainable intensification of farm production. The overall objective of the project was to integrate knowledge from different research areas on sustainable intensification of smallholder farming systems, in particular in SSA. The specific aims were to 1) review the evidence for and interdependence of management options for sustainable intensification and through modelling explore the effects of selected management options, and 2) review the evidence on whether or not agroecological interventions enhance soil fertility and pest control in the humid tropics and scrutinise the efficiency of the interventions through meta-analysis of the literature. The project has produced 1) a comprehensive review of intensification options suitable on smallholder farms and quantified – for a case site in the sub-humid SSA – the relative effect of weed management vs that of fertilisation and soil fertility management, and of their combinations. The study revealed that sustainable intensification of crop production requires that multiple constraints be addressed simultaneously. The success of crop intensification options will also depend on proper targeting to different farm types as well as field soil fertility gradients. The project has also produced 2) the first meta-analytical review of how agroforestry practices influence pest control and soil health. The results show that agroforestry generally has positive effects on both soil fertility and pest control. Agroforestry resulted in lower abundances of both parasitic and non-parasitic weeds and affected natural enemies of pests positively.

Summary in Swedish

Minskande markbördighet och minskning av andra ekosystem tjänster såsom reglering av ogräs, ohyra och sjukdomar leder till negativa återverkningar på jordbruksproduktionen i Afrika söder om Sahara, framför allt i småjordbruken. När befolkningen ökar och konsumtionsmönstren samtidigt förändras ökar behovet av jordbruksprodukter och att på ett hållbart sätt intensifiera produktionen. Det övergripande syftet med detta projekt var att sammanställa befintlig kunskap inom olika forskningsområden som rör hållbar intensifiering, speciellt avseende produktionen på småjordbruk i Afrika. De specifika målen var att 1) granska olika skötselåtgärders hållbarhet och om de medför en intensifiering och genom modellering undersöka effekterna av några utvalda skötselåtgärder, och 2) granska beläggen för om agroekologiska interventioner ökar markbördigheten och regleringen av ogräs, ohyra och sjukdomar eller inte i humida, tropiska områden samt genom en meta-analys av publicerad litteratur fingranska interventionernas effektivetet. Projektet har 1) gett en omfattande kunskapssammanställning av åtgärdsalternativ anpassade för småjordbruk och kvantifierat den relativa effekten av ogräsbekämpning respektive gödsling och markvård i en fallstudie. Studien visade att hållbar intensifiering bara kan nås genom att samtidigt åtgärda flera begränsande faktorer. För att lyckas krävs också att åtgärderna anpassas efter gårdstyp liksom markbördighetsgradienter inom gården. Projektet har även 2) gett den första meta-analysen av hur agroforestry påverkar markens egenskaper och regleringen av ogräs, skadeinsekter och sjukdomar. Resultaten visar att agroforestry vanligen har en positiv effekt på markens egenskaper och på regleringen av ogräs, skadeinsekter och sjukdomar. Förekomsten av både parasitära och icke-parasitära ogräs var lägre i agroforestrysystemen, medan den var högre för skadeinsekternas naturliga fiender.

Background

Increased human populations and pressure on natural resources have resulted in deforestation, land degradation and a loss of ecosystem services in many developing countries. The decline of critical ecosystem services, such as soil fertility and pest control, has a negative impact on agricultural productivity. Indeed, in many parts of Sub-Saharan Africa (SSA), agricultural productivity has stagnated or is declining, due in particular to loss of soil fertility, but also due to large losses to invertebrate pests, plant diseases and weeds, in particular the parasitic weed Striga, that become more prevalent in poor soils. Agroecological interventions can be a cheap, safe and sustainable way of restoring these ecosystem services and enhancing productivity for smallholder farmers. Examples of agroecological interventions include for example incorporation of leguminous trees and crops into the crop rotation. Reallocation and improved targeting of labour to key farm activities may also increase farm productivity. Many studies have been conducted on the effects of such interventions on pest control and soil fertility, but systematic reviews of this work are few and this is currently limiting the adoption of these practices. Structured assessment of the longer-term effects of single and combined interventions on pest control and soil fertility on smallholder farms are also lacking.

Aims/Objectives

The overall objective of the project was to contribute to the integrated knowledge concerning sustainable intensification of smallholder farming systems in developing countries with a particular focus on SSA. One specific aim was to review the evidence for and interdependence of management options for sustainable intensification of farming in SSA. The factors most likely to limit production in a former case-study area were addressed in scenarios and the medium-term (ten years) effects of suggested management options explored with the NUANCES modelling tool. Another specific aim was to review the evidence that agroecological interventions enhance soil fertility and pest control in the humid, tropical parts of Africa, America and Asia. This regional restriction was selected because the project was closely linked to the CGIAR-led research programme Humidtropics that aims to sustainably enhance agricultural productivity for small-holder farmers in this region. A further objective was to provide training in statistical meta-analysis for post-doctoral researchers in Nairobi.

Photo: Sigrun Dahlin

Intercropping of maize and banana.

"The results show that agroforestry generally has positive effects on both soil fertility and pest control."

Collaborators

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Description of the activity and how it was conducted

Review and modelling of interventions for sustainable intensification of smallholder crop production in SSA

Post-doctoral researcher Leonard Rusinamhodzi (CIAT/CIRAD, Zimbabwe) was recruited and worked with senior scientist Sigrun Dahlin (SLU) on the review and modelling. The project began with a meeting in Uppsala (October 2013) where the scope and outline of the work was discussed along with the search strategy for

the review. The criteria for selecting interventions to be included in scenarios were also discussed, and biophysical and socio-economic data from a previous field-based project revisited to select suitable field sites which could provide input data to the scenarios. The review was subsequently carried out, and interventions for inclusion in scenarios selected based on their relevance to the field sites: nutrient and organic matter inputs, weed management strategies and intercropping with legumes. The medium-term effects of the scenarios on crop and farm productivity and soil fertility were then modelled using NUANCES. At another meeting in Uppsala in December, the outcome of the review was discussed and the quality of preliminary model outputs assessed. The subsequent work involved the final model runs, writing a report and two manuscripts. Between the two meetings communication has been through e-mail and Skype meetings.

The project core team has consisted of Sigrun Dahlin (project leader and led the literature review) and Leonard Rusinamhodzi (simulations). Håkan Marstorp (SLU) and Mark Corbeels (CA2Africa/CIRAD) have had a more consultative role with contributions to one journal paper each.

Meta-analysis on agroecological interventions to improve pest management and soil health

Two postdoctoral researchers conducted the majority of the review work. The project began with a workshop in Nairobi 4-6 September 2013, where we first held an introductory course in meta-analysis. At the workshop we also discussed how to structure the review, which interventions to consider, the search strategy, search strings, criteria for inclusion of studies, etc. After the workshop an initial, scoping literature search was conducted by the postdoctoral researchers. This initial literature search revealed a huge number of potentially relevant studies, and we therefore decided to focus on only one category of agroecological interventions in this project, viz. agroforestry practices. The subsequent work has involved final selection of papers, extraction of data, statistical meta-analysis, writing papers and presenting results at the World Congress on Agroforestry in New Delhi, India, in February 2014. Most of the communication within the research team has been via email, but three Skype conferences have also been held.

The project team has consisted of: Edmundo Barrios (project leader, ICRAF), Mary Nyawira Muchane (postdoctoral researcher, soil fertility, ICRAF, Kenya), Sileshi Weldesemayat (meta-analysis specialist, ICRAF), Charles Midega (icipe), Sofia Gripenberg (meta-analysis specialist, University of Oxford, UK), Lorena Pumariño (post-doctoral researcher, pest control, SLU), Riikka Kaartinen (SLU), Mattias Jonsson (project leader, SLU).

Results

Review and modelling of interventions for sustainable intensification of smallholder crop production in SSA

The review has been completed and a report published on SLUGlobal´s web. One manuscript has been written and is close to submission for the Agriculture, Ecosystems & Environment and another manuscript is in preparation. The literature review showed that publications presenting options to address poor crop productivity on smallholder farms in Africa are abundant and only a selection of 246 papers were included in the report to provide entry points to the various scientific fields.

In spite of the large number of suggested interventions and technologies, those practically relevant to address farmers' needs are few. Differences in resource ownership and bio-physical circumstances lead to different opportunities for farmers. Efforts to tailor interventions to defined targeted farmers should thus be pursued where possible. The study has revealed that sustainable intensification of crop production requires that multiple constraints are addressed simultaneously. Success of crop intensification options will also depend on proper targeting to different farm

Photo: Mattias Jonsson

Growing coffee in the shade of trees.

types as well as field soil fertility gradients.

Although smallholder farmers in SSA have limited assets, the scenario modelling outputs revealed the existence of local opportunities to increase current crop productivity whilst increasing soil fertility in the studied field sites in central Mozambique. In some cases, changes in management do not need substantial capital inputs by the farmers, but more efficient use and targeting. The study has also revealed that despite their high technical efficiency, some production options such as conservation agriculture may not fit within the broader farming system as well as within the farmers' production orientation and resource capacities in SSA

Meta-analysis on agroecological interventions to improve pest management and soil health

The meta-analysis on pest control has been completed and a manuscript has been written and is close to submission. Due to the much larger number of useful studies found in the soil fertility review this work has not yet been completed, but preliminary results are available.

The initial search for literature on agroforestry effects on pest control yielded as many as 3 008 papers. However, following further inspection of these papers it turned out that only 42 contained information relevant for meta-analysis on this topic. In all, 125 observations could be extracted from these papers. In the analysis, we differentiated between studies conducted in annual and perennial crops, between effects on above and below ground organisms and between parasitic (Striga) and non-parasitic weeds. We found that agroforestry resulted in lower abundances of both parasitic and non-parasitic weeds and generally had a positive effect on natural enemies of pests.

For the meta-analysis of agroforestry effects on soil fertility, we have focused

on the effects on nutrient cycling (phosphorus and nitrogen availability) and soil structure (soil erosion, soil carbon and infiltration). The initial literature search identified 1 756 articles on nutrient cycling and 1 955 articles on soil structure. After further inspection of these studies, we identified 225 studies on nutrient cycling and 130 on soil structure useful for our meta-analysis. A preliminary meta-analysis of these studies suggests that available nitrogen in the soil increases with agroforestry and that soil erosion decreases.

Overall, our meta-analysis thus suggests that agroforestry in general has positive effects on both pest control and soil fertility. However, in particular as regards pest management, studies to date have been conducted on only a few crop-pest systems and the mechanisms underlying the effects of agroforestry are usually not known.

Communication of results

The primary mode of communicating the results from this project is through production of scientific publications. Two papers on the meta-analysis and two papers based on the review and scenario modelling have been prepared. Results also contribute to at least one further paper and to a book chapter. The results will also feed into the CGIAR research program Humidtropics, where they will assist in identifying suitable management options for sustainable intensification of agriculture in the different action areas of that project. Preliminary results from the meta-analysis have been presented at the World Congress on Agroforestry held in New Delhi, India. When all results are ready, we will produce two policy briefs summarizing the results and providing recommendations (one for each sub-project). At least one of these will be published within the Sida-financed network SIANI.

Gender aspects

Although women make up a large share of the farmers in SSA, female-headed households (incl. farmers) as a group have less access to and control over resources such as land, drought power and livestock manure. This limits their possibilities to optimize production even further compared with male-headed households. Both female-headed and male-headed farms were therefore selected for the scenario analyses.

A similar number of female and male researchers participated in the project (7 and 5). This included one female and one male meta-analysis teacher, and both men and women in the research teams. Two female and one male researcher received post-doctoral training. For one of the subprojects care was also taken to ensure a balance of team members at all levels between Europe and Africa, whereas for the other subproject an equal gender balance was achieved only in the core team.

Greatest value of the project and next steps

This project has produced a comprehensive review of intensification options suitable on smallholder farms in areas of differing agroecological conditions across SSA, covering a wider range of farm management than provided in the literature. These cover, for instance, soil fertility, water and pest management, and potential synergies and trade-offs between technologies. The review provides entry points to the literature within the different fields of farm management required to achieve sustainable intensification of crop production. Simulations have quantified the effect of weed management vs that of fertilisation and soil fertility management, and their combinations, and highlighted the paramount importance of combining other intensification technologies with good weed management.

The project has also provided the first meta-analytical review of how agroforestry practices influence pest control and soil health. The results show that agroforestry generally has positive effects on both soil fertility and pest control. This is important for developing sustainable intensification programmes in general, and more specifically will inform the CGIAR-led research and development program-

Some of the researchers participating in the metaanalyses.

me Humidtropics. The project has also identified important knowledge gaps. For example, for the majority of crops there is a lack of studies exploring impacts of agroforestry on pest control, and the underlying mechanisms for the patterns observed are often not known. Based on this, members of the project team have developed a research application to further explore effects of agroforestry on pest, disease and weed control in Kenya (see Appendix: Applications for funding). If funding can be secured we also plan to continue with the meta-analysis work, exploring the impacts of annual mixed cropping and addition of organic material.

Based on contacts made during the project, members of the project teams have further developed a proposal for a capacity-building programme at Makerere University, Uganda.

A summary of the statistics for this project on p. 157

Capacity building and collaborative research between SLU and Wondo Genet School of Forestry in the area of land use, climate change and food security

Project leader: Erik Karltun

Summary

The project activities in this project aimed to strengthen research capacity on how land-use and climate change affect food security and to build laboratory capacity for analysis of plant and soil samples needed for the research at WGCF-NR. The support was given in four different forms; (1) financial support for field and laboratory work for two MSc and four PhD students, (2) supervisory support to PhD and MSc students, (3) an assessment and maintenance consultancy of the soil and plant laboratories of WGCF-NR and (4) a two-week course in laboratory management and chemical analysis of soil and plant samples. Measures were taken to strengthen gender equality during the laboratory support and training by using gender quotas in the invitation and by adapting the course modalities to ensure quality participation for both genders.

Background

Wondo Genet College of Forestry and Natural Resources (WGCF-NR) was established in 1978. SLU has for more than thirty years had an on-going capacity-building collaboration with WGCF-NR. Through Sida support, SLU has been instrumental in building up the academic capacity of WGCF-NR. The support from Sida was phased out some years ago but SLU and WGCF-NR have recently signed an MoU at the university level expressing their mutual interest in a continued collaboration. WGCF-NR currently has nine undergraduate programmes and there are eight approved graduate MSc programmes. Two PhD programmes have also begun this academic year in the areas of climate change and bio-energy. There are also on-going collaborative research projects between SLU and WGCF-NR. Most of these projects are related to the effects of different types of land use on natural resources. In Ethiopia, WGCF-NR is acknowledged for having a potential in research related to climate change and WGCF-NR has the ambition to become a national centre of excellence in land-use related climate change research and education. In discussions, the dean of WGCF-NR has expressed a specific interest in support of the newly-established PhD program on climate change and capacity building of the laboratories.

Objectives

The aim of the project was

(1) to strengthen research capacity at WGCF-NR related to questions of how land use and climate change affect food security and (2) to build laboratory capacity for fundamental analysis of plant and soil samples needed for the research.

The project aimed for a gender-balanced support.

Collaborators

SLU

Erik Karltun (project leader), Workneh Bedada – Dept. of Soil and Environment

Wondo Genet College of Forestry and Natural Resources

Fantaw Yimer, Dong-Gill Kim, Fikru Muda (MSc student), Amisalu Milkeas (MSc student), Berhanu Terefe (PhD student), Haji Kedir (PhD student), Nebi Morke (PhD student), Shimels Girma (PhD student)

Umeå University

Lars Lundmark – Dept. of Chemistry

Soil laboratories

Jimma Agricultural Research Center
Mekele Soil Research Center
Hawassa Soil Testing Laboratory
Nekemt Soil Research Center
Bahir Dar Soil Testing and Fertility Improvement Center

Summary in Swedish

Projektet syftade dels till att stärka forskningskapaciteten gällande hur markanvändning och klimatförändringar påverkar matsäkerhet och till att bygga laboratoriekapacitet för analys av växt och jordprover – en kapacitet som behövs i forskningen vid WGCF-NR. Stödet gavs i fyra olika former; (1) finansiellt stöd för fält- och laboratoriearbete för 2 MSc och 4 doktorander, (2) handledningsstöd till dessa studenter, (3) ett utrednings- och underhållsbesök av en svensk laboratoriekonsult för att analysera och förbättra laboratorieverksamheten vid WGCF-NR och (4) en två veckors kurs i laboratorieskötsel och kemisk analys av mark och växtprover. Gender aspekten beaktades i stödet till laboratorieutbildningen genom könskvotering till kursplatser och genom att anpassa kursformen så att båda könen gavs lika möjligheter att ta del av kursinnehållet.

Photo: Erik Karlstun

Laboratory work.

Description of activities

Supervisory and project support for MSc and PhD students

Wondo Genet currently has four PhD students within the area of climate change and land use. The project has supported these students and two MSc students with funding to conduct some fieldwork and to buy basic equipment for their studies. SLU staff have also been involved as assistant supervisors both for the two MSc students and for one of the PhD students. Unfortunately, the time plan for the PhD students's research activities has been delayed, which has led to a situation where many of their research activities are still pending.

Technical support with repair and maintenance of laboratory equipment

In 2014 a Swedish laboratory engineer, Lars Lundmark, visited Wondo Genet Lab for two weeks to assess the current status of infrastructure and existing analytical equipment. He also repaired and serviced existing equipment. A new motherboard for a Kjeltech instrument was purchased and the instrument made functional in November 2013. A report of his work and his recommendations were submitted to the dean of WGCF-NR.

Course in Good Laboratory Practice (GLP) and analytical methods

A course in soil laboratory management and analysis was held in November 2014. The course was targeted at laboratory technicians, laboratory-responsible academic staff and PhD students who through their research are required to do analytical work in the laboratory. In addition to Wondo Genet staff, people from the National Soil Testing Centre and regional soil laboratories were invited to participate. A conscious effort was made to achieve a gendered-balanced course. Thus, course and each

> "...the laboratory management course allowed the local staff in Wondo Genet to build a laboratory network with collegues at other labs."

Photo: Erik karltun

Study visit in the laboratory.

participating lab was therefore invited to participate with two staff, one male and one female. Three Swedish teachers and three Ethiopian teachers participated with lectures and supervising of practical exercises. One week of the course was held in the Wondo Genet Soil Laboratory and the other week at the National Soil Testing Center in Addis Ababa which has a wider range of laboratory equipment types than the Wondo Genet lab. A total of 23 participants, eight of whom were women, took part in in the course.

The course contained the following lectures, practical exercises and study visits;

- Importance of quality in soil analysis laboratory work
- Cleaning of water for laboratory use – principles and examples of different methods
- Good Laboratory Practice
- How to clean lab ware
- Spectrophotometer – theory and demonstration
- AAS – theory and demonstration
- AAS – optimization and maintenance
- Determination of nitrogen with the Kjeldahl method
- Analytical measurements
- Control charts – construction and evaluation
- Infrared spectral techniques – theory
- IR spectral techniques – applications in soil and plant science
- Soil texture determination

Practical exercises:

- Checking water quality
- Soil sample preparation
- Measurement of phosphorous with spectrophotometer

Course participants.

- Measurement of potassium with AAS
- Cleaning lab ware
- Construction and evaluation of standard curves
- Construction and evaluation of control charts
- Measurement of soil samples with mid infrared spectroscopy
- Measurement of soil texture with laser diffraction

Study visits:

The laboratory at the Ethiopian Institute of Agricultural Research, Addis Ababa

Gender aspects

The project tried to consider gender aspects in the different activities. Unfortunately, the selection of PhD and MSc students, who were all male, was beyond project influence since the students had already been recruited. In the invitation to the laboratory course, it was specifically stated that each participating laboratory could send one female and one male participant. This resulted in some labs only participating with one male since no female candidates were available at that lab. Despite these efforts there were more male participants on the course due to some of the PhD and MSc students also participating, where gender selection could not be influenced by the project. During the course the group work and practical exercises were organised so that the female participants worked together in order to avoid male dominance. This ensured that the female participants actually gained hands-on experience of operating the instruments and doing practical work.

Greatest value of the project

The greatest value of the project was definitely the laboratory management course, which allowed the local staff in Wondo Genet to build a laboratory network with other collegues at other labs.

A summary of the statistics for this project on p. 158

Subsistence agriculture, land degradation and water security in Ethiopia – breaking the downward spiral

Project leader: Kevin Bishop

Summary

The project "Subsistence agriculture, land degradation and water security in Ethiopia – breaking the downward spiral" is part the larger programme "Food security and Degraded lands". The aim of the project was to help improve food security by addressing the underlying issues of water security and land degradation. The project was hosted by the Ethiopian Institute of Water Resources (EIWR), Addis Ababa University. The results include research visits from SLU to EIWR, support for one post-doc at EIWR (Solomon Gebreyohannis Gebrehiwot), and four MSc theses. Major outputs from the project include a regional workshop on "water management and food security", two international journal articles and the MSc theses.

A key finding of the work is that local knowledge adapted to the specific conditions of the catchment and climate are essential for making wise land use decisions. In this regard, community knowledge is a complement to observational records and a resource for the development of effective local management strategies. But local knowledge also needs needs to be supported by more specialized knowledge that brings in other perspectives and insights. An important spinoff from the project was therefore the engagement of SLU in supporting the planning for over a dozen MSc and PhD projects at EIWR and Lilongwe University of Agriculture and Natural Resources. This has been formalized into a research design course at EIWR that SLU aims to support in the years to ahead.

Background

Subsistence rain-fed agriculture provides livelihood for a large majority of the Ethiopian population. A downward spiral resulting from the pressure to produce more food has led to land degradation which can change the hydrological cycle in ways that threaten food security. These hydrological changes include reduced availability of water in the dry season and increased soil erosion during the wet season. To improve water security and thus food security, it is necessary to understand how land use influences the hydrological cycle.

In previous projects financed by Sida-Sarec and the Swedish Ministry for Foreign Affaris we have demonstrated that combining community perception with observations of flow and land use can reveal the local relationships between land use and water security that influence farmers' strategies to cope with the need to increase food production. This trans-disciplinary approach involves participatory methods to involve the farmers in the research process. Our results show that it is necessary to understand and address local conditions to better understand the possibilities for improving the water security on which progress in food security and remediation of degraded land rests. A central part of our earlier work has considered the complicated relationship of forests to the water cycle as summarized in the recent international workshop "Water as the mirror of landscapes: How useful a hypothesis for resource management?"

The graduate research school Natural Resource Management and Livelihoods in International Development (NRML), based at the Faculty of Agriculture and Natural Resources (NL), conducted a course on "Land Use, Land Use Change and Climate Change in November 2012. During this course, participants and facilitators from partner countries in Africa expressed the need to explore opportunities for training, supervising students and conducting research together. Dr Solomon Gebreyohannis and Dr David Mkwambisi had an urgent need for the supervision of their students studying issues related to agriculture, land use change and climate change. To fast-track the areas that we could initiate collaboration within, three Swedish scientists travelled to Ethiopia and Malawi, specifically to:

- Establish the need for training and supervision
- Identify feasible research issues that could be jointly undertaken
- Explore ways of working together that could lead to a memorandum of understanding for the exchange of human and other resources

Summary in Swedish

Syftet med projektet var att förbättra livsmedelsförsörjningen genom att ta itu med de bakomliggande frågorna om vattensäkerhet och markförstöring. Värd för projektet var Etiopiska institutet för vattenresurser (EIWR), Addis Ababa University. En viktig slutsats av arbetet är att lokal kunskap anpassad till de lokala förhållandena i avrinningsområdet och klimat är avgörande för kloka beslut kring markanvändning. I detta avseende är inhemsk kunskap ett komplement till "vetenskaplig" kunskap för utveckling av effektiva lokala förvaltningsstrategier. Lokal kännedom behöver också stödjas av mer specialiserad kunskap som ger andra perspektiv och insikter. Således var en viktig spinoff från projektet stödet för över ett dussin MSc och doktorandprojekt. Detta har formaliserats i en kurs i forskningsdesign som SLU kommer att stödja under de kommande åren.

Photo: Kevin Bishop

Key informant interview.

Aims and Objectives

The overall aim of our research is to improve the water security upon which subsistence agriculture depends. A negative spiral of pressure to produce more food has led to land degradation which can change the hydrological cycle in ways that threaten food security. These hydrological changes include reduced availability of water in the dry season and increased erosion during the wet season. Climate change is another threat to the water supply which underpins people's livelihoods.

Description

In this this project we built on the results from the previous projects by improving the analysis of how land use/degradation influences the water from observational data using a combination of new data (adding the most recent decade of data to the 50 year record previously compiled), new techniques (recession curve analysis of uncertainties) and a modelling approach that allowed for the use of prediction of climate change influences on the land water relationship. This was the central focus of the post-doctoral year for Solomon Gebreyohannis at EIWR. This focus is particularly appropriate given the new strategy for "Green Development" in Ethiopia that will increase forest cover substantially (mostly in the form of planted Eucalyptus). It is essential that this afforestation in some areas (and deforestation in other areas) be evaluated to assess the local consequences for water security.

This project also had an exchange of researchers/teachers between Ethiopia and Sweden that developed several new paths of research:

- Systematically documenting community knowledge as a complement to observational records and a resource for the development of effective local management strategies (Linley Karltun)?
- Explore the suitability of water harvesting techniques as a climate adaption measure by repeating an earlier survey (Woldeamlak Bewket)

"The young researcher mentoring programme initiated within the project provides an opportunity for the lessons learned to be passed on to more of the many new graduate level students in Ethiopia who will be working to improve food security."

• Comparing large scale irrigation to the potential of improving harvests through improved nutrient supplies by means of a combination of fertilizer and compost (Erik Karltun)

Results

The titles of the scientific publications resulting from this project so far give insights into the questions addressed. One was published in the Journal of Environmental Change: The long-term hydrology of East Africa's water tower: statistical change detection in the watersheds of the Abbay Basin. Gebrehiwot, S.G., Gärdenäs, A.I., Bewket, W., Seibert, J., Ilstedt, U., & Bishop, K. 2013. The second publication was published in GeoJournal, Community perceptions of forest-water relationships in the Blue Nile Basin of Ethiopia. Gebrehiwot, S.G., Bewket, W., & Bishop, K. 2014.

A PhD student, Habiba Gashaw, started her research training in November 2013 with support from this project. The PhD study, Methylmercury accumulation in fish, fish intake metaylemercury exposure, and health risks: in reference to Lake Tana, is co-supervised by Professor Kevin Bishop.

Various aspects of water and land use issues in Ethiopia are being addressed within the project by students in their MSc theses. They are:

• Tarik Asaye, Detecting land use and land cover change and its effects on stream flow patterns using GIS, remote sensing and community consultation in Amin watershed, Amhara Region.

• Adanech Yared, Water resource development and adaptation to climate change, EIWR

• Melese Alamirew, Land use change and water management, Haramaya University.

• Zenebu Fikre, Soil moisture, agroforestry practice and climate adaptation, Wondo Genet College of Forestry, Hawassa University.

One noteworthy visit was by Dr Linley Chiwona Karltun, who works to systematically develop the documentation of community knowledge as a complement to observational records and a resource for the development of effective local management strategies.

Communication

A central part of the project communication was the regional workshop organized by EIWR on "Water management and Food security". This was held at the Akaki Campus of Addis Ababa University on 12 March 2014. This was organized by the Ethiopian Institute of Water Resources (EIWR) with support from SLU and the UD15 project.

Three workshops had three objectives:

• Five seminars focused on water management and food security in the Ethiopian context

• Interactive discussions based on these seminars identified the needs for future research directions

• The five seminars and ensuing discussions were developed into the conference proceedings

Gender aspects

MSc students are recruited on an equal opportunity basis. Collaboration with and encouraging participation of women is a priority within all activities of the project. A young researcher mentoring programme has been initiated within the project through Drs Tena Alamirew and Woldeamlak Bewket and Prof. Kevin Bishop at

Addis Ababa University, and at the Ethiopian Institute of Water Resources (EIWR). Three of the four MSc students and the one PhD student supported by the project are female.

Are forests good for water security in Ethiopia? Photo: Kevin Bishop

Greatest value of the project and next steps

Subsistence rain-fed agriculture provides livelihood for a large majority of the Ethiopian population. A downward spiral resulting from the pressure to produce more food has led to land degradation which can change the hydrological cycle in ways that threaten food security. These hydrological changes include reduced availability of water in the dry season and increased soil erosion during the wet season.

To improve water security and thus food security, this project has emphasized the understanding of how land use influences the hydrological cycle. The project has worked towards that goal by using a new data and new techniques to build the capacity to improve water security. This is particularly appropriate since Ethiopia's "Green Development" strategy will increase forest cover substantially (mostly in the form of planted trees). A key finding of the work is that local knowledge adapted to the specific conditions of the catchment and climate are essential for making wise land use decisions. In this regard, community knowledge is a complement to observational records and a resource for the development of effective local management strategies. But local knowledge also needs supported by more specialized knowledge that brings in other perspectives and insights.

For the future, it is therefore essential that more people be trained to assess the local consequences for water security of land use choices. The young researcher mentoring programme initiated within the project through Drs Tena Alamirew, Woldeamlak Bewket and Linley Chiwona Karltun and Prof. Kevin Bishop provides an opportunity for the lessons learned from the project to be passed on to more of the many new graduate level students in Ethiopia who will be working to improve food security.

Collaborators

SLU
Kevin Bishop (project leader) – Department of Aquatic Sciences and Assessment
Linley Chiwona Karltun – Department of Urban and Rural Development
Erik Karltun – Department of Soil and Environment
Richard Hopkins – Department of Ecology

Addis Ababa University
Yilma Seleshi (Head) – Ethiopian Institute of Water Resources
Solomon Gebreyohannis Gebrehiwot (Postdoc) – Ethiopian Institute of Water Resources
Tena Alamirew – Ethiopian Institute of Water Resources
Adaneh Yared (PhD student) – Ethiopian Institute of Water Resources
Woldeamlak Bewket – Department of Geography and Environmental Studies
Tarik Asaye (MSc student) – Department of Geography and Environmental Studies

Haramaya University, Ethiopia
Melese Almirew (MSc student)

Wondo Genet College of Forestry and Natural Resources, Ethiopia
Zenebu Fikre (MSc student)

A summary of the statistics for this project on p. 159

Knowledge syntheses within Land use and climate change

Project leader: Richard Hopkins

Summary

Land use, in terms of cropping and livestock systems, holds a dual place in climate change issues. On the one hand, agricultural systems contribute to the causation/mitigation of climate change, through their central role in areas such as carbon storage, water cycles and the release of green-house gases. However, any mitigation of climate change will act too slowly for us to avoid the consequences of changes already taking place. An urgent development of knowledge on the interactions between land use and climate change is under way. A better understanding of key issues in land use and climate change is called for. Under the remit of this project we have stimulated the production of four knowledge syntheses. In order to support this we have funded a mix of workers in Sweden and in Africa, representing men and women at SLU and at a range of universities and research institutes in sub Saharan Africa. At the time of writing, two of the syntheses are submitted and under review, and two are in relatively advanced states of production.

Aims/Objectives

The aim of this project was to produce four knowledge syntheses, linking Swedish researchers with colleagues in Sub-Saharan Africa.

Description of the activity and how it was conducted

Contact with researchers on issues of climate change and land use was solicited through networks within the SLU theme. Following a process of outlines and discussion, support was given to four sub-projects within the climate change and land use theme. Authors were supported financially to free time to work on a synthesis, and were given support in forming a network for the piece where needed. Detailed descriptions of each synthesis follow below, with the abstracts of the two already submitted.

Forests, water and food security in the northwestern highlands of Ethiopia: knowledge synthesis

Author: 1 male

Solomon Gebreyohannis Gebrehiwot; Ethiopian Institute of Water Resources (EIWR), Ethiopia & Department of Aquatic Sciences and Assessment, SLU, Sweden

This paper synthesizes the spatial and temporal relationship between forest cover and water, as well as its implications for food security in the northwestern highlands of Ethiopia. Different studies addressing the topic of hydrology and land cover have been reviewed. Analyses of 20-40 year long time series showed little and inconsistent relationship between forest cover change and hydrology on meso-scale (100 – 1000s km^2) sized watersheds. Spatial studies, however, showed stronger relationships between low flow and land cover features such as grasslands and woodlands. Studies of local knowledge suggested land cover change impacts are more pronounced at smaller scale (< 100 km^2) watersheds, which is consistent with small-scale and plot-scale observational studies. The stronger relationships between forests and water flows at smaller scale suggests orienting land management programmes to farm level conditions, where water is vital for the food security of subsistence farmers, who comprise 86% of the population of the northwestern highlands.

Currently under review at Water Resource Management.

Assessing and managing intensification in smallholder dairy systems for food and nutrition security in Sub-Saharan Africa

Authors: 3 male, 4 female

Mizeck G.G. Chagunda, Future Farming Systems Group, SRUC, UK
Agnes Mwangwela, Lilongwe University of Agriculture and Natural Resources, Malawi
Chisoni Mumba, Department of Disease Control, University of Zambia, Zambia
Filomena dos Anjos, Veterinary Faculty, Eduardo Mondlane University, Mozambique
Bettie S. Kawonga, Lilongwe University of Agriculture and Natural Resources, Malawi
Richard Hopkins, Natural Resources Institute, University of Greenwich, UK
Linley Chiwona-Karltun, Swedish University of Agricultural Sciences, Sweden

Summary in Swedish

Markanvändning, i termer av odlingssystem och djurhållningssystem, innehar dubbel plats inom klimatförändringsfrågor. Jordbrukssystem både vållar och lindrar klimatförändringen, genom sin centrala roll inom områden som koldioxidlagring, vattnets kretslopp och frisläppandet av växthusgaser. Dock går inbromsningen av klimatförändringen för långsamt för att undvika konsekvenserna av redan pågående förändringar. En angelägen utveckling av kunskapsområdet kring samspel mellan markanvändning och klimatförändring är på gång. En bättre förståelse för centrala frågor inom markanvändning och klimatförändringar krävs. I detta projekt har vi bidragit till produktionen av fyra kunskapsammanställningar inom området, genom att finansiera ett antal forskare och tjänstemän, både män och kvinnor, vid SLU och vid en rad universitet och forskningsinstitut i Afrika söder om Sahara. I skrivande stund är två av sammanställningarna inlämnade för granskning, och två är i ett långt framskridet produktionsstadium.

Photo: Richard Hopkins

Fishponds, combining water storage with food production in Kenya.

Smallholder farmers play an important part in the dairy value chain in most countries in Sub-Saharan Africa. Milk yields per cow, however, remain low, at average of 10 litres per day. This low productivity and poor milk quality require improvement. Over the past two decades, three technological approaches have been used: applying agricultural ecological processes (ecological intensification), utilising modern livestock breeding (genetic intensification), and the other, utilising modern livestock breeding (genetic intensification), and socio-economic intensification. In terms of ecological intensification, strategies that have been applied are continuous housing of cows applying a cut-and-carry feeding system, introduction of purpose-bred forages and pastures, and the introduction of agroforestry within the dairy systems. Genetic intensification strategies have included importation of the world-renowned dairy breeds such as Holstein Friesian (HF) and Jerseys, crossbreeding of the indigenous breeds with HF with the aim of upgrading towards HF. Training and capacity building activities to create sustainable livelihoods have been initiated to not only impart farming and technological practices of animal husbandry but also to enhance appropriate leadership and corporative-building skills that would create and support an enabling environment for sustainability. Examples of the outcome of these initiatives are the emergence of rural artisanal groups such as village farmer technicians, para-veterinary practitioners, lead farmers and farmer extension workers. These improvements and initiatives in the service delivery have been championed by either the national governments or development partner institutions and nongovernmental organisations through different programmes and projects. Challenges of intensification include matching management to genetic potential of imported and crossbred improved dairy breeds, ensuring low post-harvest losses, proper utilisation, and environmental impact challenges.

Currently still under review at the journal Regional Environmental Change.

"A better understanding of key issues in land use and climate change is called for."

Urbanisation, consumption patterns and ecological intensification of livestock in Malawi

Authors: 4 male, 3 female

Linley Chiwona-Karltun, Swedish University of Agricultural Sciences, Sweden
Patrick Kambewa, University of Malawi, Zomba, Malawi
Andrew Jamali, National Statistical Office, Malawi
Richard Hopkins, Natural Resources Institute, University of Greenwich, UK
Susan Chikagwa Malunga, Lunyangwa Agricultural Research Station, Malawi
Indre Giedraityte, Swedish University of Agricultural Sciences, Sweden
Mizeck G.G. Chagunda, Future Farming Systems Group, SRUC, UK

Outline

1. Demographic transition in Malawi
   a. Timeline of population development past 15 years
   b. How is this taking place; rural, peri-urban and urban areas
   c. Food needs and consumption patterns
2. Rising demand for animal products in relation to rising income
   a. How incomes in Malawi have been developing past 15 years
   b. Rural, peri-urban and urban
   c. Link this to change in consumption patterns and what does this mean
3. Livestock production linkages with markets and demand
   a. Demand strongly linked with availability
   b. Availability constrained by demand and production
   c. So the knowledge gap is how to meet growing urban demand's for animal products in affordable and safe ways
4. Providing the environment for producing livestock for urban consumption
   a. Agroforestry
   b. Non-grain feeds
   c. Improving the grazing systems
   d. Land-livestock interactions
   e. Land tenure and livestock intensification
   f. Zero grazing
5. Conclusion

Genetic resources for drought tolerance in crops and livestock in East Africa

Authors: 4 male, 1 female

Vitalis Wekesa, Technical University of Kenya
Jan Philipsson, Animal Breeding and Genetics, SLU
Emelie Zonaband, Animal Breeding and Genetics & ILRI, SLU
Rodomiro Ortiz, Plant Breeding, SLU
Richard Hopkins, NRI, University of Greenwich, UK

1. Description of overall climate pattern in East Africa
   a. Current situation and recent history of drought
   b. Predicted climate change and impact on drought occurrence
   c. Need for integrated systems for nutrition
2. Genetic resources in cereal crops
   a. Existing situation for maize and potential for development.
   b. Genetic constraints and potential for maize production
3. Genetic resources in legumes
   a. Importance of nitrogen fixing crops to integrated production
   b. Genetic resources available
   c. Constraints on legume adaption to drought
4. Genetic resources in small ruminants
   a. Importance of small ruminants
b. Constraints and opportunities for development
5. Constraints on development of integrated systems.
   a. Constraints and opportunities for development
   b. Imbalances in knowledge and development potential

Photos: Richard Hopkins

Heavy rainfall causes high levels of erosion.

Growing demand for livestock production in Sub-Saharan Africa.

Gender aspects

Overall, seven female and nine male researchers have been supported in the production of knowledge syntheses. These included both men and women who have their primary research site in Africa and in Sweden.

Production

To date, two articles have been submitted and two articles are in a state of production, with putative submission before the end of 2014.

Collaborators

SLU
Linley Chiwona-Kartlun, Indre Giedraityte – Dept. of Urban and Rural Development
Emelie Zonabend – Dept. of Animal Breeding and Genetics & ILRI
Rodomiro Ortiz – Dept. of Plant Breeding
Jan Philipsson – Dept. of Animal Breeding and Genetics
Solomon Gebrehiwot – Department of Aquatic Sciences and Assessment (also at Ethiopian Institute of Water Resources (EIWR), Ethiopia

Eduardo Mondlane University, Mozambique
Filomena dos Anjos – Veterinary Faculty

Lunyangwa Agricultural Research Station, Malawi
Susan Chikagwa Malunga

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National Statistical Office, Malawi
Andrew Jamali

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Bettie S. Kawonga

University of Malawi, Zomba, Malawi
Lilongwe Patrick Kambewa

NRI, University of Greenwich, UK
Richard Hopkins

University of Zambia, Zambia
Chisoni Mumba – Department of Disease Control

Lilongwe University of Agriculture and Natural Resources, Malawi
Agnes Mwangwela

Technical University of Kenya
Vitalis Wekesa

A summary of the statistics for this project on p. 161

Restoration of degraded rural landscapes

Project leader: Anders Malmer

Summary

A number of activities were initiated under the newly-formed thematic area of *Restoration of degraded rural landscapes* within SLU's programme Agricultural Sciences for Global Development; SLU Global. A constituting workshop for SLU researchers was conducted to formulate a basis for research cooperation with international partners. The major focus of the project was a research cooperation in Burkina Faso where three small subprojects have in different ways contributed to understanding the multiple benefits of trees in agricultural landscapes and specifically the synergies between the use of trees in the restoration of agricultural land and carbon uptake and management. Outputs from this component include a number of students and young researchers trained in Burkina Faso and in Sweden as well as a number of scientific papers and theses.

Background

To feed 9 billion people by 2050 there will inevitably be a shortage of land and competition for land between different interests and different needs (food, fodder, fibres and fuel). More efficient land use and cultivation will be needed as expressed in discussions about sustainable intensification of agricultural crops. Part thereof, and additionally, restoration of degraded land will need to be a focus area. The estimations for Africa alone are that 650 million hectares are necessary to restore productivity. Most of these lands are already in extensive use by small-scale farmers and pastoralists, which is a challenge for all restoration efforts. Hence, there is a strong link between rural development, livelihoods and restoring land. On the technical side, restoration is often a combination of creating physical structures such as terraces, water-harvesting units etc. and tree planting. Organic material is often the key property lacking in degraded soils; trees and other woody plants can utilize soils below the exhausted topsoil and are the most efficient accumulators of organic material (carbon) to the soils. Interestingly, there may thus be strong links between the focal areas livelihoods, food security, restoration and carbon mitigation/REDD+ (reduce emissions from deforestation and forest degradation + conservation and sustainable management of forests).

Aims and objectives

When these funds were allocated to SLU Global's thematic areas, they were in an initial stage of establishing networks and defining areas of interest. A portion of the funds therefore supported a workshop in liaison with the CGIAR institutes the Center for International Forestry Research (CIFOR) and the World Agroforestry Centre (ICRAF).

In addition to establishing the liasons mentioned above, the main objective of this restoration project was to support specific key investigations that contribute to a long-term activity between SLU and partners in Burkina Faso. At the centre of these activities lies the key question of whether the connections between broad societal goals alleged in the background above may be true as co-benefits, or if there are trade-offs as well. Apart from assisting with key research in the main objective, the aim of this project was to contribute to defining and establishing the SLU Global theme and network, to contribute to capacity building, to foster more networking in the field of restoration and to engage departments and researchers within SLU that have not previously been active in global-development research. The focus was on drawing Swedish key competences (in this case, remote sensing and carbon calculations on forests and trees) into global development research.

Collaborators

Workshop on landscape restoration

SLU

Anders Malmer (project leader) – Dept. of Forest Ecology and Management and SLU Global along with eight workshop participants from five different departments

CIFOR (Center for International Forestry Research, CGIAR)

Manuel Guariguata

ICRAF: *Sara Namirembe, Minh-Ha Hoang*

Summary in Swedish

Denna komponent innehåller ett antal aktiviteter som initierades under, det då under etablering varande, verksamhetstemat *Restaurering av degenererade rurala landskap* inom SLU Global. Ett mindre stöd gavs till en konstituerande workshop där SLU-forskare formulerade en plattform för forskningssammarbete med ett antal internationella partners. Huvuddelen av denna komponent fokuserade på forskningssammarbete med Burkina Faso, där tre mindre subprojekt på olika sätt har bidragit till förståelsen av multipla värden av träd i jordbrukslandskap och särskilt synergier kring användning av träd för mark-restaurering och kolbindning och kolbalans. Produkter från denna komponent inkluderar handledning av ett antal studenter och unga forskare både i Burkina Faso och i Sverige såväl som ett antal vetenskapliga publikationer och examensarbeten.

Photo: Anders Malmer

Pastoralist landscape transforming with enclosures for grazing leading to incresing vegetative cover and trees.

University of Helsinki: *Olavi Luukkanen* – Viikki Tropical Resources Institute

Institute for Agricultural and Environmental Research (INERA) Burkina Faso
Patrice Savadogo

Secretariat for International Forest Issues (SIFI): *Fredrik Ingemarsson*

Local tree species suitable for soil restoration and farmers needs
SLU
Anders Malmer (joint project leader) - Dept. of Forest Ecology and Management and SLU Global
INERA, Burkina Faso: *Patrice Savadogo* (joint project leader)

University of Ouagadougou: *Diawara Sata* (MSc student), *Hadjara Saydo Alcho* (MSc student), *Sanou Lassina* (MSc student)

Carbon estimations for traditional agroforestry
SLU
Ulf Söderberg (project leader), *Torgny Lind, Hans Petersson* - Dept. of Forest Resource Management

INERA, Burkina Faso: *Jonas Koala* (PhD student)

Supervision of remote sensing for scaling up
SLU
Heather Reese (project leader), *Håkan Ohlsson, Kenneth Nyström* – Dept. of Forest Resource Management

Linköping University
Madelene Ostwald, Martin Karlson – Center for Climate Policy Research (CSPR)

Specific activities

Workshop on landscape restoration
This workshop was organized by the SLU restoration theme in cooperation with CIFOR. The funds of the Swedish Ministry for Foreign Affairs also made it possible for participants from ICRAF, the institute for Agricultural and Environmental Research (INERA) of Burkina Faso and the University of Helsinki to participate and supported parts of the venue costs. The scope of the workshop was to bring together relevant research groups at SLU and the other participating partners to cultivate networks and awareness of experiences and ongoing activities as well as to discuss research needs and possible cooperation.

Local tree species suitable for soil restoration and farmers needs
With consideration to the lack of research on the suitability of regional tree species for cultivation for restoration, INERA has initatied an activity of collecting the seed of trees in the agricultural landscape and establishing suitability trials at research stations. In this activity one young researcher visited Sweden for studies and discussions on technical restoration and support was given to INERA for developing existing on-station trials and a trial on farmland for regeneration of indigenous species.

The trials are the basis for one MSc student and are a part of the studies for one PhD student, both of whom are based at Ouagadougou University. The title of the MSc study was *Restoration in the face of rural livelihood diversification and climate change adaptation* and the PhD thesis project *Restoration of degraded landscapes of rural Burkina Faso: effects of seed provenance and characteristics of micro-habitats on the growth and survival of native species*. The MSc thesis, apart from some evaluation of the species trial towards regeneration techniques, includes a small ethnobotanical study on which tree species are perceived by local rural people in their landscape vicinity to be the most important to satisfy their subsistence needs and which require restoration efforts.

Another MSc thesis at Ouagadougou University has also been supported under this project with the title *Rehabilitation of mining sites in Burkina Faso: realities, challenges and suggestions of solutions*. This latter study has also been supported by the NGO International Institute for Water and Environmental Engineering (2iE).

Carbon estimations for traditional parkland agroforestry
Swedish reporting on carbon in forests and trees, and the underlying science, is state-of-the-art and is a part of SLU's role in combining research and national environmental

Photo Jonas Koala

Validation of carbon estimations for trees in agroforestry parkland, Burkina Faso.

monitoring. Our project brought this knowledge to Burkina Faso in order to supervise construction of allometric functions for carbon-content modelling for trees in the traditional West-African parklands (traditional agroforestry system). This parkland often has up to 25 % tree-crown coverage and stores considerable amounts of carbon. There are therefor multiple values in maintaining and restoring trees in these agricultural systems. One local PhD student conducted investigations with Swedish supervision in the field and visited Sweden twice during 2013 for supervision and to perform analyses. In addition, a young researcher from the University of Ouagadougou came to Sweden with a local grant for isotopic carbon analysis for a study on *Carbon pool dynamics in contrasting land cover and soils in semi-arid West Africa*. Our project added funds to suffice for the latter visit, as well as for analyses and joint analyses to be conducted.

Supervision of remote sensing for scaling up

In a joint project between SLU, Gothenburg University (GU), Linköping University (LiU) and INERA on *Trees, carbon and water – synergies or trade-offs* one PhD student at LiU works with efforts to scale up processes between these values on the village level to the larger landscape level. The ratio of carbon to water in trees needs to be based on single trees. Remote sensing on single trees is currently developing and is one of SLU's strong research environments (remote sensing on forests and trees). This field is at the technological forefront, but up to date has not much been involved in the South. The PhD student at LiU has received distance supervision and support for his work and for two periods at the SLU's Department of Forest Resource Management in Umeå. One MSc student at SLU has also completed a thesis project on the field verification for this research.

Results

Workshop on landscape restoration

The workshop was held in Uppsala, Sweden, during two full days on 31 of October and the 1 of November 2012 with the participation of 15 researchers (SLU 8, CIFOR 2, ICRAF 2, Helsinki University 1, INERA 1 and the Secretariat for International Forest Issues (SIFI/KSLA) 1). One major function of the workshop was to bring together SLU researchers from six different research groups based at two faculties at three different locations, all doing relevant research in the perspective of land restoration in the South. The workshop was also

"Long term studies are started to address a significant lack of knowledge in regeneration practices for indigenous trees in agricultural landscapes"

a good opportunity for discussions between potential research partners. The major substantial outcome was a report, for internal circulation, on definitions, frames and ideas for needed research and research applications. The most pertinent application submitted based (partly) on this workshop was *European Long Term Social-Ecological-Economic Research initiative for Biodiversity and Ecosystem Services in the Tropics (EU-BIOTROPES)* submitted to a Horizon 2020 call (TOPIC SC 5-06-2014). Besides the partners in the workshop, the partners in the application also included the French Agricultural Research for Global Development Centre (CIRAD) and Toulouse University of France, Wageningen University and the Norwegian University of Life Sciences. Unfortunately, the application was not granted, but the work put in and contacts can be recycled in the future.

Local tree species suitable for soil restoration and farmers needs

The trials supported by the Foreign Ministry funding aim for long-term evaluation, so the full objective cannot be achieved within the time frame of this support. The two MSc students have defended their theses and there are three scientific manuscripts for publication under preparation from the activities in this subproject. Conclusions include a general survival of indigenous tree species of 87%, but there are significant differences between the six species tested and between fenced and unfenced farmland. Furthermore, planting early in the wet season seems important. As for the ethnobotanical investigation, values for firewood, non-timber forest products and fodder were identified for all indigenous species in the trials. There were no significant gender differences in the knowledge but there is a general and significant lack of knowledge on regeneration practices of the trees in the agricultural landscape.

For the study on restoration of mining sites, the main challenges are the physical and chemical stability of the waste rock piles, the tailings and the open pit, participatory monitoring and evaluation of the activities, management of crop fields and pastureland, reforestation with utilitarian and adapted species to the climate and soil, protection of reforested sites, and cohabitation with the miners.

Partly as an effect of these activities, one student involved in a related activity won a PhD scholarship grant from the Volkswagen fund, and the SLU restoration theme leader is connected to this grant as a mentor. The young researcher visiting Sweden and initiating the activity has received a position on dryland agroforestry in the Sahel for the International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT) based in Niamey, Niger, and is also affiliated with ICRAF representation in Mali. Another young researcher has succeeded in the role for leading the trial in Burkina Faso.

Carbon estimations for traditional agroforestry

From this activity it was possible to establish a strong relationship between the trunk diameter (DBH) of trees and their respective dry weight biomass (and thus carbon content) for the two most common and predominant tree species *Vitellaria Paradoxa* and *Parkia Biglobosa*. The results also included a relation with distance to villages, as pruning of branches and leaves for animal fodder is a common practice. These results will feed into the activity below on quantifying biomass and carbon, based on levels from the single tree up to the landscape level. One manuscript for international peer-review publication is under preparation. The result may seem a simple research exercise, but the field data collection included measuring and weighing of 60 full-grown trees. This is an example of descriptive empirical research which in the North was typically done in earlier years of research development. Today such studies often have low priority in comparison with pertinent modelling and process-oriented research. However, without good empirism, the knowledge about agricultural systems in the South will remain weak and have low predictive power for policy formation.

Supervision of remote sensing for scaling up

This activity has contributed to the team and will soon present a first remote sensing estimation of the biomass of trees in a parkland agroforestry system on village/landscape levels, based on single trees and with thorough validation of field data on the ground (one manuscript for internationally reviewed publication is under pre-

paration).

Based on this activity the theme leader was invited to present findings at a high-level workshop in Washington DC on *Monitoring trees across the Sahel*, hosted by World Resources Institute (WRI). The workshop brought together experts from WRI, United States Geological Survey (USGS), the United Nations Food and Agricultural Organization (FAO), ICRAF, the International Food Policy Research Institute (IFPRI), Word Bank, USAID, Global Environmental Fund (GEF) and others to discuss the need for technical backing for large coming restoration-related support efforts – their possibilities for baselines and evaluations.

Gender aspects

The ethnobotanical investigations about values from forest and indigenous trees included gender profile in local knowledge. However, the knowledge was most significant across gender to a lack of knowledge on regeneration practices of the trees in the agricultural landscape. The Burkinabee students involved were equally men and women.

Greatest value of the project and next steps

This project has contributed with understanding of use of local tree species in agriculture for the shared benefits of restoring soils and for storage of carbon for mitigation. The results feed into ongoing research cooperation between Swedish and Burkinabee researchers. The initiated field trials of regeneration of local tree species will deliver results in the years ahead.

A summary of the statistics for this project on p. 162

Structuring and increasing SLU's cooperation with the World Agroforestry Centre (ICRAF)

Project leader: Anders Malmer

Summary

This programme integrated two components to synthesize knowledge related to landscape restoration and to increase and widen cooperation between ICRAF, SLU and other partners in food security related science. The literature study concentrated on a systematic review on multiple values of trees in landscapes and on a narrative review on enclosures for animals as an alternative to pastoralism and effects on landscape restoration. The systematic review revealed a dominance of co-benefits between 15 different values of trees. Empiric studies mainly deal with farm and field scale, but there is a lack of analysis on a larger scale, for example landscape scale. Likewise, there is a lack of analysis and reporting on cultural services at tree level. As for enclosures, there are examples of co-benefits of food security, landscape restoration, and other aspects of development with agro-pastoralism, but broad analysis is uncommon.

A workshop and an accompanying field trip covering one full week together were held in Nairobi and in NW Kenya respectively. 12 researchers from 8 departments at SLU and 23 ICRAF staff participated actively. During the first period into 2014 the workshop and field trip have resulted in eight research applications in partnership between SLU, ICRAF, national partners in SSA and others. Furthermore, new contacts have generated four manuscripts for international review publication: one systematic review, one narrative review and two regular research papers.

Summary in Swedish

Detta program integrerade två komponenter för att syntetisera kunskap relaterad till restaurering av landskap och för att öka och bredda samarbetet mellan ICRAF, SLU och andra partners inom vetenskap relaterad till uthållig livsmedelsförsörjning. Litteraturstudierna koncentrerades till en systematisk litteratursammanställning om mångfacetterade värden av träd i landskap och en litteratursammanställning om inhägnader för djur som ett alternativ till fri betesdrift och pastoralism och effekten på restaurering av landskap. Den systematiska litteratursammanställningen kom fram till att synergier dominerar mellan 15 olika värden givna av träd, men de flesta grundläggande studier handlar om fält- och gårdsskala, men det råder brist på studier på landskapsskala. Likaledes råder en brist på analyser av kulturella värden av träd i landskapet. För effekter av inhägnader, konstaterades exempel på synergier för hållbar livsmedelsförsörjning, landskaps-restaurering och andra aspekter på utveckling av agropastoralism, men få breda studier finns inom ämnet.

En workshop och en tillhörande exkursion på sammanlagt en vecka hölls i Nairobi respektive i NV Kenya. 12 SLU-forskare från 8 olika institutioner och 23 forskarfe från ICRAF deltog aktivt. Under den första perioden efter workshopen och in under 2014 har denna aktivitet resulterat i 8 forskningsansökningar med partnerskap mellan SLU, ICRAF och andra partner i Afrika söder om Sahara och andra. Vidare har nya kontakter genererat fyra vetenskapliga manuskript för internationell publicering; ytterligare två litteraturstudier samt två reguljära empiriska studier.

Background

The research on food security, sustainable agricultural intensification and restoration of degraded landscapes is a complex multidisciplinary task with many actors from multilateral institutes like in the CGIAR system, over regional African projects and institutes to national universities and institutes from the North and in the South. SLU has many research groups relevant to these subjects and these have various established contacts with CGIAR centres as well as African universities. There is therefore much to be gained from coordination and joint efforts. This has been identified specifically for making knowledge reviews and for linking SLU's contacts with African universities (for example in bilateral capacity development programmes) to link to the CGIAR centers.

Aims and objectives

Reviewing current state of knowledge

In this review effort, the objective was to make a systematic review of current knowledge in two specific fields central to strategies for restoring and intensifying the use of mixed land-use landscapes. This was in contrast to covering of the whole general field of restoration where there is much policy-related work, but scientific review attempts may become "encyclopedic" and too broad. The two fields (or literature research questions) chosen for review were 1) Enclosures – a productive, sequestering and sustainable alternative to pastoralism in dryland ecosystems? and 2) Assessing the multi-functionality of trees on farms and in agricultural landscapes – synergies and trade-offs? The aim has been to deliver both presentations suitable for a broader audience as well as scientific reviews published in international journals.

Structuring and increasing SLU's cooperation with the World Agroforestry Centre (ICRAF)

The objective of this effort was to mobilize the broader the competences within SLU to team up with ICRAF in terms of restoration and in agroforestry and food security in general. The components of this effort aimed to facilitate contacts and concrete plans for cooperation trough 1) a workshop at ICRAF in Nairobi and 2) action in cooperation and establish a base for cooperation in the form of the reviews above.

Collaborators

Reviewing current state of knowledge

SLU

Anders Malmer (project leader), *Gert Nyberg* - Department of Forest Ecology and Management, *Ewa Wredle* – Department of Animal Nutrition and Management,

Photo: Anders Malmer

SLU - ICRAF workshop field trip visiting local entrepeneur supplying tree seedlings to farmers in Kisumu, Kenya.

Sigrun Dahlin – Department of Soil and Environment, *Mattias Jonsson* – Department of Ecology, *Ylva Nyberg* (PhD student) – Department of Crop Production Ecology

ICRAF
Ingrid Öborn (also SLU Department of Crop Production Ecology), *Edmundo Barrios, Fergus Sinclair, Sara Namirembe, Catherine Muthuri, Jan de Leeuw, John Nyaga, Christine Majagu*

ILRI (International Livestock Research Institute, CGIAR)
Mohammed Said, Shem Kifugo

Jomo Kenyatta University of Agriculture and Technology
Shem Kuyah (part-time post-doc at ICRAF), *Peter Mwangi*

University of Nairobi
Stephen Mureithi

Structuring and increasing SLU's cooperation with the World Agroforestry Centre (ICRAF)

SLU
Anders Malmer (joint project leader) - Department of Forest Ecology and Management and SLU Global along with eleven workshop participants from eight different departments

ICRAF
Ingrid Öborn (joint project leader) along with 22 ICRAF staff (including all "Science domain leaders")

Specific activities

Reviewing current state of knowledge

The reviews are made by teams of researchers from a range of institutions. Involved institutions in 1) are SLU departments of Animal Husbandry, Soil and Environme-

"Most empiric studies deal with field and farm scale, but there is a lack of analysis and reporting on larger scales, like the landscape scale"

nt and Forest Ecology and Management, ILRI, ICRAF and Jomo Kenyatta University of Agriculture and Technology, and in 2) SLU Global Restoration Theme, ICRAF and Jomo Kenyatta University of Agriculture and Technology (JKUAT). Both teams have worked through a number of workshops as well as joint activities and a common field trip combined with the component on cooperation with ICRAF below. For 2) a coordinating part-time post-doc position at ICRAF has been arranged for a young researcher from JKUAT. Additionally a PhD student at JKUAT is connected to ICRAF with joint supervision from SLU.

Structuring and increasing SLU cooperation with World Agroforestry Center (ICRAF)

The workshop was held at ICRAF during two days in mid-November 2013 with 12 researchers from 8 departments at SLU participating and 23 ICRAF staff active in the whole or parts of the workshop. In the workshop the SLU researchers were matched with researchers from all of ICRAF's "Science domains". The output of the workshop is a number of now ongoing preparations for specific research concepts. The ongoing reviews gave input in the workshop and have been facilitated by common travel and some common cost for researcher time. After the workshop there was a three day field trip involving 11 SLU researchers, 7 ICRAF staff and one member of staff from ICIPE. The field trip visited farms and landscapes in north-western Kenya (around Kisumu and Kitale). The NGO VI-Agroforestry (Swe: Vi-skogen) participated in the field trip and was instrumental for the logistics of the activity.

Results

Reviewing current state of knowledge

The major result from this component is two manuscripts, one under publication and one soon to be submitted.

The review on introduction and use of enclosures in dryland pastoralist systems was presented as a poster at the World Congress of Agroforestry in New Dehli, India in early 2014. It describes the gradual shift from traditional pastoralist systems to more intensive agro-pastoral systems where livestock production still dominates and grazing systems are managed but also with introduction of crop agriculture in high potential drylands. It is noted that information on the socio-economic and biophysical productivity, sustainability and resilience of these system changes is scarce, while a number of co-benefits are scantily reported and also observed in the area of West Pokot in NEW Kenya in focus for the research platform "Triple L" (see the section (Gerts rapport för S-faks anslag). The co-benefits typically include recovery of soils, soil carbon and landscape tree density as well as livestock productivity and adoption of market economy, smallholder inclusive value chains and increasing influence of women on agriculture and market.

The review "Synergies and trade-offs amongst ecosystem services provided by trees in agricultural landscapes of Sub-Saharan Africa" was also presented with a poster as well as with an oral presentation at the World Congress of Agroforestry in New Dehli, in early 2014. It was positively received for focusing on the trees in the landscapes but covering a broad spectrum of values and benefits. It was also tentatively reported on at the Swedish national meeting Agri4D in September 2013. The review refers to 205 different sites in Sub-Saharan Africa and deal with 15 different ecosystem services. Most empiric studies deal with farm and field scale, but there is a lack of analysis on larger scales such as the landscape scale. Likewise, there is a lack of analysis and reporting on cultural services by trees. Dominantly, there are reports on synergies between different services provided by trees, but there were also reports of trade-offs. These trade-offs often concern high water use by trees, but notably this trade-off is not absolute, but rather a matter of scale and management that relate to context specifics of biophysical and socioeconomic environments.

Photo: Anders Malmer

SLU - ICRAF workshop field trip visiting a farmer to demonstrate soil restoration in West Pokot, Kenya.

Structuring and increasing SLU's cooperation with the World Agroforestry Centre (ICRAF)
The contact activities invested in have values for research networking for a long time ahead. During the first period into 2014 the workshop and field trip has resulted in eight research applications in partnership between SLU, ICRAF, national partners in SSA and others. Two have been granted, three have been turned down and three are still under review (October 2014). The two granted applications are both applications for expert groups for networking, granted from Swedish International Agricultural Network Initiative (SIANI) to preform research and policy relevant networking for 1) "Synergies between energy access and food security" and 2) "The role of forests and trees in restoration of rural landscapes for food security". Furthermore, new contacts have generated four manuscripts for international review publication: one systematic review, one narrative review and two regular research papers. All four, initiated in 2014 are still (October 2014) in preparation.

Gender aspects

It is noted that information on the socio-economic productivity and livelihood resilience of the gradual shift from traditional pastoralist systems to more intensive agro-pastoral systems. This is especially noted with regard to how this transition impacts on the labor of the household carries important gender implications; how income and food respectively raised from livestock based agro-pastoral systems are distributed among female- and male-headed households as well as within male-headed households.

Greatest value of the project and next steps

This component has contributed reviews on key issues for sustainable intensification of forming systems in complex landscapes; intensification in agro-pastoral systems in semi-arid regions and the multiple values (and possible trade-offs) of trees in agricultural landscapes. The reviews combined with the constellations set up between Swedish, African and ICRAF researchers have improved future possibilities for joint research, mirrored in the number of joint research applications as an outcome.

A summary of the statistics for this project on p. 164

Thematic activities within Scale issues in relation to food security and poverty alleviation

Project leader: Lennart Salomonsson

Summary

The world is facing many challenges in food security, both on local and global scales. These challenges involve complex relationships and processes typically studied with methods used in natural science as well as in the social sciences and the humanities. To recognize and analyse these challenges at different systems scales and with the combined efforts of people in relevant disciplines, this project has focused on activities that can bring together actors in higher education and advisory services to broaden their perspectives of how food security and poverty alleviation are inter-related and can be addressed in the future. Another aim has been to organize meetings using project resources to bring together actors with diverse experiences and appropriate disciplinary knowledge to open up future collaboration across disciplinary boundaries. Trans-disciplinary teams are essential to address complex challenges in an era of future uncertainty.

Background

In a time when essentially all vegetated land is impacted by human decisions and dominated by a utilitarian focus on short-term human benefits and individual profit, the future of many fundamental life-support functions in our biosphere is under threat. Problems include losses of genetic information in biodiversity, carbon sequestration potential by plants, and climate and hydrological regulation by forests and diverse natural landscapes. These challenges also threaten our global food systems and operate across different time and space scales. This is the rationale to address 'scale issues of food security and poverty alleviation'. Complex issues from local to global scale defy all understanding unless they are observed and analysed across a spatial spectrum ranging from the cell, to species, from field to farm and landscape, and from human communities to society at large. It is also essential to evaluate challenges with particular attention to the historical perspective, to current needs, and to future projections. This requires thoughtful analysis and evaluation by combinations of people in different disciplines who can pool their expertise in designing research and education activities.

Aims/Objectives

The main objective of this project has been to support different initiatives by teams at SLU and beyond that address the challenges outlined above. To effectively address questions of food security and poverty alleviation, the methods have included (1) multi- or inter-disciplinary approaches, (2) operating with the realization of the importance of 'scale-issues' in relation to food systems, and (3) inspiring new initiatives in research, higher education, and advisory sevice directed at long-term solutions to growing food challenges at local to global scale.

Collaborators

Universities

Aarhus University (Denmark), Addis Ababa University (Ethiopia), Cornell University (USA), Hawassa College of Agriculture (Ethiopia), Lund University (Sweden), Michigan State University (USA), Norwegian University of Life Sciences (Norway), Lilongwe University for Agriculture and Natural Resources, (Malawi) Mekelle University (Ethiopia), Roskilde University (Denmark), University of Liège; Campus d'Arlon (France), Uganda Martyrs University, Universidad Nacional Agraria (Nicaragua), Universidade Nova de Lisboa (Portugal), University of California, Davis, (USA), University of Copenhagen (Denmark), University of Ghana, University of Gastronomic Sciences in Italy, University of Minnesota in St. Paul (USA), University of Natural Resources and Life Sciences in Vienna (Austria), University of Ruhuna (Sri Lanka), University of Stellenbosch (South Africa), University of Wisconsin-Madison (USA), Wageningen University (the Netherlands), University of Nebraska - Lincoln, (USA).

Summary in Swedish

Världen står inför många utmaningar på livsmedelsförsörjningens område, såväl på lokal som global nivå. Dessa utmaningar är oftast kopplade i komplexa relationer av processer inom områden i så väll naturvetenskap som samhällsvetenskap och humaniora. Eftersom vi behöver kunna se och analysera dessa utmaningar utifrån olika systemnivåer och i kombination med olika discipliner, har detta UD15 projekt inriktats på olika aktiviteter som kan hjälpa aktörer inom högre utbildning och rådgivning att öppna sina perspektiv på dessa komplexa relationer i livsmedelsförsörjningen. Målet har också varit att mötena med aktörer från olika kompetenser och discipliner, som möjliggjorts med detta UD15-projekt, skall kunna öppna upp för framtida samarbete över ämnesgränserna.

Photo: Geir Leiblein

Some of the participants in plenum discussions after group work, at the workshop *Developing an international network to support PhD education in agroecology.*

Institutes and other organisations

Danish Institute for International Studies, Centre for Social Research, IFPRI International Food Policy Research Institute, IIED International Centre for Research in Organic Food Systems, International Institute for Environment and Development, Biodiversity International, IITA International Institute for Tropical Agriculture, ILRI International Livestock Research Institute, INRA Toulouse, World Agroforestry Institute ICRAF, World Fish.

Description of the activity and how it was conducted

Three workshops within the thematic area have been supported: 1. An international workshop on Developing an international network to support PhD education in agroecology; 2. An international workshop for the area Agriculture for nutrition and health (A4NH) coordinated by IFPRI; 3. A domestic workshop on Gender and the politics of environment. All three workshops highlighted different important aspects and needs within food security and poverty alleviation, and the complexity of the overall area. They were then characterized by an interdisciplinary approach to the subjects.

Three international PhD courses were supported: 1. Conservation, development and communication in diverse landscapes: theories and methods, was held in Managua, Nicaragua in February-March 2013 and a similar PhD course (same title), was held in Managua, Nicaragua in February-March 2013; 2. Nature-society

"Many new contacts and networks between researchers from different disciplines have been established."

relationships in transition – action research methodologies to collectively deal with experience and utopia was held in Portugal in June 2012; and 3. Land use, land use change and climate change, was also held in Sweden, in November 2012. All three PhD courses highlighted interdisciplinary research.

A seminar series at SLU on 'Scaling-up' – Filling the gap between academic knowledge and farming practice, with three seminars: 1. Action research, held in March 2013; 2. From technical transfer to farmer field schools, held May 2013; and 3. Appropriate scale – agricultural technology and smallholder farming, held in June 2013.

One international capacity building and research project was supported: Expanding cassava utilisation in south-eastern Africa, which included a planning workshop in at the Lilongwe University for Agriculture and Natural Resources, Malawi with the aim of exploring and laying the foundation for a collaborative integrated cassava research programme.

Results

Workshop: Developing an international network to support PhD education in agroecology

The workshop established an international network of researchers from 25 different universities/research institutes from 15 countries. The workshop was established on the foundation of one of the most exciting newly-established MSc degree programmes in agroecology at two universities in Africa: Mekelle University in Ethiopia and Uganda Martyrs University; together with a similar programme in SLU Alnarp, these advanced education activities are enhancing SLU's international reputation as an institution truly interested in food security and poverty alleviation in the South.

The workshop goals were to establish a global network that can plan and facilitate doctoral studies in the trans-disciplinary field of agroecology and capacity building in agroecology. The workshop identified key areas to elaborate for implementing such goals: provide a platform for designing and sharing courses and educational materials, share supervision, elaborate criteria for selection of students and orientation of supervisors for doctoral studies, establish action teams for finding funds for students, including research and mobility, and design evaluation and validation criteria for graduates and for agroecology.

International workshop: Agriculture for nutrition and health with IFPRI

The aim of the workshop was to explore and establish research cooperation between SLU's and CGIAR's research programme Agriculture For Nutrition and Health, with participants from SLU, IITA, ILRI and World Fish. SLU hosted the programme directors and held discussions with them on how SLU could support the programmes particularly in integrating nutrition into their programmes. The following people were engaged in these discussions: A4NH, Dr John McDermott (IFPRI); Humidtropics, Dr Kwesi Atta-Krah; Livestock and Fish Research Systems, Dr Thomas Randolph (ILRI) and Dr Delia Grace (ILRI); Dr Patrick Duggan (World Fish). In June 2014, the first SLU-ILRI partnership workshop that examined in depth how SLU could be an active partner in the new CGIAR research programmes was held and the nutrition aspect was exemplified.

Workshop: Gender and the politics of environment

Gender aspects in relation to environmental politics are central in understanding food security aspects in low-income countries. The idea of the workshop was to think about research the participants have in the field and how to move forward in the network. Discussion groups were led by graduate students, assembled around themes presented by the keynote speaker and other presentations. The workshop participants decided to set up an email list and develop future activities such as

Photo: Nadarajah Sriskandarajah

Participants in the PhD course Conservation, development and communication in diverse landscapes: theories and methods, in Managua 2013.

courses, workshops, and a symposium at a larger yearly conference. The workshop brought together researchers from all over Sweden and generated a functioning network.

PhD course: Conservation, development and communication in diverse landscapes: theories and methods, in Managua 2013

The overall objective of the course was to elaborate on themes in the field of theory of science and research methodology, with special focus on themes as such as social constructionism, reflexivity, gender and development, and methodologies such as action research and case studies. The objective of the case visit within the course was to understand conservation and development dilemmas in situ, then use the experience in the classroom to describe and analyse the experience as a complex whole and recognise researchable questions and consideration of appropriate methods /methodology.

Some of the main achievements as expressed by the course participants were: students were able to discuss practical application of the theories and methods in the context of a field trip; group discussions and interactions provided a place for collective learning despite their diverse background; visit to the Kiang'ondu community was a source of inspiration and learning for the students, which can serve them to better formulate their research questions; integration of disciplines and approaches; and meeting with PhD students from different countries and cultures.

PhD course: Nature-society relationships in transition – action research methodologies to collectively deal with experience and utopia

Understanding sustainability not as a static objective, but as an on-going process of continuous change at the social-ecological level, we focus on transition towards sustainability in nature-society relationships. Transitions are long-term, co-evolutionary and multi-actor processes that require changes both on system and actor level. A crucial dimension in such transition processes is the local collective dimension. Action research has a perspective on how to conduct research: on the one hand, research should support a normative change (in problem-solving or transition processes) and on the other hand such experiences should produce new knowledge. The course aimed to bring together a multidisciplinary group of people interested in action research, exploring the relationships between practice and reflective learning, and broadly, in transition processes, in order to share, discuss, and reflect on their experiences with different methods and activities. The course was attended by 16 students from 12 countries with a mix of backgrounds. Within the broad theme of Action Research, the emphasis on methodologies and reflective processes was received well, similar to courses in previous years.

PhD course: Land use and climate change – drivers, interrelations and policy

The main objective of this course was to introduce the learner to key concepts and debates related to land use and climate change in the context of land use change and forestry issues, gender, rights and food security. Through lectures, group work and self-studies, the following questions were discussed: what are the drivers of land use change? How do land use and climate change interrelates? How is the institutional landscape of land use evolving? What is the situation of land ownership of land resources globally? How can tenure and rights contribute to addressing the consequences of land use change for climate change? Participants were required to write a critical essay illustrating their research and how that was related to the themes of land-use and climate change. The course was attended by 13 students with half of the students coming from African Universities collaborating with SLU. The other students were registered doctoral students at SLU or other universities in Sweden. The course was inspired by discussions between scientists from SLU and the International Institute for environment and Development (IIED) that has also led to strengthening collaborations between the two institutions. The course has also resulted in SLU students conducting their internships and thesis research at Lilongwe University of Agriculture and Natural Resources (LUANAR) particularly within the Masters programme Urban & Rural Development.

The seminar series 'Scaling-up' – filling the gap between academic knowledge and farming practice

The seminar series on scaling-up had the aim to broaden up perspectives for researchers at SLU in different research on the concept of 'scaling-up'. The seminars had limited participants from SLU, but the seminars were recorded and together with the invited guest's Power Point Presentations, will be uploaded on the home page of the SLU Global theme (www.slu.se/slu-global/scale-issues).

The international capacity building and research project 'Expanding cassava utilisation in Southeastern Africa'.

This CATISA activity has grown considerably with the support of the Swedish Foreign Ministry's Food Security Initiatives. In order to expand cassava utilization in Southeastern Africa, an in-depth understanding of the utilization of cassava and its potential was required. Aside from mapping, explorations were undertaken as research questions in the area of cassava product modification and development. This was done in collaboration with the National Agricultural Research Systems (NARS), University of Zambia, University of Ghana, Copenhagen University, Michigan State University, Natural Resources Institute (NRI) together with the

farmer organization Chinangwa, Mbatata, Roots and Tubers Enterprises Farmers Group (CMRTE), and two non-governmental organisations Programme Against Malnutrition (PAM) and Rural Women Foundaton. The results show that cassava production is the main limiting factor for expanding utilization in Southeastern Africa. This partly has to do with the lack of preferred planting material, dependency on a unimodal rain-fed system, pests and diseases and the lack of coordination between delivery of inputs and weather. Without addressing these issues, other factors dealing with post-harvest would merely be treating the symptoms rather than the causes. In addition to the research, an international workshop was held at Lilongwe University of Agriculture and Natural Resources to explore and establish an integrated cassava research programme with regional implications. Working groups and a think tank were established and seed money for writing joint research proposals was established by LUANAR.

Communication of Results

The reports from each of the single activities and some materials from them (as PPP) will be uploaded on the home page of the SLU Global theme (www.slu.se/slu-global/scale-issues).

The materials and the participant list for the workshop on Agroecology network for PhD training can also be found on the Community homepage Entry Scape: https://edu.entryscape.com/ (Community 'Agroecology PhD Global').

Gender aspects

Most of the activities (especially the PhD courses) included gender aspects in food security. The workshop 'Gender and the Politics of Environments' had, of course, the gender aspect as its focus.

Greatest value of the project and next steps

The greatest value of the project has been to widen perspectives on the complexity and the many dimensions of food security and poverty alleviation, with the target groups of researchers, PhD students and other actors participating in the different activities in this UD15 project. Many new contacts and networks between researchers from different disciplines have been established, as well as collaborations between SLU and participating universities in Global South.

A summary of the statistics for this project on p. 166

Knowledge synthesis within Scale issues in relation to food security and poverty alleviation

Project leader: Lennart Salomonsson

Summary

The world is facing many challenges in food security, both on local and global scale. These challenges are typically intertwined in complex relationships of processes within the field of natural science as well as the social sciences and humanity. These complex relationships operate at different system scales, at different time and space scales, and can be interpreted from different disciplinary perspectives, theories and concepts. This 'knowledge synthesis' has the aim to present a glimpse of these broad aspects of 'scale issues in relation to food security and poverty alleviation'. The knowledge synthesis is a set of manuscripts, intended for scientific publication, covering some of these complex aspects, including some overview of important scientific references on the issues in focus for each article.

Background

Global food security is facing a great many different challenges in producing more food for more people with less of the resources we today use for high yielding industrial agriculture (such as fossil fuel and pesticides), and more equity in distribution of the food produced These challenges are typically intertwined in complex relationships of processes operating at different dimension and over different time and space scales, and what we have called 'scale issue on food security poverty alleviation'.

There are many different disciplinary and interdisciplinary research efforts to analyse, describe and understand this complexity. To highlight some of these very different aspects, and hopefully widen perspectives on these complex relationships, we have asked different researchers to give some overview of scientific literature within the field of their own research area on food security aspects. Some of the manuscripts we received will have a case study focus, to highlight the aspects elaborated in a very concrete way. Others are more in a theoretical focus.

Aims/Objectives

The main objective of this specific UD15 project has been to highlight the complexity of global food security aspects, seen from different scientific research perspectives. But also to show how research efforts are trying to deal with some of this complexity of processes, interwoven between 'nature' and 'society'.

Collaborators

The list below shows the title and the authors of different manuscripts:

1. Scale issues and food-security: Making 'hidden' values visible with application of interdisciplinary theory. By Professor Lennart Salomonsson, SLU, Professor Charles Francis, Nebraska University and Torbjörn Rydberg.
2. Sustaining food production and ecosystems integrity. By Prof. Lennart Salomonsson, SLU, Prof. Charles Francis, Nebraska University.
3. Is the term 'scale neutral' useful for comparing smallholder adoption of new crop varieties during the Asian green revolution and in today's Africa? By Dr Klara Jacobson, SLU.
4. Scaling the shea trade. Gendered and political consequences of differentiating and niching the shea trade in Burkina Faso. By Dr Marlene Elias, Bioversity International, Selangor Darul Ehsan, Malaysia, and Associate Prof. Seema Arora-Jonsson, SLU.
5. Rethinking scale as politics of land grabbing governance. By Marie Widengård, PhD candidate, Gothenburg University.
6. Scales, risks and food security outcomes in agrarian transitions: comparative evidence from Nepal and Vietnam. By Prof. Adam Pain, SLU, and Ian Christoplos, Danish Institute for International Studies.
7. Balancing food production for optimal global health and nutrition in the food-feed-fiber-fuel competition in low-income countries. By Dr Linley Chiwona Karltun, SLU,

Summary in Swedish

Världen står inför många utmaningar för sin livsmedelsförsörjning, såväl på lokal som global nivå. Dessa utmaningar är oftast kopplade till komplexa interaktioner i processer som täcker områden inom såväl naturvetenskap som samhällsvetenskap och humaniora. Dessa komplexa relationer är verksamma på olika systemskalor, över olika tids- och rumsskalor, och kan tolkas från olika disciplinära perspektiv, teorier och begrepp. Denna "kunskapssyntes" syftar till att presentera en glimt av bredden av dessa aspekter av "skalfrågor i relation till livsmedelsförsörjning och fattigdomsbekämpning". Kunskapssyntesen utgörs av en uppsättning av manuskript, med sikte på vetenskaplig publicering, som täcker en del av dessa komplexa frågor, inklusive överblick över viktiga vetenskapliga referenser på frågorna i fokus för varje artikel.

Photo: Lennart Salomonsson

Dr Klara Jacobson in the maize fiield during her PhD field work in South Africa.

Dr. Joyce Kinabo, Sokoine University, Tanzania and Dr Leif Hambraeus, Karolinska Institutet.

8. Agricultural input subsidy experiences in Malawi – opportunity costs and benefits. By Dr.Linley Chiwona-Karltun, SLU, MSc Florence Conteh, International Consultant, PhD candidate Joseph Nagoli, SLU, Engineer Olof Hesselmark Consultant, Stockholm, PhD candidate Andrew Jamali, National Statistical Office, Malawi,Dr David Mkwambisi, Lilongwe University of Agricultural & Natural Resources Malawi, and Dr Blessings Chinsinga, Centre for Social Research, Malawi.

Description and results of the activity

Part of the abstracts, or discussions/conclusions, highlights in the articles are listed below:

1. Scale issues and food-security: Making 'hidden' values visible with application of interdisciplinary theory.

Increasing attention to complex phenomenon and processes, operating over time and space in interconnected ways, has also developed new strands of complex system resear-

"It also shows how issues usually covered by natural science or the social sciences separately, in the real world are intertwined and need more interdisciplinary research efforts."

ch. These theories are based on the concept that complex systems are open, interactive and responsive, which make them develop and change over time. In this development processes 'unpredictable new events' are key factors. Applying complex systems theory on today's food security issues could also be useful to identify and understand co-evolutionary processes in the interaction between agrarian ecosystem and social structures and the impacts of these two structures on global life-support systems.

2. Sustaining food production and ecosystem integrity.

This paper presents an overview of two main, but simplifying, 'strands' in how global food security can be described, analysed and generate policy recommendation from. The still dominated perspective have the focus on the production per land or animal, with a recommendation that an implementation of modern industrial agriculture on a global level is the answer on the challenges (Green Revolution 2.0). The other main strands put the focus on the unsustainable components on present industrialized agriculture, as demanding on fossil fuel technology (directly in production and indirectly in support of goods and services), reducing biodiversity (directly and indirectly), contamination of environment with agrochemicals. These factors are often neglected by the first perspective, or handled by "it does not have to be so" arguments. The other perspective on the other hand often underestimates the magnitude of challenges in the fact that most people today lives in cities and need a constant inflow of cheap food for their living.

3. Is the term 'scale neutral' useful for comparing smallholder adoption of new crop varieties during the Asian green revolution and in today's Africa?

In summary, this paper has shown that the concept of scale neutrality has little to offer in a discussion of the use and usefulness of new crop varieties in African smallholder contexts. First of all, the same relationship does not apply to contemporary African settings as it did during the Asian Green Revolution (GR) between the critical factors for establishing scale neutrality: labour, credits and markets. Secondly, the shift in attention from rice and wheat to maize also makes a major difference as differences in crop biology on balance have more negative effects for smallholders' adoption. Lastly, the privatised and highly regulated seed development industry today does not recognise small farmer needs and preferences to the same extent as the largely publicly funded R&D during the Asian GR. Talking about new crop varieties as scale neutral does not help us understand their adoption and usefulness in small farmer contexts. If anything, it blurs the relationship between crop biology and farm size and makes it more difficult to understand why farmers do or don't adopt and benefit from particular crop varieties.

4. Scaling the shea trade. Gendered and political consequences of differentiating and niching the shea trade in Burkina Faso.

In sum, this paper has explored the shea nut commodity chain, whose actors reap distinct benefits from the trade. Originating our analysis at the macro-scale and sequentially moving towards an examination of small-scale producers has revealed the ways these actors respond to and influence such global processes. As the case of shea illustrates, changes in the global political economy have decidedly local consequences, and the benefits and drawbacks of these processes are unevenly distributed within a population. Ethnicity, gender, and age, among other identity features, mediate the ways actors respond to new economic prospects. The local manifestations of international market shifts extend well beyond the economic sphere, affecting the very way societies are organized and the norms surrounding the use and trade of traditional commodities. Renewed attention to these phenomena is required to create policies that can ease the transition of local actors into new economic configurations and ensure that vulnerable segments of the population benefit from emerging opportunities.

Photo: Marie Widengård

View of seedlings for palm-oil plantation of the kind described in the article *Rethinking scale as politics of land grabbing governance.*

5. Rethinking scale as politics of land grabbing governance.

Recently, much attention has been given to a sharp rise in land deals in the global South. This article explores the state of knowledge surrounding these deals and the effects that knowledge has had on land practice. It finds that academia is increasingly moving away from a polarised debate of an optimistic "win-win" versus a critical "land grabbing" narrative. More recent literature has taken a reflexive turn discussing perspectives and evidence, and downsized the race for killer facts of acquired land areas and displaced people. Instead, focus is given to land grabbing as a multi-scalar question, also allowing for the possibility that rural residents may both resist and benefit from these land deals. Meanwhile, the land grabbing literature has contributed to pushing land into global governance, involving land-related voluntary guidelines and criteria in sustainability standards and certification schemes that may both assist and hinder affected land users in acquisition processes. This means the question of how land deals affect rural populations, poverty, livelihoods and food security has

Photo: Marie Widengård

View of Jatropha plantation of the kind described in the article *Rethinking scale as politics of land grabbing governance*.

become an increasingly networked question taking place both on-ground and at great distances from the land where global rules are set and practiced. This article therefore proposes a networked and scalar perspective in understanding how actors, issues, and claims (may better) practice sustainable and responsible land deals.

6. Scales, risks and food security outcomes in agrarian transitions: comparative evidence from Nepal and Vietnam.

Through a detailed examination of two country case studies – Vietnam where an agrarian transition has largely been achieved and Nepal where it has not, the paper explores the complex dimensions of scale and risk in relation to food security and agrarian transitions and how they have evolved over time. The role of the state in facilitating individual freedom to act built on a social contract that ensure ssfood security is critical. In Vietnam, the legitimacy of the state with a large and powerful bureaucracy has long been recognised as essential where the risks of water related disasters are high. It has further been anchored in the fight against privilege, whereas in Nepal the hierarchy is largely intact. Nepali society has largely tolerated structural inequalities whereas Vietnam has a proactive stance in overcoming them. The comparative advantages of landlocked Nepal in relation to globalisation are few (tourism and migration being notable exceptions) whereas farmers in Vietnam have relatively good access to domestic and international markets. History and geography frame the scope and scalar factors affecting the legitimacy of the state and have implications for gaining food security in Sub-Saharan countries.

7. Balancing food production for optimal global health and nutrition in the food-feed-fibre-fuel competition in low-income countries.

The nutrition transition as a result of the socio-economic development started in

the affluent societies but occurs today in all countries. Unfortunately this has also lead to unhealthy dietary habits resulting in chronic diseases, e.g. cardiovascular diseases, obesity, diabetes. In 2010, a UN System network for Scaling Up Nutrition (SUN) was launched to reduce malnutrition and many countries are scaling up programs with demonstrable results. However, so far most interest in the SUN is devoted to more or less purely nutrition activities, e.g. producing superfoods to combat hidden hunger and stimulating breastfeeding and fortification of food items with micronutrients. Little interest, if any, has been devoted to stimulating collaboration between optimal food production in balance with increased bioenergy yielding crops. A focus on such collaborative programmes could counteract increased land grabbing activities in low income countries that are aimed at supplying food and energy needs of more affluent societies. The evidence from the case study will be used to stimulate discussions with various stakeholders, particularly policy makers.

8. Agricultural input subsidy experiences in Malawi – opportunity costs and benefits.
This paper critically reviews Malawi's farm input subsidy programme and draws some conclusions and lessons for others. Malawi has gained international recognition for its rather successful Farm Input Subsidy Programme (FISP) which resulted in a peak national maize production of 2.1 metric tons in the 2005/2006 season. However, there are ongoing debates around the long-term sustainability of the programme and concerns about FISP not being all inclusive particularly with the youth. Furthermore, although the subsidy programme is generally deemed successful by the Government of Malawi in alleviating food insecurity; Malawi still faces critical food shortages and at times is unable to sustain supplies of maize in its strategic grain reserves. A recent donors and stakeholder meeting in Malawi and a report by Pauw and Thurlow (2013) asks where to now with FISP in Malawi? It concludes that while FISP has enabled some households to be food secure, it has also crowded out other socio-economic spending and that careful understanding and quantification of the opportunity costs and outcomes is required. The fact is that FISP crowds out the budget of the Ministry of Agriculture and Food Security (MoAFS), taking up as much as between 75% and 80% of the budget at the expense of such activities as research, development and rural infrastructural development. The paper concludes that an innovative FISP could contribute towards Malawi's development beyond what is currently being undertaken. The focus will probably drift towards the role of subsidies and how to create a system for the farmers participating in paying in part or wholly for the inputs.

Communication of Results

All manuscripts will be submitted for scientific peer review publication.

Gender aspects

Many of the articles cover gender aspects. Article 4 has it as the main focus.

Greatest value of the project and next steps

The greatest value of this 'knowledge synthesis' on a very broad, but urgently important, subject, namely food security issues, is that it highlights many aspects of the subject. It helps to widen the on-going debate and policy works on the subject, by highlighting the complexity of the subject. It also shows how issues usually covered by natural science or social science separately, in the real world are intervened and need more interdisciplinary research efforts. Most of the articles also use case studies as examples of what they analyse, and make the analyses very concrete.

A summary of the statistics for this project on p. 168

Urban and peri-urban farming for food security

Project leader: Ulf Magnusson

Summary

This project deals with the contribution of urban and peri-urban farming in low income countries to food security, in particular analysing the pros and cons of this farming practice and identifying knowledge gaps. Three main activities were run within the project resulting in the following: An anthology of 68 pages Urban and Peri-urban Agriculture for Food Security in Low-income Countries – Challenges and Knowledge Gaps (SLU-Global Report 2014:4) written by 26 researchers at Swedish and Ugandan universities and a start for a network for research on urban and periurban farming in low-income countries. A meta-analysis on the scientific literature on zoonoses in cities is under way as a cooperation between researchers at the International Livestock Research Institute in Kenya. Following a meeting with the international research programme "Livestock and Fish" within the CGIAR system to identifying common research agendas and complementary competencies with SLU researchers, a process has started to make SLU a full partner of Livestock and Fish as agreed between the Vice-Chancellor and the programme director, respectively. All in all, Swedish research and stakeholders have been sensitized to the importance of and challenges in urban and periurban farming in low-income countries and Swedish researchers have got a kick-start for liaising with and contribute to international research in this field.

Background

Today more than half of the planet's inhabitants live in cities. The world-wide migration of rural people to cities is particularly prominent in Africa and Asia. Some are "pushed" there because of poor security and shortage of food, whereas others are "pulled" to the city, for example because of better job opportunities. Rural dwellers moving to cities, regardless of the reasons, often bring agricultural practices with them for food security and livelihood reasons. Practices like keeping pigs, poultry and dairy cows or cultivating fruitsand vegetables and collecting firewood can be run within the city or in the periphery and play a variable, and sometime very significant, role for life in the city. However, there are also downsides related to urban and peri-urban farming, for example threats to the public health from zoonotic diseases in livestock, sanitary issues from cultivation and livestock-keeping and local environmental degradation from pollution and deforestation.

Analyzing the pros and cons of this farming practice, and identifying knowledge gaps is the overall objective of this project. Please note that this project started in April 2013 and has thus not run for the whole period.

Aims/Objectives

The project had three aims:

- To make a survey of the current knowledge about urban and peri-urban farming in low-income countries with emphasis on pros and cons and identification of knowledge gaps;
- To use the insights and experiences from the survey to establish international cooperation on research and capacity building within the area;
- To increase awareness and knowledge about the extent, importance and risks of urban and peri-urban farming for food security among Swedish stakeholders.

Collaborators

SLU
Ulf Magnusson (project leader)

Uppsala University
Cecilia Fårheaus

International Livestock Institute
Delia Grace, Kristina Roesel

Kyambogo University, Uganda
Eli Katunguka-Rwakishaya

Summary in Swedish

Detta projekt rör urbant och periurbant jordbruk i låginkomst länder för säkrad livsmedelsförsörjning. Särskild vikt har lagts vid att analysera för och nackdelar samt identifiera kunskapsluckor. Inom projektet har tre huvudaktiviteter genomförts som resulterat i det följande: en antologi på 68 sidor med titeln Urban and Peri-urban Agriculture for Food security in Low-income Countries - Challenges and Knowledge Gaps (SLU-Global Report 2014:4) skriven av 26 forskare vid svenska och ugandiska universitet och en start för ett nätverk för forskning om urbant och periurbant lantbruk. En påbörjad metaanalys av den vetenskapliga litteraturen rörande zoonoser i städer tillsammans med forskare vid International Livestock Research Institute i Kenya. Som följd av ett möte med det internationella forskningsprogrammet "Livestock and Fish" inom CGIAR-systemet där gemensamma forskningsinriktningar och komplementära kompetenser identifierades tillsammans med SLU forskare, startade, efter överenskommelse mellan rektor och programchefen, en process att söka få SLU att bli en "full partner" till Livestock and Fish. Sammantaget har svenska forskare och intressenter blivit medvetandegjorda om betydelsen av och utmaningarna för urbant och periurbant jordbruk i låginkomstländer och det har givit svenska forskare en snabbstart för att knyta kontakter med och bidra till forskning inom området.

Photo: Richard Hopkins

Livestock serves as a "living bank account" for many poor families in African cities as they get both food and income from their animals.

Lund University
Magnus Jirström, Agnes Andersson Djurfeldt, Christopher Turner

Makerere University
Charles Masembe, Kokas Ikwap, benon Kanyama, Constantine Katongole, Benon Mbabazi Kanyima

Description of the activity and how it was conducted

A network of scientists at three Swedish and two Ugandan universities working on different aspects of urban and peri-urban farming in low-income countries was established for writing a survey over the area. This was made in the format of a structured anthology. The anthology was then presented and discussed at a public book launch. Cooperation was established with colleagues at the International Livestock Research Institute (ILRI) in Kenya and a meta-analysis of the peer-reviewed literature on zoonoses in urban settings was started in order to investigate the geographical distribution of studies and diseases.

Contacts were sought for within the CGIAR system and contact was established with the international research programme "Livestock and Fish" within CGIAR. Following discussions, a match-making meeting was arranged in Märsta, Sweden in June 2014 for identifying common research agendas and complementary competencies. The meeting attracted some ten researchers from Livestock and Fish and some 20 from SLU.

"...it has given Swedish researchers a kick-start with respect to the opportunity to liaise with and contribute to international research in this field."

Results

Communication of results

The work on the anthology resulted in the 68-page report Urban and Peri-urban Agriculture for Food Security in Low-income Countries - Challenges and Knowledge Gaps (SLU-Global Report 2014:4) and also a start for a network for research on urban and periurban farming in low-income countries.

The work on the metaanalysis on zoonoses in cities has expanded and is still going on and has tightened the links between researchers at ILRI and SLU.

The meeting with Livestock and Fish has started the planning of several new cooperation-projects between researchers at SLU and within the programme. Most important, though, is that a process has started to make SLU a full partner of Livestock and Fish as agreed between the Vice-Chancellor and the programme director, respectively.

Gender aspects

The gender aspects, both the equity aspect and the "under used-potential" aspect have been emphasized, especially the latter, in the prepared anthology as well as in the cooperation planning with the "Livestock and Fish" programme. Considerable elaborations have been made around the paradox that women in many low income countries have a subordinate in decision making and poor access resources in general and at the same time put a lot of work into farming and have a large responsibility for the food security of the household. The formula for success and progression that has been discussed in the project is how to match the existing workload and responsibility with appropriate decision making capacity and other resources.

Greatest value of the project and next steps

There are two main achievements and value of this project. Firstly, Swedish research colleagues and stakeholders have been sensitized to the importance of and challenges in urban and periurban farming in low-income countries. Secondly, it has given Swedish researchers a kick-start with respect to the opportunity to liaise with and contribute to international research in this field. Next steps are to use the current momentum and exploit established national and international networks to conduct research or generate research resources in the field.

Photo: Malin Planting

Participants in the international workshop *Livestock and fish – by and for the poor* (within the CGIAR system), hosted by SLU Global from 10-11 June 2014.

A summary of the statistics for this project on p. 169

Projects with research, educator and staff exchange and capacity development

Photo: Annika Nordin

Sustainable systems for integrated fish and vegetable production — new perspectives on aquaponics

Project leader: Beatrix Alsanius

Summary

Global food security is characterized by four major distinctions, namely food availability, physical and economic access to food, food utilization and food stability. As not only food quantity but also food quality is essential to public health, high-yielding production systems that encourage production of animal protein and fish lipids as well as high-value horticultural produce that are high in fibre, minerals and bioactive compounds are highly interesting. One potential system approach that combines these is displayed by aquaponic (AP) systems, integrating fish and seafood rearing with production of horticultural produce. Such engineered systems also meet demands posed by some of the grand global challenges, such as global population growth, urbanization, global climate change and imited access to resources for agricultural activities (e.g. water and land use) and sustainability.

The project team consisted of Swedish and Ethiopian researchers, with expertise in horticulture, fisheries, microbiology, food safety and environmental sciences. A concept-based approach was used in order to elaborate on resource-efficient and safe AP systems. Gaps of knowledge were identified in order to optimize AP with respect to fish and horticultural produce yield as well as with respect to food safety and environmental impacts.

Background

The idea of combining fish and vegetable/berry production is not new. Most approaches, however, focus on fish and seafood rearing, considering the horticultural part of the cropping system rather as wetlands for bioremediation of the fish water than as a resource-efficient production unit for vegetables, berries or ornamentals. AP systems may be designed as low- or high-tech systems. Due to their engineered nature, they may be placed on sites with either premier conditions for resource provision or with high food demand, such as urban and peri-urban environments. They can make use of sites that are not suitable for other forms of food production, or with low impact on the existing habitat.

According to the current literature, AP systems are based on the following components (fig. 1). Each of them displays a unique habitat with specific demands for optimal function, production and/or quality. In most literature, these components are viewed as single units linked together without any further consideration of the fact that this uni-factorial view will inevitably lead to a suboptimal system that is limited by its weakest link. Some previous studies acknowledge these differences, but opt for a compromise instead of optimization of the entire system.

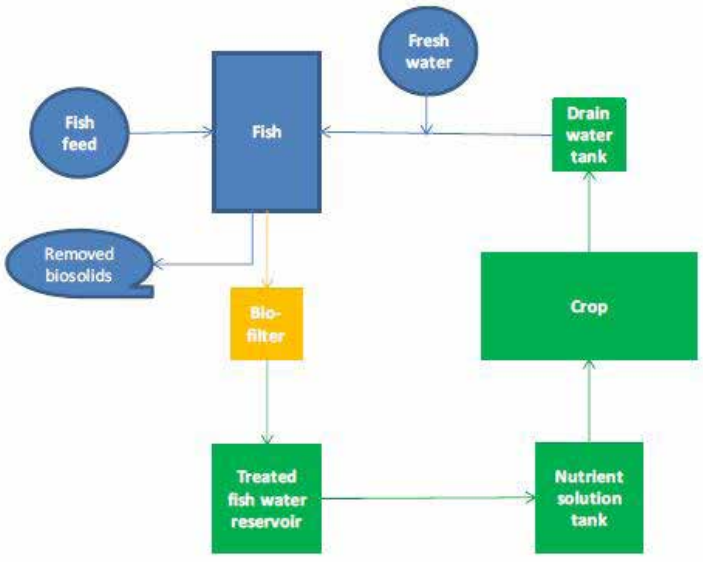

Figure 1. Basic design of an aquaponic production system (© B. Alsanius; Alsanius et al., 2014)

Summary in Swedish

Global livsmedelstrygghet kännetecknas av fyra huvuddistinktioner, livsmedelstillgänglighet, fysisk och ekonomisk tillgång till livsmedel, livsmedelanvändning och livsmedelstabilitet. Inte enbart mängden utan också kvalitet är väsentlig för den globala folkhälsan. I detta sammanhang spelar fisk- och grönsaks- och fruktbaserade livsmedel en viktig roll. Ett möjligt tillvägagångssätt för att öka och säkra tillgång till dessa grupper av livsmedel på ett uthålligt sätt är genom kombinerade produktionssystem för fisk och grönsaker, så kallad akvaponiska system. Dessa produktionssystem möter många av de stora framtida globala utmaningar, såsom global befolkningstillväxt, urbanisering, GCC och begränsad tillgång till naturresurser som är avgörande för areel produktion (t.ex. vatten, mark) och uthållighet.

Projektgruppen för detta projekt bestod svenska och etiopiska forskaren med expertis i hortikultur, zoologi (fisk), mikrobiologi, livsmedelhygien och miljövetenskap. En konceptbaserad ansats valdes för att arbeta fram resursefficienta och säkra akvaponiska produktionssystem. Kunskapsluckor identifierades för att optimera akvaponiska system både med hänsyn till den odlade fisken och de odlade grönsaker/bär vad gäller avkastning, livsmedelssäkerhet och inverkan på miljön.

Photo: Beatrix Alsanius

Hydroponic part of aquaponic system.

Aim

To create a basis for optimized co-production systems for fish and horticultural produce (vegetables, berries).

Collaborators

SLU
Beatrix Alsanius (project leader), *Sammar Khalil, Anna Karin Rosberg, Karl-Johan Bergstrand, Rahel Hartmann* – Department of Biosystems and Technology

Addis Ababa University, Ethiopia
Abebe Getahun, Abebe Tadesse – Department of Zoological Sciences, Fisheries and Aquatic Sciences Stream

Approach

We have chosen to address the question through literature studies which are compiled in a review article. The article will be submitted for publication in a peer-reviewed scientific journal. In the framework of this project we address the topic from a system approach, using concept mapping tools.

Results

Technical details on the fish rearing and crop production unit are presented within

Parameter	Unit	Threshold value	Reference
Temperature (°C)	Warm water fish	24-30	
	Cold water fish	12-23	
	Crop	>15	Wilcox et al. 1962, Martin & Wilcox 1963
		20-24	Thompson et al. 1998, Hurewitz & Janes 1983, Gosselin & Trudel 1985, Diáz-Péréz et al. 1985, Panova et al. 2004, Sopher 2012
Oxygen content (mg L^{-1})	Warm water fish	>2	Bhatnagar et al. 2004
	Cold water fish	>5	Boyd 1992
	Crop	BOD <10 COD <60	DIN 19650 1999
pH	Fish	7.5-8.5	Bhatnager et al. 2004
	Crop	>5; <7	Lieth & Oki 2008
Electrical Conductivity (mS cm^{-1})	Fish	30-5000	
	Crop	<3	Lieth & Oki 2008
Alkalinity (meq)	Fish	50-300	
	Crop	<3	Lieth & Oki 2008
Carbon content (mg L^{-1})	Fish	<12	Bhatnager et al.2004
	Crop	<20-40 (TOC)	Alsanius 2011

Table 1. Physio-chemical demands prevailing in the fish and plant units of aquaponic systems.

the framework of the review article. There are at least nine different basic approaches for growing horticultural crops in soilless systems. Likewise there are five approaches for rearing fish. In the review article, these approaches are briefly summarized from a technological point of view, and low- and high- tech aquaponic systems are presented.

Based on the concept approach, AP systems were – in the present project - broken down into different loops of importance for optimization, such as the water loop, trophic loops (incl. nutrients, nitrogen and carbon) and microbial loops (incl. the microbial biogeography, fish, plant and human microbial pathogens as well as beneficial microorganisms). These loops are closely interrelated. Circulating water is the dominant feature that links the fish and plant sections together. It represents the vehicle for nutrients (in a broad sense) and microorganisms between the sections, but also has a habitat function. Fish and plants have different requirements concerning water quality, with respect to physical (e.g. temperature, pH, oxygen content), chemical (e.g. pH, nutrient load, load of certain chemical elements, load of organic compounds) and biological (e.g. microbial load, microbial activitiy, occurrence of certain microorganisms) properties. Physio-chemical threshold values for water properties associated with the fish and plant production units are shown in Table 1.

Most aquaponic literature considers nutritional factors. The AP nutrient pool is characterized by nutrient sources (fish feed, plant fertilizers, fresh water) and nutrient converters (fish, target crop and other autotrophic organisms, heterotrophic microbiota, organisms associated to biofilters). The basic and major nutrient input (fish feed) quality and quantity correlates with the trophic fish type, size and age, but since all fishes are carnivorous at early age, high protein requirements are necessary. Plants' nutrient requirements vary among plant species and their phenological stages. In addition, plant nutrients influence product quality. In general, during a vegetative stage of the crop, the N:K ratio must be higher, whereas during the generative stage (fruit set) it will decrease. Many publications focus on the nitrogen situation in AP systems and do not consider that the sum of nutrients from non-used fish feed and of fecally released nutrients does not necessarily equal the nutrient demand of the grown crop. To be a viable alternative for securing access to food, AP systems optimize both the

Photo: Beatrix Alsanius

Tilapia in aquaponics.

fish and crop production unit and thus optimize the nutrient supply to the grown crop with respect to its demand during various developmental stages. This has not been acknowledged in the scientific literature so far.

The AP carbon pool has seven major sources, namely the macrophyte, phytoplankton, fish, fish feed, autochtonous carbon, additive compounds to secure plant or fish health (e.g. plant protection products, antibiotic compounds) as well as the biofilm. It may be fed into the systems in dissolved or in particulate form. Dissolved organic carbon (DOC) may be released as deposits from plant roots, as metabolic waste products from fish, such as non-utilized degraded fish feed or as metabolic phytoplanktonic compounds. Autochthonous organic carbon (OC) may originate from the raw water, the plant growing medium and the equipment. Chemical agents promoting fish and plant health contribute to the pool of dissolved organic carbon in the AP system, but also affect carbon uptake ratios and mortility ratios in the system. Particulate organic carbon is displayed by plant debris, organic plant growing medium, phytoplankton, fish debris or non-consumed fish feed. To the best of our knowledge, the aquaponic systems' organic carbon pool and its turn-over have not yet been estimated. Readily degradable OC content in the recirculating water leads to oxygen consumption and affects the oxygen situation for macroorganisms associated to the AP system. Besides pool sizes, the quality of organic compounds is an essential issue for optimizing aquaponics from a biological and microbiological point of view.

In general, the microbiota associated to AP systems can be separated upon their impact on the target organism (fish, plant) into the resident commensal microbiota, deleterious microbiota (microorganisms pathogenic to fish and/or plants roots) as well as beneficial microbiota (microorganisms improving fish health and/or stimulatory to plant growth and development as well as improving root health). Microbial communities associated with AP may also be viewed from the perspective of their function in cycling energy. As fish and crops cultured in aquaponics will eventually end up as human food, loops of human pathogens within the system need to be considered.

"The greatest value of the project was the establishment of concept-based maps for different decisive cycles in aquaponics"

Information on microbial loops from the scientific literature is scarce. Some assumptions can be made from existing literature on the microbial ecology of hydroponic systems. However, there are substantial differences between these two ecosystems and the microbial dynamics in the aquatic phase of co-cultured fish and plants is more complex. The spatial and temporal distribution of microbial biodiversity (microbial biogeography) in AP systems has not yet been described. In the framework of the present project, the authors make a first approach to describe the microbial biogeography in AP by using the island biogeography theory. Fish, plant and human pathogens in AP systems are a challenge to food security and food safety as well as public health and are addressed within the framework of microbial loops in AP systems. Beneficial microorganisms are also specifically highlighted. Food safety aspects are raised with respect to chemical and microbial food hazards. In a final chapter, the impact of AP on ecosystem services is described. The present review gives a basis to reconsider AP approaches, to suggest new solutions and to foresee consequences of changes in set-ups and designs. These findings are inserted into an optimized AP design ensuring secured access to both fish and vegetables.

The approach to aquaponics presented within the framework of the present project is novel. It is an innovative way to identify knowledge gaps and to optimize the potential of these systems and to contribute to global food security. Gaps to be filled consider optimization of

- nutrient supply to AP grown plants,
- trophic loops,
- microbial factors,
- chemical and microbial food safety,
- interactions between AP systems and the environment.

Communication of results

The results will be communicated in a peer reviewed scientific journal. They will also be presented at conferences focusing on food security issues, aquaponics and food safety. Furthermore, they will be displayed through the SLU homepage when published.

Gender aspects

Gender aspects may be viewed both from the perspective of the project and of how the results will be used. The project team consisted of an equal number of women and men, from different countries and with various cultural backgrounds. With respect to the use of the results, efficient co-production systems for fish and horticultural produce will lead to sustained livelihoods especially for the urban poor who are particularly vulnerable to rising global food prices. In the context of sub-Saharan Africa, the intersectionality between poverty and gender makes women and female-headed households particularly vulnerable and offers a ource of income diversification and entrepreneurship.

Greatest value of the project and next steps

The present project was a minor project conducted within a narrow time slot. The greatest value of the project was the establishment of concept-based maps for different decisive cycles in aquaponics which allows AP systems to be improved, especially with respect to plant production, and their management irrespective of low- or high-tech system design.

The next step to contribute to global food security and food safety through integrated fish and crop production systems is to apply for research grants to make use of the developed concept maps, and further on to gather data for crop modelling, simulate and verify the models.

Photo: Beatrix Alsanius

Pepper growing in an aquaponic system.

A summary of the statistics for this project on p. 170

NERICA upland rice market integration in Uganda – a joint scientific publication by SLU and Makerere University researchers

Project leader: Johanna Bergman Lodin

Summary

In this project I wrote an academic article together with my Ugandan colleague Julius Twinamasiko from the School of Agricultural Sciences, Makerere University of Kampala, Uganda, drawing on data that we had earlier collected but only partially analyzed. We used a two-stage Heckman procedure to establish determinants of market participation of 302 households growing NERICA, an upland rice, in Hoima District, Uganda, as well as the underlying factors explaining the participation decision and level of integration. Julius visited SLU Ultuna during two weeks in March-April 2014. This also allowed the Department of Urban and Rural Development at SLU to explore potential avenues for collaboration with the School of Agricultural Sciences at Makerere University. The plan is now to submit a research project proposal to the Swedish Research Councils Vetenskapsrådet and FORMAS in 2015.

Background

The data used in this publication project derive from my PhD project (2008-2012), during which Julius Twinamasiko was my field assistant. In 2011, Julius and I initiated the work on developing the market integration model considering 302 NERICA grower households in Hoima District, Uganda, but we never completed the work. We shared the draft models with colleagues and received valuable feedback that would enable us to move forward and finalize the modelling and write the article.

> "...our article provides new insights into cereal-and-household specific constraints small-scale farmers face in accessing markets."

Aims/Objectives

The major objective of this project was to finalize the modelling and write the article.

Collaborators

SLU

Johanna Bergman Lodin (project leader), *Linley Chiwona-Karltun* – Dept. of Urban and Rural Development

Makerere University, Kampala, Uganda

Julius Twinamasiko – The School of Agricultural Sciences

Description of the activity and how it was conducted

Prior to Julius' visit to SLU, we reacquainted ourselves with the previous work we had done on developing the statistical model. During this phase, we also initiated a desk review to strenghten the background and theory chapters. During the two weeks in March-April 2014 when Julius was visiting, we worked on revising and finalizing the statistical model. Unfortunately, this was more time consuming than anticipated, so we never reached the article write-up stage. Hence, we wrote the article after his visit. The final draft was then shared with a colleague and we are revising the article in line with his suggestions before submitting it to the selected journal. During the time Julius was at SLU, we also explored potential avenues for further collaboration between the Department of Urban and Rural Development at SLU and the School of Agricultural Sciences at Makerere University.

Results

The key output of the project was the article: Determinants of market participation by NERICA upland rice grower households in Hoima District, Uganda."More specifically we examined how transaction costs and factors related to households' differential asset endowments and access to public goods and services affect these households' decisions to participate in markets as well as their level (intensity) of participation. We employed the well-established Heckman procedure to avoid a potential sample selection bias that may be created by the fact that sales are only observed for a subset of the sample population. Hence, market participation was modelled as a two-step process: First, a probit model with sample selection was used to identify the factors affecting a household's decision whether or not to participate in rice markets. The inverse Mills ratio was generated and used in the second stage, Ordinary Least Squares (OLS) regression. This regression allowed us to explain factors affecting the intensity of participation (how much the household supplies) after the household has decided to market some of its produce. We successfully identified several factors that determine market participation.

Summary in Swedish

Detta projekt möjliggjorde för mig att tillsammans med min kollega Julius Twinamasiko från the School of Agricultural Sciences, Makerere Universitet i Kampala, Uganda, skriva en artikel utifrån data som vi tidigare samlat in men bara delvis analyserat. Vi använde oss av Heckmankorrektionen för att i två steg undersöka vilka faktorer som förklarar om och till vilken grad 302 hushåll som odlar NERICA-riset i Hoima distrikt, Uganda, saluför sin gröda. Julius besökte SLU Ultuna under två veckor i mars-april 2014. Detta erbjöd även en chans att undersöka möjliga vidare samarbetsformer institutionerna emellan. Planen är nu att gå in med en forskningsansökan till Vetenskapsrådet och FORMAS 2015.

Mrs Honest Sheila Tainage, NERICA upland rice farmer in Hoima District, Uganda (above). Mr Julius Twinamasiko during fieldwork in Uganda (right). NERICA upland rice (bottom right).

All photos: Johanna Bergman Lodin

Communication of results

The results will be communicated through the publication of the article in an academic journal. Most likely, we will submit the article to either Agricultural Economics or the African Journal of Agricultural and Resource Economics (AfJARE).

Gender aspects

My earlier research shows that NERICA upland rice has proved to be an economic opportunity in terms of cash income that is particularly important for women farmers, both in female- and male-headed households. This may contribute towards more equitable production, productivity and marketing conditions and women's empowerment. Our article specifically explores the marketing aspects, using female- and male-headed households as the unit of analysis due to the configuration of the dataset. The findings can inform agricultural development debates and policymakers, researchers and extension service providers envisaging an agricultural trajectory of change that engages and is of benefit to both female- and male-headed households.

Greatest value of the project

Our article contributes to the currently growing body of empirical literature that explores the determinants of small-scale farmers' market participation in developing countries. The food grain markets in Sub-Saharan Africa in particular have been identified as under-researched in this regard, with only a limited number of empirical evaluations being available, and none on NERICA upland rice in Uganda. Hence, our article provides new insights into cereal-and-household specific constraints small-scale farmers face in accessing markets.

The project also allowed the Department of Urban and Rural Development at SLU to explore potential avenues for collaboration with the School of Agricultural Sciences at Makerere University. The plan is now to submit a research project proposal to the Swedish Research Councils Vetenskapsrådet and FORMAS in 2015.

A summary of the statistics for this project on p. 171

Capacity building and bioinformatics challenges

Project leader: Erik Bongcam Rudloff

Summary

Modern biotechnology, based on recent advances in genomics, proteomics and especially high throughput sequencing technologies, has revolutionized agricultural research to increase crop yield, reduce vulnerability of crops to environmental stresses, increase nutritional qualities and reduce dependence on fertilizers, pesticides and other agrochemicals. It is also being used to clean up contaminated environments through bioremediation technologies and biotransformation processes. Underpinning these new methodologies is Bioinformatics.

Bioinformatics is an interdisciplinary field, which addresses biological problems using computational techniques, and constitutes a key component in modern biotechnology. However, bioinformatics tools and skills are poorly developed, if not entirely lacking, in the eastern and central African region and only a limited number of scientists have been trained in the application of bioinformatics. In addition, they lack the necessary infrastructure in their respective institutes making it difficult to apply this new discipline in agricultural biotechnology at any significant level. For this reason the SLU-Global Bioinformatics Centre (SGBC) and Biosciences eastern and central Africa (BecA) started building capacity in the field of bioinformatics to empower African scientists to solve Africa's agricultural challenges in 2006. Since then this collaboration has organized 11 training courses and has trained more than 300 students and scientists in the basics of bioinformatics sciences (Example: http://hpc.ilri.cgiar.org/beca/training/AdvancedBFX2013_2/Oct_2013/).

Funding from the Swedish Ministry for Foreign Affairs and the Swedish International Development Cooperation Agency (Sida) 2012-2014 has contributed to training sessions and to the development of a stand-alone bioinformatics training platform, the eBioKit, (demo at: www.ebiokit.eu) and has deployed eBioKits in 14 countries.

Summary in Swedish

Moderna biotekniska framgångar bidrar till att skapa nya möjligheter inom den globala jordbrukssektorn och till att på lång sikt minska fattigdom och hunger. Nya växtgenotyper som till exempel är toleranta mot torka eller översvämning eller som klarar av insekt- eller svampangrepp är några exempel. Metodutveckling inom bioinformatik ligger till grund för många av dessa framgångar. Få afrikanska forskare har fått utbildning i hur man använder och drar nytta av dessa verktyg och det saknas en utvecklad infrastruktur inom området bioinformatik i det afrikanska vetenskapssamhället. Projektet syftar till att bygga upp bioinformatikkapacitet inom afrikanska jordbruksuniversitet och institutioner. Detta kommer att bidra till ett förbättrat bioteknikstöd i jordbrukets kamp mot hunger.

Forskare från SLU tillsammans med afrikanska partners (från ILRI-BecA (International Livestock Research Institute - Biosciences of Eastern and Central Africa), ICPE (International Center for Insect Physiology and Ecology) and ICRISAT (International Crops Research Institute for the Semi-Arid Tropics)) arbetar för att öka samarbetet mellan svenska och afrikanska forskare inom bioinformatik och för att bygga upp en afrikansk bioinformatikinfrastruktur. Flera workshops och utbildningstillfällen har genomförts i Sverige och Afrika under 2013. I december hålls en bioinformatikkurs vid Mikocheni Agricultural Research Institute (MARI) i Dar es Salaam, Tanzania och vid PWANI University i Kilifi, Kenya. Där har projektet möjliggjort att servrar som är till endast för bioinformatikdata (eBioKit-servrar) installerats. Detta gör att forskare inom olika "Life Sciences"områden får tillgång till "open source" mjukvaror och att alla databaser som behövs finns tillgängliga så att forskare kan bygga sina egna databaser anpassade till egna forskningsområden.

Background

From an initial survey of agricultural research institutes and universities in the Eastern and Central African region, the lack of dedicated bioinformatics infrastructure and teaching of bioinformatics at University or College level has been highlighted as one of the major constraints to the application of modern biotechnology in agricultural research.

Project objectives

To provide basic training within the area of bioinformatics for students and scientists working in the agricultural and life sciences. This training will provide a sound biotechnical support for agriculture in the challenge to reduce poverty and hunger.

Collaborators

SLU
Erik Bongcam-Rudloff (project leader), *Juliette Hayer* – SLU-Global Bioinformatics Centre, Department of Animal Breeding and Genetics

KEMRI-Wellcome Trust Research Programme, Kilifi, Kenya
Etienne de Villiers

Biosciences eastern and central Africa hub BecA/ILRI, Nairobi, Kenya
Mark Wamalwa

Biosciences eastern and central Africa hub BecA/ILRI, Nairobi, Kenya
Appolinaire Djikeng

Pwani University, Department of Chemistry and Biochemistry, Kilifi, Kenya
Santie de Villiers

International Livestock Research Institute (ILRI), Nairobi, Kenya
Steve Kemp

International Center of Insect Physiology and Ecology, *icipe,* Nairobi, Kenya
Anne Fisher Jores

Photo: Erik Bongcam-Rudloff

Workshop in Tanzania, eBioKit at front.

Description of the activity and how it was conducted

Experience gained by both SLU and the International Livestock Research Institute (ILRI), Kenya in conducting bioinformatics training courses in Kenya, Uganda, Mauritius and Zimbabwe showed that it was difficult to successfully teach and demonstrate several bioinformatics resources, due to limitations in computing infrastructure and often limited or slow Internet access. For this reason a stand-alone bioinformatics platform, eBioKit, was engineered to ease the administrative burden of regularly updating large databases and installing software. This platform contains more than 200 bioinformatics applications and all relevant databases locally, solving the network speed related problems and problems associated with the installation of software. This system has been successfully tested in real world situations both for capacity building and research in Kenya at ILRI, BecA, KEMRI Wellcome Trust Research Programme (KWTRP) and PWANI University.

The system has further been deployed in the SANBio bioinformatics network in southern Africa (10 countries) and Sri Lanka and has recently been adopted by the H3ABioNet, a National Institutes of Health (NIH)-funded Pan African Bioinformatics network comprising 32 bioinformatics research groups distributed amongst 15 African countries that provide bioinformatics training and computing services at nodes in the network (http://www.h3abionet.org).

Activities

The first step in this collaborative project was the workshop organised on "Capacity building and Bioinformatics Challenges" at SLU´s campus Ultuna in Sweden. The aim of this workshop was to reinforce interaction and cooperation between Swedish and internationally recognised scientists who were based in Africa within the area of 13 bioinformatics and applications in the Life Sciences. The main goal was to build long-term successful relationships and collaborations. The agenda included a one-day scientific presentation

"The platforms allow the training of hundreds of researchers even in areas with no or very poor internet accessibility."

by SLU, ILRI, BecA, *icipe,* The International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT) researchers, one day of group work and visits to SLU institutions, and finally one day dedicated to social activities. Several activities were agreed among the participants after lively discussions in theme groups and resulted in among other things research proposals, bioinformatics training and future course planning.

Bioinformatics training conducted

1) *Advanced bioinformatics workshop on metagenomics and next generation sequencing,* 7-18 October, 2013 at BecA-ILRI hub, Nairobi. Thirty-five students from ten African countries and ten teachers participated.

2) Joint BecA Hub and UNESCO Advanced Genomics and Bioinformatics: *Viral/bacterial metagenomics and next generation sequencing workshop*, 13-17 August 2013, ILRI-BecA, Nairobi, with 25 participants.

3) *H3ABioNet introduction to bioinformatics using the eBioKit platform*, 29 July to 2 August 2013. International Centre for Insect Physiology and Ecology (icipe) Nairobi, Kenya with 25 participants.

4) In collaboration with H3Abionet and BecA-ILRI Hub, two eBioKit-based bioinformatics workshops were held from 10-14 December 2013 in Dar es Salaam, Tanzania. Each course consisted of a five-day intensive training course for 20 participants that provided general knowledge on bioinformatics and its applications in modern agricultural research as well as appropriate hands-on exercises using the eBioKit on aspects relevant to the participants and their research projects. Focus was on the training of trainers in mainly MARI and PU, who are currently already involved in some aspects of Bioinformatics or projects, which can benefit from Bioinformatics applications. Two eBioKits were installed in Tanzania to be used locally for bioinformatics teaching and research and one in PU. See EMBnet.journal 20, e755. http://dx.doi.org/10.14806/ej.20.0.755 .

Results

This project has received international attention and in addition to funding from the Swedish Foreign Ministry and the Swedish Agency for Development Cooperation Sida, has attracted financing from the Syngenta Foundation for Sustainable Agriculture, Bill and Melinda Gates Foundation, United Nations Educational, Scientific and Cultural Organisation UNESCO) and is now a partner within the African Bioinformatics Network (H3ABioNet) http://www.h3abionet.org and collaborates with SANBio, the bioinformatics network in southern Africa and Sri Lanka.

The eBiokits

More information about eBiokits can be found at http://journal.embnet.org/index.php/embnetjournal: Jaufeerally-Fakim Y, Fuxelius H and Bongcam-Rudloff E (2011) The contribution of the eBioKit to bioinformatics Education in Southern Africa. EMBNet.journal. 16(1):29-30.

Gender aspects

Bioinformatics is dominated by male participants and for this reason the project adopted the ETAN (European Technology Assessment Network) group´s recommendation for "Equal Treatment" and "Positive Action" to increase the participation of women in all the activities.

We profiled the role that women play in research in our selection of tutor and speakers at the workshops. We were also careful to ensure that the training offered to female researchers was flexible and sympathetic to gender-specific needs.

Photos: Erik Bongcam-Rudloff

Workshop and training at BeCa/ILRI.

Greatest value of the project

The project identified the great need to enhance bioinformatics capacity in many African research and academic/training institutes to address previously intractable problems constraining Africa's development. It subsequently made available genomics protocols, computational hardware and bioinformatics software used to conduct research in areas that offer promise. The scope covered health, agriculture and food security, environment and the sustainable use of natural resources. The project also strengthened the existing collaborations between SLU and partners in Africa and participated in the creation of an education platform that is being deployed in several African institutes. This platform will allow the training of hundreds of researchers, even in areas with no or very poor internet accessibility.

The existence of these bioinformatics platforms has encouraged several African researchers to develop research proposals in collaboration with SLU partners (listed separately) and several more are being developed.

A summary of the statistics for this project on p. 172

Global Challenges University Alliance – activities 2012-2014

Project leaders: Sara Brännström and Johan Schnürer

Background

By 2050 the world's population will exceed nine billion, requiring agricultural, forest- and fishery systems to produce food, animal feed, fibres, energy and other materials for another two billion people. The crucial issue is how to achieve this with very little new land to use and without causing unsustainable ecological consequences, during an ongoing climate change. Meeting these global challenges can only be done through obtaining greater scientific knowledge about the fundamental conditions for life – translating knowledge into relevant action – and through dedicated international collaboration.

SLU has recently initiated a project that aims to form a Global Challenges University Alliance (GCUA), and is planning to involve 25 of the world's top "bio-economy" universities on all continents. The partner universities should be strong in agricultural sciences (including food, veterinary, and forest sciences and landscape architecture), environmental sciences and/or the life sciences.

The alliance will be built up through thematic Global Challenges University Workshops with 4-8 participating universities, and by organizing corresponding thematic Global Challenges Summer Schools for MSc/PhD students. Both research and education components will train the young "bio-economy" leaders of the future and provide an active global network very early in their careers.

Activities during 2012 and 2013

In September 2012 a workshop on "Biofuels and Biorefineries" was held in Uppsala. Twenty-seven researchers from seven universities participated: China Agricultural University (China), University of Tokyo (Japan), National University of Singapore (Singapore), University of Pretoria (South Africa), Swedish University of Agricultural Sciences (Sweden), Makerere University (Uganda) and Cornell University (USA).

In May 2013 a workshop on "Future of food – security, safety and quality". Forty-two researchers from 13 universities participated: University of Queensland (Australia), University of Sao Paulo (Brazil), University of Ougadougou (Burkina Faso), University of British Columbia (Canada), China Agricultural university (China), Addis Ababa University, (Ethiopia), Bogor Agricultural University (Indonesia), University of Tokyo (Japan), Wageningen University (Netherlands), Makerere University (Uganda) and Cornell University (USA).

In September 2013 a workshop on "Environmental monitoring and detection of invasive species – current challenges" was held in Uppsala. Twenty-five researchers from seven universities participated: University of Tokyo, (japan), Wageningen University (Netherlands), National Agriculture University (Nicaragua), University of Pretoria (South Africa), Swedish University of Agricultural Sciences (Sweden), Chulalongkorn University (Thailand) and Cornell University (USA).

In November 2013 the first GCUA Summer School was held in Uppsala. The theme was Biofuels and biorefineries. Twenty students from different parts of the world had an intense course for ten days with lectures mixed with study visits. The students found this course rewarding both research wise and for network building. They started a new international network within their field of interest and learned that different parts of the world struggle with different challenges in relations to biofuels.

Activities during 2014

In March 2014 a workshop on "Green and sustainable cities – the role of landscape architecture" was held in Uppsala. Thirty-two researchers from 12 Universities participated: University of Melbourne, University of Queensland (Australia), University of Guelph (Canada) , Tokyo University (Japan) University of Putra (Malaysia), Lincoln University (New Zealand), Universidad Nacional Agraria (Nicaragua), St Petersburg State Forest Technical University (Russia), Swedish University of Agricultural Sciences (Sweden), Chulalongkorn University (Thailand), Makerere Universtiy (Uganda), Cornell University (USA).

In June 2014 we arranged a workshop with the title "The future of forests – to manage forests for people". Twenty-five esearchers from nine universities participated: Murdoch

Summary in Swedish

GCUA är ett SLU-initaitv med syfte att utifrån de globala utmaningarna som världen står inför, bidra med vetenskapligt baserad kunskap till en globalt hållbar bioekonomi. I GCUA ska de främsta lantbruks/LifeScience universiteten på varje kontinent samlas för att genom globala samarbeten bedriva relevant forskning och utbildning.

Participants in the workshop Future of food – security, safety and quality, May 2013, Uppsala.

University (Australia), University of Melbourne (Australia), Boku Univeristy (Austria), Univeristy of British Colombia (Canada) University of Florence (Italy), University of Tokyo (Japan), Univeristy of Putra (Malasia), SLU (Sweden) and Makrere (Uganda).

All workshop programmes can be found at the webpage www.slu.se/gcua. The page will continuously be updated with opinion papers, summer school programmess etcetera.

In September 2014 a summer school was held within the topic of food. Forty MSc and PhD students from all continents met for a ten-day concentrated course with theoretical and practical lectures.

The overall outcome of the workshops is that the researchers co-produce an opinion paper stating the most current challenges within the topic and themes of the workshop. Furthermore, the group form a planning group of researchers that will serve as a reference team to the organizers of a GCUA summer school on the same topic. The summer school takes place about one year after the initial workshop. So far, two summer schools have been held in Uppsala (Bioenergy and Food), and two more are at the planning state (Green and sustainable cities and Forestry).

The fundamental base of this initiative is to form a collaborative Global Alliance comprising the top agricultural universities in the world. When all continents and climate zones are represented and there is a broad cultural diversity among the participants, then the collaboration can become truly global and act globally. The contribution of the Swedish Ministry for Foreign Affairs provided the means for travel and planning funding of this project has made it possible to connect several African universities to this alliance at an early stage. The participation of these researchers has given the workshops valuable perspectives on the challenges, the knowledge gaps and the future needs of research and education to find sustainable solutions. The workshop in May 2013 had a unique theme in combining the topics food security, food safety and food quality in the same meeting. By doing this, new collaborations were initiated which will hopefully contribute to new research and education aimed at solving the challenge of food security in a global perspective. The UD15 has also made it possible for MSc students and doctoral students in African universities to participate in summer schools which perhaps is the most important activity within the Alliance. The summer schools offer, apart from scientific depth in the topic, a valuable network of colleagues from all parts of the world in an early state of their careers.

"When all continents and climate zones are represented and there is a broad cultural diversity among the participants, then the collaboration can become truly global and act globally."

A summary of the statistics for this project on p. 174

Capacity building in teaching and research in ruminant reproduction in Uganda – for improved dairy production efficiency and food security

Project leader: Renée Båge

Summary

Low productivity in small-holder farms is the major challenge for food security in low-income countries. Reproduction and lactation are key parameters for production and profitability in a dairy herd. By using suitable diagnostic tools and strategies in herd health programmes and by implementing knowledge and relevant practices, food security can be improved. Academic staff members are crucial for disseminating this kind of knowledge to undergraduate and postgraduate students, and to extension service staff, farmers and policy makers. Therefore, five academic staff members from the College of Veterinary Medicine, Animal Resources and Biosecurity (COVAB), Makerere University, Uganda, were invited to SLU, Sweden, in March 2014 for capacity-building activities. A special programme was organized for them, containing the high-profile, international research course "Epigenetics and Reproduction", a clinical training course in large animal gynaecological ultrasonography, a journal club for the critical reading of scientific publications, and a series of supervised workshops for scientific writing. They also had an opportunity to study the procedures of doctoral thesis defense at SLU. By increasing the academic staff members' knowledge in diagnostic techniques and in recent research advances, information is expected to efficiently spread both in academic environments and in animal production settings, with long-lasting effects and high dissemination.

"...the customized capacity-building activities for university staff, are expected to have long-lasting effects and high dissemination."

Summary in Swedish

Den största utmaningen för livsmedelsförsörjningen i låginkomstländer är den låga produktiviteten hos småskaliga lantbruk. I mjölkkobesättningar är fruktsamheten en nyckelfunktion som styr mjölkproduktionen och påverkar gårdens lönsamhet. I djurhälsoarbetet på gården kan man använda lämpliga diagnostiska hjälpmedel och tillämpa kunskaper och praktiska skötselråd för att effektivt öka produktiviteten och trygga livsmedelsförsörjningen. Akademisk universitetspersonal är viktig för teoretisk och praktisk kunskapsspridning till studenter, forskarstuderade, fältrådgivare, bönder och beslutsfattare. I mars 2014 bjöds fem universitetslärare från College of Veterinary Medicine, Animal Resources and Biosecurity (COVAB) vid Makerereuniversitetet, Uganda, in till SLU. Ett skräddarsytt, kapacitetsuppbyggande program sattes ihop för gruppen. Bland aktiviteter fanns den internationella forskarkursen "Epigenetics and Reproduction", en klinisk träningskurs i gynekologiskt ultraljud för stordjur samt en kurs i vetenskapligt skrivsätt som innehöll kritisk granskning av litteratur och eget skrivande under handledning. Gruppen fick också möjlighet att studera proceduren för offentligt försvar av en doktorsavhandling på SLU. Genom att öka den akademiska personalens kunskap om diagnostik och om de senaste forskningsrönen förväntar vi oss att informationen effektivt sprids vidare både inom den akademiska sfären och inom djurhållning och livsmedelsproduktion, med långsiktiga effekter på livsmedelsförsörjningen.

Background

The major challenge for food security in low-income countries is the low productivity in small-holder farms. There is a need for changes in farmers' practices that will rapidly increase efficiency and ensure food security - without increasing the negative effects of production on the climate and environment. Reproduction and lactation are key parameters for production and profitability in a dairy herd. With more refined diagnostic techniques than those used today, fertility traits can be accurately monitored and studied. This in turn can lead to higher reproductive performance and productivity through relevant reproductive health management practices that are deployed in dairy farms in Uganda.

During the last years, reproduction research has had a strong focus on epigenetics, i.e. changes in the regulation of gene activity as a response to environmental cues without altering the DNA sequence, in response to environmental cues.

Management and feeding can thus influence gene activity and affect the quality of egg, sperm and embryo and eventually the offspring's health as an adult. It is therefore important to study epigenetic changes in research on interactions between phenotype, genotype and environment, e.g. when investigating how exotic and cross-bred dairy cow breeds' reproductive physiology, health and milk production is influenced by climate and improper management and feeding regimes, in comparison to indigenous cattle breeds that better cope with prevailing conditions.

Academic staff members in the Reproduction group are critical for the teaching of undergraduate veterinary students, supervision of research students and training of artificial insemination technicians. They also provide extension service to dairy farms. By increasing their knowledge in diagnostic techniques and in recent research advances, information can efficiently spread both in academic environments and in animal production settings.

Aims/Objectives

The aim of this project was to increase the knowledge and competence in current research in animal reproduction and in diagnostic tools used in teaching and research in ruminant gynaecology, as a capacity-building activity at SLU, Sweden, for senior colleagues in the Reproduction group at COVAB, the College of Veterinary Medicine, Animal Resources and Biosecurity, at Makerere University.

Collaborators

SLU

Renée Båge (project leader), *Ulf Magnusson* – Dept. of Clinical Sciences

Makerere University, Uganda

Joseph Erume, Benon Mbabazi Kanyima, Ann Nanteza, Maria Goretti Nassuna-Musoke, David Okello Owiny

Photo: Renée Båge

Ugandan reproduction specialists attending a clinical training course at SLU in gynaecological ultrasonography. From left: David Okello Owiny, Maria Goretti Nassuna-Musoke, Benon Mbabazi Kanyima.

Communication of results

All five visitors from Uganda have prominent positions from where they can influence teaching and research strategies at Makerere University. They are members of stakeholders' reference groups with the possibility to interact with decisions for the cattle industry and in governmental policy-making.

Information from the research course in epigenetics will be included in the curriculum of the reproduction course for knowledge-transfer to undergraduate veterinary students and postgraduate research students at COVAB, Makerere University. Theoretical information and clinical competences in gynaecological ultrasound will be used in teaching, in the university's extension service (herd health and fertility monitoring) as well as in planned research projects.

The scientific writing workshops resulted in completion of two manuscripts based on research data collected in research projects financed from other sources. One manuscript was submitted shortly after the visit to Sweden. It was accepted and published with open access in the peer-reviewed scientific journal "Reproduction in Domestic Animals" in June 2014. The second manuscript is currently (in June 2014) under final revision by the research group to be submitted during summer 2014 to the peer-reviewed scientific journal "Tropical Animal Health and Production".

Gender aspects

Two female and three male senior lecturers and researchers from Makerere visited SLU, and they interacted with both male and female Swedish colleagues during their stay in Sweden. The research course "Epigenetics and Reproduction" included presentations and discussions on ethics and legislation in assisted reproduction in both animals and humans, including gender and LGBT (Lesbian, Gay, Bisexual, Transgender/Transsexual) perspectives.

Greatest value of the project and next steps

The greatest value of this programme was the customized capacity-building activities for university staff, which is expected to have long-lasting effects and high dissemination. The fact that they came to Sweden together during an intensively planned period will facilitate for them as a group to further spread and implement new knowledge, attitudes and practices at Makerere University and in their extension service. A valuable ingredient during the visit was the opportunity for them, after an introductory crash course in critical reading, to spend focused time as a group and together with the Swedish co-workers finalize and submit scientific manuscripts for publication.

A summary of the statistics for this project on p. 175

Strengthening Africa's Strategic Agricultural Capacity for Impact on Development (SASACID). Report from Inception Workshop: 23rd-25th April 2012 Kenyatta University, Nairobi, Kenya

Project leaders: Helena Eklund Snäll, Carl-Johan Lagerkvist, Anders Malmer and Roger Pettersson

Summary

Africa is in a situation where a critical number of highly qualified agricultural graduates is urgently needed to realise the continent's potential in agriculture (http://anafe-africa.org/). To achieve this, ANAFE, the *African Network for Agriculture, Agroforestry and Natural Resource Education* urges the African stakeholders in higher education, or more specifically within tertiary agricultural education, to work together towards the common goal of improving the tertiary agricultural education in Sub-Saharan Africa in particular. With this distinct objective in focus and with funding from the *Swedish International Development Cooperation Agency* (Sida), ANAFE in 2011 initiated a four-year programme called *Strengthening Africa's Strategic Agricultural Capacity for Impact on Development* (SASACID). For the implementation of SASACID ANAFE pointed out SLU as the key implementing partner and four SLU staff were invited to participate in the programme inception workshop in April 2012.

Background

SASACID is a Sida-funded programme (2011-2014) that has been developed by the *African Network for Agriculture, Agroforestry and Natural Resource Education* (ANAFE) with a specific aim to "…improve the quality, relevance and application of tertiary agricultural education in Sub-Saharan Africa" (meeting report from working group meeting, January 2012). The overarching goal of SASACID is to address the urgent need for a sufficient number of highly qualified agricultural graduates in Africa with the right knowledge, skills and attitudes needed to develop the agricultural sector on the continent. Or to quote ANAFE: "The broad objective of SASACID programme is to strengthen the capacity of Africans for building endogeneous innovation systems to generate and sustain scientific and technological development in agriculture and natural resource management in the knowledge-based global economy." (Report on selection of pilot institutions for SASACID, March 2012).

ANAFE works with and through its 134 African member institutions from 35 countries to improve the quality, relevance and efficiency of agricultural teaching and training in Africa. The foundation of the SASACID programme is thus that a tertiary agricultural transformation in Africa must be African-owned and African-implemented.

The SASACID programme comprises six projects which are being implemented by 16 selected institutions from 14 Sub-Saharan African countries. The six projects, which are listed below, have been consolidated into the two main themes "Agribusiness" and "Management of risk and uncertainty in agriculture".

SASACID projects:

1. Refocusing agricultural education objectives and improving curricula;
2. Establishing the capacity of agricultural scientists to develop relevant learning resources based on African knowledge and experiences;
3. Building capacity for innovation systems approach: Linking agricultural policy with research, education, industry and practice;
4. Strengthening capacity for agribusiness education and training, particularly strengthening the interest and capacity of women and youth to take up agricultural careers;
5. Managing risk and uncertainty in agriculture, including agrochemicals, biosafety and climate change;
6. Strengthening methods for teaching and learning and enhancing agricultural information and knowledge management.

In addition, certain cross cutting issues (see below) are being implemented alongside with the other activities.

To make the implementing institutions and partners fully aware of what the SASACID project encompasses, and to develop a work plan and a budget for the

Summary in Swedish

För att till fullo kunna ta tillvara på potentialen inom den afrikanska jordbrukssektorn är kontinenten i stort behov av en kritisk massa högkvalificerad arbetskraft med högre utbildning inom jordbruksområdet (http://anafe-africa.org). För att detta behov ska kunna uppfyllas krävs enligt ANAFE, the *African Network for Agriculture, Agroforestry and Natural Resource Education,* att de afrikanska aktörerna och intressenterna inom högre utbildning, eller mer specifikt inom högre jordbruksutbildning, arbetar tillsammans mot det gemensamma målet att förbättra högre jordbruksutbildning i speciellt subsahariska Afrika. Med denna tydliga målsättning i fokus och med finansiering från Sida initierade ANAFE 2011 det fyraåriga programmet SASACID (*Strengthening Africa's Strategic Agricultural Capacity for Impact on Development*). Som nyckelpartner för implementeringen av programmet utpekade ANAFE SLU, och fyra SLU-anställda inbjöds att delta i programmets "uppstartsworkshop" i april 2012.

Photo: Helena Eklund Snäll

Coffee break between sessions. Roger Pettersson (SLU) in foreground.

implementation of the project, an inception workshop was organised at Kenyatta University, Nairobi, Kenya, in April 2012. By invitation from ANAFE and with partial support from *The SLU Global Food Security Research and Capacity Development Programme 2012-2013* and partial support from ANAFE four SLU representatives attended the workshop, which in total brought together 63 participants from mainly Africa and to a lesser extent Europe, the US and other parts of the world.

The workshop's main focus was on the two main themes of the SASACID programme and two sets of cross-cutting activities.

Main themes:

1. Strengthening agribusiness education and training
2. Managing risks and uncertainty in agriculture;

Cross-cutting activities:

1. Learning resources and quality assurance
2. Innovation systems, linkages, women and youth.

In addition, the development of systems for quality assurance and monitoring and evaluation were discussed and the role of partners agreed on. The workshop lasted for three days and included presentations in plenary, discussions in plenary and smaller working groups, process reviews and regional group discussions.

Working group focusing on innovation systems, quality assurance, and monitoring and evaluation. SLU participant: Dr Helena Eklund Snäll.

Working group focusing on strengthening capacity for agribusiness education and training. SLU participant: Prof. Carl Johan Lagerkvist.

Working group focusing on managing risks and uncertainty in agriculture. SLU participant: Prof. Anders Malmer.

WS photos: Sebastian Chakeredza, ANAFE

Working group focusing on knowledge management, teaching and learning methods, research and publication. SLU participant: Docent Roger Pettersson.

With respect to the working groups, participants could choose one of four thematic working groups:

1. Strengthening capacity for agribusiness education and training
2. Managing risks and uncertainty in agriculture
3. Innovation systems, quality assurance, and monitoring and evaluation
4. Knowledge management, teaching and learning methods, research and publication

Each working group met during two sessions. The task for the first session "Refining the SASACID programme" was to:

1. Review the funded SASACID programme activities, work plan and budget, and identify specific sub-activities
2. Identify and assign roles and responsibilities between pilot institutions, RAFTs and partners
3. Review the SASACID project activities that are not funded and make recommendations for implementation and additional support from the ANAFE secretariat
4. Propose strategic steps for resource mobilization for scaling up activities.

The task for the second session "Refining the regional work plans and indicators" was to identify indicators for each (sub-)activity and to outline a realistic time frame for all activities.

Objectives

The main objective of SLU's participation in the SASACID inception workshop was to contribute input to the plans for implementing the programme, and in particular to identify areas in which experts at SLU can contribute their knowledge and experience.

Collaborators from SLU and description of the workshop

In total, there were 63 workshop participants from mainly Africa and to a lesser extent Europe, the US and other parts of the world. Four SLU participants contributed to the workshop by participating in the discussions and by giving plenary presentations or chairing working groups as is described below.

Dr. Helena Eklund Snäll: Chaired the working group on innovation systems, quality assurance, and monitoring and evaluation. Helena also coordinated SLU's participation in the initial phases of the SASACID programme and inception workshop. After the implementation workshop she worked on an SASACID-SLU agreement (see below).

Prof. Carl Johan Lagerkvist: Participated in the working group on strengthening capacity for agribusiness education and training. After the workshop Carl Johan was involved in one of the resulting collaborative projects between ANAFE and SLU within the SASACID context (see below).

Prof. Anders Malmer: Gave a plenary presentation of SLU's experience in education and research on managing risks and uncertainties in agriculture. Anders also participated in the working group on managing risks and uncertainty in agriculture. After the workshop Anders was involved in one of the resulting collaborative projects between ANAFE and SLU within the SASACID context (see below).

Docent Roger Pettersson: Chaired the working group on knowledge management, teaching and learning methods, research and publication. After the workshop Roger was project leader for one of the resulting collaborative projects between ANAFE and SLU within the SASACID context (see below).

Results

The concrete outcome of SLU's participation in the SASACID inception workshop is that an agreement for collaboration was signed. Based on this agreement two projects were conducted, with financing from SASACID/ANAFE:

1. A desk study review and a synthesis of existing knowledge on risk and uncertainty in agriculture, including a proposition on research topics.

2. Delivery and facilitation of a course in pedagogy and andragogy which was designed by SLU.

Project 1 resulted in a written report while project 2 resulted in two pedagogic workshops, conducted in Nairobi, Kenya (for English speaking participants) and Abidjan, Ivory Coast (for francophone participants). References to the reports from both projects are available in the annex.

> "The main objective of SLU's participation in the SASACID inception workshop was to contribute input to the plans for implementing the programme, and in particular to identify areas in which experts at SLU can contribute their knowledge and experience."

Gender aspects

Gender issues, with focus on gender-sensitive teaching but also including related issues such as the role of women in the academy and gender equality, were addressed in both pedagogic workshops. A summary of the experiences from some of those discussions is available in the report from the Ivory Coast workshop. Women were encouraged to apply to the sessions and prioritised when selecting participants: the SASACID workshop in the Ivory Coast had the highest number of female participants of any ANAFE training events ever. Given the focus of the initiative on long-lasting organisational change, the workshops targeted younger generations of lecturers and teaching staff.

A summary of the statistics for this project on p. 176

Tertiary Agricultural Education (TAE) in Africa – a prospective study

Project leader: Sebastian Hess

Summary

The global trend towards more knowledge intensive and quality oriented value chains in the agri-food sector poses major challenges to African universities. The prospective study is in this respect aims to identify and analyse the changes that are expected in the African agri-food sector in a medium- to long-term perspective, and their likely consequences for the development of Tertiary Agricultural Education (TAE) in Africa. The first step of this prospective study establishes a synopsis of scientific studies from two broad fields: the role of higher education for the competitiveness of the African agribusiness on the one hand, and the present state of higher education in the realm of African institutions on the other. The second methodological step of the prospective study consists of a survey with African stakeholders in academia, government and agribusiness. Results from the survey indicate, among others, that the African TAE programmes that currently provide their students with the best job market prospects are part of universities with a large number of academic exchange programmes, alumni networks, relatively high levels of perceived academic freedom among the staff, as well as close ties to rural areas and relevant practical education.

Background

Global agricultural production is rapidly transforming from a natural resource based provider of raw materials towards a multinational knowledge-based processing industry for food, fibre and bio-energy products. This is posing the challenge to develop ecologically, economically and politically sustainable ways to utilize global ecosystems resources. It is increasingly recognized that these challenges can only be met with a highly skilled agricultural work force that is trained to not only think in terms of global market opportunities but that is also ready to transform knowledge into sustainable local production activities and manage successful enterprises. This agricultural workforce will have to be more entrepreneurial, more interdisciplinary, more international and more ready to handle modern knowledge and communication resources than any other agricultural work force before.

In response to these challenges, the New Partnership for Africa's Development (NEPAD) and its Comprehensive African Agriculture for Development Program (CAADP) have identified Tertiary Agricultural Education, TAE, as a means to achieve robust growth in the agricultural sector and channel it in socially beneficial directions. This initiative is led by the Tertiary Education in Agriculture Mechanism in Africa (TEAM-Africa), which has a mandate to support institutional reform and curriculum development at African universities. TEAM-Africa is an initiative under the New Partnership for Africa´s Development (NEPAD) to bring greater efficiency to TAE in Africa.

Project Objectives

The core objective of this UD15 project is to conduct a prospective study about African TAE and its role for the competitiveness of the African agribusiness. This prospective study is aiming at identifying and analyzing, with a medium to long term perspective and a continental based focus, the changes that are expected in the agri-food sector, and their likely impacts on the development of TAE in Africa. The study is expected to provide guidance for future transformation and reform needs that allow African universities to create relevant agricultural educational programs to meet the new demands of skills sets, and respond to expected emerging developmental challenges, while pointing out best practices for institutional reform.

Collaborators

The Project Steering Committee involves members from the Department of Economics at the Swedish University of Agricultural Sciences, Uppsala, Sweden, the School of Agriculture, University of Lisbon, Portugal, TEAM Africa and The

Summary in Swedish

Den globala trenden mot mer kunskapsintensiva och kvalitetsinriktade värdekedjor inom livsmedelssektorn innebär stora utmaningar för afrikanska universitet. I denna kontext syftar den prospektiva studien till att identifiera och analysera de förändringar som väntas på medellång till lång sikt inom den afrikanska livsmedelssektorn, och deras troliga konsekvenser för utvecklingen av Tertiary Agricultural Education (TAE) i Afrika. Det första steget i denna prospektiva studie upprättar en sammanfattning av vetenskapliga studier från två breda områden: rollen av högre utbildning för den afrikanska jordbruksindustrins konkurrenskraft å ena sidan, och det nuvarande status av högre utbildningen i områden av afrikanska institutioner på andra sidan. Det andra metodologiska steget i den prospektiva studien består av en enkät med afrikanska aktörer inom akademi, regering och jordbruk. Resultat från undersökningen visar bland annat att de afrikanska TAE programmen som förser sina elever för närvarande med de bästa utsikterna på arbetsmarknaden är de som hör till universitet med ett stort antal akademiska utbytesprogram, alumnnätverk, relativ höga nivåer av upplevd akademisk frihet bland personal, samt nära band till landsbygden och relevant praktisk utbildning.

Photo: Assem Abouhatab

A member of the Prospective Study team moderating a discussion on future of higher agricultural education in Africa

World Bank.

The project's Scientific Advisory Board brought together TAE experts from academic and government institutions in Benin, Niger, Nigeria, Tanzania, Denmark, USA, France, Sweden, Ghana, Portugal, the Netherlands and South Africa

Description of the activity and how it was conducted

European researchers with administrative support from the World Bank. From a scientific perspective, the project addresses the following two main research questions: i) What changes are expected in the agri-food sector, and how will / should these changes affect the development of TAE (including higher education, R&D and technology transfer and extension)? ii) What changes are expected in tertiary education, and how will / should these changes affect the development of TAE (especially higher education, but also considering the integration with R&D and technology transfer / extension)?

These questions are addressed through a two-step methodology. The first step establishes a synopsis of existing evidence across two fundamentally distinct strands of literature: first, scientific studies on the role of higher education for agricultural productivity and competitiveness of the African agribusiness and, second existing studies about the present state of higher education in the realm of African institutions are synthesised.

The second methodological step consists of a survey with African stakeholders in academia, government and agribusiness. This survey has been distributed to about 700 carefully selected people in relevant leadership positions across about 20 African countries.

Furthermore, obtaining in-depth insights about the status quote and prospects

Photos: Assem Abouhatab

Presentation of a group discussion results during one of the prospective study workshops

for TAE programmes at African agricultural faculties requires a contact network consisting of a representative sample of relevant stakeholders. These contacts have been obtained through the project partner TEAM-Africa.

Implementation: The prospective study is conducted by an interdisciplinary team with researchers and experts from SLU Global, SLU's Department of Economics, University of Lisbon, the World Bank and TEAM Africa.

Scientific partners: In order to ensure continuous interdisciplinary peer review throughout all project stages, the study has established a scientific advisory board. This board includes people from major institutions in Africa, such as ANAFE, Sokoine University in Tanzania and the University of the Free State in South Africa. Outside Africa, advisory board members are with the Swedish University of Agricultural Sciences, the University of Lisbon, Michigan State University, Wageningen University, the World Bank, and AgriNatura.

Foreign relations: The prospective study supports and contributes to a larger enterprise initiated in 2010 by a congress of African Agriculture, Education and Finance Ministers, which calls for reform in TAE as a mechanism to improve food security in Africa through increased economic growth within the agricultural sector. This initiative is led by the Tertiary Education in Agriculture Mechanism in Africa (TEAM-Africa).

Results

The global agri-food sector is in need of a larger and better educated agricultural workforce. Attracting, training and keeping such a workforce will be crucial for the competitiveness of all major agriculture-based economies. Tertiary agricultural

Workshop participants filling out the prospective study questionnaire.

education institutions (TAEI) in Africa face major challenges in this respect: they appear underfunded and fragmented; teachers often do not work as researchers and have low salaries, insufficient pedagogical training and limited career options. Curricula suffer from a lack of related labor market relevance, partly due to inadequate practical training and a lack of exchange between education institutions and the private sector. Experiences with distance learning and ICT point to a great potential in those countries that can provide the required infrastructure. ICT training, however, is no panacea as long as course contents do not evolve dynamically in response to labour market needs, and do not promote innovative and interdisciplinary thinking as well as further goals such as good governance.

Emerging private TAE institutions are described in the literature as financially weak with a tendency to provide low quality education. However, accreditation and evaluation routines seem to be well-established in some countries but insufficient or absent in others. International support is most helpful in capacity building projects for teachers, but not sufficient. Our findings suggest that African institutions can help themselves best if they engage in private-public partnerships and exchange programmes with TAE in other African and non-African countries.

Results from the prospective study survey confirm that TAE can unfold its beneficial potential for African agribusiness only after the most fundamental constraints to productivity growth, market integration and institutional development have been overcome. African TAE programs are most successful and have the strongest impact on technical and organizational change in the agricultural sector where due attention is paid to the needs of prospective employers in the agri-food industry, where the overall institutional environment is rather flexible and capable of meeting challenges, and where soft skills and practical education constitute important

"...a rich set of qualitative and quantitative information about the status quo and the future of TAE across African countries has been compiled."

parts of the curricula. According to the analysis, good institutional governance seems to be closely related to flexible TAE programmes that also align themselves closely to the corresponding labour market needs outside university. Such TAE programmes with good job market prospects for students are furthermore characterized by a large number of academic exchange programs, alumni networks, perceived academic freedom, as well as close ties to rural areas.

Building Africa's global agricultural competitiveness in terms of productivity and product quality requires urgent TAE reforms. Both may come from closely aligning future TAE with an African agenda for agricultural science, research and development. However, it seems unlikely that solutions can fruitfully be imposed top-down from a very high level. Instead, it will be necessary to trigger decentralized efforts of individual universities and faculties to respond to the needs of the local labour markets that they face.

Communication of Results

Project results have been summarized in two working papers that are currently in preparation for submission to scientific journals. The first working paper is titled: "Agriculture, Agribusiness and Tertiary Agricultural Education in Africa: A systematic review of the literature"; the second working paper is titled "A Preliminary Analysis of Survey Results from the Prospective Study". Findings from the project have furthermore been presented at international conferences and workshops with relation to African institutions of higher education, such as RUFORUM and FARA. TEAM-Africa will use the findings from this study as a basis for new approaches and models within higher education, research and development, and technology transfer and extension.

Gender aspects

Facilitating equal access for female students to TAE programmes in Africa is still a major challenge, even though the literature synopsis revealed that in this respect substantial regional disparity seems to exist across Africa.

In our sample of questionnaires returned by African academic TAE stakeholders (e.g. senior lecturers, professors, deans, senior administrators or CEOs in private companies), 20.5% of respondents are female and 79.5% are male.

During several stages of practical implementation of the prospective study, student assistants have been involved. When recruiting these student assistants, attention has been paid to maintain a balance not only with respect to gender but also with respect to students' home universities in either Africa or Europe.

Greatest value of the project and next steps

The project has established a network of international TAE experts from African-, North American- and European universities. Furthermore, based on visits in Africa, through interviews with African TAE stakeholders and through participation in related African conferences and workshops, a rich set of qualitative and quantitative information about the status quo and the future of TAE across African countries has been compiled. As one element of this, a structured questionnaire has been developed and sent electronically to about 700 TAE stakeholders across Africa. To our knowledge, this is the first attempt to systematically survey the status quo and prospects for TAE in Africa at an Africa-wide level.

The Prospective Study project has led to two follow-up projects: First, through a network-formation initiative SLU and the University of Lisbon are planning to extend the Prospective Study survey also to TAE universities in Egypt, Tunisia and Morocco.

Second, the structured questionnaire has been further developed such that it can be used within the framework of the Delphi method. Under the Delphi approach,

a series of academic capacity building workshops for African researchers will be conducted in late 2014. These workshops will follow a participatory and creative approach, building scenarios and new pathways to transform the future of TAE in three different African regions.

Survey Participants

This study has benefited from the time and support that stakeholders have provided by answering interview questions and responding to the online survey. The survey has been made available in three different languages. The regional coverage of returned questionnaires has been 46.3% from anglophone countries, 26.2% from francophone countries and 27.5% from lusophone countries. The slight overrepresentation of the latter group, relative to the corresponding share in the African population, is most likely due to the large number of pre-existing contacts that one of the collaborating institutions had in Angola and Mozambique.

Workshops and Congress Participations

In order to trigger as much response and attention to the Prospective Study as possible, it was necessary to participate in one way or the other way in many of the major agricultural congresses that were held in 2013 and 2014 in Africa. In addition, project-internal workshops and regular phone conferences have also been held:

"6th Africa Agriculture Science Week And FARA General Assembly", 15-20 July 2013

"Building agricultural capacity in post-conflict countries: case studies from South Sudan and Sub-Saharan Africa". Workshop held at the Sheraton Kampala Hotel, Kampala, Uganda, 21 August, 2013

"Agricultural Research for Development Conference 2013", 25-26 of September at SLU in Uppsala

"AGRINATURA Science Days" 5-8 May 2014, Vienna.

"Stakeholder Consultative Workshop On West Africa TAE Institutional Reforms (TIR)" NPCA/AET and ECOWAS workshop in Ouagadougou, Burkina Faso, 17-19 July, 2014.

"Prospective Study Project workshops": February 2013, August 2013, January 2014 in Uppsala.

A summary of the statistics for this project on p. 177

Novel intervention strategy against malaria mosquitoes – development of a low-cost odour-based trapping system for egg-laying mosquitoes

Project leader: Sharon Hill

Summary

Ongoing government sponsored changes in agricultural practices aimed at improving food security are increasing the prevalence of malaria in Ethiopia. Volatiles from emerging monoculture cultivations attract female *Anopheles arabiensis*, the major malaria mosquito in Ethiopia, to lay eggs in the suitable breeding grounds provided. From the odours in these landscapes, we have developed an urgently needed low-cost odour-based trapping system to catch gravid malaria mosquitoes to decrease the number of infected mosquitoes, reduce the mosquito population and decrease the risk of malaria.

Aims/Objectives

In an effort to increase the safety of these highly productive agricultural landscapes for their inhabitants, and thus improve food security, we are using these identified volatiles to *develop the first gravid-trap for malaria mosquitoes.* The addition of a cost-effective gravid-trap to the vector control arsenal, which currently relies heavily on indoor application of chemical insecticides, represents a significant step forward for the immediate reduction of infected mosquitoes, the long-term reduction in the *An. arabiensis* population and the ultimate reduction of malaria prevalence.

Collaborators

SLU
Sharon Hill (project leader), *Rickard Ignell, Göran Birgersson* – Dept. of Plant Protection Biology
Addis Ababa University, Addis Ababa, Ethiopia
Habte Tekie, Betelehem Wondwosen (PhD student), *Yelfwagash Asmare* (PhD student), Dept. of Zoological Sciences

London School of Hygiene and Tropical Medicine, UK
Ulrike Fillinger, Medical Entomology & Malaria Control

icipe (International Center of Insect Physiology and Ecology), Nairobi, Kenya
Baldwyn Torto, Behavioural and Chemical Ecology Dept.

Background

In Ethiopia, the implementation of irrigation development schemes that shift the agricultural landscape from a patchwork of smallholder subsistence farms to larger-scale monocultures is viewed by policy makers as one of the most effective ways to improve food security, reduce poverty and promote economic growth. They argue that such schemes enhance the self-sufficiency of the rapidly increasing human population by raising crop production through enhanced yield, acreage and number of crop cycles per year, as well as reducing the risk of crop failure by lowering the dependency on rain-fed agriculture. However, these changes are also considered to be among the main factors driving the increase in the malaria burden. In Ethiopia, malaria cases have risen by 35% between 2006 and 2011. Micro-planning surveys indicate that formerly malaria-free rural areas have recently had malaria outbreaks, and that regions with historically low-level seasonal infections now experience a substantially elevated risk of infection year round. The geographic distribution of malaria coincides closely with the recent realisation of monoculture cultivation, indicating a causal relationship between malaria transmission intensity and the emerging agricultural landscape. Together with our collaborators at Addis Ababa University (AAU), we have identified volatile chemical cues associated with the new monoculture landscape that malaria mosquitoes use to locate and identify suitable breeding sites.

Approach

We have shown that female *An. arabiensis* exploit certain odours (which for patent reasons we will not disclose) that are associated with monoculture cultivations to

Summary in Swedish

De av den Etiopiska regeringen sponsrade förändringar i jordbrukssystem som syftar till att förbättra livsmedelsförsörjningen, ökar förekomsten av malaria. Lukter från monokulturodlingar attraherar honor av *Anopheles arabiensis,* den viktigaste malariamyggan i Etiopien, till att lägga sina ägg på dessa platser, som även bidrar med näring till mygglarver. Vi har utvecklat en syntetisk doftblandning baserad på denna lukt som attraherar äggläggande malariamyggor. Som ett nästa steg planerar vi studier där målet är att att minska antalet infekterade myggor, minska malariamyggpopulationen samt minska risken att smittas av malaria.

drive their egg-laying site selection behaviour in laboratory assays. We then tested to see if the the mosquito could smell each individual component in the complex odour blend. To do so we used a technique called combined gas chromatography and electroantennogram detection (GC-EAD). Synthetic blends, with a full complement of active compounds as well as reduced sets of compounds, have been tested in short range egg-laying and attraction assays. To test long-range attraction behaviours, binary choice assays were conducted inside a 100 m^2 semi-field enclosure available through our collaborators at the International Centre of Insect Physiology and Ecology icipe (Mbita Pt, Kenya), using traps placed 20 m apart. We used a trap design that is simple, not patented, and may be assembled using lowcost easily available materials. The formulation of the synthetic blend was also evaluated, to ensure longevity in field conditions and at a low cost.

Results

A low-cost, minimal component, blend was produced. A formulation and method of blend release was found that is stable and long-lasting and can be scaled up for use in semi-field and field trials. The semi-field trials revealed that the traps baited with this blend caught 4 times more gravid malaria mosquitoes than similar unbaited traps. Therefore, this trap shows great promise for the upcoming field trials.

Communication of results

Visits and capacity building

Betelehem Wondwosen, a PhD student from Addis Ababa University (AAU), visited *icipe* (Mbita Pt, Kenya) to perform semifield experiments and visited the chemical ecology unit, SLU Alnarp, together with another AAU PhD student, Yelfwagash Asmare, to attend courses, learn techniques, perform behavioural and chemical assays and write manuscripts.

Scientific communication and innovations

Four manuscripts for publication in peer reviewed journals are now under production. The low-cost odour-based trapping system that targets egg-laying malaria mosquitoes is undergoing continued testing to verify its efficacy in different environments. In order to protect the results of this research from potential commercial abuse, these results are currently under patent evaluation.

Gender aspects

Malaria affects both men and women, and the vulnerability of each sex can vary due to differences in the working environment, increasing the burden on either men or women depending on the local circumstances. Access to medical treatment is, however, strongly influenced by gender and rarely favours women. In combination with biological differences in susceptibility to malaria (e.g. pregnancy), these socioeconomic influences have led women and children to be at the highest risk of contracting disease.

The project leader, Sharon Hill, plays an important role in mentoring young scientists of both genders. Funding for this project has provided opportunities for the first two female entomology PhD students in Ethiopia to expand their skill sets, experience foreign research environments and work closely with a female senior scientist, an opportunity not yet available at their home institution.

Greatest value of the project and the way forward

We developed a low-cost odour based trapping system that targets egg-laying malaria mosquitoes. By targeting gravid mosquitoes, we remove them from the population as well as hundreds of her offspring from the next generation. This trap has the potential to rapidly reduce the mosquito population to below the threshold number needed to maintain malaria transmission. The next phase of this project is the rigorous field testing of the synthetically-baited traps in malarious regions of Kenya and Ethiopia while we track the number of mosquitoes caught, the number that are infected with the malaria parasite and the prevalence of malaria in the human population over time.

The Ethiopian malaria mosquito *Anopheles arabienses*. Photo: Sharon Hill

> "We developed a low-cost odour based trapping system that targets egg-laying malaria mosquitoes ... to rapidly reduce the mosquito population to below the threshold number needed to maintain malaria transmission."

A summary of the statistics for this project on p. 179

Report on studies on twelve varieties of sweet potato conducted in SLU, Sweden

Project leader: Kristine Koch

Summary

Sweet potato is one of the important root crops produced and widely consumed in Ghana. Due to its high starch content, there is a great potential for use as raw material in manifold industrial applications. Increased utilization of sweet potato leads to products that gives farmers, consumers and industry added value .

In this project, we studied the interrelation between physical, chemical and functional properties of flour from 12 new varieties of Ghanaian sweet potato. The properties of starch in sweet potatoes were established to be suitable for a wide variety of culinary and industrial applications. The project strengthens the linkage between SLU and the Council of Scientific and Industrial Research (CSIR) Institute in the field of food and agriculture, with emphasis on starchy Ghanaian root and tuber crops.

Aims/Objectives

The overall objective is to increase the utilization of the important Ghanaian crop sweet potato, with the aim to create added value for farmers, consumers and industry. In this project, the specific aim was to screen twelve new sweet potato varieties and to elucidate the interrelation between their physicochemical and functional properties.

Collaborators

SLU

Kristine Koch (project leader), *Carolin Menzel (PhD student)* – Dept of Food Science

Council of Scientific and Industrial Research (CSIR), Ghana

Paa Toah Akonor, Charles Tortoe (Head FPDE, CSRI-FRI Food Research Institute)

> "The project has generated very important scientific data on sweet potato."

Background

After cassava and yams, sweet potato *(Ipomoea batatas)* is the third most important root and tuber crop in Ghana. Its importance is reflected in the increase in production quantities over the past decade. It is predominantly cultivated by peasant and smallholder farmers throughout Ghana, with the Upper, Central and Volta regions serving as the leading hubs of production. These three regions account for more than 60% of the 135,000 MT of the crop produced in year 2012 (SRID, 2013).

The main importance of sweet potato roots as food is attributed to it being well endowed with easily digestible carbohydrates, which make up nearly 90% of its dry matter. It is a high source of energy and provides more than 450 KJ/100g. It contains substantial concentrations of vitamin A and could thus be promoted to counter vitamin A deficiency among children of school-going age. The major inorganic elements contained in sweet potatoes are potassium, phosphorus and calcium (Woolfe, 1992).

The crop contributes significantly to food security in Ghana and has huge industrial prospects, but knowledge of the characteristics of its starches and other physicochemical properties is quite limited. It is therefor imperative that these properties be investigated with the release of twelve new sweet potato varieties. This would provide more information with regard to the suitability of the crop for domestic and industrial applications. Studies into the physicochemical and functional characteristics as well as their interrelation was therefore conducted at the Council of Scientific and Industrial Research (CSIR)-Food Research Institute, Ghana, and the Swedish University of Agriculture, Sweden.

Description of the activities and how they were conducted

The twelve varieties of Ghanaian sweet potatoes used in the studies were Apomden, Faara, Bohye, Patron, Otoo, Santom Pona, Ligri, Histarch, Dadanyuie, Ogyefo, Sauti and Orange flesh. The activities conducted under the project were as follows:

1. Determination of physicochemical properties.
2. Determination of starch, amylose and amylopectin content of flours of sweet potatoes using enzymatic procedures.
3. Molecular characterization of starch components using Size Exclusion Chroma-

Summary in Swedish

Sötpotatis är en av de viktigaste jordbruksgrödorna i Ghana och utgör en stor del av humankonsumtionen. På grund av dess höga stärkelseinnehåll finns en stor potential som råvara i olika typer av industriella användningsområden. Med en ökad användbarhet av sötpotatis följer ett mervärde för lantbrukare, konsumenter och industrin. I detta projekt studerades sambanden mellan fysikaliska, kemiska och funktionella egenskaper i mjöl från tolv olika sötpotatissorter. Resultaten från den fysikaliska och kemiska karaktäriseringen belyser ett brett spektrum av industriella användningsområden för de studerade sorterna. I och med detta projekt stärks det redan etablerade samarbetet mellan SLU and the Council of Scientific and Industrial research (CSIR) Institute inom områdena livsmedelvetenskap och jordbruksvetenskap, med fokus på stärkelserika grödor från Ghana.

Photos: Kwadwo Adofo

Different varieties of sweet potato. From left: Apomuden, Faara and Patron.

tography (SEC).
4.Viscometric characterization of starches in the flour using the RapidVisco Analyzer (RVA)
5. Scanning Electron Microscopy (SEM) to study the granular morphology of starches in the flours; and elemental analysis of granular components.
6. Chain length distribution of amylopectin fraction in the flours with HPAEC-PAD.

Results

Chemical analysis showed flours for twelve varieties of sweet potato as having a fairly neutral pH with swelling, solubility and water binding capacity similar to that of other root and tuber crops such as cassava. Eleven out of the twelve varieties contained more than 60% starch, the twelfth having 49% starch, while amylose and amylopectin which determine starch functionality ranged between 10% and 20% and 80% and 90%, respectively. The sweet potato varieties were fairly similar in the distribution of their amylose and amylopectin showing a trend of high amylopectin peak and a broad amylose peak. Viscometric studies showed that all twelve flours have very good cooking and pasting ability, while SEM studies indicated that the sizes and shapes of starch granules for the flours were different among the varieties. Granules from the different starches showed spherical, oval and other irregular shapes, with most of the granules existing freely. Overall, the results give an indication that the sweet potato varieties could be processed into flours and other forms to serve as raw materials in a wide range of culinary and industrial applications.

Communication of results

The results of the project will be communicated to the international, national and scientific community, stakeholder and players in the food industry through manuscript publications and presentations at local and international workshops and stakeholder meetings.

Gender aspects

The results of the study, when published will serve as a real scientific background which would further advance the utilization of sweet potatoes. This would enhance the livelihood of sweet potato farmers who are predominantly women, market women and other actors along the sweet potato value chain.

Greatest value of the project and next steps

The project has generated very important scientific data on the sweet potato. The project has also created a linkage between the Swedish University of Agriculture (SLU) and CSIR-Food Research Institute (CSIR-FRI) for collaborative research in the area of food, nutrition and agriculture. In a broader perspective, the collaboration has combined our fields of expertise to improve the use of food crops. Additionally, the collaboration has successfully submitted a new proposal for funding further studies on starches of Ghanaian root and tuber crops.

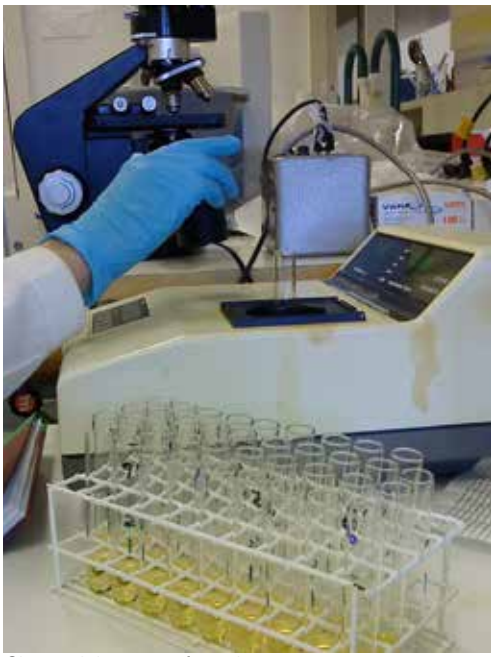

Photo: Kristine Koch

Chemical detection of starch using spectroscopy.

A summary of the statistics for this project on p. 180

International Field Course: Global development, natural resources and livelihoods – SLU in co-operation with Kenyatta University and Embu University College

Project leader: Jan Lagerlöf

Summary

A multidisciplinary MSc field course aiming at studies of the socio-economic, ecological and environmental aspects of use of natural resources, especially food production, was held. Funding by UD15 during 2013 and 2014 made it possible to arrange the course together with two Kenyan universities (Kenyatta University and Embu University College) and to admit equal numbers of Kenyan and SLU students. The course consisted of one week of theoretical studies at the students' home universities and three weeks of field studies in Kenya followed by a few days of summing up of results and submitting reports. The students worked in groups of two SLU and two Kenyan students. They collected information and tested their research question on different aspects of use of natural resources and development by interviewing farmers, representatives of different companies and officers from local governmental administration, and were supervised by both SLU and Kenyan teachers. The course programme also included study visits to a national park for study of the importance of nature protection for tourism and water supply and studies of a Rift Valley lake where exploitation and conservation aspects are in conflict during the economic development of the area. The students' achievements were presented as oral and written project reports and individual excursion reports. The outcome of the course was very successful and was given the highest scores in the course evaluation, concerning learning outcome as well as course administration. Spin off results include signing of Memorandum of Understanding between the Kenyan Universities and SLU and further co-operation in teaching and research is planned.

Aims

The aim of the course was to give the students in-depth knowledge of ecological and socio-economic limitations for development and use of living natural resources. The course is multi-disciplinary and gives the students opportunity to see problems from many points of view and to test their theoretical knowledge in reality. Focus lies on the agricultural and forestry sectors in a broad sense with special empahsis on food production.

Collaborators

Institutions

Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden
Kenyatta University (KU), Nairobi, Kenya
Embu University College (EUC), Embu, Kenya

Teachers and students on field course: Global development, natural resources and livelihoods, year 2014

SLU teachers

Prof. Jan Lagerlöf, course leader, responsible for ecological and natural science aspects
Dr Oscar Jansson, deputy course leader, responsible for socioeconomic aspects
MSc Emelie Zonabend, lecturer animal husbandry

KU teachers

Dr Michael Gicheru, leader of KU part, lecturer health and ethics
Dr Kakai, lecturer Kenyan history
Dr Waswa, lecturer society and nature
Prof. Kokwaro, lecturer natural resources
Dr Kavinda, lecturer democracy, governance and development
Dr Mwangi, lecturer research methodology and natural conditions and land use in Lake Naivasha region

EMU teachers

Dr Jamleck Muturi John, leader of EUC part and principal organiser of field activities

Students

SLU

Kristina Berglund, Maria Kjellander, Elsa Lagerqvist, Clara Limousin (France), *Martha*

Summary in Swedish

En multidisciplinär fältkurs på masternivå med mål att studera socioekonomiska, ekologiska och miljövetenskapliga aspekter på naturresursanvändning, särskilt livsmedelsproduktion, har genomförts. Med stöd från UD under 2013 och 2014 möjliggjordes samarbete med två kenyanska universitet (Kenyatta University and Embu University College) och lika många kenyanska studenter som SLU-studenter kunde delta.

Kursen bestod av en veckas teoretiska studier på studenternas respektive hemuniversitet och tre veckors fältstudier i Kenya. Studenterna arbetade i grupper om två från SLU och två från de kenyanska universiteten. Under handledning av lärare från alla samarbetsuniversiteten testade studenterna sina frågeställningar genom intervjuer med lantbrukare, näringslivsrepresentanter och tjänstemän. Kursprogrammet innehöll även studiebesök i en nationalpark och vid en sjö i Rift Valley där konflikter mellan naturskydd och exploateringsintressen belystes. Studenternas resultat presenterades som projektrapporter och individuella exkursionsrapporter. Kursen genomfördes med mycket gott resultat och studenterna gav högsta poäng i utvärderingen vid bägge kurstillfällena. Genom kursen har ytterligare samarbete mellan universiteten utvecklas och samarbetsavtal (MoU) har undertecknats.

Planning of group work. Photo: Jan Lagerlöf

Mancheva (Bulgaria), *Nea Pakarinen* (Finland), *Emma Söderberg, Aksel Ydren*

KU

Brenda Akinyi (Kenya), *Joseph Kibe Karanja* (Kenya), *Reginald Kashakuro* (Tanzania), *Mark Sindeti M'masi* (Kenya), *Julius W. Teathon* (Liberia)

EUC

Alex Kipnyargis (Kenya), *Sammy Musyoka* (Kenya), *Evelyn Wambui Njogu* (Kenya)

Background

The course is part of the SLU course package Global development: natural resources and livelihoods and is intended for students at Master's level in many different study programmes. The course was given for the first time in 2012, at that time with only SLU students. Thanks to the financial support by the Swedish Ministry for Foreign Affairs in 2013 and 2014, we were able to give the course in co-operation with Kenyatta University (KU) and in 2014 also with Embu University College (EUC). During these two years we had equal numbers of SLU and Kenyan students on the course.

Summary of the course performance

The field course: Global Development, Natural Resources and Livelihoods was held during the spring term 2014 with 16 participant; half from Kenya and half from SLU. Participants included eight SLU students with varied study backgrounds in study programmes of agronomy and development studies, six Master's students from Kenyatta University (KU) and two from Embu University College (EUC) who study natural or social sciences. The students worked at their home universities before the three field-course weeks in Kenya. SLU, KU and EMU

Interviewing the Kenya Forest Service. Photo: Jan Lagerlöf

teachers took part in the planning and performance of the field-course weeks.

The course began with one week of theoretical studies as a preparation for the field work. This included studies of natural conditions and natural-resource use in Kenya as well as Kenyan history, economy and political structure. The Kenyan and SLU students prepared themselves at their respective home university. Themes for project works during the field weeks were selected and the students were divided into groups of two SLU students and two Kenyan students per group. Each group was assigned a particular project to work on during the field weeks.

The three field weeks in Kenya began with two days at KU campus where the student groups worked out plans for the projects they were to undertake and KU and SLU teachers gave lectures. In addition, methods for field studies and interview techniques were discussed. In the district of Embu at the foot of Mount Kenya the project work was done during the subsequent week. The study groups collected information through interviews and field visits to different farms, companies and other sites of interest in relation to their tasks. The themes for the projects were different aspects of use of natural resources in agriculture, forestry and aquaculture. This included production as well as organization of the activities and distribution to the market. It also included environmental aspects. We also had visits with the whole class to local and county administrations, water supply facilities, industries and the Mt Kenya Forest Reserve. The groups had access to chauffeur-driven four-wheel drive cars for transport to the informants far out in the countryside. The student groups gave oral presentations of their completed projects and at the end of the course they submitted written reports. Another part of the examination on the course was a day-to-day diary for the field course where each student gave an individual account of the study visits and activities and their reflections and impressions in relation to the aim of the course.

Boat excursion Lake Naivasha. Photo: Jan Lagerlöf

After the Embu week we continued the field weeks with a visit to Aberdare National Park where we studied the fauna and flora of the park and its importance for conservation of biodiversity of flora and fauna and water supply for a large part of the country. The park administration informed about the maintenance of the park, the importance of tourism and co-operation with the local community and conflicts with other types of land use, including damage of agricultural crops by wild life and the conflicts involving pouching and illegal logging.

The field trip continued to the Rift Valley where we studied natural conditions and land use around Lake Naivasha - a freshwater lake of great importance for nature conservation as well as for fishery and water supply not only for the growing human population but also for the large-scale horticultural industry. All these activities lead to conflicts and over-use of natural resources and environmental problems as well as socio-economic problems. Our Kenyan colleagues informed us about their projects in the area and arranged contact with local administration of natural resources. A study visit to a flower farm gave insight into an industry that brings substantial export incomes but also causes problems of different kinds.

The scheduled course activities concluded with one day at KU campus in Nairobi for summing up of experiences and course evaluations. All students who participated in the course were given a certificate of participation.

Results

The course was very successful and according to the course evaluation, both Kenyan and SLU students learned a great deal and upgraded their skills and abilities in relation to the aim of the course. The multidisciplinary approach was appreciated and work in mixed groups with students from other backgrounds was rewarding but challenging. The project reports were of high quality and the students had managed to design their work properly, collect and analyse data and present their results well in oral and written form. The

"The mixed SLU-KU co-operation gave insights for both sides into similarities and differences in approaches to studies and attitudes to many aspects of life and society."

themes for the reports were 1) coffee production, 2) tea production, 3) fish farming and 4) illegal logging. The excursions and study visits also went well and gave new insights.

A spin-off result of the course is the Memoradum of Understanding between EUC and SLU that was signed during the course. This will be a starting point for further co-operation between the two institutions on courses, student and teacher exchange and research applications.

Communication of results

The project reports have been communicated to the Embu County Administration. They give insight into the different activities and suggestions for further development.

Gender aspects

All projects looked into division of labour, responsibility, influence and revenue between men and women. There was an equal distribution between male and female students.

Greatest value of the project

The co-operation with the Kenyan students and teachers gave additional value for the SLU students. Thanks to this co-operation they have been exposed to and studied situations and activities from different perspectives and the Swedish students could have better contact with the Kenyan informants, since the KU students could help to explain practices and interpret from the local languages to English. The mixed SLU-KU co-operation gave insights for both sides into similarities and differences in approaches to studies and attitudes to many aspects of life and society. It also gave mutual friendship that may continue for long time. The KU students had less training in working in groups and in formulating research questions and planning the work than did the SLU students.

Through long-term connections with KU and other partners we can at SLU offer our students good study possibilities at African universities, where they can have competent supervision on thesis and other projects under safe and well organized conditions. Co-operation with a local university opens many doors to activities and processes that one wants to study. Exchange in the other direction, from KU to SLU, is also very important. KU students could gain much understanding from studies of development and different aspects of use of natural resources in Sweden. KU teachers could also take part in teaching on many courses at SLU. The co-operation could also be extended to PhD level with research projects and research schools. All of this can only be successful in a long-term perspective and with financial support beyond what SLU can offer within its ordinary budget for basic and advanced education.

Photo: Jan Lagerlöf

Field course participants in Mt Kenya Forest, April 2014.

A summary of the statistics for this project on p. 181

Availability and utilisation of urban/peri-urban livestock feed resources: a farmers' handbook

Project leader: Jan Erik Lindberg

Summary

In urban and peri-urban areas, farmers have limited possibilities to grow feed for their animals and there are difficulties related to transport and purchase of feed. By-products of varying origin are therefor commonly used as animal feed. However, the quality of available feed resources may vary and there is a lack of knowledge on how to optimize their use.

In the current project, data about each feed resource has been compiled and presented in booklet form with regard to availability, animal species/types for which the feed should be used, nutritional quality, limitations to its use as animal feed and practical recommendations. The photographs provided in the handbook help describe better the feed resources.

By better utilizing available feed resources livestock productivity can be improved, which will improve the food security and nutrition of rural and urban poor, and can generate extra income.

Aim

The aim of the Farmers' Handbook was to in an easily accessible form organize and present data obtained on feed resources that was generated during a previous Swedish Foreign Ministry-funded project in Uganda.

Background

The idea behind this handbook was initiated in the collaborative research project on Feed for livestock in urban/peri-urban areas between the Swedish University of Agricultural Sciences and Makerere University, which was funded by the Government of Sweden through its Ministry for Foreign Affairs in 2010. However, due to limited funding within the project it was not possible to realise this idea earlier.

Collaborators

SLU

Jan Erik Lindberg (project leader) – Dept. of Animal Nutrition and Management

Makerere University, Kampala, Uganda

Constantine Bakyusa Katongole (local coordinator), *David Mutetikka* – School of Agricultural Sciences

Non-academic

Jimmy Baguma (farmer) - Kampala, Uganda

Activities

Data on and photographs on available feed resources found in urban/peri-urban Kampala have been collected and compiled. A short text has been written for each feed resource with regard to availability, animal species/types to which the feed should be fed, nutritional quality, limitations to its use as animal feed and practical recommendations.

Results

The available feed resources for urban/peri-urban livestock production in Uganda has been organized in four broad categories: Crop/Food wastes (by-products generated during crop/food production, processing/preparation, marketing/distribution and consumption); Forages (either grown/planted on the farm or growing naturally in open access lands); Agro-industrial by-products and Others.

The handbook describes the availability and efficient utilization of major feed resources for urban/peri-urban livestock production. Each feed resource is described separately with reference to availability, animal species/types on which the resources can be fed, nutritional value, constraints to its use as animal feed and practical implications/recommendations. Photographs are provided to help describe the feed resources better. The notes have been written in a style and language that are easy to follow and understand.

Summary in Swedish

I städer och stadsnära områden har bönderna ofta begränsad möjlighet att odla eget foder till djuren och det finns svårigheter med att transportera och köpa in foder. Det är därför vanligt att djuren utfodras med restprodukter av olika slag. Förutom att tillgängliga foderresurser kan ha varierande kvalité, råder det brist på kunskap om hur dessa kan utnyttjas på ett optimalt sätt.

I detta projekt vi samlat, och i bokform sammanställt, information om fodermedel med avseende på tillgänglighet, lämplighet för olika djurslag, näringsvärde, eventuella begränsningar och praktiska rekommendationer för deras användning. Fotografier har använts för att underlätta beskrivningen av de olika fodermedlen.

Genom att bättre utnyttja tillgängliga foderresurser kan djurens produktion förbättras, vilket kan bidra till en förbättrad livsmedelssäkerhet och ett förbättrat näringsintag för människor i resurssvaga hushåll i städer och stadsnära områden, och kan dessutom bidra till ökade inkomster

Photo: Constantine Katongole

Crop waste at market place and sorting of food waste.

Communication of results

The Farmers' Handbook will be been printed in 500 hard copies. These will be used as an extension tool to impart knowledge to the urban/peri-urban livestock farmer on how best to utilize the available feed resources.

Most resource-poor livestock farmers in urban and peri-urban areas of Kampala are women. Therefore it is crucial to reach this group of farmers with information which they can use to improve their livelihoods.

Gender aspects

The work with the current project has been male-dominated. However, in the previous project supported by the Swedish Ministry for Foreign Affairs, on which this project was based, the research team from SLU and Makerere University (active in the project) comprised both males and females. The students from SLU were all female. while the students from Makerere University were male. The key stakeholders (farmers, extension workers and local leaders) of the UD40 project were both male and female, but with a majority of females amongst the farmers. The participants in the dissemination conference for the UD40 project were dominated by females.

Greatest value of the project and next steps

Thanks to the support received from the Swedish Ministry for Foreign Affairs, it has been possible to compile data obtained during our previous project supported from the Ministry, in Uganda, as well as complementary information, and to present this in an easily accessible form. Moreover, the project has made it possible to continue and deepen the collaboration between researchers in Animal Science at SLU and at Makerere University. This opens up new opportunities for future collaboration with regard to capacity building in Sweden and Uganda, and with regard to joint research and development projects.

> "This opens up new opportunities for future collaboration with regard to capacity building in Sweden and Uganda."

A summary of the statistics for this project on p. 182

Good health and a safe work environment – a requirement for sustainable livelihood and food security among Ugandan farmers

Project leader: Christina Lunner Kolstrup

Summary

A pilot study was conducted among Ugandan farmers in May 2014. Six male and female farmers were interviewed about their experiences and attitudes towards health, safety and risk factors in agriculture, and how these affected their livelihood. In general, the level of knowledge and awareness of agricultural health and safety risks as well as disease and injury prevention was low. The farmers found milking, spraying of animals and plantation work demanding work tasks. The main findings concerned the farmers reporting symptoms of poisoning when they sprayed the animals with insecticide and lack of safety information. The farmers expressed the need for information and practical training in agricultural health and safety, and disease and injury prevention.

Background

'Sustainable agriculture' and food security require 'sustainable health' and safe working conditions for farmers and farm families. Farmers in good health will be able to provide for their families and contribute to the local farm community. The information and research that is available is limited regarding health and safety of farmers in Uganda and data is essential to understand and change patterns of human health and safety aspects. In Uganda, these issues are not considered, discussed or studied from an agricultural aspect although several risk factors regarding human health and safety are related to agriculture. Furthermore, farmers often lack education and information on the health and safety hazards they may face.

Objectives

The objective was to interview Ugandan farmers and family members regarding their attitudes towards health, safety and risk factors in an agricultural context, and how these affected their daily lives and livelihood. The pilot project also aimed to identify existing needs, possibilities and obstacles regarding human agriculture-related health and safety issues in Uganda for future research and collaboration.

Collaborators

This pilot project was developed and carried out in close collaboration with Uganda Martyrs University (UMU) and SLU. Both UMU and SLU are engaged in the Agroecology educational programme (originally financed by SIDA) and this pilot project was a spin off from the Agroecology programme.

SLU
Christina Lunner Kolstrup (project leader, researcher) – Dept. of Work Science, Business Economics & Environmental Psychology (AEM)

Uganda Martyrs University (UMU)
Tonny Kiggundu Ssali (MSc in Agroecology) - Faculty of Agriculture, Nkozi, Kampala, Uganda
Daniel Kizza (MSc in Livestock Production) - Faculty of Agriculture, Nkozi, Kampala, Uganda
Julius Mwine (PhD, Dean) - Faculty of Agriculture, Nkozi, Kampala, Uganda

Uganda Catholic Management and Training Institute, Kampala, Uganda
Meresiane Nnassuna (Principal)

Approach

The pilot study was conducted in Mbarara district in the Western region of Uganda during the period of 19-23 May 2014. The pilot project comprised interviews with three male farmers, a female farmer and a female farm family member, in addition to transect walks on each farm. A female veterinarian was also interviewed. The interviews were performed in English by the project leader from SLU and in the local language by one of the team members from Uganda Martyrs University (UMU).

An interview guide was developed in collaboration with the UMU team and included

Summary in Swedish

En pilotstudie genomfördes bland ugandiska lantbrukare maj 2014. Sex manliga och kvinnliga lantbrukare intervjuades om erfarenheter och attityder till hälsa, säkerhet och riskfaktorer inom jordbruket, och hur det påverkade deras försörjning. Generellt var kunskapsnivån och medvetenheten om hälsa och säkerhet i jordbruket låg. Mjölkning, insektsbehandling av djur och markarbete var fysiskt krävande arbetsuppgifter. De viktigaste resultaten var lantbrukarnas rapporter om förgiftningssymptom när de behandlade djuren med insektsmedel och bristen på information om hälsa och säkerhet. Lantbrukarna uttryckte behov av information och praktisk utbildning i hälsa, säkerhet samt förebyggande av sjukdomar och skador i jordbruket.

Photo: Christina Lunner Kolstrup

Hand-milking involving squatting and kneeling at a large dairy farm.

questions about the demographics of the farms and the participants, the daily work tasks and tools used on the farm, the participants' perceived health and occurrence of injuries. Further, the guide contained questions concerning the participants' experiences, attitude and awareness of the following: hazardous, physical and mentally demanding work tasks and situations, hazardous farm chemicals and drugs, how to avoid getting ill or injured when farming, possible benefits of a healthy and safe farm environment, and questions about availability and demand for information and training in agricultural health and safety.

Results

Demographics. Three of the four farms visited in Mbarara District, Uganda, practiced smallholder agro-pastoral farming. Besides pasture for the animals, the farms grew plantain (cooking banana), sweet potatoes, beans, cassava, yams, millet, sorghum and ground nuts on a few hectares.

The farms also reared livestock and had on average 7-13 dairy cows and heifers of local- or crossbreeds, 10 goats, 10 chickens, 3 pigs and 5 sheep. Hand tools such as machete, shovels and hoes were the only equipment used to cultivate the land. The farms were all owned and managed by male farmers aged 40-70 years of age with help from their wives and children.

The fourth farm was, in an Ugandan perspective, a large farm with the main focus

"...the project has provided us with a better understanding of how Ugandan farmers and farm families consider and perceive agricultural health and safety issues."

on dairy production (125 cattle including 30 dairy cows). The farm was 80 hectares and included pastures, Napier grass for animal feed (silage), plantain, traditional vegetables for human consumption, and timber production. The land was cultivated using the traditional hand tools; however the dairy farm had a milking machine (lacked spare parts, so did not work), a biogas plant and hydropower for for electricity and water supply. This farm was owned and managed by a female widow in her sixties and her 25 employees. All four farms applied Integrated Pest Management (IPM, meaning not using pesticides, insecticides or fungicides on the crops).

Daily work tasks. In the western region, females are usually the ones responsible for the household chores and children, working in the plantation and managing the smaller livestock such as pigs, sheep, goats and poultry. The men are often the ones responsible for the cattle, milking, participating in plantation work if needed and in some cases having off-farm jobs. A usual working day on the visited farms started early in the morning (6 am) with prayers, a bath, the men milking and the women feeding and watering the animals. After breakfast, work was done in the plantation and vegetable garden. After lunch and a few hours' rest, the afternoon was spent in the plantation or the vegetable garden, on tailoring, maintenance, household chores and milking, feeding and watering before dinner (6 pm). The day ended socializing with family and neighbors, praying and sleeping at 9 pm.

Hazardous and demanding work tasks and situation. In general, the level of knowledge and awareness of agricultural health and safety risks, disease and injury prevention was low. When we asked the farmers, they claimed few agricultural related complaints, injuries or diseases. It was obvious from the farmers' responses that health and safety concerns such as diarrhoea, cough, fever, cuts while using the machete in the plantation, bruises when handling the animals and symptoms of poisoning from using insecticides on the animals, were nothing worth talking about and considered to be part of the occupational hazard. The veterinarian explained that Ugandan farmers consider life in itself to be hard (work) and the mental pressure and concerns regarding drought, not getting enough food for the animals and family, having to pay for expensive medication if and when you fall ill and school fees for the children are more significant than a few cuts, bruises and diseases.

During the interviews and transect walks, however, the farmers began to tell their stories and several issues came to light. Hand-milking the dairy cows involving squatting and kneeling, carrying the back sprayer with insecticide and working in the plantations were regarded as physically demanding and sometimes hazardous work tasks. One farmer commented (translated): *"When my wife is taking care of the children at home and I have to work alone, doing hard work like digging in the banana plantation, I feel stressed and anxious that an injury could happen."*

The most important topic mentioned by the farmers and the veterinarian was the use of chemicals and drugs related to livestock. Once a week the farmers sprayed the animals with an insecticide to prevent ticks, lice, tsetse flies and other biting nuisance flies using a back or hand sprayer. The spraying was conducted without personal protection equipment (PPE) such as face masks (except for the large dairy farm), gloves, overalls or gumboots. According to the people interviewed, PPE was considered to be too expensive and difficult to obtain. The farmers explained that they usually felt unwell or dizzy, vomited, had pain and a burning sensation in the face and eyes after spraying. The symptoms of poisoning lasted from a couple of hours to several days. Sometimes the symptoms were so severe that they needed treatment and bought medication without prescription at the local drugstore. The storekeeper often had limited or no knowledge at all about the chemicals or drugs, except for dosage and one of the farmers said: *"They don't give information, they just sell. You go to those (drug) shops, you tell them what's wrong, then they tell you, this one is for spraying, then they give you simple instructions on how to mix and how to apply – but not how to protect yourself."* Furthermore, the label text on the jar was tiny and the farmers did not understand or relate to the warning signs on the labels. Another critical problem was that several farmers in the region were illiterate.

When we asked the farmers what they did in order to stay healthy and avoid getting ill, they stated that it was important to eat well and rely on local real food (indigenous food, meaning without chemicals). They claimed that they seldom fell ill and if they did it was just local diseases and fever. In the literature, fever, coughing and diarrhoea are quite common among Ugandan farmers and are often related to malaria or brucellosis (zoonotic disease, infection by unpasteurised milk). Almost all the people interviewed were unaware that some diseases could be transmitted from animals to the humans and vice versa; they did not know of brucellosis, typhoid or salmonella – it was just a fever or a simple cough.

The farmers explained that they often used indigenous knowledge and local herbs to treat diseases, cuts and wounds and they seldom visited the medical clinic (too expensive, no trust and often too far away). If they had a fever they bought medication at the local drug store. This brought up a sensitive topic, which related to farmers using animal medication for human treatment and the veterinarian explained the reasoning among farmers: "*Here I am (as the farmer), I've been growing up with this animal, it falls sick, it gets a fever (we call it fever), it's given medicine and it heals – so, I have a fever, I can share the drug.*"

Benefits of a healthy and safe farm environment. The female dairy farmer was a progressive farmer. She viewed her farm as a business and believed that a healthy and safe environment for the animals and humans would result in profitable production and healthy and happy workers. She had developed routines for milking hygiene, animal handling, animal book keeping and safety. She had chosen to employ labour instead of investing in technical equipment and she commented: "*I'm not really keen on mechanizing because we have the human resource everywhere and I could just as well employ, so that they can also earn their livelihood from here.*" She took care of her employees; she taught them how to manage dairy cow records, gave them fair wages, housing conditions and access to medical care and believed that managing the human capital at her farm was essential.

Availability of and demand for health and safety education. No agricultural health and safety training was available in the region. Almost all those interviewed were eager to attend training in health and safety prevention. The farmers had confidence in NGOs and veterinarians and preferred them to conduct the training courses in collaboration with agricultural health and safety specialist. The farmers also mentioned the urgent need for simple first aid kits and PPE such as face masks and gloves.

Photo: Christina Lunner Kolstrup

The chute where the animals once a week were sprayed with insecticide to prevent ticks, lice and tsetse flies.

Communication of results

The pilot study was conducted in May 2014 and the results was presented on different occasions such as lectures for SLU and UMU students and faculty members in autumn 2014. In 2015 we plan to present the results at a conference on Rural Health in Italy and at the annual African Livestock Conference and Exhibition. Based on the results from the pilot project, the SLU and UMU team are also planning for a scientific paper and a new research application in 2015.

Gender aspects

The research team consisted of one female member of staff from SLU (project leader), and one woman and two men from UMU. Three of the people interviewed were women.

Greatest value of the project and next steps

The programme has given us the unique opportunity to initiate and develop the conceptual idea and conduct a pilot study with a focus on agricultural human health and safety issues in close collaboration with the team at UMU in Uganda. Further, this possibility has strengthened and opened up further opportunities for collaboration. In general, the project has provided us with a better understanding of how Ugandan farmers and farm families consider and perceive agricultural health and safety issues and has highlighted some of the key issues to be addressed in further research.

A summary of the statistics for this project on p. 183

Evaluation of the microbial safety of Peepoo sanitisation in Kibera urban slum, Kenya

Project leader: Annika Nordin

Summary

Peepoo is a single-use, self-sanitising, biodegradable toilet which can improve health by preventing the spread of diseases and by increasing crop production with a locally available fertiliser produced from human excreta. The objective was to study the inactivation of pathogens and indicator organisms in the Peepoo sanitation and excreta collection system as undertaken by the initial launch project (ILP) Nairobi, in the urban slum Kibera. The presence of parasite eggs and cysts in 47% of Peepoos examined after 2 weeks indicates an initial high prevalence of parasite infection and exposure to unsanitary conditions. The proportion of Peepoos containing parasite eggs and cysts decreased with the storage time as did the giant roundworm *Ascaris lumbricoides*, egg viability. For a safe reuse according to WHO guidelines (2006), the treatment must be combined with other barriers to disease transmission, e.g. incorporation in soil, latency between spreading and harvest, and crop choice.

Background

In low-income countries, the two major health risk factors are related to malnutrition and lack of sanitation. Sustainable sanitation is a reuse-oriented sanitation approach emphasising, among other resources, a hygienically safe reuse of nutrients from human excreta. Peepoo is a single-use, self-sanitising, biodegradable toilet which can improve health by preventing disease dissemination and by increasing crop production by providing a locally-available fertiliser.

Aims/Objectives

The objective was to study the inactivation of pathogens and indicator organisms in the Peepoo sanitation and excreta collection system as undertaken by the initial launch project (ILP) Nairobi in the urban slum Kibera.

Collaborators

SLU

Annika Nordin (project leader) – Dept. of Energy and Technology

University of Nairobi, Kenya

Nduhiu Githai (PhD student) – Dept. of Public Health, Pharmacology and Toxicology

Violet Nyakoega (MSc student)– Dept. for Land resource management & Agricultural technology

Activities

Sampling of used Peepoos was conducted at the largest collection point (Undugu) in Kibera, an informal settlement in Nairobi, where in total approximately 5 000 schoolchildren and 5 000 people from the community use Peepoo as a sanitation solution. Three woven polypropylene bags with a tube liner of polyethene containing approximately 600 used Peepoos each were separated from the normal collection to be stored for a period of 2, 4 and 6 weeks during which the inner and ambient temperature were monitored. After 2, 4, and 6 weeks, respectively, 50 faecal samples were then withdrawn from each collection bag and analyses were made of pH, total ammonia nitrogen, parasite eggs and cysts and thermo-tolerant coliform bacteria (indicator bacteria) were performed.

Results

The presence of parasite eggs and cysts (*Ascaris lumbricoides*, whipworm *Trichuris trichura*, dwarf tapeworm *Hymenolepsis nana*, *Entamoeba coli* and *histolytica*,) in 47% of Peepoos examined after two weeks indicates an initial high prevalence of parasite infection and exposure to unsanitary conditions. The proportion of Peepoos containing parasite eggs and cysts decreased with the storage time as did the *Ascaris lumbricoides* egg viability (considered to be the pathogen most resistent towards

Summary in Swedish

Peepoo är en själv-hygieniserande, bio-nedbrytbar engångstoalett som kan förbättra hälsa genom att förhindra smittspridning och genom ökade skördar från ett lokalt tillgängligt gödselmedel.

Syftet med denna studie var att studera inaktivering av patogener och indikatororganismer i Peepoo sanitets och insamlingssystem som det praktiseras i Kibera, slumområde i Kenya. Förekomsten av parasit-ägg och cystor i 47 % av proverna analyserade efter två veckor indikerar att förekomsten var initial hög och att användare lever i under osanitära förhållanden. Proportionen av Peepoos som innehöll cystor och ägg av parasiter minskade över tid såsom viabiliteten hos spolmask ägg (Ascaris lumbricoides). För en säker näringsåterföring enligt WHOs riktlinjer (2006) skall användningen av det producerade gödselmedlet kombineras med andra barriärer för smittspridning såsom t.ex. nedbrukning, val av gröda och karensperioder.

chemical treatments). The thermo-tolerant coliform bacteria decreased both as the proportion of positive samples and in the concentration per gram faeces resulting in concentrations that batch-wise meet the WHO 2006 recommendations for safe use of human excreta. The ascaris egg viability that decreased to 48% after two weeks to 5% after 6 weeks implies that the fertilizer according to the WHO guidelines from 2006 must be combined with other barriers to disease transmission such as incorporation in soil, latency between spreading and harvest, and crop choice. The analysis of pH and ammonia revealed that these factors cannot be used solely to validate sanitization rates but that the viability of ascaris eggs should also be used.

Communication of results

The results from the study will be published in a paper to the scientific community whereas the practical implications of the study are communicated directly to Peepoople Kenya in order to apply the best practices for ILP Nairobi to produce a safe fertiliser.

Gender aspects

Women often suffer the most from lack of sanitation since they are more closely bound to the home and due to the fact that it is less socially acceptable for them to use shared facilities or defecate in the open. This results in stress and health problems such as urinary tract infections and constipation as well as to an increased risk of physical and sexual abuse when seeking to relieve themselves during the night. This study does not directly investigate user aspects but supports the acceptance of a sanitation solution that can be implemented directly without long-term investments from the users. Women will benefit indirectly from improved health in general since taking care of children and other sick family members is usually their responsibility.

Greatest value of the project and next steps

The greatest value of the project is that it provided data on the sanitization rates in the Peepoos when collected on a larger scale so that human excreta systems shall be managed so that nutrients can be reused in a safe way. The next phase of the project is to expand to a wider range of microorganism for a prolonged storage period and, based on present and future results, make a quantitative risk assessment for the sanitation and reuse system.

> "The project provided data so that human excreta systems shall be managed so that nutrients can be reused in a safe way."

Peepoos collected in lined, woven polyethene bag (below).
Plates for microbial count of total thermo-tolerant coliform bacteria (right).

Photo: Annika Nordin

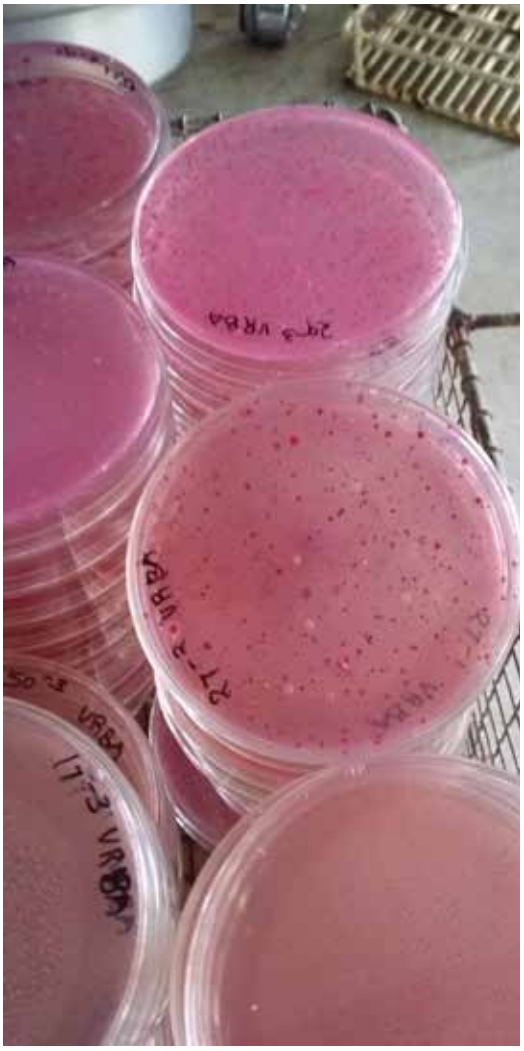

Photo: Nduhiu Githai

A summary of the statistics for this project on p. 184

International workshop on sustainable aquaculture in Sub-Saharan Africa

Project leader: Anna Norman Haldén

Summary

As a means to promote sustainable aquaculture in Sub-Saharan Africa, an international workshop was held at the Aquacultural Research and Development Center in Kajjansi, Uganda. Researchers and representatives from governmental institutions from Uganda, Kenya, Tanzania, Rwanda, Malawi and Cameroon participated as well as researchers from SLU. The specific aims of the workshop were to build a network of researchers from different Sub-Saharan African countries and Sweden, exchange experiences within the field of aquaculture, identify knowledge gaps, and discuss possible future joint applications and projects. Three topics were addressed; alternative feed and farming systems, fish health and environmental impact, and genetics in aquaculture. Specific recommendations for the way forward are presented for each topic.

Background

More than 500 million people depend, directly or indirectly, on fisheries and aquaculture for their livelihoods, and, especially in developing countries with inland or coastal waters, fish is the most important source of animal protein (FAO 2009). Driven by enormous population increases, the demand for aquatic food products is expected to accelerate. However, most of the main fishing areas have reached their maximum yield potential and in many countries capture fisheries have been rapidly declining. Aquaculture is therefore expected to play a major role in future global food supply and to meet the needs of peoples' nutrition, food security, and income. Aquaculture is developing, expanding and intensifying globally; about 47% of fish for human consumption is supplied by aquaculture. In Africa, aquaculture production still constitutes a minor part of the total fish production. However, the contribution from aquaculture has increased steadily in many African countries, and there is a political will to further develop and expand this sector in Africa. For aquaculture to be a sustainable food resource for people in Africa, the aquaculture sector needs improvements and development. Sustainable food supplies for aquaculture require feed that is produced in a way that does not deplete or destroy natural fish populations, but is cost-effective, of high nutrient value, and is environmentally sustainable. Moreover, sustainable aquaculture requires the use of locally-adapted and improved fish strains, healthy fish, and that the aquacultures' local environmental impact can be limited. For the aquaculture sector to develop in the African region there is a need for strong and effective collaborations among actors in aquaculture.

Aim/Objectives

The overall aim is to promote sustainable aquaculture in Sub-Saharan Africa in order to obtain increased fish production and thereby increase welfare and reduce poverty and hunger. The specific aims of the workshop were to build a network of researchers from different Sub-Saharan African countries and Sweden, to exchange experiences within the field of aquaculture, identify knowledge gaps, and to discuss possible future joint applications and projects.

Collaborators

Sweden
SLU
SVA

Uganda
Makerere University
Aquaculture Research and Development Centre (ARDC)
Ministry of Agriculture, Animal Industry and Fisheries

Summary in Swedish

Fisk är i många länder den viktigaste källan till animaliskt protein och miljontals människor är indirekt eller direkt beroende av fiske för sitt uppehälle. Mot bakgrund av de minskade vildfiskbestånden världen över finns stora förväntningar på att vattenbruket, däribland odling av fisk, ska kunna möta människors behov av mat och inkomst. Vattenbruk är den livsmedelssektor som ökar mest globalt, men än så länge är vattenbruksproduktionen mycket låg i stora delar av Afrika samtidigt som det finns stora förutsättningar i många länder avseende odlingsbara arter och tillgång på lämpliga odlingsplatser. För att främja utvecklingen av en långsiktigt hållbar och produktiv fiskodling i Afrika söder om Sahara anordnades en workshop vid Aquaculture Research and Development Center i Kajjansi, Uganda. Bland deltagarna fanns representanter från statliga myndigheter och forskare från universitet i Uganda, Kenya, Tanzania, Rwanda, Malawi och Kamerun, samt forskare från SLU. De specifika målen med workshopen var att bygga ett nätverk av forskare från Afrika och Sverige, utbyta erfarenheter inom området vattenbruk, identifiera kunskapsluckor och diskutera möjliga framtida gemensamma projekt. Tre huvudsakliga ämnesområden diskuterades; foder och odlingssystem, genetik och avel, samt fiskhälsa och miljöpåverkan. Under workshopen arbetades det fram rekommendationer för respektive ämnesområde för hur man ska gå tillväga i framtiden för att främja fiskodlingssektorn i Afrika söder om Sahara.

Photo: Erik Bongcam-Rudloff

Fish market, Uganda.

NAFIRRI (National Fisheries Resources Research Institute)
RUFORUM
SWEACC (Swedish East African Chamber of Commerce) in Uganda
Kabeihura Fish Farmers, Ssenya Fish Farm, TENDO Integrated Farm, Source of the Nile Fish Farm

Rwanda
National University of Rwanda
Ministry of Agriculture and Animal Resources

Tanzania
Sokoine University of Agriculture
Ministry of Livestock and Fisheries Development

Kenya
University of Nairobi
Ministry of Agriculture, Livestock and Fisheries

Cameroon
University of Bamenda
Ministry of Livestock, Fisheries and Animal Industries

Malawi
Bunda University
Malawi Department of Fisheries

Description of the activity and how it was conducted

The initiative for the workshop was taken by SLU in close collaboration with Makerere University. Responsible for organizing the workshop were Dr Anna Norman Haldén at SLU and Dr Charles Masembe at Makerere University.

Researchers and representatives from governmental institutions from six African countries (including Uganda) were invited, as well as researchers from SLU. Mainly Eastern African countries were represented (Uganda, Kenya, Tanzania, Rwanda), but also Southern (Malawi) and West African (Cameroon) countries. These countries were selected based on previous collaborations within the aquaculture field and on already existing scientific contacts with Makerere University or SLU.

Common to all participating countries is an expressed interest in developing the aquaculture sector. Researchers from SLU with expertise in nutrition, alternative feed and farming systems, fish health, and fish ecotoxicology/environmental health participated.

The workshop was held at the Aqua-cultural Research and Development Center in Kajjansi, Uganda. The four-day programme contained presentations, discussions, and fish-farm visits. The first day began with an introduction to the fisheries and aquaculture sectors in Africa (Uganda, Cameroon, Malawi, Rwanda, Tanzania and Kenya), both from researchers', governmental, and fish farmers' perspective. Different farming systems, strengths and challenges were presented and discussed.

The programme for the second day consisted of a full-day excursion to two fish farms: a small farm close to Kampala and a larger commercial farm in Jinja. On the third day, Claire Ntwali from RUFORUM (The Regional Universities Forum for Capacity Building in Agriculture) explained their role in coordinating agricultural research and education in the Sub-Saharan region, and Erik Frisk from SWEACC (Swedish East African Chamber of Commerce) in Uganda presented how they are working to promote the development of trade and investments between Sweden and East African countries. Discussions were the held in three breakout sessions: Alternative feed and farming systems, Fish health and environmental impact, and Genetics in aquaculture. Results from the discussions are presented in the results section below. The day ended with a visit to the fish landing site in Kampala. The fourth day of the workshop was devoted to general conclusions and discussions on how to continue this project; financial possibilities, joint applications, and ways forward. Before the workshop ended, a representative from NaFIRRI (National Fisheries Resources Research Institute, Uganda) gave participants a guided tour of the Aquacultural Research and Development Center and showed their fish research facilities and feed production site.

Results

Three topics were addressed during the workshop; alternative feed and farming systems, fish health and environmental impact, and genetics in aquaculture. Knowledge gaps were identified and specific recommendations for the way forward are presented for each topic.

Alternative feed and farming systems

Discussion questions:

- What are the constraints for a development of aquaculture?
- What is needed to change the situation?

Suggested ways forward:

- Perform baseline survey of fish feeds and feeding practices. In order to provide necessary baseline data for future activities, field surveys are performed to collect information on current use of feeds and applied feeding practices by fish farmers.
- Based on the outcome of the survey, make a selection of locally available feed ingredients for assessment of nutritional and anti-nutritional properties (chemical composition and anti-nutritional factors). Perform digestibility trials to assess the nutritional values (energy value and protein value), and perform dose response growth trials to assess the feed value (palatability, potential feed intake, growth performance, feed utilisation).
- Specify nutrient requirements for fish species of interest. Perform studies on fish species of interest, and where no data are available, assess requirements of protein, indispensable amino acids and essential fatty acids.
- Perform growth trials to evaluate least cost combinations of identified ingredi-

ents. Evaluate the impact of feed processing on feed properties (buoyancy, stability) and fish growth performance. Identify and evaluate feed processing methods with potential to reduce the negative impact of anti-nutritional factors and fibre content.

• Evaluate the impact of feeding practices (frequency, levels, phasing) on fish growth performance and cost effectiveness. Evaluate the impact of fish mono- vs. polyculture on fish yield and cost effectiveness. Evaluate the impact of integrated fish – livestock – crop farming systems on food production potential, net return and environment. Develop fish farming systems based on the combined supply of nutrients to pond-cultured fish from the natural food web and formulated feeds.

• Strengthen capacity by improving the infrastructure and investing in higher academic education. Training of farmers to improve knowledge and skills related to feed formulation, feed compounding and feeding practices.

Fish health and environmental impact

Discussion questions:

• Is there a problem with fish diseases and mortality in African aquaculture?

• How to build capacity for enhancing fish health in African aquaculture?

• How to reach the farmers with the knowledge of diseases?

• What can a farmer do if he finds signs of disease? Where to report?

• How to handle the movement of fish between countries in the region considering spread of pathogens?

Suggested ways forward:

• Educate aquaculture students in fish diseases and diagnostics. Strengthening laboratories capacity of diagnosing fish diseases. Training extension workers/governmental advisors to reach the farmers with knowledge of diseases. Managers of hatcheries could be one possible link between the universities and the farmers.

• Train farmers/stakeholders in basic disease mitigation. Inform farmers about simple measures that they can adopt to prevent diseases. Educate farmers about the diseases that can be identified and treated by them directly, e.g. white spot disease (formalin). Inform farmers about the risks involved with antimicrobial resistance. Africa farmers can easily get antibiotics to treat their fish without consulting a fish health expert. Create systems for reporting diseases to authorities. Inform farmers about potential problems with zoonotic pathogens that thrive in warm water.

• Integrating farming systems with for example fish and mussels may improve water quality and reduce nutrient losses from fish farms.

• Establish quarantine centres to prevent spread of diseases between countries. In Uganda, the fish health expertise at the School of Veterinary Medicine and Animal Resources at Makerere University, the School of Bio-Sciences (Department of Biological Sciences) at Makerere University and the NaFIRRI research centre constitutes a knowledge resource. These bodies can be linked to maximise improvement of fish health.

Genetics and Aquaculture

Discussion questions:

• What is needed and what are the constraints?

• How to improve fish in aquaculture for desirable traits? Growth? Fat? Disease resistance?

• Why are tilapias resistant to most fish diseases?

• How to monitor the spread of diseases between countries?

• How to strengthen collaboration between countries on the African continent?

”The internet platform should form the basis for knowledge transfer from researchers to governmental institutions and farmers.”

- How to build capacity for genetic enhancement globally?

Suggested ways forward:

- Maintain the fish collections that have been made for genetic analysis. Improve databases with regard to phylogeny and species characterization – focus on specific traits of interest, not whole-genome studies.
- Create a record tracing system to track the distribution of fish and brood stock among the African countries. Establish a record system of fish strains being produced through selective breeding.
- Develop bio-banks which can later be connected to genetics, SLU has developed an animal bio-bank which can serve as a model for African countries. Sample wild populations from areas where the current farmed fish were collected.
- Catalogue the fish species used in each country (genetic basis). Complement the genetic work with quantitative trait loci (QTL) selection where loci for traits of importance are selected. The genome of tilapia has already been developed and is freely accessible on-line. Engage students and people to analyse the data and address these issues.

Communication of results

The main goal of the project was attained; to initiate a capacity building network within aquaculture in sub-Saharan Africa. Further developments will be achieved by education of students at universities, encouragement and support of research, and through outreach activities.

Participants were deeply engaged in the discussions during the workshop. These experts have communicated the insights at their home universities and agencies at the local and national levels. It was agreed that aquaculture researchers from other countries, especially Burundi, should be invited to participate in the coming discussions regarding the project. In that way all countries within the East African Community would be represented in the now-established network.

Gender aspects

The workshop focused on research and capacity building for development, which contributes to the provision of more fish for the poor. This is very timely since women, children and the elderly have little access to fish protein, which is needed for physical wellbeing and cognitive development. The small-scale fish farmers are predominantly women and yet they are also faced with the task of providing for their families. Therefore, women will eventually benefit from training activities aimed at to improving aquaculture management and farming practices, which will strengthen the families' economy and quality of life.

Greatest value of project and next steps

The greatest value of the project is that researchers and stakeholders from the Sub-Saharan region and Sweden have met, exchanged experiences and have drafted a joint proposal for future capacity building within aquaculture in sub-Saharan Africa.

The draft proposal has three main parts:

1) Education; A master's program on Sustainable Aquaculture based in Uganda. (Makerere University) coordinated by Makerere University and SLU. The programme would consist of three students from each participating African country and Burundi; one focusing on feed, one on genetics, and one on fish health.

2) Network; Coordination of research, education and knowledge-based information to society and industry via an internet platform. The platform should form the basis for knowledge transfer from researchers to governmental institutions and

Photo: Erik Bongcam-Rudloff.

Participants in the Aquaculture workshop in Uganda.

farmers.

3) Research and development fund: To support research projects. Researchers within the network can apply for project funding.

The collaborating partners will jointly seek funding for the capacity building activities listed above. An important part of the continuation of the project is that researchers identify projects and partners within the network for joint applications and projects within their different field of expertise (feed, genetics or health) as well in integrated projects. Continued collaboration within the established research network is anticipated.

A summary of the statistics for this project on p. 185

Adoption and adaptation of enclosures for pasture – management differences and gender effects

Project leader: Gert Nyberg

Summary

Preliminary results indicate that there are gendered differences in the management of enclosed pasture systems and that these have changed over time; this being partly due to the "new" system of enclosing pastures. Very generally, women have more tasks on the farm and hence a heavier work burden, but they are also more empowered in farming decisions and are more active on the local market than they were 30 years ago. Thereby they have access to finances that they control entirely and hence women are very positive to the changes. Results also indicate that there are large differences in the management intensity of enclosed areas as well as in the productivity of the livestock in these enclosures. The system is adopted to a large extent and there is very little migration with livestock. The little migration that does exist is for short distances and periods and mostly to rented pasture lands (enclosed by someone else). Differences in management seem to be correlated to when the famer was given information (how long enclosures have been used) and to what extent farmers received information through extension services (Vi Agroforestry or government).

When finalized, results from this project may inform:

- Triple L (Land, Livestock and Livelihood Dynamics in semi-arid landscapes) scientist on identification of future research issues,
- Extension agents on management systems to include in their messages,
- Local policy makers on productivity and gender effects of different pasture management systems and hence enable them to adjust policies and incentives towards desired directions.

Summary in Swedish

Preliminära resultat indikerar att ett system med stängslade betesmarker medför skillnader och förändringar av könsroller och arbetsfördelning mellan män och kvinnor. Mycket generellt får kvinnor visserligen fler arbetsuppgifter men framförallt mer inflytande över beslut om odling och avsalu inom jordbruket än för 30 år sedan. Eftersom kvinnor blir mer aktiva på marknaden och får en viss "egen" ekonomi är kvinnor generellt mycket positiva till förändringen av jordbruks/betesmarks-systemet.

Resultaten antyder också stora skillnader i intensiteten av skötsel av inhägnade betesmarker och därmed av produktiviteten i kreatursbesättningen. Systemet med inhägnade betesmarker har anammats av flertalet bönder i området, vilket bl.a. innebär att långväga migration med kreaturen i stort sett upphört. Den migration som förekommer är kort, under begränsad tid och till hyrda inhägnade betesmarker. Skillnader i skötsel och intensitet tycks bero på när (hur länge markerna varit stängslade) och hur (från myndigheter, grannar eller Vi skogen) bönderna fick kunskap om det "nya" systemet. När slutliga resultat föreligger kommer de att bistå:

- Forskare inom Triple L att identifiera framtida forskningsfrågor.
- Rådgivningsorganisationer (t.ex. Vi skogen) om vilka skötselmetoder de kan inkludera i sina råd till bönder.
- Lokala myndigheter och beslutsfattare om olika skötselsystems effekter på produktivitet och på könsroller; och därmed möjliggöra för dem att utforma policies och incitament i önskad riktning.

Background

The research initiative Land, Livestock and Livelihood Dynamics in semi-arid landscapes, West Pokot, Kenya (Triple L Initiative), is a multidisciplinary research network coordinated by SLU (Gert Nyberg). One important factor in the development in the area is the use of enclosure systems, often including tree planting and/or natural regeneration of trees to regulate grazing pressure. The use and management of these enclosures are of vital importance for the meat and milk production of the system and in the area. Furthermore, the more sedentary lifestyle implicated by the enclosure system enhances the inclusion of more crop agriculture in the system. The system change in the area has occured during the last three decades and is obvious (and dramatic) on a landscape scale.

Aims/Objectives

To collate data from the two MSc students from satellite image change analyses and combine it with:

a) Data from the two soil science students,
b) Data on management of the enclosure systems,
c) Data on the expansion and management of cropping systems in the area,
d) Data on gender effects on these management changes.

Description of the activity and how it was conducted

After collating data from the two Swedish students it was concluded that these data were not sufficient for a scientific publication on its own. However, data from Sara Svanlund's MSc thesis is to be included in a joint multidisciplinary scientific publication early in 2015. Writeshops via Skype for this have begun and the major focus on the writing will be annexed to the Triple L workshop in November 2014. The satellite images developed and analysed by the other student (Anna Hallmén) were used in various research applications to VR and Formas during 2014.

Indications from the work of Sara and Anna indicated differences in management intensity and quality, which was one of the bases for the application for this research project. Differences in gender effects of the enclosed pasture system and of the general development in the area was indicated in Julia Vernersson's MSc thesis (Gothenburg

Photo: Gert Nyberg

Interviewing a farmer.

University 2013). Both Sara's and Julia's MSc theses can be found on the Triple L web site (https://arbetsplats.slu.se/projects/TLI/SitePages/Home.aspx).

Gert Nyberg travelled to Kenya for three weeks to initiate the studies. They are two, one focusing on the gendered effects, carried out by Vera Karmebäck, a student at Lund University and University of Nairobi, and one on dry land development carried out by John Waiore, also an MSc student at University of Nairobi.

We planned and constructed the two questionnaires and began the field interviews. The gender study has completed the interviews and the results are to be published partly in a thesis by Vera and in 1-2 joint scientific publication by myself, Vera, John and Willis Kosura, Stephen Mureithi, Peter Mwangi, and John's Kenyan co-supervisors. The interviews for the management study were begun by John and Gert, and John was to finish them after Gert's return to Sweden. However, John met with administrative problems at University of Nairobi and was delayed. The problems have now been resolved and he has resumed his field work. Since he is to carry out 180 interviews altogether (his Kenyan supervisors recently doubled the sample size), we expect him to continue until November 2014. The results will form the basis for John's MSc thesis and will partly be included in 1-2 joint scientific publication by him, myself, Vera and the Kenyan co-supervisors. Some management data and satellite images from Sara's and Anna's work might also be included in these publications (in which case they will be included as co-authors). To facilitate Vera and John's field work, a field assistant and a number of translators were hired temporarily. Staff from Vi Agroforestry assisted in finding famers and for transport.

This research is conducted in collaboration with Peter Mwangi, Jomo Kenyatta University of Agriculture and Technology, and Stephen Mureithi, University of Nairobi, acting as co-supervisors in biophysical sciences and with Magnus Jirström, Lund University, and Willis Kosura, University of Nairobi, in socio-economic sciences.

Preliminary results

Preliminary results indicate that there are gender differences in management of enclosed pasture systems and that these have changed over time and that they are partly due to the

"The results will also guide government and NGO extension services as to what management options to include in their information."

"new" system of enclosing pastures. Very generally, women have more tasks to do on the farm and hence have a heavier burden, but they are also more empowered in farming decisions and more active on the local market than they were 30 years ago. They thereby have access to finances that they control entirely and hence women are very positive to the changes. They attribute this partly to the systems of enclosures but also point out the market and infrastructure development during the period, not least the increased facilities and requirements for education enabling almost 100% of all children to attend school.

The other study on dry land development is even more preliminary, but indicates that there are large differences in the management intensity of enclosed areas and also in the productivity of livestock in these enclosures. The system is adopted by livestock keepers to a great extent and there is very little migration with livestock. The little migration that does exist is for short distances and periods and mostly to rented pasture lands (enclosed by someone else). Differences in management seems to be correlated to when the famer was given information (how long enclosures have been used) and to which extent farmers received information through extension services (Vi Agroforestry or government). Farmers' level of education and age also seem to influence enclosure management quality and productivity.

Communication of results

Results from this project and other Triple L activities will be reported to policy makers and officials as well as publically reported at a public meeting in Chepareria, Kenya (the village where the studies were conducted) on November 20th and 21st 2014, see attached Triple L workshop program.

Gender aspects

Gender aspects are one of the major issues studied in this project, see Preliminary results above.

Greatest value of the project and next steps

Results from this project will contribute to the formulation of further research question in the Triple L Initiative. The results will also guide government and NGO (e.g. Vi Agroforestry) extension services as to what management options to include in their information. Results may also guide policy makers on productivity and gender effects of different pasture management systems and hence enable them to adjust policies and incentives towards desired directions. The results will be included in these (science, extension and policy) discussions in the coming Triple L workshop in November 2014.

Collaborators

SLU
Gert Nyberg (project leader), Dept. of Forest Ecology and Management

Jomo Kenyatta University of Agriculture and Technology
Peter Mwangi

University of Nairobi
Stephen Mureithi

University of Nairobi
Willis Kosura

Lund University
Magnus Jirström

Students participating:
Vera Karmebäck Lund University and University of Nairobi, *John Waiore*, University of Nairobi

Field assistant: *Benjamin Lokorwa*, Chepareria, Kenya

Photo: Gert Nyberg

Interviewing farmers.

A summary of the statistics for this project on p. 186

Regional workshops on Animal Genetic Resources in Sub-Saharan Africa 2013

Project leaders: Jan Philipsson (SLU) and Julie Ojango (ILRI)

Summary

Sub-Saharan Africa (SSA) faces serious challenges in food security and must considerably increase production of meat, milk and eggs to meet future demands, while the natural resources must be considered. Further challenges are that many indigenous livestock breeds are threatened by extinction and that there is a shortage of trained staff to work with these problems. Therefore, SLU and ILRI (International Livestock Research Institute), supported by Sida, have jointly conducted Capacity Building for a sustainable use of Animal Genetic Resources (AnGR), built on the concept "Training the Trainers", and addressing scientists in SSA. A selected number of previous course participants and also national coordinators of FAO and AU-IBAR (Interafrican Bureau for Animal Resources), all potential leaders of future development of AnGR, were invited to regional workshops in November 2013 to be further empowered. The workshops were conducted by ILRI and SLU in collaboration with FAO and AU-IBAR and took place in Burkina Faso for West & Central Africa, in Rwanda for Eastern Africa, and in Botswana for Southern Africa. In total 147 people from 47 countries in SSA participated in the workshops in kind. Important stakeholders in SSA, i.e. TEAM Africa, RUFORUM, ASARECA (east), CORAF (west), SADC and CCARDESA (south), co-hosted or supported in kind the workshops. Thus, a politically high recognition was achieved.

Proposals and networks were developed aimed at improving higher education in animal breeding and genetics for increased productivity and sustainable use of AnGR, and also to undertake relevant research and capacity development for improved breeding and conservation programmes. Proposals have been presented to various national and regional authorities. Continued collaboration between ILRI, SLU, FAO, AU-IBAR and TEAM Africa is anticipated.

Sammanfattning

Det är en stor utmaning att utveckla jordbruket i Afrika söder om Sahara (SSA) så att man kan möta den förväntade efterfrågan på mjölk, kött och ägg med beaktande av olika miljöaspekter. Utmaningen består också i att många inhemska djurraser, som är anpassade till klimatet, är utrotningshotade och att man har knapphet på utbildat folk som kan arbeta med dessa problem. SLU och ILRI (International Livestock Research Institute) har mot denna bakgrund bedrivit ett program för fortbildning av universitetslärare och forskare under konceptet "Training the Trainers" för att öka utbildningskapaciteten inom ämnet husdjursgenetik med inriktning på hållbara avelsprogram för ökad livsmedelsproduktion. Ett antal av tidigare kursdeltagare, samt nationella representanter i husdjursavelsfrågor för FAO och AU-IBAR (Interafrican Bureau for Animal Resources), alla potentiella ledare, inbjöds att deltaga i regionala workshops, anordnade av ILRI och SLU under november 2013 i samarbete med FAO och AU-IBAR, i Burkina Faso för västra och centrala Afrika, i Rwanda för östra Afrika och i Botswana för södra Afrika. Viktiga organisationer i SSA (TEAM Africa, RUFORUM, CORAF, ASARECA, SADC, CCARDESA) deltog aktivt och bidrog till att våra workshops fick en hög politisk acceptans. Totalt deltog 147 representanter för 47 länder i SSA.

Deltagarna utarbetade förslag till utökad regional samverkan för högre utbildning, forskning och fortbildning för tillämpning av effektiva avelsprogram med syfte att öka livsmedelsproduktionen med krav på ökad miljöhänsyn. Förslagen förs fram i olika nationella och regionala fora. Fortsatt samarbete mellan ILRI, SLU, AU-IBAR, FAO och TEAM Africa kan förväntas.

Background

Livestock contributes to 30-50% of the agricultural GDP in most countries of Sub Saharan Africa (SSA), and demand for food of animal origin is expected to double by 2050. So far, increased needs for food have been met largely by increasing livestock numbers resulting in increased gas emissions, overgrazing and subsequent environmental degradation of land. There are huge numbers of indigenous livestock, well adapted to the climate, but their productivity is usually low. SSA thus faces serious challenges in food security and must considerably increase production of meat, milk and eggs from fewer and fewer animals and birds, to ensure that the natural resource base on which such production depends is restored and used efficiently. A further challenge is that many indigenous livestock breeds are threatened by extinction, yet such breeds may harbour some desirable genes, especially for the unpredictable future needs.

Genetic improvement of livestock breeds is highly needed, but hardly any well thought-out and long-term breeding programmes are currently in place in SSA. Enabling policies are often lacking. Infrastructure to support a sustainable use of the Animal Genetic Resources (AnGR) is weak and there is a shortage of staff trained in Animal Breeding and Genetics (ABG). To alleviate these problems, SLU and ILRI, supported by Sida, jointly conducted a capacity building programme for scientists in SSA, and also in South and South-East Asia. This program was built on the concept "Training the Trainers", i.e. continued education of researchers and university lecturers, to up-date their professional skills (through courses, workshops and a web-based training resource). The programme ran from 1999 to 2011 and was reviewed very positively internationally. A final ILRI-SLU workshop (with FAO as co-organizer) was conducted in 2011 for a selected number of "champions" from SSA, i.e. previous course participants and some national coordinators, all potential leaders of future development of AnGR. Several ways forward were presented in the the project's final report: Training the Trainers – An innovative and Successful Model for Capacity Building in Animal Genetic Resource Utilization in Sub-Saharan Africa and Asia. Available in print and as a pdf file at: cgspace.cgiar.org/handle/10568/16393

Photos: Birgitta Malmfors

Promising indigenous cattle breed (in Botswana) for which trait recording and genetic evaluation have been implemented by Kethusegile Raphaka, previous participant in an ILRI-SLU training course. Participant also in the Southern Africa workshop.

Objectives

During the ILRI-SLU-FAO workshop in 2011 it was envisaged that regional networks should be established and that the champions should meet with the ILRI-SLU team at regional workshops in 2013. They would then be further empowered to take over the role of training trainers at their national or regional level. The purpose would also be to develop concepts for increased regional collaboration in the area of AnGR for uptake within the political and institutional systems of SSA for higher education and research.

The main objectives of the workshops were to enhance regional collaboration in order to:

1. Improve university teaching incl MSc and PhD training in animal breeding and genetics for sustainable use of AnGR.
2. Plan and undertake research for development in prioritized areas of AnGR.
3. Design and implement improved conservation and breeding programs for sustainable use of identified AnGR.
4. Design and improve capacity development including outreach activities in relevant areas.

Collaborators

SLU
Jan Philipsson (SLU project leader), Birgitta Malmfors – Dept of Animal Breeding and Genetics

ILRI (International Livestock Research Institute), Nairobi, Kenya
Julie Ojango (ILRI project leader), Okeyo Mwai, Iddo Dror, Diana Brandes

FAO (Food and Agriculture Organisation of the United Nations), Rome, Italy
Paul Boettcher, Beate Scherf

AU-IBAR (Interafrican Bureau for Animal Resources), Nairobi, Kenya
Simplice Nouala, Edward Nengomasha, Mary Mbole-Kariuki, Bosso Austin N'Guetta

TEAM-Africa (Tertiary Education for Agriculture Mechanism)
Hamidou Boly

Close collaboration also with ASARECA, SADC, CCARDESA, RUFORUM, and CORAF

Project activities

Regional workshops were held in November 2013 as follows:
- West & Central Africa region: Ouagadougou, Burkina Faso: 5-8 Nov
- East-Africa region: Kigali, Rwanda: 19-22 Nov
- Southern Africa region: Gaborone, Botswana: 26-28 Nov.

The workshops were planned and conducted by the ILRI – SLU team (Julie Ojango and Mwai Okeyo from ILRI, Jan Philipsson and Birgitta Malmfors from SLU). Support in facilitation of the workshops was provided by specialists on the Capacity Development team of ILRI (Iddo Dror and Diana Brandes). Resources were mobilized from SLU Global (UD 15) and from ILRI (CRP 3.7). Relevant stakeholders were invited, i.e. FAO, TEAM Africa, RUFORUM, ASARECA (east), CORAF (west), SADC and CCARDESA (south), and were supporting the workshops as co-hosts or in kind. In a final stage of planning the workshops, FAO and AU-IBAR (Interafrican Bureau for Animal Resources) approached the ILRI-SLU team with a proposal to join and extend our workshops with the participation of the AnGR National Coordinators (NCs) of FAO and AU-IBAR for all countries in SSA. FAO needed to reach out to all their NCs as a follow up of the Global Plan of Action and for preparation for the second report on the State of the World on Animal Genetic Resources. AU-IBAR had just obtained EU-funding to support development of AnGR in the coming 5-year period and deemed it important to have their NCs participate in the workshops. Each workshop programme was therefore extended by 1.5 days and the number of participants was more than doubled compared to initial plans, thus enabling all countries in SSA to be represented. At the same time the workshops got a high level political recognition in each region. AU-IBAR supported/funded the participation of the NCs and met all the costs for the extended days of the workshops.

Results

In the first workshop there were 64 participants from 24 countries in Western and Central Africa. The workshop was officially opened by the Minister of Livestock and Fisheries in Burkina Faso.

In the second workshop there were 40 participants from 11 countries in Eastern Africa. The Deputy Minister of Agriculture and Livestock of Rwanda opened the workshop.

The third workshop was attended by 43 participants from 12 Southern African countries and was held in collaboration with the regional institutions SADC and

Photos: Birgitta Malmfors

Preparation of group work reporting (above).

Intense discussions on optional AnGR issues between 3-4 people in an inner circle (Samoan Circle), while those in the outer circle listened attentively and could at any time replace a person in the inner circle (right).

CCARDESA, and was thus endorsed by the highest political level within the region.

The following workshop outputs and outcomes are worth highlighting:

• Key policy makers were made aware of the challenges and needs for investments in conservation and sustainable use of domestic AnGR by improving their productivity if food security is going to be achieved while environmental degradation must be avoided.

• Close networks and a platform for future activities have been established within each region as regards institutions and people involved in AnGR activities, especially between ILRI-SLU champions, who are well trained in ABG, and NCs of FAO and representatives of AU-IBAR.

• Awareness was created among all participants of the role of sustainable use of AnGR through appropriate breeding strategies for genetic improvement and that this must be based on various kinds of livestock recording. Such schemes, including information on animal ID, production and reproduction traits, serve the purpose of providing data for genetic improvements, for research and development and for management and monitoring of farm animal production.

"...sharing experiences and providing effective dissemination of the knowledge needed to develop the domestic AnGR of Sub-Saharan Africa."

• Issues concerning harmonization of curricula in ABG at MSc and PhD levels were considered important and will be pursued by individual champions at their home universities and by TEAM Africa with relevant authorities including the Vice-Chancellor´s conference in SSA. Proposals were made to investigate opportunities for joint PhD courses within each region for best use of existing resources.

• The importance of closer national and regional institutional collaboration between universities, research institutes, ministries and NGOs related to AnGR was highlighted as a necessity for implementation of cost-effective activities for improved sustainable use of AnGR.

• Priorities for future development of activities in the area of AnGR were set by the participants of each workshop for action within each country.

• The newly launched EU-financed AU-IBAR project on AnGR in SSA was presented and discussed, whereby valuable suggestions for efficient execution of the project in coming years were given.

Communication of results

The workshops were primarily based on group discussions among participants with introductory presentations by the participants and by specialists on various subjects. A written report on the content, outputs and expected outcomes will be jointly published in 2014 by ILRI, SLU and AU-IBAR. All information presented and documented during the workshops has been made available on the ILRI website, see: http://ilri-angr.wikispaces.com/Regional+Workshops+Presentations

Gender aspects

Livestock are an important asset for women in developing countries, and women constitute almost 70% of the estimated 600 million poor livestock keepers in the world. The women are major actors in subsistence livestock keeping, and often have a preference for locally adapted livestock breeds and thus support genetic diversity. The importance of women in livestock production, however, has not been well reflected among scientists in SSA. Within the ILRI-SLU "Training the Trainers" programme great efforts have been made to increase the number of female teachers and researchers as course participants. A total of 25 women participated in the three workshops. It was observed during the workshops that in SSA, the proportion of female animal science students is increasing. There is however a need to further empower female scientists as leaders for future development of higher education and research on livestock subjects in SSA.

Greatest value of project and next steps

The most important achievements of the workshops may be summarized as follows:

• The workshops enabled the ILRI-SLU team to strengthen its joint efforts and resolve to further empower "champions" from previous capacity development activities in AnGR to become regional leaders in "training trainers", thereby sharing experiences and providing effective dissemination of the knowledge needed to develop domestic AnGR in SSA.

• Awareness was created among policy makers and all workshop participants of the needs to invest in R&D as well as in implementation of better designed breeding programmes and the activities involved, including the supportive infrastructure needed for livestock recording of important traits, in order to improve productivity of domestic AnGR in SSA for reasons of food security and natural resource management.

• Networks were established among the ILRI-SLU "champions" and the national coordinators of AnGR activities of FAO and AU-IBAR, and also with representa-

Photo: Jan Philipsson

Participants, organizers and high officials just after the inauguration of the East-Africa workshop.

tives of regional actors responsible for livestock development and higher education.

• The involvement of TEAM Africa, as a new player in the area of developing higher education in SSA on behalf of NEPAD, and as promoter of the proposals by workshop participants.

The opportunity to collaborate with AU-IBAR on development of the AnGR of SSA at the onset of its 5-year EU-financed project may open up for further collaborations between ILRI, SLU, FAO and AU-IBAR.

A summary of the statistics for this project on p. 187

Fuel use efficiency and emissions from biochar-producing cook-stoves in Kenya

Project leader: Cecilia Sundberg

Summary

Biochar has recently gained attention in scientific and popular media for its potential to sequester carbon, enhance soil fertility and provide opportunities for reduced indoor-air pollution during cooking. The objective of this activity was to analyse the fuel use efficiency and emissions of gasifying cook stoves that produce biochar, using different fuels. Experiments were performed in rural households in Kenya. The tested stove reduced smoke and reduced the fuel needed for cooking, compared to current practices.

Introduction

Biochar has recently gained attention in scientific and popular media for its potential to sequester carbon, enhance soil fertility and provide options for food preparation through biochar stoves. Biochar can be produced in gasifying cook stoves, where biomass is heated under limited oxygen conditions; the gases produced are burned to provide heat for cooking, while the remaining biomass is converted to char. Such cook stoves may reduce the pollution from burning and thus contribute to reduce the negative impacts of cooking on health and the environment.

The objective here was to analyse the fuel use efficiency and emissions of gasifying cook stoves that produce biochar, using different fuels, under conditions realistic for rural households in Kenya.

> "We have been able to show that the biochar-producing cook stoves give significantly reduced indoor air emissions as well as reduced need for cooking fuel."

Method

After preliminary testing of a number of cook stoves, one promising design was selected for further analysis. This stove gasifies the fuel and produces char as a by-product. Experiments were performed in the kitchens of five farm households in Embu, Kenya. In a first set of experiments, char was produced while cooking in the gasifying cook stoves. In a second set of experiments, the char was used as a cooking fuel. Unconventional fuels, from waste products, were compared to conventional fuels (firewood and charcoal).

Stoves were tested for:

- ability to burn unconventional fuels (coconut shells, maize cobs, maize stover and grevillea prunings),
- energy efficiency (amount of fuel needed to bring water to the boil and to cook a common Kenyan meal),
- emissions (particulate matter, carbon monoxide, carbon dioxide),
- ability to produce char.

For the tests of energy efficiency, laboratory analyses were performed of the content of dry matter, volatile solids and ash and calorific value of feed stocks and produced char.

Summary in Swedish

Biokol har uppmärksammats för möjligheter attt lagra kol i marken, förbättra markens bördighet samt minska luftföroreningarna vid matlagning. I projektet undersöktes bränsleeffektiviteten och utsläppen vid förbränning av olika bränslen i spisar som producerar biokol. Mätningar genomfördes i hem på landsbygden i Kenya. Den undersökta spisen minskade röken och mängden bränsle som behövs, jämfört med nuvarande matlagningsteknik.

Results

Cooking with gasifier stoves reduced emissions of carbon monoxide and particulate matter significantly, compared to current practices, a three-stone open fire. Particulate matter emissions were in most cases reduced by 70-90%. The tested stoves also used at least 20% less fuel and cooked faster than the current cooking practices. Most households preferred the tested stove to their current cooking method.

Results communication

Some results have been published in a BSc thesis report by Swedish students. An SLU MSc thesis report is under preparation. Short summaries and links to full reports are published on our website (www.slu.se/bio-char-kenya). We have plans for wider communication in Kenya, at a later stage when we have developed sound conclusions and recommendations from our research. We have also initiated an African Biochar

Photo: Cecilia Sundberg

Bio-char producing cookstove with maize cobs as fuel.

Consortium, linking researchers and practitioners in biochar across Africa. This network will be an excellent platform for disseminating the results from our research.

Gender issues

As cooking is an activity performed by women, gender issues are obviously important in a project that investigates cooking. Decisions regarding fuels and stoves are embedded in gender roles in the household and the community. Even though this project is focused on engineering aspects such as fuel use efficiency and emissions, these depend on the practical management of stoves, and therefore we perform many of the experiments in direct collaboration with women on Kenyan farms. Potential benefits from improved cook stoves, such as reduced need for fuel collection and less smoke are mainly expected to positively affect women and children.

Greatest value of the project and next steps

The greatest value of the project is that we have been able to show that the bio-char-producing cook stoves give significantly reduced indoor air emissions as well as reduced need for cooking fuel. This is very promising for women and children who inhale smoke during cooking.

The next phase of the project is to distribute the cook stoves to 60 households in three regions in Kenya, in order to get real-life testing of the stoves.

Collaborators

SLU
Cecilia Sundberg – Dept. of Energy and Technology

ICRAF
Mary Njenga

IITA
Kristian Roing de Nowina, *Dries Roobroek*

Photo: Cecilia Sundberg

Cooking tests are performed together with women farmers.

A summary of the statistics for this project on p. 188

Activities to strengthen new initiatives within food security

Project leader: Carolyn Glynn and Arvid Uggla

Summary

This section describes three activities that were made possible by the funding from the Swedish Ministry of Foreign Affairs' program for food security. In the first activity journalists from African countries participated in 'Solutions for a green future', a Master's class taught by the International Federation of Agricultural Journalists (IFAJ). Agricultural journalism is a powerful means to inform farmers on issues that help them in their day-to-day work and gives farmers a voice. In the second activity, PhD students in African countries were given the chance to present their research during the poster session at the First international conference on global food security in The Netherlands. In the third activity Sweden, through SLU's programme Agricultural Sciences for Global Development, SLU Global, was able to participate in and take a leading role in the development of an application for funding through Horizon 2020. The call was in the Societal Challenges work program Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy in the call for Sustainable food security; sustainable food production systems. Each of these activities contributed to the further development of partnerships between African and international communities that address food security and nutrition issues.

Summary in Swedish

Detta avsnitt beskriver tre aktiviteter som finansierats av Utrikesdepartementets särskilda satsning på livsmedelsförsörjning. I den första aktiviteten deltog journalister från afrikanska länder i en kurs på mastersnivå, 'Solutions for a green future', som gavs av organisationen International Federation of Agricultural Journalists (IFAJ). Journalistiskt arbete med focus på jordbruksfrågor är en kraftful mekanism för att informera jordbrukare om nyheter som kan bidra till bättre arbetssätt. Det kan också ge jordbrukare en röst i media. I den andra aktiviteten fick doktorander från afrikanska länder möjlighet att presentera sin forskning vid konferensen 'First International Conference on Global Food Security' i Nederländerna. Den tredje aktiviteten bidrog till att Sverige deltar och har en ledande roll i utvecklingen av en ansökan till EU:s Horizon 2020, främst genom en satsning från SLU:s program 'Agricultural Sciences for Global Development, SLU Global'. Utlysningen gick ut via EUs program 'Societal Challenges work program - Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy'. Utlysningen gällde 'Sustainable food security; sustainable food production systems'. Alla dessa aktiviter bidrar till en vidareutveckling av partnerskapet mellan de afrikanska och internationella aktörer som arbetar med matförsörjnings- och nutritionsfrågor.

Background, aims, results and next steps

International Federation of Agricultural Journalists

The Royal Swedish Academy of Agriculture and Forestry (KLSA) in association with the International Federation of Agricultural Journalists (IFAJ) and Agriterra (a Dutch agricultural agency) held for international agricultural journalists a Master's class with the title: Ethics in food production. The International Federation of Agricultural Journalists (IFAJ) is a non-political, professional association for agricultural journalists in 32 countries. IFAJ supports and encourages the practice of agricultural journalism in countries embracing freedom of the press. The course in 2012, Solutions for a green future, had two main objectives: to provide journalists with the opportunity for comprehensive professional development experiences with focus on policy, agricultural issues, media trends and agribusiness. It also created an international forum for discussion between journalists from developed and developing countries, giving insights into important issues that have agricultural as well as humanitarian relevance. Funding from the Swedish Ministry for Foreign Affairs was used to send two journalists from Tanzania to participate in the class and to the IFAJ World Congress 2012 that was held in Sweden directly after the course. Results of this initiative were that the participants contributed with an article to a special edition of the magazine for the Dutch Cooperative Council and provided articles for the digital platform for Farmers Fighting Poverty Program (http://asiadhrra.org/wordpress/programs/farmers-fighting-poverty-ffp/). The journalists from Tanzania that were supported by this initiative got help from IFAJ in setting up a guild in their country.

The next step for the journalists that participated in the course is to continue contact within their networks. The master class was structured to lead to many new initiatives such as the improvement of contacts among and between journalists from developed and developing countries and the establishment of new guilds within the IFAJ, despite the fact that in many countries there is limited or no freedom of press. Ideas for these initiatives that were discussed in the course can be found in the IFAJ Global Strategic Plan see www.ifaj.org. Funding to support this important work is needed.

The First International Conference on Global Food Security

The First International Conference on Global Food Security, hosted by the Netherlands, was organized to increase understanding on the economic, social, biophysical, technological and institutional drivers of current and future global food security issues. Focal areas addressed during the presentations and ensuing discussions were food production and access, and the trade-offs between competing environmental, economic or social objectives and outcomes. The aims of the biennial conference are to deliver state-of-the-art analyses, inspiring visions and innovative research methods arising from interdisciplinary research.

The conference made a special effort to encourage young scientists to present papers or posters and participate in the current debate on food security issues. We took on this challenge and created an opportunity for African PhD students to participate. We asked

researchers from SLU's broad areas of expertise including agriculture and biotechnology, forestry, veterinary medicine and animal sciences, plant breeding and protection, landscape planning and landscape architecture to encourage their PhD students from developing countries to apply to present a poster or an oral presentation at the conference. The result was that those PhD students that were accepted by the conference scientific advisory committee got their travel costs covered including airfare and all accommodations.

For the young researchers working on their doctoral theses, this conference was an opportunity to join the community of researchers from many scientific disciplines. Especially memorable is that they participated in the first-ever international conference on global food security at a time when the discussions centered around the emergence of the post-2015 Sustainable Development Goals.

Towards a long-term Africa-EU partnership to raise sustainable food and nutrition security in Africa

CIRAD, France and the WUR from the University of Wageningen, Netherlands together with 13 other European agricultural research institutions approached the Forum for Agricultural Research in Africa, FARA, an agency of the African Union (AU) with an idea of a cooperative proposal. The aim of which was to engage agricultural institutions in the preparation of a new, strategic, long term and ambitious partnership between Europe and Africa. The focus is on improved food security and livelihood through sustainable intensification of agricultural food systems. There are many European and African institutions that have been conducting joint research activities over the decades yet, surprisingly; no coherent approach has been made to identify effective strategies for agricultural producer, farmers and decision makers. After almost two years of development of concepts and methods, on an application was sent to the European Union's Horizon 2020. The result of this process is an active consortium that is dedicated to the development of sustainable intensification of agriculture was formed between European and African institutions. In November 2014, the application was granted; the EU will fund this large-scale scientific collaboration for a period of two year (2015-2017) with a Coodination Support Action (CSA). This enables the consortium to further develop a future scientific program and a formal structure that will implement the ideas mentioned above. If the group is successful in establishing this structure and finding co-financing after these two years, then an application to a so-called 'Article 185 programme' will be sent to the European Union. This potentially gives the consortium the possibility to develop in a longer-term perspective for the period 2017-2027.

The application title: Towards a long-term Africa-EU partnership to raise sustainable food and nutrition security in Africa. Applicants: Wageningen International (WUR) Netherlands, Forum for Agricultural Research in Africa (FARA) Ghana, Centre de Cooperation International en Recherche Agronomique pour le Development (CIRAD) France, West and central African Council for Agricultural Research and Development (CORAF/WECARD), Senegal, Université Catholique de Louvain (UCL) Belgium, Center for the Coordination of Agricultural Research and Development in Southern Africa (CCARDESA) Botswana, Swedish University of Agricultural Sciences (SLU) Sweden, Crops Research Institute, (CSIR) Kumasi Ghana, Agricultural Rsearch Council (ARC) South Africa, Instituto de Investigacao Cientifica Tropical (IICT), Portugal, Agricultural Research Finland (MTT), African Forum for Agricultural Advisory Services (AFAAS) Uganda, University of Copenhagen (UCPH) Denmark, Association for strengthening Agricultural Research in Eastern and Central Africa (ASARECA) Uganda, Rheinishce Friedrich- Wilhelms Universitat Bonn (ZEF) Germany, University of Greenwich (NRI) England, Ceska Zemelska Univerzita V Praze (CULS), Czech Republic, Instituto Nacional de Investigación y Tecnologia Agraria y Alimentaria (INIA) Spain, Agricultural and Food Development Authority (TEAGASC) Ireland, Universitaet Fuer Bondenkultur Wien (BOKU) Austria, Szent Istvan University (SZIU) Hungary, Norwegian Institute for Agriculutral and Environmental Research (BIOFORSK) Norway, Institut de l'Environnement et de Recherches Agricoles INERA, Burkina Faso. Horizon 2020 Call: H2020-SFS-2014-1 Topic: SFS-06-2014, Type of action CSA Proposal number SEP-210139393 Acronym PROIntensAfrica, Granted 2015-2017.

A summary of the statistics for this project on p. 189

Appendices

Herding of cattle in Uganda.
Photo: Christina Lunner Kolstrup

Program summary statistics

Number of projects 28

Budget 15 000 000 SEK

Collaborations

Number of countries 77

Number of academic institutions 75

Number of organisations 65

Publications

Published in peer-reviewed scientific journals 12

Manuscripts for peer-reviewed scientific journals 43

Scientific reports/conference proceedings/popular science publications 20

Capacity-building activities

Support to BSc, MSc, PhD, Post-doc and visiting researchers 31

Courses, workshops and seminars 55

Applications for future funding

Number of applications written 38

Countries

Country	No. of projects
Angola	1
Australia	1
Austria	3
Belgium	2
Benin	2
Botswana	2
Brazil	1
Burkina Faso	6
Burundi	2
Cameroon	2
Canada	1
Chad	1
China	1
Cote d'Ivoire	1
Czech Republic	1
Denmark	3
Djbouti	1
Democratic Republic of Congo	3
Equitorial Guinee	1
Eritrea	1
Ethiopia	5
Finland	1
France	3
Gambia	2
Germany	1
Ghana	6
Guinea	1
Guinea Bissau	1
Hungary	1
Indonesia	1
Ireland	1
Italy	2
Japan	1
Kenya	11
Lesotho	1
Liberia	1
Madagascar	1
Malawi	3
Malaysia	2
Mali	1
Mauritius	1
Mozambique	2

Academic institutions

Academic institution	No. of projects
Aarhus University, Denmark	1
Addis Ababa University, Ethiopia	4
Agricultural Research Finland (MTT), Finland	1
Bamenda University, Cameroon	1
Bogor Agricultural University, Indonesia	1
Bunda University, Malawi	1
Centre de Cooperation International en Recherche Agronomique pour le Development (CIRAD) , France	2
China Agricultural University, CAU, China	1
Chulalongkorn University, Thailand	1
Cornell University, USA	2
Czech University of Life Sciences (CULS), Czech Republic	1
Dar es Salaam University, Tanzania	1
Eduardo Mondlane University, Mozambique	1
Embu University College, Kenya	1
Hawassa College of Agriculture, Ethiopia	1
Instituto de Investigacao Cientifica Tropical (IICT), Portugal	1
Instituto Nacional de Investigación y Tecnologia Agraria y Alimentaria (INIA), Spain	1
Jomo Kenyatta University of Agriculture and Technology, Kenya	1
Karolinska Institutet, Sweden	1
Kenyatta University, Kenya	1
Legon University, Ghana	1
Liège University, France	1
Lilongwe University of Agricultural and Natural Resources, Malawi	2
Lincoln University, New Zealand	1
Lund University, Sweden	4
Makerere University, Uganda	7
Mekelle University, Ethiopia	1

Academic institutions, *continued*

Academic institution	No. of projects
Michigan State University, USA	1
National University of Rwanda, Rwanda	2
Nicaragua Agriculture University, Nicaragua	1
Norwegian Institute for Agriculutral and Environmental Research (BIOFORSK), Norway	1
Norwegian University of Life Sciences, Norway	1
Ouagadougou University, Burkina Faso	1
Oxford University, UK	1
Roskilde University, Danmark	1
Scotlands Rural College, UK	1
Sokoine University of Agriculture, Tanzania	2
St. Petersburg State Forest Technical University, Russia	1
Szent István University (SZIU), Hungary	1
Technical University of Kenya, Kenya	1
Uganda Martyrs University, Uganda	2
Univeristy of Sokoine, Tanzania	1
Universidad nacional Argraria Peru, Peru	1
Universidade Nova de Lisboa, Portugal	1
Université Catholique de Louvain (UCL), Belgium	1
University of Bonn (ZEF), Germany	1
University of British Columbia, Canada	1
University of California Davis, USA	1
University of Copenhagen (UCPH), Denmark	2
University of Dar es Salaam, Tanzania	1
University of Dschang, Cameroon	1
University of Gastronomic Sciences, Italy	1
University of Ghana, Ghana	1
University of Gothenburg, Sweden	2
University of Greenwich (NRI), UK	1
University of Helsinki, Finland	1
University of Linköping, Sweden	1
University of Lisbon, Portugal	1

Academic institutions, *continued*

Academic institution	No. of projects
University of Minnesota, USA	1
University of Nairobi, Kenya	4
University of Natural Resources and Life Sciences, Vienna (BOKU), Austria	3
University of Nebraska, USA	1
University of Ouagadougou, Burkina Faso	1
University of Pretoria, South Africa	1
University of Putra, Malaysia	1
University of Queensland, Australia	1
University of Ruhuna, Sri Lanka	1
University of Sao Paulo, Brazil	1
University of Stellenbosch, South Africa	1
University of Tokyo, Japan	1
University of Wisconsin-Madison, USA	1
University of Zambia, Zambia	1
Uppsala University, Sweden	2
Wageningen University, The Netherlands	4
Wondo Genet College of Forestry and Natural Resources, Ethiopia	1
Total projects	104

Other collaborating institutions

Organisation	No. of projects
2iE International Institute for Water and Environmental Engineering, Burkina Faso	1
AFAAS African Forum for Agricultural Advisory Services, Uganda	1
ANAFE The African Network for Agriculture, Agroforestry and Natural Resources Education, Kenya	1
Aqua-cultural Research and Development Center in Kajjansi, Uganda	1
ARC Agricultural Research Council, South Africa	1
ASARECA Association for strengthening Agricultural Research in Eastern and Central Africa, Uganda	2
AU-IBAR African Union- African Bureau for Animal Resources, Kenya	1
Bahir Dar Soil Testing and Fertility Improvement Center, Ethiopia	1
BecA-ILRI Hub Biosciences eastern and central Africa - International Livestock Research Institute; Kenya	1
Bioversity International, Italy	1
CCARDESA Center for the Coordination of Agricultural Research and Development in Southern Africa	1
Centre for Social Research, Malawi	1
CGIAR Research Program Livestock and Fish, multinational	1
CIAT International Center for Tropical Agriculture, Columbia	1
CIFOR Center for International Forestry Research, Indonesia	1
CIRAD Centre de Cooperation International en Recherche Agronomique pour le Développement, France	1
CIRDES Centre Internatinal de Recherche-Developpement sur L'evevage en Zone Subhumide, France	1
COMESA Comman Market for Eastern and Southern Africa, Zambia	1
CORAF/WECARD West and central African Council for Agricultural Research and Development, Senegal	2
CSIR Crops Research Institute, Ghana	1

Other collaborating institutions, *continued*

Organisation	No. of projects
CSIR-FRI Council of Scientific and Industrial Research - Food Research Institute, Ghana	1
Danish Institute for International Studies, Denmark	1
Department of Aquatic Sciences and Assessment Future Farming Systems Group, SRUC, UK	1
Ethiopian Institute of Agricultural Research, Addis Ababa, Ethiopia	1
EU European Union	1
European Bioinformatics Institute a part of the European Molecular Biology Laboratory (EMBL), Germany	1
FAO United Nations Food and Agriculuture Organization, Italy	1
FARA Forum for Agricultural Research in Africa, Ghana	1
Foundation Agriterra, the Netherlands	1
Hawassa Soil Testing Laboratory, Ethiopia	1
Icipe International Centre of Insect Physiology and Ecology, Kenya	3
ICRAF World Agroforestry Institute, Kenya	5
ICRISAT The International Crops Research Institute for the Semi-Arid-Tropics, Mali	1
IFAJ International Federation of Agricultural Journalists, The Netherlands	1
IFPRI International Food Policy Research Institute, USA	2
IGAD Intergovernmental Authority on Development, Djibouti	1
IIED International Institute for Environment and Development, UK	1
IITA International Institute of Tropical Agriculture, Nigeria	3
ILRI International Livestock Research Institute, Kenya	5
INERA Research Institute for Agriculture and Environment, Burkina Faso	2
INRA French National Institute for Agricultural Research, France	1

Other collaborating institutions, *continued*

Organisation	No. of projects
International Centre for Research on Organic Food Systems, Denmark	1
Jimma Agricultural Research Center, Ethiopia	1
JTI Swedish Institute of Agricultural and Environmental Engineering, Sweden	1
Lunyangwa Agricultural Research Station, Malawi	1
Mekele Soil Research Center, Ethiopia	1
NaFIRRI National Fisheries Resources Research Institute, Uganda	1
National Soil Testing Centre Addis Ababa, Ethiopia	2
National Statistical Office, Malawi	1
Natural Resources Institute University of Greenwich, UK	1
Nekemt Soil Research Center, Ethiopia	1
NEPAD New Partnership for Agricultural Development in Africa, South Africa	2
Peepoople organization, Kenya	1
RUFORUM The Regional Universities Forum for Capacity Building in Agriculture, Uganda	3
SADC Southern African Development Council, Botswana	1
SAqSSA Sustainable Aquaculture in Sub Saharan Africa, mulitnational	1
SIANI Swedish International Agricultural Network Initiative, Sweden	1
SWEACC Swedish East African Chamber of Commerce in Uganda	1
TEAGASC Agricultural and Food Development Authority, Ireland	1
TEAM-Africa Tertiary Education in Agricultural Mechanism in Africa, South Africa	2
Uganda Catholic Management and Training, Kampala, Uganda	1
UNESCO United Nations Educational, Scientific and Cultural Organization, France	1

Other collaborating institutions, *continued*

Organisation	No. of projects
WALIC West African Livestock Innovation Centre, The Gambia	1
World Bank, USA	1
World Fish, Malaysia	1
Total projects	86

Published in peer reviewed scientific journals

Published in peer reviewed scientific journals, *continued*

Publication	Page
11. Mellander P-E., Gebrehiwot S.G., Gärdenäs A.I., Bewket W. and Bishop K. 2013. Summer rains and dry seasons in the Upper Blue Nile Basin: the predictability of half a century of past and future spatiotemporal patterns. PLoS ONE 8(7): e68461. doi:10.1371/journal.pone.0068461.	24
12. Öborn, I., Kuyah, S., Jonsson, M., Dahlin, A.S., Hosea, M. and DeLeeuw, J. 2014. Landscape-level constraints and opportunities for sustainable intensification in smallholder systems in the tropics. In: Peter A Minang, Meine Van Noordwijk, Jan de Leeuw, Cheikh Mbow (eds.), Climate-smart landscapes: multi-functionality in practice. Published by Partnership for Tropical Forest Margins. http://www.asb.cgiar.org	14

Manuscripts prepared for peer-reviewed scientific journals

Manuscripts prepared for peer-reviewed scientific journals, *continued*

Manuscripts prepared for peer-reviewed scientific journals, *continued*

Manuscript	Page
28. Muchane, M.N., Weldesemayat, S.G., Jonsson, M., Pumariño, L., Gripenberg, S., Kaartinen, R., Midega, C. and Barrios, E. Effects of agroforestry on soil health: a meta-analysis.	14
29. Nyberg, G., de Leeuw, J., Mwangi, P., Said, M., Kifugo, S., Mureithi, S. and Wredle, E. Enclosures - a productive, carbon sequestering and sustainable alternative to pastoralism?	38
30. Ofori, D.A., Yeboah, E., Peprah, T. , Tsobeng, A., Dahlin A.S. and Jamnadass, R. The effect of indigenous and foreign growth media on Allanblackia parviflora A. Chev in Ghana.	38
31. Pain, A. and Christoplos, I. Scales, risks and food security outcomes in agrarian transitions: comparative evidence from Nepal and Vietnam.	48
32. Pumariño, L., Weldesemayat, S.G., Gripenberg, S., Kaartinen, R., Barrios, E., Muchane, M.N., Midega, C. and Jonsson, M. Effects of agroforestry on pest, disease and weed regulation: a meta-analysis.	14
33. Rusinamhodzi L., Dahlin A.S., and Corbeels M. Living within their means: reallocation of farm resources can help smallholder farmers improve yields and soil fertility.	14
34. Salomonsson, L., Francis, C., Sustaining food production and ecosystems integrity.	48
35. Salomonsson, L., Francis, C., and Rydberg, T. Scale issues and food-security: making 'hidden' values visible with application of interdisciplinary theory.	48
36. Sanou L., Savadogo P., Dayamba S., Malmer A. and Thiombiano A. Variation among provenances morphometric traits of seed germination and seedling growth of species identified candidates for restoration and domestication.	32
37. Savadogo P., Alcho S. H., Dayamba S. D. and Malmer A. Perceiving land-degrading activities and post mining mine sites rehabilitation from the lay perspective in Burkina Faso: realities, challenges and suggested solutions.	32
38. Savadogo P., Diawara S., Malmer A. and Dayamba S. D. Effect of planting time on establishment success and growth of four woody species used for the restoration of abandoned fallows in Burkina Faso.	32
39. Wekesa, V., Philipsson, J., Zonaband, E., Ortiz, R., and Hopkins, R. Genetic Resources for drought tolerance in crops and livestock in East Africa.	28
40. Widengård, M. Rethinking scale as politics of land grabbing governance.	48
41. Wondwosen B., Hill S.R., Tekie H., Torto B., Birgersson G., and Ignell R. Low input odour-based gravid trap for malaria mosquitoes, Anopheles arabiensis.	86

Manuscripts prepared for peer-reviewed scientific journals, *continued*

Scientific reports, conference proceedings, popular-science publications, *continued*

Scientific reports	Page
1. Aspengren, P. and Pettersson, R. 2013. SLU mission report – pedagogic workshop Teaching for sustainable education in higher education for ANAFE/SASACID. 13-17 May 2013, Nairobi, Kenya.	76
2. Dahlin, A.S., Hall, O., Marstorp, H., Adolfsson, N, and Jirström, M. 2014. Variations in productivity - causes and effects on food security and on sustainability of cropping systems. Workshop report, SIANI.	14
3. Dahlin, A.S., and Rusinamhodzi, L. Review of interventions and technologies for sustainable intensification of smallholder crop production in sub-humid sub-Saharan Africa – with an assessment of effectiveness of selected options on differently endowed case study farms. A working paper. SLU-Global Report 2014:5.	14
4. Magnusson U. And Follis-Bergman K., (editors), 2014. Urban and peri-urban agriculture for food security in low-income countries - challenges and knowledge gaps (SLU-Global Report 2014:4) 68 p. ISBN: 978-91-576-9229-0	54
5. Magnusson, U., Karltun, E., Lagerkvist, C.J., Malmer, A., Marstorp H., and Sundström, J. 2012. Risks for African agriculture – a review for identifying research areas.	14
6. Jellinek, N. 2013. Report. Seminar on teaching and learning. SASACID seminar, 1-6 July 2013, Abidjan, Ivory Coast.	76
7. Kuyah, S. 2014. Synergies and trade-offs amongst ecosystem services provided by trees in agricultural landscapes of Sub-Saharan Africa. Seminar given at the World Agroforestry Centre, Nairobi, Aug. 19, 2014.	32
8. Kuyah S., Öborn I., Malmer A., Barrios E., Dahlin A.S., Jonsson M., Muthuri C., Namirembe S., Nyaga J., Nyberg Y., and Sinclair F.L. 2014. Synergies and trade-offs amongst multiple functions of trees in agricultural landscapes. World Congress on Agroforestry, Delhi Feb 10-14, 2014 (oral presentation).	32
9. Macay H. and Öborn I. 2013. Multifunctional landscapes Part 2: Enhancing productivity and restoring ecosystem services. In H Macay & G Nyberg (Eds), Agricultural research towards sustainable development goals, Conference Proceedings 25-26 September 2013. SLU-Global Report 2013:3, 48-49.	32
10. Malmer A., and Öborn, I., 2014. Report on a SLU – ICRAF workshop 11 – 12 November 2013 at ICRAF Campus with a field trip in NW Kenya 13 – 15 November 2013. Unpublished report.	32
11. Öborn I., Musee C., Wachiye E., Nyberg Y. Impact of sustainable agricultural land management practices on smallholder farm productivity and livelihood. 2014**.** World Congress on Agroforestry, Delhi, 10-14 February 2014 (poster presentation).	32
12. Nyberg, G., de Leeuw, J., Mwangi, P., Said, M., Kifugo, S., Mureithi, S. and Wredle, E. Enclosures – a productive, carbon sequestering and sustainable alternative to pastoralism? World Congress of Agroforestry, Delhi, 10-14 February 2014 (poster presentation).	32

Scientific reports, conference proceedings, popular-science publications, *continued*

Scientific reports

Popular-science publications

Support to MSc/PhD/Post-doc/visiting researcher

Support to MSc/PhD/Post-doc, *continued*

MSc/PhD/Post-doc/visiting researcher	Page
13. Koala, Jonas. Carbon dynamics in parkland agroforestry. PhD student at the University of Bobo Dioulasso in Burkina Faso. At SLU November and December 2012 and June and July 2013.	32
14. Lassina, Sanou. Effects of seed provenance and charactetistics of micro-habitats on the growth and survival of native species. Laboratoire de Biologie et Ecologie Végétale, Ouagadougou University. PhD student supported for some months during 2014. Restoration of degraded landscapes of rural Burkina Faso.	32
15. Larsson, Lovisa. 2014. Emissions and energy use efficiency of household biochar production during cooking in Kenya ISSN: 1650-8319, TVE 14 018 Examensarbete 15 hp, Uppsala universitet, http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-225772.	120
16. Milkeas, Amisalu. MSc student from Ethiopia. Assessment of reasons for increasing on-farm *Eucalyptus* plantation and related partial nutrient losses in the Arsi Zone, Oromia Region, Ethiopia.	20
17. Morke, Nebi. PhD student from Ethiopia. Woody plant diversity and carbon stocks in Bale Mountains.	20
18. Muda, Fikru. MSc student from Ethiopia. Farmers' perception on composting and their application as a soil fertility improvement practice: the case of Arsi Ngelle District, South Central Ethiopia.	20
19. Nyakoega, Violet. Master student at Department for land resource management & agricultural technology (LARMAT), University of Nairobi is currently performing her master project on Peepoo fertilizer production and crop response.	102
20. Nyawira, Muchane, Mary. ICRAF, Kenya was a postdoctoral researcher, working on soil fertility issues of the review Interventions for sustainable intensification of smallholder crop production in SSA.	14
21. Njenga, Mary. ICRAF Post-doctoral project in bioenergy.	120
22. Pumariño, Lorena. SLU was a postdoctoral researcher, working on pest control issues for the review Interventions for sustainable intensification of smallholder crop production in SSA.	14
23. Rusinamhodz,, Leonardi. from CIAT/INRA, Zimbabwe was a post-doctoral researcher who worked on the review and modelling of Interventions for sustainable intensification of smallholder crop production in SSA on two occasions: 12-18 October and 15-21 December 2013.	14
24. Savadogo, Patrice. Research leader at ICRISATi Niger and ICRAF in Mali. Visiting researcher at SLU in September and October 2012.	32

Support to MSc/PhD/Post-doc, *continued*

MSc/PhD/Post-doc/visiting researcher	Page
25. Seydou Alcho, Hadjara. Rehabilitation of mining sites in Burkina Faso: realities, challenges and suggestions for solutions. MSc student thesis, Ouagadougou University and International Institute for Water and Environmental Engineering.	32
26. Svanlund, S. Carbon sequestration in the pastoral area of Chepareria, western Kenya : a comparison between open-grazing, fenced pastures and maize cultivations. MSc thesis 2014., SLU Department of Forest Ecology and Management. Avaliable at http://stud.epsilon.slu.se/6602/	32
27. Tafesse, Tirkaso. Wondmagegn MSc student Department of Economics, SLU worked on the systematic review of the literature; a prospective study on the future of tertiary agricultural education in Africa. He is now a PhD student at SLU.	80
28. Terefe, Berhanu. PhD student from Ethiopia. Impact of land use change (converting home garden, shifting cultivation and wetland to mono-cropping) on carbon stocks andgreenhouse gas fluxes in Ethiopia.	20
29. Yelfwagash, Asmare. PhD student. How landscape shapes oviposition behaviour in malaria mosquitoes, Anoph*eles arabiensis*. Department of Zoological Sciences, Faculty of Life Science, Addis Ababa University, Ethiopia.	86
30. Zeleke Aklilu, Abenezer. MSc student at the Department of Economics at SLU worked on the systematic review of the literature within the project Prospective study on the future of tertiary agricultural education in Africa. He is now a PhD student.	80
31. Recruiting a MSc student within Food Science to continue the work on the analysis of the fine structure of sweet potato amylopectin. Title: Starch fine structure in twelve different sweet potato samples from Ghana.	88

Courses, workshops and seminars

Courses		Page
1.	Agrigenomics. PhD course 4 HEC, Organism biology research school, SLU 14 Dec. 2012 - 27 Feb. 2013.	68
2.	Clinical training course: Ultrasound in large animal reproduction, under field conditions. March 14 and 18, 2014. Three participants from Uganda. Course organizer, lecturer and clinical supervisor: Renée Båge, SLU.	74
3.	Conservation, development and communication in diverse landscapes: theories and methods. PhD course. Held in Managua, Nicaragua February-March 2013.	42
4.	Epigenetics and reproduction. March 3-7, 2014. 15 participants from Uganda. Course organizers: Göran Andersson, Renée Båge and Bodil Ström-Holst from SLU and Anneli Stavréus-Evers from Uppsala University.	74
5.	Exploring trade-offs around farming livelihoods and the environment - using farming systems modelling was organized in Uppsala, August 2012 (3 ETCS). 18 participants, 12 of whom were from African countries.	10
6.	Field course: Global development, natural resources and livelihoods – SLU course BI1181 (7.5 credits), spring term 2014 in co-operation with Kenyatta University and Embu University College. Preparatory work in Uppsala, Sweden, and in Kenya. Field work in Kenya 31 March – 2 May 2014.	90
7.	Harnessing the application of bioinformatics for agriculture and food security in Africa. This is an ACP EU Co-operation Programme in Science and Technology (S&T II). Partners include the African Network of Scientific and Technological Institutions (ANSTI), SLU and ILRI/BeCa (Kenyan coordinator). December 2013.	68
8.	Laboratory management and chemical analysis of soil and plant samples. A two-week course. One week of the course was held in the Wondo Genet Soil Laboratory, Ethiopia, and the other week at the National Soil Testing Center in Addis Ababa, Ethiopia.	20
9.	Land use, land use change and climate change, PhD course. Held in Sweden in November 2012.	42
10.	Nature-society relationships in transition – action research methodologies to collectively deal with experience and utopia. PhD course held in Portugal in June 2012.	42
11.	Summer school in biofuels and bio-refineries, June 2014, Uppsala. Funds from the Swedish Ministry of Foreign Affairs facilitated participation of PhD students from African universities and contributed to planning time for course organizers.	72
12.	Summer school in future of food – security, safety and quality. September 2014. Funds from the Swedish Ministry of Foreign Affairs facilitated participation of PhD students from African universities and contributed to planning time for course organizers.	72

Courses, workshops and seminars, *continued*

Workshops/Seminars	Page
13. A national workshop on gender and the politics of environment. The planning process for a workshop on 'Scaling-up' – from technical transfer to empowerment.	42
14. A seminar series at SLU on 'scaling-up' – filling the gap between academic knowledge and farming practice: Action research, March 2013; From technical transfer to farmer field schools, May 2013; Appropriate scale – agricultural technology and smallholder farming, June 2013.	42
15. A workshop was held at ICRAF headquarters in Nairobi from 11-12 November 2013 and a field excursion conducted from 13-15 November 2013.	38
16. Advanced bioinformatics workshop on metagenomics and next generation sequencing. 7-18 October 2013, BecA - ILRI hub, Nairobi. Thirty-five students from ten African countries and ten teachers participated.	68
17. An assessment and maintenance consultancy of the soil and plant laboratories of Wondo Genet College of Forestry and Natural Resources (WGCF-NR), part of Hawassa University.	20
18. An international workshop on the topic agriculture for nutrition and health (A4NH) coordinated by IFPRI.	42
19. An international workshop for the area Agriculture for nutrition and health (A4NH) coordinated by IFPRI.	42
20. An international workshop on developing an international network to support PhD-education in agroecology.	42
21. Animal genetic resources in Sub-Saharan Africa East-Africa region: Kigali, Rwanda: 19-22 Nov 2013.	114
22. Animal genetic resources in Sub-Saharan Africa, Southern Africa region: Gaborone, Botswana: 26-28 Nov 2013.	114
23. Animal genetic resources in Sub-Saharan Africa, West & Central Africa region: Ouagadougou, Burkina Faso: 5-8 Nov 2013.	114
24. Biofuels and biorefineries. September 2012, Uppsala. 27 researchers from 7 universities participated. Funds from the Swedish Foreign Ministry facilitated in part the participation of researchers from African universities.	72
25. Capacity building and bioinformatics challenges international workshop at SLU´s campus in Ultuna, Sweden. 12-14 June 2013, Uppsala, Sweden.	68
26. CRP 1.2 Humid tropics inception workshop. SLU and IITA, Ibadan, Nigeria. 19 -21 November 2012.	10

Courses, workshops and seminars, *continued*

Workshops/Seminars	Page
27. Environmental monitoring and detection of invasive species – current challenges. September 2013, Uppsala. 25 researchers from 7 universities participated. Funds from the Swedish Foreign Ministry facilitated in part the participation of researchers from African universities.	72
28. Exploring trade-offs around farming livelihoods and the environment - using farming systems modelling was organized in Uppsala, August 2012 (3 ETCS). 18 participants, 12 of whom were from African countries.	10
29. Future of food – security, safety and quality. May 2013, Uppsala. 42 researchers from 13 universities participated. Funds from the Swedish Foreign Ministry facilitated in part the participation of researchers from African universities.	72
30. Green and sustainable cities, the role of landscape architecture. March 2014, Uppsala. 32 researchers from 11 universities participated. Funds from the Swedish Foreign Ministry facilitated in part the participation of researchers from African universities.	72
31. H3ABioNet introduction to bioinformatics using the eBioKit platform. 29 July to 2 August 2013. International Centre for Insect Physiology and Ecology (*icipe*), Nairobi, Kenya with 25 participants.	68
32. IFAJ global initiative – Agricultural journalists worldwide supporting farmers fighting poverty – Master classes for agricultural journalists from developing countries. Participation by journalists from Africa was made possible through UD funding. 12-15 August 2012.	122
33. International capacity building and research project was supported: Expanding cassava utilisation in South-eastern Africa, which included a planning workshop in at the Lilongwe University for Agriculture and Natural Resources, Malawi.	42
34. International workshop on Sustainable aquaculture in Sub-Saharan Africa in Kampala, Uganda 5-8 February 2013.	104
35. Joint BecA Hub and UNESCO Advanced genomics and bioinformatics: Viral/bacterial metagenomics and next generation sequencing workshop, 13-17 August 2013, ILRI-BecA, Nairobi, with 25 participants.	68
36. Journal club in reproduction: critical evaluation of evaluated scientific papers within the field of reproduction, knowledge of study design and statistical methods and ability to apply this knowledge to the assessment of experimental studies. 13 March 2014. Three participants from Uganda. Organizers and supervisors: Ylva Sjunnesson, Patrice Humblot and Ann-Sofi Bergqvist, SLU.	74
37. Land use, climate change and food security. Capacity building and collaborative research between SLU and Wondo Genet College of Forestry and Natural Resources (WGCF-NR).	20
38. Meta-analysis workshop, Nairobi, Kenya. 4-6 September 2013.	14
39. Plant science, social science and agronomy groups workshop with IITA and SLU, Alnarp, Sweden. 27-28 August 2013.	10

Courses, workshops and seminars, *continued*

Workshops/Seminars	Page
40. Variations in productivity - causes and effects on food security and on sustainability of cropping systems, Kampala/Mbale, 31 January - 6 February 2014.	10
41. Subsistence agriculture, land degradation and water security in Ethiopia – breaking the downward spiral: Water management and food security. Addis Ababa University, Akaki Campus. Five seminars focused on water management and food security in the Ethiopian context.	24
42. The Future of forests, to manage forests for people. June 2014, Uppsala. 25 researchers from nine countries participated. Funds from the Swedish Ministry for Foreign Affairs facilitated in part the participation of researchers from African universities.	72
43. The workshop Strengthening Africa's Strategic Agricultural Capacity for Impact on Development (SASACID); Strengthening agribusiness education and training and managing risks and uncertainty in agriculture. 23-25 April 2012, Kenyatta University, Nairobi, Kenya.	76
44. Three Prospective study project workshops, in Uppsala, Sweden, during February 2013, August 2013, and January 2014.	80
45. Towards an enhanced cooperation between IITA and SLU, workshop I, Alnarp, Sweden. 10-12 April 2013.	10
46. Towards an enhanced cooperation between IITA and SLU, workshop I, Ibadan, Nigeria. 10-12 April 2013.	10
47. Towards an enhanced cooperation between IITA and SLU, workshop II, Alnarp, Sweden. 29-30 August 2013.	10
48. Two eBioKit-based bioinformatics workshops were held in collaboration with H3Abionet1 and BecA-ILRI Hub2, from 10-14 December 2013 in Dar es Salaam, Tanzania.	68
49. Variations in productivity - causes and effects on food security and on sustainability of cropping systems, Kampala/Mbale, Uganda, 31 January - 6 February 2014.	10
50. Workshop on Animal genetic resources in Sub-Saharan Africa, East-Africa region: Kigali, Rwanda: 19-22 November 2013.	114
51. Workshop on Animal genetic resources in Sub-Saharan Africa, Southern Africa region: Gaborone, Botswana: 26-28 November 2013.	114
52. Workshop on Animal genetic resources in Sub-Saharan Africa, West & Central Africa region: Ouagadougou, Burkina Faso: 5-8 Nov 2013.	114
53. Workshop on landscape restoration. Uppsala, Sweden, 31 October - 1 November 2012, with participation of 15 researchers from SLU, CIFOR, ICRAF, Helsinki University, INERA, and SIFI/KSLA.	38
54. Write-shops in Nairobi for a review on enclosures in drylands, 21-23 August 2013 and final write-shop will be held in November 2014.	38
55. Write-shops in Nairobi for planning and structuring of the review work on 19 April 2013 and from 7-8 November 2013 (multipurpose trees).	32

Applications for funding

SLU-Global Thematic Areas

Efficiency in farming systems

1. Building research and training capacities to develop innovations in sustainable intensification of maize–based cropping systems for improving productivity, food security and resilience to climate change in Uganda, submitted to Sida, August 2014. Applicants Herbert Talwana (Makerere University (MAK), Uganda), Sigrun Dahlin (SLU), Moses M. Tenywa (MAK), Johnny Mugisha (MAK), Paul Kibwika (MAK), Jeninah Karungi – Tumutegyereize (MAK), John Baptist Tumuhairwe (MAK), Mattias Jonsson (SLU), Konstantinos Karantininis (SLU). *Decision pending.*

2. Combining geospatial and survey data in assessing the prospects of smallholder agricultural development in sub-Saharan Africa, submitted to The Swedish Research Council. Applicants: Göran Djurfeldt (Lund University), Ola Hall (Lund University), Sigrun Dahlin (SLU), Magnus Jirström (Lund University), Håkan Marstorp (SLU), Steven Wambugu (Kenyatta University, Kenya), Fred Dzanku (Ghana University, Ghana). *Granted by Swedish Research Council VR 2015-2017.*

3. Demystifying legumes: unravelling the interplay between niches, soil fertility, and legume attributes within smallholder farming systems of Sub-Saharan Africa. A research programme was outlined where past successes and failures of legume intensification will be analysed and demand-driven approaches used so that niches for multi-purpose legumes can be identified that fit the heterogeneity in farming systems and farmer objectives and address soil constraints within such niches. The overall benefits and trade-offs of legumes to farmers' livelihoods and the natural resource base will be evaluated. *Awaiting suitable call*.

4. Developing contestable markets for innovation and viable value chains in Africa, Submitted to DfID-ESRC (Department for International Development, UK; Economic and Social Research Council) Growth Research Programme Call 2. Applicants: William Bowser (IITA, Nigeria), Konstantinos Karantininis (SLU), Johanna Bergman Lodin (LU), Holger Kirscht (IITA, Nigeria), Bridget Okumu (International Fertilizer Development Center, Kenya), Scott Wallace (International Fertilizer Development Center, Nigeria), Evelyne Lazaro (Sokoine University of Agriculture, Tanzania). *Not granted but reached the second evaluation step.*

5. Evolving gender relations in transforming cassava value chains and implications for intra-household nutrition and health. The case of Tanzania. Johanna Bergman Lodin (SLU) and Holger Kirscht (IITA, Nigeria). A joint HumidTropics-A4NH-SLU Project. *Granted.*

6. Evolving gender relations in transforming cassava value chains and implications for intra-household nutrition and health. The case of Tanzania. Submitted to Formas by Johanna Bergman Lodin for the project that will be carried out in collaboration with IITA and IFPRI through the CGIAR Research Program 4: Agriculture for Nutrition and Health (A4NH). *Granted.*

7. Harnessing soil bacteria to replace chemical nitrogen fertilizer and improve nutritional quality of foods. Applicants: JG Davis (Colorado State University, USA), S Dahlin (SLU), JB Tumuhairwe (Makerere University, Uganda), TE Wolde-Meskel (Hawassa University, Ethiopia). Submitted to Ekhagastiftelsen. *Decision pending.*

8. Improved African livelihood s through adoption of improved cassava and yam systems. Roots and tuber cropping systems with cassava and yam will be analysed using an interdisciplinary approach including aspects of market drivers, adoption, properties of the planting material, breeding methodology, food safety, and natural resource management. *Awaiting suitable call.*

Applications for funding, *continued*

9. Integrated weed management in cassava based systems in Sub-Saharan Africa: case of Speargrass (Imperata cylindrica), submitted to Formas/Sida. Applicants: Libère Nkurunziza, Lars Andersson, Göran Bergkvist, David Chikoye, Peter Kulakow, Ekeleme Friday. *Not granted.*

10. MFS visit to IITA in Burundi and Tanzania, submitted to Universitets- och högskolerådet. Libere Nkurunziza travel grant to meet Mateete Bekunda (IITA, Tanzania) and Emmanuel Njukwe (IITA, Cameroon) involved in the WP 5 for planning MSc/MFS collaboration and discussing joint project proposals. *Granted.*

11. The effects of agroforestry on crop pests and yield at smallholder farms in Kenya. Submitted to the VR call for Development research, April 2014: Applicants: Mattias Jonsson (SLU), Lorena Pumariño (SLU), Sileshi Weldesemayat, Ingrid Öborn (ICRAF, Kenya), Tim Pagella (Bangor University, UK). *Decision pending.*

12. Unravelling the causes and implications of crop productivity gaps in underperforming regions through integration of geospatial, biophysical and socio-economic factors, submitted to Formas. Applicants: Ingrid Öborn (ICRAF), Håkan Marstorp (SLU), Sigrun Dahlin (SLU), Fred Dzanku (University of Ghana, Ghana), Ola Hall (Lund University), Per Hillbur (Malmö University); Magnus Jirström (Lund University). *Granted by Swedish Research Council Formas 2015-2017.*

13. Using Next generation sequencing to search for virus resistance genes in cassava for enhanced breeding, submitted to The Swedish Research Council, Swedish Research Links programme. Applicants: Erik Bongcam-Rudloff (SLU), Andreas Gisel (IITA, Nigeria), Anders Carlsson (SLU), Livia Stavolone (IITA, Nigeria), Melaku Gedil (IITA, Nigeria), Lava Kumar (IITA, Nigeria), Ismail Rabbi (IITA, Nigeria). *Not granted.*

Land use and climate change

14. Deforestation, water and coffee production in the headwaters of Wabe-Shebele Basin, Ethiopia. Kevin Bishop. *Decision pending.*

15. Linking biodiversity, productivity and climate change adaptation & mitigation. SSEESS Research Links 2014. Erik Karltun. *Granted.*

16. The impact of the Koga irrigation project on livelihood and adaptation to climate changes. Kevin Bishop and Soloman Gebrehiwot submitted to SIANI . *Not granted.*

17. Water balance under different forests as climate changes in the south-western highlands of Ethiopia. Soloman Gebrehiwot and Kevin Bishop Application to the Swedish Institute. *Granted.*

Restoration of degraded rural landscapes

18. Co-investment in tree based agriculture to build resilience and buffers against climate variability and risks. Main applicant Ingrid Oborn SLU/ICRAF, co-applicants from ICRAF-Tanzania, ICRAF-Uganda and ICRAF HQ Nairobi. *Not granted*.

19. European long term social-ecological-economic research initiative for biodiversity and ecosystem services in the tropics. (ERU-BIOTROPES), under the call TOPIC SC 5-06-2014: Biodiversity and ecosystem services: drivers of change and causalities. Partners in addition to Ulrik Ilstedt and other SLU researchers were ICRAF, CIFOR (CRP 6), CIRAD and a number of European universities. *Not granted.*

20. Improving livelihoods of the rural poor through *Allanblackia* cultivation - need for knowledge on soil requirements and dependence on symbionts" Application to the Swedish Research Council (VR). Main applicant is Sigrun Dahlin at SLU and co-applicants are from ICRAF and Kenya National Herbarium. *Not granted.*

Applications for funding, *continued*

21. Land, livestock and livelihood dynamics: uncovering the transition towards sedentary livestock based agro-pastoralism in semi-arid east Africa. Application to The Swedish Research Council Formas . Anders Malmer at SLU is the main applicant and co-applicants are from ICRAF and the universities in Lund and Gothenburg in Sweden as well as from Chalmers University of Technology. *Not granted.*

22. Sustainable biomass use for briquetting in JoJi Agroforestry, Ethiopia. Main applicant Ioannis Dimitriou SLU, co-applicants from JoJi Agroforestry Plc, ICRAF-Ethiopia and ICRAF HQ Nairobi. *Not granted.*

23. Synergies between energy access and food security. Main applicant Ioannis Dimitriou SLU, co-applicants from Swedish and international limited companies, NGOs, African universities, ICRAF and others. Submitted to Swedish International Agricultural Network Initiative (SIANI). *Granted 2014 and 2015.*

24. The role of forests and trees in restoration of rural landscapes for food security. Main applicant Gert Nyberg SLU, co-applicants from other Swedish universities, African universities, NGOs, development support practitioners and others. Submitted to Swedish International Agricultural Network Initiative (SIANI). *Granted 2014 and 2015.*

25. Trees, cows, carbon and water: Is degradation reversible in the dry tropics? Application to the Swedish Research Council (VR). Main applicant is Anders Malmer SLU with co-applicants at ICRAF, Jomo Kenyatta University of Agriculture and Technology and SLU. *Not granted.*

Projects with research, educator and staff exchange and capacity development

26. B3 Africa: Bridging Biobanking and Biomedical Research across Europe and Africa. Collaboration between South Africa, Kenya, Uganda, Nigeria, France and Sweden. SLU coordinator. Horizon 2020 Call: H2020-INFRASUPP-2014-2. *Decision pending.*

27. Biochar as soil amendment or fuel? From rural to urban applications. Main applicant Cecilia Sundberg. Submitted to VR Swedish Research Links. *Not granted*

28. Empowering African universities to meet the new challenges of recent advances in the biotechnology era: a test case project. Kenya – Sweden collaboration, SLU coordinator. Submitted to the Swedish Research Council, Swedish Research Links 2014. *Not granted.*

29. Enhanced and sustainable small-scale aquaculture for increased food production in Uganda. Submitted to VR U-forsk 2014. Applicants: Researchers from SLU and Makerere University. *Not granted.*

30. Establishment and application of next generation sequencing approaches to assess the effects of anthropogenic activities on east African and Mauritian coral reefs and genetic diversity of key species management. Marine Science for Management (MASMA) programme: Partners include SLU, ICRISAT, Pwani University, Kilifi, Kenya. The proposal was submitted to BioInnovate: "Finger millet genome sequencing consortium" and coordinated by Santie deVilliers and ICRISAT. *Decision pending.*

31. Harnessing the application of bioinformatics for agriculture and food security in Africa. This is an ACP EU Co-operation Programme in Science and Technology (S&T II). Partners include the African Network of Scientific and Technological Institutions (ANSTI), SLU and ILRI/BeCa (Kenya coordinator). *Decision pending.*

32. Identifying the molecular optimum of starch for the development of sustainable materials based on renewable sources. A collaboration on starch-rich roots and tubers from Ghana. The application was submitted to the Swedish Research Council in 2014. *Not granted*.

Applications for funding, *continued*

33. Improving tertiary agricultural education leadership in Africa - a training tool for African academic leaders to bring relevant issues into their programs. Sebastian Hess and Assem Abu Habab (SLU), Hamidou Boly (TEAM-Africa), Luis Mira da Silva (University of Lisbon, Portugal). Application to Innovative doctoral training programme funded by the Swedish Foreign Ministry. *Granted for 2013-2014*.

34. Linnaeus-Palme application for student and teacher exchange between SLU and Embu University College, Kenya. The course will be a multi-disciplinary field course at the Master of Science level and will include social-economical, ecological and environmental science aspects of natural resource management. Main applicant Jan Lagerlöf. *To be submitted in November 2014*.

35. Small-scale and sustainable aquaculture to secure future food production in Uganda. Applicants: Researchers from SLU and Makerere University. Submitted to the Swedish Research Council, U-forsk 2014. *Not granted*.

36. Sustainable small-scale aquaculture to secure future food production in Uganda. Applicants: Researchers from SLU and Makerere University. Submitted to Sida, U-forsk 2013. *Not granted*.

37. Towards a long-term Africa-EU partnership to raise sustainable food and nutrition security in Africa. Applicants: Wageningen International (WUR) Netherlands, Forum for Agricultural Research in Africa (FARA) Ghana, Centre de Cooperation International en Recherche Agronomique pour le Développement (CIRAD) France, West and Central African Council for Agricultural Research and Development (CORAF/WECARD), Senegal, Université catholique de Louvain (UCL) Belgium, Center for the Coordination of Agricultural Research and Development in Southern Africa (CCARDESA) Botswana, Swedish University of Agricultural Sciences (SLU) Sweden, Crops Research Institute, (CSIR) Kumasi Ghana, Agricultural Research Council (ARC) South Africa, Instituto de Investigacao Cientifica Tropical (IICT), Portugal, Agricultural Research Finland (MTT), African Forum for Agricultural Advisory Services (AFAAS) Uganda, University of Copenhagen (UCPH) Denmark, Association for strengthening Agricultural Research in Eastern and Central Africa (ASARECA) Uganda, Rheinishce Friedrich- Wilhelms Universitat Bonn (ZEF) Germany, University of Greenwich (NRI) England, Ceska Zemelska Univerzita V Praze (CULS), Czech Republic, Instituto Nacional de Investigación y Tecnologia Agraria y Alimentaria (INIA) Spain, Agricultural and Food Development Authority (TEAGASC) Ireland, Universität für Bodenkultur Wien (BOKU) Austria, Szent Istvan University (SZIU) Hungary, Norwegian Institute for Agricultural and Environmental Research (BIOFORSK) Norway, Institut de l'Environnement et de Recherches Agricoles INERA, Burkina Faso. Horizon 2020 Call: H2020-SFS-2014-1 Topic: SFS-06-2014, Type of action CSA Proposal number SEP-210139393 Acronym PROIntensAfrica. *Granted 2015-2017*

38. Transcriptional profiling of host responses in pigs resistant or susceptible to African swine fever virus (ASFV) - a novel strategy to elucidate key components in a protective immune response to the virus which can lead to vaccine candidates: ANIHWA: ASF GLEAN FOR VACCINE. Partners include ILRI, SLU and the Swedish Veterinary Medicine Agency (SVA). (Erik Bongcam-Rudloff, SLU Coordinator). *Decision pending.*

Efficiency in farming systems

Project leader: Sigrun Dahlin/Håkan Marstorp | Budget: 1 200 000 SEK

Collaborations

Countries:
- Columbia
- France
- Ghana
- Kenya
- Uganda
- Nigeria
- Netherlands
- Sweden
- USA

Academic institutions:
- Legon University, Ghana
- Wageningen University, The Netherlands

Other organisations:
- IITA International Institute of Tropical Agriculture, Nigeria
- IFPRI International Food Policy Research Institute, Washington DC, USA
- ICRAF World Agroforestry Institute, Kenya
- Icipe International Centre of Insect
- Physiology and Ecology, Kenya
- CIRAD Centre de Cooperation International en Recherche Agronomique pour le Développment, France
- CIAT International Center for Tropical Agriculture, Columbia
- JTI Swedish Institute of Agricultural and Environmental Engineering, Sweden

Publications

Published in peer reviewed scientific journals 1

Dzanku F, Jirström M, and Marstorp H. Yield-gap based poverty gaps in rural Sub-Saharan Africa. In press World Development.

Manuscripts for peer reviewed scientific journals 1

Hall, O., Marstorp, H., Dahlin, S. and Jirström M. A new approach to analyse variation in productivity in small-scale farming systems.

Book chapters/conference proceedings/reports/popular science publications 5

Dahlin AS, Hall O, Marstorp H, Adolfsson N, Jirström M. 2014. Variations in productivity - causes and effects on food security and on sustainability of cropping systems. Workshop report, SIANI

SLU and IITA explore areas of collaboration: article on the first workshop in IITA Bulletin, 2167, in April 2013 www.iita.org/c/document_library/get_file?p_l_id=45268&folderId=2491628&name=DLFE-5899.pdf

Enhanced cooperation between SLU and IITA - first workshop: news note on SLU Global web www.slu.se/en/international/slu-global/scientific-themes/efficiency-in-farming-systems/activities-efficiency-in-farming-systems/enhanced-cooperation-between-iita-and-slu/

Enhanced cooperation between SLU and IITA – follow up workshop: news note on SLU Global web www.slu.se/en/international/slu-global/scientific-themes/efficiency-in-farming-systems/activities-efficiency-in-farming-systems/enhanced-cooperation-between-iita-and-slu-/

Workshop in Uganda Highlights the Impact of Variations in Productivity on Food Security: SIANI reported the pilot study in their newsletter 19 March 2014 /www.siani.se/sv/node/12055#.U-NF2U2KAdU

Efficiency in farming systems, *continued.*

Support given to Master/Bachelor/PhD/ Post-doc/visiting researcher 1

Fred Dzanku from Legon University, Ghana, was visiting scientist for six months at SLU. Yield Gap Based Poverty Gaps in Rural Sub-Saharan Africa. March-August, 2013.

Activities organised

Scientific conferences/workshops 5

CRP 1.2 Humidtropics Inception Workshop. SLU and IITA, Ibadan, Nigeria. 19 -21 November 2012.

Towards an enhanced cooperation between IITA and SLU, workshop I, Ibadan, Nigeria. 10-12 April 2013.

Plant science, social science and agronomy groups workshop with IITA and SLU, Ultuna, Sweden. 27-28 August 2013.

Towards an enhanced cooperation between IITA and SLU, workshop II, Alnarp, Sweden 29-20 August 2013.

Variations in productivity - causes and effects on food security and on sustainability of cropping systems, Kampala/Mbale, Uganda 31 January - 6 February 2014.

Courses/training activities 1

Exploring tradeoffs around farming livelihoods and the environment - using farming systems modelling was organized in Uppsala, August, 2012 (3 ETCS). 18 participants, 12 of whom were from African countries.

Applications for funding 13

The effects of agroforestry on crop pests and yield at small-holder farms in Kenya. Submitted to the VR call for Development research, April 2014: Applicants: Mattias Jonsson (SLU), Lorena Pumariño (SLU), Sileshi Weldesemayat, Ingrid Öborn (ICRAF, Kenya), Tim Pagella (Bangor University, UK). *Not granted.*

Building Research and Training capacities to develop innovations in sustainable intensification of maize–based cropping systems for improving productivity, food security and resilience to climate change in Uganda, submitted to Sida, August 2014. Applicants Herbert Talwana (Makerere University (MAK), Uganda), Sigrun Dahlin (SLU), Moses M. Tenywa (MAK), Johnny Mugisha (MAK), Paul Kibwika (MAK), Jeninah Karungi – Tumutegyereize (MAK), John Baptist Tumuhairwe (MAK), Mattias Jonsson (SLU), Konstantinos Karantininis (SLU). *Decision pending.*

Evolving gender relations in transforming cassava value chains and implications for intrahousehold nutrition and health. The case of Tanzania. Johanna Bergman Lodin (SLU) and Holger Kirscht (IITA, Nigeria). A joint HumidTropics-A4NH-SLU Project. *Granted*.

Evolving gender relations in transforming cassava value chains and implications for intra-household nutrition and health. The case of Tanzania. Submitted to Formas by Johanna Bergman Lodin for the project that will be carried out in collaboration with IITA and IFPRI through the CGIAR Research Program 4: Agriculture for Nutrition and Health (A4NH). *Granted.*

Efficiency in farming systems, *continued.*

MFS-Kontakresa till IITA I Burundi och Tanzania, submitted to Universitets- och högskolerådet. Libere Nkurunziza travel grant to meet Mateete Bekunda (IITA, Tanzania) and Emmanuel Njukwe (IITA, Cameroon) involved in the WP 5 for planning MSc/MFS collaboration and discussing joint project proposals. *Granted.*

Developing Contestable Markets for Innovation and Viable Value Chains in Africa, Submitted to DfID-ESRC (Department for International Development, UK; Economic and Social Research Council) Growth Research Programme Call 2. Applicants: William Bowser (IITA, Nigeria), Konstantinos Karantininis (SLU), Johanna Bergman Lodin (LU), Holger Kirscht (IITA, Nigeria), Bridget Okumu (International Fertilizer Development Center, Kenya), Scott Wallace (International Fertilizer Development Center, Nigeria), Evelyne Lazaro (Sokoine University of Agriculture, Tanzania). *Not granted but reached the second evaluation step.*

Integrated weed management in cassava based systems in Sub-Saharan Africa: case of speargrass *Imperata cylindrica*, submitted to Formas/Sida. Applicants: Libère Nkurunziza, Lars Andersson, Göran Bergkvist, David Chikoye, Peter Kulakow, Ekeleme Friday. *Not granted.*

Unraveling the causes and implications of crop productivity gaps in underperforming regions through integration of geospatial, biophysical and socio-economic factors, submitted to Formas. Applicants: Ingrid Öborn (ICRAF), Håkan Marstorp (SLU), Sigrun Dahlin (SLU), Fred Dzanku (University of Ghana, Ghana), Ola Hall (Lund University), Per Hillbur (Malmö Högskola); Magnus Jirström (Lund University). *Granted.*

Combining geospatial and survey data in assessing the prospects of smallholder agricultural development in sub-Saharan Africa, submitted to The Swedish Research Council. Applicants: Göran Djurfeldt (Lund University), Ola Hall (Lund University), Sigrun Dahlin (SLU), Magnus Jirström (Lund University), Håkan Marstorp (SLU), Steven Wambugu (Kenyatta University, Kenya), Fred Dzanku (Ghana University, Ghana). *Granted.*

Using Next Generation Sequencing to search for virus resistance genes in cassava for enhanced breeding, submitted to The Swedish Research Council, Swedish Research Links programme. Applicants: Erik Bongcam-Rudloff (SLU), Andreas Gisel (IITA, Nigeria), Anders Carlsson (SLU), Livia Stavolone (IITA, Nigeria), Melaku Gedil (IITA, Nigeria), Lava Kumar (IITA, Nigeria), Ismail Rabbi (IITA, Nigeria). *Not granted.*

Harnessing Soil Bacteria to Replace Chemical Nitrogen Fertilizer and Improve Nutritional Quality of Foods. Applicants: JG Davis (Colorado State University, USA), S Dahlin (SLU), JB Tumuhairwe (Makerere University, Uganda), TE Wolde-meskel (Hawassa University, Ethiopia). Submitted to Ekhagastiftelsen. *Decision pending*

Demystifying legumes: unravelling the interplay between niches, soil fertility, and legume attributes within smallholder farming systems of sub-Saharan Africa. A research program was outlined where past successes and failures of legume intensification will be analysed and demand-driven approaches used so that niches for multi-purpose legumes can be identified that fit the heterogeneity in farming systems and farmer objectives and address soil constraints within such niches. The overall benefits and trade-offs of legumes to farmer livelihoods and the natural resource base will be evaluated. *Awaiting suitable call.*

Improved African livelihood s through adoption of improved cassava and yam systems. Roots and tuber cropping systems with cassava and yam will be analysed using an interdisciplinary approach including aspects of market drivers, adoption, properties of the planting material, breeding methodology, food safety, and natural resource management. *Awaiting suitable call.*

Reviews and meta-analysis within Efficiency in farming systems

Project leader: Sigrun Dahlin/Håkan Marstorp | Budget: 600 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Zimbabwe	- Oxford University	- IITA International Institute of Tropical Agriculture, Nigeria - ICRAF World Agroforestry Institute, Kenya - Icipe International Centre of Insect Physiology and Ecology, Kenya - CIRAD Centre de Cooperation International en Recherche Agronomique pour le Développement, France - CIAT International Center for Tropical Agriculture, Columbia

Publications

Published in peer reviewed scientific journals 2

Öborn, I., Kuyah, S., Jonsson, M., Dahlin, A.S., Hosea, M., and DeLeeuw, J. 2014. Landscape-level constraints and opportunities for sustainable intensification in smallholder systems in the tropics. In: Peter A Minang, Meine Van Noordwijk, Jan de Leeuw, Cheikh Mbow (eds.), Climate-smart landscapes: multi-functionality in practice. Published by partnership for tropical forest margins. http://www.asb.cgiar.org

Dzanku F, Jirström, M. and Marstorp, H. 2015.Yield Gap Based Poverty Gaps in Rural Sub-Saharan Africa. *In press* World Development.

Book chapters/conference proceedings/reports/popular science publications 2

Dahlin, A.S., Hall, O., Marstorp, H., Adolfsson, N, and Jirström, M. 2014. Variations in productivity - causes and effects on food security and on sustainability of cropping systems. Workshop report, SIANI

Dahlin, A.S., and Rusinamhodzi, L. Review of interventions and technologies for sustainable intensification of smallholder crop production in sub-humid sub-Saharan Africa – with an assessment of effectiveness of selected options on differently endowed case study farms. A working paper. SLU-Global Report 2014:5

Activities organised

Scientific conferences/workshops

Towards an enhanced cooperation between IITA and SLU, workshop I, Alnarp. 10-12 April 2013. 3

Plant science, social science and agronomy groups workshop with IITA and SLU, Alnarp, Sweden. 27-28 August. .

Variations in productivity - causes and effects on food security and on sustainability of cropping systems, Kampala/Mbale, 31 January - 6 February 2014.

Courses/training activities 1

Exploring tradeoffs around farming livelihoods and the environment - using farming systems modelling. Organized in Uppsala, August, 2012 (3 ETCS). 18 participants of which 12 were from African countries.

Capacity building and collaborative research between SLU and Wondo Genet School of Forestry

Project leader: Erik Karltun

Budget: 700 000 SEK

Collaborations

Countries:
- Ethiopia

Academic institutions:
- Wondo Genet College of Forestry and Natural Resources, Hawassa University, Ethiopia

Other organisations:
- Bahir Dar Soil Testing and Fertility Improvement Center
- Ethiopian Institute of Agricultural Research, Addis Ababa
- Hawassa Soil Testing Laboratory
- Jimma Agricultural Research Center
- Mekele Soil Research Center
- National Soil Testing Centre Addis Ababa
- Nekemt Soil Research Center
- Regional soil laboratories, Ethiopia

Publications

Support to Master/Bachelor/PhD/Post-doc 6

Fikru Muda. MSc student from Ethiopia. Farmers' perception on composting and their application as a soil fertility improvement practice: the case of Arsi Ngelle District, South Central Ethiopia.

Amisalu Milkeas. MSc student from Ethiopia. Assessment of reasons for increasing on-farm Eucalyptus plantation and related partial nutrient losses in the Arsi Zone, Oromia Region, Ethiopia

Berhanu Terefe. PhD student from Ethiopia. Impact of land use change (converting home garden, shifting cultivation and wetland to mono-cropping) on carbon stocks and greenhouse gas fluxes in Ethiopia

Haji Kedir. PhD student from Ethiopia. Land cover/land use change and carbon stocks in Bale Mountains.

Nebi Morke. PhD student from Ethiopia. Woody plant diversity and carbon stocks in Bale Mountains.

Shimels Girma. PhD student from Ethiopia. Carbon sequestration potentials in conserved Acacia woodland in Central Rift Valley, Ethiopia.

Pamphlets/teaching/laboratory materials 1

A new motherboard for a Kjeltech instrument was purchased and the instrument made functional in November, 2013

Activities organised

Courses/training activities 4

A two weeks course in laboratory management and chemical analysis of soil and plant samples.

One week of the course was held in the Wondo Genet Soil Laboratory

One week course at the National Soil Testing Center in Addis Ababa

An assessment and maintenance consultancy of the soil and plant laboratories of WGCF-NR

Subsistence agriculture, land degradation and water security in Ethiopia

Project leader: Kevin Bishop

Budget: 600 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Ethiopia	- Ethiopian Institute of Water Resources (EIWR), Addis Ababa University in Ethiopia - Haramaya University - Wondo Genet College of Forestry, Hawassa University - Uppsala University	

Publications

Published in peer reviewed scientific journals 2

Gebrehiwot, S.G., Bewket, W., & Bishop, K. 2014. Community perceptions of forest-water relationships in the Blue Nile Basin of Ethiopia. GeoJournal, 79(5), 605-618, DOI: 10.1007/s10708-013-9519-5.

Gebrehiwot, S.G., Gärdenäs, A.I., Bewket, W., Seibert, J., Ilstedt, U., & Bishop, K. 2013. The long-term hydrology of East Africa's water tower: statistical change detection in the watersheds of the Abbay Basin.

Manuscripts for peer reviewed scientific journals 2

Adanech, Y. Impacts of water infrastructure development and climate change on the hydrology and water resources of the Omo-Gibe river basin, Ethiopia.

Gebrehiwot, S.G., Water in the face of afforestation in the Nile Basin. Submitted

Support to Master/Bachelor/PhD/Post doc/ visiting researcher 6

Solomon G Gebrehiwot. Post doctoral researcher. Subsistence agriculture, land degradation and water security in Ethiopia. EIWR Addis Ababa University.

Habiba Gashaw, PhD student. Methylmercury accumulation in fish, fish intake metaylemercury exposure, and health risks: in reference to Lake Tana, A. Co-supervised by Professor Kevin Bishop.

Tarik Asaye, MSc student. Detecting land use and land cover change and its effects on stream flow patterns using GIS, remote sensing and community consultation in Amin watershed, Amhara Region. EIWR Addis Ababa University.

Adanech Yared, MSc student. Water resource development and adaptation to climate change, EIWR Addis Ababa University

Melese Alamirew, MSc student. Land use change and water management, Haramaya University.

Zenebu Fikre, MSc student. Soil moisture, agroforestry practice and climate adaptation. Wondo Genet College of Forestry, Hawassa University.

Subsistence agriculture, land degradation and water security in Ethiopia, *continued*

Activities organised	
Scientific conferences/workshops	1

Water management and Food security. Addis Ababa University, Akaki Campus
12 March 2014. Five seminars focused on water management and food security regarding the Ethiopian context.

Applications for funding	3

The impact of Koga irrigation project on livelihood and adaptation to climate changes. Submitted to SIANI, Stockholm, September 2013. Not successful at SIANI but ready to be submitted to other calls.

Water balance under different forest vegetation classes in the highlands of Ethiopia. *Waiting for a suitable call.*

Deforestation, water and coffee production in the headwaters of Wabe-Shebele Basin, Ethiopia. *Waiting for a suitable call.*

Knowledge synthesis within Climate change and land use

Project leader: Richard Hopkins Budget: 600 000 SEK

Collaborations

Countries:
- Ethiopia
- Kenya
- Malawi
- Mozambique
- UK

Academic institutions:
- Lilongwe University of Agriculture and Natural Resources, Malawi
- Eduardo Mondlane University, Mozambique
- Technical University of Kenya

Other organisations:
- Ethiopian Institute of Water Resources (EIWR)
- Ethiopia & Department of Aquatic Sciences and Assessment Future Farming Systems Group, SRUC, UK
- Natural Resources Institute University of Greenwich, UK
- Swedish University of Agricultural Sciences, Sweden
- National Statistical Office, Malawi
- Lunyangwa Agricultural Research Station, Malawi
- ILRI International Livestock Research Institute, Kenya

Publications

Manuscripts for peer reviewed scientific journals 4

Gebreyohannis Gebrehiwot, S, Forests, Water and Food security in the northwestern highlands of Ethiopia: knowledge synthesis. Submitted.

Chagunda, M.G.G., Mumba, C., dos Anjos, F., Kawonga, B.S., Mwangwela, A., Hopkins, R., Chiwona-Kartun, L. Assessing and Managing Intensification in Smallholder Dairy Systems for Food and Nutrition Security in Sub-Saharan Africa. Submitted.

Chiwona-Kartun L., Kambewa, P., Jamali, A., Hopkins, R. , Chikagwa Malunga, S. Indre Giedraityte I., Chagunda, M.G.G. Urbanisation, consumption patterns and ecological intensification of livestock in Malawi.

Wekesa,V., Philipsson, J., Zonaband, E., Ortiz, R., and Hopkins, R. Genetic Resources for Drought Tolerance in Crops and Livestock in East Africa.

Restoration of degraded rural landscapes

Project leader: Anders Malmer

Budget: 1 200 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Burkina Faso - Finland - Sweden	- Ouagadougou University - University of Helsinki - University of Gothenburg - University of Linköping	- INERA Research Institute for Agriculture and Environment, Burkina Faso - CIFOR Center for International Forestry Research, Indonesia - ICRAF World Agroforestry Center, Kenya - 2iE International Institute for Water and Environmental Engineering, Burkina Faso

Publications

Published in peer reviewed scientific journals 1

Dayamba S.D., Savadogo P., Diawara S. and Sawadogo L, 2014. Perspectives in restoration: storage and pre-treatments of seeds for better germination of Sudanian savanna-woodland species. *In press* Journal of Forest Science.

Manuscripts for peer reviewed scientific journals 5

Savadogo P., Alcho S. H., Dayamba S. D. and Malmer A. Perceiving land-degrading activities and post mining mine sites rehabilitation from the lay perspective in Burkina Faso: realities, challenges and suggested solutions.

Sanou L., Savadogo P., Dayamba S., Malmer A. and Thiombiano A. Variation among provenances morphometric traits of seed germination and seedling growth of species identified candidates for restoration and domestication.

Savadogo P., Diawara S., Malmer A. and Dayamba S. D. Effect of planting time on establishment success and growth of four woody species used for the restoration of abandoned fallows in Burkina Faso.

Koala, J., Pettersson, H. and Söderberg, U. Biomass functions for parkland Vitellaria paradoxa in Burkina Faso, West Africa. Karlson, M., Reese, H. and Ostwald, M. 0000.

Karlson, M., Reese, H. and Ostwald, M. Tree crown delineation in managed woodlands of semi-arid West Africa (Burkina Faso) using WorldView-2 imagery and Geographic Object Based Image Analysis.

Support to Master/Bachelor/PhD /Post-doc/visiting researcher 7

Sata Diawara, MSc student Laboratoire de Biologie et Ecologie Végétale, Ouagadougou University. Restoration of degraded rural landscape in the face of climate and for livelihood diversification.

Hadjara Seydou Alcho, MSc student. Ouagadougou University and International Institute for Water and Environmental Engineering. Rehabilitation of mining sites in Burkina Faso: realities, challenges and suggestions of solutions.

Sanou Lassina, PhD student supported one year, 2014. Laboratoire de Biologie et Ecologie

Restoration of degraded rural landscapes, *continued.*

Végétale, Ouagadougou University. Restoration of degraded landscapes of rural Burkina Faso: effects of seed provenance and characteristics of micro-habitats on the growth and survival of native species.

Patrice Savadogo, ICRISAT, Niger and ICRAF Mali Visiting researcher at SLU in September and October 2012.

Jonas Koala, PhD student at the University of Bobo Dioulasso in Burkina Faso. Thesis title: Carbon dynamics in parkland agroforestry. Supported during November and December 2012 and June and July 2013.

Martin Karlson, PhD student at Linköping University. Support with supervision on the thesis Up-scaling to landscape scale - trees carbon and water in agroforestry parklands.

Gustaf Dal, MSc student SLU. Relations of tree-form to soil carbon in parklands in Central Burkina Faso.

Activities organised

Scientific conferences/workshops	1

Workshop on landscape restoration. Uppsala, Sweden during 31 October – 1 November 2012 with participation of 15 researchers from SLU, CIFOR, ICRAF, Helsinki University, INERA, SIFI/KSLA.

Structuring and increasing SLU cooperation with World Agroforestry Center (ICRAF)

Project leader: Anders Malmer | Budget: 1 100 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Kenya		- ICRAF World Agroforestry Institute

Publications

Manuscripts for peer reviewed scientific journals 6

Kuyah, S., Öborn, I., Malmer, A., Jonsson, M., Dahlin,S., Nyaga, J., Magaju, C., Barrios, E., Namirembe, S., Muthuri, C., Nyberg, Y. and Sinclair, F.L. Synergies and trade-offs amongst ecosystem services provided by trees on in agricultural landscapes of Sub-Saharan Africa. Submitted.

Nyberg, G., de Leeuw, J., Mwangi, P., Said, M., Kifugo, S., Mureithi, S. and Wredle, E. Enclosures – a productive, carbon sequestering and sustainable alternative to pastoralism?

Bostedt, G., Hörnell, A. and Nyberg, G., Agroforestry extension and dietary consumption – an analysis of the importance of fruit and vegetable consumption.

Ofori, D.A., Yeboah, E., Peprah, T. , Tsobeng, A., Dahlin A.S. and Jamnadass, R., The effect of indigenous and foreign growth media on Allanblackia parviflora A. Chev in Ghana.

Kuehl, Y., Nasi, R., Dimitriou, I., et al. (21 contributors),
Should wood-energy be a priority for international and national development strategies in Sub-Saharan Africa (SSA)? A systematic review.

Dimitriou, I and Tumaising, W., Waste recycling to maximize energy and food output in SSA –a review.

Book chapter/conference proceedings/reports/popular science publications 2

Macay H. and Öborn I. 2013. Multifunctional landscapes Part 2: Enhancing productivity and restoring ecosystem services. In H Macay & G Nyberg (Eds), Agricultural research towards sustainable development goals, Conference Proceedings 25-26 September 2013. SLU-Global Report 2013:3, 48-49

Malmer A., and Öborn, I., 2014. Report on a SLU – ICRAF workshop 11 – 12 November 2013 at ICRAF Campus with a field trip in NW Kenya 13 – 15 November 2013. Unpublished report, SLU Global

Support to Master/Bachelor/PhD/Post-doc/ visiting researchers 1

Svanlund, S., 2014. Carbon sequestration in the pastoral area of Chepareria, western Kenya : a comparison between open-grazing, fenced pastures and maize cultivations. MSc thesis, SLU Department of Forest Ecology and Management. Available at http://stud.epsilon.slu.se/6602/

Activities organized

Scientific conferences/workshops 3

Structuring and increasing SLU cooperation with World Agroforestry Center (ICRAF), *continued.*

Write-shops in Nairobi for planning and structuring of the review work on 19th April 2013 and

on 7-8th November 2013 (multipurpose trees).

Write-shops in Nairobi for a review on enclosures in drylands 21 – 23 August 2013 and final write-shop will be held in November 2014.

A workshop was held at ICRAF headquarters in Nairobi on November 11-12 2013 and a field excursion was performed on November 13-15 2013.

Applications for funding 8

Co-investment in tree based agriculture to build resilience and buffers against climate variability and risks. Main applicant Ingrid Oborn SLU/ICRAF, co-applicants from ICRAF-Tanzania, ICRAF-Uganda and ICRAF HQ Nairobi. *Not granted*.

Sustainable biomass use for briquetting in JoJi Agroforestry, Ethiopia. Main applicant Ioannis Dimitriou SLU, co-applicants from JoJi Agroforestry Plc, ICRAF-Ethiopia and ICRAF HQ Nairobi. *Not granted.*

Synergies between energy access and food security. Main applicant Ioannis Dimitriou SLU, co-applicants from Swedish and international limited companies, NGO's, African universities, ICRAF and others. Submitted to Swedish International Agricultural Network Initiative (SIANI). *Granted 2014 and 2015* .

The role of forests and trees in restoration of rural landscapes for food security. Main applicant Gert Nyberg SLU, co-applicants from other Swedish universities, African universities, NGO's, development support practitioners and others. Submitted to Swedish International Agricultural Network Initiative (SIANI). *Granted 2014 and 2015.*

European Long Term Social-Ecological-Economic Research initiative for Biodiversity and Ecosystem Services in the Tropics. (ERU-BIOTROPES), under the call TOPIC SC 5-06-2014: Biodiversity and ecosystem services: drivers of change and causalities. Partners apart from Ulrik Ilstedt and other SLU researchers were ICRAF, CIFOR (CRP 6), CIRAD and a number of European universities. *Not granted.*

Land-, livestock- and livelihood dynamics: uncovering the transition towards sedentary livestock based agro-pastoralism in semi-arid east Africa. Application to the Swedish Research Council Formas in Sweden. Anders Malmer at SLU is main applicant and co-applicants are from ICRAF and Swedish universities in Lund and Gothenburg as well as from Chalmers University of Technology. *Not granted.*

Trees, cows, carbon and water: Is degradation reversible in the dry tropics? Applications to the Swedish Research Council (VR). Main applicant for the first one is Anders Malmer, SLU with co-applicants at ICRAF, Jomo Kenyatta University of Agriculture and Technology and SLU. *Not granted.*

Improving livelihoods of the rural poor through Allanblackia cultivation - need for knowledge on soil requirements and dependence on symbionts" Applications to the Swedish Research Council (VR). Main applicant is Sigrun Dahlin at SLU and co-applicants are from ICRAF and Kenya National Herbarium. The fate of these applications will be decided in November 2014. *Not granted.*

Thematic activities within Scale issues in relation to food security and poverty alleviation

Project leader: Lennart Salomonsson — Budget: 1 200 000 SEK

Collaborations

Countries:
- Austria
- Belgium
- Denmark
- Ethiopia
- France
- Italy
- Kenya
- Malawi
- Netherlands
- Nicaragua
- Norway
- Portugal
- South Africa
- Sri Lanka
- Uganda
- USA

Academic institutions:
Aarhus University Denmark, Addis Ababa University Ethiopia, Cornell University USA, Hawassa College of Agriculture Ethiopia, Lund University Sweden, Michigan State University USA, Norwegian University of Life Sciences, Roskilde University Denmark, The University of Liège, Campus d'Aron, France, Universidad Nacional Agraria Peru, Universidade Nova de Lisboa Portugal, University of California-Davis USA, University of Copenhagen, University of Ghana, University of Gastronomic Sciences in Italy, University of Minnesota in St. Paul USA, University of Natural Resources and Life Sciences in Vienna Austia, University of Ruhuna Sri Lanka, University of Stellenbosch South Africa, University of Wisconsin-Madison USA, Wageningen University the Netherlands,

Other organisations:
- IFPRI International Food Policy Research Institute, USA
- IIED International Institute for Environment and Development, UK
- Biodiversity International, Italy
- Danish Institute for International Studies, Denmark
- Centre for Social Research, Malawi
- IITA International Institute of Tropical Agriculture, Nigeria
- World Fish, Malaysia
- ILRI International Livestock Research Institute, Kenya
- ICRAF World Agroforestry Institute, Kenya
- International Centre for Research in Organic Food Systems, Denmark
- INRA French National Institute for Agricultural Research, France

Publications

Pamphlets/teaching materials — 1

The seminar series 'Scaling-up' – filling the gap between academic knowledge and farming practice. www.slu.se/en/international/slu-global/scale-issues

Activities organised

Scientific conferences/workshops — 5

An international workshop on Developing an international network to support PhD-education in agroecology

An international workshop for the area Agriculture for nutrition and health (A4NH) coordinated by IFPRI;

A domestic workshop on Gender and the politics of environment. The planning process for a workshop on 'Scaling-up' – from technical transfer to empowerment.

A seminar series at SLU on 'Scaling-up' – filling the gap between academic knowledge and farming practice:
-Action research, March 2013
-From transfer to farmer field schools, May 2013
-Appropriate scale – agricultural technology and smallholder farming, June 2013

Thematic activities within Scale issues in relation to food security and poverty alleviation, *continued.*

International capacity building and research project was supported: Expanding cassava utilisation in southeastern Africa, which included a planning workshop in at the Lilongwe University for Agriculture and Natural Resources, Malawi.	
Courses/training activities	3
PhD course. Conservation, development and communication in diverse landscapes: Theories and methods, took place in Managua, Nicaragua in February-March 2013.	
PhD course. Nature-society relationships in transition – action research methodologies to collectively deal with experience and utopia took place in Portugal in June 2012.	
PhD course. Land use, land use change and climate change, also took place in Sweden, in November 2012. All three PhD courses highlighted interdisciplinary research.	

Knowledge synthesis within Scale issues in relation to food security and poverty alleviation

Project leader: Lennart Salomonsson | Budget: 600 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Malawi	- Lilongwe University of Agricultural and Natural Resources, Malawi	- Biodiversity International, UK
- Tanzania	- University of Nebraska, USA	- Centre for Social Research, Malawi
- Ethiopia	- Gothenburg University, Sweden	- Danish Institute for International Studies, Denmark
- Uganda	- Karolinska University, Sweden	- National Statistical Office, Malawi
	- Sokoine University, Tanzania	
	- Mekelle University, Ethiopia	
	- Uganda Martyrs University	

Publications

Manuscripts for peer-reviewed scientific journals 8

Salomonsson, L. and Francis, C. Sustaining food production and ecosystems integrity.

Salomonsson, L., Francis, C., and Rydberg, T. Scale issues and food-security: making 'hidden' values visible with application of interdisciplinary theory.

Jacobson, K. Is the term 'scale neutral' useful for comparing smallholder adoption of new crop varieties during the Asian green revolution and in today's Africa?

Elias, M., Darul Ehsan, S. Arora Jonsson, S. Scaling the shea trade. Gendered and political consequences of differentiating and niching the shea trade in Burkina Faso.

Widengård, M. Rethinking scale as politics of land grabbing governance.

Pain, A. and Christoplos, I. Danish Institute for International Studies. Scales, risks and food security outcomes in agrarian transitions: comparative evidence from Nepal and Vietnam.

Chiwona Karltun, L. SLU, Kinabo, J. and Hambraeus, L. Balancing food production for optimal global health and nutrition in the Food-Feed-Fiber-Fuel competition in Low-income countries.

Chiwona Karltun, L. Conteh, F., Nagoli, J., Hesselmark O. Jamali, A., Mkwambisi, D., and Chinsinga, B. Agricultural input subsidy experiences in Malawi – opportunity costs and benefits.

Urban and peri-urban farming for food security

Project leader: Ulf Magnusson

Budget: 1 200 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Uganda - Sweden	- Makerere University, Uganda - Lund University, Sweden - Uppsala University, Sweden	- ILRI International Livestock Research Institute, - CGIAR Research Program Livestock and Fish

Publications

Manuscripts for peer reviewed scientific journals 1

Lindahl J., Follis-Bergman K. Grace D, and Magnusson U, 2014. Geographical distribution of studies on zoonoses in cities – what does it reflect?

Popular science publications 1

Magnusson U. And Follis-Bergman K, (editors), 2014. Urban and peri-urban agriculture for food security in low-income countries - challenges and knowledge gaps. SLU-Global Report 2014:4 68 p. ISBN: 978-91-576-9229-0

Activities organised

Scientific conferences/workshops 2

2014, June 18: Launch of the anthology urban and peri-urban agriculture for good security in low-income countries - challenges and knowledge gaps. SLU-Global Report 2014:4 in Stockholm, with international attendence and over 30 participants.

2014, June 10-11: Match-making workshop in Märsta, Sweden between about 10 researchers from CGIAR Research Program Livestock and Fish and 20 from SLU.

Sustainable systems for integrated fish and vegetable production, perspectives on aquaponics

Project leader: Beatrix Alsanius		Budget: 70 000 SEK
Collaborations		
Countries:	Academic institutions:	Other organisations:
- Ethiopia	- Addis Ababa University, Ethiopia	-

Publications

Manuscripts for peer reviewed scientific journals 1

Alsanius, B.W., Getahun, A., Khalil, S., Rosberg, A.K., Bergstrand, K.J., Hartmann, R., and Tadesse, A. Sustainable systems for integrated fish and vegetable production – new perspectives on aquaponics.

NERICA upland rice market integration in Uganda

Project leader: Johanna Bergman Lodin		Budget: 65 000 SEK
Collaborations		
Countries: - Uganda	Academic institutions: - Makerere University, Kampala, Uganda	Other organisations:

Publications

Manuscripts for peer reviewed scientific journals	1

Bergman Lodin, J. and Twinamasiko, J. 2014. Determinants of market participation by NERICA upland rice grower households in Hoima District, Uganda.

Capacity building and bioinformatics challenges

Project leader: Erik Bongcam Rudloff

Budget: 500 000 SEK

Collaborations

Countries:
- France
- Kenya
- Tanzania
- Uganda

Academic institutions:
- Makerere University, Kampala Uganda
- Dar es Salaam University, Tanzania

Other organisations:
- ILRI, International Livestock Research Institute
- BecA-ILRI Hub Biosciences eastern and central Africa at ILRI, Kenya
- icipe, International Centre of Insect Physiology and Ecology, Kenya
- ICRISAT, The International Crops Research Institute for the Semi-Arid-Tropics
- UNESCO United Nations Educational, Scientific and Cultural Organization, France

Publications

Pamphlets/teaching materials 2

Two eBioKits were left in Tanzania to be used locally for bioinformatics teaching and research. See EMBnet.journal 20, e755. http://dx.doi.org/10.14806/ej.20.0.755.

Activities organised

Scientific conferences/workshops 1

Capacity building and Bioinformatics Challenges International Workshop at SLU´s campus Ultuna in Sweden. 12-14 June 2013, Uppsala Sweden.

Courses/training activities 5

Advanced Bioinformatics Workshop Metagenomics and Next Generation Sequencing. Date: 7th to the 18th of October, 2013, Venue: BecA - ILRI hub, Nairobi. Thirty five students from ten African countries and ten teachers participated.

Joint BecA Hub and UNESCO Advanced Genomics and Bioinformatics: Viral/Bacterial Metagenomics and Next generation sequencing Workshop 13th to the 17th August 2013, ILRI-BecA, Nairobi, with 25 participants.

H3ABioNet introduction to bioinformatics using the eBioKit platform 29th of July to 2nd of August 2013. International Centre for Insect Physiology and Ecology (icipe) Nairobi, Kenya with 25 participants.

PhD course Agrigenomics 4 HEC, Organism Biology research school, SLU 14 Dec. 2012 - 27 Feb. 2013.

Two eBioKit-based bioinformatics workshops were held in collaboration with H3Abionet1 and BecA-ILRI Hub2, from 10-14 December 2013 in Dar es Salaam, Tanzania.

Capacity building and bioinformatics challenges, *continued.*

Applications for funding 5

Harnessing the Application of Bioinformatics for Agriculture and Food Security in Africa. This is an ACP EU Co-operation Programme in Science and Technology (S&T II), partners include the African Network of Scientific and Technological Institutions (ANSTI), SLU and ILRI/BeCa (Kenya coordinator). *Decision pending.*

Transcriptional profiling of host responses in pigs resistant or susceptible to African swine fever virus (ASFV) - a novel strategy to elucidate key components in a protective immune response to the virus which can lead to vaccine candidates: *ANIHWA: ASF GLEAN FOR VACCINE*. Partner include ILRI, SLU, Swedish Veterinary Medicine Agency (SVA). (Erik Bongcam-Rudloff, SLU Coordinator). *Decision pending.*

Establishment and application of next generation sequencing approaches to assess the effects of anthropogenic activities on east African and Mauritian coral reefs and genetic diversity of key species management. Marine Science for Management (MASMA) program: Partners include SLU, ICRISAT, Pwani University, Kilifi,Kenya. The proposal was submitted to BioInnovate: "Finger millet genome sequencing consortium" and coordinated by Santie deVilliers and ICRISAT. *Decision pending.*

Empowering African universities to meet the new challenges of recent advances in the biotechnology era: a test case project. Kenya – Sweden collaboration, SLU coordinator. Sent to the Swedish Research Council, Swedish Research Links 2014. *Not granted.*

B3 Africa: Bridging Biobanking and Biomedical Research across Europe and Africa. Collaboration between South Africa, Kenya, Uganda, Nigeria, France and Sweden. SLU coordinator. Horizon 2020 Call: H2020-INFRASUPP-2014-2. *Decision pending.*

Global Challenges University Alliance – activities 2012-2014

Project leaders: Sara Brännström, Johan Schnürer | Budget: 500 000 SEK

Collaborations

Countries:

- Australia, Austria, Brazil, Burkina Faso, Canada, China, Ethiopia, Indonesia, Italy, Japan, Malaysia, Netherlands, Nicaragua, New Zealand, Nicaragua, Russia, Sweden, Thailand, Uganda, USA

Academic institutions:

- University of Queensland Australia, University of Boku Austria, University of Sao Paulo Brazil, University of Ougadougou, Burkina Faso, University of British Columbia Canada, China Agricultural University China, Addis Ababa University, Ethiopia
- Bogor Agricultural University Indonesia, University of Tokyo Japan, University of Putra Malaysia, Wageningen University Netherlands, Lincoln University New Zealand, Agriculture University Nicaragua, St. Petersburg State Forest Technical University Russia, University of Pretoria South Africa, Swedish University of Agricultural Sciences. Sweden, Chulalongkorn University Thailand, Makerere University, Uganda and Cornell University USA

Publications

Pamphlets/teaching materials — 1

The presentations made during the workshops can be found at
www.slu.se/en/international/global-challenges-university-alliance/
www.slu.se/gcua

Activities organised

Scientific conferences/workshops — 5

Funds from the Swedish Foreign Ministry facilitated in part the participation of researchers from African universities and planning of summer schools.

Biofuels and biorefineries. September 2012, Uppsala. 27 researchers from 7 universities participated.

Future of food – security, safety and quality. May 2013, Uppsala. 42 researchers from 13 universities participated.

Environmental monitoring and detection of invasive species – current challenges. September 2013 Uppsala. 25 researchers from 7 universities participated.

Green and sustainable cities, the role of landscape architecture. March 2014, Uppsala. 32 researchers from 11 universities participated.

The Future of Forests, to manage forests for people. June 2014, Uppsala. 25 researchers from 9 countries participated.

Courses/training activities — 2

Funds from the Swedish Ministry for Foreign Affairs facilitated participation of PhD students from African universities and contributed to planning time for course organizers.

Summer School in Biofuels and biorefineries June 2014, Uppsala.

Summer School in Future of food – security, safety and quality. September 2014.

Capacity building in teaching and research in ruminant reproduction in Uganda

Project leader: Renée Båge | Budget: 144 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Uganda	- Makerere University, Kampala, Uganda - Uppsala University	-

Publications

Published in peer reviewed scientific journals — 1

Kanyima B, Båge R, Owiny D, Ntallaris T, Lindahl J, Magnusson U, Nassuna-Musoke M. Husbandry Factors and the Resumption of Luteal Activity in Open and Zero-Grazed Dairy Cows in Urban and Peri-Urban Kampala, Uganda. Reprod Domest Anim. 2014 Aug; 49(4):673-678. doi: 10.1111/rda.12346. Epub 2014 Jun 16.

Manuscripts for peer reviewed scientific journals — 1

Kanyima Mbabazi B, David Okello Owiny; Båge, R; Nassuna-Musoke MG, Humblot P, and Magnusson U. Managerial practices and factors influencing reproductive performance of dairy cows in urban and peri-urban areas of Kampala and Gulu, Uganda.

Pamphlets/teaching materials — 1

Clinical training course material: Ultrasound in large animal reproduction, under field conditions. The course included theory on advantages and limitations of imaging with ultrasound. Strategic aspects for reproductive health programs including planning and farm economy were presented and discussed. Course material (PowerPoint presentation) was prepared for this occasion but also for the future use by the Makerere group in their teaching and supervision in Uganda.

Activities organised

Courses/training activities — 4

Epigenetics and reproduction. March 3-7, 2014. 15 participants from Uganda. Course organizers: Göran Andersson, Renée Båge and Bodil Ström-Holst from SLU and Anneli Stavréus-Evers from Uppsala University.

Clinical training course: Ultrasound in large animal reproduction, under field conditions. March 14 and 18, 2014. Three participants from Uganda. Course organizer, lecturer and clinical supervisor: Renée Båge, SLU.

Journal club in reproduction: critical evaluation of evaluated scientific papers within the field of reproduction, the knowledge of study design and statistical methods and ability to apply this knowledge to the assessment of experimental studies. March 13, 2014. Three participants from Uganda. Organizers and supervisors: Ylva Sjunnesson, Patrice Humblot and Ann-Sofi Bergqvist, SLU.

Scientific writing workshops: Half-day supervised sessions March 10, 13, 17, 18 and 28, plus individual work task in between. Five participants from Uganda. Organizers and supervisors: Ulf Magnusson and Renée Båge, SLU.

Strengthening Africa's Strategic Agricultural Capacity for Impact on Development (SASACID)

Project leader: Helena Eklund-Snäll

Budget: 50 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Kenya	- ANAFE represents 134 African universities and vocational colleges	- ANAFE The African Network for Agriculture, Agroforestry and Natural Resources Education, Kenya

Publications

Book chapters/conference proceedings/reports 3

Aspengren, P. and Pettersson, R 2013. SLU Mission Report – pedagogic workshop Teaching for Sustainable Education in Higher Education for ANAFE/SASACID. 13-17 May 2013, Nairobi, Kenya.

Ulf Magnusson,M., Erik Karltun, E., Lagerkvist, C.J., Malmer, A., Marstorp H., and Sundström, J. 2012. Risks for African agriculture – a review for identifying research areas.

Natalie Jellinek; N. 2013. Report. Seminar on teaching and learning. SASACID seminar, 1-6 July 2013, Abidjan, Ivory Coast.

Activities organised

Scientific conferences/workshops 1

The workshop Strengthening Africa's Strategic Agricultural Capacity for Impact on Development (SASACID); Strengthening agribusiness education and training and managing risks and uncertainty in agriculture. 23-25 April 2012 Kenyatta University, Nairobi, Kenya

Tertiary Agricultural Education (TAE) in Africa – a prospective study

Project leader: Sebastian Hess

Budget: 700 000 SEK

Collaborations

Countries:
- Benin
- Denmark
- France
- Ghana
- Netherlands
- Niger
- Nigeria
- Portugal
- South Africa
- Tanzania
- USA

Academic institutions:
- University of Lisbon, Portugal

Other organisations:
- TEAM-Africa Tertiary Education in Agriculture Mechanism for Africa, South Africa
- NEPAD, the New Partnership for Agricultural Development, South Africa
- World Bank, USA
- RUFORUM, Regional Universities Forum for Capacity Building in Agriculture, Uganda

Publications

Published in peer reviewed scientific journals 1

Abu Hatab, A. and Hess, S. (2013). Opportunities and constraints for small agricultural exporters in Egypt. International food and agribusiness management review. Volume 16, Issue 4, 77-100.

Manuscripts for peer reviewed scientific journals 2

Hess, S., Abu Hatab A., Mira da Silva, L., Boly H., Glynn, C. Frey, H. 2013. Agricultural agribusiness and tertiary agricultural education in Africa: A systematic review of the literature.

Hess, S., Abu Hatab A., Mira da Silva, L., Boly H., Glynn, C. Frey, H. 2014. A preliminary analysis of survey results from aprospective study.

Book chapters/conference proceedings/reports/popular science publications 1

Långsiktig satsning I Afrika; litteraturstudie som startpunkt för dialog. 2013. Resurs SLUs personaltidning 4/13:14-15.

Support to Master/Bachelor/PhD/Post-doc 3

Assem Abu Hatab, Swedish University of Agricultural Sciences. Post doctoral studies 2013. Agricultural agribusiness and tertiary agricultural education in Africa.

Abenezer Zeleke Aklilu MSc student Department of Economics, SLU worked on the systematic review of the literatur. He is now at PhD student.

Wondmagegn Tafesse Tirkaso MSc student Department of Economics, SLU worked on the systematic review of the literatur. He is now a PhD student.

Tertiary Agricultural Education (TAE) in Africa – a prospective study, *continued*

Pamphlets/teaching materials	1

TEAM-Africa pamphlet with information about mission statements and stakeholders designed and produced by Assem Abu Hatab.

Activities organised

Scientific conferences/workshops	3

Three Prospective Study project workshops, in Uppsala Sweden during
February 2013,
August 2013,
January 2014.

Applications for funding	1

Improving tertiary agricultural education leadership in Africa - a training tool for African academic leaders to bring relevant issues into their programs. Sebastian Hess and Assem Abu Habab (SLU), Hamidou Boly (TEAM-Africa), Luis Mira da Silva (University of Lisbon, Portugal). Application to Innovative doctoral training program funded by the Swedish Foreign Ministry. *Granted for 2013-2014.*

Novel intervention strategy against malaria mosquitoes

Project leader: Sharon Hill

Budget: 90 000 SEK

Collaborations

Countries:
- Ethiopia
- Kenya

Academic institutions:
- Addis Ababa University, Ethiopia

Other organisations:
- *icipe* International Centre of Insect Physiology and Ecology, Kenya

Publications

Manuscripts for peer reviewed scientific journals 4

Wondwosen B, Hill SR, Tekie H, Torto B, Birgersson G, and Ignell R. Low input odour-based gravid trap for malaria mosquitoes, *Anopheles arabiensis.*

Wondwosen B, Hill SR, Tekie H, Torto B, Birgersson G, and Ignell R. Volatiles from the emerging monoculture landscape attract ovipositing malaria mosquitoes.

Wondwosen B, Hill SR, Tekie H, Torto B, Birgersson G, and Ignell R. A superlure for gravid malaria mosquitoes based on agricultural landscape volatiles.

Asmare Y, Hill SR, Tekie H, Birgersson G, and Ignell R. Malaria mosquitoes oviposition preferences in a grassland odour-scape.

Activities

Support to Master/Bachelor/PhD/Post doc 3

Low input odour-based gravid trap for malaria mosquitoes, *Anopheles arabiensis.* How landscape shapes oviposition behaviour in malaria mosquitoes, *Anopheles arabiensis*. Fil licentiate to be recruited

Wondwosen Betelehem PhD thesis to be defended 2015-11. Low input odour-based gravid trap for malaria mosquitoes*, Anopheles arabiensis*. Department of Zoological Sciences, Faculty of Life Science, Addis Ababa University, Ethiopia.

Asmare Yelfwagash PhD thesis to be defended 2016-06. How landscape shapes oviposition behaviour inmalaria mosquitoes, *Anopheles arabiensis.* Department of Zoological Sciences, Faculty of Life Science, Addis Ababa University, Ethiopia.

Pamphlets/teaching materials 1

Teaching materials prepared for this occasion but also for the future use by the Makerere group in their teaching and supervision in Uganda.

Report on studies on twelve varieties of sweet potato conducted in SLU, Sweden

Project leader: Kristine Koch

Budget: 53 000 SEK

Collaborations

Countries:
- Ghana

Academic institutions:

Other organisations:
- CSIR-FRI Council of Scientific and Industrial Research - Food Research Institute, Ghana.

Publications

Published in peer reviewed scientific journals 2

Eriksson, E., Koch, K., Tortoe, C. Toah Akonor, P and Baidoo, E. 2014. Physicochemical, functional and pasting characteristics of three varieties of cassava in wheat composite flours. British Journal of Applied Science & Technology, 4 (11): 1609-1621.

Eriksson, E., Koch, K., Tortoe, C. Toah Akonor, P. and Oduro-Yeboah, C. 2014. Evaluation of the physical and sensory characteristics of bread produced from three varieties of cassava and wheat composite flours. Food and Public Health, 4(5): 2014-22.

Manuscripts for peer reviewed scientific journals 1

Toah Akonor, P., Tortoe, C., Koch, K., Menzel, C. and Adofo, K. Interrelationship between physical, chemical and functional properties of flour from 12 varietiesof Ghanaian sweetpotato.

Support to Master/Bachelor/PhD/ Post-doc/visiting scientists 2

Eriksson, E. 2013. Flour from three local varieties of Cassava (Manihot Esculenta Crantz) - physico-chemical properties, bread making quality and sensory evaluation: a Minor Field Study in Ghana study. Swedish University of Agricultural Sciences. Dept of Food Science, 2013:371. Supervisors: Assoc. Prof. Kristine Koch (SLU, Sweden) and Dr Charles Tortoe (CSIR-Food Research Institute, Ghana)

Estelle Eriksson, Masters student in Food Science; the analysis of the fine structure of sweet potato amylopectin. Title: Starch fine structure in twelve different sweet potato samples from Ghana. Supervisors: Assoc. Assoc. Prof. Kristine Koch (SLU, Sweden) or MSc Carolin Menzel (SLU, Sweden) and Dr Charles Tortoe (CSIR-Food Research Institute, Ghana).

Activities organised

Applications for funding 1

Identifying the molecular optimum of starch for the development of sustainable materials based on renewable sources. A collaboration on starch-rich roots and tubers from Ghana. The application was sent to the Swedish Research Council 2014. *Not granted*.

International field course

Project leader: Jan Lagerlöf Budget: 445 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Kenya	- Kenyatta University, Kenya - Embu University College, Kenya	

Activities organised

Courses/training activities 1

Field course: Global development, natural resources and livelihoods – SLU course BI1181 (7.5 credits) spring semester 2014 in co-operation with Kenyatta University and Embu University College. Preparatory work in Uppsala, Sweden and Kenya. Field work in Kenya 31 March – 2 May 2014.

Applications for funding 1

Linnaeus-Palme application for student and teacher exchange between SLU and Embu University College, Kenya. The course will be a multi-disciplinary field course at the Master of Science level and will include social-economical, ecological and environmental science aspects of natural resource management. Main applicant Jan Lagerlöf. *To be submitted in November 2014*

Availability and utilisation of urban/peri-urban livestock feed resources: a farmers' handbook

Project leader: Jan Erik Lindberg

Budget: 106 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Uganda	- Makerere University, Kampala, Uganda	

Publications

Pamphlets/teaching materials 1

Availability and utilization of urban/peri-urban livestock feed resources: a farmers' handbook. Feed resources discussed: crop/food wastes, pastures, agro-industrial, others. The handbook is printed in 500 hard copies and will be used as an extension tool to impart knowledge to urban and peri-urban farmers.

Good health and a safe work environment – a requirement for sustainable livelihood and food security among Ugandan farmers

Project leader: Christina Lunner Kolstrup	Budget: 90 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Uganda	- Uganda Martyrs University, Uganda	- Uganda Catholic Management and Training, Kampala, Uganda

Publications

Manuscripts for peer reviewed scientific journals	1

Pilot study on farmers' experiences and attitudes to health, safety and risk factors associated with farming. This will be the basis for research publications.

Evaluation of microbial safety of Peepoo sanitisation in Kibera urban slum, Kenya

Project leader: Annika Nordin

Budget: 70 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Kenya	- University of Nairobi	- Peepoople organization, Kenya

Publications

Support to Master/Bachelor/PhD/ Post-doc/visiting researchers 2

Nduhiu Githai, presently Chief Technologist, Department of Public Health Pharmacology and Toxicology, University of Nairobi, Kenya is currently defending his proposal for PhD studies regarding the Peepoo sanitation system in Kibera.

Violet Nyakoega, Master student at Department for Land resource management & Agricultural technology (LARMAT), University of Nairobi is currently carrying out her master project on *Peepoo fertilizer production and crop response*.

Pamphlets/teaching/laboratory materials 1

Five (5) temperature loggers Tiny tag TGU-4017 with reading plate. Located at Peepoople Kenya, Nairobi for continuous temperature monitoring.

International workshop on sustainable aquaculture in Sub-Saharan Africa

Project leader: Anna Norman Haldén | Budget: 304 000 SEK

Collaborations

Countries:
- Cameroon
- Kenya
- Malawi
- Rwanda
- Tanzania
- Uganda

Academic institutions:
- Bamenda University, Cameroon
- Bunda University, Malawi
- Makerere University, Kampala, Uganda
- National University of Rwanda
- Sokoine University of Agriculture, Tanzania
- University of Nairobi, Kenya

Other organisations:
- ARDC Aqua-cultural Research and Development Center in Kajjansi, Uganda
- Department of Fisheries, Malawi
- Department of Fisheries, Uganda
- Kabeihura Fish Farmers
- NaFIRRI National Fisheries Resources Research Institute, Uganda
- RUFORUM The Regional Universities Forum for Capacity Building in Agriculture
- Ssenya Fish Farm
- Source of the Nile Fish Farm
- SWEACC Swedish East African Chamber of Commerce in Uganda
- TENDO Integrated Farm

Publications

Pamphlets/teaching materials 1

The production of presentations by researchers under four main topics: environmental impact of fish farming, feed and farming systems, fish health, and genetics in aquaculture.
All presentations can be found at:
http://teacher.bmc.uu.se/SLUGLOBALAQUA/SLUGLOBALAQUA/Welcome.html

Activities organised

Scientific conferences/workshops 1

International workshop on Sustainable aquaculture in Sub-Saharan Africa in Kampala, Uganda 5-8 February 2013.

Applications for funding 3

Sustainable small-scale aquaculture to secure future food production in Uganda. Applicants: Researchers from SLU and Makerere University to Sida, U-forsk 2013. *Not granted*.

Small-scale and sustainable aquaculture to secure future food production in Uganda. Applicants: Researchers from SLU and Makerere University to Swedish Research Council, U-forsk 2014. *Not granted.*

Enhanced and sustainable small-scale aquaculture for increased food production in Uganda. Sent to VR U-forsk 2014. Applicants: Researchers from SLU and Makerere University. *Not granted.*

Adoption and adaptation of enclosures for pasture – management differences and gender effects

Project leader: Gert Nyberg		Budget: 250 000 SEK
Collaborations		
Countries: - Kenya	Academic institutions: - Jomo Kenyatta University of Agriculture and Technology - University of Nairobi - Lund University - University of Nairobi	Other organisations:

Research activities

Preliminary results indicate that there are gendered differences in the management of enclosed pasture systems and that these have changed over time; this being partly due to the "new" system of enclosing pastures. Very generally, women have more tasks on the farm and hence a heavier labour burden, but they are also more empowered in farming decisions and are more active on the local market than they were 30 years ago. Thereby they have access finances that they control entirely and hence women are very positive to the changes. Results also indicate that there are large differences in the management intensity of enclosed areas as well as in the productivity of the livestock in these enclosures. The system is adopted to a large extent and there is very little migration with livestock. The little migration that does exist is for short distances and periods and mostly to rented pasture lands (enclosed by someone else). Difference in management seems to be correlated to when the famer got information (how long enclosures have been used) and to what extent farmers got information through extension services (Vi Agroforestry or government).

Regional workshops on Animal Genetic Resources in Sub-Saharan Africa

Project leaders:
Jan Philipsson, Julie Ojango

Budget: 530 000 SEK

Collaborations

Countries:
Angola, Benin, Botswana, Burkina Faso, Burundi, Djibouti, Eritrea, Ethiopia, Cameroon, Congo, Chad, Cote d'Ivoire, Democratic Republic of Congo, Equatorial Guinee, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe

Organisations:
-ASARECA Association for strengthening Agricultural Research in Eastern and Central Africa, Uganda
-AU-IBARAU-IBAR African Union- African Bureau for Animal Resources, Kenya
-CIRDES Centre Internatinal de Recherche-Developpement sur L'evevage en Zone Subhumide, France
-COMESA Common Market for Eastern and Southern Africa, Zambia
-CORAF West and central African Council for Agricultural Research and Development, Senegal
-EU European Union
-FAO United Nations Food and agriculture Organization
-IGAD Intergovernmental Authority on Development, Djibouti
-ILRI International Livestock Research Institute, Kenya
- NEPAD New Partnership for Agricultural Development in Africa, South Africa
- RUFORUM The Regional Universities Forum for Capacity Building in Agriculture, Uganda
-SADC Southern African Development Council, Botswana
-TEAM-Africa Tertiary Education in Agricultural Mechanism in Africa, South Africa
-WALIC West African Livestock Innovation Centre, The Gambia

Publications

Pamphlets/teaching materials 1

Training the Trainers: Animal genetic resources utilization in Sub-Saharan Africa and Asia; web-based format. See link to Sub-Saharan Africa workshops 2013 at: http://agtr.ilri.cgiar.org/
or go directly to: http://ilri-angr.wikispaces.com/Regional+Workshops%2C+Sub+Saharan+Africa .

Activities organised

Scientific conferences/workshops 3

Workshop on Animal genetic resources in Sub-Saharan Africa, West and Central Africa regions: Ouagadougou, Burkina Faso: 5-8 Nov 2013.

Workshop on Animal genetic resources in Sub-Saharan Africa, East-Africa region: Kigali, Rwanda: 19-22 Nov 2013.

Workshop on Animal genetic resources in Sub-Saharan Africa, Southern-Africa region: Gaborone, Botswana: 26-28 Nov 2013.

Fuel use efficiency and emissions from biochar-producing cookstoves in Kenya

Project leader: Cecilia Sundberg | Budget: 62 000 SEK

Collaborations

Countries:	Academic institutions:	Other organisations:
- Kenya	-	- ICRAF World Agroforestry Institute

Publications

Support to Master/Bachelor/PhD/ Post-doc/visiting researcher 3

Hanna Helander, Lovisa Larsson, 2014. Emissions and energy use efficiency of household biochar production during cooking in Kenya ISSN: 1650-8319, TVE 14 018 Examensarbete 15 hp, Uppsala universitet, http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-225772.

Nemer Achour , 2014. Determining fuel quality of biochar produced from biochar-producing stoves and its potential as a fuel. MSc thesis. Department of Energy and Technology, SLU.

Njenga, Mary ICRAF Post-doctoral project in Bioenergy

Pamphlets/teaching/laboratory materials 5

Moisture meter Testo 606. Located at SLU Uppsala
Thermocouple and datalogger. Located at SLU Uppsala
CO meter Located at SLU Uppsala
26 gasifier stoves and 6 improved cookstoves. One gasifer stove located in Uppsala, all others located in Kenya, at IITA, Nairobi
Keyspan cable for measurement equipment. Located at ICRAF, Nairobi.

Activities organised

Applications for funding 1

Biochar as soil amendment or fuel? From rural to urban applications. Main applicant Cecilia Sundberg. Submitted to VR Swedish Research Links. *Not granted.*

Activities to strengthen new initiatives within food security

Project leaders:
Arvid Uggla, Carolyn Glynn

Budget: 500 000 SEK

Collaborations

Countries:
- Austria
- Belgium
- Botswana
- Denmark
- Germany
- Ghana
- Hungary
- Portugal
- Uganda

Academic institutions:
- Agricultural Research Finland (MTT), Finland
- University of Wageningen, the Netherlands
- Université Catholique de Louvain (UCL), Belgium
- Instituto de Investigacao Cientifica Tropical (IICT), Portugal
- University of Copenhagen (UCPH), Denmark
- Rheinishce Friedrich-Wilhelms Universitat Bonn (ZEF), Germany
- University of Greenwich (NRI), UK
- Ceska Zemelska Univerzita V Praze (CULS), Czech Republic
- Instituto Nacional de Investigación y Tecnologia Agraria y Alimentaria (INIA), Spain
- Universitaet Fuer Bondenkultur Wien (BOKU), Austria
- Szent Istvan University (SZIU) Hungary,

Other organisations:
- Agricultural Research Council (ARC), South Africa
- Agricultural and Food Development Authority (TEAGASC), Ireland
- African Forum for Agricultural Advisory Services (AFAAS), Uganda
- ASARECA Association for strengthening Agricultural Research in Eastern and Central Africa, Uganda
- FARA Forum for Agricultural Research in Africa, Ghana
- CIRAD Centre de Cooperation International en Recherche Agronomique pour le Development, France
- CCARDESA Center for the Coordination of Agricultural Research and Development, Southern Africa
- CORAF/WECARD West and Central African Council for Agricultural Research and Development, Sengal
- CSIR Crops Research Institute, Ghana
- International Federation of Agricultural Journalists IFAJ, The Netherlands
- Norwegian Institute for Agriculutral and Environmental Research (BIOFORSK)

Activities organised

Scientific conferences/workshops 1

Participation for an African student to participate with a poster at the First international conference on global food security, Noordvjikerhout, The Netherlands 29th September – 2nd October 2013.

Courses/training activities 1

Activities to strengthen new initiatives within food security, *continued*

IFAJ global initiative – Agricultural journalists worldwide supporting farmers fighting poverty Masters classes for agricultural journalists from developing countries. Participation by journalists from Africa was made possible through UD funding. 12-15 August 2012

Applications for funding 1

Towards a long-term Africa-EU partnership to raise sustainable food and nutrition security in Africa. Acronym PROIntensAfrica. Applicants: Wageningen International (WUR) Netherlands, Forum for Agricultural Research in Africa (FARA) Ghana, Centre de Cooperation International en Recherche Agronomique pour le Development (CIRAD) France, West and Central African Council for Agricultural Research and Development (CORAF/WECARD), Senegal, Université Catholique de Louvain (UCL) Belgium, Center for the Coordination of Agricultural Research and Development in Southern Africa (CCARDESA) Botswana, Swedish University of Agricultural Sciences (SLU) Sweden, Crops Research Institute, (CSIR) Kumasi Ghana, Agricultural Research Council (ARC) South Africa, Instituto de Investigacao Cientifica Tropical (IICT), Portugal, Agricultural Research Finland (MTT), African Forum for Agricultural Advisory Services (AFAAS) Uganda, University of Copenhagen (UCPH) Denmark, Association for strengthening Agricultural Research in Eastern and Central Africa (ASARECA) Uganda, Rheinishce Friedrich- Wilhelms Universitat Bonn (ZEF) Germany, University of Greenwich (NRI) England, Ceska Zemelska Univerzita V Praze (CULS), Czech Republic, Instituto Nacional de Investigación y Tecnologia Agraria y Alimentaria (INIA) Spain, Agricultural and Food Development Authority (TEAGASC) Ireland, Universitaet Fuer Bondenkultur Wien (BOKU) Austria, Szent Istvan University (SZIU) Hungary, Norwegian Institute for Agriculutral and Environmental Research (BIOFORSK) Norway, Institut de l'Environnement et de Recherches Agricoles INERA, Burkina Faso.
Horizon 2020 Call: H2020-SFS-2014-1 Topic: SFS-06-2014, Type of action CSA Proposal number SEP-210139393 *Granted 2015-2017.*

The SLU Global Food Security Research and Capacity Development Programme 2012-2014 – a Swedish Government Initiative

In late 2011 the Swedish Ministry for Foreign Affairs made an allocation to SLU to be used to strengthen Sweden's cooperation with African universities, research institutes and organizations in the area of food security. The allocation was made with the long-term aim of reducing hunger and malnutrition by supporting the improvement of agricultural productivity through research and higher education. Key components in SLU's mission have been mutual exchange, focus and longevity in results with African partners. Aspects of gender in natural resources management and research education and training have been central. In terms of research areas, priorities have included plant breeding, farming systems, animal health and disease control and land restoration. This report presents the results generated from projects within the programme.

The **Swedish University of Agricultural Sciences (SLU)** has core competence within the agricultural sciences, including forestry and veterinary sciences. The university´s areas of expertise cover urgent global issues such as food production, energy supply, climate change, biodiversity conservation and control of infectious diseases in animal and man.

To strengthen SLU's involvement in issues related to improving productivity in agriculture, food security and sustainable livelihood in low-income countries, the university has established the programme **Agricultural Sciences for Global Development, (SLU Global)**. The programme's mission is to coordinate and visualize SLU's competence in research, education and expert councelling within the framework of the Swedish Policy for Global Development.

www.slu.se/slu-global

SLU