Towards a new approach to assess grassland restoration potential: can we use vegetation spectra to track soil phosphorus availability?

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Problem statement

Species-rich seminatural grasslands *
→ two big trends in Europe since 1960’s
  • Land abandonment
  • Intensification
→ large scale degradation

* Dengler et al., 2014; Walker et al., 2004
Problem statement

Species-rich seminatural grasslands
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Need for restoration!! *
Problem statement

• High soil P-levels reduce biodiversity*
  • grassland productivity ↑
  • competitive interactions ↑

→ Soil P determines restoration potential!

* Wassen et al., 2005; Ceulemans et al., 2014; van Dobben et al., 2017
Can we use vegetation spectra to track soil phosphorus availability?
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hypotheses

Intro
Set-up

Mesocosm experiment
Communities of typical grassland species*
→ grown on P-gradient
→ 2 scenarios: with biota or no biota added

*Nardus grasslands, habitat code 6230
Soil P
- bio-available soil P (Olsen P)

Plant P
- Spectrally derived P = NIRS
- Chemically derived ‘wet lab’ total P
NIRS = near infrared reflectance spectroscopy

Reducing sample quantity and maintaining high prediction quality of grassland biomass properties with near infrared reflectance spectroscopy
Pilot study - results

vegetation P

concentration (mg/kg)

stock (mg)

no biota added

biota treatment

bioavailable soil P (Olsen P) (mg/kg)

Moenclaey et al. (in prep)
Pilot study - results

vegetation P

concentration (mg/kg)

no biota added

biota treatment

Biomass effect!!!

bioavailable soil P (Olsen P) (mg/kg)

Moenclaey et al. (in prep)
B) vegetation P
link biochemical ~ spectral

Pilot study - results

no biota added

biota treatment

Chemical P concentration (mg/kg)

Moeneclaey et al. (in prep)
Pilot study - results

link soil P – spectral P

no biota added

biota treatment

bioavailable soil P (Olsen P) (mg/kg)

Moenclaey et al. (in prep)
Conclusion

expectations

hypotheses

reality

results

A

spectral
signature

B

biochemical
signature

soil nutrients

A

B

+/-
Conclusion

expectations hypotheses

reality results

spectral signature
biochemical signature
soil nutrients

A
B
Can we use vegetation spectra to track soil phosphorus availability?

- NIRS P – soil P link!  
  ➔ physiological basis?

- Factors constraining the links  
  ➔ biota effect  
  ➔ noise on chem-spec link  
  ➔ biomass effect  
  ➔ species-specific responses
Thank you!