Land reclamation and soil health in mining area

Forum 4 Global Initiatives in Harmony with nature

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Abstract
Presentation Transcript: Land reclamation and soil health in mining area

一、Soil and Soil Health

1.Soil is the foundation of food security, but also the cornerstone of biological health on Earth, healthy soil is a prerequisite for healthy life. The U.S. Department of Agriculture's Natural Resources Conservation Service defines soil health as the continued ability of soil to serve as an important biological ecosystem for sustaining plants, animals, and humans.

In China's Cultivated Land Quality Grade (GB/T 33469-2016), soil health is defined as the continuous ability of soil to maintain its function as a dynamic living system, mainly through soil cleaning capacity and biodiversity.

Some chinese scholars believe that soil health and human health, animal health, environmental health is a big organism, soil health and microbial cycle in the "soil-plant-human (animal)" continuum is the core to achieve "big health". Therefore, it has positive implications from the whole large biosphere. Soil health pays more attention to the internal relationship between soil physical function, chemical function and biological function, and emphasizes the synergistic improvement of soil biological function, crop yield quality and health.

2. Soil Microbiome and Soil Health

Soil contains the richest microbial communities on Earth, such as bacteria, archaea, fungi, viruses, protists and some micro-animals, which can be collectively referred to as the soil microbiome. They play a crucial role in the cycling of soil organic matter, nitrogen and phosphorus, regulate many ecological processes, such as the production and emission of greenhouse gases such as methane and nitrous oxide, and are closely related to soil health and crop production.

The soil microbiome meets most of the criteria indicating biological indicators of soil health and can be used as an important indicator of soil health. Studies have shown that soils with higher microbial diversity exhibit more ecological functions, higher resistance to environmental stress and higher crop productivity. In the future, the soil microbiome can also be regulated to improve soil health and crop yield, reduce the application of pesticides and fertilizers, so as to reduce resource consumption in agricultural

production and alleviate environmental pollution problems, and achieve the second "green revolution" in agricultural production.

With the breakthrough of high-throughput sequencing technology and the development of bioinformatics, the research on soil microbiome and soil health has been developing rapidly. Especially since 2012, the number of relevant research papers has increased linearly, indicating that the use of microbiome to study soil health has gradually attracted the attention of researchers.

Research direction: Coupling of soil microbiome function and soil health. The combination of microomics and stable isotope probes has changed people's understanding of the structure and function of microbial dark matter, revealed the rich microbial genetic diversity, and discovered new bioreactors and new biogeochemical approaches. These molecular biological analysis methods are useful for predicting the function of soil ecosystem services. Uncovering the mechanisms by which the soil microbiome drives soil health is critical.

二、 Land Reclamation and Soil Health in Mining Areas

1. Destruction of soil resources in coal mining area

Soil destruction in coal mining area is a phenomenon of soil degradation with local characteristics. In areas rich in coal resources, human coal mining activities not only promote economic development, but also cause serious ecological environment damage. During the mining process, on the one hand, the geological structure is destroyed by geotechnical stripping; on the other hand, a large amount of land is damaged and occupied, the surface vegetation is destroyed, the ecosystem is seriously damaged, and the carbon storage is greatly reduced. The changes of physical and chemical properties such as heavy soil capacity, small porosity, poor soil structure and poor nutrients in coal mining area seriously hinder agricultural production, thus limiting the input of plant litter and plant roots into soil organic carbon.

2.mining land reclamation

Due to the decomposition of vegetation litter and plant roots, soil bulk density, pH value, organic matter content and other soil physical and chemical properties are gradually improved in the reclaimed coal mine ecosystem. Soil carbon storage increases in pairs with the increase of litter biomass, which has a huge carbon sink potential. Land reclamation and ecological restoration in mining areas have dual sink enhancement effects, which can not only restrain the carbon emissions of damaged land, but also restore the original carbon sink, and further increase the carbon sink through the innovation of restoration technology, which has great development opportunities under the background of carbon neutrality.

三、Soil and Soil Fertility

1. Soil aggregate and soil fertility

The magic of soil lies in the aggregate structure of soil and the function it plays. The polymer organic matter of soil binds together nano-sized clay particles, larger silt particles and larger sand particles. The "glue" secreted by microorganisms and roots makes the aggregates further larger and more

stable. The soil has voids of different sizes and has the performance of water retention and ventilation. The aggregate and the space formed by it become the home of various organisms in the soil, and the aeration and water retention of the soil provide conditions for the survival and reproduction of various organisms in the soil.

2. Soil carbon cycle and soil health

The carbon cycle is the core of the material cycle in the Earth's ecosystem, and the increase in atmospheric greenhouse gases will have an important impact on global climate change. Two-thirds of the Earth's terrestrial carbon is stored in soil organic matter. Soil organic carbon pool is one of the largest and most active carbon pools in the surface layer of terrestrial ecosystems. It is generally believed that the global soil organic carbon reserve is 1500Pg based on 1 meter soil mass. Soil stores more carbon than all plants, all animals and the atmosphere combined, roughly four times that of living plants or more than three times that of the atmosphere. Small changes in the amount of soil carbon profoundly affect the concentration of carbon dioxide in the atmosphere and bring about climate change, so soil carbon sequestration is more significant for mitigating climate problems.

四、Scientific Soil Management to Promote Soil Health

It is well known that soil formation is an extremely slow process, and it is difficult to see soil changes on the human life scale, and it is difficult to feel the impact of soil changes on human health and the future. On average, it takes 500 years to form an inch of topsoil. In the absence of human activity, it has been estimated that it would take 1,400 years to lose an inch of soil, but it currently takes 60 years or less to lose an inch of soil under human influence. The properties of soil are easily changed dramatically by human interference. Therefore, soil scientific management is an important means to make soil healthy development and solve food nutrition and food security.

1. Soil biodiversity is key to soil management.

According to research, there are at least 8.7 million species of life on Earth co-existing with humans, and about a quarter of them are in the soil beneath our feet. The organisms in the soil participate in the cycle of geochemical elements, decompose and release various elements in the rocks, transform carbon, nitrogen, phosphorus, sulfur and other substances, and supply plant nutrients. A large part of the photosynthetic products of plants are secreted into the soil through the roots. Both the litter and the dead roots of plants serve as food for soil organisms, supporting them and further promoting the geochemical cycle of elements. Soil biodiversity is the engine of earth evolution.

Microbial diversity is closely related to agricultural production. There are abundant and diverse biological groups in soil, which play an important role in soil ecological functions such as accumulation and turnover of organic matter, fixation and transformation of nutrients, improvement of soil structure, decomposition and transformation of pollutants, and transmission and control of soil-borne diseases. Soil contains both organisms that are good for plants and pests that cause disease. The organisms in a healthy soil-plant system are

in a state of interdependent dynamic equilibrium, and soil biodiversity is the cornerstone of the system's balance and stability, but now the decline of soil biodiversity, this balance system is suffering serious damage.

2. Soil organic matter is the core of soil management.

Soil organic matter generally refers to the substances derived from life in soil, including soil microorganisms, soil animals and their secretions, plant residues and plant secretions in soil. Soil organic matter can be divided into four parts: the living biological part is the engine of soil nutrient transformation; the fresh soil organic matter such as dead leaves is the potential food source of soil organisms; the decomposed organic matter is the carbon source and energy of soil organisms, and also the "glue" to build soil aggregates; and the stable organic matter, or humus, is the nutrient reservoir of soil. Make the soil buffer. Organic matter has a positive impact on the physical, chemical and biological properties of soil. Therefore, the scientific management of soil organic matter is the key to "storing grain and technology".

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