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Impact of Farmland Ecosystem on the Realization of Carbon Neutralization Goal

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Abstract

At present, the gradual increase of global temperature has brought a series of ecological and environmental problems. In the face of global warming, countries all over the world are taking positive actions to save energy and reduce emissions. As an active promoter and practitioner of energy conservation and emission reduction, China is constantly exploring to achieve the goal of carbon neutralization. Farmland ecosystem is the main part of terrestrial ecosystem. Its carbon source and carbon sink are of great significance in regulating farmland soil carbon sequestration and emission reduction. This paper points out the main measures affecting carbon emission and carbon sink increase in farmland ecosystem, which has guiding significance for China to achieve the goal of carbon neutralization as soon as possible.

Keywords

Farmland ecosystem; Carbon neutralization; Carbon emission reduction, Carbon exchange enhancement.

1. Background of Carbon Neutralization

Climate change is a common concern of the international community. Global warming leads to the melting of glaciers, the rise of sea level, the shortening of cold seasons, the prolongation of warm and hot seasons, and the frequent extreme weather such as drought and typhoon, which have an important impact on the world food. Over the past 30 years, the international community has made great efforts to deal with climate change and mitigate global warming, and formulated various climate change conventions and agreements (United Nations Framework Convention on climate change, Kyoto Protocol, Copenhagen agreement, Paris Agreement and Glasgow climate agreement). Especially in recent years, countries all over the world are taking major actions to slow down global warming and have successively announced the independent emission reduction targets of "double carbon" (carbon peak and carbon neutralization) [1].

From an important participant to a leader in global climate governance, China is also actively promoting the realization of "carbon neutrality". China promises that carbon dioxide emissions will reach the peak by 2030 and achieve carbon neutralization by 2060. The difference between "carbon peak" and "carbon neutralization" is only 30 years. However, China is in the process of industrialization and modernization. Therefore, it must accept the challenges of technological upgrading and industrial transformation [1].

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"Carbon peak" refers to the peak of CO2 emissions caused by the use of fossil fuels. In 2015, China promised to peak its carbon emissions by 2030. "Carbon neutralization" refers to the balance between the carbon emissions caused by fossil fuel use and land use change and the carbon absorbed by land and sea ecosystems and stored by other technologies, that is, the net CO2 emission is 0 [1]. In order to achieve "carbon neutralization", China has taken positive actions in energy conservation and emission reduction, formulated a variety of measures to effectively reduce carbon emissions. At the same time, it is also necessary to increase carbon absorption and storage through the exertion of ecosystem functions. "Carbon neutralization" is an important way to effectively control the rapid rise of global temperature, promote the green transformation of energy utilization, and promote scientific and technological progress such as green and low-carbon. It is a new driving force to improve the earth's environment and promote world economic development and growth.

2. Role of Farmland Ecosystem in Achieving Carbon Neutralization Goal

Farmland ecosystem is one of the three major ecosystems of terrestrial ecosystem. Its carbon pool is not only the most active part of the global carbon pool, but also the most vulnerable to human activities. Its carbon source and sink intensity, carbon flux, carbon storage and technology of reducing source and increasing sink have become the focus of carbon cycle research [2], it plays an important role in maintaining the global carbon balance. The carbon balance of farmland ecosystem is a complex process, which is affected not only by natural factors such as climate, vegetation, soil attributes and terrain, but also by human factors such as farmland management measures (such as fertilization methods, planting systems, farming methods and irrigation methods), and there are also interactions among various factors [3].

Human activities are one of the main causes of greenhouse gas emissions, in which human agricultural planting activities account for a large proportion of greenhouse gas emissions [4]. FAO reports that agriculture has become the second largest source of greenhouse gas emissions [5]. The Intergovernmental Panel on climate change (IPCC) studies that agricultural production, land use and land cover change account for 20% of the global annual CO2 emissions [5]. Research of Xia Longlong et al[6] shows that a large amount of CH4 and N2O are produced in the field production process of agricultural and grain crops, which is an important emission source of greenhouse gases. A large number of studies have shown that the application of chemical fertilizers [7], pesticides and field film laying[8] all lead to a large number of greenhouse gas emissions. As one of the important branches of terrestrial ecosystem, farmland ecosystem affects carbon emissions by changing land use type, mode, intensity and structure [9], which has a great impact on terrestrial ecosystem and even global carbon emissions. In addition, China is a large agricultural country, this phenomenon seems to be more prominent [3]. As a result, farmland ecosystems must reduce their own carbon emissions in the process of "carbon neutralization".

As an important part of terrestrial ecosystem, farmland ecosystem mainly includes vegetation carbon sink and soil carbon sink [10]. Vegetation carbon sink generally refers to plant parts, including aboveground parts of plants, surface litter and underground living roots [11], plants can absorb CO2 to synthesize organic matter through photosynthesis, so as to reduce the concentration of CO2 in the atmosphere, which is also the main process of carbon cycle [12], its carbon sequestration is closely related to crop biomass. The results of Zhang Baocheng [13] show that planting different crops has different carbon sequestration capacity; The results of Zhang Xia [14] show that changing field management measures can increase plant carbon sink. Different from vegetation carbon sink, soil carbon pool includes soil organic carbon pool and inorganic carbon pool [3]. As the core of soil and farmland ecosystem carbon cycle, soil carbon pool not only plays a key role in maintaining soil quality, but also plays an important role in

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controlling the global climate. The results of Liu Xianghong[11] show that different tillage measures can be changed to slow down the mineralized emission of organic and inorganic carbon in soil, and increase soil carbon sink by adding organic and inorganic carbon materials. The results of Yuan Qin [15] show that the application of organic materials (straw, farmyard fertilizer, organic fertilizer, peat, etc.) can improve soil organic carbon sink. The results of Miao Na [16] show that the application of nitrogen fertilizer will increase the emission of soil inorganic carbon, which is not conducive to improve the soil inorganic carbon sink, but the application of nitrogen fertilizer in several times can reduce the release of soil CO2 and increase the soil inorganic carbon sink. There is a certain transformation relationship between soil organic carbon sink and inorganic carbon sink, and a large number of studies show that there is a negative correlation between them [17, 18], some studies also show that there is a positive correlation between organic carbon sink and inorganic carbon sink [19].

3. Conclusion

Farmland ecosystem can help realize carbon neutralization through the following aspects: 1) Carbon sink function can be increased by adjusting aboveground crops; 2) Increase carbon absorption and reduce carbon emissions by changing land use; 3) By changing the type of fertilizer, increase carbon absorption and reduce carbon emission.

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