



Overabundant ungulates in French Sologne? Increasing red deer and wild boar pressure may not threaten woodland birds in mature forest stands

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Abstract

Increasing ungulate populations have been considered to drive changes in woodland bird communities in temperate and boreal forests. Ungulates may negatively affect understory-dependent woodland birds either directly or indirectly. For instance ungulates may prey on nests, or they may reduce the availability of nesting sites, foraging resources or cover for understory-dependent bird species.

We conducted ungulate pressure, vegetation and bird surveys on 95 plots, in 19 mature forest stands (9 fenced and 10 unfenced properties) located in the Sologne region (France). In such private forests, ungulate population densities are highly variable; we were therefore able to explore the effects of varying red deer (*Cervus elaphus*) browsing and wild boar (*Sus scrofa*) rooting intensity on bird communities. Bayesian Binomial mixture models indicated that ground-nesting birds were more abundant in forests with high observed wild boar rooting intensity.

Generally, increasing deer browsing pressure did not have any negative effect on woodland birds in mature forest stands with a developed canopy, and did not result in lower shrub cover. Most previous studies documenting a negative effect of browsing on birds focused on young forest stands where overstory vegetation was scarce. Our results suggest that the impact of ungulate pressure on forest birds may decrease with forest stand age.

Zusammenfassung

Zunehmende Huftierpopulationen werden für Verursacher von Änderungen in Vogelgemeinschaften von gemäßigten und borealen Wäldern gehalten. Die Huftiere können unterholzabhängige Waldvögel direkt und indirekt negativ beeinflussen. Sie können Nester plündern oder die Verfügbarkeit von Nistplätzen, Nahrung oder Deckung reduzieren. Wir führten Erhebungen zur Belastung durch Huftiere, zur Vegetation und zu den Vögeln auf 95 Probestellen in 19 reifen Wäldern (9 davon eingezäunt) in der Sologne-Region (Frankreich) durch. In solchen privaten Wäldern sind die Siedlungsdichten der Huftiere sehr variabel. Wir konnten deshalb die Effekte von unterschiedlichen Intensitäten der Beweidung durch Rothirsche (*Cervus elaphus*) und der Wühl­tätigkeit von Wildschweinen (*Sus scrofa*) auf die Vogelgemeinschaften untersuchen. Bayessche binomiale gemischte Modelle zeigten, dass die Abundanz der Bodenbrüter in Wäldern mit hoher Wühlintensität von Wildschweinen höher war.

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Allgemein hatte zunehmende Beweidungsintensität durch Rotwild keine negativen Effekte auf die Waldvögel dieser reifen Waldbestände mit einer entwickelten Kronenschicht und führte nicht zu einer geringeren Unterwuchsbedeckung. Die meisten früheren Untersuchungen, die einen negativen Einfluss der Beweidung auf die Vögel feststellten, konzentrierten sich auf junge Waldbestände mit einem spärlichen Kronendach. Unsere Ergebnisse legen nahe, dass der Einfluss der Huftiere auf die Waldvögel mit zunehmendem Bestandsalter abnehmen könnte.

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Introduction

Since the last century, wild ungulate populations have increased spectacularly in many temperate and boreal forests. This dramatic spread of ungulate populations has been counted among the main drivers of global environmental change (Auer & Martin 2013). Viable populations of large herbivores require large areas of land, and their browsing profoundly affects plant communities (Wallis De Vries 1995; Rooney & Waller 2003). Beside their direct effect on plant communities, wild boar and deer may have such a widespread impact on vegetation that they can indirectly affect the whole ecosystem functioning (Côté, Rooney, Tremblay, Dussault, & Waller 2004; Genov & Massei 2004; Bressette, Beck, & Beauchamp 2012). Deer and wild boar are thus considered keystone species in forested ecosystems (Waller & Alverson 1997).

In particular, increasing ungulate populations have been considered a strong driver of change in forest bird communities, especially because understory-dependent birds may be threatened (Schley & Roper 2003; Holt, Fuller, & Dolman 2014; Newson, Johnston, Renwick, Baillie, & Fuller 2012). Ungulates negatively affect bird communities either directly by wild boar preying on nests, nestlings or adult birds (Schley & Roper 2003), or indirectly by modifying understory plant species composition and structure through wild boar rooting or deer browsing (Genov & Massei 2004; Heinken, Schmidt, von Oheimb, Kriebitzsch, & Ellenberg 2006; Boulanger et al., 2009). The so-called cascading effect hypothesis assumes that modification of the understory structure may reduce habitat quality for low-nesting birds, and decrease food availability for low-foraging insectivorous birds (Bressette et al. 2012; Teichman, Nielsen, & Roland 2013). It has often been suggested in the literature that the lower in the vegetation the bird species forage or nest, the more they would be threatened under high ungulate pressure (Holt, Fuller, & Dolman 2011; Newson et al. 2012; Holt et al. 2014). However, most of these studies considered the woodland understory layer as a whole, and combined shrub-dependent, grass-dependent and bare-ground-dependent bird species into the same bird guild (Holt et al. 2011, 2014; Fonderflick, Besnard, & Martin 2013). In addition, authors have often mixed information about species requirements for nesting and for foraging in order to classify bird species as understory-dependent (Allombert, Gaston, &

Martin 2005; Teichman et al. 2013). Ungulates may induce a shift from shrub to grass cover in the understory and they have been said to reduce habitat quality for some shrub-dependent woodland birds (Genov & Massei 2004; Holt et al. 2011). However, ground-foraging bird species could benefit from an increase in bare soil areas (Schaub et al. 2010). Ground-nesting and ground-foraging bird species may also suffer higher predation risk in patches with higher vegetation layers (Low, Arlt, Eggers, & Pärt 2010). Understory-dependent bird species may thus respond in very different ways to increasing deer (Tymkiw, Bowman, & Shriver 2013) and wild boar (Barrios-Garcia & Ballari 2012) population densities.

Fencing is a fast spreading practice worldwide, especially as a wild game management tool (Somers & Hayward 2011). As an experimental tool, fencing has been used either to exclude ungulates from fenced study sites (Holt et al. 2011, 2014), or to vary ungulate population densities inside fenced lots (DeCalesta 1994). However, artificially high deer browsing intensities are likely to occur when the experimental enclosures are smaller than estimated deer home ranges (Tymkiw et al. 2013). To overcome such limitations, we studied how the actually encountered ungulate population densities may affect forest bird communities in nine fenced and ten unfenced forests in the French Sologne region. In this area, forest and game management practices vary widely depending on the owners' wishes and objectives; fences are often erected in order to maintain high game population densities within fenced lots. Deer browsing and wild boar rooting intensity vary as a result of the varying management practices: this quasi-experimental design allowed us to study how man-induced ungulate pressure may affect forest bird communities. We investigated the validity of a three-step-cascading-effect hypothesis compliant with deer-woodland bird interactions, as frequently described in the published literature (Allombert et al. 2005; Holt, Fuller, & Dolman 2010). Firstly, we tested whether fencing resulted in higher deer browsing and wild boar rooting intensity inside fenced lots as compared to unfenced control forests (our first hypothesis). Secondly, we tested whether the understory vegetation layer varied according to varying ungulate pressure (our second hypothesis). Thirdly, we tested whether woodland bird communities – especially understory-dependent species – were affected by ungulate pressure and modifications in the understory vegetation layer (our third hypothesis).

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