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The effects of nitrogen addition on the growth of two exotic and two native forest understory plants

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Abstract Many studies have linked the spread of exotic, invasive species to high nitrogen supply, but most of this work does not distinguish between various inorganic forms and different concentrations of available nitrogen. Previous research has suggested that exotic, invasive species common in eastern deciduous forests may preferentially utilize nitrate in contrast to native species that preferentially make use of ammonium. We tested this hypothesis by comparing the growth response of two common forest invaders, *Berberis thunbergii* and *Microstegium vimineum*, and two co-occurring native species (*Vaccinium pallidum* and *Hamamelis virginiana*) to different forms of nitrogen under varying concentrations in a greenhouse experiment. Two forms of nitrogen (nitrate or ammonium) were added at different concentrations (22, 106, and 212 mg N l⁻¹) to all species. Growth response variables included survival, stem length, stem diameter, above and belowground biomass, and estimated seed production (*Microstegium* only). Unexpectedly

the exotic species did not respond preferentially to nitrate addition. *Microstegium* responded most strongly to both nitrogen forms depending on the response variable. *Berberis* and *Hamamelis* surprisingly reacted similarly to nitrogen additions. As expected, *Vaccinium* fared poorly under most treatment conditions, but did show some growth in NH₄⁺ treatments. Our findings suggest species response to nitrogen addition is complex, and that exotic species do not all respond similarly to nitrogen inputs. In this study, the response of exotic and native species to available nutrients does not provide a general mechanism of invasion success.

Keywords Nitrogen · *Berberis thunbergii* · *Microstegium vimineum* · Invasive species · Forest understory

Introduction

Understanding the mechanisms behind the success of exotic, invasive species is crucial for predicting the likelihood of further spread and for designing effective control strategies. In eastern deciduous forests, several exotic shrubs and herbaceous plants have become highly abundant, forming extensive monocultures at the expense of native understory plants (Ehrenfeld et al. 2001; Baiser et al. 2008; Gilliam 2007; Gurevitch et al. 2008). Previous research has

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