



RESEARCH ARTICLE

Regeneration complexities of *Pinus gerardiana* in dry temperate forests of Indian Himalaya

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Abstract *Pinus gerardiana* is considered an important species in dry temperate forests of North-Western Indian Himalaya because of its influence on ecological processes and economic dependence of local people in the region. But, large numbers of biotic and abiotic factors have affected *P. gerardiana* in these forests; hence, there is a crucial need to understand the regeneration dynamics of this tree species. The present investigation was conducted in *P. gerardiana* forests to understand vegetation pattern and regeneration processes on different sites in the region. Statistical analysis was performed to know variability in growing stock and regeneration on sample plots, while correlation coefficients and regression models were developed to find the relationship between regeneration and site factors. The vegetation study showed dominance of *P. gerardiana*, which is followed by *Cedrus deodara*, *Pinus wallichiana* and *Quercus ilex* in the region. The growing stock of *P. gerardiana* showed steep increasing and then steadily declining trend from lower to higher diameter class. The distribution of seedling, sapling, pole and trees was not uniform at different sites and less number of plots in each site were observed to have effective conditions for continuous regeneration, but mostly showed extremely limited regeneration. Regeneration success ranging from 8.44 to

15.93 % was recorded in different sites of the region, which suggests that in different sites regeneration success is influenced by collection of cone for extracting seed, grazing/browsing and physico-chemical properties of soil. Regeneration success showed significant correlation and relationship with most of abiotic and biotic factors. The regeneration success is lower than the requirement of sustainable forest, but varies widely among sites in dry temperate forests of Himalaya. More forest surveys are required to understand the conditions necessary for greater success of *P. gerardiana* in the region.

Keywords *Pinus gerardiana* · Regeneration · Himalaya · Growing stock · Biotic factor · Abiotic factor

Introduction

Pinus gerardiana Wall. ex D. Don is an important ecological and economic species of North-West Indian Himalaya. The species yields edible nuts/seeds, a rich source of carbohydrates, proteins, fats, fiber and mineral matter (Thakur et al. 2009). But, this species is subjected to various biotic and abiotic disturbances (Fig. 1) that have reduced and limited