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LAND DESERTIFICATION

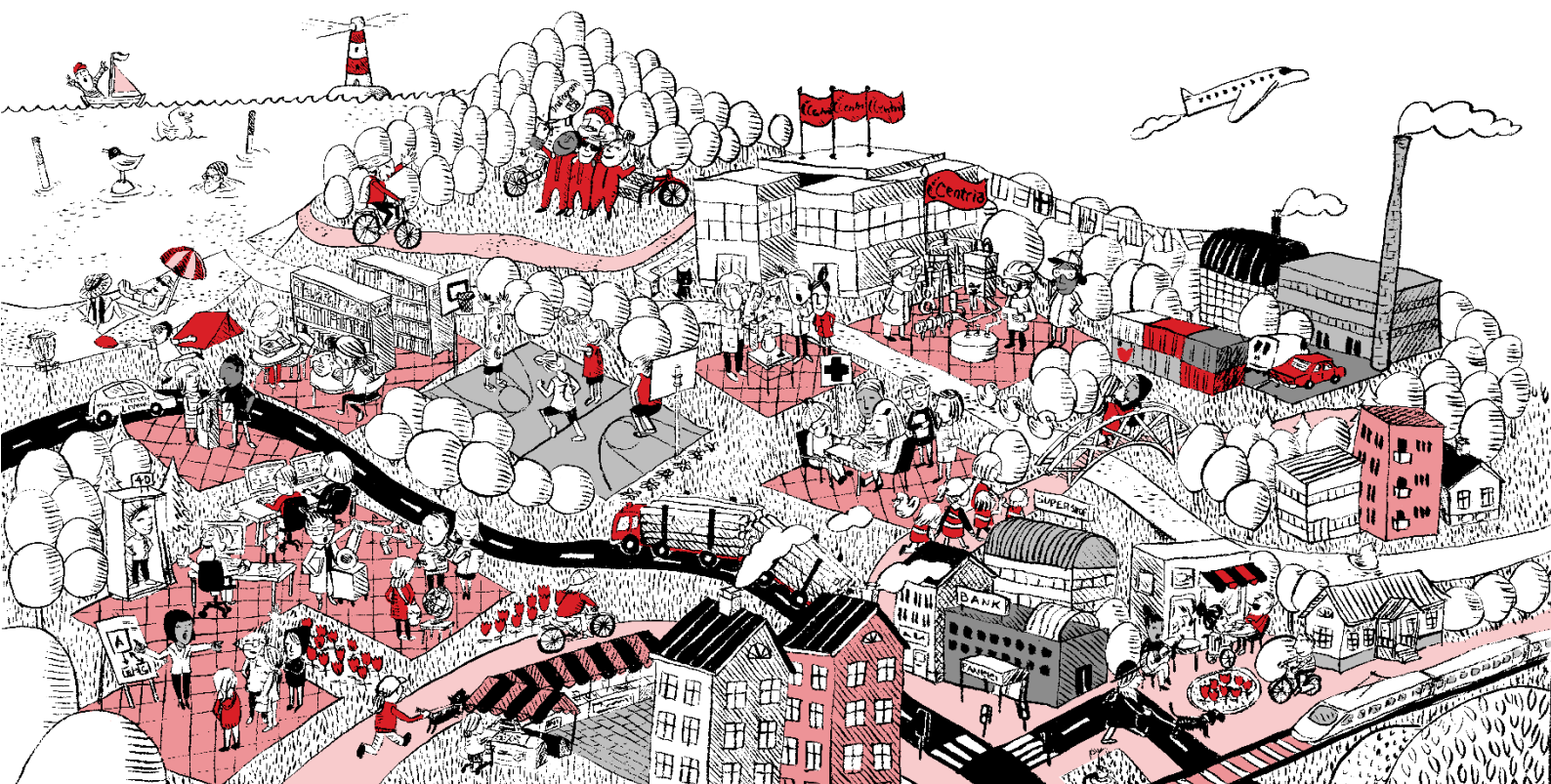
Causes, status and prevention measure of land desertification

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ABSTRACT

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<p>This thesis introduces land desertification from many aspects and makes a narrow and broad interpretation of land desertification.</p> <p>After that, the status quo of land desertification is introduced according to the previous research. 40% of the land around the world is arid land. This has caused a severe burden on people, desertification and poverty, and formed a vicious circle. At the same time, desertification threatens food production, affects biodiversity, and political stability, leading to immigration and causing and aggravating poverty.</p> <p>The causes of land desertification are divided into natural factors and human factors. Natural factors include drought, loose surface substances, wind erosion, no vegetation and improper activities such as the use of water resources. The human factor is that population growth and economic development put too much pressure on the land. Over-cultivation, over-grazing, deforestation and unreasonable use of water resources have severely degraded the land, the forest has been destroyed, the climate has gradually become dry, and finally, the land has been desertified.</p> <p>The form of land desertification is severe. There are four types of desertification in China: wind erosion desertification, water erosion desertification, permafrost desertification and soil salinization. According to the information released by the government department of the State Forestry Administration in 1998, China is one of the countries with the most severe desertification globally.</p>		

<p>Key words Frozen desertification, land desertification, soil salinization, water erosion desertification, wind erosion desertification</p>
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1 INTRODUCTION

Desertification is a natural phenomenon in which soil productivity is greatly reduced or lost due to factors such as drought and lack of rainfall, vegetation destruction, overgrazing, strong wind erosion, running water erosion, and soil salinization.

Desertification can be divided into a narrow sense and a broad sense, and the factor that determines the narrow sense or the broad sense is the sandy surface condition of the desertified land. Desertification, in a narrow sense, refers to the destruction of the balance between nature and fragile ecosystems due to the influence of natural factors or human activities under the sand surface conditions of extremely arid, arid, semi-arid and partially sub-humid areas, and sand activities appear in the form of wind erosion and Aeolian landform structure landscape. It marks the gradual formation of the land degradation process.

Sand surface conditions are the key to defining desertification in the narrow sense and desertification in the broad sense. Because of this, all the land that has undergone the process of desertification is called desertified land. Sandified lands also include desert fringes where dunes move forward under the influence of wind, where original fixed and semi-fixed dunes are activated by vegetation destruction, and where dune activity occurs.

Desertification in a broad sense refers to the formation of arid, semi-arid and even sub-humid areas caused by human and natural factors, including salinization, grassland degradation, soil erosion, soil desertification, and desertification in a narrow sense, vegetation, and dune intrusion in historical periods. The general process of specific degradation of the natural environment is marked by environmental factors.

The term desertification originated in the late 1960s and early 1970s when a severe drought in the Saharan region of West Africa caused an unprecedented disaster. The term "desertification" began to spread. (Chuzhou Meteorological Bureau. 2020.)

This thesis includes the causes, classification, current situation, and control measures of land desertification. The causes are natural factors and human factors. Land desertification can be divided into narrow desertification and general desertification, and there are also classifications such as desertification and salinization. The current form of land desertification is not optimistic, but China has found its control measures. It is believed that with time, with the update in technology, the problem of land desertification will be solved entirely.

2 CAUSES OF LAND DESERTIFICATION

Desertification can be roughly divided into two categories: natural factors and human factors. These factors affect the state of the land, causing the land to degrade gradually and the land for production to gradually decrease, resulting in desertification. These two factors also affect the land environment in China. (Wang, 2013.)

2.1 Natural factors

Natural factors include drought, loose surface material, strong winds, and lack of vegetation. Taking the process of forming desertification under the action of wind as an example, the desertification formed by wind erosion is mainly divided into three stages: occurrence, development and formation. (Wang, 2013.)

During the occurrence stage of desertification, only the climate is dry, and the surface vegetation is destroyed. This is called potential desertification. The formation of desertification can be effectively inhibited when discovered and treated during this phase. (Wang, 2013.)

When wind erosion desertification reaches the development stage, the vegetation on the ground has been destroyed, and wind erosion, coarsening, spotted quicksand and low shrub sand piles occur frequently. Shifting dunes and sand piles commence with the intensification of Aeolian sand activities. The stage is between the developing desertification, where the desertified land accounts for less than 20% of the land area, and the strongly developing desertification, where the desertified land accounts for 20% to 50% of the land area. If the desertification of the land is found and managed at this moment, the land condition can improve and gradually recover after a few years. (Wang, 2013.)

During the formation stage of wind-eroded desertification, the vegetation on the surface has been almost destroyed, and the floating dunes and blowing sand piles are widely distributed on the surface. The desertified land accounts for more than 50% of the land area, and the desertification is severe. Under these circumstances, it would take sixty or seventy years to restore the land to a fertile state. (Wang, 2013.)

2.2 Human factor

Human factors include over-harvesting, over-grazing, over-cultivation, excessive exploitation of mineral resources, water resources and other human misconduct. Population growth and economic development bring excessive pressure on the land. The land is severely degraded by overuse, leading to the destruction of forests, resulting in a gradual drying of the climate and eventually the formation of deserts. Human and natural factors act on the fragile ecological environment, causing vegetation damage, and desertification begins to appear and develop. The degree of desertification and its spatial expansion is affected by drought and the intensity of human and animal pressure on land. Desertification also has the possibility of reversal and self-recovery. The magnitude of this possibility and the duration of the desertification reversal process is affected by different natural conditions, surface conditions and the intensity of human activities. (Milton & Saier 2010.)

Table 1 shows the human factors.

TABLE 1 Human Factor (Milton & Saier 2010.)

Human factor	Damage causes and typical areas	Main hazards
Over cutting	Woodcutting and natural vegetation are the primary means to solve the fuel problem in energy-deficient areas (such as the Ordos sand area and Kulun banner in eastern Inner Mongolia). ² In order to increase their income, some farmers and herders dig medicinal materials and <i>Nostoc flagelliforme</i> in grassland areas without planning and control.	The vegetation for sand fixation, prevention of wind sand moving forward and inhibition of sand rising on the surface is damaged.
Overgrazing	To gain short-term economic benefits, herders graze their livestock as much as possible in semi-arid steppe countryside and on the fringes of arid oases.	The accelerated process of grassland degradation and desertification.
Over reclamation	Engage in agricultural production in arid and semi-arid sandy soil areas, especially at the edge of sandy areas, especially in sandy soil areas without shelter forest protection.	Desertification of land is gradually severe.

2.3 Causes of land desertification in China

Desertification in China is divided into wind-eroded desertification, water-eroded desertification, freeze-thaw desertification, and soil salinization. The formation of land desertification is a complex process resulting from the interaction between irrational human economic activities and a fragile ecological environment. Natural geographical conditions and climate variability create conditions for the formation and development of desertification. However, the process is slow, while human activities stimulate and accelerate the process of desertification, becoming the leading cause of desertification. Abnormal climatic conditions, especially severe drought conditions, can easily lead to vegetation degradation, accelerated wind erosion and desertification. Arid climatic conditions determine the vulnerability of the local ecological environment to a large extent, so drought contains the potential threat of desertification. An abnormal climate can make the fragile ecological environment unbalanced, the leading natural factor leading to desertification. When the climate becomes drier, desertification develops, and desertification reverses when the climate becomes humid. Global warming, the increasingly severe drought in the northern hemisphere, and the trend of semi-aridization have all contributed to the intensification of desertification. (Milton & Saier 2010.)

Population growth and economic development have put too much pressure on the land. Over-cultivation, over-grazing, deforestation, and limited water resources have severely degraded the land, destroyed forests, gradually dried the climate, and eventually formed deserts. (Zhou, Zhang, Xu, Gao & Zhao 2016.)

2.3.1 Natural factors of land desertification in China

Drought is the most significant natural factor of land desertification in China. The western part of China is located in the centre of the Eurasian continent, deep inland, with little precipitation, and the evaporation is severely more than the precipitation. This place is far away in the deep inland, and the ocean water vapour in the Pacific Ocean is challenging to reach. Moreover, it is surrounded by high mountains, and the Qinghai-Tibet Plateau blocks the southwest, so the water vapour of the Indian Ocean is challenging to reach. In winter, this location is close to the Siberian wind source, and the terrain is small and undulating. These problems make it difficult for vegetation to survive, with sparse vegeta-

tion and low coverage. The sparse vegetation will lead to soil loosening and gradually desertification. The inland environment dehumidifies the cold flow from the southwest and north, resulting in dry air. (Zhou et al. 2016.)

2.3.2 Human factors of land desertification in China

Excessive reclamation will degrade the land after the crops have been planted on a large scale. Overgrazing greatly exceeds the carrying capacity of the grassland and degrades the grassland. Excessive deforestation of forests is also a significant cause of land desertification. The disappearance of forests has destroyed the degree of sand fixation of the land. The excessive utilization of water resources makes soil pollutants exceed the standard, causes land salinization, and causes severe damage to vegetation. Improper protection of land vegetation in the construction of traffic lines and other projects will destroy the land and aggravate desertification. (Milton & Saier 2010.)

3 CURRENT SITUATION OF LAND DESERTIFICATION

At present, for the land of the Earth, the arid land occupies 40% of the Earth. Among them, 70% of the land in the African continent is desert or arid land. Although there are rainforests in Latin America and the Caribbean, 25% of land remains desert or arid. In Asia, 400 million people live in the desert or arid land. Although the arid land does not mean barren, the arid area is still increasing 2500 square kilometres per year. (Hoffman, 2020.)

Human production, life, war and other activities have affected the natural desertification process for a long time. For example, overgrazing beyond the carrying ability of the land can lead to vegetation loss and soil erosion that are difficult to recover. About half of the world's cows, 1/3 of sheep and 2/3 of goats graze in the arid region, and excess planting leads to nutrient loss and soil erosion. In addition, excessive irrigation causes water to evaporate, and salt still exists in the soil. The formation of saline land is also degraded. On a global scale, irrigation cultivated land accounts for 17% of total cultivated land, accounting for 40% of world food production. However, crop yield decreases due to flooding, irrigation and salting, resulting in approximately 2 million hectares of land degradation. (Wei, Wang & Niu 2020.)

From a global perspective, the United Nations Convention on Serious Drought and Desertification Countries, especially in African Countries, adopted by the United Nations, desertification refers to various factors, including climate variability and human-induced arid semi-arid and land degradation. (Lira, 2004.)

Desertification and poverty intensify each other and form a malignant cycle. Poverty leads to more infertile use and utilisation of the short-term land and natural resources. At the same time, desertification threatens food production, affects biodiversity, and political stability, leading to migration, which leads to poverty. The United Nations Environment Program estimated that desertification directly affected people's lives in more than 110 countries. The threatened arid area covers an area of 40%, involving approximately 2 billion people, including developed countries and developing countries, such as southern Africa, the Middle East, Russia, Australia, USA, Mexico, Brazil, Southwestern Brazil, North China, and Iceland. Desertification affects 16% of the global agricultural land, 75% in Central America, 20% in Africa, and 11% in Asia with severe degeneration. Due to desertification, global an-

nual crop loss is estimated to be \$ 42 billion, mainly in Asia and African developing countries. Due to desertification, the Sahara desert area in Africa lost 3% of its rural GDP. (Jiang, Jiapaer, Bao, Kurban, Guo, Zheng & Maeyer 2019.)

From the late 1960s to the early 1970s, severe drought in the Saharan West Africa caused unprecedented disasters. The issue of land degradation in arid regions worldwide was closely watched. The term desertification began to spread. According to the United Nations, currently, 1/5 of the world's population and 1/3 of the land are affected by desertification. The world environment and development have been listed as a sector of the international community. The United Nations started the intergovernmental negotiation of the "United Nations Convention to Combat Serious Drought or Desertification" in 1993. The text was officially adopted on June 17, 1994. The United Nations General Assembly passed a resolution in December 1997 that starting from 1995, June 17 would be the Global Day to Combat Desertification and Drought. (Hoffman, 2020.)

4 SPECIFIC CLASSIFICATION OF LAND DESERTIFICATION

In a narrow sense, Land desertification refers to the excessive economic and social losses caused by human beings in fragile ecosystems. Economic activities disrupt its balance, resulting in an environmental change process similar to desert landscapes in primitive non-desert areas. Because of this, any land with a desertification process is called desertified land. (Chuzhou Meteorological Bureau. 2020.)

In a broad sense, land desertification refers to desertification formed by artificial and natural factors in arid, semi-arid and even sub-humid areas. Common types of desertification include sandy desertification, silky desertification, stony desertification, marine desertification, urban desertification, and alpine desertification. (Hoffman, 2020.)

Sand desertification refers to the process of environmental change in primitive non-desert areas similar to desert landscapes, mainly distributed on the edges of arid and semi-arid deserts. In addition, natural causes can also be related to overgrazing, over-cultivation, and burning wood, which ultimately leads to a decrease in land productivity or depletion. Sand desertification is not only the primary type of desertification but also one of the most harmful desertification. This desertification is expected in north-west China. (Jiang et al. 2019.)

Saline desertification is also a common type of desertification known as salt desertification. When the soluble salt ions on the soil surface are particularly large, this soil is called saline-alkali soil. In arid and semi-arid regions, due to the dry climate and significant evaporation, soluble salts in groundwater accumulate on the surface, which is related to excessive irrigation, eventually leading to a decrease in land productivity and resulting in desertification effects. This desertification is mainly distributed in the North China Plain and Qinghai Province. (Cao, Yang, Li, Wang, Liu & Xiao 2020.)

Rocky desertification is a process of soil erosion, soil thinning, and gradual exposure of bedrock due to human activities such as steep slope reclamation, forest reclamation, and reclamation. It is mainly distributed in areas with heavy rainfall, strong wind, or steep slopes, such as the bedrock mountainous areas in China. Soil erosion leads to severe rocky desertification. Especially in the limestone area of Yunnan-Guizhou Plateau, the typical karst rocky desertification is more prominent. Mountain rocky

desertification includes rocky hillside desertification, rocky valley desertification, and beach. (Chuzhou Meteorological Bureau 2020.)

A country's territorial waters are an essential part of its territory. The degradation of the ecological environment quality of the territorial sea is a basic form of land degradation in a country, which is similar to marine desertification. With industry development, a large amount of waste oil is discharged into the ocean, forming a thin oil film spread on the ocean. This oil film can inhibit the evaporation of the sea surface, hindering the release of latent heat, causing the increase in seawater temperature and sea surface temperature, and exacerbating the daily and annual temperature changes. At the same time, due to the weakening of evaporation, the air on the sea surface becomes dry, weakening the adjustment effect of the ocean on the climate, resulting in a desert-like climate on the sea surface. Therefore, some people call this effect the marine desertification effect. (Samiro & Johannes, 2020.)

Marine desertification refers to reducing the productivity of oceans and coastal areas under human action. That is, the development of oceans is not conducive to human beings. For example, red tides lead to decreased biological productivity, oil pollution leads to decreased sea surface evaporation, and desertification effects. Attention should be paid to the deterioration of the marine ecological environment. (Samiro & Johannes, 2020.)

Urban desertification, which occurs in cities, is an environmentally harmful process similar to desert environmental effects due to population increases and changes in surface properties. Urban rocky desertification, urban water scarcity, dry ground, urban dust storm activity, and reductions in urban biodiversity have similar impacts to deserts due to a warmer and drier urban climate. (Hoffman, 2020.)

Alpine desertification is also known as apathy. It refers to the subpolar upper part of the high mountains and high latitudes. Due to the physiological drying caused by low temperature, the vegetation is barren, and the land is gradually destroyed to form a desert. (Cuo, Zhang, Wu & Hou 2020.)

5 RESEARCH PROGRESS AND CONTROL MEASURES OF LAND DESERTIFICATION

Africa and Asia are the regions with the most severe soil desertification. Research on land desertification and proposing reasonable solutions is urgent. This concerns the lives of the inhabitants of Asia and Africa and the environment of the Earth. (Sarparast, Ownegh & Sepehr , 2020.)

5.1 Research progress of land desertification

The United Nations convened the World Conference on Desertification in 1977 and put forward an action program to combat desertification. At the same time, the United Nations Environment Programme organized scientists from various countries to compile a 1:2.5 million world desertification map jointly. This map presents four reports on climate and desertification, desertification and ecological change, population, society and desertification, science and desertification, and the reports involve technology and some regional studies. These reports analyze the causes and processes of desertification and propose control measures. Scholars in many countries have conducted extensive research on desertification. (Milton & Saier 2010.)

The research in China on desertification mainly focuses on terrestrial sandy desertification, including a comprehensive investigation of the causes and characteristics of desertification, especially in the semi-arid cross-zone of agriculture and animal husbandry. The Lanzhou Desert Research Institute of the Chinese Academy of Sciences has compiled 1:500,000 desertification maps of key desertification regions, forecast maps of desertification development trends in typical regions, and proposed desertification process and control plans in northern China. Research on agricultural development strategies in desertification areas intersects with agriculture and animal husbandry and the development of desertification in China. (Lira, 2004.)

The methods and measures of desertification control are different in establishing desertification control demonstration test bases in different types of desertification areas. In China, according to the characteristics of desertified land in the north, the prevention and control measures in the semi-arid area of the north, the land use structure that is not conducive to the virtuous cycle of the ecological environment is adjusted, and the proportion of agriculture, forestry and animal husbandry is reasonably arranged. Reclamation of desertified wasteland and degraded grassland to restore vegetation, adopt the

method of zonal crop rotation to limit the carrying capacity, and adoption of the method of sand fixation mainly based on plants and supplemented by engineering. (Jiang et al. 2019.)

Comprehensive planning shall be carried out in the inland river basin as the ecological unit regarding the prevention and control measures in arid areas. The proportion of water bodies in the upper, middle and lower reaches shall be reasonably allocated, the oasis edge with a combination of arbours and shrubs, a narrow forest belt with small grids and a shelter forest system. For the moving dunes on the edge of the oasis, the protection system of setting up sand barriers on the dune surface and planting sand-fixing plants in the dunes should be adopted. Soil improvement measures should be adopted based on sand prevention and control. (Chuzhou Meteorological Bureau. 2020.)

5.2 Control measures for land desertification

In the long years of human beings, desertification has caused considerable harm to human civilization, so one or more programs to combat land desertification should be formulated. Scientists have made many efforts in this regard. First, they analyzed the overall situation of China and came up with a set of governance plans suitable for China's national conditions. (Zhou et al. 2016.)

5.2.1 Analysis of the crux of the current desertification control measures

After nearly half a century of research and practice, China has taken many measures the prevention and control desertification. Human production, life, war and other activities have long affected the natural desertification process. Vegetation plays an essential role in preventing and controlling soil wind erosion. According to many experimental observation data, such as wind tunnel simulation, soil wind erosion disappears when the vegetation coverage reaches more than 60%. Therefore, it is very natural to combine planting trees and grass with desertification control. The measures to control desertification by returning farmland to vegetation are based on controlling soil wind erosion. The specific methods of desertification control vary from place to place. In the farming areas where desertification has occurred and developed more seriously, returning part of the desertified cultivated land to forest land and grassland is adopted to restore desertified land. (Zhou et al. 2016.)

To reduce livestock damage to grass, it is necessary to implement the grassland contract responsibility system, stipulate a reasonable amount of livestock, vigorously promote enclosures and grazing in rotation, vigorously develop artificial grasslands or artificially improved grasslands, and raise livestock in sheds. (Hoffman, 2020.)

The industrial structure needs to be adjusted, and the proportion of animal husbandry needs to be allocated according to market demand. Supporting the development of the animal husbandry and processing industry will disperse the surplus rural labour force, thereby reducing the pressure on the local population to use land. It is also possible to develop tourism, exploration, scientific research and other industries by utilizing desertified areas with unique resources such as light and heat, natural landscapes, cultural folk customs, and surplus labour. Moreover, optimize the use of animal husbandry energy, convert old energy such as combustion power generation into clean energy such as wind energy and solar energy, and reduce damage to forests and grasslands. (Xu. 2020.)

Fencing is land desertification in grassland areas due to excessive livestock stress and overgrazing. Therefore, the control of desertification usually adopts fencing measures, dividing the grassland into several districts, constructing grass coulombs, and implementing rotational grazing. The enclosed grassland can recover naturally due to the reduction or disappearance of livestock pressure. The self-reversal ability of the desertification process determines the process of desertification development. When the external disturbance of human activities is excluded, the desertification process has the characteristics of gradual termination. The self-reversal ability of the desertification process depends on the degree of development of the desertification process and the characteristics of the natural environment in the area where the desertification process occurs. (Zhou et al. 2016.)

According to research, the self-resilience of desertification will continue to decline as desertification intensifies. Similar degrees of desertification, natural conditions, and exceptionally average annual precipitation directly impact self-recovery ability. For example, in the southeastern Horqin grassland sandy area and the southeastern part of the Ordos grassland Muwusu sandy area, the annual precipitation is 400-500 mm, which are areas that are easy to restore. It takes 3-5 years to recover from the quicksand condition to the state where the vegetation coverage exceeds 60%. In the southern part of the Ulanqab grassland, the Chahar grassland and the Bashang plateau, the annual precipitation is 300-400 mm. There are bushes and sand piles on the surface, and the self-recovery time of the sand is 5-7 years. The quicksand area with 200-300 mm precipitation will take more than ten years. (Zhou et al. 2016.)

5.2.2 Thoughts on the way of land desertification control

Most of the severe desert areas in China are located in the interlaced area of agriculture and animal husbandry in the northwest, where most of them are dry farming, and their agricultural output is greatly affected by climate fluctuations. Therefore, the agriculture here is vividly called fluctuating agriculture. The characteristic of fluctuating agriculture is widely planted and harvested to recuperate for the deficit. This agricultural characteristic is pronounced in Gansu's Dingxi and Mu Us areas. The fluctuating agriculture, which cultivates a wide variety of crops and offsets the deficit, is driven by population pressure to continuously cultivate wasteland suitable for agriculture and expand the area of arable land, which has become its inevitable behaviour. When the scope of reclamation is limited, the structure of the agricultural system is simplified, and the food chain of the population is shortened to feed a larger population. Therefore, fluctuating agriculture is the mechanism for the development and deterioration of desertification in this area. (Akbari, Shalamzari, Memarian & Gholami 2020.)

The key to controlling desertification is to start from the root cause of desertification, breakthrough technical limitations. Moreover, organically combine desertification management with the development of the rural economy from economics, ecology, and desertology. It is essential to effectively combine with the development of the agricultural economy, increase the yield per unit area of grain by applying high and new technology and transform the conditions of production factors; and take the road of agricultural industrialization through industrial restructuring, improving technology content. Improving rural economic conditions and increasing farmers' economic income can make the carrying capacity of the desertified land jump, thereby eliminating the root cause of desertification and making the overall reversal of desertified land. (Akbari et al. 2020.)

5.2.3 Governance measures

Regarding the control of desertification, while protecting the existing vegetation, it is necessary to strengthen the construction of forests and grass. China should optimize governance measures, effectively solve the problem of human and livestock stoves, and strictly protect the forest and grass vegetation in the sandy area. A multi-forest, multi-tree, and multi-layered three-dimensional protection system will be constructed to expand the proportion of forests and grasses through afforestation and rational allocation of trees, shrubs, and grasses. While doing well in artificial governance, comprehensively use the self-healing function of the ecosystem, increase the protection of the ban, and promote the natural restoration of the ecology. As a result, aerial seeding has the characteristics of high speed, less labour, low cost, and sound effect. It is of greater significance for restoring vegetation in sparsely populated areas, inconvenient transportation, remote desert sand, and barren mountains. (Cabrera, Villarreal, Gómez & Díaz 2020.)

A lasting ecological revolution is needed in desertified regions. The key to accelerating the process of desertification reversal is to allocate water resources to ensure ecological water use rationally. For example, an unreasonable water resource allocation system is the direct cause of the shortening of rivers in northwest China, shrinking or even drying up of lakes, declining groundwater levels, and desertification of land. (Samiro & Johannes 2020)

The family planning policy should be strictly implemented to control excessive population growth. By carrying out publicity and education on environmental protection awareness, the ideological awareness level of the whole nation will be improved. People consciously participate in environmental transformation and construction, forming a social trend. At the same time, the state must plan to implement ecological migration in areas where local desertification is severe, grasslands and arable land are almost entirely abandoned, and the harsh natural environment is no longer suitable for human survival. (Milton & Saier 2010.)

It is necessary to reverse the backward situation of raising livestock by the sky and reduce the damage to the pastures. China should implement the grassland joint production contract responsibility system, rationally adjust the number of livestock, vigorously promote captive and rotational grazing, vigorously develop artificial grasslands or artificially improved grasslands, and implement shed raising of livestock. (Zhou et al. 2016)

After that, the adjustment of industrial structure should be accelerated, and the proportion of agriculture, forestry, animal husbandry and sideline industries should be allocated reasonably according to market demand. The population pressure on land can be alleviated by actively developing aquaculture and processing industries to divert surplus rural labour. It is also possible to use desertified areas with unique resources such as natural landscapes, cultural folk customs, and surplus labour to develop tourism, exploration, scientific research and other industries. (Liang, Li, Wang, Shun, Ka, Chuluun, Altansukh & Davaadorj 2021)

The energy structure of farming and pastoral areas needs to be optimized. The masses should be vigorously advocated and encouraged to use wind energy, solar energy, biogas and other clean energy sources to reduce the damage to forests, grasslands and other resources for combating desertification. (Liang et al. 2021)

6 DISCUSSION

Land desertification is one of the most severe ecological and environmental problems globally, causing severe environmental degradation and economic poverty. It is listed as one of the top ten environmental and development problems that threaten human existence. China is one of the countries most seriously affected by desertification globally, and the direct economic loss caused by desertification is as high as 54 billion yuan every year. Therefore, the study of desertification is of great significance to China. (Wei et al. 2020.)

The essence of land desertification is land degradation, but land desertification does not mean land degradation. Land degradation is a dynamic process, and desertification is a particular stage of land degradation, and there should be a boundary between the two. Otherwise, there is no need to propose a concept of desertification based on land degradation, and the special composition makes desertification different from general land degradation and desertification. (Shihab & Al-hameedawi 2020.)

Everything has its defined boundaries, such as the three forms of water. Once the boundaries are broken, water is further divided into ice and water vapour. When land degradation is in different boundary ranges, it becomes three different conceptual categories of land degradation, land desertification and desert. (Zhu & Zhu 2020.)

Table 2 Land degradation, Desertification, Desert

General land degradation	Desertification	Desert
Sandification	Sandy desertification	Desert
Salinization	Salinity desertification	Salt desert
Petrochemical	Stony desertification	Rocky desert
Soil erosion	Water erosion desertification	Desert

In order to curb the increasingly difficult situation of land desertification, people have been fighting against it for a long time and have achieved specific results. In particular, under the great attention of China, it has called on and organised the people to fight against desertification. It has accumulated rich

experience in long-term governance, and desert governance has achieved remarkable results. (Cai, 2021.)

However, natural disasters are not easy to overcome, and desertification control in the short term has little effect. After the reform and opening-up, China's comprehensive national strength has gradually increased. Its scientific and technological strength has been continuously improved, providing strong financial and technical support for the current desert governance. (Cai, 2021.)

After a long period of desert control, China has acquired certain desertification control technologies and formed an effective management organisation, teaching and scientific research system. Moreover, it formulated a series of policies and regulations, reaching the world's highest level in desertification control. (Zhang & Jiang 2020.)

However, it is thought-provoking that despite increasing investment and governance efforts year by year, desertification is expanding quickly and tends to intensify further. This shows that there are some problems in the current desert governance. (Li & Cao 2019.)

Desertification control in my country has always followed the traditional concept of prevention first and governance as a supplement. Due to the imperfect supporting measures for combating desertification in the past, it has been difficult to achieve the expected goals in combating desertification. Greening cannot keep up with desertification. Desertification has formed a passive situation of partial reversal and overall deterioration. Therefore, this concept is not advisable. It is necessary to emphasize sand control and change passive prevention into active management. (Xu, 2020.)

7 CONCLUSION

Desertification is a natural phenomenon in which soil productivity is significantly reduced or lost due to drought and lack of rain, vegetation destruction, overgrazing, intense wind erosion, running water erosion, and soil salinization. It can be divided into a narrow sense and a broad sense, and the decisive factor is the sand surface condition of the desertified land. Common types of desertification include: sandy desertification, silky desertification, stony desertification, marine desertification, urban desertification and alpine desertification.

The causes of desertification can be divided into two categories: natural factors and human factors. Natural factors include drought, loose surface material, strong winds and lack of vegetation. Human factors include over-harvesting, over-grazing, over-farming, excessive exploitation of mineral resources, unreasonable use of water resources and other human misconduct.

The form of land desertification is not optimistic. As far as the Earth's land is concerned, dry land accounts for 40% of the Earth's area. In Asia, 400 million people live in the desert or arid lands. Although dry land does not mean barren, the dry land area grows at 2,500 square kilometres per year. Desertification and poverty intensify each other, forming a vicious circle. At the same time, desertification threatens food production, affects biodiversity and political stability, and leads to migration and poverty.

As for controlling land desertification, China has a complete governance system. Human production, living and other activities have long affected the natural desertification process. Vegetation plays a vital role in preventing soil wind erosion. Therefore, it is natural to combine planting trees and grass with combating desertification. The measures to control desertification by returning farmland to grassland are based on controlling soil wind erosion. Specific approaches to combating desertification vary from place to place. In the agricultural areas where desertification occurs and develops severely, the desertified land should be restored by returning part of the desertified farmland to forests and grasslands. The industrial structure needs to be adjusted, and the proportion of animal husbandry needs to be allocated according to market demand. China should support the development of the livestock processing industry, disperse the surplus rural labor force, and reduce the pressure on the local population to use land. (Xu. 2020.)

These measures significantly affect China's desertification control, and the sand and dust weather is the most direct reflection of the desertification status. Taking Inner Mongolia Autonomous Region as an example, the sand and dust weather has generally shown a decreasing trend in the past ten years. According to the monitoring results of the State Forestry Administration, the overall sand and dust weather in the northern region also tends to decrease. The reduction of sand and dust weather has also significantly reduced the hazards of wind and sand. (Zhou et al. 2016)

Facts have proved that the current control measures and technologies are adequate for combating desertification. It is believed that with the further development of technology in the future, the funds and efforts invested in the control of desertification will further increase, and it will no longer be a problem to restore desert areas to their original land appearance. Land desertification will no longer exist, and nature will return to its best state. (Hu, Zhang & Han 2018.)

Further research suggests focusing on the Qinghai-Tibet Plateau in southwest China, such as cultivating cold-tolerant plants that can survive at high altitudes where oxygen is scarce and selecting plants with developed root systems that can take root sincerely to obtain water and nutrients.

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