

Ecological and landscape-forming role of saigas of the Ural population in modern conditions

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Abstract. This article into the intricate biology and ecology of the Ural saiga (*Saiga tatarica*) population, offering a comprehensive update on its current status and dynamics. Drawing upon extensive field studies conducted at various key locations including lambing sites, and summer and winter habitats, the research aims to provide a nuanced understanding of the evolving relationship between saiga and agriculture. One of the primary focuses lives in assessing the landscape-modifying impact of saiga within contemporary environments. By examining the role of saiga in shaping local ecosystems, the study sheds light on the intricate interplay between these magnificent animals and the agricultural activities that often encroach upon their habitats. A significant aspect addressed in this research is the conflict of interests arising between the burgeoning Ural saiga population and agricultural practices. This conflict tends to intensify during periods of population peaks, posing challenges for both conservation efforts and the agricultural development. To mitigate these conflicts and pave the way for sustainable coexistence, the study puts forward preliminary measures for resolution. These measures are designed to reconcile the divergent interests of saiga conservation and agricultural productivity. Furthermore, the research identifies potential pathways for integrating the growing saiga population harmoniously into modern agricultural landscapes. By exploring innovative approaches and collaborative strategies, the study seeks to foster a mutually beneficial relationship between saiga conservation and agricultural sustainability. Overall, this article serves as a vital resource for policymakers, conservationists, and stakeholders invested in the preservation of the Ural saiga population and the cultivation of sustainable agricultural practices in the region.

1 Introduction

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The saiga, an enigmatic antelope species native to the Eurasian steppes, has garnered significant attention in recent decades due to its remarkable population dynamics and ecological significance. Over the years, the saiga has experienced dramatic fluctuations in its numbers, with instances of rapid population increases followed by devastating mass die-offs. These events, documented in 1981, 1984, 1988, and 2015, have underscored the species' vulnerability to various environmental pressures [1]. Historically, the saiga faced near-extinction in the 1920s, only in the 1950s and 1970s, the population rebounded to likely its highest recorded levels, estimated at around 1.5 million individuals. However, another crisis was precipitated due to the rampant poaching driven by the demand for their horns in Chinese traditional medicine, pushing the species to the brink of extinction by the turn of the 21st century. Fortunately, concerted conservation efforts, particularly in Kazakhstan, have led to a remarkable recovery, with the saiga population rebounding significantly over the past two decades [2, 3, 4].

All of these changes are strongly influenced by human activity [5, 6]. Climate change affects not only temperature, but also to the extinction of many species in nature [7], a decline in species diversity [8], and the extinction of endemism [9,10].

Presently, Kazakhstan harbours 90-95% of the global saiga population, with three distinct populations inhabiting the region: the Betpakdala population situated between Balkhash Lake and the Aral Sea, the Ustyurt population spanning the area between the Aral Sea and the Caspian Sea, and the Ural population occupying the territory between the Volga and Ural rivers [11, 12, 13].

In recent years, intensive research has been conducted to assess the status, resources, and migratory patterns of saiga populations, with particular emphasis on the Ural population. This focus stems from the critical role saigas play in shaping the landscape and ecosystems of the right bank of the Ural River in the West Kazakhstan region [14, 15].

Observations of saiga behaviour and their environmental impact suggest significant changes in the local landscape, indicating the species' growing influence as a keystone species. As the saiga population expands, it becomes a pivotal factor in ecosystem dynamics, influencing the composition of pastures and microrelief in the region. Moreover, the burgeoning saiga population serves as a catalyst for ecological processes, attracting predators, notably birds of prey, and contributing to the overall biodiversity and ecological stability of the region.

2 Materials and Methods

To investigate the impact of saigas on the landscape, field expeditions were conducted to the habitats of the Ural population at various times throughout the year. Observations of saiga behaviour were recorded, and data on grazing patterns and trail formation were analysed. Additionally, predator tracking of saigas was conducted through direct observations and collection of data on various species, including corsac fox, fox, wolf, white-tailed eagle, vulture, steppe eagles, swamp owls, and others.

3 Results and discussion

The Ural saiga population has experienced a fivefold increase over the past five years. This remarkable growth can be attributed to a combination of favourable factors, foremost among them being the highly effective measures implemented to combat poaching in Kazakhstan, sustainable livestock management practices maintaining land below carrying capacity, winter mitigation efforts, decreased frequency of spring frosts, and the absence of large-scale epizootics. Current data on the Ural population, coupled with findings from our

expeditions in Western Kazakhstan, indicate that this population is currently among the largest in the world (Table1).

Table 1. Dynamics of the saiga population in Kazakhstan

Years	Name of population, considered, a thousand heads			Total
	Ural	Ustyrt	Betpakdala	
2000	17 500	116 000	15 000	148 500
2001	9 400	58 000	12 000	79 400
2002	6 800	19 100	4 000	29 900
2003	6 500	12 900	1 800	21 200
2004	8 800	15 000	6 900	30 700
2005	10 000	19 600	9 900	39 600
2006	12 800	17 800	16 800	47 400
2007	15 600	16 400	22 800	54 800
2008	18 300	10 400	32 300	61 000
2009	26 600	9 200	45 200	81 000
2010	31 300	4 900	53 400	89 600
2011	17 900	6 100	78 000	102 000
2012	20 000	8 300	109 200	137 500
2013	26 400	5 400	155 200	187 000
2014	39 500	2 200	215 000	256 700
2015	51 700	1270	242 500	295 470
2016	70 200	1900	36 200	108 300
2017	98 200	2700	51700	152 600
2018	135 000	3 700	76 400	215 100
2019	217 000	5 900	111 500	334 400
2020	-	-	-	-
2021	545 000	12 000	285 000	842 000
2022	801 000	28 000	489 000	1 318 000
2023	1 130 000	39 700	745 300	1 915 000

Note. The registration of saigas was not conducted in 1995 and 1996 in certain populations due to financial constrains, and in 1997, no registration was carried out at all. Additionally, in 2020, accounting was also not performed due to the COVID-19 pandemic.

In order to study the condition, resources, and migration routes of the saiga population and to assess the consequences of its impact on agricultural landscapes, a series of scientific expeditions were conducted:

1. Mass lambing observation (May 2022): An expedition was conducted to observe the mass lambing sites of the Ural saiga population. During this expedition, conducted from 7th to 11th May 2022, significant observations were made. Prior to our arrival on May 8th, it was noted by the inspectors of the Hunting Industry that from the 3rd to the 7th of May, a cluster of several thousand saigas had gathered for lambing near the village of Zhaksybai in the Zhanibek district. It was observed upon arrival that most of the herd had already moved on, leaving only a few female saigas continuing to lamb. Traces of grazed grass and remnants of dried placentas were discovered at the site. Subsequently, on May 9th, we visited a maternity site located 15 kilometres southwest of the village of Karaoba in the Kaztalov district. Here, approximately 100 thousand female saigas had congregated across an area of about 5 thousand hectares for lambing. Throughout the territory, numerous saigas were observed basking in the sun (Fig.1), with some females accompanied by pairs of offspring, indicating twin births.



Fig. 1. Saiga cub

1. Flyover in the West Kazakhstan region (July 2022): This expedition, conducted in July 2022, involved aerial observation over the West Kazakhstan region to track saiga migration routes and assess their distribution in the area.

2. Wintering observation in the Northern Aralsor (February 2023): An expedition was undertaken to observe saiga populations during their wintering period in the northern Aralsor region in February 2023.

3. Post-wintering Assessment in the Northern Aralsor region (March 2023): A follow-up expedition was conducted in March 2023 to assess the saiga population's condition and behaviour in the northern Aralsor region.

4. Pre-Lambing Survey (April 2023): An expedition was carried out in April 2023 to survey saiga populations prior to the lambing season, focusing on registration and preparation activities.

These expeditions facilitated comprehensive research into the biology, geography, and ecology of the Ural saiga population in the Ural-Caspian region. They also enabled the identification of new ethological insights and strategic proposals for integrating the saiga population into modern agricultural landscapes.

During the summer expedition, the Ural population was studied at summer pastures, where more than 100 thousand saiga heads were noted in the area of Aralsor Lake. It was determined that at summer pastures the majority of the modern population inhabits areas with freshwater ponds on the watercourses flowing into them. This natural-anthropogenic combination provides optimal conditions for saigas: proximity to the forage base, water sources, and resting areas; fresh water in ponds; safe resting spots; and salt on the salt marshes, providing good visibility. Modern conditions have required saigas to fully utilise their adaptive potential, including the ability to utilise anthropogenic sources of freshwater and graze alongside domestic animals, primarily horses. Presently, a pasture ecosystem is forming based on the joint grazing of ungulates, artiodactyls, and antelopes, reminiscent of the pasture landscapes of the Late Pleistocene. We consider this additional factor as a contribution to tourist attractiveness (Fig.2).

Pasture lands are crucial landscapes with multifaceted functions that hold significant social and environmental importance. Among these functions, the coexistence of wildlife and livestock stands out, albeit posing risks such as disease transmission between species. Effectively managing this dynamic necessitates the exchange of social and environmental knowledge [16, 17, 18].



Fig. 2. Joint grazing of saigas and domestic horses north of the road "Kastalovka-Zhanibek".

Saigas utilise winter and summer pastures alongside livestock, primarily horses without conflicts. Herds are somewhat dispersed at watering holes, which protects coastal vegetation from trampling. The removal of steppe vegetation is optimal, pastures are well-grazed and evenly fertilised with a distinct network of saiga and pet trails.

At the end of the wintering period, the departure of saigas in winter is easily discernible, as undecayed and uneaten carcasses of fallen animals are visible from a distance. Overall, based on our observations, this year's winter mortality rate is low and primarily consists of large individuals who likely succumbed after the rutting season (Fig.3).



Fig. 3. The fallen male saiga

During the spring expedition in April 2023, we encountered several herds of males near Aralsor Lake. The largest herds of females preparing for lambing were found in the northwest of the region, bordering the Russian Federation.

Regarding predators, there is a notable presence of corsac foxes and foxes. Also, several wolf tracks were found on Aralsor Lake in the salt marsh. Conversations with local residents, farmers, and Bokeiorda Reserve inspectors revealed that wolf populations are currently not very abundant. Farmers have reported that wolves have not preyed on cattle in recent years. However, we anticipate that with sufficient food supply, wolf numbers may increase in the coming years.

Amidst the ongoing aridification of the Aralsor region and other areas within the Volga-Ural interfluvium, coupled with the resurgence of the saiga population, the white-tailed eagle has adapted its foraging behaviour from primarily fish-based to including saiga as a significant prey item. This shift is attributed to dwindling open water sources and fish populations, alongside the expanding saiga population. Observations indicate that eagles now actively prey on saigas, establishing a novel ecological relationship between the two species. This evolving saiga-eagle interaction could potentially become a foundational component of a sustainable pasture system in the Aralsor region.

Conducted in Kazakhstan research highlights the saiga's reemergence as a pivotal species shaping the landscape. Saiga herds attract various birds of prey, including the steppe eagle (*Aquila nipalensis*), white-tailed eagle (*Haliaeetus albicilla*), griffon vulture (*Gyps*), long-legged buzzard (*Buteo rufinus*), short-eared owl (*Asio flammeus*), and seagulls (*Larus*). The white-tailed eagle, in particular, functions as a crucial aerial sentinel of the saiga steppe ecosystem, underscoring the intricate ecological dynamics in the region.

4 Conclusion

The study underscores the significance of the expanding saiga population in influencing the landscape and ecosystem of the right bank of the Ural River in the West Kazakhstan region. Further investigation is necessary to comprehensively grasp these ecological dynamics and their repercussions on regional ecosystems. In conclusion, the saiga antelopes of the Ural population currently hold significant ecological and landscape-forming importance. To address the emerging conflicts between saigas and agriculture, we recommend the following measures:

1. Establishment of specialised commissions tasked with assessing agriculture damage caused by saigas and the provision of state-funded compensation to affected agricultural producers.

2. Development of cross-border Russian-Kazakh cooperation on saiga conservation. In this direction, on 03/3/2023, the Aralsorsky International Research semi-station was established on the territory of the Aschiozek Nature Reserve and the Bokeiorda Natural Reserve with the participation of the Steppe Institute of the Ural Branch of the Russian Academy of Sciences and the Makhambet Utemisov West Kazakhstan University.

3. Execution of a program for the prudent management of the saiga population, which may involve partial culling during periods of overpopulation.

These steps aim to uphold a delicate equilibrium between biodiversity conservation and the safeguarding of agricultural interests.

Authors' contribution

Investigation, Resources, Writing – Original Draft Preparation *Talgat Begilov*; Review & Editing, Supervision *Yurii Grachev*, *Birlıkbay Yeszhanov*.

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