From Forest Nursery Notes, Summer 2007

42. © The long-term effects of fire suppression and reforestation on a forest landscape in Northeastern China after a catastrophic wildfire. Wang, X., He, H. S., and Li, X. Landscape and Urban Planning 79:84-95. 2007.

Available online at www.sciencedirect.com
ScienceDirect
Landscape and Urban Planning 79 (2007) 84–95
LANDSCAPE AND URBAN PLANNING
This article is also available online at: www.elsevier.com/locate/landurbplan

The long-term effects of fire suppression and reforestation on a forest landscape in Northeastern China after a catastrophic wildfire

Xugao Wang [a,c,*], Hong S. He [b], Xiuzhen Li [a]

[a] *Institute of Applied Ecology, Chinese Academy of Science, P.O. Box 417, Shenyang 110016, China*
[b] *School of Natural Resources, University of Missouri, Columbia, MO 65211, USA*
[c] *Graduate School of Chinese Academy of Science, Beijing 100039, China*

Received 14 October 2005; received in revised form 21 March 2006; accepted 23 March 2006
Available online 19 June 2006

Abstract

This study used the LANDIS model to evaluate the effects of fire suppression and reforestation on fire dynamics, species abundance, and age structure of two main species (larch (*Larix gmelinii*) and white birch (*Betula platyphylla*)) in Tuqiang Forest Bureau on the northern slopes of Great Hing'an Mountains after a catastrophic fire in 1987. Three fire regimes (no fire, low fire suppression, and current high fire suppression) and two planting strategies (no planting and larch planting) were compared in a 3×2 factorial design using 10 replicated simulations per treatment combination over a 300-year period. The results showed that compared with low fire suppression scenario, high fire suppression would create a landscape with lower-frequency and higher-intensity fire, whereas reforestation had no significant influence on cumulative area damaged by fire in the study landscape. High fire suppression positively influenced larch abundance, but negatively influenced white birch abundance. The results showed under high fire suppression scenario, over-mature larch forests had greater abundance than that under low fire suppression scenario, whereas younger cohorts show an opposite pattern to the old age cohorts. Under the "larch planting" scenario, larch at each age class had a greater abundance than that under the "no planting" scenario. Younger cohorts of white birch under the high fire suppression scenario had a lower abundance than that under the low fire suppression.

The results also showed that reforestation positively influenced larch abundance, but negatively influenced white birch abundance. Compared with the "no planting" scenario, it would take 30–40 years longer for larch abundance to return to pre-fire abundance in 1987 than under the "larch planting" scenario. Also, under the "larch planting" scenario, larch always had an obviously greater abundance than that under the "no planting" scenario in the 300-year simulation. Therefore, reforestation would benefit larch recovery, which could last for more than 300 years. These results have important implications for forest managers to design sound forest restoration projects for landscapes affected by large infrequent disturbances by fire. In particular, the results suggest that high fire suppression and reforestation would be appropriate in the study landscape, based on the purpose of local government to increase the abundance of coniferous forests as soon as possible.

Keywords: Great Hing'an Mountains; LANDIS; Fire suppression; Reforestation; Forest recovery

1. Introduction

The deciduous and coniferous forests of the Great Hing'an Mountains in northeastern China provide greater wood production than other forested regions in the country. This area also encompasses unique ecological and environmental systems (Zhou, 1991; Xu, 1998). Fire disturbance is the important driving force of forest ecosystem dynamics in the region (Zhou, 1991). Fire disturbance regimes have been strongly modified by humans during 20th century. The success of fire suppression, coupled with a warmer, drier climate due to global warming (Xu, 1998), have led to fuel buildup and resulted in fires of greater intensity and extent than those that occurred historically in the region. On May 6, 1987, a catastrophic fire occurred on the northern slopes of Great Hing'an Mountains, burning a total area of 1.3×10^6 ha, with disastrous effects on forest composition and structure, ecosystem processes, and landscape pattern (Xiao et al., 1988; Shu et al., 1996).

Forest recovery in such vastly burned areas is challenging because the long-term landscape-level vegetation dynamics in a forest landscape are complicated by spatial and temporal inter-

* Corresponding author. Tel.: +86 24 83970350; fax: +86 24 83970351.
E-mail addresses: wxg_7980@163.com, wangxugao@hotmail.com (X. Wang), HeH@missouri.edu (H.S. He), lixz@iae.ac.cn (X. Li).

0169-2046/$ – see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.landurbplan.2006.03.010