

Succession of Collembola in Stumps of Douglas-Fir Seres Representing Clearcuts to Old-growth Forest

Heikki Setälä

University of Jyväskylä
Finland

Valin. G. Marshall

Forestry Canada, Pacific Forestry Centre
Victoria, B.C.

Introduction

The importance of coarse woody debris (CWD) as an essential component of terrestrial ecosystems has been recognized only recently (Harmon *et al.* 1986). Most of the CWD input in North American coastal forests is as logs, but in continuously harvested areas stumps may form the major part of CWD in the forest floor. Although CWD is reported to provide an array of important ecological functions, little information on the importance of stumps in forest ecology exists.

The aims of this study were to provide information on the succession of soil fauna during the decomposition of stumps in old-growth and managed Douglas-fir ecosystems, and to predict the outcome of forestry practices on the biodiversity of this fauna. Data on Collembola distribution and diversity are presented in this paper.

Material and Methods

The study was carried out in the chronosequence study areas established for the Forest Ecosystem Dynamics Program. Soil animals were sampled from Douglas-fir stumps of three different decay classes (from relatively intact to well-decayed wood). The sampling was repeated three times (in late summer, winter, and spring) in each of the four successional forest seres (regeneration, immature, mature, and old-growth) at three locations.

Results and Discussion

Stumps as a habitat

Decaying stumps of Douglas-fir proved to harbour a species-rich and abundant community of soil-inhabiting collembolans. A total of 72 species was detected during the study, covering the three locations with each successional sere and decay class of the stumps. On a volume basis, the population density in well-decayed stumps was equal or even exceeded that of the organic layers of surrounding soil. Moreover, as compared to other similar studies, the stumps seemed to be richer in soil microarthropods than were logs. These findings indicate that Douglas-fir stumps provide an important habitat for Collembola, and are, contrary to a general view (Lloyd 1963; Seastedt *et al.* 1989), not exploited by the fauna as a marginal habitat only.

Distribution of Collembola in the successional seres

The four successional seres of forests can be divided into two distinct groups with respect to the organization of the collembolan populations in the stumps: the three forested stands are distinctly separated from the clearcut stand. The number of specimens was significantly less in the regeneration site than in the forested sites. Also, the average number of species found in the regeneration site was slightly smaller compared to that number found in the forests.

The forested seres showed a collembolan fauna of similar composition. However, ordination analysis (DCA) indicates a weak clustering of the fauna into "seral communities." Of the total of 72 species encountered, none was restricted to any particular successional sere. However, two species of *Collembola* showed a marked preference for stumps in the regeneration site.

Conclusions

The collembolan fauna in the stumps of the earliest successional stage after disturbance (clearcutting) differed both qualitatively and quantitatively from the fauna typical of old-growth forest. This is probably due to the acute physical disturbance (reduced moisture, increased irradiation) caused by clearcutting and to the subsequent slashburning. This kind of perturbation is severe enough to decrease the collembolan diversity for at least some decades following the felling of old growth. Because the functional importance of *Collembola* in decomposition and nutrient mobilization of the wood is unknown, it is difficult to predict the ecological consequences of the reduction of the *Collembola* due to clearcutting.

Further analysis will include other faunal groups and an attempt to relate the findings to whole-tree logging and destumping practices.

References

- Harmon, M.E., J.F. Franklin, F.J. Swanson, P. Sollins, J.D. Lattin, N.H. Anderson, S.V. Gregory, S.P. Cline, N.G. Aumen, J.R. Sedell, G.W. Lienkaemper, K. Cromack, Jr., and K.W. Cummins. 1986. The ecology of coarse woody debris in temperate ecosystems. *Recent Advances in Ecological Research* 15:133-302.
- Lloyd, M. 1963. Numerical observations on the movements of animals between beech litter and fallen branches. *J. Anim. Ecol.*, 32:157-163.
- Seastedt, T.R., M.V. Reddy, and S.P. Cline. 1989. Microarthropods in decaying wood from temperate coniferous and deciduous forests. *Pedobiologia* 33:69-77.