Conservation Status of the Last Himalayan Cattle Breed of Bhutan

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Abstract

Siri cattle (*Bos indicus*) are native to the mid-hills of the Himalayan region and are reared for milk, draught power, manure, and meat. In this study, we quantified Siri population trends in Bhutan over the last 11 years, evaluated factors threatening their survival, and analyzed conservation efforts. Also, necessary action plans to strengthen its sustainable management were identified. Data were collected from the participants through a stratified random sampling according to the role of each respondent: farmers (n=25), service providers or extension officials (n=172), and policymakers (n=29). Results showed that the Siri population is expected to decline over the next 10 years (2030) to 60,000 from the existing 86492. Several factors contribute to a population decline, including reduced economic returns, government incentives for stall-feeding with a small number of high-yielding cows, and a farm labor shortage. More than 80% of service providers and policymakers supported the idea of the conservation of native breeds owing to their usefulness as draught animals and in providing income to marginalized farmers. They also supported the idea of having a rigorous government policy to conserve the Siri cattle population. Some conservation measures, such as ex-situ and in-situ conservation of genetic materials, have been initiated; however, this seems inadequate to reverse the rapid decline of the Siri cattle population. This is exacerbated by the lack of coherent policies and strategies, which limits conservation efforts. Therefore, it is recommended to have a robust and specific policy for Siri cattle conservation and priority actions in Bhutan.

Keywords: Conservation, Nublang, Thrabum, Siri cattle, Bhutan

Introduction

Indigenous cattle breeds form an important reservoir of global animal genetic resources, providing food and nutrition security to the world's poorest and marginalized farmers. They originate from specific geographical regions, are adapted to any environmental conditions, and are often utilized in traditional agricultural production systems as they are highly adaptable to harsh environments and require low inputs (Dorji et al., 2010). They also resist emerging and re-emerging diseases. Indigenous cattle would also help farmers to adapt to the increasing threat of global climate change. Modern breeding techniques have less influence on native breeds as their selection is based on adaptability and other essential traits linked to local traditions and animal husbandry practices for meat, milk, or draught power (Pal & Chakravarty, 2019).

Siri cattle (*Bos indicus*) is a broad term used for the Himalayas' indigenous cattle in Bhutan and some parts of India; West Bengal, Sikkim, Darjeeling, and in Nepal. The Siri cattle breeding tract has steep hills with narrow valleys (Tantia et al., 1996). In Bhutan, Siri cattle is popularly known as Nublang, for the male and Thrabum, for its female counterpart. Nublang existed in Bhutan 1000 years ago (Dorji, 2005) and it is identified as Bhutan's sole traditional cattle breed. It is genetically unique and different from any other cattle in neighboring countries (Dorji et al., 2009). They are currently found in rural areas, up to 3000 meters above sea level across the country (Dorji et al., 2010).

Siri animals are small, well-built, and docile. They are well built, characterized by a well-developed hump with long hair on the top; short neck with well-developed pendulous dewlap; long face, long hair on the poll; proportionate body conformation; long, hairy, thick switch; strong, tall, rounded hooves (Dorji et al., 2009). The color varies from black to black-white patches or brown with white patches (Dorji et al., 2009; Tantia et al., 1996).

Bhutanese believe Siri cattle originated from Sangbaykha block in the Haa district in western Bhutan (Bera et al., 2016). It is thought to have originated from the legendary lake Nub Tshonapata, which is located on the western mountain ranges of Haa in the Sangbaykha block. According to folklore, the first breeding bull was given to a cow herder as a gratitude for his charity in providing a night shelter and food to a distressed mermaid (*Tshomen*) of Nub Tshonapata. The *Tshomen* praised the cow herder and promised that he would be rewarded for his charity with a bull. As promised, the cow herder noticed a weak bull approaching his herd a few days after Tshomen's departure. The herder took good care of the bull, which sired progeny. The Nublang breed quickly grew popular and widespread in the region. Thus, Sangbaykha block was recognized as having the best Nublang breed in the Kingdom.

For 1000s of years, Nublang has formed an essential part of Bhutanese society's socioeconomic, cultural, and religious life. The cattle provide milk, draught power, and manure and form an integral part of the agriculture system in the country (Sharma et al., 2008). Nublang cattle are an ancient traditional breed with a long history of hybridization with Mithun. The hybrid population of Jatsa (male crossbred) and Jatsham (female crossbred) provided the backbone of the Bhutanese agricultural economy by providing draught power, and dairy products and was regarded as a valued asset. These cattle provide organic manure, as the acidic nature of the soil limits the use of inorganic fertilizers (Tantia et al., 1996).

Most farmers keep cattle and produce some milk, mainly for home consumption. However, market-oriented production is increasing in areas near the market and accessible by motor vehicles. Most farmers in such areas produce milk over and above the household needs and earn a substantial income from selling it. Dorji et al. (2009) reported the average milk output of a Nublang cow in a day as 3.5 liters from forest grazing alone, with no concentrated feed. For instance, farmers in the Deothang (southeastern part of Bhutan) Milk Cooperative Society sell an average of 1.5-3 litres daily. The cows are selected and stall-fed, averaging 1360 litres of milk per lactation if they are stall-fed and not free ranging. If the animal is not stall-fed, the Siri cattle yield about 1.8 litres of milk per day (549 litres in 305 days) (Adhikari, 2018).

There is a global concern for the trend of genetic diversity loss of traditional breeds, which is exacerbated by international breeding strategies that have intensified the economic competition among breeds. Promoting a few selected breeds for dairy and beef production has replaced less productive breeds with more productive ones and increased the number of endangered breeds globally (Sharma et al., 2008). As a result, it was observed that the population of Siri in India has been declining over the last few years due to extensive crossbreeding with Jersey (Tantia et al., 1996). It is estimated that nearly 30% of native breeds worldwide are endangered (Ovaska et al., 2021). There is also an unprecedented decline of Siri cattle in Bhutan (Bera et al., 2016; Dorji et al., 2009). For example, in 2001, Bhutan had 228,437 Siri cattle (Dorji et al., 2003), but by 2020, it had declined to 86,492 (National Statistics Bureau [NSB], 2020), greater than a 60% decline. A similar trend was observed in West Bengal in India, where the Siri population decreased to 5,479, and in Sikkim, where the Siri

population declined to 11,254 (Bera et al., 2016). The cattle population was said to slightly increase in Sikkim in 2019 (K. Doma, personal communication, November 20, 2019).

The number of native breeds has diminished due to the requirements of intensive livestock farming and global economic development as farmers shifted focus on raising exotic breeds rather than native animals for their improved production performance. Crossbreed species are rising, whereas native livestock breeds have suffered a decrease and deterioration over the years. Crossbreeding is usually between Jersey and Holstein breeds via artificial insemination (Bera et al., 2016; Sharma et al., 2008; Tantia et al., 1996). Subsequently, the altered cattle breeding system severely threatens the breed's long-term viability. For many years, in Bhutan, the primary goals of the government's 5-year plans have been the genetic development of livestock through the supply of foreign breeds (Jersey and Brown Swiss), damaging the protection of the indigenous Nublang breed. Furthermore, shifting from an extended or semi-intensive system (to which this breed is well suited) to intense market-oriented dairy farming, which requires high-yielding cow breeds, adds to the breed's genetic degradation (Dorji et al., 2009). Despite environmental conservation occupying a pivotal place in the country's development policies and strategies, initiatives for the conservation of domestic animal biodiversity have been limited. Similarly, Siri cattle in Nepal are believed to be an insignificant proportion of the whole cattle population, leading to extinction due to negligence and lack of conservation strategies (Joshi & Rasali, 1998). For instance, Dorji et al. (2009) noted that some interventions to halt the decline of Siri cattle are already in place and documented in Bhutan. However, this might not be enough to halt the decline unless some urgent intervention occurs. Therefore, a sustainable management plan for Nublang is critical before it becomes extinct. The extinction of this precious animal genetic resource would be a significant loss of biodiversity and a missed opportunity to consider nature-based solutions in the current times of climate crisis.

The objective of this study was to 1) quantify the Siri population trends over the last 11 years in Bhutan and 2) analyze the drivers of change threatening its existence and ongoing conservation efforts. The study's findings may help devise appropriate conservation measures through policy interventions at national and regional levels for sustainable management of Siri cattle.

Methods and Materials

The literature search was conducted using Google Scholar, ResearchGate, and Research for Life. It was followed by collecting qualitative data, including reviewing policies, rules, and acts. In contrast, quantitative data, including herd structures, were identified and gathered through limited field and online surveys using Google Forms. A detailed description of the data collection methods is as follows:

Primary data

A stratified (according to the role of each respondent) random sampling was used to gather information from farmers (n=25), service providers (n=172), and policymakers (n=29) to triangulate the need for the conservation of Siri cattle in Bhutan.

Farmers: Sangbaykha block (Fig. 1) under the Haa district is considered home to Siri cattle. It has an area of 434.6 square kilometers and comprises 13 main settlements and six Chiwogs (electoral districts). It is located between 1500 and 3000 meters above sea level and has subtropical vegetation of broadleaf forest with diverse flora and fauna. It has warm subtropical summers and cold temperate winters. Aside from agricultural activities,

livestock is a significant source of income. Local cattle dominate the livestock population. Farmers also raise horses and mules, poultry, sheep, and goats.

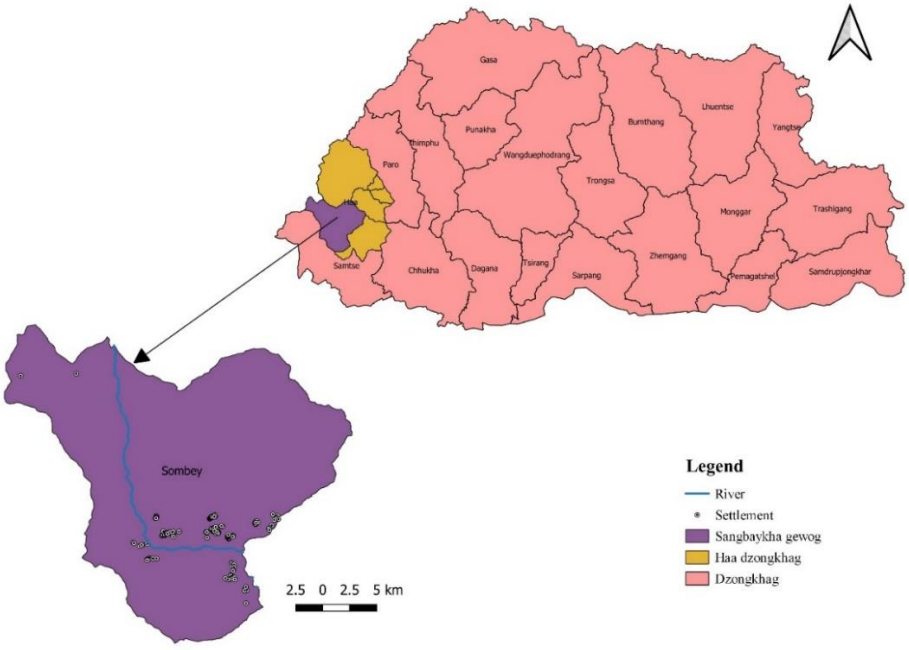

Figure 1 Sangbaykha blocks (village groups for administrative purposes)

The questionnaire was developed in Microsoft Excel. It consisted of 40 questions to gather information on current farm strength, milk yield, lactation length, migration, challenges and issues, and perception of conservation of indigenous breeds. The extension officer administered the survey and later validated it by phone.

Service Providers: An Online Google form was used to collect the response from the targeted service providers (District Livestock Officers, Veterinary Officers, Livestock Production Officers, and Extension Staff). Questions included their name, gender, position level, workstation, districts, cattle breed preference, the current status of indigenous breeds in the country, and existing conservation practices. In addition, the study received 172 responses through various platforms such as official WhatsApp, Telegram, Messenger groups, and personal emails.

Policymakers: An online Google form was to gain information from policymakers (members of parliament, executives, specialists, and professionals) and used similar questions asked of service providers. About 29 officials responded to the questionnaire.

Secondary Data

The secondary data was collected from the Department of Livestock and the National Statistics Bureau (NSB). The data consisted of the population of Siri cattle, their production performance (eg. milk yields), and households that reared particular breeds of cattle. In addition, the farm manager of the Nublang breeding farm of Tashi Yangphu and the extension officer of Sangbaykha block in Haa district were consulted to capture the current conservation status and prospects. The mode of communication was through emails and phone calls. Regional information on Siri cattle was generated via an online consultation with an expert from Sikkim and Nepal (Bhutia, 2019; Doma, 2019; Dorji, 2019; Lobsang, 2021).

Data analysis

The data were sorted, filtered, and analyzed using Microsoft Excel 2013. A descriptive analysis was also performed. Results are presented in table, line graph, and bar graphs. Siri population trend was forecasted using a linear regression model and trendline formula:

$$y = mx + b;$$

Where:

Y = population of Siri cattle,

m = slope,

x = year,

b = intercept.

The questionnaires in the Google form were auto-analyzed. The analyzed data and charts were transferred to Excel and Word documents using the clipboard.

Results

Siri cattle are found in all 20 districts of Bhutan, with the highest in Samtse, followed by Wangdue Phodrang and Chukha, and the least in Gasa (Fig. 2).

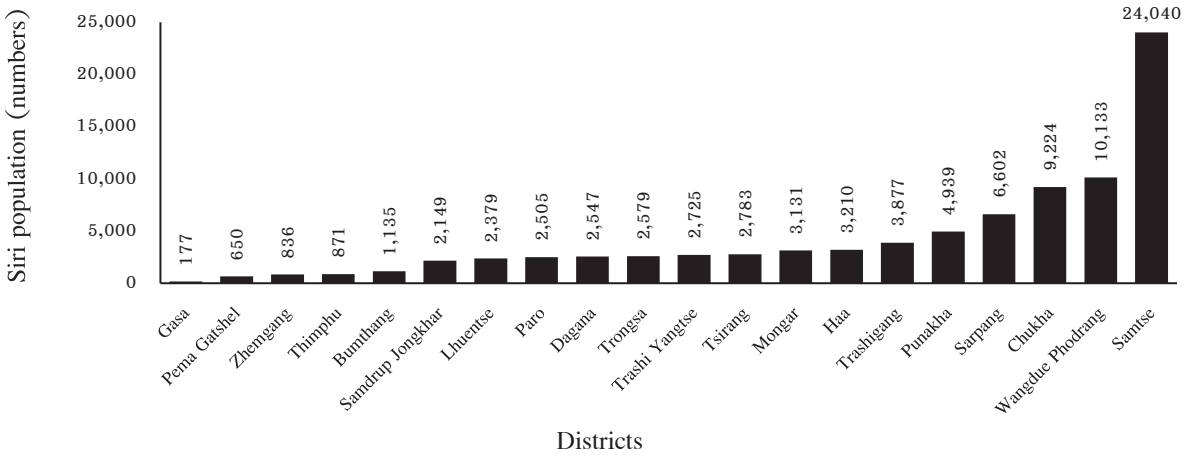

Figure 2 Distribution of Siri cattle across the country

The latest cattle population of Bhutan recorded was 317,000 (DoL, 2020), of which only 86,492 were Nublang and Thrabum breeds. The remainder are Jersey crosses and Mithun hybrids. Over the 11 years between 2009 and 2020, the Nublang and Thrabum population decreased by 41,982, and Jatsha and Jatsham decreased by 14,786 (Fig. 3). In contrast, due to extensive crossbreeding, Jersey-Siri crosses increased by 56,534 in their region. Linear regression analysis ($R^2 = 0.80$) indicates that with the current trend, the Siri population in Bhutan will reduce to 60,000 by 2030 (Fig. 4). A similar decline of 9% in Nublang from 2010 - 2020 was reported by Tenzin et al. (2023).

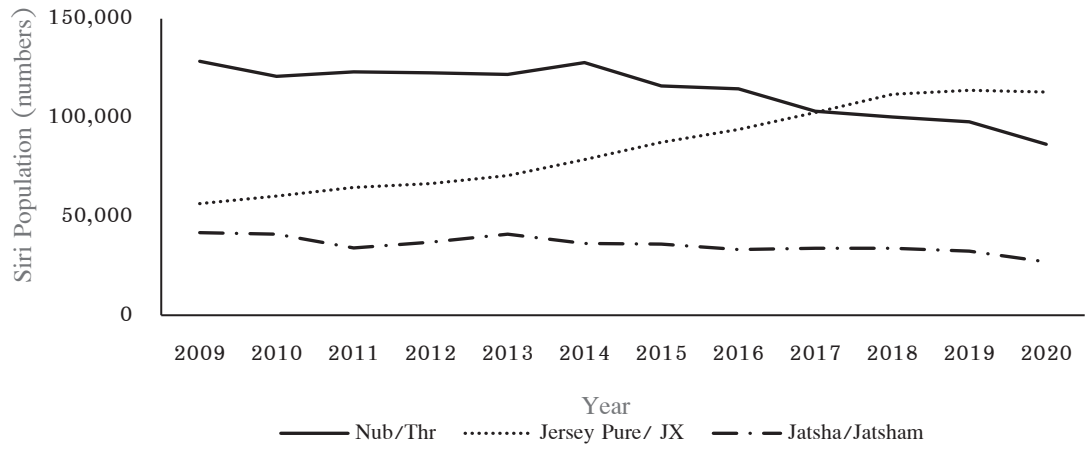

Figure 3 Trend of cattle population (indigenous and exotic) over last 11 years

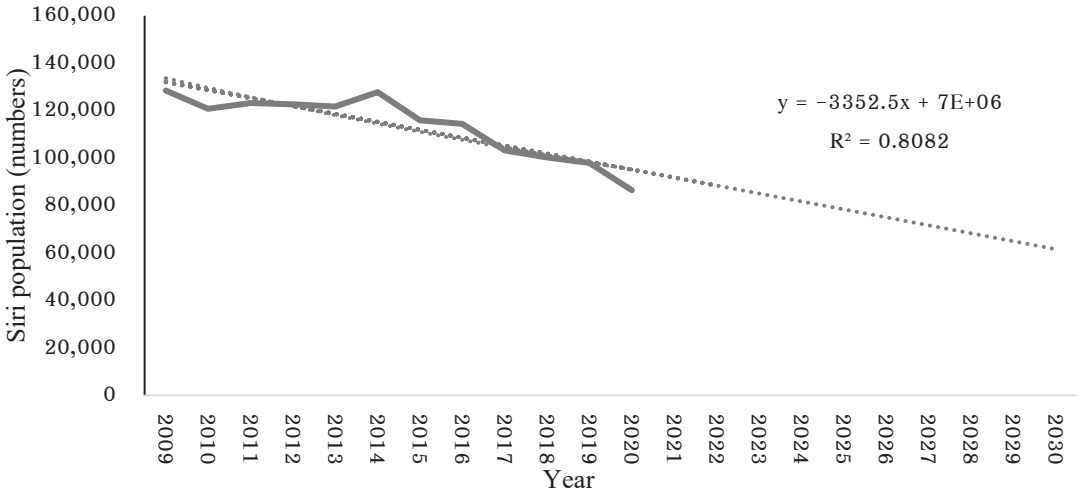

Figure 4 Siri cattle forecast for 10 years

Analysis of current cattle herd structure

The Sangbaykha block of Haa is the original Nublang home tract and is also associated with the ongoing Nublang conservation program. Therefore, sample households were selected in Sangbaykha block to analyze the current cattle herd composition. Out of 20 surveyed households, all still own Nublang and Thrabum breeds. However, there is an increasing trend of adopting Jersey crossbreds and Jatsha-Jatsham (Table 1).

Table 1 Herd composition of the households (n - 20)

Species	Cattle strains	Calf <1 year	Heifers	Milch	Breeding Bull	Bullock	Bull	Total herd	Avg. milk yield
Nublang/Thrabum	100	15	38	24	4	3	12	96	1.10
Jatsha/Jatsham	25	14	0	15	0	1	0	30	2.67
Jersey Cross	40	7	13	10	1	0	4	35	3.56

Factors contributing to the decline in Siri cattle population.

The online survey of service providers and policymakers generated similar results on the factors responsible for the decline in the Siri cattle population in Bhutan. The perception of 172 service providers who responded to the survey is summarized in Table 2. Lower economic returns, government incentivizing promotion of stall-feeding with a small number of high- yielding cows, and increasing farm labor shortage seems to be significant

factor. These findings concur positively with the 79% of the respondents from service providers advocating the adoption of Jersey crosse (Fig. 4).

Table 2 Possible factors contributing to the decline in Siri cattle numbers

Factors for changes	Frequency	Percentage (%)
Lower economic returns due to low milk yield	129	73.30
Government initiatives for promoting stall-feeding with fewer numbers of high-yielding cows	87	49.43
Shortage of farm labor to take care of a large number of cattle heads	87	49.43
Reduced dependency on bullocks	62	35.23
Government programs that discourage transhumant migratory system	35	19.89
Limited incentives for breeding Siri compared to crossbreeding with exotic	31	17.61
Increasing incidences of livestock depredation	17	9.66
Government policy favoring crossbreeding with exotic cattle (Jersey and Brown Swiss)	2	1.14

Support for Siri cattle conservation

The majority of Service providers, as well as policymakers, identified the need for Siri cattle conservation. For instance, 145 out of 172 Service providers and 24 out of 29 policymakers (Fig. 5) interviewed were concerned with the need for Siri conservation.

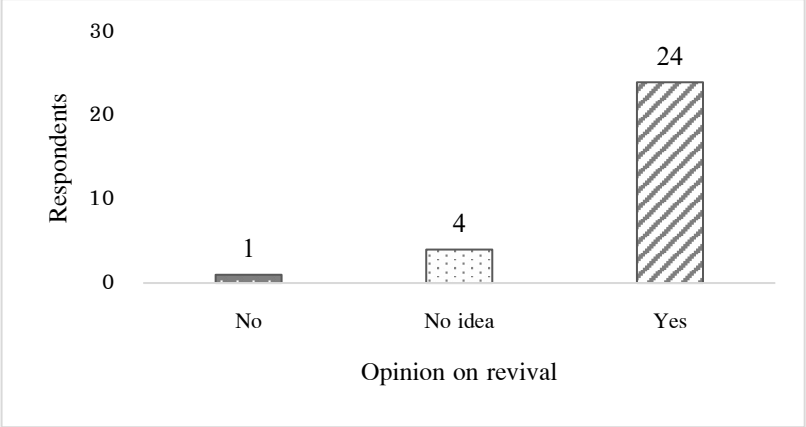

Figure 5 Policymakers' opinion on the need for Siri cattle conservation

Table 3 highlights conservation actions by the Service providers. Most respondents identified the need for specific government policies to conserve indigenous animal genetic resources.

Table 3 The recommendation suggested for the conservation of traditional breeds.

Recommendations	Frequency	Percentage (%)
Develop specific government policy for conserving indigenous Animal Genetic Resources	120	80
Strengthen existing breeding stations with good infrastructure and qualified human resources	54	36
Increase Investments in reproductive biotechnology (e.g., Embryo Transfer)	37	24.7
Incentives to farmers for rearing indigenous livestock	63	42
Promote value addition of indigenous livestock products, brand and create niche market linkages	2	1.4

Analysis of Siri conservation policies and strategies

The Livestock Act 2001 and Livestock Rules and Regulations 2017 (Royal Government of Bhutan, 2017) do not have any specific clause or article on the conservation of Siri cattle. However, in chapter III, section VI under the Livestock Act, Article 6.1 broadly states, "The ministry may establish its farms for the genetic improvement and conservation of livestock, poultry, and fish." In addition, the National Biodiversity Action Plan 2002 describes and discusses Siri cattle's importance and conservation strategies. Chapter III of the National Biodiversity Bill 2021 also contains proposals for strengthening on-farm conservation and the gene bank to promote sustainable genetic resources in the country. The proposed bill is yet to be deliberated in the 6th session of the third parliament. However, approval of the proposed bill would certainly strengthen existing *in-situ* and *ex-situ* conservation activities.

Ex-situ conservation program (National Nublang Breeding Farm, Tashi Yangphu)

The National Nublang Breeding Farm (Department of Livestock, 2022) was established under the royal command of His Majesty the Fourth Druk Gylpo Jigme Singye Wangchuk in 1994 as a nucleus farm. It was started with 40 Thrabum heifers, 4 breeding bulls, and 2 bullocks from Sangbaykha Haa. It is situated at an altitude ranging from 1950 masl to 2350 metres above sea level (masl). The farm has an area of 276.06 acres. The farm is mandated to produce pure breed Siri cattle and distribute pure Nublang bulls to farmers of potential pocket areas for conservation purposes. The latest record of the farm shows that it is stocked with four breeding bulls, 53 heifers, 33 dry cows, 34 milch cows, 22 young bulls, 25 male calves, and 30 female calves for a total herd size of 205. The production performance at the National Nublang Breeding Farm of Tashi Yangphu is shown in Table 4.

Table 4 Production performance of Thrabam and Jersey at the National Nublang Breeding Farm of Tashi Yangphu

	Production Performance	
Traits	**Siri**	**Jersey**
Average age at first mating (months)	33	24.60
Average age at first calving (months)	48	33.90
Average calving interval (days)	560	462
Average gestation period (days) (mean ±sd)	280 ± 10	278 ± 5
Average lactation yield (305 days) (litres)	457.50	3235
Average fat (%)	4.25	5

Source: Department of Livestock (2022)

Cryopreservation of genetic materials (Frozen Nublang semen and embryo)

In the *ex-situ* conservation program, 772 doses of frozen Nublang semen and 22 viable Nublang embryos are cryopreserved in the gene bank at the National Biodiversity Centre, Serbithang (T. Dorji, personal communication, November 25, 2021). In addition, the national bovine frozen semen processing unit at Yusipang produces frozen semen from three cattle breeds (Jersey, Mithun, and Nublang). The center distributed 5000 (4340 Jersey, 630 Mithun, and 30 Nublang) doses from 2020 to 21 (National Dairy Research & Development Centre, 2022).

In-situ conservation at Sangbaykha, Haa

The livestock census, 2020, (National Statistics Bureau, 2020) reported 1,027 Nublang and Thrabum and 183 Jersey breeds. The farmers started raising the exotic breed (Jersey) in the conservation area, as stated in Table 5. If this trend continues, pure Siri cattle may become extinct in the coming decades.

The cryopreservation of semen might help to prevent the ultimate loss of the genetic pool of Nublang in the country. Farmers' groups such as "Nublang Gonor Detshen (Conservation)" which was established in 2009 to conserve the Nublang breed and maintain the pure breed at Sangbaykha might come into rescue under the aegis of the Integrated Livestock and Crop Conservation Project (ILCCP) in collaboration with National Biodiversity Centre. The group was formed with 12 men and 18 women members from different villages (Sangbayama, Garekha, Nakhikhikha, Longjiuna, and Nabji Goenpa). Those villages were not accessible to farm roads earlier, and during that time, it was believed that they owned pure breed Nublang and Thrabum. Thus, conservation activities were seen as promising.

In addition, the department of livestock, Ministry of Agriculture and Livestock (MoAL), previously organized an event similar to the "Nublang Expo" to create awareness and appreciation for the conservation of a genetically unique cattle breed of Bhutan and extend the market for Nublang cattle. Until 2013, the "Nublang Expo" was organized as an annual event. This event influenced the farmers because the cash prizes were awarded to the best Nublang owner. Unfortunately, the farmers were influenced by promoting exotic breeds meant for high production and gradually lost interest in rearing the native breed. As a result, the group did not function well and dissolved. However, in 2018, the Nublang conservation group was revived again in the Nakha/Tashigang community under Sangbay block with 28 group members (male-14, female-14). The group members collectively own 127 Nublang and Thrabum pure breeds currently. The group functions to conserve the indigenous breed and to produce organic butter and cottage cheese (Jatsho & Rinzin, personal communication, November 2021).

Table 5 *Population status at Sangbaykha*

Species	Calf male	Calf female	Heifer	Milch	Dry	Breeding bull	Bull	Bullock	Total
Nublang-Thrabam	156	154	129	346	97	2	107	36	1027
Jersey cross	29	39	18	80	9	1	7	0	183

Discussion

Siri cattle are found all over the country, indicating the adaptability of Siri across broad agro-ecological zones (Dorji et al., 2009; Tantia et al., 1996) and that Siri cattle distribution is widely scattered (Mean:4324, SD: 5029 and Median: 2652). On the contrary, the distribution of Siri cattle in Sikkim is limited to certain potential regions (Lobsang, personal communication, December 5, 2021). Tantia et al. (1996) also observed limited distribution of Siri cattle in Sikkim. The Nublang and Thrabum decreased drastically over the years. A similar decline is reported by (Dorji et al., 2009). This is mainly due to extensive crossbreeding and promoting exotic breeds over local cattle.

Farmers are increasingly opting for either purebred or crossbred cattle, whereas in earlier days, Sangbaykha farmers were known to rear only pure Nublang-Thrabum. Some farmers also preferred Jatsham because they are a robust and resilient breed, produce sufficient milk, and can be managed easily. Therefore, native animals are

easy to manage, consume less feed, and are resistant to disease which Namgay et al. (2013) acknowledge the favorable characteristics of the native breed. However, there is increasing preference for the Jersey breed due to high milk yield, no risk of wildlife predation (reared under intensive care) and is easily managed under a stall-fed system. Farmers opting for Jersey breed in milk yield has been reported in earlier studies (Wangdi et al., 2014).

Lower economic returns, incentivizing stall-feeding, and labor shortages have contributed to the decline in population. Tamang and Perkins (2005) also claim that labor shortage is one of the significant factors affecting livestock farming. The preference for Jersey crosses was based on their higher milk yield, easy handling due to their docile nature, and adaption to stall feeding. That factor aligns with the earlier report by Dorji et al. (2009). Nepal's Siri population declined because of inadequate conservation strategies (Joshi & Rasali, 1998). Both the stakeholder groups prioritized similar actions that are critical for Siri conservation. However, the Livestock Act, 2001 (Royal Government of Bhutan, 2001) and Livestock Act Rules and Regulations 2017 (Royal Government of Bhutan, 2017) require a specific clause to support the conservation of Siri cattle, which it does not currently have. The existing breeding farms for Nublang might not be sufficient to prevent the ultimate demise of the Nublang breed in the country.

The performance traits of the existing national nucleus farm Tashiyangphu aligns with the finding of Tantia et al. (1996) in the parameter such as age at first calving and calving interval. However, it contradicts the milk production yield. In Sikkim, cows yield about 3-4 kg daily in 7 to 9 months. The Nublang farm experienced a slightly lower calving and mating interval than the findings of Dorji et al. (2009), but close milk yield production was observed. The production similarities could be due to similar genetic makeup and differences in performance parameters due to environmental factors such as good farm management practices and proper recording keeping of the farm.

Conclusion and Suggestions

This study aimed to identify and quantify the continual decline in the population of the Siri cattle in Bhutan, and to forecast the projected decline up to 2030. Additionally, the existing herd structure and perception among stakeholders regarding the conservation of Siri cattle were ascertained. Currently, Sangbaykha block at Haa rears Siri cattle and serves as the living museum. However, the study found that if drastic policy interventions are not taken, the decline of the Siri cattle population will be exacerbated in the coming years and may lead to the breed's extinction. The service providers and policymakers favor having strategic and robust policies to support the conservation of the native germplasm. While there are *ex-situ* and *in-situ* conservation practices in place, this might need policy interventions and strengthening, particularly in terms of breeding support, which would entail improvement of its genetics, technological expertise, and provision of subsidies because Siri cattle produce less, and they are less economical to rear. Therefore, urgent intervention and robust policies are required to conserve the Siri cattle.

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Author Contributions

Chimi Wangmo, Nima Norbu and Jigme Tenzin: Conceptualization of the research, Development or design of methodology, Data analysis and interpretation, Investigation, Data analysis and interpretation, Manuscript writing, Manuscript review and editing.

Chimi Wangmo, Nima Norbu and Jigme Tenzin: Collection of data, Manuscript review and editing.

Chimi Wangmo, Nima Nobu and Jigme Tenzin: Providing materials subjects, Data analysis and interpretation.

Conflict of Interests

The authors declare no conflicts of interest.

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