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Are invasive species drivers or passengers of succession?

[1]Jan Thiele & [2]Maike Isermann

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[1] University of Münster, Institute of Landscape Ecology, Robert-Koch-Str. 28, 48149 Münster, Jan.Thiele@uni-muenster.de

[2] University of Bremen, Vegetation Ecology and Conservation Biology, Leobener Str., NW 2, 28359 Bremen, Maike.Isermann@uni-bremen.de

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Research questions

- Does successional state control invader cover?
- Do invaders affect successional states or trajectories?

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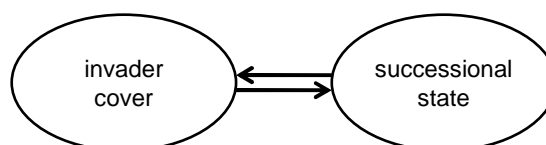
Study species (invaders)

| Scientific name	*Heracleum mantegazzianum*	*Rosa rugosa*
Engl. name	Giant Hogweed	Japanese Rose
Life form	Monocarpic tall-herb	Polycormic shrub
Invaded habitats	Mesic grassland, disturbed ground, nitrophilous tall-herb communities	Yellow and grey dunes, dune heath, also inland habitats

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Data sets

	Heracleum mantegazzianum	*Rosa rugosa*
No. of plots	202	63
Plot size (m²)	25	16
Study regions	Western, central and southern Germany	East Frisian Islands (Spiekeroog, Norderney, Juist)

• Invader cover percentage
• Lists of vascular plant species (+ cryptogams with *R. rugosa*)
→ species numbers of different plant groups (~ syntaxon. orders or classes)
• Habitat type

Statistical methods

- Detrended Correspondence Analysis (DCA)

- Generalized Linear Models (GLM):
  invader cover ~ DCA score + (DCA score)^2
  [species number ~ DCA score + (DCA score)^2]

- Canonical Correspondence Analysis (CCA):
  CCA axes ~ habitat type + invader cover

DCA of *Heracleum mantegazzianum* relevés
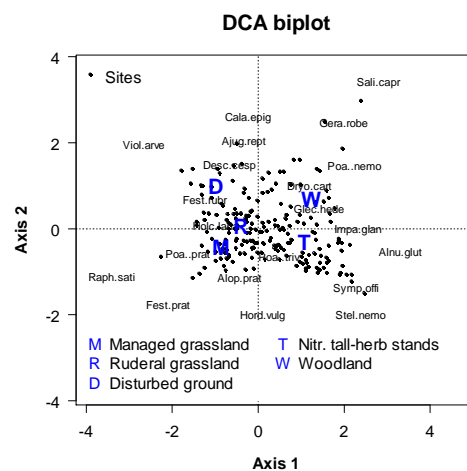
GLM of *H. mantegazzianum* cover and species numbers

Heracleum GLM

Predictor	P
DCA1	< 0.001
(DCA1)²	< 0.001
Pseudo R²	0.18
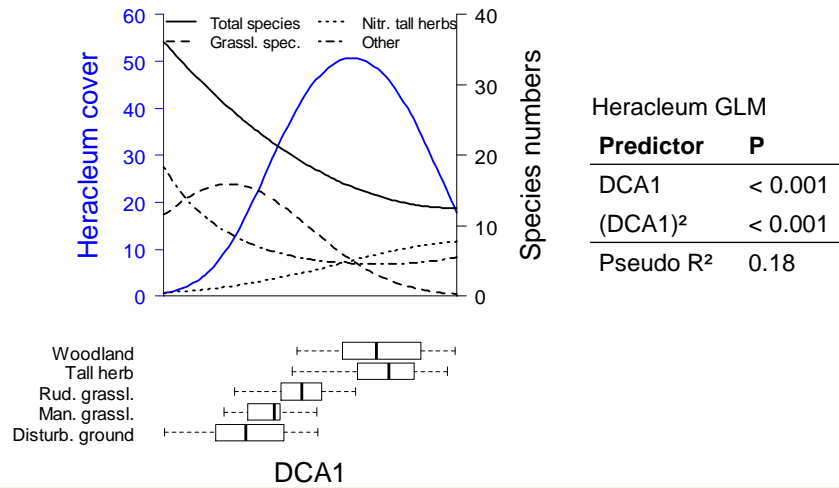
CCA of *Heracleum mantegazzianum* relevés

	Df	Chi²	F	Perm.	P
Habitat	4	1.02	3.27	999	0.001
H. mantegazzianum cover	1	0.09	1.21	999	0.073
Residual	196	15.23			

Possible interpretations for *Heracleum mantegazzianum*

|	Passenger	Driver
Cover of *H. mantegazzianum*	Controlled by environment (management, competition)	Cover increases by time
Succession of vegetation	Later-successional species (tall herbs, trees) establish; Succession proceeds normally	Later-successional species repelled or displaced; Succession shifts away from normal trajectory

Likely
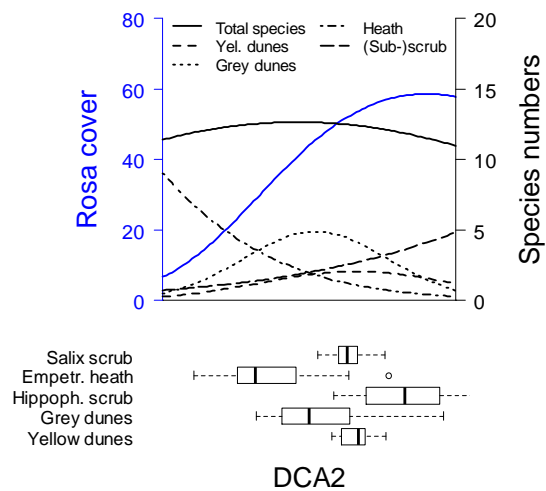

DCA of *Rosa rugosa* relevés
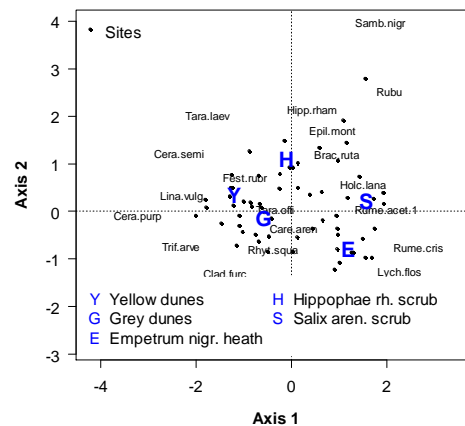
GLM of *Rosa rugosa* cover and species numbers (DCA1)
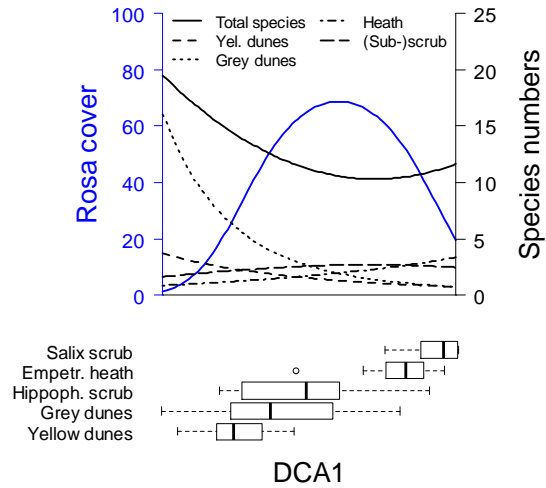
Rosa GLM 1

Predictor	P
DCA1	0.011
(DCA1)²	< 0.001
Pseudo R²	0.21

GLM of *Rosa rugosa* cover and species numbers (DCA2)

Rosa GLM 2

Predictor	P
DCA2	0.021
(DCA2)²	0.017
Pseudo R²	0.08

CCA of *Rosa rugosa* relevés

	Df	Chi²	F	Perm.	P
Habitat	4	1.34	3.60	999	0.001
R. rugosa cover	1	0.21	2.31	999	0.001
Residual	57	5.23			

Possible interpretations for *Rosa rugosa*

	Passenger	Driver
Cover of *R. rugosa*	Controlled by site conditions	Cover increases by time
Succession of vegetation	Later-successional species (dune-heath species) establish; Succession proceeds normally to brown dunes and, only later, to Rhamno-Prunetea scrub or woodland	Later-successional species (dune-heath species) repelled or displaced; Dune grasslands and dune heath transformed to dominant Rosa stands Successional trajectory prematurely shifts towards Rhamno-Prunetea scrub

Likely

Conclusions

- *Heracleum mantegazzianum* is likely to be a passenger of secondary successions
- *Rosa rugosa* is likely to accelerate primary succession to scrub, but to block further succession to woodland
- Long-term observations needed for proof