Westfälische Wilhelms-Universität Münster

Justus-Liebig-Universität Giessen

Universität Bremen

Jan THIELE[1], Johannes KOLLMANN[2], Annette OTTE[3] & Maike ISERMANN[4]

Institute of Landscape Ecology, Environmental Planning Group, WWU Münster

Impact scores of invasive plants are biased by disregard of environmental co-variation and non-linearity

Aims

The aims of our study were to model the effects of three invasive plants on species richness, and to assess the influence of model choice on impact scores.

Methods

A. We modeled effects of *Heracleum mantegazzianum*, *Lupinus polyphyllus*, and *Rosa rugosa* on species richness with Generalized Linear Models (GLM) using 1. simple linear models ("basic"), and 2. models that accounted for environmental co-variation and non-linearity ("full") :

richness ~ habitat type + invader cover + (invader cover)²

(Thiele et al. 2010a, see bottom left).

B. We calculated impact scores by averaging predicted species loss over all sampled sites (see Equ. 1) using the basic and full models (Thiele et al. 2010b, see bottom right).

Equ. 1: $$\frac{\sum_i^n (\hat{y}_0 - \hat{y}_{x_i})}{n}$$, where $\hat{y}$ = predicted species richness, x_i = invader cover of site i, and n = number of sampled sites.

Results

All full models showed significant habitat effects on species richness. *Heracleum mantegazzianum* had regular linear effects; *L. polyphyllus'* effects interacted strongly with habitat type; effects of *R. rugosa* were non-linear. Impact scores differed markedly between the basic and full models (Fig. 1).

Conclusions

The choice of effect model is important for assessment of impacts of invasive plants. Effect models should account for environmental co-variation and include non-linear terms, if significant.

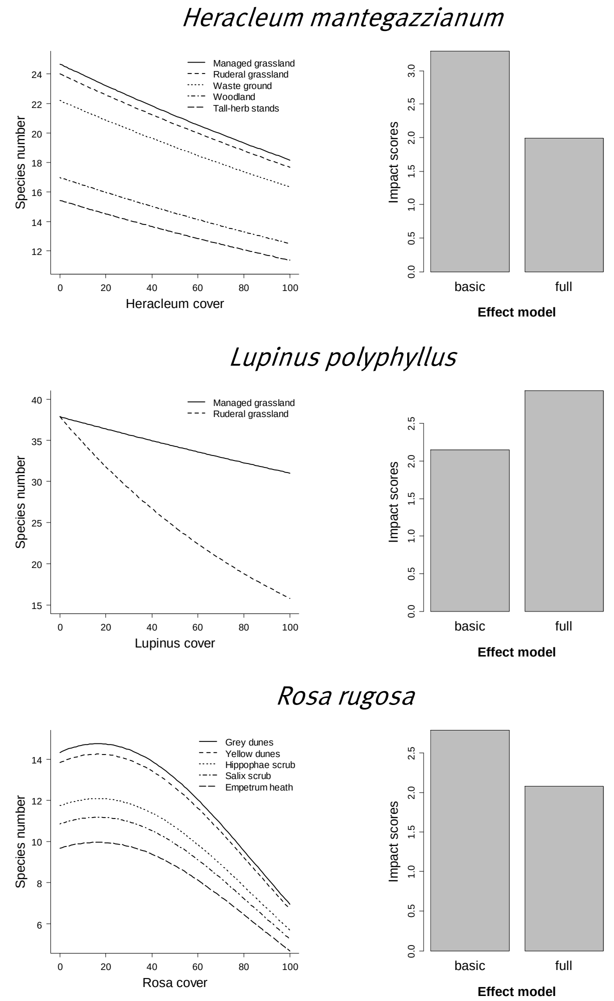

Fig. 1, left panels: Effect models (GLM) of three invasive plants on species richness. Models included habitat type, invader cover and squared invader cover (if significant). **Right panels:** Impact scores based on simple linear models („basic") and on the GLM shown in the left panels („full").

Competitive displacement or biotic resistance? Disentangling relationships between community diversity and invasion success of tall herbs and shrubs

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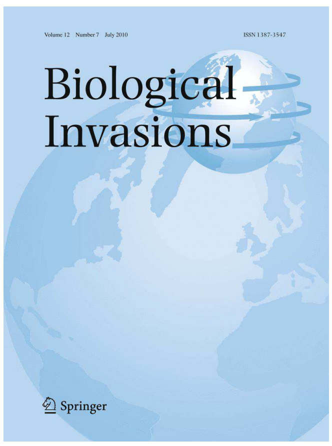

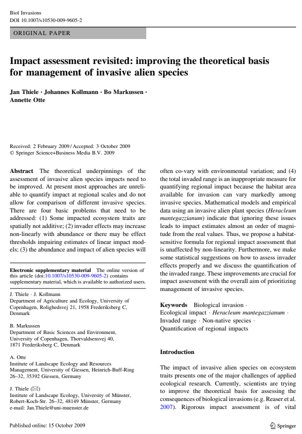

ORIGINAL PAPER

Impact assessment revisited: improving the theoretical basis for management of invasive alien species

Jan Thiele · Johannes Kollmann · Bo Markussen · Annette Otte

[1]Jan.Thiele@uni-muenster.de; University of Münster, Institute of Landscape Ecology, Robert-Koch-Str. 28, 48149 Münster, Germany
[2]Jok@life.ku.dk; University of Copenhagen, Department of Agriculture and Ecology, Rolighedsvej 21, 1958 Frederiksberg C, Denmark
[3]Annette.Otte@umwelt.uni-giessen.de; University of Giessen, Institute of Landscape Ecology and Resources Management, Heinrich-Buff-Ring 26–32, 35392 Giessen, Germany
[4]Maike.Isermann@uni-bremen.de; University of Bremen, Vegetation Ecology and Conservation Biology, Leobener Strasse, NW 2, 28359 Bremen, Germany