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The Vulnerability of Animal Husbandry to Snowstorms as a Result of Climate Change

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Abstract

Creature cultivation is a prevailing and customary wellspring of work and pay. One of the most common snow disaster areas in the world is the Qinghai-Tibetan Plateau, which is the third largest snow-covered area in China. Therefore, the issue of the animal husbandry industry's vulnerability to snow disasters must be addressed immediately for the purpose of disaster mitigation and adaptation in light of the increasing likelihood of these disasters occurring as a result of future climate change. However, very little research has been done on the animal husbandry's vulnerability on the Qinghai-Tibetan Plateau. The purpose of this assessment is to determine the spatial scale of animal husbandry's vulnerability and the causes of that vulnerability for the purposes of adaptive planning and disaster mitigation. First, the characteristics of previous snow disasters have been looked at and used to calculate the spatial weight for assessing vulnerability. Second, a model and indicator system for indicator-based vulnerability assessment has been developed. In an integrated vulnerability index, we combined the risk of snow hazard, livestock sensitivity to disaster, physical exposure to disaster, and community adaptability to snow disaster. Last but not least, the Qinghai-Tibetan Plateau's animal husbandry's vulnerability to snow disaster has been evaluated. According to the findings, the eastern and central plateaus have the greatest concentration of high vulnerabilities, while the vulnerability gradually decreases from the east to the west. Over the past few decades, the trend toward vulnerability has somewhat abated as a result of global warming. High vulnerability is primarily caused by a lack of livestock barns and forage, exposure to blizzard-prone regions, and high livestock density. In the conclusion, the significance of the local government and community's assistance to pastoralists in reducing their vulnerability to the snow disaster and frozen hazard is emphasized. This paper's methods can be used to effectively reduce vulnerability to natural hazards in other regions, improve resilience, and mitigate snow disasters.

Keywords: Creature cultivation; Animal husbandry; Vulnerability; Pastoralists

Introduction

The snow disaster, which is a type of cryospheric hazard, is one of the major natural disasters that is getting worse, especially with more uncertainties and changes due to faster global warming. A blizzard is an extreme weather condition marked by a sudden drop in temperature and a powerful storm that dumps a lot of snow, especially in pastoral areas. This causes a frozen disaster with no forage and livestock deaths. Vulnerability of animal husbandry is the degree of risk and consequences of a frozen disaster, susceptibility and inability to cope with adverse effects, particularly the shocks and stresses experienced by socio-ecological systems under the changing frequency and severity of disasters with climate change [1]. This is a critical inherent characteristic of animal husbandry to combat snow disaster. Disaster is a common topic in catastrophology, and there is a lot of research done on it. If disaster is looked at alone, it is a common topic. By forecasting the economic losses and impact extent of disasters, the vulnerability assessment of animal husbandry to snow disaster emphasizes the degree of inability to adapt to extreme weather and disaster risks.

In mountainous and arid/semiarid regions, animal husbandry is a vital economic sector that heavily relies on natural or cultivated pasture resources for livestock forage. Climate regimes have a direct impact on the dynamics and biomass of vegetation, as well as the carrying capacity, scale, and structure of livestock. As a result, they have a significant impact in regions that are heavily dependent on animal husbandry. A growing number of studies in recent years have demonstrated that the frequency of extremes, severity, and damage caused by natural disasters have steadily increased over the past few decades and are expected to continue in the coming decades, increasing risks and losses and enhancing vulnerabilities in every system on Earth [2]. Spatially, the areas with a relatively high risk of disaster are always those with a high frequency of disaster outbreaks, a wide range of climates, a high level of exposure and vulnerability for people and livestock, and a poor capacity to adapt to extreme events. For this reason, it is necessary to conduct a spatial analysis of the natural disaster distribution pattern in order to evaluate the vulnerability of animal husbandry and suggest efficient adaptations.

Along with assessing losses at risk from natural disaster, key aspects of vulnerability assessment include comprehending and illustrating vulnerability. Vulnerability determines these losses and risks. From fighting disaster, there are two basic definitions of vulnerability. I) emphasizing the extent of a system's damage caused by a disaster. The degree of exposure, such as livestock density, population, distance from the disaster or risk, etc., is the central issue in animal husbandry in this situation. And the system's adaptability to a variety of impacts and frequency of disasters. However, the capacity for adaptation and resilience to disasters is frequently overlooked. II) Viewing vulnerability as an existing condition prior to the onset of disaster, which stems from the inherent characteristics of animal husbandry systems? As a result, the primary focus is on examining the structural aspects of animal

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husbandry that are affected by disasters in a specific location [3]. In recent years, vulnerability hotspots have emerged around the concepts of sensitivity and resilience, both of which are becoming increasingly accepted.

The idea that sensitivity is the intrinsic degree to which system elements are likely to be influenced by extrinsic shocks of hazards, as well as the dependence on a specific driver and its importance to a sector, such as the animal husbandry sector, is widely accepted in recent years, despite the fact that sensitivity varies widely between research fields and research perspectives. Sensitivity typically correlates with a system's resilience and adaptability because it is an essential property. One definition of resilience is: I) the amount of time it takes for a system to recover from its impacted state to its unaffected initial stage, and II) the volume of external impacts it takes in from its current state to its next one. Rose defined resilience as the internal preventive and adaptive capacity for avoiding shocks and losses in a disaster [4]. She also defined resilience as the time spent recovering from a disaster to the unaffected initial stage at the lowest cost. Resilience is mostly viewed from three perspectives: resilience as stability, recovery, and transformation are all aspects of resilience. According to Dong, resilience is, in general, a system, community, or organization's capacity to withstand loss or damage and recover from the effects of a crisis or disaster.

Vulnerability is viewed from three perspectives: vulnerability as a "state," vulnerability as a component of a community, and vulnerability to a hazard Vulnerability is broadly defined as the frequency, magnitude, timing, and intensity of a community's exposure to a natural hazard in the field of natural hazard studies. As a result, the most important indicators for determining a system's resilience are the time and financial costs associated with disaster recovery. The vulnerability is relatively high due to the high time and economic costs. One of the most important characteristics of vulnerability from the perspective of disaster recovery is the social capacity to prevent and reduce shocks and losses during or after a disaster. The importance of social collective intelligence and the abundance of resources for disaster prevention are emphasized [5]. Considered to be an essential means of reducing vulnerability is the creation of favourable social system conditions, such as the construction of a barn or greenhouse or the storage of forage for the winter. In general, vulnerability is frequently thought to be the result of sensitivity, exposure, resilience, or capacity for adaptation, and has a strong connection to the magnitude and frequency of disasters or risks. With the broadening of the research field and the increasing emphasis on social issues, its concept and implications are evolving.

Despite the fact that it is challenging to clearly and precisely distinguish and defines vulnerability, it is possible to some extent to depict and measure it using a variety of approaches to characterize its magnitude and extent. "Vulnerability could be quantified," Arnell stated. Vulnerability and risk assessments have seen significant development in recent years as demand for risk identification and evaluation has grown. It is a useful tool that can be used to predict potential effects on coupled animal husbandry environment systems, support targeted interventions, and inform and direct policy decision-making [6]. Disaster risk, livestock structure, food security, linkages between vulnerability, adaptation, and resilience, livelihood and animal husbandry-environment sustainability, climate change adaptation and mitigation, and other topics are covered in vulnerability assessment, which ranges from individual indicator modelling analysis to combined multifactor evaluation. Dong, for instance, has looked at how vulnerable pastoralism is to global change. In vulnerability-related assessment, numerous developed methodologies are utilized. The Analytical Hierarchy Process is frequently utilized for weighting indicators in order to examine how each index contributes to the overall risk or vulnerability and determine the weight coefficient for each index. The risk of a snow disaster in the pastoral areas of the Qinghai-Tibet Plateau was assessed after Liu weighted the indicators [7]. Wang depicted the flood risk by weighting the four risk indices of disasters caused by glacial lake outburst floods in the Chinese Himalaya. When it comes to assessment modelling, indicator-based models like Artificial Neural Networks and Logistic Regression, for instance, offer some advantages over traditional evaluation criteria equations. Wu used back-propagation ANN to assess the danger posed by heavy snowfall disasters in Inner Mongolia, achieving improved performance through ANN. Ettinger improved the evaluation model and estimated the probability of damage from the qualitative vulnerability assessment using logistic regression [8]. To recognize the circumstances and logical results chains of weakness, component based assessment systems, e.g., Strain State-Reaction structure, are generally utilized in evaluation as the nearby coordinated factors between pointers. Utilization of remote sensing and GIS geospatial techniques, as well as integrated vulnerability index and vulnerability model based on assessment indicator systems, has increased recently. For estimating a system's risk and preventing and mitigating disasters, vulnerability assessment is gradually becoming an essential and effective tool and judging criterion.

One of China's most important pastoral regions is the Qinghai-Tibetan Plateau, which includes the two major pastoral provinces of Qinghai and Tibet Autonomous Region. In QTP, animal husbandry is the predominant traditional means of earning a living, contributes a significant amount to the gross domestic product, and is extremely important to the locals. The majority of the QTP is plateau cold or sub-frigid, with annual mean temperatures below 0 °C and an average elevation above 4000 m [9]. In addition to the snow-covered Altai Mountains in northwest China and the northeast China snow zone, the QTP is China's third largest snow-covered area. Additionally, it is a significant snow disaster area worldwide. There are a lot of days with snow, freezing, and strong winds, especially in the winter and spring. The primary causes of the snow disaster in animal husbandry are the sudden drop in temperature following snowfall, which is also accompanied by strong winds and makes it difficult for livestock to graze on snow-covered grass [10, 11]. Ma evaluated the risk of snow cover using daily air temperature and precipitation data from weather stations for the QTP's snow risk assessment. He came to the conclusion that the majority of stations with "at-risk" accumulated snow were situated on the southern and eastern edges of the QTP. Using 18 snow disaster indexes weighted using the AHP method, Liu analyzed the QTP's snow risk and came to the conclusion that the central QTP's high-altitude areas were more at risk than the plateau's edges [12, 13]. Yeh used the Nagqu prefecture as the area for the questionnaire in the QTP. There, she looked at how the political ecology strategies of local pastoralists had changed. She thought that changes in mobility and labor power were the main reasons pastoralists were vulnerable to climate change. The risk of a snow disaster has begun to garner attention as a result of these studies, which have presented a fundamental framework for vulnerability research on the QTP. Sadly, very little research has been done on the QTP's vulnerability to animal husbandry from a snow disaster perspective, especially in the context of accelerated warming.

In this study, we use the QTP as a whole as the unit of evaluation. Our goal is to find out how and where snow disasters have happened in the QTP in the past, from 1961 to 2015, and how much they affect animal husbandry and how vulnerable it is to snow disasters from a QTP disaster perspective. First, the spatiotemporal characteristics of previous snow disasters are examined for the purpose of determining the vulnerability. Second, a four-part vulnerability assessment indicator system is established: potential snow disaster hazard, livestock sensitivity to disaster, physical exposure, and adaptive capacity. The integrated vulnerability index and frozen index assessment models are then developed. Finally, the driving factors are examined and the degree of vulnerability is measured using the integrated index method and GIS technology [14, 15]. The study provided data for snow hazard analysis, exposure assessment, and sector vulnerability assessments. In addition, it demonstrated significant theoretical references to disaster mitigation and prevention, as well as to the ability of animal husbandry in other regions to adapt to snow disasters and adaptive climate change planning.

Conclusions

By combining risk of snow hazard, livestock sensitivity to disaster, physical exposure to disaster, and community capacity to adapt to snow disaster into an integrated vulnerability index using GIS spatial analysis techniques, this paper has quantified vulnerability to snow disaster using an indicator-based assessing model and evaluation system.

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