



# Annual Report Year 1 – Improving Nutrition and Productivity of Buffaloes to Adapt to the Impacts of Climate Change in Nepal

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## Research Brief

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

### Abstract

*As the climate changes, farmers in Nepal struggle to find forage for their buffaloes, which account for more than half of the milk and meat production of large ruminants in the country. A Livestock Innovation Lab-funded project is working with 90 farmers to develop strategies and methods to increase forage availability and nutrition as well as improve buffalo reproduction and productivity. In its first year of funding, the project has established three research sites in the Gandaki River Basin, formed collaborative ties with local partners, provided critical resources, and hosted several trainings and workshops on improving feed and production. The initial results from the first year of research will help the researchers build into their next two years of research, producing information and experience that will help farmers throughout Nepal.* 

### Buffalo Farmers in Nepal Struggle to Find Forage for Buffalo in Changing Climate

Living on less than one hectare of land, most farmers in Nepal depend upon the health of their crops and large ruminants, like buffaloes and cattle, to sustain their livelihoods. In particular, buffaloes contribute more than 70 percent of milk and 65 percent of meat production for large ruminants in the country. But as temperatures increase and precipitation levels fluctuate unpredictably, soil fertility declines, the land begins to degrade, crop production decreases, and the total land available to forage cultivation shrinks. This leaves farmers with fewer feed options for their livestock, putting family nutrition, health, incomes, and overall food security at risk.

Now in its second year since its start in August 2012, a project funded and supported by the Feed the Future Innovation Lab for Collaborative Research on Adapting Livestock Systems to Climate Change is working in collaboration with several partners to help rural farmers improve forage crop cultivation, buffalo feeding, and reproduction management in three districts in the Gandaki River Basin.

“The goal of this collaborative project is to enhance the productivity of buffalo in Nepal through improved feeding and reproductive strategies and to enhance the ability of smallholder buffalo farmers to adapt to the consequences of climate change,” wrote project Principal Investigator Dr. Nanda Joshi, Michigan State University, in an annual report.

In its first year, the project has made considerable progress: collecting baseline data, testing the productivity of different winter crops, training technicians in artificial insemination (AI), collecting weather data, providing equipment, and hosting workshops for farmers on buffalo feed and reproduction.

Ninety farmers will benefit directly from this project, but the information and adaptation strategies studied will have a far-reaching impact on the rest of the country.

“The results and experience gained from this project will be disseminated to the farmers throughout the country through the outreach program of the Department of Livestock Services,” Joshi said.



*The buffalo of a progressive farmer. Chitwan, Nepal.  
(Photo credit: Dr. Upreti)*





*Oat trial in Chitwan, Nepal. (Photo credit: Dr. Nanda Joshi)*

## **Project Helps Farmers Improve Feed Production and Reproduction Management**

*Baseline Survey Reveals Farmers have Limited Knowledge on Feed Nutrition and Artificial Insemination*

After selecting the districts of Gorkha, Chitwan, and Tanahun for study, the research team began the project by gathering data on existing feed and reproduction management via surveys and face-to-face interviews with at least 100 farmers from each research site.

The survey revealed that most farmers have limited knowledge about improved forage species and are not aware of the importance of nutrients in feed formulation.

In addition, 70 percent of respondents reported that natural breeding served as the dominant breeding method, with only a third of respondents using AI. Although only a third of respondents reported having knowledge about climate change, most farmers related breeding problems, such as low conception and reduced milk, to climate change.

Respondents also reported that women spent, on average, an extra hour per day managing buffaloes than men. Women are usually more involved with production and management related responsibilities, whereas men are more involved with market related activities. Accordingly, the respondents believed that with climate change women's workloads would increase, as they would have to spend more time on feeding management.

From the respondents, the researchers selected 90 consenting farmers, each with 2 to 3 buffaloes, to participate in the remainder of the study.

*Drought-Tolerant Feed Species Harvestable After Winter Season*

Starting in the Winter of 2012, the research team worked with the 90 project farmers to plant, care for and harvest a crop of oats, a feed species more tolerant to drought, at each project demonstration plot. The crop was not irrigated or weeded, testing its full potential under natural precipitation and weed competition. After a one-day training on forage production, the farmers received a mini kit of seeds to plant on their own farms. The farmers have already requested more seeds after seeing the results on the demonstration plot.

"After the crop harvesting, the farmers expressed that they were able to grow the fodder and even use it in balanced rations for their animals" Joshi wrote.

The oat plantings have fared very well, producing a higher yield than existing forage species. Statistical analysis is in progress to determine the nutrition of the feed and total herbage mass.

The research team has already begun to prepare for the summer growing season, experimenting with Teosinte, a drought-tolerant grass, as a viable feed option.

In addition to learning how to plant and care for their crops, 20 farmers (75% women) participated in a six-day training on ration and feed formulation, receiving a booklet prepared by Dr. Chet Raj Upreti and Sujaya Upreti titled "Bovine Feeds, Ration Formulation and Feeding."

"Pre and post examination to the participating farmers revealed that the training was beneficial on fodder production and ration formulation," Joshi wrote.

Lastly, the research team distributed more than 1,000 fodder tree saplings to the participating farmers and farmers near the project sites. These saplings will provide an additional feed source in two years when they are ready for harvest. Eighty percent of the plants distributed to the farmers are surviving and growing well. This particular species of fodder tree, the Rai Khanyu tree, *Ficus semicordata*, grows at a faster rate, but has a lower survival rate. The study aims to determine the potential of the Rai Khanyu as a feed source.

"Observing the performance of the distributed saplings to the participating farmers, neighboring buffalo raisers are also planting fodder trees that they get from local private nurseries," Joshi wrote.

*Farmers Receive Resources for and Training in Artificial Insemination*



*Reproduction Workshop. (Photo credit Dr. Nanda Joshi)*

Three technicians from each project site participated in a two-week training by the National Livestock Breeding Center on AI. After the training, the nine technicians received an AI training license and have been authorized to do AI on animals. Thus far, the technicians have completed AI on about 1,000 buffaloes in and around the research sites. All of the equipment necessary for AI has been provided by the project to each study site.

In addition, two breeding Murrah buffalo bulls have been provided by the NLBC to be used for breeding in Palungtar and Gorkha. By breeding the local buffaloes, which produce about 800 liters of milk per lactation, with Murrah buffalo bulls, a breed that produces about 3,000 liters of milk per lactation, the resulting offspring will have improved milk production. Throughout the study, the participating farmers will keep records on milk production, breeding, and

vaccinations and medications for each of the buffalo under the study. Each Livestock Service Center in the study area has been provided with basic equipment, such as microscopes, so that LSC technicians can identify parasites and examine fecal matter.

“As the record keeping of all production and reproduction records are available, we can measure the impacts of the project on various objectives,” Joshi said. “The project has been successful in convincing farmers on the importance of record keeping for improvement in their livestock production.”

The project also hosted a national level workshop on buffalo reproduction in May 2013. Thirty scientists and researchers representing NARC, AFU and DLS participated in the two-day workshop and received a certificate of completion afterwards.

*“The project has been successful in convincing farmers on the importance of record keeping for improvement in their livestock production.”*

#### *Collected Climate Data Reveals Variation in Temperature*

In order to monitor current climate conditions, the project team has installed temporary weather equipment from Michigan State University at two of the project research sites. The project is collaborating with another Livestock Innovation Lab project also collecting weather data in the region, to garner data for the third research site.

Researchers will analyze the relation between the data collected and fodder production, behavior, physiology, health and performance of the buffaloes. Although more data will be collected, preliminary results reveal temperature variations. Preliminary findings will be presented in the annual review workshop on December 8, 2013 in Kathmandu.

#### **Future Steps**

##### *Farmers and Researchers Benefit from Year 1 Results*

Farmers have already begun to benefit from the first year of research as they learn more about their changing world and how to adapt.

“Results of this research is visible to the farmers as they participate at various stages of our research activities and training in various aspects of forage cultivation, ration formulations, breeding management and health care,” Joshi said.

The project’s partnering organizations are also beginning to experience project benefits.

“Scientists from our partner institutions (NARC, AFU and DLS) are engaged from the very beginning of the concept and design of the project. There is an ownership of the project and they understand the importance of the success of the project and benefits to the farmers and experience gained in implementing the research project and training and capacity building in and outside of Nepal,” Joshi said.

#### *Researchers Plan for Year Two*

After a successful first year of identifying farmers, establishing research sites and providing trainings in forage cultivation, ration formulating, breeding management and animal health care, the research team looks to its second year goals.

“In year two, we will be working closely with the participating farmers on leguminous forage crops in combination with grasses to further improve feed and forage availability for increasing milk production, ration formulations, and feeding techniques. This will improve efficiency, and ways and means to reduce heat stress due to changing climate,” Joshi said. “In addition, we will be studying the parasitic loads to deliver proper medication for deworming.”

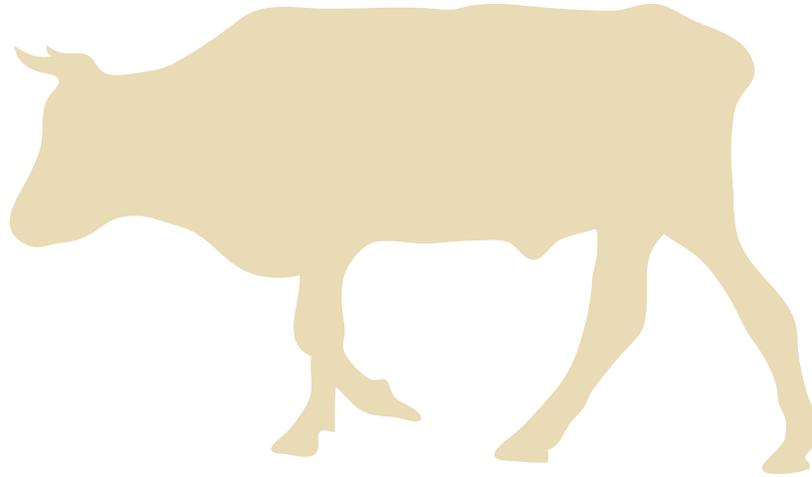
#### **Specific goals and objectives for year two include:**

- Introducing leguminous forage crops in combination with annual grass species for improved feeding for different age groups of buffaloes.
- Working with NARC, AFU and DLS to develop pregnancy diagnosis techniques and to train farmers in heat detection in buffaloes.
- Completing weather stations and climate data recording systems for the three research sites and acquiring temperature and precipitation records for the three districts from the Department of Metrology and Hydrology for 30 years.
- Completing the book on “Buffalo Management Systems in Gandaki River Basin” to be distributed to farmers in the region through DLS outreach program in buffalo improvement program.
- Adjusting priorities based on the project review workshop recommendations and comments from evaluators.
- Facilitating field visits for the farmers to other districts to learn the differences and similarities in forage crop production and feeding and management practices.
- Hosting additional farmer training (training and visits) for the participating farmers.
- Studying gender roles using focus groups to learn their specific roles in management and their perception on the impact of climate change. Base information collected in year one will be used as a comparison to examine the impact of and any change in their perception on climate change.

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

**1,000** fodder saplings distributed to farmers  
**5** collaborating institutions **3** study sites  
**9** technicians trained in artificial insemination  
**30** scientists, academician and development workers benefiting from project  
**90** farmers that directly benefit from project **1,500** farmers that indirectly benefit from project

Figure 1: Visual diagram of the project achievements.



*Improving Nutrition and Productivity of Buffaloes to Adapt to the Impacts of Climate Change in Nepal*

*Principal Investigator: Dr. Nanda Joshi, Michigan State University*

*Buffaloes are the most important large ruminants in Nepal, contributing more than 70% of milk and 65% of meat production, making buffalo the choice livestock species of smallholder farmers. Nepalese farmers, on average, keep 3.8 large ruminants (cattle/buffaloes) on less than one ha land in a crop-livestock mixed farming system. However, due to shrinking forage cultivation land, declining soil fertility, land degradation, and decreasing crop production, forage and crop residues for livestock feeding is steadily declining. Globally, Nepal is considered to be the 4th most vulnerable country to climate change impacts. Climate change threatens to add additional stress on livestock production systems through increasing temperatures, faster melting glaciers, and unpredictable precipitation. Without adaptation, these factors will adversely affect livestock productivity and livelihoods of smallholder farmers, particularly female farmers, with implications on family nutrition, health, income, and overall food security. MSU, in collaboration with NARC, AFU and the DLS in Nepal, will conduct collaborative research on forage crop cultivation, feeding, and reproduction management in three districts: Chitwan, Tanhu and Gorkha of the Gandaki River Basin. These research sites will serve as platforms for applied research, farmer training, outreach and technology transfer. The project will collaborate with an ongoing buffalo genetic improvement project funded by USAID. The forage crops that perform well will be selected for scaling up and integration into local farming systems. The research outcomes will help local farmers better adapt to the impacts of climate change by increasing buffalo milk and meat productivity through improved feeding and reproduction strategies.*



**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.**

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