



# Capacity-Building And Strengthening Of Livestock Production System While Adapting To Climate Change In Nepal

**Project Leader:** Dr. Durga D Poudel, *School of Geosciences, University of Louisiana at Lafayette, Louisiana, USA*

**Project Partners:** Dr. Ram Pukar Thakur, Dr. Timothy W. Duex, Mr. Amleshwar Singh, Dr. Kamal Kanta Acharya, Dr. Eldred Griffin Blakewood, Dr. Bishnu Chapagain, Mr. Shiva Adhikari, Dr. Alan DeRamus, Dr. Robert B. Gramling

RB-12-2013

May 2013

## Research Brief

Feed the Future Innovation Lab for Collaborative Research on Adapting Livestock Systems to Climate Change

### Abstract

*Climate change, along with other factors, such as deforestation and land-use changes, threaten to degrade the health of mixed farming systems in Nepal. For the majority of the nation's population, agriculture is a source of livelihood, and any degradation in the agro-ecosystem has tenfold effects. To learn more about climate change impacts and to develop adaptation techniques, an Innovation Lab for Livestock project team selected a watershed in the Nuwakot district as a study site, with a research strategy that aimed to not only improve livestock health and productivity but also, ultimately, to improve livelihood and standard of living for Nepalese farmers. After collecting important scientific data on water availability, soil quality, disease and more, the project team organized several workshops and trainings for the local livestock communities in the watershed. Trainings focused on improving and expanding livestock productivity, formulating nutritional feed, treating animals for disease and keeping data records. By the end of the study, more than 350 households had received the skill set and knowledge to sustainably adapt to a changing climate.* 🐄

## Climate Change and Other Factors Degrade Nepalese Livestock Systems

### Background

For almost 23.2 million people in Nepal — 80 percent of the total population — agriculture is a way of life. For a large segment of the population, the ability to feed families, send children to school, or simply maintain a livelihood depends upon the health of the agro-ecosystem. Mixed farming, the primary agricultural system in Nepal involves close ties between livestock, crop production, soil quality, water sources and forest resources.

Climatic and land-use change threaten this way of life. Deforestation, disease, rising temperatures, droughts, floods, overgrazing and other factors compromise the health and future of these systems, and thus the livelihoods of small landholders.

Livestock play an integral role in the mixed farming systems of Nepal. The animals provide milk, meat and profit to the family and manure to fertilize the soil for crops. In turn, crops and forest resources serve as the animals' feed. But, like the rest of the system, livestock suffer due to disease, limited feed availability and degraded health. In addition, farmers lack proper knowledge and training to care for animals under a new climate, leaving this critical link in the system at risk if adaptation measures are not taken.



*Local communities are quite interested in intensive animal farming, especially after they visited the modern dairy farm in Gorkha district. Thulokhola local communities observing a dairy farm in Gorkha. (Photo credit D.D. Poudel)*

Feed the Future Innovation Lab for Collaborative Research on Adapting Livestock Systems to Climate Change

Colorado State University Fort Collins, CO 80523-1644

[www.LCCCRSP.org](http://www.LCCCRSP.org)





Researchers are welcomed. (Photo credit Bishnu Chapagain)

### **Innovation Lab for Livestock Project Helps Farmers Adapt to Climate Change**

In June 2011, the Feed the Future Innovation Lab for Collaborative Research on Adapting Livestock Systems to Climate Change awarded a project team led by Dr. Durga D. Poudel, professor at University of Louisiana at Lafayette, a grant to research changes and problems facing livestock owners in Nepal and to provide corresponding trainings and resources to help farmers adapt.

“The inability of local communities to fully cope with the wide range of emerging problems related to climate change, population growth and land-use changes has become the fundamental limitation to livestock climate change adaptation,” Poudel said.

With these problems in mind, the project team developed a research strategy that aimed to not only improve livestock health and productivity but also, ultimately, to improve livelihood and standard of living for Nepalese farmers.

By first understanding the causes of livestock system degradation and the impacts of climate change on farmers, the project team worked with local livestock communities to develop applicable climate change adaptation techniques and skills. Throughout the research process, the project team addressed issues of gender equality and sustainability. Then, at the end of the study, the project team disseminated the research findings so that policy makers, organizations and other farming communities could better understand the problems facing farmers and how best to solve these problems.

“This project was very successful, as it not only impacted local communities through capacity-building and livestock climate change adaptation, it also generated hard scientific data on fecal, fodder, feed, soils, water quality, spring sources and sociological aspects,” Poudel said.

More than 350 households received the skill set and knowledge to sustainably adapt to a changing climate when the 18-month study concluded. But, the results of the study will benefit these Nepalese farmers far beyond these skills. The data collected will provide support to livestock climate change adaptation policies at the local, regional and national level that could provide further assistance to farmers.

### **Study Site in Nuwakot District Selected as a Representative of Larger Nepal**

The project team selected the Thulokhola watershed, located 1.5 miles south of the town of Devighat in the Nuwakot district, as their study area. Situated in the mid-hills of Nepal, the Thulokhola watershed is home to 359 households, which depend upon mixed farming as a livelihood. Because of this, the watershed adequately represents the majority of livestock systems in Nepal, providing the project team the ability to scale up results to the rest of country. Researchers split the watershed, which spans in elevation from 440 meters to 1,648 meters, into three different elevation zones to compare how climate change might have different effects at different elevations.

*“More than 350 households received the skill set and knowledge to sustainably adapt to a changing climate when the 18-month study concluded.”*

### **Data Collection Results Reveal Health Issues**

Through surveys and sample collection, the research team, which included experts across many different fields of study, determined parasites, soil acidity and water scarcity as the greatest problems facing the watershed’s livestock system due to impacts of climate change.

#### *Anemia Found in Goats Due to Gastrointestinal Parasites*

Researchers found a high prevalence of gastrointestinal parasites in the livestock, especially in goats after analyzing more than 1,400 fecal samples. Living in the digestive tract, the parasites feed off of the animals’ blood, causing anemia, or blood loss.



*The goat production and management training participants use FAMACHA card for anaemic scoring of a goat. (Photo credit D.D. Poudel)*



*The Non-CLG members training participants use FAMACHA card for anaemic scoring of a goat. (Photo credit D.D. Poudel)*

#### *High Soil Acidity Reduces Crop Yields and Plant Growth*

Thulokhola farmers have witnessed a change in their soil over the years. The soil that used to crumble beneath their fingertips now feels compact and dense, limiting plant growth.

“Soil fertility in our lands has declined in recent years,” a focus group of farmers in the middle elevation told researchers. “Our soils were friable [easily crumbled] in the past; now, they are clayey. We have very bad soils; we cannot make them friable anymore.”

After taking 90 composite soil samples, researchers discovered the reason: high soil acidity in the lower elevations of the watershed.

As Poudel explains, high soil acidity “causes aluminum and manganese toxicities to plants, poor root growth, reduced nutrient uptake by the plants, reduced biological activity in soils and lower crop yields.” The project team suggested the farmers use lime to correct the soil acidity.



*Dr. Bhoj Raj Joshi talking to the participants about infectious diseases, goat health management, and parasitic diseases and their prevention. (Photo credit D.D. Poudel)*

#### *Water Conservation Efforts Needed in Face of Water Scarcity*

The researchers discovered that much of the watershed is drying up at a fast rate after a survey of 41 water sources.

“Eighty-five percent of water sources surveyed had either dried completely or had declined in flow over the past 10 years in this watershed. This has resulted in serious impacts to the watershed’s hydrology, affecting drinking water supplies, as well as water needed for agricultural and livestock production,” Poudel said. “The decline in annual precipitation, more frequent and prolonged droughts and drying up of water sources exceeded our original expectations.”

To address this issue, the project team met with Judy Ogelthorpe of World Wildlife Fund’s Nepal Hariyo Ban Program to share the Innovation Lab project’s research findings with the possibility of scaling-up climate change adaptation strategies to a larger scale, as the conditions of livestock communities in the study area mirror conditions in other regions of Nepal.

#### *Farmers Identify Major Problems*

Researchers conducted Participatory Rural Appraisals, which provided farmers a forum to express their opinions and share knowledge. Through the PRAs, the farmers identified their greatest problems, the severity of each problem and the limits of solving these problems. Researchers met with a group of farmers from each of the three elevation zones. The farmers identified drought, drying water sources, a decline in crop productivity, poor animal health, lack of feed and poor breeding conditions as major impacts caused by climate change. Also, farmers credited poor animal health to new diseases, delayed livestock pregnancies, poor soil fertility, feed shortages, landslides, forest degradation, poor crop yields, water shortages and an increase in women’s workloads.

“We had a lot of wildlife in our forest until about 10 years ago,” a focus group of farmers from the upper elevation told researchers. “Although we seldom see deer in a limited area, we have not seen most of the wildlife in recent years that we used to see frequently in the past. We have no more tigers, leopards, jackal and tita in our forest these days. Deforestation has severely impacted our wildlife. As a community we have not been able to take any initiative for preserving our wildlife.”

#### *Climate Change Determined as Only One of Many Factors*

After data analysis, researchers concluded that climate change is only one of



*The Thulokhola community PPR vaccinated 2,968 goats with the help of SLPS project, DLSO, Asta-Ja Abhiyan Nepal, and community volunteers. (Photo credit D.D. Poudel)*

multiple factors causing the degradation of livestock systems. Other factors at work include lack of knowledge and resources, land use change, policy and political measures, deforestation and small landholding sizes.

## Local Communities Receive Vital Trainings Over the Course of the Study

After discovering the greatest challenges facing livestock communities, the researchers formed nine Community Livestock Groups, which, in total, consisted of 51 farmers representing the three elevations of the watershed, in order to increase the abilities of local livestock communities to adapt to climate change. Each CLG consisted of a group of five to seven farmers; each elevation zone had three CLGs. As the project aims to encourage gender equality, women represented half of the farmers in the CLGs with a 25:26 ratio of men to women, respectively. The project team hosted trainings and hands-on experiences for these CLG members, as well as 100 non-CLG members, from the watershed, focused on improving animal health and expanding livestock

*“I have the same amount of work, but I have a khasi [castrated male goat] that weights 40 kilograms, worth 20,000 rupees now”*

productivity.

“Capacity-building empowers local communities with the necessary knowledge and skills to address their problems and achieve desired outcomes,” Poudel said. “Through this process, local communities become less dependent on outside help in solving their problems. Through capacity-building, local communities can adapt to climate change with minimal outside support.”

Over the course of the study, CLG members participated in four training sessions and activities:

### 1) CLG Members Learn to Monitor Water Quality and Keep Daily Livestock Records to Recognize Developing Problems

In order to help recognize developing problems in the future, CLG members learned how to monitor water quality and record livestock data daily on feed types, livestock health, livestock marketing and manure management in July 2011. Livestock communities received a water quality monitoring kit after learning how to test their water for pH, coliform bacteria (which indicates the possible presence of more harmful pathogens), turbidity (clarity of the water), dissolved oxygen and phosphate and nitrate levels. The researchers used the data CLG members collected in their research analysis.

### 2) Goat Health and Nutrition Improves After Goat Production and Management Training

Thulokhola farmers have already noticed a change in the health and nutrition of their goats as they continue to use the skills they learned in a goat production and management training in October 2011. This change means more money for the farmer — as the goat’s health improves, the worth and selling price increases.

In this training, the CLG members learned how to use FAMACHA cards to score the severity of anemia in their goats based upon the color of the animal’s eye mucus, as researchers identified parasites as a major problem in the watershed’s livestock. Since this hands-on training, livestock communities report a 70 percent decrease in parasitic infections in their goats. In addition,

80 percent of livestock communities who received FAMACHA cards say they use the resource regularly and treat their animals accordingly.

Another hands-on session focused on improving feed nutrition. Farmers learned how to use local resources to make goat feed by using the Pearson’s Square technique to determine the rations and proportions of each resource.

“I have the same amount of work, but I have a khasi [castrated male goat] that weights 40 kilograms, worth 20,000 rupees [US - \$366.84] now,” said Binda Nepal, a CLG member. “After receiving goat production and management training from this project, I regularly check my goats for anemia and formulate feed locally for my goats.”

### 3) CLG Members Take a Tour of a Modern Dairy Farm to Learn About Livestock Commercialization

In response to the smallholder livestock community’s interest in expanding and commercializing livestock production, researchers organized a tour of Kamadhenu Gai Palan Kendra, a modern dairy farm in Chyangli, Gorkha, in January 2012. The tour allowed the CLG members to see how a commercialized production system works, including the breeds of cattle used, how the animals are fed and milked and how feed is prepared.

### 4) Goats Vaccinated for Viral Disease

In order to help improve animal health and productivity, the farmers learned how to vaccinate their goats for Peste Des Petits Ruminants, a “highly contagious and infectious viral disease of domestic and wild small ruminants,” Poudel said. A total of 2,968 goats were vaccinated in July 2012 with the help of the Department of Livestock Services, Asta-Ja Abhiyan Nepal and the local communities.

### Non-CLG Members Receive Training in Goat Production and Management

Not wanting to limit trainings to only CLG members, the project team hosted two goat production and management trainings for non-CLG members in October 2012. One hundred participants from the Thulokhola watershed learned about goat health, management, housing, nutrition, breeding, production and disease.



*A technician at NARC teaches participants about the laboratory determination of livestock pathogens. (Photo credit Anita Bhattarai)*

*“Our results have already impacted the local communities as their goat mortality rates have significantly declined.”*

*Six Community Members Will Serve as Veterinary Resource After Animal Health Training*

Six members of the watershed community, two from each elevation zone, will now serve as a veterinary resource for the livestock communities after participating in a Village Animal Health Worker Training in October 2012. The Nepal Agricultural Research Council hosted the 12-day training and hopes to provide a refresher course in the future.

“Animal health was one of the major issues that the local communities were facing when it comes to the issue of climate change adaptation. Insufficient governmental services due to distant offices and the absence of technicians in the local areas were major concerns of the livestock producers,” Poudel said. “In order to provide services and make simple medicines available locally, there was need for trained manpower to provide such services locally.”

**What the World Can Learn from Thulokhola**

Our agricultural produce from lands is just enough for food. When animals die we cannot even afford schooling of our children; we will need 10 years to pay the debt because of the death of our large animals,” a focus group of farmers from the middle elevation told researchers at the beginning of the study.

A majority of Nepal’s population, and much of the world’s population, depends on mixed agricultural systems for a living. Like the farmers in the Thulokhola watershed, any break in the system, any loss of livestock, any degradation of health has tenfold effects on the people whose livelihoods revolve around the health of the land. So, as the environment changes, the people must, too.

Throughout this study, the people of the Thulokhola watershed showed their full commitment to understand and to adapt to their changing world. Some farmers would walk more than four hours to attend trainings and workshops. And, their commitment has paid off. As the Innovation Lab for Livestock project concludes, the communities now have a sustainable toolbox of adaptation techniques, such as feed formulation and animal health management. Best of all, the project has already helped to improve the watershed’s livestock systems and thus, the livelihoods of the farmers.

“Our results have already impacted the local communities, as their goat mortality rates have significantly declined. They have started formulating feed for livestock with locally available materials and they know how to use a FAMACHA card in anemic scoring. Also, having enhanced the capacity of these local communities, their income level will likely increase and family nutrition will improve,” Poudel said. “Project results will clearly indicate that livestock climate change impacts are very serious and climate change impacts and other factors, such as deforestation, declining water sources, land-use change, and lack of farm labor, as well as lack of fodder trees, are impacting livestock production systems.”

So, what does a small watershed in the mid-hills of Nepal mean to the rest of the world?

“With some degree of variation, livestock production systems worldwide will likely suffer similar impacts, which may result in the degradation of their livestock production systems,” Poudel said. “The world can learn from the Thulokhola watershed.” 

**Project Achievements by the Numbers....**

**359**

**215**

livestock producers  
adapting new technology

households benefiting from project

**157**

individuals who received  
project-supported livestock training

**8**

policies, regulations and administration  
procedures analyzed as a result

**2**

new technologies made available (anemic  
scoring and feed formulation)

**8**

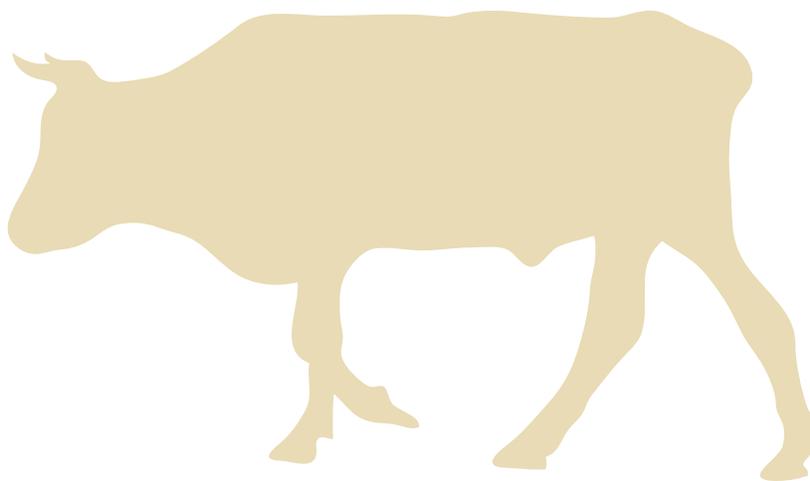
organizations and  
agencies involved

Figure 1: Visual diagram of the project achievements.

## Further Reading

Poudel, D.D. 2011. Challenges of climate change and sustainable livestock production in Nepal, Telegraphnepal, Available at <http://www.telegraphnepal.com/national/2011-08-17/challenges-of-climate-change-and-sustainable-livestock-production-in-nepal.html>; accessed on August 29, 2011.

Poudel, D.D. 2011. The Asta-Ja management capacity-building framework (Asta-Ja MCBF) for sustainable development in Nepal, International Journal of Sustainable Development. Vol. 15, No. 4, pp.334-352.



### *Capacity-building and Strengthening of Livestock Production Systems While Adapting to Climate Change in Nepal (SLPS)*

*Principal Investigator: Durga D. Poudel, University of Louisiana at Lafayette*

*The SLPS project was initiated to: (1) identify factors responsible for the downward spiral of the livestock production system, (2) identify impacts of climate change on livestock production and the adaptation measures practiced, and (3) assess opportunities and challenges for capacity-building at the national, district, and local level.*

*Rapid land use changes, forest degradation, soil erosion, climate change, policy deficits, and community inability to handle these challenges have caused a downward spiral of the livestock production system in Nepal. We hypothesize that the livestock production system in Nepal is intricately related to forest resource, soil quality, and crop productivity, and its development and adaptation to climate change requires capacity-building and strengthening of the production system. We have identified a representative watershed in Nuwakot district for this study. An interdisciplinary team is involved in reconnaissance surveys, household surveys, group interviews, field visits, and round table discussions for a comprehensive understanding of the livestock production system and its adaptation to climate change. Assessment of challenges and opportunities for capacity-building at the community level will be done by forming Community Livestock Groups in the watershed and conducting various activities in relation to skills development such as feed storage, feed quality improvement by enriching rice straw with urea, and livestock monitoring. Similarly, capacity-building at the national, district and local levels will be assessed through institutional analyses, policy reviews, and office visits. Research results will be disseminated through various media outlets including scientific journals, newspapers, meetings, workshops, conferences, and community organizations.*



**Feed the Future Innovation Lab for Collaborative Research on Adapting Livestock Systems to Climate Change is dedicated to catalyzing and coordinating research that improves the livelihoods of livestock producers affected by climate change by reducing vulnerability and increasing adaptive capacity.**

*This publication was made possible through support provided by the Bureau for Economic Growth, Agriculture, and Trade, U.S. Agency for International Development, under the terms of Grant No. EEM-A-00-10-00001. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Agency for International Development or the U.S. government.*

