



## Impact of Veterinary Technologies in Reindeer Husbandry for Adaptation to Climate Change

Alexander Dmitrievich Reshetnikov<sup>1\*</sup>, Anastasia Ivanovna Barashkova<sup>1</sup>

<sup>1</sup>FRC YaSC SB RAS M.G. Safronov Yakut Scientific Research Institute of Agriculture, Yakutsk, Russia.

### ABSTRACT

The impact of new veterinary technologies in reindeer husbandry on the adaptation of indigenous people to climate change was studied. The work was carried out in 2013 in the reindeer husbandry of the Anabar region of Yakutia (Russia). The consent of the herd manager Roman Tuprin was obtained for the interview. Warming, causing thawing of the permafrost soils of the tundra, contributes to the massive development of eggs and larvae of blood-sucking mosquitoes. From July 12 to July 28, the deer were attacked around the clock without a decrease in the number. With entomological registration, the number of mosquitoes ranged from 3,328 to 6,080 individuals. During this period, the deer suffered from acute entomosis and other diseases. Animals became uncontrollable, with the herd endlessly whirling in one place until a complete loss of strength. Up to a thousand or more animals perished. The use of veterinary technology to protect against mosquitoes rescues animals. Veterinary support for domestic reindeer breeding contributes to the preservation of the indigenous peoples of the North.

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

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**Corresponding author:** Alexander Dmitrievich Reshetnikov

**E-mail** ✉ [a.reshetnikov.2020@bk.ru](mailto:a.reshetnikov.2020@bk.ru)

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### INTRODUCTION

The IPCC Intergovernmental Panel on Climate Change Special Report on the impacts of global warming of 1.5°C above pre-industrial levels outlines that the impacts of climate change on the Earth's population are overwhelmingly negative [1]. An acceleration of permafrost degradation has been noted. Observed climate changes are already having a noticeable impact on human habitats and economic activities.

For the indigenous peoples of Russia's Arctic, such as the Dolgans, Evens, Evenks, Chukchi, and Yukaghirs, northern domestic reindeer husbandry is the only occupation. They maintain a nomadic way of life in the area they live, raising domestic reindeer, hunting wild reindeer, fur-bearing animals, wolves, migratory birds, and fishing.

The warming of the climate is most dramatic in the Arctic, where indigenous peoples are the original inhabitants. Arctic Indigenous peoples

are living in a very vulnerable environment, and signs of degradation of permafrost soils are beginning to appear. Tundra waterlogging, melting soils, and the emergence of dangerous zoonotic pathogens are increasing [2].

For indigenous peoples, reindeer husbandry is a key source of livelihood, meeting the basic needs of the indigenous population and enabling them to exist in the most adverse environmental conditions [3]. The rapid changes in the lifestyle and nutrition of indigenous peoples lead to a prevalence of diabetes mellitus, overweight, and other associated risks [4].

However, it should be considered that health assessment of indigenous populations varies from country to country, and discussion of this important issue can positively influence the strategy to improve the health of circumpolar peoples [5-7].

Ignoring the interdependence of traditional lifestyles, nutrition, and the principle of respect for individuality does not contribute to a deep

understanding of Indigenous experiences of food and health. The increase in chronic illnesses among Indigenous peoples in Canada is linked to lifestyle changes that affect diet. Nutritional research and treatment activities should acknowledge the local understanding of healthy eating. Lifestyle and nutrition research should be understood as "It's all interconnected... like a spider web" (E. Goettke, J. Reynolds) [8].

An in-depth understanding of the worldview of the indigenous peoples of the North has enabled the formulation of the One Health paradigm (K. Hueffer, M. Ehrlander, K. Etz, A. Reynolds) [9]; the unity of public health and environmental well-being, which can provide mitigating adaptive technologies.

To preserve reindeer husbandry, it is necessary to ensure the application of adaptive veterinary measures to effectively protect domestic reindeer, reduce ecological damage from industrial activities, and contribute to improving the quality of life of the indigenous peoples of the Circumpolar North [10].

The objective of our research is to examine the impact of new veterinary technologies in reindeer husbandry in the Circumpolar North aimed at adapting indigenous peoples to climate change.

## MATERIALS AND METHODS

The work was carried out in 2013 during reindeer herd No. 7 of the Anabar district migrating from the forest-tundra zone to the shore of Khatanga Bay with several reindeer of over 2,000 head. The study was funded by the Basic Scientific Research Program of the Russian Academy of Sciences 2013-2020. The reindeer herd was managed by the Tuprin family, Roman, Ekaterina, and their sons. Apart from them, two related families work as herders. An agreement was obtained from Roman Tuprin, the brigadier, to conduct interviews, observations of their traditional way of life, reindeer husbandry methods, and veterinary care of domestic reindeer.



**Figure 1.** A map identifying the location of the Anabar district of the Republic of Sakha (Yakutia) (Map Data © 2020 Google).

The Anabar area lies between 962'-97°9'N and 111°3'-113°2'E (**Figure 1**). The area is bounded to the north by the Laptev Sea, which for 9-10 months is completely covered by a layer of ice 1.5-2.0 m thick and more, which creates difficulties for navigation and the existence of flora and fauna. Almost the entire area of the district is situated in the coastal polar tundra. The forest-tundra begins in the southern part of the area. The climate of the area is extremely continental, with extremely low temperatures. The average annual air temperature is 4°C, in January -35.1°C, in June -5.5°C; the absolute minimum is -58°C and the maximum is +36°C. The area is covered by snow for 8 months. The vegetation lasts for 60-70 days.

## RESULTS AND DISCUSSION

In 2013, at the invitation of Lyubov K. Dzhabrailova, Head of the Anabar district, we, Yakut Scientific Research Institute of Agriculture scientists, carried out scientific research into the specifics of Dolgan reindeer husbandry, their traditional reindeer breeding, and the impact of new veterinary technologies in Circumpolar Northern reindeer husbandry on indigenous peoples' adaptation to climate change in the Anabar district of the Sakha Republic (Yakutia). Dolgan reindeer husbandry is characterized by a high culture of breeding domestic reindeer and the greatest diversity of their housing systems. For example, on the Bolshoy Begichev Island, free-range reindeer are kept year-round; on the Khara-Tumus Peninsula and the adjacent areas

of Nordvik Bay, semi-free-range reindeer are kept. In herds migrating from the forest-tundra to the shore of the sea bay, 24-hour guarding and herding of reindeer are practised. The Dolgan language, formed in the process of spreading the Yakut language in the macroregion of the interaction of different ethnic groups, is an independent Turkic language at this stage of its development [11]. The Dolgans are the only ethnoses among reindeer herding peoples, who live year-round in transportable houses, roaming the vast expanses of the Arctic tundra year-round. In winter, their families live in insulated winter transportable houses, and in summer, they use lighter summer houses. In summer, they roam across the coastal tundra to the shore of the Laptev Sea, and back to the forest-tundra in autumn.



**Figure 2.** Moment of reindeer herders' summer migration across the Anabar tundra to the sea with lightweight transportable summer houses.

Reindeer migrate northwards through the summer pastures to the shore of the Khatanga Bay in the Laptev Sea starting on June 30. By this time, newborn calves become adapted to migrating, following their mothers in the herd. Mature animals also gain strength after a difficult winter. In herd number 7, the first crossings are made over a distance of up to 3-4 km once every two days. Reindeer are herded from nomadic camps (suurt) over a distance of 2-3 km (**Figures 2 and 3**).



**Figure 3.** Grazing of reindeer from nomadic camps is carried out at a distance of 2-3 km.

The first mosquitoes are noted from July 5, but they do not bother the reindeer much yet (**Figure 4**). When hot weather arrives in 10 days, the number of mosquitoes increases dramatically and they start attacking reindeer in very high numbers, sucking out very much blood, calves and adult reindeer are exhausted and die. In a week, several thousand reindeer can be killed (**Figure 4**). The main reason for the dangerously high number of mosquitoes on reindeer herds is the increase in air temperature, which causes the water in water bodies to warm up, where the bloodsucking insects massively emerge.



**Figure 4.** An attack by blood-sucking mosquitoes on a deer.

The only solution to save animals and reindeer herders is the use of adaptive veterinary technology to protect domestic reindeer from blood-sucking mosquitoes by spraying up to

2,000 or more animals simultaneously. The effectiveness of this technology reaches up to 100% [12].

The mass flight of mosquitoes ends at the end of July, single flights of subcutaneous and nasopharyngeal gadflies are observed until the end of August. At this time, night temperatures drop to 10-15 degrees below zero.

From August 25, free grazing activities are organized along the coast of the Laptev Sea until September 15, where fodder is plentiful and coolness is constant. The bays and rivers are tidal. Green grass along the shores of the bays and rivers with a flavour of sea salt is well eaten, and, thereby, domestic reindeer make up for salt deficiencies in their bodies.

Planned adaptive veterinary measures in reindeer herds are carried out during corralling in the pen. At the beginning of March, spring round-ups are carried out (**Figure 5**). This includes vaccination against highly dangerous diseases such as anthrax, rabies, and brucellosis, research for infectious diseases, counting the number of reindeer by sex and age group, and tagging the calves of the current year of birth.

From August 20 to 23, a veterinary autumn correlation is held, where horns are sawn off from sires, two-year-old sires are castrated for slaughter, anthrax vaccination, brucellosis testing, and early chemotherapy against subcutaneous and nasopharyngeal gadfly larvae are carried out.



**Figure 5.** Veterinary preventive vaccinations against anthrax in domestic reindeer.

From the 25th of October to the 15th of November, there is a favourable period for reindeer, enabling them to recover and preserve the fatness of the herd. During this period, the temperature ranges from -20 to -35°C, with occasional light winds.

Reindeer breeders in the Anabar tundra start calculating winter on the 1st of November. The polar night begins on the 15th of November and ends with sunrise on the 26th of January, and winter lasts until the end of March (**Figure 6**). The winter migration of the herd has its peculiarities. The winter season is divided into the following periods, depending on the favourable conditions for reindeer.

The unfavourable period is from the 15th of November to the 24th of December. Temperatures range from -40 to -52°C. Animals begin to lose body weight. In late December-February, herd number 7 reaches the beginning of the forest-tundra strip. On the 26th of January, reindeer herders greet the sunrise after a long polar night.



**Figure 6.** Winter herd migration during the polar night.

Calving is the most important campaign in reindeer husbandry, the success of which depends primarily on the fatness of the mother reindeer, the right choice of pastures, and the skilful work of the reindeer herders. In herd № 7, calving begins on the 6th of April and continues until the 10th of June. In early March, during calving, preventive veterinary measures such as rabies vaccination, blood sampling for brucellosis testing, marking of calves of the current year of birth, counting the number of calves by sex and age groups, castration of old males, and the division of the herd into two parts: uterine – females, and nonfertile – males: bulls-producers over 3 years, castrated bulls, young males.

The uterine part of the herd is driven 20-40 km to the north from the non-fallow part, the latter is kept at home, near the reindeer herders' transportable cabins. Calving begins at different times, depending on the favourable weather conditions of spring, summer, and autumn and

the success of the rut (optimum timing and intensity of the rut) (Figure 7).



**Figure 7.** Reindeer and its calf near the herd during calving in winter.

When selecting calving sites, herders choose locations based on the terrain relief with shelter from spring winds and blizzards. Experienced heifers prefer to calve in familiar areas where they instinctively know in advance the best places to build nesting sites in the snow for their newborn calves. Snow digging is important not only for forage but also for creating a favourable climate for newborn calves. A successful dug nest protects the calf from winds. Several successive nests in the snow cause early melting of the snow, eliminate cases of abandonment of newborn calves by the heifers, turning it into a kind of maternity home for newborn reindeer calves. A heifer, without moving away from the newborn calf, starts digging new nests in a chain. During a blizzard that lasts for 2-3 days, the heifer nurses her calf in the nest and feeds the baby, although she does not feed herself at this time, protecting the calf from bad weather.

The extinction of up to 30,000 species a year is a worldwide problem. Agriculture in the livestock sector is experiencing alarming changes due to the emergence of dangerous infectious and invasive diseases of farm animals. For the indigenous peoples of the Russian Arctic, domestic reindeer is the only occupation and source of livelihood. They lead a nomadic lifestyle in their territories, breeding domestic reindeer, hunting wild animals and migrating birds, and fishing. The primary basis for the conservation of the indigenous peoples of the North is the preservation of their way of life and the land for traditional reindeer herding, hunting, and fishing. At the same time, their

healthy nutrition with national traditional products is preserved. In the context of the industrial development of Russia's northern territories, the fragile ecology of the Arctic must be respected.

In the 19th century in the absence of veterinary vaccines against infectious diseases, there were mass deaths of farm animals from anthrax, blackleg, tuberculosis, and other particularly dangerous diseases. Scientific veterinary support in the fight against especially dangerous diseases played a major role in the eradication of these diseases. On the 12th of July, 1908 in Yakutsk, the Veterinary and Bacteriological Laboratory was organized to diagnose infectious and parasitic diseases, produce vaccines and serums against anthrax, blackleg, and other especially dangerous infectious diseases, and widely immunize animals. Based on the veterinary and bacteriological laboratory, the Yakutsk Research Institute of Agriculture was established after a series of transformations.

Veterinary support for reindeer herding in the Arctic by eradicating dangerous infectious and invasive diseases of domestic reindeer contributes to the preservation of small indigenous peoples of the North, ensuring their traditional healthy lifestyles. The collective work of indigenous ancestral communities provides comfort, protection for family group members, and spiritual bonding.

## CONCLUSION

The impacts of global warming outlined in the Special Report of the IPCC Intergovernmental Panel on Climate Change are already having a significant negative impact on the climate of the Circumpolar North, where indigenous peoples live permanently. Warming causing the tundra's permafrost soils to thaw contributes to the formation of numerous shallow pools of water with sufficient temperature for the eggs and larvae of blood-sucking mosquitoes to emerge. The abundance of biotopes contributes to the mass expulsion of larvae, which causes a sharp increase in the number of blood-sucking mosquitoes that attack domestic reindeer. The mosquitoes cause acute entomosis in reindeer, leading to mass mortalities. There are cases where up to 6,000 domestic reindeer are killed

in a matter of weeks by a huge number of flying mosquitoes.

In such conditions, the development of effective veterinary technologies for the prevention of acute entomoses and preventive vaccinations against particularly dangerous infectious diseases such as anthrax and brucellosis of reindeer is a prerequisite for preserving the only industry where representatives of the indigenous minority population of Russia work. Veterinary support of domestic reindeer husbandry in the polar north contributes to the conservation of the small indigenous peoples of the North.

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