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The Role of Veterinary Innovations in Reindeer Husbandry for Climate Change Adaptation

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ABSTRACT

A study was conducted to examine how advances in veterinary technologies in reindeer husbandry are affecting the ability of Indigenous communities to adapt to climate change. The research was conducted in 2013 in the Anabar region of Yakutia, Russia. Permission for an interview was obtained from the herd manager, Roman Tuprin. Rising temperatures have led to the thawing of permafrost in the tundra, creating favorable conditions for the rapid proliferation of blood-sucking mosquito eggs and larvae. Between July 12 and July 28, reindeer faced relentless attacks, with no decline in mosquito activity. Entomological monitoring recorded mosquito populations ranging from 3,328 to 6,080 individuals. During this period, the animals suffered from acute entomosis and various health complications. The herd became restless and moved in chaotic circles until exhaustion set in, leading to the deaths of up to a thousand or more reindeer. The use of veterinary technology for mosquito protection plays an important role in safeguarding reindeer, while veterinary support in domestic reindeer breeding helps sustain the indigenous populations of the North.

Keywords: Climate change, Impact of veterinary technologies, Reindeer husbandry, Indigenous peoples of the North, Reindeer diseases

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Introduction

The IPCC (Intergovernmental Panel on Climate Change) special report on the effects of a 1.5 °C rise in global temperatures above pre-industrial levels highlights that climate change has overwhelmingly negative consequences for human populations [1]. One of the notable impacts is the accelerated degradation of permafrost. The environmental changes already observed are significantly affecting both human settlements and economic activities.

For Arctic Indigenous groups in Russia, including the Dolgans, Evenks, Evens, Chukchi, and Yukaghirs, reindeer husbandry remains their primary livelihood. These communities lead a nomadic existence, sustaining themselves by herding domestic reindeer, hunting wild reindeer and fur-bearing animals, capturing wolves and migratory birds, and fishing.

The effects of global warming are most pronounced in the Arctic, the ancestral homeland of these Indigenous groups. This region is exceptionally fragile, and early indicators of permafrost degradation are becoming evident. Issues such as tundra flooding, soil instability, and the emergence of hazardous zoonotic diseases are on the rise [2].

For these Indigenous communities, reindeer husbandry is not just an economic activity but a fundamental means of survival, meeting essential needs while allowing them to endure the region's harsh conditions [3]. However,

rapid shifts in lifestyle and diet have led to an increase in diabetes mellitus, obesity, and related health risks among Indigenous populations [4].

It is important to recognize that assessments of Indigenous health vary across different nations. Addressing this issue in a meaningful way can play a vital role in shaping effective strategies to enhance the well-being of circumpolar Indigenous groups [5-7].

Neglecting the deep connection between traditional ways of life, food practices, and respect for cultural identity hinders a full appreciation of Indigenous perspectives on health and nutrition. Among Indigenous groups in Canada, the rise in chronic diseases has been linked to dietary and lifestyle changes. Research on nutrition and healthcare should incorporate local knowledge of healthy eating. Understanding Indigenous approaches to food and wellness requires acknowledging that "It's all interconnected... like a spider web" [8].

A comprehensive understanding of the worldview of Indigenous peoples of the North has played a key role in shaping the One Health paradigm [9], which emphasizes the interconnectedness of environmental well-being and public health and serves as a foundation for developing adaptive mitigation strategies.

The long-term sustainability of reindeer husbandry depends on implementing adaptive veterinary interventions that safeguard domestic reindeer, minimize the environmental impact of industrial activities, and enhance the overall well-being of Indigenous communities in the Circumpolar North [10].

This study focuses on evaluating the role of new veterinary technologies in reindeer husbandry across the Circumpolar North, particularly in their contribution to helping Indigenous peoples adapt to climate change.

Materials and Methods

The study was conducted in 2013 during the migration of reindeer herd No. 7 in the Anabar district, as it moved from the forest-tundra zone toward the shore of Khatanga Bay. The herd consisted of more than 2,000 reindeer. This research was supported by the Basic Scientific Research Program of the Russian Academy of Sciences (2013–2020).

The Tuprin family, including Ekaterina, Roman, and their sons, oversaw the management of the reindeer herd, with assistance from two other related families who worked as herders. Permission was granted by Roman Tuprin, the brigadier, to conduct interviews and document their traditional lifestyle, reindeer husbandry techniques, and veterinary practices used for domestic reindeer.

The Anabar area is located between 96°2'-97°9' N and 111°3'-113°2' E **(Figure 1)**. To the north, it is bordered by the Laptev Sea, which remains entirely frozen for 9 to 10 months each year, with an ice layer measuring 1.5-2.0 meters or more in thickness. These harsh conditions pose significant challenges for both navigation and the survival of local flora and fauna.

Figure 1. A map showing the geographical position of the Anabar district in the Republic of Sakha (Yakutia) (Map Data © 2020 Google).

Most of the Anabar district lies within the coastal polar tundra, while the forest tundra begins in its southernmost part. The region experiences an extremely continental climate, characterized by severe temperature fluctuations. The average annual temperature is 4 ºC, with January temperatures dropping to -35.1 ºC and June averaging -5.5 ºC. The absolute temperature extremes range from a minimum of -58 ºC to a maximum of +36 ºC. Snow covers the area for approximately eight months, and the growing season lasts between 60 and 70 days.

Results and Discussion

In 2013, at the invitation of Lyubov K. Dzhabrailova, Head of the Anabar district, researchers from the Yakut Scientific Research Institute of Agriculture conducted a study examining the distinct features of Dolgan reindeer husbandry, their traditional breeding methods, and the influence of new veterinary technologies on the ability of indigenous peoples in the Circumpolar North to adapt to climate change within the Anabar district of the Sakha Republic (Yakutia).

A defining aspect of Dolgan reindeer husbandry is its advanced breeding practices and the wide variety of reindeer management systems. On Bolshoy Begichev Island, reindeer remain in a free-range system year-round, whereas on the Khara-Tumus Peninsula and in areas around Nordvik Bay, a semi-free-range system is used. Reindeer herds migrating from the forest tundra to the sea bay shores are continuously monitored, with 24-hour herding and guarding implemented.

The Dolgan language, which emerged through the spread of the Yakut language within a region of extensive ethnic interactions, has evolved into a distinct Turkic language at its current stage of development [11].

Among all reindeer herding peoples, the Dolgans are unique in living year-round in transportable houses, moving continuously across the vast Arctic tundra. During winter, they reside in insulated transportable houses, while in summer, they shift to lighter portable dwellings. Their seasonal migration takes them across the coastal tundra to the Laptev Sea during the summer months, before returning to the forest-tundra in autumn.

Starting on June 30, the reindeer begin their northward migration from the summer grazing grounds toward the shore of Khatanga Bay in the Laptev Sea. At this stage, the newborn calves have adjusted to the migration process and follow their mothers within the herd. The mature animals, having recovered their strength after a challenging winter, are also ready to continue. In herd number 7, the initial crossings are made over distances of 3-4 km, occurring every two days. The reindeer are herded from the nomadic camps (suurt) over distances of 2-3 kilometers **(Figures 2 and 3)**.

Figure 2. A scene depicting reindeer herders during their summer migration across the Anabar tundra toward the sea, transporting lightweight summer dwellings.

Figure 3. Reindeer grazing takes place at a distance of 2-3 kilometers from the nomadic camps.

Mosquitoes are first observed around July 5, but at this point, they do not significantly disturb the reindeer **(Figure 4)**. However, as the hot weather sets in after 10 days, the mosquito population surges, and they begin to attack the reindeer in large numbers, feeding heavily on their blood. Both calves and adult reindeer become exhausted and die as a result. Within just a week, several thousand reindeer may be lost **(Figure 4)**. The primary factor contributing to the overwhelming mosquito population is the rising air temperature, which warms the water in nearby bodies, providing an ideal environment for the bloodsucking insects to breed in large numbers.

Figure 4. A deer being swarmed by blood-feeding mosquitoes.

To protect both reindeer herders and animals, adaptive veterinary technology is essential for safeguarding domestic reindeer from blood-feeding mosquitoes. This technology enables the simultaneous treatment of up to 2,000 or more animals, achieving an effectiveness rate of up to 100% [12].

Mosquito swarms generally disperse by the end of July, with occasional flights of subcutaneous and nasopharyngeal gadflies continuing until late August. During this period, night temperatures drop to 10-15 °C below freezing.

From August 25 until September 15, free grazing activities take place along the coast of the Laptev Sea, an area abundant in feed and consistently cool temperatures. The tidal bays and rivers are rich with green grass, which is heavily grazed by the reindeer, helping them replenish their salt reserves due to the seawater's salt content.
Adaptive veterinary procedures for the herds are conducted during the annual corralling event. Early March marks the spring round-ups **(Figure 5)**, during which crucial health measures are carried out, including vaccinations for serious diseases such as rabies, rabies, and brucellosis, disease testing, reindeer population assessments by age and sex, and tagging of calves born that year.
From August 20-23, the autumn veterinary procedures take place, which involve sawing off the horns of the sires, castrating two-year-old sires for slaughter, vaccinating against anthrax, testing for brucellosis, and administering early treatments for subcutaneous and nasopharyngeal gadfly larvae.

Figure 5. Preventive veterinary vaccinations for anthrax in domestic reindeer.

From October 25 to November 15, a favorable period for reindeer allows them to recover and maintain their body condition. During this time, temperatures range from -20 to -35 ºC, accompanied by occasional light winds.
Reindeer breeders in the Anabar tundra mark the start of winter on November 1. The polar night begins on November 15 and lasts until January 26, with winter continuing until the end of March **(Figure 6)**. The herd's winter migration follows specific patterns influenced by conditions that are favorable for the reindeer.
The unfavorable period spans from November 15 to December 24, with temperatures dropping between -40 to -52 ºC, causing the animals to lose weight. By late December through February, herd number seven reaches the edge of the forest-tundra zone. On January 26, reindeer herders welcome the first light of day after the long polar night.

Figure 6. Migration of the herd during the winter polar night.

Calving represents the most critical event in reindeer husbandry, with its success largely determined by the mother reindeer's body condition, proper pasture selection, and the expertise of the reindeer herders. In herd № 7, calving starts on April 6 and lasts until June 10. Early in March, during the calving period, preventive veterinary procedures are carried out, including rabies vaccination, blood collection for brucellosis testing, marking of the calves born that year, counting the calves by age and sex, castrating older males, and dividing the herd into 2 groups: the uterine group (females) and the non-fertile group (males such as breeding bulls over three years, castrated bulls, and young males).

The uterine group is driven 20-40 kilometers northward, while the non-fertile group stays closer to the reindeer herders' mobile cabins. Calving times vary, depending on favorable weather conditions in summer, spring, and autumn, as well as the success of the rut, which depends on its timing and intensity **(Figure 7)**.

Figure 7. A reindeer with its calf beside the herd during calving in the winter season.

When choosing calving locations, herders prioritize areas with favorable terrain that offer shelter from spring winds and snowstorms. Experienced heifers tend to calve in familiar spots where they instinctively know the best places to create snow nests for their calves. Digging snow is crucial not only for food access but also for providing a safe environment for newborn calves. A well-dug nest offers protection from the wind. Over time, multiple nests in the snow can hasten melting, reducing the likelihood of heifers abandoning their calves, effectively turning these nests into maternity areas for the newborn reindeer. The heifer, without straying from the calf, begins digging successive nests in a chain. During a 2-3 day blizzard, the heifer nurses and protects her calf in the nest, refraining from feeding herself, as she shields the calf from harsh conditions.

Globally, the extinction of up to thirty thousand species annually is a growing concern. The livestock sector faces alarming challenges due to the rise of dangerous infectious and invasive diseases in farm animals. For the indigenous peoples of the Russian Arctic, reindeer herding is their sole livelihood and primary occupation. These nomadic peoples breed reindeer, hunt wild animals and migratory birds, and engage in fishing within their territories. The survival of their culture and way of life hinges on preserving their land and traditions, which include hunting, reindeer herding, and fishing, while also maintaining access to a healthy diet of traditional foods. Amid the industrial development of Russia's northern regions, it is vital to respect the delicate ecology of the Arctic.

In the nineteenth century, before the availability of veterinary vaccines for infectious diseases, mass die-offs of livestock occurred due to anthrax, tuberculosis, blackleg, and other highly dangerous illnesses. Scientific veterinary intervention played a critical role in eliminating these diseases. On July 12, 1908, the Veterinary and Bacteriological Laboratory was established in Yakutsk to diagnose parasitic and infectious diseases, develop vaccines and serums for blackleg, anthrax, and other severe diseases, and implement widespread animal vaccinations. This laboratory later became the foundation for the Yakutsk Research Institute of Agriculture after a series of transformations.

Veterinary support for reindeer herding in the Arctic, through the elimination of harmful invasive and infectious diseases affecting domestic reindeer, helps preserve the indigenous peoples of the North and ensures their traditional, healthy ways of life. The collaborative efforts of these indigenous communities foster comfort, protection, and spiritual connection among family members.

Conclusion

The effects of global warming, as highlighted in the IPCC Special Report, are already significantly altering the climate of the Circumpolar North, home to indigenous communities. The warming is causing the permafrost in the tundra to thaw, leading to the formation of numerous shallow water pools that provide an ideal environment for the development of blood-sucking mosquito eggs and larvae. This increase in biotopes contributes to a rapid surge in mosquito populations, which in turn leads to a sharp rise in the number of mosquitoes attacking domestic reindeer. The mosquitoes cause severe entomosis in the reindeer, resulting in mass deaths. In some cases, up to 6,000 reindeer have been killed within weeks due to the overwhelming number of mosquitoes.
In these conditions, the development of effective veterinary solutions to prevent acute entomoses and provide vaccinations against dangerous infectious diseases like anthrax and brucellosis is essential for safeguarding reindeer herding, the primary livelihood of indigenous minority groups in Russia. Veterinary support for reindeer herding in the polar north is crucial for the preservation of these small indigenous populations.

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