



**FEED THE FUTURE**

The U.S. Government's Global Hunger & Food Security Initiative



## **Feed the Future Innovation Lab for Legume Systems Research**

# FY 2019 Annual Report October 1, 2018 – September 30, 2019

## A. Management Entity Information

The Feed the Future Innovation Lab for Legume Systems Research (hereafter Legume Systems Innovation Lab), Cooperative Agreement No. 7200AA18LE00003, was awarded to Michigan State University (MSU) for a five-year period as Prime of the Leader with Associate Award (LWA), on August 23, 2018. The Management Entity (ME) is housed at MSU's College of Agriculture and Natural Resources.

The ME includes the following staff:

- Barry Pittendrigh, Director
- Cynthia Donovan, Deputy Director
- Doreen Gordon, Financial Officer
- David DeYoung, Program Manager
- Jan Fierro, Communication Manager
- Jane Payumo, Monitoring and Evaluation (M&E) Specialist

## B. Technical and Advisory Committee Information

The Legume Systems Innovation Lab's Technical Management and Advisory Committee (TMAC) monitors projects and advises the Legume Systems Innovation Lab ME on strategic planning. The ME consults with the TMAC on emerging issues and technologies, strategies for building sustainable institutional capacity and achieving development impacts, and program management approaches.

In FY 2019, members who served on the TMAC are:

- Robert Easter, TMAC Chairperson, University of Illinois Urbana-Champaign, Illinois, USA
- Jeff Alwang, Virginia Tech, Virginia, USA
- Jeff Ehlers, Bill and Melinda Gates Foundation, Washington, USA
- Louis Jackai, North Carolina Agricultural and Technical State University, North Carolina, USA
- Esther Njuguna-Mungai, International Crops Research Institute for the Semi-Arid Tropics, Nairobi, Kenya
- Greg Varner, Michigan Bean Commission, Michigan, USA
- Joe Cramer, Michigan Bean Commission, Michigan, USA (through July 2019)
- Jessica Fanzo, Johns Hopkins University, Maryland, USA (through July 2019)
- Therese Gondwe, International Institute for Tropical Agriculture, Zambia (through June 2019)
- Joe Tohme, International Center for Tropical Agriculture, Colombia (through August 2019)

The USAID Agreement Officer's Representative (Daniel Bailey) is also an ex-officio member of the TMAC.

After the awarding of research and capacity building projects in the three Areas of Inquiry (AOI) outlined in the cooperative agreement, the principal investigators (PIs) of the awarded projects will participate in the process of selecting up to three additional TMAC members to join the members listed above.

### C. Map of Countries of Work

The Legume Systems Innovation Lab’s current subaward projects, as indicated in Figure 1 below, are in Benin, Burkina Faso, Senegal, Niger, Nigeria, Ghana, Guatemala, and Honduras.

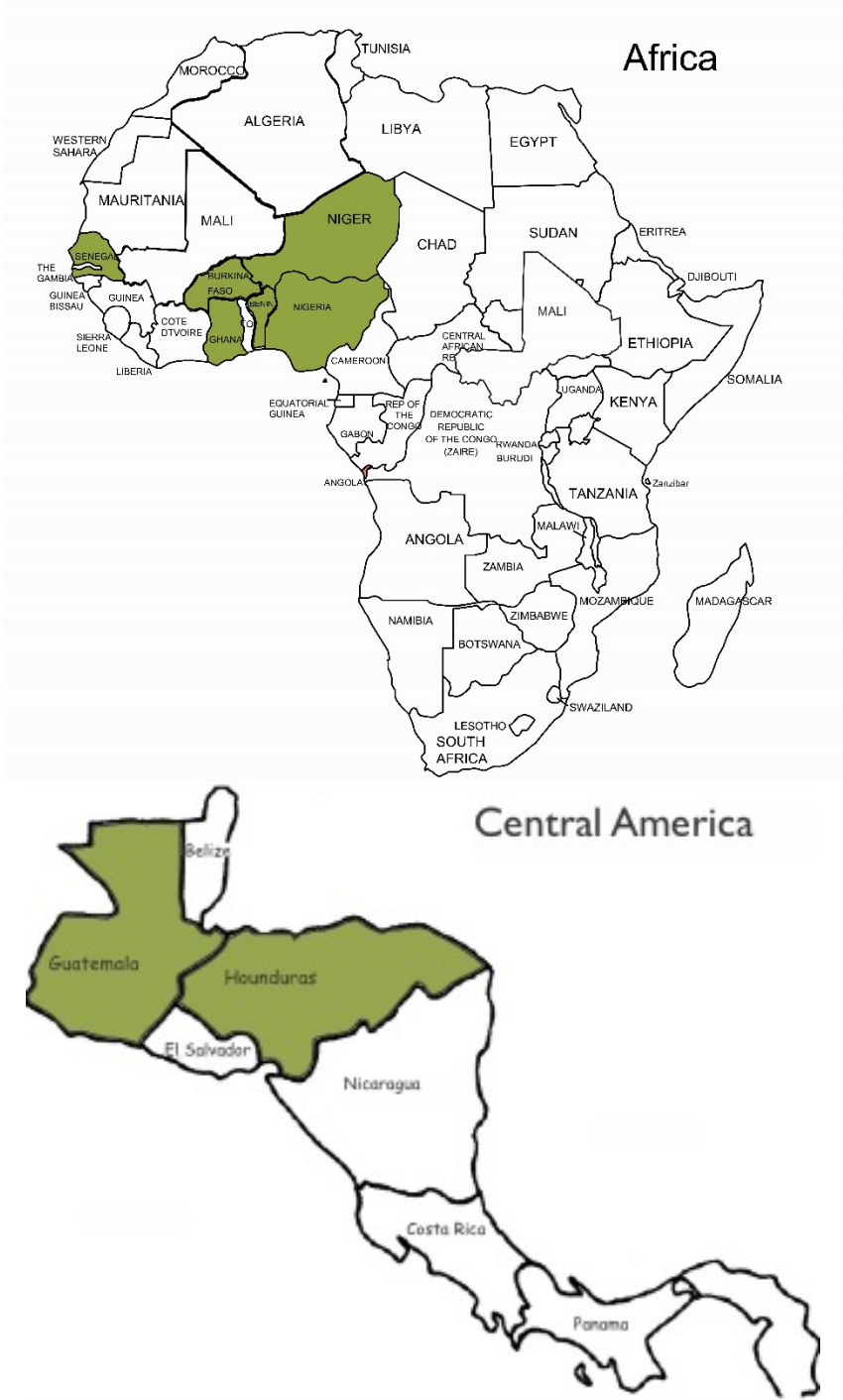


Figure 1: Map of Legume Systems Innovation Lab Target Countries Projects in FY 2019

## D. List of Program Partners

The Legume Systems Innovation Lab works with the following U.S. partners and international partners:

### United States

Colorado State University  
Kansas State University  
Michigan Bean Commission  
North Dakota State University  
University of Puerto Rico  
Washington University in St. Louis

### Benin

International Institute of Tropical Agriculture  
University of Abomey-Calavi

### Burkina Faso

Institut de l'Environnement et du Recherches Agricoles

### Ghana

University of Ghana Legon  
Crops Research Institute

### Guatemala

Instituto de Ciencias y Tecnología Agrícolas

### Niger

L'Institut National de la Recherche Agronomique  
University of Maradi  
Université Abdou Moumouni de Niamey

### Nigeria

University of Ilorin  
Bayero University in Kano

### Sénégal

Institut Sénégalais de Recherches Agricoles  
Agence Nationale de Conseil Agricole et Rural

### Honduras

Zamorano University

## E. Acronyms

AOI	Area of Inquiry	INERA	Institut de l'Environnement et du Recherches Agricoles du Burkina Faso
AOR	Agreement Officer's Representative		
BIFAD	Board for International Food and Agriculture Development	INRAN	L'Institut National de la Recherche Agronomique du Niger
CBNP	Community-Based Neem Production	IR	Intermediate results
CGAIR	Consortium of International Agriculture Research Centers	LINCC	Legume Industry Consultative Council
CLA	Collaborative, Learning and Adapting	LWA	Leader with Associate Award
Co-PI	Co-Principal Investigator	ME	Management Entity
CR	Commissioned Research Project	M&E	Monitoring and Evaluation
DDL	Development Data Library	MSU	Michigan State University
DEC	Development Experience Clearinghouse	NARS	National Agricultural Research Systems
DMP	Data Management Plan	NIFA	National Institute of Food and Agriculture
EMMP	Environmental Management and Mitigation Plan	OPI	Organizational Performance Index
FtF	Feed the Future	PCCMCA	The Central American Cooperative Program for the Improvement of Crops and Animals (Acronym in Spanish)
FTFMS	Feed the Future Monitoring System	PI	Principal Investigator
FY	Fiscal Year	PMP	Performance Management Plan
GFSS	Global Food Security Strategy	SI Toolkit	Sustainable Intensification Assessment Framework
HICD	Human and Institutional Capacity Development	TMAC	Technical Management Advisory Committee
IA	Initial Activity	TOC	Theory of change
ICT	Information and Communication Technology	USAID	United States Agency for International Development
ICTA	Instituto de Ciencias y Tecnología Agrícolas	USDA	United States Department of Agriculture
IEE	Initial Environmental Examination	USG	United States Government
IL	Innovation Lab		

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## I. Executive Summary

The Feed the Future Innovation Lab for Legume Systems Research completed its first full fiscal year on September 30, 2019. The goal of the Legume Systems Innovation Lab is to “foster the development and growth of dynamic, productive, profitable, and environmentally sustainable legume systems that will increase food security and nutrition and contribute to the Global Food Security Strategy (GFSS) goal to sustainably reduce global hunger, malnutrition, and poverty” (Technical Proposal, p. 1). After assembling the components of the designed framework for the Legume Systems Innovation Lab, putting in place the management team, and structuring the advisory committee, the Legume Systems Innovation Lab has been active in identifying research needs in legume systems in Central America and West Africa. The Legume Systems Innovation Lab has assembled a wide network of legume system scientists and practitioners from across the globe in order to support the direction and efforts of the Legume Systems Innovation Lab and is currently working with 19 different partner organizations in nine countries.

As part of this effort, the Legume Systems Innovation Lab issued calls for proposals for three Areas of Inquiry (AOI). To date, the Legume Systems Innovation Lab has approved awards for six Initial Activities, one Commissioned Research Project, is finalizing awards for three proposals in AOI 1, and is currently reviewing proposals in AOI 2 and 3. It has also, together with the Technical Management Advisory Committee (TMAC), identified at least three areas ripe for commissioned scoping or piloting projects. In the course of these Year 1 efforts, over 466 members of the legume systems in Central America and West Africa received short-term training related to the funded research projects. Among the early targeted successes of the funded projects are:

- A sustainable pest management system for cowpea in West Africa using bio agents.
- Improved remote sensing methods for legume cropping systems.
- Statistical modeling of the impact of pigeonpea adoption on ecosystem services.
- The release of drought tolerant common bean germplasm for the dry corridor of Guatemala.
- New methods for measuring individual cowpea consumption.
- Key data collected for evaluating legume value chains and markets in West Africa.

The Legume Systems Innovation Lab recently contracted the services of experts in gender and capacity development who will make a major contribution to the effectiveness of proposals currently under consideration in Areas of Inquiry 1-3. Their efforts will significantly strengthen the work of the partner institutions in their various locales and provide a basis for collecting data on improvement in these two cross-cutting issues over time.

Overall, the Legume Systems Innovation Lab is well-positioned to make a significant impact on legume systems in West and Southern Africa. Although the current foreign policy of the US prevents continued work in Central America, the Legume Systems Innovation Lab is well-positioned to make a significant impact on legume systems in Central America should the funding picture be clarified there. Based on the long-term success of previous USAID funded legume research programs at MSU, the quality and potential impact of the research supported by the Legume Systems Innovation Lab are significant and the legacy of these efforts will be felt for generations to come.

We are grateful to USAID for its support of these efforts and look forward to making a contribution to food security worldwide.

## II. Program Activities and Highlights

The Legume Systems Innovation Lab is still in the initial phase of setting up and framing the research projects for the next four years. Nevertheless, the Legume Systems Innovation Lab was able to make significant strides forward as the following program highlights reveal. Upon initiation, the Management Entity (ME):

- Reviewed the award and remained in regular consultation with the Agreement Officer Representative (AOR) in order to build a solid relationship with USAID and understand targets, deliverables and indicators.
- Established the Technical and Management Advisory Committee (TMAC) and hosted an initial planning meeting with the Legume Industry Consultative Council (LINCC).
- Reviewed all proposed Initial Activities with the TMAC, AOR and USAID Missions, and then negotiated requested changes with Principal Investigators (PIs), followed by the establishment of subaward contracts for the six Initial Activities described in Section III.
- Contracted Piestar DPx to provide the Legume Systems Innovation Lab's knowledge management systems to support collaborative data and project management, streamline strategic plans, maintain compliance, monitor progress, evaluate program impact and report results. Piestar RFX, a separate site, was prepared to assist with competitive proposals, including receipt and review.
- Identified performance measures and indicators for the Feed the Future Monitoring System: number of individuals who received USG-supported degree training in non-nutrition-related food security training and number of technologies, practices, and approaches under various phases of research, development and uptake as a result of USG assistance.
- Prepared all program plans, including the Workplan for Year 1, Performance Management Plan, Communications Plan, Branding and Marketing Strategy, Data Management Plan, and the Environmental Mitigation and Monitoring Plan.
- Designed and distributed the requests for concept notes for the Areas of Inquiry (AOI) 1 through 3, including efforts to reach out to Minority Serving Institutions (details provided below).
- With the assistance of the AOR, initiated communication with relevant USAID Missions.
- Reviewed the received concept note proposals for AOI 1-3 with the TMAC and AOR and selected the best concept notes to submit full proposals and shared reviewers' comments with PIs to incorporate in their full proposals.
- Reviewed and selected AOI 1 full proposals and worked with PIs to incorporate remaining needed changes.
- Awarded one (1) Commissioned Research Project to collect baseline market information in key legume markets in West Africa and six (6) Initial Activity projects.
- Participated in various USAID and Innovation Lab webinars and meetings, including the Annual Innovation Lab meeting in Washington DC and the regional Innovation Lab meeting in Ethiopia.
- Made various presentations on the Legume Systems Innovation Lab and on the role of legumes at a number of events.

### III. Key Accomplishments

#### A. Initial Activity and Commissioned Research Projects

The ME awarded six Initial Activity projects and one Commissioned Research Project (see Section VI below) during FY 2019 (see Research Funding section of Annual Workplan). As part of the activities of these projects, over 466 individuals received short term training. As a result of these projects, five (5) technologies, practices and/or approaches were under different phases of research, development and uptake. (see Outcomes and Performance Indicators section and Appendix C of PMP).

#### B. Competitive Research Proposals (AOI 1-3)

In FY2019, the Legume Systems Innovation Lab posted calls for concept notes in the three AOIs to a wide range of distribution lists and communication media to ensure that the calls for concept notes and proposals were viewed by many potential researchers and institutions. In response to the calls for concept notes in the three AOIs, the ME received 80 concept notes, of which the ME, TMAC, and AOR moved 21 concept note proposals on to the full proposal stage. By the end of FY 2019, three (3) full proposals selected for AOI 1 were under final negotiation before contracting and publicly announcing awards, while full proposals for AOIs 2 and 3 were still under review, with selection anticipated in the first quarter of FY 2020 (see Research Funding section of Annual Workplan). Piestar RFX, a separate system from the Legume Resource & Reporting Hub mentioned below, was used to announce the request for concept notes, receive applications, and coordinate proposal reviews.

#### C. Establish Monitoring and Evaluation (M&E) System

During the reporting period, the ME finalized the contract with the web-based data collection and performance management system and implemented the Legume Resource & Reporting Hub designed by Piestar. Initial Activity and Commissioned Research Project PIs submitted project data for the FY 2019 Annual Report and Feed the Future Monitoring System (FTFMS) via the Legume Resource & Report Hub. The system is used to communicate and track international travel requests between PIs, the ME and AOR (see Monitoring and Evaluation section of Annual Workplan and Web-based Data Collection System and Reporting of PMP). Given changing USAID and Innovation Lab needs, the ME will continue to work with Piestar to ensure that it meets the needs for tracking and reporting, while facilitating the research programs.

#### D. Collaboration with Global Legume Community

The Legume Systems Innovation Lab Director Barry Pittendrigh was one of the organizers (and a co-PI on the supporting USDA grant) of the NIFA funded conference “Emerging Opportunities for Pulse Production: Genetics, Genomics, Phenomics, and Integrated Pest Management” held June 24-25, 2019 in Pullman, WA. Washington State University (WSU), in partnership with Michigan State University (MSU), hosted the event, and Deputy Director Cynthia Donovan represented the Innovation Lab at the conference (see Engagement with Stakeholders section of Annual Workplan).

## IV. Research Program Overview and Structure

As an LWA, The Legume Systems Innovation Lab research program is based upon competitively awarded projects and selected commissioned research projects. The Legume Systems Innovation Lab addresses Global Food Security Strategy (GFSS) objectives around sustainability in agricultural systems, resilience among people and systems, and food security and nutrition, especially among women and children. The Legume Systems Innovation Lab seeks to enable research to enhance the multifunctionality of legumes in production and market systems, offering scientifically validated innovations, including methods of research, policy recommendations, and technologies that benefit farmers, traders, processors and consumers in Feed the Future priority areas. The initial geographical foci of the research and capacity building efforts are Central America and West Africa. Due to USAID funding restrictions on new activities in the northern triangle of Central America, no new projects were funded in Central America beyond the Initial Activities.

The Legume Systems Innovation Lab pursues strategic collaborative research with research-intensive institutions, host country governmental and nongovernmental organizations, and private sector partners. Research is based on three AOIs:

- AOI One: Integration of legumes into sustainable smallholder farming systems and agricultural landscapes
- AOI Two: Integration of legumes within local/regional market systems, including trade
- AOI Three: Analysis of sociocultural and/or economic motivators or barriers to legume utilization at various stages and scales within production and market systems

As part of the journey to self-reliance, the Legume Systems Innovation Lab also provides graduate research and training and other forms of capacity development to support sustainable research systems in the host countries and institutions of funded projects. The results will be increased transfer, dissemination, and access to new knowledge and technologies via people, institutions, and countries with improved capacity to sustain agricultural research systems able to produce and disseminate their own technological advances.

## V. Theory of Change and Impact Pathways

Figure 2 illustrates the Legume System Innovation Lab's approach to implementing adaptive and results-based management with its theory of change (TOC) as the guiding framework along defined impact pathways, focused on immediate results delivery. The TOC begins with a set of critical inputs. These inputs include the time and resources that the ME, in partnership with USAID, and local and international partners representing the public and private sectors, networks of researchers, and the global legume community, contribute to the program. The Collaborate, Learn and Adapt (CLA) approach, combined with prior needs assessments, risk management strategies, and USAID resources, makes key program activities possible. Investments in targeted research and a balanced legume systems research portfolio will result in gender- and youth-responsive, nutrition-sensitive outputs. These outputs will fill gaps in the innovation pipeline of the legume systems in key parts of the world and produce game-changing technologies (e.g., advanced cowpea breeding lines with desirable traits), knowledge and management practices (e.g. pest control), or evidence-based research findings (e.g. improved market system strategies for producers, buyers, consumers and other players driving economic activity in the market). Through effective outreach initiatives, in partnership with relevant players, including the public and private sectors, donors, and local governments, and complemented by strategic program activities, these outputs can then be transferred to end-users (e.g., farmers and consumers) in the legume systems value chain to encourage adoption. The CLA feedback loops of collaboration, learning, and adoption, with recognition of culture, process and resources, are essential to producing cross-cutting intermediate results (IRs).

Each project is expected to use Legume Systems Innovation Lab’s generalized TOC as a guide to design their own TOC. As outlined in the Legume Systems Innovation Lab’s Performance Management Plan (PMP), the careful design of TOC for the program and all funded projects, will help map the link of inputs-outputs-outcomes – goals and specifically, how, why, and to what extent change (measured through carefully selected FTFMS and custom indicators, e.g. introduction of new technologies from research, increase in number of trained scientists for partner countries, establishment of new public-private sector partnerships) happened as a result of program and project interventions. Training and refresher courses on TOC and impacts pathway for funded projects are planned for a Lab-wide meeting in February 2020.

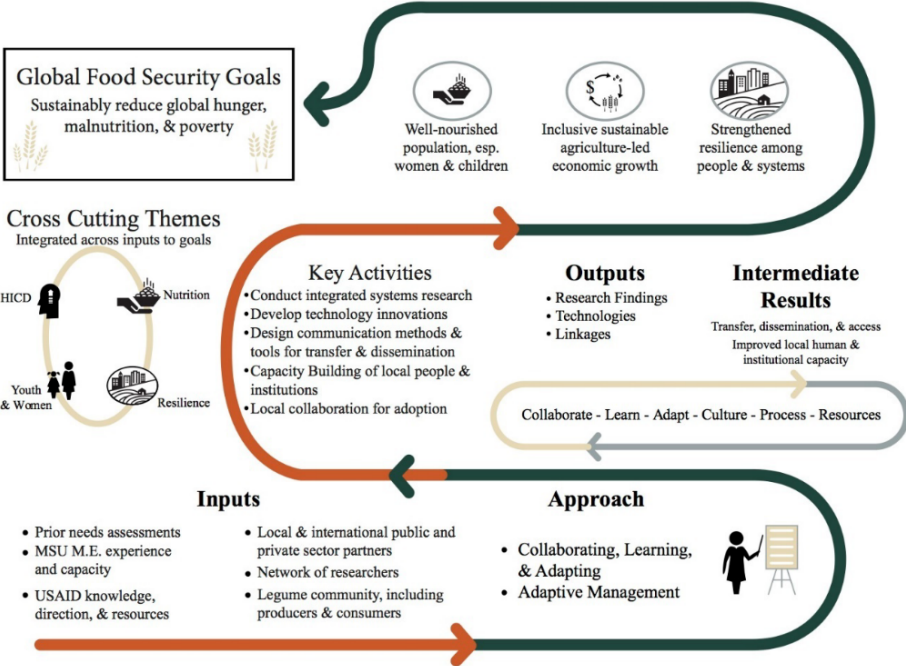


Figure 2: A Generalized View of the Legume Systems Innovation Lab’s Theory of Change.

In early 2019, the Legume Systems Innovation Lab launched Piestar’s Legume Resource Reporting Hub, which will help capture data generated by the program. Initial Activities of the program used the Legume Resource Reporting Hub to report highlights of accomplishments (see succeeding pages for details) and provided information to address the following questions (as an alternative to TOC and impacts pathway since these projects were not required to submit TOC and impacts pathway):

1. What activities do you have planned for your project?
2. What outputs do you expect to have from these activities (what products will these activities generate)?
3. What outcomes do you expect to have from these activities (what will change as a result of these activities)?
4. How will these activities lead to these outcomes?

Integration of CLA into programming of the Legume Systems Innovation Lab’s activities also started this year and can be outlined as follows:

1) Collaborating (*Is the Legume Systems Innovation Lab collaborating with the right partners at the right time?*) - all Areas of Inquiry advocate for collaboration with the right partners to promote research synergy and cutting-edge global collaboration, yet locally relevant research;

2) Learning (*Is Legume Systems Innovation Lab addressing strategic issues and critical questions related to the program and sharing those answers to its stakeholders for their learning?*) - The Legume Systems Innovation Lab actively maintains its website, monthly e-newsletter, and social media accounts, and Legume Resource Reporting Hub, to encourage knowledge and information sharing among its PIs and partners.

3) Adapting (*Is the Legume Systems Innovation Lab using the information it gathers through collaboration, consultation and learning for insights, decision making and adjustments as needed?*): Recently, the Legume Systems Innovation Lab has commissioned research that will help understand the value chain (e.g. capacity needs and gaps) for key legume markets in West Africa; results of this study will inform future decisions and needed adjustments in target markets.

4) Enabling Conditions (*Is the Legume Systems Innovation Lab working in an organizational environment that supports CLA efforts?*): Recent discussion to overcome counterincentives to CLA, especially organizational culture and HICD efforts are also underway.

## VI. Research Project Reports

### Initial Activity I: Sustainable Insect Pest Management for Cowpea in West Africa

**Locations:** Niger (Maradi, Dakoro, Madaroufa, and Mayahi), Burkina Faso (Bama, Banfora, Bobo-Dioulasso, and Satiri), and Benin (Zou, Donga, and Collines)

**Description:** For the past 9 years, this team has been working as a network to develop and deploy integrated pest management approaches. The activities in this project are a spin-off from past Legume Innovation Lab project outputs. First, experimental releases of the biocontrols against the pod borer were conducted in Benin and Burkina Faso. Before expanding the inoculative releases to the Feed the Future countries of Ghana, Niger and Nigeria, data will be collected on establishment of, and ecological impact on, pod borer populations in the original release areas. Second, the ‘neem tea bag’ was recently tested at a research station and in more than 30 villages of Niger. Treatments based on neem seeds aqueous extracts resulted in yield increases of 346 to 806% compared to untreated control plots.

**Theory of Change and Impact Pathways(s):** Not required for Initial Activity

**Collaborators:** Manuele Tamò, International Institute of Tropical Agriculture (IITA), Benin. Fousseini Traoré, Institut de l'Environnement et du Recherches Agricoles (INERA), Burkina Faso. Amadou Laouali, L'Institut National de la Recherche Agronomique du Niger (INRAN), Niger. Ibrahim Baoua, Université de Maradi, Niger.

**Achievements:** In Benin, the team established a total of eight (8) experimental cowpea fields (with no pesticide applications) in Igoho and Houngpogon in South-Central Benin. The fields were planted in May with the local variety Kpodjigogue. From each field, a total of ten (10) entire plants were removed at each sampling date, and all flowering and podding structures were placed separately into paper bags for incubation. Overall, the population of the pod borer *Maruca vitrata* was consistently low, with a maximum average per plant of 0.52 caterpillars, compared to an average of 3.82 caterpillars recorded during the same time of the year in the same region by Toffa et al. (2014). Most importantly, the team was able to recover adults of the parasitoid *Therophilus javanus* from parasitized caterpillars collected from cowpea pods. This is really a breakthrough, indicating that this parasitoid is still well established three (3) years after the first experimental releases in the region. The other released parasitoid, *Phaneortoma syleptae*, was also found to be very firmly established on patches of wild host plants including *Lochocarpus* and *Pterocarpus* trees. In Burkina Faso, the team recently planted an early (60 day) cowpea variety, “Komcalle,” in five experimental fields (no pesticide applications) close to the parasitoids release areas. In Niger, a trip was conducted in June to target the farmers’ cooperative for establishing the community-based neem production units (CBNP) in the

departments of Dakoro, Madaroufa and Mayahi. The farmers involved in the process of neem biopesticide production were all women. Training on Farmer Field Schools and neem-based biopesticides held in June at INRAN, Maradi. Fifteen Farmer Field Schools (FFS) were conducted in July in the same three departments as above (5 FFS per department), with, on average, 20 to 25 participants, including women. Twenty-eight biopesticide demonstration fields (DF) were established in 30 villages with 88 farmers including 46 women.

**Capacity Building:** In Niger, a total of 413 people received training in bio-pesticide production and usage.

**Lessons Learned:**

- Women are eager to engage in learning and take a leadership role in programs such as the community-based neem production units (CBNP). Promoting open access gender policies benefit projects and lead to greater success.
- When implementing farmer field schools, they must be coordinated and led by local partner organizations the farmers trust, otherwise they may be poorly attended or farmers may be skeptical of the information being shared.

**Presentations and Publications:** None to date

## Initial Activity 2: Evaluating Spatial Resolution of Remote Sensing Imagery to Monitor Crop Growth in Legume-based Cropping Systems: How Much Information Is Lost Due to Coarse Spatial Resolution?

**Locations:** Ghana (Northern Ghana) and Honduras (Dry corridor)

**Description:** The team used high resolution satellite imagery to monitor legume-based systems to identify the optimal spatial resolution for capturing plant growth variation and productivity at selected smallholder farmers in Ghana and Honduras. Activities focused on three areas: 1) determinations of satellite platforms with different spatial resolutions; 2) identification of legume-based systems in Ghana, and critical legume cultivation areas in Honduras; and, 3) analysis of the impact of spatial resolution on monitoring legume growth. The research was designed to better understand the spatial resolution of remotely sensed images to monitor and understand legume systems at smallholder farms. Comparisons were made between different sources of images (at different spatial resolutions) in both Ghana and Honduras. Test areas were selected based on an analysis of the maps depicting general vulnerability to drought based on Global high-resolution water balance and remotely sensed vegetation indices (dry years vs normal years), terrain analysis, and precipitation.

**Theory of Change and Impact Pathways(s):** Not required for Initial Activity

**Collaborators:** Bruno Basso, Michigan State University, USA. Lin Liu, Michigan State University, USA. Guanyuan Shuai, Michigan State University, USA. Ruben Ulbrich, Michigan State University, USA.

**Achievements:** Key achievements for the study areas in Ghana were as follows: 1) processed images from three satellite platforms, including Landsat (30 meter resolution), Sentinel-2 (10 meter resolution) and PlanetScope (3 meter resolution); 2) evaluated the differences in spectral information among the satellite platforms; and 3) evaluated the impact of spatial resolution on vegetation indices.

Key achievements for Honduras were: 1) identified precipitation pattern, identification for the study of the dry corridor and land cover in Honduras; 2) identified locations of legume-based cropping systems in Honduras; 3) downloaded more than 10,000 square kilometers images from the PlanetScope for Honduras; and 4) processed images from three satellite platforms. Highlights of these outputs included: 1) high-

resolution images capturing the smallholder farmers' field boundary; 2) satellite imageries were able to capture the changes in canopy cover in time during the crop growing seasons for the legume-based systems and could be used to monitor crop growth; and 3) the signals of crop growth differed across the satellite platforms.

**Capacity Building:** A collaboration was established with the Crop Research Institute of Kumasi in Ghana. The project supported technical skill development of a PhD candidate on the research team including integrated knowledge of remote sensing and agronomy to legume-based smallholder farming systems and image analysis skills on Google Earth Engine.

**Lessons Learned:** Adding a ground-truthing data collection activity to validate the remote sensing data to future research would be beneficial for research of this type.

**Presentations and Publications:** None to date

### Initial Activity 3: Systems Research to Identify Legume Options for Sustainable Intensification: Pigeonpea as a Test Case for Scaling in West Africa

**Locations:** Ghana (Central and Northern)

**Description:** The project goal was to implement a systems research approach to scaling out technologies through a test case of the suitability niche for pigeonpea and mungbean. These two crops are not currently grown on any significant scale in West Africa, yet both have the potential to fill unique cropping system functions. Pigeonpea is a long-duration, multipurpose crop — in addition to being a food source, this crop provides vegetation for fodder and has a unique ability in association with the root biome to enhance soil nitrogen and phosphorus availability. Recently developed varieties of mung bean have extra early planting, short duration growth properties and can be grown in relay and intercrop systems for a 'hungry season' food source and novel source of income generation.

Through modeling and geospatial analysis, the biophysical and socioeconomic niche was mapped for the introduction of pigeonpea and mung bean. Specifically, high potential sites were identified where pigeonpea and mungbean are predicted to grow well as part of integrated cropping systems in Mali, Burkina Faso, Ghana and Nigeria. As a proof of concept, the research team assessed the potential impact of pigeonpea in Mali.

**Theory of Change and Impact Pathways(s):** Not required for Initial Activity

**Collaborators:** Sieglinde Snapp, Michigan State University, USA. Xinyi Tu, Michigan State University, USA. Daniel TerAvest, Michigan State University, USA. Princess Hayford, Independent Consultant.

**Achievements:** The team evaluated the range of impact expected from sorghum system diversification with pigeonpea in terms of enhanced soil fertility, fodder, and potential for production of more stable sorghum yields. Outputs have included geo-visualizations and scenario analyses to assess potential impact through crop introduction, including long-term sustainability, system resilience, and income and nutrition – particularly as a potential novel protein source for female-headed households. A literature review was completed and draft maps of the pigeonpea suitability niches, detailed for Ghana and West Africa in general, were produced. Travel to Ghana enabled collection of primary data on pigeonpea growth and receive field researchers' validation of draft map products. Statistical and systems modeling analyses are underway to assess potential impact on ecosystem services through adoption of the pigeonpea. A mungbean literature review has been started, however, data scarcity is a challenge.

**Capacity Building:** None



**Lessons Learned:** In addition to gathering data through published research literature, it is important to remember to also seek the knowledge of people in the field; farmers, traders, etc. this is especially important when the published data is sparse. Taking time to look outside traditional published research literature while conducting a literature search is an important step to fully understand the current state of the topic.

**Presentations and Publications:** None to date

### Initial Activity 4: Selection and Release of Climate Resilient Common Bean Germplasm for the Highlands and Dry Corridor of Central America

**Locations:** Guatemala (Jutiapa, Jalapa, Chiquimula, Zacapa, El Progreso, Huehuetenango, Baja Verapaz Izabal, Chimaltenango, Sacatepéquez, and Sololá)

**Description:** The project team objectives of this Initial Activity are: 1) release the Bolonillo-type climbing bean variety ICTA-Quiché for the highlands of Guatemala; 2) release the bush type variety ICTA-Patriarca adapted to the Dry Corridor and lowlands of Guatemala; and, 3) continued field testing/selection of four advanced bruchid-resistant black bean breeding lines on 1.0 hectare (0.25 hectare each) and lab screening of the lines.

**Theory of Change and Impact Pathways(s):** Not required for Initial Activity

**Collaborators:** Phillip McClean, North Dakota State University, USA. Juan Osorno, North Dakota State University, USA. Angela Miranda, Instituto de Ciencia y Tecnología Agrícolas (ICTA), Guatemala.

**Achievements:** Seeds of ICTA-Patriarca were planted and increased in the field in San Geronimo, Baja Verapaz, Guatemala, with 250 5-pound bags being created from the harvested seeds. The distribution of the seeds in these bags began on September 4, 2019, at a formal release event in Jutiapa, Jutiapa, Guatemala. Seeds of ICTA-Quiche were tested in the field. This data is being evaluated for a near future release.

**Capacity Building:** None

**Lessons Learned:** ICTA is a very reliable research partner for USAID U.S. researchers

**Presentations and Publications:** None to date

### Initial Activity 5: Enhancing Resilience and Nutrition in the Peanut Basin of Senegal through Integration of Newly Released, Improved Cowpea Varieties

**Locations:** Senegal (Bambey, Darou Mousty, and Boulel)

**Description:** The project team will evaluate the scaling potential of newly released cowpea varieties across different agroecological zones and identify barriers to adoption across biophysical and socioeconomic factors using a “mother-baby” trial design.

**Theory of Change and Impact Pathways(s):** Not required for Initial Activity

**Collaborators:** Zachary Stewart, Kansas State University, USA. Moussa Diangar, Institut Sénégalais de Recherches Agricoles, Senegal. Aliou Faye, Institut Sénégalais de Recherches Agricoles, Senegal. Amadou Diallo, Institut Sénégalais de Recherches Agricoles, Senegal. Madam Dieye, Agence Nationale de Conseil Agricole et Rural, Senegal. Djimin cor Fall, Institut Sénégalais de Recherches Agricoles, Senegal.

**Achievements:** The team developed a research design to evaluate the scaling potential of newly released cowpea varieties across different agroecological zones and to identify barriers to adoption across biophysical

and socioeconomic factors. In April, the team trained 40 participants to use the Sustainable Intensification Toolkit to conduct a systems analysis. The experimental design uses the “mother-baby” trial approach to conduct agronomic evaluations of improved cowpea genotypes across different agroecological zones. A follow-up survey with farmers was conducted that trialed the varieties to determine socioeconomic barriers to adoption as well as gender and nutrition sensitivities of improved cowpea genotypes, and provide trainings to empower farmers, extension agents, and researchers using bi-directional learning (i.e. “mother-baby” trials). Trials were planted at three research centers: Bambey, Darou Mousty and Boulel. Around each center, baby trials are under evaluation in four (4) villages. Each village trial includes nine (9) farmers totaling 108 farmers testing different management systems. Subsequent socioeconomic surveys and N15 analysis of cowpea plant tissue protocols have been developed and will be implemented at the end of the growing season.

**Capacity Building:** A training was conducted with 40 scientists, graduate students and Peace Corps volunteers on the use of the Sustainable Intensification Toolkit. A Masters’ graduate student lead the collection of data for the “mother-baby” trials and contributed to the trial design.

**Lessons Learned:**

- Collecting, shipping, and analyzing samples is a time-consuming process and took longer than anticipated and allotted. Time must be built into the project workplan to allow for these activities well after the growing season otherwise the project jeopardizes the ability to complete the work as designed.
- Projects should consider Bi-directional learning (mother-baby field trials) when addressing farmers concerns about new variety crop adoption as it allowed farmers to experience first-hand new variety benefits while supported by the study. They proved quite successful for our project.

**Presentations and Publications:** None to date

## Initial Activity 6: Measuring Cowpea Consumption

**Locations:** Ghana (Mion)

**Description:** At present, there is no reliable and convenient way to measure the quantity of cowpea consumed on an individual basis. This limits the ability to assess the effectiveness of projects that promote legume consumption, nutrition education efforts, as well as compliance in clinical trials that promote legume consumption as supplements. Without reliable data on the extent of cowpea consumption, it is difficult to commit the resources necessary to take projects to scale in developing countries. The project deployed a method developed by Dr, Mark Manary of Washington University that uses a urinary biomarker unique to cowpea to confirm dietary exposure and quantify levels of dietary intake for children and adults. The fieldwork was conducted in the upper northwest region of Ghana. The objective of the project is to identify a novel set of dietary biomarkers that will measure cowpea consumption that is free from participant recall bias and serve to quantify legume intake.

**Theory of Change and Impact Pathways(s):** Not required for Initial Activity

**Collaborators:** Mark Manary, Washington University in St. Louis, USA. David Taylor Hendrixson, Washington University in St. Louis, USA. Matilda Steiner-Asiedu, University of Ghana, Ghana. Firibu Saalia, University of Ghana, Ghana.

**Achievements:** All samples were collected as of August 30, 2019 and were transported back to the U.S. for processing.

**Capacity Building:** None

**Lessons Learned:**

- Careful consideration must be given to portion quantity when conducting a study that involves food consumption. Accounting for volumetric consumption during experiment design will lessen the probability that you will have to make adjustment while conducting the experiment.
- Understanding cultural nuances is critical when conducting human study experiments. In Ghana, local lore believes that if a woman says that she is pregnant out loud, this will cause her not to give birth to a healthy baby. This was a challenge in identifying pregnant women for the study. These issues can be easily identified pre-experiment by reviewing experimental design with local participants.

**Presentations and Publications:** None to date

## Commissioned Research Project: Value Chain Assessment for Key Legume Markets in West Africa

**Locations:** Niger (Niamey), and Nigeria (Kano and Kwara)

**Description:** This project supports future research initiatives on legume value chains in West Africa through a targeted survey in three large cities in or near the West African Sahel region – Ilorin and Kano in Nigeria, and Niamey in Niger. The surveys document key actors along the value chains, and buyer-supplier relationships from farmers to consumers for legume market systems. A resilient and well-functioning value chain/market system is critical for farmers to generate income and earn livelihoods, and for consumers to access food, and other agricultural products. Information about market linkages therefore has great potential for mitigating the effects of events that may disrupt the flow of food from producers to final consumers.

**Theory of Change and Impact Pathways(s):** Not required for Commissioned Research Project

**Collaborators:** Michael Olabisi, Michigan State University, USA. Mywish Maredia, Michigan State University, USA. Hakeem Ajeigbe, Bayero University, Kano and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Nigeria. Toyin Benedict Ajibade, University of Ilorin, Nigeria. Abdoulaye Djido, Universite Abdou Moumouni de Niamey, Niger.

**Achievements:** Key data collection steps completed in Kano. Similar steps are underway in Ilorin and Niamey.

**Capacity Building:** None

**Lessons Learned:**

- The project team faced an added institutional requirement to have a Memorandum of Understanding between the PIs and University Administrators, because the focused countries were deemed high security risk. Completing this internal newly established process took almost six weeks. Future projects need to plan more flexibility into the timing of projects, especially if the proposed work is in countries deemed high risk.
- The project was further delayed five to six weeks due to institutional uncertainty of contracting subawards within the institution. The ME and institutional offices now have a procedure and list of required documents to approve an internal MSU project.

**Presentations and Publications:** None to date.

## VII. Associate Award Research Project

The Legume Systems Innovation Lab did not have any Associate Award Research Projects in FY 2019.

## VIII. Human and Institutional Capacity Development

As noted above in the section devoted to our Theory of Change, “The Collaborative, Learning and Adapting (CLA) approach, combined with prior needs assessments, risk management strategies, and USAID resources, make key program activities possible” (p. 4). CLA forms the core of our capacity development approach, whether at the individual level, the organizational level, or the systems level. In order to set in motion this process, Legume System Innovation Lab has undertaken a process of project initiation that will allow HICD to be based on the CLA model. In order to accomplish this, Legume Systems Innovation Lab developed the following process:

### Collaborate

The first component of CLA is collaboration. The Legume Systems Innovation Lab will undertake a process of jointly developing capacity development plans for each activity in such a way that there is local input and local ownership of capacity development efforts. For each proposal, institutional letters of commitment were required as a first step.

### Stakeholder capacity needs inventory

In order to understand the capacity of funded activity stakeholders to deliver on project deliverables, a stakeholder inventory will be developed in which PIs, together with their implementation teams, identify stakeholders, assess the capacity of stakeholders to deliver on project deliverables, and prioritize capacity needs of individuals, organizations, and systems identified. The Legume Systems Innovation Lab will use the Organizational Performance Index (OPI) developed by USAID as the base tool for this assessment but will adapt it according to circumstance.

### Capacity development plan

Together with the PIs and the activity implementation team, the Legume Systems Innovation Lab will develop a capacity development plan for the activity. The plan will identify recipients for capacity development, recommended capacity development activities, and expected outcomes. Capacity development plans will focus on two things: sustainability and self-reliance. The purpose of these capacity development efforts will be to introduce into the system of which the activities are a part new capacities that not only remain as part of the systems into which they have been introduced over time (sustainability), but also can be successfully multiplied within the system after the funded activity is over (self-reliance).

### Indicators

Together with the PIs, the activity implementation team, and identified stakeholders, the Legume Systems Innovation Lab will develop indicators for the planned capacity building activities to measure progress on capacity development.

### Monitoring and Evaluation (M&E)

An M&E will be put in place that allows for data collection in conjunction with capacity development activities. The data will be reviewed jointly with the PIs and the implementation team to ensure that HICD activities are achieving their objective and supports the overall HICD goals of the Legume Systems Innovation Lab.

## Learn

Results from M&E will be shared and discussed between Legume Systems Innovation Lab personnel, the PIs and the activity implementation teams at previously agreed timelines. These discussions will focus on whether capacities developed are indeed effective in supporting the successful delivery of project deliverables, whether the right capacities have been targeted and sustained, and whether additional capacities need to be developed in order to ensure that project activities are successful. The results of these evaluations will be shared broadly in the Legume Systems Innovation Lab in order to share best practices and develop a community of learning around capacity building and international development.

## Adapt

After the results of ongoing capacity development efforts have been disseminated and discussed, the capacity development plan will be reviewed. Those activities that are proving to be ineffective will be stopped, new activities identified as important to project success will be incorporated, and new indicators, and M&E plans will be adapted to accommodate the change in activities.

### A. Short-term training

In the meantime, while a capacity development framework and process is implemented, the Legume Systems Innovation Lab has been active in providing short-term technical training in a variety of contexts for a variety of stakeholders. The following table provides an overall description of those activities.

**Table I: Short-term Training**

Country of Training	Activity	Brief Purpose of Training	Who was Trained?	Number Trained <sup>1</sup>		
				M	F	Total
Senegal	AI <sup>2</sup> 6 KSU	Training on the Sustainable Intensification Assessment Framework tool to ISRA graduate students, ISRA scientist, and Peace Corps Volunteers	ISRA graduate students, ISRA scientist, and Peace Corps Volunteers	27	13	40
Niger	AI 1 IITA	Farmer Field School and demonstration trails for bio-pesticides	Farmers, Farmer Field School facilitators and CBO agents	277	136	413
Nigeria	CR <sup>3</sup> 1 MSU	Train how to conduct market surveys using Computer Assisted Personal Interview	Enumerators	7	3	10
Niger	CR 1 MSU	Train how to conduct market surveys using Computer Assisted Personal Interview	Enumerators	3	0	3
Total				314	152	466

<sup>1</sup> Disaggregated by sex

<sup>2</sup> Initial Activity

<sup>3</sup> Commissioned Research Project

These trainings were conducted based on informal assessment of capacity needs in conjunction with the implementing partners activities in both Initial Activities and Commissioned Research Projects.

## B. Long-term training

The Legume Systems Innovation Lab did not have any long-term training in FY 2019.

## C. Institutional Development

### Description

No current institutional development activities are underway. Once the subawards for competitive projects are established, the next step in institutional development will be to conduct an organizational needs assessment together with partner organizations using the OPI assessment and other available tools. In the meantime, the Innovation Lab supported training activities with partner organizations intending to strengthen their ability to deliver on research objectives of the Initial Activities and Commissioned Research Project.

### Partners

ICTA in Guatemala – prior to implementation restrictions in Central America, the Legume Systems Innovation Lab supported the travel of three young scientists from ICTA, the Guatemalan NARS, to participate in the 2019 Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos y Animales (PCCMCA) Annual Meetings held 29 April – 3 May in Honduras. PCCMCA is a regional forum for research collaboration on both plant and animal research and the conference has a special legumes section each year.

Zamorano University in Honduras – prior to implementation restrictions in Central America, the Legume Systems Innovation Lab supported the participation of two young scientists from Zamorano University to participate in the 2019 PCCMCA Annual Meetings held in Honduras, as described above.

## IX. Innovation Transfer and Scaling Partnerships

The plan of action developed by the ME of the Legume Systems Innovation Lab for innovation transfer and scaling partnership varies by project and host country institution. In some cases, as detailed below in Guatemala and Niger, the NARS programs involved in the research are also scaling partners. The ME, recognizing that USAID Missions play a key role in identifying scaling partners, shared all selected concept notes and full proposals to begin a discussion of scaling the technologies proposed in those projects. The ME additionally recognizes the importance of using tools such as the Research Rack Up to include technologies in the Feed the Future Innovation Exchange.

In Guatemala, the host country NARS program (ICTA) has full-time staff members dedicated to technology transfer. The new ready-to-scale technology is the bean seed variety developed with North Dakota State University (see Initial Activity 4 Project Report above). In Niger, the host country NARS program (INRAN) transferred existing neem plant-based insecticide production technology to CBNP units (see Initial Activity 1 Project Report above). INRAN also established demonstration fields and farmer field schools to demonstrate use of the products produced by the CBNP.

## X. Environmental Management and Mitigation Plan (EMMP)

The Legume Systems Innovation Lab submitted an initial EMMP addressing the Initial Environmental Examination (IEE) conditions as they relate to the Initial Activity projects. In preparation for AOI 1-3

subawards, the ME prepared the documents and procedures to collect information from PIs to update the EMMP and amend the IEE. The Legume Systems Innovation Lab is in the process of preparing the EMMP portal in the Legume Resource & Reporting Hub so that monitoring and mitigation activities will be in place prior to initiating project activities. In cases of seeds, fertilizers, and pesticides purchase and use, project partners will provide appropriate personal protective equipment and training for the safe use of the materials. The current Piestar EMMP module used by other Innovation Labs includes a fertilizer, pesticide, and microbial inoculant purchase request/approval system. A seed purchase request/approval system will be added and annual environmental mitigation activity reviews are incorporated into the Piestar system through the Impact Modules reporting process.

## XI. Open Data Management Plan

The Legume Systems Innovation Lab's Data Management Plan (DMP) was approved during FY 2019. This plan guides the program, Initial Activities, Commissioned Research Projects, and soon its AOI-funded projects in sharing and making findings, outputs and research data available to the wider scientific community.

All Initial Activities and Commissioned Research Projects are in the process of data collection, data cleaning, or data analysis. All research data and information generated by these projects will be shared to USAID's platforms: Development Data Library (DDL), Development Experience Clearinghouse (DEC), and open source data repositories such as Harvard Dataverse or Open Science Framework. All AOI-funded projects will use the DDL repositories at a minimum and will submit a DMP that outlines the following: 1) contact person responsible for the data, 2) dataset type; 3) data privacy and restrictions; 4) data processing for privacy impact assessment; 5) date on final data deliverable; 6) estimated publication date and any embargo request; 7) name of the data repository that will be used; 8) responsible party for data submission; and, 9) target submission date.

## XII. Governance and Management Entity Activity

The TMAC members, listed on page ii, have extensive experience in leadership and research at U.S. universities (including Minority Serving Institutions), CGIAR centers, private donor foundations, private industry commissions, and advisory boards, including BIFAD. Together, the TMAC members provide technical expertise in a wide range of topics pertinent to the Legume Systems Innovation Lab. During FY 2019, and given the demands of their current engagements in research and leadership, four TMAC members, Joe Tohme, Joe Cramer, Jessica Fanzo, and Therese Gondwe, determined it was necessary to finalize their commitments serving on the TMAC. The ME is grateful for their valuable leadership and guidance while serving on the TMAC.

The TMAC members reviewed and recommended for approval all proposed Commissioned Research and Initial Activity Projects. In the competitive award process, the TMAC reviewed and selected concept note proposals from each of the three AOIs in the first round. In the second round, the TMAC reviewed and recommended for funding the full proposals based on their review and the recommendation of external reviewers.

To avoid conflict of interest, no TMAC members are employed by Michigan State University. During the review process, and to avoid bias and competing interest, no TMAC members were allowed to review concept notes or full proposals submitted by individuals from their home institutions. Furthermore, concept notes and full proposals submitted by MSU researchers were reviewed by the TMAC without comments from the ME staff based at MSU.

The ME, with the input of the TMAC, compiled a list of potential external reviewers with competence in the diverse subject areas, to review full proposals in the three AOI. In one instance during the competitive award process, the ME and TMAC leadership determined a significant conflict of interest in the review of a proposal. To avoid any potential bias in favor of the proposal, the TMAC chairperson contacted an expert in the field to determine the appropriate external reviewers and obtained external reviews of the proposal without direct involvement of the ME.

Aside from the commissioned and competitive award processes described above, the ME staff, as listed on page ii, interacted with the international legume research community through participation in annual meetings and conferences, video and audio calls, and field and food processing center site visits of both public and privately funded research. The ME began distribution of a monthly e-newsletter and encourages readers of this report to subscribe at: <https://www.canr.msu.edu/legumelab/enewsletter-sign-up>.

### XIII. Other Topics

No other topics to discuss for FY 2019.

### XIV. Issues

The Legume Systems Innovation Lab faced several issues and challenges during FY 2019. Near the end of the first quarter and extending into the second quarter of FY 2019, a government shutdown forced the ME to operate without communication with USAID at a critical moment when the ME sought to hire personnel, contract Initial Activity projects, and finalize requests for proposal documents related to its three AOI. During the shutdown, the ME proceeded to prepare program documents and administrative procedures in preparation for the competitive award process.

#### A. Central American Funding

The Legume Systems Innovation Lab, in its cooperative agreement with USAID, is to focus its funded projects in the West Africa region and the Republics of Guatemala and Honduras in Central America. In preparation for the competitive process in Central America, the ME began to reach out to existing and new partners in the Central American region including participation in a regional research conference, communication with the USAID missions including a visit to the USAID Honduras Mission, and HICD support of the NARS programs. During the third quarter of FY 2019, and with outstanding request for concept notes, the ME was informed it could only use the unrestricted FY 2017 congressional allocations funds for activities in Central America. The ME adjusted the request for concept note budgetary instructions to limit proposal budgets in line with the funds available from FY 2017 congressional allocations. On or near the day that the AOI concept note proposals were due, the ME was informed that USAID legal office had ruled that no new activities could be funded, regardless of FY source of funds. This is a major disappointment and leaves a major gap in the program, especially for research related to common beans. The ME informed applicants proposing research in Central America from the three AOIs that their proposed research and capacity building activities would not be funded. The ME also informed some of the existing and new partners in the region of the USAID funding restrictions specific to Central America. The funding limitations in Central America do present an opportunity to fund bean research in the southern Africa bean corridor. Given the timing, the ME will be limited to commissioned research projects or a consortium approach.

#### B. Ghana Activities

As noted above, West Africa is one of the Legume Systems Innovation Lab focus regions. Three Initial Activity projects and additional potential projects from the competitive award process proposed research



activities in Ghana. The USAID Ghana Mission had received a large volume of requests for program and project concurrence and indicated the excessive administrative demand on their staff. Given the mission staff's workload and as advised by the AOR, the Legume Systems Innovation Lab is coordinating legume research management with Africa RISING to reduce the transactions costs of the mission. The initial coordination with Africa RISING delayed implementation of the Initial Activity projects as the ME pursued a collaborative management scenario with Africa RISING through a Memorandum of Understanding between MSU and IITA. For the AOI 1-3 calls for proposals, the ME included a footnote indicating the potential for future delays in research and capacity development activities in Ghana. The ME anticipates only one research project in Ghana after FY 2020.

### C. Feed the Future Countries and Security Levels

Additionally, a challenge facing the Legume Systems Innovation Lab ME and its funded research and capacity building activities are the security levels in target countries. Researchers and ME staff have and will continue to face additional administrative requirements from their institutions to travel to countries with high U.S. State Department travel risk advisory levels. The ME will continue to use the International Travel Request system to ensure ME, AOR, and USAID Mission are informed prior to travel and ensure communication with travelers should conditions on the ground change. Additionally, researchers and ME staff will coordinate with their home institutions travel offices according to institutional policies if and where they exist. The Department of State STEP program will be used by travelers to ensure that both travelers and embassies are informed of travel.

## XV. Future Directions

### A. Awarding Research Projects in Three Areas of Inquiry

The Legume Systems Innovation Lab will select the sub-awards from the three AOIs in the first quarter of FY 2020. The ME will negotiate changes with the PIs, seek USAID approval, and begin contracting in the first quarter of FY 2020.

### B. Complementing Research Portfolio with Commissioned Research Projects

During the competitive research proposal process for the three AOIs, the ME and TMAC identified several research opportunities to explore technology innovations that warrant a scoping or pilot study. Examples of such research are bio irrigation with shrubs and information and communication technologies (ICT) approaches for trade facilitation for legumes. The commissioned research projects allow the ME to engage other ILs and USAID initiative to fill research gaps and collaboratively leverage existing resources, knowledge, and personnel.

### C. Startup Meeting in West Africa

In the second quarter of FY 2020, the ME will host a startup meeting with PIs, co-PIs and collaborators of the sub-award projects in the three AOIs. During the meeting, specialists will work with PIs to incorporate cross-cutting themes in their research. With the assistance of specialists, this year's meeting will emphasize incorporation of gender and youth in sub-award research. Additional cross-cutting themes to discuss at the meeting are resilience and nutrition and implementation of the HICD assessment tool described above (p. 12). The PIs will also work on their workplans and project level Theory of Change.

### D. Southern Africa Bean Corridor Research

Given the funding limitations specific to USAID spending in Central America, the Legume Systems Innovation Lab will pursue a research portfolio in the form of commissioned research projects in the southern Africa bean corridor.

### **E. Mission Engagement**

The Legume Systems Innovation Lab's ME will continue to engage USAID missions in the early planning process of research projects to ensure the research meets mission priorities. Given the importance of legumes in Central American diets, the ME will also seek engagement with missions in Central America despite the current funding restrictions.

### **F. West Africa Regional Representative**

The ME will announce, recruit, and select a West African regional representative in the first half of FY 2020. The specific qualifications required in a regional representative will depend on the selected sub-award projects' location and research areas.

### **G. Initial Activities and Finalizing Commissioned Research Projects**

The Legume Systems Innovation Lab requested and received an end date extension (period of performance) through June 2020, without changes to budget, for the six Initial Activity projects. Several of the projects are scheduled to conclude research prior to June 2020. The commissioned research project will conclude in the third quarter of FY 2020. Upon conclusion of the Commissioned Research and Initial Activity projects, the ME and PIs will share results with the USAID missions and stakeholders.

## Appendix A: List of all awards given to partners.

**Title:** Sustainable Insect Pest Management for Cowpea in West Africa

**Awarded institution:** International Institute of Tropical Agriculture

**Dates:** January 1, 2019 – June 30, 2020

**Current year funding:** \$32,483

**Total funding:** \$69,839

**Title:** Evaluating spatial resolution of remote sensing imagery to monitor crop growth in legume-based cropping systems: how much information is lost due to coarse spatial resolution?

**Awarded institution:** Michigan State University

**Dates:** January 1, 2019 – June 30, 2020

**Current year funding:** \$19,987

**Total funding:** \$95,086

**Title:** Systems research to identify legume options for sustainable intensification: Pigeonpea as a test case for scaling in West Africa

**Awarded institution:** Michigan State University

**Dates:** January 1, 2019 – June 30, 2020

**Current year funding:** \$36,927

**Total funding:** \$100,000

**Title:** Selection and Release of Climate Resilient Common Bean Germplasm for the Highlands and Dry Corridor of Central America

**Awarded institution:** North Dakota State University

**Dates:** January 1, 2019 – June 30, 2020

**Current year funding:** \$16,472

**Total funding:** \$52,000

**Title:** Enhancing Resilience and Nutrition in the Peanut Basin of Senegal through Integration of Newly Released, Improved Cowpea Varieties

**Awarded institution:** Kansas State University

**Dates:** January 1, 2019 – June 30, 2020

**Current year funding:** \$31,490

**Total funding:** \$50,000

**Title:** Measuring Cowpea Consumption

**Awarded institution:** Washington University in St. Louis

**Dates:** January 1, 2019 – June 30, 2020

**Current year funding:** \$22,747

**Total funding:** \$132,725

**Title:** Baseline Value Chain Assessment for Key Legume Markets in West Africa

**Awarded institution:** Michigan State University

**Dates:** April 1, 2019 – April 30, 2020

**Current year funding:** \$48,635

**Total funding:** \$103,922

## Appendix B: Success Stories

### Helping Guatemala Farmers Adapt to a Changing Climate Through Improved Bean Varieties

Residents of Guatemala’s dry corridor are hungry. In 2018, drought-related crop failures directly affected one in 10 Guatemalans and caused extreme food shortage for upwards of 840,000 people according to the UN’s Food and Agriculture Organization (FAO). Thousands of Guatemalans support and feed their families through subsistence farming and the alarming climate trends of the dry corridor are making each year harder to survive. Guatemala already has the sixth-highest rate of chronic malnutrition with nearly one out of every two children under five suffering from stunting or low height-for-age (USAID).

Herminio Jerónimo, 45, lives in Camotán, Chiquimula in the shadows of the Sierra de las Minas mountains and in the heart of the dry corridor. As a farmer he is no stranger to the setbacks the dry conditions and changing climate have caused. This year however, Herminio has been given new hope for his fields in the form of an improved climate resilient bean variety. The seeds, named “ICTA-Patriarca,” were distributed to farmers across the dry corridor and could be the answer he and his neighbors have been waiting for.



*Mr. Herminio Jerónimo with his ICTA Patriarca crop.*

*Photos courtesy of Angela Miranda*

ICTA-Patriarca seeds were produced and distributed with funding from USAID and the Feed the Future Innovation Lab for Legume Systems Research as a part of an initial activity project titled, “Selection and Release of Climate Resilient Common Bean Germplasm for The Highland and Dry Corridor of Central America”. Dr. Phil McClean and Dr. Juan M. Osorno from North Dakota State University lead the project and work closely with the Institute of Agricultural Science and Technology (ICTA) in Guatemala. Angela Miranda leads the bean program for ICTA. Specific results of the project include the release for ICTA-Patriarca, a bush type variety adapted to the dry corridor of Guatemala. “More than 250 farmers from Jutiapa, Jalapa, Chiquimula and Zacapa were benefited with seed, in a protocolary act with participation of the Ministry of Agriculture and some Municipalities” says Miranda. “With this project, ICTA-Patriarca has been made available to farmers, which has desirable characteristics such as good yield (with 43% average yield increase compared to local variety checks in 37 farmer plots), drought tolerance and adaptation to the dry corridor of Guatemala, helping to improve the productivity of bean producing farms and generating better income for families.”

The project is also preparing another climate resilient variety that is expected to be released soon. ICTA Quiché is a new climbing “bolonillo” grain type bean variety and a cash crop for smallholder farmers in the highlands of Guatemala. “As a team, we are working with great enthusiasm to help create a better Guatemala,” says Miranda. The new variety release is accompanied by training in agronomic management using extension technicians and seed producers’ associations. “I hope that with these varieties, Guatemalan bean producers will have greater production and thereby contribute to improving their living conditions.”



*Angela Miranda*

For more information on this Initial Activity project visit the Feed the Future Innovation Lab for Legume Systems Research Projects page at [www.canr.msu.edu/legumelab/project](http://www.canr.msu.edu/legumelab/project).

## Women and Youth in Niger Prosper with Creation of New Business Opportunities

Neem trees are a part of the beautiful landscape across Africa. Their oblong shaped leaves appear almost palm like as they sway in the breeze while providing welcoming shade from the hot Nigerien sun. The seeds of the tree are light green and cluster among the leaves. To Aicha Elh Kané and Bassirou Haruna this tree and these seeds have provided an opportunity for a better life for their families and communities — opportunity that is now being realized with the implementation of a program funded through the Feed the Future Innovation Lab for Legume Systems Research.

The seeds of the neem tree provide natural protection against the legume pod borer, a pest that attacks cowpea fields and can account for up to an 80% crop loss. Cowpea is an important crop in this region, providing food for humans and animals. A team of researchers, led by Dr. Manuele Tamò from the International Institute of Tropical Agriculture (IITA) in Benin, in collaboration with Prof. Ibrahim Baoua from the University of Maradi and Amadou Laouali from L'Institut National de la Recherche Agronomique du Niger (INRAN), Maradi, are working to develop innovative cowpea pest management solutions that incorporate non-synthetic, locally produced pesticide options. The neem seed alternatives have proven on experimental station plots to more than double yield compared to untreated plots, while also providing economic opportunities, especially for the women and youth in rural villeges in Niger — women like Haruna and Kané from a village in the department of Mayahi, in the Maradi Region. The project taught Haruna and Kané and other women how to harvest and manufacture the seeds into natural pesticide packets suitable for use in the local cowpea fields.

This year, 14 members of the local women's association started producing the *neem tea bag* for sale to cowpea farmers. This activity is organized like any value chain, with youth and women collecting the seeds and selling them to the processing group, who transform the seeds into the *neem tea bag*. In addition to generating income for the 14 women directly involved with the processing, this activity also provides revenue for some 50 seed collectors. The project has also launched the program in other communities in Niger with similar results.



*Aicha Elh Kané (right) and Bassirou Haruna (left) grind neem seeds in Guidan Mai Ganga. Photo courtesy of Amadou Laouali, INRAN, Maradi*

“With the additional income generated by the production and sale of *neem tea bags*, I was able to purchase more food during the lean period (hunger gap in the Sahel, between June and August), as well as goats, farming implements and also new clothing for the traditional ceremonies” says Aicha Elh Kané.

The project has awakened an entrepreneurial spirit in the women. “Right now, we have sold all of our *neem tea bags*, we have even sent some to town (Maradi). We would like to save funds for modernizing our production unit by purchasing a mill and sewing machines (to sew the bags), as well as installing a drying shed for the [neem seeds]” says Bassirou Haruna.

To learn more about the “Sustainable Insect Pest Management for Cowpea in West Africa” project visit the Feed the Future Innovation Lab for Legume Systems Research website [www.canr.msu.edu/legumelab](http://www.canr.msu.edu/legumelab).

## The Impact of Collaboration: Leveraging Synergies Between Innovation Labs for Success In Senegal

You may find Dr. Aliou Faye enjoying “Ndambe,” the Senegalese sauce made from cowpeas that can be mixed with just about anything or eaten just as it is. It is one of Aliou’s favorite legume dishes. Through his position with the Center of Excellence on Dry Cereal and Their Cropping Systems within the Senegalese Agricultural Research Institute (ISRA), Dr. Faye has leadership roles in research activities funded through two Feed the Future Innovation Labs<sup>4</sup>.

Due to Dr. Faye’s cross-over leadership, the two Innovation Labs successfully collaborated on cowpea varietal release trials in Senegal using sustainable intensification indicators. This cross-pollination of research efforts created synergies allowing for efficiencies of scale and scope in legume cropping system decision approaches. Both the Innovation Labs and farmers have benefitted from this cross inter-lab collaboration of people and skills. “I would like to work as long as possible with the Legume Systems Innovation Lab which allows looking for synergies and tradeoffs with other Innovation Labs to strengthen the collaboration for better impacts for the great benefits of smallholder farmers in Senegal and beyond,” says Faye of his unique position.

“These participatory research approaches have allowed for better systems assessment of both biophysical and socioeconomic parameters that are key drivers of farmer adoption and ultimately sustainable intensification,” said Dr. Zach Stewart, principle investigator<sup>5</sup>. Participating farmers are seeing the benefits of the improved varieties and the synergies of the coordinated project management approach. Fatou Thiam lives in Keur Bassirou Thiam village, Darou Mousty Commune in the Louga Region in Senegal, “I am extremely happy with the project and the new cowpea varieties on dissemination because here in our region of Louga the rainy season is very short and rainfall amount small. Here, crops like peanut have difficulties for maturing, also, as women we prefer to grow cowpea. The new cowpea variety grows faster with higher yields and nutrient density compared to the one we had before. I am also happy with these varieties because here in the middle of the rainy season you can harvest and cook for your family or sell in the market and solve your own problems,” says Fatou.



*Fatou Thiam checks on cowpeas on her farm in Keur Bassirou Thiam Village, Senegal. Photo courtesy of Racine Kane*

She is encouraged by the new opportunities the new varieties offer. “We are happy because it looks like the new varieties are more productive than the varieties we have, we hope to have more money for our family. We wish the project to grow so that other parts of the region benefit. I am encouraging other women to consider this project,” shares Thiam.

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<sup>4</sup> Feed the Future Innovation Lab for Legume Systems Research (Michigan State University) and the Feed the Future Innovation Lab for Collaborative Research on Sustainable Intensification (Kansas State University)

<sup>5</sup> Of the Initial Activity Project “Enhancing Resilience and Nutrition in the Peanut Basin of Senegal through Integration of Newly Released, Improved Cowpea Varieties”