Ecological experiments with model ecosystems
# Anke Jentsch & Kerstin Grant

Project suggestions

Ecological experiments with model ecosystems:

- 4 SWS, 5 LP
- Small groups (2-3)
- Course assessment: written project report as a scientific manuscript
- Workload (150 h):

      active participation 120h

      analyses & report 30h

Aim of course

4 P s of experimental research

-Planning (hypotheses, methods)
-Projects (field work, data analyses)
-Publication (scientific report)
-Problems (always)
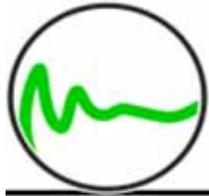
Bayreuth EVENT Experiments

EVENT I
Since 2005, 150 plots

Constructed grassland and heathland communities); 6 biodiversity levels x 6 weather manipulations, i.e. drought, heavy rain, freeze-thaw cycles

EVENT II
Since 2008, 150 plots

Semi-natural grassland, diverse, multi-factorial; land use intensity differs, drought, heavy rain, winter / summer warming, + winter precipitation

EVENT III
Since 2009, 3000 pots

Controlled pot experiment for European proveniences of key grass / tree species; drought, summer warming

EVENT V
Since 1996, former BIODEPTH, 64 plots

Long-term reference system in constructed grassland starting at various biodiversity levels; drought, winter rain

EVENT IV
Since 2010

Controlled microcosms; soil moisture, soil warming, freeze-thaw cycles

Mean annual temp.: 7,8 °C
Mean annual precip: 709 mm
Soil: sandy loam (EVENT I)
C/N-ratio: 15.4–20.2 (EVENT I)
pH: 5.5 (EVENT I)

SIGNAL: European gradients of resilience in the face of climate extremes *(Jentsch et al., BiodivERsA)*

(b) Stress (ongoing, eg drought)

End of drought

Invasion window

Abiotic resistance threshold

Biotic resistance threshold

Resistance to invasive species growth

Time →

Diez et al. 2012 Frontiers Ecol Env

biodiversa

Biodversity x
Drought x
Invasion Experiment
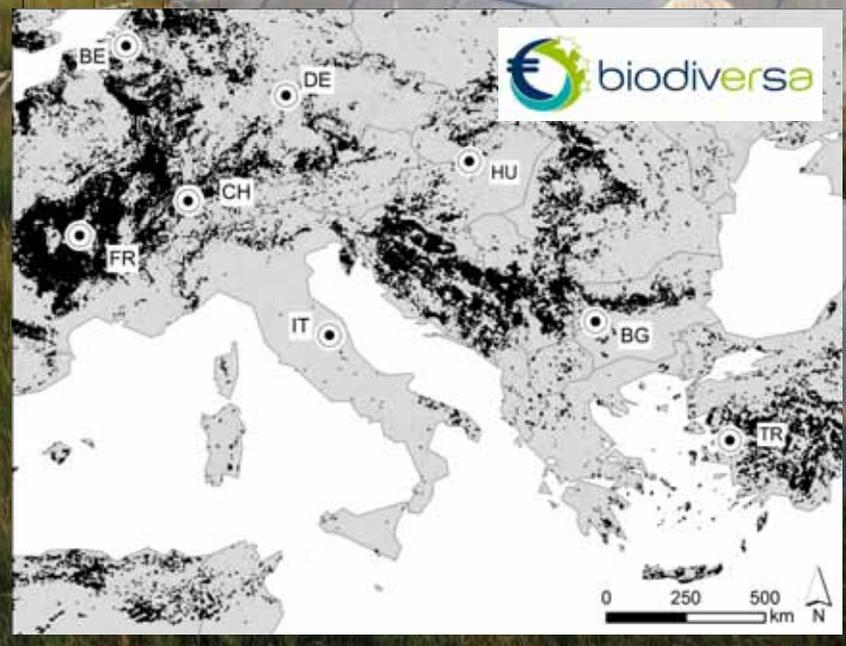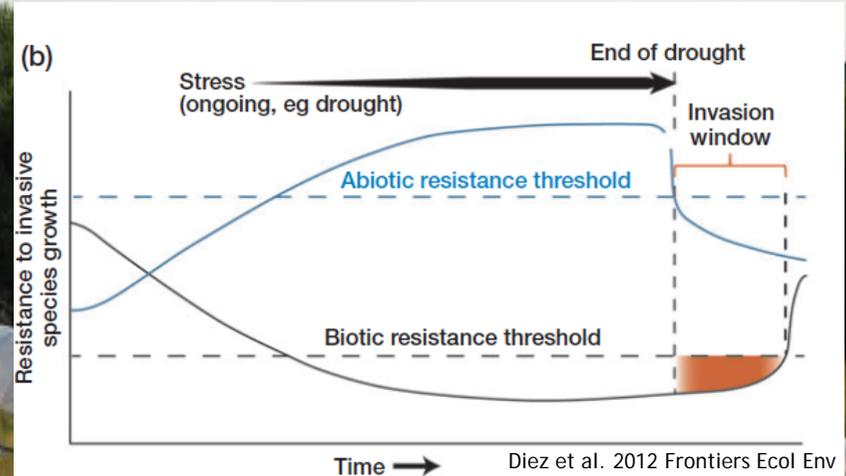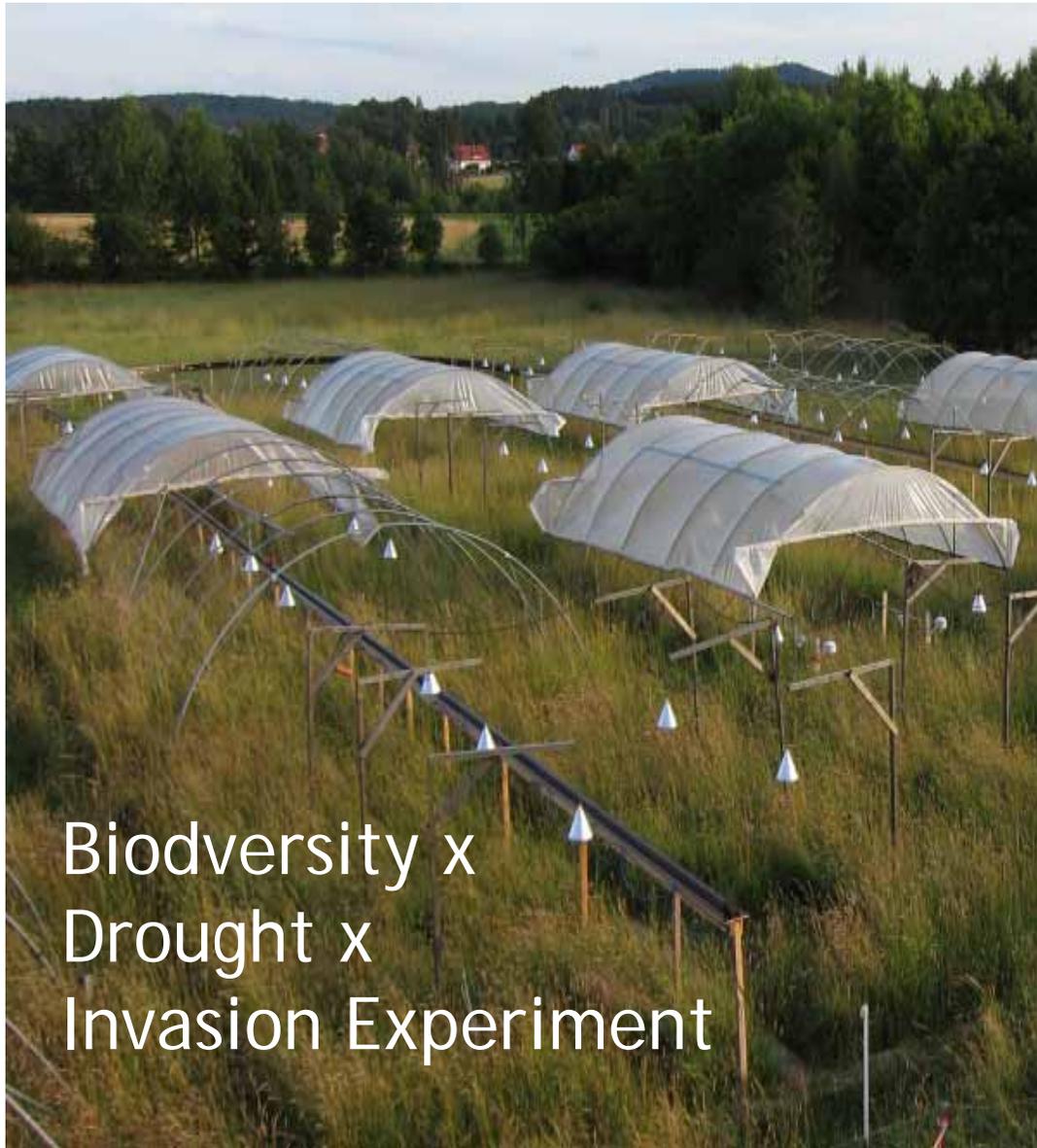
Project suggestions

SIGNAL: European gradients of resilience in the face of climate extremes-

Assembly rules

➢ Mapping fine-scale movements of species to find mechanisms driving vegetation patterns

➢ Fieldwork: presence of rooting species & further factors (e.g. rocks, bare soil, dense litter)

➢ Time: Beginning of June and/or Mid of July

➢ Further scientists involved: Kerstin Grant

SIGNAL: European gradients of resilience in the face of climate extremes-

Invader monitoring

➤ Two non-native invaders (*Senecio inaequidens*, *Lupinus polyphyllus*) in the face of drought

➤ Fieldwork: Planting Invaders (25./26.7. onwards) Species –specific cover and/or biomass (to mid October)

➤ Further scientists involved: Roman Hein /Jürgen Dengler
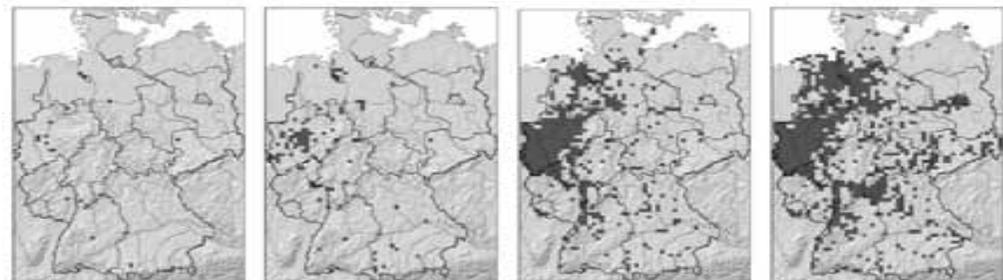
Fig. 4. Spread of *Senecio inaequidens* in Germany (1979, 1989, 1997, 2003) after Radkowitsch 1997, www.floraweb.de and other sources; taken from Heger and Bohmer (2005)

SIGNAL: European gradients of resilience in the face of climate extremes-

Drought effects interacting with mowing height on grassland

- Fieldwork: cover estimation & biomass harvest
- Time: Mid/end of July

- Further scientists involved: Roman Hein

Spring future: Designing a competiton experiment among mosses along a warming and drought gradient

- ➢ Mosses - phyto-indicator for future climatic gradients in springs?
- ➢ Literature research for experimental design
- ➢ Running the experiment?!
- ➢ Further scientists involved: Andreas Schweiger/ Kerstin Grant

Verbascum thapsus -*bottelencks of establishment of a global invader*
(MIREN – Mountian Invasion Ecology Network)

➤ Limiting ecological filter experiment in native range

➤ Field work: Germination tests in varying climates (in all of the greenhouses & ambient climate of Bayreuth (ÖBG))

➤ Further scientists involved:

  Nobel Arfin-Khan

Günther Blaich

Günther Blaich

Winter climate change (EVENT IV): Effects of winter warm spells on grass and dwarf shrub species

- ➤ Species –specific biomass
- ➤ Harvest end of May (2 days) + weighing
- ➤ Focus on data analysis, Linear Mixed Effect Models (R-competence)
- ➤ Further scientists involved: Jan Schürings

Winter climate change: *Among and within species variability - Responses to cold acclimation & deacclimation experiments*

Winter temperature variability experiment

(Plasticity of the growth response of *A. elatius, L. corniculatus, T. pratense* based on ecotype and different winter scenarios)

➤ Field work: Seed production (seed weight), species biomass, flowering

➤ Time: harvest when seeds mature

➤ Further scientists involved: Andrey Malyshev

Winter climate change: *Among and within species variability - Responses to cold acclimation & deacclimation experiments*

Winter temperature variability experiment

(Plasticity of the growth response of *A. elatius* based on ecotype and different winter scenarios)

➤ Field work: growth monitoring (e.g. height, leaf width,…), biomass & seed harvest

➤ Time: 10 d interval until seed maturity

➤ Further scientists involved: Andrey Malyshev

Beech-Project: How does beech recover from drought?

- **Pre-exposure:** no/1x drought/2x drought in 2012
- Drought treatment and recovery in June/July

- Field work: continuous watering 2x week/10min, growth estimate (height/ stem diameter) before drought, stress parameter during drought (stomatal conductance, wilting, leaf flourescence?), end of September above- & belowground harvest)

- Further scientists involved: Julia Walter

EVENT II: Long-term effects of increased intra-annual precipitation variability

Root turnover

➢ Finding a way to highligt root turnover

➢ Fieldwork: Root-scans (July), Tracking roots with root software on scans from repeated measurements

➢ Find research hypotheses

➢ For tinkerer with patience!!!

➢ Further scientists involved: Jose Carlos/ Kerstin Grant/ Reinhold Stahlmann
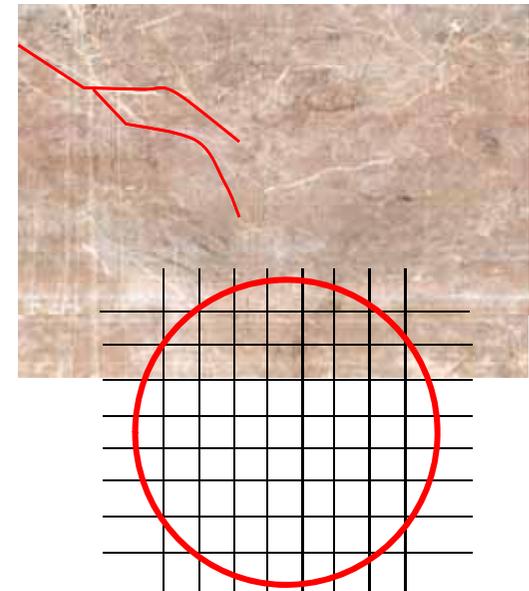
EVENT II: *Does grassland remember 5 years of increased intra-annual precipitation variability?*

- ➤ Species –specific biomass
- ➤ Harvest end of June
- ➤ Further scientists involved: Kerstin Grant

1. SIGNAL: **Assembly rules**

2. SIGNAL: **Invader monitoring**

3. SIGNAL: Drought effects interacting with **mowing height** on grassland

4. Spring future: Designing a **competiton experiment** among mosses

5. Verbascum thapsus – establishment of a **global invader**

6. Winter climate change: **Effects of winter warm spells** on grass and dwarf shrub species

7. Winter climate change: Among and within species variability - **seed weights**

8. Winter climate change: Among and within species variability – **growth monitoring**

9. **Beech-Project:** How does beech recover from drought?

10. EVENT II: Increased intra-annual precipitation variability & **root turnover**

11. EVENT II: Does grassland remember 5 years of increased intra-annual precipitation variability?

Next steps:

➢ Decide on a project until 26th April (Email to Kerstin)

➢ Contact project supervisor for approx. timeframe & details

➢ Start (literature) research on topic & methods

➢ Write a work draft/outline –approx.1 page (incl. title, hypotheses, method and schedule for fieldwork, analyses & report) ➔ send to Kerstin.Grant@uni-bayreuth.de until 15th May 2013

➢ Write report at the end of project (format: Research Article in *Journal of Ecology*)

➢Questions: Kerstin Grant, Room 015-2 GEOII, Tel. 0921/552188, Kerstin.Grant@uni-bayreuth.de