



Patterns of vole gnawing on saplings in managed clearings in Central European forests



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ABSTRACT

Sustainable management of European forests aims to ensure economic targets (timber production) as well as ecological aims of the forest (maintenance of biodiversity). Smaller-sized clear-cutting followed by artificial planting creates a mosaic of small forest patches suitable for many small mammals including three possible pest species – the bank vole (*Clethrionomys glareolus*), the field vole (*Microtus agrestis*) and the common vole (*Microtus arvalis*). The vole gnawing pattern was studied on a number of small-sized clearings (up to 2 hectares) situated in managed forests in the Czech Republic (Central Europe). Damage by voles gnawing occurred almost in all study areas; mostly damaged were saplings on clearings at the age up to 5 years after planting, with herb layer dominated by grasses and situated above 700 m a.s.l. The field vole was identified as the main pest species and its density was identified as the most important predictor of gnawing occurrence even though its density on clearings was usually lower than that of the bank vole. Gnawing by voles caused direct mortality of saplings to a greater degree than other biotic factors including deer fraying and browsing; however, saplings were able to repress the effect of gnawing by natural re-grow of bark and the majority of damaged saplings survived, even though with significant stem deformations. While strong inter-annual variation in damage rate is reported in northern Europe, damage rates in Central European managed forests are lower (at about 3.5% per annum) but more consistent with only moderate inter-annual variation. As a result, despite the relatively low rate of damage which may occur in any given year, damage levels can accumulate over several years after planting with significant economic implications for forestry management.

1. Introduction

Small rodents represent an important part of forest ecosystems. They provide a crucial food resource for a variety of predators (Dawson and Bortolotti, 2000; Kouba et al., 2017) and the herbivorous rodents significantly influence the diversity and structure of plant communities through selective grazing or seed predation (Giller, 1984; Ostfeld and Canham, 1993; Grellmann, 2002; Hipkiss et al., 2008; Henden et al., 2009). Moreover, voles, especially, are considered to be serious pests in silviculture in many regions of the world (Hansson and Zejda, 1977; Gill, 1992a; Baxter and Hansson, 2001; Huitu et al., 2009). Voles may frequently cause direct damage during the earliest phases of forest regeneration by removing bark from young seedlings or severing them

entirely (Gill, 1992a; Baxter and Hansson, 2001; Niemeyer and Haase, 2002; Borowski, 2007; Sullivan and Sullivan, 2008). In addition to a direct negative effect in the form of increased mortality, the effects of bark gnawing may also be indirect. Removal of part of the bark can facilitate entry of wound-infecting pathogens which may then further affect seedling condition and subsequent timber quality (Bazzigher, 1973; Roll-Hansen and Roll-Hansen, 1980; Gill, 1992b). Resulting infections can increase mortality at later stages of tree development, and may also reduce the economic value of timber, e.g., through stem deformations or “staining” of the timber (Heikkilä and Löyttyniemi, 1992).

Even though rodent damage in forestry is known from both hemispheres (Baxter and Hansson, 2001), the most extensive damage is

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