

气候遗留效应和河流缓冲作用对北方河岸森林植被生长的影响研究

李滢钰¹, 孙巧奇^{1*}, 邹红菲^{1*}, Petra Marschner²

1 东北林业大学野生动物与自然保护地学院

2 澳大利亚阿德莱德大学农业、食品和葡萄酒学院

摘要:【目的】北方河岸森林是生态系统过程的重要区域之一,对气候变化很敏感。温度、降水和积雪对北方河岸森林生态系统的植被生长有着很大影响。气候对植被生长的影响可能是长期的,这种长期影响通常被称为“气候记忆”或“气候遗留效应”。过去和当前的气候对北方河岸森林植被生长影响的研究较少,特别是积雪持续时间的气候记忆尚不清楚。此外,植被与河流的距离是否会进一步改变气候记忆,这一点存在很大的不确定性。【方法】本研究基于 MODIS 卫星 2001 年至 2020 年 NDVI 的时间序列以及气候网格数据,量化了北方河岸林中不同植被类型(灌木林、落叶针叶林和落叶阔叶林)对过去和当前的气候(温度、降水和积雪持续时间)的响应,并进一步确定了与河流距离相关的气候记忆。【结果】结果表明,温度升高、降水增加以及较长的积雪覆盖时间有利于植被的生长。不同植被类型的气候记忆大小有所不同。同时,植被与河流的距离会改变温度和积雪持续时间对植被生长的持续性影响。【结论】本研究强调了积雪持续时间对北方河岸森林植被生长的重要性,建议未来在研究北方森林和类似生态系统对气候变化的响应模型构建时,考虑积雪的持续性影响。

关键词: 北方河岸森林; 气候记忆; NDVI; 积雪持续时间; 河流缓冲作用

Climate Legacy and River Buffering Effect on Vegetation Growth in a Boreal Riparian Forest

Yingyu Li¹, Qiaoqi Sun^{1*}, Hongfei Zou^{1*}, Petra Marschner²

1. College of Wildlife and Protected Area, Northeast Forestry University, 26 Hexing Road, Harbin 150040, China

2. School of Agriculture, Food and Wine, The University of Adelaide, SA 5005, Australia

*Corresponding author: qiaoqi.sun@nefu.edu.cn; hongfeizou@163.com

Abstract

Objective: The boreal riparian forest is one of the important areas in the ecosystem process and is sensitive to climate change. Temperature, precipitation, and snow cover have a significant impact on the vegetation growth of

the boreal riparian forest. The effect of climate on vegetation productivity/growth can be long-lasting, and this extended impact is commonly referred to as “climate legacy” or “climate memory”. However, little is known that the impact of concurrent and antecedent climate, particularly snow cover duration, on vegetation growth in a boreal riparian forest. Additionally, large uncertainty exists regarding whether distance to a river (as a proxy of groundwater availability) further modifies these climatic legacy effects on vegetation growth.

Methods: To fill this knowledge gap, we quantified the responses of different vegetation types (shrub, deciduous coniferous and broadleaf forests) to concurrent and antecedent climate variables (temperature, precipitation, snow cover duration) in a boreal riparian forest, and further determined the magnitude and duration of climate legacies in relation to distance to a river, using MODIS derived NDVI time series with gridded climate data from 2001 to 2020.

Results: Results showed that higher temperature and precipitation and longer snow cover duration increased vegetation growth. The climate memory varies among different vegetation types. Distance to a river modified the concurrent and antecedent temperature and snow cover duration legacy effects on vegetation growth.

Conclusions: Our research highlights the importance of snow cover duration on vegetation growth and that closeness to a river can buffer adverse climate impacts by shortening the strength and duration of climate legacies in a boreal riparian forest. We suggest that future studies on investigating the response of boreal forests and similar ecosystems to climate change should consider the positive and long-lasting effect of snow cover.

Key words: Boreal riparian forest; Climate memory; NDVI; Snow cover duration; Buffering effect