



## FEED THE FUTURE INNOVATION LAB FOR LIVESTOCK SYSTEMS

### ANNUAL REPORT (FY 2019)

OCTOBER 2019

**Recommended Citation**

Management Entity. 2019. Feed the Future Innovation Lab for Livestock Systems Annual Report, Fiscal Year 2019. Gainesville, FL, USA: Feed the Future Innovation Lab for Livestock Systems.

**Essential Bibliographic Information**

Leader with Associates Cooperative Agreement Award No. AID-OAA-L-15-00003

Sponsored by the USAID Bureau for Food Security

*Sustainably intensifying smallholder livestock systems to improve human nutrition, health, and incomes*

**Disclaimer**

This work was funded in whole or part by the United States Agency for International Development (USAID) Bureau for Food Security under Agreement # AID-OAA-L-15-00003 as part of Feed the Future Innovation Lab for Livestock Systems. Any opinions, findings, conclusions, or recommendations expressed here are those of the authors alone.

Cover photo: V. Bado / ICRISAT

FEED THE FUTURE INNOVATION LAB  
FOR LIVESTOCK SYSTEMS

**ANNUAL REPORT**  
**Fiscal Year 2019**

OCTOBER 2019

## Management Entity Information

At the end of Fiscal Year (FY) 2019, the Feed the Future Innovation Lab for Livestock Systems Management Entity (ME) core team consisted of 11 full-time and 2 part-time staff, and 10 faculty members led the Areas of Inquiry (AOIs), Cross-Cutting Themes (CCTs), and Monitoring and Evaluation efforts.

**Table 1: The Management Entity Core Team, as of September 30, 2019**

Name	Position
Dr. Adebola Adesogan	Director
Saskia Hendrickx	Deputy Director
Andrea Bohn	Project Manager
Damien Chevaillier	Chief Financial Officer
Dr. Erica Odera	Monitoring & Evaluation and Impact Specialist
James Harper	Communications Manager
Lacey Harris-Coble	Project/Research Assistant
Joel Paras	Fiscal Assistant
Vacant	Administrative Assistant
Dr. Zeleke Mekuriaw	Regional Coordinator, East Africa (Ethiopia and Rwanda)*
Varijaksha Padmakumar	Regional Coordinator, Asia (Cambodia and Nepal)*
Dr. Isidore Gnanda	Country Coordinator, Burkina Faso (part-time)*
Dr. Moctar Karimou	Country Coordinator, Niger (part-time)*

\*Hired by ILRI. All other core staff listed are with the University of Florida.

**Table 2: Management Entity Faculty Members**

Name	Position
Dr. Geoffrey Dahl	Leader, Animal-Source Food Production and Marketing AOI
Dr. Arie Havelaar	Co-Leader, Livestock Disease Management and Food Safety AOI
Dr. Jorge Hernandez	Co-Leader, Livestock Disease Management and Food Safety AOI
Dr. Greg Kiker	Leader, Future Livestock Systems AOI
Dr. Renata Serra	Leader, Enabling Policies for Livestock AOI*/Co-Leader, Role of Gender in Livestock Systems CCT
Dr. Kathleen Colverson	Co-Leader, Role of Gender in Livestock Systems CCT
Dr. Sandra Russo	Leader, Human and Institutional Capacity Building CCT
Dr. Rebecca Williams	Research Associate, Human and Institutional Capacity Building CCT
Dr. Sarah McKune	Leader, Human Health and Nutrition CCT
Dr. Sebastian Galindo	Technical Monitoring and Evaluation Supervisor

\* Dr. John Vansickle, the Co-Leader for this AOI retired in July 2019.

# Technical and/or Advisory Committee Information

## External Advisory Board (EAB)

**Table 3: EAB Members, Positions, and Organizations, as of September 30, 2019\***

Name	Position and Organization
Dr. William Weldon, Chair	WCW Animal Health Consulting, LLC – former Vice President of Research, Development and Regulatory at Elanco
Dr. Joyce Turk, Vice Chair	Independent consultant – former Senior Livestock Advisor, USAID Bureau of Food Security
Ms. Ladd	Senior Technical Director of Nutrition, ACDI/VOCA
Dr. Asamoah Larbi	Independent consultant – former Country Representative and Chief Scientist, Africa RISING, International Institute of Tropical Agriculture (IITA)
Dr. Harinder Makkar	Independent consultant – former Senior Animal Production Officer, FAO
Dr. Kola Olofinboba	Managing Partner at Fairview, USA
Dr. Rob Readnour	Managing Partner at Mountain Group Capital
Dr. David Sammons	Emeritus Dean, University of Florida (UF) International Center
Dr. Iain Wright	Deputy Director General, Research, International Livestock Research Institute (ILRI)
<i>Donor representatives</i>	
Dr. Tyrell Kahan	Livestock Advisor, USAID, Livestock Systems Innovation Lab’s Activity Manager
Dr. John Bowman	Senior Agriculture Advisor, USAID Bureau for Food Security, (alternate Agreement Officer’s Representative)
Dr. Lindsay Parish	Infectious Disease and Vaccine Advisor, USAID Bureau for Global Health & Bureau for Food Security (Peste des Petits Ruminants [PPR]-Vaccine Associate Award Agreement Officer’s Representative)
Ms. Kristen MacNaughtan	Program Officer, Bill & Melinda Gates Foundation

\*Drs. Butler, Jacobs and Rothschild stepped down from the board in FY 2019, and three new board members (Ms. Ladd and Drs. Olofinboba and Readnour) joined in late FY 2019.

## Internal Advisory Committee (IAC)

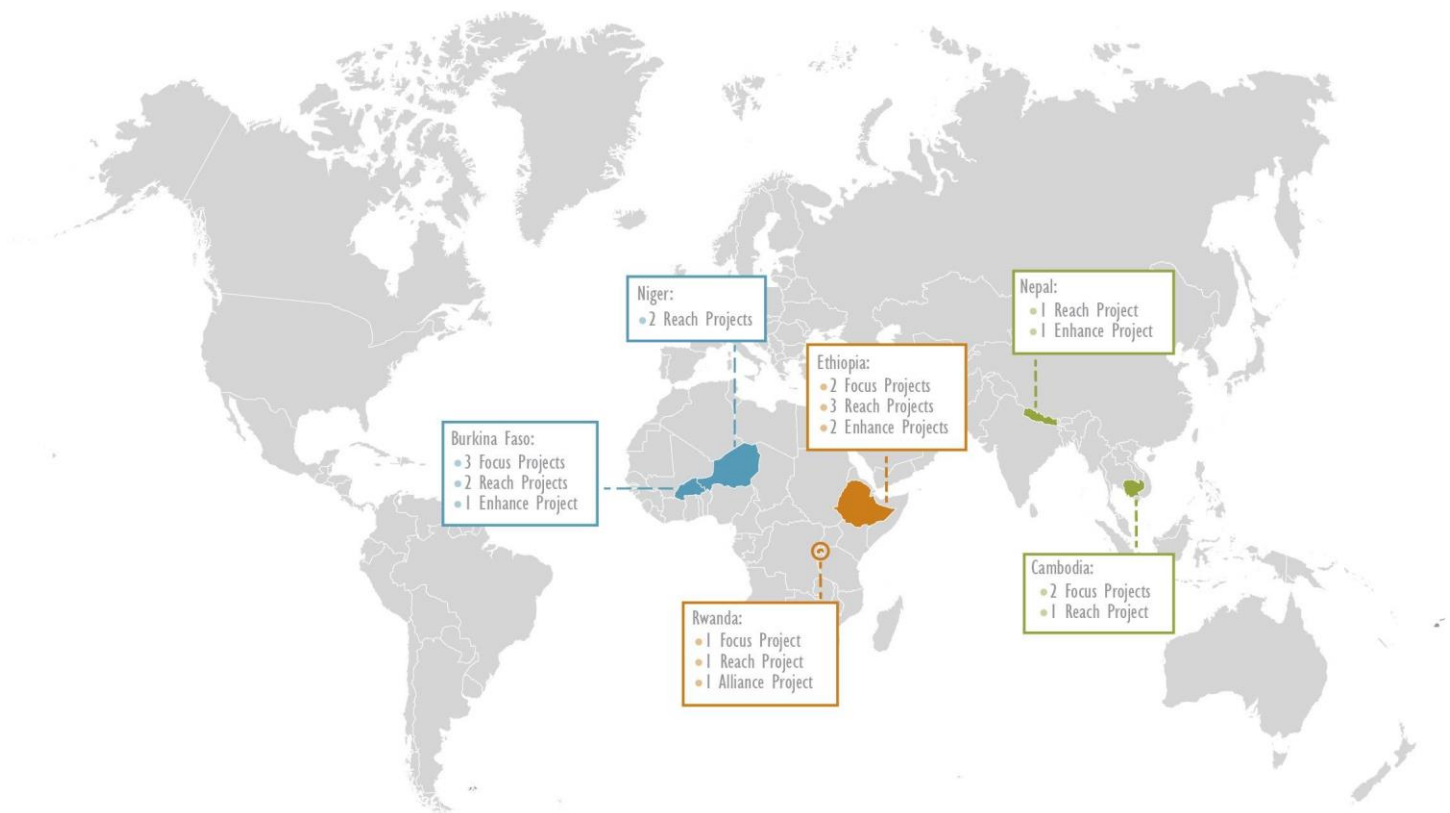
**Table 4: IAC Members, Positions, and Departments, as of September 30, 2019**

Name	Position
Dr. Glenn Morris, Jr.	Director, UF Emerging Pathogens Institute
Dr. Geoffrey Dahl	Harriet B. Weeks Professor. UF Department of Animal Sciences
Dr. Sandra Russo	Director, Office for Global Research Engagement, UF International Center
Dr. Pedro Sanchez	Research Professor, Institute for Sustainable Food Systems and Soil and Water Sciences Department, UF

# List of Focal Countries

**Table 5: List of focal countries with regions where research is being implemented**

Region	Countries	Provinces or regions
Asia	Nepal	Eastern, Central, Western, and Mid-Western regions
	Cambodia	Phnom Penh, Siem Reap, Battambang, Siem Reap, and Kampong Thom provinces
East Africa	Ethiopia	Amhara, Oromia, Somali, Southern Nations, Nationalities and People’s, and Tigray regions and Addis Ababa chartered city
	Rwanda	Northern, Southern, Eastern, Western, and Kigali provinces
West Africa	Burkina Faso	Sahelian, Centre-Nord, Nord, East, and Centre regions
	Niger	Tilabery, Maradi, and Zinder regions



**Figure 1: Overview of focal countries and USAID projects**

# List of Project Partners

## List of Partners

Even if not listed here, key partners in all countries include Ministries of Agriculture and/or Livestock, Ministries of Health, National Agricultural Research Institutes, and other related agencies. We actively collaborate with other Feed the Future Innovation Labs such as:

- Fish
- Food Safety
- Food Security Policy
- Nutrition
- Reduction of Post-Harvest Loss
- Small-Scale Irrigation

## Donors

- USAID
- Bill & Melinda Gates Foundation

## Implementing partners

- University of Florida (UF)
- CGIAR/International Livestock Research Institute (ILRI)

## Burkina Faso

- Africa's Sustainable Development Council (*Conseil de développement durable pour l'Afrique*)
- Catholic Organization for Development and Solidarity (*Organisation Catholique pour le Développement et la Solidarité*)
- Environmental and Agricultural Research Institute (*Institut de l'Environnement et de Recherches Agricoles*)
- Research Institute for Applied Sciences and Technology (*Institut de Recherche en Sciences Appliquées et Technologies*)
- Nazi Boni University (*Université Nazi Boni*)
- University of Prof. Joseph Ki Zerbo, Ouagadougou (*Université Prof. Ki Zerbo, Ouagadougou*)

## Cambodia

- Center of Excellence on Sustainable Agricultural Intensification and Nutrition
- Livestock Development for Community Livelihood (Former: Centre for Livestock and Agriculture Development, CelAgrid)
- National Animal Health and Production Research Institute
- Royal University of Agriculture
- University of Battambang

## Ethiopia

- Addis Ababa University
- Africa RISING/ILRI
- Arsi University
- Eden-Field Agri-seed Enterprise
- Ethiopian Institute for Agricultural Research
- Ethiopia Public Health Institute
- Ethiopia Strategy Support Program
- Gondar University
- Haramaya University
- Hawassa University
- Mekelle University
- National Animal Health Diagnostic and Investigation Center
- Oda Bultum University
- Policy Studies Institute (Former: Ethiopian Development Research Institute)
- Project Mercy
- University of Gondar
- Verde Beef
- Veterinary Drug and Animal Feed Administration and Control Authority
- Yabello Pastoral and Dryland Agriculture Research Centre



## **Nepal**

- Agriculture and Forestry University
- Heifer International/Nepal
- Interdisciplinary Analysts
- Nepal Agricultural Research Council

## **Niger**

- Abdou Moumouni University (*Université Abdou Moumouni*)
- National Agronomic Research Council (*Conseil National de Recherche Agronomique*)
- National Institute for Agricultural Research (*L'Institut National de la Recherche Agronomique du Niger*)

## **Rwanda**

- Rwanda Agriculture Board
- University of Rwanda

## **USA**

- Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance
- Agricultural Research Service/U.S. Department of Agriculture
- Digital Green
- Emory University
- International Food Policy Research Institute
- Iowa State University
- Kansas State University
- Land O'Lakes Venture 37
- Mercy Corps
- New Mexico State University
- Ohio State University
- RTI International
- TechnoServe
- Texas A&M University
- Texas Tech University
- Three Stones International
- Tufts University
- University of California, Davis
- University of Georgia
- University of Tennessee

## **Other International Partners**

- International Crops Research Institute for Semi-Arid Tropics
- National Veterinary Institute, Sweden
- Swedish University of Agricultural Sciences
- University of Edinburgh
- University of Utrecht
- The African and Malagasy Council for Higher Education (*Universités du Conseil africain et malgache pour l'enseignement supérieur*)
- Växa Sverige

## Acronyms

AAU	Addis Ababa University
AAU/ALIPB	Addis Ababa University/Aklilu Lemma Institute of Pathobiology
ADSA	American Dairy Science Association
AFU	Agriculture and Forestry University
AGM	Annual General Meeting
AgPOSA	Agriculture Producer Organization Sustainability Assessment
AI	Artificial Insemination
AMR	Anti-Microbial Resistance
APEX	Agriculture Policy Environment eXtender
AOI	Area of Inquiry
ASF	Animal-Source Food
ASUDEC	<i>Conseil de développement durable pour l'Afrique</i> / Africa's Sustainable Development Council
A-WEAI	Abbreviated Women's Empowerment in Agriculture Index
BIFAD	Board for International Food and Agricultural Development
BSL	Biosafety level
CDAIS	Capacity Development within the Agricultural Innovation Systems Framework
CAGED	<i>Campylobacter</i> Genomics and Environmental Enteric Dysfunction
CAHW	Community Animal Health Worker
CCAFS	Climate Change, Agriculture and Food Security
CCD	Community Concept Drawing
CCT	Cross-Cutting Theme
CDC	Department of Communicable Disease Control within the Ministry of Health in Cambodia
CelAgrid	Centre for Livestock and Agriculture Development (now called LDC)
CEHO	Community, Environment, and Health Officers
CESAIN	Center of Excellence on Sustainable Agricultural Intensification and Nutrition
CGIAR	Consultative Group on International Agricultural Research
CHW	Community Health Worker
CILSS	<i>Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel</i> /Permanent Interstate Committee for Drought Control in the Sahel
CMT	California Mastitis Test
CNRA	<i>Conseil National de Recherche Agronomique</i> / National Council for Agricultural Research
CP	Crude Protein
CPET	Center for Precollegiate Education and Training
CRCT	Cluster Randomized Control Trial
DDL	Data Development Library
DEC	Development Experience Clearinghouse
DFID	Department for International Development
DPC	Development Planning Commission in Ethiopia
DVM	Doctor of Veterinary Medicine
EAB	External Advisory Board
EDRI	Ethiopian Development Research Institute (now called PSI)
EEA	Ethiopian Economics Association
EED	Environmental Enteric Dysfunction
EIAR	Ethiopian Institute of Agricultural Research
ELISA	Enzyme-linked immunosorbent assay
EMMP	Environmental Management and Mitigation Plan
EPHI	Ethiopian Public Health Institute
FAO	Food and Agriculture Organization of the United Nations
FARMSIM	Farm Income and Nutrition Simulator
FCU	Farmer Cooperative Union
FGD	Focus Group Discussion
FEAST	Feed Assessment Tool
FY	Fiscal year
CGE	Computable General Equilibrium

GHP	Good Hygiene Practices
GIS	Geographic Information System
HDM	Herd Dynamics Model
HICAST	Himalayan College of Agricultural Sciences and Technology
HICD	Human and Institutional Capacity Development
HPLC	High Performance Liquid Chromatography
HU	Hawassa University
IAC	Internal Advisory Committee
IAFP	International Association for Food Protection
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDA	Interdisciplinary Analysts
IDRC	International Development Research Centre
IDSS	Integrated Decision Support Systems
IFPRI	International Food Policy Research Institute
IITA	International Institute for Tropical Agriculture
ILRI	International Livestock Research Institute
INA	Integrated Nutrition and Agriculture
INERA	<i>Institute de l'Environnement et de Recherche Agricole</i> / Environmental and Agricultural Research Institute
INRAN	<i>Institut National de Recherche Agronomique</i> / National Institute for Agricultural Research
IOMD	Invitro Organic Matter Digestibility
IP	Innovation Platform
IRB	Institutional Review Board
IRSAT	<i>Institut de Recherche en Sciences Appliquées et Technologies</i> /Research Institute for Applied Sciences and Technology
KAP	Knowledge, attitude, and practice
KII	Key Informant Interviews
KSU	Kansas State University
LABOCEL	<i>Laboratoire Central de l'Elevage</i> / Central Livestock Laboratory
LDC	Livestock Development for Community Livelihood (formerly CelAgrid)
LMP	Livestock Master Plan
LOC	Levels of Concern
LSIL	Livestock Systems Innovation Lab
MCC	Milk Collection Center
ME	Management Entity
MINAGRI	Ministry of Agriculture and Animal Resources
MIS	Management Information System
MPH	Master in Public Health
MoA	Ministry of Agriculture
MSM	Micro-Simulation Module
NAHDIC	National Animal Health and Disease Investigation Center
NAHPRI	National Animal Health and Production Research Institute
NARC	Nepal Agricultural Research Council
NARI	National Agricultural Research Institute
NCD	Newcastle Disease
NCE	No Cost Extension
NDF	Neutral Detergent Fiber
NECDP	National Early Childhood Development Program
NGO	Non-Governmental Organization
NIRS	Near Infra-red Spectroscopy
OIE	World Organization for Animal Health
PACA	Partnership for Aflatoxin Control in Africa
PI	Principal Investigator
PO	Producer Organization
PPE	Personal Protective Equipment
PPR	Peste des Petits Ruminants
PPR VAA	Peste des Petits Ruminants Vaccine Associate Award
PSI	Policy Studies Institute (formerly EDRI)

REGIS-AG	Resilience and Economic Growth in the Sahel – Accelerated Growth
Q	Quarter (of a fiscal year)
RAB	Rwanda Agricultural and Livestock Resources Development Board
RBC	Rwanda Biomedical Center
RFA	Request for Applications
RUA	Royal University of Agriculture
SAM	System for Award Management
SCM	Subclinical Mastitis
SBCC	Social and Behavior Change Communication
SDM	Systems Dynamic Model
SEBI	Supporting Evidence-Based Interventions
SFFF	Safe Food Fair Food
SLU	Swedish University of Agricultural Sciences
SSI	Small Scale Irrigation
SMS	Short Message Service
SOPs	Standard Operating Procedures
SNNP	Southern Nations, Nationalities and Peoples’ Region
SWAT	Soil and Water Assessment Tool
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TAMU	Texas A&M University
TBC	Total Bacteria Count
TLU	Tropical Livestock Unit
TOT	Training of Trainers
TSI	Three Stones International
UBB	University of Battambang
UC-Davis	The University of California, Davis
UF	University of Florida
UG	University of Gondar
UGA	University of Georgia
UR	University of Rwanda
USAID	United States Agency for International Development
UT	University of Tennessee
USDA	United States Department of Agriculture
VAHW	Village Animal Health Worker
VCC	Virtual Collection Center
VDFACA	Veterinary Drug and Animal Feed Administration and Control Authority
VSLA	Village Savings and Loan Associations
WASH	Water, Sanitation and Hygiene
WBSF	Warner-Bratzler Shear Force
WHO	World Health Organization
YSM	Young Stock Mortality

# Table of Contents

Management Entity Information.....	5
Technical and/or Advisory Committee Information .....	6
List of Focal Countries.....	7
List of Project Partners .....	8
Acronyms .....	10
Table of Contents .....	...
I) Executive Summary.....	14
II) Program Activities and Highlights .....	15
III) Key Accomplishments .....	16
IV) Research Program Overview and Structure.....	17
a) Overview .....	17
b) Structure.....	18
V) Theory of Change and Impact Pathways.....	20
VI) Research Project Reports.....	22
a) Burkina Faso – Focus and Enhance Project Reports .....	22
b) Burkina Faso and Niger – Reach Project Reports .....	26
c) Cambodia – Reach and Focus Project Reports.....	28
d) Ethiopia – Reach, Focus, and Enhance Project Reports.....	31
e) Nepal – Reach and Enhance Project Reports .....	38
f) Rwanda – Reach, Focus and Alliance Project Reports .....	40
g) Non-competitive Project Reports .....	43
h) Other non-competitive activities .....	48
i) Bill & Melinda Gates Foundation funded Equip project .....	49
VII) Human and Institutional Capacity Development .....	52
a) Short-term Training .....	52
b) Long-term Training .....	54
c) Institutional Development.....	58
VIII) Innovation Transfer and Scaling Partnerships.....	60
a) Plan of Action.....	60
b) Steps taken.....	60
c) Partnerships made.....	60
d) Technologies ready to scale .....	60
e) Technologies transferred.....	60
f) Technologies scaled .....	60
IX) Environmental Management and Mitigation Plan.....	64
a) Report on mitigation and monitoring activities in relation to the EMMP .....	64
1. BSL compliance.....	64
2. Monitoring and mitigation conducted .....	64
b) Coaching, support, and monitoring provided by the Management Entity.....	66
X) Open Data Management Plan.....	68
XI) Governance and Management Entity Activity .....	68
XII) Other Topics.....	69
XIII) Issues .....	69
XIV) Future Directions .....	70
Appendices.....	71
a) List of Awards Given to Partners.....	71
b) Success Stories .....	74
c) List of Publications .....	80

## I) Executive Summary

Fiscal year (FY) 2019 was a productive year for the Feed the Future Innovation Lab for Livestock Systems with 37 technologies produced, 63 trainings completed, 2162 people trained, 88 students supported and 200 communication products developed. Of the 37 new/adapted technologies or practices, 12 were in the first innovation phase (under research), 12 in the second phase (under field testing), 11 in the third phase (made available for uptake) and 2 in the fourth phase (demonstrated uptake). As in previous years, human capacity development was a priority. Across the 6 target countries, 63 separate short-term trainings were conducted, reaching a total of 2,162 persons (1,158 men, 1,004 women) including 1,020 producers (37% men, 63% women), 740 civil society members (63% men, 27% women), 330 government workers (55% men, 45% women), and 72 private sector representatives (85% men, 15% women). A total of 88 students (54 men and 34 women) were supported through various projects in FY 2019. Of these, 14 are enrolled in Bachelor's degree programs, 35 in MS programs, 10 in Doctor of Veterinary Medicine (DVM) programs, and 29 in PhD programs.

The Lab continued to build on the work from the previous three years to reach new milestones, such as the completion of five research projects, while expanding its reach through the initiation of four new Enhance and Alliance projects. All ending projects developed a scaling plan, which identified institutional partners for scaling and the anticipated funding needs. As in previous years, collaborative in-country partnerships were a priority for the Livestock Systems Innovation Lab, which were strengthened through the annual multi-stakeholder Innovation Platform (IP) meetings in Ethiopia, Rwanda, Nepal, Cambodia, and Burkina Faso as well as by the third Global Nutrition Symposium held in Kathmandu, Nepal titled "Extending Our Reach: Improving human nutrition and incomes through effective livestock research and extension partnerships."

The Lab provided thought leadership in the area of consumption of safe and nutritious animal-source foods (ASF) to prevent stunting and enhance cognitive development as follows: In May, the Director was a keynote speaker at the University of California, Davis symposium on the importance of animal-source foods (ASF) for human nutrition and health. In June, the Lab hosted a symposium in Washington, DC, which brought together various experts to discuss the evidence on contributions of ASF to the prevention of stunting and enhancement of cognitive development. The Lab hosted two symposia on ASF themes to highlight results of funded research at the annual professional meetings of the American Dairy Science Association (ADSA) and the International Association for Food Protection (IAFP). The Lab also co-hosted workshops on prevention and mitigation of aflatoxin in foods and feeds with the governments of Ethiopia and Rwanda and their respective USAID missions, and it hosted a webinar on proper sampling and analysis of aflatoxin by the Texas State Chemist. In addition, the ME hosted a one-day workshop at the University of Florida (UF) with the UF One Health Center of Excellence on food safety risk communication, using aflatoxin contamination of food or feed as an example. Further, more than 200 communication products were produced, including 10 peer-reviewed manuscripts, 5 webinars, 11 training manuals, 12 innovation summaries, 14 videos, and dozens of posters and presentations. The "One Egg" project in Burkina Faso, which increased egg consumption among children from nearly 0 to about 6 per week, was featured on the national news in the country and has generated considerable interest in other countries. The ME is working with key stakeholders to determine the best strategies for scaling this and other technologies.

The Feed the Future Innovation Lab for Livestock Systems has planned several events and activities in FY 2020 that build upon its successes and chart new territory. The Innovation Lab will continue to seek opportunities to expand its scope and impacts and ensure scaling and long-term sustainability of its evidence-based innovations.

## II) Program Activities and Highlights

In FY 2019, the Feed the Future Innovation Lab for Livestock Systems continued to conduct research in the six focal countries through ongoing Focus and Reach projects. In Q1 FY 2019, the Enhance (8) and Alliance (2) projects were selected for funding, and extensive exchanges with the principal investigators (PI) followed to incorporate the comments provided by the Technical Evaluation Panel and External Advisory Board (EAB) into the project protocols.

Highlights from the research activities in FY 2019 include the completion of four Focus projects, two in Cambodia and two in Rwanda, and initiating or catalyzing scaling of evidence-based innovations. All projects shared their results with in-country stakeholders, which were supportive of the findings and are integral to the scaling efforts. Scaling of innovations from earlier completed Focus projects continued. The most successful to date is the [Feeding Support Tool](#), an innovation from a Focus project implemented by Heifer International in Nepal that has attracted interest from various development partners.

Many research projects produced interesting results. In Burkina Faso, the University of Florida (UF)-led [egg supplementation study](#) increased infant egg consumption from 0.3 to over 6 eggs weekly and showed significant reduction of wasting, by having community leaders gift chickens to children and providing training to mothers. The Reach projects in Burkina Faso and Niger completed their baseline reports and are conducting research on adapted dual-purpose and drought resistant forage varieties. The baseline of the [Crop-Livestock Systems project](#) led by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) showed that while over 90% of the interviewees indicated agriculture as their primary activity, there was a low youth involvement, low farmer organization and limited support by the extension services. The Mercy Corps-led Reach project assessed the impact of existing animal health policies, animal feed production quality control of zoo-veterinary inputs, and marketing of small ruminants in both countries. To avoid duplications and share findings, the forage research of both projects happened in close coordination with the Bill & Melinda Gates Foundation Equip project working in Burkina Faso. In Cambodia, the International Livestock Research Institute (ILRI)-led [Safe Food Fair Food project](#) conducted multiple surveys. The cost of illness survey showed that each case of foodborne disease costs \$62 to the Cambodian economy. The Kansas State University (KSU)-led [pig health and nutrition project](#) demonstrated that soybean meal and a base mix containing vitamins and minerals is a more economical feeding strategy for producers that is more profitable by \$10/pig within the 42-day experiment as compared to current practices. The project also convened the first Cambodian Swine Day, a multistakeholder meeting of 139 participants that discussed the project results and other pertinent swine production topics. Notably, the government is now committed to making this an annual event.

In Ethiopia, the Kansas State University (KSU)-led Reach project on linking agriculture to nutrition published two peer reviewed journal articles and progressed with the feeding trial. The International Food and Policy Research Institute (IFPRI)-led study on the Ethiopian dairy sector highlighted important aspects, such as a rapid increase in expenditures on dairy products by urban consumers and the tripling of the number of dairy processing firms in Ethiopia over the past 10 years. The research of the University of California – Davis (UC Davis)-led team into [Young Stock Mortality causes](#) showed that most of the diarrhea is caused by *Cryptosporidium parvum* infection and the diarrhea partly reflects lack of colostrum feeding to newborns. This is easily preventable through increased training and raising of awareness livestock keepers on the importance of feeding colostrum and improving farm hygiene. The results have been shared with the members of the government led Young-stock mortality consortium and an additional brief outlining recommendation for the government has been developed.

In Nepal, the UF-led project working with female livestock cooperatives started the training of female Community Animal Health Workers (CAHWs) with both a traditional (presential) and virtual teaching approach. It also launched the goat marketing app to facilitate information exchange between goat buyers and goat producers organized in cooperatives. In Rwanda, the ILRI-led [behavior-change nutrition project](#) completed monthly training sessions with Community, Environment, and Health Officers (CEHO) and Community Health workers (CHWs) to improve the ASF consumption and nutrition outcomes among children 12-23 months of age and pregnant and lactating women.

In addition to the competitively selected research projects, non-competitive project activities were conducted for all the Cross-Cutting Themes (CCTs) as well as the Future Livestock Systems and Enabling Policies for Livestock Areas of Inquiry (AOIs). The Human and Institutional Capacity Development (HICD) team worked with Agriculture and Forestry University (AFU) colleagues in Nepal on the development of a policy brief resulting from a policy meeting on Agricultural Education in Nepal conducted in November 2018. The team also helped setting up an Institutional Review Board (IRB) at AFU. The team also worked with the Royal University of Agriculture in Cambodia to deliver three technical training courses on theriogenology, animal genetics, research design and animal welfare for faculty and students. The Future Livestock Systems and Enabling Policies for Livestock project teams conducted a joint scenarios and policy workshop in Rwanda that brought together over 30 participants from various backgrounds. The gender team organized two workshops in Ethiopia and Rwanda on “Integrating Gender and Nutrition into the Livestock Research Project Planning Cycle.”

The Management Entity (ME) organized two aflatoxin prevention and control workshops in Ethiopia and Rwanda in close collaboration with the focal country governments and the USAID mission. It also coordinated and contributed to the publication of 10 peer reviewed articles, 7 of which were published in FY 2019, and 3 have been accepted for publication.

### III) Key Accomplishments

#### **Expansion of Scope:**

In FY 2019, important efforts were made to share research findings and create awareness about the importance of Animal Source Foods (ASF) for health, growth and cognitive development. In April 2019, the third Annual General Meeting and Global Nutrition Symposium was held in Kathmandu, Nepal, in collaboration with Ministry of Agriculture and Livestock Development, Heifer International and the Nutrition Innovation Lab, which hosted a session. Over 120 participants attended the Symposium, which focused on invigorating partnerships between research and extension for improving human nutrition and livestock productivity. In June 2019, the Lab hosted a Symposium titled “Ensuring children’s cognitive and physical development through animal-source foods” in Washington, DC, which brought together various experts to discuss the existing evidence on contributions of ASF to prevent stunting and enhance cognitive development. A Symposium on “Dairy production in developing countries” was hosted at the American Dairy Science Association (ADSA) Annual Meeting in June. In July, a Symposium on “Safety of animal-source foods in low-and middle-income countries” was hosted at the International Association Food Protection (IAFP) Annual Meeting. For both events, PIs were invited to present their research.

The Director of the Livestock Systems Innovation Lab was nominated as Chair of the Council of Innovation Lab Directors, consequently, the Lab organized the Regional Innovation Lab Partners’ meeting in May 2019 in Addis Ababa, Ethiopia and the Annual Meeting of Feed the Future Innovation Labs in Washington, DC in September 2019.

Research and awareness creation on aflatoxin contamination in feed and ASF continued with the hosting of national level stakeholder meetings in Ethiopia and Rwanda to discuss prevention and control strategies. In November 2018, the ME also hosted an event titled “One Health International Symposium on risk communication in resource-limited countries” at UF together with the One Health Center of Excellence to present ongoing research and discuss best approaches for risk communication on this topic. A webinar by Dr. Timothy Hermann (Texas A&M AgriLife Research) on Managing Aflatoxin Risk was hosted in June 2019. Furthermore, a study was commissioned in collaboration with Dr. Felicia Wu from Michigan State University to assess the links between aflatoxin M1 in milk and stunting and cancer.

In FY 2019, faculty involved in the Management Entity (ME) also obtained \$1.9 million for four additional grants from the Bill & Melinda Gates foundation—three of which were co-funded by the Department for International Development (DFID) for food safety research in Ethiopia. The Canadian International Development Research Centre (IDRC) also awarded ME faculty a \$1.1 million grant to work on gendered aspects of livestock vaccine value chain research in Nepal, Senegal, and Uganda. The Lab was also approached by various international non-governmental organizations (NGO) to collaborate on various USAID Notice of Funding Opportunities.

Lastly, as in previous years we conducted Innovation Platform meetings in all focal countries and various members of the ME participated in workshops and conferences organized by other Innovation Labs in various countries.

#### **Technology Innovations & Scaling:**

In FY 2019, the Livestock Systems Innovation Lab researched and developed 37 technologies and practices distributed over all four USAID phases as compared to 29 innovations in FY 2018. Of the innovations, 12 were in phase I, 12 were in phase II, 11 were in phase III and 2 were in phase 4. In FY 2019, four projects completed their activities: two in Rwanda and two in Cambodia. As in FY2018, the completion of these projects allowed the Livestock Systems Innovation Lab and the PIs to develop scaling plans outlining the organizations best positioned to scale the innovation and required institutional and financial arrangements needed for successful scaling. In addition to the projects that were completed, the ongoing research projects made significant progress in FY 2019 in developing innovations to enhance livestock productivity and marketing and to improve disease management and food safety. For instance, the virtual community animal health worker manual was piloted in Nepal, and milk samples were collected and analyzed for bacterial and mycotoxin contamination in Burkina Faso.

#### **Enabling Environment and Capacity Development:**

The AOI on Enabling Livestock Policies conducted network analyses in Burkina Faso, Nepal, and Niger to understand the interrelatedness of the various organizations involved in livestock policy setting. The HICD team conducted multiple technical training courses and developed training materials to address some of the knowledge gaps identified during FY 2017 and FY 2018. Topics included R Statistical Package, Qualitative Research Methods, and Proposal Writing. The team also worked with AFU to establish an Institutional Review Board (IRB). The materials developed for AFU will be converted into more generic documents to expand their use to other countries. Institutional capacity was further developed through the Livestock Systems



Innovation Lab's activities with universities, government agencies, research institutions, producer organizations, and women's groups. In FY 2019, twenty institutions were supported, mostly research institutions, through activities aiming to strengthen research capacity, including laboratory management and financial reporting.

Mr. Ndahetuye, lecturer at the University of Rwanda, PhD Candidate at the Swedish Agricultural University (SLU) and PI with the Lab, won the 2019 student research award from the Board for International Food and Agricultural Development (BIFAD).

#### **Women's Empowerment:**

A total of 88 students (54 men, 34 women) were supported through the various projects in FY 2019. Across the six focal countries, 2,162 persons participated in one of 63 short-term trainings. Of those who received short-term training, 54% were male (1,158) and 46% were female (1,004). Some projects in Burkina Faso, Nepal, and Rwanda primarily targeted women, training 624 on nutrition (350 in Burkina Faso and Rwanda) and small ruminant health and marketing (274 in Nepal). An example of a project that empowered women is the One Egg project in Burkina Faso that trained women on best agricultural practices and the importance of eggs in diets. In addition to reducing wasting and underweight by increasing egg consumption by infants, this project seemed to have empowered women as many more of them reported that during the study, they became the household decision maker on poultry and egg consumption issues in the home. The follow up Enhance project by the same project team conducts further research on this aspect using the Abbreviated Women's Empowerment in Agriculture Index (A-WEAI).

## **IV) Research Program Overview and Structure**

### **a) Overview**

The Feed the Future Innovation Lab for Livestock Systems aims to improve the nutrition, health, incomes and livelihoods of the poor by sustainably increasing livestock productivity and the marketing and consumption of ASF. This aim will be achieved by introducing new location-appropriate technologies, by improving management practices, skills, knowledge, capacity and access to and quality of inputs across livestock value chains, and by supporting the development of a policy environment that fosters sustainable intensification and increased profitability of smallholder livestock systems.

The Lab's efforts encompass three CCTs and four AOIs. Each of these is led by one or two UF faculty members, and the Future Livestock Systems AOI is co-led by ILRI. The Lab's CCTs are (1) the Role of Gender in Livestock Research, (2) Human and Institutional Capacity Development, and (3) Human Health and Nutrition, while the four AOIs are:

- ASF Production and Marketing, which employs a multidisciplinary, integrated research approach to develop location-appropriate nutrition, lactation, management, and health technologies that will enhance livestock production.
- Livestock Disease Management and Food Safety, which supports and strengthens existing One-Health research and training platforms and projects on livestock disease management and ASF safety. The focus is on improving surveillance for and conducting multidisciplinary research on priority animal and zoonotic pathogens and diseases in order to reduce disease burdens and to increase ASF safety.
- Enabling Policies for Livestock, which facilitates the development and implementation of policies that enhance the production, marketing, and consumption of ASF.
- Future Livestock Systems, which uses mechanistic models and analytical tools to examine how ASF production systems may be affected by emerging challenges or improved by introduced technologies.

The Livestock Systems Innovation Lab awards the following types of competitive projects within its framework:

- Reach projects: Competitive, larger projects with budgets of up to \$1.25 million, lasting for up to four years. These involve multiple partners engaging in research and capacity building and employing an integrated, multidisciplinary approach.
- Focus projects: Competitive, smaller projects with budgets of up to \$150,000, lasting up to 1.5 years. These are for proof of concept or research for development bridging studies.
- Enhance projects: Competitive, smaller projects with budgets of up to \$100,000, lasting up to 1.5 years. These projects add value to the existing Livestock Systems Innovation Lab projects in one or more of its countries.
- Alliance projects: Smaller projects with budgets of up to \$100,000, lasting up to 1.5 years, for strengthening the research capacity of the Rwanda Agricultural and Livestock Resources Development Board (RAB) in Rwanda and the Nepal Agricultural Research Council (NARC) in Nepal in areas that align with livestock research priorities identified in the country.

The ME also implements research activities and focused activities in the AOIs and CCTs. To date, the program has received one Associate Award: a three-year (2017-2020) *Peste des Petits Ruminants* Vaccine Associate Award (PPR VAA), which is being implemented in Kenya and Uganda. Under the umbrella of the Strategic Partnership between USAID Bureau for Food Security (BFS) and the Bill & Melinda Gates Foundation, the Lab also implements a \$8.7 million funded project (2017-2022) to conduct research in Ethiopia and Burkina Faso on improving the supply of quality livestock feeds and understanding the causes and developing mitigation strategies for environmental enteric dysfunction. In FY 2019, Lab-affiliated faculty also obtained \$1.9 million in four additional grants from the Bill & Melinda Gates foundation (three of them co-funded by the Department for International Development (DFID)) for food safety research in Ethiopia. The Canadian International Development Research Centre (IDRC) also awarded UF with \$1.1 million to work on livestock vaccine value chain research in Nepal, Senegal and Uganda. The Lab was also approached by various NGO's to collaborate on various USAID Notice of Funding Opportunities.

## **b) Structure**

The Lab's research portfolio consists of over 40 projects supported by USAID and the Gates Foundation. This includes those that have been completed and some that are starting up in FY2020, in the six countries of Ethiopia, Rwanda, Burkina Faso, Niger, Nepal, and Cambodia. The PPR VAA project works in Uganda and Kenya, and Gates Foundation-funded projects work in Ethiopia and Burkina Faso. The Livestock Systems Innovation Lab encourages (in the case of Focus and other smaller projects) and requires (Reach projects) that projects address more than one AOI, which facilitates cross project linkages across the project countries. Table 6 shows the USAID funded projects (excluding Gates Foundation) and the Associate Award, organized by country, project type, AOI and CCT. The AOIs on ASF production and marketing and livestock disease management and food safety were split into sub-themes in order to highlight the specific aspect of the research within that AOI. Similarly, HICD was split into three subsections to indicate the specific types of HICD activities occurring in each project.

**Table 6. Distribution of USAID Funded Projects under the Prime Award by Focal Country, Area of Inquiry and Cross-Cutting Theme**

Country	Project Title	Areas of Inquiry										Cross-Cutting Themes					
		Production & Marketing						Disease Management		Enabling Policies	Future Systems	HICD			Human Health & Nutrition	Gender	
		Feed Productivity	Feed Quality	Milk Quality	Meat Production	Meat Quality	Market Assessment	Disease Management	Assessment & Surveillance			Institutional Capacity	Short-term Training	Student Involvement			
<b>Reach Projects</b>																	
BF & NE	Enhancing the productivity of small ruminants through improved and cost effective feeding and animal health interventions	•			•				•		•		•	•			•
BF & NE	Enabling value chains to create sustainable income for vulnerable people in crop-livestock systems	•	•			•	•	•			•		•	•			•
CM	Safe food, fair food for Cambodia						•	•			•		•	•			•
ET	Improving the evidence and policies for better performing livestock systems							•			•		•	•			•
ET	Linking cattle nutrition to human nutrition: A value chain approach to improving the production, handling, and consumption of ASF	•	•	•	•	•	•						•	•	•		•
ET	Addressing young stock mortality in smallholder farms and pastoral herds of Ethiopia								•	•			•	•	•		•
NP	Designing and evaluating innovations for development of smallholder female livestock cooperatives	•			•			•			•		•	•	•		•
RW	Enhancing production, quality and consumption of milk for income and improved nutrition			•							•		•	•	•		•
<b>Focus Projects</b>																	
BF	Assessment of aflatoxin-related health risk for milk consumers in rural and peri-urban areas		•	•			•						•	•	•		•
CM	Improved pig health and nutrition: the major drivers of profitability and sustainability for smallholder farmers		•		•			•					•	•	•		•
CM	Living fences for improved livestock feed in smallholder systems	•			•								•	•	•		•
ET	Improving handling practices and microbiological safety of milk and milk products in Borana pastoral communities			•									•	•	•		•
ET	Mycotoxin prevalence and mitigation measures in Ethiopia		•											•			•
RW	Milk production practices, udder health and the impact on milk quality, safety and processability in Rwanda			•		•		•					•	•	•		•
<b>Enhance/Alliance Projects</b>																	
ET	Application of integrated decision support systems to improve livestock systems											•		•			•
ET	Modeling livestock system dynamics and economywide policy impacts									•							•
BF	Enhancing egg consumption through women's empowerment													•			•
NP	Strategies to increase milk consumption among children in rural Nepal													•			•
RW	Challenges of implementing modern milk quality standards in developing countries										•						•
<b>Other Projects</b>																	
UG & KE	Peste des Petits Ruminants (PPR)							•	•				•	•	•		•
ALL	Gender in livestock systems																•
ALL	Human health and nutrition																•
ALL	Human and institutional capacity development											•	•				•
ALL	Enabling policies for livestock systems									•							•
ALL	Future livestock systems											•					•

## V) Theory of Change and Impact Pathways

The goal of the Feed the Future initiative is to reduce global poverty and hunger through fostering growth in the agricultural sector and improving the nutritional status of vulnerable people around the world. The Livestock Systems Innovation Lab supports this mission through increasing the knowledge of how the evolving livestock system is interlinked with human health and nutrition. This increased knowledge then serves as the foundation for advancing four key areas: 1) to develop, identify and/or adapt innovations and policies to increase ASF consumption and marketing; 2) to reduce adverse environmental impacts of livestock systems; 3) to reduce the constraints faced by women engaged in the ASF value chain; and 4) to promote sustainable improvements in both the incomes and nutrition of livestock holders and consumers. Through research, the Lab enhances human and institutional capacity to use livestock sector knowledge and technologies for the livestock sector to be more sustainably intensified within the focal countries. All together these efforts will contribute to reducing global poverty and hunger by accelerating the growth of the agricultural sector while improving nutrition. By conducting the research in a collaborative manner with international and national partners, research findings can immediately contribute to strategic planning by governments and contribute to necessary policy reform. The impact pathway for the Livestock Systems Innovation Lab is guided by the U.S. Global Food Security Research Strategy.

The Livestock Systems Innovation Lab integrates research efforts focusing on four AOIs: (1) ASF Production and Marketing; (2) Livestock Disease Management and Food Safety; (3) Enabling Policies for Livestock; and (4) Future Livestock Systems. Three cross-cutting themes—the Role of Gender in Livestock Research, HICD, and Human Health and Nutrition—are integrated throughout the research and capacity building efforts of each of the AOIs.

### AOI 1. ASF Production and Marketing

ASF production is often constrained due to limited access to sufficient and high-quality inputs, such as feeds, credit, and extension services. Conducting research on improved, dual-purpose and drought resilient food and forage varieties will produce higher volumes and quality of animal feed throughout the year. Dual-purpose crops in particular can increase crop production for human consumption as well. Animal trials can develop context-specific livestock diets, which maximize nutritive value and ASF profitability while minimizing adverse environmental impacts. Research on feed quality, such as mycotoxin detection, quantifies toxin levels, improves handling and storage practices, and guides policy makers towards evidence-based feeding standards that increase food safety. Improved regulations on food safety will benefit consumers and potentially increase market demand for ASF products. Importantly, ASF products free of toxins can aid in the reduction of public health issues such as childhood stunting and foodborne diseases.

### AOI 2. Livestock Disease Management and Food Safety

Livestock diseases and ASF pathogens pose risks to livestock, humans, and the environment. However, reducing disease is difficult, especially in the absence of effective livestock and foodborne disease surveillance systems and data. Documenting disease occurrence is the critical first step to quantifying potential losses to farmers, the livestock sector, and public health. Using new ways to approach this problem is necessary. Utilizing a One Health approach in conceptualizing the issue, involving diverse grassroots level actors in changing practices, and building a country's abilities to effectively conduct research and surveillance of disease are examples of new ways to approach the issue. Consequently, ASF value chains will become safer and result in higher production of more nutritious ASF. This will ultimately improve the health of consumers, especially children and infants.

### AOI 3. Enabling Policies for Livestock Systems

In the focal countries, livestock are a main source of income; however, livestock systems generally struggle with low profitability and productivity. Research is necessary to achieve sustainable intensification of livestock systems, yet current livestock systems policy environments lack scientific knowledge and dialogue about technologies, interventions, and practices for the sector to thrive. Research-based dialogue efforts should not only inform new policies but should also allow for reflecting upon existing policies. This creates an enabling policy environment for supporting a sustainable livestock sector. This approach will positively impact the productivity, efficiency and profitability of livestock to meet the growing demand for livestock products.

### AOI 4. Future Livestock Systems

Improved understanding of current ASF production and consumption contexts, drivers, and potential future scenarios is key to understanding how technologies, practices, and policies should be targeted, adapted, and disseminated in the future. Modeling and scenario analyses of potential impacts of changes in technologies, practices, and policies related to ASF production, marketing and consumption will identify and highlight areas for prioritization and investment. It is envisioned that participatory foresight methods coupled with quantitative and qualitative priority setting tools will help decision makers implement livestock-related interventions and policies at different scales that improve food and nutrition security and reduce poverty.

### CCT 1. Human and Institutional Capacity Development

Scientists and institutions must have the capacity to engage in developing and applying research to strengthen the livestock sector across the focal countries. Improved skills for researchers and institutional administrations can be facilitated through targeted training and program development. As a result, strengthened university and research institutions can become the venue for improved livestock systems research needed to meet the demand for food and feed in developing countries. The desired results are engaged, knowledgeable livestock researchers working within competent, supportive research institutions serving the needs of livestock producers, consumers and governments.

### CCT 2. The Role of Gender in Livestock Research

Livestock systems have important gender dimensions. However, women—key players in such systems—frequently lack access to and control of resources and face decision-making barriers. Understanding the roles that men and women play in the livestock value chains can inform technologies and interventions to increase not only gender equity but also household food security, therefore contributing to poverty reduction. Addressing gender issues and constraints both along the value chain and within household decision-making for livestock development programs will lead to increased ASF consumption and improved nutritional outcomes in poor households in the focal countries. This approach will enable women to be more empowered to make decisions that improve household nutrition related to ASF consumption.

### CCT 3. Human Health and Nutrition

Increasing ASF consumption is influenced by several factors beyond their positive human health and nutrition benefits, including gender, socio-cultural factors, and income, among others. Improved nutrition and health can be compromised by risks posed by ASF-borne pathogens and toxins. There is a need for research and interventions at household and market levels to focus on behavior change and messaging, nutrition and safe ASF preparation, and development and support of ASF regulatory facilities. This change will lead to more widespread production and purchase of ASF, and meeting of nutrient requirements, which will create a more productive workforce, while reducing diseases, death, and malnutrition—especially among infants, children and the elderly.

## VI) Research Project Reports

### a) Burkina Faso – Focus and Enhance Project Reports

<b>Improving nutrition in children through increased egg consumption in Burkina Faso (the “One Egg per Day” project)</b> Focus project, May 1, 2018 – Aug. 31, 2019	
<b>PI Name &amp; Institution:</b> Sarah McKune, University of Florida (UF)	<b>Collaborators:</b> Institute de l’Environnement et de Recherche Agricole (INERA), Hawassa University
<b>Description:</b> This project aims to increase the proportion of children consuming 3 or more eggs per week through the gifting of chickens by religious leaders to the children. The project has 5 objectives: 1) increase animal-source food (ASF) production through donating chickens and providing monthly training on proper chicken husbandry; 2) increase ASF, particularly egg consumption, through innovative nutrition messaging and integrated nutrition and agriculture trainings; 3) build resiliency by increasing food security at targeted households; 4) promote gender equality by engaging women in animal extension services and training women caregivers in chicken husbandry practices to increase flock size; and 5) reduce zoonotic disease through integrated nutrition and agriculture training and education on water, sanitation and hygiene (WASH) education.	
<b>Location:</b> Centre-Nord (Santamenga) region	

#### Theory of Change and Impact Pathway

Malnutrition and stunting rates are high in Burkina Faso, attributable to food insecurity and unavailability, inadequate complementary feeding, and poor diets. Interventions to increase child (6 to 12 months) egg consumption to one egg a day through gifting chickens could change the present cultural beliefs and stigma surrounding egg consumption. As a result, households will diversify consumption of nutritious foods and production and purchase of chickens and eggs will increase, while decreasing household and national spending on malnutrition and disease outbreaks.

#### Achievements

**Increase ASF production:** Three chickens were distributed to each of the children enrolled in the full treatment arm of the study. Women within the full and partial intervention arms of the study also received monthly Integrated Nutrition and Agriculture (INA) trainings. The pattern of monitoring, counseling, and training women happened every month resulting in 10 trainings for the two research arms. At endline, the full, partial, and control groups of the study had significantly different numbers of chickens within the household (18.5, 9.4, and 6.2, respectively).

**Increase egg consumption in children under 2:** Across full – gifting of chickens and monthly Integrated Nutrition and Agriculture trainings, partial – training only, partial, and control study arms, mother-reported egg consumption by the child in the week prior was 95.2%, 75.3%, and 28.1%, respectively, corresponding to average child egg consumption for the week prior of 6.3, 2.4, and 1.0 eggs across the same groups. Given that only 4.6% of mothers (overall) reported egg consumption the week prior among children at baseline, these findings represent a significant impact of the intervention (between the full intervention group and the control group, as well as partial intervention group compared to control group). Overall knowledge of the value of ASF foods is being assessed and will be reported in upcoming manuscripts.

The project is designed to improve food availability, particularly ASF, in the household. Eggs are being consumed at a greater level than pre-intervention. More eggs are available and are consumed in the full intervention group than in the partial intervention group, and more of those children are eating eggs.

**Promote gender equality:** While the monthly INA sessions are open to others in the community, the targeted participants are the mothers of young children enrolled in the study. Roughly 180 women received training at least monthly. Decision making about both poultry and eggs shifted significantly in the full intervention and partial intervention, to an increased number of women reporting “self” as the decision maker within the household about those items.

**Disease reduction:** Monthly trainings emphasized the importance of vaccinating chickens against Newcastle Disease (NCD). Women were trained in NCD vaccination to ensure the practice is sustained. The project team is working with the district livestock office to facilitate training of the women enrolled in the study who are interested in becoming village vaccinators.

**Malnutrition:** Though not powered around child growth indicators, preliminary analysis indicates that both wasting and underweight were improved through the intervention, when the full intervention group is compared to the control group.

#### Capacity Building

Three Master’s and one PhD student (2 men, 2 women) received degree-granting support through the project. Distribution of chickens to the children in the partial and control arms of the study was completed, and women in the full and partial intervention arms trained women in the control arm. A formal closing ceremony was held with media coverage and estimated attendance of over 350 people, not including children. The team is currently working on 4 peer reviewed publications and it produced a short [video](#) explaining the rationale and results of the project. The project has generated interest of stakeholders, including the government, and follow up discussions are planned to possibly scale the activities to other parts of Burkina Faso.

#### Lessons Learned

- 1) Involvement of motivated and flexible team of local researchers was critical to the success of the project;
- 2) Another data collection software program should be considered given the challenges faced with REDcap due to poor internet connectivity;
- 3) Adaptive management is needed to allow incorporating changes suggested by the proposal reviewers;
- 4) Strong methodologies and study design are highly needed in studies on ASF consumption.

## Enhancing egg consumption through women's empowerment in Burkina Faso

Enhance project, March 1, 2019 – Dec. 31, 2019

**PI Name & Institution:** Sarah McKune, University of Florida (UF)

**Collaborators:** Institut de l'Environnement et de Recherches Agricoles (INERA)

**Description:** This project aims to understand the relationships between women's empowerment and the "One Egg per Day" project's behavior change tools as well as understand the influence of women's empowerment and nutrition training on ASF consumption.

**Location:** Centre-Nord (Santamenga) region

### **Theory of Change and Impact Pathway**

The "One Egg per Day" Focus project found evidence of increased consumption of animal-source foods (ASF) among children under two as a result of the project interventions. However, it is not clear how different levels of women's empowerment may have influenced the outcomes of the project, which may have implications for future scalability. This project will examine the relationships between women's empowerment, behavior change tools and ASF consumption.

### **Achievements**

**Measure women's empowerment:** This Enhance project uses the widely-used Abbreviated Women's Empowerment in Agriculture Index (A-WEAI) to collect quantitative data on five domains of empowerment. It also uses an innovative tool called community concept drawing (CCD), created by UF researchers, to capture sensitive information that may not be shared using traditional research methods such as interviews or surveys. This tool is intended to triangulate data on empowerment collected through the more traditional A-WEAI tool. In Q3 FY 2019, the A-WEAI survey instrument was administered to all households in the study population and CCD was administered in 9 villages. Focus group discussions were conducted in 9 villages to gain insight into the facilitating factors and barriers to behavior change adoption within the study population. Follow-up data through household surveys, anthropometry of children, and focus groups were collected in Q4 FY 2019. Based on preliminary findings demonstrating the success of the behavior change intervention, additional funds were allocated to investigate whether the intervention had any effect on child cognitive development. The project team consulted with UF's Anita Zucker Center for Excellence in Early Childhood Studies to identify and adapt the most appropriate metrics for child development for use in rural Burkina Faso. In September, the project manager traveled to Burkina Faso to train the enumerators on data collection of child head circumference and implemented the Ages and Stages questionnaire. The results are still being analyzed.

### **Examine the relationships between women's empowerment, behavior change tools and training and ASF**

**consumption:** Distribution of chickens to households in the partial and control arms of the Focus project study population took place at the end of May. The impact on poultry production and empowerment were assessed in July. The goal is to examine the potential of livestock assets (chickens) to improve ASF consumption in populations that have received repetitive nutrition and livestock information trainings and in populations without this training history.

### **Capacity Building**

Four short-term trainings were conducted by the project in FY 2019, primarily to prepare the field team (4 men, 2 women) for the research. Along with the three Burkinabe Master's students involved in the earlier Focus project, another Burkinabe Master's student was added to complete the field research team. A UF Master in Public Health (MPH) biostatistics student has been integral to working on the data collected in May 2019 and is contributing to several forthcoming publications. A post-doctoral fellow at UF has been collaborating with the International Food Policy Research Institute (IFPRI) to adapt the A-WEAI code for R, and this effort took more time than anticipated but was completed in Q4 2019. Another MPH student at UF is working on analysis of the cognitive development data and outlining a manuscript. A PhD graduate student in One Health at UF will lead the three major papers coming out of this project, which will collectively comprise her dissertation.

### **Lessons Learned**

- 1) While data collection using tablets is useful, extensive data cleaning and management is still needed before analysis can start.
- 2) The deteriorating security situation hindered project implementation and required patience, flexibility, and commitment of the project team to achieve the project goals. Consideration should be given to targeting sites that are less prone to security problems in the future.

<u>Assessment of aflatoxin-related health risk for milk consumers in rural and peri-urban areas in Burkina Faso</u>	
Focus project, Aug. 7, 2018 – March 30, 2020	
<b>PI Name &amp; Institution:</b> Silvia Alonso, International Livestock Research Institute (ILRI)	<b>Collaborators:</b> Institut de l'Environnement et de Recherches Agricoles (INERA), Institut de Recherche en Sciences Appliquées et Technologies (IRSAT)
<b>Description:</b> Milk and dairy products are a key source of essential nutrients, but they are also greatly vulnerable to contamination with microorganisms and chemicals that can cause illness in people. This project aims to assess the amount of such hazards in dairy products and identifying steps along the dairy supply chain to reduce them.	
<b>Location:</b> Centre (Kadiogo) and Sahel (Séno) regions	

### Theory of Change and Impact Pathway

Increased demand for dairy products by urban populations in Burkina Faso has been accompanied by a growing consumer awareness about dairy quality. Improved knowledge of the prevalence of main pathogens as well as aflatoxin M1 will improve milk safety and, thus, human nutrition through reducing risks of foodborne illness.

### Achievements

**Map dairy value chains:** The dairy value chain mapping exercises were conducted in Ouagadougou and Dori (Region du Sahel). Through a participatory process, the workshop participants identified the multiple value chain actors, discussed the various challenges and opportunities to enhance the functioning of the value chain and developed some actionable solutions.

**Assess aflatoxin contamination levels in dairy cattle feed and milk:** Field protocols for collection of feed and milk samples were developed in Q2 FY 2019 and the first round of field work was conducted in Q3. Milk and feed samples were collected, alongside information on farming practices from 100 dairy farms in peri-urban Ouagadougou and from 165 in the Dori area. This first round of sampling was successful and a total of 365 samples from 27 different types of feed as well as 265 milk samples were collected. In Q4 FY 2019 the laboratory in charge of the aflatoxin testing at INERA tested all samples except for fresh leaves and fodder samples. These were not tested because the laboratory lacked a protocol for processing the samples. Alternative options for getting those samples tested are being explored.

**Estimate aflatoxin-related health risks:** A risk assessment model to estimate the aflatoxin-related health risk for rural and urban consumers of liquid cow milk, with a focus on children under 5yrs and pregnant and lactating women has been built, under the supervision of a risk assessment expert from University of Prince Edward Island, Canada. Data to fit the models and estimate aflatoxin-related health risk from milk consumption were obtained in the first round of field work. The data analysis will start in Q1 FY 2020 using data on milk consumption and aflatoxin levels in the dry season.

### Determine the presence of milk-borne pathogens:

Over the course of the year difficulties were experienced in the procurement of laboratory materials. It also became clear that the original budget required by IRSAT for these laboratory tests had been underestimated and discussions were held on how to re-organize the laboratory work to stay within budget. It was decided that laboratory tests will be conducted over one season and not over two as originally proposed. A modification to the original plan for microbiological analysis was submitted to UF for approval. Laboratory consumables have now been ordered and they are due to arrive to Burkina in the coming weeks. Laboratory work will be conducted in the first quarter of 2020. Approvals are also being obtained from ILRI's Institutional Biosafety Committee for these analyses.

### Capacity Building

So far, no specific capacity building has taken place. A presentation was given to ILRI's graduate fellows on the project aims and objectives, aflatoxin and public health and risk assessment by an ILRI research fellow who is supporting this project.

### Lessons Learned

- 1) The need to stop field work activities due to the deteriorating security situation near Dori prevented the project from completely meeting one of its objectives (data collection was done in 1 season as opposed to 2 seasons). Adaptive project management and frequent communication with the LSIL ME is needed to work in Burkina Faso where the security situation is quickly deteriorating. Consideration should be given to targeting sites that are less prone to security problems in the future.
- 2) In Burkina Faso all project partners must speak either English or French to avoid misunderstandings that can comprise project performance.

The project was granted a no cost extension (NCE) until March 30, 2020 (original project end was July 31, 2019).



<b>Intervention in low guinea fowl productivity and related products consumption in Burkina Faso</b>	
<b>Focus project, June 1, 2018 – Mar. 31, 2020</b>	
<b>PI Name &amp; Institution:</b> William Kisaalita, University of Georgia (UGA)	<b>Collaborators:</b> Africa's Sustainable Development Council (ASUDEC), Nazi Boni University
<b>Description:</b> This project aims to increase animal source protein production through more productive guinea fowl farming among smallholder households. It will improve nutrition of guinea fowl using fly larva and hence increase egg production; egg hatching will also be increased by using a low-cost evaporative cooling egg storage method as well as synchronized hatching.	
<b>Location:</b> Centre (Kadiogo) region	

### **Theory of Change and Impact Pathway**

Improved guinea fowl production practices such as evaporative cooling egg storage will result in more birds and eggs which can be an important source of protein in some parts of Burkina Faso. As a result, production and purchase of guinea fowl and eggs will increase allowing households to diversify diets, consume more nutritious foods, particularly ASF, which will decrease household and national spending on malnutrition and disease outbreaks.

### **Achievements**

**Producing fly larva and establishing the optimum percentage of fly larva meal in the diet:** Various substrates for maggot production have been evaluated. Based on this evaluation, pig waste was selected as its composition is consistent, however, poultry waste is being considered as a more sustainable alternative substrate for large scale production as it can be dried and stored for rehydration and use when needed, does not require an attractant and is more readily available from local farmers than pig waste. Some 23 kg dry larva have been produced in a production protocol based on poultry waste that will be followed throughout the study. The feeding trial was delayed due to low keet production. This was because the number of eggs laid decreased due to shortening day length. The problem has been fixed with the installation of solar lamps in the coops to extend daylight hours.

**Establishing efficacy of integrating the three practices for year-round production of healthy keets:** The prerequisite for testing integrating evaporative cooling for the storage of eggs was to build a cooler locally. The first unit was delivered and tested but needed further improvements. While it now works satisfactorily, the difference between the inside and outside temperatures remains as low as 5°C. This difference may be due to insufficient thickness of the jute or to the current low ambient temperature. Thus, the thickness of the jute coverage will be increased. It is anticipated that the three working units will be ready early in FY 2020. However, because of the delay, there may not be enough eggs for the experiment due to seasonal variability in egg production. For this reason, 100 additional female guinea fowls have been ordered and may be received early in FY 2020. Also, 22 hens have been added to increase the flock size to 62 hens. Thus, the overall the number of guinea fowls has increased to enable completion of all the experiments within the remaining duration of the project.

### **Capacity Building**

Two Bachelor's students from Nazi Boni University (2 male) started in August 2019. They have received technical training on data collection, determining the best substrate for fly larvae production, defining the best methodology for harvesting and drying fly larvae, managing the flock of young keets, and increasing egg production through installation of solar lamps.

### **Lessons Learned**

1) Sufficient time should be allocated for completion of contracts and transfer of funds to partners in Burkina Faso. These aspects caused significant delays in the current project and partly necessitated the no-cost extension was needed. The project was granted an NCE until March 30, 2020 (original project end was May 31, 2019).

## b) Burkina Faso and Niger – Reach Project Reports

### Enabling sustainable value chains of crop-livestock systems in Burkina Faso and Niger

Reach project, Jan. 26, 2018 – Sept. 30, 2020

<b>PI Name &amp; Institution:</b> Vincent Bado, International Crops Research Institute for Semi-Arid Tropics (ICRISAT)	<b>Collaborators:</b> International Livestock Research Institute (ILRI), Conseil National de Recherche Agronomique (CNRA), and Institute de l'Environnement et de Recherche Agricole (INERA)
<b>Description:</b> This project aims to increase production of animal-source foods through the integrated management of crop-livestock systems with the participation of livestock keepers. The project has three objectives: 1) develop inclusive crop-livestock value chains and conducive policy environments; 2) develop improved feed and feeding systems to improve animal health and animal-source food production; and 3) participatory development of improved scenarios for crop-livestock farming systems, which enhance resilience, productivity, and sustainability, and increase participation of youth and women in income-generating enterprises.	
<b>Location:</b> Burkina Faso: Sahel (Séno) and Centre-Nord (Sanmatenga) regions, Niger: Maradi (Madaroumfa, Groumdji, Dakoro) and Tilabery (Say) divisions	

### Theory of Change and Impact Pathway

Sahelian countries face water scarcity, droughts and other climate change risks. As large proportions of the population engage in crop and livestock activities, understanding optimal crop-livestock integration will help develop sustainable innovations and policies. As a result, crop-livestock systems will become more productive, profitable and resilient. This will improve food security and incomes while stabilizing markets and alleviating poverty.

### Achievements

**Improve crop-livestock systems:** The baseline study showed that while over 90% of the interviewees indicted agriculture as their primary activity, there was a low youth involvement, low farmer organization and limited support by the extension services. Millet and sorghum are the main cereal crops and over 90% of the production is for home consumption. Use of new agricultural technology is very low. Livestock is an important part of these farming systems with household livestock ownership varying from 2.09 to 2.5 Tropical Livestock Units (TLU) in Niger and Burkina Faso, respectively. The baseline data will be used for modelling and simulation of management options for crop-livestock systems.

In Burkina Faso, the innovation platform (IP) members meet regularly in Korsimoro and Sampelga and are currently mostly focusing on improving small ruminant marketing opportunities as well as improved feeding techniques. As a result, producers were linked to 166 butchers in the Ouagadougou area to facilitate the sale of animals. At the IP meeting in Torodi, Niger, efforts also focused on improving marketing opportunities as well as improved access to feed. The project team facilitated the contact between feed traders from Maradi and livestock producers Torodi. Despite the long distance between the two sites about 12.6 tons of feed priced at \$3,600 have been sold in less than 6 months.

**Improve feed systems and animal health:** The Feed Assessment Tool (FEAST) was used to evaluate the existing and potential feed resources in the study sites. At all the sites, farmers purchased feeds to overcome shortages. Grazing accounted for between 38% and 52% of the dry matter of animal diets at all the project sites while crop residues accounted for between 21% and 28%. Market surveys revealed that quality feeds attracted higher prices. In Niger, the participatory evaluation of pearl millet varieties with 60 farmers showed the highest preference index for variety ICMV167005 (67.5%), followed by the Chakti variety (59.17%). In Burkina Faso, Socat-c88 (millet), Sarioso 14 (sorghum) and K VX 745-11P (cowpea) are being tested by 100 farmers. The feeding trials using millet residues (from six different varieties) and cowpea rations with 36 sheep over 90 days showed that animals fed with variety ICMV167005 had higher ( $p < 0.05$ ) final live weight, average daily live weight gain and feed intake compared to those fed with varieties 167006, 167002, ICMH 167111, Chakti and a local landrace. The residues of ICMV167006 were second to ICMV167005 for improving digestibility, feed intake and liveweight gain. Out of the six varieties, it is these two that could be recommended as the best dual-purpose millet varieties for crop-livestock systems in Niger. A network of Community Animal Health Workers (CAHWs) was established at Maradi and Torodi, Niger. In Burkina Faso, an animal health innovation platform was established aiming to improve access to veterinary services in rural areas.

**Improved scenarios of crop-livestock systems:** Three and four crop-livestock farming systems were identified in Burkina Faso and Niger, respectively based on land size, family size, livestock ownership, small ruminant ownership, technology use, and animal traction use. Farm-modelling scenarios for these farm types were shared with the platform members in Niger to illustrate the potential impact of adoption of fodder and market interventions.

### Capacity Building

In FY 2019, 5 short-term workshops took place, training 209 persons (151 men, 58 women). Among these, 191 small-ruminant livestock farmers (92 women) learned feeding strategies to improve productivity. Among these, 167 smallholder ruminant farmers (50 women) learned about feeding strategies to improve productivity.” One postdoc (woman), three PhD students (2 in Niger, 1 in Burkina Faso, all men), as well as 4 Master’s students (1 woman; 3 in Niger, 1 in Burkina Faso), and one Bachelor’s student (male, in Burkina Faso) are now involved in the project.

### Lessons Learned

- 1) Involvement of graduate students from partner institutions (Universities, National Research Institutions) enhanced and expedited implementation of activities.
- 2) Multiple meetings with farmers are needed to ensure they fully buy in into project activities.

**Enhancing the productivity of small ruminants through improved and cost-effective feeding and animal health interventions in Burkina Faso and Niger**

**Reach project, May 1, 2018 – Sept. 30, 2020**

**PI Name & Institution:** Salissou Issa, L'Institut National de la Recherche Agronomique du Niger (INRAN), Mercy Corps

**Collaborators:** Texas A&M University (TAMU), and Institute de l'Environnement et de Recherché Agricole (INERA)

**Description:** This project aims to increase production of animal-source foods through three objectives: 1) Improve the production, transformation, conservation and commercialization of nutritionally-rich and cost-beneficial fodder and improved animal feed; 2) Improve the health and productivity of livestock through better management of parasites that prevent optimal utilization of the nutrients from supplemental feed and fodder; 3) Support improved implementation of policies related to small ruminants.

**Location:** Burkina Faso: Sahel (Séno, Yagha), East (Komondjari, Gnagna), Centre-Nord (Namentenga, Sanmatenga, Bam) and Nord (Loroum) regions; Niger: Maradi (Maradi) and Zinder (Zinder) divisions

### **Theory of Change and Impact Pathway**

Enhancing the productivity of small ruminants by improving forage/feed systems and parasite control and associated policy implementation will improve outcomes for all the ways that livestock are used. As a result, livestock smallholders will be more food secure, more resilient, and have greater capacity to market their products.

### **Achievements**

**Improve fodder and feed:** In Niger, the fodder production trials started in Q2 FY 2019 with 54 farmers (27 women) in Maradi and 73 farmers (24 women) in Zinder region. Four crops - cowpea, millet, moringa oleifera, and sorghum - were produced in Zinder and Maradi region. Substantial fodder was produced in the pilot villages, which allowed the purchase of 81 small ruminants including 27 sheep used in forage and pelleted feed trials. All animals were dewormed and earmarked. The feeding trial started in July and will last for 90 days. In Burkina Faso, 72 producers were identified prior to rainy season and trained in fodder production. Among the trainees, forty volunteers (of whom 19 are women) are testing dual-purpose crops including: Sorghum "Sorghum bicolor" Sepon 82 (type R1), on Kaya site Landrace Millet variety Maiwa (type R2), at Dori site; and Landrace cowpea variety Lakade (type R2) at Kaya and Dori sites. The fodder is being produced on a total of 4,800 m<sup>2</sup>. and performance data is still being analyzed.

**Improve the health and productivity of livestock:** In Q2 FY 2019, blood and feces samples were collected in Burkina Faso (1,404 samples). *Strongyles* was the most common parasite detected with a prevalence rates of 63.5% in Kaya and 66.18% in Dori. A survey to collect data on the anthelmintic plants was also conducted with 325 respondents among agro-pastoralists, herbalists, and traditional healers. Focus group discussions with these actors will help validate the survey results. All related data are being analyzed. In Niger, 1,476 samples were collected and are currently being processed and analyzed.

**Improve implementation of policies:** Stakeholder meetings were held in each country in Q1 and Q3 FY 2019. Participants analyzed the policy strategies using the strengths, weaknesses, opportunities, and threats (SWOT) methodology and made recommendations to both policy makers and other actors in the livestock sector. Niger has shown good progress in the control of animal health in the context of transhumant livestock farming and cross-border marketing. However, despite the predominant position of livestock in the rural economy, the livestock sub-sector has had very little investment. The SWOT analysis in Burkina Faso showed that the institutional framework has gradually improved with the creation of the Ministry of Animal Resources, decentralization and diversification of technical services. The fight against the main epizootics and vector borne diseases has also had convincing results. In the area of livestock statistics and economics, national livestock census and market monitoring have helped to give the sub-sector better visibility.

### **Capacity Building**

Over the course of FY 2019, one training took place to teach research technicians about how to identify and analyze gastrointestinal parasites. Ten men and 3 women were trained in Burkina Faso on this technique." Six students are conducting graduate level research as part of this program including 2 Master's students (1 man, 1 woman) from the University of Niamey in Niger, 3 Master's students in Burkina Faso (1 man, 1 woman from the University of Ouagadougou and 1 man from the Institute of Rural Development) and 1 PhD student (man) from the University of Ouagadougou.

### **Lessons Learned**

- 1) Sufficient time should be allocated to complete contractual arrangements including securing prior approvals for purchasing restricted commodities.
- 2) Conducting feeding trials during the rainy season is challenging, due to lack of dry forage and effects of heat and humidity on animal performance. Future trials should begin before the rainy season.
- 3) Collaboration with the USAID Resilience and Economic Growth in the Sahel (REGIS-AG project on improved husbandry practices) ensured increased project impact.
- 4) The laboratory assessment by the visiting UF laboratory manager revealed several deficiencies. Planned capacity development by the project had to be adapted to meet this need.
- 5) The coordination of activities with the Reach project led by ICRISAT and the Bill & Melinda Gates Foundation Equip project in Burkina Faso helped to ensure cross project learning and avoid duplication.

## c) Cambodia – Reach and Focus Project Reports

### Safe food, fair food for Cambodia

Reach project, July 20, 2017 – July 19, 2020

**PI Name & Institution:** Delia Grace, International Livestock Research Institute (ILRI)

**Collaborators:** National Animal Health and Production Research Institute (NAHPRI), Livestock Development for Community Livelihood (LDC, formerly CelAgrid), Emory University

**Description:** This project assesses the multiple burdens of foodborne diseases associated with key animal-source food (ASF) value chains in Cambodia, in order to adapt and evaluate a market-based approach to improving food safety. The overall aim of the project is to reduce the burden of foodborne disease in informal, emerging formal, and niche markets. The project will target small and medium scale producers following a holistic, One-Health approach.

**Location:** Siem Reap (Siem Reap) and Phnom Penh (Phnom Penh) provinces

### Theory of Change and Impact Pathway

Unhygienic ASF can cause foodborne diseases and directly impact health and the economy, as a sick person is less productive than a healthy one. Understanding the occurrence and impact of foodborne diseases from livestock is needed to provide evidence to inform policies. Ultimately, industry accountability for placing safe ASF on the market and adherence to food safety standards will lead to improved accessibility, affordability and stability across the value chains, while reducing the prevalence of and costs associated with foodborne diseases at national and household levels.

### Achievements

**Risk profiles for food safety problems in ASF value chains:** In Q1 and Q2 FY 2019, to identify the presence of priority hazards in the pork and chicken value chains, 496 samples of pork, chicken and cutting board swabs were collected from traditional markets in 25 provinces. A second round of sampling took place in Q4 in 4 provinces (Phnom Penh municipality, Siem Reap province, Sihanoukville, and Battambang). The average prevalence of *Salmonella* was 43.1% (214) across all samples and chicken and pork meat samples scoring 39.3% and 39.7% respectively. Risk rankings were conducted with stakeholders on the importance of food safety and key hazards in Cambodia. The data are being analyzed. Quantitative microbial risk assessments were conducted, starting with an experiment that simulated the cross-contamination of *Salmonella* from chicken to other food during food preparation at home. As part of a cost of illness study, a total of 266 foodborne disease cases were collected from 3 levels of clinics. The average cost per case was \$62.76, but ranged from \$185.88, \$44.62, and \$7.57 per episode of hospitalization and per treatment day for national and provincial hospital and community health center, respectively. The major diagnosis was acute diarrhea (198 cases, 74.4%), followed by food poisoning 65 (24.4%), Typhoid 2 (0.8%) and chronic diarrhea (0.4%). A quantitative and in-depth nutrition study was conducted in FY 2019 to assess the association of perception on food safety and food environment with intake frequency of meat, fruits and vegetables in mothers and children between 6 months and 2 years old. A cross-sectional survey was conducted with 100 women living in Phnom Penh and 105 in Siem Reap to ask a range of questions about food insecurity experience, perception of food environment and food safety, dietary diversity and food consumption frequency. The result shows that women in Siem Reap have lower education level, have fewer household assets, experience more food insecurity and have lower intake frequency of meat, fruits and vegetables. After controlling for socioeconomic factors, overall negative perception is significantly and strongly associated with lower intake frequency of meat, fruits and vegetables in both children and mothers. Food environment and food safety perception is associated with intake frequency, which calls for stronger collaboration between food safety and nutrition programs. Consumers are concerned with food safety but know little about food safety and foodborne health risks.

**Evidence-based recommendations:** The project supports the food safety technical working group in Cambodia with case studies, risk assessment expertise, and provides linkages with other food safety projects in the region.

### Capacity Building

The project involves ten students who are involved in various aspects of the sample collection, processing and data analysis. One female student from Vietnam is a PhD candidate at Emory University in the US and a male student from Cambodia is pursuing his PhD at the Swedish University of Agricultural Sciences (SLU). Two veterinary students (DVM, 1 man, 1 woman) and four Bachelor's students (3 men, 1 woman) from the Royal University of Agriculture (RUA) contribute to the project. One Bachelor's student (female) from Prek Leap National College of Agriculture graduated in August 2019 and one female Master's student in public health at Emory University in the United States. Several short-term training courses were delivered to researchers and students were involved in various surveys conducted.

### Lessons Learned

- 1) Adaptive project management and frequent communication with the LSIL ME is needed to ensure that adverse events like the outbreak of African Swine Fever in Cambodia, do not hinder project activities.
- 2) Strong partnership with the Department of Communicable Disease Control (CDC) within the Ministry of Health is needed to obtain enough foodborne disease cases from hospitals for a cost of illness study. Similarly, partnership with the National Institute of Public Health, Ministry of Public Health was important in implementing the nutrition study.

<a href="#">Living fences for improved livestock feed in Cambodian smallholder systems</a>		<b>Focus project, June 10, 2017 – Sep. 30, 2019</b>
<b>PI Name &amp; Institution:</b> Tom Gill, University of Tennessee	<b>Collaborators:</b> Royal University of Agriculture (RUA), University of Battambang (UBB)	
<b>Description:</b> This project assesses leguminous trees as living fences for supplemental livestock nutrition and for protection of crops in Cambodian smallholder livestock systems. The project has 4 objectives to: 1) evaluate living-fence species using livestock feeding trials; 2) improve capacities of farmers to produce and manage living fences; 3) evaluate constraints and impacts of using living fences on farms and 4) evaluate the potential to use living fences to protect food crops and fodder.		
<b>Location:</b> Battambang (Battambang) and Siem Reap (Siem Reap) provinces		

### Theory of Change and Impact Pathway

Access to affordable quality animal feed is a serious livestock production constraint in Cambodia. Cattle can roam freely and often destroy crops. Establishment of living fences with forage trees around crop paddies can provide protein for cattle nutrition as well as protect cropping areas. As a result, farmer's incomes will increase through the sales of better fed animals and from selling crops. The ability to afford more nutritious foods could improve household nutrition.

### Achievements

**Evaluate living fence production and protection in on-station conditions:** Living fences of *Moringa oleifera*, *Leucaena leucocephala*, and *Gliricidia sepium* continue to grow in the demonstration plot around the rice paddy at the technology park in Battambang. These were sufficient for statistical testing. Between Nov. 2018 and July 2019, approximately once per month, fresh biomass was collected, and dry matter weight was measured. *Leucaena* was still producing between 1.0 - 4.0kg biomass per week per 100 trees in the early part of the dry season (into February), 2-3 months after the rains ended in late November 2018. Due to a delayed 2019 rainy season *Leucaena* growth stagnated for a longer period than anticipated. Once rains started in May, *Leucaena* biomass production accelerated. Farmers indicated that they had no interest in using the moringa for cattle protection as they would prefer to grow it for human consumption. Biomass measurements were also collected on-farm from January to March 2019 in Anlong Thmey village from a farmer who has adopted a *Leucaena* and *Gliricidia* fence. The on-farm work was for demonstration purposes, to show what is possible under normal field conditions. Feed quality was analyzed at the Royal University of Agriculture (RUA) in Phnom Penh, showing that *Leucaena* consists of about 27% crude protein. A *Leucaena*-fence around a 1-hectare paddy should be enough to produce enough dry season biomass for a farmer to supplement the diets of two cows through the period of November-May, if cattle are kept contained in a cut-and-carry system.

**Evaluate living fence species through on-station trials:** In consultation with the Management Entity, the feeding trial protocol was adjusted to just one species (*Leucaena leucocephala*), which was the most readily-available one, and it aimed to examine effects of supplementing the typical diets of cows in the late dry season in Battambang with the species. Local cattle owners loaned 24 cows for the trial. Over the course of the 107-day trial, average weight gain for cows in the treatment group was 4.2% versus -0.7% for cows in the control group (rice straw only).

**Improve capacities of farmers to produce and manage living fences:** From the 49 farmers (18 men, 31 women) trained in Q2 FY 2018 on production and management of living fences, 28 of the 36 respondents adopted the living fence technology.

**Evaluate constraints and impacts of living fences in on-farm conditions:** Two technical notes capture learnings from the project: "Examples of living fences in Cambodia - highlighting various examples of adoption and innovation of living fence uses for livestock control and fodder" and "How to establish a living fence - outlining to farmers in Battambang the "how to" steps of establishing and using a living fence for livestock control and fodder production". The main recommendation is that: smallholder farmers work together to identify paddies that can be fenced to address the lack of fodder particularly in the dry season. *L. leucocephala* is the most widely known species, the most prevalent and the most likely to be adopted by the farmers.

### Capacity Building

In Q3 FY 2019, 37 farmers (14 men, 23 women) were trained on Improving cattle health through living fences. In Q4 FY 2019, during the final project workshop, which included a field visit to Anlong Thmey village, Battambang Province, the results of the research were presented to 77 farmers (40 men, 37 women). One UBB Masters of Sustainable Agriculture student (man) is still supported on his research on *Acacia pennata* adoption in Anlong Thmey. Undergraduate student interns from UBB continue to manage the living fence demonstrations at the Battambang tech park although the project has ended. An extension technical note on "how to conduct a cattle feeding trial in rural Cambodia – lessons learned" provides the steps and things to consider for such a feeding trial, along with lessons learned from the feeding trial. The main target audience for this document was researchers considering implementing a cattle feeding trial. This could be transferable to researchers working in other low-income contexts.

### Lessons Learned

- 1) Sufficient time should be allocated to complete contractual arrangements and for building the capacity of in-country partners to ensure they meet UF and USAID financial reporting requirements.
- 2) A cost-reimbursable model is difficult to handle with foreign subawardees who have limited ability to front on-the-ground research expenses.
- 3) Detailed planning at the project design stage is needed to ensure sufficient and suitable animals are available for trials.

<b>Improved pig health and nutrition: The major drivers of profitability and sustainability for smallholder farmers in Cambodia</b>	
<b>Focus project, July 17, 2017 – May 31, 2019</b>	
<b>PI Name &amp; Institution:</b> Mike Tokach, Kansas State University (KSU)	<b>Collaborators:</b> Royal University of Agriculture (RUA)
<b>Description:</b> This project aims to improve pig productivity in Cambodia through research on improved pig nutrition and disease management. The project has 2 objectives to: 1) assess the nutritional composition of locally available feed resources in rural and peri-urban Cambodia and provide economical diet options and recommendations to smallholder farmers; and 2) assess the current disease management strategies on smallholder farms in rural and peri-urban communities and provide practical recommendations for improved pig health outcomes.	
<b>Location:</b> Battambang (Battanbang, Moung Ruessei, Sangkae), Siem Reap (Siem Reap, Kralanh, Puok, Soutr Nikom) and Kampong Thom (Kampong Thom, Baray, Kampong Svay, Stueng Saen) provinces	

### Theory of Change and Impact Pathway

Access to affordable quality animal feed is a serious livestock production constraint in Cambodia, which is further aggravated by poor animal health practices. This seriously reduces livestock productivity and the competitiveness of the Cambodian pig sector. Research into current feeding, health and biosecurity practices will provide evidence to inform improved strategies. This will result in more productive and healthier pigs and consequently more income for pig farmers.

### Achievements

**Assessment of the nutritional composition of locally available feed:** Available feed ingredients were analyzed, and research was conducted to determine economical feeding strategies. The 81 feed stores surveyed almost all carried complete feed (95%) and high protein supplement (83%), with few other protein sources or premixes available. Approximately 12% sold vitamin and mineral premixes for pigs. A total of 305 feed and ingredient samples were obtained from farmers, and 104 were analyzed for composition. The survey and analysis revealed that rice bran was the major energy source being fed by smallholder pig producers, with high variability in quality. Surveys also revealed the lack of protein source availability and the high cost of protein supplements, which is leading producers to feed protein deficient diets. A total of 60 crossbred pigs were used in a 42-day experiment to evaluate the effect of replacing high protein supplement with base mix and soybean meal in rice bran-based diets on pig growth performance. The experiment demonstrated that soybean meal and a base mix containing vitamins and minerals could be used to replace the protein supplement. This will provide a more economical feeding strategy for producers with approximately \$10/pig increase in profit.

**Assessment of disease management strategies:** Biosecurity is at risk due to farmers sharing scales (48%), cages (16%), trucks or carts (10%) or other supplies. Almost all farmers (93%) allowed visitors near their pigs without restrictions. Kitchen waste was fed by 51% of the farmers, 39% including meat scraps in the kitchen waste. Manure management was also an issue with manure not being collected or managed on 74% of farms. Farmers and village animal health workers (VAHW) were trained on practical biosecurity plans. In view of the outbreak of African Swine Fever, addressing biosecurity was a much greater need than vaccine strategies and lack of diagnostic tools made determining best vaccine strategies too difficult for small farmers. The before and after biosecurity surveys given at each training revealed improved knowledge on the possible source of disease transmission. Similar improvements were made in trainee understanding of other areas of biosecurity to prevent disease transfer.

### Capacity Building

Various types of trainings were conducted throughout the entire project period: First, through seminars over 150 RUA faculty and students were educated on pig health and nutrition topics. Second, the first Cambodia Swine Day in Siem Reap reached 139 attendees, with 14 presentations covering topics including feed ingredients, nutrition, disease control, biosecurity, marketing and raising pigs, and food safety. Third, two-day in-depth trainings on biosecurity, nutrition and swine disease were conducted in Siem Reap, Battambang, and Phnom Penh. A total of 191 people were trained, including village animal health workers, farmers, and students. Numerous training materials were developed, including: 1) flip charts with disease information; 2) tabletop booklet with feeding recommendations, biosecurity and disease management information, and record-keeping sheets; 3) biosecurity stop signs for farmers to use at their farms; 4) numerous slide presentations; and design recommendations used to build Danish entries at the technology parks and at RUA. These materials were used at the various farmer and village animal health worker trainings. Five factsheets will be published in conjunction with the Center for Excellence in Sustainable Agriculture Intensification and Nutrition (CE SAIN). Five journal articles are currently being written, three of which are part of two graduate student's degrees. Two students that worked on the project are starting graduate programs in swine in other countries.

### Lessons Learned

- 1) The existing collaboration between KSU and RUA greatly helped with project development and implementation.
- 2) Additional resources, such as that received from the American Soybean Association, may be needed to allow funding of important project components (e.g. the construction of the enclosure for the feeding trial) that cannot be paid for with USAID funding.

## d) Ethiopia – Reach, Focus, and Enhance Project Reports

### Addressing young stock mortality in smallholder farms and pastoral herds in Ethiopia

Reach project, Oct. 17, 2016 – April 16, 2020

**PI Name & Institution:** Woutrina Smith, University of California-Davis (UC-Davis)

**Collaborators:** Addis Ababa University (AAU), University of Gondar (UG), National Animal Health Diagnostic and Investigation Center (NAHDIC)

**Description:** This project assesses the causes of morbidity and mortality of young stock and develops technically sound and context-specific solutions to the constraints identified. It complements recent and ongoing efforts by the Ministry of Agriculture (MoA) to reduce young stock mortality (YSM) in Ethiopia.

**Location:** Amhara (Semien Gondar) and Addis Ababa (Addis Ababa) regions

#### **Theory of Change and Impact Pathway**

Young stock morbidity and mortality constrain livestock production, reducing incomes and worsening livelihoods of smallholder farmers. To address the problem, young stock epidemiology, risk factors and intervention strategies need to be investigated. Adoption of improved management practices will reduce the livestock diseases and their impact on farms, increasing farmer incomes from livestock sales and their products, thus improving household health and nutrition.

#### **Achievements**

**Epidemiological data on young stock mortality:** By the end of FY 2019, the graduate students had collected at least 1868 samples (fecal, blood and oral) from youngstock from 450 households across different production system locations. Students are investigating causes of diarrheal and respiratory diseases in calves as well as the risk factors, including the study of failure of passive transfer of colostral immunity and its impact on future animal health. The project team has been working with the same laboratory protocols and diagnostic methods that will yield results that will be combined with findings from previous years. UC-Davis facilitated procurement of diagnostic supplies to contribute to sampling efforts and diagnostics by Addis Ababa University, the National Animal Health Diagnostic Center (NAHDIC). Laboratory staff at both Addis Ababa University/Aklilu Lemma Institute of Pathobiology (AAU/ALIPB) and University of Gondar (UG) have increased their technical capacity and were better able to assist this year's graduate students with their laboratory assays and field sample collection. Findings to date include detection of diverse pathogens in young animals experiencing diarrhea and/or respiratory problems that are associated with lack of colostrum feeding to the newborn. These findings speak to improved hygiene and colostrum feeding as important interventions that could have a large impact on improving livestock health and production.

**Livestock health intervention packages:** The project is part of a YSM consortium led by the Ministry of Agriculture (MoA). During Quarter 3, the Ministry replaced AAU/ALIPB with NAHDIC, for intervention implementation and evaluation in three districts AAU/ALIPB was responsible for. The UG interventions activities proceeded as planned. Ongoing negotiations and the changes above caused a delay in the intervention implementation. Since May 2019, all districts have completed the pre-intervention baseline questionnaire and are in the intervention implementation and evaluation phase. In Gondar city district (urban/peri-urban dairy system), 150 households are enrolled in the intervention campaign, which receives bi-monthly monitoring visits. Six interventions are being implemented with a focus on four farm management and husbandry interventions and two animal health interventions. With guidance and supervision from the Supporting Evidence-Based Interventions (SEBI, led by the University of Edinburgh) project's, YSM consortium members developed standard operating procedures (SOPs), questionnaires, and training materials for the implementation and evaluation of the minimum intervention packages.

**Cost-benefit models developed to evaluate effectiveness of intervention compared to baseline young stock mortality data:** Due to prolonged delays in the startup, baseline evaluation and implementation of the minimum intervention packages led by the MoA and other consortium partners, which were out of the control of the project, the intervention packages and evaluation are no longer scheduled to be completed before the completion of the project period.

#### **Capacity Building**

In Q1 FY 2019, a new cohort of Ethiopian graduate students were trained on research methods, including introduction to the Institutional Review Board (IRB) and how to get approvals, sample size calculation, and sampling design (9 students, all men). The intervention packages were rolled out to 150 farmers (134 men, 16 women) in May 2019. In FY 2019 overall, 14 students (11 men, 3 women) were engaged in the project. This included 1 PhD, 8 DVM and 5 MS students.

#### **Lessons Learned**

- 1) Adaptive project management was needed to deal with the changing security situation in the project areas.
- 2) Detailed SOPs on data handling, standardized surveys, and close mentorship are needed to ensure that data collected by students is representative, fit for purpose and of good quality

The project was granted an NCE until April 16, 2020 (original project end was Oct. 16, 2019).

[Linking cattle nutrition to human nutrition: A value chain approach to improving the production, handling, and consumption of animal source foods in Ethiopia](#)

Reach project, Oct. 17, 2016 – Sept. 30, 2020

**PI Name & Institution:** Jessie Vipham and Dustin L. Pendell, Kansas State University (KSU)

**Collaborators:** Hawassa University, Oda Bultum University, Ethiopian Institute of Agriculture Research (EIAR), Texas Tech University, ACIDI/VOCA, Digital Green, Ethiopia Public Health Institute, Eden-Field Agri-seed Enterprise, Project Mercy

**Description:** This project aims to create a systems-based research approach that strengthens linkages between improved animal-source food (ASF) production and consumption practices and human nutrition outcomes in Ethiopia. Efforts span research in forage, ruminant nutrition, meat science, dairy science, food safety, human nutrition and gender.

**Location:** Dire Dawa (Dire Dawa), and Oromia (Misraq Shewa, Mirab Harege, Mirab Arsi) and Southern Nations, Nationalities, and Peoples (SNNP) (Sidama) regions

### Theory of Change and Impact Pathway

Research that strengthens linkages between improved ASF production and consumption practices and human nutrition outcomes will fill current knowledge gaps in Ethiopia and interlink critical research domains: forages, cattle nutrition, milk and meat quality, and food safety. In turn, interventions in each domain will improve ASF productivity and profitability as well as human consumption of and access to safer and more nutritious ASF.

### Achievements

**Forage domain:** Field performance studies continued for the 9 most promising dual-purpose sorghum genotypes identified in the previous years. The nutritional quality measured in terms of Crude protein (CP %), In vitro Organic Matter Digestibility (IVOMD %) and Neutral detergent fiber (NDF %) contents varied significantly among the sorghum variety groupings and experimental locations with the best producing 13% CP and 50% IVOMD. Forage production experiments focusing on intercropping of sorghum with pigeon pea and another on planting density of pigeon pea are ongoing. A household survey in sorghum growing areas targeted 325 household (274 men, 49 women). Results showed that feed shortage happens from May to August and crop residues contribute almost half of the total feed resources, with sorghum residues used most.

**Ruminant nutrition domain:** Experimental feeds have been prepared (Sorghum silage and sorghum stover, pigeon pea leaf meal) or purchased (including Niger seed cake, wheat bran and grass hay). Using Hawassa University (HU) funds, an old barn was renovated to conduct two feeding trials, one for assessing the growth and economic impacts of supplementing a grass hay diet for weaned calves with either pigeon pea hay or concentrate feeds; the other for assess the lactation and economic impacts of supplementing a grass hay diet for lactating cross-bred cows with either pigeon pea hay or concentrate feeds.

**Meat science domain:** Eating quality of meat samples from Haramaya community abattoir and Dukem abattoir were tender with average Warner-Bratzler Shear Force (WBSF) values of  $23.15 \pm 1.72$  N and 16.438 N, respectively. The effects of age on quality of beef were determined for cattle slaughtered at the three abattoirs; meat from cattle in age categories from 3-7 was tender with WBSF value of 23.15 - 28.70 N, than from those aged 7-9 were intermediate with WBSF value of  $38.25 \pm 2.49$  N and for those above 9 years, the meat was tough a with WBSF value of  $50.22 \pm 2.5$  N. [Three peer-reviewed publications](#) resulted from this work and another 3 were submitted for publication.

**Dairy science domain:** Over a 4-month period, a survey among 320 households in 4 districts around the Addis Ababa and Awassa milk shed was conducted. It aimed to assess key bottlenecks for dairy product consumption, including identifying, ranking of importance and determining the willingness to pay for newly developed dairy products. Analysis is ongoing.

**Food safety domain:** A [systematic review and meta-analysis](#) of the prevalence of bacterial isolates from meat and meat products in Ethiopia has been published. Findings showed that data gaps exist on the seasonal effect on bacterial prevalence, a low level of studies collecting enumeration data, and few studies investigating interventions outside of training and education. Analysis is ongoing for the knowledge, attitude, and practice (KAP) data collected from 422 abattoir workers from Addis Ababa (246), Hawassa (84) and Dire Dawa (92). Abattoir carcass swab sampling and laboratory microbial analysis is on-going.

**Human nutrition:** Human nutrition practice gaps among women with children 6-23 month were identified. The behavioral change communication intervention package is being developed. Results specific to the ASF consumption frequency were generated based on the community level assessment of 690 mother-child pairs and will be published shortly.

### Capacity Building

Two seminars were conducted at Hawassa University in early Q2 FY 2019, each with 18 participants (including 1 woman). One focused on strategies used by successful research teams to execute projects that address key challenges and have an impact on the target audiences. The other aimed to improve the ability of participants to select complementary feedstuffs to optimize animal health and productivity. During FY 2019, 2 Master's and 6 PhD students (all men, all but one) were involved in the project. Seven of the students are from Hawassa University and one is from Oda Bultum University.

### Lessons Learned

- 1) Frequent communication with all subproject PIs is important to keep activities on track. This can be challenging with intermittent internet connections.
- 2) At the outset, all parties involved in the research need a clear understanding of how data generated will be used and how draft publications should be authored, routed and approved before submission to journals.



## Improving the evidence and policies for better performing livestock systems in Ethiopia

Reach project, Oct. 17, 2016 – April 16, 2020

**PI Name & Institution:** Bart Minten, International Food Policy Research Institute (IFPRI)

**Collaborators:** Policy Studies Institute (PSI, former EDRI), Ethiopian Institute for Agricultural Research (EIAR)

**Description:** The purpose of this project is to incorporate ASF markets and consumption, in addition to production, as an integral component of research on livestock systems. This will contribute to more informed and evidence-based decision making, which will improve the performance of the Ethiopian livestock sector. The project addresses 2 broad research themes: (1) understanding the dairy value chain and (2) understanding consumption and markets of ASF.

**Location:** Oromia (West Shewa, North Shewa) and Addis Ababa (Addis Ababa) regions

### **Theory of Change and Impact Pathway**

Market and demand issues that might inhibit the adoption of livestock innovations are frequently ignored. Research on national market and consumption issues and dynamics is crucial for evidence-based decision making to improve livestock sector performance in Ethiopia. The resulting ASF policy framework and attitudes could shift, increasing demand for safe, quality ASF and its consumption, and therefore improve human nutrition.

### **Achievements**

**Dairy sector analysis:** The study on the Ethiopian dairy sector highlighted important aspects such as a rapid increase in expenditures on dairy products by urban consumers and the tripling of the number of dairy processing firms in Ethiopia over the past 10 years. There is evidence of strong spatial heterogeneity in dairy milk productivity in Ethiopia. With each additional hour of travel time, the milk productivity per cow is reduced by almost 1 liter per day, a reduction by 26% on average. While milk yields have improved, they are still low compared to other countries. Adoption of cross-bred cows has increased, but it is often only the relatively richer households that can afford to invest in the costly but also riskier cross-bred cows. While artificial insemination (AI) is increasingly adopted, the AI supply chain is still problematic. Feed markets are rapidly developing, and an increasing number of dairy farmers are relying on them. However, feed-blending is often done without scientific advice even for the better performing farms. Location matters enormously for the adoption of improved practices in dairy, likely linked to incentives and the perishability of milk. The Ethiopian government has improved service delivery in the livestock sector by investing in public extension workers, animal health workers, and public pharmacies. Not all dairy farmers benefit equally from this improved service delivery as small farms and farms in remote areas participate disproportionately less.

**Assessing patterns, changes, and drivers of ASF consumption in Ethiopia:** The PI and his collaborators presented the research findings at multiple fora in Ethiopia and internationally as well as contributed to [multiple publications](#). The project team also organized a session at the African Association of Agricultural Economists on “Innovating for efficient and inclusive value chains in Africa: The case of dairy”, in Abuja, Nigeria, September 24<sup>th</sup>, 2019. The above paper as well as comparative work on the functioning of the dairy value chain between Uganda and Ethiopia was presented. Analysis has started on changes in consumption of dairy products over time using the National Households Consumption Expenditure Survey of 2016.

**Analysis of the market price behavior of ASF and Livestock:** Work is ongoing with Policy Studies Institute (PSI) on pricing and incentives in the livestock export sector. The analysis of price data from many markets in Ethiopia, showed that real prices of all nutritionally rich food groups increased significantly (between 19 and 62 percent) over the period 2007 to 2016. This contrasts with (1) staple crops (grains, roots, and tubers), which did not show any price increase, and (2) oils, fats, and sugar, the prices of which decreased substantially. Prices of nutritionally-rich food groups – compared to cereals – are relatively less affected by international trade and exchange rate changes but more so by rapidly increasing local and city demand. This rising demand is likely due to recent income growth and rapid urbanization and the high-income elasticities for nutritious foods in Ethiopia. Moreover, local production changes affected prices of nutritious items little, but national price rises were found to have been significantly linked with food price rises in commercial clusters in the country. Changes in transaction costs – fuel and transport costs – explained relatively little of the observed food price changes.

### **Capacity Building**

Two students from Addis Ababa University are conducting their Ph.D. research on the project. One research officer from PSI is working full-time on the project. One collaborator from EIAR is involved in the project doing a qualitative assessment of the dairy value chain. Another PSI collaborator is working on an assessment of export pricing of live animals. Training on data repositories was conducted for 12 persons (7 men, 5 women) from of the Ethiopian Public Health Institute (EPHI). Three training courses on the STATA software package focusing on analysis relevant for the livestock sectors was provided to 81 persons (59 men, 22 women) from EIAR, EPHI, and from different government and non-governmental agencies who are members of the Ethiopian Economics Association (EEA). Trainings on Market Policy and Value Chain Analysis (focus on Agriculture and Livestock) and on Efficiency and Productivity Analysis (focus on livestock) were given to 63 EEA members.

### **Lessons Learned**

1) The combination of new primary data with data from multiple secondary sources (including 2004/05, 2010/11, and 2015/16 survey data from the Central Statistics Agency proved to be a suitable method for acquiring representative data for dairy value chain analysis. A similar approach could be used in other sectors.

The project was granted an NCE until April 16, 2020 (original project end was Oct. 16, 2019).

<a href="#">Mycotoxin prevalence, risk assessment and mitigation measures in Ethiopia</a>	
<b>Focus project, Nov. 1, 2016 – March 31, 2019</b>	
<b>PI Name &amp; Institution:</b> Deon van der Merwe and Yacob Zereyesus, Kansas State University (KSU)	<b>Collaborators:</b> ACIDI/VOCA
<b>Description:</b> This project collaborated with the USDA-funded Feed Enhancement for Ethiopian Development – Phase II & III (FEED II & III) project to assess mycotoxin levels in the Ethiopian feed supply network by sampling feed materials at various farmer cooperative unions. The project also involves enhancing mycotoxin testing capacity of laboratories and building capacity in preventing mycotoxin contamination of feeds.	
<b>Location:</b> Tigray (Mehakelegnaw, Debubawi, Misraqawi, Mi'irabawi), Oromia (Mirab Arsi, Misraq Shewa, Debub Mirab Shewa, Mirab Shewa, Misraq Welega), Amhara (Misraq Gojjam, South Wollo, Agew Awi, Bebug Wollo, Debub Gondar) and SNNP (Gamo Gafa Omo, Wolayita, Sidama, Kembata Tembaro, Hadiya, Silti) regions	

### Theory of Change and Impact Pathway

Mycotoxins in livestock feed reduce feed quality and availability, and they could affect human health through exposure via ASF consumption. Sampling and analysis of feed for mycotoxins combined with improved and more affordable laboratory capacities can lead to improved feed safety, feed productivity, handling practices and ultimately feed policies. As a result, livestock productivity will improve and ASF safety will increase.

### Achievements

**Determination of mycotoxin prevalence:** Earlier on in the project, feed samples were collected at 24 Farmer Cooperative Unions (FCUs) located in the project four regions within the ACIDI/VOCA network. A total of 932 Charm EZ radioimmunoassay aflatoxin tests were conducted. In addition, 107 representative validation samples from 22 locations were analyzed for aflatoxins, fumonisin, vomitoxin, and ochratoxin at the Veterinary Medical Diagnostic Laboratory at the University of Missouri for further analysis using validated High-Performance Liquid Chromatography (HPLC) methods. Aflatoxin was shown to be the most problematic mycotoxin in livestock feed ingredients, with concentrations above the Level of Concern (LOC) found in 31% of samples. Mycotoxin concentrations above the LOC were strongly associated with oil seed cake samples, including oil seed cakes prepared from noug (Niger) seed, sesame seed, cotton seed, linseed, and soybeans. Non-oil seed cake samples, including maize, rice, wheat, sorghum, and raw soybean, were generally associated with low or non-detectable mycotoxin concentrations. No additional research into mycotoxin prevalence was conducted in FY 2019.

**Communication of mycotoxin risk information:** Mitigation options and policy briefings and recommendations were provided to various stakeholders in partnership with ACIDI/VOCA, the Ministry of Agriculture (MoA), the Veterinary Drug and Animal Feed Administration and Control Authority (VDFACA), and the Partnership for Aflatoxin Control in Africa (PACA). Attention was given to discussions of the results with key persons in the Ethiopian feed regulation services responsible for assessing risks and for communicating potentially sensitive information to other stakeholders and the public. The end of project capstone workshop was delayed due to concerns from stakeholders regarding the sensitivity of the research findings. It was converted to an event at which more than just the study results would be presented and that would focus on mitigation strategies and advise on risk communication to the public so it would be more relevant to key stakeholders. Thus, a workshop on “Prevention and Mitigation of Aflatoxin Contamination of Animal Feed and Animal-Source Foods” was held on the ILRI campus on March 26, 2019, with a carefully selected group of participants approved by the MoA and in collaboration with the Management Entity and the USAID mission funded Value Chain Activity. The workshop report was not shared publicly due to the sensitive nature of the data but was shared with government authorities.

### Capacity Building

No training took place in FY 2019 as these had been completed in FY 2017. Over the course of the project, though, 25 individuals (24 men, 1 woman), including 9 government lab personnel, 3 service providers, 8 NGO workers, and 5 individuals from academic or research organizations were trained on topics ranging from biology of fungi; signs of fungal infestation in feeds; toxicology of mycotoxins in feeds; management of mycotoxins in feeds; Standard Operating Procedures (SOPs) for collecting feed samples for mycotoxin analysis; Standard Operating Procedure for analysis of feeds for mycotoxins using the Charm radioimmunoassay aflatoxin tests; and implementing lateral flow testing for mycotoxin in feeds. Additionally, three institutions were provided with technical support through the provision of Charm-EZ readers. These institutions include Mekelle University, Bahir Dar University, and the Ethiopian Institute of Agriculture Research (EIAR).

### Lessons Learned

- 1) Collaboration with an in-country partner, in this case, ACIDI/VOCA, was essential for successful project implementation as it allowed the project build on their earlier work and existing relationships with stakeholders in the livestock feed industry and with FCUs.
- 2) Policy guidance on the sensitivity of data and its impact on various stakeholders should always be sought prior to the release and dissemination of sensitive information.
- 3) After surveys reveal high levels of contaminants in feeds or ASF, joint identification of follow-up studies with key stakeholders is needed to develop effective risk reduction and management strategies.

The project was granted various NCEs until March 31, 2019 (original project end was Oct. 31, 2017).

**Improving handling practices and microbiological safety of milk and milk products in Borana pastoral communities in Ethiopia**

**Focus project, Nov. 1, 2016 – Dec. 31, 2019**

**PI Name & Institution:** Kebede Amenu Ejeta, Addis Ababa University (AAU) and Silvia Alonso, International Livestock Research Institute (ILRI)

**Collaborators:** University of Tennessee (UT), ILRI, United States Department of Agriculture (USDA), Yabello Pastoral and Dryland Agriculture Research Centre, Arsi University

**Description:** This project aims to improve handling practices for milk and dairy products and thus improve food safety for pastoralists in Borana by (1) improving knowledge, attitudes, and practices of women in the areas of milk consumption and handling and the associated health risks, and (2) improving milk storage to maintain its nutritional and hygienic quality.

**Location:** Oromia (Borena) region

### **Theory of Change and Impact Pathway**

Unsafe milk can result in pathogenic transmission, causing human disease (e.g., *E. coli* O157:H7 infection). The impact of smoking traditional wooden milk utensils, a common cleaning practice in southern Ethiopia, on milk quality and leaching of aluminum from containers that could replace the wooden utensils is unknown. Improved milk handling and processing will reduce foodborne disease and improve access to safe ASF for improved human health.

### **Achievements**

**Assessment of knowledge, attitude and practices of women in milk consumption and handling:** Of the 120 women who had been trained on milk hygiene, consumption and prevention methods of milk borne zoonotic diseases in FY 2018, it was possible to interview 119 as part of a post-training questionnaire survey conducted in Q2 FY 2019. Data analysis and interpretation are underway and should be finished by Q1 FY2020.

**Assessment of improved storage containers and smoking of containers:** In FY 2019, the experiment that assessed the effect of smoking traditional containers on the microbial load of yoghurt was repeated due to inconclusiveness of the results. The findings were initially published as a MSc thesis and they are currently under revision. Findings from the assessment of social and cultural acceptability of stainless-steel milk containers for the preparation of yoghurt were presented during the annual meeting the American Dairy Science Association held in Cincinnati in June 2019 and will also be written up as a peer reviewed article for the journal.

**Assessment of presence of foodborne bacterial pathogens in milk and feces:** No additional testing was conducted in FY 2019. Findings from earlier research were presented as a poster at the annual meeting of the International Food Protection Association in Louisville, KY, in July 2019 and as a seminar at a symposium on “Safety of animal-source foods in low-and middle-income countries” at the International Association for Food Protection. In preparation for shipping bacteria isolates for molecular characterization to the University of Tennessee (UT), an attempt was made to resuscitate the bacterial isolates already stored. Resuscitation was successful for 12 out of 25 *Salmonella spp*; 19 out of 21 *E. coli* O157:H7; and 79 out of 94 *Staphylococcus aureus* isolates. Obtaining import permits and the contractual arrangements between ILRI and UT delayed the process of shipping and analyzing samples at UT significantly. It is now expected for the samples to be tested in the US during Q1 FY 2020.

**Suitability of aluminum containers for preparation of traditional yoghurt:** No additional research was conducted under this objective during FY 2019. The FY 2018 experiment showed that aluminum concentration in fifth- and seventh-day yogurt samples was 3.14 and 6.47 times more than the third day. Hence, there is continuous leaching of aluminum from the container into the yoghurt with increased fermentation duration, after adjustment for the aluminum level in fresh milk. Consequently, aluminum cans should not be used for preparation of yogurt. The findings have already been published as a MS thesis and will also be published as a journal article.

### **Capacity Building**

In FY 2019, an end of project workshop was held to share the project results with guests from agricultural research centers, pastoral development offices, NGOs and pastoralists (27 total, 15 men, 12 women). The Master’s student (woman) in Veterinary Public Health from AAU who had contributed to the project graduated in June 2019.

### **Lessons Learned**

- 1) International research collaborations such as being part of LSIL can result in further funding and research opportunities. In this case, being part of LSIL helped to attract additional funding from the Bill & Melinda Gates Foundation and Department for International Development (DFID) for further research on food safety in Ethiopia.
- 2) At the project design stage, project partners should discuss and clarify issues regarding (international) transfer of genetic material. Specifics should be included in contractual agreements between institutions as it will prevent delays at a later stage.
- 3) To prevent delays in project implementation, it is important to allow enough time to procure reagents and laboratory consumables especially if these need to be imported.

The project was granted various NCE until December 31, 2019 (original project end was Oct. 16, 2017).

## Application of integrated decision support systems to improve livestock systems in Ethiopia

Enhance project, May 1, 2019 – July 31, 2020

**PI Name & Institution:** Raghavan Srinivasan, Texas A&M University (TAMU)

**Collaborators:** Innovation Lab for Small-Scale Irrigation (ILSSI) University of Florida (UF), Bahir Dar University, Ministry of Agriculture (MoA)

**Description:** This project uses integrated decision support systems (IDSS) to study improved forages and livestock feed crops and their production, environmental and socio-economic impacts in Ethiopia. The analysis will also evaluate feed strategies for on-farm production and market sale.

**Location:** Addis Ababa (Addis Ababa) region

### **Theory of Change and Impact Pathway**

Insufficient quantity and quality of feed is a key constraint for improved livestock systems in Ethiopia. As large proportions of the population engage in crop and livestock activities, improved understanding of where best to grow which fodder crops is needed. As a result, the livestock system will become more productive and resilient. This will also improve food security.

### **Objectives and Achievements to date**

**Adapt and apply the IDSS to Ethiopia's livestock sector:** The focus in Q3 and 4 FY 2019 was on adapting the Integrated Decision Support System (IDSS) models to inform the livestock sector. The IDSS is a suite of biophysical and socio-economic models, namely the Soil and Water Assessment Tool (SWAT), Agriculture Policy Environment eXtender (APEX), and Farm Income and Nutrition Simulator (FARMSIM). The evaluation of the livestock systems was conducted in sites where data was collected through the Feed the Future Innovation Lab for Small Scale Irrigation and partner projects such as the Africa Rising in Lemo, Robit, Sinana, Debre Birhan and Maychew. The field data has been synthesized in a manner that supports the biophysical and socio-economic models. The main fodder crops have been identified, namely, Napier (*Pennisetum purpureum*), alfalfa (*Medicago sativa*) and desho (*Pennisetum pedicellatum*) for poultry, cattle, or small ruminant production systems, since these were prioritized in the Ethiopian Livestock Master Plan. The biophysical modeling has been established to estimate the fodder supply and demand equilibrium in districts where demand data has been collected by ILRI. Suitability analysis will be done to identify most suitable areas for fodder production across the country. The aim is to estimate the potential to use cultivated forage for livestock production using biophysical and socio-economic analysis. The model will also estimate the potential to produce fodder yield/biomass in all the areas that are deemed suitable to cultivate fodder.

**Use the adapted IDSS to study the impacts of improved forages and feed crops in Ethiopia:** In FY 2020, several livestock technologies and strategies will be analyzed to identify and evaluate systems that increase feed production and quality in Ethiopia. Various land use practices will be analyzed along with bio-physical and socio-economic factors. Land use practices include agronomic practices, grazing management practices, water and land management practices. Bio-physical and socio-economic factors include climate, soil fertility, improved forages, improved seeds, use of inorganic fertilizers, irrigation technologies, availability of labor, and access to markets. Ultimately these analyses will be used to identify optimal forage production systems and their potential geographic locations to inform policies aiming to increase the quantity and quality of forage in Ethiopia. Potential technological, climatic and institutional constraints to the scale up of improved livestock systems will be identified and potential measures to mitigate these constraints will be explored. Importantly, the IDSS analysis will be carried out at both the field and national level, in order to identify the most beneficial technologies and fodder species in specific locations while examining the economic and nutrition outcomes that could be achieved.

**Use the adapted IDSS to study the impacts of improved forages and feed crops in Ethiopia:** In FY 2020, the gaps, constraints and nutrition potential of fodder crops cultivated under small scale irrigation (SSI) will be evaluated. The study will be based on farmers' experience in two different ecological zones in Ethiopia. Fodder samples collected at the time of harvest will be used to evaluate the feed quality and gaps and constraints of the fodder production. The study will be based on farmers' experience in two different ecological zones in Ethiopia. The analysis will be on Napier or Elephant grass (*Pennisetum purpureum* Schumach) production in the Robit watershed which is located in north Ethiopia, and mixed vetch (*Lathyrus cicera*) and oats (*Avena sativa*) in Lemo watershed, which is located in south Ethiopia. The IDSS will be used to assess impacts of SSI at the watershed and field-scale levels. Fodder samples collected at the time of harvest will be used to evaluate the feed quality and gaps and constraints of the fodder production. Thereafter, the mitigation measures to the gaps and constraints will be studied in the fourth quarter.

### **Capacity Building**

So far, no training has taken place, but capacity building activities are planned for Q2 FY 2020.

### **Lessons learned**

None so far. The project is ongoing.

## Modeling livestock system dynamics and economy-wide policy impacts in Ethiopia

Enhance project, April 1, 2019 to May 31, 2020

**PI Name & Institution:** James Thurlow, International Food Policy Research Institute (IFPRI)

**Collaborators:** Policy Studies Institute (PSI)

**Description:** This project aims use modelling to evaluate the livestock system in Ethiopia and its linkages to the broader economy as well as assess alternative national development scenarios and economywide impacts from improved livestock value chains.

**Location:** Addis Ababa (Addis Ababa) region

### **Theory of Change and Impact Pathway**

Understanding the true contribution of livestock to the wider economy is crucial for evidence-based decision making to improve livestock sector performance in Ethiopia. Improved understanding of the linkages between producers and consumers could increase the demand for safe, quality ASF and its consumption, and therefore improve human nutrition.

### **Objectives and Achievements to date**

**Develop a systems-based analytical model that integrates the livestock system within the larger economy:** Progress in developing the livestock-economy model has been made, but model documentation is not yet available because the framework is still being refined and tested. After reviewing alternative model options, FAO's Herd Dynamics Model (HDM) was selected as a starting point, since it is this model that was used for Ethiopia's Livestock Master Plan (LMP), i.e., the current policy-guiding analysis that will be reassessed under the second objective. The HDM tracks animal life cycles and herd sizes separated by sex, breed and age. The specification of the HDM has been completed and the model has been calibrated to historical data. Unforeseen hurdles in the data delayed the process and a data smoothing technique had to be developed. The HDM is currently being validated and refined, with a focus on subnational modeling and trends. A new 2017 Social Accounting Matrix (SAM) and Computable General Equilibrium (CGE) model have been constructed. Ethiopia released re-estimated national accounts data in early 2019 and so it was necessary to rebuild, rather than simply update, the SAM (i.e., the CGE model's core database). As part of this rebuild, the treatment of the livestock sector was also further refined, including separating raw milk and dairy products; and meat from primary livestock (e.g., cattle, poultry, small ruminants, etc.). The new SAM is currently being disaggregated across subnational regions and embedded in the CGE model, along with a new Micro-Simulation Module (MSM) for tracking poverty outcomes. Ultimately, the model will situate the livestock system within the broader agricultural and national economic landscape. It's economywide structure means that it will include equally detailed information on both livestock and non-livestock-related value chains. This will allow the model to compare policies across sectors.

**Use the model to assess future development scenarios for Ethiopia's livestock system:** The economywide model will be used by the project to study how different national economic growth and demographic projections affect the trajectory of the livestock system. The analysis will consider different types of future scenarios to identify robust policy priorities for the livestock sector and how different scenarios influence development outcomes, particularly economic growth, agricultural employment, rates of poverty, and dietary diversity. The team is close to finishing the development of the model, at which point they will conduct the actual scenario analyses.

**Use the model to evaluate economywide impact of policies to enhance Ethiopia's cattle-dairy system:** The third objective of the project is to use the integrated model to examine the economywide impacts of improvements in Ethiopia's dairy system, such as the successful implementation of reforms identified in previous value chain-specific studies, in order to provide potential evidence of net economywide impacts from dairy sector investments for policy makers. The team has started to compile the data necessary to conduct these scenarios, but this work can only start in earnest once the integrated model is completed.

### **Capacity Building**

This project aims to improve human and institutional capacity through the dissemination of scientific publications based on the project findings, presentations given on the research and through capacity-building workshops for policy analysts and researchers, but this has not yet taken place. The PI/project team, separate from this project, has been approached by Ethiopia's Development Planning Commission (DPC) to help them expand their capacity for policy modeling. While not only focused on livestock policy, this engagement with DPC will use the same integrated model developed under this project during any capacity and institution building efforts.

### **Lessons Learned**

1) To avoid future delays, careful planning is crucial at the project design stage, to ensure availability of different team members (especially outside consultants) at different times during the project period.

## e) Nepal – Reach and Enhance Project Reports

<u>Designing and evaluating innovations for development of smallholder female livestock cooperatives in Nepal</u>	
Reach project, Oct. 17, 2016 – Sep. 30, 2020	
<b>PI Name &amp; Institution:</b> Conner Mullally, University of Florida (UF)	<b>Collaborators:</b> Kansas State University, University of Georgia, Nepal Agricultural Research Council (NARC), Interdisciplinary Analysts (IDA), and Heifer International
<b>Description:</b> This project aims to design, implement, and rigorously evaluate 3 innovative and potentially transformative interventions to improve goat value chain functionality in rural Nepal. These include innovations in animal feeding, strengthening of animal health services through community animal health workers, and improving the efficiency and sustainability of cooperatives.	
<b>Location:</b> Eastern (Koshi, Janakpur), Central (Janakpur, Bagmati, Narayani), Western (Gandaki, Dhawalagiri, Lumbini) and Mid-western (Rapti, Bheri) regions	

### Theory of Change and Impact Pathway

Goats are an essential source of income and ASF in Nepal; however, goat ownership, for women, has minimal benefits as the value chain is weak. Improving access to nutritious feed, animal health services and profitable markets will lead to cooperatives producing goats according to market demands, resulting in more household income and resilience through increased goat sales and delivery of animal health services from those trained as community animal health workers (CAHWs).

### Achievements

**Feed and forage trials:** The field, nutritive, and feeding trials with four different fodder combinations were concluded in FY 2018. Some of the forage samples fed to the animals were sent to ICRISAT in Hyderabad (India) for analysis. Delays in shipping the samples caused delay in the finalization of the report and extension materials resulting from the research. This will now happen in early FY 2020.

**SMS platform:** Although the goat marketing platform (i.e., the Virtual Collection Center, VCC, app) appears to be a success with some cooperatives, uptake remains below expectations. To address this, Heifer International undertook refresher trainings designed to increase the use of the app in Q4 FY 2019. Low uptake also motivated the project team to explore alternative strategies for improving goat marketing. The idea to use a call center rather than a smartphone app emerged from those discussions. In collaboration with Pathway, the same firm that programmed the VCC app, Heifer successfully launched a call center with the Banke District Union in September 2019. The call center integrates traders as well as co-ops, giving the demand and supply sides of the market access to inventory information. Although the call center was not setup in a way that lends itself to a formal evaluation, Heifer and the research team will continue to monitor it and assess its potential for a wider-scale rollout. Follow-up data collection for the evaluation of the VCC app will be carried out in January 2020.

**Distance learning platform:** In FY 2019, the Department for Livestock Services approved the curriculum for the Community Animal Health Workers (CAHW). The subsequent training for CAHW candidates was successfully completed in Q3 FY2019 with 58 women receiving their certification to work as CAHWs. Another 36 women included in our study were trained using the traditional classroom system. The difference in the number of trainees reflects the impact of the distance learning system on recruitment, as equal numbers of women (75) were invited to train under each system. The first round of follow-up data collection and midline evaluation will be conducted in January 2020 (six months after training completion). Later, in June 2020, an endline data set will be collected and the final evaluation of the intervention will be carried out.

### Capacity Building

The main training activity was the certification of 94 women as CAHW. Three PhD students (all men) from the Agriculture and Forestry University (AFU) continue their research on animal breeding, pasture fodder use, and animal nutrition with the project. One PhD student (woman, UF) is contributing in the area of use of mobile technology for education, extension, and agricultural aspects. Another PhD student (man, UF) is exploring the benefits to women livestock producers of selling through cooperatives, and the individual, household, and cooperative-level factors that explain heterogeneity in returns to marketing livestock through cooperatives (using the Heifer goat-producing cooperatives as a case study). Dr. Mullally and Co-PI Dr. Nicholas Magnan have been working with a University of Georgia PhD student (1 woman) to develop ideas for research articles to be written using data collected for Objective 3 (Increase the percentage of women CAHWs for improved livestock productivity and the reduction of animal disease).

### Lessons Learned

- 1) A more conservative approach for the adoption of the VCC app by the cooperatives would have been better. For example, a more sensible design would have been to survey a subset of self-help groups (which is what was ultimately done) and introduce the app to them with intensive training on how to use it. The cooperatives would then have the option to extend use of the app throughout their entire membership, but the evaluation of the intervention would not hinge on whether the technology disseminated throughout entire cooperatives. The large size of the cooperatives (500 members each on average), the apparent need for intensive training and monitoring to build momentum to use the app, and constraints on Heifer's capacity to deliver training to widely dispersed cooperative members underline the need for a more targeted approach.
- 2) At the project design phase, a thorough assessment of partner institution's internal functioning is needed to avoid misunderstandings, delays and allow development of realistic timelines.

<a href="#"><u>Strategies to increase milk consumption among children in rural Nepal</u></a>	
<b>Enhance project, March 10, 2019 to Sep. 9, 2020</b>	
<b>PI Name &amp; Institution:</b> Bhola Shrestha, Heifer International Nepal	<b>Collaborators:</b> Tufts University, Tribhuvan University
<b>Description:</b> This project aims to assess the relationship between household milk production and child milk consumption through understanding: 1) the extent to which good husbandry practice behavior change was sustained, 2) other factors related to child milk consumption; and 3) the relationship between milk consumption and child growth outcomes.	
<b>Location:</b> Central (Bagmati) region	

### **Theory of Change and Impact Pathway**

Animal-source foods such as milk can be an important source of nutrients for the growth and development of infants and young children in low-income settings. Improved understanding of household milk production and child milk consumption will help to address possible barriers. As a result, households will diversify diets and improve nutritional status of children through consumption of milk while decreasing household and national spending on malnutrition and disease outbreaks.

### **Objectives and Achievements to date**

The Institutional Review Board (IRB) approval from Tufts university was obtained in May 2019. Approval of research involving human subjects through Nepal Health Research Council was received in August 2019. The project was registered with the Valley Research Group as well as with Dr. Merina Shrestha (Institute of Medicine, Dept of Pediatrics, Kathmandu). A project manager as well as nutrition advisor have been hired. The nutrition curriculum, training materials, and nutrition training implementation (Training-of Trainers and village level components) are being developed. The baseline survey in potential project sites, to aid in identifying suitable households for enrollment, has been conducted. The household questionnaire and developmental testing instrument has been prepared and translated. The plan for training of enumerators (anthropometry, questionnaire administration, developmental testing) is in place. In each of the project sites, the local leaders, health assistants, participating women farmers were briefed about the project objectives, major activities, implementation modalities, importance etc. Field work is scheduled to begin in mid-November 2019. The project also managed to secure additional funding from the Nutrition Innovation Lab (\$30,000) for complementary research as well as from the Livestock Systems Innovation Lab (\$10,000) for milk sample collection and testing for the presence of aflatoxin from the participating households.

**Measure household level Good Hygiene Practices (GHP) practices, milk production and milk consumption:** To examine the sustainability of the behavior change in good husbandry practices measured in prior research, the project will measure the current level of good husbandry practices among the households that were previously trained as well as the amount of milk production over a lactation cycle, the levels of household hygiene and the levels of household milk consumption.

**Assess the relationships between household factors, milk availability, milk consumption and health:** Once data is collected on good husbandry practices, milk production and milk consumption, the project will examine the relationships between these factors. For example, the project will assess the nature of the relationship between household milk availability and child consumption of milk as well as the relationship between social factors and child milk consumption. In addition, the project will assess the relationship between the amount of non-milk dairy products consumed and child milk consumption and the relationship between child milk consumption and child health outcomes.

**Assess the efficacy of nutrition training emphasizing milk consumption:** The project will also assess the efficacy of nutrition education given to households by assessing several factors including 1) whether household that receive nutrition training have children who consume more milk, 2) whether mothers who receive nutrition training have changed knowledge, attitudes or practices regarding child feeding, and 3) whether households exposed to nutrition training have higher levels of milk consumption among non-child household members.

### **Capacity Building**

At this moment we don't foresee the involvement of graduate students in this project, however, this may change if an opportunity arises. We do plan to conduct several short time training courses including training-of-trainer courses starting Q1 FY 2020. This project will disseminate and discuss the project findings with national policy makers as well as district and local decision makers.

### **Lessons Learned**

None so far.

## f) Rwanda – Reach, Focus and Alliance Project Reports

### Enhancing milk quality and consumption for improved income and nutrition in Rwanda

Reach project, Jan. 1, 2017 – July 31, 2020

**PI Name & Institution:** Emily Ouma, International Livestock Research Institute (ILRI)

**Collaborators:** RTI International, University of Rwanda (UR), TechnoServe, Three Stones International (TSI)

**Description:** This project examines the effects of combining nutrition messaging to increase consumption of high-quality milk through the Government of Rwanda’s Girinka one-cow-per-poor family program on milk consumption, and if improving the capacity of cooperatives will improve milk marketing.

**Location:** Eastern (Bugesera, Gatsibo, Kayanza, Nyagatare, Rwamagana), Northern (Gicumbi, Musanze, Rulindo), Southern (Kamonyi, Huye, Nyanza), and Western (Nyabihu, Rubavu) provinces

#### **Theory of Change and Impact Pathway**

To reduce stunting, evidence is needed about the importance of education on benefits of ASF consumption by children under 5 and mothers in poor households, for improved marketing performance of dairy cooperatives, and for the viability of supplying quality milk. As a result, malnutrition in infants will be reduced and overall health of mothers and children improved through better quality milk produced according to milk quality standards and ultimately improving national workforce health and productivity.

#### **Achievements**

**Impact of nutrition education on ASF consumption and nutrition outcomes:** The baseline nutrition survey was completed, and the data analyzed. The final sample size was 686 households (study arms: 234 GIRINKA and social behavior change communication (SBCC), 228 GIRINKA only, and 224 control). There were significant differences in stunting and weight-for-height z-score among the children in the GIRINKA and non-GIRINKA groups. While the report was shared with government staff at national and district levels end of Q2 FY 2019, it has not yet been presented during a technical working group meeting. Three Stones International (TSI) and RTI International developed the SBCC material which includes 5 counseling cards in the same style as the national nutrition counseling cards, a brochure, and a poster. The material was piloted in Q1 FY2019. Subsequently, TSI implemented the trainings for the SBCC intervention using a cascade model. Community Health Workers (CHW) implemented intervention activities throughout FY2019. In preparation for the endline nutrition survey, RTI revised the baseline nutrition survey questionnaire to include additional knowledge questions related to SBCC messages and to measure participants’ exposure to the different components of the intervention.

**Assess and enhance the performance and capacity of dairy cooperatives:** TechnoServe completed an intensive capacity building intervention targeting 4 producer organizations (PO) and a less intense training package targeting 16 POs. Capacity building included exposure visits and business performance reviews. A repeat of last year’s Agricultural Producer Organization Sustainability Assessment (AgPOSA) showed that the POs have improved on all aspects including financial management, governance and operations. The project supported the development of strategies for the individual POs in order to drive milk volumes, quality and profitability. Through Data Sharma, TS was able to develop a Management Information System (MIS) that will enable these POs to improve on data capture and management. The award system involves in-kind support to the 4 POs in order to close identified capacity and capability gaps. After stakeholder consultation, TS developed a Dairy Industry Strategic Plan for the dairy sub-sector in Rwanda to have a deeper understanding of the strategic context of the sub-sector, its performance, overview of the value chain as well as opportunities, challenges and recommendations.

**Evaluate the costs and benefits of supplying quality milk:** In FY 2019, meetings were held with the Rwanda National Dairy Platform to agree on the qualitative dairy value chain map and to obtain values for parameterizing the map using System Dynamics model to assess cost and benefits to dairy value chain actors and the resulting margins due to adoption of the dairy best practices. Subsequently, the model was parameterized, but some values were still missing. These gaps will be filled using data that will be generated from the producer level surveys to be conducted in FY 2020. In FY 2020, University of Rwanda (UR) will also start with the milk testing. This was delayed because of staffing changes at UR and because the UR laboratories where the testing will take place had to be inspected and approved for use by ILRI’s Institutional Biosafety Committee (IBC) and USAID. The USAID approval was obtained on June 7, 2019.

#### **Capacity Building**

Staff from the National Early Childhood Development Program (NECDP) and Rwanda Biomedical Center (RBC) at the national level, Community, Environment, and Health Officers (CEHO) at the district level, and CHWs at the community level were trained to conduct ASF promotion SBCC activities (222 total; 94 men, 128 women). TechnoServe trained 46 farmers on the importance, benefits and concepts of Village Savings and Loan Associations. One Rwandan PhD student (man) in Agricultural Economics from Egerton University in Kenya continues to work with the project.

#### **Lessons Learned**

1) At the project design phase, engagement with the leadership of the relevant government institutions, in this case the NECDP, will help them better understand the research objectives and how they will benefit their work. This will also allow for better planning and budgeting of the project’s activities.



2) To avoid delays in project activities, it is important to work with in-country project partners knowledgeable about the IRB application and renewal process.

The project was granted an NCE until July 31, 2020 (original project end was Dec. 31, 2019).

<u>Milk production practices, udder health and their impact on milk quality, safety and processability in Rwanda</u>	
Focus project, Oct. 17, 2016 – Dec. 31, 2018	
<b>PI Name &amp; Institution:</b> Jean Baptiste Ndahetuye, University of Rwanda (UR)	<b>Collaborators:</b> Swedish University of Agricultural Sciences (SLU), National Veterinary Institute (Sweden), Växa Sverige
<b>Description:</b> The objective of the project is to develop best practices that enhance dairy cow udder health and milk quality in Rwanda. The project investigates factors that affect dairy cow udder health and how the udder health and handling of milk from farms to milk collection centers affects the quality of milk.	
<b>Location:</b> Eastern (Rwamagana, Nyagatare), Northern (Gicumbi), Western (Rubavu, Karongi), and Southern (Nyanza, Kamonyi) provinces	

### Theory of Change and Impact Pathway

Mastitis, or udder infection, compromises productivity and milk quality, resulting in economic losses and diseases in humans. Given their key role in the milk value chain, milk collection centers (MCCs) should test innovative solutions to reduce mastitis. Improved knowledge of mastitis and its mitigation among MCCs and farmers will improve milk safety and, thus, human nutrition through reducing risks of foodborne illness.

### Achievements

**Develop best practices for udder health and identification of zoonotic bacteria:** No further testing was done in FY 2019. To recap, 577 cows had been screened for subclinical mastitis (SCM) using the California Mastitis Test (CMT), and the results showed an average prevalence of 61.7%. The highest prevalence (82%) was recorded in the Northern Province. *Staphylococcus aureus* and non-aureus *staphylococci* species were the most frequently found pathogens in SCM cases; 63.6% of these pathogens were beta-lactamase positive or penicillin resistant (n=327). To evaluate milk quality and safety, the following were measured: total bacterial count (TBC), total coliform, *Escherichia coli* count, somatic cell count, and Brucella antibodies in milk and antimicrobial residuals in milk. Generally, TBC increased during transport from farms to respective MCCs, suggesting multiplication and/or additional contamination during transport. The average total coliform count across all farms visited was  $5.38 \times 10^5$  cfu/ml with a variation between 0 and  $158 \times 10^6$  cfu/ml. There was no increase or decrease in total coliforms during transport from farms to MCCs, suggesting coliforms originate from farms. In total, 9.6% of farm level bulk milk samples tested positive for *E. coli*. Bulk milk at 4 MCCs tested positive for *E. coli* on more sampling occasions (4) than the other MCCs. Hygiene is a challenge especially for MCCs with many single cow holders, and there is a risk of foodborne diseases associated with such milk. Using the i-ELISA assay, Brucella antibodies were detected in 5 out of 337 screened milk samples and *Salmonella* was detected in 44 out of 337 tested milk samples. Antimicrobial residues were detected in 5 out of 408 screened samples from farms and MCCs. While all farmers could immediately see the outcomes of the CMT, many farmers as well as veterinary officers and MCCs workers also expressed keen interest in other results such as SCC, Mastitis etiology and resistance to antibiotics. In early FY 2019, the project team started sharing advanced results with veterinary officers in Rwamagana and Nyagatare, with plans to also share with those at the other sites.

**Training on udder health and milk safety:** Training courses were conducted on best practices for mastitis prevention and control, cow shed management and best practices for milk handling (including sanitation and appropriate ways to store milk), milk safety (potential zoonosis contamination where best practices are not applied), milk quality and the role of milk in human nutrition. Pamphlets on post-harvest handling of milk, cow management and housing, and mastitis prevention were distributed at the trainings. A second, more advanced training for veterinarians, students and extension officers was conducted on udder health and milk quality. The results from evaluations indicated that the project intervention helped MCCs understand a) how mastitis in dairy cows affects bulk tank milk quality at MCC, b) how MCC technicians can carry out and interpret CMT results, and c) MCCs can (and should) itself carry out training of farmers on mastitis prevention and control more often.

### Capacity Building

Overall, 271 persons (187 men, 84 women) under all planned categories were trained on best practices for good udder health and milk quality. This is higher than 236 initially targeted. This was due to large numbers of farmers that needed the training. The vast majority were farmers (223 in total, 152 men, 71 women) from 8 participating MCCs. In addition, 45 veterinarians, students, extension officers and MCC technicians (32 men, 13 women) were trained on udder health, milk productivity and milk quality. The 2 Rwandan Master's students (1 man, 1 woman) who worked on this project graduated in FY 2019. The 1 PhD (man) student, also the PI of this project, is expected to complete his degree in FY 2020. He was honored as the 2019 recipient of the Board for International Food and Agricultural Development (BIFAD) Student Researcher Award for Scientific Excellence in a Feed the Future Innovation Lab.

### Lessons Learned

1) Complementary activities such as improving hygiene on farms and during milk transportation will be needed to maintain and scale the improvements in milk quality/ safety achieved by the project.

- 2) Collaboration with organizations that are more extension- and/or development-focused is needed to scale research-based technologies and knowledge both at farmer's and at agriculture professional's levels.
- 3) Further research is needed to evaluate the efficacy of different interventions to address milk quality in Rwanda.

<u>Challenges of implementing modern milk quality standards in developing countries</u>	
Alliance project, July 9, 2019 - September 30, 2020	
<b>PI Name &amp; Institution:</b> Anselme Shakya, University of Rwanda (UR)	<b>Collaborators:</b> Rwanda Agricultural and Livestock Resources Development Board (RAB), International Livestock Research Institute (ILRI)
<b>Description:</b> This project aims to collect data on the informal milk sector in Rwanda as well as consumer preferences. Data collected on the informal milk sector will be compared to previous data on the formal milk sector and incorporated into an existing model of the milk sector in Rwanda to produce policy recommendations.	
<b>Location:</b> Kigali (Kigali) province	

### Theory of Change and Impact Pathway

Despite formalization efforts, the informal sector is still an important part of the dairy sector in Rwanda. Improved understanding of its magnitude and incorporation of the findings in mathematical models for the Rwanda milk sector will allow for better projections of the milk supply and improve overall milk quality by addressing the bottlenecks. This will result in more evidence-based dairy sector policies and will improve milk safety and, thus, human nutrition through reducing risks of foodborne illness.

### Objectives and Achievements to date

**Compile evidence on actors in the informal dairy sector related to milk quality and milk production:** The compilation of existing literature related to informal dairy subsector in Rwanda in terms of milk quality and overall milk production was initiated in Q4 FY 2019. In FY 2020, data on informal milk market actors will be collected through mixed methods based on the ILRI value chain assessment toolkit. Methods include focus group discussions to elicit consumer preferences and decision-making patterns on milk and milk products, and key informant interviews with value chain actors to understand their business performance and drivers.

**Assess household milk consumption, consumption behavior and preferences:** The project will use a consumer survey to collect data on 1) household milk production, purchase and consumption, 2) timing of peak and low periods for milk production, purchase and consumption, 3) importance of milk quality attributes for consumers, 4) knowledge about product certification, and 5) changes in purchase or consumption levels based on milk prices in the formal and informal sector. The survey will cover both men and women respondents from each household to examine potential gender-differentiated preferences and to understand the role of women in household behavior preferences regarding milk quality.

**Evaluate microbiological milk quality attributes:** At each node of the informal milk value chain the project will collect milk samples, which will undergo microbiological and physicochemical analyses. Factors that will be analyzed include total mesophilic count, total coliforms, *Staphylococcus aureus*, somatic cell count, density, and acidity among others. The results obtained from these analyses will be compared with previous results from the formal milk sector.

**Expand the systems dynamic model to include informal milk marketing:** Using the data collected on milk actors for parameterization, the project will expand the systems dynamic model (SDM) at ILRI to incorporate the informal milk sector including milk producers, collectors, traders, retailers, processors and consumers. The SDM will then be used to assess the distribution of costs and benefits accruing to the various nodes of the value chain in both the informal and formal sector. This information can help to inform policy makers on best practices for upgrading the milk sector in Rwanda.

### Capacity Building

Students (Bachelor's and Master's level) will be recruited from the University of Rwanda's (UR) programs in Food Science and Technology, Rural Development and Agricultural Economics Department. The students will participate in data collection activities as well as in laboratory analysis. The students will be invited to stakeholder meetings to expose them to how science-based evidence is communicated to various stakeholders and policymakers to facilitate informed decision-making. So far, two students have been identified (1 man, 1 woman).

### Lessons Learned

- 1) At the project design phase, all participating institutions should obtain the required USAID information such as the U.S. federal System for Award Management (SAM) registration number and the lead organization should share an example of a contract with other subawardees. This will avoid delays in starting the project.

## g) Non-competitive Project Reports

<u>Gender in Livestock Systems</u>		Oct. 1, 2017 – Sept. 30, 2020
<b>PI Name &amp; Institution:</b> Kathleen Colverson and Renata Serra, University of Florida (UF)	<b>Collaborators:</b> N/A	
<b>Description:</b> This project aims to integrate gender throughout the subaward research projects through 2 objectives, which are: 1) to enhance the gender components of Livestock Systems Innovation Lab funded-research, and 2) to enhance the human and institutional capacity of Livestock Systems Innovation Lab partner institutions in focal countries.		
<b>Location:</b> Burkina Faso, Cambodia, Ethiopia, Nepal, Niger and Rwanda		

### Theory of Change and Impact Pathway

Understanding the roles that men and women play in livestock value chains can inform technologies and interventions to increase gender equity and household food security. Promoting and integrating gender-sensitive livestock training and knowledge within the current research portfolio can address gender constraints along the value chain and within households, which will enable women to be more empowered to make decisions that improve household nutrition and ASF consumption.

### Achievements

In Q1, assistance was given by Dr. Colverson to the individuals who attended two gender trainings she organized on “Integrating Gender and Nutrition into the Livestock Research Project Planning Cycle” in Rwanda and Ethiopia. Dr. Serra attended the Innovation Platform (IP) meeting in Niger and provided support to PIs on how to integrate gender early on in their data collection and analysis efforts. In Q3, Dr. Colverson reviewed and edited Dr. Kebede Amenu’s dairy training manual “Improving Handling Practices and Microbiological Safety of Milk and Milk Products in Borana Pastoral Communities, Ethiopia” to better integrate gender and provide effective assessments for pre and post training knowledge gained by workshop participants. Also, in Q3, Dr. Serra consulted with Dr. Connor Mullally regarding overlap for research in Nepal on his Reach project with the newly funded IDRC project “Leveraging Intersectionality for Integrating Gender in Livestock Vaccine Value Chains.” Over the course of the year, several resources were added to the Livestock Systems Innovation Lab Gender [webpage](#), including the annotated bibliography from FY 2018, the facilitator’s manual on “Integrating Gender and Nutrition into the Project Cycle of Livestock Research”, training material on “Integrating Gender and Nutrition into Food Safety Concerns in the Pork Value Chain” as well as two infographics (“Empowering Women in Livestock Value Chains”, “Gender and Livestock Production”). Dr. Colverson and colleagues from the University of Florida and the International Livestock Research Institute (ILRI) completed an article for a special issue of the Global Food Security journal entitled “Evolution of a Gender Tool – WEAI, WELI and Livestock Research”. Dr. Serra is collaborating with Dr. McKune (Nutrition CCT) and one graduate student on a technical paper titled “Gendered norms, women’s empowerment and food taboos: implications for dietary diversity”. Plans are to present the paper at meetings and conferences during FY 2020. A methodology was developed for use in FY2020 to harvest gender learnings from the funded projects.

### Capacity Building

Dr. Colverson worked with Lacey Harris-Coble, research assistant in the ME, to develop a literature review and PowerPoint presentation on the topic of “Food Taboos and Gender Myths Surrounding the Consumption of Animal Source Foods.” The literature review was incorporated in a PowerPoint presentation titled “Equity and barriers to animal-source food (ASF) consumption in low- and middle-income countries” given by Dr. Adegbola Adesogan at a conference in May at the University of California, Davis. In April, Dr. Colverson provided an interactive seminar to the UF Gender Working Group on “Why Can’t I Eat This? Animal Source Food Myths and Taboos from a Gender Perspective” (ca. 20 participants). Also, in April, Dr. Serra gave a lecture titled “Gender Integration in Agricultural Value Chains – with a focus on livestock” to students in the Masters’ in International Cooperation and Development (Mid-Western University) in Kathmandu, Nepal. The lecture was attended by about 20 students and generated much interest in follow-ups and future collaborations. Dr. Colverson gave a presentation to two veterinary student groups at UF on “Why Integrate Gender into Livestock Research?”.

In response to requests made by partner organizations at the Innovation Platform meeting in Ethiopia and leveraging funds from the projects funded by the Bill & Melinda Gates Foundation in collaboration with Department for International Development (DFID), two workshops on “Integrating Gender and Nutrition into Food Safety Issues in the Beef and Dairy Value Chains” were conducted at Haramaya and Addis Ababa Universities in Ethiopia in August 2019.

### Lessons Learned

- 1) For future projects, sensitization and training sessions should be provided to PIs at the project design phase or shortly after a project is awarded.
- 2) To improve gender related learning, a gender specialist should attend all in-country Project and Innovation Platform meetings and a gender section could be added to the quarterly reports. For this to be successful, enough staff time needs to be allocated to the gender team.

<a href="#">Human Health and Nutrition</a>		Oct. 1, 2017 – June 30, 2020
<b>PI Name &amp; Institution:</b> Sarah McKune, University of Florida (UF)	<b>Collaborators:</b> N/A	
<b>Description:</b> This project aims to integrate human health and nutrition throughout the subaward research projects through 2 objectives, which are: 1) to enhance the human health and nutrition components of Livestock Systems Innovation Lab funded-research, 2) to enhance the human and institutional capacity of Livestock Systems Innovation Lab partner institutions in focal countries.		
<b>Location:</b> Burkina Faso, Cambodia, Ethiopia, Nepal, Niger and Rwanda		

### Theory of Change and Impact Pathway

Increasing ASF consumption is influenced by gender, socio-cultural factors, and income, among others. Improved nutrition and health can also be compromised by risks posed by ASF-borne pathogens, mycotoxins and environmental enteric dysfunction. Technical support for evidence-based research on the effects of ASF consumption, behavior-change interventions, and innovations can improve nutrition, growth and cognitive development, especially of children and women.

### Achievements

#### Enhance human health and nutrition research components

Through multiple virtual meetings and email exchanges to discuss changes in research methodology, Dr. McKune has supported the ILRI Reach project in Rwanda led by Emily Ouma in Rwanda. Originally planned for Feb 2019, the CCT lead has been in ongoing contact with H3N, the Nigerien nutrition program, and is awaiting their invitation to collaborate. Activities are now tentatively planned for Q2 FY2020. The Nutrition CCT has collaborated with the ME on two articles that were recently published in *Animal Frontiers* journal and another one “Animal source foods: contributions to food and nutrition security” that was presented at the Global Agenda for Sustainable Livestock (GASL) meeting in Manhattan, Kansas in September 2019. Dr. McKune is working with Dr. Adesogan’s research lab to develop a meta-analysis of ASF impact on child development and, possibly, mental health; to be published in FY 2020. She also contributed to the development of a paper on the value of ASF and the problem with current discourse around the problem of meat consumption rather than its value to the world’s most vulnerable. The paper, titled “Sustainable diets must include animal-source foods” was approved for publication in *Global Food Security*. Dr. McKune also finalized analysis and drafting a paper for the special edition in *Global Food Security*, which focuses on nutrition in livestock programs and reaching the goal of nutrition and ASF consumption. An annotated bibliography of research related to animal source food consumption is being continuously updated by Dr. McKune’s research lab. Analysis of the interaction between women’s empowerment and dietary diversity was initiated over summer 2019. A postdoc. Researcher, as well as a PhD, and an MPH student are working to analyze the data. An abstract has been accepted by the Nutrition Innovation Lab for presentation at their Nutrition Symposium in Kathmandu in December 2019. Lastly, Dr. McKune is also working closely with the ME and USAID on mechanisms for shifting narratives around ASF consumption and its value to infants and young children.

#### Capacity Building

Though no student was directly funded on the CCT Nutrition project last fall, several students were involved in Dr. McKune’s research lab and worked on Nutrition/ASF related work of benefit to the Lab. in the following areas: a) Re-analysis of Dr. McKune’s dissertation data from Niger to look at relationships among ASF consumption, resilience, climate change, and livelihoods (1 MPH student, 1 MHS student, and 1 PhD student in One Health); b) Re-structure and drafting of a paper looking at pathways from livestock to human nutrition in Ethiopia, Niger, and Nepal (2 MDP students and 1 PhD student); c) Research and development of a proposal to investigate the impact of egg consumption on children during the first 1000 days, written for Honduras and Haiti (5 MDP students and 1 MPH student); d) Development of a paper looking at livestock, resilience and ASF in Niger (1 MDP student and 1 Master’s student); e) Development of the Nutrition CCT Thematic Working Group paper (1 MPH student); f) Systematic review of barriers to ASF consumption in Ethiopia (1 MPH student); g) Annotated Bibliography on ASF consumption (1 undergraduate public health student).

#### Lessons Learned

- 1) Development and submission of manuscripts to peer reviewed journals takes a long time with processes varying in length depending on the journal.
- 2) Continued effort must be put into discussing the positive role that ASF can and does play in diets of poor populations around the world, especially given the negative coverage of livestock and ASF in the context of climate change.

## Human and Institutional Capacity Development

June 1, 2017 – Sept. 30, 2020

**PI Name & Institution:** Sandra Russo, University of Florida (UF)

**Collaborators:** N/A

**Description:** This project aims to build human and institutional capacity in Livestock Systems Innovation Lab focal countries and partner institutions through 2 objectives, which are: 1) to identify the Human and Institutional Capacity Development (HICD) issues within key Livestock Systems Innovation Lab partner institutions, and 2) to develop and conduct activities that fill HICD gaps in targeted Livestock Systems Innovation Lab partners in order to improve research in ASF systems.

**Location:** Burkina Faso, Cambodia, Ethiopia, Nepal, Niger and Rwanda

### Theory of Change and Impact Pathway

Knowledgeable livestock systems scientists, extension systems (public and private), and organizations are essential for the development of livestock innovation systems. In the absence of infrastructure or equipment support, it is crucial to fill Human and Institutional Capacity Development (HICD) gaps, provide support to ongoing research efforts, and facilitate an enabling environment for the dissemination and adoption of livestock technologies, practices and policies. Such support creates added value and improves national systems research.

### Achievements

The HICD team conducted multiple technical training courses and developed training materials to address some of the knowledge gaps identified during FY 2017 and FY 2018. Topics included R statistical package, Qualitative Research Methods, and Proposal writing. The team also worked with AFU to establish an Institutional Review Board (IRB). The materials developed for AFU will be converted into more generic documents to expand their use to other countries. Institutional capacity was further developed through the Livestock Systems Innovation Lab's activities with universities, government agencies, research institutions, producer organizations and women's groups.

**Identify HICD gaps:** In FY2019, a full HICD gap analysis was conducted in Rwanda, working closely with the University of Rwanda College of Agriculture, Animal Sciences and Veterinary Medicine (UR CAVM), and the Rwanda Agricultural and Livestock Resources Development Board (RAB, a research arm of the Ministry of Agriculture and Animal Resources (MINAGRI)). Interviews with representatives from the private sector and NGOs were also conducted as part of this assessment. In Niger and Burkina Faso technical trainings began in Q3 FY 2019 and organizational capacity development was started with a focus on the assessment of research laboratories. During Q3 the HICD team traveled to Cambodia to meet with the Animal Science and Veterinary Medicine faculty at the Royal University of Agriculture (RUA) to discuss their 10-year plan and their needs for curriculum development support within this plan. In FY 2020 the HICD team will be conducting two short-term activities in support of this plan.

**Develop and conduct activities to address HICD gaps:** Numerous training courses focusing on various research methodology related aspects as well as statistics in R were conducted in Ethiopia, Nepal and Rwanda. See section VII for details on the individual training courses. A train the trainer program for veterinary services and paravet organizations, on "Recognition and Reporting: Transboundary Animal Diseases" was implemented in Niger in partnership with International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and in Burkina Faso in partnership with the Environmental Institute for Agricultural Research (INERA). Four training courses were conducted at the University of Florida in partnership with the Master of Development Practice program and with students working on Livestock Systems Innovation Lab activities. The team supported the Agriculture and Forestry University (AFU) in Nepal in writing a paper on higher education policy, which was disseminated to policymakers in Nepal in Q3 FY 2019. Another FY 2019 activity with AFU was the development of an ethics review protocol and the establishment of an Institutional Review Board (IRB) at AFU. Two manuals were finished in Q4, one focusing on ethics in animal research and the other in ethics in non-medical human subjects research. Both manuals are under review by AFU. The plan is to collaborate with AFU to develop training materials to accompany the manuals in FY 2020. Seven manuals were completed or under review by the ME, covering topics addressed in the short-term on the courses outlined above. Furthermore, the team has been developing an online series of short "just in time" trainings. The current trainings completed are "The HICD Process" and "Developing a Manual for Training of Trainers." The HICD team collaborated with the Food Security Policy Innovation Lab, Wageningen University, the International Food Policy Research Institute (IFPRI), and the USAID Washington, DC bureau to develop a process for analyzing gaps in capacity development within the agricultural innovation systems framework (CDAIS). During Q4 the HICD team and Management Entity staff participated in workshops in Addis Ababa and Washington, DC with the CDAIS team to test and finalize the tools and deliverables for the CDAIS project. This will include the launch of a website which will occur during Q1 of FY2020.

### Lessons Learned

- 1) Having intensive 1-2 week training courses with a reduced number of faculty with a follow-up training within six months proved to be an efficient approach to strengthen capacity in target counties.
- 2) Future projects should consider embedding faculty longer term in our partner institutions to maximize learning.
- 3) The HICD Gap Analyses of the livestock research system have proven to be useful documents for university administrators as well as the LSIL ME as they inform the possible next steps regarding HICD.

**PI Name & Institution:** Renata Serra, University of Florida (UF)**Collaborators:** N/A**Description:** This project aims to examine the enabling policy environment for livestock systems in Livestock Systems Innovation Lab focal countries by: 1) producing evidence on the policy priorities in each focal country, 2) providing subawardees with support to improve the policy relevance of their research and to communicate relevant policy recommendations, and 3) contributing to policy dialogue with in-country policymakers and Livestock Systems Innovation Lab partner institutions through policy roundtables.**Location:** Burkina Faso, Cambodia, Ethiopia, Nepal, Niger and Rwanda**Theory of Change and Impact Pathway**

Research is necessary to achieve sustainable intensification of livestock systems, yet the current livestock systems policy environments in the focal countries lack scientific knowledge and dialogue about technologies, interventions, and practices for the sector to thrive. Workshops, knowledge dissemination, and policy support to research projects will increase knowledge among stakeholders of policy options and innovative solutions, leading to their implementation at a national level.

**Achievements**

**Policy evidence and dialogue:** Early in FY 2019, qualitative and quantitative research activities using an electronic network survey and Key Informant Interviews (KII) were carried out in Niger and Burkina Faso to understand the interrelatedness of the various organizations involved in livestock policy setting. Dr. Serra and Joanna van Asselt participated in the IP meetings of the two countries respectively, and conducted interviews with representatives from the government, private sector, universities and development partners. A similar research activity took place in Nepal right after the Annual General Meeting in conjunction with the Monitoring and Evaluation team, by combining the focus on enabling policy environments with attention to the factors that facilitate, or prevent, innovation dissemination in the country. This was reflected by an expanded electronic survey module and modified guide for KII. The report on the findings from the research will be completed in early FY 2020. Dr. Serra worked with the Human and Institutional Capacity Development (HICD) team to facilitate dialogue and supporting discussion on possible options to bridge the gap between institutions involved in agricultural research, teaching and extension in Nepal. In Q4, a Policy Round Table was conducted in Rwanda which was well attended by representatives from Universities, civil society, donors and private sector. A report is being finalized and is about to be shared to all participants, with summaries of what was discussed and recommendations on ways forward. A brief highlighting the main lessons from this experience to be posted on the Lab's website and shared more widely will be produced during Q1 FY 2020.

**Policy support:** In Q3, Renata Serra gave a plenary presentation during the Annual General Meeting (AGM) in Kathmandu focused on best strategies to integrate key thematic and country-specific policy issues into research and project activities. The session was attended by over 30 participants (subawardees) and generated lively and pertinent discussions. Several country groups made plans to turn commitments into practice and discussed how different actions could be undertaken over the following months. Dr. Serra worked with two research teams (led by Dr. Maier and Dr. Ouma respectively) and helped them to convert some of their research materials into Briefs. After many rounds of feedback and input the policy brief based on the research conducted by Dr. Sah in Nepal was completed and presented at the AGM, however the External Advisory board (EAB) requested further revisions. The revised brief will be shared for comments at the first EAB meeting in Q1 FY 2020. Dr. Serra recorded [two short videos](#) on the topic of Bridging Research and Policy; in these videos she explains the reasons why this gap needs to be bridged and reviews some steps and modalities to better link research and policy activities. These two communication products have been shared widely with participants who attended the Rwanda policy session (see below) but will be shared more broadly with all other partners of the lab. The videos produced are high quality and have the potential to reach and communicate to a wider audience than webinars.

**Capacity Building**

Dr. Serra conducted a policy discussion session at the Niger Innovation Platform meeting focusing on how best to coordinate various in-country activities in the livestock policy domain and how to organize a platform meeting that is successful and highly participatory. Several informal training and mentoring activities were conducted by the Policy team as by-products of its numerous planned and reported activities. At UF, Dr. Serra holds works closely with 2 MS students (1 man, 1 woman) who contribute to various topics. One MS student also traveled to Nepal for his field practicum in Q3 FY 2019.

**Lessons Learned**

- 1) Despite the use of different methods for eliciting responses, the response rates to electronic surveys remains low in all target countries and alternative methodologies are needed for future research.
- 2) Having an agreed process and format for LSIL policy briefs will help shorten the time to develop them.
- 3) Having more staff time to conduct LSIL policy work will help complete the deliverables in a shorter time.

<a href="#">Future Livestock Systems</a>		<b>Dec. 13, 2017 – Sept. 30, 2020</b>
<b>PI Name &amp; Institution:</b> Greg Kiker, University of Florida (UF)	<b>Collaborators:</b> International Livestock Research Institute (ILRI)	
<b>Description:</b> This project aims to examine future livestock systems through 2 objectives, which are: 1) to understand and predict future drivers influencing ASF production systems, and 2) to develop analytical and modelling tools to analyze ASF value chains.		
<b>Location:</b> Burkina Faso, Cambodia, Ethiopia, Nepal, Niger and Rwanda		

### Theory of Change and Impact Pathway

Improved understanding of current ASF production and consumption contexts, drivers, and potential future scenarios is key to understanding how technologies, practices, and policies should be targeted, adapted, and disseminated in the future. Modeling and scenario analyses of potential impacts of changes in technologies, practices, and policies related to ASF production, marketing and consumption will identify and highlight areas for prioritization and investment.

### Achievements

**Future livestock systems scenarios workshop:** Four short video modules were recorded to provide information and background for in-country partners, also as preparation for scenario workshops. The Future Livestock Systems and Enabling Livestock Policies and the Human and Institutional and Capacity Development teams collaborated to conduct a Future Livestock Systems workshop in Kigali, Rwanda (September 11-13, 2019). The workshop had 35 participants including representatives from the government, non-governmental organizations and private enterprises. The meeting analyzed four future scenarios with respect to the Rwanda Livestock Master Plan. Each scenario highlighted both opportunities and challenges within each potential future.

In Q4 FY 2019, a team member had meetings with World Health Organization (WHO), World Organization for Animal Health (OIE) and the United Nations Food and Agriculture Organization (FAO) officials who have interest in developing a scenario planning manual for Anti-Microbial Resistance (AMR) issues. This work will start in FY 2020.

**Future systems modelling:** In collaboration with ILRI, the effects of tenure reform induced grazing access alterations on rangeland productivity and household wellbeing in pastoral communities of Dirre grazing unit of the Borana in Ethiopia are being modelled. In Q3, USAID/BFS representatives received a research briefing on this work and a journal article is in progress. Other models are being fine-tuned: 1) A basic network description was completed to classify and describe data in terms of livestock traded and country/market-level connectivity in West Africa. Additional analysis was conducted to explore the resilience of the trade network to historical disruptions. A paper on “Network Analysis of livestock trade in West Africa” is in its second review by PLoS One. A technical report and recorded web module on “Network description of the West African Livestock Trade Network from the Permanent Interstate Committee for Drought Control in the Sahel (CILSS in French) database: 2013-2017” will be released after acceptance of the above journal submission. An animal trade network model is also under development; 2) Work continues on the system dynamic, value chain model and global sensitivity/uncertainty analysis, with a corresponding paper on Gender-sensitive small-ruminant value chain modelling in the Lowveld of Swaziland being in preparation for peer reviewed journal submission; 3) A household model using FARMSIM (Farm Income Simulator) and Agricultural Policy / Environmental eXtender (APEX) is being refined. Development and/or adaptation of these models is relevant to the Lab’s work as it will allow to apply similar methodology to datasets generated through the Lab’s research projects.

In early FY 2020 a video module on Household modeling and Livestock Systems – An Example with FARMSIM and Rwanda will be recorded and a technical brief on “Integrating household food security, livestock-based interventions and gender in rural households using the FARMSIM/APEX model” will be published. Further discussions included talks with Heifer International personnel to collaborate in using Heifer-Nepal data to test value chain models. In Q3 FY 2019, ILRI partners (Drs. Thornton and Enahoro) published the [IMPACT projections](#) for the Lab’s focal countries.

### Capacity Building

Two UF PhD candidates (women) are working as part of this AOI. In FY 2019, one presented research findings at four and the other at one conference. A Zimbabwean Research Fellow (woman) at ILRI-Nairobi is finalizing her PhD on the effects of tenure reform explained above at the University of Nairobi and is working closely with Dr. Greg Kiker. One UF Masters in Development Practice student (female) is being supported, together with the Gender and Nutrition CCT, in mapping the goat value chain with respect to vaccine and gender.

### Lessons Learned

1) Thorough preparation with in-country partners, other project collaborators and the LSIL ME resulted in a successful scenarios workshop in Rwanda. This approach will be used for future workshops.

## **h) Other non-competitive activities**

In FY 2019, the Management Entity also conducted short-term training courses in Cambodia and Niger. The topics for these trainings were identified and prioritized as part of the Human and Institutional Capacity Development (HICD) gap analysis and the challenges to ASF production and consumption identified during the scoping visits and Innovation Platforms.

### **i. Twinning between University of Florida (UF) and Royal University of Agriculture (RUA), Cambodia: Theriogenology, Mushtaq Memon**

Dr. Mushtaq Memon, Emeritus Washington State University (WSU) professor, presented a 10-day training course (6 hours per day) for faculty and last year students at RUA, Cambodia. Dr. Memon was assisted by 2 clinicians from the RUA veterinary teaching hospital and training course participants. The main course objective was to enhance the capabilities of current and future veterinarians in animal reproduction technologies, infertility diagnoses and the prevention and treatment of reproductive diseases. The course included several practical hands-on sessions which were highly appreciated by the trainees. There were 14 participants (11 men, 3 women).

### **Animal Welfare and Statistical Analysis, Tony Oltenacu**

Dr. Oltenacu, Emeritus UF professor, presented a 5-day workshop (4 hours per day) at RUA focusing half of the time on animal welfare and the other half on statistical analyses in animal science. The animal welfare course consisted of six modules that focused on animal welfare science, assessing the welfare of animals on farms and in the lab, the influence of the marketplace on animal welfare, livestock welfare controversy case studies, the connection between animal welfare and food regulations, and how animal welfare is used in research regulations. The statistical analysis sections of the course were designed to provide attendants with a deeper understanding of appropriate experimental designs and statistical methods commonly used in animal science. For 3 days (4 hours each day), attendants were introduced to several statistical procedures and how to apply them to data from laboratory and field experiments using appropriate software. Emphasis was placed on statistical concepts and principles, design of experiments, error control, testing of hypotheses, and communication of findings to other scientists, as well as data management. There were 42 participants (31 men, 11 women).

### **Animal Genetics, Raluca Mateescu**

Dr. Mateescu, UF Animal Genetics professor, presented a 5-day workshop (4 hours per day) at RUA focusing on animal genetics. The short course included examination of principles of livestock inheritance, basic principles of Mendelian, population and quantitative genetics as applied to improvement of domestic animals. In addition, basic principles of selection, inbreeding and crossbreeding strategies for genetic improvement of livestock were discussed. Quantitative trait loci (QTL) mapping strategies and functional genomic approaches used for genomic selection and improvement programs in livestock animals were also mentioned. There were 42 participants (31 men, 11 women).

### **ii. Training Workshop on One Health – Disease Surveillance Systems & Data for Decision Making in Niger**

In Q3, FY 2019, Dr. Jorge Hernandez, co-leader of the AOI on Livestock Disease Management and Food Safety, facilitated a One Health workshop. Former Peace Corps volunteers in Niger, Mr. Thomas and Mrs. Patsy Lightbown, co-funded this activity by paying for Dr. Hernandez's airfare. The training was co-facilitated by three researchers from Niger working in Academia and the National Veterinary Laboratory. The 3-day workshop took place in Niamey, Niger for 17 participants (14 men, 3 women). The main objective of the workshop was to examine and apply epidemiologic methods and techniques used for formulation, implementation, and evaluation of disease surveillance systems in human and livestock populations in Niger. Participants came from various universities, research institutes and government agencies. There were 17 participants (14 men, 3 women).



## i) Bill & Melinda Gates Foundation funded Equip project

<b>Campylobacter Genomics and Environmental Enteric Dysfunction (CAGED) subproject</b>	
<b>Equip project, Nov. 27, 2017 – Dec. 31, 2022</b>	
<b>PI Name &amp; Institution:</b> Arie Havelaar, University of Florida (UF)	<b>Collaborators:</b> Haramaya University (HU), Ohio State University (OSU), Washington University in St. Louis (WU)
<b>Description:</b> The project aims to increase understanding of how smallholder poultry production, an endeavor largely undertaken by women, can be improved so that the positive impact of household poultry production on child nutrition is maximized.	
<b>Location:</b> Haramaya woreda, East Hararghe Zone, Oromia Region	

### Achievements to date

**The ethnographic research** was conducted in four kebeles of Haramaya woreda in Ethiopia from April through June 2018. This research generated in-depth data of local community contexts, socio-cultural beliefs and practices, and social organization in relation to poultry, dietary intake, water, sanitation and hygiene (WASH), and child growth as they pertain to *Campylobacter* epidemiology. These data have been used to finalize the cross-sectional study design and other studies as well as establish a working relationship at the community, regional, and national levels necessary for data collection in this area.

**The cross-sectional study** involved 102 children 12-16 months of age who were selected randomly from five kebeles of Haramaya woreda and examined for the prevalence of infection with *Campylobacter* spp., environmental enteric dysfunction (EED), and stunting. Fecal samples were obtained from livestock (chickens, cattle, and goats) in the households of these children. Detailed questionnaires were administered to mothers or guardians of the study participants and their male partners. Data analysis included descriptive, univariate, and bivariate statistics and general mixed-effects regression models. Diarrhea and fever were frequently reported. Rates of breastfeeding at birth and at the time of data collection were high, and most children were introduced to other foods after six months of age. Only half of the children met the definition of having been exclusively breastfed, due to the common practice of giving some other food directly after birth. Dietary diversity of most children did not meet the minimum threshold. A majority of children consumed grains, roots, and tubers, and legumes and nuts. Just over half of children had consumed dairy products in the previous 24 hours, while 5% had consumed eggs. Sanitation was generally poor with high levels of unimproved latrines and open defecation. Most households had access to an improved source of drinking water with 42% needing more than 30 minutes to collect it. Approximately half of households had no chickens or did not keep them in the house overnight. Of the households who kept chickens in the home overnight, approximately half did not confine the animals. Half of women achieved an aggregate score reflecting adequate empowerment, with lowest population level empowerment in the domains of Time and Access and Decisions about Credit. *Campylobacter* prevalence in children was 50% by conventional Polymerase chain reaction; culture assays were not completely successful. Speciation by PCR identified *C. jejuni* in 13 children, *C. coli* in 2 children while other species were detected in 36 children. Metagenomic sequencing confirmed the presence of the *C. jejuni/coli* group, and also identified several non-thermotolerant *Campylobacter* species, with *C. hyointestinalis* as the dominant species. EED prevalence was 50%, based on combined results of dual sugar absorption test and concentration of fecal myeloperoxidase. 41% of children were stunted, 5% were wasted. No significant relationships were observed between stunting, EED, *Campylobacter*, and potential explanatory variables. Note that the study was powered for prevalence estimation.

**A coop experiment** aimed to test if chickens can be confined in movable poultry houses. In-depth interviews with farmers were performed. Coops were accepted by households, but feed supply was considered critical. Placing coops reduced visible chicken droppings outside the homes by 88-100%. Chicken feeding behavior and activity was not affected by coop placement.

**Next steps:** Of the five go / no-go criteria to decide on proceeding with the Cluster randomized controlled trials (CRCT), four (prevalence of stunting > 30%, prevalence of EED > 30%, prevalence of *Campylobacter* in children > 30%, reduction of visible chicken droppings by coop placement > 75%) were confirmed by the formative research. An evaluation of the attribution of *Campylobacter* infections to children has not been achieved because of technical problems while isolating pure cultures. It was concluded that there is not sufficient evidence to go ahead with the CRCT as originally proposed. A longitudinal study to understand the species composition, reservoirs, and transmission pathways of all *Campylobacter* species is currently planned. This study might inform the design of later intervention studies.

### Capacity development

The subproject involves 7 students: 1 PhD (man), 5 Master's (2 men, 3 women) and 1 Bachelor's (woman).

### Lessons learned

- *Campylobacter* in other species beyond poultry is poorly understood and more research is needed.
- The need for a strong field team supported by a laboratory team is key to the success of the project.
- More effort should be made to work using methodologies and materials that require minimal cold chain storage.
- Undernutrition is a key problem in the area, as is poor WASH practices related to human and animal excreta.
- Effectively working in the area requires active investment in community involvement which is vulnerable to social tensions within but also outside of the study area due to amplification of messages through social media. The success of the project depends strongly on proactive attitude of the local partner.

<b>Feed Subproject</b>		<b>Equip project, Nov. 27, 2017 – Dec. 31, 2022</b>
<b>PI Name &amp; Institution:</b> Adegbola Adesogan, University of Florida	<b>Collaborators:</b> See below.	
<b>Description:</b> The project aims to 1) In Ethiopia increase the number and productivity of cattle through improvements in feeding as well as genetics and health, and thereby grow the domestic cow milk production; 2) In Burkina Faso increase animal productivity and production, with a focus on harvesting and conserving natural forages, use of agricultural byproducts, intensification of forage production and increased procurement of concentrates.		
<b>Location:</b> Ethiopia: Tigray, Oromia, Amhara, Southern Nations, Nationalities, and Peoples (SNNP) Regions; Burkina Faso: Sahel. Central and Western region.		

**Achievements to date.** These are described under the following five subcomponents.

<b>Subcomponent 1:</b> Inventory feed resources through a landscape analysis, to document the quantities, nutritional qualities and prices, availability and accessibility of feeds that can be used to improve livestock productivity.	
<b>PI Name &amp; Institution:</b> For ET: Dr. Adugna, Hawassa University For BF: Dr. Ayantunde, International Livestock Research Institute (ILRI)	<b>Collaborators:</b> For ETH: Ethiopian Institute for Agricultural Research (EIAR), Tanager-ACDI/VOCA and ILRI For BF: Institute de l'Environnement et de Recherche Agricole (INERA)

**Ethiopia:** A review of available feed resources in Ethiopia and their nutritional contents is ongoing from ILRI and EIAR feed databases and grey literature. Feed types identified so far include; Agro-industrial by-products; fodder trees and shrubs; cereals and legumes, greens; roots and tubers; herbaceous forages and food crops.

**Burkina Faso:** 1) A literature review on the available feed resources in the Sahel is available; 2) Two of the three rounds of the feed availability and feed market survey were conducted; 3) A total of 280 feed samples have been analyzed using Near Infra-Red Spectroscopy (NIRS) and measurement of herbaceous and woody biomass is being finalized; 4) The survey for evaluation of feed resources was undertaken using the Feeding Assessment Tool (FEAST); 5) A poster on dry season feed markets in Burkina Faso was presented at ILRI Institute-wide Planning Meeting in Addis Ababa in September 2019.

<b>Subcomponent 2:</b> Examine strategies to increase the yield, quality and preservation of fodder with location-specific improved forages for the countries different agroecologies.	
<b>PI Name &amp; Institution:</b> For ET: Dr. Feyissa, EIAR For BF: Dr. Ken Boote, UF	<b>Collaborators:</b> For ETH: Hawassa University, ILRI For BF: INERA

**Ethiopia:** Agronomic evaluation trials to date include varietal evaluation of 3 oat varieties, 3 ryegrass varieties and 3 clover varieties, population density trials (6 for Desho grass and 7 for Maralfalfa) and economic comparison of food-forage crops (4 treatments in two sites including oats, rye grass, wheat and barley). In 2019, oat-vetch mixture seeds, Desho grass and maralfalfa root splits, and tree lucern and Sesbania seedlings have been planted by 112 farmers on 0.25 ha of land each. The forage produced will be used for feeding trials.

**Burkina Faso:** Data on on-station evaluation of 5 cow pea varieties, 5 millet varieties and 9 sorghum varieties, 4 peanut varieties and 4 maize varieties for forage and grain yield and quality, in three locations, have been collected for FY 2018 and the experiments continue in FY 2019. Interaction effect of cultivar and locations (agro-ecologies) observed for three of the forage types with some of the new cultivars showing significantly higher forage and grain yields. In 2019, some of the promising cultivars have been introduced for on-farm agronomic evaluation with 33 trained farmers.

<b>Subcomponent 3:</b> Determine and meet nutrient requirements of indigenous livestock with balanced rations.	
<b>PI Name &amp; Institution:</b> For ET and BF: Dr. Kebreab, University of California - Davis	<b>Collaborators:</b> For ETH: EIAR, Hawassa University For BF: INERA

A literature review on the nutrient requirement of tropical and sub-tropical dairy cattle in Ethiopia was completed while the one for small ruminants in Burkina Faso has just started. In Ethiopia, the GreenFeed machine was installed at the EIAR in Holetta. Dairy cows from local Ethiopian breeds were trained to use the GreenFeed machine for the feeding trial. Development of the Amharic language ration formulation software is almost complete. In Burkina Faso, the GreenFeed machine for small ruminants was installed at INERA but training of animals for the feeding trial is yet to begin. The nutritive value data from the landscape analysis projects in Ethiopia and Burkina Faso will be incorporated in feed composition tables for development of ration formulation software.

<b>Subcomponent 4:</b> Improve the capacity to analyze the nutritional value of livestock feeds	
<b>PI Name &amp; Institution:</b> For ET: Dr. Michael Blummel, ILRI For BF: Dr. Augustine Ayantunde, ILRI	<b>Collaborators:</b> For ETH: EIAR; Bless laboratory, Hawassa University For BF: INERA

The project has already scanned and obtained spectra of over 500 Ethiopian feed samples and more than 55 from Burkina Faso and developed 35 new calibration equations. These equations have been shared with 9 members of NIRS community of practice (CoP) established in Ethiopia. The National Agricultural Research Institute (NARI) of Eritrea has request to join the CoP. Fifteen technicians from CoP member organizations were trained on the use of NIRS for feed quality analysis. Six handheld NIRS brands have been tested for their accuracy and suitability and a publication on the results of the test is being prepared. A NIRS desktop model was delivered to Burkina Faso and is currently housed at ILRI. A public-private-partnership was established to discuss the modality for use. The project is also collaborating with US-based laboratory in refining NIRS techniques for the detection of aflatoxin in feeds.

<b>Subcomponent 5:</b> Examine effects of synergizing feed, management and genetic interventions on milk production in Ethiopia	
<b>PI Name &amp; Institution:</b> Dr. Carl Birkelo, Tanager (ASI) - ACIDI/VOCA	<b>Collaborators:</b> EIAR, Ethiopian Regional Cooperative Extension Service, University of Florida

For the feeding trial, 96 dairy farming households from four regions in Ethiopia were identified and 22 technicians were trained as trainers on the experimental protocol to work with farmers. The experiment includes three groups of farmers (one control group, one training intervention group and one training and feed intervention group) has started with feeding interventions for 32 farmers across the four regions. Baseline data on household demographics and herd characteristics has been collected. Data on productive, reproductive and health parameters of animals is being recorded from the farms involved in the trails. Additional household information will also be shared by ILRI.

### Capacity building

The subproject involves 23 students: 7 PhD (5 men, 2 women), 8 Master's (5 men, 3 women) and 8 Bachelor's (5 men, 3 women). Short term training was provided to 38 technicians: 1 technician on G-FEAST use, 15 technicians on NIRS machine use, and 22 technicians trained as trainers for improved dairy management and feeding. Also 208 farmers were trained: 112 on forage cultivation and crop residue management and 96 farmers on improved dairy farming and management. Finally, also 2 PhD students were trained on the Greenfeed machine use<sup>1</sup>.

### Lessons learned

- Traditional estimation of biomass from range and grasslands proved problematic. The project team is exploring the use of alternative methods such as a geographic information system (GIS) and remote sensing-based techniques as alternatives.
- Various grasses and some oat varieties performed well in the two evaluations. The clover varieties did not do well. Seed viability testing is ongoing to understand the reason for the varying performance.
- The use of the Greenfeed machine proved challenging as extensive training of the dairy animals and small construction work was needed.
- Cheaper and user friendly hand-held NIRS machines can be used for analyzing feed quality with a level of accuracy that is almost comparable with the more expensive, less flexible desktop NIRS.
- Based on samples analyzed to date, NIRS does not seem to predict aflatoxin in feed correctly.
- Regular communication on technical and financial aspects with project collaborators is key to the successful implementation of the project.

<sup>1</sup> No information available on sex disaggregation for all training courses at this moment.

## VII) Human and Institutional Capacity Development

### a) Short-term Training

**Table 7. Summary of Short-term Trainings**

Country	Brief Purpose of Training	Who was Trained	Participants		
			M	F	Total
Burkina Faso	Fodder production and conservation and fattening of small ruminants	Smallholder Producers	67	31	<b>98</b>
Burkina Faso	Recognition and reporting of transboundary animal diseases	Extension Workers, Researchers	19	4	<b>23</b>
Burkina Faso	Gastrointestinal parasite identification and analysis	Research Technicians	10	3	<b>13</b>
Burkina Faso	Integrated nutrition training and training on egg consumption	Smallholder Producers	0	154	<b>154</b>
Burkina Faso	Abbreviated - Women's Empowerment in Agriculture Index (A-WEAI) methodology for data collection	Researchers, Students	2	2	<b>4</b>
Burkina Faso	Focus Group Discussion (FGD) methodology for data collection	Researchers, Students	4	2	<b>6</b>
Burkina Faso	Ages & Stages Questionnaires® (ASQ®) Methodology for developmental and social-emotional screening for children	Researchers, Students	4	2	<b>6</b>
Burkina Faso	Methodology to measure infant head circumference as a proxy for cognitive development	Researchers, Students	4	2	<b>6</b>
Cambodia	Use of living fences to improve cattle performance	Smallholder Producers	14	23	<b>37</b>
Cambodia	Training on standard operating procedures to carry out laboratory experiments	Students	3	3	<b>6</b>
Cambodia	Training on laboratory methods for detection of Salmonella and S. aureus	Students	3	3	<b>6</b>
Cambodia	Training on laboratory protocols and food safety considerations regarding Salmonella	Researchers	5	5	<b>10</b>
Cambodia	Development of focus group discussion outlines and facilitation skills	Researchers	5	5	<b>10</b>
Cambodia	Course on animal welfare and data analysis	Faculty, Students	31	11	<b>42</b>
Cambodia	Swine Biosecurity, Swine Nutrition and Feeding, and Food Safety	Smallholder Producers, Students, Civil Society Members, Government Workers	99	40	<b>139</b>
Cambodia	Swine Biosecurity, Nutrition Disease and Records Training	Smallholder Producers, Civil Society Members, Government Workers	65	26	<b>91</b>
Cambodia	Swine Biosecurity, Nutrition, Disease and Records Training	Smallholder Producers, Civil Society Members, Government Workers	30	14	<b>44</b>
Cambodia	Swine Biosecurity, Nutrition, Disease and Records Training	Producers and Students	41	15	<b>56</b>
Cambodia	Improved pig health and biosecurity	Students	69	22	<b>91</b>
Ethiopia	Research design and biostatistics	Faculty, Students	13	3	<b>16</b>
Ethiopia	STATA statistical software training (applied to the dairy sector)	Researchers	21	2	<b>23</b>
Ethiopia	STATA statistical software training (applied to the dairy sector)	Researchers	19	10	<b>29</b>
Ethiopia	Data repository training	Researchers	7	5	<b>12</b>
Ethiopia	STATA statistical software training (applied to the dairy sector)	Members of the Ethiopian Economics Association	19	10	<b>29</b>
Ethiopia	Market Policy and Value Chain Analysis (with a focus on Agriculture and Livestock)	Members of the Ethiopian Economics Association	27	5	<b>32</b>

Ethiopia	Efficiency and Productivity Analysis (with applications to the livestock sector)	Members of the Ethiopian Economics Association	30	1	<b>31</b>
Ethiopia	Introduction and overview of the Young Stock Mortality project & related methodology: familiarization with IRB approvals, sample size, field forms, and sampling design	Students	9	0	<b>9</b>
Ethiopia	Sample collection and data entry	Students	9	0	<b>9</b>
Ethiopia	Hands on practice with Excel for data analysis and data quality evaluation	Students, Laboratory Technicians	10	1	<b>11</b>
Nepal	Biostatistics and R Follow-Up Training	Students, Faculty	10	1	<b>11</b>
Nepal	Training of Trainers on participatory teaching methods and pedagogy	Faculty	17	13	<b>30</b>
Nepal	Training of Trainers on qualitative data analysis	Faculty	10	7	<b>17</b>
Nepal	Training of Trainers on participatory data collection	Faculty	16	10	<b>26</b>
Nepal	Training of Trainers on community development planning in agriculture, livestock, and rural livelihoods (practical session)	Civil Society Members	28	24	<b>52</b>
Nepal	Qualitative Research Methods	Faculty, Students	15	5	<b>20</b>
Nepal	Certification to work as Community Animal Health Workers	Smallholder Farmers	0	94	<b>94</b>
Nepal	Refresher training in use of the Virtual Collection Center (VCC) app	Smallholder Farmers	0	180	<b>180</b>
Niger	Recognition and reporting of transboundary animal diseases in Niger	Extension Workers, Researchers	20	2	<b>22</b>
Niger	Strengthening the capacity of small ruminant livestock farmers on feeding strategies to improve productivity	Farmers	50	19	<b>69</b>
Niger	Strengthening farmer's capacities in development and management of small businesses in crop-livestock value chains	Farmers, Extension Workers	12	6	<b>18</b>
Niger	Strengthening the capacity of farmers/research technicians in forage production.	Farmers, Researchers	11	2	<b>13</b>
Niger	Use of Feed Assessment Tool (FEAST) to evaluate feed availability	Researchers	11	0	<b>11</b>
Niger	One Health	Faculty and Researchers	14	3	<b>17</b>
Rwanda	Qualitative Research Methods	Faculty and Students	10	5	<b>15</b>
Rwanda	Scenario-guided policy review workshop	Researchers, Civil Society Members, Government Workers	28	8	<b>36</b>
Rwanda	Training of trainers workshops on Social Behavioral Change Communication (SBCC) intervention	Researchers, Community-based Health Workers	94	128	<b>222</b>
Rwanda	Training of trainers to pilot the SBCC materials	Community Members, Community-Based Health Workers	6	9	<b>15</b>
Rwanda	Peer to peer learning through a visit to the best performing dairy cooperative in the country	Board of Directors of Producer Organizations	24	8	<b>32</b>
Rwanda	Introduction to the Government of Rwanda online service portal (Irembo)	Board of Directors of Producer Organizations	6	3	<b>9</b>
Rwanda	Annual operating plan training	Board of Directors of Producer Organizations	2	3	<b>5</b>
Rwanda	Annual operating plan training	Board of Directors of Producer Organizations	2	0	<b>2</b>
Rwanda	Keys to financial success training and business performance review	Board of Directors of Producer Organizations	12	6	<b>18</b>
Rwanda	Keys to financial success training and business performance review	Board of Directors of Producer Organizations	10	2	<b>12</b>
Rwanda	Introduction to the benefits of establishing village savings and lending associations	Producer Organizations	31	11	<b>42</b>

Rwanda	Financial and Tax Computation Training	Managers of Producer Organizations	0	2	2
Rwanda	Agricultural Producer Organization Sustainability Assessment (AgPOSA) feedback session and business performance review	Board of Directors of Producer Organizations	11	2	13
Rwanda	Knowledge sharing among producer organizations and dairy processing plant	Producer Organizations	22	8	30
Rwanda	Market system facilitation between producer organizations and smallholder producers	Producer Organizations	8	6	14
United States	Participatory action research and Participatory rural appraisal in development	Students	8	6	14
United States	Socio-economic, gender, and ethno-racial systems in development.	Students	8	6	14
United States	Ethics, cultural, and Institutional Review Board (IRB) considerations	Students	8	6	14
United States	Theoretical & methodological aspects underlying development practice: Case studies of challenges in development.	Students	8	6	14
Vietnam	Training workshop on System Effects Modelling	Government Workers, Students, Faculty	7	9	16

## b) Long-term Training

**Table 8. Summary of Long-term Trainings**

#	Sex	University	Degree	Major	Program End Date <sup>2</sup> (month/year)	Degree Granted <sup>3</sup> (Y/N)	Home Country
1	M	National School of Livestock and Animal Health	Bachelor's	Animal production	July/2019	Y	Burkina Faso
2	F	University of Ouagadougou	Master's	Animal Biology	June/2020	Y	Burkina Faso
3	M	University of Ouagadougou	Master's	Animal Nutrition	June/2020	Y	Burkina Faso
4	M	Institute for Rural Development	Master's	Animal Nutrition	June/2020	Y	Burkina Faso
5	M	Saint Thomas Aquinas University	Master's	Animal Science	May/2020	N	Burkina Faso
6	M	Saint Thomas Aquinas University	Master's	Animal Science	May/2020	N	Burkina Faso
7	F	Saint Thomas Aquinas University	Master's	Animal Science	May/2020	N	Burkina Faso
8	M	Nazi Boni University	Master's	Animal and Poultry Sciences	Nov/2020	N	Burkina Faso
9	M	Nazi Boni University	Master's	Animal and Poultry Sciences	Nov/2020	N	Burkina Faso
10	F	University of Ouagadougou	Master's	Journalism	May/2020	N	Burkina Faso
11	M	Nazi Boni University	PhD	Animal production	Dec/2021	Y	Burkina Faso
12	M	University of Ouagadougou	PhD	Animal Health	June/2021	N	Burkina Faso
13	M	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Dec/2019	N	Cambodia
14	F	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Dec/2019	N	Cambodia
15	M	Prek Leap National College of Agriculture	Bachelor's	Veterinary Medicine	Aug/2019	Y	Cambodia
16	F	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Dec/2019	N	Cambodia

<sup>2</sup> Anticipated graduation date or end of program support

<sup>3</sup> Indicate if program support resulted in a degree

17	F	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Oct/2019	N	Cambodia
18	M	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Oct/2020	N	Cambodia
19	M	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Oct/2020	N	Cambodia
20	F	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Oct/2018	Y	Cambodia
21	F	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Oct/2020	N	Cambodia
22	M	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Oct/2018	N	Cambodia
23	F	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Oct/2018	Y	Cambodia
24	M	Royal University of Agriculture	Bachelor's	Veterinary Medicine	Oct/2018	N	Cambodia
25	F	Royal University of Agriculture	Master's	Agricultural Management	Oct/2019	Y	Cambodia
26	M	Royal University of Agriculture	Master's	Animal Nutrition	Oct/2020	Y	Cambodia
27	M	University of Battambang	Master's	Sustainable Agriculture	April/2020	N	Cambodia
28	M	Royal University of Agriculture	Master's	Veterinary Medicine	May/2019	Y	Cambodia
29	M	Royal University of Agriculture	DVM	Veterinary medicine	Dec/2019	N	Cambodia
30	F	Royal University of Agriculture	DVM	Veterinary Medicine	Dec/2019	N	Cambodia
31	M	Swedish University of Agricultural Sciences	PhD	Biomedical Science	Dec/2021	N	Cambodia
32	F	University of Florida	PhD	Agricultural & Biological Engineering	May/2020	N	Dominican Republic
33	F	Addis Ababa University	Master's	Veterinary Public Health	June/2019	Yes	Ethiopia
34	M	Addis Ababa University	Master's	Epidemiology	Oct/2019	N	Ethiopia
35	M	Addis Ababa University	Master's	Epidemiology	Oct/2019	N	Ethiopia
36	M	University of Gondar	Master's	Epidemiology	Oct/2019	N	Ethiopia
37	M	Addis Ababa University	Master's	Animal Physiology	July/2019	Y	Ethiopia
38	M	University of Gondar	Master's	Epidemiology	Dec/2018	Y	Ethiopia
39	M	Hawassa University	Master's	Meat Science	Aug/2020	N	Ethiopia
40	M	Oda Bultum University	Master's	Food Science	Nov/2018	N	Ethiopia
41	M	Wollo University	DVM	Veterinary Medicine	July/2019	Y	Ethiopia
42	F	Haramaya University	DVM	Veterinary Medicine	July/2019	Y	Ethiopia
43	F	Addis Ababa University	DVM	Veterinary Medicine	July/2019	Y	Ethiopia
44	M	Samara University	DVM	Veterinary Medicine	July/2019	Y	Ethiopia
45	M	University of Gondar	DVM	Veterinary Medicine	July/2019	Y	Ethiopia
46	M	University of Gondar	DVM	Veterinary Medicine	July/2019	Y	Ethiopia
47	M	University of Gondar	DVM	Veterinary Medicine	July/2019	Y	Ethiopia
48	M	University of Gondar	DVM	Veterinary Medicine	July/2019	Y	Ethiopia
49	M	Hawassa University	PhD	Food Safety	Aug/2020	N	Ethiopia
50	M	Hawassa University	PhD	Animal nutrition	Aug/2020	N	Ethiopia

51	M	Hawassa University	PhD	Dairy Science	Aug/2020	N	Ethiopia
52	M	Hawassa University	PhD	Human Nutrition	Aug/2020	N	Ethiopia
53	M	Hawassa University	PhD	Animal Nutrition	Aug/2020	N	Ethiopia
54	M	Hawassa University	PhD	Tropical Animal Production	Aug/2020	N	Ethiopia
55	M	Addis Ababa University	PhD	Economics	Oct/2019	N	Ethiopia
56	M	Addis Ababa University	PhD	Economics	Oct/2019	N	Ethiopia
57	F	University of Florida	PhD	Food and Resource Economics	May/2021	N	India
58	M	University of Florida	Master's	Sustainable Development Practice	May/2020	N	Indonesia
59	M	University of Florida	Bachelor's	Public Health	May/2022	N	Japan
60	M	Agriculture and Forestry University	PhD	Animal Science	Dec/2019	N	Nepal
61	M	Agriculture and Forestry University	PhD	Animal Science	July/2020	N	Nepal
62	M	Agriculture and Forestry University	PhD	Animal Science	July/2020	N	Nepal
63	F	University of Niamey	Master's	Animal Nutrition	June/2020	N	Niger
64	M	University of Niamey	Master's	Animal Nutrition	June/2020	N	Niger
65	M	Abdou Moumouni University	Master's	Animal production	Oct/2020	Y	Niger
66	F	Abdou Moumouni University	Master's	Animal production	Oct/2020	Y	Niger
67	M	Abdou Moumouni University	Master's	Animal production	Oct/2020	Y	Niger
68	M	Abdou Moumouni University	PhD	Animal nutrition	Jan/2022	Y	Niger
69	M	Abdou Moumouni University	PhD	Agriculture Engineering	Jan/2021	Y	Niger
70	F	University of Rwanda	Master's	Animal Production	March/2019	Y	Rwanda
71	M	University of Rwanda	Master's	Animal Production	Nov/2018	Y	Rwanda
72	M	Swedish University of Agricultural Sciences	PhD	Animal Health	Nov/2019	N	Rwanda
73	M	Egerton University	PhD	Agricultural Economics	Aug/2021	N	Rwanda
74	F	University of California-Davis	PhD	Epidemiology	March/2020	N	Spain
75	F	Emory University	Master's	Public Health	May/2019	Y	USA
76	F	University of Florida	Master's	Public Health	May/2019	Y	USA
77	F	University of Florida	Master's	Sustainable Development Practice	Dec/2018	Y	USA
78	F	University of Florida	Master's	Public Health	May/2019	Y	USA
79	F	University of Florida	Master's	Public Health	Dec/2018	Y	USA
80	F	University of Florida	Master's	Sustainable Development Practice	May/2020	N	USA
81	F	University of Florida	PhD	Agricultural & Biological Engineering	May/2020	N	USA
82	F	University of Florida	PhD	Health Communication, Journalism	Jan/2020	N	USA
83	F	University of Florida	PhD	Public Health	May/2023	N	USA



84	F	University of Florida	PhD	Behavior Analysis, Psychology	May/2020	N	USA
85	F	University of Florida	PhD	Public Health	May/2020	N	USA
86	F	University of Florida	PhD	Food and Resource Economics	May/2023	N	USA
87	F	Emory University	PhD	Nutrition	Dec/2022	N	Vietnam
88	F	University of Nairobi	PhD	Livestock and Range Science	Aug/2020	N	Zimbabwe

### c) Institutional Development

**Table 9. Summary of Institutional Development**

Institution Name	Institution Type	Country	Description of Institutional Development
Environmental and Agricultural Research Institute	Research Institute	Burkina Faso	Support was provided on Crop-Livestock Production Systems research design and implementation. Researchers at the institution have gained more skills to not only conduct rigorous research, but to also design and implement studies. The institutions were informed on research opportunities on Crop-Livestock systems and value chains.
Environmental and Agricultural Research Institute	Research	Burkina Faso	Improved technical and organizational (lab management) ability to conduct animal health research in particular for parasitology.
Environmental and Agricultural Research Institute	Research institution	Burkina Faso	Improved program management skills in particular, financial reporting as per donor requirements.
Ouagadougou Animal Health Lab	Research & analysis	Burkina Faso	Improved capacity to effectively operate a research laboratory.
University of Ouagadougou	University	Burkina Faso	Support was provided on Crop-Livestock Production Systems research design and implementation. Researchers at the institution have gained more skills to not only conduct rigorous research, but to also design and implement studies. The institutions were informed on research opportunities on Crop-Livestock systems and value chains.
Royal University of Agriculture	University	Cambodia	Supported curriculum development on living fences ed; technical notes; presentation at lecture series for CE SAIN
University of Battambang	University	Cambodia	Improved capacities of graduate students in the Masters of Sustainable Agriculture program by tapping into USAID-funded researchers working on projects in Battambang Province and their research findings. It is anticipated that this will inform new curriculum development in specific areas.
Development for Community Livelihood (Former: CelAgrid)	Research	Cambodia	Improved understanding about food safety and foodborne diseases, as well as the use of participatory risk assessment and epidemiology tools for data collection. As food safety is of great concern in Cambodia, this knowledge will help the institution potentially contribute to other research efforts in this area in the future.
National Animal Health and Production Research Institute	Research	Cambodia	
Center for Disease Control, Ministry of Health	Research	Cambodia	Improved understanding about food safety and foodborne diseases, and the cost of foodborne diseases through economic analysis.
Royal University of Agriculture (RUA)	University	Cambodia	Supported university faculty with developing, carrying out, and monitoring a robust student mentorship program for data collection and field work. Faculty, administrators, and students at RUA were trained and mentored on how to use tablets to collect survey data. Faculty and deans were also capacitated on conducting pig-related research in rural areas of Cambodia, an area of expertise currently lacking, as well as setting up a pig feeding trial and carrying it out in a way that is up to western standards, including accounting for biosafety issues and considerations. Finally, RUA has been supported in how to conduct effective extension work within Cambodia to reach a wider audience and more end-users.

Hawassa University	University	Ethiopia	Supported development of Master's in Food Safety degree program within the Department of Food Science and Nutrition at Hawassa University. The project helped develop curriculum for a course titled "Advanced Food Safety and Processing." This Food Safety Master's program is unique in Ethiopia. As Food Safety becomes more important in Ethiopia, developing courses that support student training and education in this area is essential to future progress in this discipline.
Melkassa Research Station	Research	Ethiopia	Support was provided on forage research design and implementation. Researchers at the institution have gained more skills to not only conduct rigorous research, but to also design and implement studies.
Addis Ababa University	University	Ethiopia	Supported the conduct of field, laboratory, and program management. The universities were given support in improving the technical and organizational ability to conduct investigations into the causes of young livestock mortality.
University of Gondar	University		
National Animal Health and Diagnostic Center Laboratory	Government	Ethiopia	Improved technical and organizational ability to conduct investigations into the causes of young livestock mortality at NAHDIC. Students, laboratory staff and faculty are benefiting from the project through training in research methods on study design, fieldwork, laboratory sampling, and data analysis.
Djirataoua Agriculture Cooperative	Producer Organization	Nepal	Improved technical and organizational ability to conduct gender research.
Agriculture and Forestry University	University	Nepal	Improved understanding of requirements for the development of an institutional Review Board (IRB) process, The IRB protocol has been developed and is under committee review at AFU
Mercy Corps	NGO	Niger	Improved understanding on how carry our research for development project activities.
National Institute for Agricultural Research	Research	Niger	Improved technical and organizational (lab management) ability to conduct animal health research in particular for parasitology.
Central Livestock Laboratory	Research & Vaccine production	Niger	Improved technical and organizational (lab management) ability to conduct animal health research in particular for parasitology.
Abdou Moumouni University	Education	Niger	Improved lab management ability to conduct animal health research.
University of Rwanda	University	Rwanda	HICD assessments to identify capacity gaps at human, institutional, enabling environment levels, including participatory decision-making workshops
University of Rwanda	University	Rwanda	Improved understanding of capacity gaps at human, institutional, enabling environment levels through participation and follow up activities by the Human and Institutional Capacity Development Team at UF.

## VIII) Innovation Transfer and Scaling Partnerships

### a) Plan of Action

The Livestock Systems Innovation Lab has implemented three strategies to promote the transfer of innovations and the creation of scaling partnerships, which are Innovation Platforms, scaling plans and research partnerships.

- **Innovation Platforms:** These annual multi-stakeholder meetings in each focal country are at the heart of the Livestock Systems Innovation Lab's impact pathway and innovation transfer and scaling partnership strategy. These meetings involve diverse stakeholders including the ministries, national agricultural research systems, universities, USAID-funded and other donor-funded projects, and the private sector. The initial Innovation Platform meeting in each country developed demand-driven priorities for the projects in a participatory manner with stakeholders. In the subsequent meetings, the stakeholders provide input on the progress of the research and discuss plans and opportunities for the transfer and scaling of the researched innovations and technologies.
- **Scaling plan:** Each project under the Livestock Systems Innovation Lab develops a scaling plan, i.e., a plan that details the innovation, beneficiaries/users, target agroecologies, administrative areas or livestock systems, potential extension/dissemination approaches, policy implications and dimensions, knowledge products needed to effectively disseminate the innovation, and steps needed to ensure effective research to development bridging. We will continue working with the PIs in FY 2020 to develop such plans and seek input from in country partners. The ME plans to support the implementation of the scaling plans and evaluate their effectiveness.
- **Research partnerships:** The Requests for Applications (RFAs) issued by the Livestock Systems Innovation Lab require that all research project teams include development or private sector partners to ensure that technology transfer and scaling efforts can be considered from the outset of the project and developed as the project evolves.

### b) Steps taken

In FY 2019, Innovation Platform meetings were held in Nepal (November 2018), Burkina Faso (December 2018), Niger (December 2018), Ethiopia (February 2019), Rwanda (April 2019). Due to availability of government officials and PIs, the FY 2019 IP meeting in Cambodia was held in early October 2019 and will not be summarized in this FY 19 report. Evaluations of five Innovation Platform meetings in FY 2019 by 137 participants showed that 94% felt that the objectives of the meetings were met and 86.3% responded that the conclusions of the meeting were clear. Also, 94.8% of respondents appreciated the interactive and participatory set up of the meetings that allowed for a lot of interaction.

### c) Partnerships made

During FY 2019, Innovation Platforms continued to facilitate partnerships between research and development stakeholders. Competitively funded research projects continued to make progress in creating and capitalizing on partnerships for innovation transfer and scaling as detailed by the examples below for each focal country.

### d) Technologies ready to scale

At the end of FY 2019, the Innovation Lab had 11 technologies ready to scale (see Table 10 below).

### e) Technologies transferred

At the end of FY 2019, the Innovation Lab had 2 technologies that were transferred (see Table 10 below).

### f) Technologies scaled

At the end of FY 2019, the Innovation Lab had 0 technologies that were scaled (see Table 10 below).

**Table 10. Summary of Innovations**

#	Innovation Title (i.e., tech/practice title)	PI Name	Lead Institution	Innovation Category	Innovation Phase			
					Phase 1: Under research	Phase 2: Under field testing	Phase 3: Made available for uptake	Phase 4: Demonstrated uptake
<b>BURKINA FASO AND NIGER</b>								
1	Innovation Platform approach for small ruminant value chain enhancement	Vincent Bado	ICRISAT	Management/Cultural Practice	0	1	0	0
2	Dual purpose millet varieties for animal feed	Vincent Bado	ICRISAT	Biological	1	0	0	0
3	Dual purpose sorghum production for animal feed	Vincent Bado	ICRISAT	Biological	1	0	0	0
4	Improved feeding systems to improve small ruminant productivity	Vincent Bado	ICRISAT	Management/Cultural Practice	1	0	0	0
5	Improved crop residue utilization to improve small ruminant productivity	Salissou Issa	INRAN	Management/Cultural Practice	1	0	0	0
6	Forage and dual-purpose crops for animal feed	Salissou Issa	INRAN	Biological	1	0	0	0
7	Improved small ruminant feeding strategy using a forage chopper	Salissou Issa	INRAN	Management/Cultural Practice	1	0	0	0
8	Improved small ruminant feeding strategy using a forage grinder	Salissou Issa	INRAN	Management/Cultural Practice	1	0	0	0
9	Improved small ruminant feeding strategy using forage pellets and nutritional block	Salissou Issa	INRAN	Management/Cultural Practice	1	0	0	0
10	Intervention package to increase egg consumption by children	Sarah McKune	University of Florida	Management/Cultural Practice	0	0	1	0
11	Risk assessment to determine milk contamination levels	Silvia Alonso	ILRI	Management/Cultural Practice	0	1	0	0
12	Integrating evaporative cooling for eggs' storage	William Kisaalita	University of Georgia	Management/Cultural Practice	0	1	0	0
13	Larvae production for guinea fowl feed	William Kisaalita	University of Georgia	Biological	1	0	0	0
<b>CAMBODIA</b>								

14	Risk assessment to determine leading foodborne disease causes	Delia Grace	ILRI	Management/ Cultural Practice	1	0	0	0
15	<i>Gliricidia sepium</i> tree species for living fences and animal feed	Thomas Gill	University of Tennessee	Biological	0	1	0	0
16	<i>Acacia pennata</i> tree species for living fences and animal feed	Thomas Gill	University of Tennessee	Biological	0	1	0	0
17	<i>Moringa oleifera</i> tree species for living fences and animal feed	Thomas Gill	University of Tennessee	Biological	0	0	1	0
18	<i>Leucaena leucocephala</i> tree species for living fences and animal feed	Thomas Gill	University of Tennessee	Biological	0	0	1	0
19	Recommendations of disease management methods to decrease disease transmission	Michael Tokach	Kansas State University	Management/ Cultural Practice	0	0	1	0
20	Improved pig feeding strategy using locally available feed resources in Cambodia	Michael Tokach	Kansas State University	Management/ Cultural Practice	0	0	1	0
<b>ETHIOPIA</b>								
21	Sorghum genotypes for livestock feeding	Jessie Vipham	Kansas State University	Biological	0	1	0	0
22	Improved feeds and feeding strategies for dairy cattle	Jessie Vipham	Kansas State University	Management/ Cultural Practice	1	0	0	0
23	Biolog microbial identification system for bacterial identification and characterization	Woutrina Smith	UC-Davis	Biological	0	1	0	0
24	Radial Immunodiffusion (RID) plates to determine levels of passive immune transfer in calves	Woutrina Smith	UC-Davis	Biological	0	1	0	0
25	Pathasure® kits for the diagnostic of pathogens causing diarrhea in calves	Woutrina Smith	UC-Davis	Biological	0	1	0	0
26	Aluminum storage containers for milk and yoghurt <sup>4</sup>	Kebede Amenu	ILRI/AAU	Management/ Cultural Practice	1	0	0	0
27	Best practices to enhance the microbiological quality	Kebede Amenu	ILRI/AAU	Management/ Cultural Practice	0	0	1	0

<sup>4</sup> This innovation was found to leach aluminum into the milk and yoghurt products and thus unsafe for human consumption. The innovation will stay in this phase.

	and safety of milk & yoghurt							
28	Training approach to strengthen detection of public and private good animal diseases	Corrie Brown	University of Georgia	Management/ Cultural Practice	0	0	1	0
<b>NEPAL</b>								
29	SMS "Virtual collection center" (VCC) smartphone app	Conner Mullally	University of Florida	Other/ Approach	0	0	1	0
30	Distance learning platform for Community Animal Health Workers	Conner Mullally	University of Florida	Management/ Cultural Practice	0	1	0	0
31	Improved fodder combinations for goats	Conner Mullally	University of Florida	Management/ Cultural Practice	0	0	1	0
32	Technology package for prevention and control of mastitis in dairy animals	Keshav Sah	Heifer International Nepal	Management/ Cultural Practice	0	0	0	1
33	Smartphone app for dairy animal ration formulation	Bhola Shrestha	Heifer International Nepal	Other/ Approach	0	0	0	1
<b>RWANDA</b>								
34	Social and behavior change communication (SBCC) strategy for improving animal-source food consumption in Rwanda	Emily Ouma	ILRI	Management/ Cultural Practice	0	1	0	0
35	Business and dairy cooperative governance practices that improve value proposition to members and enhance linkages	Emily Ouma	ILRI	Management/ Cultural Practice	0	1	0	0
36	Best management practices for milk production and handling	Jean-Baptiste Ndahetuye	University of Rwanda	Management/ Cultural Practice	0	0	1	0
37	California Mastitis Test (CMT) for identification of subclinical mastitis	Jean-Baptiste Ndahetuye	University of Rwanda	Management/ Cultural Practice	0	0	1	0
<b>TOTAL</b>					<b>12</b>	<b>12</b>	<b>11</b>	<b>2</b>

## IX) Environmental Management and Mitigation Plan

### a) Report on mitigation and monitoring activities in relation to the EMMP

#### 1. BSL compliance

Several projects require biosafety level 2 (BSL2) facilities, which, while present in most focal countries, are not certified as per USAID standards. Solutions included the following:

- The project led by Dr. Delia Grace (ILRI) conducted biological sampling and laboratory experiments studying the prevalence of different pathogens in animal-source foods (poultry and pork products) sold at the markets in Cambodia. The sample analysis took place at the Bacteriology and Parasitology Laboratory, located in the National Animal Health and Production Research Institute (NAHPRI). This laboratory was audited by the Biosafety Unit at ILRI in July 2018. The protocols and approval letter signed by ILRI (August 2018) were approved by the Bureau Environmental Officer at USAID on October 29, 2018.
- The project lead by Dr. Emily Ouma received ILRI approval for the protocols for use at the Kigali campus of the University of Rwanda in April 2019 following an audit done by the ILRI Biosafety Unit in October 2018 and the required changes were implemented. The protocols and approval letter signed by ILRI were approved by the Bureau Environmental Officer at USAID on June 7, 2019.

#### 2. Monitoring and mitigation conducted

##### Project team environmental monitoring

Projects that conducted research activities in FY 2019 implemented diverse mitigation activities as well as monitoring to ensure that mitigation measures included in their EMMP were adequate and complied with. The list below highlights the actions taken by selected projects that completed activities listed in their EMMPs in FY 2019:

##### **Assessment of aflatoxin-related health risk for milk consumers in rural and peri-urban areas in Burkina Faso**

Silvia Alonso | International Livestock Research Institute

At the start of the project, the PI visited the two laboratories at INERA and IRSAT to observe the laboratory infrastructure and human capacity. As a result of a change in project activities (decided upon in consultation with the ME in April 2019), no EMMP monitoring activities were conducted in FY 2019. Monitoring activities are now planned for Q1 FY 2020 when laboratory work at both laboratories will be ongoing. As part of the applications for ILRI's Institutional Biosafety Committee (IBC), an assessment of laboratory capacity was conducted by the project partners. The project received approval from the IBC for the time periods of the 15<sup>th</sup> June, 2019 until the 15<sup>th</sup> April, 2020 to conduct aflatoxin testing at INERA. The IBC application for the microbiology work at IRSAT was submitted and we expect approval soon.

##### **Enabling sustainable value chains of crop-livestock systems in Burkina Faso and Niger**

Vincent Bado | International Crops Research Institute for Semi-Arid Tropics

Procurement and handling of seeds, feeds and animals followed USAID restricted commodities requirements and was approved by the respective national regulatory authorities. Residues of the crop varieties were also used in the animal feeding trial that took place at ICRISAT using dedicated infrastructure. Animal manure was composted and the product was utilized as organic fertilizer in the agronomic trials. This allowed the study to reduce the use of mineral fertilizers. All technicians involved in the animal trials were on the various protocols in place for Niger and Burkina Faso. Vaccines used on the study animals were approved for use by the national authorities of Burkina Faso and Niger. Trained animal health technicians administered the vaccines.



## **Enhancing the productivity of small ruminants through improved and cost effective feeding and animal health interventions in Burkina Faso and Niger**

Salissou Issa | Mercy Corps - Institut National de la Recherche Agronomique du Niger (INRAN)

The process to obtain the Initial Environmental Examination (IEE) amendment – Pesticide procedures (PERSUAP) took more than six months with multiple email exchanges between the subawardee, UF and USAID. It was finally approved by the USAID BFS Environmental Officer on May 30, 2019. The approval for fertilizer use was received on February 8, 2019, just in time to start the planting activities. For all agriculture activities, only organic fertilizers, pesticides, and insecticides were applied.

Procurement and handling of seeds, feeds and animals followed USAID restricted commodities requirements. The intercropped pearl millet, sorghum and cowpea varieties used are safe for the environment, and resilient agriculture approaches were used to protect the soil against water and wind erosion as well as to ensure better infiltration of water through the cowpea cover. The resilient agriculture techniques were taught in farmer field schools. The animal trials were conducted as per the protocol using individual stalls. The manure produced by the animals was collected in a pit where it will be transformed into compost, which will be used to fertilize crops on the farm.

Blood samples from animals were taken by veterinarians and technicians from the Central Veterinary Laboratory (LABOCEL) who have been trained in biological sample collection including safe handling of materials, as well as their storage, treatment and disposal, good hygiene, proper packaging and labeling, and appropriate courses of action for spills, injury and exposure. Fecal samples were collected by trained technicians in biological sample collection including safe handling of materials, as well as their storage, treatment and disposal, good hygiene, proper packaging and labeling. All employees working with both blood and fecal samples wore personal protective equipment (PPE). The fecal samples were analyzed at the National Laboratory for Burkina and the LABOCEL for Niger. These laboratories are equipped with facilities for disposal of chemical residues. Lab staff were trained in biological sample collection including safe handling of materials, as well as their storage, treatment and disposal, good hygiene, proper packaging and labeling, and appropriate courses of action for spills, injury and exposure.

## **Living fences for improved livestock feed in Cambodian smallholder systems**

Tom Gill | University of Tennessee

The planted living fences are being managed by the Center of Excellence on Sustainable Agricultural Intensification and Nutrition (CE SAIN) tech park technicians in Battambang, Siem Reap and at the Royal University of Agriculture (RUA), Phnom Penh. No fertilizer or pesticides were used on the trees. Fences are not irrigated but are cultivated under rainfed conditions, typical of Cambodian smallholder systems. Crop living fences are being protected in some instances with plastic to prevent cattle grazing on young seedlings. They are also being trellised with bamboo to link trees and prevent gaps in the fence for more effective control of animal movement.

## **Safe food, fair food for Cambodia**

Delia Grace | International Livestock Research Institute

All microbiological analysis of the samples collected at multiple markets in Phnom Penh and Siem Reap provinces were conducted at the NAHPRI laboratory in Phnom Penh. The staff wore PPE and adhered to the approved protocols.

## **Improving handling practices and microbiological safety of milk and milk products in Borana pastoral communities, Ethiopia**

Kebede Amenu Ejeta | Addis Ababa University; Silvia Alonso | International Livestock Research Institute

All environmental safety and mitigation plans were followed this year. The person who had been trained in the safety procedures for processing the samples was the same individual who carried out the resuscitation of the bacteria isolates using BSL2 facilities. He followed the established protocol for various procedures such as sample processing and waste disposal. Import permit from USDA APHIS and CDC to import 19 *Escherichia coli* 0157:H7, 12 non-typhoid *Salmonella* spp. and 79

*Staphylococcus aureus* isolated from feces and milk of dairy cows and camels was severely delayed but were obtained in September 2019. It is expected that the testing will take place in Q1 FY 2020.

### Addressing young-stock mortality in smallholder farms and pastoral herds in Ethiopia

Woutrina Smith | University of California - Davis

All environmental safety and mitigation plans were followed this year at the various laboratories involved in the research. Appropriate monitoring logs were signed by all individuals running laboratory diagnostics.

#### b) Coaching, support, and monitoring provided by the Management Entity

In December 2018, Zeleke Mekuriaw, the East Africa regional coordinator, traveled to Burkina Faso to work with the country coordinators from Burkina Faso and Niger to provide hands-on training on project activity and environmental compliance monitoring. The team visited the intervention villages of the UF-led Focus project when poultry vaccination was taking place.

In FY2019, two Master of Sustainable Development Practice students participated in an effort led by the Monitoring & Evaluation team to conduct interviews, surveys, and observations of project activities occurring in Rwanda and Nepal. The information gathered from these extended field visits is still being analyzed and will be presented in a separate report.

To support the environmental monitoring efforts of the subawardees, the Livestock Systems Innovation Lab monitored projects that had initiated the activities outlined in their EMMPs in two ways: (1) through routine check-ins, discussions and activity participation by the Regional and Country Coordinators and (2) through field visits as part of the evaluation framework. In Q3 FY 2019 the Monitoring and Evaluation Specialist, with a UF Master of Sustainable Development Practice student, conducted an evaluation mission in Nepal looking at adoption and dissemination of technologies. In Q4 FY2019, the regional coordinator for East Africa and another UF Master of Sustainable Development Practice student conducted a similar exercise in Rwanda. The information gathered from these extended field visits is still being analyzed and will be presented in a separate report. A summary of the pertinent issues related to other evaluation activities is given below.

- **PI, Alonso:** Monitoring visit to observe Aflatoxin M1 and B1 testing. During the analysis, two researchers, one research assistant, and one student worked together to appropriately identify the two types of aflatoxin in milk and animal feed samples. Procedural instructions and a stopwatch were used to ensure that activities were carried out accurately and timely way. All personnel wore PPE. Packaging, bottles, and waste from the use of reagents were collected and deposited at the incinerator of the Kamboinsé research station.
- **PI, McKune:** Monitoring visit to observe 1) vaccination of chickens and 2) nutrition and sanitation training session for women. A research assistant conducted the vaccinations. He used PPE while vaccinating. Different sized needles were used for chicks and hens. Needles were sanitized with alcohol between vaccinations and all used needles were kept in a plastic bottle when vaccinations were completed to be incinerated at the district sanitation station. The training focused on WASH, egg consumption by children, and chicken health management. The training materials were provided in a picture format to accommodate various literacy levels. The challenges noticed during the visit have been discussed with the PI and corrective measures were taken. Some examples: after the visits, the project team started providing refreshments to the women, given the long training session duration. The administration of the vaccine subcutaneously in the neck rather than in the wing was recommended to avoid unnecessary stress in the birds.
- **PI, Gill:** Monitoring visit to observe feeding trial procedures. The purpose of the trial was to understand the impact of *Leucaena* supplementation on the growth of beef cattle. It was observed that the shed in which animals were housed had adequate ventilation and flooring. Data were adequately recorded in Excel and procedures for the experiment were appropriately followed, with different groups of beef cattle being given different diets (straw with local grass or straw with local grass supplemented with *Leucaena*). One challenge that was noted is that the protocols

- describing procedures for the feeding trial were written and available only in English and should be translated into Khmer for future trials.
- **PI, Tokach:** Monitoring of the first national Swine Day in Siem Reap. Over 170 people attended the event. Audience members included pig farmers, input suppliers, provincial and central level officials, students, and RUA and KSU faculty, and representatives from FAO. Simultaneous translations ensured that presentations by faculty in English were well understood.
  - **PI, Grace:** Two different monitoring visits were carried out this fiscal year.
    - i. Monitoring visit to observe laboratory activities. On the day of the visit, no project related samples were tested. However, we observed how the team members read the samples for the antibiotic sensitivity analysis they are conducting as part of another research project. Biosecurity measures were in place. Meetings and discussion occurred with 6 senior lab personnel and students.
    - ii. Monitoring visit to observe analysis of meat/cutting board swab samples in the NAPHRI bacteriology lab at Phnom Penh. The samples were collected in plastic bags, labelled, and placed in an ice box during transportation to the lab. The visit found that all protocols were followed, the staff were trained to carry out sampling and analysis, and the experimental samples were autoclaved and safely disposed of in general waste. The staff wore PPE and used antiseptic for sanitizing their hands. All samples were safely handled as per the protocols.
  - **PI, Amenu:** Monitoring of laboratory activities related to milk microbial identification and bacterial culturing was conducted. Milk samples were collected and transported to the laboratory in labeled and tightly closed containers within an icebox during the air transportation to the ILRI campus in Addis Ababa. During the sampling, transportation, and laboratory testing, all standard operating procedures were followed, and PPE was worn by all trained personnel interacting with the samples. Proper waste disposal mechanisms were followed both in the field as well as in the laboratory when disposing of milk. Materials used for microbiological tests were autoclaved before disposal and plastic materials and sample leftovers were incinerated.
  - **PI, Smith:** Two different monitoring visits were carried out this fiscal year.
    - i. The first visit focused on observing laboratory work and procedures. The laboratory was sufficiently equipped to conduct virology, bacteriology and parasitology testing. During the site visit, three MSc students were observed undertaking laboratory analysis. All personnel in the laboratory used PPE, followed standard operating procedures, and used proper waste disposal techniques. All disposable materials were kept in plastic bags labeled for that purpose until discarded by assigned authority from the Institute. Students confirmed that they had been given training on sampling techniques, microbiological tests, associated risks and mitigation measures prior to their involvement in actual pathogen identification work.
    - ii. The second monitoring visit was focused on observing a training workshop for DVM and MSc students supported by the project. The purpose of the workshop was to equip students with skill sets related to data entry, quality assessment and analysis, as well as to share individual research interests and understand how these individual interests support the goals of the larger project.
  - **PI, Ouma** Monitoring visit to observe nutrition messaging training-of-trainers from ten communities. The training was organized and facilitated by Three Stones International, a subcontractor from RTI International. The target audience were community and district health workers. The training involved group discussion and sharing of field experiences. All trainees received a trainer's manual and counseling cards prepared in the local language.

## X) Open Data Management Plan

In FY 2019, the Livestock Systems Innovation Lab continued its open data efforts. In FY 2019, 3 projects uploaded 10 datasets to the Dataverse page (<https://dataverse.harvard.edu/dataverse/livestock-lab>). The Lab also created and submitted for review 2 data sets, with affiliated data files. Despite repeated efforts by the ME staff, low quality of the data sets and lack of supporting documents (i.e. codebooks) by the PIs hampered the ability to submit more datasets to the Data Development Library (DDL). In the next FY we plan to address this issue by engaging more and earlier with the PI's throughout their data review and submission process to ensure better quality initial submissions and to provide them with examples of codebooks and other supporting documentation if necessary. Finally, the Lab has continued to monitor the datasets planned for collection and submission by the subawardees, and all projects have updated an Open Data Plan for FY 2020. The Open Data Plans will be compiled and submitted along with FTFMS reporting with changes highlighted, which will then be finalized in Q1.

In FY 2019, the Livestock Systems Innovation Lab uploaded 22 publications to USAID's Development Experience Clearinghouse (DEC). Documents uploaded to the DEC in FY 2019 included six major reports from the ME, such as annual or semi-annual reports, and 16 reports and country updates from non-competitive activities relating to six countries. The Livestock Systems Innovation Lab will continue to upload documents in an effort to make information and research results as openly accessible as possible.

Many other documents and products are available on the Livestock Systems Innovation Lab's website (<http://livestocklab.ifas.ufl.edu/>), which houses videos, webinars and scientific presentations. For example, a webpage dedicated to the 2019 Global Nutrition Symposium offers a short summary, a booklet of poster abstracts, and seven in-depth presentations. Additionally, other publications and communications materials developed by competitive and non-competitively selected projects were uploaded to the website. This includes, for example, a video and presentation for a webinar on Managing Aflatoxin Risk. Research-based publications added in FY 2019 to the website this fiscal year include eight journal articles, several reports and briefs, and new pages of content for the themes of gender, future livestock systems, and human and institutional capacity development.

## XI) Governance and Management Entity Activity

During FY 2019, the Management Entity continued to provide thought leadership, management, and coordination functions for the Livestock Systems Innovation Lab. Some key activities are explained under section III – Key Accomplishments.

The Livestock Systems Innovation Lab also continued to execute core functions including providing support to subawardees, conducting communications and outreach, monitoring and evaluation activities, and submitting applications for additional funds as detailed below.

- Administration and finance: Support was provided to subawardees prior to contracting in order to finalize their technical narratives and budgets. In addition, continued support was given during the research project implementation, including for review of protocols, performance reports and invoices, revisions of budgets and subaward agreements; in addition, subaward management training was provided.
- Compliance: Support was provided to subawardees on compliance, including with guidelines on restricted commodities, procurement, participant support, export controls, and environmental and research compliance.
- Human Resources: In FY 2019 the Management Entity underwent staffing changes for several positions (i.e. Project Manager, Monitoring, Evaluation and Learning specialist, Fiscal and Administrative Assistants). The regional coordinators for East Africa, South Asia, Burkina Faso and Niger provided critical support to the Innovation Lab's work throughout FY 2019.
- Communications: The project website (<http://livestocklab.ifas.ufl.edu/>) is monitored daily and updated regularly. It contains 61 videos of mostly research presentations, with 14 of them created in FY19, and 24

of these videos are shared on YouTube. In December 2019, the entire website was renovated. New pages have been created for evaluation, news, gender, human and institutional capacity development, future livestock systems, and opportunities. The publication page has recent journal articles, resources organized by country, 5 infographics, 8 newsletters, and 13 stories. Active communication and updates on the project and Agrilinks' websites resulted in 15 blog posts, 227 Facebook posts and 285 Tweets. Most Tweets featured original material instead of re-Tweets. Facebook page likes increased in FY 2019 from 448 to 684. Twitter followers increased in FY19 from 506 to 799. Four issues of the *Lively* newsletter were published in FY 2019 and are also on the website.

- Monitoring and Environmental Mitigation and Monitoring: Active support and coaching was provided to subawardees, (see above section IX).

Finally, the ME continued to coordinate the functioning of the wider network of the Livestock Systems Innovation Lab including the External Advisory Board (EAB), Internal Advisory Committee (IAC) and University of Florida faculty.

- EAB and IAC meetings: four EAB meetings were held during FY 2019, and one of them was in Kathmandu during the AGM in April 2019. All others were held virtually on December 2018, March and July 2019. Three EAB members resigned and three new members joined the Board.
- Engagement of the IAC continued to be challenging in FY 2019 due to the very busy travel schedule of all four members. Nevertheless, they met twice as planned (December 2018 and September 2019). In addition, several meetings were held with individual members of the IAC and written updates were shared with them.
- Faculty meetings: faculty meetings were held throughout the year on a bi-weekly basis and during the summer semester on a monthly basis. Apart from updating each other on the project progress, the Management Entity tries to have an invited speaker at these meetings at least once a month.

## XII) Other Topics

No other topics to report.

## XIII) Issues

### **Budget**

University of Florida policies require that any funds obligated to a subawardee be set aside and cannot be used or re-budgeted for other purposes. Given the project's large number of subawardees, a large portion of project funds are committed to subawardees. While the project burn rate has increased over time due to improved frequency of financial reporting (from \$182,000 in November 2018 to over \$500,000 in July and August 2019), a large portion of project funds are still committed to our many subawardees.

In the past, when requesting funding commitments from USAID through the submission of pipeline reports, the project gave very conservative estimates for commitments and did not include any management entity salary commitments. After consultation with USAID and UF administration, a revised approach to reporting commitments to USAID increased the project's burn rate. Nonetheless, the project only received \$4,000,623 in committed funds from USAID in FY19, significantly less than requested (\$7.5 million). In September 2019, some funds were received which will allow the Lab to continue certain activities but will require the delay of other activities up to February 2020, when new funds are expected. The project has informed these subawardees that they will receive no significant funding increase at this time until additional funding is received from USAID. It is likely that these subawardees will need to receive no-cost extensions when additional funding is provided by USAID in order to fully fund the research projects and complete planned activities. The project is now entering its final year, having received \$13,564,688 (out of an anticipated ceiling of \$19 million).

## **Staffing**

The Management Entity has experienced some staffing changes over the past year. Andrea Bohn was hired as Project Manager on January 3, 2019. Cassy Summerlin resigned from the Fiscal Assistant position on March 21, 2019 and was replaced by Joel Paras on July 18, 2019. Erica Odera replaced Brigitte Pfluger as the Monitoring and Evaluation Specialist on July 18, 2019. At the end of this reporting period (September 30, 2019), the Administrative Support Assistant position was vacant, but it has since been filled.

Due to the flexibility of the Management Entity team, as well the continued support of the University of Florida core offices, the project has been able to ensure continuity of project operations, while recruitment was ongoing.

## **XIV) Future Directions**

### **Future directions – FY 2020**

The Feed the Future Innovation Lab for Livestock Systems looks forward to numerous exciting events and activities in FY 2020. Some of these include the following:

- To start outstanding Enhance and Alliance projects and to complete all projects.
- To submit a no-cost extension to ensure all projects are satisfactorily completed within the lifespan of the Innovation Lab for Livestock Systems.
- To continue collaborating with PIs and in-country partners to ensure take up of innovations resulting from the Livestock Systems Innovation Lab's research projects, as all of them will end in FY 2020.
- To host the fourth Annual General Meeting and the Global Nutrition Symposium and possibly other symposia and events to further promote the consumption of safe and nutritious animal-source foods (ASF) to prevent stunting and enhance cognitive development.
- To publish research findings in peer reviewed journals as well as other types of publications such as policy and research briefs and innovation summaries.
- To continue the Equip research subprojects funded by the Bill & Melinda Gates Foundation.
- To pursue associate award and buy-in opportunities from various sources.
- To strategize on the main target areas for the next 5-year phase of the Livestock Systems Innovation Lab.

## Appendices

### a) List of Awards Given to Partners

Project Name	Lead Institution	Grant Type	Country	Project Start Date	Project End Date	Project Budget
<b>U.S. Institutions</b>						
Designing and evaluating innovations for development of smallholder female livestock cooperatives in Nepal	UF (PI: Mullally)	REACH	Nepal	17-Oct-16	30-Sep-20	\$1,233,989
Linking cattle nutrition to human nutrition: a value chain approach to improving the production, handling, and consumption of animal source foods in Ethiopia	KSU (PI: Vipham)	REACH	Ethiopia	17-Oct-16	30-Sep-20	\$1,038,237
Improving the evidence and policies for better performing livestock systems in Ethiopia	IFPRI (PI: Minten)	REACH	Ethiopia	17-Oct-16	16-Apr-20	\$667,067
Addressing young stock mortality in smallholder farms and pastoral herds of Ethiopia	UC-Davis (PI: Smith)	REACH	Ethiopia	17-Oct-16	16-Apr-20	\$599,851
Enhancing the productivity of small ruminants through improved and cost-effective feeding and animal health interventions in Burkina Faso and Niger (enhance)	Mercy Corps (PI: Issa)	REACH	Burkina Faso & Niger	1-May-18	30-Sep-20	\$1,250,000
Assessment and mitigation of aflatoxin and fumonisin contamination in animal feeds in Rwanda	Iowa State University (PI: Maier)	FOCUS	Rwanda	10-Dec-16	30-Sep-18	\$146,504
Improved pig health and nutrition: the major drivers of profitability and sustainability for smallholder farmers in Cambodia	KSU (PI: Tokach)	FOCUS	Cambodia	17-Jul-17	31-May-19	\$141,015
Improving dairy animal productivity and income of dairy farmers through effective control of mastitis disease	Heifer International (PI: Sah)	FOCUS	Nepal	1-Oct-16	31-Mar-18	\$129,108
Feeding support tool development for enhancing dairy animal productivity for improved livelihood of smallholder dairy farmers in Nepal	Heifer International (PI: Shrestha)	FOCUS	Nepal	1-Oct-16	31-Mar-18	\$129,528

Living fences for improved livestock feed in Cambodian smallholder systems	University of Tennessee (PI: Gill)	FOCUS	Cambodia	10-Jun-17	30-Sep-19	\$125,827
Mycotoxin prevalence, risk assessment and mitigation measures in Ethiopia	KSU (PI: Zereyesus)	FOCUS	Ethiopia	1-Nov-16	31-Mar-19	\$107,469
Empowerment of village women for detection and control of livestock diseases in Nepal	Colorado State University (PI: Bowen)	FOCUS	Nepal	1-Oct-16	31-Mar-18	\$98,401
The effect of passive surveillance training on animal health parameters, northern Ethiopia	University of Georgia (PI: Brown)	FOCUS	Ethiopia	1-Oct-16	30-Apr-18	\$98,348
Intervention in low guinea fowl productivity and related products consumption in Burkina Faso	University of Georgia (PI: Kisaalita)	FOCUS	Burkina Faso	1-Jun-18	31-Mar-20	\$150,000
Improving nutrition in children through increased egg consumption in Burkina Faso	UF (PI: McKune)	FOCUS	Burkina Faso	1-May-18	31-Aug-19	\$149,965
Strategies to increase milk consumption among children in rural Nepal	Heifer International (PI: Shrestha)	ENHANCE	Nepal	10-Mar-19	9-Sep-20	\$100,000
Modeling livestock system dynamics and economy-wide policy impacts in Ethiopia	IFPRI (PI: Thurlow)	ENHANCE	Ethiopia	1-Apr-19	31-May-20	\$100,000
Application of integrated decision support systems to improve livestock systems in Ethiopia: research and capacity development	TAMU (PI: Shrinivasan)	ENHANCE	Ethiopia	1-May-19	31-Jul-20	\$99,149
Enhancing egg consumption through women's empowerment in Burkina Faso	UF (PI: McKune)	ENHANCE	Burkina Faso	1-Mar-19	31-Dec-19	\$104,954
Short courses to improve technical research and teaching capacity at the royal university of agriculture, Cambodia	UF (PI: Hernandez)	NCA*	Cambodia	1-Sep-18	30-Sep-19	\$58,946
Strengthening human and institutional capacity development in livestock innovation laboratory partner institutions	UF (PI: Russo)	NCA*	All	1-Jun-17	30-Sep-20	\$430,645
Strengthening policy implications in livestock systems innovation lab partner institutions	UF (PI: Serra)	NCA*	All	13-Dec-17	30-Sep-20	\$50,000

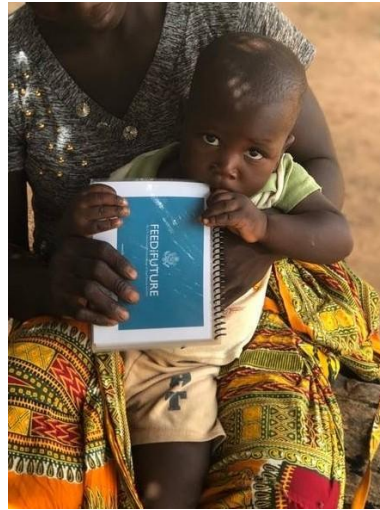


Scenario and livestock systems analysis to support sector policy and interventions in livestock systems innovation lab focus regions	UF (PI: Kiker)	NCA*	All	13-Dec-17	30-Sep-20	\$382,058
Strengthening gender integration in livestock systems innovation partners' research and activities	UF (PI: Colverson)	NCA*	All	1-Oct-17	30-Sep-20	\$37,500
Strengthening livestock systems innovation lab partners' ability to integrate human health and nutrition into their research	UF (PI: McKune)	NCA*	All	1-Oct-17	30-Sep-20	\$37,500
<b>Non-U.S. Institutions</b>						
Enhancing milk quality and consumption for improved income and nutrition in Rwanda	ILRI (PI: Ouma)	REACH	Rwanda	1-Jan-17	31-Dec-19 <sup>1</sup>	\$1,037,709
Safe food, fair food for Cambodia	ILRI (PI: Grace)	REACH	Cambodia	20-Jul-17	19-Jul-20	\$774,717
Improving handling practices and microbiological safety of milk and milk products in Borana pastoral communities, Ethiopia	ILRI/Addis Ababa University (PI: Alonso/Ejeta)	FOCUS	Ethiopia	1-Nov-16	31-Dec-19	\$121,892
Milk production practices, udder health and their impact on milk quality, safety and processability in Rwanda	UR (PI: Ndahetuye)	FOCUS	Rwanda	17-Oct-16	31-Dec-18	\$84,491
Assessment of aflatoxin-related health risk for milk consumers in rural and peri-urban areas in Burkina Faso	ILRI (PI: Alonso)	FOCUS	Burkina Faso	7-Aug-18	30-Mar - 20	\$149,964
Enabling value chains to create sustainable income for vulnerable people in crop-livestock systems of Burkina Faso and Niger	ICRISAT (PI: Bado)	REACH	Burkina Faso & Niger	26-Jan-18	30-Sep-20	\$1,249,572

\*NCA= Non-competitive activity; <sup>1</sup> Project requested No-Cost Extension up to July 30, 2020.

## b) Success Stories

### Success Story 1: Mothers see healthier children in the “One Egg Per Day” project in Burkina Faso



“Bicycle chicken” is a national dish in Burkina Faso, and even Bill Gates shared a video about it and

blogged that chicken rearing can [reduce extreme poverty](https://www.gatesnotes.com/Development/Why-I-Would-Raise-Chickens) (https://www.gatesnotes.com/Development/Why-I-Would-Raise-Chickens). But what about the eggs?

Recent [research in Burkina Faso](#), sponsored by the Feed the Future Innovation Lab for Livestock Systems, has found that educating mothers about the benefits of eggs can change the diets they feed their children in ways that produce rapid, significant improvement in nutritional status.

The change in behavior was profound. Before this research-based intervention, young children in 18 rural villages in Kaya District rarely ate eggs. Within four months, some children were eating an egg a day, and their mothers were impressed with the results. Problems with wasting and underweight both dropped significantly in less than a year.

National television news covered the phenomenon in the summer of 2019, and one mother explained the process and its impact: “Eggs are valuable and we are now aware of it. Each of us received 3 chickens, and we the parents had to contribute one chicken so that we have sufficient production of eggs for the child’s nutrition. We have seen the importance of eggs for children, and they make the child more intelligent,” said Lea Ouedraogo in the broadcast (translated from French).

The mothers told the researchers that they were seeing improvements in their children’s resilience and psychomotor functioning. The leader of the research project, Dr. Sarah McKune from the University of Florida, heard them say that “our kids aren’t getting sick. Something’s different about these kids.”



*A study participant describes the benefits in a nationally televised news segment. (credit: Burkina Faso TV)*

### Justification and Methods

The idea to pursue this research and dietary intervention germinated from discussions at an Innovation Platform meeting with stakeholders in Burkina Faso. Certainly, eggs are available, but rural people prefer to sell chickens and their eggs to gain income. Would poverty prevent them from changing their behavior? A prior pilot study in Ethiopia provided hope, and the leader of that study, Anteneh Omer of Hawassa University, joined Dr. McKune as a co-Principal Investigator. The other co-Principal Investigator was Dr. Aissata Wereme from the Institute of Environment and Agricultural Research (INERA-Burkina Faso).

To study the effects of an educational campaign, the project divided mothers into three groups of about 90 women each. One group served as a control, while the other two groups received training every two weeks about chicken husbandry and the importance of eggs for children under the age of two.



*A trainer uses a flipbook to advise a mother about chicken husbandry.*

The third, full intervention group received three chickens in a ceremony led by a village leader. Participating mothers pledged to obtain an additional hen and to feed their child one egg daily. This group showed the greatest behavioral change, with nearly all children consistently eating an egg daily. Across the control, partial, and full study arms, mother-reported child egg consumption changed from nearly 0 to 1.0, 2.4, and 6.3 eggs per week, respectively.

This change may bring many benefits. An intervention in Ecuador in 2017 showed that it may nearly halve rates of stunting. The study in Burkina Faso is investigating such effects, and it has received an additional grant from the Livestock Systems Innovation Lab to expand its research into cognitive development.

### **Why did it work?**

Instead of a single factor, McKune cites the project's multi-pronged approach as a recipe for success. Messages were consistent, and a childproof, laminated flipbook used culturally relevant graphics to educate non-literate participants. She credits colleague Omer with fostering camaraderie among the project's nearly 270 participants, and his approach included creating a jingle in the local language that they sang to inaugurate meetings: "One Child, One Egg, Per Day."

The simplicity of the approach was another plus. "It feels so accessible, so doable. This is very low tech," said McKune.

In addition to poultry production, the project targeted women's empowerment as an essential ingredient. The trained women demonstrated it at the project's closing event on May 28, 2019, when they trained the women in the control group on how to boil eggs and feed their children properly.

All participants expressed eagerness to continue sharing what they had learned. With the additional grant, the researchers can continue studying the process and effects of behavioral and dietary change.

Next, the researchers will speak in November 2019 at the American Public Health Association meeting in Philadelphia. There is also interest to conduct the intervention in Niger and Rwanda.

## Success Story 2: First multi-stakeholder Swine Day in Cambodia educates about disease, opportunity



*Opening the first Cambodia Swine Day is H.E. Sen Sovann, Director General of Cambodia's General Directorate of Animal Health and Production. (credit: S. Hendrickx)*

In April 2019, the Cambodian government confirmed the presence of African Swine Fever, which is extremely fatal to pigs and has spread into nine east Asian countries since 2018. The disease can devastate the holdings of pig farmers, but humans cannot be infected.

How should pig farmers in Cambodia prepare themselves for this threat and other challenges? A major step forward in educating smallholder Cambodian pig farmers and other stakeholders of the pork value chain took place on November 30, 2018. The first Cambodian “Swine Day” event welcomed 139 attendees and armed them with knowledge about diseases, biosecurity, and the nutrition of pigs.

Because of Swine Day’s success, Cambodia’s Ministry of Agriculture plans to integrate it into the country’s yearly Livestock Day. Swine Day originated with a [research project supported by the Feed the Future Innovation Lab for Livestock Systems](#) and led by Dr. Michael Tokach from Kansas State University

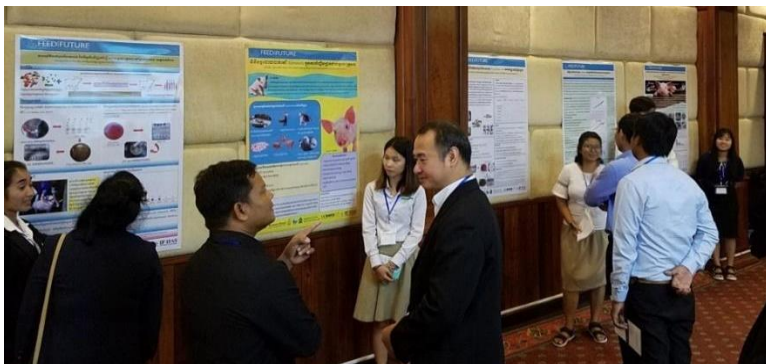
(KSU). Swine Days have been an annual tradition at KSU since 1968. The event in Cambodia was co-organized by KSU and Cambodia’s Royal University of Agriculture and co-supported by two Feed the Future Innovation Labs devoted to livestock and to horticulture.

Featuring a full day of presentations and demonstrations, Cambodia’s inaugural Swine Day was held in Siem Reap, a city in the country’s northwest and a gateway to the famed ruins of Angkor Wat.

### Concept to Execution

The idea for Swine Day emerged after initial project surveys in 2017 found that stakeholders were eager for disease transmission education. A concept note in 2018 targeted two objectives: to share recent findings from the project’s research and experiments, and to convene diverse stakeholders to exchange current knowledge about pig nutrition and diseases.

Swine Day featured 14 presentations, in a mixture of English and Khmer languages, by more than 20 local and international experts in swine nutrition, production, diseases, and marketing. In addition, 15 Cambodian students competed with scientific



*Students shared posters of their research and competed for prizes at Swine Day. (credit: S. Hendrickx)*

posters and won prizes from Cambodia’s Centre of Excellence on Sustainable Agricultural Intensification and Nutrition. Of the 179 attendees, 59 were female and 120 were male, and 57 farmers represented the largest subgroup.

### **Did It Work?**

After the event, all participants agreed that the training increased their personal or organization’s capacity, according to the event evaluation. Also, 95 percent felt that it increased their understanding of swine nutrition and feeding practices, and 97 percent gained knowledge about food safety and the status of the swine industry in Cambodia. In other words, it worked.

While Swine Day was a singular event, the project has held many other extension activities. In early 2019 alone, 198 people (74 Village Animal Health Workers, 71 farmers, and 53 students) attended trainings on biosecurity, nutrition, and swine diseases.

### **The Project’s Scope**

The project that organized 2018’s Swine Day, [Improved pig health and nutrition: the major drivers of profitability and sustainability for smallholder farmers in Cambodia](#), conducted research from July 2017 to May 2019. Currently, it is producing fact sheets in Khmer and at least five journal articles about feed ingredients, an experiment on supplement replacement (demonstrating \$10/pig profit within 42 days), biosecurity, animal health products, and experiential learning. It supported 27 Cambodian students pursuing degrees, and overall it trained 568 people directly.



*This farmer participated in both surveys and trainings with the project on improved pig health and nutrition. (credit: Facebook page of Cambodia Swine Day)*

### Success Story 3:

## Applied business model for animal feed generates revenue and improves livelihoods of smallholder farmers in Niger



*Various project team members interacting with feed traders in Torodi, Niger (Photo credit: Dr. A Whitbread, ICRISAT)*

A new business supplying animal feeds to rural Niger is helping to overcome vast distances and other hurdles that constrain the productivity and incomes of goat and sheep farmers.

Though 90 percent of the rural population in Niger owns livestock, the income generated and impacts on nutrition and livelihoods remains very low. Smallholder farmers, especially women, own an average of two small ruminants in many rural parts of Niger. The main constraint to expansion is the availability of feed (cowpeas, groundnuts, and cereal bran), particularly during the dry season. Relying on crop residues, which barely meet their needs, animals are scarcely ever well fed therefore, mortality rates are as high as 30 percent, and animals are sold at low market prices. Incomes generated from livestock rarely cover the cost of investments, and farmers remain in a vicious cycle of poverty and food insecurity.

To overcome the root problem of feed shortages, new connections were fostered through [a project funded by the Feed the Future Innovation Lab for Livestock Systems](#) and directed by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The initiative, called *Feed for small ruminants*, implemented a marketing business model to connect feed producers near the city of Maradi with isolated farmers from the villages of Torodi, about 370 miles (600 km) apart.

Assisted by the project, farmers from three villages in Torodi (Sirimbana, Dioga, Ticko and Patti) and feed actors in two villages in Maradi (Banbon Kori and Karazome) created business relationships focused on supplying feed such that two feed traders from Maradi would collect, transport and sell animal feed in Torodi.

### **Banking the Feed**

The farmers of Torodi created a feed bank to store the purchased feed on the site of a previous feed bank. Such feed banks are established, managed and owned by the community so the project assisted the community to set up a small committee to manage the revival of the new feed bank on the old site.

The feed traders from Maradi were happily surprised to note how quickly this small market grew. One of the traders, Mr. Habibou, testified: “I used to spend weeks in Niamey searching for feed markets where I could get good returns. But now I come to Torodi, and in one day I have sold all my feed. I never knew that Torodi presented such a huge opportunity for feed markets.”

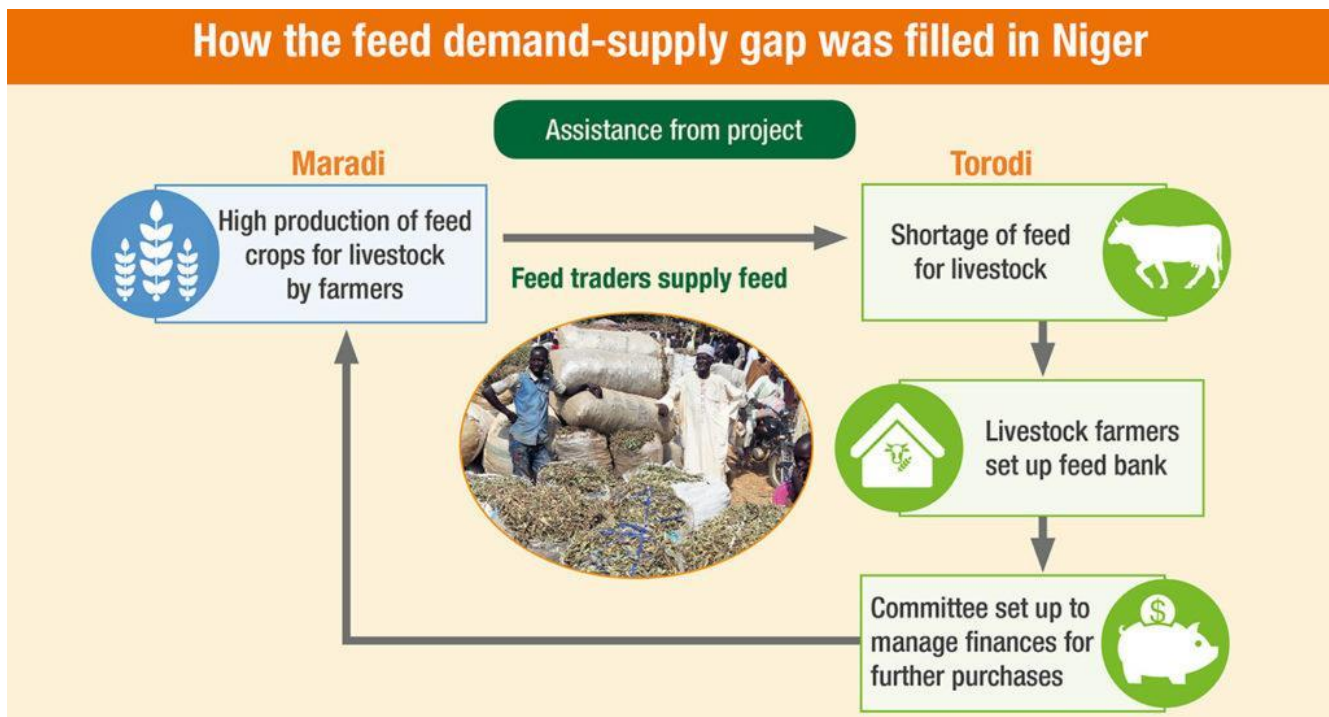
Many traders compete in the large markets of Niamey, but lesser competition in Torodi combined with high demand for feed means that these traders are saving money and time. The distance to transport the feeds is shorter, and the time to sell their merchandise has been reduced from weeks to one day.

Nearly 300 male and female livestock farmers from the Torodi area are buying feed through this newly established mechanism. In addition to the greater availability of feed, Torodi farmers pay prices that are 30 percent lower than those at the markets they used previously. About 12.6 tons of feed valued at \$US 3,600 has been sold through the Torodi market in less than 6 months.

More and cheaper available feed will allow livestock keepers, particularly women, to fatten more sheep and goats and earn more income.

“This feed business is an excellent initiative for our community, and now we can buy feed in our village. This contributes significantly to improving the productivity of our animals,” said Mr. Moussa Oumarou, a farmer at Torodi.

The project team and its partners are now working towards improving credit access for the various groups involved. The first plan is to link feed traders with financial institutions to allow them to purchase more feed for re-sale; a second plan is to establish credit groups (village savings groups) in each community that will allow livestock producers to access funds to purchase feeds to fatten animals. “By helping farmers to save money to be able to purchase feed during the dry season feed shortage period, we will increase the demand for feed during that period. This demand will be met by the increased feed supply from the Torodi market ” explained the project principal investigator, Dr. Vincent Bado.



Overview of feed demand and supply in Niger (Credit: ICRISAT Happenings Newsletter, September 27, 2019. <https://www.icrisat.org/solving-the-livestock-feed-supply-demand-puzzle-in-niger/>)

### c) List of Publications

#### **Improving nutrition in children through increased egg consumption in Burkina Faso**

Sarah McKune | University of Florida

Anderson, H. S., Sapp, A., and McKune, S. 2019. Brief. Increasing egg consumption through innovative behavior change in Burkina Faso: Preliminary findings.

Sapp, A., Anderson, H. S., McKune, S., and Yang, Y. April 4, 2019. Poster. Improving nutrition in children under two through increased egg consumption in Burkina Faso, a Statistical Analysis. Presented at Public Health and Health Professions Research Day, University of Florida, Gainesville, FL, USA.

McKune, S. June 5, 2019. Seminar Presentation. Improving nutrition in children under two through increased egg consumption in Burkina Faso. Presented at Symposium on Ensuring children's cognitive and physical development through animal-source foods, organized by the Feed the Future Innovation Lab for Livestock Systems in Washington, DC, USA.

McKune, S., Sapp, A., and Anderson, H. S. 2019. Preliminary baseline report for the project on improving nutrition in children under two, Burkina Faso

McKune, S., Sapp, A., and Anderson, H. S. 2019. Preliminary midline report for the project on improving nutrition in children under two, Burkina Faso.

Sapp, A. 2019. Thesis. Improving nutrition in children under two through increased egg consumption in Burkina Faso; a Statistical Analysis.

McKune, S. 2019. Video. Increasing Egg Consumption in Burkina Faso. Shown at Symposium on Ensuring children's cognitive and physical development through animal-source foods, organized by the Feed the Future Innovation Lab for Livestock Systems in Washington, DC, USA.

#### **Assessment of aflatoxin-related health risks for milk consumers in rural and peri-urban areas in Burkina Faso**

Silvia Alonso | International Livestock Research Institute

Alonso, S. and Ayantunde, A. October 10, 2018. Presentation. AflaRisk - Aflatoxin-related health risk for milk consumers in rural and peri-urban areas in Burkina Faso. Presented at the AflaRisk launch meeting and value chain mapping meeting, Ouagadougou, Burkina Faso.

De Sousa, F.M. September 20, 2019. Presentation. Assessment of aflatoxin-related health risk for milk consumers in rural and peri-urban areas in Burkina Faso. Seminar presented to ILRI's graduate fellows, Addis Ababa, Ethiopia.

#### **Intervention in low guinea fowl productivity and related products consumption in Burkina Faso**

William Kisaalita | University of Georgia

Kisaalita, W. 2018. Leaflet. Intervention in low guinea fowl productivity and related products consumption in Burkina Faso.

#### **Enabling sustainable value chains of crop-livestock systems in Burkina Faso and Niger**

Vincent Bado | International Crops Research Institute for the Semi-Arid Tropics

Kumar, S. 2018. Blog post. Boosting confidence in farm innovations – simulating impact with systems modelling tools. Blog in ICRISAT Happenings. <https://www.icrisat.org/boosting-confidence-in-farm-innovations-simulating-impact-with-systems-modelling-tools/>

Umutoni, C., Bado, V. B., and Whitbread, A. M. 2019. Case study. Feed and small ruminants in a business model that generates revenues and improving livelihoods of smallholder farmers in Niger.

Umutoni, C., Bado, V. B., and Whitbread, A. M. 2019. Case study. Tabaski: a huge market opportunity for small ruminants in Niger.

Umutoni, C. and Bado, V. B. September 2019. Newsletter article. Solving the livestock feed supply-demand puzzle in Niger. In: ICRISAT Happenings, No. 1821. <https://www.icrisat.org/solving-the-livestock-feed-supply-demand-puzzle-in-niger/>



Umutoni, C., Kumar, S., and Amadou, A. May 2019. Newsletter article. Livestock value chain strengthening essential for improving production and food security in Niger, say scientists. In: ICRISAT Happenings, No. 1794. <https://www.icrisat.org/livestock-value-chain-strengthening-essential-for-improving-production-and-food-security-in-niger-say-scientists/>

Umutoni, C. 2019. Poster. An overview of the project: Enabling value chains to create sustainable income for vulnerable people in crop-livestock systems of Burkina Faso and Niger.

Umutoni, C., Bado, V. B., Whitbread, A. M., Ayantunde, A., Abdoussalam, I., and Seydou Korombe, H. September 18-20, 2019. Poster and presentation. Evaluation of the feed quality of six dual purpose pearl millet varieties and growth performance of sheep fed their residues in Niger. Presented at Tropentag 2019, Kassel, Germany.

Bado, V. B. October 10, 2018. Presentation. *Renforcement des chaînes de valeur pour fournir des revenus durables aux populations vulnérables d'Agro-pasteurs du Burkina Faso et du Niger*. French language. Presented at Mercy Corps, Niamey, Niger.

Whitbread, A. M. and Bado, V. B. October 3-6, 2018. Presentation. Taking agricultural land and water management (alwm) to scale in the drylands under a changing climate. Presented at Global Water Security for Agriculture and Natural Resources Conference, Hyderabad, India.

Bado, V. B. March 6 and 7, 2019. Presentation. *La recherche sur les systèmes de production Agriculture-Élevage: Quelle approche?* French language. Seminar presented at INERA and at University of Ouagadougou, Bobo-Dioulasso, Burkina Faso.

Ayantunde, A., Boubacar, H.A., Adamou, K., Moumini, O. and Umutoni, C. September 2019. Technical note. Evaluation of feed resources in the mixed crop-livestock systems of the Sahelian zone in Burkina Faso and Niger.

### **Enhancing the productivity of small ruminants through improved and cost effective feeding and animal health interventions in Burkina Faso and Niger**

Issa Salissou | Institut National de Recherche Agronomique / National Institute for Agricultural Research

Issa, S. 2018. Leaflet. Enhancing the productivity of small ruminants through improved and cost-effective feeding and animal health interventions (ENHANCE) in Burkina Faso and Niger.

Issa, S. June 5, 2019. Presentation. Sorghum and millet-based multi-nutritional blocks for livestock are widely transferred in West Africa. Seminar presented to animal nutrition class at Tahoua University, Tahoua, Niger.

Munroe, M. and Mercy Corps. 2019. Baseline report and a literature review on livestock policies in Niger for the ENHANCE program.

### **Safe Food, Fair Food for Cambodia**

Delia Grace | International Livestock Research Institute (ILRI)

J. Kimani and Nguyen C. 2019. Blog post. Cambodia's Safe food, fair food project addresses major food safety issues. <https://blogs.ifas.ufl.edu/lsil/2019/10/01/cambodias-safe-food-fair-food-project/>

Nguyen-Viet H, Unger, F., Lindahl, J., Roesel, K., Sothya, T., Ty, C., Young, M., Alonso, S., Chea, R. and Grace, D. September 2018. Poster. Safe Food, Fair Food for Cambodia project. Presented at Tropentag 2018, Ghent, Belgium. <http://hdl.handle.net/10568/97594>

Roesel, K., Craven, L., Ty, C., Hung Nguyen-Viet and Grace, D. November 2018. Poster. Using system effects modelling to evaluate food safety impact and barriers in low-income-countries: an example from urban Cambodia. Presented at 15<sup>th</sup> International Symposium of Veterinary Epidemiology and Economics, Chiang Mai, Thailand. <https://hdl.handle.net/10568/98397>

Rortana, C., Grace, D., Nguyen-Viet, H., Tum, S., Dang-Xuan, S., Theary, R., Sophary, S., Koam, S., Pheany, S., Sotheany, H., Heng, T., Sarim, S. and Lindahl, J. March 2019. Poster. Prevalence of *Salmonella* and *Staphylococcus aureus* from meat in Cambodian markets. Presented at Regional Symposium on Research into Smallholder Pig Production, Health and Pork Safety, Hanoi, Vietnam. <https://hdl.handle.net/10568/100728>

Brown, M. April 25-26, 2019. Poster. "Our food may not be very safe because now days everything uses chemicals": Women's perceptions of food safety and nutrition in Phnom Penh, Cambodia. Presented at the Global Nutrition Symposium, Feed the Future Innovation Lab for Livestock Systems, Kathmandu, Nepal.

Nguyen-Viet, H., Thi, T.T., Duc, P.P., Sinh, D.X., Unger, F., Sothyra, T., Ty, C., Srey, T. and Grace, D. November 12-16, 2018. Presentation. Research and training partnership to assist food safety in Vietnam and Cambodia. Presented at the 15<sup>th</sup> International Symposium of Veterinary Epidemiology and Economics, Chiang Mai, Thailand. <https://hdl.handle.net/10568/98298>

Nguyen-Viet, H. July 30, 2019. Presentation. Health and agri-food systems: Ensuring safe and fair foods for everyone. Seminar presented at Department of Global Health, Emory University, Atlanta, USA.

Nguyen-Viet, H. July 21-24, 2019. Presentation. Safe food, fair food in South East Asia: Research and policy. Presented at annual meeting of International Association for Food Protection (IAFP), Louisville, KY, USA.

Nguyen-Viet, H. July 26, 2019. Presentation. Food safety and antimicrobial resistance research: A One Health perspective. Seminar presented at the Emerging Pathogens Institute University of Florida, Gainesville, FL, USA. Video recording available at <http://media.epi.ufl.edu/Hung-Ngyuen-7-26.mp4>

Nguyen-Viet, H. August 4, 2019. Presentation. One Health and EcoHealth in Southeast Asia. Seminar presented at Gadjah Mada University, Yogyakarta, Indonesia.

Nguyen-Viet, H, and Dang, S. August 12, 2019. Presentation. One Health and food safety research in developing countries. Seminar presented at University of Battambang, Cambodia.

ILRI. 2018. Report on food safety risk assessment for informal value chains training conducted in Cambodia, 15 to 17 January 2018. Safe Food, Fair Food for Cambodia. Nairobi, Kenya: International Livestock Research Institute.

ILRI. 2018. Report on gender and livestock training held in Cambodia, January 22 to 23, 2018. Safe Food, Fair Food for Cambodia project. Nairobi, Kenya: International Livestock Research Institute.

ILRI. 2019. Report. Training on system effects modelling. Report of a training course held on 21-23 May 2019. Nairobi, Kenya: International Livestock Research Institute. <https://hdl.handle.net/10568/101942>

Brown, M. Ty, C., Samkol, P.; Nguyen-Viet, H., Grace, D.; Young, M. 2019. Thesis. "Our food may not be very safe, because now days everything uses chemicals": Women's perceptions of food safety and nutrition in Phnom Penh, Cambodia. University of Emory, Atlanta, USA.

Nguyen-Viet, H. 2018. Video. Safe food, fair food for Cambodia project: Progress highlights for the first year. Uploaded December 17, 2018. [https://youtu.be/-IXwXq\\_qQUY](https://youtu.be/-IXwXq_qQUY)

### **Living fences for improved livestock feed in Cambodian smallholder systems**

Tom Gill | University of Tennessee

Ader, D. November 6-8, 2018. Presentation. Diversifying livestock systems and improving management practices. Presented at Agroecology Futures Regional Forum, Siem Reap, Cambodia.

Lear, A. May 10, 2019. Presentation. Understanding maternal-fetal interactions during infectious disease. Seminar presented at Royal University of Agriculture, Phnom Penh, Cambodia.

Ader, D. and Gill, T. 2019. Technical note. Conducting a cattle feeding trial in rural Cambodia: Lessons learned.

Ader, D. and Gill, T. 2019. Technical note. Examples of living fences in Cambodia.

Ader, D. and Gill, T. 2019. Technical note. How to Establish a Living Fence.

### **Improved pig health and nutrition: The major drivers of profitability and sustainability for smallholder farmers in Cambodia**

Michael Tokach | Kansas State University

Tokach, L., Bunna, C., Kroesdan, K., Tokach, M. D., and Vipham, J. 2019. Card. Swine Diseases in Cambodia. Laminated disease identification cards.

Kroesna, K. and Bunna, C., Eds. November 30, 2018. Posters. Fifteen posters by students, mostly in Khmer language. Presented at Swine Day in Siem Reap, Cambodia.

Bunna, C. and Keo, S. November 30, 2018. Presentation. Vaccinations and biosecurity examples for pigs. Presented at Cambodia Swine Day, Siem Reap, Cambodia.

Kroesna, K. and DeRouchey, J. November 30, 2018. Presentation. Pig feed ingredients and feed cost in Kampong Thom, Siem Reap, and Battambang Province, Cambodia. Presented at Cambodia Swine Day, Siem Reap Cambodia.

Sreng, S. November 30, 2018. Presentation. Pig Experiment results. Presented at Cambodia Swine Day, Siem Reap Cambodia.

Tokach, L. and Bunna, C. November 30, 2018. Presentation. Pig production and biosecurity in the context of Cambodian smallholder farmers. Presented at Cambodia Swine Day, Siem Reap Cambodia.

Tokach, L. April 30, 2019. Presentation. Swine diseases in Cambodia: Reducing the risk of disease, preventing, and treating pig diseases in Cambodia. Seminar presented at Royal University of Agriculture, Phnom Penh, Cambodia.

Tokach, M. D. May 2, 2019. Presentation. Effective research design idea generation, designing for impact, guaranteeing uptake. Presented at USAID panel on effective research design, Phnom Penh.

Vipham, J. and Tokach, L. November 30, 2018. Presentation. Food safety and biosecurity consideration in pigs. Presented at Cambodia Swine Day, Siem Reap, Cambodia.

Tokach, M. D., Tokach, L., Bunna, C., Kroesna, K., and Vipham, J. 2019. Training module. Improved pig health and nutrition. Khmer language.

Bunna, C., Kroesna, K., Tokach, L., Tokach, M. D., Vipham, J., and Keo, S. 2019. Six in-depth training presentations for farmers and for Village Animal Health Workers on pig health, nutrition, disease, and record keeping. Khmer language.

### **Addressing young-stock mortality in smallholder farms and pastoral herds in Ethiopia**

Woutrina Smith | University of California-Davis

Smith, W., Fentie, T., Kebede, N., Lane, J., Jackson, W., and Vidal, G. April 25-26, 2019. Poster. Addressing causes of young stock morbidity and mortality in smallholder farms and pastoral herds in Ethiopia. Presented at the Global Nutrition Symposium, Feed the Future Innovation Lab for Livestock Systems, Kathmandu, Nepal.

Smith, W., Fentie, T., and Kebede, N. May 2019. Poster. Addressing causes of young stock morbidity and mortality in smallholder farms and pastoral herds in Ethiopia. Presented at Aligning the Food Systems for Improved Nutrition in Animal-Source Foods, University of California, Davis, CA, USA.

Vidal, G. May 16-18, 2019. Presentation. Workshop on data analysis and data quality. Presented to students of University of Gondar and Addis Ababa University, Addis Ababa, Ethiopia.

Vidal, G. November 22-30, 2018. Presentation. Introduction to the young-stock mortality project. Presentation given during workshops at University of Gondar and Addis Ababa University, Ethiopia.

Ambaw, B. 2018. Thesis. Passive immunity status in new-born calf under pastoral production system, Ethiopia. MSc thesis. Addis Ababa University, Ethiopia.

Belete Zewudie, S. 2018. Thesis. Study on incidence rate of calf diarrhea and associated risk factors in Amibara pastoral districts of Afar Regional State, Ethiopia. MSc thesis. Addis Ababa University, Ethiopia.

Berhanu, T. 2019. Thesis. Prevalence of gastrointestinal helminths in calves in Sululta, Ethiopia. DVM thesis. College of Veterinary Medicine, Haramaya University, Ethiopia.

Danissie, A. 2019. Thesis. Isolation, identification and penicillin susceptibility profile of *Pasteurella multocida* from calves in Awash-Fentale district, Afar region, North Eastern Ethiopia. DVM thesis. School of Veterinary Medicine, Wollo University, Ethiopia.

Demil, E. 2018. Thesis. Seroprevalence and factors associated with bovine viral diarrhea in dairy cattle in and around Gondar town, Ethiopia. MSc thesis. University of Gondar, Ethiopia.

Desta, N. 2019. Thesis. Serum immunoglobulin G concentration in lamb and goat kids, Awash Fentale, Afar Nations Regional State, Ethiopia. MSc thesis. College of Veterinary Medicine and Agriculture, Addis Ababa University, Ethiopia.

Endashaw, D. 2019. Thesis. Isolation and identification of *Escherichia coli* K99 and *Salmonella enterica* responsible for calf diarrhea and its potential risk factors in household farms of Dalocha district, Southern Ethiopia. MSc thesis. College of Veterinary Medicine, Mekelle University, Ethiopia.

- Fola, F. 2019. Thesis. Identification of bacterial pathogens causing calf pneumonia and their drug susceptibility pattern in Gondar town, North Western Ethiopia. DVM thesis. College of Veterinary Medicine, University of Gondar, Ethiopia.
- Gebeyehu, B. 2018. Thesis. Isolation and characterization of *Salmonella* species and *Escherichia coli* K99 responsible for calf diarrhea and their determinant factors from dairy cattle farms of Sululta town, Ethiopia. MSc thesis. College of Veterinary Medicine, Mekelle University, Ethiopia.
- Gebrie, Z. 2018. Thesis. Isolation of *Escherichia coli* in diarrheic preweaned dairy calves in Gondar town. DVM thesis. University of Gondar, Ethiopia.
- Genetu, L. 2019. Thesis. Serological investigation of major enteropathogens causing calf diarrhea in dairy calves in Gondar town, North Western Ethiopia. DVM thesis. College of Veterinary Medicine, University of Gondar, Ethiopia.
- Manaye, T. 2018. Thesis. Isolation of bacterial causes of respiratory infections of calves in smallholder dairy farms in and around Gondar town. DVM thesis. Haramaya University, Ethiopia.
- Mohammed, N. 2018. Thesis. Study on prevalence and risk factors of calf coccidiosis in Gondar town, North West Ethiopia. MSc thesis. University of Gondar, Ethiopia.
- Seyoum, E. 2018. Thesis. Isolation of *Salmonella* in diarrheic preweaned dairy calves in Gondar town. DVM thesis. University of Gondar, Ethiopia.
- Shibabaw, A. 2019. Thesis. Seroprevalence of bovine *Parainfluenza* virus-3 and Respiratory Syncytial virus causing pneumonia in dairy calves in Gondar town, Ethiopia. DVM thesis. College of Veterinary Medicine, University of Gondar, Ethiopia.
- Tefera, Y. 2019. Thesis. A study on the identification and prevalence of babesiosis and anaplasmosis in dairy calves in Gondar town, North Western Ethiopia. DVM thesis. College of Veterinary Medicine, University of Gondar, Ethiopia.
- Tekaw, A. 2019. Thesis. Seroprevalence and risk factors associated with Bovine viral diarrhea virus in less than six months aged dairy calves in and around Gondar town, Ethiopia. DVM thesis. College of Veterinary Medicine, Samara University, Ethiopia.
- Yismaw, M. 2018. Thesis. Isolation of *Escherichia coli* and *Salmonella* from diarrheic lambs in and around Gondar town, North-Western Ethiopia. DVM thesis. Jimma University, Ethiopia.
- Yitbarek Mengistu, C. 2018. Thesis. Investigation of major enteric pathogens and associated risk factors in calf diarrhea in dairy farms of Gondar town, Ethiopia. MSc thesis. University of Gondar, Ethiopia.

**Linking cattle nutrition to human nutrition: A value chain approach to improving the production, handling, and consumption of animal source foods in Ethiopia**

Jessie Vipham | Kansas State University

Gadisa, B., Yusuf, Y. and Yousuf, M. 2019. Evaluation of eating quality in sensory panelist and instrumental tenderness of beef from Harar, Arsi and Bale Cattle Breeds in Oromia, Ethiopia. Int. J. Agric. Sc. Food Technol. 5(1): 035-042. <http://doi.org/10.17352/2455-815X.000039>

Gadisa, B., Yusuf, Y., Kurtu M.Y. 2019. Evaluation of physical facilities, operation and management practice in selective public abattoirs in Eastern Oromia, Ethiopia. Int. J. Agric. Sc. Food Technol. 5(1): 043-049. 10.17352/2455-815X.000040. <https://www.peertechz.com/articles/IJASFT-5-140.php>

Tefera, T.D., Mammed, Y.Y., Kurtu, M.Y., Letta, M.U., O'Quine, T.G. and Vipham, J.L. July 2019. Effect of age and breeds of cattle on carcass and meat characteristics of arsi, boran, and harar cattle in Ethiopia. Open Journal of Animal Sciences, 9, 367-383. <https://doi.org/10.4236/ojas.2019.93030>

Zelalem, A., Sisay, M., Vipham, J. L., Abegaz, K., Kebede, A. and Terefe, Y. 2019. The prevalence and antimicrobial resistance profiles of bacterial isolates from meat and meat products in Ethiopia: A systematic review and meta-analysis. International Journal of Food Contamination 6(1). <https://doi.org/10.1186/s40550-019-0071-z>

Mekasha, A., Vipham, J., Min, D., Tadesse, T., Ayana, G., Bascom, N., Pendell, D., Tegegn, A. September 2019. Poster. Linking cattle nutrition to human nutrition: Exploring forage values of sorghum in Ethiopia. Presented at

the 9th annual Global Agenda for Sustainable Livestock (GASL) Multi Stakeholder Partnership, Manhattan, KS, USA.

## **Improving the evidence and policies for better performing livestock systems in Ethiopia**

Bart Minten | International Food Policy Research Institute

Minten, B., Habte, Y., Tamru, S. and Tesfaye, A. April 25-26, 2019. Poster. Inclusiveness of small and remote farmers in access to livestock services (extension, animal health, and medicines) in Ethiopia: The case of dairy. Presented at the Global Nutrition Symposium, Feed the Future Innovation Lab for Livestock Systems, Kathmandu, Nepal.

Minten, B. April 25-26, 2019. Poster. Better performing livestock systems in Ethiopia: Reviewing the evidence to improve policies. Presented at the Global Nutrition Symposium, Feed the Future Innovation Lab for Livestock Systems, Kathmandu, Nepal.

Beyene, S. T. May 2, 2019. Presentation. Inclusive transformation in the livestock sector. Presented at Inclusive transformation of rural Ethiopia: Patterns and options. Addis Ababa, Ethiopia.

Minten, B. May 2019. Presentation. Agricultural value chains in Ethiopia: Changes of F&V supply chains in context. Presented at Department for International Development, Addis Ababa, Ethiopia.

Headey, D., Hirvonen, K., Hoddinott, J. March 2019. Presentation. Animal sourced foods and child stunting. Presented at the Ethiopian Public Health Institute.

Hirvonen, K. November 9, 2018. Presentation. Changes in nutrition outcomes in Ethiopia, 2000-2016. Presented at Changes in Nutrition Outcomes in Ethiopia, 2000-2016. Addis Ababa, Ethiopia.

Minten, B. December 11, 2018. Presentation. Transforming agri-food systems in Africa: Evidence from the dairy value chain in Ethiopia. Presented at LICOS and PIM Workshop on Value Chains and Development in Africa, Belgium.

Minten, B. May 20-23, 2019. Presentation. Transformation of Ethiopia's livestock market systems: Implication for prices, inclusiveness, and resilience. Presented at Feed the Future Innovation Labs Regional Partners Meeting - Building Food Security Resilience through Research for Development. Addis Ababa, Ethiopia.

Minten, B. September 23-26, 2019. Presentation. Innovating for efficient and inclusive value chains in Africa: The case of dairy. Presented at 6th African Conference of Agricultural Economists. Abuja, Nigeria.

Minten, B., Bachewe, F., and Hirvonen, K. July 19-21, 2019. Presentation. The increasing costs of nutritious foods in Ethiopia: Evidence and determinants. Presented at 17th International Conference on the Ethiopian Economy (EEA). Addis Ababa, Ethiopia.

Minten, B., Beyene, S. T., Habte, Y., and Tesfaye, A. July 19-21, 2019. Presentation. The transforming dairy sector in Ethiopia. Presented at 17th International Conference on the Ethiopian Economy (EEA). Addis Ababa, Ethiopia.

Minten, B., Beyene, S. T., Habte, Y., and Tesfaye, A. July 19-21, 2019. Presentation. Transforming Agri-food Systems in Ethiopia: Evidence from the Downstream and Midstream Segment of the Dairy Value Chain. Presented at 17th International Conference on the Ethiopian Economy (EEA), Addis Ababa, Ethiopia.

Tesfaye, A. and Minten, B. 2018. Report. The commercial dairy cattle value chain and milk supply to the city of Addis Ababa. Ethiopian Institute of Agricultural Research (EIAR), and International Food Policy Research Institute (IFPRI), Addis Ababa, Ethiopia.

Bachewe, F. N., and Minten, B. August 2019. The rising costs of nutritious foods: The case of Ethiopia. ESSP Working Paper 134. International Food Policy Research Institute (IFPRI) and Federal Democratic Republic of Ethiopia Policy Studies Institute. Washington, DC and Addis Ababa, Ethiopia.  
<http://www.ifpri.org/publication/rising-costs-nutritious-foods-case-ethiopia>

Minten, B., Habte, Y., Tamru, S. and Tesfaye, A. 2018. Transforming agri-food systems in Ethiopia: Evidence from the dairy sector. ESSP Working Paper 129. Ethiopian Development Research Institute (EDRI), Addis Ababa, and . International Food Policy Research Institute (IFPRI) Washington, DC and Addis Ababa, Ethiopia.  
<http://www.ifpri.org/publication/transforming-agri-food-systems-ethiopia-evidence-dairy-sector>

Minten, B., Tamru, S. and Reardon, T. 2019. Post-harvest losses in rural-urban value chains: Evidence from Ethiopia. ESSP Working Paper 135. Federal Democratic Republic of Ethiopia Policy Studies Institute, Addis Ababa, Ethiopia, and International Food Policy Research Institute (IFPRI); Washington, DC and Addis Ababa, Ethiopia. <https://doi.org/10.2499/p15738coll2.133411>

Vandecasteele, J., Minten, B., and Tamru, S. September 2019. Cities, value chains, and dairy production in Ethiopia. Ethiopia Strategy Support Program (ESSP), Working Paper 137. International Food Policy Research Institute (IFPRI); Washington, DC and Addis Ababa, Ethiopia. <https://www.ifpri.org/publication/cities-value-chains-and-dairy-production-ethiopia>

### **Improving handling practices and microbiological safety of milk and milk products in Borana pastoral communities in Ethiopia**

Kebede Amenu Ejeta | Addis Ababa University

Amenu, K. January 2019. Brochure. Improving Handling Practices and Microbiological Safety of Milk and Milk Products in Borana Pastoral Communities, Ethiopia.

Hunduma, D., Alonso, S., Agga, G., Dege, O., and Wieland, B. July 2019. Poster. Occurrence and Antimicrobial Resistance of Escherichia coli O157: H7 and Salmonella in the Milk and Feces of Lactating Dairy Cows and Camels in Borana Pastoral Community, Ethiopia. Presented at annual meeting of International Association for Food Protection (IAFP), Louisville, KY, USA.

Amenu, K. July 21-24, 2019. Presentation. Safety of traditional dairy products in East Africa. Presented at annual meeting of the International Association for Food Protection (IAFP), Louisville, KY, USA.

Amenu, K., Tiki, W., Amdhun, K., Agga, G., and Desta, H. June 23-26, 2019. Presentation. Interventions towards improving the microbiological quality of traditional yogurt in Borana pastoral communities, Ethiopia. Presented at annual meeting of the American Dairy Science Association (ADSA), Cincinnati, OH, USA.

Amenu, K., Desta, H., and Alonso, S. 2018. Training manual. Guide for training of pastoralists (women) in Borana Zone, Oromia Region, Ethiopia on good milk production, handling and processing practices and prevention of the transmission of milk-borne zoonotic diseases. <https://cgspace.cgiar.org/rest/bitstreams/165051/retrieve>

### **Designing and evaluating innovations for development of smallholder female livestock cooperatives in Nepal**

Conner Mullally | University of Florida

Gorkhali, N., Janzen, S., Magnan, N., Mullally, C., Sharma, S., Shrestha, B. and Thapa, B. September 2019. Poster. Technical innovations for female entrepreneurs in the livestock value chain in rural Nepal. Poster. Presented at the 9th annual Global Agenda for Sustainable Livestock (GASL) Multi Stakeholder Partnership, Manhattan, KS, USA.

Mullally, C., Janzen, S., Magnan, N., Miller, S. July 22, 2019. The impact of a smartphone marketing application on smallholder livestock producers in Nepal: Pre-analysis plan. Presented at the annual meeting of Agricultural and Applied Economics (AAEA), Atlanta, GA, USA.

### **Development of a feeding support tool for enhancing dairy animal productivity for improved livelihood of smallholder dairy farmers in Nepal**

Bhola Shrestha | Heifer International Nepal

Joshi, N., Neupane, S., Neupane, S., and Thorne-Lyman, A. April 25-26, 2019. Presentation. "More milk, please!" Does increased milk consumption lead to better child growth and development in rural Nepal? Presented at the Global Nutrition Symposium, Feed the Future Innovation Lab for Livestock Systems, Kathmandu, Nepal.

Miller, L., Joshi, N., Lohani, M., Rogers, B., Neupane, S., Neupane, S., Ghosh, S. and Webb, P. April 25-26, 2019. Poster. Multisector community development improves child diet quality relative to other household members more than nutrition training alone in rural Nepal. Presented at the Global Nutrition Symposium, Feed the Future Innovation Lab for Livestock Systems, Kathmandu, Nepal.

Miller, L. June 5, 2019. Presentation. Cognitive development of children and the role of animal-source foods. Presented at Symposium on Ensuring children's cognitive and physical development through animal-source foods, organized by the Feed the Future Innovation Lab for Livestock Systems, Washington, DC.

Miller, L., Joshi, N., Neupane, S., Neupane, S., and Thorne-Lyman, A. June 23-26, 2019. Presentation. “More milk, please!” Does increased milk consumption lead to better child growth and development in rural Nepal? Presented at Annual meeting of the American Dairy Science Association (ADSA), Cincinnati, OH, USA.

### **Enhancing the quality and consumption of milk for improved income and nutrition in Rwanda**

Emily Ouma | International Livestock Research Institute

Kimani, J. and Harper, J. March 2019. Blog post. Research helps parents “give milk” to improve nutrition and livelihoods in Rwanda. <https://livelihoods-gender.ilri.org/2019/03/15/research-helps-parents-give-milk-to-improve-nutrition-and-livelihoods-in-rwanda/>

Schreiner, M. 2018. Brochure. Gabura Amata Mubyeyi. English and Kinyarwanda languages. International Livestock Research Institute (ILRI), Nairobi, Kenya and Kigali, Rwanda

Schreiner, M. 2018. Card. Gabura Amata Mubyeyi: Nutrition counselling cards in English and Kinyarwanda. International Livestock Research Institute (ILRI), Nairobi, Kenya and Kigali, Rwanda.

Flax, V., Ouma, E., Schreiner, M., Izerimana, L., and Niyonzima, E. 2019. Poster. Does the GIRINKA Program Improve the nutrition of young children and can the impact be increased through social behavior change communication? [http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Rwanda\\_LSIL\\_nutrition\\_poster.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Rwanda_LSIL_nutrition_poster.pdf)

Schreiner, M. 2018. Poster. Gabura Amata Mubyeyi: Poster on importance of animal-source foods. English and Kinyarwanda. International Livestock Research Institute (ILRI), Nairobi, Kenya and Kigali, Rwanda.

Bizinde, B. September 3, 2019. Presentation. The dairy industry strategic plan for Rwanda. Technoserve. Presented at Chez-Lando, Kigali, Rwanda.

Flax, V., Ouma, E., Poole, J., Izerimana, L., and King, G. September 2019. Report. Rwandan government livestock asset transfer program (“Girinka”) is associated with improved child nutrition. [http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Nutrition-study-brief\\_LSIL-JH-clean.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Nutrition-study-brief_LSIL-JH-clean.pdf)

Schreiner, M. 2018. Report. Gabura Amata Mubyeyi: Pilot Activity report on the nutrition interventional materials. International Livestock Research Institute (ILRI), Nairobi, Kenya and Kigali, Rwanda

Flax, V., Ouma, E., Poole, J., Izerimana, L., and King, G. 2019. Report. Enhancing milk quality and consumption for improved income and nutrition in Rwanda Nutrition: Household Baseline Survey Report.

Bizinde, B., Kariuki, J., and Ouma, E. A. 2019. Technical brief. Performance of dairy cooperatives in Rwanda: Outcomes of selected capacity development interventions. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Schreiner, M. 2018. Training manual. Gabura Amata Mubyeyi: Facilitator guide and teaching materials. English and Kinyarwanda. International Livestock Research Institute (ILRI), Nairobi, Kenya and Kigali, Rwanda

### **Milk production practices, udder health and their impact on milk quality, safety and processability in Rwanda**

Jean Baptiste Ndahetuye | University of Rwanda

Ndahetuye, J., Persson, Y., Nyman, A., Bage, R., Artursson, K., Diangwani, J., and Shyaka, A. 2019. Report. Executive summary of a focus project funded by the Livestock Systems Innovation Lab. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

### **Assessment and mitigation of aflatoxin and fumonisin contamination in animal feeds in Rwanda**

Dirk Maier | Iowa State University

Nishimwe, K., Bowers E., Ayabagabo, J.D., Habimana, R., Mutiga, S. and Maier, D. 2019. Assessment of aflatoxin and fumonisin contamination in feeds and associated risk factors in Rwanda. *Toxins* 2019, 11(5), 270; <https://doi.org/10.3390/toxins11050270>

Nishimwe, K. April 3, 2019. The aflatoxin contamination status quo. Workshop on prevention and mitigation of aflatoxin contamination of food and feeds. Organized by the Ministry of Agriculture and Animal Resources in collaboration with the Feed the Future Innovation Lab for Livestock Systems, and USAID/Rwanda Hinga Weze Activity. Kigali, Rwanda.

Nishimwe, K. April 3, 2019. Hermetic Storage and Driers. Workshop on prevention and mitigation of aflatoxin contamination of food and feeds. Organized by the Ministry of Agriculture and Animal Resources in collaboration with the Feed the Future Innovation Lab for Livestock Systems, and USAID/Rwanda Hinga Weze Activity. Kigali, Rwanda.

## Non-competitive Activities

Gender, Nutrition and HICD CCTs, Enabling Policies and Future Systems AOIs | University of Florida

Harris-Coble, L., LeBeau, K. and Colverson, K. 2018. Brief. Gender in the dairy value chain and implications for the GIRINKA program (“One Cow per Poor Family”) in Rwanda. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Colverson, K. C. 2019. Case Study for Cambodia: Integrating gender and nutrition into food safety issues in the pork value chain. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Colverson, K. C. 2019. Case Study for Cambodia: Integrating gender and nutrition into food safety issues in the pork value chain. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Colverson, K. 2019. Infographic. Women livestock keepers - making progress. Infographic. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Harris-Coble, L. N. 2018. Infographic. Empowering women in livestock systems. Infographic. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Colverson, K. April 24, 2019. Presentation. Why integrate gender into livestock research? Presented at University of Florida Veterinary College. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. Gainesville, FL, USA

Colverson, K. April 9, 2019. Presentation. Why can't I eat this? Food myths and taboos from a gender perspective. Presented to the Gender Working Group at the International Center, University of Florida. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Colverson, K. June 25, 2019. Presentation. Does "Gender" have anything to do with Food Safety? Presented at Center for Precollegiate Education and Training (CPET) High School day. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Serra, R. April 29, 2019. Presentation. Gender Integration in Agricultural Value Chains - with a focus on Livestock. Guest lecture at Mid-Western University of Nepal. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Colverson, K. 2019. Training manual for researchers: Integrating Gender and Nutrition into the Project Planning Cycle. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Adesogan, A., S. McKune, Eilitta, M., Havelaar, A., and Dahl, G. 2019. Animal source foods: sustainability problem or sustainability and malnutrition solution? Perspective matters. *Global Food Security*. <https://www.sciencedirect.com/science/article/abs/pii/S2211912419300525> (accepted for publication in FY 2019, published early October 2019)

McKune, S. July 2019. Blog post. Letter to the New York Times about Malnourished Kids. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <https://blogs.ifas.ufl.edu/lcil/2019/07/16/letter-to-the-new-york-times-about-malnourished-kids/>

McNamara, K. and McKune, S. 2019. Brief. Nutrition-sensitive livestock interventions. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Anderson, H. S. June 25, 2019. Presentation. Improving Nutrition in Children Under Two Through Increased Egg Consumption in Burkina Faso. Presentation at CPET High School Day. University of Florida, Gainesville, FL, USA.

Haase, K. 2018. Presentation for Biostatistics training in Ethiopia. Research Design. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.



Haase, K. 2019. Presentation for Biostatistics training in Ethiopia. Intro to R. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Haase, K. 2018. Presentation for Biostatistics training in Ethiopia. Statistical Tests 1. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Haase, K. 2019. Presentation for Biostatistics training in Ethiopia. Statistical Tests 2. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Haase, K. 2018. Presentation for Biostatistics training in Ethiopia. Statistical Tests 3. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Haase, K. 2019. Presentation for Biostatistics training in Ethiopia. Probability Distributions. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Williams, R. J. 2019. Brief. Capacity Development Gap Analysis: Burkina Faso. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/hicd/>

Williams, R. J. 2019. Brief. Capacity Development Gap Analysis: Cambodia. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/hicd/>

Williams, R. J. 2019. Brief. Capacity Development Gap Analysis: Ethiopia. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/hicd/>

Williams, R. J. 2019. Brief. Capacity Development Gap Analysis: Nepal. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/hicd/>

Williams, R. J. 2019. Brief. Capacity Development Gap Analysis: Niger. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/hicd/>

Hallett, M. 2018. Case Study: Improving the capacity to conduct research in Nepal. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/hicd/>

Das, A.K., Pyakuryal, K., Sharma, M.D., and Upreti, B.R. 2019. Policy paper. Prospects of Establishing a Land-Grant University Model: Policy Paper on the Agriculture and Forestry University of Nepal. Eds., Williams, R.J. Devkota, N.R and Adesogan, A. Gainesville, FL, USA: Feed the Future Innovation Lab for Livestock Systems, and Agriculture and Forestry University, DOREX, Chitwan Nepal. <http://livestocklab.ifas.ufl.edu/themes/hicd/>

Williams, B., Ludgate, N., and Russo, S. April 25-26, 2019. Poster. Cross-country analysis of human and institutional capacity development challenges in livestock systems research: Problematizing training as a research capacity development solution. Presented at the Global Nutrition Symposium, Feed the Future Innovation Lab for Livestock Systems, Kathmandu, Nepal.

Leitel, H. and Williams, B. 2019. Report. Agriculture and Forestry University Ethical Review Board AFU-ERB Standard Operating Procedure for Non-Medical Human Subjects Research. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Williams, R. J. 2018. Report for Himalayan College of Agricultural Sciences and Technology. HICAST Human and Institutional Capacity Development Gap Analysis: Summary Report and Recommendations for Work Plan and MOU Development. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. [http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/HICAST\\_HICD\\_Report\\_2018.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/HICAST_HICD_Report_2018.pdf)

Williams, R. J. and Russo, S. L. 2019. Report. Human and Institutional Capacity Development Gap Analysis in Ethiopia: Summary report and recommendations. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/hicd/>

Brown, C. 2019. Report on train-the-trainer in Burkina Faso: Recognition and reporting, transboundary animal diseases. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Brown, C. 2019. Report on train-the-trainer in Niger: Recognition and reporting, transboundary animal diseases. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Hallett, M. 2019. Training manual for teaching research design. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

- Hallett, M. 2019. Training manual for teaching mobile data collection. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.
- Hallett, M. 2019. Training manual for teaching research tools and techniques. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.
- Hallett, M. and Haase, K. 2019. Training manual for teaching biostatistics using R. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.
- Williams, R.J. 2019. Participatory Training for Adult Learners Activities and Examples for Trainers in Livestock Systems. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.
- Williams, R.J. 2019. Qualitative Research Methods for Livestock Systems Research Course Manual. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.
- Harris-Coble, L., Serra, R., and Adesogan, A. 2019. Poster. Using Network Surveys to Map Livestock Policy Stakeholders. Presented at Aligning the Food System for Improved Nutrition in Animal Source Foods, University of California, Davis, California.
- Serra, R. December 11, 2018. Presentation. *Les activités par le Lab d'Innovation-Groupe Thématique sur les Politiques*. Policy Session at the Innovation Platform Meeting, Niger, Niamey, Niger.
- Serra, R. September 13, 2019. Presentation. Joint sharing and planning for improved livestock policies. Presented at Policy Round Table, Kigali, Rwanda.
- Serra, R. 2019. Video. Bridging Research and Policy Through Engagement and Communication. Part 1. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <https://mediasite.video.ufl.edu/Mediasite/Play/691e01460be74b23a9daabbac312209c1d>
- Serra, R. 2019. Video. Bridging Research and Policy Through Engagement and Communication. Part 2. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <https://mediasite.video.ufl.edu/Mediasite/Play/cb93668b57b14d02bf544dbff232997e1d>
- Enahoro D, Mason D'Croz D, Mul M, Rich K, Robinson T, Thornton P, Staal S, 2019a. Supporting sustainable expansion of livestock production in South Asia and Sub-Saharan Africa: Scenario analysis of investment options. *Global Food Security* 20, 114-121. <https://doi.org/10.1016/j.gfs.2019.01.001>
- Zougmore R, Partey ST, Totin E, Ouédraogo M, Thornton PK, Karbo N, Sogoba B, Dieye B, Campbell BM, 2019. Science-policy interfaces for sustainable climate-smart agriculture uptake: Lessons learnt from national science-policy dialogue platforms in West Africa. *International Journal of Agricultural Sustainability*. <https://doi.org/10.1080/14735903.2019.1670934>
- Cohen, A.A.B., Cohen, P.R., and Kiker, G. February 2019. Poster. Modeling Gender Inequity in Household Decision-Making. Presented at Women and Gender in International Development, Virginia Tech, Blacksburg, Virginia; and in May at Modeling the World's Systems 2019 conference, Washington, DC, USA.
- Valerio, V., Muneeppeerakul, R., Kiker, G.A., Eilitta, M. and Walther, O. October 2018. Poster. Quantifying the Growth, Development and Resilience of the West African Livestock Trade Network. Presented at the Diversity Graduate Research Symposium, University of Florida, Gainesville, FL, USA.
- Valerio, V. May 2019. Presentation. Mapping Regional Food Trade: The Structure of Live Animal Movements in West Africa. Presented at NetSci2019, University of Vermont, VT, USA.
- Valerio, V. June 25, 2019. Presentation. Modelling Livestock Value Chains. Presented at CPET High School Day. University of Florida, Gainesville, FL, USA.
- Cohen, A., Cohen, P., and Kiker, G. July 2019. Presentation. Modeling Gender Inequity in Household Decision-Making. Presented at SBP-BRiMS 2019 conference on social and behavioral modeling, Washington, DC, USA
- Enahoro, D., Njiru, N., Thornton, P. and Staal, S.J. 2019. Report. A review of projections of demand and supply of livestock-derived foods (LDF) and the implications for livestock sector management in LSIL focus countries. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). <https://ccafs.cgiar.org/publications/review-projections-demand-and-supply-livestock-derived-foods-and-implications-livestock#.Xa8RdEF7mU1>

Kiker, G. August 2019. Video. Future Systems - Introduction to Modeling. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/future-livestock-systems/>

Kiker, G. August 2019. Video. Future Livestock Systems - How can models and scenarios work together? Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/future-livestock-systems/>

Rutting, L. August 2019. Video. Future Systems - Introduction to Scenarios. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/future-livestock-systems/>

Rutting, L. August 2019. Video. Future Systems - Scenarios: how to develop them? Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/themes/future-livestock-systems/>

## Management Entity Activities

Management Entity | University of Florida

Balehegn, M., Mekuriaw, Z., Miller, L., McKune, S., and Adesogan. A. T. 2019. Animal source foods for improved cognitive development. *Animal Frontiers*. <https://doi.org/10.1093/af/vfz039> (accepted for publication in FY 2019, published early October 2019)

Varijakshapanicker, P., McKune, S., Miller, L., Hendrickx, S., Balehegn, M., Dahl, G. E., and Adesogan, A. T. 2019. Sustainable livestock systems to improve human nutrition, health, and economic status. *Animal Frontiers*. <https://doi.org/10.1093/af/vfz04> (accepted for publication in FY 2019, published early October 2019)

Adesogan, G. and Harper, J. March 2019. Blog post. The Payoff of Investing in Research for Growing Economies, American Farm Bureau Federation. <https://www.fb.org/viewpoints/the-payoff-of-investing-in-research-for-growing-economies>

Harper, J. October 2019. Blog post. Peering into the Future of Livestock Systems. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <https://blogs.ifas.ufl.edu/lstil/2018/10/08/peering-into-the-future-of-livestock-systems/>

Management Entity. June 2019. Innovation Summary for Mastitis Control. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. [http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Ndahetuye\\_UR\\_RWANDA\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Ndahetuye_UR_RWANDA_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary for Mastitis Package. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. [http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Sah\\_Heifer\\_NEPAL\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Sah_Heifer_NEPAL_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary for Mycotoxin Testing. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. [http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Zereyesus\\_KSU\\_ETHIOPIA\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Zereyesus_KSU_ETHIOPIA_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary for Mycotoxins in Feeds. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. [http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Maier\\_Iowa-State\\_RWANDA\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Maier_Iowa-State_RWANDA_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary for Pathasure Kits. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. [http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Smith\\_UC-Davis\\_ETHIOPIA\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Smith_UC-Davis_ETHIOPIA_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary for Social & Behavior Change Communication. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. [http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Ouma\\_ILRI\\_RWANDA\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Ouma_ILRI_RWANDA_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary for Sorghum Genotypes. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA

[http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Vipham\\_KSU\\_ETHIOPIA\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Vipham_KSU_ETHIOPIA_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary for Yoghurt Safety. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

[http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Amenu\\_AAU\\_ETHIOPIA\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Amenu_AAU_ETHIOPIA_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary of Disease Detection. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

[http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Brown\\_UGA\\_ETHIOPIA\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Brown_UGA_ETHIOPIA_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary of Diseases App. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

[http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Bowen\\_COState\\_NEPAL\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Bowen_COState_NEPAL_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary of Feed App. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

[http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Shrestha\\_Heifer\\_NEPAL\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Shrestha_Heifer_NEPAL_Innovation-Summaries_April-2019.pdf)

Management Entity. June 2019. Innovation Summary of Goat Marketing App. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

[http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Mullally\\_UF\\_NEPAL\\_Innovation-Summaries\\_April-2019.pdf](http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/Mullally_UF_NEPAL_Innovation-Summaries_April-2019.pdf)

Management Entity. October 2018. Lively Newsletter, Issue 5. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <https://mailchi.mp/e210cb447bbf/lively-newsletter-5-partnerships-build-potential>

Management Entity. November 2018. Lively Newsletter, Issue 6. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <https://mailchi.mp/84dabe4c9af6/lively-newsletter-6-focus-on-nepal>

Management Entity. March 2019. Lively Newsletter, Issue 7. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <https://mailchi.mp/fc5b4c462e6d/lively-newsletter-7-future-systems>

Management Entity. July 2019. Lively Newsletter, Issue 8. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/media/livestocklabifasufledu/pdf-/LIVELY-Newsletter-8-Policies,-Projects-and-Partnerships.pdf>

Adesogan. A. T. October 16, 2018. The vital role of livestock in meeting global economic, education, sustainability needs. Tropilunch Seminar Series. Tropical Conservation and Development Center, University of Florida, Gainesville, FL, USA.

Adesogan, A. November 19, 2018. Presentation. Research findings from two aflatoxin projects conducted in Ethiopia and Rwanda and steps taken to date by the Livestock Systems Innovation Lab. Presented at One Health International Symposium: Risk communication in resource-limited countries. University of Florida, Gainesville, FL, USA.

Adesogan. A. T. November 25, 2018. The US land-grant university system: A key to US agricultural productivity and advancements. Nepal Agricultural Education Policy Symposium, Bharatpur, Nepal.

Adesogan. A. T. November 30, 2018. Mycotoxins feeds, and feed supply chains. National Stakeholder Consultation Workshop on Mycotoxin Mitigation for Health, Nutrition, Agricultural Productivity and Prosperity in South Asia. Organized by the Feed the Future Innovation Labs for Nutrition and Post-Harvest Loss Reduction, and the Government of Nepal. Nepal Academy of Science and Technology (NAST), Satdobato, Lalitpur, Nepal.

Adesogan A. T. January 13, 2019. The payoff of investing in research in developing economies. Feed the Future Innovation Labs. American Farm Bureau Federation National Convention, New Orleans, LA, USA.

Adesogan A.T., March 26, 2019. Biological, chemical, physical and management strategies for preventing and mitigating aflatoxin. Workshop on the Prevention and Mitigation of Aflatoxin Contamination of Animal Feed and Animal-Source Foods. Addis Ababa, Ethiopia.

Adesogan A.T. April 3, 2019. Biological, chemical, physical and management strategies for preventing and mitigating aflatoxin. Workshop on prevention and mitigation of aflatoxin contamination of food and feeds. Organized by the Ministry of Agriculture and Animal Resources in collaboration with the Feed the Future Innovation Lab for Livestock Systems, and USAID/Rwanda Hinga Weze Activity. Kigali, Rwanda.

Adesogan, A.T., S. McKune and K. Colverson. May 13-15, 2019. Gender equity, food taboos and animal-source food consumption. Presented at Aligning the Food Systems for Improved Nutrition in Animal-Source Foods, University of California, Davis, CA, USA.

Adesogan A.T. July 8-11, 2019. Sustainable diets must include animal source foods. Proc. Annual Meeting of the American Society of Animal Science, Austin, TX, USA.

Adesogan A.T., September 4, 2019. Animal source foods: Critical for sustainability, cognition, education and economic productivity. Animal Sciences departmental seminar. University of Florida, Gainesville, FL, USA.

Adesogan, A.T. and Hendrickx, S.C.J. September 19, 2019. Feed the Future Innovation Lab: for Livestock Systems - Update on project progress. Bureau for Food Security, USAID, Washington, DC, USA.

Dahl, G.E. S. McKune, A. Havelaar, A. Adesogan, S.C.J. Hendrickx, and J. Vipham. September 9, 2019. Animal Source Foods: Contributions to Food and Nutritional Security. Global Agenda for Sustainable Livestock Annual Meeting. Manhattan, KS, USA.

Galindo, S. April 2, 2019. Presentation. Evaluating Research for Development. Presented at 35th Annual AIAEE Conference: Linking, Innovating, Motivating, and Engaging for Resilient Agricultural Systems, Port of Spain, Trinidad & Tobago.

Havelaar, A. February 13, 2019. Presentation. The public health burden of unsafe foods. A need for global commitment. Presented at the WHO conference at African Union Conference Center, Addis Ababa, Ethiopia.

Havelaar, A. June 25, 2019. Presentation. Ensuring the Safety of Animal-Source Foods. Presented at the CPET High School day. University of Florida, Gainesville, FL, USA.

Hendrickx, S. C. J. and Adesogan. October 25, 2018. Careers in animal science; a noble profession. Department of Animal Sciences, University of Florida, Gainesville, FL, USA.

Management Entity. 2018. Proceedings of the 2018 Global Nutrition Symposium. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/events/2018-global-nutrition-symposium/>

De Vries, A. and Kaylegian, K. 2018. Report. Rapid assessment of the gaps in dairy cattle feeding, management and milk processing that constrain milk quality and quantity in Nepal. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Hernandez, J. and Hendrickx, S. February 2019. Report. Workshop on livestock epidemiology, data analysis, and health policy. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Kaylegian K.E. 2018. Report on train-the-trainer dairy food basics: Fundamentals of quality & safety. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA.

Management Entity. 2018. Webinar. Livestock Systems Innovation Lab Program Evaluation Framework. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/about-us/evaluation/>

Management Entity. 2018. Webinar. Library Access for Success: Accessing & searching AGORA for research literature. Held on October 13, 2018. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/events/webinars-on-literature-access/#d.en.536025>

Management Entity. 2018. Webinar. Library access for success: Search strategies for successful literature reviews. Held on October 18, 2018. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/events/webinars-on-literature-access/#d.en.536025>

Management Entity. 2018. Webinar. Library access for success: How to store your references and content. Held on November 14, 2018. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/events/webinars-on-literature-access/#d.en.536025>

Management Entity. 2019. Webinar. Managing aflatoxin risk: Proper sampling and analytical techniques to ensure accurate and defensible results. Held on June 12, 2019. Feed the Future Innovation Lab for Livestock Systems, University of Florida, Gainesville, FL, USA. <http://livestocklab.ifas.ufl.edu/events/webinars-on-managing-aflatoxin-risk/>

Management Entity. 2018. Website. One Health International Symposium: Risk communication in resource-limited countries, held at University of Florida, Gainesville, FL, USA, on November 19, 2018. <http://livestocklab.ifas.ufl.edu/events/risk-communication-symposium>

Management Entity. 2019. Website. Innovation Platform meeting held in Addis Ababa, Ethiopia, on February 18, 2019 <http://livestocklab.ifas.ufl.edu/events/innovation-platforms/ethiopia-2019-innovation-platform/#d.en.590908>

Management Entity. 2019. Website. Innovation Platform meeting held in Kigali, Rwanda, on April 2, 2019. <http://livestocklab.ifas.ufl.edu/events/innovation-platforms/rwanda-2019-innovation-platform/>

Management Entity. 2019. Website. Extending our Reach: Symposium on improving human nutrition and incomes through effective livestock research and extension partnerships. Links provide Symposium Summary, booklet of poster abstracts, and 7 presentations. Event held in Kathmandu, Nepal, from April 25-26, 2019. <http://livestocklab.ifas.ufl.edu/events/2019-global-nutrition-symposium/>

Management Entity. 2019. Website. Symposium: Ensuring children's cognitive and physical development through animal source foods. Links provide speaker biographies, program, and 8 presentations. Event held June 5, 2019 at Capitol Hill Club, Washington, DC. Webpage: <http://livestocklab.ifas.ufl.edu/events/symposiumdc/>