

Hindu Kush Himalayan Yak Network: Building partnerships for conservation and development of yak in the Third Pole

Seventh international conference on
sustainable animal agriculture for
developing countries

9 November 2019
Pokhara, Nepal



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Abbreviations and acronyms

FAO	Food and Agriculture Organization	IPCC	Intergovernmental Panel on Climate Change
FMD	Foot and mouth disease	IYC	International Yak Congress
HKH	Hindu Kush Himalaya	KL	Kangchenjunga Landscape
HS	Haemorrhagic septicaemia	KLCDI	Kangchenjunga Landscape Conservation and Development Initiative
IBR	Infectious Bovine Rhinotracheitis	NTFP	Non-timber forest product
ICAR-NRC	Indian Council of Agricultural Research- National Research Centre	SAADC	Sustainable animal agriculture for developing countries
ICIMOD	International Centre for Integrated Mountain Development	TTP	Tibet Treasure of Plateau Yak Dairy Industry Co. Ltd

Executive summary

Yaks play a critical role in ecosystem management, food, and energy security, as well as in the livelihood enhancement of the highlanders in the Hindu Kush Himalaya (HKH). They are also integral to the culture, tradition, and social life of the high-mountain communities. However, yak herding is impacted by climate change, closure of international borders, and increasing disinterest among the youth in the yak herding system. This has heightened the social vulnerability of the yak-dependent communities, especially the women and children. Given this backdrop, ICIMOD organized a parallel session during the 2019 “International conference on SAADC” with the following objectives: to discuss the challenges and opportunities in sustainable yak development in the HKH; share experiences on innovations, technologies, and cooperation in yak rearing in the region; and to discuss the way forward for establishing an HKH-wide yak network and reviewing its potential.

The session was attended by more than 70 delegates comprising of yak herders, entrepreneurs, academicians, researchers, and policymakers from the HKH countries and elsewhere. A total of 13 technical papers were presented at the session. The presentations covered updates on yak production by the HKH countries, and other important subjects such as: policies; production (fodder, health, and

breeding); husbandry and management; value chains; business models; institutions; sociocultural services; and investments and markets. Furthermore, a moderated panel session provided a platform for interaction among the yak herding communities, the scientists, entrepreneurs, and the policymakers.

The meeting recognized that the current policies in the HKH are inadequate to address the issues around yak herding and that there is a need for developing a mechanism for multi-stakeholder participation in support of yak production. It found out that supporting and connecting local yak networks to national, regional (HKH), and global levels could provide a voice to the herders and a pathway for sustained efforts towards investments. Furthermore, it established that strengthening transboundary cooperation can encourage technological innovation and promote South-South cooperation for technology transfer in yak production. It was also recognized that partnerships with the private sector to enter into new business models such as social entrepreneurship that engage youth and women are critical to promoting the yak value chain. Also, events such as yak festivals need to be supported in order to value the yak tradition and culture through linkages to responsible tourism.

Background

Yaks are an iconic species of the HKH which are exceptionally adapted to the harsh climatic conditions of the region. They are found at altitudes between 2000 and 5000 masl in Afghanistan, Bhutan, China, India, Myanmar, Nepal, and Pakistan (Wu et al. 2016) that encompasses the transboundary landscapes of HKH. These transboundary landscapes are subsets of larger trans-Himalayan transects, where ICIMOD and its partners gather scientific information and strengthen interventions to promote conservation and the management of landscapes with ecological and sociocultural significance across nations (Chettri et al. 2009). ICIMOD's transboundary landscape visualizes conservation and the sustainable use of natural resources at the scale of larger landscapes defined by ecosystems. The landscape programme aims to enhance socioecological resilience to environmental changes. In the HKH, four transboundary landscapes initiatives are in operation: Hindu Kush Karakoram Pamir; Kailash; Kangchenjunga; and the Far-East Himalaya. These landscapes are rich in terms of biodiversity, culture, and traditional knowledge.

One of the prominent traditional practices in the region is a transhumance system that supports the culture and livelihoods of the mountain communities. Yak is one of the key species of this transhumance system that plays a critical role in supporting the livelihoods of people and in managing the ecosystem. Yaks are the flagship species in all landscape initiatives for their key role in ecosystem management and food security of the highlanders. They are the source of milk, meat, fibre, hide, and fuel, and are also used for transporting goods in the hilly terrains (Sarkar et al. 2006). Yaks are also integral to the culture, tradition, and social life of the high-mountain communities (ICIMOD 2018).

The communities that rear yak lead a semi-nomadic life – moving with the animals to higher altitudes in summer and to the lower altitudes during winter across the HKH region. For instance, in the Kangchenjunga Landscape covering an area of 25,081 square kilometres spreading across parts of eastern Nepal, India's Sikkim, and West Bengal, and the western and south-western parts of Bhutan

(ICIMOD 2018), the culture and economy of yak rearing has connected people for centuries. The movement of herders between the highlands of these three countries has been an age-old practice that has contributed to the socio-economic prosperity of the herding communities.

However, a drastic decline in the yak population of the region and its consequent impacts on local livelihoods and cultures have become a cause for concern (Wu et al., 2016). The major issues here are the following: unplanned development practices; closure of international borders leading to restricted germplasm exchange and breed deterioration; controlled grazing; the limited will of the younger generation in the yak herding system; and climate change. Moreover, the increase in temperature in the high-altitude regions have also had impacts in terms of pasture, fodder availability, tolerance to heat, and reproduction (Haynes et al. 2014). For instance, more than 300 yaks died in north Sikkim due to heavy snow in early 2019 (Economic Times, 12 May 2019).

As a result of such factors, the population of yak and its productivity are on the decline, and the local cultures of yaks herding are vanishing. This has exaggerated the social vulnerability of the yak-dependent communities, especially the women and children. There is now a growing challenge to maintain the number of yaks, improve the condition of the pastures, increase the value chain efficiency of yak products such as wool and hard cheese, and raise the living standards of the herders in the region (ICIMOD 2018). More importantly, the yak communities who had once shared similar lifestyles and cultures across the borders hardly get a chance to talk about their common issues and challenges. Besides, these challenges are not well voiced at national and international forums; so, they need specific consideration in policies across the region (FAO, 2018). In this context, the establishment of a regional “HKH Yak Network” is under discussion.

The need for such a yak network has been emphasized at several local and international fora. The 6th International Yak Congress (IYC) held in 2018 in Xining, China, was one of them where the Food and Agriculture Organization (FAO) and the representatives of the local herding communities from different countries like Bhutan, China, India,

and Nepal reiterated the need for such a network in order to tackle all the relevant issues and advocate solutions in policy, forum, and practices across scales. The FAO, in particular, has been emphasizing on filling the gaps in global policy discussions on livelihood development and sustainable yak husbandry in the region (ICIMOD 2018).

The Transboundary Landscapes regional programme of ICIMOD, which envisages biodiversity conservation and sustainable use across borders, provides an ideal platform to establish this HKH Yak Network. The network is expected to provide a regional voice to the challenges and opportunities of yak conservation and development at national and international fora. Some potential activities could be: holding regional yak festivals; systematic exchange of good quality breeding bulls; and exchange of knowledge and experience on yak value chains and relevant technologies across the HKH. This will help conserve the traditional practice of yak rearing in the HKH and contribute to conservation of ecosystems and development of the highlanders, especially women and children; it will also help them to adapt well to the issues arising out of climate change.

Given this backdrop, ICIMOD organized a parallel session during the “7th international conference on sustainable animal agriculture for developing countries” (SAADC 2019) in order to discuss the challenges and opportunities in yak conservation and development.

SECTION 2

Objectives

The parallel session's objectives were:

- Discuss the challenges and opportunities of sustainable yak development in the HKH;
- Share experiences on innovations, technology, and cooperation in yak rearing in the region;
- Develop a way forward for establishing an HKH-wide yak network; and
- Build partnerships for conservation and development of yak and its surrounding culture and environment, as well as promote livelihood in the HKH/Third Pole.

SECTION 3

Sessions

Session 1: Opening session

David Molden, Director General of ICIMOD, welcomed all the participants and distinguished guests to ICIMOD's parallel session. He talked about the importance of the biodiversity and ecosystem services of the HKH while focusing on the significance of yak for the region and its people. He also remarked that yak and pastoral livelihoods are facing several challenges such as: climate change; weather anomalies; loss of genetic diversity; inaccessibility of pastures; and the exclusion of yak from mainstream development. He stated that ICIMOD has already been working on such issues as the main objective of the organization is to serve the mountains and its people. He also said that ICIMOD's work has much relevance now than ever before as changes are happening faster in the mountains than in any other regions on the earth.

KEY MESSAGES

- Yak herding plays a crucial role in mountain livelihood and ecosystem management. Development of yak farming should be mainstreamed in policy, encouraging more stakeholder participation. For this, such forums should be organized more often where policymakers, practitioners, and researchers from different mountain nations can exchange knowledge, experience, and ideas.
- Regional cooperation in terms of technology transfer between nations can help tackle significant issues. Each nation can learn from the other's experience and join hands for conservation of yak. ICIMOD continues to provide such platforms.
- Yak herding communities should be invited to such discussions so that their voices can be heard. A yak herders' network is a viable option for considering and tackling the issues they are facing.
- The private sector can play an important role in supporting the livelihoods of the yak farming communities.

Ruijun Long, ICIMOD, made a presentation on “Yaks in the Hindu Kush Himalaya”. He stated that yak is a key species that maintains rangeland/mountain ecosystem functions and processes. As for the challenges that yak herding has to deal with, he listed them out as: natural, economic, and social. And the challenges that need special attention, he said, are: climate change (ecology and environment); yak and rangeland degradation; lack of fodder in winter; pressure of socio-economic development; less agricultural product processing and added value chains; underdeveloped enterprises and marketing; youth outmigration, lack of communication among the herding communities and other stakeholders; and lack of electric and solar power.

KEY MESSAGES

- The HKH is a global asset by way of food, energy, water, and carbon, as well as its cultural and biological diversity. Yak is well adapted to the high altitudes because of its unique genetic and physiologic nature. It is also a nitrogen-saving and low-carbon animal.
- Policy interventions can address the following areas: nationalization of grasslands; ban on traditional burning of grasslands; expanding protected areas and community forests; restricting transboundary movements; non-timber forest products (NTFPs); and tourism.
- Yak herding has climatic and geographical advantages. National and international cooperation can be fostered in the spheres of technology transfer, investment, capacity building, transportation, and transboundary and transregional marketing.
- Eco-cultural and food tourism can be promoted through the very nature of the landscape that consists of glaciers, lakes, forests, pastures, rivers, and mountains. Tourism prospects can be boosted by showcasing cultural heritage, religious/historical sites, museums, and the provision of homestays.

Lekha Bahadur Thapa Magar, Minister, Ministry of Land Management, Agriculture and Cooperative, Gandaki Province, Nepal, remarked that the Gandaki Province has a significant population of yaks in its higher altitudes, and has been giving priority to yak-based programmes. The minister stated that heavy snowfall in the winter in high-altitude pastures is one of the major problems in

yak conservation. He mentioned that approximately 3,500 yaks got killed due to snowfall during the past year. He acknowledged that the harsh environment of the yak habitat limits research and development, and called for promoting technology and knowledge transfer among the neighbouring yak-rearing countries. In particular, he stressed that innovative ideas are required for yak value chain development and linking it to high-end markets in order to attract the younger generation of herders and sustain the tradition of yak farming.

KEY MESSAGES

- The Gandaki Province has prioritized yak development for the conservation and development of the highland ecosystem and livelihoods.
- Yak conservation and development require efficient technology transfer which is suitable for the challenging environment of the Himalaya.
- Knowledge on yak value chains, branding, and market linkages are key to increasing profitability from yak enterprise and to keep the younger generation of herders motivated

Session 2: Status of yaks in the HKH, yak culture, and yak networks

Towchu Rabgay, Bhutan, elaborated on “Yak Development in Bhutan – Challenges, Policy Intervention and Opportunities”. He stated that the Royal Government of Bhutan is aware of the challenges faced by the yak herding communities. The challenges, he said, are being addressed through policy reforms in favour of yak farming. These reforms, he explained, aim to create positive changes in institutional linkages, transboundary cooperation, accessibility to goods and services, delivery of health services, yak breed development, and the health of the rangeland. As for strengthening of institutions, he cited instituting a highland research centre, an integrated yak services centre, and a yak herders’ association. Roads and communication networks are being improved for easy accessibility to resources and facilities, he added. As regards the major challenges, he listed the following: decline in yak breed; transboundary yak health risk; the addressing of human–wildlife conflict; fodder shortage in the winter; and lack of product diversification, branding, and marketing. He also said that policy reforms favour transboundary

cooperation as a means to wider sharing of resources and knowledge in the Himalayan region.

KEY MESSAGES

- Yak production is one of the important farming systems in Bhutan, with 41,000 yaks in 11 districts and 25 sub-districts. The total households rearing yaks are 1,038.
- The decline in the number of yak herders population, labour shortages, rangeland degradation, high calf mortality, loss of yak genetic resources, limited technical expertise, and weak institutional linkages are the challenges that impede yak farming in Bhutan.
- Bhutan continues to make efforts at revamping yak farming through policy support by institutionalizing a dedicated Highland Development Programme under the Department of Livestock, Ministry of Agriculture and Forest.
- Bhutan considers regional cooperation (with neighbouring countries like Nepal and India, and South-South cooperation with China and Mongolia) to be extremely important for exchange of knowledge and technologies in yak farming

Yan Ping, China, spoke about “Yak Industry in China: Development Trends and Challenges”. Ping elaborated on a comprehensive yak breeding system that included a wild yak breeding station, nuclear herds (also called cross-breeding populations among the F3 and F4 generations), and the multiple herds maintained at the Datong farm to provide breeding animals to other yak production areas. He noted that selection of hornless yaks (similar to the pooled Angus cattle breed) is an important research agenda for easy management and higher meat performance. Such a comprehensive breeding system, he said, ensures diversity in yak resources and fulfils different meat needs of the market. In combination with conventional breeding, he informed, a study is under way on the genetic mechanism of hornless traits at the molecular level by means of transcriptome, re-sequencing, and methylation. Combined with histology, developmental biology, and other disciplines, he said the genetic mechanism of yak horn characters are being investigated for enhanced breeding performance.

KEY MESSAGES

- About 95 per cent of yaks in the Himalayan region are found in China, with 17 local and two cultivated breeds.
- Wild yak is one of the precious animal resources in the Qinghai Tibet Plateau and comes under the protection of the state. At present, about 30,000 wild yaks in China are valuable and rare genetic resources.
- The Datong yak is bigger and stronger than the domestic yak. Therefore, it is popular among the plateau dwellers. The frozen semen of the Datong yak is being distributed for breeding, which aims to boost the economy of the ethnic minorities in the region.

Karma Bhutia, India, presented an overview of “Yak Farming in the Indian Himalayas: Current Trends and Future Prospects”. He informed that a total of 58,000 yaks are found across Arunachal Pradesh, Sikkim, Uttarakhand, Ladakh, and Jammu and Kashmir. His presentation focused on the following: the ecological importance of yak; traditional yak products; challenges in yak herding; the adaptive measures that are being practiced; and future prospects in yak farming. He said that yak herders continue to cross yaks with native cattle to produce hybrids for higher milk yield. The yak industry, he said, faces several challenges, including rural–urban migration, weak market linkages, lack of economic incentives, inbreeding, insufficient feed and fodder in the winter, disease outbreaks, and depredation of wildlife.

KEY MESSAGES

- Yaks are an important source of livelihood for the communities living in the yak-rearing pockets of India. Schemes are being developed to mobilize the herders to form cooperative societies, develop skills in value chains, introduce artificial insemination, and strengthen yak health services.
- Investments in yak research are aimed at diversification of yak products, such as cheese, wool, and leather goods for high-end markets.
- Emphasis is being given to address feed shortage in winter by promoting feed blocks, highland pasture, and silvopasture development.

- For the sustainable development of yak husbandry, the following are required: a dedicated institution such as a Highland Livestock Development; the distribution of feed block; organizing a highlander annual yak festival; promoting commercial markets for yak products; and adopting modern techniques like IVF.

Shafiq Ahmad, Pakistan, made a presentation on “Trends and Sustainability of Yak Farming in Pakistan”. He mentioned that in Pakistan, yaks are reared in Gilgit-Baltistan and Chitral that cover an area of 84,000 square kilometres. It is the most mountainous region in the world, he said, with more than half the area lying above 4,500 masl, and temperatures ranging from +45°C in the summer to -25°C in the winter. The annual rate of rainfall, he indicated, rarely exceeds 200 mm in areas below 3,000 masl, while the snowfall level ranges from 3 to 20 ft. The current yak population stands at 34,140, he informed, and said that the key interventions that are required in this area include rangeland assessment to estimate the seasonal carrying capacities of different rangeland types and determining the proper stocking rate. There is also a need, he said, for improving market linkages, particularly facilitating cross-border trade among Afghanistan, Pakistan, and Tajikistan. He suggested that a community-based self-sustaining system like fodder banks could help cope with emergencies during extreme climatic events. He also recommended that improvements in productivity of pastureland, a livestock insurance mechanism, and promotion of ecotourism could help sustain yak production.

KEY MESSAGES

- Yaks in Pakistan are found in the northern mountain ranges from the Hindu Kush through the Karakoram into the west Himalaya, i.e. from Chitral to Gilgit-Baltistan.
- The key challenges in yak farming in Pakistan include Insufficient feed and fodder, decline in yak population, climate change, lack of modern yak breeding technology, wildlife predation, natural disasters, and restricted access to markets.
- The government is focusing on establishing yak farms, enterprises, and cooperatives, and exploring markets for yak meat and fibre through brand promotion and access to international markets.

Lily Shrestha and Srijana Rijal, ICIMOD, made a presentation on “Ethnic and Cultural Diversity amongst Yak Herding Communities in the Asian Highlands”. They said that yak herding is closely tied with the social and cultural aspects of the ethnic communities living in the mountains in Asia, including the HKH. They informed that yak herding ethnic communities are found in 10 countries and their 11 mountain ranges across the Asian highlands. The challenges that are faced by the yak herding communities, the presenters said, involved climate change, rangeland degradation, outmigration, and border issues. In order to strengthen the diverse cultures and yak herding tradition, they said that national policies are needed to encourage integration of traditional knowledge in yak herding with rangeland management. Scientific research, they emphasized, is necessary to find solutions to these issues and challenges. Talking about opportunities, they mentioned the production of niche products, adding value to the products, promoting organic yak goods, and linking yak activities with ecotourism.

KEY MESSAGES

- There are 32 major ethnic groups involved in yak husbandry in the Asian highlands, and some of these communities have transboundary ethnicity.
- The ethnic yak herders and their diversity are reservoirs of traditional knowledge in managing livelihoods under the harsh Himalayan mountain ecosystems
- Challenges of climate change, along with other drivers of social and economic development, are putting pressure on the sustainability of the rich yak tradition and culture across the Himalaya.
- There is an urgent need to reorient government policies in favour of yak and highland ecosystem conservation and development.
- Transboundary cooperation among the yak herding communities in the form of activities such as yak festivals and linkages with the growing ecotourism sector can contribute to the welfare of yak cultures.

Tashi Dorji, ICIMOD, spoke on the “Yak Network in the Hindu Kush Himalaya: A Case from the Kangchenjunga Landscape”. Within the Kangchenjunga Landscape of Sikkim, he informed that there are 6,220 yaks reared by the Bhutias, Tibetans, and Dokpas. In Bhutan, he said the districts of Haa and Paro have 8,000 yaks, reared mainly by the Bjops (semi-nomads). In the case of Nepal, he said in Taplejung, Ilam, and Panchthar, the overall population of yaks is 4,300, which are reared by the Limbus, Rais, Bhotes, Sunuwars, Sherpas, and Lepchas. These yak communities in the landscape, he said, face similar challenges which can be addressed through collective action. However, he pointed out that there is no local institution among the yak communities or platforms for voicing herders’ issues. In this regard, he said that ICIMOD’s regional programme on Transboundary Landscapes provides an ideal platform to establish an HKH-wide yak network. Such a network, he said can provide a regional voice to the challenges and opportunities in yak conservation and development in the HKH at national and international forums. Then he listed out some of the activities that can be carried out by such a network: organizing regional yak festivals; systematic exchange of good quality breeding bulls; and exchange of knowledge and experience on yak value chains and relevant technologies across the HKH. He said that annual yak festivals can also serve as a tribute to the age-old yak herding tradition in the mountains.

KEY MESSAGES

- Yak herding in the Kangchenjunga Landscape faces several challenges, including those arising from climate change, inconsistent rangeland policies, expanding protected areas and community forests, restriction on local and transboundary movements, and policies around NTFPs such as the Chinese caterpillar.
- Mobilizing yak networks is important for voicing the needs of the herders and raising their issues at the policy forums.
- The Kangchenjunga Landscape yak network needs to be extended to form subnational and national yak networks, which can then lead to the formation of a HKH network as well as a global yak network.
- Yak festivals can serve as platforms for multi-stakeholder dialogue and forge people-to-people contact leading to transboundary cooperation

Session 3: Yak value chain development

Guo Peng, China, made a presentation on the “World’s Hottest-Selling Yak Milk Brand from the Qinghai-Tibetan Plateau, China”. He informed that the company – Tibet Treasure of Plateau Yak Dairy Industry Co. Ltd (TTP) – that produces this milk brand was founded in 2000. It, he said, is the world’s biggest and most modern producer of yak milk and milk products. He explained that the TTP has four yak milk processing plants around the Qinghai-Tibet Plateau where raw yak milk is processed into pure yak milk, yak yoghurt, yak milk powder, and yak milk probiotic slice. The company, he stated, promotes global yak milk production and processing standards for the benefit of a prosperous and well-regulated yak milk product industry. He also mentioned that the company sponsors special research projects on yak dairy product diversification in order to cater to the demands of high-end dairy markets.

KEY MESSAGES

- The TTP has developed four yogurt-making strains that are essential for processing high-value probiotic powder and pills for mass production.
- The company implements strict raw milk purchasing standards and regularized collection procedures to ensure high-quality end products
- Scientific tests and inspection procedures are implemented across the yak dairy value chains, covering each critical control point from source of supply to manufacturing, packaging, and delivery.
- The company strives to develop a Tibetan yak dairy brand that is recognized at national and global levels which can contribute to improved livelihoods of the herdsman.

Liang Qi, China, presented an overview of the “Quality Control Technology for Development of the Yak Meat Industry in the Tibetan Plateau of China”. He informed that the total demand for consumption of beef in China was 7,210 kilotons in 2015 and that this demand is expected to be 7,960 kilotons in 2020. In 2018, he said, the yak meat yield was 150 kilotons in Qinghai province alone, which is more than one-third of the total production in China.

KEY MESSAGES

- Yak meat has excellent nutritional properties because of its high protein, low fat, and high mineral content compared to beef from yellow cattle.
- The consumer's attitude towards meat products is changing with the change in the demographic structure of China. The meat industry needs to reorient its products to cater to this changing population structure.
- The quality of yak meat is largely determined by the age when the animal is slaughtered – the best meat is of yak that are three to four years old. Meat from older yaks requires the application of the post-mortem tenderization technology to improve its quality.

Alen Degen, Ben-Gurion University, Israel, made a presentation on “Products of Yak in Nepal and Tibet” based on a case study from Mustang. Yak herders in the study sites, he said, were mostly from the Thakali ethnic group who resides between Jomsom and Lete in Lower Mustang. Here, he said, absentee herd ownership also exists wherein the shepherds (usually non-Thakalis) who herd the yaks do not own them. Talking of migration, he said the yaks migrate between winter pastures at 3,000–4,000 masl and summer pastures at 4,000–5,000 masl. The total population of yaks in Lower Mustang is 1,522, he informed. A typical herd, he said, consists of 51 animals: 4 adult males, 27 adult females, 9 sub-adult males, 9 sub-adult females, 8 male calves, and 6 female calves. Tukuche, he said, has the highest number of average yak holding, with some owners having 70 yaks, while Naurikot has the lowest, with 40 yaks per owner on an average. In general, he said the number of yaks has been decreasing due to “government restrictions on livestock numbers and movement in national parks”. Also, he said the grasslands have become less productive. Further, he pointed to the closed Tibetan border which has had a deleterious impact upon the number of yaks in Nepal. Degen also described the significance of yak farming in the Tibetan plateau.

KEY MESSAGES

- The mortality rate among calves is as high as 50 per cent. Therefore, the number of live calves every year is 25 per cent of the number of mature yaks, or 6 to 7 live calves yearly for 27 adult females.

- The traditional blood-drinking ceremony (khoon khaney parwa in Nepali; kateo kathunbo in Thakali) is conducted twice a year: during Baisakh (April–May) and Shrawan (July–August). The Thakalis believe that the blood in Baisakh is mainly drunk to cure gastritis and malaria, whereas the blood in Shrawan is drunk to make the people strong and healthy.
- The Dairy Development Corporation of Nepal started cheese production from yak milk in 1964. It operates nine factories in five districts. The private sector also produces cheese. Yak cheese is 50 per cent more profitable than butter/ghee and chhurpi.
- The main livestock raised in the Qinghai-Tibetan Plateau are yaks and Tibetan sheep. Animal products from the rangeland areas fulfil more than 50 per cent of the people's food and agricultural needs.
- The Tibetan nomads place so much value on yak that the Tibetan word for yak, nor, is also translated as wealth. In this harsh environment, it is the yak that sustains human life, and has been the single most important factor in the advent of civilization in the Tibetan Plateau.

Minjur, Tibet, China, spoke on “A Business Model for Promoting Nomadic Culture and Economic Sustainably in Tibet, China”. He said that while most businesses are driven by profit and materialism, in order to build a good society, a social entrepreneurship model should be in place, one that bears moral obligation in terms of both means and ends. Unlike conventional business models, he said that the social business model is guided by a sense of social responsibility that solves a certain kind of social problem and promotes people's wellbeing. He stated that the yak leather business he runs is a social entrepreneurship venture where the motive is not only profit but also solving the issues plaguing his community. This business, he said, solves the problem of yak leather waste and provides the local herders the opportunity to sell their yak skin for income.

KEY MESSAGES

- Enterprise in yak products is a viable option for promoting nomadic culture and economy sustainability.

- Market opportunities, product diversification, and value addition to yak products can help attract the younger generation towards yak husbandry.
- The social entrepreneurship model of running a business as a process of creating values for both individual and society would be suitable for yak systems.
- Yak systems provide opportunity for businesses to brand their products by leveraging the yak's rich cultural value and the green and pristine environment of the Tibetan Plateau.
- The F1 hybrids have better milk yield (25 per cent) and produce more meat (22 per cent). They also have better draught ability, better conception rate, and are suitable to the intermediate zone between cattle and yak habitats.
- Systematic selection of hill cattle together with pure yaks could enhance the productivity of the hybrid yak populations.

Neena Amatya Gorkhali, Nepal, presented an overview on the “Pattern and Use of Yak–Cattle Hybridization in Hindu-Kush Himalayas”. She said that from time immemorial, yak has been intimately associated with the culture, religion, and social life of the herders and their families. Despite many constraints and lack of opportunities, she said that the herders continue to rear yaks, which is essential for the sustenance of the livelihoods of the highlanders. She informed that the HKH region continues to have a high level of genetic diversity, including the habitat of wild yaks. She stated that the hybridization of yak with cattle is a common practice in China, Bhutan, Nepal, India, Pakistan, Kyrgyzstan, Mongolia, and Russia. Yak–cattle hybridization, she explained, produces fertile female and sterile male hybrids. She pointed out that hybrid yak has greater milk and meat production capabilities, but the F1 male hybrid cannot produce sperm which prevents heterosis from being inherited. She also touched upon the issue of climate change which she said has several implications in terms of: livestock feed resource availability; adaptation; diseases; parasitic patterns; and reproduction. Then she listed out the strategies to adapt to climate change: migrate to a higher altitude; change the timing of migration; diversify herds; change the pasture utilization practice; expand the duration of migration; rejuvenate degraded high-altitude pastures; look for feed supplementation; modify healthcare practices; and seek alternative sources of income

KEY MESSAGES

- Hybridization is an important natural process which has helped facilitate adaptation in connection with both domestication and environmental changes. Hybridization increases production (meat and milk).

Prithviraj Chakravarty, from ICAR-National Research Centre on Yak, India, elaborated on the “Advances in Yak Breeding, Genetics, and Biotechnology in India”. He explained about the status of yak husbandry in the north-east Indian Himalaya, highlighted the constraints and issues in yak production, and presented the aim of the Indian Council of Agricultural Research-National Research Centre (ICAR-NRC, ON YAK) to generate technologies for yak development. The constraints in yak production in north-east India, he mentioned, are inadequate nutrition, harsh physical and climatic conditions, reduction in grazing areas, inbreeding, climate change, and lack of economic incentives to yak herders due to poor market linkages. He said the ICAR-NRC has been making efforts to resolve some of these prevailing issues through: genetic characterization of yak breeds; nutritional intervention for feed storage and pasture development; conservation of superior yak germplasm; value addition to yak products; and the alternative use of yak for ecotourism and the capacity building of farmers.

KEY MESSAGES

- The ICAR-NRC (ON YAK) generates cost-effective technologies for the socio-economic upliftment of the highlanders involved in yak husbandry.
- Introduction of new technologies and regular trainings to veterinarians and veterinary assistants on the latest yak genetics and breeding technology are crucial for yak conservation and development.
- For sustainable yak production, increased investments are required to promote nucleus-breeding herds and to improve reproductive and productive traits through proper selection of superior animals.
- Strategies for long-term conservation and management of yaks should integrate the impact of climate change, and economic and social dimensions.

Vijay Raika, Bhutan, presented an overview on “Transboundary Yak Health and Disease Management in the Context of Climate Change”. He stated that yak herding is facing some common transboundary challenges such as remoteness of yak herds, minimal veterinary services, and less practice of curative treatments. The other challenges he highlighted were: decrease in grazing land; closure of political borders and protected areas; inbreeding due to non-availability of germ plasm; and decline in yak populations and the number of yak herders. He pointed out that constant warming in the mountains is having a negative impact on the yak populations wherein they suffer from heat stress and have reduced feed intake. Besides, he stated that the availability of fodder in the alpine pasturelands has been affected through reduction in productivity.

KEY MESSAGES

- Climate warming has increased incidences of pests and diseases. Ailments such as foot-and-mouth disease, brucellosis, anthrax, IBR (infectious bovine rhinotracheitis), HS (haemorrhagic septicaemia), and gid have been reported from various yak-rearing countries. In 2018, about 238 cases of gid incidences were reported from Thimphu, Bumthang, and Haa districts. The Gasa district has reported a yak mortality rate of 24.28 per cent.
- When yaks drink water from stagnant ponds, they are poisoned. An antidote comprising activated charcoal and magnesium oxide, and broad-spectrum antibiotics have been reported to be beneficial.
- Pyrrolizidine alkaloid poisoning is a photosensitization caused by the hepatotoxin alkaloid contained in the plants. A large number of deaths among yak in eastern Bhutan have been due to pyrrolizidine alkaloid poisoning.
- Yak hypodermosis (warble fly infestation) is a significant problem. Young yaks are susceptible to it. About 85 out of 88 (96.6 per cent) yak herds in Laya were affected with warbles.
- The management of diseases requires transboundary cooperation and collaborative research in terms of quarantining and developing a contingency plan for infectious diseases.

Session 4: Panel discussions

Nakul Chettri, ICIMOD, moderated the panel session that deliberated on the key issues limiting sustainable yak farming in the HKH, and to propose a practical way forward, particularly focusing on regional cooperation. The selection of the panel members were based on the criteria of giving due representation to different stakeholders: communities, business, science, policy, etc.

KEY MESSAGES

- Yak herding across the HKH is facing a number of challenges such as reduction in the population of yak and practices of yak herding; reduction in genetic diversity and difficulty in maintaining genetic resources; human–wildlife conflict and livestock depredation; climatic changes; lack of feed; border issues; and negative impacts from tourism.
- The yak husbandry sector is getting very less priority from the state and national governments. National policies should prioritize the conservation of yak and the development of yak farming for sustainable mountain livelihoods.
- Molecular and biotechnological interventions by way of artificial insemination and developing climate-resilient yak breeds are a promising way to maintain genetic resources in yak.
- Mechanisms are required for convergence of expertise of each yak herding country for cross-learning and complementing each other at the regional levels.
- Youth engagement in yak farming requires investments towards market development, product diversification, enterprise opportunities, and value addition to yak products.
- National, regional, and international platforms are required for different stakeholders (policymakers, practitioners, yak herders, and researchers) in order to exchange ideas, knowledge, experience on yak herding, and to prioritize investments for yak conservation and development.

Display of yak products

Yak products were exhibited during the parallel session of ICIMOD. Yak leather, milk, and meat products were the main attraction at the exhibition. The participants appreciated the diversity of the products that can be produced from yak. In particular, the innovative packaging and branding of yak products by young entrepreneurs of China served as a motivation for the yak stakeholders from other HKH countries.

Key achievements

- Participation of about 70 delegates, comprising of yak herder representatives, entrepreneurs, academicians, researchers, and policymakers from the HKH countries (Bhutan, China, India, Nepal, Pakistan)
- Updated data and information on yak farming in the HKH; deliberations on the challenges, opportunities, and the way forward for further yak development were the major highlights of the technical presentations and panel discussion
- Provided a platform to develop South-South cooperation for technology transfer in the yak value chain development, especially through business and enterprise connections
- Strengthened the role of ICIMOD in providing a platform for multi-stakeholder agencies in the HKH and beyond to converge and collaborate on issues of yak conservation and development Received overwhelming support and commitments from the delegates to form an HKH-wide yak network to be coordinated by ICIMOD

Key recommendations

1. Yak herding plays a critical role in livelihood development in the highland areas, which is not acknowledged adequately in the current policies in the HKH countries. Policy attention should be focused on developing a mechanism for multi-stakeholder participation among policymakers, scientists, business entrepreneurs, yak communities, and relevant lobbies for increased investments.
2. Transboundary cooperation can help encourage technological innovation and promote South-South cooperation for technology transfer in yak production (breed, fodder, health) and in the yak value chain development. In particular, promotion of cross-border cooperation can counter the genetic degradation of yak arising from restricted movements of yak herders between countries. ICIMOD's Transboundary Landscape initiative can continue to provide the necessary entry point for forging transboundary cooperation.
3. Supporting and connecting local yak networks to national, regional, (HKH) and global levels, as well as to government and research agencies, can play a pivotal role in addressing the current challenges in yak herding, including those related to nutrition, overall health, and access to markets.
4. Partnership with the private sector can lead to the development of new business models such as social entrepreneurship that engage youth and empower women. Such schemes can promote new yak products, certifications, and common branding at the landscape level which will provide herders with a better market position and economies of scale.
5. Yak tradition and culture are an integral part of the Himalayan identity. There is an urgent need to hold and strengthen sub-national, national, and transboundary yak festivals as a platform for valuing yak culture for livelihood co-benefits, including linkages to responsible tourism.

Follow-up actions

- Publish one regional knowledge product based on the papers presented in the parallel session
- Lobby for increased policy support and national investments in yak conservation and development in the HKH countries to sustain the yak agenda
- Upscale engagement among the HKH countries in order to formalize the HKH Yak Network, including developing terms of reference of the network
- Strengthen national and transboundary yak festivals as entry points for valuing yak tradition and culture, facilitate people-to-people connect, and forge multi-stakeholder partnerships for sustaining the yak system
- Mobilize resources for yak nutrition, health, and breeding in close coordination with the departments of livestock of the respective HKH countries in order to address urgent field challenges faced by the yak herders and extension officials

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Annexes

Annex 1: Programme agenda

Time	Topic	Speaker
9.00–10.00	Arrival and registration	Ms Prabha Shrestha, Programme Associate, ICIMOD
10.00–11.00	Inaugural session	
10.00–10.10	Welcome remarks	Dr David Molden, Director General, ICIMOD
10.10–10.20	Introduction and Objectives of the session	Prof. Ruijun Long, Theme Leader, Ecosystem Services, ICIMOD
10.20–10.45	Key remarks by the Chief Guest	Honourable Lekha Bahadur Thapa Magar, Minister, Ministry of Land Management, Agriculture and Cooperative, Gandaki Province, Pokhara, Nepal
10.45–11.00	<i>Break</i>	
11.00–12.30	Country presentations	
11.00–11.15	Policy Initiatives for Highland Development in Bhutan	Mr Towchu Rabgay, Chief, Department of Livestock, Ministry of Agriculture and Forest, Bhutan
11.15–11.30	Opportunities and Challenges in Sustainable Development of Yak Industry in China	Prof. Yan Ping, Lanzhou Institute of Husbandry and Pharmaceutical Sciences
11.30–11.45	Yak Farming in the Indian Himalayas: Current Trends and Future Prospects	Dr Karma Bhutia, Deputy Director, Department of Animal Husbandry, Livestock, Fisheries and Veterinary Science, India
11.45–12.00	Ethnic and Cultural Diversity amongst Yak Herding Communities in the Asian Highlands	Ms Lily Shrestha/Dr Srijana Rijal, ICIMOD
12.00–12.15	Trends and Sustainability of Yak Farming in the Hindu Kush Karakorum Pamir Landscape	Mr Shafiq Ahmad, Pakistan
12.15–12.30	Rationale and Proposal for HKH Yak Network: A Case Example from the Kangchenjunga Landscape	Dr Tashi Dorji, Senior Ecosystem Specialist, ICIMOD
12.30–13.30	<i>Lunch</i>	
13.30–15.15	Technical presentations	
13.30–13.45	World's Hottest-selling Yak Milk Brand from the Qinghai-Tibetan Plateau, China	Mr Guo Peng, Vice President, Tibet Treasure of Plateau Yak Dairy Industry Co. Ltd
13.45–14.00	Quality Control Technology Promotes the Development of Yak Meat Industry in the Tibetan Plateau of China	Prof. Liang Qi, Director, Department of Food Quality and Safety

Time	Topic	Speaker
14.00–14.15	Pattern and Use of Yak–Cattle Hybridization in the Hindu-Kush Himalaya	Dr Neena Amatya Gorkhali, Senior Scientist (S-4), Animal Breeding Division, National Animal Science Research Institute, Nepal Agriculture Research Council, Khumaltar, Lalitpur, Nepal
14.15–14.30	Fodder and Nutrition Management for Addressing Seasonal Feed Shortage in Yak Farming	Dr Shang Zhanhuan/Prof. Alen Degen, Ben-Gurion University, Israel
14.30–14.45	Advances on Yak Breeding, Genetics, and Biotechnology in India	Dr P. Chakravarty, Principal Scientist & Director (Acting), ICAR-National Research Centre on Yak, Dirang, West Kameng District, Arunachal Pradesh, INDIA
14.45–15.00	Transboundary Yak Health and Disease Management in the Context of Climate Change	Dr Vijay Raika, Programme Director, National Highland Research and Development Centre, Bumthang, Department of Livestock, Ministry of Agriculture and Forest, Bhutan
15.00–15.30	<i>Tea break</i>	
15.30–16.30	Panel discussion on thematic areas and issues Key themes and issues to be identified from various presentations; and relevant questions prepared so that the panel members provide practical way-forward/solutions	Moderated by ICIMOD
16.30–17.00	Closing session	
16.30–16.40	Concluding Statements	Country Representatives
16.40–16.50	Way Forward	Dr Tashi Dorji, Senior Ecosystem Specialist, ICIMOD
16.50–16.55	Concluding Remarks	Dr, Nakul Chettri, Regional Programme Manager, Transboundary Landscapes, ICIMOD
16.55–17.00	Vote of Thanks	ICIMOD

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