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基于有害干扰的森林生态系统健康评价指标体系的构建

Assessment indicators system of forest ecosystem health based on the harmful disturbance

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中文摘要:

在分析国内外提出的众多森林生态系统健康评价指标的不足后,对评价指标进行研究和筛选。最终在森林生态系统健康评价指标体系的构建上提出了一个新的思路,即从森林火灾、林业有害生物、大气污染、人为有害干扰以及森林生态系统内部的增益干扰5个方面选取20个指标构建森林生态系统健康评价指标体系。其中森林火灾干扰包括平均降水量、平均气温、郁闭度、海拔、坡度、坡向、易燃树种的比例和林地距离8个指标,林业有害生物包括有害生物等级、危害程度和寄主树的比例3个指标,大气污染干扰通过叶片、土壤和污染物的分析测定,人为有害干扰包括森林经营措施、采伐措施和林地植被管理3个方面,而森林生态系统内部的增益干扰由物种多样性、群落结构和近自然度3个指标构成。同时对关键评价指标的意义进行了具体分析。此指标体系摒弃传统的评价观念,结合了近年来影响全国森林健康的几个重要原因,更能准确的反应目前森林生态系统的健康状况。研究思路和方法的提出在一定程度上可以丰富森林生态系统健康评价研究理论与方法体系。

English Summary:

Healthy forests are closely related to global ecological stability and sustainable development of human society. It is important to study forest ecosystem health including developing theories related to forest health and exploring various assessment methods. Reasonable methods lead to accurate assessments of forest ecosystem health. The definition of forest health is controversial. The concept of health is well understood as applied to humans but the human concept of health may not be appropriate for ecosystems. The difficulties of defining the optimal conditions for ecosystem health have led to a lack of universally accepted indicators to measure ecosystem health. In this paper, a healthy forest ecosystem is defined as a system having good mechanisms for self-regulation, such as beneficial mechanisms that allow an ecosystem to react to external harmful disturbances. Positive ecosystem responses to negative changes keep forest ecosystems intact, stable and sustainable. With this concept of forest ecosystem health in mind, we can discuss assessment methods which can be used to monitor forest ecosystem health. Several forest ecosystem health assessment systems already exist. For example, ecosystem health can be assessed using measures of resilience, vigor and organization. Today, most assessment systems are based on this concept. Based on the concept of forest ecosystem health presented above, a new approach is proposed, which considers four external harmful disturbances: forest fire, forest pest species, air pollution and human-caused disturbances. This method is designed to build assessment indicator systems which can be used to monitor and evaluate forest ecosystem health. It also considers beneficial disturbances in this assessment indicator system. This method includes an analysis of forest fire disturbance, which causes severe damage to forest ecosystems, followed by eight other indicators of forest health including average precipitation, average temperature, proportion of flammable species, crown density, altitude, slope gradient, slope direction and distance between the forest and the nearest road. Disturbance caused by forest pests can also be measured. These include disturbances caused by forest animals, such as rat and rabbit damage, as well as indicators like forest diseases and forest pests, the degree of damage and rate of infection in host trees. Air pollution disturbance can be measure by studying leaf damage as well as soil and contamination analysis. The study of harmful human-caused disturbances includes measurement of forest management techniques such as timber harvest and management of undergrowth vegetation. Measurements of forest ecosystem stability include measurements of biological diversity, forest community structure and measurements documenting how closely a forest is to natural conditions, with natural conditions defined as being free of human-caused disturbances. These types of measurements have been used frequently to measure ecosystem complexity and health. Next, the content and significance of key indicators were also well-analyzed. This forest ecosystem health assessment indicator system abandons traditional assessment ideas and combines the most important factors which have been determined to be closely related to forest ecosystem health in recent years. This assessment indicator system focuses at the ecosystem level and has mostly been applied to forests both in South and North China. Information is presented for use by forest and district resource managers as well as academic experts. This assessment indicator system establishes a scientific basis for conducting forest health projects, provides a context for planning ecosystem restoration, and contributes to the understanding of the physical, biological, and human dimensions of these ecosystems. This research may enrich the theories and methods used in assessing the health of ecological systems.

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