

Analysis of Land Degradation and Its Impact on China's Food Security

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Abstract: Land degradation is an important problem facing the world. China's attention and scientific research on land degradation started relatively late, and it is still in the process of understanding and deepening in many aspects. Important scientific issues such as the concept of land degradation, the causes and classification of degradation, the monitoring indicators and means of degradation, the evaluation system and the early warning mechanism are still in the early stage of discussion, and the academic circles at home and abroad are still in the stage of controversial exploration in many aspects, and no general consensus has been formed so far. Therefore, through the research and analysis of domestic and foreign literature, this paper summarized the meaning of land degradation, analyzed the current situation of land degradation research and the impact of land degradation on China's food security, in order to provide scientific basis for land degradation prevention and management, and provide decision-making basis for improving the quantity and quality of arable land in China and ensuring food security.

Keywords: Land degradation, Problem analysis, Meaning, Current situation, Food security.

1. Introduction

As the material basis for human survival and development, land resources are the source of all production and all existence, the conditions of existence and reproduction that cannot be transferred, and the necessary means of labor for social production. The quantity, quality and distribution of land resources determine the population load of land and the quality of people's average life [1]. Land quality status is an important factor in protecting biodiversity and maintaining the stable output of ecosystem services [2]. Yet land degradation is getting worse. Land degradation has become an important global issue and is central to the survival and development of human beings and other life forms.

The problem of land degradation is accompanied by the survival and reproduction of human beings. In the process of land quality forward development and succession, there is also a process of reverse degradation. Only with the rapid increase of population, people's living environment and conditions are increasingly constrained by the shortage of land resources and quality degradation, and the world has paid special attention to the problem of land degradation. Currently, 33% of the world's land is moderately to highly degraded, and against the backdrop of increasingly frequent, intense, and widespread extreme weather events caused by global warming, future climate change will further exacerbate land degradation, affect food security, threaten biodiversity and water resources, and land degradation will in turn exacerbate climate change. The land sector bears the dual challenge of adapting to and mitigating climate change [3-4]. In addition, there is a strong correlation between land degradation issues and food safety, living environment safety, and economic development in impoverished areas. Therefore, the widespread and interconnected nature of land degradation has had irreversible impacts on a global scale, and has become a

major issue that humanity must face and urgently need to solve. This study mainly discusses the current global issues of land degradation, the current status of land degradation research, and its impact on global food security.

2. The Meaning of Land Degradation

As early as the 1970s, FAO put forward the concept of "land degradation". Due to the relatively late start of the concern and scientific research on land degradation, it is still in the process of understanding and deepening in many aspects. For the important scientific issues such as the concept of land degradation, the causes and classification of degradation, the monitoring and means of degradation indicators, the evaluation system and the early warning mechanism, It is still in the early stage of discussion, and the academic circles at home and abroad are still in the stage of controversial exploration in many aspects, so far there is no general consensus and perfect system. The 1994 United Nations Convention to Combat Desertification defines land degradation as follows: "Land degradation" means the reduction or loss of biological or economic productivity and complexity of rain-irrigated, irrigated or grassland, rangeland, forest and woodlands in arid, semi-arid and arid subhumid areas as a result of the use of land or as a result of a force (natural force) or a combination of forces, including: (1) loss of soil material through wind erosion and water erosion; (2) degradation of physical, chemical and biological or economic properties of soil; (3) Long-term loss of natural vegetation. Since then, different scholars have given different definitions of land degradation from different perspectives, which can be summarized as follows: land degradation refers to the decline of land productivity and utilization value under the influence of adverse natural factors and unreasonable use of land by human beings [5]. Two key aspects need to be highlighted: first, there must be a significant decline in the productivity of

the land system, and second, this decline is the result of human activity or adverse natural events. The concept of land degradation not only defines the causes of degradation, but also includes two aspects of the harm degree of degradation.

As a loose surface layer on the Earth's land surface that can produce plant harvests, soil degradation generally refers to the process of causing agricultural production capacity or land use and environmental regulation potential of the soil under the influence of various natural, especially human factors, that is, soil quality and its sustainable decline (including temporary and permanent), or even complete loss of its physical, chemical, and biological characteristics [6]. Soil degradation, including past, present and future degradation processes, is the core part of land degradation. To put it simply, soil degradation includes both quantity reduction and quality reduction.

Based on the opinions of many experts at home and abroad, there are grounds and reasons to believe that land degradation refers to the process of land quality decline or even desertification caused by human unreasonable development and utilization of land. The main content includes forest destruction and decline, grassland degradation, water resource degradation, and soil fertility decline, etc. The land scope includes not only arable land, but also forest land, grassland, and all other land use categories with regenerative ability.

3. Current Status of Land Degradation Research

Land degradation is by no means a new phenomenon, it is accompanied by the development of human society, land degradation has been going on, and many ancient civilizations and ancient civilizations are closely related to land degradation. In modern times, the problem of soil and land degradation worldwide caused by various unreasonable human activities has become increasingly serious, which has seriously threatened the sustainability of world agricultural development [7]. Nowadays, land degradation caused by human activities poses a threat to the livelihoods of about 2/5 of the global population. At the same time, frequent issues such as food security and environmental damage caused by land degradation have posed global challenges and become a major issue that humanity urgently needs to address [8].

Land degradation is the result of the interaction between the natural environment and human activities. The unreasonable development and utilization of land by natural forces or human beings lead to the decline of land quality and productivity, and the two pressures drive each other to cause different land degradation processes. Drought, flood, wind, rainstorm, sea tide and other natural forces as well as inappropriate reclamation and random cutting by human beings, unreasonable planting system and irrigation, and improper use of pesticides and fertilizers will all cause land desertification, soil erosion, soil salinization, soil fertility decline, soil pollution and other degradation types [9,10]. Due to the continuous expansion of population and the increasing demand for land use, the structure and quality of land have undergone non-benign changes, and the continuous demand for land development and utilization has intensified the land degradation process. The global soil chemical degradation includes soil nutrient attenuation, salinization, acidification, pollution and other types, affecting a total area of 2.4 million km². The main driving factors of degradation are the irrational

use of agriculture and the destruction of forests. The total area of physically degraded soil in the world is about 830,000 km², mainly concentrated in temperate zones, and most of it is related to the compaction of agricultural machinery [11].

After consulting relevant data, the total land degradation area in China accounts for 40% of the total land degradation area in the country, equivalent to 1/4 of the total land degradation area in the world [12]. Among them, the total area of soil and water loss accounts for 1/6 of the total land area (and some data show that it is 1/3), the annual loss of soil is about 500,000 tons, and the loss of soil nutrients is equivalent to 1/2 of the total national fertilizer production, polluting rivers and lakes. The Loess Plateau in the northwest, the red soil autumn forest area in the south and the black soil area in the northeast belong to the serious soil erosion area. The total area of desertification accounts for 11.4% of the total land area [13]. The grassland degradation area accounted for 21.4% of the total grassland area of the country, which mainly occurred in some agricultural and pastoral areas in the west and northwest. Soil environmental pollution has become increasingly serious. In the early 1990s, the farmland area polluted by three industrial wastes was equivalent to the entire cultivated land area of 50 major agricultural counties [14]. Land degradation has not been effectively curbed yet, and its development speed is surprising. Due to the wide range of degradation areas in China, land degradation has different manifestations in different regions, of which North China is mainly salinized, northwest is mainly Desertification, southwest is mainly mountainous stony, east is mainly barren and polluted, loess plateau and the middle and upper reaches of the Yangtze River are mainly water and soil loss, and Qinghai Tibet plateau is mainly frozen and poor soil. These land degradation accounts for 1/4 of the total global degradation area [15].

The high-yield fields in China, which can be described as flat land, deep soil layer, good water supply and drainage, fertile soil, and without obvious obstacles, are approximately less than 1/4 of the total arable land area [16]. According to the quality and productivity level of cultivated land, high yielding land accounts for 22%, medium producing areas account for 37%, and low yielding land accounts for 41%; The arable land area threatened by destructive natural factors is approximately 529000 square kilometers, accounting for 40% of the total arable land area; Among them, 86% of the arable land is affected by soil erosion, 9% is salinized, and 5% is sandy. Soil erosion is the main factor among destructive factors [13]. Water scarcity and drought are also important limiting factors affecting the development of agriculture in China. According to statistics, the total area of arid and water deficient arable land in China is 424300 square kilometers, accounting for 32% of the total arable land area [17].

4. The Impact of Land Degradation on China's Food Security

One of the most serious problems faced by Chinese agriculture is the large population and limited arable land. The heavy burden of future food production development will mainly be on the almost no choice choice but to continuously increase the yield per unit area. Effectively controlling land degradation is an important measure to implement the strategy of storing grain in the land and storing grain in technology, and to ensure national food security. It has significant practical and far-reaching strategic significance in

alleviating the contradictions between population, food, land, economy, and environment. Land degradation exacerbates climate change, and the land sector bears the dual challenges of adapting and mitigating climate change. Land degradation will affect the changes in the climate system, and climate change in turn will exacerbate land degradation and desertification in various ways. Climate change causes extreme disasters to become increasingly frequent, bringing many challenges to land degradation and food security. Future population growth, economic development, and consumption upgrading will create greater demand for land, triggering a series of climate risks.

Climate warming can exacerbate the global water cycle, leading to changes in extreme precipitation events in the region. Drought is affected by many factors such as precipitation, temperature, wind speed and soil moisture, and involves many different definitions (such as meteorological drought, hydrological drought, agricultural drought, etc.). It is difficult to identify the Secular variation trend of drought events on a global scale [18]. However, at the regional scale, the increase in the frequency and intensity of drought events is relatively obvious. Climate change and the increase in the frequency and intensity of extreme events have had a negative impact on the functions of the Terrestrial ecosystem, and accelerated the process of desertification and land degradation in many regions, thereby affecting food security. Under the influence of human activities and climate change, the extent and intensity of desertification in some arid areas have increased in the past few decades. Desertification is closely linked to the frequency, intensity and duration of drought, due to geographical constraints by definition. Drought itself is not a form of land degradation, as the productivity of the land may be fully restored after the drought ends. However, in arid regions, desertification may occur when the frequency, intensity and duration of drought increase beyond the resilience of ecosystems [19].

5. Conclusion and Suggestions

Understanding the current situation of land degradation in China is a meaningful task that urgently needs to be carried out. At present, the institutional, policy, and governance responses to address land degradation issues are often passive and decentralized, which is also the fundamental reason for the failure to address land degradation. Existing national and international policies and governance responses on land degradation typically focus on mitigating the damage already caused, and many policies are typically decentralized in nature, only targeting specific and obvious degradation drivers of specific economic sectors without considering other drivers. However, land degradation is usually the result of multiple factors, and there are many types of land degradation with complex causes. Therefore, it is necessary to coordinate and collaborate with multiple departments to conduct in-depth investigations on the current situation of land degradation in China, establish a monitoring and research network for explicit and implicit degradation, and monitor the types, scope, and degree of land degradation in key regions and at different scales, providing a practical basis for the prevention and control of degraded land.

The object of land remediation is unused, unreasonable use, damage, and degradation of land. According to the requirements of the management of the mountains, rivers, forests, fields, lakes, and grasslands system, land degradation prevention and control work needs to balance increasing the

quantity and improving the quality of cultivated land, and pursue the tasks of conservation, intensification, and ecological protection. On the basis of putting people first, we will further optimize the spatial layout of our land, strengthen the research and development of restoration technologies for degraded and damaged landscapes, forests, fields, lakes, and grass ecosystems, and carry out land degradation prevention and control work with the goal of creating livable living spaces and suitable production spaces. At the same time, it is necessary to fully combine the regional environment and geographical conditions to carry out key technologies for soil quality restoration and reconstruction, as well as experimental demonstration research on their integrated application, in order to provide decision-making consultation and demonstration models for soil degradation prevention and control.

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