MINI REVIEW

Considering ways to improve the management of natural resources

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ABSTRACT

A history of low-level to advanced growth may be seen in the evolution of human society over the past tens of thousands of years, from the earliest forms of civilization to the agricultural, industrial, and ecological ones. "Respecting nature, conforming with nature, and protecting nature" is the cornerstone of the ecological civilization and is crucial to the peaceful coexistence of man and nature. To achieve the win-win of resource development and environmental protection, this peaceful coexistence necessitates continually improving systems and mechanisms for the development of national space, the conservation and utilization of natural resources, and the protection of the ecological environment.

Key Words: *Natural resource; Earth critical zone; International social science Counsel*

INTRODUCTION

Human society has evolved over the past tens of thousands of years from a prehistoric society to an agricultural civilization, an industrial civilization, and finally, an ecological civilization, which represents a progression from primitive to advanced development. For man and nature to coexist peacefully, "respecting nature, complying with nature, and protecting nature" is at the core of ecological civilization. To achieve a win-win of resource development and environmental protection, this peaceful coexistence necessitates continually improving systems and mechanisms for national space development, resource conservation, and use, and ecological environment protection. It is a millennia-long strategy to build an ecological society based on coordinated control of the environment. In terms of fully enacting the concepts of "Big Resources" and "Big Science," the establishment of the Ministry of Natural Resources in April 2018 is a turning point for China's management of its natural resources. This is also a significant step toward advancing the development of an ecological civilization. We must create a strong technical support system, assemble a highly skilled and competent geologic survey team, and follow the direction of Earth System Science to substantially strengthen the unified management system and scientific restoration capability of natural resources.

Earth System Science (ESS) is the core theoretical foundation of the unified management and systemic restoration of natural resources

The earth is a vast, intricate system that can be visualized in space as having several layers and processes occurring on various spatial and temporal scales. According to Earth system science, the atmosphere, biosphere, lithosphere, and mantle/core are all part of a single, cohesive system. It seeks to construct the earth's evolutionary framework through long-span multidisciplinary research, comprehend current earth processes and mechanisms, and forecast potential future changes. In terms of geographical scale, the research topic of Earth System Science ranges from molecular structure to the global scale, and in terms of temporal scale, from the evolution over a hundred million years to brief rupture and deformation.

Since the 1980s, Earth System Science has advanced and changed continuously. One may say that if the theory of evolution was the biggest advancement in earth science in the 19th century, the theory of plate tectonics was the breakthrough in the 20th century, and the theory of Earth System Science is the advancement in the 21st century. In order to address the unprecedented environmental and economic challenges, senior officials of the U.S. federal government strongly advocated in 2008 for the creation of an independent agency for Earth System Science by merging the National Oceanic and Atmospheric Administration (NOAA) and United States Geological Survey (USGS). This strongly suggests that Earth System Science is having a significant impact on the reformation and advancement of natural science institutions. In the future, Earth System Science, should pay special attention to the three key issues: the shallow crust

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("root"), the critical zone ("branch"), and the human-earth coupling system ("leaf").

How to conduct the exploration of detailed fine structures in the shallow crust (0 km–10 km) and scientific utilization of resources, environments, and spaces.

The majority of these resources, including deep oil and gas reserves, mineral resources, and geothermal resources, are found in the shallow crust, between 0 km and 10 km below the surface. In contrast, processes on deeper Earth influence reservoir development, mineralization, and thermal accumulation [1]. To address important concerns of resources and ecosystems, it is crucial to comprehend how the deeper earth functions and evolves in various processes at various space-time scales. It must be decided whether to acquire deep ground resources and locations. Exploring fine structures and the distribution of resources and energy in the earth's crust between 0 km and 10 km is crucial, as is figuring out how to employ urban underground spaces to support the security of the nation's resources and energy as well as the growth of the economy and society.

Way to comprehend the Earth Critical Zone's mechanisms, and processes, and use it

The Earth Critical Zone is a complex system in the epigeosphere where the atmosphere, biosphere, hydrosphere, and lithosphere interact with one another. It also serves as a vital link in the linked flow of material and energy between the climate systems, surface processes, and deep earth processes. In the critical zone, where water is the primary force promoting the circulation and conversion of substances and the earth serves as its core, the natural habitats on the surface of the earth are driven by interface processes such as soil-water, soil-air, soil-organisms, and soil rock interactions, which provide resources for the continued evolution of living things. creation of the critical zone, modeling of the systems and processes, and logical solutions to the development and exploitation of natural resources [2-4]. To investigate the critical zone's structure, formation, and evolution mechanisms, material transformation processes and their interactions investigate the critical zone's service functions and sustainable development, model the processes and systems, and offer logical solutions for the exploitation and development of natural resources, systematic science will be applied.

The system of human-earth connection: linkage of local resource ecosystems and human activities. The major factor behind the evolution of the earth's surface system has steadily changed from human activity to the environment to interactions between the two. Understanding how people and the environment interact is crucial for understanding environmental change, adapting to it, and promoting sustainable development on a range of spatial dimensions. Studying the relationship between humans and the earth helps us better comprehend how the world's surface is changing and the mechanisms that are contributing to it, record and analyze how the planet is changing, and suggest appropriate coping measures. The research topics "Dynamic Planet, Global Development, and Transition to Sustainability" are presented in Future Earth, which was jointly founded by the International Council for Science (ICSU) and International Social Science Council (ISSC), implying that the human-earth coupling relationship has become a major direction in the international community of earth science and a key issue for the academic community to engage in the governance of resources and the global environment.

Unified management and systemic restoration of natural resources require a strong technical system establishment covering all processes of investigation and evaluation, probing and monitoring, and simulation and prediction.

In order to provide comprehensive data services and technical solutions for integrated management of natural resources, it is necessary to establish a strong technical system covering all processes of investigation and evaluation, probing and monitoring, and simulation and prediction. Standardized, consistent, and authoritative basic data are also necessary for the systemic restoration of natural resources.

Investigation and evaluation system

Understanding the formation process, material composition, space-time distribution, and structural evolution of natural resources is essential for the integrated management of natural resources and can be achieved through investigation and evaluation. To collect the characteristic data of natural resources with regard to factors like quantity, attitude, and distribution, integrated ground-air-space survey methodologies and techniques are required under the integrated management system for natural resources. To provide an accurate and reliable foundation to support homeland space planning and application controlling, new technologies like Big Data and Cloud Computing are used to comprehensively evaluate resources in respect of quality, ecological value, and benefits. These technologies take attribute features of different resource categories into account.

Probing and monitoring system

Monitoring is crucial to comprehending how different parts of natural resources of different categories vary over time, and probing is a key technology to find energy, resources, and places within the Earth [5]. The Global Environment Monitoring System (GEMS), Global Terrestrial Observing System (GTOS), Global Climate Observing System (GCOS), International Long-term Ecological Research Network (ILTER), Flux Observation Network (FLUXNET), and Integrated Global Observing Strategy (IGOS) have all been established at the global level. These systems serve as the foundation for the use and management of environmental resources on both a global and regional scale [6]. To create an observation and monitoring system that covers land, mineral resources, water, marine space, forests, grasslands, and intertidal zones, among other things, and to meet the requirements for unified management of natural resources and the control usage of national space, it is necessary to improve probing of resources, ecosystems, environments, and spaces of the earth.

Simulation and prediction system

For the sensible use, quantitative appraisal, and risk anticipation of natural resources, simulation and prediction are crucial. To predict and warn against any potential changes in the natural resource ecosystems at national, regional, and local levels as early as possible, the hydrological, biogeochemical, and ecological processes that may occur during the process of developing and exploitation of natural resources will be simulated. This will provide a scientific basis for administrators and decision-makers to develop contingency plans as well as establish response mechanisms for risk mitigation. A vital part of a technical system is investigation and assessment, probing and monitoring, and modeling and prediction. We made effective efforts in the past to investigate and assess the situation, and we gathered a ton of knowledge and data about numerous categories of natural resources. Probing and monitoring have gradually improved over the past few years, but simulation and prediction are just getting started and require quick reinforcement.

Create an integrated geological survey team system that is of the highest caliber, complete, capable, and robust in order to manage natural resources holistically and restore them systemically

We must set up an integrated geological system made up of highly skilled and specialized teams in order to achieve integrated management of natural resources. Since it was restructured in 1996, USGS, which is associated with the U.S. Interior Department, which is in charge of holistically overseeing natural resources, has evolved into a federal institution with responsibilities for natural resource inquiry and evaluation. An excellent example of a thorough natural resource survey is Geoscience Australia, which was established in 2001 as a result of the emergence of the Australian Surveying and Land Information Group (AUSLIG) and the Australian Geological Survey Organization (AGSO). Integrated management of natural resources urgently demands the establishment of a research institute for Earth System Science, whether based on global experiences or the growth of Earth System Science.

The research institution would have the function to thoroughly investigate and evaluate varieties of natural resources including land, mineral resources, marine resources, water, forests, and grass. It is expected that this institution can play a unique role in the production, integration, and release of authoritative data on natural resources, evaluation of environmental resource carrying capacity, homeland space suitability, and systematic simulation along with the prediction of natural resources development and exploitation.

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