生态学报 2006 26 (2006(07)): 2356～2364 ISSN: 1004-616x CN: 44-1063/R

专论与综述

流域径流泥沙对多尺度植被变化响应研究进展

张志强[1]，王盛萍[1]，孙阁[2]，谢宝元[1]

1. 北京林业大学水土保持学院，教育部水土保持与荒漠化防治重点实验室,北京100083
2. Southern Global Change Program, USDA Forest Service, Raleigh, NC 27606, USA

收稿日期 2005-12-12 修回日期 2006-4-20 网络版发布日期: 2006-7-25

摘要 植被变化与流域水文过程构成一个反馈调节系统，是目前生态水文学研究的重点对象。由于植被自身的生长发育以及受自然因素和人为干扰的作用，植被变化具有多尺度性；由于受流域水文环境的异质性和水文通量的变化性的影响，流域水文过程也同样具有多尺度性。因此，只有通过对不同尺度生态水文过程分析，才能揭示流域径流泥沙对植被变化的响应机理。从不同时空尺度回顾了植被生长、植被演替、植被分布格局变化、造林以及森林经营措施等对流域径流泥沙影响的主要研究成果；概括了目前研究采用的3种主要方法，即植被变化对坡面水流动力学影响的实验室模拟、坡面尺度和流域尺度野外对比观测实验以及水文生态模型模拟方法；分析了植被变化与径流泥沙响应研究要考虑的尺度问题，从小区尺度上推至流域尺度或区域尺度时应考虑不同的生物物理控制过程。研究认为，要确切理解植被与径流泥沙在不同时空尺度的相互作用，必须以等级生态系统的观点为基础，有效结合生态水文与景观生态的理论，从地质-生态-水文构成的反馈调节入手，系统地理解植被变化与径流泥沙等水分养分之间的联系及反馈机制，建立尺度转换的基础。同时，作为有效的研究工具，今后水文模型的发展应更加注重耦合植被生理生态过程以及景观生态过程，从流域径流泥沙对多尺度植被变化水文响应的过程与机制入手，为植被恢复与重建、改善流域水资源状况和流域生态环境奠定基础

关键词 植被变化；径流泥沙；尺度；水文模型

分类号 Q948.2

Runoff and sediment yield response to vegetation change at multiple scales: A review

ZHANG Zhi-Qiang[1], WANG Sheng-Ping[1], SUN Ge[2], XIE Bao-Yuan[1]

1.Key Lab. Soil and Water Conservation and Desertification Combating, Ministry of Education, Beijing Forestry University, Beijing 100083, China;

2. Southern Global Change Program, USDA Forest Service, Raleigh, Raleigh, NC 27606, USA

Abstract One of the key research areas in modern ecohydrology is studying the feedbacks between vegetation dynamics in structure, distribution, and succession and hydrologic processes at multiple spatial and temporal scales. Coupling vegetation dynamics at multiple scales is essential to explore the mechanisms of water and sediment yield response to vegetation changes such as vegetation reestablishment, development, succession, distribution, and management practices. We reviewed literature on advances in studying the processes and mechanisms of the vegetation influence on runoff and sediment production in relations to vegetation growth, vegetation succession, vegetation patterns and distribution, as well as afforestation and deforestation. Our review suggests that empirical experimental ecohydrological research methods include laboratory approach that employs hillslope hydrodynamic theories, field hillsclope experiments, and watershed experiments. Watershed-scale simulation models are also well used in ecohydrological research. This study suggests that up-scaling the results of hydrological studies at small scales must take into account the interactions and feedbacks of geology-vegetation-hydrological processes in a hierarchical system. Understanding the feedbacks and dominant controlling mechanisms among vegetation, hydrology, erosion, and nutrient dynamics is the key to scaling research results at multiple scales Integration of landscape ecophysiological processes and hydrological processes in spatially distributed, physicall

y-based hydrological modeling is the key to understanding the vegetation-hydrology-soil erosion a nd sediment yield processes.

Key words vegetation dynamics； runoff and sediment production； scale

DOI

通讯作者 张志强 zhqzhang@bjfu.edu.cn