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О ВЛИЯНИИ «AURORA BOREALES» НА СОЦИО-ЭКОНОМИЧЕСКОЕ РАЗВИТИЕ АРКТИЧЕСКИХ РЕГИОНОВ РОССИИ

ABOUT THE IMPACT OF AURORA BOREALES ON THE SOCIO-ECONOMIC DEVELOPMENT OF THE ARCTIC REGIONS OF RUSSIA

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Аннотация: Арктика как обладатель колоссальных объемов природно-ресурсного потенциала является стратегическим регионом Российской Федерации в части минерально-сырьевой и топливно-энергетической базы. Реализация природно-ресурсного потенциала территорий Арктической зоны наделяет их статусом приоритетных и определяет необходимость формирования отдельного направления арктической политики. Основными задачами которой, является не только необходимость развития транспортной инфраструктуры, обеспечивающей условия для добычи ресурсов, но и создание социо-эколого-экономических условий для комфортной жизни населения. Наряду с экстремальными погодными условиями, влияющими на здоровье населения, необходимо уделить внимание уникальному природному явлению - aurora boreales (северное сияние), которые обладает как положительным, так и отрицательным воздействием на природную экосистему и социо-экономическое развитие Арктики.

Abstract: The Arctic, as the owner of enormous amounts of natural resource potential, is a strategic region of the Russian Federation in terms of mineral resources and fuel and energy resources. The realization of the natural resource potential of the territories of the Arctic zone gives them priority status and determines the need to form a separate direction of Arctic policy. The main objectives of which are not only the need to develop transport infrastructure that provides conditions for resource extraction, but also the creation of socio-ecological and economic conditions for a comfortable life for the population. Along with extreme weather conditions affecting the health of the population, it is necessary to pay attention to a unique natural phenomenon - aurora borealis (northern lights), which has both positive and negative effects on the natural ecosystem and socio-economic development of the Arctic.

Ключевые слова: Арктика, природно-ресурсный потенциал, северное сияние.

Keywords: Arctic, natural resource potential, aurora boreales.

In areas with high latitudes of the Earth, for example, in the extreme northern regions of Russia, an amazing natural phenomenon often occurs — Auroras. When night falls, the dark sky, like a huge curtain, is thrown back, and multicolored rays, like living ribbons, decide to dance in the

fresco. Green light panels, like ghosts, melt easily, periodically mixing with pink and purple auroras. Sometimes they scatter like fireworks, and sometimes they flow like rivulets [1]. This fantastic sight is not only one of the most beautiful masterpieces of nature, but also has a special significance in the culture of countries located near the Arctic Circle, including Russia. In Russian folk legends, the aura was perceived as the fire of the gods or the dance of the souls of the dead. She embodies people's fear of mystical forces and dreams of an unknown world [2]. A deep study of the aura from a scientific point of view is, in fact, the door to the mystery of the interaction of the Earth and the Universe.

Considering the scientific causes of the Aurora, we note that, in essence, the appearance of an aura is a cosmic «party» that takes place in the upper layers of the Earth's atmosphere. The sun, which is constantly radiating tremendous energy, continuously throws huge streams of charged particles into space, which we call the solar wind. When these high-energy particles reach the Earth, they cannot enter the atmosphere directly because the Earth has a powerful magnetic field that acts as an invisible shield [4]. In the polar regions of the Earth, the magnetic field lines are almost perpendicular to the Earth's surface. This creates a «green passage» for solar wind particles that can descend along the magnetic field lines into the upper layers of the Earth's atmosphere.

The upper atmosphere contains atoms and molecules of various gases, such as nitrogen and oxygen [3]. When solar wind particles collide with these atoms and molecules, they transfer their energy to them. The atoms and molecules that have received energy are in an unstable, high-energy state and then return to a low-energy state by emitting photons. It is these photons that make up the light of the aura that we see.

Different atoms and molecules of gases emit light of different colors when excited. For example, excited oxygen atoms usually emit green or red light. Oxygen atoms located at relatively low altitudes (about 100-150 kilometers) mostly form a green aura, while oxygen atoms at higher altitudes (about 200-400 kilometers) tend to emit red light. Excited nitrogen molecules emit blue or violet light.

As for the shape of the aura, it reflects the dynamic process of interaction between the solar wind and the Earth's magnetic field. In the Russian Federation, the natural phenomenon «aurora boreales» can be observed in the Arctic zone (Fig.1).

Figure 1 –The territory of the Arctic zone of the Russian Federation: Nenets, Yamalo-Nenets, Taimyr, Chukotka Autonomous Okrug, Republic of Sakha (Yakutia), Krasnoyarsk Territory, Arkhangelsk and Murmansk regions

The Murmansk Region is located between 68°-70° north latitude, beyond the Arctic Circle, in the north of the Kola Peninsula. The Murmansk Region is one of the most accessible areas in the world for observing aurora boreales, which can be seen more than 150 days a year, due to the influence of the North Atlantic current, winters are relatively mild (-10°C to -15°C). The best viewing platform is the coast of the Barents Sea, the absence of light pollution, the reflection of the aurora in the water.

The Nenets Autonomous Okrug is located at 67°-70° north latitude, adjacent to the Pechora Sea and has a tundra climate. In the district, the polar night lasts from December to January, which allows you to observe aurora boreales around the clock. The Nenets Autonomous Okrug has an undeveloped infrastructure with one regional population center, the city of Naryan-Mar, which hinders the development of the tourist flow to the district.

Yamalo-Nenets Autonomous Okrug is located 66°-73° north latitude, and is the largest gas field in Russia. The aurora boreales part is dominated by a green glow (oxygen atom activity, wavelength 557.7 nm). From the point of view of tourist content, the district is attractive as a Nenets camp, in conditions of extreme temperatures (-40°C).

Krasnoyarsk Territory is located on the Taimyr Peninsula, geographical location: 74°-77° north latitude. This is the northernmost point of mainland Russia. The Arctic base of the professional observatory of Port Dickson is a tourist destination for visiting and observing Aurora Boreales.

The Republic of Sakha (Yakutia) is located in extreme conditions, in which the so-called «poles of cold» are located - the cities of Oymyakon and Verkhoyansk with record temperatures in the Northern Hemisphere (-67.7 °C). On the territory of Yakutia, low humidity reduces cloud cover, which allows you to observe the purple aurora due to active nitrogen molecules. In terms of tourist content, Yakutia is attractive for rock paintings of ancient Asian peoples with symbols resembling the aurora borealis, dating back more than 3,000 years.

In the Arkhangelsk region, Novaya Zemlya is located at a geography of 73°-77°. This is the area of the former USSR nuclear tests. In this regard, there is increased UV radiation due to the ozone hole, which increases the brightness of the aurora.

The Republic of Komi, the natural phenomenon «aurora boreales» can be observed only in the northern part of the taiga, in the city of Vorkuta, on the territory of the Pechora-Ilych Nature Reserve, which is located at 67.5° north latitude.

In the Republic of Karelia, «aurora boreales» can be observed on the southern border in the city of Petrozavodsk, located in the Kandalaksha Bay of the White Sea at 61.8° north latitude with a frequency of 1-2 times a year.

The influence of aurora boreales on nature is great. In terms of the effect on the atmosphere, during the aurora borealis, high-energy particles carried by the solar wind interact with atoms and molecules of gases in the upper atmosphere, releasing a significant amount of energy [5]. This process significantly changes the temperature, density, and chemical composition of the atmosphere. Intense auroras can cause local heating of the upper atmosphere, which in turn affects atmospheric circulation patterns. For example, in the Arctic, changes in atmospheric temperature caused by auroras can disrupt the stability of the polar vortex, which affects the global climate system. In addition, collisions of high-energy particles with gas molecules in the atmosphere lead to ionization or excitation of some of the molecules, changing the chemical composition of the atmosphere. This process can affect the

stability of the ozone layer. Although the impact of a single aurora event on the ozone layer is relatively small, the long-term cumulative effects cannot be ignored.

The impact of «aurora boreales» on ecosystems is reflected in the following. Many animals rely on the Earth's magnetic field for navigation, migration, and foraging. Geomagnetic disturbances caused by auroras can disrupt the ability of animals to perceive the magnetic field. Reindeer, which are typical representatives of the fauna of the Russian North, often deviate from their migration routes during intense auroras. Studies have shown that geomagnetic disturbances can cause errors in the signals perceived by magnetic receptors in the inner ear of deer, which leads to their disorientation. In addition, the activity of some nocturnal animals may also change due to the bright light of the aurora borealis. For example, the behavior of arctic foxes during hunting can be disrupted, as the sudden appearance of the aurora borealis can cause them to miss the optimal time for food production, which affects their survival and reproduction.

There is very little scientific research on the effect of «aurora boreales» on plant growth, but scientists suggest that radiation and changes in the magnetic field caused by the aurora borealis can affect the physiological processes of plants. Changes in radiation during the aurora can change the quality and intensity of light needed for plant photosynthesis, which will affect its effectiveness. At the same time, changes in the magnetic field can disrupt the bioelectric activity and ion transport in plant cells, which can affect the absorption of mineral ions by plant roots, as well as the synthesis and transport of plant hormones, which in turn can affect the growth, development and expression of plant genes. However, additional experiments and observations are needed to confirm this.

Let us note the influence of aurora boreales on the society of the Arctic zone of Russia. In the Russian North, «aurora boreales» has a deep cultural significance. For example, in Russian folk lore it is associated with a fiery serpent ("fiery serpent"), which, according to legend, seduces women in the absence of husbands. The Sami believe that when seeing the northern lights, it is necessary to remain careful and quiet — ridicule or singing can "summon" the aurora and bring disaster. The bright and dynamic colors of the aurora inspire residents to create works of art. His motifs are often found in local paintings, music, and dances.

The impact of aurora boreales on the economy and tourism was noted in the Murmansk Region and the Yamalo-Nenets Autonomous District. Due to their accessibility to observing natural phenomena, these territories have become the most popular in terms of tourists from Russia and other countries. This stimulates the growth of the hotel business, catering, transport and souvenir industries, creating new jobs and income for local residents. Northern Lights increases the global visibility of the Russian North, helping to attract investment and develop infrastructure.

The natural phenomenon «aurora boreales» has an impact on the daily life and psychology of Northerners, adding brightness to the lives of northerners, especially during the long polar night, giving aesthetic pleasure and emotional support. The beauty and mystery of the aurora evoke a sense of awe, making you think about the greatness of nature and the place of man in it, which positively affects the psychological state of the inhabitants.

In terms of scientific research, «aurora boreales» allows scientists to study geomagnetic phenomena, solar activity, and atmospheric physics. Schools and research centers in the region regularly organize observations, contributing to the training of new specialists. So, the Aurora Borealis is a unique natural phenomenon that has both positive and negative effects on nature and

residents of the northern regions of Russia. In this regard, it is necessary to conduct further research to better understand the mechanisms of aurora's interaction with the environment, as well as to develop methods to prevent or minimize its negative impact.

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