COMMON PASTURES:
SUSTAINING FLOCKS, FARMS AND FAMILIES
FINAL REPORT

Volunteers for Economic Growth Alliance (VEGA) Special Program Support Project
Browse and Grass Growers Cooperative Farmer-to-Farmer, Mali
June 15, 2016 - July 14, 2017

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Common Pastures: Sustaining Flocks, Farms and Families

Common Pastures Initiative

Farmer-to-Farmer Mali
VEGA Special Program Support Project
Final Report

Browse and Grass Growers Cooperative
*Common Pastures: Sustaining **F**locks, **F**arms and **F**amilies*
N12835 County Rd Q
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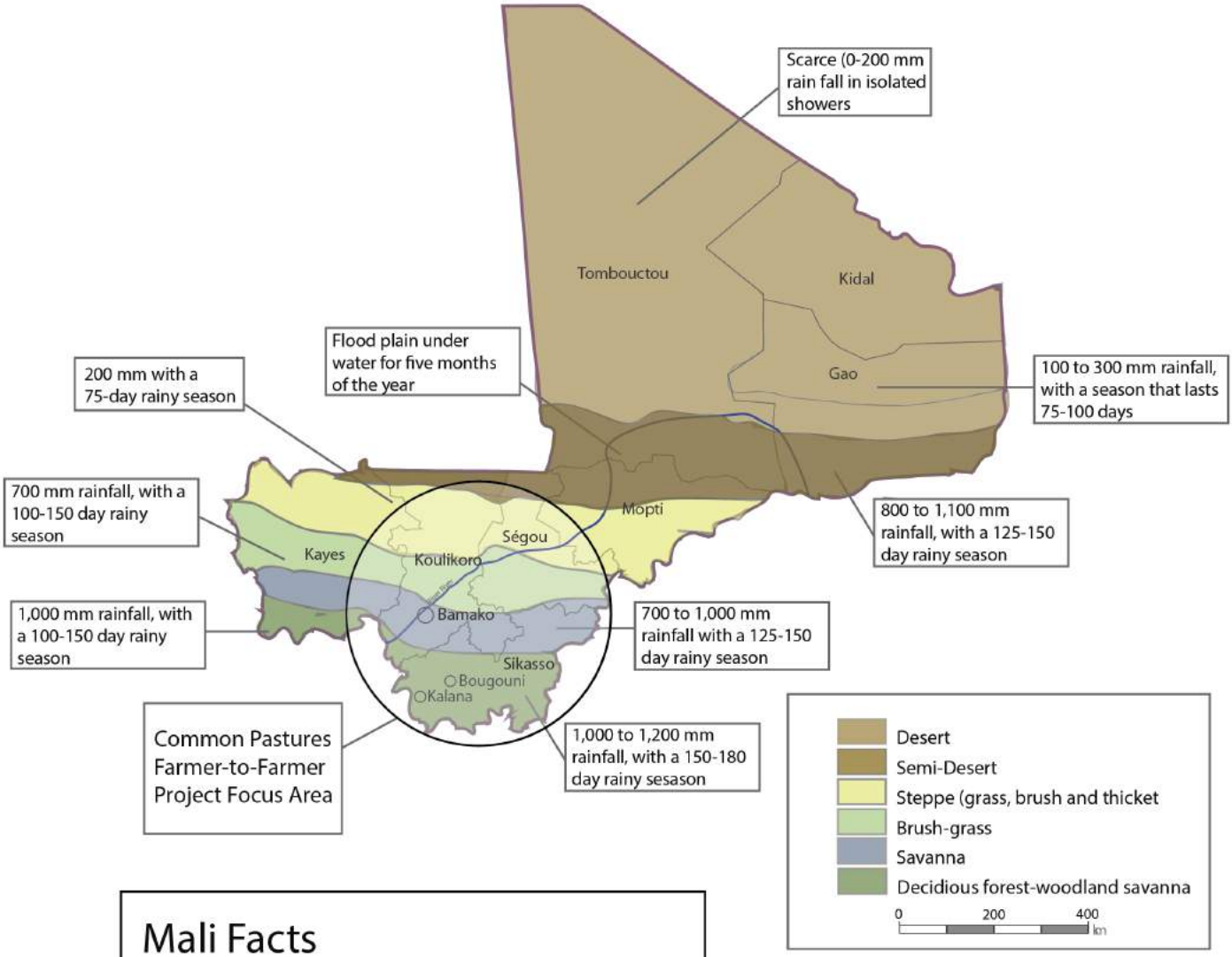
Region: West Africa

Mali's Diverse Climate

Mali is the eighth-largest country in Africa, with an area of just over 1,240,192 km^2 (480,000 sq mi). Mali's climate varies drastically from the north to south. The northern Sahara zone experiences a hot and dry climate, while the subtropical southern area is hot and humid.



Mali Facts

- Population: 13,518,000 inhabitants
- Language: Bambara - 80%; French - 21%; 13 national languages; 50 local languages
- Literacy rate: 33%
- Life expectancy: 54 years

COMMON PASTURES
SUSTAINING FLOCKS, FARMS & FAMILIES

Common Pastures: Sustaining Flocks, Farms & Families

COMMON PASTURES: Sustaining flocks, farms, and families project (F3P) is implemented by the U.S. based Browse and Grass Growers Cooperative as a Volunteers for Economic Growth Alliance (VEGA) Farmer-to-Farmer Special Program Support Project funded by the U.S. Agency for International Development (USAID).

This report marks the end of BGGC's second successful Farmer-to-Farmer (F2F) small grant initiative in Mali, West Africa, actualizing the **concept of farmers helping farmers and cooperatives helping cooperatives.**

Browse and Grass Growers:
"The art and science of integrating grazing animals with trees, shrubs, crops and pasture."

The Goal of this project is to enhance the quality of life for farmers and their families through information, training, and cost-effective implementation of sustainable small ruminant production, management, and marketing practices. Internationally, improving small ruminant production and marketing practices through information, technical training, and value-chain development is a primary need for smallholder farmers and is critical for Mali farmers.

The Program Beneficiaries are smallholder, low-resource, cooperative members, and their families, including youth, single and widowed women, farmers with disabilities, and students attending agricultural secondary and postsecondary schools.

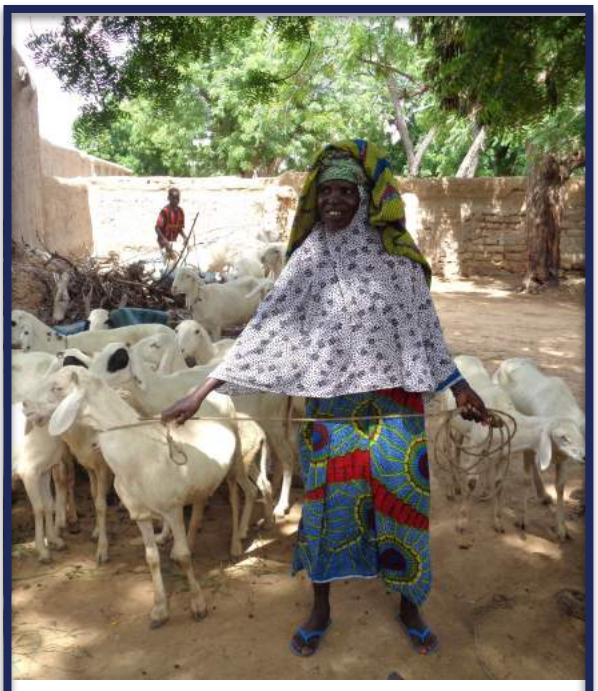
Hosts are smallholder, low-resource farmer cooperatives and agro-pastoral institutes in the Koulikoro, Sikasso, and Ségou regions of Mali, West Africa (see map page 3).

Challenge: There is a high regional demand for Malian livestock and meat. Mali possesses the most important livestock population in West Africa. Livestock products rank among the top 10 agricultural commodities produced in Mali and the combined value accounts for approximately half of Mali's agricultural GDP (FAO, 2014). Small ruminants are especially important in rural Mali as 80 percent of the population own sheep and/or goats and depend on their contribution to family income and food security. They are a socially acceptable business for women, with low initial investment, minimal labor demand, and easy market access. Youth and young children safely interact and share in the daily care of sheep and goats, keeping both out of trouble for much of the daylight hours outside of school.

And yet, livestock inventories over the last 20 years have not been increasing in productivity and are far behind the productivity rates in other developing countries. The nomadic or semi-nomadic grazing traditions and techniques are quickly becoming less effective and not transferrable to the smallholder farmers' more confined flocks. This is due to many factors, including climate change and sparse grazing areas being broken up by increased violence and drought in the north; large landholders; open pit mining; and foreign investors in the south. The demand for animal products in Mali is only partially being met, while the demand for meat is predicted to grow steadily in coming decades (FAO, 2014). The productivity of Malian herds will need to improve dramatically to prevent the gap between demand and supply from increasing further.

The demand for animal products in Mali is only partially being met, while the demand for meat is predicted to grow steadily in coming decades (FAO, 2014).

Opportunities for financial impact: Small ruminants in Mali, as in other developing countries, play an important role in alleviating the poverty of rural communities (Alary et al. 2011). In addition to being a tradable commodity, sheep and goats serve as a preferred wealth store, not only among farmers and herders, but also among urban dwellers (Roncoli et al. 2007, Turner 2009). Sheep and goat investment is safer due to "lower perishability (compared to grain stores and paper money), limited liquidity (protection from requests by others), and ability to grow over time" (Turner, 2009 p. 749). Small ruminants serve as a source of cash-on-hand to cover household emergency expenses (Alary et al. 2011) and provide insurance to mitigate the risk of catastrophic crop losses (Turner et al. 2014).



Showing all her sheep

Advantage: Sheep and goats are unique when compared to other livestock. They do not thrive in industrial farm confinement systems or reproduce with the frequency or volume of chickens or hogs (e.g., three kids or lambs versus 20 haram piglets or more per year). In comparison to cattle and hogs, more labor is required per meat yield. Yet, in low resource environments, sheep and goats do remarkably well. They are able to utilize moisture from morning dew and harvest their own maintenance feed from prickly brush and high branches.

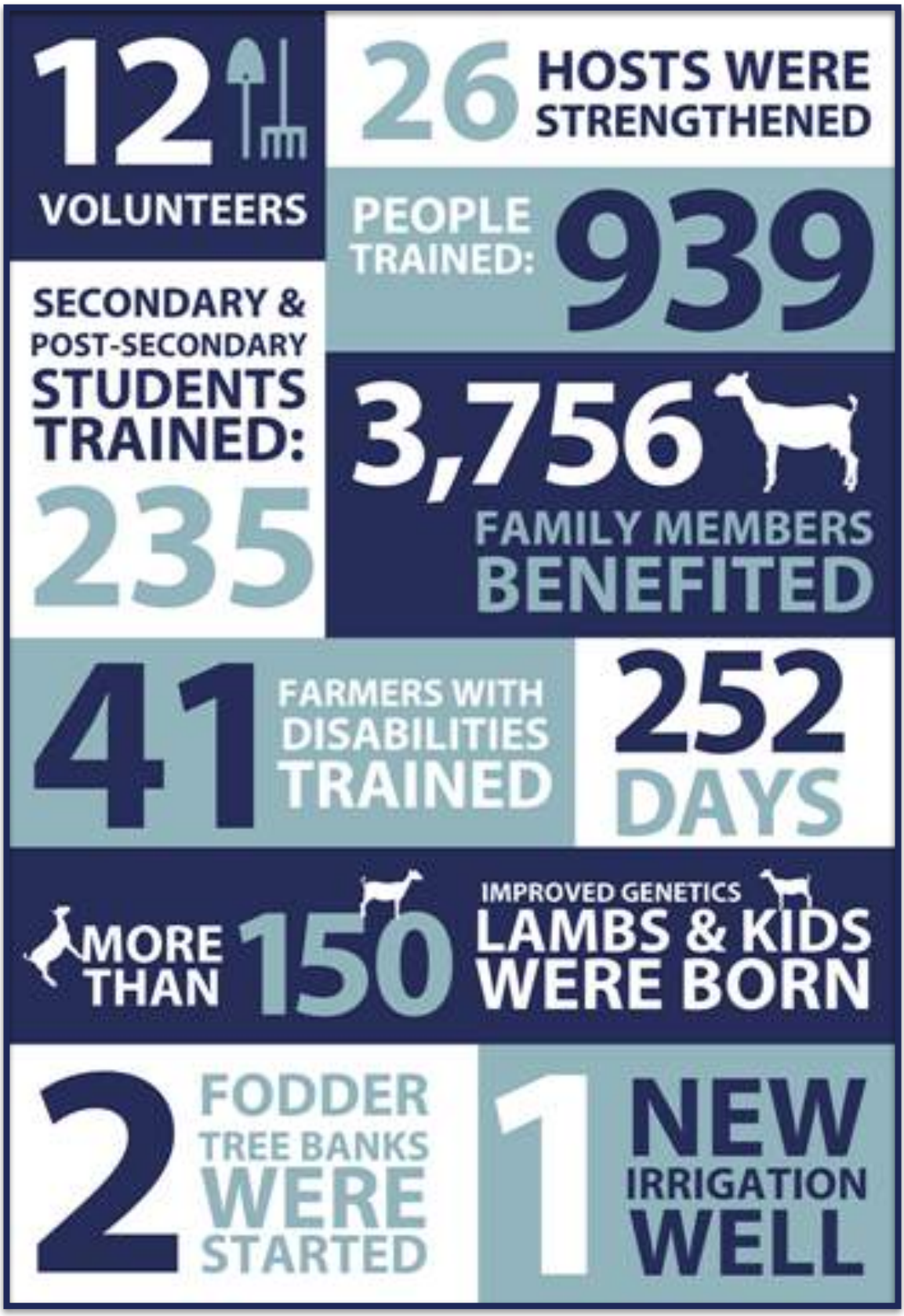
Around the world, in desert, or drought areas, sheep and goats thrive where cattle will perish. With stable sources of water and adequate nutrition, goats are milked through dry seasons that quickly dry up cows. Increasing the productivity of Mali's small ruminant breeds will provide a predictable source of income for smallholder farmers and a high quality source of protein and fat to supplement the family's basic diet of rice or maize, even in the face of climatic uncertainty. Small ruminant production in villages, assuming best practices, is unlikely to be threatened by the potential invasion of large industrial farming systems.

Around the world, in desert or drought areas, sheep and goats survive where cattle perish.

Objectives addressed by the 12 volunteers include:

- **Feed and forage supplementation strategies:** 2 assignments. 4 volunteers.
- **Flock productivity through breeding:** 1 assignment. 1 volunteer.
- **Cooperative capacity building and leadership:** 2 assignments. 2 volunteers.
- **Product branding and marketing:** 1 assignment. 2 volunteers.
- **Food security and family nutrition:** 3 assignments. 3 volunteers.

Matt McIntosh fastening GPS collar on goat to determine pasture grazing patterns.


12
VOLUNTEERS
26
HOSTS WERE STRENGTHENED
PEOPLE TRAINED:
939
SECONDARY & POST-SECONDARY STUDENTS TRAINED:
235
3,756
FAMILY MEMBERS BENEFITED
41
FARMERS WITH DISABILITIES TRAINED
252
DAYS
MORE THAN
150
IMPROVED GENETICS
LAMBS & KIDS WERE BORN
2
FODDER TREE BANKS WERE STARTED
1
NEW IRRIGATION WELL

Feed and Forage Supplementation Strategies

Small Ruminant Fodder Production Systems: Michael O'Neill Ph.D.

Koulikoro, Bougouni Regions. Hosts: Mafaya, Dladie, Katibougou, Cooperative des Embouchure including Toula, and Solla-Bougouda Cooperative.

The primary objective of this assignment was to provide the F3P supported farmers with knowledge, skills and tools to practically implement better strategies for feeding animals on a year-round basis to provide better marketable products (e.g., meat, milk, breed). Although sheep and goats will survive periods of drought through scavenging, their production and life span suffers. Farmers are not always aware of the cost of this lost opportunity. Lack of feed during the dry season is an ongoing challenge for producers.

Previous years' legume fodder tree plantings were evaluated and issues noted. Over 3,000 seedlings of *Leucaena leucocephala*, *Gliricidia, sepium*, and *Moringa oliefera*, were transplanted into common lands associated with the cooperatives during 2016. In the Koulikoro and Bougouni areas, farmers have been producing their new saplings from seeds and cuttings for planting during July and August 2017, matching the rainy season. The farmers are planting more trees with seeds and cuttings from the previous year's planting in fodder banks and facilitating seed exchange between cooperatives. BGGC provided an approximate 25% match with legume saplings, mostly Glyricidia, as these trees grow significantly slower and require three to four years to produce seeds. Glyricidia, in our experience, does appear to survive tough conditions better.

Goats enthusiastically attack branches provided by herders. Legume tree leaves have been tested with higher crude protein levels than prime alfalfa and tend to hold their feed value into the dry season.

The Leucaena and Moringa plantings have been expanding in the project common areas as these two trees grow quickly and provide seeds within a year.

The Katibougou farmers, as expected, experienced the most difficulty in managing their tree fodder banks due to late planting during the end of the rainy season and destruction by wandering animals, especially cattle, sheep, and goats.

Trees in protected fields such as at Toula village near Bougouni, had the highest survival rates due both to higher rainfall and adequate fences.

Tree Banks: Two tree banks have been established, one in Katibougou and the other in Toula near Bougouni. During year 1 saplings from U.S. donations were planted. Due to rapid growth of legume trees, seeds and cuttings were harvested for the year 2 plantings. In addition, farmers purchased approximately half the new saplings from local nurseries encouraged by the project to carry fodder trees. U.S. donations provided an irrigation well at Katibougou, Koulikoro to help compensate for the significantly dryer weather (see map page 3).

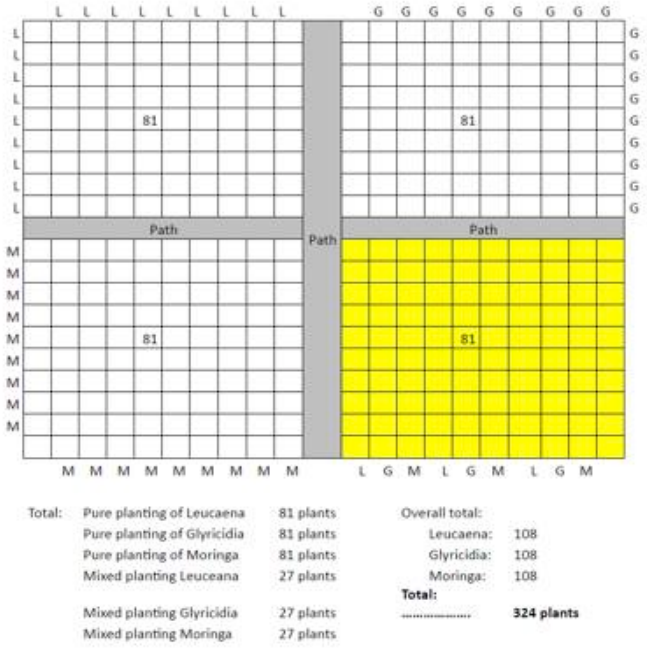
Fenced hectare prepared for trees after the rains begin Katibougou, Koulikoro.

Method: Timely transplanting of nursery stock at the beginning of the rainy season is important. After seeds are procured, they must be planted into nursery containers several months before the rains are apt to begin. While the seedlings are growing in the nursery, holes must be dug in the fields where seedlings are expected to be transplanted. Once the rains begin, distribution of the seedlings are undertaken via donkey cart. Transplanting of the seedlings must be carried out in a gentle manner.

Legume and Moringa trees grow quickly. Shown is one-year growth already bearing seed pods. Trunk is protected from goats. Mafeya, Koulikoro.

Celebrating reaching water at the U.S. donated irrigation well at Katibougou, Koulikoro

Equally crucial for successful fodder shrub and tree production is protection from sheep, goats, cattle, and other hungry animals for the full 12 months per year over a period of several years. The fodder shrubs and trees used in this and other projects are highly palatable to livestock – they were selected because of this attribute – and will be browsed by roaming herbivores if left unprotected. This is especially difficult on a large basis, but if the Cooperative members work together for their common cause, it can be done. Care must be taken to protect the transplants sufficiently high, as small ruminants, especially goats, can jump fences.



Total:	Pure planting of Leucaena	81 plants	Overall total:		
	Pure planting of Glyricidia	81 plants		Leucaena:	108
	Pure planting of Moringa	81 plants		Glyricidia:	108
	Mixed planting Leuceana	27 plants		Moringa:	108
			Total:		
	Mixed planting Glyricidia	27 plants	.....		324 plants
	Mixed planting Moringa	27 plants			

In Process:

The establishment of small fodder banks in an enclosure stand provides the highest chance for success.

The first steps were taken at the Katibougou cooperative. The layout plan had on-farm shrub/tree fodder banks of 2,000 trees in a block planting arrangement. The saplings were sourced from small, local tree nurseries in the Koulikoro region. The area is fenced and irrigation is being set up from a new well.

Difference in rainfall and growing conditions: rich rangeland close to Bougouni (left) and the drier, more depleted Ouendebougou area and Koulikoro region (right).

Small Ruminant Production and Nutrition Systems: Andrés Cibils Ph.D., and graduate students Janet Ott and Matt McIntosh

Ségou Region. Hosts: Dougoukouna and Ouendebougou Womens Association, University of Ségou, Agri-Sup Training Center.

Dr. Cibils developed and presented a graduate student seminar: "**Feeding Grazing Ruminants in the Tropics"** to 17 master's students in agricultural economics at the University of Ségou. The short course consisted of a 40-hour training delivered over six days. The course involved discussions and readings covering the basics of forage quality, ruminant physiology, grazing management and feed supplementation. During the afternoons, Andrés Cibils, Common Pastures Project Director Bara Kassambara, and Dr. Konimba Bengali held lecture and discussion sessions on each topic, and in the mornings Matt McIntosh and Janet Ott met with the students to help with reading assignments and to answer questions pertaining to the previous day's lecture.

A short four-day course (from 8 a.m - 12 p.m.) on grazing management and supplement feeding strategies was also provided to secondary and technical students at the Agri-Sup school of Ségou. This program included morning lectures and discussion, and hands-on exercises involving calculation of stocking rates by Andrés.

Alternative feeds: Specifically cassava foliage silage was discussed and demonstrated as a supplement to increase digestibility of low quality hay and/or straw fed to large and small ruminants during the dry season. Farmers were educated on overgrazing, inadequate grazing and erosion threats. Improving pastoral land use and identifying local feed supplementation options are important first steps to improving food security.

The U.S. donated chopping equipment was demonstrated at the Dougoukoun village. The chopper is moved by donkey.

This equipment eliminates some of the tedious work of hand chopping crop residue to make the plant fibers more palatable to small ruminants.

Preparing and feeding cassava residue was demonstrated at two villages, Dougoukouna and Ouendebougou. The training included information about foliage green matter yield and weight of silage obtained at each site. Cassava foliage processing steps, from green leaf and stem harvest to silage, were explained in detail. Participants were able to see photographs on a tablet that showed each stage of the process. Also discussed was the chopping, addition of a soluble carbohydrate source, bagging, storage, and recommended proportion of cassava in small ruminant rations. Before the volunteers' arrival, cassava foliage had been harvested, chopped, and ensiled, but not enough time had passed to allow lactic fermentation to take place to demonstrate the product and last step of the process.

Women in both villages were excited to learn about the availability of a forage chopper to reduce the time and effort needed to prepare the cassava foliage for ensilage (see photos below). In the village of Ouendebougou, Mr. Dembele, the chief of the village, suggested that the women associations should be involved in learning the technique of cassava foliage silage due to its potential for providing a new revenue source to support household economies. Dr. Bengaly and his assistants indicated that the University of Ségou would provide follow-up support to help train the women in the development of silage as an alternative feed to be used, especially during the dry season.

On the last day of the volunteers' stay in the Ségou region, a ceremony was conducted in the village of Dougoukuna to celebrate the donated forage chopper. Members of the Women's Association and the village chief expressed their heartfelt gratitude for the donation provided from private U.S. citizens. Meeting feed and forage requirements of small ruminants is the most urgent need for Malian farmers according to a meta-analysis of documentation associated with 36 USAID-funded F2F volunteer assignments and involved input from over 1,100 smallholder farmers (Cibils et al. 2015, Challenges and Opportunities for Agro-pastoral Livestock Smallholders in Mali. Outlook on Agriculture 44: 69-80). Utilizing cassava residue will help alleviate this constraint.

Members of the Women's Association of Dougoukouna testing the new forage chopper (left) and standing next to the chopper after the donation ceremony (right).

GPS Mapping: Matt McIntosh

Ségou Region. Hosts: Dougoukouna and Ouendebougou cooperatives, and the University of Ségou.

Matt McIntosh focused on GPS tracking of sedentary small ruminant herds to understand livestock grazing patterns on rangeland and crop fields and included:

- Testing a lighter GPS (igotU) model furnished by New Mexico State University and cost shared with BGGC.
- Development of a GIS database and corresponding maps of land cover types (whether village, cropland, or rangelands) within a 3 km radius of the villages of Dougoukouna and Ouendebougou.
- Training and development of a protocol for deployment and data retrieval of the igotU GPS devices.

The use of GPS collar data results allowed informed discussions with farmers on the challenges of food shortage and herding styles. Data collected during an assignment in Koutiala last year suggested that the time that small ruminants spent grazing while on their daily herding circuits was insufficient to meet their nutritional needs. This demonstrated the need for providing additional forage in the village pens to fully meet the needs of their small ruminants. The topic of cassava silage was discussed as a potentially economical, alternative feed source.

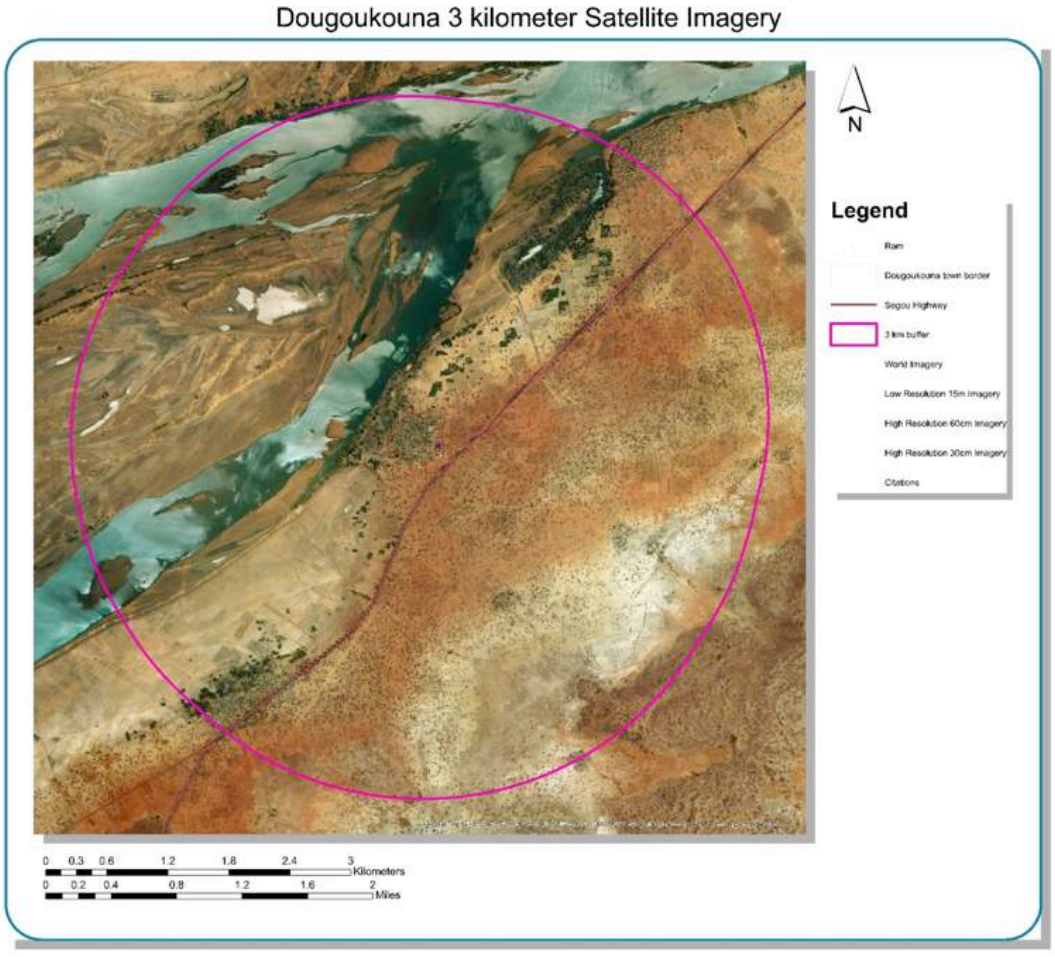
> *"This assignment allowed us to do something that I believe is also novel and that, to my knowledge, has not yet been achieved with our stakeholders in the United States. That is, to use livestock GPS data to inform grazing management decisions and diagnose grazing problems. The fact that we were able to discuss our GPS results with village farmers and that we were able to receive their reactions to these results, is a novel phenomenon even for rangeland managers in the U.S. I am proud that we are pioneering efforts of this sort in the villages of Ségou in Mali!" - Team Leader:* Dr. Andrés Cibils

Matt placing GPS collar on goat (left) at Dougoukouna, and Janet Ott removing GPS collar from a goat (right) at Ouendebougou.

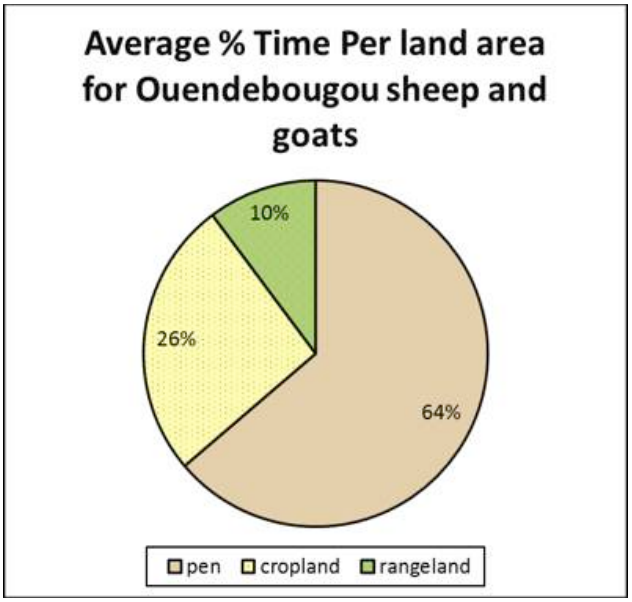
Farmers in Dougoukouna indicated that they thought the Koutiala example was similar to their situation. They mentioned the scarcity of grazing lands and problems with parasite loads in grasses harvested from the Niger river banks at this time of the year. One of the farmers indicated that since the first cassava training he had successfully and consistently used cassava foliage to feed his livestock.

Land cover maps for the grazing area surrounding the villages of Dougoukouna and Ouendebougou were developed. A high resolution Spot Satellite image was used to separate village and village compounds from the cropping and grazing areas surrounding the village. Based on preliminary GPS data collected during this and previous assignments (which agree with information provided by farmers in the village of Ouendebougou) all land within a 3 km radius of the villages was considered the most probable grazing area for small ruminants.

Land within this radius was classified into three categories: 1) cropland; 2) rangeland; or 3) village. In the case of Dougoukouna, a fourth category was created to account for areas occupied by the Niger river. Roads and the main highway were also digitized on the map shown below. By merging satellite and geospatial technologies, grazing locations and activities were visually displayed and showed potential nutritional gaps.



The GPS collar tests in Dougoukouna and Ouendebougou were successful. Preliminary data showed movement velocity patterns similar to those observed in the data sets collected in Koutiala and Dougoukouna in 2015-2016. It was also possible to determine the time spent in different land cover types. Movement velocity and distances traveled (approximately 8 km/day) suggest that animals were spending insufficient time grazing when they were out at pasture. This technology allows for the development of strategies to use high protein supplements (e.g. legume browse trees, cassava, urea byproduct silage) in the most cost effective and efficient manner. Data collected also allows for the determination of : 1) the kinds and amounts of feed that small ruminants are likely harvesting while grazing; and 2) the amount of energy they are likely to expend doing .



Percent time spent in the pen vs. rangeland vs. crop fields by a ram and two nannies tracked with GPS units at one minute intervals over approximately three days in June 2017 in the Ouendebougou.

The data suggests insufficient time was spent grazing.

Matt teaching small ruminant anatomy and rumen processing at the University of Ségou.

Flock Productivity Through Selective Breeding

Upgrading Stock Genetics: Breeding Systems: Terry Gipson Ph.D.

Ségou, Bougouni and Koulikoro regions. Hosts: Bougouni and Katibougou Cooperatives. University of Ségou. Agriculture schools: Institute of Agro-Sylvo Pastoral, Bougouni; Centre d'Apprentissage Agricole, Samanko; and the Agri-Sup, Ségou.

To support the ongoing breeding program, trainings and hands-on demonstrations were provided on genetics and nutrition for students at the Centre d'Apprentissage Agricole Samanko, University of Ségou, Agri-Sup Ségou, and for members of the Association of Livestock Producers of Bougouni. **One** presentation was on linear appraisal for goats, with application for sheep, as a means to select for milk production by secondary, morphologic traits. A **second** presentation was on the concept and calculation of inbreeding and other measures of relationship between animals in a herd or flock with the objective to plan future matings to diminish or even eliminate inbreeding. A **third** presentation was on the organization of community-based breeding programs and its use in improving a breed, not only in individuals, but also in the breed population.

Dr. Terry Gibson demonstrates how to examine sheep and goats as part of preventative health instruction.

It is important to ensure animals are in good health with all the appropriate vaccinations before engaging in improved breeding strategies.

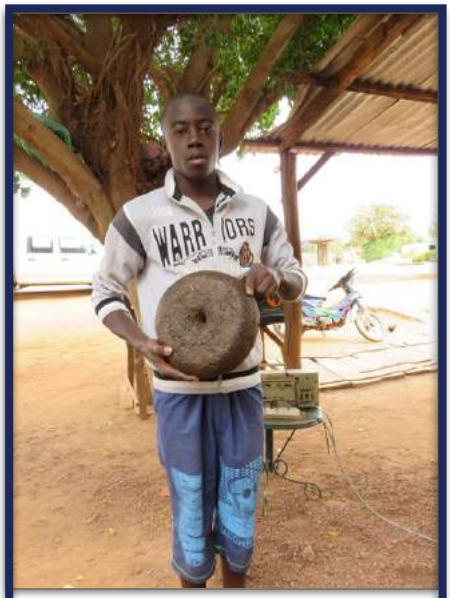
Best practices were emphasized to assure a good foundation of animal health and nutrition before engaging in genetic improvement. Improved genetics will not be expressed without this foundation. These best practices include:

- Vaccinate sheep and goats annually against common diseases.
- Use anthelmintic when needed and on an individual basis.
- Supplement sheep and goat to achieve genetic potential.

Adama Guindo, VALID student uses proper technique to examine teeth to determine age

Cost effective nutrition interventions were detailed and demonstrated:

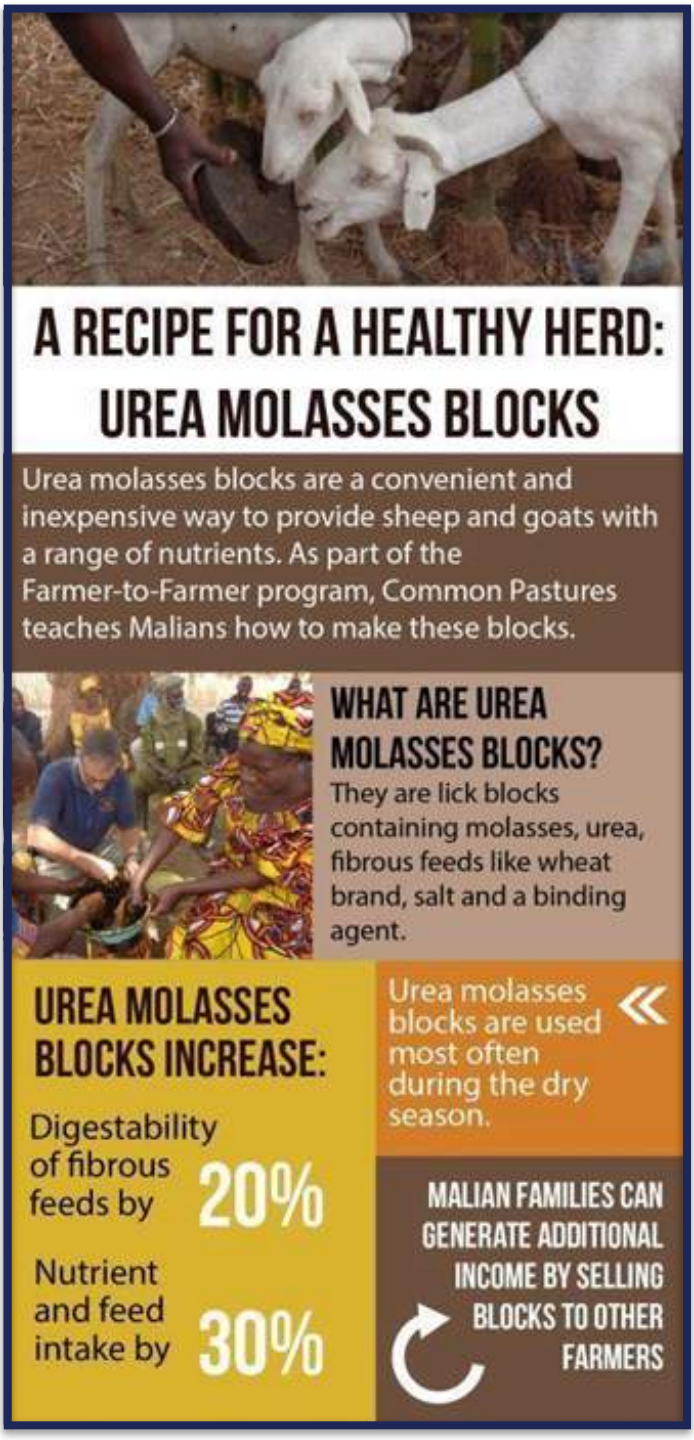
- Treat crop residues such as bush straw, corn stover, sorghum stover, or rice straw with urea to increase the feed's digestibility for sheep and goats during the dry season. It is advisable to begin this process of urea treatment when crop residues are available and plentiful. Residues from corn or sorghum should be chopped to provide a greater surface area for the treatment process and to increase subsequent intake.
- When molasses becomes available, make urea molasses blocks and give them to sheep and goats for supplemental feeding, especially during the dry season. If molasses is not available, then search for a suitable replacement such as honey or a fruit syrup, such as from mangos, when the fruit is abundant and cheap.



Improved 5-kg mineral

- Health and milk production requires water to be available at all times.
- Institute a community-based breeding program with bylaws and policies.
- Remember that most economic traits are quantitative and are affected by genotype and environment. So it is important that members of the community-based breeding program practice a standard health and nutrition program.
- Castrate all inferior males, those rams not selected, and control the breeding of the sheep; otherwise there can be no genetic improvement.

An infographic was created and shared on the Common Pastures Facebook page and website to share information about urea molasses blocks and the efforts the program is making to teach Malians about them.



Improved Breeding Practices: It is difficult to measure immediate improvement or impacts, but knowledge of genetic improvement was transferred and attitudes seemed to have changed. The advantage of consecutive assignments is that one can see the impact of previous assignments and what is understood or not understood. Further training is needed on the selection and identification of how to identify superior breeding stock along with the concept of a community-based breeding program.

Donated breeding buck

Training in inbreeding and its negative consequences was conducted. Rams and bucks will be moved between cooperatives and then replaced so that new genetics are introduced to each group. However, a deeper understanding is needed to ensure improvement.

Farmers in Bougouni raised 120 improved genetics lambs and kids to weaning.

Farmers in Koulikoro raised over 30 improved genetics lambs and kids to weaning.

Participants of the Breeding Program in Bougouni

Household/owner	2016		2017		TOTAL
	Male	Female	Male	Female	
Village: Sola Bougouda					
Fousseyni Mariko	3	6	5	7	**21**
Zoumana Mariko	-	-	1	2	**3**
Drissa Mariko	-	-	1	-	**1**
Moussa Mariko	-	2	2	3	**7**
Bakary Mariko			1	1	**2**
Village : Yorola					
Amidou Doumbia	2	3	2	2	**9**
Seydou Diakite	1	1	5	8	**15**
Bakary Kone	-	-	-	2	**2**
Bougouni city					
Yacouba Diarra	12	18	7	7	**44**
Fily Traore	-	-	-	1	**1**
Amala Diakite	1	2	2	2	**7**
Papou Ballo	1	4	-	3	**8**
TOTAL	**20**	**36**	**26**	**38**	**120**

New baby goats from donated buck doing great in Koulikoro.

Yacouba Diarra testing mineral block firmness.

Last February, training in supplemental nutrition (urea treatment of roughages and fabrication on urea-molasses blocks) was given in the same locations as the present training. The Deputy Director of Agri-Sup informed us that the replication of the urea treatment of straw has been incorporated in their extensive education of producers in the surrounding area. This is encouraging as urea treatment and ensilage is an inexpensive method of improving the nutrients of crop residue.

In addition, Yacouba Diarra, the president of the Farmers' Cooperative of Bougouni, has continued with the fabrication of the urea-molasses blocks and has made modifications that better match the local environment. He has increased the amount of cement and keeps the freshly made blocks in the shade for two days before moving them to the sun to dry. It is expected block production will continue and become a source of income for cooperative members.

Cooperative Capacity Building and Leadership

Organizational and Management Capacity Building: Mitchelle Makanjoula

Youth Training: Training on Leadership, Documentation, and Health Surveillance: Jake Holmes

Ségou and Sikasso Regions and the Bamako Capital District. Hosts: Kalana Farmer Cooperative, Lions Club International, University of Ségou. Technical Schools: Institut des Sciences Politiques Relations International, and Balla Fasseke Kouyate

Volunteers Mitchelle Makamjoula and Jake McIntosh worked both separately and as a team. Both assignments focused on helping farmers, professionals, and students understand and implement best practices, improve management of their cooperatives, and set appropriate goals to increase productivity. This included trainings focused on specialized marketing that explored more profitable methods to help young adults and farmers increase their confidence in their own ability, explore entrepreneur opportunities and to create collaborative projects with profit potential. Interactive workshops include:

The Pitch Challenge: Participants were asked to break into groups to create a pitch presentation by identifying a social problem which occurs within their community. They were then asked to define the problem, state why the problem is occurring, state the history of the problem, and develop a possible solution to the problem, including what resources are needed, how to collaborate and include community members (i.e., encourage civic engagement), what obstacles may occur and how to execute their solution successfully. Young adults especially were enthusiastic participants but even the elders joined in.

Mitchelle and Jake were treated to a special ceremony.

Agricultural Production Preservation: In the second workshop, participants were taken through some training and shown techniques on how to preserve overproduction of crops such as tomatoes, fruit and peppers. These preservation techniques include using extra produce that would otherwise go to waste for pickled chili, fruit preserves and tomato sauce. Participants were also informed on the importance of livestock nutrition and vaccinations, and a varied and balanced diet, along with surveillance and preventative health practices.

Separately, Jake worked with young adults, building on skills to enhance their community citizenship, volunteering, networking and future career skills. This included young adults at the Conservative Balla Fasseke Kouyaté, University of Ségou, Institute of Agro-Sylvo Pastoral Bougouni, and the Lions Club International. The Lions Club held a *Lions Fight Hunger Week* during his assignment. This provides a supportive environment for young adults to take pride in working in their communities and to make contacts. This model could be expanded to the technical schools to encourage young adults to make contact with professionals in their chosen fields and to build a culture of civil service. Although the technical schools have few resources, these activities can be done at a low cost and provide an opportunity for others to see the good work of the schools and to perhaps become involved.

Jake working with technical school students at Ségou.

Mitchelle working with students and their lettuce gardens

The trainings were well received as illustrated in the evaluations:

"Your training was really great. What I like more during the training was the way all the slides were understandable. Well done. Congratulations."

"I call myself bless. This training was great. Thanks so much"

"I am pleased with the training because I have gained a lot of information. I would like to receive a second training."

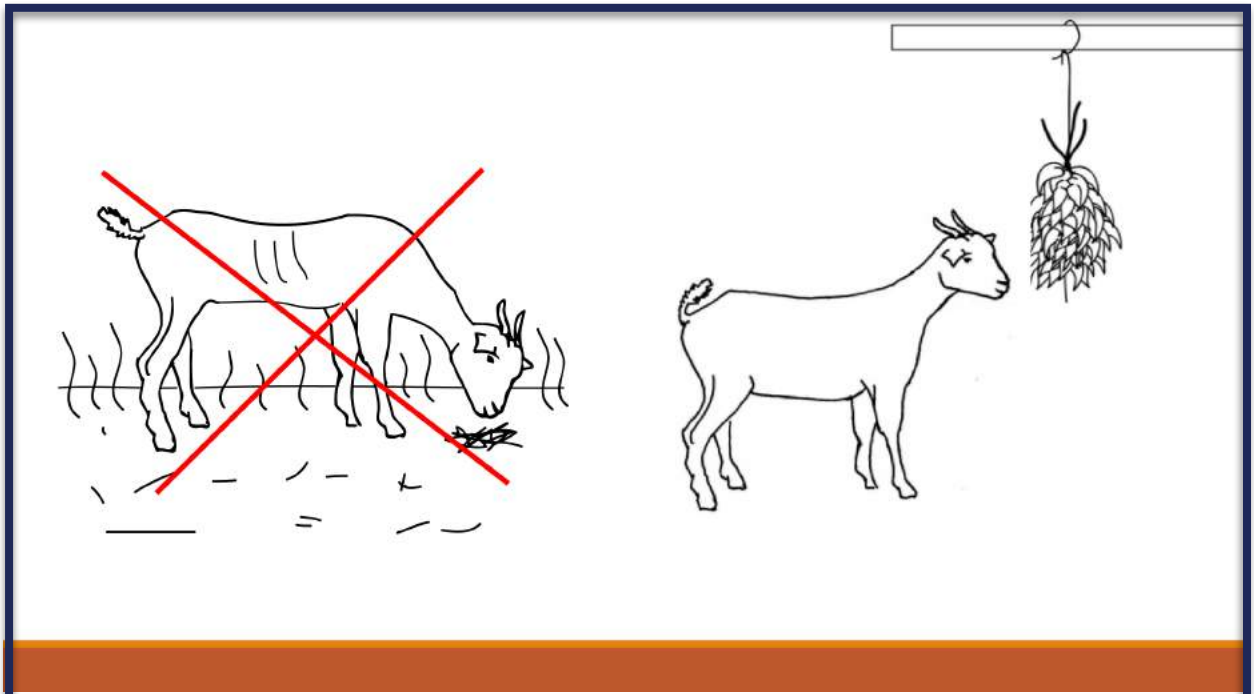
Product Branding and Marketing

Enhance Local Production Methods: Sharman Davis Barrett and Rosemary Neville

Ségou Region and Bamako Capital District. Hosts: Goro Moringa Enterprise, Womens Cotton Producer and Processor of Ségou, Youth Vegetable Association of Ségou, and Laboratorie de Technolgie.

Rosemary Neville and Sharman Davis Barrett provided trainings and technical support to expand value-added options for livestock and other crops being produced by smallholders. The hosts were Goro Moringa Enterpises, Women Cotton Producers and Processors of Ségou, Youth Vegetable Association of Ségou, and the Laboratoire de Technologie Alimentaire (food technology).

Lack of technical knowledge, business start-up, and marketing are some of the driving forces for Malian entrepreneurs. Four out of five Malians live off the land or river. Most depend on cash crops, cereals, livestock, and fish for their livelihood. The agricultural sector, the driven force of Mali economy, counts for more than 53% of the GNP, employs 83% of the working population. Women and youth remain the main workers but are poorly trained and organized with the lack of land, capital, and equipment.



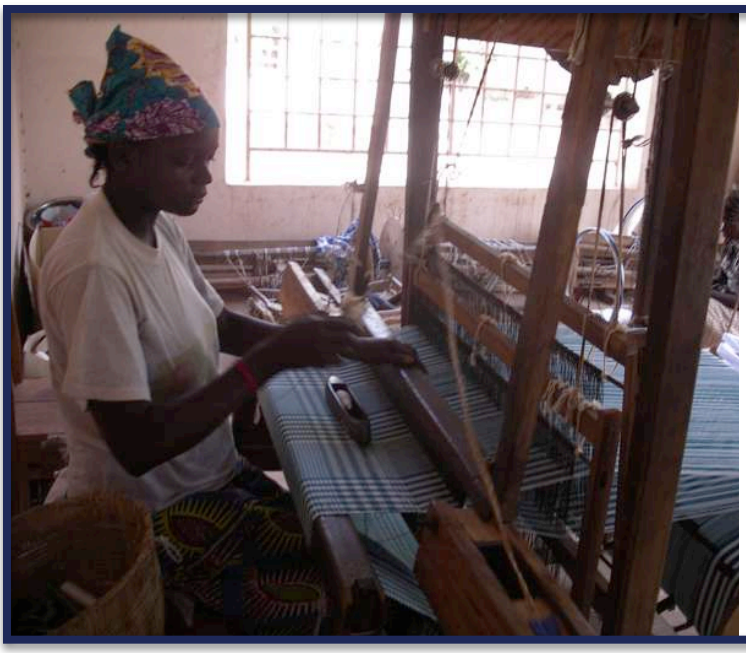
Laminated cards were introduced to help smallholders easily understand and remember the best way to care for their animals to ensure optimal health and safety. On the left is a sick goat living in substandard conditions; the goat on the right is healthy, has clean living quarters and is eating in an appropriate and healthy way.

Small vegetable gardens along the Niger River at Ségou.

The overall objective of the assignment was to provide knowledge, skills, and tools about improved marketing and sales strategies. Diverse farms include small ruminants, cattle and mixed products such as vegetables, fonio, Moringa, shea butter, and cotton. Trainings included information on business and marketing concepts, evaluation and the creation of a seven year business and marketing plan.

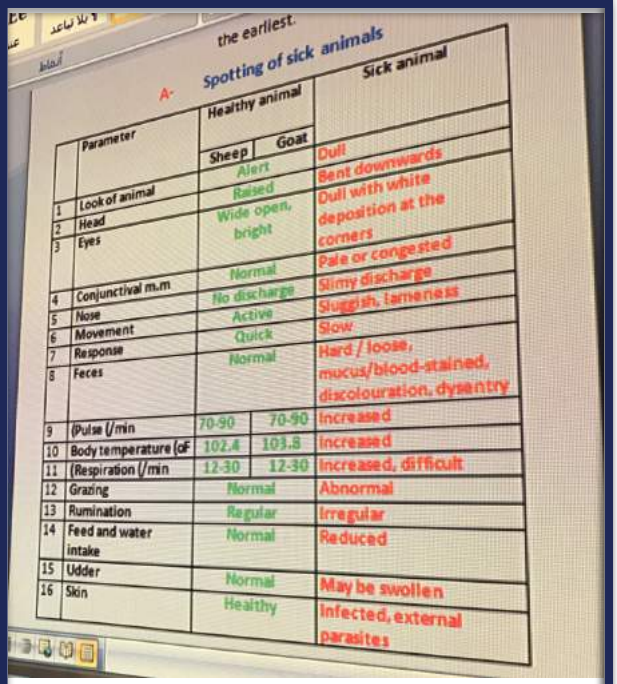
Improvement of the population's livelihoods, especially for women and youth, were addressed by an assessment of the main opportunities targeting producer organizations in small ruminant production, nutrition, and entrepreneurship. Individual technical assistance was provided to participants interested in combining sheep and goat production and other crops such as fonio, Moringa, vegetables and cotton to help them identify gaps in production, development and marketing. Obstacles and challenges were identified and next steps for improving strategies or making linkages defined. Recommendations were provided on ways to improve their investment in the small ruminant and specialty crop value chain for increased family income and productivity.

Marketing assistance was also provided to the owner of a traditional weaving business. Technical assistance was provided to a Bogolan business owner, producer, manufacturer and distributer and to the program AMPJE for young women and girls (ages 6-25) that provide training in gardening, sewing, photography, and soccer.



"The youth who participated expressed a future of hope, progress and improved economic development. These young women and men are looking for newer and more efficient ways to reach new markets and be a part of the overall growth of Mali. Thank you for allowing me this wonderful opportunity to share what I know." Sharman

Learning to notice and to identify health and potential illness by surveillance of the flock.



A- Spotting of sick animals the earliest.

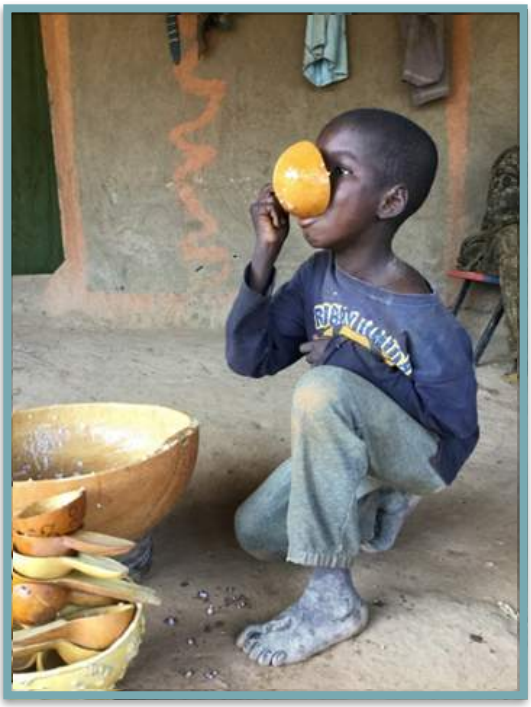
	Parameter	Healthy animal		Sick animal
		Sheep	Goat	
1	Look of animal	Alert		Dull
2	Head	Raised		Bent downwards
3	Eyes	Wide open, bright		Dull with white deposition at the corners
4	Conjunctival m.m	Normal		Pale or congested
5	Nose	No discharge		Slimy discharge
6	Movement	Active		Sluggish, lameness
7	Response	Quick		Slow
8	Feces	Normal		Hard / loose, mucus/blood-stained, discolouration, dysentry
9	(Pulse (/min	70-90	70-90	Increased
10	Body temperature (oF	102.4	103.8	Increased
11	(Respiration (/min	12-30	12-30	Increased, difficult
12	Grazing	Normal		Abnormal
13	Rumination	Regular		Irregular
14	Feed and water intake	Normal		Reduced
15	Udder	Normal		May be swollen
16	Skin	Healthy		Infected, external parasites

A spreadsheet of the good health characteristics of sheep and goats.

Cooperative Members' Nutrition Assessment: Protein Choices and Opportunities: Chef Benedicto Marinas

Ségou and Sikasso Regions and Bamako Capital District. Hosts: Solla-Bougouda, Kle, Bougouni, and Molodo Farmer Cooperatives, the Bamako Barbecue Chicken (BBC), Broadway Café, Sleeping Camel Restaurant, and CAA Samako Technical School.

Benedicto Marinas had a two month assignment and worked in four villages: Bougouni, Klé, Solla-Bougouda (Sikasso region), and Molondo (Ségou region). His assignment included both the assessment of the nutritional eating habits of the participants, especially children age 6 months to 5 years; presentations on nutrition; and interactive cooking activities using local products often from the participants' own community gardens. He worked with more than 200 farmers, of which over half were women, but men and elders enthusiastically participated, too.



During the training workshops, Benedicto built the capacity of the participants in cooking new recipes based on local ingredients available in the village or at low cost at the market.

This included dishes such as: "*corn plain round flat cake"* with fresh corn, powder corn, eggs, onion leaves, sugar, water, and shea butter. The standard meals for families are corn porridge, or corn paste with tomatoes and onion or okra sauce for both breakfast and dinner.

The chief of the village, Mr. Djeka Mariko, 69 years old, said:

> ***"Benedicto, you are a benediction for Solla-Bougouda by coming so far and training to make healthy, delicious, nutritious and cheap meals. Henceforth this dish will be my breakfast in replacement of my usual corn porridge."***

Preparing rice with child on back

Benedicto: "The biggest effect of my assignment on a personal level is the discovery that this kind of work can be so fulfilling it can be addictive; I want to do it again and again."

Fresh corn and Moringa leaf dish

The workshop held in Molodo, Ségou region (see photo on right) is an area hard hit in the past with a polio epidemic and political disruption.

At the two-day training, 38 individuals attended, 36 with physical disabilities.

Participant joyfully bringing her contribution to the nutrition workshop (left).

Items for determining the level of nutrition in children and infants (below).

Making mayonnaise

Benedicto also worked with young adults at the agro-pastoral school, CAA-Samanko, on the importance of nutrition. Evaluation of their breakfast, lunch and dinner showed that they ate from limited food options, similar to villagers, even though they had access to more variety and could afford to pay for more than two sodas per day.

Recipe example: Corn salad is highly nutritious and easy to make. It contains carbohydrate from the maize, vitamin A from carrot and tomatoes, protein from the egg and lipid from oil.

Boil corn to soften for 15 minutes. Mix with chopped green pepper, onions and carrot. Season with black pepper and salt. Add homemade mayonnaise. Mix well and enjoy.

Fresh corn salad with green peppers.

Specialized Marketing: Full Carcass Utilization Restaurant, Lamb-Goat Sausage, Curing, Smoking: Chef Sarah Master

Bamako Capital District. Hosts: Broadway Café, Sleeping Camel and the Bamako Barbecue Chicken Restaurant.

During the second month, Chef Sarah Master joined Benedicto. They provide training and technical support on menu development using local foods, presentation, restaurant efficiencies, and food preservation.

Morning activities included visiting the market for fresh vegetables and the butcher shop to choose the animal. The carcass was brought back to the restaurant. All parts were used or preserved. Curing, smoking, and pickling were taught because electricity to keep meat cold was erratic.

Chef Sarah Master surrounded by her pickles

A series of trainings was provided specifically to chefs, and their staff on menu development, presentation and production flow. This included three chef/owners and 13 staff of the Sleeping Camel, Bamako Barbecue Chicken (BBC) and the Broadway Café. Nine of the staff were young adults, including a few who had been homeless before being employed at the BBC. The owner of BBC has a strong commitment to training young adults off the street. He provides the opportunity for youth to learn, and develop their confidence while taking on the responsibility and authority to make food preparation decisions.

In another training, Sarah taught 16 employees at the three restaurants/hotels how to butcher and utilize the entire animal, including fish, lamb, and goat. They used all the off-cuts and offal to provide a unique dinner to guests of Sleeping Camel, Broadway Café and BBC. They introduced testicle soup, braised intestines, braised tongue, grilled livers and hearts, chicken heads, and feet to guests, tourists and employees. The utilization of off-cuts and offal provides an opportunity to taste something different while on a budget.

New menu items were introduced to guests, and feedback was requested. Full use of local ingredients was emphasized to make from-scratch menu items along with a nose-to-tail approach with meats. In addition, two tasting events were facilitated at BBC to introduce the new menu items created. Flyers were produced and distributed in collaboration with BBC's staff. Common local ingredients were used. One of the events featured offal and the three chefs created six dishes from cow testicles, intestines, tongues, liver, tripes and hearts. The restaurant was packed. The expats who came had nothing but great words about the food.

The offal dinner was the highlight of our collaboration. Half of Bamako came to the party. That is an exaggeration, of course, but the restaurant was jam-packed.

We heard nothing but high praises. I am particularly proud of my cow's balls soup, because it was first time to do it. A woman from United Nation claimed that it was the best soup she has ever tasted. (Naturally, she became my best friend.)

The dinner party was so exhilarating that we decided to have another one, and I suggested that we focus on pasta. Considering how many grains they have here, I thought it would be exciting to create a dinner that promotes the local flours. As fate would have it, one of the guests owns a large rice-contributing company. I charmed him to sponsor the party.

— Benedicto

Meat: New ways of using the entire animal (i.e., fish, lamb and goat) were explored. As an example, a whole goat was purchased at the live animal market, slaughtered, cut up, and smoked for quick sandwiches as well as using the liver to make pate for a spread. Market vegetables (e.g., carrot, okra, green pepper, and onion) were pickled to use as a condiment. Methods of preparing meats combined with vegetables were experimented with leading to a special dinner event featuring off-cuts and offal. A creative menu consisting of testicles, intestines, tongue, livers, hearts, chicken heads and feet along with vegetables was introduced to staff and delighted guests. “Best meal I have ever tasted” raved a restaurant guest from the United Nations.

Vegetables and Fruits: Local vegetables were pickled to use as a condiment and compliments to their menu. The recipes can also to preserve fresh, nutritious vegetables and fruits from the local markets. Fruits and vegetables are easily preserved by drying, canning and pickling. In-season baskets of ripe, fresh fruits and vegetables line the roadways. Limes readily grow in Mali and can be used to raise the acidity level for canning. Supplies needed are simple and include a heating source, stockpot, mixing bowls, knife, slotted spoon, fork, and sterilized jars with lids.

*T*he recipes for pickling and preserving can be used not only as condiments and compliments to their menus, but also to preserve fresh, nutritious vegetables and fruits from the local markets. The chefs all had concerns about the electricity and refrigeration

issues in Bamako. Demonstrating economical methods of preserving the nutrition and freshness in meats, fruits and vegetables was an important part of the assignment.

Preparing a goat carcass for the menu.

"I provided the businesses with recipes and ideas to continue to grow their whole animal production as well as learning how to pickle and preserve not only vegetables, but meat as well.

All of the staff at all three restaurants were attentive and curious learners in respect to the butchering. I did one side of the animal while the staff took turns with parts of the other side. They were quick learners and eager to get their hands into and try for themselves whatever I was teaching them."

— Sarah

"My assignment really opened my eyes to the lack of regulations on spoilage and safe food handling practices.

It made me want to go back to Mali to help with setting up a clean abattoir or to teach more people how to preserve their meats and vegetables through prickling, smoking and drying."

—Sarah

Student learning to preserve tomatoes.

Sleeping Camel Restaurant Staff and Kitchen.

Meat prepared for menu.

“Immediately that evening they implemented a special using two of the cuts we took off the animal that afternoon and served it with some local vegetables purchased at the market earlier that day.”

— Sarah

Chef Sarah with BBC restaurant owner, manager and staff.

Bringing Out the Best in Local Foods: Chef Ben Spangler

Ségou Region and the Bamako Capital District. Hosts: Doni Blon Institute, Bamako Barbecue Chicken and Sleeping Camel Restaurants.

An egg and vegetable breakfast dish

The primary objective of this assignment was to train chefs, and staff on creatively utilizing local foods to meet the needs of a diverse international customer base and to provide training on menu creation that considers cost, nutrition, and presentation factors. The introduction of nutrient dense foods is desired when available to counter the generally low nutrient, high carbohydrate diet. This might include affordable menu options developed for a diverse local and international customer base.

Ben described his activities as:
"We would first visit the market and begin to choose products that were in season and the best quality and then base our cooking practices around those ingredients. Advocating seasonal quality produce over concept: let the food guide your cooking.

First menu options were vegetable based. The owners of Sleeping Camel wanted more vegetarian and European options. We worked on creating a menu utilizing and showcasing vegetables as a full meal. Along with the basics of vegetable handling and cookery, we implemented numerous cooking practices for each ingredient, including roasting, grilling, mashing, whole chunks or raw. This was done to expand the cooks' views as to what is possible with each vegetable and protein, in different ways. The team created a new menu to showcase at the Sleeping Camel restaurant and the American Club.

I trained employees on expanding their breakfast menu, including new options for brunch and advising restructure to the breakfast program. Menu items were soft scrambled eggs with cured salmon, additional crepe add ons (e.g., crepe suzette, banana foster), poaching eggs, vegetable frittata, and shrimp and grits. I provided them with the knowledge and recipes to utilize the entire product, take risks and to be more creative with their cooking."

I provided them with the knowledge and recipes to utilize the entire product and be more creative with their cooking. - Chef Ben Spangler

Spaghetti and local tomato dish

Ben also conducted a seminar at the University of Ségou for hospitality students.

> "*I discussed the misconceptions about malnutrition and ways to achieve optimal nutrition, while demystifying health myths and shedding light on nutrition labels. We designed menus around food variety, color, nutrition, and presentation."*

Plating skills with local meats and vegetables

Targets and Results

#	Assignment Title	Volunteer	Dates	Day	M/F	New
01	Nutrition assessment: protein choices and food opportunities	Bendicto Marinas, Nutritionist / Chef	Sep 9 - Oct 31	53	M	Y
02	Specialized marketing: full carcass utilization, lamb-goat sausage, curing, smoking	Sarah Master, Chef	Oct 10 - 20	11	F	Y
03	Upgrading Stock Genetics: breeding systems. Agro-pastoral school trainings.	Terry Gipson, PhD. Animal Production, Small Ruminants	Nov 27-Dec 18	22	M	N
04	Youth Training: Leadership, documentation and animal health surveillance.	Jake Holmes, Student International Studies	Dec 18 -Jan 15	29	M	Y
05	Bringing out best in local foods	Ben Spangler, Chef	Feb 20 - Mar 8	17	M	Y
06	Enhance Local Production Methods livestock and crops	Team: Sharman Davis Barrett, Rosemary Nevelle, Marketing	Mar 10 - 26	17 17	F F	Y Y
07	Small Ruminant Fodder Production Systems	Michael O'Neill, PhD. Agriculture Science	Mar 27- Apr 9	14	M	Y
08	Organizational and Management Capacity Building	Mitchelle Makanjuola, International Program	Dec 30 -Jan 15	17	F	Y
10	Small Ruminant Production and Nutrition Systems. GPS pastoral assessment. Livestock survey.	Team: Andrés Cibils, PhD. Range Science. Jan Ott, Matt McIntosh Graduate Students	Jun 4 - Jun 22 Jun 4 - Jun 21 Jun 4 - Jun 21 **Total Days**	19 18 18 **252**	M F M **5 F**	N Y Y **10 N**

Indicator	Target	Actual
Number of Volunteers	**10**	**12**
Number of Hosts Strengthened	17	26
Number of Person Trained	750	939
Number of Family Members Benefited *	3,000	3,756
Secondary and Postsecondary Students	400	235
Farmers with Disabilities Trained	30	41
Total Days	200	252

*Average family size in Mali is stated as 5 per the *Mali Demographic and Health Survey* (MDHS-III 2001)

Ten of our 12 volunteers were new!

Three of our new volunteers were chefs!

Public Outreach and Impact

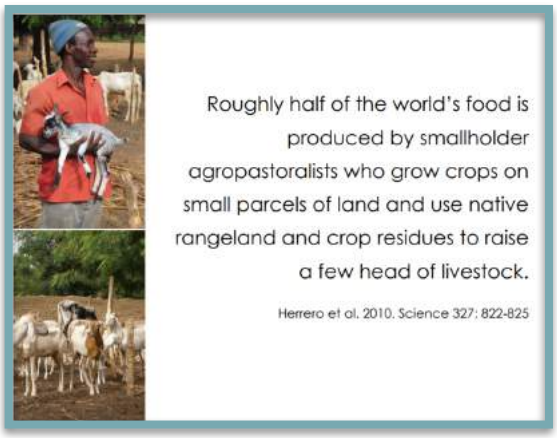
Infographics

A series of six infographics were created to inform and educate Common Pastures supporters on Malian culture, recipes and Common Pastures volunteer activities. These infographics were shared on the Common Pastures and Shepherd Song Farm Facebook pages and websites, where they were viewed by thousands of people.

Contacts, Resources and SEO

Four volunteers discussed with over 140 members of the community face-to-face and in two home meetings. Donations were collected for breeding stock and an irrigation well. A collection of 30 recipes featuring Moringa and local foods has been developed by chef Benedicto and will be distributed later this fall.

Volunteer Andrés Cibils presented a poster session at a conference in Canada (http://bit.ly/2vER7Uu) for approximately 250 views and discussions. Andrés also talked about Mali and the project in his classes and seminars to approximately 150 students and colleagues. He recruited and accompanied two graduate students on the small ruminant production and nutrition assignment.



A paper was written by Cibils, Bengaly, and two other professors. *Human Population Growth, African Pastoralism, and Rangelands: A Perspective. Rangeland Ecology and management.* Holechek, Cibils, Bengaly, Kinyamario (http://bit.ly/2hL49dm) to an unknown readers.

Alfousenni Sidibe provided information for a video on the Young African Leadership Initiative (YALI) (http://bit.ly/2vFvy6p) and blog on the YALI fellowship (http://bit.ly/2vjThYN) which received over 20,000 views.

Social media was posted on six volunteers' Facebook pages, three Youtube channels, Vimeo, two websites, LinkedIn pages, Twitter, Google+, and Instagram, and receiving over 6,000 hits.

Browse and Grass Cooperative sent email news updates to over 70 recipients four times.Project Director provided eight flash drives and eight CDs of project information to organizations in Mali.

A crowd funding video is being prepared for fall release on widows and children.

Expected Impact:

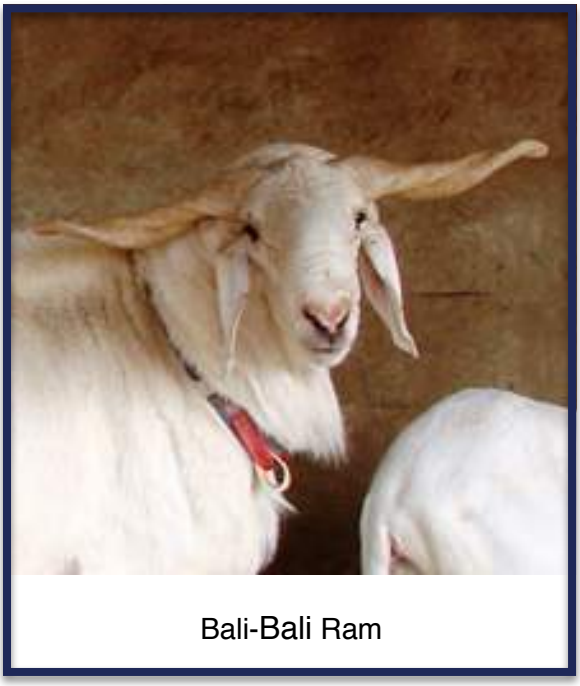
Students: The VALID project initiated by BGGC (2015) in partnership with the University of Ségou will continue at the end of this project. VALID provides field study opportunities for agriculture and animal science students. Currently, with additional support from the New Mexico State University Las Cruces, VALID is facilitating research on cassava silage feed supplementation of small ruminants at the villages of Dougoukouna and Ouendebougou. This project has undergone several phases (inventory of small ruminants, cultivation of cassava silage and training of breeders) and is preparing for the supplementation phase. Two Ségou University students, as part of the VALID project, will receive stipends to reside in the villages for 2 months to oversee the process.

The VALID students have provided over 1,000 free vaccinations for small ruminants under the collaborative supervision of private veterinarians and Ségou University staff each year of the project. They plan to continue this effort as critical vaccinations are not provided by the government. One of the former VALID students, Adama Guindo, has been awarded a university fellowship through a Dutch project for a master's program in Benin.

Along with being a coordinator on this project, Alfousenni Sidibe received a six-week fellowship to attend the Young African Leadership Initiative (YALI) at the Arizona State University followed by a four-week business and marketing seminar in Washington D.C. the summer of 2016. He is the founder of a youth organization, *Living Your Dream,* to encourage other young adults to take more initiative in expanding their goals, becoming involved in civil engagement and volunteering along with seeking out entrepreneurship opportunities. *Live Your Dream* provides social media and video services to private businesses and conferences. They utilize the many resources on the Internet such as YouTube to both teach themselves and to mentor and train others. Facebook page: https://www.facebook.com/LYDMali/

Alfousenni with daughter preparing for YALI

Breeding: The breeding program with the close involvement of two VALID students is the most successful and sustainable activity. Farmers are proud to share their results and the physical difference with the local breeds is obvious. The project breeding results are “spreading like wildfire” states Yacouba Diarra, the president of the Farmers’ Cooperative of Bougouni. Many other villages in the region are requesting the program’s support to improve their small ruminant breeds. The follow up provided by the VALID students help to emphasis the need for continued attention to improved nutrition, housing, management and preventative health care.



Bali-Bali Ram

The improved local Bali-Bali and Moor rams and Sahelian bucks provided through U.S. donations will continue to be shared among cooperative members to improve local genetics. They are being rotated among cooperatives to prevent the in-breeding risk of maintaining a set of rams or bucks at one location. Preventative health and improved nutrition will enable the birth of healthy offspring and increased economic returns. Rations will be balanced to the extent possible and recipes shared with fellow cooperative members and the project team. Pregnant, lactating and growing animals will receive the most attention and be separated for feeding if necessary.

Legume Trees: The tree program is now a joint venture. During the first year the program provided over 3,000 young saplings and training on appropriate handing and management. Although, many of these first plantings did not make it through the dry season the Leuceana and Moringa that survived grew quickly and produced seeds. Small ruminants demonstrated their preference for leaf fodder and farmers began to invest in their own small fodder plantings.

Fodder trees will continue to be grown from collected seeds and cuttings, protected and utilized as a feed source. With ongoing support leaf fodder will be dried and stored for supplementation during the dry season. The protein is level is generally around 25 percent so no more than 20-30% leaf fodder is an adequate supplement.

Challenges:

Ten out of the 12 volunteers were new. Four were college or graduate students. The new volunteers took more than double the support time than experienced volunteers both preparing them for their assignment and debriefing after. Without exception the new volunteers wanted to return to Mali to do more of this people-to-people work. Two commented on how out-of-the-ordinary and important this experience was and how different from “backpacking adventurers”.

New volunteers Jake (back row), Mitchelle (center) and Alfousenni coordinator (left end) with group of students.

The project planned to reach more postsecondary and secondary students (400 versus 235). This proved difficult due to availability of many of the volunteers conflicting with school recess in Mali. The best time for volunteers tended to match the students’ vacation periods. Both Ben Spangler and Jake Holmes met with students during the students’ vacation period with good results. This shows that the project is well recruited and has a high level of organizational ability but more students could have been reached if schedules had matched better.

Children of all ages are responsible for small ruminants and are responsible for where and

how long small ruminants graze.These young adults are at the perfect age to absorb new information and express eagerness to work with their animals. They peer into the adult trainings and join their parents when school schedules allow. The timing was not ideal to fully address this opportunity. This project did demonstrate the potential to work with young adults and that students from both cultures bond and enjoy working together.

Coordinating volunteers, flights and in country assignments within the limited 12-month time period of the project proved difficult. The best times for farmers to work with volunteers did not necessarily match the volunteers' vacation schedules. The first month of the project was focused on required tasks to prepare scopes of work and the final work plan before volunteers could be recruited. Flights need to be arranged at least four weeks in advance to avoid paying premium. These requirements reduced the grant year to slightly less than 10 months. Within this time period it is not always possible to match appropriate volunteers to the need due to the farmers' seasonal heavy work load making some months not appropriate to provide trainings.

Lessons Learned:

It is important to develop and maintain in-country relationships and networks. Members of our cooperative previously volunteered through the Farmer-to-Farmer program or had been exposed to volunteer presentations, including virtual contact with Malian farmers through problem solving requests. This provided an understanding of needs and a realistic baseline. It would have been difficult to be successful without the earned trust and support from many of the farmers we trained. During earlier volunteer assignments the request was "Come back. Don't forget us." Just coming back and remembering individuals, their children and issues is a huge advantage in gaining trust and collaboration. This in turn increases the likelihood farmers will take the risk of implementing new ideas and methods.

Cultures have their own pace. Attempting to take large steps too soon is not effective. Farmers need to buy into new ideas and methods as they invest their own thinking and resources in the implementation. Projects that do not engage the people from the start and throughout the process are often not sustainable. Even small grants, if well planned and appropriately managed, can make a significant impact if done in collaboration with farmers and local organizations.

Recommendations:

Students: Continue the VALID project at the University of Ségou as these agriculture and animal science students are the future extension workers, progressive farmers and entrepreneurs. The rural village farmers have been very receptive to the students' in-

residence support over past two years providing meals and housing. One of the students shares a room with the chief's son. The students in turn, learn to transfer their academic training to solve practical problems. They are also exposed to the importance of volunteering and civic engagement. This will help them network and build the relationships important to their professional advancement.

Alternative Feed: The workshop participants in the Bougouni region should continue to treat their crop residues with urea, ensile, and use as feed, thereby increasing the nutritional status of livestock and improve breeding outcomes.

Additional methods of alternative feed supplementation needs to be explored, such as dried ground nut foliage, ensilaged cassava, and urea treated rice straw. Results should be shared with fellow cooperative members and the project team.

Fodder Trees: Continue the establishment of enclosed Cooperative nurseries with available water, plastic pots and planting medium would be a significant, important and possible undertaking as cutting and seeds are already being started by farmers. The need and advantage of fodder trees has been experienced and appreciated. With some encouragement this beginning is likely to continue.

Diakité's basic fodder tree nursery, Bougouni.

Mineral Supplement: One or two cooperatives or individual members should continue to manufacture and improve the urea-molasses block being developed for small ruminants, thereby increasing efficiency of production and resulting in improved nutrition during the dry season. Making them available for sale in the surrounding villages could potentially be a source of income for women.

Improved Breeding: Health surveillance by the livestock owners should be continued and basic health care provided in a timely manner. Continue consultations with the private veterinarians supporting the VALID students during this project to strengthen the relationship between farmers, students and professionals.

Continue to control intact male rams and bucks to prevent unwanted and inferior breeding. Continue to select the best offspring for future breeders—not for religious slaughter. Both of these recommendations will be difficult to maintain without additional training.

Nutrition: Additional training on appropriate animal nutrition and grazing is needed. More encouragement for families to eat balanced and varied diets is also important. It will be difficult for families to understand the need of appropriate nutrients for their livestock if it is not first appreciated in the family.

The three chefs, after experiencing the need for understanding nutrition, cleanliness in food preparation, and the multitude of great produce also wanted to return to do more. It was difficult for them to comprehend why farmers would sell their vegetables and fruits at roadside markets, with much of the inventory succumbing to the heat, rather than utilizing the extra in simple meals.

Chef Benedicto delighting in fresh vegetables at roadside markets.

Nutritious family meals and restaurant menus should continue to be developed utilizing Mali's abundant local fresh fruits, vegetables and livestock. This will require ongoing encouragement and support to help change habits and eating expectations for both village and urban consumers.

Appendix

Case Studies:

- Benedicto is a Blessing
- Preserving Precious Nutrients though Currying, Pickling, and Canning
- Healthy Goats Improve Family Health and Wealth
- Trees for Madian

Scopes of Work

Volunteer Reports