Livestock, Climate Change, and Genetic of Adaptation in Nepalese Context

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Climate change and livestock

Climate change refers to greenhouse gases (GHG) in the earth's atmosphere that prevent heat from escaping the atmosphere. Emissions of human caused greenhouse gases like Carbon Dioxide (CO2), Methane (CH), and Nitrous Oxide (N,O) that account for much of the problem. Increased concentrations of heat-trapping greenhouse gases are causing temperatures to increase. Earth's temperature has increased an average 1.2-1.4°F since 1900, and it is estimated that if greenhouse gases continue to increase, Earth's temperature will raise 2.5 to 10.4°F by the end of this century. Almost 80 percent of the Nepalese population depend on agriculture for their subsistence, accounting for 38 percent of the GDP (Feed the Future, 2010) and the share of livestock sector is 32 percent of AGDP (CBS, 2007). Livestock is an integral part of the Nepalese agricultural system, although a vast majority of farmers practice mixed farming. Nepalese farmers depend on livestock for food, animal products, and household income, and are also known to depend on livestock to support and pay for education of their children. Nepal is considered highly vulnerable to climate change impacts. Plain area is vulnerable to floods, temperature rise, droughts, and fire, while the mid-hills are vulnerable to landslides and water shortages. Similarly, the Himalayas are vulnerable to snow melts, glacier retreats, and glacial lake outbursts. Some of the noticeable impact of climate change in Nepal include change in weather patterns, extreme rain events and associated floods and landslides, crop failures, habitat shift, acute water shortages, incidence of new diseases and parasites, river-cuttings and land losses, and hydrological changes. According to Steinfeld et al (2006), livestock-agriculture accounts for 35-40 percent of methane and nearly 70 percent of nitrous oxide worldwide, gases that arise mainly from the digestive processes of animals, and animals' wastes. Livestock and agriculture sector emit significant amounts of CO, through the production of fertilizers and feeds and the energy required to heat and cool industrial operations and run farm machineries. Methane is emitted from animals' digestion, and nitrous oxide is emitted from the artificial fertiliser used to grow feed crops for animals. The level of GHG will continue to rise as animal numbers grow to meet the increasing demands for meat and milk from developing countries such as China and India. The emission of nitrous oxide from manure and the production of artificial fertilizers are projected to increase by 35-60 percent by 2030 (Norse, 2003). Deforestation for livestock production accounts for 89.5 percent of all CO, livestock related emissions and 34 percent of CO2, CH, and N,O emissions (Steinfeld et al., 2006).

Research on genetics of adaptation in Nepal

Many studies have indicated that developing countries including Nepal are more vulnerable to the effects of climate change due to their limited institutional and financial capacity to adapt, high poverty level, and reliance on natural resources (Thornton et al., 2006). Research on the impacts of climate change in agriculture has largely been focused on changes in precipitation or temperature on crop productivity (see, for example, Dinar et al., 1998). Some studies have been done in the areas of economic impact of climate change on animal husbandry (see, for example, Seo and Mendelsohn, 2008). Most of the careful economic analysis of animal husbandry used mathematical programming to examine the US livestock sector (Adams et al., 1999). In the literature related to climate change and livestock, far less research has examined the impact of climate change on animal characteristics related to adaptation to harsh environments based on farmers' perspective. The results of those studies are mainly in the context of Africa and not expected to generalize to Nepalese context because of variation in the outside

environment and management system. However, in Nepal no such kind of study has yet been done.

Nepal is considered to be highly sensitive to the potential consequences of climate change because most of the people rely on rain-fed agriculture, which is vulnerable to heat stress and variable precipitation in terms of form, timings and intensity. The risk of glacial lake outburst floods (GLOFS) is a particular threat in Nepal with all the catastrophes that result from sudden, intense flooding. With increased intensity of summer monsoon rain events, the risk of flash flooding, erosion, and landslides will also be increased. This is of particular concern to people living in mountainous areas and to downstream population. With warmer winter and less precipitation, particularly at higher altitudes, become sensitive to winter crops and livestock management. Precipitation records from 1948-1994 in Nepal have demonstrated significant variability on annual and decadal time scales, and distinct long-term trends have not been identified and is postulated that the lack of a long-term increasing trend in precipitation could be due to in part to atmospheric sulphate coming from Asia due to the burning of fossils fuels (Shrestha et al., 2000). According to Ichiyanagi et al. (2007), there is also support for fluctuation in precipitation in Nepal due to the relationship with El nino and Southern Oscillation Index, as also occur in India. In the face of climate challenges, impact on animal husbandry and adaptation of different livestock species in Nepal becomes highly imperative. There are both direct and indirect effects of climate change on livestock. The harsh climate factors like air temperature, humidity, and wind speed directly influence animals performances such as growth, milk production, and reproduction. However, the management of animals in marginal areas plays an essential role in their adaptation and fitness in such environment. Sansthan and Rollefson (2005) have found that indigenous livestock management practices via social and rational breeding mechanism have contributed to breed adaptation to harsh environments in India. Similarly, Lanari et al. (2005) has shown that directional selection practices by herdsmen is the main factor in adaptation of Criollo goat population in their native environments in Argentina.

A clear understanding of local practices and processes that have played a significant role in animal adaptation to harsh environments is essential for designing adaptation intervention to climate oscillation in the future. The information in this area is scarce and there is an urgent need for more research about the genetic and functional mechanisms of adaptive traits (Hoffmann and Scheref, 2006). However, there is no detailed study on livestock genetics of adaptation to climate change in Nepal. Therefore, a study to develop a framework to collect information on farmers perspective on animal adaptation to environmental extremes as well as recording animal morphological, qualitative, and functional traits that are related to animal adaptation in the mountain areas of Nepal seems imperative.

Adaptation and Mitigation

Livestock genetically suited to local environments and raised in low-density systems with good management practices can play important roles in proper land management through consuming biomass unsuitable for human consumption. Farmers can practice sustainable land management such as agroforestry, silvo-pastures, and growing cover crops. Agriculture and pasture lands can act as carbon sinks, pulling and storing carbon from the atmosphere. The adoption of sustainable land management practices can prevent carbon from being lost. In contrast, poorly managed, high-density and intensive practices are typically inhumane and destructive to the environment. Ensuring adequate animal welfare can also help to reduce GHG emissions and ultimately the future sustainability of meat, egg, and milk production.

Farmers are aware of changes occurring in livestock and agriculture production systems. Increasing incidences of new diseases, skin diseases, drug resistance, new parasites, and poor feed supply are some of the issues farmers have already perceived as problems. These problems are mostly caused by global climate change. There are

widespread reports of disappearance of ponds constructed for collecting surface runoff and rain water for buffalo wallowing, drying of natural springs, and degradation of riparian areas for grazing livestock in Nepal due to climate change. As short term mitigation measures, farmers have tried to adapt to these changes by lowering their herd sizes, switching to smaller size animals, rain water harvesting, and moving out from the Their herd sizes, switching to smaller locality. However, there are still challenges in finding long ter adaptation and mitigation measures to climate change so tha livestock production could be increased and the production system could be strengthened.

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