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USAID KENYA AFRICA-U.S. HIGHER EDUCATION INITIATIVE - PARTNERSHIP BETWEEN UNIVERSITY OF NAIROBI AND COLORADO STATE UNIVERSITY **FINAL REPORT**

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USAID KENYA University of Nairobi and Colorado State University Partnership

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ACRONYMS AND ABBREVIATIONS

ACE	American Council on Education
ASAL	Arid and Semi-Arid Lands
ASF	ASAL Stakeholders Forum
CAVS	College of Agriculture and Veterinary Science
CIM	Christian Impact Missions
CSU	Colorado State University
CSDES	Centre for Sustainable Dryland Ecosystems and Societies
DQV	Data Quality Verification
FtF	Feed the Future
FY	Fiscal Year
GIS	Geographic information systems
GOK	Government of Kenya
HED	Higher Education for Development
IGAD	Intergovernmental Authority for Development
KALRO	Kenya Agricultural and Livestock Research Organization
LARMAT	Land Resource Management & Agricultural Technology
M&E	Monitoring and Evaluation
MoU	Memorandum of Understanding
NDMA	National Drought Management Authority
NGO	Non-government Organization
PACIDA	Pastoral Community Initiative and Development Assistance
PRIME	Partnership Results and Information Management Engine
REGAL-IR	Resilience and Economic Growth in Arid Lands
UoN	University of Nairobi
USAID	United States Agency for International Development

I.AFRICA-U.S. HIGHER EDUCATION INITIATIVE PARTNERSHIP BETWEEN UNIVERSITY OF NAIROBI AND COLORADO STATE UNIVERSITY EXECUTIVE SUMMARY

This partnership was funded by the United States Agency for International Development (USAID) through a grant to American Council on Education (ACE), Office of Higher Education for Development (HED) as part of the Africa-U.S. Higher Education Initiative. The Initiative is a collaborative effort that was started in 2007 led by the Association of Public and Land-grant Universities (APLU) and supported by a number of higher education associations and other organizations to advocate for increased engagement in African higher education capacity development.

The **University of Nairobi (UoN)** and **Colorado State University (CSU)** partnership was established to address the challenges of development, marginalization and sustainability of dryland regions and its peoples in Kenya. Remote locations, poor infrastructure and low education levels contribute to marginalization of dryland pastoral and agro-pastoral communities. Furthermore, knowledge of drylands by outsiders is also poor, which hinders the development of ecologically, socially and pedagogically appropriate solutions to poverty and food insecurity in the drylands. To address these challenges, people from and working in drylands need to have access to drylands-relevant education at universities. In turn, universities need to transform their research so that it meets the needs of drylands communities and the ecosystems they depend upon.

The partnership between UoN and CSU entitled “Centre for Sustainable Drylands: A University Collaboration for Transforming Higher Education in Africa at the University of Nairobi” strengthened capacity for establishing and sustaining dryland ecosystems and human livelihoods in Kenya through higher education transformation.

The objectives of the partnership were:

1. Improved coordination of interdisciplinary education, research and outreach for drylands in Kenya.
2. Greater capacity of students and faculty to address the problems of dryland ecosystems and societies.
3. Increased research capacity and policy-relevance, and resource directions and innovations appropriate for Kenyan drylands.
4. Greater participation in higher education by pastoralists, especially women, resulting in the development of more appropriate innovations for dryland systems.

Qualitative Impact

The most significant achievement of the partnership was the establishment of **UoN’s Center for Sustainable Dryland Ecosystems and Societies (CSDDES)** linked with CSU’s Africa Center, with a goal of becoming a regional center of excellence in Africa (<http://csdes.uonbi.ac.ke/>). During the beginning phase of implementation, partners conducted a Drylands Community Voices Workshop in Nairobi to engage dryland community members in the development of the center so that it was inclusive and representative of the needs of the drylands’ peoples.

CSDDES developed **critical infrastructure**. First, the CSDDES renovated the UoN drylands field station at Kibwezi to allow for more hands-on instruction in a drylands setting. Second, the CSDDES leadership team established a major Geographic Information Systems (GIS) Laboratory with over 40 computers and associated software. This is the first lab of its kind on the campus of the College of Agriculture and Veterinary Sciences (CAVS). In addition to infrastructure development, partners invested in the

leadership of CSDES, enhancing the Center's capacity for effective management of the partnership program, including training on reporting and financial tracking.

The early steps taken by UoN-CSU to establish a strong foundation for the partnership contributed to the successful achievement of its four core objectives.

Under objective 1, the **creation of CSDES** created a new actor in the global network of institutes and organizations working in the drylands regions in Kenya. Partners were able to advocate and identify investment opportunities for Arid and Semi-Arid Lands (ASAL) in Kenya. Over the life of the partnership, UoN-CSU **leveraged \$1,197,965** in additional funds through grants from government agencies, foundations and private individuals, increasing total funding to the partnership.

Throughout the three-year period of implementation, CSDES increased coordination of drylands resources at UoN.

CSDES initiated a **seminar series** where practitioners presented on natural resource management issues to faculty and students, and discussed policy implications. The forums ignited interest around policy issues and provided an avenue for county governments and development partners to explore investment opportunities in drylands as well as partnership opportunities with CSDES/UoN. Partners organized two **student-led conferences** to share dryland research findings and CSDES-supported experiential training experiences. Policy presentations were presented in the areas of public health, food safety, and disease control in the drylands, sustainable land management in drylands, vulnerabilities and risk management in drylands, governance in dryland and natural resource management in Kenya, and the contribution of development partners through higher education in sustainable development of drylands.

During the life of the partnership, the CSDES **raised awareness** among a large group of stakeholders and created opportunities for collaborations in drylands development. Presentations focused on capacity building for sustainable land management for improved rural livelihoods in ASALs, empowering communities through participatory research in sustainable dryland ecosystems and societies, and Kenya drylands in the context of global and IGAD (Intergovernmental Authority for Development) development policy frameworks.

In addition to in-person advocacy, the partnership developed a robust **online presence** that engaged new audiences in the development issues of the dryland areas and the work of the UoN-CSU partnership (<http://csdes.uonbi.ac.ke>). By the end of the partnership, partners tracked over 9,000 visits to the site and its associated social media sites.

Under objective 2, partners revised the UoN drylands **curriculum** to make it more relevant and supported students at the undergraduate and graduate levels achieve long-term training in Drylands Management through funding and/or mentorship.

CSU and UoN/CSDES engaged faculty team members from both institutions by **developing an e-course entitled, "Sustainable African Dryland Ecosystems and Societies."** The online course is hosted by USAID's RMPortal, and will be accessible to students, practitioners, and other interested parties. Developing innovative teaching and learning methods to reach students through **distance education** was a priority of the partnership and will continue to be a focus for CSDES. Partners also facilitated the review of the Ph.D. in Dryland Resource Management curriculum to include a field component to expose students to action research and experiential learning. Additionally, the partnership supported the review of a new diploma program in Dryland Natural Resources Management. A key component of the program will be experiential learning in field and industrial environments for all students enrolled in the program.

Furthermore, a team from CSDES and LARMAT developed a course on drylands to be part of a new Bachelor of Science in Dryland Economics and Agro-Ecosystem Management at the Sheikh Technical and Veterinary School (ISTVS) in Somalia. This has given UoN/CSDES regional visibility and collaboration.

Partners engaged 274 individuals (98 females) in **short-term trainings**. These short term training sessions contributed to developing skills and knowledge of UoN faculty, staff, and students in the areas of geo-spatial database development and management, the use of course design software and new innovations in e-learning, collaborative research methods, integrated social and ecological field methods, how to publish journal articles, and curriculum development for uploading to online learning management system.

In addition to contributing to improving skills and knowledge of faculty and students at UoN, the partnership held five short-term trainings on the following topics:

- a. GIS and remote sensing
- b. Diploma curriculum review
- c. Range management
- d. Conservation and research methods in the Savanna
- e. Conservation and development in cultural landscapes.

The partnerships supported 62 undergraduate and graduate students (20 females) completing their studies with degrees in Drylands and Range Management, Agro-ecosystems and Environment, and Veterinary Medicine. Through the human capacity built through these specialized **long-term trainings**, the gap of knowledge about the drylands' will shrink and drylands communities will be better equipped to address their development challenges.

Under research objective 3, partners established a **Research for Development Fellowship** Program, designed to support graduate students to transform their research into purposeful, participatory products. UoN-CSU also created a joint **Faculty Team Research Program** to build capacity among faculty to address critical issues in dryland development and sustainability. The constant focus of the partnership was to bridge the gap between the drylands communities and the college classroom, and partners prioritized research that reflected the perspectives of the drylands' peoples.

Through the launch and implementation of CSDDES research **seed grants**, five joint faculty (UoN-CSU) research teams were awarded \$ 8,000 each by the partnership to conduct research in different dryland counties in Kenya. Furthermore, partners produced **23 publications** and **15 policy briefs** on a range of topics including natural resource management, sustainability of ecosystems, food security, pastoral livestock production systems, wildlife conservation, and the dynamics and resilience of rangelands and pastoral peoples around the globe.

Under outreach objective 4, partners held frequent **community engagement workshops** and meetings to assess needs and build new community-driven projects together. The CSDDES increased access to higher education programs by engaging communities in sustainable dryland action, and by actively recruiting students through community and other drylands network linkages. The CSDDES also actively targeted dryland community members for staffing and intern positions. Partners looked for individuals who had relevant and lifelong knowledge and experience in the drylands regions.

CSDDES held three **Stakeholder Feedback Workshops** with community members from Isiolo, Marsabit and Laikipia Counties engaging and receiving feedback directly from the communities where the research took place. In partnership with Christian Impact Missions (CIM), CSDDES conducted a **field assessment and community training** for farmers in Yatta, Machakos County to increase agricultural productivity and food security in the region. Through the training of farmers, CSDDES disseminated management practices and technologies that were expected to enhance agricultural productivity in the Yatta area, Machakos. These interventions included (1) moist gardens technology to enhance soil moisture retention in the dry areas and enhances household level production, (2) Soil fertility testing technology coupled with basic soil fertility management skills to boost production, and (3) Irrigation water analysis using modern testing kits to assist farmers by ensuring quality irrigation water is used for their crops, which sustains optimum production.

One of the partnership's most successful activities that engaged pastoral minorities was its **internship program**. Partners supported 13 interns to work with graduate fellows to obtain specialized skills and to

encourage them to pursue advanced degrees. Eleven of the 13 interns were pastoralists and five of them were females. The interns learned how to design research and to serve communities by sharing their unique, personal perspectives with CSDES.

The project established a partnership with an online portal design specialist and USAID, which offered the use of its online **Natural Resource Management Portal (RMPortal)** at no cost to the partnership. The partners took advantage of the portal to develop the faculty and research network between the universities and to create a platform for delivering online course materials that could be accessed remotely and free of charge (when not for university credit) to interested individuals.

The partnership strived to **increase access** for students from drylands and to award opportunities on a 50-50 (male-female) basis. **Admissions policies** were enacted to ensure that students from underserved areas (and female applicants) were strongly considered. In addition, the partners tried to mobilize resources for students through other partners.

By the end of the partnership, UoN-CSU directly benefited 928 females through skills strengthening, research development, and community outreach.

Quantitative Impact

During the life of the partnership, partners directly **benefited 2,864 individuals** (928 females) through human capacity development activities.

Partners conducted **18 community outreach activities** in the drylands regions of Kenya. Activities consisted of community engagement meetings, agricultural trainings, and research feedback workshops. Communities reached included Narok, Makueni, Isiolo, Marsabit, Kaijado, Turkana, Yatta Machakos, Lolita, Samburu, Taita-Taveta, and Laikipia. Many of the community activities led to strong relationships with local officials and governmental leadership in the regions.

The Centre for Sustainable Dryland Ecosystems and Societies (CSDES) within the Department of Land Resource Management & Agricultural Technology (LARMAT) at UoN supported **62 individuals to complete degrees** (20 females) in Drylands Resource Management, Agro-ecosystems, and Veterinary science. Of these, seven (two females) were awarded Doctorate degrees, 17 (five females) were awarded Master's degrees, and 38 (13 females) were awarded Bachelor's degrees.

UoN-CSU organized **18 short-term trainings** that strengthened skills and knowledge for **274 individuals** (98 females). A sample of workshop titles included; Geo-Spatial Database Development and Management, Dryland Ecosystems and Societies, Natural History of Mammals, Collaborative Research Methods, Introduction to Geographical Information Systems and Remote Sensing, and Publishing Journal Articles.

Partners organized **two student led conferences** that were attended by more than 800 participants. The first conference served as a feedback forum for all students supported by CSDES and provided a platform for interaction between students, faculty and other project stakeholders. Undergraduate students shared experiences on internships and experiential courses while graduate students presented research findings. The second conference had a stronger policy focus and encouraged dialogue around critical issues in dryland research.

During the course of the project, UoN-CSU partners submitted 40 proposals and **leveraged \$1,197,965** in additional funds through grants from government agencies, foundations and private individuals, increasing total funding to the partnership by 84.1%.

Finally, partners greatly contributed to the field of research during the three years of project implementation. UoN-CSU funded **13 Graduate Research Fellows** and **five seed grants** for joint research around subjects including food security, human-wildlife conflicts, livestock disease, community mapping, and indigenous knowledge. Partners produced **23 publications** and **15 policy briefs** on subjects including camel milk marketing, food security, forest and land management, rangeland

rehabilitation, resilience of urban pastoralists, productivity of irrigated pasture, livestock diseases, wildlife tourism, grass farming, pastoral indigenous knowledge, medicinal plants and conflict management.

Table 1 and Table 2 illustrate the full quantitative impact of the partnership.

Constraints and Opportunities

Partners found the most challenging constraint to be the changing nature of indicators and definitions, as well as objectives for the donor-required M&E Plan. The constant changes were counterproductive and made it difficult to measure achievements consistently as the project progressed.

The U.S. partners had trouble with fiscal management. From CSU's perspective, it was difficult to take on all the financial risk of the project, and they believed that sharing this burden with the donor would have helped. Unlike other U.S.-lead HED partner institutions, CSU was unable to work out an arrangement for advancement and reimbursement of funds with UoN at the outset of implementation and instead negotiated with UoN to advance its own institutional funds for implementation.

Reduced funding slowed down the engagement of CSDES-affiliated students in mentorship/internship programs and limited the number of outreach and awareness raising activities. The partnership resolved this challenge by leveraging resources through its partners.

Aligning the partnership to Feed the Future (FTF) objectives and planning for the additional obligation of funds/extended period of performance created interruptions in implementation, but it also created an opportunity for partners to revise their plans and goals. Revised objectives and activities reflected the decentralization endeavor in Kenya and allowed partners to meet the development goals in dryland counties.

Finally, University of Nairobi leadership went through a leadership transition at the Vice Chancellor level. This situation created delays in approvals of procurement and expenses, leading to implementation delays. Partners worked closely with the Administration and Finance divisions of UoN to fast-track activities. Many CSDES staff members worked over-time to meet the objectives of the project.

Despite the challenges, one of the key lessons learned was the immense value of creating an African-led development-focused and demand-driven institution to spanning the boundaries of two universities, USAID, multiple dryland communities and counties, and development practitioners. The problems that the partners attempted to address were immense and their work needs to be expanded. The partners are motivated to build upon what they have started and meet the expectations of marginalized peoples in drylands, and to deliver the fundamental education and research that they need. The full institutionalization of ideas and lessons learned from the project requires additional financial support to achieve sustainability and to keep communities engaged in the development of dryland ecosystems and societies.

Project Administration

HED/ACE worked closely with Colorado State and University of Nairobi partners toward quality and timely submission of quarterly financial expenditure reports, and annual and semi-annual implementation progress reports. HED provided guidance on issues such as developing monitoring and evaluation plans, budget realignment, and timely implementation of planned activities.

II. KEY ACHIEVEMENTS (QUALITATIVE IMPACT)

Objective 1: Improved coordination of interdisciplinary education, research and outreach for drylands in Kenya.

Creation of Center for Excellence—CSDES: This partnership started with a workshop entitled, Dryland Community Voices: Setting a Joint Agenda in Higher Education and Development from the Ground Up, with a goal to design the work of the partnership to meet the needs of drylands communities and other dryland partners. Participants recognized the importance of creating a networking center of excellence that was also closely connected with the drylands communities, hence the birth of the CSDES. The idea of the Center was to create a small and nimble innovation hub within the large university setting, composed of action-oriented groups of practitioners, faculty and students to ensure that the education and research benefited African drylands and the communities that depend on them. The engagement of the highest administrators at both universities was critical to the success of both centers, as shown by the near institutionalization of CSDES at UoN and the full institutionalization of The Africa Center at CSU.

Today, CSDES is recognized and supported well beyond UoN by many Kenyan dryland communities and policy makers for its focus on critical dryland development issues with high policy relevance, driven by the needs of local communities. Evidence of this support is the success of CSDES in attracting additional grant funds for its programs from education donors like the Meeker Foundation, major research donors like the US National Science Foundation and major development donors like DFID, IDRC, USAID, and IGAD.

Improved Coordination: CSDES participated in numerous policy meetings throughout the life of the partnership that enhanced coordination of work with other local initiatives and organizations. CSDES engaged with the ASAL Stakeholders Forum (ASF) secretariat to develop a strategic plan for ASF and to identify investment opportunities for Arid and Semi-Arid Lands (ASAL) in Kenya in line with the existing policy framework.

The following collaborative relationships were established by CSDES.

- CSDES signed a MoU with a community based organization called Christian Impact Missions (CIM) doing community development work in Machakos County to collaborate in capacity building, research and up-scaling of best practices in dryland agriculture, food security and climate change adaptation in Yatta, Machakos.
- CSDES initiated partnerships with the County Government of Marsabit, through the County Ministry of Agriculture, Livestock and Fisheries, to strategize ideas around livestock, agriculture and natural resource management.
- CSDES together with the Kenya Agricultural and Livestock Research Organization (KALRO) KALRO and Pastoral Community Initiative and Development Assistance (PACIDA) received a \$200,000 grant, through Intergovernmental Authority for Development (IGAD), for applied research in the drylands to address issues of resilience to drought and climate change in northern Kenya.
- Partners engaged several stakeholders through conference participation and course facilitation.
 - UNDP gave a presentation on sustainable land management during a student-led conference held in June of 2014.
 - The National Drought Management Authority (NDMA) also participated in the student-led conference by giving a keynote address on “Vulnerabilities and Risk Management in Drylands”.
 - Two International Livestock Research Institute (ILRI) scientists facilitated a short course on collaborative research methods.

- CSDES signed a Memorandum of Understanding (MoU) with the Centre for Dryland Agriculture (CDA) of Bayero University, Kano, Nigeria. CSDES and CDA intend to collaborate on research, staff and student exchanges, and customized short-term trainings.

Raising Awareness: The CSDES Director and staff are its greatest ambassadors. Between 2011-2014, CSDES leadership presented to a large number of audiences, capturing the interest of many key stakeholders and leading to new partnerships, which have leveraged additional resources and prompted new joint collaborative activities.

Contributing to raising awareness about drylands development, CSDES gave presentations and participated in workshops and meetings that created opportunities for better working relations. Some of the presentations included:

- “Capacity building for sustainable land management for improved rural livelihoods in ASALs” at a Stakeholder Workshop on Sustainable Growth and Adaptation in the Arid and Semi-Arid Lands of Kenya, held on November 27, 2013.
- “Empowering communities through participatory research for building resilience and economic growth in Northern Kenya” at a research feedback stakeholders’ workshop for Marsabit County on March 12, 2014.
- "Assessing 2011 drought response initiatives in the Greater Horn of Africa" at the Princeton experimental African Drought Monitor Training Workshop, held October 19- 21, 2013 in Niamey, Niger.
- “Overview of Kenya drylands in the context of global and IGAD development policy frameworks” at a workshop hosted by the Princeton Global Collaborative Network aimed at fostering collaborations across disciplinary and political boundaries, held on August 26-28, 2014.

Online Presence: CSDES created and launched its website and social media outlets in late 2011 and has been posting activities since then, primarily on its website, but also on Facebook, Twitter, and YouTube. CSDES updated content on a regular basis (<http://csdes.uonbi.ac.ke>) to inform and engage interested parties in the development issues of the dryland areas and the work of the CSU-UoN partnership. The partners used software called ClustrMaps to track the number of visits to the website. As of October 30, 2014, partners tracked over 9,000 visits to their website and social media sites during the three years of the project.

Joint Research: Partners implemented 11 joint research projects over the life of the partnership. Partners conducted six joint research projects in which six CSDES graduate students worked with Kenyan organizations, including the Mpala Research Center, King’s University College, the Africa Conservation Centre, USAID/Kenya, and the National Museums of Kenya. Research focused on the socio-economic effects of military training in Laikipia County; human-wildlife conflicts in the Tsavo West– Amboseli agro-ecosystem; and implications of land use change in Kajiado on agricultural production and gender roles.

Through the launch and implementation of CSDES research seed grants, five joint faculty (UoN-CSU) research teams were awarded \$ 8,000 each by the partnership to conduct research in different dryland counties in Kenya. Below are brief descriptions of each project:

1. Community knowledge and perceptions on food security and nutrition in Isiolo to identify the sources of livelihood and food security for the community. (Research team- UoN: Wambui Kogi-Makau, Octavian Gakuru; CSU- Kathy Galvin)
2. Integrating local communities into the management of human-wildlife conflicts in Tsavo, Taita Taveta County: Contribute to human-wildlife conflict reduction and improve community livelihoods in the Tsavo west buffer zone. (Research Team - UoN: Moses Nyangito, Cecilia Onyango; CSU- Stacy Lynn)
3. A multi-stakeholder study to enhance the control of livestock disease that limit production access

markets in dryland sites in Marsabit Kenya - to enhance the capacity of local communities in Marsabit to control livestock diseases that limit production and access to markets. (Research Team -UoN: Peter Gathumbi, Isaac Mulei; CSU- Mike Coughenour)

4. Quantifying lost livelihoods by defining risk thresholds of productive assets among urban-proximate pastoral communities in Kajiado County - to assess and explicitly define the risk thresholds of determinants of resilience in pastoral households in Kajiado County in southern Kenya (Research Team -UoN: Laban MacOpiyo, Oliver Wasonga; CSU- Randall Boone)
5. Stories lived and told: recapturing generational exchanges of environmental traditions in Samburu County whose objective is to strengthen and recapture the relationship between youth and their land amongst pastoralists in northern Kenya. (Research Team-UoN: Moses Nyangito; CSU- Brett Bruyere)

Objective 2: Greater capacity of students and faculty to address the problems of dryland ecosystems and societies.

Curricula Revised: CSDES convened a curriculum review workshop to review four programs within the department of LARMAT. The programs reviewed included these degrees: a Ph.D. in Dryland Resource Management, a M.Sc. in Land and Water, a M.Sc. in Range Management, and a B.Sc. in Range Management. Both UoN and CSU faculty and scientists were actively involved in these efforts, which were being conducted in a participatory manner with dryland stakeholder input from various regions of Kenya.

Partners contributed to the development and revisions of the following curricula:

1. The partnership developed a new online program entitled, “Sustainable African Dryland Ecosystems and Societies.” The program was mounted on the USAID RMPortal Online Learning Management system. It is expected that once the course is reviewed and approved by UoN and CSU, the respective institutions will offer the course and develop certification procedures. The curriculum was developed jointly by UoN and CSU team members, consisting of 11 instructors, 11 staff, and 6 Ph.D. students.
2. Through resources leveraged from UNDP Kenya, CSDES facilitated the revision of the Ph.D. in Dryland Resource Management curriculum, with the input of teaching staff and postgraduate students. The revised Ph.D. program contains a field induction component to expose students to action research and experiential learning.
3. The partnership also supported the review of a new diploma program in Dryland Natural Resources Management. All of the units in this diploma program were reviewed. The diploma course focuses on experiential training for technical officers who will be directly involved in management of dryland resource management. A key component of the program will be field and industrial involvement for all students enrolled in the program.

In addition to the curricula improvements at UoN, faculty also helped to develop a drylands curriculum for the Sheikh Technical and Veterinary School (ISTVS) in Somalia. The team received input from the Intergovernmental Authority on Development and the NGO TerraNuova to create coursework and admissions guidelines for the Bachelor of Science in Dryland Economics and Agro-Ecosystem Management.

Experiential Education: The partners jointly created several opportunities for experiential and applied learning for students in the LARMAT Department. Engaging with practitioners and working on the ground in dryland communities, partners built strong connections to dryland issues for these students, allowing them to better see their potential to influence sustainability and change.

Experiential and Applied Learning activities included:

1. Field courses (CSU-led and UMI-led)
2. CSDES Seminar series with invited practitioner speakers
3. Drylands Internships

4. PhD student community engagement (a formal requirement of the program)
5. Distance Education stakeholder meetings - student/intern attendees

Long-term Training: The Centre for Sustainable Dryland Ecosystems and Societies (CSDDES) within the Department of Land Resource Management & Agricultural Technology (LARMAT) at UoN supported 62 individuals (20 females) to complete degrees in Drylands Resource Management, Agro-ecosystems, and Veterinary science. Of these, seven (two females) were awarded Doctorate degrees, 17 (five females) were awarded Master's degrees, and 38 (13 females) were awarded Bachelor's degrees.

CSDDES used the graduate fellowships and seed research grants to support promising graduate students for faculty development. Four of the 13 graduate students (Staline Kibet, Judith Mbau, Oscar Koech, and Stephen Mureithi) who received partial support from CSDDES were recruited by the Department of Land Resources Management and Agricultural Technology (LARMAT), University of Nairobi. Several others received teaching positions in other universities (Frankline Otiende, Maseno University; Elizabeth Muthiani, South Eastern University; Bibianne Wanja, Mt Kenya University). Others are teaching part-time (Patrick Watete, UoN; and Henry Mwaka, Chuka University). CSDDES leveraged funds from the Mpala Research Center's Meeker Family Fund (Laikipia) for full scholarships to support six undergraduate and four Masters students from underserved dryland areas.

Short-term Training: Partners engaged 274 individuals (98 females) in short-term trainings. These short term training sessions contributed to developing skills and knowledge of UoN faculty and staff, as well as students in the areas of geo-spatial database development and management, the use of course design software and new innovations in e-learning, collaborative research methods, integrated social and ecological field methods, how to publish journal articles, and curriculum development for uploading to online learning management system. Between March 2012 and October 2014, the following trainings were implemented.

1. The Agent-based modeling course was a two-week training aimed at introducing the Ph.D. student participants to the principles of Agent Based Modeling. It equipped them with skills to be able to create their own models for solving research problems using the accessible NetLogo platform.
2. The Situation Assessment (one-day) course provided an important introduction to the concept of systems thinking to drylands graduate students. It took them through exercises to apply systems thinking to their proposed research projects, and to carry out a preliminary situation analysis and the development of a collaborative research plan specific to their unique situations.
3. The course on Participatory Research was also one day in length and was taught to undergraduate students. Students were presented about participatory research method that was found useful in involving the Samburu community in a research to identify conservation priorities and capacity-building needs in the region.
4. The Mpala field course on Computational Ecology was aimed at seeing how computer technology can be used to ease fieldwork for ecologists. It also helped to develop an appreciation between ecologists and computer scientists about their respective professions.
5. Partners implemented a series of trainings, including two experiential field courses that trained 58 individuals (18 females).
6. Training was conducted in GIS that covered spatial data and design, single- and multiple-layer analysis, queries and reasoning, transformation, interpolation and density functions, analysis basics, and indices and suitability modeling. This introductory course exposed the 26 participants (five females) to the GIS environment and applications.
7. Seventeen individuals participated (four females) in an E-Learning course. The potential of the e-learning mode of course delivery stimulated interest among faculty members to adopt e-learning, a practice that aligns with the UoN's policy to convert all courses into e-modules.
8. Twenty-four students (nine females) attended a lecture on the contrast between the North American ranching model and East African pastoralism model in an Introduction to Range Management course.
9. CSDDES worked with Goshen College (Indiana) to organize the field course, "Conservation and Research Methods in Savannas" at the Mpala Research Center in Laikipia County. The Center hosted two students (one female) and faculty.

10. University of Michigan worked with CSDES to organize a two-week field course entitled "Conservation and Development in Cultural Landscapes" for six (three females) undergraduate students. Students visited Masai Mara and the Mpala Research Center. This experiential field course exposed students to real world aspects of data gathering.
11. Mr. Peter Mwangi, CSDES IT Officer was partially sponsored to take a four-week GIS course to develop technical skills in Geo-Spatial Database Development and Management. The skills obtained are expected to support CSDES in creating a regular short GIS courses at UoN's College of Agriculture and Veterinary Sciences.
12. Six UoN faculty members (one female) participated in the development of an online, distance education course entitled "Dryland Ecosystems and Societies." Trainees were introduced and trained in the use of course design software and new innovations in e-learning.
13. Two undergraduate students (one female) from University of Nairobi joined a group of students from Princeton University for a 3-week course on Natural History of Mammals. The course objective was to introduce the students to concepts, methods, and material of comparative natural history, with African mammals as focal organisms. Perspectives shared included morphology, identification, evolution, ecology, behavior and conservation. Observations and experiments were conducted on a variety of species in different habitats. This short course provided insight into the adaptive value and underlying mechanistic function of mammalian adaptations. This course was taught in Kenya, at the Mpala Research Center and other sites in Laikipia.
14. Nineteen students (six females) from LARMAT and UoN attended a three-day training on collaborative research methods. The goal of the training was to enhance the quality of research conducted by the graduate students and focused on: science and management as a power structure; principles of collaborative research; and development of research ideas.
15. Seventeen students (five female) from LARMAT/CAVS attended a training entitled, "Introduction to Geographical Information Systems and remote sensing" to become equipped with GIS skills to upscale and complement their research projects. The training emphasized the utility of GIS in several areas of application.
16. Eight undergraduate students (four females) from CSDES/LARMAT attended a short experiential field course that integrated social and ecological field methods in Kenya. Students learned both social and ecological field methods by participation in inquiry-based experiences in Kenya.
17. Twenty-seven students and practitioners (13 females) from various disciplines at UoN CAVS participated in a one-day workshop/training on "How to Publish Journal Articles", focusing on the various steps to follow from conceptualization to publication of the journal article.
18. The partnership held a training workshop for twelve (three females) UoN faculty members participating in the development of a joint e-course on "Sustainable African Dryland Ecosystems and Societies". The workshop focused on two major areas: (1) Online Education and the RMPortal and (2) Course Development. The training was instrumental in helping the faculty members to develop curriculum materials for uploading to the RMPortal online learning management system.

Policy seminars: Partners expanded learning opportunities through a series of policy discussions from experts in the field. Topics included global knowledge management, pollination and ecosystems, sustainable livelihoods, modeling and land use, and features of Kenya's National Parks.

Objective 3: Increased research capacity and policy-relevance, and resource directions and innovations appropriate for Kenyan drylands.

The Dryland Community Voices Workshop, which involved 100 total attendees (community members, NGOs, private sector, publicity, higher education, and others) from around the country created a platform for dryland communities and organizations to voice challenges related to dryland sustainability and higher education access for dryland communities. It also facilitated the Center in setting its agenda, short and long-term goals, and next steps for research and outreach according to the needs voiced by the dryland communities.

Student-Led Conferences: In May 2013 and June 2014, CSDES-supported students, with CSDES staff, organized two major conferences to share their research results with dryland communities and other stakeholders. The conferences also enhanced networking among young professionals, research institutions and policy makers, and motivated young professionals to contribute to dryland development. These landmark events attracted widespread participation among students, faculty, development practitioners, government officials, and dryland community members. Six hundred students and other stakeholders participated in the 2013 conference, 300 participated in the 2014 conference. A couple of the important speakers included a representative from USAID Mission Kenya (Mr. Isaac Thendiu in 2013, and Dr. Millie Gadbois in 2014, Coordinator, Feed the Future Kenya Program). Others included Nancy Chege, UN Development Program, Kenya; John Smith, Director for Democracy, Rights and Governance, USAID Kenya; and Prof Agnes Mwangi'mbe, Principal, College of Agriculture and Veterinary Sciences, UoN.

During separate sessions of the second student-led conference, five presentations focusing on policy issues were presented. The titles of the presentations were:

1. One Health: A holistic approach to public health, food safety, and disease control in the drylands.
2. Sustainable land management in drylands
3. Vulnerabilities and risk management in drylands
4. Governance in dryland and natural resource management in Kenya
5. The contribution of Development partners through Higher Education in Sustainable Development of Drylands- USAID Kenya

Outreach/engagement: Partners implemented 18 outreach activities in drylands communities during the life of the partnership. The outreach/extension activities conducted by partners helped to identify community challenges and develop appropriate solutions.

Kajiado Community Engagement: CSDES assisted partners in collecting views from stakeholders on drylands training and education needs, target groups, types of courses and physical capacity of delivering courses. Representation from the Kajiado community was composed of a diverse set of young to middle-aged professionals, most of whom had already had some schooling.

Taveta Community Training: CSDES worked with communities in Taveta District to create community-driven trainings related to dryland human-wildlife conflict in a train-the-trainers model.

Samburu Outreach: CSDES conducted an outreach activity in the Samburu, Archers post area. CSDES held focus group discussions to study indigenous knowledge and the role it can play in the livelihoods of the local community.

Isiolo County action research feedback/dissemination workshop: The aim of the feedback workshop was to share action research findings with key stakeholders engaged in Arid and Semi-Arid Lands (ASAL) development in Isiolo County where CSDES supported several research activities. Three PhD students supported through research for development funds and two faculty members who received research seed grants from CSDES shared research results. Presentation titles included, "The potential of camel milk production as an adaptation to climatic variability in the Drylands of Kenya," "Performance & quality of irrigated pastures in the drylands of Kenya; Bura and Katilu Irrigation Schemes," and "Community knowledge and perceptions on food security and nutrition in Isiolo." Additionally, CSDES made a presentation on the Center's higher education model for drylands development. The audience included the deputy governor and county officials of Isiolo, as well livestock association members and representatives of local NGOs.

Marsabit County action research feedback/dissemination workshop: CSDES in partnership with another USAID-funded project, REGAL-IR (Resilience and Economic Growth in Arid Lands), jointly held a feedback workshop in Marsabit County to share findings of action research conducted in Marsabit, and relevant studies conducted in neighboring dryland counties. The keynote presentation at the workshop was entitled, "Implementing Participatory Community-Led Resilience: The Case of Marsabit Agro-Pastoral Farmers' Self-Help Groups." The meeting was attended by 34 county officials, NGOs, livestock association representatives, and community members who participated in one of the

studies. The meeting provided feedback that would enhance targeting of initiatives for increasing economic growth and resilience in the county. As a result of the workshop, the county government approached CSDES for assistance in strategic planning for the county.

Laikipia feedback workshop: CSDES facilitated a feedback workshop in Nanyuki Town, Laikipia County. Graduate students focusing on conservation who received funding from CSDES shared their research findings with community members, private conservancies and the county government. During the workshop, CSDES engaged the county government and community members on ways of addressing conservation and land-use related challenges in the county. The following presentations were given at the workshop: “Evaluating the effects of military activities on the distribution and abundance of wildlife on Mpala Ranch,” “Community experiences on natural resource conservation and governance: A case study of Il Ngwesi Conservancy in Laikipia County, Kenya,” and “The effect of community wildlife sanctuaries on pastoral livestock production systems.”

Yatta District, Machakos: CSDES conducted a one-day field visit in February 2013 to a community-based livestock and agricultural project in the semi-arid county of Machakos. The visit was meant to strengthen community outreach and explore opportunities for working with the community to promote good practices, particularly in water harvesting. This meeting was community-driven, and community members requested the opportunity to work with CSDES to both document their successes, and to deliver demand-driven trainings in subjects that they have not yet mastered.

Furthermore, CSDES conducted a three-day training in Machakos for the farmers/ members of the Christian Impact Mission's Operation Mwolyo Out project. The training involved demonstrations on: water conserving dryland farming technologies (mainly the 'moist bed'); energy saving cooking using a 'fireless cooker'; on farm soil testing; agrometeorological data collection (temperature and humidity) and interpretation; and participatory GIS for mapping community resources. The training objectives were: (1) to increase farm-level crop productivity in a sustainable way; (2) enhance efficiency of household fuel wood energy consumption and reduce pressure on tree cutting for fuel wood. Partners documented 37 participants, but the reach was much larger because several participants from Tanzania also benefited from the demonstrations on the water conserving dryland farming and energy saving technologies.

Policy Recommendations: Through the work of the CSDES outreach initiatives, conferences, and seminars, the following policy briefs were developed and disseminated to stakeholders and community. Detailed descriptions of each policy brief can be found in the partnership's Final Report, Attachment I.

1. Range Rehabilitation for Wildlife Conservation and Pastoral Livestock Production
2. How Food Secure Is Isiolo County? The Community Perceptions
3. Communal Land And Forest Management For Sustainable Livelihoods In The Dry Lands: The Case of Loita Division Narok South Sub County.
4. Is Irrigated Pasture Production The Future Of Pastoralists In The ASALS Of Kenya?
5. Landscape Interventions To Manage Common Resources In The Wildlife Migratory And Dispersal Areas in Isinya, Kajiado County
6. Sustainability Challenges Of Community Wildlife Conservancies
7. Defining Resilience Thresholds Of Productive Assets Among Urban-Proximate Pastoral Communities In Northern Kenya
8. Pastoralism Persistence Against Adversities: Is This A Role Of “The Invisible Hand” Or Shrewd Strategy?
9. A Multi-Stakeholder Study to Enhance the Capacity of Local Communities in Marsabit to Control Livestock Diseases that Limit Production and Access to Markets
10. Can Wildlife Based Tourism Co-Exist With Military Training?
11. Grass Farming As A Drought Coping Strategy In The Kenyan ASALS
12. Efficacy Safety And Conservation Status Of Medicinal Plants Used To Treat And Prevent Malaria In Embu county, Kenya
13. Major indicators of food security resilience among pastoralists of northern Kenya
14. Managing Human-Wildlife Conflicts: “The Other Option
15. Camel Milk Production: An Opportunity For Resilient Pastoral Households in The Dryland of Kenya

Objective 4: Greater participation in higher education by pastoralists, especially women, resulting in the development of more appropriate innovations for dryland systems

The goal of CSDES at UoN was to transform higher education by enabling and supporting relevant action research and engagement in dryland communities, and by making higher education more accessible to dryland communities to build human and institutional capacity for sustaining and improving dryland ecosystems and human livelihoods in Kenya and beyond. The CSDES increased access to higher education programs by engaging communities in sustainable dryland action, and by actively recruiting students through community and other drylands network linkages. The CSDES also actively targeted dryland community members for staffing and intern positions. Partners looked for individuals who had relevant and lifelong knowledge and experience in these regions.

Partners considered all individuals from drylands to be under-represented or disadvantaged in higher education. These individuals included pastoralists and hunter-gatherers. Partners recognized that while many pastoralists conduct some agriculture in addition to herding, they differentiate themselves from more traditionally agricultural and agro-pastoralist communities, and are historically more educationally disadvantaged. Women from drylands were considered even more under-represented than men.

Access: The partnership strived to increase access for students from drylands and to award opportunities on a 50-50 (male-female) basis. Admissions policies were enacted to ensure that students from underserved areas were strongly considered. In addition, the partners tried to mobilize resources for students through other partners.

Distance Education: Another way in which the partnership increased access to tertiary education was by collaborating to develop distance and online education courses, which allowed the program to reach populations who traditionally were unable to attend universities. Through a partnership with an online portal design specialist and USAID, which offered the use of its online Natural Resource Management Portal (RMPortal) at no cost to the partnership. The partners took advantage of the portal to both further develop the faculty and research network between the universities and to create a platform for delivering online course materials.

New Technologies: Through the training of farmers, CSDES disseminated management practices and technologies that are expected to enhance agricultural productivity in the Yatta area, Machakos.

The technologies developed and disseminated were:

1. Moist gardens technology enhances soil moisture retention in the dry areas and enhances household level production.
2. Soil fertility testing technology coupled with basic soil fertility management skills is expected to boost production.
3. Irrigation water analysis using modern testing kits assists farmers by ensuring quality irrigation water is used for their crops, which increases and sustains optimum production.

Funding Proposals: Over the life of the partnership, partners submitted 40 proposals for funding to strengthen and sustain the work of CSDES and to widen the scope of opportunities for drylands community members.

These proposals addressed development challenges in Kenya, including promoting social and environmental safety nets to build resilience in Kenya's drylands, community based approaches for the control of Transmissible Animal Diseases, dryland cropping Small-scale Irrigation and Rainwater Harvesting in Karamojong cluster, and sustainable land management. A sample list of donors included: U.S. Department of the Interior (USDI) Joint Fire Science Program; CSU; NSF Geographic and Spatial Sciences Program; NSF Ecosystems Studies; CSU; Ministry of Northern Kenya/UE-Kenya Rural Development Program, Christensen Fund, and Africa Union – Interafrican Bureau for Animal Resources (AU- IBAR). A sample list of donors included: U.S. Department of the Interior (USDI) Joint Fire Science Program; CSU; NSF Geographic and Spatial Sciences Program; NSF Ecosystems Studies; CSU; Ministry of Northern Kenya/UE-Kenya Rural Development Program, Christensen Fund, and Africa Union – Interafrican Bureau for Animal Resources (AU- IBAR). The following nine proposals were awarded. At the close of the partnership, partners had several outstanding proposals still pending.

1. The **USAID-CRSP** granted CSU's Prof Galvin \$80,000 to conduct a workshop and develop an award-winning participatory video on climate change and pastoralism in East Africa. 2011.
2. NSF-CNH funded a proposal entitled: "Assessing vulnerability of provisioning services in the southern highlands of Ethiopia", (Galvin, Co-PI and Lynn, Senior Investigator) [FUNDED \$250,000]
3. **CSU** granted Prof Galvin and the CSU team \$20,000 to establish The Africa Center (original called the Global Challenge Research Team called Sustainable African Ecosystems and Societies). 2013
4. The **US National Science Foundation** granted CSU's Dr. Bowser \$749,697 to create the Global Research Network on Women and Sustainability to mentor underrepresented women and women from developing countries in research on environmental sustainability. 2011- 2014.
5. The **International Social Science Research Council** granted Prof Galvin \$40,782 to develop a transformative knowledge network for the rangelands in Kenya, Mongolia and the US. 2014-2015.
6. **DFID is in the final stage of announcing** pre-awarded Mercy Corps and Prof Njoka (CSDDES budget component of \$35,000 per year for three years 2015-2017) to build resilience for climate extremes and Disasters. 2014.
7. **IGAD** Resilience program made a pre-award to Prof Jesse Njoka for a project on applied research to enhance resilience of livestock-based livelihoods in Northern Kenya (with KARI& PACIDA). \$200,000 July 2014 to November 2015.
8. **IDRC/SSHRC** awarded a proposal to look at institutional innovations with the Institutional Canopy of Conservation, with McGill University & ACC - CSDDES is a collaborator in this project.
9. The **CSU's Water Center** awarded Dr. Stacy Lynn \$30,000 to conduct a pilot study on governance of the recently discovered water aquifers in Turkana, Kenya, and to pull together another proposal for NSF.

Lessons Learned

Inclusive Capacity Building: The involvement of practitioners and external stakeholders in knowledge exchange and information sharing was a good practice and therefore an important approach in enhancing the link between the academic sphere and practice. The growing interest among students, faculty and staff at UoN to attend seminars and public lectures whose speakers/presenters were drawn from external stakeholders reflects this.

Importance of Institutionalization: Partners learned that it takes time to mobilize support within the UoN system (the department and UoN management, Senate, University Council) to support a project's institutionalization. Because of CSDDES's success, its institutionalization is being fast-tracked. The UoN administration has expressed the desire that CSDDES be upgraded from a center to an institute to give it wider mandate within and without the University.

Value of engaging Drylands Communities: CSU-UoN partners realized that communities and counties in drylands areas are ready and willing to take up research findings and there is a high demand for well-designed/practical research outputs and technologies. Furthermore, the project realized that it needs to collaborate closely with other partners to build the human/technical capacity of communities and county governments to facilitate application of sustainable land management practices, governance (in natural resource management), and economic growth and resilience building.

Host-Institution Ownership of Partnership Activities: Partners learned the importance of transferring project responsibilities to local partners early in the project's life cycle. By supporting local (CSDDES) staff and building leadership early on, the partnership knew that it would have better opportunities for sustainability. By the end of the partnership, almost all activities were transferred to CSDDES including reporting and tracking finances.

III. ACTIVITY PROGRESS (QUANTITATIVE IMPACT)

Structured around the partnership's M&E plan, this section examines the partnership's achievements, and presents data supporting progress toward achievement of the targets for each indicator. Results are presented based on performance against the partnership's targets for Higher Education Standard Indicators. Partners added several custom indicators during the second year of the partnership. Data in this report is based on annual and semi-annual reports, a final report (Attachment A) and success stories that were submitted by partners throughout the three-year period of implementation.

During the last two years of the partnership, HED utilized results-based management principles and a management information system (Partnership Results and Information Management Engine, or PRIME) to manage the performance of higher education partnerships. The HED reporting system, therefore, became more systematized and robust, in the second year of the partnership performance period, with data verification and substantiation of documents supporting data. The partnership's M&E plan and reporting in FY11 was not systematized affecting the quality of data and reports. During the first half of the performance period, the partnership was affected by several changes in USAID standard indicators and their definitions.

Disaggregated data for all activities was not available. Furthermore, for several activities under outreach and short-term training, individuals may have been counted more than once.

TABLE I: PERFORMANCE DATA TABLES FOR STANDARD INDICATORS

OUTREACH: Number of higher education institution outreach / extension activities in the host country community						
UNIT	DISAGGREGATE BY: Location, event, date and gender					
Number of outreach activities	Geographic Location	Activity Title	Date	W	M	Subtotal
	Kenya's pastoral and agro-pastoral areas, represented by lower eastern (Kitui, Mwingi and Makueni), north-eastern (Mandera/Somali ecosystem), north-western (Turkana County) and South Rift (Kajiado and Narok counties).	1. Community Baseline Survey & Needs Assessment in Drylands Regions of Kenya	Oct.-Nov. 2011	N/A	N/A	198
	University of Nairobi	2. "Dryland Community Voices: Setting a Joint Agenda in Higher Education and Development from the Ground Up" Workshop	Nov. 30-Dec. 1, 2011	N/A	N/A	46*
	*Subtotal for Activity 2 was taken from PRIME. Partners reported 100 (43W, 55M, 2NA) in their Final Partnership Report, however these numbers were not substantiated.					
	Loita Cultural and Resource Centre in Narok County	3. Lolita Community Meeting	Feb. 2012	N/A	N/A	12
	Samburu county, Isiolo County, and Makueni county	4. Community Stakeholders consultative meeting – education needs and delivery	N/A	N/A	N/A	87
	Kajiado County	5. Field Assessment and Community Engagement	Nov. 2012	9	8	17
	Machakos County	6. Field assessment of community needs	Feb. 2013	4	11	15
	Marsabit County	7. Field assessment of community needs	May 2013	1*	19*	20*
Taita-Taveta County	8. Community-driven Trainer of	May 2013	2*	10*	12*	

		Trainers program					
Kaijado County	9.	Launch of the national Agricultural Sector Development Support Programme (ASDSP)	July 2013	N/A	N/A	100*	(estimated number of participants)
Samburu County	10.	Field assessment and community engagement	August 2013	50*	40*	90*	
*Subtotals for Activities 7-10 are estimates. For outreach activities not fully organized by CSDES, it was difficult to collect data on participants due to the nature of the communities reached and documentation collection standards.							
Isiolo County	11.	Research Feedback Dissemination Workshop	October 2013	5	18	23	
Yatta Machakos County	12.	Yatta Machakos: Follow-up Workshop	November 2013	19	16	35	
Laikipia County	13.	Research Feedback Dissemination Workshop	March 2014	3	20	23	
Marsabit County	14.	Research Feedback Dissemination Workshop	March 2014	2	32	34	
University of Nairobi	15.	Student Led Conference	June 2014	N/A	N/A	307	
Yatta Machakos County	16.	Field Assessment with Christian Impact Mission	July 2014	2	12	14	
Yatta Machakos County	17.	Training of Farmers	Sep. 2014	15	22	37	
Isiolo County	18.	Livestock Workshop	Oct. 2014	2	16	18	

Results:

Baseline	FY12 (October 1, 2011-Septemeber 30, 2012)		FY13 (October 1, 2012-September 30, 2013)		FY14 (October 1, 2013-September 30, 2014)		End of Partnership	
	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
N/A	6	4	5	6	12	8	23	18

SHORT-TERM TRAINING: Number of host-country individuals (faculty and / or teaching staff, students, and administrative / other staff) affiliated with the host-country institution who completed short-term training programs

UNIT Number of host country individuals trained	DISAGGREGATE BY: Location, event, date and gender						
	Geographic Location	Activity Title	Date	Time	W	M	Subtotal
	University of Nairobi	Agent Based Modeling Training	March 2012	2 wks.	25	24	49
	University of Nairobi	Participatory Research Training	March 2012	1 day			
	University of Nairobi	Situation Assessment Training	March 2012	1 day			
	Mpala Research Center	Computational Ecology Training	March 2012	2 wks.			
*Disaggregated data was not collected for each activity conducted in March 2012.							
	University of Nairobi	Summer 2012 short-term trainings – including two dryland experiential field courses	Summer 2012	1 day – 2 wks.	18	40	58
	University of Nairobi	Distance Education—Intro to Range Management	Oct. 2012	1 day – 1 wk.	9	15	24
	University of Nairobi	Distance Education—Diploma Curriculum Review Workshop	Oct. 2012	1 day – 1 wk.	4	13	17
	University of Nairobi	GIS and Spatial Analysis Training	March 2013	1 day – 1 wk.	5	21	26
	University of Nairobi	UoN-Goshen field course—Conservation and Research Methods in Savanna	June 2013	1 wk.- 6 mos.	1	1	2
	University of Nairobi	UoN-University of Michigan Field Course—Conservation and Development in Cultural Landscapes	August 2013	1 wk.- 6 mos.	3	3	6
	University of Nairobi and Regional Centre for Mapping	GIS Course	Jan.-Feb. 2014	4 wks.	0	1	1
	University of Nairobi	E-learning Course Development workshop	March-April 2014	1 day – 1 wk.	1	5	6
	University of Nairobi and Mpala	Experiential Field Course: Natural History	Spring 2014	1 wk.	1	1	2

	Research Center- Laikipia	of Mammals		- 6 mos.			
	University of Nairobi	Online Course Delivery using USAID RMPortal	May 2014	1 day - 1 wk.	3	9	12
	University of Nairobi	Integrated Socio-ecological Methods in Kenya	May-June 2014	1 day - 1 wk.	4	4	8
	University of Nairobi	Introduction to GIS course	June 2014	1 day - 1 wk.	5	12	17
	University of Nairobi	Collaborative Research Methods Course	Sep. 2014	1 day - 1 wk.	6	13	19
	University of Nairobi	How to Publish Journal Articles	Oct. 2014	1 day - 1 wk.	13	14	27

Results:

Baseline	FY12 (October 1, 2011- Septemeber 30, 2012)		FY13 (October 1, 2012- September 30, 2013)		FY14 (October 1, 2013- September 30, 2014)		End of Partnership	
N/A	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
N/A	50	107	100	75	75	92	225	274

LONG-TERM COMPLETED: Number of host-country individuals (faculty and/or teaching staff, students, and administrative / other staff) affiliated with the host-country institution who completed long-term training programs for qualifications strengthening

UNIT	DISAGGREGATE BY: Location, event, date and gender					
	Geographic Location	Activity Title	Date	W	M	Subtotal
Number of host country individuals that completed	University of Nairobi, College of Agriculture and Veterinary Sciences	CSDS supported Doctorate Degree Awarded by the Department of Land Resources Management and Agricultural Technology	FY12	1	3	4

training	University of Nairobi, College of Agriculture and Veterinary Sciences	CSDDES supported Master's Degree Awarded by the Department of Land Resources Management and Agricultural Technology	FY12	4	10	14
	University of Nairobi, College of Agriculture and Veterinary Sciences	CSDDES supported Bachelor of Science Degree in Range Management	FY12	3	10	13
	University of Nairobi, College of Agriculture and Veterinary Sciences	CSDDES supported Bachelor of Science in Agro-ecosystems and Environment	FY12	10	13	23
	University of Nairobi, College of Agriculture and Veterinary Sciences	CSDDES supported Master's degree in Range Management awarded by the Department of Land Resources Management and Agricultural Technology	FY13	1	2	3
	University of Nairobi, College of Agriculture and Veterinary Sciences	CSDDES supported Doctorate Degree in Dryland Resources Management awarded by the Department of Land Resources Management and Agricultural Technology	FY14	1	2	3
	University of Nairobi College of Agriculture and Veterinary Sciences	CSDDES supported Bachelor of Science in Agro-ecosystems and Environment	FY14	0	1	1
	University of Nairobi College of Agriculture and Veterinary Sciences	CSDDES supported Bachelor of Science in Veterinary Medicine	FY14	0	1	1

Results:

Baseline	FY12 (October 1, 2011-Septemeber 30, 2012)		FY13 (October 1, 2012-September 30, 2013)		FY14 (October 1, 2013-September 30, 2014)		End of Partnership	
	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
N/A	18	54	9	3	13	5	40	62

ACCESS Students: Number of students with increased access from underserved and/or disadvantaged groups to tertiary education programs
(3.2.2-41)

UNIT	DISAGGREGATE BY: Location, event, date and gender					
	Geographic Location	Activity Title	Date	W	M	Subtotal
Number of new/improved policies	University of Nairobi	Increased access to tertiary education for underserved populations from drylands areas and females.	FY12	13	19	32
	University of Nairobi	Increased access to tertiary education for underserved populations from drylands areas and females.	FY13	2	5	7
	University of Nairobi	Increased access to tertiary education for underserved populations from drylands areas and females.	FY14	2	5	7

Results:

Baseline	FY12 (October 1, 2011-September 30, 2012)		FY13 (October 1, 2012-September 30, 2013)		FY14 (October 1, 2013-September 30, 2014)		End of Partnership	
N/A	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
N/A	20	32	9	7	11	7	35	46

ACCESS POLICIES: Number of new or improved policies and/or procedures that supported increased access of underserved and/or disadvantaged groups to tertiary education programs
(3.2.2-38)

UNIT	DISAGGREGATE BY: Location, event, date and gender			
	Geographic Location	Activity Title	Date	Subtotal
Number of new/improved policies	University of Nairobi	Conditional policy and or procedure that ensures access based on academic merit	FY12	1

Results:								
Baseline	FY12 (October 1, 2011- Septemeber 30, 2012)		FY13 (October 1, 2012- September 30, 2013)		FY14 (October 1, 2013- September 30, 2014)		End of Partnership	
N/A	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
N/A	6	1	3	0	0	0	9	1

RESEARCH-JOINT: Number of U.S. - host country institution joint research projects (3.2.2-35)				
UNIT	DISAGGREGATE BY: Location, event, date and gender			
Number of joint research projects	Geographic Location	Activity Title	Date	Subtotal
	University of Nairobi	Frankline Otiende Awuor a CSDES student worked with Mpala Research Center, "Evaluating the socio-economic effects of military training in Laikipia County"	FY12	1
	University of Nairobi	Hennery Mwaka a CSDES student worked with King's University College on research entitled "Pastoral community learning on natural resource conservation and governance: a case of il ngwesi conservancy in laikipia county, Kenya"	FY12	1
	University of Nairobi	Judith Mbau a CSDES student worked with Africa Conservation Centre on research entitled "An analysis of human-wildlife conflicts in tsavo west - amboseli agro-ecosystem: an integrated geospatial approach"	FY12	1
	University of Nairobi	Patrick Mwambi Mwanyumba. A CSDES student worked with USAID Kenya Dryland Livestock Development Project on research entitled "Evaluation of trade, herd dynamics and utilization of indigenous livestock of northeastern Kenya."	FY12	1

	University of Nairobi	Staline Kibet a CSDES student worked with National Museums of Kenya on a Research entitled "Linking land use dynamics to plants functional diversity, species invasion and browse production on a semi-arid savannah, Kenya"	FY12	1
	University of Nairobi	Mary Morara, a CSDES student worked with Ministry of Agriculture and Africa Conservation Center on Research entitled "Land use change in Kajiado; implications on agricultural production and gender roles"	FY12	1
	University of Nairobi	CSDES Seed Grant, \$8,000: Community knowledge and perceptions on food security and nutrition in Isiolo to identify the sources of livelihood and food security for the community. (Research team-UoN: Wambui Kogi-Makau, Octavian Gakuru; CSU- Kathy Galvin)	FY13	1
	University of Nairobi	CSDES Seed Grant, \$8,000: Integrating local communities into the management of human-wildlife conflicts in Tsavo, Taita Taveta County: contribute to human-wildlife conflict reduction and improve community livelihoods in the Tsavo west buffer zone. (Research Team - UoN: Moses Nyangito, Cecilia Onyango; CSU- Stacy Lynn)	FY13	1
	University of Nairobi	CSDES Seed Grant, \$8,000: A multi-stakeholder study to enhance the control of livestock disease that limit production access markets in dryland sites in Marsabit Kenya - to enhance the capacity of local communities in Marsabit to control livestock diseases that limit production and access to markets. (Research Team -UoN: Peter Gathumbi, Isaac Mulei; CSU- Mike Coughenour)	FY13	1
	University of Nairobi	CSDES Seed Grant, \$8,000: Quantifying lost livelihoods by defining risk thresholds of productive assets among	FY13	1

		urban-proximate pastoral communities in Kajiado County - to assess and explicitly define the risk thresholds of determinants of resilience in pastoral households in Kajiado County in southern Kenya (Research Team -UoN: Laban MacOpiyo, Oliver Wasonga; CSU-Randall Boone)		
	University of Nairobi	CSDDES Seed Grant, \$8,000: Stories lived and told: recapturing generational exchanges of environmental traditions in Samburu County whose objective is to strengthen and recapture the relationship between youth and their land amongst pastoralists in northern Kenya. (Research Team-UoN: Moses Nyangito; CSU- Brett Bruyere)	FY13	1

Results:

Baseline	FY12 (October 1, 2011-September 30, 2012)		FY13 (October 1, 2012-September 30, 2013)		FY14 (October 1, 2013-September 30, 2014)		End of Partnership	
	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
N/A	13	6	5	5	9	0	27	11

CURRICULA REVISED: Percent of curricula newly developed and/or revised with private and/or public sector employers' input or on the basis of market research (3.2.2-36)

UNIT	DISAGGREGATE BY: Location, event, date and gender			
	Geographic Location	Activity Title	Date	Subtotal
Percent of Curricula revised	University of Nairobi and ISTVS (Somalia)	UoN faculty affiliated with CSDDES and LARMAT helped develop a drylands curriculum for the Sheikh Technical and Veterinary School (ISTVS) in Somalia for a BSc in Dryland Economics and Agro-Ecosystem Management. The coursework was approved by the UoN Senate.	FY13	1

University of Nairobi	The partnership developed a new online curriculum on "Sustainable African Dryland Ecosystems and Societies" Certificate procedures are under review.	FY14	1
University of Nairobi	Through resources leveraged from the UNDP Kenya, CSDES facilitated the revision of the PhD Dryland Resource Management curriculum, with the input of teaching staff and postgraduate students	FY14	1

Results:

Baseline	FY12 (October 1, 2011- Septemeber 30, 2012)		FY13 (October 1, 2012- September 30, 2013)		FY14 (October 1, 2013- September 30, 2014)		End of Partnership	
N/A	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
N/A	0%	0%	100% (3/3)	33% (1/3)	100% (3/3)	67% (2/3)	100%	100%

EXPERIENTIAL EDUCATION: Percent of academic certificate and/or degree programs supported through the partnership that include new and/or enhanced experiential and/or applied learning opportunities (3.2.2-33)

UNIT	DISAGGREGATE BY: Location, event, date and gender			
	Geographic Location	Activity Title	Date	Percent
Percent of programs supported	University of Nairobi	Experiential education components were added to Drylands programs at the BSc, MSc (2), and Doctoral levels.	FY12	100% (4/4)
	University of Nairobi	Experiential education components were added to a Diploma in Dryland Resource Management, Ph.D. in Dryland Resource Management and an E-course on "Sustainable African Dryland Ecosystems and Societies".	FY14	27% (3/11)

Results:

Baseline	FY12 (October 1, 2011- Septemeber 30, 2012)	FY13 (October 1, 2012- September 30, 2013)	FY14 (October 1, 2013- September 30, 2014)	End of Partnership
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N/A	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
N/A	0%	100% (4/4)	0%	0% (0/9)	27% (3/11)	0%	27%	64% (7/11)

BENEFICIARIES DIRECT: Number of Direct Beneficiaries								
UNIT	DISAGGREGATE BY: Location, event, date and gender							
	Geographic Location	Activity Title		Date	W	M	Subtotal	
Number of direct beneficiaries	Nairobi and Drylands counties in Kenya.	FY12 Direct Beneficiaries: A large number participated in multiple activities. The participants represent 417 pastoralists and 364 non-pastoralists.		FY12	268	513	781	
	Nairobi and Drylands counties in Kenya.	FY13 Direct Beneficiaries: Over 500 of these were students, staff, and faculty members from UoN		FY13	313	621	934	
	Nairobi and Drylands counties in Kenya	FY14 Direct Beneficiaries: A large number of individuals benefited from the student led conference, short term trainings and outreach activities.		FY14	347	802	1149	
Results:								
Baseline	FY12 (October 1, 2011-Septemeber 30, 2012)		FY13 (October 1, 2012-September 30, 2013)		FY14 (October 1, 2013-September 30, 2014)		End of Partnership	
N/A	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved
N/A	400	781	300	934	700	1149	1400	2864

TABLE 2: PERFORMANCE DATA TABLE FOR CUSTOM INDICATORS

Custom Indicator Name	Fiscal Year 2012					Fiscal Year 2013					Fiscal Year 2014				
	Target from Annual Target Assessment	Actual: Semi-Annual Period 1	Actual: Semi-Annual Period 2	FY 2012 Total Actual	Cumulative Total Across All FY to Date	Target from Annual Target Assessment	Actual: Semi-Annual Period 1	Actual: Semi-Annual Period 2	FY 2013 Total Actual	Cumulative Total Across All FY to Date	Target from Annual Target Assessment	Actual: Semi-Annual Period 1	Actual: Semi-Annual Period 2	FY 2014 Total Actual	Cumulative Total Across All FY to Date
Funds and Resource-Raising	15	15	13	27	27	30	22	5	27	54	9	9	4	13	94
Raising Awareness of Dryland Development Issues with Policymakers, Higher Ed. Reps, Practitioners, and Others	8	14	14	28	28	10	3	3	6	34	15	5	1	6	68
Classroom Teaching: Mentoring and Training the Next Generation of Educators and Practitioners	16	16	8	24	24	16	8	2	10	34	3	4	1	5	63
Web and Media Platforms	245	19	611	630	630	300	0	2000	2000	2630	3500	2937	3568	6505	9465
Publications (and Policy Briefs)	10	8	1	9	9	12	5	0	5	14	10	15	15	30	53*
*Publications were reported more than once in PRIME depending on the stage of development. The total number of papers published is 23. The total number of policy briefs is 15. The total for the indicator is 38.															
Student Led Conference and Policy Seminars	1	1	13	14	14	4	1	1	2	16	6	5	1	6	36
FtF: Number of individuals who have received USG supported short-term agricultural productivity training on food security											80	0	37	37	37
FtF: Number of individuals who have received USG supported long-term agricultural productivity training on food security											0	N/A	0	0	0
FtF: Number of new technologies or management practices under research, field testing, or made available for transfer as a result of USG assistance											3	N/A	3	3	3
FtF: Number of stakeholders implementing risk-reducing practices/actions to improve resilience to climate change as a result of USG assistance											50	N/A	37	37	37
FtF: Number of members of producer organizations and community-based organizations receiving USG assistance											100	0	37	37	37

IV. CONSTRAINTS AND OPPORTUNITIES

Funding Levels: The Associate Award was modified with increased funding and an extended period of performance in November 2013. Aligning the partnership to Feed the Future (FTF) objectives and planning for the additional obligation of funds/extended period of performance created an opportunity for partners to revise their plans and goals. Revised objectives and activities reflected the decentralization endeavor in Kenya and allowed partners to meet development goals in dryland counties.

Changing requirements from HED/USAID: Partners found the most challenging constraint to be the changing nature of indicators and definitions, as well as objectives for the donor-required M&E Plan. The constant changes were counterproductive and made it difficult to measure achievements consistently as the project progressed. Additionally, the donor-required reimbursement system had too many links in the chain from HED to CSU to UoN and back, which delayed project implementation during multiple stages of the project. From CSU's perspective, it was difficult to take on all the financial risk of the project, and sharing this burden with the donor would have helped. UoN had to step in and share the risk with CSU by advancing funds for project implementation.

UoN Procurement System: The UoN procurement system was another challenge that slowed the pace of project implementation. Towards the end of the project, UoN fast-tracked the procurement process to allow the establishment of a GIS Lab and purchase of a project vehicle.

Joint-Research: Building joint teams for action research was another challenge for the partners. They believe that it would have been more helpful to dedicate funding to bring together teams more often throughout the period of performance.

UoN Administration: University of Nairobi leadership has been going through a transitional period as the current Vice Chancellor prepares to retire and the appointment of a new Vice Chancellor continues. This situation created delays in approvals of procurement and expenses, leading to implementation delays. Partners worked closely with the Administration and Finance divisions of UoN to fast-track activities. Many CSDS staff members worked over-time to meet the objectives of the project.

Despite the challenges, one of the key lessons learned was the immense value of creating an African-led development-focused and demand-driven institution to span the boundaries of two universities, USAID, multiple dryland communities and counties, and development practitioners. The problems that the partners attempted to address were immense and their work needs to be expanded. The partners are motivated to build upon what they have started and meet the expectations of marginalized peoples in drylands, and to deliver the fundamental education and research that they need. The full institutionalization of ideas and lessons learned from the project requires additional financial support to achieve sustainability and to keep communities engaged in the development of dryland ecosystems and societies.

V. PERFORMANCE MONITORING

The partnership's M&E plan served as the basis for HED's analysis of partnership's achievements and progress in relation to its objectives, outcomes and outputs. Results are based on performance against the partnership's targets for Higher Education Standard Indicators and Custom Indicators. Partners added the Custom Indicators during the second year of the partnership and they are based on USAID Standard Foreign Assistance indicators.

In order to meet requirements associated with an additional obligation of funds and an extension of the period of performance, HED provided guidance, technical assistance and worked closely with CSU and UoN partners to align their project objectives with the Feed the Future goals. A close and cordial working relationship between HED and the UoN-CSU partners aided a smoother transition of the partnership program.

During the last two years of the partnership, HED utilized results-based management principles and a management information system (Partnership Results and Information Management Engine, or PRIME) to manage the performance of higher education partnerships. The HED reporting system became more systematized and robust in the second year of the partnership performance period, with data quality verification (DQV) and substantiation of documents supporting data. During the DQV process, HED staff ensured that the data reported were complete and accurate. Data included quantitative information, qualitative information, and the substantiating documentation uploaded, for all partnership standard and custom indicators. HED also discussed with the partners whether or not they expected to meet their targets by the close of the partnership. Partners responded positively to this question and as evidenced in this report met or exceeded many of their targets.

The partnership's M&E plan and reporting in FY11 were subjected to changes in indicator definitions and not systematized affecting the quality of data and reports during the beginning of the partnership.

Over the three-year period of the partnership, HED/ACE worked closely with Colorado State and University of Nairobi partners toward quality and timely submission of quarterly financial expenditure reports and implementation progress reports. HED provided guidance on issues such as developing monitoring and evaluation plans, budget realignments, and timely implementation of planned activities. HED conducted field monitoring visits and produced follow-up reports to improve the effectiveness and efficiency of the partnership. During these field visits, HED worked with CSU-UoN teams, as well as the AORs, on developing or revising Results Frameworks and M&E plans, reviewing semiannual reports and subsequent year implementation plans, reviewing budget expenditures and developing realignments, identifying success stories.

VI. PROGRESS ON GENDER STRATEGY

In November 2013, the program objectives of the partnership were revised and expanded to focus on engaging women in the development of dryland areas. Under the revised objectives, collaboration with dryland communities were strengthened to bridge the gap between researchers and end users of research findings, with a special interest in enhancing interaction with women.

Partners considered all individuals from drylands to be under-represented or disadvantaged in higher education, but they considered women from drylands regions to be even more under-represented.

The partnership strived to increase access for students from drylands and to award opportunities on a 50-50 (male-female) basis. Admissions policies were enacted to ensure that students from underserved areas (and female applicants) were strongly considered. In addition, the partners tried to mobilize financial resources for students through other partners.

The project established a partnership with an online portal design specialist and USAID, which offered the use of its online Natural Resource Management Portal (RMPortal) to offer distance learning opportunities to women that could not easily attend classes and needed a more flexible schedule.

By the end of the partnership, UoN-CSU directly benefited 928 females through skills strengthening, research development, and community outreach.

VII. PROGRESS ON ENVIRONMENTAL MITIGATION AND MONITORING

The issues of dryland resilience and adaptation to climate change in the Horn of Africa opened a niche for the partnership to provide leadership in research, innovations, and knowledge management in drylands.

On September 10-12, 2014, CSDES conducted a three-day training for the farmers and community members of the Christian Impact Mission's (CIM) Operation Mwolyo Out project, in Yatta District, Machakos County. The training involved demonstrations on: water conserving dryland farming technologies (mainly the 'moist bed'); energy saving cooking using a 'fireless cooker'; on farm soil testing; agrometeorological data collection (temperature and humidity) and interpretation; and participatory GIS for mapping community resources. The training objectives were: (1) to increase farm-level crop productivity in a sustainable way; (2) enhance efficiency of household fuel wood energy consumption and reduce pressure on tree cutting for fuel wood. Partners documented 37 participants, but the reach was much larger because several participants from Tanzania also benefited from the demonstrations on water conserving dryland farming and energy saving technologies.

CSDES trainers also conducted a training of trainers for the CIM Extension staff on soil fertility testing and irrigation water analysis in order to support their efforts in establishing a soil-testing lab within the context of their model of a community based technology transfer center. Partners were committed to implementing risk-reducing practices and actions to improve resilience to climate change. A June 2014 article from the *Daily Nation* highlights the role of CSDES in environmental issues in the Drylands.

VIII. PROGRESS ON LINKS TO OTHER USAID PROGRAMS

USAID Education Strategy: The University of Nairobi (UoN) and Colorado State University (CSU), contributed to Goal 2 of the USAID Education Strategy – improved ability of tertiary and workforce development programs to generate workforce skills relevant to a country's development goals.

USAID Feed the Future Initiative: The partnership between UoN and CSU employed strategies to support FTF intermediate results for improved agricultural productivity and for increased resilience of vulnerable communities and households.

USAID/Kenya: CSDES aligned its work with USAID's 9-5-2 layering approach and collaborated with USAID resilience programs (REGAL-IR/AG). Partners linked with USAID/Kenya's Resilience and Economic Growth in Arid Lands (REGAL) initiative, by enhancing human capacity development through education and training, action research, and community engagement.

Northern Kenya Development Strategy: CSU-UoN addressed challenges that are aligned with the Kenyan Government Vision 2030 by building institutional capacity in research and extension and strengthening human capital development among the dryland communities in Kenya.

IX. PROGRESS ON LINKS WITH GOK AGENCIES

UoN-CSU developed a professional team at CSDES that is able to provide technical support for Government dryland development plans. They linked research to community priorities, and postgraduate research informed Government arid and semi-arid lands (ASAL) policies. The newly formed ASAL secretariat will benefit from their policy briefs based on action research from faculty and graduate fellows. Partners also linked with the National Drought Management Authority (NDMA), the Ministry of Education, Science and Technology, and the ASAL stakeholders Forum. They worked closely with new county governments. For example, Marsabit

County requested technical support for development of their agriculture land use master plan when funds are available. In Kajiado County, partners supported county planning efforts through the Governor's office. Additionally, CSDES formalized relationships with Kenya Agricultural and Livestock Research Organization (KALRO), for applied research in drylands to address issues of resilience to drought and climate change in northern Kenya.

X. PROGRESS ON USAID FORWARD

Partners contributed to the cornerstones of USAID Forward in the following ways.

Deliver results on a meaningful scale through a strengthened USAID

- Partners utilized a results-based management system that aligned implementation activities with their budget. Through monitoring and reporting, partners were held accountable for their actions.

Promote sustainable development through high-impact partnerships and local solutions

- Partners established long-term relationships that will continue beyond the close of the award. Partners regularly sought out new collaborative partners within the public and private spheres. Partners collaborated with Mercy Corps, Scotland, McGill University, Canada, Borlaug Leadership Enhancement in Agriculture Program (LEAP), Intergovernmental Authority for Development (IGAD), African Development Solutions (ADESO), and the Center for Dryland Agriculture (CDA), Bayero University, Kano State, Nigeria.

Identify and scale up innovative, breakthrough solutions to intractable development challenges

- Partners utilized innovative technology in their outreach activities through the development of an interactive online platform and through their e-courses, and in their research activities and GIS Laboratory.

XI. SUSTAINABILITY AND EXIT STRATEGY

The sustainability strategy of this partnership is embedded in its overall strategy to establish and strengthen institutions at UoN, namely: the establishment of CSDES; the enhancement of graduate degree programs and research programs; and the intense outreach component which aims at positioning CSDES as an integral part of the solution to drylands issues in Kenya.

The short and long term training of UoN faculty, as well as potential for CSDES to elevate to an Institute level will contribute to sustain the program, fully integrate and be fully supported by UoN and the Kenyan government in the long term. The University of Nairobi through the CSDES has expanded its regional visibility, as demonstrated by the collaboration with IGAD in the development of a drylands course for the Sheikh Technical and Veterinary School (ISTVS) in Somalia, as well as its joint research projects with faculty from other institutions.

Partners began strategizing about sustainability from day one and developed a forward-looking plan for using partnership activities to leverage long-term investment. During the course of the project, UoN-CSU partners submitted 40 proposals and were awarded \$1,197,965 in additional funds or services to strengthen and or sustain partnership activities.

The institutional partnership between Colorado State University and University of Nairobi was built on a solid foundation that dates back two decades. Partners have strengthened their relationship over the years through a number of collaborative efforts and because of this history of collaboration, the prospects for sustainability are strong. The end of the award does not signal the end of the project, but a change in dynamics as the CSDES moves into its next phase as a regional center for excellence.

XII. GLOBAL DEVELOPMENT ALLIANCE

Not applicable.

XIII. SUBSEQUENT QUARTER'S WORK PLAN

This partnership closed on October 30, 2014. Partners followed an approved annual work plan between 2011-2014.

XIV. FINANCIAL INFORMATION

TABLE 3: BUDGET DETAILS

T.E.C.: \$1,673,806

Cumulative Obligated: \$1,673,806

Cumulative Expenditures*: \$1,624,974

Obligation	Approved cumulative budget/total obligated amount	Actual expenses through 12.03.2014	Interim balance of federal funding at award close
<i>Total: \$1,673,806</i>	\$1,673,806	\$1,624,974	\$48,833
Personnel & Fringe Benefits	\$72,210	\$73,366	(\$1,156)
Travel	\$51,805	\$14,155	\$37,650
Equipment & Supplies	\$56	\$0	\$56
Contractual/Professional Fees	\$34,872	\$6,775	\$28,097
Partnership Subawards	\$1,370,000	\$1,401,737	(\$31,737)
Other Direct Costs	\$5,692	\$9,590	(\$3,898)
<i>Total Direct Costs</i>	<i>\$1,534,633</i>	<i>\$1,505,622</i>	<i>\$29,011</i>
Indirect Costs	139,171	\$119,351	\$19,820
Total USAID Estimated Cost (Federal)	\$1,673,806	\$1,624,974	\$48,833
Cost Share	\$205,533	\$205,277	\$256
Grand Total	\$1,879,339	\$1,830,251	\$49,088

*** PLEASE NOTE:** Although the table indicates an unexpended balance of \$49,088 under this award, please note that this amount represents an interim balance since the FY14 and FY15 final indirect costs rates are yet to be applied and final award expenses are still being reconciled. Currently ACE/HED is operating with provisional indirect cost rates for FY14 as determined by USAID, its cognizant agency, per attached Negotiated Indirect Cost Rate Agreement (NICRA). The final FY14 and FY15 indirect rates, which will be applicable to this award, are expected to be released by USAID during the summer of 2015 and summer of 2016. At that time, the final indirect rates will be applied to the award and billed to USAID.

BUDGET NOTES

Personnel & Fringe Benefits	Salaries for this award were slightly over the total anticipated amount due to additional effort needed for negotiation of the subaward extension during the Fall/2014.
Travel	Travel expenses have been lower than originally anticipated, partly due to the fact that consultants (for which travel provisions had been made in the budget) were not engaged at the level originally anticipated.
Equipment and Supplies	The expenses with supplies that were anticipated did not occur.
Contractual/ Professional Fees	Originally the budget predicted a more significant involvement of management consultants in this award. As activities were implemented, the engagement of consultants became less necessary, and eventually completely eliminated from the award.
Subawards	A subaward for a higher education partnership between University of Nairobi and Colorado State University was funded under this award. Originally the subaward was envisioned to be for \$1,370,000, but once ACE/HED realized savings with travel and consultants, it channeled those savings into the subaward to maximize the use of federal funding towards the accomplishment of the partnership activities.
Other Direct Costs	Total Other Direct Costs were higher than anticipated, mostly due to communication expenses (webinars, international phone calls, and cell phone usage during international travel).
Indirect Costs	Calculated per award conditions. Please see attached on Attachment II the current NICRA.

XV. ACTIVITY ADMINISTRATION

Personnel

The ACE/HED Program Officer for this award remained the same throughout the three-year period of the award; however, there was staff turnover at the Program Specialist level. In some instances, this may have resulted in under-expenditure of salaries. Managerial changes at this level did not negatively affect management of the higher education partnership.

Contract, Award or Cooperative Agreement Modifications and Amendments

The USAID/East Africa Regional Acquisition and Assistance Office administered five modifications to ACE/HED during the three-year period of the agreement.

Modification 1, signed June 6, 2011

The purpose of the first modification was to incorporate three mandatory provisions per AAPD 11-01 on a) Central Contractor Registration, b) Reporting Sub Awards and Executive Compensation, and c) Trafficking of persons. Additionally, with this modification, USAID revised the HED activities and deliverables table on page nine of the award.

Modification 2, signed June 5, 2013

The purpose of the second modification was to extend the estimated completion date of the agreement from June 7, 2013 to July 6, 2013 to allow completion of negotiations between USAID and ACE/HED for a cost extension.

Modification 3, signed July 3, 2013

With this modification, USAID gave the award a two month no-cost extension, from July 6 to September 5, 2013. The additional time was allotted to allow for the completion of negotiations between USAID and ACE/HED for a cost extension.

Modification 4, signed September 5, 2013

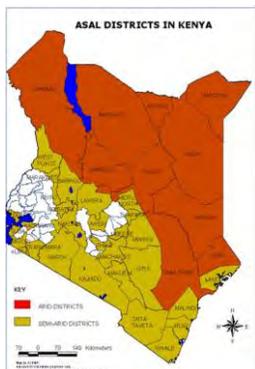
With this modification, USAID gave the award a two month no-cost extension, from September 5 to November 4, 2013. The additional time was allotted to allow for the completion of negotiations between USAID and ACE/HED for a cost extension.

Modification 5, signed November 1, 2013

This modification provided a thirteen month cost extension in support of the partnership between University of Nairobi and Colorado State University. The partnership program was extended to December 3, 2014, with an increase in the USAID Total Estimated Amount of the agreement from \$1,374,806.00 to \$1,673,806.

ACE/HED executed ten subaward modifications with this partnership during the three-year period of implementation. The purpose of the modifications ranged from subaward budget revisions to extensions of the award agreement to allow for completion of project activities.

XVI. GPS INFORMATION



Geographic location or coordinate data (latitude and longitude) was not collected for this partnership. Partners conducted activities in the following dryland counties between 2011-2014: Isiolo County, Marsabit County, Laikipia County, Turkana County, Samburu County, Kaijado County, and Yatta-Machakos County.

XVIII. SUCCESS STORIES

EMPOWERING PASTORAL COMMUNITIES IN KENYA TO IMPROVE DRYLAND CONDITIONS

The pastoralist communities of Kenya's drylands face marginalization due to drought, climate change, and its effect on natural resources. To help these communities escape the cycle of food insecurity and poverty, Colorado State University partnered with the University of Nairobi through Higher Education for Development to establish the Center for Sustainable Dryland Ecosystems and Societies (CSDES). The partnership is funded by the United States Agency for International Development.

Since its inception in 2011, the center's staff has been working to create forums to discuss the role of higher education in international development in Kenya's drylands, and engage community members in the planning of the center's research and curriculum development.

In 2011, the center held "Dryland Community Voices: Setting a Joint Agenda in Higher Education and Development from the Ground Up," a collaborative three-day workshop that gave the pastoralist communities a voice, allowing them to critique and help redesign academic programs, improve their own livelihoods, and uplift their communities. More than 45 representatives of dryland communities from across Kenya attended the workshop.

"Previous development approaches in Kenya's drylands have been accused of doing little to actively engage communities in drylands in problem identification, planning and implementation of programs targeting them," said Jesse Njoka, partnership director at the University of Nairobi and CSDES director. "By directly engaging the communities in designing CSDES higher education program and research, interventions will be more targeted and hence increase impact."

On several instances, participants observed that issues, such as gender biases prevalent in higher education often originate from ingrained attitudes, and problems in primary and secondary education. Fatuma Amin, a master's student at the University of Nairobi presented her personal story of success at the workshop. The fifth born in a family of 12, Fatuma was the first in her family to attain a formal education. Fatuma's story is an example of the integral need for higher education opportunities, particularly for women in pastoralist Kenya, but also demonstrates how cultural biases influence academic priorities.

In her pastoralist community in northern Kenya, most women are offered few opportunities for economic advancement, often expected to marry and run a household. Beginning with primary school, already low female enrollment in her community began to diminish further, said Fatuma. Out of her primary school class of more than 50, only nine were female, and of that nine, only two progressed to high school.

Beating the odds, Fatuma continued her studies past secondary school to complete a bachelor's degree in development studies. Through additional funds leveraged under the HED award, Fatuma was afforded the opportunity to pursue her master's degree in disaster management at the University of Nairobi.

"Inspired by my background, my goal has always been to reduce cultural biases, build resilience and improve livelihoods for community in the drylands, especially women," Fatuma said. With her coursework complete and only her research project left to accomplish, Fatuma is expected to graduate December 2014. Njoka said the workshop sparked stories similar to Fatuma's and discussions continue to inform education and research priorities at the University of Nairobi. As a result of the positive feedback, more community engagement meetings are set to take place in the next project phase.

E-LEARNING IMPROVES COURSE DELIVERY AT UoN

Before attending a three-day e-learning course at the Centre for Sustainable Dryland Ecosystems and Societies (CSDDES), Dr. Stephen Mureithi a Lecturer at the Department of Land Resource Management and Agricultural Technology (LARMAT), University of Nairobi (UoN) was looking for ways on how to creatively present content and ideas to his undergraduate and post graduate students. Today, Dr. Mureithi can creatively deliver his lectures using the e-learning platform.

CSDDES, which is a partnership project between UoN and Colorado State University (CSU), held a three-day e-learning training course that benefitted six faculty members. The course was facilitated by e-learning expert from CSU in the USA, Professor Emeritus, Robert Woodmansee.

The e-learning program is an effort to modernize course and content delivery to students using digital methods. This includes putting the content in PowerPoint and Adobe presenter including audio voice and short videos of the lecture. Files can be uploaded in an online platform like the USAID Natural Resource Management and Development Portal (RM-Portal). The students can then log in securely and listen to the lecturers, complete activities and assignments, report back to the lecturer and interact with each other online.

Dr. Mureithi explains that e learning is incredibly convenient because it multiplies time for both the lecturer and the student, by enabling them to interact and work online despite their physical locations at any given time. He said, “Students will not need to miss a lecture because I am out of campus, since all the lectures will be online and they will have access to particular lectures, with audio. When they have questions they can post them in the interactive forum and their colleagues or I can answer them.”

“The e-learning course has kept me on my toes trying to see how best to creatively present an idea in form of a short video, a cartoon or a picture. I have started incorporating the lessons I learned in my work, starting with putting all my lectures in power PowerPoint presentation format, followed by editing the text into notes that are ideally the script I will read when adding the audio. I am committed to see this process completed and have all my courses in this modern e-learning platform.”



Dr. Mureithi says that he is also involved in developing an online course on Sustainable Dryland Ecosystems and Societies. The course will be offered jointly between CSDDES, University of Nairobi and CSU.

Dr. Mureithi is grateful to USAID for funding the development of the RM-Portal and to CSDDES for offering an opportunity for the faculty to network with CSU colleagues. “We are learning great things from them and I hope they too are doing the same from us.”

Dr. Stephen Mureithi lecturing one of his classes at the College of Agriculture and Veterinary Sciences, University of Nairobi

WORKING WITH COMMUNITIES FOR INCREASED IMPACT

For many years, a lot of research and development projects have been carried out in the dryland regions of Kenya with an aim of enhancing sustainability of dryland ecosystems and improving livelihoods. In spite of these efforts, the dryland regions continue to face enormous ecological, social and economic challenges. Sustainable development of these areas has been constrained by inadequate human capacity, limited action research and lack of participation by the dryland communities as end users, among other challenges.

According to Prof. J.T. Njoka, Director, Centre for Sustainable Dryland Ecosystems and Societies (CSDDES), many development approaches in Kenya's drylands have been accused of doing little to actively engage dryland communities in problem identification, planning and implementation of programs targeting them. He stated, "By directly engaging the communities in problem identification and seeking interventions with them, development will be more targeted and hence increase impact." Therefore, CSDDES has embraced a community participatory approach with an aim of identifying dryland challenges and seeking solutions together with the communities.

In 2011, CSDDES awarded partial funding to thirteen UoN students to undertake research for development. The students were supposed to research on a topic that addresses specific needs of dryland communities. They were expected to identify and work closely with a research assistant/intern from the communities where they intended to carry out their research. After completing their research, the students were to hold a feedback workshop in the community to disseminate their findings back to the communities.

So far, CSDDES in partnership with other players in drylands have held three such workshops in three counties in Kenya-Isiolo, Marsabit and Laikipia. The workshops have provided the much needed platform for disseminating findings of CSDDES-supported participatory research as well as providing an opportunity to gather feedback from stakeholders in the counties.

Speaking in one of the research feedback workshops held at Marsabit, the Deputy Governor of Marsabit County Hon. Omar Abdi expressed optimism that research will provide a road map to empower the communities in resilience. "I am glad to note that the objectives of this workshop are consistent with the first pillar of Kenyan Vision 2030 towards food security and the inclusive development that factors equal opportunities for all groups and especially the under-represented ones."



Participants of the Marsabit workshop pose for a group picture outside the workshop venue. Seated, second from left is the Deputy Governor of Marsabit County Hon. Omar Abdi.

CSDDES WINS RESEARCH GRANT THAT WILL TRANSFORM MARSABIT AND ISIOLO COUNTIES

Established three years ago at the University of Nairobi (UoN), the Centre for Sustainable Dryland Ecosystems and Societies (CSDDES) envisions excellence in the management of drylands. The mission of the Centre is to contribute to sustainable dryland ecosystems and improved livelihoods through innovative trans-disciplinary education, applied research, partnerships, policy dialogue and community outreach initiatives.

In an effort to achieve its vision and mission, the Centre employs a multi- disciplinary approach that brings together experts, government institutions, researchers, communities and other key partners in the drylands to work on issues affecting drylands. It is through such partnership that CSDDES and the Kenya Agricultural and Livestock Organization (KALRO)- Marsabit Station, responded to a call by Intergovernmental Authority on Development (IGAD) on enhancing resilience of livestock- based livelihoods in Northern Kenya and was awarded a grant of 200,000 USD to undertake the project.

The project aims to increase quality and quantity of livestock products through integration of sustainable natural resource management and livestock production with improved market access. The ultimate goal is to attain resilient and sustainable livestock based livelihoods in Northern Kenya. The one year project is set to contribute to the improvement of the livelihoods of Isiolo and Marsabit residents. The project will be implemented by CSDDES as the lead institution, KALRO- Marsabit Centre, Pastoralist Community Initiative and Development Assistance (PACIDA) and County Governments of Isiolo and Marsabit.

Speaking during the IGAD project inception workshop hosted by the Centre for Sustainable Dryland Ecosystems and Societies on 17th July 2014 in Nairobi, Prof. Agnes Mwang'ombe, Principal, College of Agriculture and Veterinary Sciences commended the approach of multi-institutional and multidisciplinary applied research approach adopted by the project because it points towards the potential of a University led extension strategy where the researchers and the end users work together to solve complex problems facing the populations living in drylands.

Mr. Ali Wario, Isiolo County Director of Livestock Production acknowledged the significant role the project will play in improving livelihoods in the two counties and urged the project activities to align with the County Integrated Development Plan (CIDP).



IGAD Project Inception Workshop participants take a group photo on July 17, 2014.

ANNEXES & ATTACHMENTS

Annex I: Schedule of Future Events

This partnership closed on December 3, 2014. A schedule of future events is not applicable.

Annex II: List of Deliverable Products

Table of Leveraged Funds

Source of funding	Amount (USD)	Cash/ Value	Brief Description of Purpose of funds	Beneficiaries and status, outputs
Citizen Network for Foreign Affairs (CNFA) through Kenya Livestock Development Project supported by USAID	\$15,000	Cash	Scholarships for fieldwork	3 students benefited, each receiving USD 5000
University of Michigan (UM)	\$10,000	Cash	Scholarships for field studies for students from UM and University of Nairobi (UoN)	About 8 UoN students, 1 student from Tanzania and 16 UM students participated in field studies conducted in Kenya drylands in August 2011
University of Princeton /University of Illinois Chicago	\$6,300	Cash	Sponsorship for field course (computational ecology) offered jointly by the two USA universities and held at Mpala Research Centre in Kenya. 100 USD/day per student for 3 weeks.	3 UoN MSc. students awarded. Course completed May 2012. Paper submitted for publishing
African Conservation Centre/National Science Foundation (CSU)	\$40,000	Cash	Graduate studies –research grants for PhD	3 PhD students (Mary Morara \$ 10,000; Judith Mbau- \$ 10,000; and Dickson Kaelo- \$ 20,000). Ongoing.
International Livestock Research Institute (ILRI)	\$27,000	Cash	Funding for carrying out a study on building resilience to climate change	Complete, results disseminated in a stakeholders workshop and-report ready
African Union Inter-African Bureau for Animal Resources (AU-IBAR)	\$20,000	Cash	Funding for carrying out study on rational range use in Africa, as a contribution to UNCCD thematic programme three (TPN3)	Completed, results disseminated in a stakeholders workshop and report ready
Graham Institute (USA)	\$50,000	Cash	Research grant for Q-fever disease (veterinary study) to undertake research proposal development Field course for 6 students (travel and boarding) at around 4000 USD	2 faculty members of UoN involved; Study ongoing; Field study to be done; Masai Mara and MRC

Kings University College Canada	\$8,400	Cash	Scholarship for 24 months- masters research/stipend @350/month Partnership- Dr. Harry Spaling	1 student (Henry Mwaka) benefited. Ongoing. Research affiliate of CSEDES. Affiliation already approved by the UoN, DVC Research Production and
Meeker funds	\$100,000	Cash	Study scholarships for graduate and undergraduate students	2 students awarded fellowships for masters and 4 for bachelors program at UoN. Undergraduate students ongoing; masters to begin this year.
University of Michigan STEM Africa programme	\$3,000	Cash	Facilitation (travel and accommodation) of CSEDES Director to participate in STEM conference held in May 2012 in Ghana	Output: presentation on Environmental Science in Africa CSEDES also exploring opportunities for leveraging resources from STEM to support some of its programs
Mpala Research Centre (MRC)	\$10,000	Cash	CSEDES secured internship for 2 students from UoN for three months- each student stipend was 300USD and 50 USD per day/student Partnership for Research	2 students Completed internship under Range Monitoring project at MRC. CSEDES is in the process of establishing partnership with MRC.
Indiana University and Princeton University	3,800	Cash	Funding for 2 days training and field work (data collection) for 45 days	6 students (3 graduate and 3 undergraduate) – 1 from Moi university and 5 from UoN. Field work ongoing in Laikipia/Samburu
UoN/University of Ghent (UG)	\$500	Cash	1 PhD student secured funds from UG to summarize research results into a policy brief	Policy brief on Range Rehabilitation for Wildlife Conservation and Livestock Production complete.
International Livestock Research Institute (ILRI)	\$500	Value	Partnership- Dr. Mohammed Said sponsored by ILRI to teach PhD dryland students	1 Lecture to PhD Students 2012 class
National Museums of Kenya	\$500	Value	Partnership- Dr. Mary Gikungu	1 Lecture to 2nd years Range Management 2012 class
Michigan University	\$500	Value	Partnership- Bilal Butt Research affiliation	1 Lecture to 1st year Students Research affiliate to CSEDES. Affiliation already approved by the UoN, DVC Research Production & Extension
Gillian Bowser's Global Women's Network	\$3,000	Cash	Airfare for Drs. J. Njoka and D. Nkedianye to Washington, DC to meet with the Global Women's Network and build collaborative project cross-linkages	The projects benefited as a whole

Rose Hessmiller and Mike Colby (USAID)	\$25,000	Value	Donation of online Natural Resource Management Portal (RMPortal) system to University of Nairobi for University-wide use. Currently implementing RMPortal for use by UoN to grow and improve the distance education program (first in drylands, then across the University) for	University of Nairobi, entire HED team, UoN Drylands students, especially remote students.
National Science Foundation project, Dr. Randall Boone, PI	\$5000	Cash & Value	Student field work is being supported by this project, and students are being mentored by Dr. Boone and other project scientists.	CSDES Graduate Students; ongoing; students are generating usual products of graduate work
Colorado State University	\$10,000	Value	Funds have been promised by CSU to support a delegation by the CSU President or Provost, and the Director of International Programs, to University of Nairobi in late 2012. Additional funds may be secured for travel by several department heads and deans to a possible total value of \$30,000.	The project as a whole, and extended faculty of UoN.
Dr. Gufu Oba, Emory University	\$500	Value	Dr. Oba contributed funds to partially support his own travel to CSU to participate in the conference on Higher Education, Research and Sustainability in Africa.	Conference Participants, project team
CRSP	\$2,000	Value	Support for RR airfare to KY w/ KG	CSDES
Brett Bruyere's project funds	\$2,000	Value	Airfare leveraged to visit UoN April 2012	CSDES undergraduate students
CRSP	\$2,500	Value	Leveraged airfare for JN to travel to Colorado for CRSP meeting, used opportunity to meet with HED team	HED Project development
ILRI	\$1,200	Value	Vehicle lent to RR, DS, and SL for trip to Kenya for Community Voices Workshop	Project
11 PhD and 3 MSc self-sponsored students (including Halima) who started in 2010	\$77,160	Cash	Sponsoring of graduate education costs @ 500,000 per PhD student (5,500,000 KSH total) and 250,000 per MSc Student (750,000 KSH total). Source of funds varies from sponsoring institutions to personal funds of grad students.	Graduate Students
EU-KASAL project	6,173	Cash	Elizabeth Muthiani scholarship (500,000 KSH)	EM
Mercy Corps to UoN/CSU	\$200	Cash	Sponsorship of Chloe Stull-Lane to attend the dryland community voices workshop	DCV workshop attendees
US NIH to CSU	\$200,000	Cash	NIH fellowships funded to CSU \$200k – Kelvin Omanyi @ UoN & vet student at CSU are creating student exchanges for One Health along with Mark Stetter and Sue VandeWoude (CSU professors)	Veterinary students at CSU and UoN
CSU's Center for Collaborative Conservation	\$30,000	Value	Time contribution for RR toward project from CCC	

CSU's School for Global Environmental Sustainability (SoGES)	\$20,000	Cash	CSU GCRT funding to create a center at CSU on Sustainable African Ecosystems and Societies to build partnerships around work in Africa across CSU, as well as to partner with CSEDES and other African institutions	CSU faculty and students working in Africa, and CSEDES as a direct linking institution within CSU
Fulbright support for CSU	\$20,000	Value	CSEDES is providing support for Connor Jandreau, Fulbright Student, from University of Manitoba, Canada, during his year of field work in Kenya. CSEDES is Connor's host institution and contributed to the proposal's design.	Connor Jandreau, and CSEDES and others who will benefit from his research
ILRI	\$30,000	Value	Conferencing equipment donation from International Livestock Research Institute – in process of transfer – based on negotiations with Prof. Njoka.	University of Nairobi's College of Agriculture and Vet Sciences, including CSEDES
University of Florida	\$2,000	Value	Gillian 2 students participating in e-learning from UoN through Univ. of FL, studies on conservation, 1 course each	2 graduate students
AAAS	\$2,500	Cash	JN travel to AAAS, including airfare, two nights' accommodation, and registration	Jesse Njoka and CSEDES
AGRA	\$1,000	Value	AGRA support for speaker to CSEDES practitioner seminar series	All seminar attendees
CSU	\$35,000	Cash	Funds to support CSU delegation travel to Kenya: \$4000 each for 8 individuals for international airfare, Kenyan airfare to Maasai Mara, and accommodation, plus \$1500 each for two individuals accommodation	Both CSU and UoN for Key Strategic Partnership and partnership-building, students and faculty who attended presentation by CSU President A. Frank.
Mpala Research Inst. & Meeker Family Foundation	\$30,000	Cash	Meeker students supported by IIED through Oliver Wasonga	Two UoN graduate students
Practical Action	\$5,000	value	Patrick Watete , a PhD student at LARMAT, supported (logistics) by Practical Action to collect data in Mandera and Turkana Counties	One UoN graduate student
IIED	\$5,000	Cash	IIED supported PhD graduate student Yazan Elhadi with an additional \$5000	One UoN graduate student
IIED	\$4,000	Cash	IIED sponsored trip to Ethiopia for 4 students and 1 faculty member @ \$500 + \$100/night x 3 nights	4 UoN students, 1 UoN faculty
UoN	\$8,000	Cash	UoN sponsored travel of 2.5 administrators to CSU for administrative exchange in April 2012	CSU and UoN for IMOU signing
CSU	\$500	Cash	Funding to rent a vehicle for visiting UoN administrators April 2012	CSU and UoN for IMOU signing
Dr. Robert Woodmansee	\$10,000	Value	Donated time to project for curriculum and online system development	CSU and UoN partnership, future students of online curriculum, faculty
Brett Bruyere's project funds	\$2,000	Value	Contributed airfare and other travel costs to get to Kenya, leveraged funds	UoN partnership project and Samburu community
Princeton's Global Collaborative Network Fund	\$ 1500	value	Air ticket and accommodation for CSEDES Director to participate in a workshop in Niamey, Niger October 21-23	Jesse Njoka/CSEDES

IGAD	\$ 1000	Value	Air ticket and accommodation for CSDES to attend IGAD partners meeting at Addis Ababa (5th Nov 2013) on IGAD's applied research in drylands (ARD)program	CSDES has been selected by IGAD as a center of excellence on dryland issues and is participating in the development of the ARD program
RUFORUM (Yazan El Hadi)	\$350	Cash	Sponsorship for 10 community participants in the CSDES dissemination workshop in Isiolo on 25 October 2013	
IGAD	\$ 200,000	Cash	Grant from IGAD's Applied Research in Drylands Grant Facility	CSDES-KARI-PACIDA: July 2014 to October 2015
UNDP Kenya	\$ 30,000	Cash	Grant for review of PhD in Dryland Resource Management offered at LARMAT	July to September 2014
2 PABX @35295 each	\$70,590	Value	PABX donated by ILRI and ICRAF for replacing old models. One for CAVS and the other for the Main Campus central administration	July 2013, Installation commission of CAVS done in 2014
Pauline Gitanga field Research grant from Dick Bowen (CSU)	\$10,000	cash	To support PhD field data collection in Marsabit county	From May 2014
Dana Hoag one day seminar	\$4,300	value	Research publication for 30 graduate students valued at \$60 each student and Dana Hoag travel and accommodation for \$2,500	October 28, 2014 at CAVS
Time contribution by Jesse Njoka PI 80% effort	\$45,000	value	Working for no compensation between August 2013 to August 2014	Funds saved improved FTF activity implementation
TOTAL Leveraged Funds	\$1,197,965	USD		

Policy Briefs

	Title of Policy Brief	Author(s) (team leader/lead author in bold)
1.	Sustainability Challenges Of Community Wildlife Conservancies	Henry Mwaka Komu , Jesse T. Njoka, Vivian O. Wasonga, Harry Spaling And Elizabeth N. Muthiani
2.	Efficacy Safety And Conservation Status Of Medicinal Plants Used To Treat And Prevent Malaria In Embu County, Kenya	Bibianne Wanja
3.	Can Wildlife Based Tourism Co-Exist With Military Training?	Frankline Otiende
4.	A Multi-Stakeholder Study to Enhance the Capacity of Local Communities in Marsabit to Control Livestock Diseases that Limit Production and Access to Markets	Peter K. Gathumbi , Isaac R. Mulei, D.N. Karanja, L.W. Njagi and Michael Coughenour
5.	Pastoralism Persistence Against Adversities: Is This A Role Of "The Invisible Hand" Or Shrewd Strategy?	Staline Kibet
6.	Landscape Interventions To Manage Common Resources In The Wildlife Migratory And Dispersal Areas in Isinya, Kajiado County	Mary Morara , Wambui Kogi-Makau, Laban Macopiyo
7.	Is Irrigated Pasture Production The Future Of Pastoralists In The ASALs Of Kenya?	Koech Oscar Kipchirchir

8.	Communal Land And Forest Management For Sustainable Livelihoods In The Dry Lands: The Case of Loita Division Narok South Sub County	Peris Kariuki , Jesse Njoka, Catherine Lukhoba, Cecilia Onyango
9.	Grass Farming As A Drought Coping Strategy In The Kenyan ASALs	Machogu, C. , O.V.Wasonga, R.K. Ngugi, L. Macopiyo and W.N.
10.	Major indicators of food security resilience among pastoralists of northern Kenya	Patrick Watete
11.	Camel Milk Production: An Opportunity For Resilient Pastoral Households in The Drylands of Kenya	Yazan El Hadi
12.	How Food Secure Is Isiolo County? The Community Perceptions	Wambui K. Makau, Octavian N. Gakuru, Kathy Galvin, Jesse T. Njoka, Henry M. Komu and Narkiso O. Owino
13.	Range Rehabilitation for Wildlife Conservation and Pastoral Livestock Production	Stephen M. Mureithi , Jesse T. Njoka
14.	Defining Resilience Thresholds Of Productive Assets Among Urban-Proximate Pastoral Communities In Northern Kenya	Laban Macopiyo , Oliver Wasonga And Randy Boone
15.	Managing Human-Wildlife Conflicts: “The Other Option	Judith Mbau

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Geology and Soil Science (WE13), Laboratory of Soil Science, Krijgslaan 281/S8, B-9000 Gent, Belgium University of Nairobi, Department of Land Resources Management and Agricultural Technology, P.O Box 29053, 00625 Nairobi, Kenya Ghent University, Department of Soil Management (BW12), Research Unit of Soil Degradation and Conservation, Coupure Links 653, B-9000 Gent, Belgium Rehabilitation of Arid Environments (RAE) Trust, P.O. Box 1051, Nakuru, Kenya.

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ATTACHMENTS

Attachment I: CSU-UoN Partnership Final Report



Centre for Sustainable Drylands:

**A University Collaboration for Transforming Higher Education in Africa at
the University of Nairobi**

Final Project Narrative Report to:

**US Agency for International Development (USAID) / Kenya Mission
Higher Education for Development/ American Council of Education**

**U.S. Institution: Colorado State University (CSU)
Host Country Institution: University of Nairobi UoN)**

LWA# AEG-A-00-05-00007

Award # AID-623-LA-11-00000 4

1 April 2011 – 31 October 2014

Submitted by

**Robin Reid, Colorado State University
Jesse Njoka, University of Nairobi
Stacy Lynn, Colorado State University**

30 November 2014



1. Partnership Overview

Formation of the partnership

The partnership between the University of Nairobi and Colorado State University formed in 2010, in response to a call for proposals for the Africa-U.S. Higher Education Initiative from the USAID Kenya Mission through the American Council on Education (ACE), Office of the Higher Education for Development (HED). The Africa – US Higher education Initiative is led by the Association of Public Land-grant Universities (APLU), which collaborated in the management of the partnerships with HED. In 2011, our partnership (one of 11 from a field of 285 applicants) was funded for an initial 2-year grant, which was further extended to a 3rd year by USAID's Feed the Future program in 2013.

Why focus on African drylands?

The UoN-CSU partnership was established to address the problems of development, marginalization and sustainability of dryland peoples and the drylands themselves in Kenya. Compared to people in more productive regions, African dryland peoples experience higher infant mortality, lower GDP, faster growing human populations, more water scarcity and greater climate change impacts (Safriel et al. 2005, MEA 2005a, MEA 2005b). Remote locations, poor infrastructure and lower education levels contribute to marginalization of dryland pastoral and agro-pastoral communities. Knowledge of drylands by outsiders is also poor, which inhibits the development of ecologically, socially and pedagogically appropriate solutions to poverty and food insecurity in drylands. These challenges' complexity and intractability requires novel efforts that are trans-disciplinary, multi-institutional and collaborative in nature.

To address these dryland development challenges, people from and working in drylands need to have access to drylands-relevant education at universities. In turn, universities need to transform their research so that it meets the needs of drylands communities and the ecosystems they depend upon. This drylands-specific research and education needs to support dryland communities to build stronger and more resilient dryland institutions, and to train a drylands populace, including transformative leaders, with high quality education to compete in the global knowledge economy (APLU 2014).

We know that higher education gives very large private returns on investment to individuals in the form of increased earnings and income. Those returns are higher in sub-Saharan Africa than anywhere else in the world, \$13 for every \$1 invested (Montenegro and Patrinos 2013). In addition, higher education, especially in Africa, provides nearly double the returns (22%) than investment in either primary (13%) or secondary (11%) education (Montenegro and Patrinos 2013). Social rates of return, which include job creation, good economic and political governance, increased entrepreneurship and increased intergenerational mobility (APLU 2014), likely double this already high return on investment in higher education.

In 2009, as this partnership was forming, RUFORUM (Regional Universities Forum for Capacity Building in Agriculture) convened the Deans of the Faculties of Agriculture of 37 African universities to respond to calls by the African Union and NEPAD to improve higher education. They identified 12 needed actions to: 1) Strengthen political commitment to education, 2) Re- establish financial viability through development relevance, 3) Train managers and leaders at all

levels, 4) Build infrastructure of an international standard, 5) Conduct pre-university teaching to spark student interest, 6) Increase enrollment, 7) Develop cutting edge, multi-disciplinary, multi- institutional, team-oriented and relevant curriculum to promote innovation, 8) Increase the output and impact of research, 9) Create a new generation of entrepreneurs through mentors and internships, 10) Create centers of excellence, 11) Network inside and outside the university, and 12) Increase relevance to societal needs.

Partnership goal and objectives

This partnership's goal was to transform education, research and outreach at the University of Nairobi and Colorado State University to meet all of the needs above within a drylands-focused context. Specifically, our partnership had four main objectives: **1)** to improve coordination of interdisciplinary education, research and outreach for drylands in Kenya (coordination), **2)** to create greater capacity of students and faculty to address the problems of drylands ecosystems and societies (teaching), **3)** to increase research capacity and policy relevance, and to establish resource directions and innovations that are appropriate for Kenyan drylands (research), and **4)** to create greater participation in higher education by pastoralists, especially women, resulting in the development of more appropriate innovations for dryland systems (outreach).

Summary of activities over the life of the partnership

From 2011-2014, this partnership project completed these activities under our four objectives (see Table 1 later). Under the **coordination objective 1**, we convened 100 dryland community members and other stakeholders at the Dryland Community Voices Workshop in 2011 to create a *needs-based design for a new center of excellence, the Center for Sustainable Dryland Ecosystems and Societies (CSDES)*, with both strong university and pastoral leadership. We then designed CSDES to meet those needs by *focusing on dryland development*, which is a major policy and development priority for Kenya. We *established CSDES*, driven by dryland community needs, with 5 staff, an office, a vehicle, and a full governance structure with 20 members. We *developed important infrastructure* by rehabilitating Kibwezi drylands field station and establishing a major GIS lab. We then developed a *key strategic partnership agreement* between UoN and CSU, established via cross visits by our top university administrators. CSU then supported founding of a 'mirror' institute at CSU, The Africa Center.

Under our **teaching objective 2**, we revised the UoN drylands curriculum to make it more relevant and completed *long-term training in drylands* for graduate students. We completed a series of short and field courses on cutting edge topics related to drylands. We established a new *Internship Program* targeted at undergraduate pastoral students, especially women. Our students established linked *One Health Clubs* at the UoN and CSU to promote joint research on One Health issues. We invited *practitioners into the classroom* to teach drylands students. We developed a *collaborative online drylands course* to reach remote student in the drylands. CSDES founded the College's *first regular seminar series* to bring dryland community members and practitioners to teach students and faculty at the university.

Under **research objective 3**, we established a *Research-for-Development Fellowship Program*, designed to support graduate students to transform their research so that it was participatory and driven by dryland community needs and priorities and gave feedback of results to communities. We created a joint UoN-CSU *Faculty Team Research Program* to build capacity among faculty to address critical issues in dryland development and sustainability. We launched two *major*

annual student-led conferences to bring research results to communities and policy makers and to promote professional networking. For more information on the first Student-led Conference, please go to <http://csdes.uonbi.ac.ke/node/4297>, and for information on the second annual Student-led Conference please go to <http://csdes.uonbi.ac.ke/node/4792>.

Under **outreach objective 4**, we held frequent *community engagement workshops* and meetings to assess needs and build new community-driven projects together. CSDES leadership *engaged a wide range of policy makers and dryland development partners* to influence their work, leverage resources and get CSDES research results to users. We created a *Policy Brief and Best Practices Series* to get research results out in understandable terms. We created a widely used website, brochures, and posters. We mounted an aggressive *fund-raising campaign* to nearly double the investment in our partnership. Appendix 3 lists our leveraged resources.

Most significant achievements of the partnership

The single most significant achievement of the partnership was the establishment and near institutionalization of UoN's new Center for Sustainable Dryland Ecosystems and Societies linked with CSU's new Africa Center, through our signed strategic partnership. We conducted a Drylands Community Voices Workshop in Nairobi to bring dryland community members together to contribute to the Center for Sustainable Drylands vision. We developed all of our programs to meet the development needs of dryland communities through training transformative dryland leaders, developing drylands-relevant curricula, conducting community-driven research, holding student-led conferences, and writing policy briefs (see Figure 1 below for outcomes and impact).

Summary of impact of host--country development and prospects for sustainability The establishment of the two linked centers at the University of Nairobi and Colorado State University, and the development of our strategic partnership, is having – and will continue to have – far-reaching and long-term impacts on development in Kenyan drylands. In Figure 1, we outline the most significant outputs, outcomes and impacts of this project. To date, we have reached the outcome stage in this figure, and hope to attract additional funding to reach the impact stage. We have received support from both the county and national levels of government, and our work addresses a critical national and regional development priority in its focus on dryland sustainability and development. Sustainability will be ensured by additional funding and the institutionalization of CSDES (CSU's Africa Centre was institutionalized in 2014).

Partnership period of performance, funding amount, leveraged funds and cost share The period of performance for this partnership was 1 April 2011 to 31 October 2014. The total funding amount was \$1,422,000 over this period, with \$565,936 funding activities at the University of Nairobi and \$856,064 funding activities at CSU. The cost share was \$205,277.41, or 14%. The project partners, during the course of the project, leveraged \$1,197,965 in additional funds through grants from government agencies, foundations and private individuals, increasing total funding to the partnership by 84.1%.

2. Partnership Results

Partnership goal and objectives

This partnership's goal was to transform education, research and outreach at the University of Nairobi and Colorado State University to meet the needs of dryland communities and drylands they depend upon. Specifically, our partnership had four main objectives: 1) to improve coordination of interdisciplinary education, research and outreach for drylands in Kenya (coordination), 2) to create greater capacity of students and faculty to address the problems of drylands ecosystems and societies (teaching), 3) to increase research capacity and policy relevance, and resource directions and innovations appropriate for Kenyan drylands (research), and 4) to create greater participation in higher education by pastoralists, especially women, resulting in the development of more appropriate innovations for dryland systems (outreach).

Partnership Objective 1: Improve coordination of interdisciplinary education, research and outreach for drylands in Kenya (= coordination objective)

Demand---driven design and credible university / pastoral co---leadership of CSDES

This partnership started with a workshop entitled, *Dryland Community Voices: Setting a Joint Agenda in Higher Education and Development from the Ground Up*, with a goal to design the work of our partnership (led by our two centers, see below) to meet the needs of drylands communities and other dryland partners (see Photo 1). The workshop had high credibility at both the university and in drylands communities because it was co-led by two highly respected leaders, Prof Jesse Njoka from UoN and Dr. David Nkedianye from the pastoral community (who is now the Governor of Kajiado County), supported by long-time pastoral scholars from UoN and CSU. This attracted many participants to the workshop that would not have otherwise attended. The workshop brought 100 participants together from across the drylands of Kenya on November 30 – December 1, 2011. Meeting participants discussed a 5-year vision for the center, as well as a realistic 18-month plan.

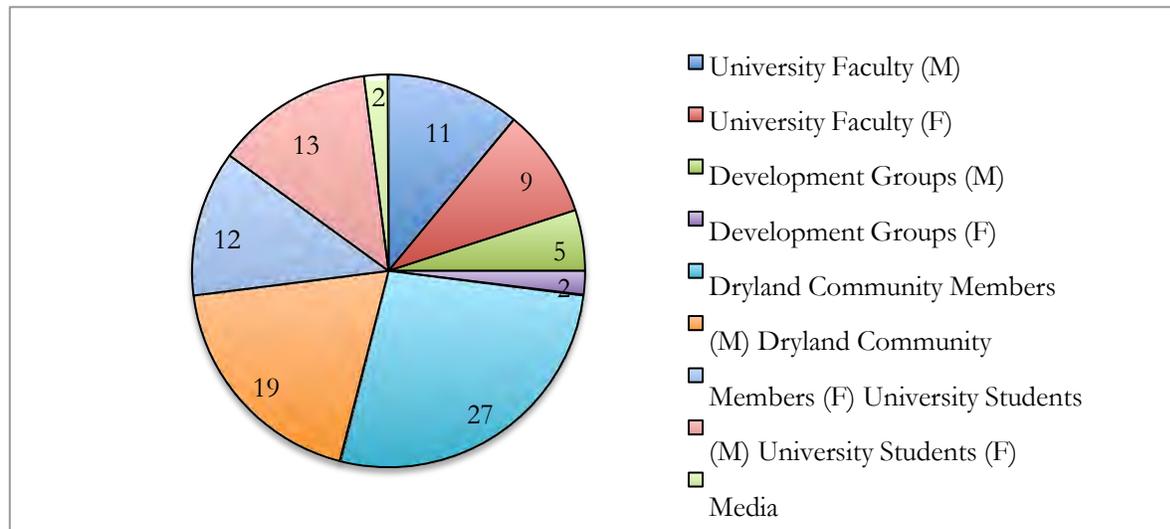


Figure 1. Attendee breakdown for the Dryland Community Voices Workshop, November 2011.



Figure 2. The CSDES Brain Trust: Photo of Dryland Community Voices Workshop attendees, Nov 30th - Dec 1 2011.

In the collective Dryland Community Voices vision, there was wide support for *better access of pastoral people* to university education and the need to address the *double marginalization of pastoral women* by equalizing access to education for those left behind. Participants recognized the importance of *creating a networking center of excellence*, as put forth in the new Kenyan constitution, to help diverse people to work together on common issues for the good of drylands and to have a consistent voice to influence policy about drylands. Participants wanted the center to be flexible, accessible and multi-disciplinary.

In development, participants wanted the center to focus on long-term development issues rather than just addressing short-term disasters. **In education**, participants saw the need for *pre- courses* to ensure dryland students are successful at university and *distance learning* for dryland professionals so that they do not have to move to Nairobi to be trained. All recognized the *great need for scholarships* for pastoral students, both men and women, to ensure wide participation. And the participants felt that the *university curricula needed to be revised not only to address myths, but to focus on the reality of life in the drylands*. Thus, the center needed to also focus on improving lecturer skills and connection to dryland communities. Participants wanted to see pastoralists welcomed to teach students in the classroom and give wider lectures at the university.

In the area of **research**, there was wide support for *community-driven research*, and *integration of indigenous knowledge with scientific knowledge*. The participants thought that the research should focus on *key issues of concern* to communities like human and livestock health, water development, institution-building, peace-building, drought, land tenure, land rights, land use laws, wildlife policy, economic value of pastoralism, and cultural heritage. Participants wanted *research results to get out widely by social media*, and to be *presented to policy makers* in brief and digestible forms, which include best practices.

Much discussion centered on the need for the center to be a *forum to influence national policy on drylands*, especially to address the widespread myths about pastoralism and raise the profile of dryland community needs. For **outreach**, communities wanted to see CSDDES reach out to the grass roots level, *encouraging communities to take action and provide their own solutions to dryland problems*. They wanted to see CSDDES establish pastoral internships that link to communities, strengthen pastoral institutions and the development of dryland management institutions and education centers within drylands. Participants wanted to see *more community- community learning and learning workshops*, catalyzed by CSDDES. And the participants welcomed the Centre staff to get out of the office and visit their communities to see issues on the ground in real life.

CSDDES, a new innovation hub for sustainable dryland development

In response to the *Dryland Voices workshop*, the partnership designed the programs of the Center for Sustainable Drylands Ecosystems and Societies (CSDDES, see <http://csdes.uonbi.ac.ke>) to meet the needs expressed by the drylands participants. The idea of the Center was to create a small and nimble innovation hub within the large university setting, composed of action-oriented groups of practitioners, faculty and students, with the goal to ensure that the education and research at our institutions benefited African drylands and the communities that depend on them. This center, by design, is a boundary organization, spanning across disciplines, across universities, and between the university and pastoral stakeholders (Guston 2001, Cash et al. 2006). Much later, the partnership created a ‘mirror’ center at CSU called The Africa Center (<http://saes.colostate.edu>) with a similar (but broader) mandate.

After it was established, CSDDES hired staff, established an office, and created a robust governance structure. CSDDES is governed by an internal (UoN) Management Committee and an external Advisory Committee.

Launching a high--level strategic partnership between our universities

Our initial goal was to establish a Memorandum of Understanding between our UoN and CSU. CSU’s International Programs suggested that we establish *CSU’s first strategic partnership in Africa* through this project. At both universities, we have hundreds of MOU’s with universities around the world. But we have very, very few strategic partnerships (usually 12 or fewer). This designation is reserved for university-wide partnerships of high importance and comes with university support at all levels. We signed this partnership with full participation of the top administrators of both universities at a signing ceremony at the University of Nairobi in November 2012. This partnership has attracted wide attention for our partnership and resulted in CSU founding of a ‘mirror’ institute at CSU, The Africa Center.



Figure 3. Signing of our Key Strategic Partnership Agreement and International MoU, by Prof. George Magoha, Vice Chancellor, UoN (seated, right) and Prof. Tony Frank, President, CSU (seated, left) on November 30th, 2012, at UoN.

Establishing wide ownership inside and outside our universities

The leaders of UoN's CSDDES and CSU's Africa Center had a vision from the outset to make sure there was very wide ownership of both centers across their universities and with the highest level administrators. They engaged across many of the colleges at each university including public health, business, engineering, distance learning, ICT, international programmes, and women studies at UoN, and business, natural resources, liberal arts, engineering, veterinary medicine and agriculture at CSU. Today, both centers are recognized as owned by many colleges, departments and individuals because of this vision. For example, the CSDDES Director created the CSDDES Management Committee so that its 15 members came from 8 different departments representing 6 different colleges at the UoN, including Humanities, Food Sciences, Education, Health and others (see Appendix 4). Likewise the 19-member Advisory Committee represents important community, development, policy and university leaders (see <http://csdes.uonbi.ac.ke/node/4154> and Appendix 4) for list of members), including some pastoralists.

The engagement of the highest administrators at both universities has been key to the success of both centers, as shown by the near institutionalization of CSDDES at UoN and the full institutionalization of The Africa Center at CSU. Both of these centers are very high profile at these universities and often used as examples of innovative programs on campus, engaging a very wide audience. The initial hope of creating innovation hubs for impact is definitely realized by these two centers and all the people, partners and programs that are associated with them.

Today, CSDES is recognized and supported well beyond UoN by many Kenyan dryland communities and policy makers for its focus on critical dryland development issues with high policy relevance, driven by the needs of local communities. Evidence of this support is the success of CSDES in attracting additional grant funds for its programs from education donors like the Meeker Foundation, major research donors like the US National Science Foundation and major development donors like DFID, IDRC, USAID, and IGAD.

CSDES also strongly engaged the USAID Kenya Mission. Over time, CSDES re-aligned and refined its program to strongly support the goals of USAID's Feed the Future and their resilience building programs in Kenya (for example, REGAL-IR and REGAL-AG).

Infrastructure development

After CSDES was established, the Center developed critical infrastructure. First, the UoN drylands field station at Kibwezi was renovated. The Kibwezi renovations were particularly important because of the need for more hands-on instruction in a drylands setting; the field station is used widely across many UoN colleges today because of this renovation, including the capacity to accommodate up to 50 students. Second, CSDES established a major Geographic Information Systems (GIS) Laboratory with over 40 computers and associated software. CSDES trained one of its staff members on GIS analysis in order to develop the capacity to run this lab. This is the first lab of its kind on the campus of the College of Agriculture and Veterinary Sciences (CAVS), and it is already widely used by students and faculty from departments across the college for teaching and research.

Leadership and management capacity building at CSDES

One of the big successes of CSDES is the leadership the director and staff have taken in project management and reporting. This includes development of project implementation plans, monitoring and evaluation, financial tracking and semi-annual and annual financial reporting. The donor requirements for these tasks are daunting for even the most experienced project managers. The CSDES Director, along with one of the CSU Co-PIs, worked over several years to train the CSDES staff. The entire process was transferred from CSU to the CSDES staff by the end of the project, such that the team is ready to manage any project of this large size with efficiency and accuracy.

Partnership Objective 2: Create greater capacity of students and faculty to address the problems of drylands ecosystems and societies (teaching)

Curriculum development

CSDES convened a curriculum review workshop to review four programs being taught within the department of LARMAT. The programs reviewed included these degrees: a Ph.D. in Dryland Resource Management, an M.Sc. in Land and Water, an M.Sc. in Range Management, and a B.Sc. in Range Management. Forty workshop participants also developed a new diploma program in agriculture to be taught at Kibwezi Field Station. CSDES received \$30,000 supplementary funds from the UNDP Kenya Sustainable Land Management Project to support the process of converting the Ph.D. in Dryland Resource Management curriculum into an Open and Distance Learning delivery mode. This will improve accessibility by dryland professionals working in remote areas for their academic advancement.

Long--term training

CSDES has used the graduate fellowships and seed research grants to support promising graduate students for faculty development. Four of the 13 graduate students (Staline Kibet, Judith Mbau, Oscar Koech, and Stephen Mureithi) who received partial support from CSDES have been recruited in the Department of Land Resources Management and Agricultural Technology (LARMAT), University of Nairobi. Several others have received teaching positions in other Universities (Frankline Otiende, Maseno University; Elizabeth Muthiani, South Eastern University; Bibianne Wanja, Mt Kenya University). Others are teaching part-time (Patrick Watete, UoN; and Henry Mwaka, Chuka University). CSDES leveraged funds from the Mpala Research Center's Meeker Family Fund (Laikipia) for full scholarships to support 6 undergraduate and 4 Masters students from underserved dryland areas.

Short--term training

We completed a series of short courses and field courses on cutting-edge topics related to drylands, including pastoral systems, collaborative research methods, GIS, remote sensing and modeling. Several courses were held at the newly refurbished Kibwezi Field Station and in our project's new GIS land remote sensing laboratory. We also held joint field courses with the University of Michigan, and Princeton University that trained 20 University of Nairobi students in field Ecology.



Figure 4. UoN and University of Michigan students on an experiential field course organized by CSDES.

Joint online course development

Thirteen UoN and six CSU faculty members participated in the development of a new online, distance education course – Sustainable African Dryland Ecosystems & Societies. The course was developed based on input from dryland community members from around Kenya both at the Community Voices Workshop in 2011, and at a set of needs assessment workshops we held in the drylands in October of 2012, conducted by a team of faculty from UoN and CSU. The

course will be offered for credit at both University of Nairobi and CSU at the Masters level, and will cover a broad set of topic related to social and ecological aspects of African drylands. Eight CSU faculty and 20 UoN faculty and staff members participated in the creation of the course, and many additional participated in training sessions on the USAID Natural Resource Management Portal (RM Portal), and/or use of the Adobe e-Learning Suite for online course development. This course was developed in strong partnership with Rose Hessmiller of Ferguson Lynch, the developer of the RM Portal. Please see Appendix 5 for a list of faculty contributors and course outline.

Student Undergraduate Internship Program

Our most difficult task in our programs was to target pastoralists, especially women. While we found few pastoralists to support at the graduate level (for example only 2 of our 13 PhD Fellows were pastoralists), there were many more at the undergraduate level. So, we created an internship program around those pastoralists, to give them special research and education experience, hoping also to attract them to take advanced degrees in our program in the future. Most of the interns served for 3 months, under the guidance of our Graduate Fellows, who were working in dryland communities around the country. We supported a total of 13 interns, of which 11 were pastoralists, and half of these 11 pastoralist interns were women. These Interns learned how to design research to serve communities, and brought special perspectives to the CSDDES programs. See what these Interns say about their internships at <http://csdes.uonbi.ac.ke/node/4166>.

Seminar series and practitioners in the classroom

CSDDES founded the College's *first regular seminar series* to bring dryland community members and practitioners to teach students and faculty at the university. Over the course of this project, CSDDES hosted 12 seminars addressed mainly by drylands practitioners. These seminars were extremely well attended and provided unparalleled opportunities for students, faculty and practitioners to learn from each other and develop stronger ties between dryland communities and the university.

Linked UoN---CSU One Health Clubs and student exchanges

Veterinary student One Health Club leaders at UoN and CSU started a One Health Club Student Exchange between our universities. The idea of the Student Exchange Program was to provide a student-led opportunity to pursue exchanges in one health work that unites the health of livestock, wildlife, people and the environment, bridging the expertise of the two universities. Two CSU students visited and worked with students at UoN for a month in 2013, and a UoN student then visited CSU later that same year. This program is ongoing, and continues to solicit funds to support additional future exchanges.



Figure 5. Left Photo: CSU students at UoN with Deputy Vice Chancellor, Prof. P.M. Mbithi (center); **Right Photo:** Mr. Kelvin Momanyi, UoN veterinary student, visiting CSU DVM students and Dr. Mark Stetter, Dean of CSU's College of Veterinary Medicine. 2013.

Partnership Objective 3: Increase research capacity and policy relevance, and resource directions and innovations appropriate for Kenyan drylands (research)

Research---for---Development Fellowship Program

This program supported 13 graduate students to work on key development challenges in drylands, using a collaborative research approach. In this approach, MSc and PhD students started their research by consulting with dryland communities to ensure their work was on issues of concern and relevance to those communities. Then the Fellows often selected an Intern from those communities to work with and collected the data under community advisement. When the research was completed, most Fellows held community feedback workshops to ensure their interpretation of their results made sense from a community point of view, and also to let the community know what they found.

Student---led conference on sustainable drylands

In May 2013 and June 2014, CSDES-supported students, with CSDES staff, organized two major conferences to share their research results with dryland communities and other stakeholders. The conference also enhanced networking among young professionals, research institutions and policy makers; strengthened partnerships among dryland communities, institutions of higher learning and other stakeholders; catalyzed interest among CSDES interns to pursue higher education, research and outreach opportunities; promoted awareness among various stakeholders about the unique needs of drylands and the need for innovative approaches for enhancing dryland livelihoods; and motivated young professionals to contribute to dryland development. These landmark events attracted heavy participation among students, faculty, development practitioners, government officials, and dryland community members. Six hundred students and other stakeholders participated in the 2013 conference, 300 participated in the 2014 conference. A few of the important speakers included a representative from USAID Mission Kenya (Mr. Isaac Thendiu in 2013, and Dr. Millie Gadbois in 2014, Coordinator, Feed the Future Kenya Program). Others included Nancy Chege, UN Development Program, Kenya; John Smith, Director for Democracy, Rights and Governance, USAID Kenya; and Prof Agnes Mwango'mbe, Principal, College of Agriculture and Veterinary Sciences, UoN.

Joint university faculty seed grants

We designed these seed grants to encourage joint UoN-CSU research on development-oriented topics, using a systems approach, on interdisciplinary teams. Our goal was to develop teams that would then apply for grants together, so that the grants provided a ‘seed’ for future, larger projects. We funded 5 projects (see http://csdes.uonbi.ac.ke/uon_research_projects for details), with subjects including food security, human-wildlife conflicts, livestock disease, community mapping and indigenous knowledge.

Major research results

- *Innovative Dryland Institutions for Research Building.* This study, carried out by Stephen ole Moiko and Profs Kathy Galvin and Robin Reid, assessed the structure, process and social and ecological outcomes of the growing conservancy institutions in Kenya. Major findings included the fact that even though these institutions started out as wildlife conservancies, they were often turning into livestock and community development conservancies, with some wildlife conservation on the side. Some focus on conflict resolution, others on grazing, while still others on human and livestock security.
- *Wildebeest Forage Acquisition in Fragmented Landscapes under Variable Climates.* This NSF-funded study was carried out by CSU Profs Randy Boone and Robin Reid, Dr. Jeff Worden, CSDDES Fellow Judith Mbau, and CSDDES Fellow Dickson Kaelo. The goal was to assess the impacts of rangeland privatization and fragmentation on wildebeest migration. Major findings included strong evidence of the collapse of the wildebeest migration outside of Nairobi National Park, very long distance migration of the Mara Loita population of wildebeest, identification of corridors for conservation action and the importance of Amboseli wildlife conservancies for wildebeest conservation.
- Research grants by the Partnership via CSDDES supported the work of 13 Research-for-Development Graduate Student Fellows and 5 Faculty Partnership Teams over the course of the project. The research findings of some of these various grants are summarized in abridged policy briefs in Appendix 6.

Partnership Objective 4: Greater participation by pastoralists, especially women, to develop more appropriate innovations for drylands (outreach)

Community engagement meetings

Throughout the project, starting with the Drylands Voices workshop, we held 12 dryland community workshops and meetings. We brought the research results to community members and county governments in Isiolo, Marsabit, Laikipa, Yatta/Machakos and Kajiado. We designed these workshops both to share results but also to better understand needs for future work with these counties. CSDDES also signed an MoU with the Yatta Community Project (Machakos) to extend technologies and to develop community capacity in sustainable land management.

Policy Brief and Best Practices Series (see list Appendix 6)

We produced 15 Policy and Best Practices Briefs as part of this project. The subject of these briefs including camel milk marketing, food security, forest and land management, rangeland rehabilitation, resilience of urban pastoralists, productivity of irrigated pasture, livestock diseases, wildlife tourism, grass farming, pastoral indigenous knowledge, medicinal plants and conflict management. These Policy and Best Practices Briefs have been widely shared both online and in print format.

General communication and outreach

Our partnership was devoted to communication and we employed one half-time staff/consultant position at CSDDES to this important task. We developed a very well-visited website. We had about 8000 hits from May 2013 to Nov 2014 with visits from over 100 countries around the world (see <http://www2.clustrmaps.com/counter/maps.php?url=http://csdes.uonbi.ac.ke/>). We also produced several periodic newsletters <http://csdes.uonbi.ac.ke/node/62>, and developed brochures (<http://csdes.uonbi.ac.ke/node/4339>) about CSDDES. The Africa Center at CSU (see <http://saes.colostate.edu>) produced an award-winning film by pastoralists about their concerns about their land and climate change.

Fund--raising in education, research and outreach

Partners developed and submitted more than 40 grant proposals to support work by our partnership (see Appendix 7). Nine of them have been funded or pre-awarded, and several others are pending. At least one proposal was in progress at the end of this project and submitted in mid-November.

- The **USAID-CRSP** granted CSU's Prof Galvin \$80,000 to conduct a workshop and develop an award-winning participatory video on climate change and pastoralism in East Africa. 2011.
- NSF-CNH funded a proposal entitled: "Assessing vulnerability of provisioning services in the southern highlands of Ethiopia", (Galvin, Co-PI and Lynn, Senior Investigator) [FUNDED \$250,000]
- **CSU** granted Prof Galvin and the CSU team \$20,000 to establish The Africa Center (original called the Global Challenge Research Team called Sustainable African Ecosystems and Societies). 2013
- The **US National Science Foundation** granted CSU's Dr. Bowser \$749,697 to create the Global Research Network on Women and Sustainability to mentor underrepresented women and women from developing countries in research on environmental sustainability. 2011- 2014.
- The **International Social Science Research Council** granted Prof Galvin \$40,782 to develop a transformative knowledge network for the rangelands in Kenya, Mongolia and the US. 2014-2015.
- **DFID is in the final stage of announcing** pre-awarded Mercy Corps and Prof Njoka (CSDDES budget component of \$35,000 per year for three years 2015-2017) to build resilience for climate extremes and Disasters. 2014.
- **IGAD** Resilience program made a pre-award to Prof Jesse Njoka for a project on applied research to enhance resilience of livestock-based livelihoods in Northern Kenya (with KARI & PACIDA). \$200,000 July 2014 to November 2015.
- **IDRC/SSHRC** awarded a proposal to look at institutional innovations with the Institutional Canopy of Conservation, with McGill University & ACC - CSDDES is a collaborator in this project.
- The **CSU's Water Center** awarded Dr. Stacy Lynn \$30,000 to conduct a pilot study on governance of the recently discovered water aquifers in Turkana, Kenya, and to pull together a team to submit a larger proposal to the NSF Coupled-Natural Human Systems program. The proposal was submitted November 2014.

Table 1. Summary of partnership achievements toward indicators 2011-2014.

STANDARD INDICATORS	Number
Training Long-term Completed	26
Training Short-term	167
Access * Students	32
Outreach/Extension Activities	18
Research * Joint Projects	14
Access * Policies	1
Beneficiaries * Direct	3017
Experiential / Applied Learning	4
Programs * New	1

CUSTOM INDICATORS	Number
Funds & Resource Raising	40
Raising Awareness	12
Mentoring & Training the next generation	15
Web & Media Platforms	8505
Publications	35
Student-led Conference & Policy Seminars	8

FTF INDICATORS	Number
Individuals receiving USG-Supported short-term agricultural productivity training on food security	37
New technologies or management practices under research, field testing, or made available for transfer as a result of USG assistance	3
Stakeholders implementing risk-reducing practices/actions to improve resilience to climate change as a result of USG assistance	37
Members of producer organizations and community-based organizations receiving USG assistance	37

Partnership’s development outcomes, significant impacts to date

The single most significant achievement of the partnership is the establishment and near institutionalization of UoN’s new Center for Sustainable Dryland Ecosystems and Societies, linked with CSU’s new Africa Center, through our signed strategic partnership. We then developed all of our programs to meet the development needs of dryland communities through training transformative dryland leaders, developing drylands-relevant curricula, conducting community-driven research, holding student-led conferences, and writing policy briefs.

Our partnership has contributed to national development and USAID priorities in the following ways. CSDES has aligned its work with USAID’s 9-5-2 layering approach and partnered with

USAID resilience programs (REGAL-IR/AG). Our partnership has trained CSDDES staff so they are highly professional, and have been able to provide technical support for Government dryland development plans. We have linked research to community priorities, and postgraduate research has informed Government arid and semi-arid lands (ASAL) policies; the newly formed ASAL secretariat will benefit from our policy briefs based on action research by our postgraduate students and Fellows. We have also linked with the National Drought Management Authority (NDMA), the Ministry of Education, Science and Technology, and the ASAL stakeholders Forum. We have also worked closely with new county governments. For example, Marsabit County has requested technical support for development of their agriculture land use master plan when funds are available. In Kajiado County, we are supporting county planning efforts through Governor's office.

The establishment of the two linked centers at our two universities and the development of our strategic partnership, is having and will continue to have, far-reaching and long-term impacts on development in Kenyan drylands. In Figure 1 below, we outline the most significant outputs, outcomes and impacts of this project. To date, we have reached the outcome stage in this figure, and hope to attract additional funding to reach the impact stage. We have received support from both the county and national governments, and our work addresses a critical national and regional development priority in its focus on dryland sustainability and development. Sustainability will be ensured by additional funding and the institutionalization of CSDDES (CSU's Africa Centre was institutionalized in 2014).

Significant challenges to implementation and how we addressed them

We have not scratched the surface of need for support of pastoral students, especially women. In Kenya alone, scholarships for 200-300 pastoral students per year would make a measurable difference in this problem. The need for community-relevant research that can influence dryland policy at the highest levels is also very, very large and requires much more effort than possible on a project of this small scale. As for best practices, creating an extension system to address community needs, backed by quality research, is also a major unaddressed hurdle.

We found the constant movement of the goalposts as far as changes in the required indicators and outcomes for the donor-required M&E to be disruptive and counterproductive. These changes also made it difficult to measure achievements consistently as the project progressed, because the way indicators were measured repeatedly changed and therefore are not additive across the full term of the project. The donor-required reimbursement system had too many links in the chain from HED to CSU to UoN and back. This delayed project implementation multiple times throughout the project. From CSU's perspective, it was difficult to take on all the financial risk of the project, and sharing this burden with the donor would have helped. UoN had to step in and share the risk with CSU by advancing funds for project implementation due to delays caused by this long chain of finances, including the financial and audit procedures at CSU. The UoN procurement system was another challenge that slowed the pace of project implementation. Towards the end of the project, UoN fast-tracked the procurement process to allow the establishment of a GIS Lab and purchase of a project vehicle. Building joint teams for action research was a challenge; funding to bring teams together multiple times would have helped.

Partnership's key achievements and major outputs

The overall, higher-level achievements of this partnership are captured in Figure 1 below.



Figure 6. Outputs, outcomes and anticipated impacts of our partnership's two centers, UoN's CSDDES and CSU's Africa Center.

We started from the perspective of dryland communities through our initiating Dryland Voices workshop (top bubble, Figure 1). We then designed UoN's CSDDES and CSU's Africa Center focusing on critical development issues in African drylands. We then did research-for-development and provided greater educational opportunities for dryland peoples, pastoralists, and especially women. Our outputs were then these transformative leaders, demand-driven research and a wide learning network through our communication infrastructure. We are now seeing the outcomes from those outputs in the form of better and faster development; better policies that support the needs of dryland communities, and stronger local entrepreneurship. Our end goal is to build the resilience and innovation in local dryland communities and strengthen local, community-based institutions. These latter impacts are only starting to build now as we end this project.

3. Conclusions

Summary of the key lessons learned and advice for future implementers

One of our key lessons is the immense value of creating an African-led development-focused and demand-driven institution to span the boundaries of two universities, USAID, multiple dryland communities and counties, and development practitioners. Despite our strong start, the problems we are attempting to address are immense and our work needs to be expanded at least 10-fold. If we do not expand upon what we have started, we once again run a very real risk of raising the expectations of marginalized peoples in drylands, while failing to deliver the fundamental education and research that they request from us. The full institutionalization of these good ideas and lessons learnt requires additional financial support to reach sustainability to keep our partners and communities engaged in sustaining dryland ecosystems and societies.

How has the partnership affected policies and practices at UoN and CSU?

This partnership affected policies and practices at UoN and CSU first by creating new institutions within both universities that focus on African dryland development and sustainability through education, research and outreach. We also developed an official key strategic partnership between our universities at the highest level, which will continue to attract research and engagement activity and some monetary support for the partnership for years to come. At UoN, significant progress has been made toward institutionalizing CSDDES, a step which will provide a permanent foundation (which has been provided for The Africa Center at CSU). The transformative programs of both centers have spotlighted how both universities can strongly engage dryland communities to have real impact on development on the ground. The partnership has also accelerated the adoption of high quality e-learning at both UoN and CSU, making higher education more accessible to the drylands, and highlighted the significant opportunities we have to pursue joint development of major curricula (and perhaps degrees).

Continuation of our partnership in the future

There is great incentive for both UoN and CSU to continue this partnership, particularly because our work has been recognized at the highest levels of our universities, and with the 2014 APLU Malone Award for International Leadership in the US. There is also the priceless incentive of trust that we have built over 25 years of working together. Development of mirror centers at our two universities also provides hubs for interaction. As many US university staff know, it is difficult to work in Africa without an institutional connection to anchor the work. We now have deep anchors at both of our universities for this work. As a consequence, we are already continuing our collaboration with 2 post-project proposals submitted in November 2014, and 3 additional major proposals planned. We have three meetings planned for 2015 for proposal development, online degree development, and further research. Additional African field courses are planned for 2015, although funding for UoN student participation has not been secured.

The prospects for sustainability as well as future opportunities

All of our programs and initiatives have focused on ensuring that education and research are useful and used by dryland communities, but we have only begun to scratch the surface of the need in this area. The real challenge here is that, to be fully effective, this type of work needs at least 10 times the current funding and needs a multi-decade time horizon. So while we have made a good start, we are all concerned that this will be another boutique project, with great ideas and great initial impact, but that fades into the history of such efforts. We currently have

good support of our university administrations, but these efforts need the full support and ownership of the development community to have impact at the magnitude and over the time horizon needed. The USAID Kenya mission supported our dryland partnership in 2013/2014 to provide backstopping services for the Feed the Future Kenya program, which is aligned to Kenya Vision 2030. Potential of leveraging resources from County Governments and other development partners and donors is very good as CSDES and The Africa Center are already working with County Governments in Isiolo, Marsabit, Kajiado, and Laikipia among others.

Innovation hubs for sustainable dryland development

Our future plans are to complete the full institutionalization of CSDES, with UoN financial support for basic personnel, and to strengthen CSU's Africa Center. We will then grow this program through external grants, and take full advantage of our strategic partnership, linking CSDES and The Africa Center. Both centers will continue to reach across our universities so that we have wide representation from various university disciplines, departments, faculties and colleges. CSDES will strengthen its governance within the framework of ongoing development initiatives by various development partners, NGOs and National and County Governments by constituting a vibrant and broad representation within Advisory Board, with CSU's support. We will also build our capacity to attract and administer major external granting programs, targeting our fund-raising at underserved communities in drylands. We will mobilize human and financial resources to engage on dryland community priorities and will seek opportunities to demonstrate and implement scientific based evidence and technologies to promote sustainable land management practices and diversified livelihoods.

Infrastructure

We will take full advantage of the infrastructure developed by CSDES in its GIS Lab and refurbished field station at Kibwezi to develop more experiential field courses and basic and advanced courses in GIS, remote sensing and modeling. We also want the GIS capacity to be useful to dryland communities and county governments, and will thus develop a strong focus on participatory mapping and planning. Through Kibwezi, CSDES hopes to engage with the private sector to enhance entrepreneurship and equip women and youth with dryland technologies and skills for alternative livelihoods. CSDES will also explore possible grants and investments to support the expansion of teaching and research facilities for all levels of human capacity development to respond to needs identified at local, county, national and regional levels.

Teaching and higher education access

We will continue to develop pre-courses and networking programs so that we can attract underserved students from drylands, especially marginalized pastoralists and women. We also will seek support to build more capacity of faculty, students and staff through targeted short and skill enhancement courses, so we can develop in-house experts with specialized skills at both our universities. Our linked centers will develop new curricula, especially online courses that bring together multiple disciplines to address dryland sustainability. CSDES will continue to partner with CSU and other dryland practitioners to build capacity for open and distance learning and e-learning, to serve a broad clientele and demand by taking advantage of existing UoN open and distance learning centers across Kenya. We will also develop short courses on cutting edge issues, and courses to prepare students for employment (leadership, management, team building, entrepreneurship and experiential learning).

Research

Our focus in research will be disaster risk reduction management and building the resilience of dryland peoples and dryland ecosystems through sustainable dryland development. We will continue our action-based research approach that engages end users in the development of the research to directly help local dryland communities. Our hope is to become the ‘go-to’ place for policy relevant research about drylands. Specifically, our research will include dryland entrepreneurship; natural resource management (NRM); dryland livestock and crop agriculture; food and nutritional security and safety; market access and trade (value chains); livelihoods, peace building and conflict management; dryland policy; valuation of dryland ecosystem services; devolution, governance and democratization of NRM; and sustainable energy and water. We will also build a monitoring, evaluation and learning system to complement the knowledge management, linking our two centers to the wider world. Our expected outcomes include higher quality research that reaches a much wider audience, a better understanding of dryland sustainability and development solutions, increased intellectual synergy among partners, increased ability by network partners to attract major research investments, increased household income, improved food security and nutrition, improved dryland ecosystem health, improved policies relating to drylands and reduced NRM-based conflicts.

Out--reach and In--reach between our universities and dryland communities

We will continue to build on our two-way engagement with dryland communities, especially strengthening the ability of communities to ‘reach in’ to the university, bringing their knowledge and expertise inside the university. Our dream is to evolve our research approach so that it is a fully co-created enterprise, rather than the traditional dissemination approach. Communities will continue to co-develop joint research agenda, co-conduct the research including their experiential knowledge, co-interpret our joint research results, and co-communicate that information to the outside world, especially dryland communities. CSDES, with the support of CSU’s Extension, will adopt a university-led extension, co-research and co-learning model to improve exchange of needs, knowledge and technologies between the university and communities and counties.

Bringing other partnerships to bear on dryland issues

We will also expand our collaborative partnerships by engaging new counties and other stakeholders. We will also involve stakeholders in discussions around policy implications through seminars and high-level meetings. We will also leverage funding from different sources and link with other USAID and GoK programs. CSDES and The Africa Center will continue to build linkages with internal and external higher education groups, government (national and county), the private sector, development partners and communities in order to tap into various synergistic attributes in order achieve long-term, sustainable development. We will conduct a stakeholder analysis to map strategic national institutions to partner with in the future. Our outcomes include increased collaboration among researchers and demand from Kenya and outside (other universities and countries), increased leveraging of resources with partners, improved connections between science and policy formulation and greater interest on the part of leaders especially from dryland counties in the problems of drylands.

4. Appendices

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Appendix 4: CSDES Management Committee and Advisory Committee

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releases, news stories or news articles about our partnership **Appendix 12:** Africa Center Symposia

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Appendix 1: Acknowledgments

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Appendix 2: References for this report

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Appendix 3: Table of Leveraged Resources -- Summary of resource mobilization achievements

Source of funding	Amount (USD)	Cash /	Brief Description of Purpose of funds	Beneficiaries and status, outputs
Citizen Network for Foreign Affairs (CNFA) through Kenya Livestock Development Project supported by USAID	\$15,000	Cash	Scholarships for fieldwork	3 students benefited, each receiving USD 5000
University of Michigan (UM)	\$10,000	Cash	Scholarships for field studies for students from UM and University of Nairobi (UoN)	About 8 UoN students, 1 student from Tanzania and 16 UM students participated in field studies conducted in Kenya drylands in August 2011
University of Princeton /University of Illinois Chicago	\$6,300	Cash	Sponsorship for field course (computational ecology) offered jointly by the two USA universities and held at Mpala Research Centre in Kenya. 100 USD/day per student for 3 weeks.	3 UoN MSc. students awarded. Course completed May 2012. Paper submitted for publishing
African Conservation Centre/National Science Foundation (CSU)	\$40,000	Cash	Graduate studies –research grants for PhD	3 PhD students (Mary Morara \$ 10,000; Judith Mbau- \$ 10,000; and Dickson Kaelo- \$ 20,000). Ongoing.
International Livestock Research Institute (ILRI)	\$27,000	Cash	Funding for carrying out a study on building resilience to climate change	Complete, results disseminated in a stakeholders workshop and-report ready
African Union Inter-African Bureau for Animal Resources (AU-IBAR)	\$20,000	Cash	Funding for carrying out study on rational range use in Africa, as a contribution to UNCCD thematic programme three (TPN3)	Completed, results disseminated in a stakeholders workshop and report ready
Graham Institute (USA)	\$50,000	Cash	Research grant for Q-fever disease (veterinary study) to undertake research proposal development Field course for 6 students (travel and boarding) at around 4000 USD	2 faculty members of UoN involved; Study ongoing; Field study to be done; Maasai Mara and MRC

Source of funding	Amount (USD)	Cash/ Value	Brief Description of Purpose of funds	Beneficiaries and status, outputs
Kings University College Canada	\$8,400	Cash	Scholarship for 24 months- masters research/stipend @350/month Partnership- Dr. Harry Spaling	1 student (Henry Mwaka) benefited. Ongoing. Research affiliate of CSEDES. Affiliation already approved by the UoN, DVC Research Production & Extension
Meeker funds	\$100,000	Cash	Study scholarships for graduate and undergraduate students	2 students awarded fellowships for masters and 4 for bachelors program at UoN. Undergraduate students ongoing; masters.
University of Michigan STEM Africa programme	\$3,000	Cash	Facilitation (travel and accommodation) of CSEDES Director to participate in STEM conference held in May 2012 in Ghana	Output: presentation on Environmental Science in Africa CSEDES also exploring opportunities for leveraging resources from STEM to support some of its programs
Mpala Research Centre (MRC)	\$10,000	Cash	CSEDES secured internship for 2 students from UoN for three months- each student stipend was 300USD and 50 USD per day/student Partnership for Research	2 students Completed internship under Range Monitoring project at MRC. CSEDES is in the process of establishing partnership with MRC.
Indiana University and Princeton University	3,800	Cash	Funding for 2 days training and field work (data collection) for 45 days	6 students (3 graduate and 3 undergraduate) – 1 from Moi university and 5 from UoN. Field work
UoN/University of Ghent (UG)	\$500	Cash	1 PhD student secured funds from UG to summarize research results into a policy brief	Policy brief on Range Rehabilitation for Wildlife Conservation and Livestock Production complete.
ILRI (International Livestock Research Institute)	\$500	Value	Partnership- Dr. Mohammed Said sponsored by ILRI to teach PhD dryland students	1 Lecture to PhD Students 2012 class
National Museums of Kenya	\$500	Value	Partnership- Dr. Mary Gikungu	1 Lecture to 2 nd years Range Management 2012 class
Michigan University	\$500	Value	Partnership- Bilal Butt Research affiliation	1 Lecture to 1 st year students Research affiliate to CSEDES. Affiliation already approved by the UoN, DVC Research Production and

Source of funding	Amount (USD)	Cash/ Value	Brief Description of Purpose of funds	Beneficiaries and status, outputs
Gillian Bowser's Global Women's Network	\$3,000	Cash	Airfare for Drs. J. Njoka and D. Nkedianye to Washington, DC to meet with the Global Women's Network and build collaborative project cross-	The projects benefited as a whole
Rose Hessmiller and Mike Colby (USAID)	\$25,000	Value	Donation of online Natural Resource Management Portal (RMPortal) system to University of Nairobi for University-wide use. Currently implementing RMPortal for use by UoN to grow and improve the distance education program (first in drylands, then across the University) for course development and delivery, and for the project to create and maintain an online project collaborative network. Value is equivalent to the Blackboard system, which is purchased by CSU at a rate of \$25,000/year.	University of Nairobi, entire HED team, UoN Drylands students, especially remote students.
National Science Foundation project, Dr. Randall Boone, PI	\$5000	Cash & Value	Student field work is being supported by this project, and students are being mentored by Dr. Boone and other project scientists.	CSEDES Graduate Students; ongoing; students are generating usual products of graduate work
Colorado State University	\$10,000	Value	Funds have been promised by CSU to support a delegation by the CSU President or Provost, and the Director of International Programs, to University of Nairobi in late 2012. Additional funds may be secured for travel by several department heads and deans to a possible total value of \$30,000.	The project as a whole, and extended faculty of UoN.
Dr. Gufu Oba, Emory University	\$500	Value	Dr. Oba contributed funds to partially support his own travel to CSU to participate in the conference on Higher Education, Research and Sustainability in Africa.	Conference Participants, project team
CRSP	\$2,000	Value	Support for RR airfare to KY w/ KG	CSEDES
Brett Bruyere's project funds	\$2,000	Value	Airfare leveraged to visit UoN April 2012	CSEDES undergraduate students
CRSP	\$2,500	Value	Leveraged airfare for JN to travel to Colorado for CRSP meeting, used opportunity to meet with HED team	HED Project development
ILRI	\$1,200	Value	Vehicle lent to RR, DS, and SL for trip to Kenya for Community Voices Workshop	Project

Source of funding	Amount (USD)	Cash/ Value	Brief Description of Purpose of funds	Beneficiaries and status, outputs
11 PhD and 3 MSc self-sponsored students (including Halima) who started in 2010	\$77,160	Cash	Sponsoring of graduate education costs @ 500,000 per PhD student (5,500,000 KSH total) and 250,000 per MSc Student (750,000 KSH total). Source of funds varies from sponsoring institutions to <u>personal funds of grad students.</u>	Graduate Students
EU-KASAL project	6,173	Cash	Elizabeth Muthiani scholarship (500,000 KSH)	EM
Mercy Corps to UoN/CSU	\$200	Cash	Sponsorship of Chloe Stull-Lane to attend the dryland community voices workshop	DCV workshop attendees
US NIH to CSU	\$200,000	Cash	NIH fellowships funded to CSU \$200k – Kelvin Omanyi @ UoN & vet student at CSU are creating student exchanges for One Health along with Mark Stetter and Sue VandeWoude (CSU professors)	Veterinary students at CSU and UoN
CSU's Center for Collaborative Conservation	\$30,000	Value	Time contribution for RR toward project from CCC	
CSU's School for Global Environmental Sustainability (SoGES)	\$20,000	Cash	CSU GCRT funding to create a center at CSU on Sustainable African Ecosystems and Societies to build partnerships around work in Africa across CSU, as well as to partner with CSEDES and other African institutions	CSU faculty and students working in Africa, and CSEDES as a direct linking institution within CSU
Fulbright support for CSU	\$20,000	Value	CSEDES is providing support for Connor Jandreau, Fulbright Student, from University of Manitoba, Canada, during his year of field work in Kenya. CSEDES is Connor's host institution and contributed to the proposal's <u>design.</u>	Connor Jandreau, and CSEDES and others who will benefit from his research
ILRI	\$30,000	Value	Conferencing equipment donation from International Livestock Research Institute – in process of transfer – based on negotiations with Prof. Njoka.	University of Nairobi's College of Agriculture and Vet Sciences, including CSEDES
University of Florida	\$2,000	Value	Gillian 2 students participating in e-learning from UoN through Univ of FL, studies on conservation, 1 course each	2 graduate students
AAAS	\$2,500	Cash	JN travel to AAAS, including airfare, two nights accommodation, and registration	Jesse Njoka and CSEDES
AGRA	\$1,000	Value	AGRA support for speaker to CSEDES practitioner seminar	All seminar attendees

Source of funding	Amount (USD)	Cash/ Value	Brief Description of Purpose of funds	Beneficiaries and status, outputs
CSU	\$35,000	Cash	Funds to support CSU delegation travel to Kenya: \$4000 each for 8 individuals for international airfare, Kenyan airfare to Maasai Mara, and accommodation, plus \$1500 each for two individuals accommodation	Both CSU and UoN for Key Strategic Partnership and partnership-building, students and faculty who attended presentation by CSU President A. Frank.
Mpala Research Inst. & Meeker Family Foundation	\$30,000	Cash	Meeker students supported by IIED through Oliver Wasonga	Two UoN graduate students
Practical Action	\$5,000	value	Patrick Watete , a PhD student at LARMAT, supported (logistics) by Practical Action to collect data in Mandera and Turkana Counties	One UoN graduate student
IIED	\$5,000	Cash	IIED supported PhD graduate student Yazan Elhadi with an additional \$5000	One UoN graduate student
IIED	\$4,000	Cash	IIED sponsored trip to Ethiopia for 4 students and 1 faculty member @ \$500 + \$100/night x 3 nights	4 UoN students, 1 UoN faculty
UoN	\$8,000	Cash	UoN sponsored travel of 2.5 administrators to CSU for administrative exchange in April 2012	CSU and UoN for IMOU signing
CSU	\$500	Cash	Funding to rent a vehicle for visiting UoN administrators April 2012	CSU and UoN for IMOU signing
Dr. Robert Woodmansee	\$10,000	Value	Donated time to project for curriculum and online system development	CSU and UoN partnership, future students of online curriculum, faculty
Brett Bruyere's project funds	\$2,000	Value	Contributed airfare and other travel costs to get to Kenya, leveraged funds	UoN partnership project and Samburu community
Princeton's Global Collaborative Network Fund	\$ 1500	value	Air ticket and accommodation for CSDES Director to participate in a workshop in Niamey, Niger October 21-23	Jesse Njoka/CSDES
IGAD	\$ 1000	Value	Air ticket and accommodation for CSDES to attend IGAD partners meeting at Addis Ababa (5th Nov 2013) on IGAD's applied research in drylands (ARD)program	CSDES has been selected by IGAD s a center of excellence on dryland issues and is participating in the development of the ARD program

RUFORUM (Yazan El Hadi)	\$350	Cash	Sponsorship for 10 community participants in the CSDES dissemination workshop in Isiolo on 25 October 2013	
IGAD	\$ 200,000	Cash	Grant from IGAD's Applied Research in Drylands Grant Facility	CSDES-KARI- PACIDA : July 2014 to October 2015
UNDP Kenya	\$ 30,000	Cash	Grant for review of PhD in Dryland Resource Management offered at LARMAT	July to September 2014
2 PABX @35295 each	\$70,590	Value	PABX donated by ILRI and ICRAF for replacing old models. One for CAVS and the other for the Main Campus central administration	July 2013, Installation commission of CAVS done in 2014
Pauline Gitanga field Research grant from Dick Bowen (CSU)	\$10,000	cash	To support PhD field data collection in Marsabit county	From May 2014
Dana Hoag one day seminar	\$4,300	value	Research publication for 30 graduate students valued at \$60 each student and Dana Hoag travel and accommodation for \$2,500	October 28, 2014 at CAVS
Time contribution by Jesse Njoka PI 80% effort	\$45,000	value	Working for no compensation between August 2013 to August 2014	Funds saved improved FTF activity implementation
TOTAL Leveraged Funds	\$1,197,965	USD		

Appendix 4: CSDES Management Committee and Advisory Committee

A4.1 CSDES Management Committee (internal)

	NAME	DEPARTMENT	EMAIL ADDRESS
1.	Prof. Jesse. T. Njoka	PI-UoN Chair: Range Wildlife and livestock Human interactions - Socio ecologist	jtnjoka@gmail.com
2.	Dr. David Nkedianye	Reto-O-Reto Foundation CSDES: Range Sociology	nkedav@yahoo.com
3.	Prof. R.K.Ngugi	Chairman, LARMAT: Range Animal Nutritionist	krngugi@gmail.com
4.	Prof. Peter Gathumbi	Veterinary / Medicine: Public Health- Ethnoveterinary ITK	gathumbi@uonbi.ac.ke
5.	Prof. Charles Gachene	LARMAT/Soil Science: Soil survey and fertility management	gachene@uonbi.ac.ke
6.	Prof. Wambui Makau- Kogi	Food Technology & Nutrition- Human Nutrition	Wkogi_makau@hotmail.com
7.	Prof. Wanjala Were	Dean, Faculty of Education: Education by	deaneducation@uonbi.ac.ke
8.	Prof. Zipporah Ngumi	College of Health Sciences- Community Health	zngumi@gmail.com
9.	Dr. Margret Jesang	Women Study center (UoN), Crop Production	m.hutchinson@uonbi.ac.ke
10.	Dr. Kimpei Munei	Agricultural Economics	kmunei@yahoo.com
11.	Dr. Cecilia Onyango	Plant Sciences- Horticulture	Cmoraa8@yahoo.com
12.	Dr. Laban MacOpiyo	LARMAT: GIS/Ecologist	labanmacopiyo@gmail.com
13.	Dr. Moses Nyangito	LARMAT – Range Livestock/Vegetation	mmnyangito@uonbi.ac.ke
14.	Prof Octavian Gakuru	Sociology	ngakuru@uonbi.ac.ke ; ogakuru@yahoo.com
15.	Prof Wanjiku Kabira	Women Study Center- Gender and Policy interface issues	wkabira@yahoo.com ; awsikenya@yahoo.co.uk

A4.2 CSDES Advisory Committee (external)

	<p><u>Prof. Agnes Mwang'ombe</u> Principal, College of Agriculture and Veterinary Sciences (CAVS), UoN</p>
	<p><u>Prof. Solomon Shibauro</u> Dean, Faculty of Agriculture, UoN</p>
	<p>Prof. Florence K. Lenga Deputy Commission Secretary, BSc, MSc (Nairobi), PhD (Utah)</p>
	<p><u>Prof. Jesse. T. Njoka</u> Professor, Land and Agricultural Resource Management and Training (LARMAT), UoN</p>
	<p><u>Prof. Gufu Oba</u> Senior Researcher, Noragric Centre for International Environment Studies Agricultural University of Oslo</p>
	<p><u>Prof. Wanjiku Kabira</u> Chair, Department of Literature, and Ag Director, African Women's Studies Centre</p>
	<p>Prof. Ephraim Mtengeti Soikoine University</p>
	<p>Dr. Mohammed Said International Livestock Research Institute</p>

	<p>Dr. David Nkedianye Governor, Kajiado County, Kenya</p>
	<p>Dr. Nuola Simplicite AU--IBR</p>
	<p>Dr. Wellington Ekaya RUFORUM</p>
	<p>Dr. David Miano KARI</p>
	<p>Dr. Ann Juenper UNDP</p>
	<p>Dr. Edmund Barrow IUCN</p>
	<p>Dr. Naomi Kipuri Former Director, Arid Lands Institute, Kenya</p>
	<p><u>Dr. Robin Reid</u> Professor and Director Center for Collaborative Conservation Colorado State University</p>
	<p>Ms. Allyce Kureiya SAIDIA</p>
	<p>Mr. Isaac Thendiu USAID</p>
	<p>Mr. Peter Odhengo Prime Minister Office</p>

Appendix 5: Online Course – Outline and list of faculty developers

Lecture#/Topic	Instructor(s)
MODULE 1: Introduction to African drylands and Systems	
1 Course Introduction	Njoka & Lynn
2 African Drylands in global context: What, where, who and why	Reid
3 Where we have been and where we are going in African drylands	Njoka
4 Current biophysical issues in African drylands	Njoka
5 Current socio-economic issues in African drylands	Moiko
6 Misconceptions about African drylands and peoples	Reid
7 Foundational Concepts - Part 1	Woodmansee
8 Foundational Concepts - Part 2	Woodmansee
MODULE 2: Dryland biophysical foundations	
9 Dryland climates and systems dynamics	Swift, Kironchi or Gachene
10 Hydrology and water issues of drylands	Mureithi
11 Dryland Soils	Coughenour
12 Dryland ecology and primary production	Woodmansee
13 Dryland animal ecology and secondary production	Swift
MODULE 3: Dryland socio-cultural foundations	
14 Social geography, history and prehistory in African drylands	Gakuru, Mwaura & Kyule
15 Dryland livelihood systems	MacOpiyo
16 Dryland peoples, culture and societies in Africa	Wasonga
17 Pastoral social institutions, gender, and resilience	Galvin
18 Dryland livestock production	Mwanyumba
19 Dryland Resource Economics	Irungu & Elhadi
20 Political Economy – theoretical framework	Gakuru & Mburu
21 Dryland conflicts	Kyule & Gakuru
22 Pastoral indigenous knowledge, science, and technology	Kibet & Mweru
MODULE 4: Dryland Social-ecological Systems in Transition	
23 Drivers of dryland systems and change – local to global perspectives	Lynn
24 Climate change and pastoralism (Parts 1 & 2)	MacOpiyo
25 Land uses and land use change in drylands	Lynn
26 Dryland crop production	Ruto
27 Dryland policies	Irungu
28 Development in African drylands	Njoka
29 Settlement, fragmentation and mobility	Boone
30 Interactions of land use, people livestock and wildlife Conservation and governance of natural resources	Reid
31 Sustainable land management, degradation and rehabilitation	Mureithi
MODULE 5: African Drylands into the Future	
32 Interdisciplinary research in African drylands: the South Turkana Ecosystem Project	Swift
33 Education in African drylands	Bruyere
34 Entrepreneurship in African drylands	Hammerdorfer
35 Land Tenure and Institutions in drylands	Mburu & Karwitha
36 One health in drylands	Momanyi & Thaiya
37 Ensuring sustainable peace in African drylands	Macharia & Karungar
38 Synthesis - The future of African drylands: Vulnerability, resilience, sustainability and innovation	Reid & Lynn

Appendix 6: CSDES Policy Briefs

A6.1 List of CSDES Policy Briefs

Title of Policy Brief	Author(s) (team leader/lead author in bold)
1. Sustainability Challenges Of Community Wildlife Conservancies	Henry Mwaka Komu , Jesse T. Njoka, Vivian O. Wasonga, Harry Spaling And Elizabeth N. Muthiani
2. Efficacy Safety And Conservation Status Of Medicinal Plants Used To Treat And Prevent Malaria In Embu County, Kenya	Bibianne Wanja
3. Can Wildlife Based Tourism Co-Exist With Military Training?	Frankline Otiende
4. A Multi-Stakeholder Study to Enhance the Capacity of Local Communities in Marsabit to Control Livestock Diseases that Limit Production and Access to Markets	Peter K. Gathumbi , Isaac R. Mulei, D.N. Karanja, L.W. Njagi and Michael Coughenour
5. Pastoralism Persistence Against Adversities: Is This A Role Of “The Invisible Hand” Or Shrewd Strategy?	Staline Kibet
6. Landscape Interventions To Manage Common Resources In The Wildlife Migratory And Dispersal Areasin Isinya, Kajiado County	Mary Morara , Wambui Kogi-Makau, Laban Macopiyo
7. Is Irrigated Pasture Production The Future Of Pastoralists In The ASALs Of Kenya?	Koech Oscar Kipchirchir
8. Communal Land And Forest Management For Sustainable Livelihoods In The Dry Lands: The Case of Loita Division Narok South Sub County	Peris Kariuki , Jesse Njoka, Catherine Lukhoba, Cecilia Onyango
9. Grass Farming As A Drought Coping Strategy In The Kenyan ASALs	Machogu, C. , O.V.Wasonga, R.K. Ngugi, L. Macopiyo and W.N.
10. Major indicators of food security resilience among pastoralists of northern Kenya	Patrick Watete
11. Camel Milk Production: An Opportunity For Resilient Pastoral Households in The Drylands of Kenya	Yazan El Hadi
12. How Food Secure Is Isiolo County? The Community Perceptions	Wambui K. Makau, Octavian N. Gakuru, Kathy Galvin, Jesse T. Njoka, Henry M. Komu and Narkiso O. Owino
13. Range Rehabilitation for Wildlife Conservation and Pastoral Livestock Production	Stephen M. Mureithi , Jesse T. Njoka
14. Defining Resilience Thresholds Of Productive Assets Among Urban-Proximate Pastoral Communities In Northern Kenya	Laban Macopiyo , Oliver Wasonga And Randy Boone
15. Managing Human-Wildlife Conflicts: “The Other Option	Judith Mbau

A6.2 Abridged Policy briefs.

1. *Sustainability challenges of Community Wildlife Conservancies (Completed) – by Henry Mwaka Department of Land Resources Management and Agricultural Technology (LARMAT)– Faculty of Agriculture*

Wildlife and livestock constitute key resources in the pastoral lands of Kenya contributing significantly to the country's economy and the livelihoods of the local communities. However, sustainability of increasing number of community-based wildlife conservancies remains in doubt if challenges emanating from land use, land tenure, revenue generation and benefits sharing, livestock production and human wildlife conflicts are not addressed.
2. *Efficacy safety and conservation status of medicinal plants used to treat and prevent malaria in Embu County, Kenya (in the final stages of completion)–by Bibianne Wanja Department of Land Resources Management and Agricultural Technology (LARMAT)–Faculty of Agriculture*

Malaria is the most common parasitic infection among the Embu county communities (Kareru et al., 2007). The disease is also the most commonly treated by herbalists in the region (Kareru 2007 al., 2007). There is limited documentation of indigenous knowledge for treatment of malaria yet the knowledge is rapidly disappearing with death of aged herbalists who serve as the repertoire of knowledge as they pass it down to later generations (Prince et al., 2001). The study documenting, validating and determining the safety of medicinal plants used to treat and prevent malaria among the Embu county communities of Kenya for the first time. The study is also determining possible biodiversity loss of medicinal plants used to treat malaria and prevent mosquito bites that could result from their utilization in malaria treatment.
3. *Can wildlife based tourism co--exist with military training? (Completed)– by Frankline Otiende Department of Land Resources Management and Agricultural Technology (LARMAT)– Faculty of Agriculture*

The growing military operations globally have necessitated an ever-growing need for armies to train on wild lands. These lands also happen to be wildlife habitats and tourism destinations. This study reveals that with proper planning it is possible for these contradicting land use options co-exist. Currently however, it is a critical issue because of the losses involved for adjacent ranches and communities. Furthermore, the full impact of training on elephant and reticulated giraffe conservation is not yet fully understood.
4. *A multi--stakeholder study to enhance the capacity of local communities in Marsabit County to control livestock diseases that limit production and access to markets (Completed. Seed faculty research grant)– by Peter Gathumbi at.el --Pathology Department –Faculty of Veterinary Medicine*

Drylands or Arid and Semi-Arid Lands (ASAL) that comprises 84% of total land mass in Kenya are largely unexploited and suitable for livestock production. The study revealed that optimum exploitation of ASAL is constrained by poor livestock husbandry and infrastructure for trade, weak animal disease management, low competence and compliance with sanitary measures that impact on market access for livestock product, limited extension services, effects of climate change, low competitiveness of products at international markets, limited

application of technology and innovation, insecurity and, competition for land between livestock, man and wildlife.

5. *Pastoralism persistence against adversities: Is this a role of "The invisible hand" or shrewd strategy? (Completed) – by Staline Kibet Department of Land Resources Management and Agricultural Technology (LARMAT)--- Faculty of Agriculture*

Pastoral economy is a high risk production system because of two main reasons; firstly it is a production system that is largely based on natural resources (nature-based) and secondly, it is practiced in some of the world harsh environment with extreme prevailing climatic conditions. Predictions have been made in the past about imminent collapse of pastoral production system especially in Africa due to increase climate variability and change; declining natural and social capital; increase conflicts among other challenges. Despite monumental constrains and lack of supportive policies pastoralism has stood test of time. The question then is "Does pastoralism's persistence against adversities the role of invisible hand or shrewd strategy among the pastoralists?"

6. *Landscape interventions to manage common resources in the wildlife migratory and dispersal areas in Isinya, Kajiado County (ongoing study) by Mary Morara, Dryland Resource Management Program at Faculty of Agriculture*

Widespread encroachment by human settlement and expansion of Nairobi metropolitan area has resulted human-wildlife conflicts around Nairobi National Park. The seasonal migration of wildlife from the park to nearby breeding areas have been cut off by fencing, settlements and mining activities along the wildlife corridors. Controlled and guided development (G.O.K, 2008), is thus a prerequisite in order promote sustainable utilization of natural resources within an environmentally and culturally acceptable framework that ensures conservation and promotion of both wildlife and livestock economies.

7. *Is irrigated pasture production the answer for pastoralists in the drylands? –(Completed) By Koech Oscar Kipchirchir, Dryland Resource Management Program at Faculty of Agriculture* This study sought to increase livestock feed supply through irrigation of native range grasses as a potential avenue to increasing fodder banks for use by pastoralists during dry seasons. The study evaluated the productivity of six range grasses (Chloris roxburghiana, Eragrostis superba, Enteropogon macrostachyus, Cenchrus ciliaris) under varied irrigation levels of 30, 50 and 80% Field Capacity within Bura irrigation scheme. S. sudanense and C. gayana had over 10t ha⁻¹ biomass yields at all the irrigation. The forage yields from the six grasses also showed better quality with crude protein above 6% when harvested at between week 8-12 phenological stages. With the current rainfall uncertainties resulting to reduced natural grazing fields, we do recommend that pasture production under irrigation be considered as a strategy for improving livestock productivity in the Kenyan ASALs.

8. *Is Communal Natural Resource Management Feasible in the Dry Lands? The Case of Loita, Narok County.(Ongoing) By Peris Kariuki, Jesse Njoka, Catherine Lukhoba, Cecilia Onyango; Dryland Resource Management Program at Faculty of Agriculture*

The land and forest in Loita division is managed communally after Elders of the Loita community refused demarcation to group ranches in the 1970s under fear that the community would lose parts of their territory and their cultural heritage following potential influx of outsiders. However internal and external pressures for land subdivision is now pushing the

Loita community to embrace land subdivision and most likely will lead to rapid loss of very rich biodiversity and cultural and religious significance of this rare dryland forest. The aim of this policy brief is to generate discussion in view of the impending land demarcation to ensure continued conservation of Loita division landscapes for continued provision biodiversity and ecosystems benefits for of Loita community and beyond for posterity.

9. *Grass farming as a drought coping strategy in the Kenyan drylands (Completed), by Machogu, C. , O.V.Wasonga, R.K. Ngugi, L. Macopiyo and W.N. Mnene*

The policy brief focuses on the potential of grass farming for “strengthening and climate resilience and ensuring sustainable livelihoods”. The study evaluated preferred native grass species for their relevance in promoting rangeland productivity (*Cenchrus ciliaris*, *Eragrostis superba*, and *Chloris roxburghiana*). In Makueni County one agropastoral community association (KAPALIG) has taken up this rangeland rehabilitation technology and are marketing native grass seeds and hay. Native grass seeds are on sale at US\$ 11 per kilogram and US\$ 2.2 for a bale of hay (about 15kg). Local and regional market demand is high. For example in 2011 the agropastoral community association sold 1.5 tons of seeds to Somalia and 1.1 ton to South Sudan. Farmers were charging US\$ 0.33 per cow per day for grazing in reseeded pastures. An enabling policy framework for rangeland rehabilitation should be formulated to promote investments in degraded rangelands.

10. *Major indicators of food security resilience among pastoralists of northern Kenya (completed-- Faculty research seed grant) by Patrick Watete , Wambui K. Makau, Jesse Njoka and Laban MacOpiyo*

The purpose of this study was to identify the relevant indicators that can be used to gauge the level of food security resilience among pastoral households of northern Kenya using the FAO resilience index model. The study was carried out in Turkana and Mandera Counties between July and September 2013. Questionnaires to capture household socioeconomic data were administered to 662 households (362 in Turkana and 300 in Mandera). The ‘Stages of progress’ method was used to identify resilient and non-resilient households. Seven indicators were found to be relevant: diet diversity score, per person daily expenditure, distance to water source, durable index, years of formal schooling by household head, employment ratio and food consumption ratio.

11. *Camel Milk Production: An Opportunity for Resilient Pastoral Household in the Dryland of Kenya –by Yazan El Hadi*

In the northeastern part of Kenya recurrent droughts have undermined the ability of cattle and small stock in supporting pastoral household livelihoods, thus weakening the resilience of pastoral production. The contribution of camel milk to household diet was 26.6% during the dry season. The sale of camel milk during wet season in Isiolo County is the highest contributor to household income with 42.1% while in the dry season camel milk sale is also a leading contributor to pastoral household income with 35.7% share of the household food basket. In the context of recurrent drought, and diminishing grazing and water resources, camel rearing is a useful alternative a pathway to a sustainable livelihood. Based on these findings, there is need to invest in the camel milk subsector by creating an enabling policy environment to enhance milk production and marketing.



RANGE REHABILITATION FOR WILDLIFE CONSERVATION AND PASTORAL LIVESTOCK PRODUCTION

POLICY BRIEF 1 February 2013

Introduction

More than half of the wildlife habitat in Kenya is located outside protected areas, dispersed in private and community grazing lands. The traditional pastoral approach to livestock husbandry is considered compatible with and complementary to wildlife. However, these areas have undergone increasing land use pressure within the past decades, leading to land degradation largely due to climatic factors, notably recurrent droughts and low and declining amounts of rainfall, increasing human and livestock population and unsustainable land uses. Pastoralists range has become too restricted for traditional livestock grazing practices forcing them to diversify livestock-based economies and agriculture. As the pressure on land intensifies, there is potential for conflict between wildlife and people over grazing land, characterised by competition for key resources, predation on domestic livestock, and disease transmission. Wildlife populations and their habitats have been adversely affected by these changes. Restoration of degraded arid environments is critically needed as a mitigation measure against land degradation, biodiversity loss, climate change (Lal, 2009) and for enhancing the adaptive capacity of the local agro-pastoral communities.

Key Questions

1. How can pasture scarcity in the livestock-wildlife interface be alleviated to promote wildlife conservation and livestock production?
2. How can range rehabilitation be up-scaled from site (enclosure) to landscape scale?
3. Besides provision of pasture and reduction of soil erosion, can range rehabilitation offer diversified income and benefits?
4. In what ways can the local communities' capacities be empowered in decision making on resources use in order to allow sustainable use of rangelands?
5. What are the emergent issues following rehabilitation of degraded grazing land in community ranches?

A: Extent of land degradation at the livestock wildlife interface in the Ewaso ecosystem

Most of the community grazing areas in Ewaso ecosystem is very poor rangeland condition, characterised by low or no herbaceous vegetation cover. This high rate of land degradation in the community grazing land present a growing need to promote ecosystem-wide and integrated landscape practices that combine rangeland restoration, livestock production and community-based conservation measures. High resolution satellite imageries coupled with visual assessments on the

ground along fence-lines show good range condition in the private ranches owing to focussed management and range improvement practices.

In the adjacent community ranches on the contrary, the interaction of human activity, heavy grazing and exacerbating effects of climatic variability has caused dramatic ecological degradation. Most areas exhibit poor range condition, with extensive areas of bare and eroded areas characterised by smooth surface crust (Kinyua et al., 2009; Oguge et al., 2006).

Passive restoration of such degraded areas (e.g. by removal of livestock) is usually insufficient, due to absence of perennials that would recolonize via stolons or rhizomes. Seeds too, if present, are inhibited from germinating on the smooth soil surface crusts prior to scratching or ripping (Kinyua et al., 2009; Opiyo et al., 2011). However despite past habitat loss to land degradation, the community areas in Ewaso ecosystem still hold significant populations of diverse wildlife.

B: Restoration of degraded land at site and ecosystem scale

In an effort to prevent further habitat loss, landscape scale conservation strategy has been implemented in several community wildlife conservancies and their constituent ranches through partnering with conservation agents like the Northern Rangeland Trust and AWF among others. Key to the success of this conservation strategy is to develop natural resource management plans (NRMPs) (Henson et al., 2009).

The NRMP process entail land use zoning (Fig. 1) to provide a framework for maintaining the integrity of the livestock wildlife interface environments while promoting wise use of the resources for sustainability and community benefit. Thus land is zoned according to its ecological capacity and the most beneficial economic activity of a particular zone. This generates three main zones in each ranch namely: core conservation, grazing and settlement zone.

Specific management strategies are laid down for each zone. For instance: withdrawal of livestock grazing and human traffic and developments in the core conservation area; range rehabilitation in the degraded grazing areas; random grass seed broadcast along stock routes; and destocking through regular livestock marketing. In the settlement zones, strategies include capacity building and alternative income generating activities for women like beadwork projects.

At Site Scale

Range rehabilitation targeted severely degraded patches in the grazing and settlement zones in order to alleviate pasture scarcity and prevent further degradation. For instance, in three group ranches (Tiamamut, Kijabe and Nkiloriti) of the Naibung'a Wildlife Conservancy, range rehabilitation started with the communities demarcating the severely degraded sites within the grazing areas. Such sites were characterised by large bare areas with a smooth hard-surface crust and soil erosion gullies on the sloping sides (Mureithi, 2011).

The sites in Tiamamut were enclosed using cut thorn-bush of *Acacia mellifera* and *A. reficiens* and are owned and managed by Tiamamut Range Rehabilitation Women Group (TRRWG). The main goal was to increase alternative income generating activities for women, ranging from the sale of grass seed and fattened stock to beadwork project, enveloped in the wider goal of restoring degraded areas within the ranches.

The sites in Kijabe and Nkiloriti are under the custody of the grazing committees on behalf of the respective group ranches, and were not fenced. Following the demarcation of the boundaries and trimming of *Acacia mellifera* branches, the sites were reseeded with grass seed mixtures of *Cenchrus ciliaris*, *Eragrostis superba* and *Entropogon macrostachyus* using 'rip-after-broadcast' method (Mureithi, 2011). This followed observations that when grass seed is broadcasted after the ripping, the risk of being blown-off by wind, eaten by ants and graminivores, and displaced by flood water is high. However, much of the grass seed is covered by soil and the grass regeneration is better when seed is broadcast prior to the ripping.

The ripping breaks the surface crust and increases plant establishment by increasing seed retention, water infiltration and the presence of favourable micro sites (van der Berg and Kellner, 2005; Opiyo et al., 2011). The umbrella-shaped under-canopies of *Acacia tortilis* were neither ripped nor reseeded since they are usually habited by *Cynodon dactylon* (Kahi et al., 2009), a perennial grass species in the East African semi-arid rangelands. Following regeneration of vegetation in reseeded areas (see Fig. 2 – 8; the status of the rehabilitated sites in TKN group ranches), these under- canopy patches enhance heterogeneity of the rehabilitated sites.

At Landscape Scale

The withdrawal of livestock grazing and human traffic and developments in the core conservation areas leads to natural (passive) rehabilitation of the rangeland. For instance, ten years after the NRM planning began in Naibung'a wildlife conservancy, herbaceous vegetation (mainly grasses) has fully recovered in Kijabe conservation areas, to the extent that the management is weighing options to open up the area for guided high intensity grazing of livestock (Mureithi et al., *submitted*).

The Kijabe conservation zone is hilly and rugged and is not preferred by zebra for grazing as the plains. Zebra is an avid grazer that opens up grass, enhancing further regeneration. Small game such as the Grant's and Thomson's Gazelles are observed to have moved out of the conservation zone due to the tall vegetation, a behavioural change to protect against predation. They are now commonly found on the open plains of the Kijabe grazing zones. Other options like mowing and burning are least desirable in the conservation area setting.

If left unattended, the range condition would decline due to the growth of shrubs and bush replacing the grasses in absence of grazers. *Themeda triandra*, an important forage species that had locally disappeared is presently abundant in Kijabe conservation area indicating the NRM planning effectiveness in restoring biodiversity.

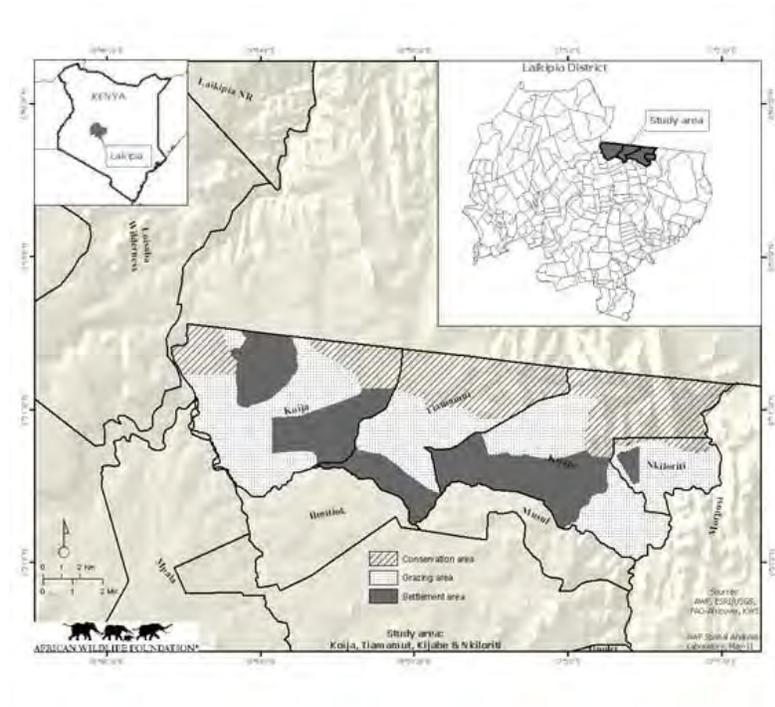


Fig. 1 Land use zones for Koiya, Tiamamut Kijabe and Nkiloriti community ranches (Courtesy of AWF)



Fig. 2 a) Wet season photo showing grass recovery and b) a gully filled up with thorn bush to control soil erosion in Tiamamut Nursery Site (Photos by S. Mureithi)



Fig. 3 a) Dry season photo showing accumulation of litter and b) elephant dung disintegrated by termites in Tiamamut Site A. Litter and dung plays important role in restoring soil quality (Photos by S. Mureithi)



a)



b)

Fig. 4 a) Dry and b) wet season photos showing grass recovery at Tiamamut Site B (Photos by S. Mureithi)



a)



b)

Fig. 5 a) The 'Kijabe' site shortly after first rains following reseeding; b) a dry season photo showing remnants of grass. Grass cover in both sites in Kijabe is not yet fully established (Photos by S. Mureithi).



a)



b)

Fig. 6 a) One of the rehabilitated areas in Nkiloriti done by community members using hand tools. b) Placing cut thorn branches on reseeded patches protects seeds from being blown off by wind (Photo by B. Lengalen)



Fig. 8 a) Grazing Scouts with a Consultant during a training session on range monitoring; b) a heap of *Sansevieria intermida* removed through uprooting by women and scouts. This practice should be encouraged all over Mukogodo rangelands to get rid of the noxious weed (Photos by S. Mureithi).

C: Emergent issues and recommendations following range rehabilitation at the livestock-wildlife interface

In the light of the achievements and positive impact of the range rehabilitation activities on the community ranch members and the environment, the identified unfulfilled needs and emergent issues, the following actions are recommended:

- i. Strengthen the capacity of the group ranches to embrace the concept of multiple use of the range that promotes sustainable NRM practices for improved livelihoods. Rehabilitated rangeland can be a source of many ecosystem services and products as already outlined in this brief, and should therefore be encouraged in all the community ranches.
- ii. Continued capacity building of the ranch, conservation and grazing committees, in leadership and governance, conservation and grazing management, financial management and book keeping among others. It is expected that this will guarantee future success and sustainability of project benefits and outcomes.
- iii. The improvement of livelihoods through income generating activities is not realized within project time-frames as most of the activities have to follow successful range restoration. Thus range rehabilitation projects' donors and implementing partners should review this with a view of further supporting the ranches to initiate the income generating activities to tap economic benefits of rehabilitation.
- iv. Rehabilitated areas have attracted high numbers of wildlife due to feed availability. There is need to secure areas under rehabilitation from invasion by wildlife which would reverse the gains made so far. For instance the feeding habit of the elephant may result to destruction of reseeded areas. However, permanent or electric fences are discouraged as they can inhibit the free movement of wildlife in the long run. Besides this, increased human-wildlife conflicts should be anticipated (Fig. 9).
- v. There is need to promote and support peer-learning exchanges among the committees of KTKN, Naibung'a Wildlife Conservancy and other conservancies in the region to bridge awareness gaps. The participants in such exchanges can then share the knowledge gained with the other group ranch members.
- vi. The attraction of wildlife to the rehabilitated sites due to feed availability is an emergent issue that AWF and other conservation partners can consider exploring. For instance, how range rehabilitation can supplement conservation work which is a significant source of group ranch income. Can it be used as a strategy to control where the wild animals go?
- vii. Encourage deliberate management effort to control increaser plants population in the rehabilitated areas. Major ones include *Sansevieria intermida* (should be completely removed, put in gullies and monitored); *Acacia reficiens* and *A. melliferra* (regular control measures should include uprooting

seedlings and pruning of shrubs). The negative aspect of *Opuntia* sp. for both humans and livestock is also a concern to communities.

- viii. Establish a long-term ecological and socioeconomic monitoring and evaluation (M&E) system of the project areas in order to gain understanding of the processes and emergent issues (for instance, the attraction of wildlife to the rehabilitated sites), and achieve increased restoration capability in the future, as well as constantly informing management strategies. Such M&E could also help us gain understanding of the restoration process, and learn lessons that can be used in out scaling programmes.
- ix. Continue to explore new and strengthen the existing livestock marketing channels, for example the AWF - Ol Pejeta Conservancy (OPC) community livestock outreach that purchased livestock from the community group ranches. The outreach reduces the stock density on the ranches while increasing income to the households and hastening range recovery. This has had a positive impact as the communities now have an assured market for their livestock.



Fig. 9 a) and b) Elephants and human beings sharing water in Lobo Soit dam near the two rehabilitated site A and B in Tiamamut group ranch. From the dam the animals concentrate in the rehabilitated sites. This potentiality of human- wildlife conflict may arise due to water scarcity (Courtesy of AWF).

D: Policy issues in sustainable resource management at the interface include:

1. Wildlife conservation and management: All the legal requirements of CAP 376 on community conservation must be fulfilled and the conservancies to be aligned with the Kenya Wildlife Service policy framework.
2. Land use development in the proposed development zones must be compatible with conservation. Strict adherence to the relevant existing laws and policies such as Environmental Management Coordination Act (EMCA) must be ensured.
3. Zonation programmes need to be incorporated into the Conservancy management plans so that the conservancy managers and community committees work in harmony.
4. Conservancy and zonation by-laws need to be gazetted to improve compliance and empower the various compliance committees.
5. Increased investment is required in development of livestock marketing facilities in order to increase livestock off-take and absorb the surplus gains made from improved range management.
6. Government to increase support to community disease monitoring and control committees, and improve delivery of veterinary services.
7. Community based eco-tourism initiatives be supported and community capacities to manage such enterprises be enhanced.
8. Harmonisation of regional zonation programmes to reduce conflicts related to outsiders grazing on zoned community conservation land when owners are conserving such land.

E: Long-term Monitoring and Evaluation (M&E) Framework

The need for effective habitat restoration is growing, but we must move beyond simply drawing lines on maps and calling the spaces “restored habitat”—we need to give much greater consideration to how we actually fill in these spaces to achieve the goals that are set. A lot of issues needs to be considered in planning and implementation of range rehabilitation projects if they are to realise their goal. Keeping in mind that the enclosed and the un-enclosed areas are parts of a unified whole, the management and socioeconomic concerns need to be geared towards environmental sustainability of both sides of the fence. This calls for long-term ecological and socioeconomic monitoring and evaluation (M&E) of the project areas in order to gain understanding of the processes and emergent issues in effort to achieve increased restoration capability in the future. Such and M&E can for example use the Millennium Ecosystem Framework that gives a set of both ecological and socioeconomic indicators.

Such long-term M & E need to also include a climatic data collection program. Long-term climatic data at local level will enhance understanding of: the functioning of ecological systems; the dynamics of water resources in springs, streams and seasonal flows; and effects of climate on the development of land use patterns and their impacts on soil and water conservation. The climate data will also facilitate the evolution of appropriate NRM systems, including use of drought tolerant plant species in appropriate areas. The climate monitoring program is therefore, essential for accurate interpretation of ecological changes within project sites. A better understanding of the interplay between climate variability and anthropological activities hinges largely on our understanding of the analysis of ecosystem changes, which can accurately be attributed to climate and human activity driving variables.

Summary

One of the key ecological constraints in the coexistence of livestock and wildlife at the livestock-wildlife interface environments is pasture scarcity. Since the pastoral economy is pinned on livestock keeping, land degradation has led to depletion of livelihoods base, leading to poverty, food insecurity and resource conflicts which pose a serious conservation challenge. Implementation of NRM plans including land use zoning within the community wildlife conservancies is a step towards finding the right solution. Range rehabilitation and improved grazing management present an avenue to address land degradation, habitat and biodiversity loss. Rehabilitation through ripping, reseeding, and random grass seed broadcasts could increase overall graminoid cover and pasture availability. It could also be integrated as a management strategy to influence the distribution of herbivores within the community ranches and their conservancies.

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A POLICY BRIEF

CAMEL MILK PRODUCTION: AN OPPORTUNITY FOR RESILIENT PASTORAL HOUSEHOLD IN THE DRYLAND OF KENYA

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INTRODUCTION

Pastoral economy is the mainstay for approximately 26 million people in Africa; this system is making a sustainable use of about 50% of the total surface of countries of East African region. The sector further contributes significantly to the Agricultural GDP of many countries within the region such as Kenya, Ethiopia and Uganda with more than 50%, 40% and 17% respectively (Scarpa *et al.*, 2003). The system is based on consumption and sale of livestock and livestock products mostly cattle besides goats, sheep and camels. The flexibility of the pastoral system permits its existence as the only means of utilizing the available resource in the dryland efficiently (Chikamai and Eriksen, 2011).

In the recent years, pastoral ecosystem experienced unusual climatic variability, evident by the unpredictable rainfall and drought occurrences. This has rendered most of the traditional coping strategies ineffective leading to vulnerable and insecure livelihood systems. Consequently, the current livelihoods and resource use patterns in drylands are insecure and can no longer maintain the living standard of pastoralists in these areas (Hussen *et al.*, 2008). This can be clearly seen in the north-eastern part of Kenya, where recurrent droughts have undermined the ability of cattle and small stock in supporting pastoral household livelihoods. During the 2011 drought the reported mortality rate ranged between 70% and 40% for cattle and goats/sheep respectively (Serna, 2011). This has consequently weakened the resilience of pastoral production system which is more exposed and vulnerable to different natural and artificial shocks than any other land use system in Kenya. Many livelihood options have been proposed and implemented by different agencies and institutions to alleviate the situation and revive the pastoral production system (Elhadi *et al.*, 2012).



These interventions, however, have failed to provide sustainable and reliable pathways to a resilient pastoral production system. One of the existing options is the camel and the camel products, as the camel is considered an important animal as a source of food in pastoral areas. This is because the camel has unique physiological, anatomical and ecological characteristics (Farah, 1996). These characteristics permit the camel to produce and supply milk to pastoral households throughout the year. Despite these abilities to enhance pastoral livelihoods under the harsh climatic conditions the camel has received a diminutive focus in comparison to other species in the in terms of allocation of resources and proper development. Kenya is estimated to have the fifth largest camel population in the world after Somalia, Sudan, Ethiopia and Mauritania (Farah *et al.*, 2007).



In 2010 all camel found in Kenya were estimated to number 1.9 million of the dromedary (one humped) type, traditionally kept by the Somali, Rendille, Gabbra, and Turkana communities (GoK, 2010). In 2010 camel milk production is estimated at over 340

million litres valued at over Ksh 8 billion at the farm level (Musinga *et al.*, 2008). This estimation makes the camel milk contribution similar to the adored sectors such as coffee and tea subsectors.

BOX1: DATA AND METHODS

Camel milk production and its contribution to pastoral household food security were studied. A household survey was conducted in 2012 covering 201 camel milk farmers in Mlango and Isiolo in central cluster and Kulamawe in Kinna cluster.

Data analysis focused mainly on the contribution of camel milk to household income and diet as well as the challenges faced by the camel milk producers. The study used descriptive statistics to derive the contribution of camel milk to pastoral household income and the household food basket analysis to derive the contribution of camel milk to pastoral household diet.

CONTRIBUTION OF CAMEL MILK TO HOUSEHOLD DIET

As shown in Figure 1, livestock products had the highest contribution with 61.1% during the wet and 88.2% during dry season collectively. During wet season, camel meat had the highest contribution (17.6%) followed goat meat and cow with 14.4% and 14.1% respectively. Milk products had the least contribution among livestock related products with 7.4 and 7.6 for cow and camel milk respectively. Similar contribution was observed for maize meal, rice, spaghetti and sugar. Oil and vegetable had the least contribution with 5.5% and 2.1% to the household food basket during the wet season respectively.

During the dry season, the contribution of different foodstuffs to pastoral household food basket changed dramatically with a general trend of increasing in the contribution of livestock products and decreasing in non-livestock products. Camel milk had the highest contribution (29.3%) followed by camel and goat meat with 26.6% and 18.2%, respectively. Cow meat and milk had the least contribution with 9.9% and 4.2%, respectively. The contribution of maize meal was 4%, while the contribution of sugar was 4.7%. Rice contributed only 1.1% of the food basket. Other items such as spaghetti, oil and vegetable contributed less than 1% each to household food basket. The contribution of most non-livestock products such as oil, rice and spaghetti decreases significantly during the dry season ($p \leq 0.05$), while camel milk and meat increases significantly ($p \leq 0.05$).

The decrease in the contribution of livestock to household food basket during the dry season is an indicator that pastoral households have less money to spend on food during the dry spells. This possibly as a result of less income generated from land-based livelihood activities. For instance, dry periods are mostly associated with inadequate pasture and water which are the primary inputs for livestock production, thus the output of this system is usually affected negatively. On the other hand, the income generated from livestock production is as well affected negatively forcing households which rely heavily on livestock as the main source of income to cut their expenditures on food by amounts that are equivalent to the reduction in their incomes. The contribution of different food items to the household food basket changed drastically in respect to seasonality. Meat items had the highest contribution across season with 46.1% and 54.7% during wet and dry seasons respectively.

During the dry season camel milk contributed significantly to the household food basket compared to wet season. The significant contribution of camel milk to pastoral household food basket implies that camel milk plays a vital role in the pastoral household diet particularly during the dry season. This can be explained by the fact that the camel is least affected by dry season compared to other livestock species in the same pastoral production system. In typical prolonged dry spell and drought, most animals are significantly affected by the lack of water and feed resources. Most of the time cattle are adversely affected compared to

camels; despite the fact that cattle are the main livestock species in most pastoral production systems in Kenya.

This is supported by many studies that compare the effect of drought and prolonged dry season across all species that constitute the pastoral production system (Schwartz, 1992; Farah *et al.*, 2004; Mehari *et al.*,

2007 and Serna, 2011). This is because the camel has the ability to withstand harsh climatic condition and has high ability to cope with shortage of water and feed during prolonged dry season. Despite the foresaid limitation, camel has the ability to supply household with milk during such periods.

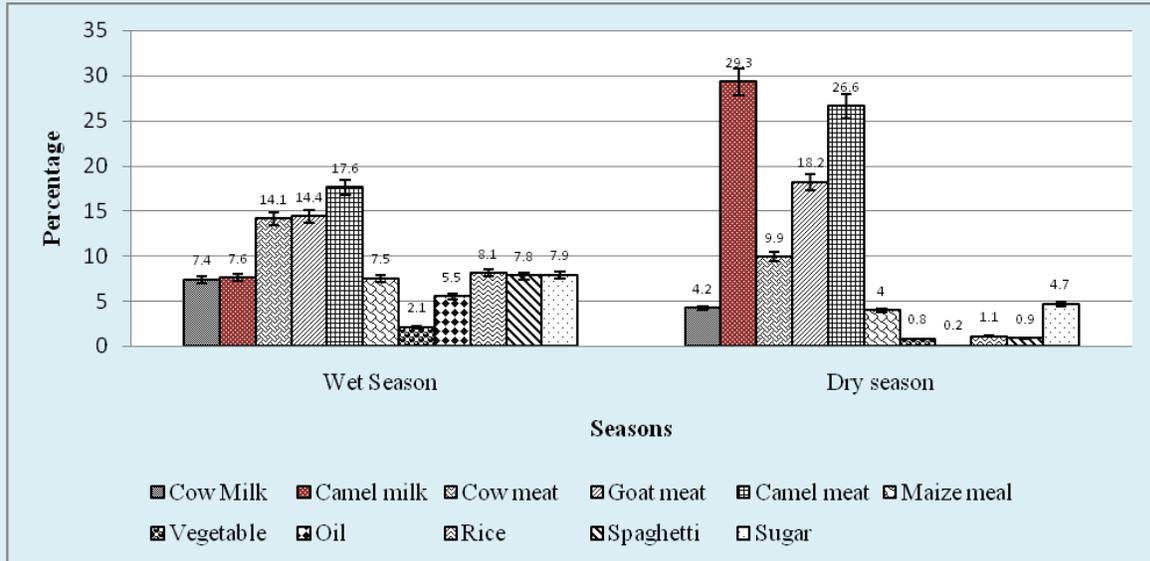


Figure 1: Household food basket during wet and dry seasons in Isiolo County

CONTRIBUTION OF CAMEL MILK TO HOUSEHOLD INCOME

Pastoral household livelihood activities are presented in Figure 2. Livestock related activities emerged to be the highest contributor to household income with 66.8% collectively. Although livestock contributed less to the pastoral household income during dry season as compared to the wet season, livestock was still the major contributor to the income during dry season (59%). During the wet season sales of camel milk emerged to be the highest contributor to household income with 42.1% followed by sales of livestock and petty trade with 23% and 15.2% respectively during the wet season. The contribution of casual labour, sales of charcoal and salary from formal employment were 7.8%, 7% and 3.3% respectively. Sales of cow milk have had the least contribution with 1.7%.

During the dry season camel milk also emerged to be the highest contributor to pastoral household income with 35.7%. This followed by sales of live animals

mostly goat and sheep (21.5%). Sales of cow milk were the least contributor to household income among livestock related activities (1.8%). Petty trade stands as the third contributors to household income with 17.3%. Other activities include sales of charcoal (11.1%), income from casual labour contributed (8.8%) and employment contributed (3.8%). The dominant contribution of livestock to household income across seasons implies that pastoral household continues to produce different livestock produce throughout the year despite water stress and scarcity of pasture as the main inputs to pastoral production system.

This continuous flow of benefits can be explained by the fat that in the herd that constitutes the production system in Isiolo County is mostly made up of camel with small stock and cattle. This pastoral herd which is predominantly made up of camel has the ability to produce milk throughout the year, which contributes significantly to pastoral household income irrespective of the season. This is true particularly taking into

account that camel production is less affected by climatic fluctuation and unlike other livestock species is not suppressed by lack of water and pasture. Therefore, sales of camel milk is not only a way for disposing milk surplus during the wet season, but an integral part of the pastoral household strategies to

provide the necessary means for purchasing other essential food items, especially during the dry seasons. This indicates that pastoral households are faced by tough decisions either to adapt to the new situation or risk being left out without sustainable income.

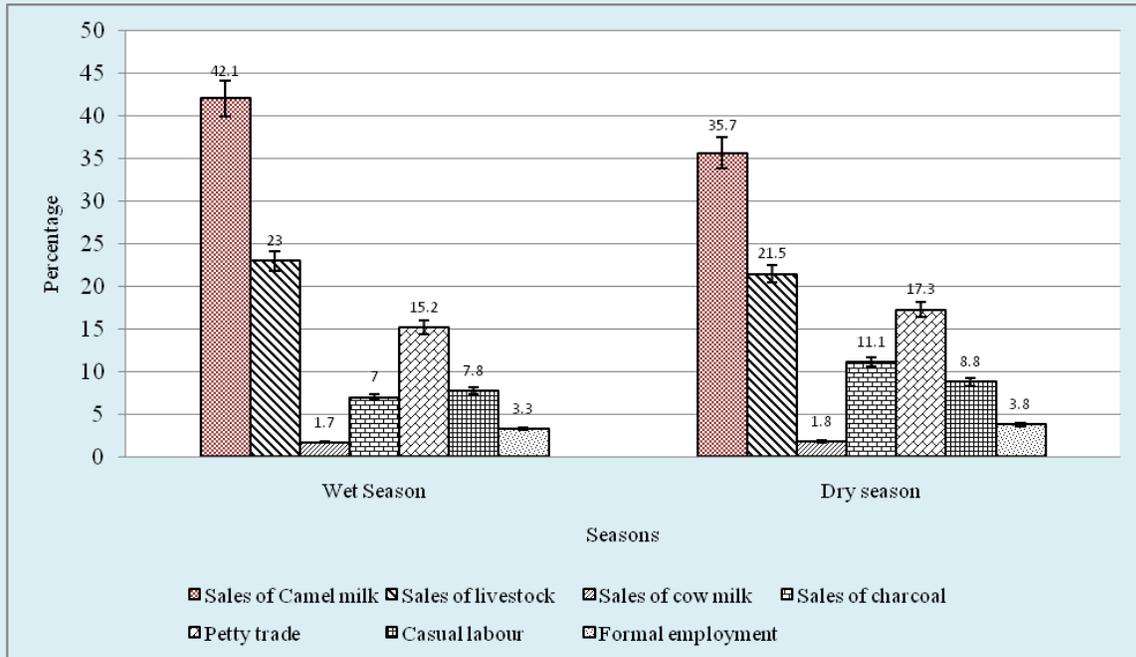


Figure 2: Pastoral household livelihood activities in Isiolo County

SUGGESTED POLICY ACTIONS

- In the context of recurrent drought, and diminishing grazing and water resources, alternatives such as rearing camels can provide a pathway to a sustainable livelihood. Based on these findings, there is need to invest in the camel milk subsector by creating an enabling policy environment to enhance milk production and marketing.
- Policies that target improved pastoral production should consider promoting camel milk production as a suitable strategy to build pastoral household resilience.
- Since, as reported, camel milk contribute markedly to household income, policies and

interventions should be directed towards improving camel milk production and marketing by establishing production and marketing systems that ensure balanced inputs, proper transport and value addition in order to attract more pastoral households to engage in camel milk production and marketing.

- Livestock interventions in drylands should include providing camels for restocking alongside other livestock species and also necessary training to build appropriate skills for sound camel husbandry to fully exploit the latent potential of camel production in addressing nutrition security and food poverty.

ACKNOWLEDGEMENT

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Appendix 7: Partnership Grant Proposals Submitted

FY12

1. Fire, TEK and Policy in TZ (11/2011; \$300k): This proposal aims to assess how traditional land and fire management is combined with new policies on fire management (and the processes used to create these new policies and their social--ecological consequences) to inform contemporary fire management in northern Tanzania (Simanjiro) and southern Mexico (Chiapas). To the USDI Joint Fire Science Program; Investigators: Stacy Lynn (PI), Erik Martinson (Co--PI), Mary Huffman (Co--PI).
2. Research Needs in TZ Drylands (12/2011; \$10k): A minigrant proposal submitted to CSU's Warner College of Natural Resources to conduct a needs assessment for future research in Maasai dryland communities of northern Tanzania. To CSU; Investigators: Stacy Lynn (PI)
3. Risksapes: Perceptions of Pastoral and Wildlife Risk in northern Tanzania (1/2012; \$583k): We proposed to jointly investigate a broad set of perceived risks to livelihoods and wildlife survival, the commonalities and differences in perceptions of risks to pastoralists and wildlife across space and time, and how actions, management, or policies related to one stakeholder may have unintended consequences for the other. To the NSF Geographic and Spatial Sciences Program; Investigators: Stacy Lynn (PI), Greg Newman (Co--PI) and Melinda Laituri (Co--PI)
4. Cross--scale integration of herbivory and ecohydrology in semiarid grazing ecosystems (1/2012): This project would investigate mechanisms for dryland degradation involving interactions between herbivory and ecohydrology at the Mpala Research Station in Kenya. To NSF Ecosystems Studies; Investigators: Michael Coughenour (PI), David Augustine, Jacob Goheen (co--PI's)
5. Enhanced Adaptation to Climate Change (subcontract, full proposal submitted by ACDI VOCA) (3/2012; ~\$2m): USAID/Ethiopia – Pastoralists Areas Resilience Improvement and Market Expansion (PRIME). The CSU researchers would conduct research in support of a large development initiative to improve pastoral resilience and market expansion. We would evaluate the elements of social--ecological vulnerability, evaluate adaptive capacity related to ecosystem services and livelihood assets, and develop a framework to incorporate development considerations under different climate regimes and resource constraints. The aims of the PRIMES project are directly relevant to the aims of the HED project. Investigators: Paul Evangelista, Dana Hoag, Mike Coughenour, David Swift, Rich Conant, Kathy Galvin, Randy Boone
6. Enhancing resilience among pastoral and agro--pastoral communities in the Greater Horn of Africa (11/2012): i. Enhance the quality of training at the University to match the development needs of the ASALs; ii. Strengthen institutional and organizational capacity of local institutions and communities to address development challenges; iii. Strengthen information sharing and dissemination for optimal development impact of research findings; iv. Reduce the vulnerability of ASAL communities to drought and other related shocks by building their capacity to enhance resilience; v. Diversification of dryland human livelihoods through targeting of youth, women and vulnerable groups. J. Njoka, PI
7. Proposal Submitted to Ministry of Northern Kenya/EU--Kenya Rural Development Programme with University of Sicily, Italy. Investigators: J. Njoka, PI, and Italian colleagues

FY13

1. World Vision for Somalia Resilience Program, for which CSDDES would be the managing partner. (DECLINED) (Njoka, Co--PI)
2. Global Alliance: Promoting social and environmental safety nets to build resilience in Kenya's drylands (DECLINED) (Njoka, Co--PI)
3. International Livestock Research Institute proposal

4. Developing primary education workshop for engagement of dryland schools, Proposal submitted to CSU's Center for Collaborative Conservation (Lynn, PI; Njoka, Co--PI) (DECLINED)
5. University of Michigan to NSF for joint research based at Mpala Research Station (TBD) (Njoka, Co--PI)
6. Indiana University for joint research at Mpala Research Station (TBD) (Njoka, Co--PI)
7. Princeton University for joint research at Mpala Research Station (TBD) (Njoka, Co--PI)
8. Integrating Modern Mobile Technology into Social--Ecological Research to CSU's NREL to develop mobile applications to facilitate social--ecological research, specifically geared toward collaborative research, participatory research, citizen science, and work being conducted in remote areas such as rural East Africa. [ACCEPTED, \$7,500]
9. Assessing vulnerability of provisioning services in the southern highlands of Ethiopia, submitted to NSF CNH program (Lynn, Co--PI) (TBD) [FUNDED \$250,000]
10. Transforming Public Participation in Scientific Research through Software Tool Development; Proposal submitted to the NSF SI2 SSE program to create mobile platforms for participatory research in the US and East African drylands. (Lynn, Co--PI; Laituri, Co--PI).
11. USDA SPECA -- This project will facilitate exchange of primary and secondary level teachers from schools in Fort Collins, Colorado, to Samburu, Kenya. (Lynn, Co--PI; Boone, Co--PI)
12. SoGES GCRT: A cross--departmental effort at CSU aimed at creating a Center for Sustainable African Ecosystems and Societies at CSU. This center will act as a connection point for African work being done in all colleges and departments at CSU, to build collaboration and also grow our programs. (Galvin, PI; Reid, Co--PI, Lynn, Co--PI) [FUNDED \$20,000]
13. SoGES GCRT #2: Cross--departmental effort at CSU aimed at creating a community of practice at CSU to discuss Equity and Environmental Justice on a global level. Participants from 5 colleges and 9 departments. (Lynn, Co--PI) [DECLINED]
14. Proposal to CSU's Warner College of Natural Resources to increase time and resources dedicated to distance learning initiatives at UoN with the team from CSU (Woodmansee, PI; Swift; Lynn)(DECLINED)
15. Assessment of cash transfer programs: IGAD Centre for Pastoral Areas and Livestock Development (ICPALD). (Njoka, Co--Pi with student lead) (TBD)
16. Community Based Approaches for the control of Transmissible Animal Diseases – IGAD Centre for Pastoral Areas and Livestock Development (ICPALD). (Njoka, Co--Pi with student lead) (TBD)
17. Dryland cropping Small--scale Irrigation and Rainwater Harvesting in Karamojong cluster -- IGAD Centre for Pastoral Areas and Livestock Development (ICPALD) (Njoka, Co--Pi with student lead) (TBD)
18. Functional literacy for improving small businesses among illiterate women-- IGAD Centre for Pastoral Areas and Livestock Development (ICPALD). (Njoka, Co--Pi with student lead) (TBD)
19. Linking Community Level Institutions to County and National Government for ASALs-- IGAD Centre for Pastoral Areas and Livestock Development (ICPALD). (Njoka, Co--Pi with student lead)(TBD)
20. Poverty monitoring, livestock, resilience-- IGAD Centre for Pastoral Areas and Livestock Development (ICPALD). (Njoka, Co--Pi with student lead) (TBD)
21. Potential areas of hides and skins enterprises-- IGAD Centre for Pastoral Areas and Livestock Development (ICPALD) (Njoka, Co--Pi with student lead) (TBD)
22. Sustainable Land Management -- IGAD Centre for Pastoral Areas and Livestock Development (ICPALD). (Njoka, Co--Pi with student lead) (TBD)

FY14

1. On 30th January 2014, CSDES submitted a "request for Engagement" to the Global Knowledge Initiative for potential research funding (USD 5000 seed grant) and linkage to relevant partners, to address challenges of invasive and alien species in drylands, under the research title "Management of invasive and alien plant species for improved ecological and socio-economic resilience in drylands". If awarded, the implementation of the full project proposal is expected to run for three (3) years. Outcome is pending.
2. Together with McGill University of Canada and a Consortium of other partners, CSDES participated in the preparation and submission of a research proposal to IDRC, titled "The Institutional Canopy of Conservation: Governance and Environmentality in East Africa", to be implemented for 7 years. Results are positive and the framework of joint work among the partners is awaiting. The project will be co-directed by the McGill University and the African Conservation Centre (Kenya).
3. On 17th December 2013, CSDES submitted a proposal to UNDP to solicit funds (US \$ 30,000) (title: Proposal for Supporting Online/Open and Distance Learning Graduate Curriculum in Dryland land Resource Management) to support the review and conversion of the PhD Dryland Resource Management program to e-learning module. The project period is one (1) year. Outcome is pending.
4. In October 2013, Mercy Corps (Scotland) and CSDES submitted a joint proposal to DFID under its 'Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) programme' to be implemented for 3 years in Kenya and Uganda. CSDES expects funding of USD 150,000. The proposal went through selection and a full proposal is being developed for consideration by DFID. Mercy Corps are the Lead Institution.
5. On 26th February 2014, CSDES together with a consortium of four (4) private companies submitted an "Expression of Interest to undertake the rangeland development and inventory study in Wajir county on behalf of OXFAM-Kenya country office". The proposed funding was USD 68,466. Results of the application are pending. CSDES is the lead organization.
6. On 16th March 2014, CSDES together with a consortium of four (4) private companies submitted an "Expression of Interest to undertake the baseline study for REGAL-IR Project In Kenya". The baseline will cover 5 counties (Turkana, Isiolo, Garissa, Wajir And Marsabit). CSDES is the consortium team leader.
7. In January 2014 UON/CSDES and CSU submitted a proposal titled 'Engineering algae production ecosystem and bio-recovery processes' under the NSF PEER Funds to be implemented for 3 years. Expected funds-- USD 60,000.
8. CSDES/UoN and CSU in partnership with the Indian Institute of Public Health, Hyderabad submitted to USAID a proposal on Dairy Value Chain (on camel milk) to solicit funds for implementation, amounting to USD 2 million over 3 years period. Outcome is pending.
9. In November 2013, Stacy Lynn together with Jesse Njoka (Uon Partner) submitted a proposal (for \$462,221.00) to the National Science Foundation -- SEES Fellows Program, titled "SEES Fellows: From Water Scarce to Water Source: The Governance and Ecology of New Water in the Kenyan Drylands". This project will investigate mechanisms of governance of recent water discoveries in Turkana, Kenya, and potential social and ecological impacts for development of these water sources. Data collected and analyses conducted through this research will both use and contribute to the much larger shared efforts of the investigators to balance local livelihoods and ecological sustainability, and to identify potential mismatches in costs and benefits of development in the drylands that could impact sustainability of the ecosystem, local to regional livelihoods, and the resources in question. The proposal was not funded--the outcome of the application was received at the end of April 2014.
10. In March 2014, Stacy Lynn submitted a proposal with Michele Betsill (CSU Political Science) and

Melinda Laituri, collaborating with Jesse Njoka, UoN, to the CSU Water Center entitled, "From Water Scarce to Water Source: The governance of New Water in the Kenyan Drylands," to study the history of water governance and use in Turkana, Kenya. FUNDED for USD \$30,000.

11. In August 2014, Stacy Lynn re--submitted a proposal to NSF--IRES Program, (International Research Experience for Students) [Pending \$250,000], entitled: "IRES: Student-led Social-ecological Research in the Drylands of Kenya." This project will bring three cohorts of five undergraduate students from CSU for social-ecological research experience in the drylands of Kenya, in Samburu and/or Kibwezi. This proposal was originally submitted in August 2013. Randy Boone and Kathy Galvin are Co-PIs.

November 2014:

1. In November 2014, Stacy Lynn together with Jesse Njoka (Uon Partner) submitted a proposal (for \$1,800,000) to the National Science Foundation – Coupled Natural and Human Systems Program, titled "CNH--L: Water Scarce to Water Source: Governance and Ecology of New Water in the Kenyan Drylands". This project will investigate mechanisms of governance of recent water discoveries in Turkana, Kenya, and potential social and ecological impacts for development of these water sources. Data collected and analyses conducted through this research will both use and contribute to the much larger shared efforts of the investigators to balance local livelihoods and ecological sustainability, and to identify potential mismatches in costs and benefits of development in the drylands that could impact sustainability of the ecosystem, local to regional livelihoods, and the resources in question. The proposal was not funded--the outcome of the application was received at the end of April 2014.

Appendix 8: Articles published by the partnership

FY12

Alkemade, R., R.S. Reid, M. van den Berg, J. de Leeuw, and M. Jeuken. In press. Assessing the impacts of livestock production on biodiversity in rangeland ecosystems. Proceedings of the US National Academy. PNAS Early Edition, www.pnas.org/cgi/doi/10.1073/pnas.1011013108.

Rodriguez, L.C., Henson, D., Herrero, M., Nkedianye, D. and Reid, R. 2012. Private farmers compensation and viability of protected areas: The case of Nairobi National Park and Kitengela dispersal corridor. *International Journal of Sustainable Development and World Ecology* 19:34--43.

Ogutu, J.O., Piepho, H--P., Dublin, H.T., Bhola, N., Reid, R.S. In press. Dynamics of natality and juvenile recruitment in Mara--Serengeti ungulates in relation to climatic and land use changes. *Population Ecology* 53:195--213.

Fernandez--Gimenez, M.E., Wang, X., Baival, B., Klein, J.A., and Reid, R.S. 2012. Restoring Community Connections to the Land: Building Resilience through Community--based Rangeland Management in China and Mongolia. CABI, Cambridge, Mass.

Reid, R.S., Galvin, K.A., Knapp, E., Ogutu, J.O. and Kaelo, D. in press. Sustainability of the Serengeti--Mara ecosystem for wildlife and people. In: Sinclair, A.R.E. and Metzger, K. *Serengeti IV: Biodiversity*. University of Chicago Press, Chicago.

Joana Roque de Pinho, Kathleen Galvin Robin Reid and Nicolas Tapia ? Maasai Voices on Climate Change (and Other Things): Kenyan Pastoralist Communities use of Participatory Video to Communicate their Perspectives on Environmental Changes. Climate Change Conference, University of Colorado, Boulder, March 2012.

Cecilia M. Onyango, Jeremy Harbinson, Jasper K. Imungi, Solomon S. Shibairo & Olaf van Kooten (2012): INFLUENCE OF ORGANIC AND MINERAL FERTILIZATION ON GERMINATION, LEAF NITROGEN, NITRATE ACCUMULATION AND YIELD OF VEGETABLE AMARANTH, *Journal of Plant Nutrition*, 35:3, 342---365.

Direct benefits derived from a rehabilitated semi--arid rangeland in Kenya S.M. Mureithia,b*, A. Verdoodta,c, J.T. Njokab, C.K.K. Gacheneb, E. Meyerhoffd and E. Van Ransta Ghent University, Department of Geology and Soil Science (WE13), Laboratory of Soil Science, Krijgslaan 281/S8, B--9000 Gent, Belgium University of Nairobi, Department of Land Resources Management and Agricultural Technology, P.O Box 29053, 00625 Nairobi, Kenya Ghent University, Department of Soil Management (BW12), Research Unit of Soil Degradation and Conservation, Coupure Links 653, B--9000 Gent, Belgium Rehabilitation of Arid Environments (RAE) Trust, P.O. Box 1051, Nakuru, Kenya.

FY13

Reid, R.S., Galvin, K.A., Knapp, E., Ogutu, J.O. and Kaelo, D. in press. Sustainability of the Serengeti--Mara ecosystem for wildlife and people. In: Sinclair, A.R.E. and Metzger, K. *Serengeti IV: Biodiversity*. University of Chicago Press, Chicago.

Alkemade, R., R.S. Reid, M. van den Berg, J. de Leeuw, and M. Jeuken. In press. Assessing the impacts of livestock production on biodiversity in rangeland ecosystems. Proceedings of the US National Academy. PNAS Early Edition, www.pnas.org/cgi/doi/10.1073/pnas.1011013108.

Ogutu, J.O., Piepho, H.-P., Dublin, H.T., Bhola, N., Reid, R.S. In press. Dynamics of natality and juvenile recruitment in Mara--Serengeti ungulates in relation to climatic and land use changes. *Population Ecology* 53:195--213.

Msoffe, F.U., Kifugo, S.C., Said, M.Y., Neselle, M., van Gardingen, P., Reid, R.S., Ogutu, J.O., Herrero, M., de Leeuw, J. in press. Drivers and impacts of land--use change in the Maasai--Steppe of northern Tanzania: an ecological--social--political analysis. *Journal of Land Use Science*.

FY14

Mbau J.S. (2013). Land use and land cover changes and their implications for human--wildlife conflicts in Semi--Arid rangelands of southern Kenya. *Journal of Geography and Regional Planning*. Vol. 6(5)193--199 (accepted July 2013).

Mbau J.S., Nyangito M.M. and Gachene C.K.K. (2013). Land use and land cover change analysis. Linking local communities to land use and land cover changes using Participatory Geographic Information Systems. ISBN No. 978--3--659--36222--4. LAP LAMBERT Academic Publishing, Germany.
MBAU, J.S, Nyangito.M.M, Gachene C.K.K, Kathumo, V. and Worden, J. (2014). Participatory Geographic Information Systems (PGIS) for Sustainable Natural Resource Management: The Case Study of Taveta District, Southern Kenya. (Accepted for publication as a book chapter under Sustainable Land Management

2013Recipient, The Jean Rouch Award for Collaborative Filmmaking (with postdoctoral fellow Joana Roque de Pinho) from the American Anthropological Association, November for the film, Maasai Voices on Climate Change. <https://vimeo.com/73980798>

Galvin, K.A. 2013 An Arid World? Can We Learn from Other Nations? Huff Post Green. The Blog. 8/20/2013. http://www.huffingtonpost.com/american--anthropological--association/an--aridworld-- can-- we-- lear_b_3768175.html

Reid, R.S., Fernandez-Gimenez, M.E., Galvin, K.A. Accepted. Dynamics and resilience of rangelands and pastoral peoples around the globe. *Annual Review of Environment and Resources*.

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[Appendix 9: Copies of key published articles or books written as a result of the partnership](#)

A9.1 Article #1

IMPACT OF COMMUNITY CONSERVATION MANAGEMENT ON HERBACEOUS LAYER AND SOIL NUTRIENTS IN A KENYAN SEMI-ARID SAVANNAH

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ABSTRACT

The impact of community conservation management on a semi-arid savannah herbaceous vegetation and soil nutrient status was studied in the conservation and grazing zones of two community ranches in Laikipia County, Kenya. Land zoning was carried out in 1999 using participatory approaches to demarcate conservation areas excluded from livestock grazing, buffer areas for grazing and high-intensity use zones for both grazing and settlement. Collected data included cover, grass species composition, standing grass biomass and topsoil chemical characteristics using line transect and quadrant methods. The conservation zones had significantly higher herbaceous diversity, species richness and relative abundance of both annual and perennial grasses, basal cover and herbage and a lower percentage of bare ground compared with the continuously grazed zones. The conservation zones also had higher total organic carbon, organic nitrogen and exchangeable basic cations content, indicating improved soil nutrient status. The grazing zones exhibited loss of vegetation cover and reduction of forage production, with a decline in rangeland condition, whereas the conservation zones showed recovery and improvement of the rangeland condition. Long-term implementation of Natural resource management programme in community wildlife conservancies seems to drive the semi-arid savannahs to exist in two steady states and transitions under the influence of grazing. We recommend long-term monitoring of the impact of the community conservation model on the rangeland and timely incorporation of remedial measures such as shifting bomas (cattle corrals) across the grazing zones, aggressive rangeland rehabilitation of severely degraded areas through reseeding and random grass seed broadcast along stock routes.

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key words: conservation management; herbaceous vegetation; land zoning; livestock–wildlife interface rangeland condition

A9.2 Article#2

Large Landscape Conservation in the Mara--Serengeti Ecosystem and Greater Maasailand: Building the Role of Local Leaders, Institutions, and Communities

Robin S. Reid, Dickson Kaelo, David K. Nkedianye, Patti Kristjanson, Mohammed Y. Said, Kathleen A. Galvin, and Isabella Gambill

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The conservation of wildlife in many large savanna landscapes in Africa depends on meeting the needs of both wildlife and local people (Brockington 2004). This imperative is especially acute when the wild animals to be conserved are large and move long distances, spilling out of core protected areas onto grazing lands where they mix with farmers and livestock. Because grazing lands cover about 40 percent of Africa and 50 percent of east Africa today (Reid et al. 2008, Reid 2012), herding has an outsized importance in that continent's conservation efforts, both because it is so widespread and because the herding lifestyle is often (but not always) compatible with wildlife and other species (Reid 2012). Outside conservation areas, most African rangelands are on land managed by pastoral communities in common, although privatization of land is a growing trend in Africa (Blench 2001).

Much of the effort to include communities in conservation of large landscapes has been driven by interests outside the savannas, either by national governments, NGOs, or foreign conservationists (Neumann 2002, Brockington et al. 2008). Once included in conservation planning only as an afterthought, local communities are now major stakeholders. However, initiatives driven, led, and managed by local leaders, communities, and institutions to meet the needs of both wildlife and people remain rare. The science of community--based conservation rarely answers the questions posed by local communities, integrates local knowledge, or builds the capacity of communities to do their own research. This chapter is the story of our efforts to turn community--based conservation around so that it is driven, led, and managed by local interests, needs, and people in Kenya's northern Serengeti--Mara ecosystem, or the Mara.

To convey the significance of the northern Serengeti--Mara, we will attempt to incorporate the points of view of the region's four predominating types of stakeholders. The first group is conservationists, who include national governments, local and international tourism businesses, local and foreign researchers, and some of the local people. From a conservation perspective, the Serengeti--Mara represents one of the jewels of conservation, an unusual example of an ecosystem relatively undisturbed by people (Sinclair et al. 2002) that we can use as a benchmark to understand how humans are modifying the earth. This ecosystem provides handsome tourism profits for governments (Honey 2008, Norton--Griffiths et al. 2008, Thirgood et al. 2008), the tourism industry (Norton--Griffiths 1995, Osano et al. 2013b), and some local elites (Thompson and Homewood 2002). A second group of stakeholders are pastoralists living within the ecosystem whose livelihoods are sometimes directly threatened by wildlife (Sitati et al. 2003, Kolowski and Holekamp 2006) and who have lost access to their ancestral grazing lands, which are now part of the Maasai Mara National Reserve (Lamprey and Reid 2004). A third group of stakeholders are the farmers who live west and north of the Mara, many of whom arrived in the area after ancient pastoral cultures but before today's Maasai pastoralists (Shetler 2007). Farmers to the north in the Mau Forest and irrigators along the Mara River diminish the flow of this crucial year--round water

source for wildlife and pastoralists downstream (Gereta et al. 2002); farmers to the west have conflicts with elephants moving into the Transmara region (Kaelo 2007). The fourth group of stakeholders are the many species of wildlife themselves, which have lived in this ecosystem side by side with hominins for millions of years, far longer than either pastoralists or farmers. We do not hear directly from wildlife, but presumably they are represented by the views of human conservationists.

In this chapter, we describe one effort to work with these stakeholders in Kenya's Mara region through conservancies and other innovative platforms that are largely codesigned by local pastoral leaders with their partners. More than a story about innovative conservation work, this is a narrative about building local institutions and enabling local leaders to work broadly across large landscapes and experiment with new models of conservation that support local livelihoods and wildlife at the same time. It is also the story of how conservation science can support and sometimes catalyze these efforts, if the scientists coproduce new knowledge with local communities that integrates both local and scientific expertise. In telling this story, we will also refer to examples from four other Maasailand ecosystems similar to the Mara, where we worked on supporting local initiatives to build pastoral livelihoods and conserve wildlife.

The Greater Serengeti--Mara Wildlife--Pastoral Ecosystem

Although this chapter will focus principally on the Mara region, we will begin by describing the greater Serengeti--Mara wildlife--pastoral ecosystem because of its status as the site of the migration of wildebeest today and the free flow of people across the area in the past. Today, conservationists define the greater Serengeti--Mara ecosystem as a 25,000 sq. km area straddling the border between Kenya and Tanzania and delimited by the savanna grazed by both the million--strong Serengeti wildebeest migration and the much smaller (approximately 30,000) Loita wildebeest migration (Sinclair 1995). While these two migrations mix in the Mara region in the dry season, they are relatively genetically distinct, since the Serengeti population breeds in Tanzania and the Loita population in Kenya. Pastoralists and their livestock also graze much of the Serengeti--Mara, which encompasses two central protected areas, Tanzania's Serengeti National Park and Kenya's Maasai Mara National Reserve; their surrounding game reserves (Maswa, Ikorongo, and Grumeti); Ngorongoro Conservation Area; the Loliondo Game Controlled Area in Tanzania, and the ranches neighboring the Mara Reserve in Kenya (Sinclair and Norton--Griffiths 1979, Thirgood et al. 2008). Although local peoples are excluded from the national parks and reserves, pastoralists and their livestock live and graze in Ngorongoro and Loliondo in Tanzania and the Mara pastoral lands in Kenya.

In the last 50 to 60 years, the Asi, Nata, Ishenya, Ikizu, Ngoreme, Ikoma, Sukuma, Kuria, Tatog, Sikazi, Ndorobo, and Maasai peoples have lost a great deal of their land due to the creation by both colonial and postcolonial governments of the core protected areas that form the heart of the greater Serengeti--Mara ecosystem today (Lamprey and Reid 2004, Shetler 2007). For millions of years, the Serengeti--Mara had been home to humans and their ancestors (Leakey and Hay 1979). In the mid--1900s, colonial governments evicted local people to create new parks and reserves for the conservation of wildlife (Neumann 1995, Shetler 2007), but these herders, hunters, farmers, and fishers still live in the ecosystem, in lands important to them and to wildlife. And, as is the case elsewhere, the vast majority of the costs of these protected areas fall on the shoulders of local people, while the vast majority of the benefits flow to more wealthy people living far away from this ecosystem (Thompson and Homewood 2002, Norton--Griffiths et al. 2008).

The greater ecosystem supports the most diverse large wildlife migration in the world (Sinclair 1995), a mass movement of about 1.1 million wildebeest; 360,000 Thomson's gazelles; 200,000 zebras; 7,500 hyenas; 2,800 lions; 850 leopards; 500 cheetahs; and about 350,000 other large animals (Stelfox et al. 1986, Ottichilo et al. 2000, Mduma and Hopcraft 2008, Reid 2012). In addition, there are more than 600 species of birds (two--thirds as many as in all of North America), at least 100 species of dung beetles, 80 grasshopper species, 20 frog species (Sinclair et al. 2008a), and many, many uncounted species.

The Kenyan Mara, the focus of this chapter, makes up only about a quarter of the ecosystem's area (5,934 sq. km [Norton--Griffiths 1995]) but assumes outsized importance because it provides crucial sources of food and water for migrating wildlife and pastoral livestock during the dry season and drought (Sinclair and Norton--Griffiths 1979). This productivity is caused by a strong rainfall gradient from Tanzania in the south (500 mm or 20 inches of annual rainfall) to the north (up to 1,340 mm or 53 inches of annual rainfall) (Norton--Griffiths et al. 1975, Ogutu et al. 2011). In the Mara, about 77 percent of the area used by the wildebeest migration is on pastoral land, and loss of their access to this land might result in a 30 percent loss of wildlife (Norton--Griffiths 1995), or perhaps half a million animals.

The way people use the land and the types of boundaries they create on their land determine how freely livestock and wildlife move and how we define this system itself (Reid 2012). Indeed, more than a million people live to the west of the Mara (Campbell and Hofer 1995) in a checkerboard of farming lands and villages reaching from the Mara to Lake Victoria, land use that creates hard boundaries in the former open savanna. But to the north and east of the Mara, the land is relatively open, with a few soft boundaries, and is used by pastoralists for grazing or rented by them to ecotourism businesses for wildlife use. Hard boundaries are physical, like fences or plowed farm fields, or social, like restrictive land use rules on private land or protected areas (Reid 2012). Soft boundaries occur in pastoral lands when people occupy land with their corrals and homesteads (but without fences), or heavily use areas around water points. As people harden boundaries, they fragment the land (Hobbs et al. 2008), which can cause migrations to collapse and deadly conflicts to arise until wildlife are extinguished from these landscapes (Ogutu et al. 2013).

Conflicts and Synergies Among People and Wildlife in the Mara

Pastoralists, wildlife, and livestock have lived side by side in the Mara for thousands of years (Lamprey and Waller 1990, Marshall 1990), sometimes in conflict and sometimes in unexpected synergy. Because the Mara is the most productive part of the ecosystem, it is also in highest demand for other uses by farmers, shopkeepers, tourism businesses, and others. Unlike Serengeti National Park, the Mara Reserve is small, and the land used outside the reserve is extensive; thus the challenges for large landscape conservation here are particularly complex and consequential for the entire ecosystem.

First, the unexpected synergies. In the open pastoral land of the Mara, wildlife not only can coexist with livestock and people, but some species appear to prefer to cluster around pastoral settlements (Reid 2012). We think this occurs because of the variation in grass heights that livestock create in this system (Bhola et al. 2012). Smaller wildlife (like small gazelles and warthogs), which have the highest risk of predation (Sinclair et al. 2003), prefer short--grass pastures where predators are visible and grass is nutritious. These short--grass pastures occur around pastoral settlements where livestock graze the grass short. Medium--sized grazers (like wildebeest, topi, and kongoni) prefer pastures with intermediate amounts of forage (Fryxell 1991), where there is a mixture of patches of grass grazed short by livestock for predator visibility as well as longer grass to meet their greater forage intake requirements. The largest wildlife, like elephants and buffalo, are relatively predator--proof and need great amounts of forage, so they often prefer long--grass areas, which occur in the Mara Reserve. Small to medium grazers therefore distribute themselves relatively close to pastoral settlements to take advantage of both predator protection and nutritious pastures nearby, and pastoralists observe these animals (and hyenas) moving close to their settlements, especially at

night when predation pressure is highest. Thus, lightly used pastoral areas are richer in wildlife than the reserve when grass is abundant in the wet season, with medium to large wildlife migrating back to the long-grass protected areas in the dry season (Bhola et al. 2012). Topi and warthogs prefer to raise their newborns in the shorter grass areas on pastoral land (Bhola et al. 2012). This scenario demonstrates the value of the Mara's diverse landscape, in which reserve and pastoral lands provide different habitat benefits for the area's diverse wildlife.

Despite these synergies, conflicts are increasing in the Mara, as measured by the overall decline in wildlife populations. Over the last 30 years, some of the pastoral land outside the Mara Reserve has progressively been converted to commercial wheat fields and growing villages (Homewood et al. 2001, Ottichilo et al. 2001, Serneels and Lambin 2001, Ogutu et al. 2009). Illegal hunting of wildlife has been particularly severe along the western side of the Mara, in the areas closest to highly populated farming areas (Ogutu et al. 2009). Dotted with scattered Maasai homesteads, much of the land remained open for both wildlife and livestock over this time. However, even with this open land, resident wildlife populations fell by 82 percent in the pastoral lands and by 74 percent in the reserve between 1977 and 2009 (Ogutu et al. 2011). Strong efforts in the western part of the Mara Reserve to halt poaching have had some effect but do not seem to be stopping the overall decline in wildlife numbers (Ogutu et al. 2011).

In the early 2000s, a new, major threat to the free movement of both wildlife and livestock began in the Mara. To comprehend this threat, it is important to understand what has been called the pastoral paradox. Pastoralists in the Mara, like many around the world, face this paradox when they consider converting their commonly managed pastures into private land parcels (Fernandez-- Gimenez 2002). How they solve this paradox deeply affects conservation. On the one hand, herding requires flexible access to land and water, so herders can move their livestock to better pastures as scattered rainfall creates patches of green grass in different parts of the landscape, and especially during the dry season and drought. This flexibility is just what wildlife need too, and largely creates the compatibility of pastoralism with wildlife conservation. On the other hand, many pastoralists also now want secure access to land and water. Thus pastoralists need flexibility but want the guarantee of security—especially in Kenya, which has a history of land grabbing by foreign governments and corporations, a phenomenon common in Africa and Asia (Rulli et al. 2013). The need for security often encourages pastoralists to stop moving, settle down, and privatize land so they can claim a piece of territory as their own. But settling often creates the hard boundaries that can stop wildlife movement, leads often to greater poaching activity, and is generally incompatible with wildlife conservation (Reid 2012). We will describe in the next section how pastoral communities are resolving this paradox by establishing partnerships with the nonprofit and private sectors in order to create wildlife conservancies.

Experimenting with the Devolution of Power to Local Stakeholders

A History of Experimentation and Research

The Mara and other game reserves in Kenya were some of the first places to experiment with local involvement in conservation. The establishment of Maasai Mara National Reserve (along with several other Kenyan reserves) in the mid--20th century signaled the rise of an innovative model of conservation for east Africa, as these entities were designed from the start to benefit local pastoral governments (Parkipuny 1991). In 1956, as the Maasai lost access to land within the Serengeti, the Kenyan colonial government allowed local district councils to create what were known as African district council (ADC) game reserves (Lamprey and Reid 2004). In 1961, the Mara ADC reserve became the Maasai Mara Game Reserve, and in 1963—under the newly independent Kenyan government—the management of the reserve became the responsibility of the local, Maasai--run

council of the Narok district, which then collected profits from gate and camping fees and lodge concessions. Until 2013, the Mara Reserve was run by both the local Transmara and Narok county councils (which joined to become the expanded Narok County Council in 2013), unlike the adjacent Serengeti National Park, which is managed by the central Tanzanian government hundreds of kilometers away.

From devolved management, the devolution of tourism profits followed. In the 1980s, both the Mara Reserve and private tourism businesses began sharing benefits with the ecosystem's people, who bear the costs of living with wildlife (Lamprey and Reid 2004, Thompson et al. 2009, Osano et al. 2013a, Osano et al. 2013b). The Maasai Mara Game Reserve began sharing 10 percent to 20 percent of their annual budgets with surrounding communities, with profits directed to local county councils and some Maasai landowners (Lamprey and Reid 2004). Unfortunately, most of the initial profits flowed into the pockets of wealthy Maasai landowners rather than the majority of poorer Maasai landowners (Thompson and Homewood 2002). In addition, tourism operators created conservation incentive programs and shared some of their profits with local community members in the Mara as well as elsewhere in Kenya and Tanzania (Lamprey and Reid 2004, Schroeder 2008, Thirgood et al. 2008).

At about the same time, a team of researchers at Colorado State University (CSU) began studying pastoral systems, first in northern Kenya and then in the Serengeti--Mara and Ngorongoro. In northern Kenya during the 1980s and 1990s, the South Turkana Ecosystem Project was among the first research endeavors to ask how the social and cultural structures of pastoral people worked, how pastoralists impacted their ecosystems, and how environmental change affected people (Ellis and Swift 1988, Little and Leslie 1999). Although no one asked the Turkana people—the subjects of the study—what questions they needed answered, some did participate in gathering data. For two decades, a group of social scientists and ecologists worked together on the project, crossing disciplinary lines to address complex human and environmental problems.

By the late 1990s, a significant amount of CSU research focused on the Serengeti--Mara ecosystem, with some researchers working in partnership with the International Livestock Research Institute (ILRI) in Nairobi. One project examined the effects of conservation policy on pastoral people in the Ngorongoro Conservation Area compared with those in the Loliondo Game Controlled Area nearby (Galvin et al. 2001, Boone et al. 2002). Another large project used integrated modeling to address human food security, conservation, and ecosystem integrity in the Maasailand ecosystems of both Kenya and Tanzania (Thornton et al. 2003, Galvin et al. 2004). For decades, biologists and ecologists at many institutions collected long--term data on everything from lion behavior to plant dynamics as demonstrated in the well--known books *Serengeti: Dynamics of an Ecosystem* and *Serengeti II: Dynamics, Management, and Conservation of an Ecosystem* (Sinclair and Norton--Griffiths 1979, Sinclair and Arcese 1995) (Brotten and Said 1995). In 2002 and 2003, this group partnered with CSU and ILRI researchers, among others, to address research on humans as part of the Serengeti ecosystem, which eventually became part of *Serengeti III: Human Impacts on Ecosystem Dynamics*, *Serengeti IV: Sustaining Biodiversity in a Coupled Human--Natural System*, and other work on the Mara (Reid et al. 2003, Kaelo 2007, Norton--Griffiths et al. 2008, Ogutu et al. 2008, Sinclair et al. 2008a, Sinclair et al. 2008b, Ogutu et al. 2009, Ogutu et al. 2010, Ogutu et al. 2011, Galvin et al. in press, Reid et al. in press). Some of this work was coproduced with local Maasai in the Mara ecosystem.

These projects helped break new ground in the areas of both research and conservation. On the conservation side, the next logical steps would be local coleadership of initiatives through better training for local leaders and stronger locally led institutions as well as the equal sharing of profits—both government gate fees and private--sector earnings—with local communities. On the research side, a revolution in approach was needed, from expert--driven to community--driven

research. The Mara region was transitioning to new forms of both conservation and research about the time the Reto--o--Reto initiative started in 2002.

The Reto--o--Reto Initiative

A team of us started the Reto--o--Reto initiative to build the role of local leaders, institutions, and communities to meet the twin demands of landscape--scale conservation and pastoral development in five ecosystems of Maasailand in northern Tanzania (Longido, Tarangire) and southern Kenya (Mara, Amboseli, and Kitengela) (Reid et al. 2009, Nkedianye and Reid 2012). The overall goal of Reto--o--Reto (which means “you help us, we help you” in Maa, the Maasai language) was to create a new model of local conservation and research that is driven by the needs of local communities and led by them, with the support of others outside their ecosystem as needed. We wanted to turn the power structure upside down, placing local communities in the lead and structuring a supportive role for the outside conservation and research community. In this way, we hoped to empower local action and research so that local needs and desires were at least as powerful as those of outsiders, and hopefully more so. We really had no idea if this would work at the beginning, and neither did our colleagues in local communities. We were far from the only groups pursuing this goal, so we are far from the only ones who should take credit or blame for what then happened. The International Livestock Research Institute led the team, but many community groups held important partnering roles, as did outside institutions such as University College London, University of Louvain, and Colorado State University.

The only way, we thought, to make sure that local voices were dominant in this initiative was to empower those voices to drive the work of the team from the start (Reid et al. 2009). To accomplish this goal, we recruited five respected Maasai leaders from each of the five ecosystems at the heart of our team to act as boundary--spanning leaders of our research and action work. Their role was to be the link among policy makers, scientists, and local communities, and to serve as catalysts for local action and research. A sixth Maasai leader worked directly with policy makers in the Kenyan national government. We took care to select leaders with one foot in their communities and one foot in the wider world. On the community side, they had to be born and raised in their communities, good and humble listeners, articulate speakers, and relatively apolitical so that they could be widely inclusive. In the wider world, they had to be reasonably well connected, so that they could interact with policy makers, and educated in the social or natural sciences, so that they were comfortable interacting with the scientists on our team. Although these requirements would be a tall order in any community, we found six such individuals after a six--month search by a specially selected Maasai search committee.

Cooperating with this group of pastoral facilitators was a transdisciplinary team of researchers: two anthropologists, two veterinarians, three ecologists, one agricultural economist, and one geographer from the International Livestock Research Institute, University College London, the University of Louvain, and Colorado State University. In this context, *transdisciplinary* means researchers who spanned the boundaries among scientific disciplines as well as those between local and scientific knowledge, and between theory and practice. This team was committed to the idea of making their work entirely relevant to local needs so that it was legitimate in the eyes of local stakeholders (Cash et al. 2003). Together, these facilitators and researchers formed the core of the Reto--o--Reto team, and this core worked closely with a wide range of community members, other researchers, government officials, NGO workers, business people, schoolteachers, and others who focused on pastoral development and wildlife conservation.

Propelled by the local leaders, our joint team decided to focus on information gathering, colearning, and empowerment of local voices and action. We quickly realized that this work had to start with the aim of improving local livelihoods and, as we built confidence and trust, could then move to include wildlife conservation. Six primary objectives for our joint work were developed (Nkedianye and Reid 2012):

1. Discover ways to add value to livestock production.

2. Assess the value of alternative land use practices to uncover any incentives or disincentives for conservation.
3. Assess trends in land use, land tenure, and wildlife.
4. Determine the causes of changes to wildlife populations over time.
5. Empower local pastoral communities to be major actors in conservation and ensure that conservation supports their livelihoods and vice versa.
6. Work with local and national policy makers to promote pastoral initiatives that conserve wildlife and support pastoral livelihoods.

Linking Action with Knowledge and Knowledge with Action

The Reto--o--Reto initiative developed a continuous engagement model that empowers local voices; links action with knowledge; and encourages information sharing across disciplines, cultures, languages, and knowledge levels (Reid et al. 2009). In this model, the Maasai community facilitators were assigned to communicate local needs and information to the team, and the researchers were assigned to respond to these needs by finding existing or new information to address reported issues or problems. For example, pastoralists consistently ranked East Coast Fever as a major source of mortality for their livestock. As Reto began, epidemiologists were testing a new vaccine in Tanzania and found it particularly effective. The joint Reto team brought this information to Kenyan pastoralists, who thus had a new option for treating their livestock. This reversed the traditional “loading dock” model of research (Cash et al. 2006) in which scientists find a result and then deliver it to communities; in this case, communities needed information and the research responded by finding existing information that was useful. To ensure that the Reto work was quickly responding to new needs, facilitators worked daily in their communities and then met with the researchers for two days once every two months to discuss progress and new directions.

One particularly effective tool was outcome mapping (Earl et al. 2001), in which we planned our work backwards from the outcomes desired by communities and then built our outputs to satisfy those outcomes. This process encouraged researchers to be more flexible about the questions they asked, the science they conducted, and the ways in which they integrated local and scientific knowledge. Local community members also had to articulate their needs for information from research, which was often a new experience for them.

The Reto team soon found that the information needs of community members and policy makers were far greater than we were able to fulfill. Research is often slow; it can take years to reach a reliable, rigorous answer to any question. We tackled this problem by using research to satisfy information needs only when absolutely needed. Once communities articulated a need for help with an issue, we responded in one of four ways. First, if the facilitators or researchers had no experience with the problem and did not have any information to contribute from their expertise, we told communities that we could not help them. This, however, did not happen often. Second, the facilitators often “traded” knowledge, connecting community members or policy makers to existing knowledge from other community members, other organizations, or sometimes from research. For example, in the Mara, community members were struggling with the pastoral paradox and were not sure if they should privatize their land, since they would then lose the flexibility to move their cattle. The Reto facilitator from the Mara, Dickson Kaelo, took Mara community members to the Kitengela, where communities had privatized their land in the 1980s, to learn about their experiences with using neighborhood agreements to share private grazing lands across property boundaries. This helped Mara communities decide how to solve their own pastoral paradox.

A third approach was knowledge synthesis, in which the facilitator interpreted and combined existing local and scientific knowledge in new ways for community members or policy makers. In the Mara, Kaelo used an economic study (Norton--Griffiths et al. 2008) to learn how much tourism operators needed to pay local pastoral landowners to give them a disincentive to convert land to farming. This amount, eventually set at US\$50 per hectare per year, was the profit needed from wildlife tourism to create a real alternative to subdividing and developing land (Norton--Griffiths et al. 2008).

Finally, if there was no information available about an issue identified by community members, the team developed research to generate new knowledge using a collaborative approach. In this approach, community members (and sometimes policy makers) were part of the process from start to finish: joint teams identified the problem or question together and then collected, entered, analyzed, interpreted, and communicated the data together. To cite one example, the pastoral community could not see that livestock grazing harmed wildlife, because they observed that the Serengeti wildebeest migration ran north across the Mara Reserve to preferentially graze around their settlements outside the park. This threw open the larger question of whether it made conservation sense to create parks that excluded traditional pastoral livestock grazing. The joint Reto community--researcher team then wrote a proposal to fund work comparing wildlife use in the nearby Mara Reserve (wildlife use only) and the adjacent pastoral lands. As described above in the section on synergies, this research partially supported pastoralist observations that wildlife prefer to use pastoral lands in the wet season but also showed the importance of the reserve for dry season wildlife grazing (as well as dry season livestock grazing in the reserve at night; see Butt et al. 2009, Butt 2011).

In a case similar to the knowledge synthesis example above, the Reto facilitator in the Kitengela, David Nkedianye, and Reto economists Patti Kristjanson and Maren Radeny created information on how much income households received from crop cultivation to help determine fair payments for a land--leasing program that provides pastoral families with incentives to avoid fencing land and to keep land corridors open for wildlife and livestock movements (Kristjanson et al. 2002, Kristjanson et al. 2009, Nkedianye et al. 2009).

Also in Kitengela, a joint community--researcher team mapped 6,741 fencelines to create a fine--resolution land--use map. The map was then presented to the local district commissioner, who worked with the Ministry of Lands to conduct a land--use planning exercise with community groups and county councilors. The resulting land--use map is now the basis for Kenya's first land--use plan for a privatized rangeland (Nkedianye et al. 2009). In 2013, David Nkedianye was elected the first governor of Kajiado County, which includes the Kitengela area. In early 2014, this map became the basis for his six--month moratorium on land development in the area, to slow down the subdivision of land and to give officials time to create a revised land use plan.

In 2009, Reto partnered with CSU to foster community--wide understanding of climate change and other environmental issues. The team facilitated comprehension of the issues and explored local needs for decision making (Galvin et al. 2013). Local people defined the environmental problems, coproduced a number of films to demonstrate their knowledge, and discussed possible solutions (Roque de Pinho 2013).

At the national level, the Reto team has been actively working on policy issues concerning pastoralism and wildlife. In 2013, for example, Reto--o--Reto director Ogeli Ole Makui was a member of the national taskforce on wildlife. Other Reto members (Nkedianye, Kaelo, and Said) worked to empower local community voices about the Wildlife Conservation and Management Bill and were involved in its review with the bill's national commission. Passed in December 2013, the law

supports and encourages wildlife conservation and management as a form of land use on public, community, and private land.

Reto Outcomes: Building Local Leaders, Institutions, and Communities for Conservation and Livelihoods

It is impossible to separate conservation and livelihood outcomes from the charismatic leaders who helped catalyze them. In the Mara, Reto facilitator Dickson Kaelo was the architect of multiple wildlife conservancies on former group ranch land. These entities are private–private partnerships led jointly by pastoral communities or landowners and tourism businesses. Partners negotiated agreements that allow local communities and landowners to receive significant profits from tourism businesses if they allow free movement of wildlife on their land and move their settlements outside the conservancy (Osano et al. 2013a). Most conservancies also allow pastoral partners to graze their livestock in the conservancies seasonally, some recognizing the benefit of livestock grazing for wildlife. These arrangements clearly benefited pastoral livelihoods, often through monthly payments of profits to the local bank accounts of each landowner.

For those who benefit, these Mara conservancies have big social impacts. The payments made to landowners (also called payments for wildlife conservation, or PWC) are their most equitable income source; these monies promote income diversification and buffer households from livestock income declines during periods of severe drought (Osano et al. 2013b). Local pastoralists earn more than US\$3.6 million annually, now paid directly to households on a flat rate based on land holdings. The cobenefits of PWC implementation include the creation of employment opportunities in the conservancy and provision of social services. Likewise, in Kitengela, payments from the land–leasing program can double the incomes of the poorest households in the dry season (Kristjanson et al. 2002) and thus have significant livelihood benefits (Nkedianye et al. 2009).

It is not yet clear, however, if the conservancies are slowing the decades–long decline of wildlife populations, even though wildlife are closely monitored. Certainly the eight conservancies cover a large area of the Mara ecosystem: about 92,000 hectares, which is more than half (61%) of the area of Maasai Mara National Reserve itself (150,000 hectares). As such, the conservancies are benefiting wildlife (and livestock) by maintaining large, connected, fence–free landscapes bordering the Mara Reserve, which is a major accomplishment. Local observations suggest that lion populations are recovering in the Olare Orok Conservancy (R. O’Meara, personal communication), after Maasai moved their settlements and no longer chased lions away from their livestock. But once Maasai moved out of the conservancies, they observed that many small and medium–sized wildlife moved out of the tall (and predator–rich) grass of the conservancy closer to pastoral settlements outside the conservancy (D. Kaelo, personal observation). Some conservancies now try to mimic livestock grazing, creating patches of short and long grass that will be attractive to grazers of different sizes (R. O’Meara, personal communication).

By contrast, in the Kitengela, the land–leasing program may be an example of too little too late. Because of rapid population growth next to the city of Nairobi, payments are not stemming rangeland fragmentation enough and did not restore the wildebeest migration that collapsed in the early 2000s (Ogutu et al. 2013). We conclude that while the programs in the Mara and Kitengela show some promise of slowing the conversion of savannas into villages, maize farms, resort cities, and other conservation–incompatible developments, they must be of sufficient scale to be effective (Greiner 2012, Osano et al. 2013a).

Perhaps the biggest impact of the Reto initiative was how it affected the way all team members—both community members and researchers—approached their work and how their capacity as leaders grew. In late 2013, Dickson Kaelo described a personal change of mind in this way: “In our universities, we are taught that pastoralism is wrong, it is failing, it is maladaptive. Instead, our Reto

work in the Mara, working closely with local community members, created a belief in the community that they can do it, they can make conservation work for their communities.” Indeed, Kaelo takes little credit for himself, partly because he saw that our many Mara Reto team members (about 30) grew confident as our research confirmed their observations that livestock and wildlife can benefit each other, convincing them that wildlife conservancies can work if they allowed seasonal livestock grazing. Kaelo also credits his Reto experience for giving him the perspective, experience, and balanced views of livestock and wildlife that enabled him to attain a position as the first CEO of the new Kenya Wildlife Conservancy Association. Governor David Nkedianye concurs about his experience as a Reto facilitator in the Kitengela: “That was the defining period for me, an accelerated, pressurized learning period. I had the opportunity to focus on critical community issues and expose myself to the best science in the world, to travel and build confidence.” From the researcher perspective, Robin Reid, now at Colorado State University, says, “This experience completely changed how I think about and do science, and how to link that science to real action on the ground. You really can be a scientist and do work that helps local communities and wildlife at the same time, if you include them every step of the way.”

The Reto initiative also helped local communities speak up for themselves. For example, before Reto started, government ministers often arrived in marginalized Maasai communities and made pronouncements about new programs and policies without any consultation or collaboration. Partly as a result of Reto, many communities will no longer participate in government initiatives unless they are consulted at the outset and, often, government officials willingly oblige.

Project Transferability and Ability to Endure

Can this level and intensity of engagement between communities and researchers be replicated elsewhere, or is it just too much work? In fact, our broad team is busy applying different versions of this approach in Africa, Asia, and the United States. The form of the approach is different in each place, but its essential elements are the same: collaborative learning to support local action on critical issues. To do this, it can require redirecting funding to community work and action, sometimes at the expense of deeper research. In our experience, however, the expansion of local residents’ capacity to learn and adapt is so great that this redirection is more than worth it. So we say yes: this approach is highly transferable, the impacts on local capacity are highly durable, and these efforts can create positive examples of hope through action on the ground in local communities to promote local livelihoods and large landscape conservation.

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Appendix 10: Success stories and other information about partnership's accomplishments

Please see all our success stories, posted at <http://csdes.uonbi.ac.ke/node/4159>

We include selected stories below.

Success story 1: Dryland Communities Design Higher Education to Suit Their Development Needs



It is rare for universities to ask poor and marginalized communities to critique and redesign their academic programs to meet their development needs. But the University of Nairobi is taking the lead. In early December, 2011, the new Centre for Sustainable Drylands Ecosystems and Societies (CSDDES) based at the University of Nairobi held a workshop entitled, Dryland Community Voices: setting a joint agenda in higher education and development from the ground up. The workshop highlighted the importance of the current devolution of governance to the Kenyan counties and the opportunities to improve education in drylands through this devolution.

Community participants highlighted the importance of training students to break the dominant myths about pastoralism. Instead, students should understand the importance of larger herds as a wise drought coping strategy. Community also highlighted on the need to be mobile to maximize pastoral production, and the high value of pastoral products to Kenya's national economy. Participants also stressed the need to have students succeed from primary to secondary to tertiary education. This would enable students succeed in local universities. All participants agreed that higher education was a key strategy to make families more resilient and able to climb out of poverty.

More than 45 representatives of dryland communities from across Kenya attended the workshop, including those from Isiolo, Loitoktok, Laikipia, Samburu, Mandera, Wajir, Garissa, Marsabit, Magadi, Narok, Kajiado, Illbisil, West pokot, Turkana, Loita, Tharaka, Kibwezi, Makueni, Tana River and Mwingi among other areas. Other stakeholders who participated in the workshop were representatives from Colorado State University, USAID, RUFORUM, Mercy Corps and Church World Service. Also present were members of the press and students from University of Nairobi.

Success story 2: Kibwezi Field Station Acquires A New Face



For the past few years, University of Nairobi (UoN)'s Kibwezi Field Station has been neglected. Located approximately 250 Kilometers from the capital Centre Nairobi in a dryland area, the field station was at one time almost on its deathbed. This is despite education value the center's vicinity holds for drylands students. Students have had to persevere the dropping in standards of the facility.

In line with the need to provide a serene environment for education and research to thrive, the Centre for Sustainable Dryland Ecosystems and Societies (CSDDES); a partnership program between the University of Nairobi (UoN) and Colorado State University (CSU) has restored its lost glory. Among the structures that got a lion's share in the renovation project were students' hostels, the dining hall and water carriage systems across the station.

The facility is now up on its toes and helping meet its mandate of providing research facilities in different capacities. Recently it housed University of Nairobi 3rd year range management students for three nights 24th to 27th July 2012. CSU and CSDDES management team also visited the Centre to ascertain the standards of the field station. Locals extolled CSDDES for restoring the field station.

Success story 3: Working With Communities for Increased Impact

For many years, a lot of research and development projects have been carried out in the dryland regions of Kenya with an aim of enhancing sustainability of dryland ecosystems and improving livelihoods. In spite of these efforts, the dryland regions continue to face enormous ecological, social and economic challenges. Sustainable development of these areas has been constrained by inadequate human capacity, limited action research and lack of participation by the dryland communities as end users, among other challenges.

According to Prof. J.T. Njoka, Director, Centre for Sustainable Dryland Ecosystems and Societies (CSDDES), many development approaches in Kenya's drylands have been accused of doing little to actively engage communities in dryland in problem identification, planning and implementation of programs targeting them, "By directly engaging the communities in problem identification and seeking interventions with them, development will be more targeted and hence increase impact". Therefore, CSDDES has embraced a community participatory approach with an aim of identifying dryland challenges and seeking solutions together with the communities.

In 2011, CSDDES awarded partial funding to thirteen UoN students to undertake research for development. The students were supposed to research on a topic that addresses specific needs of dryland communities. They were expected to identify and work closely with a research assistant/intern from the communities where they intended to carry out their research. After completing their research, the students were to hold a feedback workshop in the community to disseminate their findings back to the communities.

So far, CSDDES in partnership with other players in drylands have held three such workshops in three counties in Kenya-Isiolo, Marsabit and Laikipia. The workshops have provided the much-needed platform for disseminating findings of CSDDES-supported participatory research as well as providing an opportunity to gather feedback from stakeholders in the counties.

Speaking in one of the research feedback workshops held at Marsabit, the Deputy Governor of Marsabit County Hon. Omar Abdi expressed optimism that research will provide a road map to empower the communities in resilience. "I am glad to note that the objectives of this workshop are consistent with the first pillar of Kenyan Vision 2030 towards food security and the inclusive development that factors equal opportunities for all groups and especially the under-represented ones", he noted.

Success story 4: Giving Hope to Youths in Drylands



About two years ago, Mr. Abdi Ali Hassan was among many youths in the drylands of Kenya who faced a daunting future. Born 30 years ago to a pastoral family in Isiolo County, Mr. Abdi had to confront myriad challenges associated with the marginalized population. Some of these challenges included: acute unemployment; limited access to natural resources, financial hardship, and lack of skills and knowledge to transform economic circumstances.

Due to these challenges, Mr. Abdi had no confidence and lacked hope for a better future. However, his story has taken a different turn courtesy of the Centre for Sustainable Dryland Ecosystems and Societies (CSDDES).

CSDDES is a partnership between the University of Nairobi (UON) and Colorado State University (CSU) that is funded by USAID through the Higher Education for Development initiative. It was established two years ago at UON with a mission to contribute to sustainable dryland ecosystems and to improved livelihoods through innovative trans-disciplinary education, research, partnerships, policy dialogue and community outreach.

To achieve the mission of the Centre, a number of interns from dryland areas in Kenya were competitively recruited to work with PhD students in different dryland parts of the country. They were expected to assist in; data collection, provide community linkage, assist in organizing community meetings to prioritize local needs, interpret local issues and disseminate back knowledge generated to the community. On the other hand the PhD students were expected to mentor the interns.

Abdi was one of the interns from Isiolo County who was selected in early 2012 to work with Mr. Yazan Elhadi, a UoN Range Management PhD student. Abdi worked closely with Elhadi on his research related to value chains for camel milk in Kenyan drylands, and was an important resource for connecting Elhadi with Isiolo County communities.

By the close of the internship period, Mr. Abdi had acquired skills in conducting research, data analysis and communication. These skills opened many new opportunities for him in carrying out dryland-related research. He has worked as a research assistant with a number of researchers from UoN and Egerton University, and has become a representative for the Kenya Camel Association in Isiolo County.

“As a CSDES intern working with Yazan Elhadi, I interacted with very many people and became confident. I was able to improve my communication skills through the many meetings I organized and participated in. Today I am so motivated, particularly through the mentorship, encouragement and guidance of Mr. Yazan. I am optimistic that my tomorrow will be better,” he says.

Mr. Abdi now dreams of joining a higher education institution to pursue a course in animal health. A young man who 2 years ago had no hope for a better future is proud to have a chance to develop his professional life and impact his community.

Appendix 11: Selected press releases, news stories and news articles about our partnership

A11.1 Press release on establishment of CSDES

**DRYLAND PRODUCTIVITY.....NEWSLINE
5 JUNE 14**

Kenya Broadcasting Corporation Radio Service

As fears continues to grip residents of Northern Kenya over an imminent Drought ,calls have been made to institutions of higher learning to help by offering transformative education that is accessible to dryland communities and research that generates Knowledge to inform development in these areas.

The government says its through building human capital that the dryland communities will be able to uptake technologies and innovations to enhance resilience, improve livelihoods and environmental sustainability.

Most of the drylands in Kenya the government stresses suffer from low human capacity and knowledge gaps yet they have enormous untapped potential to contribute to National development.

The Knowledge, the government reitarates will help it achieve its intended focus of ensuring a secure and prosperous Northern Kenya and other Arid and semi arid areas, which is in line with vision 2030.

The government's call comes at time when the Kenya Meteorological Department says the long rains season performed poorly in the Arid and Semi Arid areas and the situation was compounded by the poor short rains season last year.

Samburu and Turkana have been cited to be among the areas that will be affected by the Drought.

Speaking during the opening of the second student led conference at the Nairobi University college of agriculture and veterinary sciences the principal secretary in the ministry of education science and Technology Collette Suda whose speech was read by George Ombakha specifically urged the university of Nairobi to take a lead role in nurturing and motivating young people to come with innovations and technologies that will lead to sustainable utilization management and development of drylands in Kenya .

George Ombakho is the director of research management and development in the ministry of education science and Technology.

The move to ensure drylands in the country she added is an effort that should be pushed by the government as well as development partners, private sector education institutions and communities.

Develop plans to exploit potential in arid areas, study centres urged

BY NATION CORRESPONDENT

Institutions of higher learning in Kenya have been challenged to develop innovative technologies to help exploit the massive potential of drylands in Kenya.

Speaking at a forum on sustainable development in drylands organised by the University of Nairobi's centre for sustainable dryland ecosystems and societies (CSDES), Principal Secretary for State Department of Science and Technology, Prof Colette Suda, said that Kenya's drylands suffer from a lot of myths, low human capacity and knowledge gaps despite their untapped potential.

Drylands constitute over 80 per cent of Kenya's land mass and is occupied by about 35 per cent of the over 40 million population yet they are largely ignored or overlooked in the development agenda.

Human capital

"This calls for transformative education that is accessible to dryland communities and research that generates knowledge to inform development in these areas. By building human capital, dryland communities will adopt technologies and innovations that enhance resilience, improve livelihoods and environmental sustainability," Prof

Suda said.

She was represented by the director of research management and development in the ministry of Education Science and Technology, Mr George Ombakho.

She said institutions of higher education should nurture and motivate scholars to come up with innovations that will lead to sustainable use, management and development of drylands in line with Kenya's Vision 2030 for secure and prosperous communities in the arid areas.

"Some of the unique challenges of education in expansive drylands relates to access, quality and relevance of training. High levels of poverty and

climate disasters hamper equitable access to education for dryland communities," she said.

This call comes in the wake of persistent cases of drought and famine in Northern Kenya over the years. Low human capacity and knowledge gaps can be reversed by training the communities.

Hit by drought

Already, the weatherman has predicted a gloomy picture for most of the arid and semi-arid areas this year owing to failure of the long rains. The situation is worsened by poor short rainfall season last year. Samburu and Turkana have been

cited to be among areas that will be worst hit by the drought this year.

The University of Nairobi vice-chancellor, Prof George Magoha, said the institution had earmarked CSDES as a specialised centre contributing to sustainable dryland ecosystems and improved livelihoods through education, research, partnerships, policy dialogue and community outreach.

"CSDES is currently collaborating with the Inter-governmental Authority on Development's applied research in development programme as one of the centres of excellence for drylands in the Horn of Africa," Prof Magoha said.

Link to story:

<http://www.nation.co.ke/business/Develop-plans-to-exploit-potential-in-arid-areas/-/996/2341468/-/pypc67/-/index.html>

A11.3 Press release on CSU--UoN strategic partnership

<http://today-archive.colostate.edu/story.aspx?id=8212>

Today@Colorado State

WCNR's scientists strengthen partnerships in Africa

February 14, 2013

Colorado State University is continuing to strengthen its international engagement and enhance its global impact as a leading research institution.



At the end of 2012, a delegation from CSU traveled to Africa to sign Key Strategic Partnerships with Hawassa University in Ethiopia and University of Nairobi in Kenya.

Decades of collaboration

The two strategic partnerships are the culmination of decades of ongoing collaboration and outreach efforts between CSU researchers and their African counterparts, and with the support of University leaders will help to strengthen institutional cohesion and expand opportunities for even greater multidisciplinary collaboration in the future.

The strategic partnerships provide financial resources to support a variety of initiatives such as faculty exchange, collaborative research, short-term teaching, shared academic programs, joint degrees, and joint research institutes. The partnerships were led by scientists from CSU's Warner College of Natural Resources and are an integrated, cross-campus effort including involvement from multiple academic departments at Warner, its Center for Collaborative Conservation and Natural Resource Ecology Laboratory, the College of Agricultural Sciences, the College of Veterinary Medicine and Biomedical Sciences, the School for Global Environmental Sustainability, and others.

Multi-disciplinary collaboration



“CSU’s Key Strategic Partnerships in Ethiopia and Kenya are two of 15 such partnerships around the world where the university is focused on developing effective opportunities for multi-disciplinary collaboration,” said Jim Cooney, vice provost of International Programs at CSU. “These partnerships and the support from CSU President Tony Frank are a testament to the international involvement of our faculty and the strong relationships they have built in these countries.”

CSU’s partnership with University of Nairobi was led by Robin Reid, director of the Center for Collaborative Conservation, joint professor in the Warner College of Natural Resources, senior research scientist with the Natural Resource Ecology Laboratory (NREL) and Warner College alumna. Reid’s work in Africa is world-renowned, and she has a long history and strong friendship with her colleagues at the University of Nairobi and the Maasai people in Kenya.

Reid spent more than 20 years living in Kenya only half a mile from University of Nairobi, and continues to pioneer collaborative solutions for critical conservation issues in the region. She also recently published her award-winning book “Savannas of our Birth” which tells the sweeping story of the role that East African savannas played in human evolution, how people, livestock, and wildlife interact in the region today, and how these relationships might shift as the climate warms, the world globalizes, and human populations grow.



As part of the delegations trip to Kenya, they made a special visit to Base Camp for Reid’s research. In 2012, Reid and her team of co-authors were awarded the prestigious ESA Sustainability Science Award for their collaborative paper which detailed their research in East Africa and development of a new community-based sustainability model that integrates local knowledge and community participation with scientific data. During the visit, Reid and the delegation exchanged gifts with the Maasai People and presented them with certificates to commemorate their valuable team work and contributions to the award-winning research.

“Whether it is CSU, Ethiopia or Nairobi – natural resources, agriculture, or veterinary medicine: the issues facing local and global communities continue to become intertwined and demand opportunities for cross-disciplinary, international collaboration,” said Reid. “These unique partnerships give us the opportunity to work together and make a genuine impact around the globe, and also to enrich education and research here in Colorado.”

The Ethiopian Key Strategic Partnership with Hawassa University was led by Paul Evangelista, research scientist with CSU's NREL and Warner College alumnus. Evangelista's lifelong passion for collaborative research and outreach in Ethiopia began in 1999. Since then, he has continued to work on dozens of studies and initiatives including wildlife management and conservation, floral inventories, and mapping of ecosystem services that are critical to the livelihoods of local people. He has also been involved with strengthening the teaching capacity of rural schools, construction of water-supply systems, reforestation of native trees, professional training for wildlife managers, and other partnerships that collectively address Ethiopia's environmental and social challenges from multiple approaches.



CSU signed an International Memorandum of Understanding with Hawassa University in January of 2012, and the new strategic partnership strengthens the commitment between the institutions and provides enhanced access to opportunities for collaborative research and education.

Strong ties through Peace Corp

In addition to a wide range of established faculty involvement and research partnerships, the university also has strong ties with Ethiopia through its Peace Corps involvement. Warner College retired instructor and forester Bob Sturtevant and his wife Nancy have spent two years serving with the Peace Corps at Hawassa University in Ethiopia and have helped coordinate collaborative research opportunities and graduate student exchanges between the two universities.

Other ties with Ethiopia, such as the Peace Corps Master's International (PCMI) program allows student volunteers to pursue a unique Master's degree through CSU coursework and two years of service. For example, PCMI student Carl Reeder recently returned from two years of volunteer service working with the Ethiopian Wildlife Authority mapping the country's national parks and protected lands. Reeder is now completing his thesis and expects to graduate this summer.

The CSU delegation included:

- Tony Frank, *president*
- Jim Cooney, *vice provost for International Affairs*
- Lou Swanson, *vice president for Engagement and Director of CSU Extension*
- Craig Beyrouthy, *dean of the College of Agricultural Sciences*
- Diana Wall, *University Distinguished Professor, director of the School of Global Environmental Sustainability, and senior research scientist with the Natural Resource Ecology Laboratory*
- Robin Reid, *director of the Center for Collaborative Conservation; joint faculty in the Departments of Human Dimensions of Natural Resources, Forest and Range Stewardship and Ecosystem Science and Sustainability; senior research scientist, Natural Resource Ecology Laboratory*
- Paul Evangelista, *research scientist, Natural Resource Ecology Laboratory*

- Kathleen Galvin, *professor in the Department of Anthropology; acting director of the School of Global Environmental Sustainability; and senior research scientist, Natural Resource Ecology Laboratory*
- Lee E. Sommers, *director of the Agricultural Experiment Station and associate dean for Research, College of Agricultural Sciences*
- Susan VandeWoude, *associate dean for Research and Graduate Education, College of Veterinary Medicine and Biomedical Sciences*

Reid and Evangelista are just two examples of a broad variety of faculty and researchers across campus who have made incredible commitments and collaborative partnerships in Africa. The Key Strategic Partnership between CSU and University of Nairobi and Hawassa University will help to strengthen and continue the legacy of collaboration and interdisciplinary research between the institutions for years to come.

Permalink: <http://www.today.colostate.edu/story.aspx?id=8212>

A11.4 Press release on ESA 2012 Sustainability Science Award

The press release below was written to recognize an award given to to the CSU team for their long-term research in African drylands, collaborating closely with dryland communities, policy makers and African universities. Part of the reason for this award was the long-term partnership with the University of Nairobi, funded under this grant.



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CSU Scientist Robin Reid Awarded Ecological Society of America 2012 Sustainability Science Award

For Immediate Release Thursday, August 02, 2012

Contact for Reporters: Jennifer Dimas 970.491.1543 Jennifer.Dimas@ColoState.EDU

More than 4,000 scientists, researchers and students are gathering in Portland this month to present and share ideas on environmental challenges and sustainability at the Ecological Society of America's 97th Annual Meeting.

During the meeting, Colorado State University scientist Robin Reid and her co-authors will be awarded the prestigious 2012 ESA Sustainability Science Award for their collaborative paper, "Evolution of models to support community and policy action with science: Balancing pastoral livelihoods and wildlife conservation in savannas of East Africa."

Their paper describes the revolutionary method of collaborative research and outreach they conducted in four study areas of different pastoral ecosystems East Africa. The team developed a new community-based sustainability model that integrates local knowledge and community participation with scientific data. The model makes scientific research more useful and accessible to the communities it is designed to serve.

"By creating teams of facilitators who work together with local policy makers, community members and researchers, we were able to bridge a communications gap and identify unique issues within communities," Reid said. "The collaborative approach opened up a two-way conversation that drove our research plan and created outcomes that communities were able to better implement and benefit from. We helped them create sustainable pastoral and wildlife policies that balance the need for poverty alleviation with wildlife conservation."

The esteemed ESA Sustainability Science Award is given annually to authors of a peer reviewed paper published in the past five years that makes the greatest contribution to the emerging science of ecosystem and regional sustainability through the integration of ecological and social sciences. The paper was published in Proceedings of the National Academy of Sciences in 2009, and was co-authored by a collaborative team of 17 scientists. At the meeting, Reid also will present a first look at her new book, "Savannas of Our Birth," which will be released in October and has already been selected by the UC Press Foundation to be included in this year's Author's Imprint.

Reid is the director of the Center for Collaborative Conservation, an initiative of Colorado State University's Warner College of Natural Resources, and is also a Warner College alumna, professor and senior research scientist whose research is recognized around the world and was featured on 60 Minutes. She credits her paper's ground-breaking research to her colleagues and co-authors from CSU and Harvard, and her Maasai colleagues in Kenya – without whom, the collaborative endeavor wouldn't have been possible.

“It was groundbreaking because of them,” Reid said.

CSU's co-authors on the paper include Kathy Galvin, Natural Resource Ecology Laboratory senior research scientist and Department of Anthropology professor; Randall Boone, Natural Resource Ecology Laboratory research scientist and Department of Ecosystem, Science and Sustainability associate professor; and Shauna BurnSilver, CSU alumna and senior sustainability scientist and assistant professor at Arizona State University.

“The award subcommittee found the multi-partner, multidisciplinary approach of this paper laudable, not only because the authors illustrate how important it is to tackle sustainability problems from multiple angles, but also because they show that these collaborations are possible and serve to inspire us all,” said Eleanor Sterling, ESA Sustainability Science Awards sub-committee chair. “Dr. Reid and her co-authors' paper focuses not just on research, but on the research process itself - providing valuable and detailed insights into how ecological research can better align itself with end-goals, including conservation and poverty alleviation.”

The paper is a labor of love for Reid and the product of a multi-phased evolution of research methodology founded by her mentor, James Ellis. Starting with an endeavor to better answer the tough questions of policy makers, Reid and her peers have pushed to not only provide solution-oriented research, but to collaborate with communities throughout the research process to ensure their work is as relevant and meaningful as possible.

“It is a lot of hard work, and it isn't the fastest or easiest way to conduct research, but the outcomes are so rewarding,” Reid said. “This award is such an honor, and I am very excited and hopeful that this recognition will raise awareness about our research and inspire continued pursuit of meaningful, collaborative sustainability research and outreach around the world.”

See press release posted at: <http://www.news.colostate.edu/Release/Print/6329>

A11.5 Press release on APLU's 2014 Michael P. Malone's International Leadership Award

In June 2014, CSU's Prof. Robin Reid, co-project director for this partnership project, was the national faculty awardee for **Association of Public and Land Grant University's 2014 Michael P. Malone International Leadership Award**. Part of the reason for this award was Reid's co-leadership of the strategic partnership described here with the University of Nairobi. See APLU posted press release at: <http://www.aplu.org/page.aspx?pid=3007>. Below is the press release from CSU's International Programs.

CSU Professor Robin Reid receives Michael P. Malone International Leadership Award

Posted on July 15, 2014

Robin Reid of Colorado State University has received the 2014 Michael P. Malone International Leadership Award for her career of significant contributions to advancing international education at public and land-grant institutions. Reid was one of three recipients of the Malone Award, which is sponsored by the Association of Public and Land-grant Universities (APLU).

Reid and fellow recipients Amit Chakma of Western University and Krishnaswami Srihari of Binghamton University received awards during a ceremony at APLU's 2014 Commission on International Initiatives (CII) summer meeting July 14, Berkeley, CA.

"Robin Reid personifies the interdisciplinary approach that Colorado State University fosters in our faculty," said Rick Miranda, provost and executive vice president of Colorado State. "She has made enormous contributions to international education and development, and she is a passionate advocate who displays her infectious enthusiasm for her work at every level."



Figure 7. Robin Reid (center) is recognized for receiving the APLU Malone Award by CSU President A. Frank (second from right); J. Cooney, Vice Provost for Int'l Affairs, CSU (left); P. McPherson, APLU President (second from left); and C. Hoseth, Director of Int'l Initiatives, CSU (right).

Reid is director of the Center for Collaborative Conservation, a professor in the Department of Ecosystem Science and Sustainability, and a senior scientist at the Natural Resource Ecology Laboratory – all based in Colorado State University’s Warner College of Natural Resources.

For the last 27 years, she has led education, research and outreach projects in the drylands of Africa, Asia and North America. Her current work focuses on how to transform international higher education to be more inclusive of under-represented groups and more useful for local problem solving. She was also instrumental in forging the first Key Strategic Partnership between CSU and an African university, the University of Nairobi, in 2012.

“In receiving this award, I represent our talented teams at Colorado State University and our international university partners, as we build new ways to bring the highest quality education to all peoples of the world, especially under-represented students from the world’s remote drylands,” Reid said. “Our main goal is to build the next generation of transformative leaders who can better tackle the accelerating challenges of our world. We will use the momentum of this award to ignite new and stronger opportunities to help students build the confidence and skills to build a stronger global society.”



Figure 8. Robin Reid receives the APLU Malone Award.

Reid’s research focuses on how collaborative governance at the community level works around the world and its social and ecological outcomes. From 1992-2007, she lived and worked in east Africa, doing research with pastoral peoples, on the social and ecological sustainability of their ecosystems. Her team of researchers and pastoralists won the 2012 Sustainability Science Award from the Ecological Society of America, for their paper describing their efforts to make science useful to local communities and policymakers.

“Traditionally, researchers have thought of silver bullets to global sustainability challenges as technologies like vaccines, or communication technology, or a new crop variety. While these technological fixes are surely important, even more important is building the capacity of people and institutions to innovate and build their own futures through co-learning, co-producing knowledge, linking science with their local knowledge,” said Reid in her acceptance speech. “We have learned that science and education can have

the most impact when we put local communities and their needs at the center of all we do, and focus our research on helping them to build the confidence and skills to build a stronger and more sustainable society.”

The Malone Award is named in honor of Michael P. Malone, president of Montana State University from 1991 until his death in 1999. Malone made many contributions to MSU and U.S. public higher education through his work as chair of APLU Commission on International Initiatives where he focused the group’s efforts on issues critical to international programs and increased its stature within APLU and elsewhere.

APLU is a research, policy and advocacy organization representing 234 public research universities, land-grant institutions, state university systems and affiliated organizations. Founded in 1887, APLU is North America’s oldest higher education association with member institutions in all 50 U.S. states, the District of Columbia, four U.S. territories, Canada and Mexico. Annually, APLU member campuses enroll 4.7 million undergraduates and 1.3 million graduate students, award 1.1 million degrees, employ 1.3 million faculty and staff, and conduct \$41 billion in university-based research.

Higher Education, Research & Sustainable Development

in Africa:

CSU's History and Future

The first conference on African
ecosystems and societies at
Colorado State University

Colorado State University

Lory Student Center

April 13th, 2012



CONFERENCE INTRODUCTION

This conference will explore the potential for a campus-wide initiative to address the multifaceted and serious challenges facing African ecosystems and societies via Colorado State University's African Ecosystems and Societies Program (AESoP), which is based at the Natural Resource Ecology Laboratory, Warner College of Natural Resources. With broad participation from across campus by individuals who have previously engaged, are currently engaged, or aspire to engage in research and education in Africa, we anticipate the emergence of many exciting new ideas for synergizing our collective knowledge, experiences, and aspirations for the long-term sustainability and vitality of African ecosystems and societies in the broadest and most integrated sense. Our collective and multidisciplinary efforts have a variety of potential linkages through human livelihoods, cultures, economies and politics, as well as through uses and/or protection of common natural resources and landscapes.

We are fortunate to have a Kenyan delegation from the University of Nairobi and a Kenyan community NGO visiting CSU, so we have incorporated them into the program to bring the voices of African scientists and educators into this discussion with the goal of informing CSU's vision of research, education, and action on the African continent.



CONFERENCE PROGRAM

MORNING SESSIONS: INTRODUCTION TO THE ISSUES CSU SENATE CHAMBERS

- 9:00-9:30 **Introduction to the Conference and AESoP**
Dr. John Moore, Dr. Michael Coughenour, Dr. Robin Reid
- 9:30-9:45 **Welcome and opening remarks**
Dr. James Cooney, CSU Vice Provost of International Affairs

- 9:45-10:00** **Opening Remarks**
 Professor Peter Mbithi, Deputy Vice Chancellor, University of Nairobi, Kenya
- 10:00-10:45** **Panel #1: Opportunities of Sustainable Development in Africa**
 Dr. Kathleen Galvin, CSU Department of Anthropology
 Dr. Carl Hammerdorfer, CSU College of Business
 Dr. J. Terrence McCabe, Department of Anthropology, University of Colorado, Boulder
 Dr. David Nkedianye, Deputy Director, Center for Sustainable Dryland Ecosystems and Societies, , University of Nairobi, and Reto-o-Reto Foundation
 Professor Peter Gufu Oba, Professor of International Environment and Development Studies, Norwegian University of Life Sciences
Moderators: Dr. Jesse Njoka, University of Nairobi; Dr. Robin Reid, Center for Collaborative Conservation, CSU
- 10:45-11:00** Tea and Coffee Break
- 11:00-11:45** **Panel #2: The Role of Higher Education in Sustainable Development in Africa**
 Dr. Brett Bruyere, Department of Human Dimensions of Natural Resources, CSU
 Professor Charles Mulei Matiku, Dean of Veterinary Science, University of Nairobi
 Professor Agnes Mwang'ombe, Principal of Faculty, College of Agricultural and Veterinary Sciences, University of Nairobi
 Professor Jesse Njoka, Director, Center for Sustainable Dryland Ecosystems and Societies, University of Nairobi
 Dr. Robin Reid, Director, Center for Collaborative Conservation, CSU
Moderators: Dr. David Nkedianye, Reto-O-Reto Foundation, Kenya; Dr. Stacy Lynn, Natural Resource Ecology Laboratory, CSU
- 11:45-1:00** Lunch Break

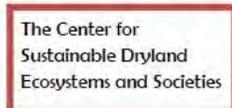
**AFTERNOON SESSIONS: AFRICA-RELATED RESEARCH IN CSU COLLEGES
 LORY STUDENT CENTER, ROOMS 224-226**

- 1:00-1:30** **CSU's College of Liberal Arts**
 Dr. Kathleen Galvin, Department of Anthropology
 Dr. Thaddeus Sunseri, Department of History

- 1:30-2:00 CSU College of Engineering**
Dr. Bryan Willson, Director, Engines and Energy Conversion Laboratory
- 2:00-2:30 CSU College of Agriculture**
Dr. Nancy Irlbeck, Associate Dean for Academic Affairs
- 2:30-3:00 CSU Warner College of Natural Resources**
Dr. David Swift, Senior Research Scientist, Natural Resource Ecology Laboratory
- 3:00-3:30 CSU College of Veterinary Medicine and Biomedical Sciences**
Dr. Christine Hardy, Director of Operations, Animal Cancer Center
Dr. Richard Bowen, Professor of Biomedical Sciences and Head of the Adapting Livestock Systems to Climate Change Collaborative Research Support Program (LCC CRSP)
- 3:30-4:00 CSU College of Business**
Dr. Carl Hammerdorfer, Director, Global Social and Sustainable Enterprise Program (GSSE)
- 4:00-4:15 The Higher Education for Development Project: Transforming Higher Education in African Drylands**
Dr. Robin Reid, Director, Center for Collaborative Conservation, CSU
Professor Jesse Njoka, Director, Center for Sustainable Dryland Ecosystems and Societies (CSDDES), University of Nairobi
- 4:15-4:30 Reflection and Visioning a Way Forward**
- 4:30-5:30 Informal social — Building partnerships and continuing dialog**
Avogadro's Number, 605 South Mason St., Fort Collins



THANK YOU TO OUR SPONSORS



APRIL 9, 2014
Symposium and Panel Discussions, Grey Rock Room and LSC 230 Lory Student
Center, CSU
Free and Open to the CSU Community

Schedule of Events

7:30---8:00 Registration: Breakfast and coffee served in Grey Rock Room, LSC

8:00---8:15 Welcome and Introduction: Joyce Berry, Dean, Warner College of Natural Resources & Kathleen Galvin, Professor, Department of Anthropology, & Senior Research Scientist, Natural Resource Ecology Laboratory

8:15---9:15 Panel I: Global One---Health: What are the states and trends of climate, environmental and social processes on environmental, animal and human health for Africa? How can we ensure sustainable ecosystem function and animal and human health?

Panelists

- Richard Bowen, Professor, Biomedical Sciences, CVMBS
- Brian Foy, Assistant Professor, Microbiology, Immunology, and Pathology, CVMBS
- Francisco Olea---Popelka, Assistant Professor, Clinical Sciences, CVMBS
- Jennifer Troyer, Program Director, Human Heredity and Health in Africa, National Human Genome Research Institute, National Institute of Health

Moderator: Sue VandeWoude, Professor, Department of Microbiology, Immunology, and Pathology, and Associate Dean for Research, College of Veterinary Medicine and Biomedical Sciences.

9:15---10:15 Panel II: Food and Water: What knowledge is needed for sustainable, secure and fair stewardship of food and water in Africa? What are the patterns, trade---offs and options to sustainable and equitable access to food and water? What are the implications of climate change, population and policy for sustainability of food and water in Africa?

Panelists

- Dr. Bekele Lemma, Head of the School of Natural Resources and Environmental Studies, Hawassa University, Ethiopia
- Job Mapesa, Kenya Methodist University, Kenya
- Kevin Henry, Coordinator, "Where the Rain Falls", CARE & Visiting Fellow, School of Global Environmental Sustainability, CSU
- Jessica Davis, Professor and Graduate Program Coordinator, Department of Soil & Crop Sciences, CSU

Moderator: Jessica Davis, Professor and Graduate Program Coordinator, Department of Soil and Crop Sciences, and Coordinator, Peace Corps Masters International Program, College of Agricultural Sciences

10:15---11:00 Poster Session & Coffee Break LSC Room 230

11:00---12:00 Panel III: Ecosystem Services and Biodiversity: What do we know about the patterns, trade---offs and access to biodiversity and ecosystems services in Africa? What knowledge is needed for sustainability of biodiversity and ecosystem services in Africa? How can biodiversity and ecosystem services be ensured into the future? Are there relationships between biodiversity and ecosystem services? What types of conflicts exist between local, regional and global stakeholders?

Panelists

- Bethlehem Abebe Astella, Department of Wildlife and Ecotourism, Hawassa University, Ethiopia
- Dr. Andrew Seidl, Department of Agricultural and Resource Economics, CSU
- Dr. Brian Miller, North Central Climate Science Center, CSU

Dr. Charles Rhoades, Rocky Mountain Research Station, US Forest Service

Moderator: Dave Swift, Senior Research Scientist, Natural Resource Ecology Laboratory, Warner College of Natural Resources

12:00 ---1:30 Lunch Break. People on their Own

1:30---2:30 Panel IV: Governance, Equity and Energy: How does governance affect global environmental change in Africa? How is energy affecting environmental change and development in Africa? What are the patterns, tradeoffs and options for access to equitable energy and development with reduced environmental impacts? Can emerging technologies provide viable solutions to global environmental changes and promote sustainable development? How do values and worldviews influence behavior to more sustainable lifestyles and environmental sustainability?

Panelists:

- Luka Powanga, Executive Director, Global Commerce Forum & School of Management, Regis University
- Jessica Alderman, Director of Communications and Public Relations, Envirofit
- Morgan DeFoort, Managing Director, Energy Institute, CSU
- Carl Hammerdorfer, Director, Global Social and Sustainable Enterprise MBA, CSU & Executive Director, Center for the Advancement of Sustainable Enterprise (CASE), CSU

Moderator: Stacy Lynn, Research Scientist, Natural Resources Ecology Laboratory & Faculty Affiliate, Center for Disaster and Risk Analysis, Department of Ecosystem Science and Sustainability, CSU

2:30---3:00 Poster Session & Coffee Break, LSC Room 230: Student Poster Prize Announced

3:00---3:50 Panel V: Development, Education and Sustainability for the Future of Africa: Building a Transdisciplinary, Solution-Based Science to Tackle Complex Social-Ecological Issues. What are the links between biodiversity, ecosystems, human, animal and environmental health and sustainable development? What approaches, theories and models do we need to make projections for now and the future? What options are available economically, technologically, in governance and environmentally to ensure sustainable environment and development for human, animal and ecosystem needs for food, water, energy and, health.

Panelists:

- Montague Demment, Vice President for International Programs, Association of Public and Land-grant Universities, Washinton, D.C.
- David Nkedianye, Governor, Kajiado County, Kenya
- Robin Reid, Professor, Department of Ecosystem Science and Sustainability, Director, Center for Collaborative Conservation, & Senior Research Scientist, Natural Resource Ecology Laboratory, CSU
- Jesse Njoka, Professor, Department of Land Resources Management and Agricultural Technology and Director, Center for Sustainable Dryland Ecosystems and Societies, University of Nairobi, Kenya

Moderator: Kathleen Galvin, Professor, Department of Anthropology, & Senior Research Scientist, Natural Resource Ecology Laboratory

3:50---4:00 Closing Remarks: Kathleen Galvin, Professor, Department of Anthropology, & Senior Research Scientist, Natural Resource Ecology Laboratory & Jim Cooney, Vice Provost for International Affairs, CSU

Attachment II: Negotiated Indirect Cost Rate Agreement



NEGOTIATED INDIRECT COST RATE AGREEMENT

November 7, 2014

ORGANIZATION

American Council on Education
 One DuPont Circle, Suite 800
 Washington, D.C. 20036

The rates approved in this Agreement are for use on grants, contracts and other agreements with the Federal Government to which OMB Circular A-122 applies, subject to the conditions in section II.A, below. The rate(s) were negotiated by the U.S. Agency for International Development in accordance with the authority contained in Attachment A, Section E.2.(a), of the Circular.

SECTION I: NEGOTIATED INDIRECT COST RATES

Type	Effective Period		Indirect Cost Rates					
			Fringe Benefits		Overhead		Subaward Admin (e)	G&A (f)
	From	Through	Perm (a)	Temp (b)	CLLL Depart. (c)	Grant & Contract (d)		
Final	10-01-12	09-30-13	30.65%	8.13%	6.29%	8.07%	3.25%	43.27%
Provisional	10-01-13	Until Amended	27.44%	6.55%	5.15%	7.57%	3.32%	41.20%

Base of Application

- (a) Total permanent salary dollars
- (b) Total temporary salary dollars
- (c) Total CLLL direct costs
- (d) Total federal direct labor plus associated fringe benefits
- (e) Total subaward costs
- (f) Total costs excluding G&A expenses and subaward costs

U.S. Agency for International Development
 1300 Pennsylvania Avenue, NW
 Washington, DC 20523
www.usaid.gov

SECTION II: GENERAL

- A. **LIMITATIONS:** Use of the rate(s) contained in this Agreement is subject to all statutory or administrative limitations and is applicable to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rate(s) agreed to herein is predicated upon the following conditions:
1. That no costs other than those incurred by the grantee or allocated to the grantee via an approved central service cost allocation plan were included in its indirect cost rate proposal and that such incurred costs are legal obligations of the grantee and allowable under the governing cost principles,
 2. That the information provided by the grantee which was used as a basis for acceptance of the rate(s) to herein is not subsequently found to be materially inaccurate,
 3. That the same costs that have been treated as indirect costs have not been claimed as direct costs, and
 4. That similar types of costs have been accorded consistent treatment.
- B. **ACCOUNTING CHANGES:** The grantee is required to provide written notification to the indirect cost negotiator prior to implementing any changes which could affect the applicability of the approved rates. Any changes in accounting practice to include changes in the method of charging a particular type of cost as direct or indirect and changes in the indirect cost allocation base or allocation methodology require the prior approval of the Office of Overhead, Special Cost and Closeout (OCC). Failure to obtain such prior written approval may result in cost disallowance.
- C. **NOTIFICATION TO FEDERAL AGENCIES:** A copy of this document is to be provided by this organization to other Federal funding sources as a means of notifying them of the Agreement contained herein.
- D. **PROVISIONAL-FINAL RATES:** The grantee must submit a proposal to establish a final indirect cost rate within nine months after its fiscal year end. Billings and charges to Federal awards must be adjusted if the final rate varies from the provisional rate. If the final rate is greater than the provisional rate and there are no funds available to cover the additional indirect costs, the organization may not recover all indirect costs. Conversely, if the final rate is less than the provisional rate, the organization will be required to pay back the difference to the funding agency.

E. SPECIAL REMARKS:

1. Indirect costs charged to Federal grants/contracts by means other than the rate(s) cited in the agreement should be adjusted to the applicable rate(s) cited herein which should be applied to the appropriate base to identify the proper amount of indirect costs allocable to the program.
2. Grants/contracts providing for ceilings as to the indirect cost rate(s) or amount(s), which are indicated in Section I above, will be subject to the ceilings stipulated in the grant, contract or other agreement. The ceiling rate(s) or the rate(s) cited in this Agreement, whichever is lower, will be used to determine the maximum allowable indirect cost on the grant or contract agreement.
3. The rates hereby approved are subject to periodic review by the Government at any time their use is deemed improper or unreasonable. You are requested to advise the Government promptly of any circumstances, which could affect the applicability of the approved rates.
4. You are directed to promptly submit adjustment vouchers or final vouchers for all flexibly priced grants, contracts or other agreements. Audit adjustments should be clearly delineated so as to be readily identifiable for verification by this office. Care should be taken that amounts claimed do not exceed award limitations or indirect cost rate ceilings.

ACCEPTED: American Council on Education

By: Jeffrey R. Davies
Signature
Jeffrey R. Davies
Printed or Typed Name
Vice President - Finance
Title
November 7, 2014
Date

James N. Davis
Signature
James N. Davis
Printed or Typed Name
Contracting Officer
Overhead, Special Cost and Closeout Branch
Cost, Audit and Support Division
Office of Acquisition and Assistance
U.S. Agency for International Development