Stress as a key factor for the Niobe Fritillary (*Argynnis niobe*) in heavy-metal grasslands

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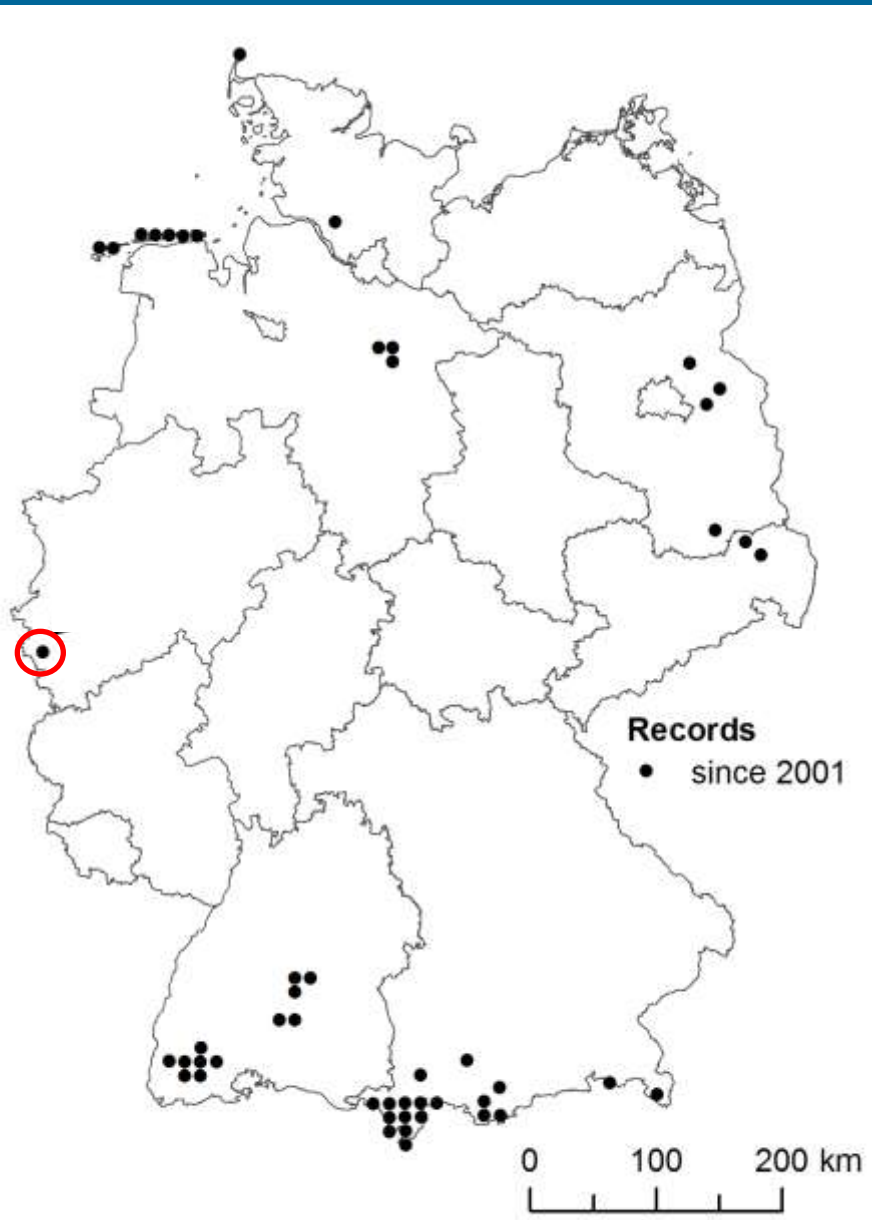
AG Biozönologie

International Symposium: Future of Butterflies in Europe III
Wageningen, 29th to 31st March 2012

Motivation

- dramatic decline throughout Central Europe
- habitat preferences are well known for coastal dunes (Salz & Fartmann 2009)
- BUT: Poor knowledge about inland populations

→ Comparison of habitat requirements in heavy-metal grasslands and costal dunes



Salz & Fartmann (2009): J. Insect. Conserv. 13: 643-654

Study species

Argynnis niobe

- univoltine
- hibernates as an egg
- larvae hatch in spring
- flight time: June to August
- host plant: *Viola* spp.

L5

Pupa

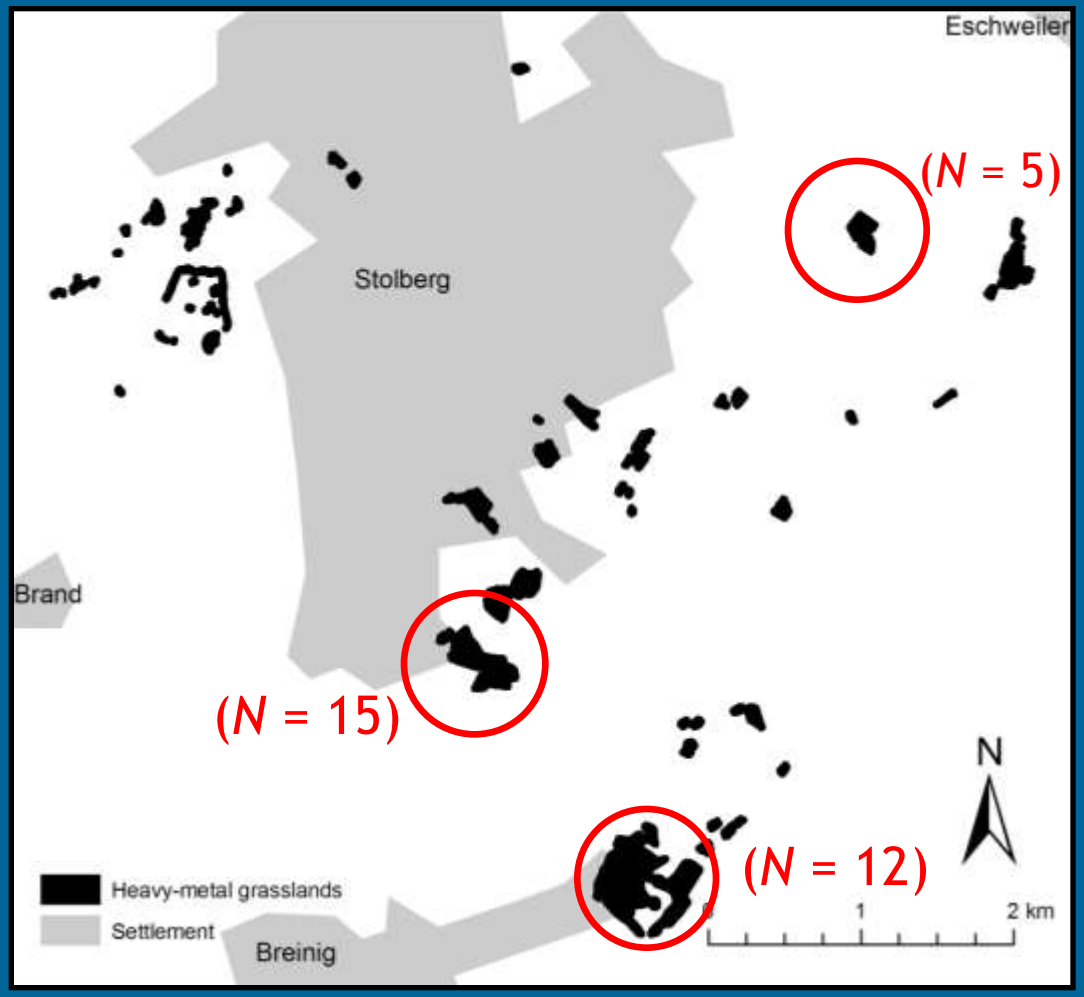
Male

Study area

Heavy-metal grasslands

- high heavy-metal contents in soil
  → physiological stress to plants
  → heavy-metal tolerance as adaptation
- heavy-metal concentrations in soil reduce speed of succession
- *Viola calaminaria*
  → Host plant

Study area


Eschweiler
Stolberg
Brand
Breinig
(N = 5)
(N = 15)
(N = 12)
N
Heavy-metal grasslands
Settlement
1
2 km

Microhabitat: Larvae sites

	Occupied (*N* = 32)	Random (*N* = 25)	P
Turf height (cm)	12 (4-25)	15 (4-25)	0 NS
Cover (%)			
Shrub layer	0 (0-35)	0 (0-20)	0 NS
Herb layer	50 (25-70)	60 (30-80)	- **
Litter	40 (20-90)	50 (5-80)	0 NS
Moss	7.5 (0-80)	5 (0-80)	0 NS
Lichen	0 (0-30)	0 (0-15)	0 NS
Bare ground	0 (0-7.5)	0 (0-5)	0 NS
V. calaminaria	10 (2-25)	5 (0.5-25)	+**
Maximum daily direct insulation (June)	15 (10-16)	14 (8-16)	0 NS

Microhabitat: Generalized linear model

(Larvae sites vs. random sites)

Explanatory variables	
Cover of herb layer	- **
Cover of *Viola calaminaria*	+ **
Pseudo R^2 [Mc Fadden] = 0.22	

Take-home message I

Habitat requirements in heavy-metal grasslands

(i) Cover of herb layer (-) → warm microclimate

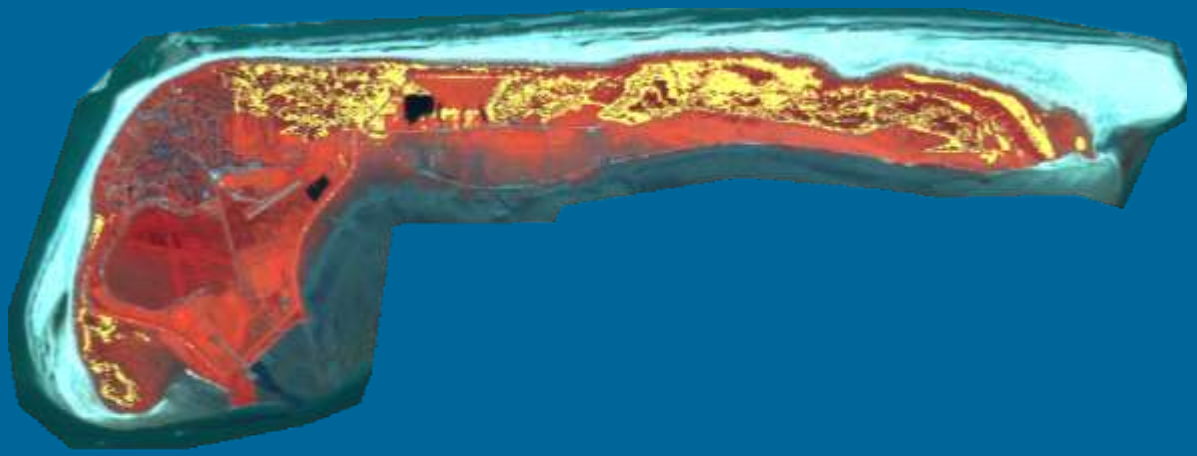
(ii) Host-plant density (+)

Why is stress a key factor for *Argynnis niobe* in heavy-metal grasslands?

- High heavy-metal concentrations in soil keep the vegetation sparse and favour high densities of *V. calaminaria*

  → high habitat quality

Reference area: Langeoog



Coastal dunes

- Larval habitat: Dune grassland with *Viola canina*, *V. tricolor*
- Key factors: short-turf grey-dune vegetation (warm microclimate) with *Viola* stands

➡ Natural disturbance

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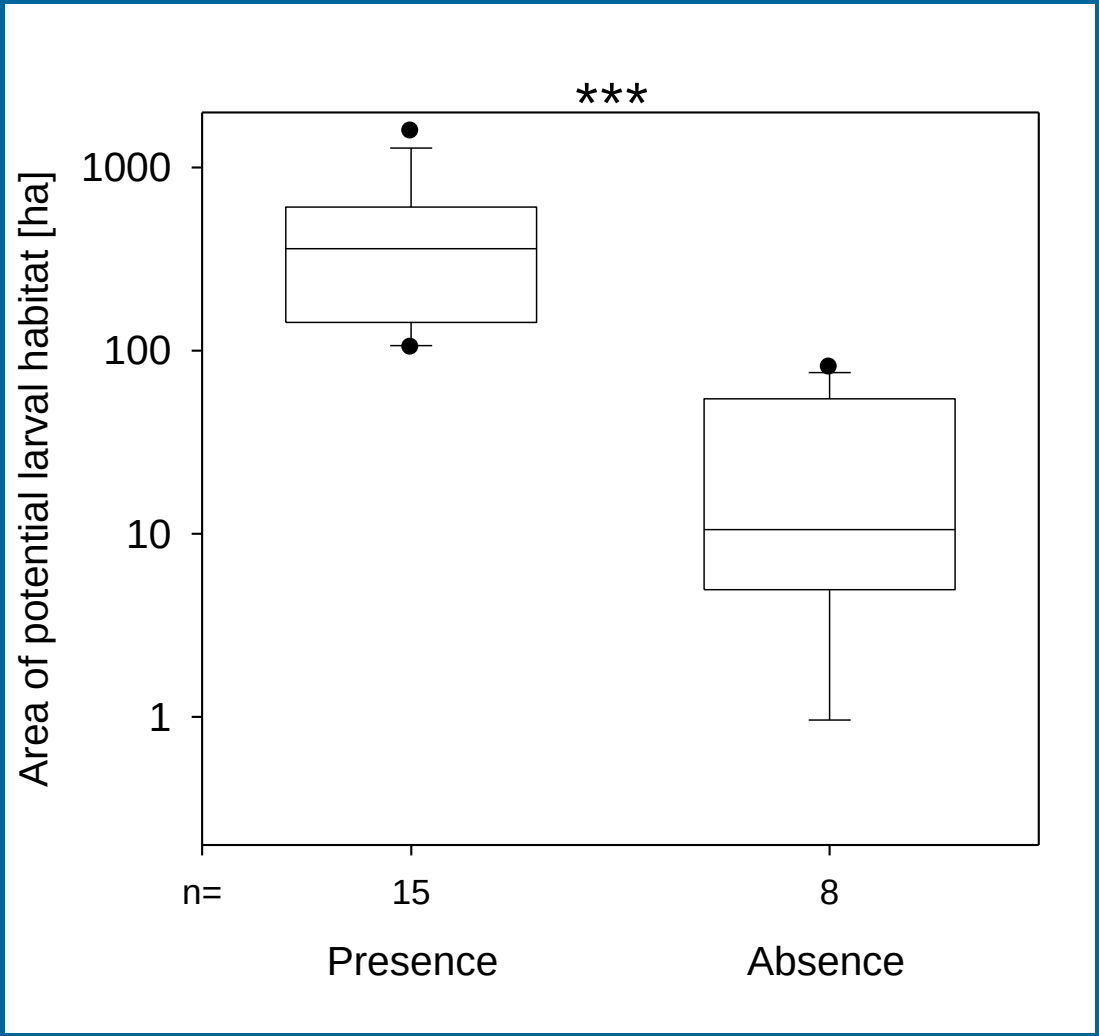
Reference area: Langeoog



Area of potential larval habitats (grey-dune vegetation) on islands in the North Sea between Texel (NL) and the peninsula of Skallingen (DK)

→ High area requirements

Microhabitat: Heavy-metal grasslands vs. coastal dunes

	Stolberg (*N* = 32)	Langeoog (*N* = 66)	P
Turf height (cm)	12 (4-25)	11 (4-30)	0 NS
Cover (%)			
Shrub layer	0 (0-35)	0 (0-25)	0 NS
Herb layer	50 (25-70)	35 (10-75)	+ **
Litter	40 (20-90)	15 (0-70)	+ ***
Moss	7.5 (0-80)	62.5 (5-90)	- ***
Lichen	0 (0-30)	0 (0-40)	0 NS
Bare ground	0 (0-7.5)	0 (0-60)	0 NS
Host plants	10 (2-25)	5 (1-45)	+ **
Sunshine duration (June)	15 (10–16)	15 (12-16)	0 NS

Take-home message II

Key factors in heavy-metal grasslands and coastal dunes

	Heavy-metal grasslands	Coastal dunes
Physiological stress	**+**	**-**
Disturbance	**+/-**	**+/-**
Area of potential larval habitats	~ 40 ha	> 100 ha

→ High host-plant density in heavy-metal grasslands compensates for small area of larval habitats

Thank you for your attention!