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Do Browsing Ungulates Diminish Avian Foraging?

Studies of Woodpeckers in Forest Understory Communities of Central Europe and Western North America Show Cause for Concern

By Stanley Scher

Keywords: Browsing; ungulates; *Capreolus*; *Odocoileus*; songbirds; *Passeriformes*; woodpeckers; *Picidae*; *Colaptes*; *Dendrocopos*; *Hypopicus*; *Picoides*; *Picus*; sapsuckers; *Sphyrapicus*; foraging substrates; forest understory; vegetation structure; Common yew; *Taxus baccata*; Pacific yew; *Taxus brevifolia*. FDK 174.7 Taxus: 148.2: 149: 181.42: (73): (494.34)

1. Introduction

In forest communities, vegetation structure is a key determinant of avian abundance and diversity (MacArthur and MacArthur, 1961; Moss, 1978). Forest understory structure can be modified by browsing pressure from herbivores, subcanopy fires, silvicultural practices, application of herbicides, and other anthropogenic i.e. human-caused disturbances (McShea and Rappole, 1997). In a previous report, we called attention to interactions between browsing damage from ungulates such as deer, elk, and moose, to Pacific yew (*Taxus brevifolia*), an understory tree or shrub, and avian foraging in the Siskiyou Mountains and Cascade Range of southern Oregon (Scher, 1997). This paper addresses the following questions: How does ungulate herbivory change the structure and accessibility of foraging substrates? How do such changes influence avian abundance and local diversity? Do ungulate-induced structural changes in forest vegetation and their impact on bird populations represent cause for concern? To set this work in context, we provide background information on herbivore damage to understory trees and shrubs, briefly review the foraging ecology of woodpeckers, cite case studies to document ungulate damage to *Taxus* species in Central Europe and western North America, and explore impacts on woodpeckers with similar foraging strategies that occur on both continents.

2. Background

Many songbirds (*Passeriformes*) depend upon forest understory vegetation for food resources. Where densities of ungulate populations exceed the carrying capacity, heavy browsing alters the understory vegetation structure used by songbirds as foraging substrates (*deCalesta*, 1994, 1997; *McShae* and *Rappole*, 1997; *Scher*, 1997).

Gill (1992) defines browsing damage as removal of buds, foliage, shoots, and uprooting of seedlings. Browsing of terminal buds results in loss of apical dominance, replacement of leaders by laterals, development of multiple stems, and reduction of height growth (*Eiberle*, 1987; *Welch et al.*, 1991; *Putman*, 1996). Some ungulates also strip and consume the bark from stems (*Parks* and *Tiedemann*, 1993; *Putman*, 1996).

In Central Europe, the influence of deer browsing on understory forest vegetation has been documented for centuries (*Bechstein*, 1821; *Burckhardt*, 1865; *Brueckner*, 1993; *Roth*, 1996). In Switzerland, *Leuthold* (1980) noted decline of the common yew (*Taxus baccata*) as a consequence of damage from excessive roe deer (*Capreolus capreolus*) populations.

In North America, browsing damage by white-tailed deer (*Odocoileus virginianus*) influences reproductive biology of Canada yew (*Taxus canadensis*) (*Allison*, 1990a, 1990b). Deer and other ungulates – elk and moose – retard vertical growth, reduce abundance, and suppress natural regeneration of Canada yew (*Snyder* and *Janke*, 1976; *Reisenhoover* and *Maass*, 1987; *Balگوویان* and *Waller*, 1995) and Pacific yew (*Taxus brevifolia*) (*Nelson* and *Leege*, 1974; *Pierce*, 1984; *Parks* and *Tiedmann*, 1993; *Scher*, 1997).

Woodpecker Foraging Ecology

Members of the *Picidae* family display a wide range of foraging strategies. Flickers (*Colaptes*) obtain their food primarily by foraging on the ground. Sapsuckers (*Sphyrapicus*) capture insects from the air like flycatchers (*Muscicapidae*) (*Bent*, 1939; *Howell*, 1952; *Kilham*, 1977; *Raphael* and *White*, 1984; *Shuford*, 1993); but most woodpeckers drill holes in the bark of trees to collect insects.

The North American Acorn Woodpecker (*Melanerpes formicivorus*) (*MacRoberts*, 1970; *Winkler et al.*, 1995) and four species of sapsuckers (*Sphyrapicus*) (*Tate*, 1969, 1973; *Scher*, 1997) drill small (approximately 3–8 mm diameter), evenly-spaced holes in horizontal rows or rings, often arranged in vertical columns or in spiral patterns to produce characteristic arrays in the bark of trees or other woody plants (*McAtee*, 1911; *Rushmore*, 1969) (*Figure 1*). Sapsuckers revisit and maintain thousands of drill holes as a food resource. Other birds, mammals, and insects visit woodpecker holes to

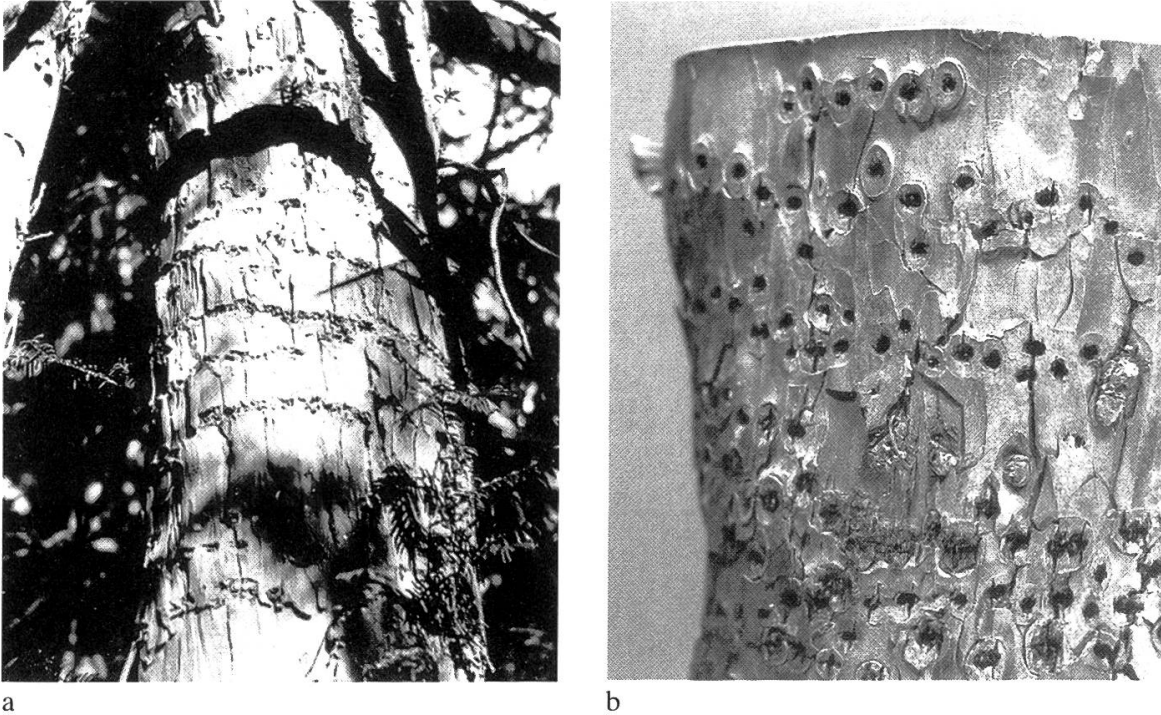


Figure 1. Woodpecker drill-hole patterns on the bark of: a. Common yew (*Taxus baccata*), (Kučera, 1972) and b. Pacific yew (*Taxus brevifolia*), (Scher, 1997).

consume sap, inner bark, and glean associated insects (Bolles, 1891; Kilham, 1953, 1958; Nickell, 1956; Foster and Tate, 1966; Miller and Nero, 1983; Ehrlich and Daily, 1988; Williams, 1990; Daily et al., 1994).

Several genera of European and Middle-Eastern woodpeckers – *Dendrocopus*, *Picoides*, *Picus* – (Turcek, 1954; Klima, 1959; Ruge, 1970; Kučera, 1972; Miech, 1986; Mossadegh, 1997; see reviews by Cramp et al., 1985, and Winkler et al., 1995) and at least one Asian sapsucker (*Dendrocopus*, *Picoides* or *Hypopicus*) (Osmaston, 1916; Abdulali, 1968; Zusi and Marshall, 1970) also create sapsucker-like drill-hole patterns in the bark of selected trees where they function as community feeding stations.

3. Study sites and Methods

In western North America, we investigated ungulate damage to Pacific yew in a mixed conifer forest on the Dead Indian Plateau in the Cascade Range, approximately 32 km (20 miles) east of Ashland in Jackson County, southwestern Oregon. Slopes on the plateau are gentle to flat, and elevations range from 1340 to 1830 m (4500 to 6000 ft.) (Minore, 1978).

In Central Europe, we observed evidence of ungulate damage to the common yew (*Taxus baccata*) in the beech- (*Fagus sylvatica*) dominated forests of Üetliberg in the lower Alps, just southwest of Zurich where slopes are steep and elevations range from 480–870 m (1575–2854 ft.) (Koch, 1975).

We used hedging of yew as a measure of ungulate browsing. In southwestern Oregon, we estimated the number and distribution of drill holes as evidence of woodpecker activity on understory and overstory conifers, and compared cumulative counts to integrate foraging activity over multiple years (Scher, 1997).

4. Results

We found evidence of ungulate damage to unprotected yew trees and shrubs in the forest understory on both continents. Terminal bud browsing by ungulates resulted in formation of multiple leaders, reduced rate of height growth, and increased production of lateral branches compared with unbrowsed controls.

In western North America, the number of sapsucker drill holes per tree ranged over several orders of magnitude, approaching several thousand on Pacific yew stems greater than 10 cm (4 inches) diameter at breast height (DBH) (Scher, 1997). At two sites in Central Europe – one near St. Gallen in the Canton of Appenzell, Switzerland (Kučera, 1972), and another at Guggenberg bei Adnet, about 10 km (6 miles) southeast of Salzburg, Austria (Eichberger and Heiselmayer, 1995) – attempts to quantify the number of woodpecker drill holes on common yew were impeded by attenuated horizontal spacing resulting in an overlapping pattern (Figure 1).

Yew trees heavily browsed by ungulates lacked evidence of woodpecker foraging. Absence of woodpecker drill holes on yew modified by growth responses to ungulate damage suggests that the altered branching structure of heavily browsed plants may limit access to woodpeckers and other bark-foraging birds in North America and Eurasia.

5. Discussion

Using hedging as a measure of ungulate damage and drill-hole patterns as evidence of woodpecker foraging activity, we explored the relationship between ungulate browsing and bark-foraging on Pacific yew in southwestern Oregon and the common yew in Central Europe. Our early observations lead us to the hypothesis that ungulate damage induces growth responses in yew species resulting in modified branching patterns which serve as a barrier to restrict or exclude access of woodpeckers and other bark-foraging bird species to foraging substrates and food resources. By modifying the forest understory structure, large populations of ungulates can strongly influence resource availability to other organisms (Jones *et al.*, 1997).

As noted above, drill holes created and maintained by sapsuckers and other woodpeckers with similar foraging strategies serve as feeding stations for other birds, mammals, and insects (Bolles, 1891; Batts, 1953; Kilham, 1953, 1958; Nickell, 1956; Foster and Tate, 1966; Miller and Nero, 1983; Ehrlich and Daily, 1988; Williams, 1990). Avian visitors to such feeding stations include other woodpeckers, other bark-foraging bird species such as creepers (*Certhidae*) and nuthatches (*Sittidae*), as well as wrens (*Troglodytidae*), warblers (*Parulidae*), chickadees (*Paridae*), hummingbirds (*Trochilidae*), kinglets (*Sylviidae*), siskins and goldfinches (*Fringillidae*) (Ehrlich and Daily, 1988). Accordingly, by restricting access to woodpecker foraging substrates, ungulate browsing may indirectly impact bird abundance and local diversity. These observations are consistent with previous work demonstrating declines in forest understory bird populations (Boone and Dowell, 1986; Baird, 1990) and diversity (Casey and Hein, 1983; Dessecker and Yahner, 1987) attributed to high deer densities.

This work, taken together with other relevant studies (deCalesta, 1994, 1997; McShea and Rappole, 1997; Scher, 1997) raises the question: At what point should action be taken to prevent further ungulate-induced damage to forest understory communities? In response to this question, Noy-Meier (1981) and McShea and Rappole (1997) agree on one criterion: when damage by ungulate populations interferes with conservation efforts to protect other species.

Summary

This paper explores impacts of ungulate browsing on avian access to bark-foraging substrates in the forest understory of Central Europe and southwestern Oregon. We used hedging as a measure of growth responses to ungulate damage to the common yew (*Taxus baccata*) and Pacific yew (*Taxus brevifolia*). To study woodpecker foraging behavior, we estimated the number and distribution of woodpecker drill holes on the bark of yew stems. The absence of drill holes on hedged plants provides evidence of an indirect effect of browsing on woodpecker foraging activity. The widespread use of woodpecker drill holes as a food resource by other woodpeckers, other bark-foraging bird species, other songbirds, as well as mammals and insects suggests that structural changes in forest understory vegetation resulting from ungulate browsing may influence abundance and local diversity of songbirds and other woodpecker-dependent members of the understory community.

Résumé

L'abroustissement de l'If par les ongulés diminue-t-il les perforations corticales par les oiseaux?

Des études de Pics dans des communautés du sous-étage forestier d'Europe Centrale et de l'Ouest de l'Amérique du Nord révèlent des relations de cause à effet

Ce travail explore les impacts de l'abroustissement par des ongulés sur l'accès à des substances nutritives corticales pour des oiseaux, dans les sous-bois d'Europe Centrale et de l'Oregon du sud-ouest. La réaction à des dommages causés par des ongulés à l'If commun (*Taxus baccata*) et à l'If du Pacifique (*Taxus brevifolia*) fut établie par l'intermédiaire de tailles expérimentales. Pour l'étude du comportement nutritif du Pic, il fut procédé à l'estimation du nombre et de la distribution des points de perforation dans l'écorce de fûts d'ifs. L'absence de perforations sur les plantes soumises à une taille met en évidence un effet indirect de l'abroustissement sur l'activité du Pic. L'utilisation générale de ces points de perforation par d'autres pics, d'autres espèces d'oiseaux à comportement nutritif analogue, de même que par des mammifères et des insectes suggère que des changements de structure du sous-étage forestier suite à l'abroustissement par des ongulés pourraient influencer l'abondance et la diversité locale des oiseaux chanteurs et des autres membres de cette communauté liée au Pic.

Traduction: *Ernst Zürcher*

Zusammenfassung

Wirkt sich Wildverbiss nachteilig auf die Nahrungssuche von Vögeln aus? Untersuchungen über Spechte in der Unterschicht von Wäldern in Mitteleuropa und im Nordwesten von Amerika geben Anlass zur Besorgnis

Diese Arbeit handelt von den Auswirkungen des Schalenwildverbisses in der Unterschicht von Wäldern in Mitteleuropa und im südwestlichen Oregon auf die Zugänglichkeit der Gehölze für Vögel, die ihre Nahrung von der Rinde ablesen. Um die Wuchsreaktion der Gemeinen Eibe (*Taxus baccata*) und der Pazifischen Eibe (*Taxus brevifolia*) auf Wildverbiss bemessen zu können, wurden diese Gehölze wie Hecken geschert. Um das Verhalten von nahrungssuchenden Spechten zu untersuchen, wurde die Anzahl und die Verteilung von Spechtlöchern in der Rinde von Eibenstämmen ermittelt. Das Fehlen von Spechtlöchern an zurückgeschnittenen Gehölzen legt eine indirekte Wirkung des Verbisses auf die Nahrungssuche der Spechte nahe. Es ist üblich, dass vorhandene Spechtlöcher von weiteren Spechten, anderen rindenabsuchenden Vogelarten, anderen Singvögeln sowie auch von Säugetieren und Insekten als Nahrungsquelle benutzt werden. Strukturelle Veränderungen der Vegetation der Unterschicht aufgrund von Wildverbiss können deshalb Einfluss haben auf die Abundanz und die lokale Diversität von Singvögeln und anderen Bewohnern der Unterschicht, die von der Aktivität der Spechte abhängig sind.

Übersetzung: *Erica Zimmermann*

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