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Research on the impact of optimizing the use of grassland resources on promoting the development of animal husbandry on the Qinghai-Tibetan Plateau

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Abstract. The Qinghai Tibet Plateau, located in central Asia, is the highest plateau region in the world with an average altitude of over 4000 meters. Due to its unique geographical location and high altitude characteristics, the Qinghai Tibet Plateau is sometimes vividly referred to as the "Roof of the World", and thus has been given the nickname "Third Pole". The Qinghai Tibet Plateau provides a good foundation for the development of animal husbandry, but at the same time, due to the harsh climate conditions and degradation of grassland resources on the Qinghai Tibet Plateau, the development of animal husbandry is also facing a series of challenges. In order to increase the content of forage on the Qinghai Tibet Plateau and enrich its grassland resources. This article uses literature research method to conduct environmental analysis on animal husbandry in the Qinghai Tibet Plateau and other countries such as the United States. Comparative research method is used to analyze the differences in the development of animal husbandry in the Qinghai Tibet Plateau and other countries such as the United States. Interdisciplinary research method is used to propose solutions for the development of animal husbandry in the Qinghai Tibet Plateau (mainly for grassland development). That is, by selecting suitable grass species, establishing a "grazing light complementary" photovoltaic power station, and implementing grassland protection monitoring technology. Finally, the conclusions and shortcomings of the research were obtained

Keywords: grassland resource degradation, select suitable grass species, implement grassland protection monitoring technology

1. Introduction

The grassland resources of the Tibetan Plateau, the "third pole", provide conditions for the development of animal husbandry [1].

This paper focuses on promoting the development of animal husbandry by enriching grassland resources on the Qinghai-Tibetan Plateau. Previous researchers have promoted the development of animal husbandry by means of water protection, policy support and technological innovation, but this has also been accompanied by problems such as overgrazing and degradation of grassland resources. Both domestically and abroad, research on grassland resources has focused on the sustainability of grassland ecosystems, and international cooperation is increasing in the field of research on grassland resources. Many countries and international organizations are conducting cooperative research and

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sharing data and experiences to solve the global grassland degradation and ecological problems. This paper proposes a solution to the development of grassland resources on the Tibetan Plateau, which can be achieved by selecting and breeding adapted grass species, establishing "pasture-photovoltaic" photovoltaic power plants, and implementing grassland protection and detection technologies. The productivity of grasslands on the Tibetan Plateau has been improved, thereby increasing the theoretical carrying capacity of the Tibetan Plateau and promoting the development of animal husbandry on the Tibetan Plateau.

2. Environmental analysis of animal husbandry on the Tibetan Plateau

2.1. Disadvantages of livestock development on the Tibetan Plateau

2.1.1. Harsh climatic conditions. The Tibetan Plateau has a high altitude, a thin atmosphere, intense solar radiation and long hours of sunshine. However, the Tibetan Plateau has low temperatures and low cumulative temperature is low, resulting in a short growth cycle and low vegetation cover, limiting the growth and yield of pasture grasses, which in turn affects pasture forage supply of grasses. The 2018 near-surface air temperature map of the Tibetan Plateau is shown in Figure 1.Figure 2 shows the spatial distribution of annual precipitation on the Tibetan Plateau in 2100.

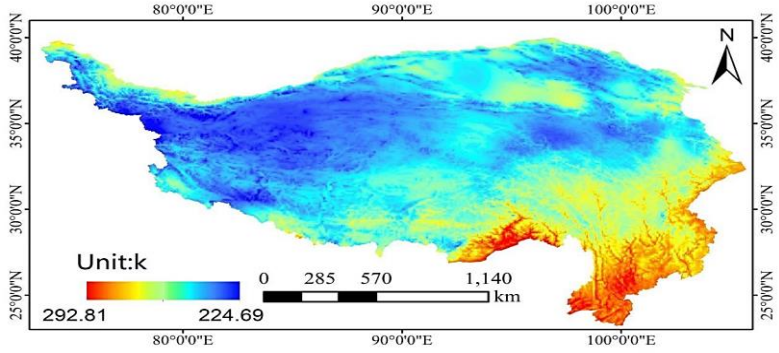

Figure 1. Map of 2018 near-surface air temperatures on the Tibetan Plateau

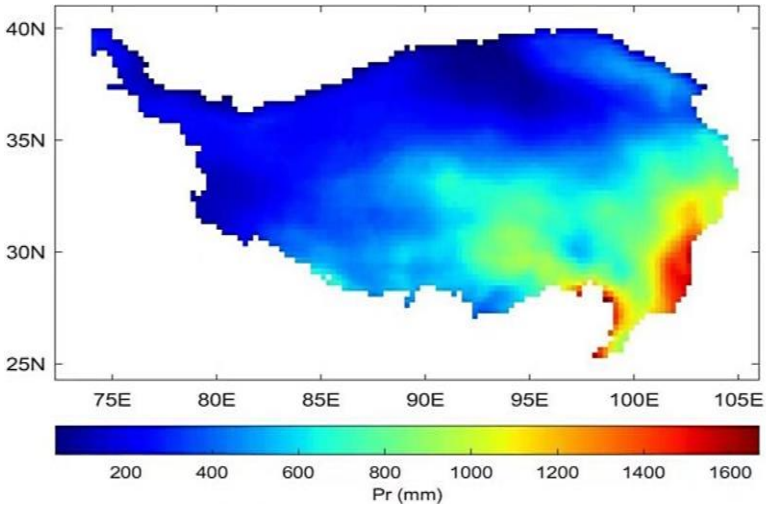

Figure 2. Spatial distribution of annual precipitation on the Tibetan Plateau in 2100.

2.1.2. Degradation of grassland resources. Climatic conditions make grassland resources scarce on the Tibetan Plateau, and overgrazing is also an important cause of grassland degradation. Excessive

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livestock nibbling by domestic animals destroys the natural growth cycle of grassland, affecting the normal renewal of vegetation and soil stability. In addition to overgrazing, the irrational land management and utilization have also led to the degradation of grasslands on the Tibetan Plateau, destroying the ecological balance of the grasslands.

Taking the Sanjiangyuan area of the Qinghai-Tibet Plateau as an example, from the mid-to-late 1970s to the present, the area of moderately degraded grassland in the Sanjiangyuan area has reached 5.72×10^4 km^2 , accounting for 55.40% of the usable grassland. By the end of 1990s, the degraded and sandy area had reached 40% of the total area of Qinghai-Tibet Plateau. As of 2007, the degraded area of grassland in the Gansu section of the upper reaches of the Yellow River reached 2.32×10^4 km^2 , accounting for more than 50% of the available grassland area. It is also reported that in the past 20 years, nearly 5×10^5 km^2 of grassland in the Qinghai-Tibet Plateau has been degraded, resulting in a 30% decrease in productivity [2]. The total grass production in 2018 on the Tibetan Plateau is shown in Figure 3.

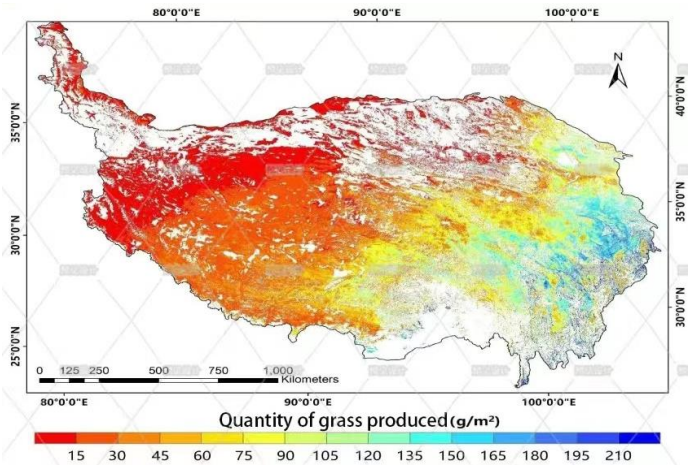

Figure 3. Distribution of total grass production on the Tibetan Plateau in 2018

2.1.3. Limited technology and management levels. Livestock production technology on the Tibetan Plateau is relatively backward and relies on traditional grazing methods. The traditional grazing method on the Tibetan Plateau is nomadic grazing. This type of grazing means that herders move freely on the grasslands with their livestock, choosing their grazing sites according to the season and the condition of the grasslands. In the summer, herders will take their livestock high up in the mountains to graze, while in the winter, they will go down to lower altitudes to find suitable grasslands. Nomadic grazing is characterized by its flexibility and its ability to make full use of grassland resources, while at the same time ensuring the health of domestic animals. But this grazing method also has certain defects. This mode of production is more restricted by the natural environment, and the production efficiency is low, making it difficult to meet the market demand. Farmers and herdsmen in the Tibetan Plateau region generally lack modern management experience and skills, leading to waste of resources and management chaos in the livestock production process, affecting production efficiency and product quality. However, with the development of society and changes in the ecological environment, grazing practices on the Tibetan Plateau have been adapted and adjusted.

2.2. Advantages of livestock development on the Qinghai-Tibetan Plateau

2.2.1. Unique livestock breeds. The Tibetan Plateau has some unique livestock breeds, such as Tibetan sheep and yaks. These livestock are adapted to the alpine and oxygen-poor environment, and have the characteristics of tolerance to rough fodder, hunger and thirst, slow growth, etc. Their meat is delicious and their dairy products have high nutritional value, which is very popular among consumers. Taking Maqu County on the Qinghai Tibet Plateau as an example, in 2020, the year-end inventory of various livestock in Maqu County was 840400, a decrease of 0.6% compared to the previous year; The number

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of large livestock was 486300, an increase of 1.7% compared to the previous year; The number of sheep was 354100, a decrease of 3.6% from the previous year; The survival rate of various types of livestock was 97.52%, an increase of 0.29% compared to the previous year; The total growth rate of various types of livestock was 43.55%, an increase of 4.11% compared to the previous year.

2.2.2. Traditional cultural support. Herders in the Tibetan Plateau region have been making a living from animal husbandry for generations, and have accumulated a wealth of farming experience and skills. This traditional culture provides a solid support for the local animal husbandry development provides a solid support, and at the same time gives livestock products unique cultural connotations and values. To collaborate with local farmers and herdsmen, discover each other's wisdom, understand each other's thoughts, and seek understanding and consensus between different cultures and values. We cannot simply abandon the traditional development concept of Zhongshi. To transform the characteristics of disadvantages into advantages for development, and to find development methods that are suitable for local characteristics [3].

2.2.3. Policy support and assistance. In order to promote economic development in the Tibetan Plateau region, the government has introduced a series of supportive policies, such as tax exemptions, and loan support, and infrastructure development. support, and strengthening infrastructure construction. These policies have provided a favorable external environment for the development of the livestock industry.

2.2.4. Growing market demand. With the improvement of people's living standards and the pursuit of healthy diet, the demand for green and organic livestock products from the Qinghai-Tibet Plateau region is is growing. This provides a broad market space and development opportunities for the development of the local livestock industry. Taking Maqu County on the Qinghai Tibet Plateau as an example, in 2020, there were 413000 various livestock commodities in Maqu County, a decrease of 6.2% compared to the previous year; The total meat production was 21700 tons, a decrease of 6.9% from the previous year; The milk production was 44500 tons, an increase of 13.5% compared to the previous year; The production of sheep wool was 354 tons, a decrease of 3.5% from the previous year.

3. Environmental analysis of countries such as the United States, Australia, and Northern Europe

3.1. Advantages of developing grass industry

(1) Rich natural resources: These countries have vast grassland resources and sufficient water and thermal conditions, providing a good natural foundation for the growth of grassland industry.

(2) High contribution rate of technology: Grassland and animal husbandry are often capital intensive and technology intensive industries in these countries, and the contribution rate of technology to industrial development is relatively high. This means that advanced technology and equipment may be used in various stages from planting, management to harvesting, improving efficiency and yield.

(3) Policy support: These countries often have a sound policy system to support the development of grassland industry, including subsidies, tax incentives, scientific research investment, etc., all of which are conducive to the long-term stable development of grassland industry [4].

(4) High degree of marketization: The production and operation of these countries are market-oriented, with a high degree of liberalization, intensification, and scale. This helps to form an effective supply-demand relationship and promote the healthy development of the industry.

3.2. The advantages of developing centralized scale aquaculture

(1) Highly mechanized: These countries have achieved a high degree of mechanization in the agricultural sector, which greatly improves production efficiency.

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(2) Breeding of varieties: Countries such as the United States and Australia attach great importance to the breeding of varieties and have specialized breeding companies dedicated to cultivating high-quality varieties with high yield and high survival rate.

(3) Technological innovation: Technology plays an important role in the development of modern agriculture. The innovation in aquaculture technology and equipment in these countries, such as the application of intelligent management systems, has further improved aquaculture efficiency and product quality [5].

3.3. The difference in the development of animal husbandry between the Qinghai Tibet Plateau and countries such as the United States

(1) Natural limitations: The Qinghai Tibet Plateau is located in a high-altitude region with harsh climate conditions and a short growing season, which limits the growth of vegetation and the productivity of grasslands. At the same time, the soil type and precipitation in plateau areas also affect the growth of crops and forage, which restricts the development of grass planting and animal husbandry to a certain extent.

4. Technical lines of research and development

4.1. Selection of suitable grass species

4.1.1. Survey of grass species resources

(1) Conduct a comprehensive survey of grass resources in the Tibetan Plateau region to understand the climate and soil conditions of different regions, as well as the growing conditions of local grass species.

(2) Fieldwork was conducted on different grassland types on the Tibetan Plateau to record and collect samples of different grass species for species identification and diversity analysis. This includes detailed investigation and classification of grass species in major grassland types such as alpine meadows and alpine grasslands.

(3) By monitoring the rejuvenation and wilting periods of dominant grass species, record the air temperature, precipitation, soil temperature and soil moisture and other environmental factors and analyzing the effects of these factors on the growth cycle of grass species [2].

4.1.2. Research on grass seed selection and breeding. Use of modern biotechnology, such as gene editing and cross-breeding, to improve the adaptability and productivity of grass species.

(1) Using gene editing technologies such as CRISPR/Cas9, key genes of grass species are precisely edited to improve their cold resistance, growth rate and yield.

(2) Through transgenic technology, exogenous genes with specific functions are introduced into grass species to give them new traits such as cold tolerance, high yield.

(3) Utilizing molecular marker technology to rapidly screen out grass species with excellent traits such as cold resistance and high yield and improve breeding efficiency.

4.2. Establishment of "pastoral-photovoltaic" photovoltaic power plants

The "pastoral-photovoltaic complementary" model refers to the installation of photovoltaic power stations in grassland pastures, the use of solar panels for photovoltaic power generation, planting pasture under the panels, raising livestock production mode, that is, the coupling of animal husbandry and photovoltaic power generation. The schematic diagram of the "Mu Guang Complementary" photovoltaic power station is shown in Figure 4.

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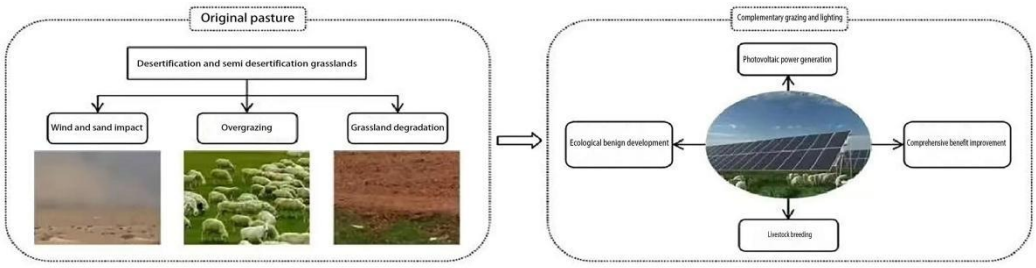

Figure 4. Schematic diagram of "Mu Guang Complementary" photovoltaic power station

4.2.1. Effectiveness of "pastoral-photovoltaic" photovoltaic power plants

(1) Solar panels block air movement; solar panels block light, reduce evaporation, increase soil moisture and promote vegetation recovery; photovoltaic industry provides energy for the local area, which is conducive to vegetation protection.

(2) Herds nibble overgrown grass, reducing the shading of the panels by weeds and improving power generation efficiency; photovoltaic power generation and grazing sheep coexist, which can improve the land utilization rate; herds clean up weeds, reduce the cost of manual maintenance, and reduce the risk of fire, etc. [6].

(3) Located in the alpine zone of Qinghai-Tibet Plateau, the ecology is fragile, and the photovoltaic support is 1.5 meters above the ground to provide space for vegetation restoration, and to reduce the impact of vegetation restoration. It also reduces the impact of vegetation recovery on power generation, and the design of pile foundation with different heights avoids extensive land leveling, which is favorable to the growth of original vegetation on the ground. The renderings of the "Mu Guang Complementary" power station are shown in Figures 5.

Figure 5. The renderings of the "Mu Guang Complementary" power station

4.3. Implementation of grassland conservation monitoring techniques

(1) Remote sensing monitoring technology: The use of satellite remote sensing data for long-term monitoring of changes in grassland cover can help scientists to understand the extent and rate of grassland degradation and the effectiveness of restoration measures. By comparing remote sensing images from different time periods, it is possible to assess the trend of changes in the health of grassland ecosystems.

(2) Geographic Information System (GIS): GIS technology is used to collect, manage and analyze geospatial data, which can help researchers accurately map the distribution of grasslands on the Tibetan Plateau, analyze the spatial distribution of grassland degradation characteristics, and develop targeted protection and recovery strategies.

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(3) Ground Observation and Sampling: By setting up fixed sample plots in the grassland, field observation and sample collection of vegetation cover, species diversity, soil fertility and other indicators will be carried out regularly to obtain direct data on the health of the grassland ecosystem.

(4) Ecological model simulation: establish the ecosystem model of grassland and simulate the impact of different management measures on grassland ecosystem through computer to predict the trend of grassland change in the future, and provide scientific basis for the protection and management of grassland.

5. Conclusions and shortcomings of the study

Although this article has conducted an environmental analysis of the livestock industry on the Qinghai Tibet Plateau, it has conducted theoretical research and sorting out the disadvantages and advantages of the development of livestock industry on the Qinghai Tibet Plateau, elaborated on the current situation of the development of livestock industry on the Qinghai Tibet Plateau, and conducted an environmental analysis of livestock industry in countries such as the United States, Australia, and Northern Europe, proposing suggestions that are conducive to the green development of livestock industry on the Qinghai Tibet Plateau. However, due to the complexity and specificity of the research itself, the special plateau environment has led to numerous limitations and uncontrollable factors in the research. In addition, the time constraints of the research and my limited knowledge level make it difficult to obtain some information and data, resulting in insufficient depth in the research paper and still having shortcomings: **Firstly**, due to the complex terrain and harsh environment in plateau areas, it is difficult to conduct field investigations and data collection. This has resulted in some key data missing, limiting the depth and breadth of research in the region. **Secondly**, although some studies have focused on the impact of climate change on the Qinghai Tibet Plateau, there is still a need for more in-depth research on the climate system, ecosystem changes, and their contributions and responses to global change in this region in the future. **Thirdly**, there is insufficient research on some key and difficult issues in the green development of grassland animal husbandry in the Qinghai Tibet Plateau, such as precise livestock carrying capacity, precise classification of high-quality livestock and grass species. The resolution of these issues constitutes the author's future research prospects [7].

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