A trait–based model to describe plant community dynamics in managed grasslands (GrasslandTraitSim.jl v1.0)

Synthesis project 72

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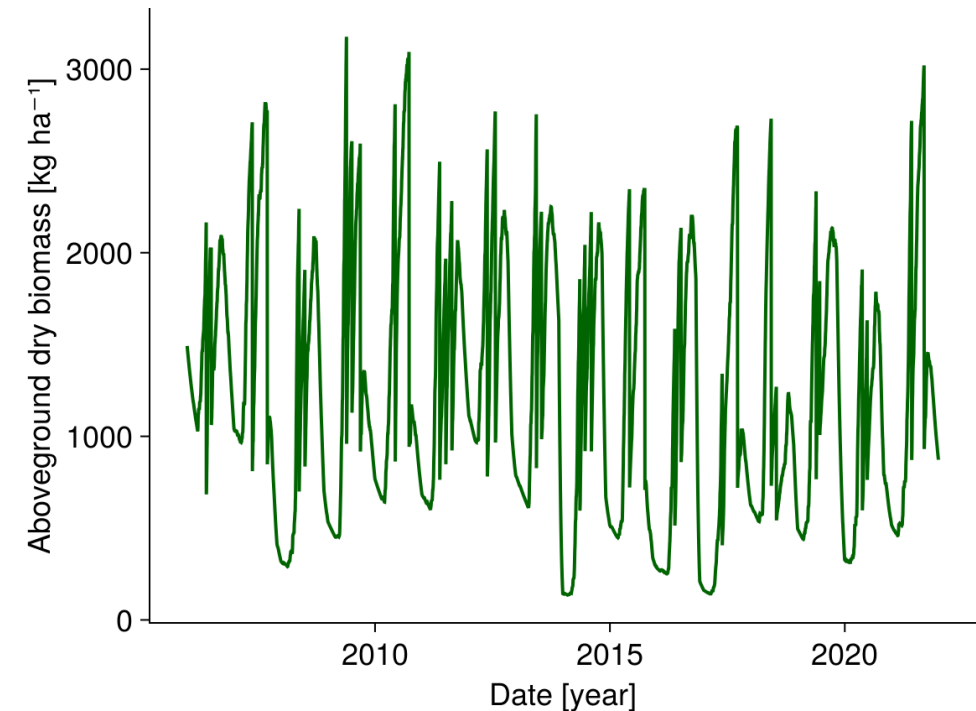
Overview

Equation–based model

State variables:
- Biomass of each plant functional type
- Soil water content

Derived output:
- Community weighted mean traits over time
- (Functional) Diversity indices over time

Temporal resolution: daily
Spatial resolution: patch

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Traits are linked to processes

Plant traits
- specific leaf area (SLA)
- root surface area per aboveground biomass (RSA)
- potential plant height (PH)
- arbuscular mycorrhizal colonisation rate (AMC)
- leaf biomass per total biomass (LMPM)
- leaf nitrogen content per leaf mass (LNCM)

Transfer functions → **Demographic rates, Response to management**
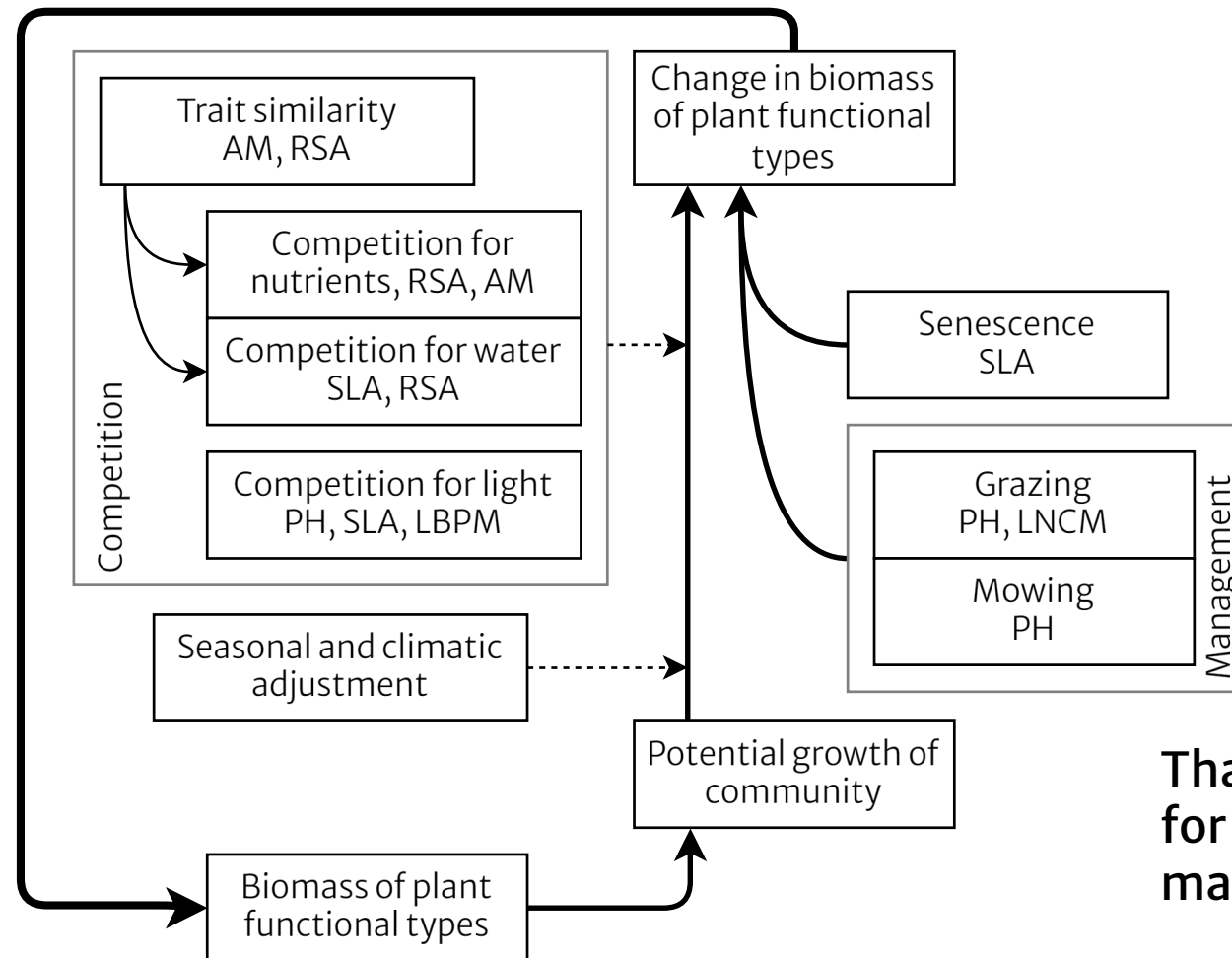
Hard to measure

Easier to measure

Chalmandrier et al. (2021): Linking functional traits and demography to model species-rich communities.

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Biomass dynamics

Loop: day + 1

Competition:
- Trait similarity AM, RSA
- Competition for nutrients, RSA, AM
- Competition for water SLA, RSA
- Competition for light PH, SLA, LBPM

Change in biomass of plant functional types

Senescence SLA

Management:
- Grazing PH, LNCM
- Mowing PH

Seasonal and climatic adjustment

Potential growth of community

Biomass of plant functional types

Thanks for all data contributors for trait, climatic, edaphic, and management inputs!

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Development

Open source software – Julia package:
https://github.com/felixnoessler/GrasslandTraitSim.jl

Documentation and tutorial:
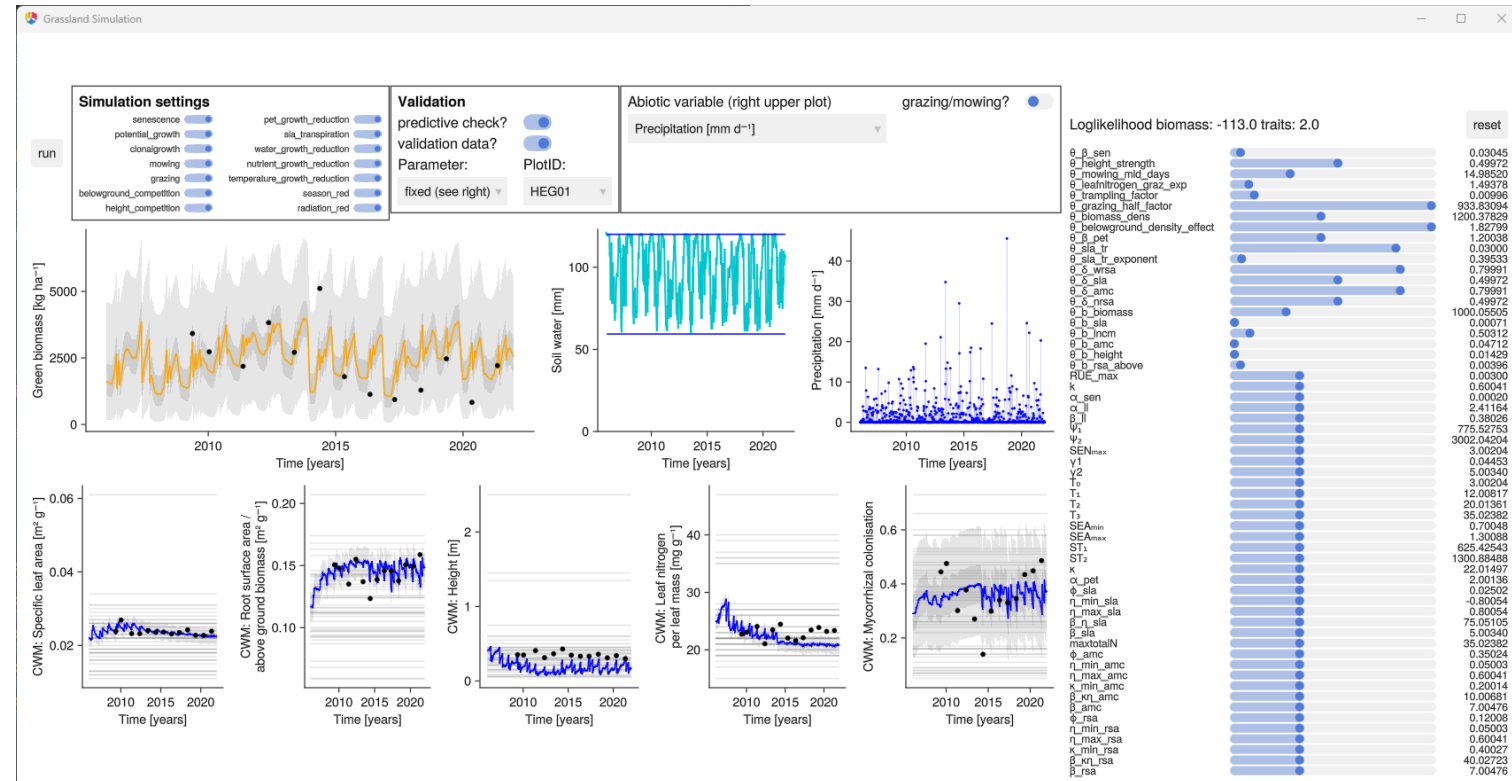https://felixnoessler.github.io/GrasslandTraitSim.jl/
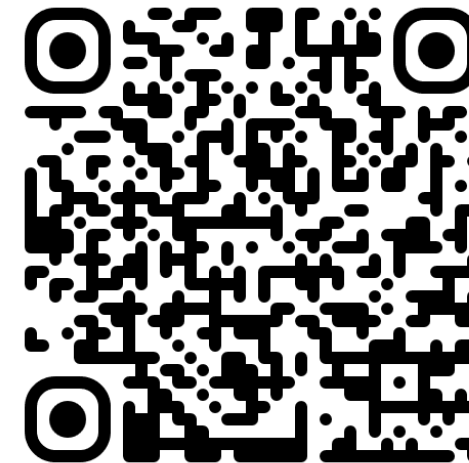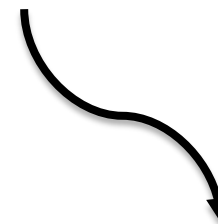
Current steps

Model calibration and validation
- Biomass
- Community weighted mean traits

Preparation of manuscript for journal Geoscientific model development until 04-2024
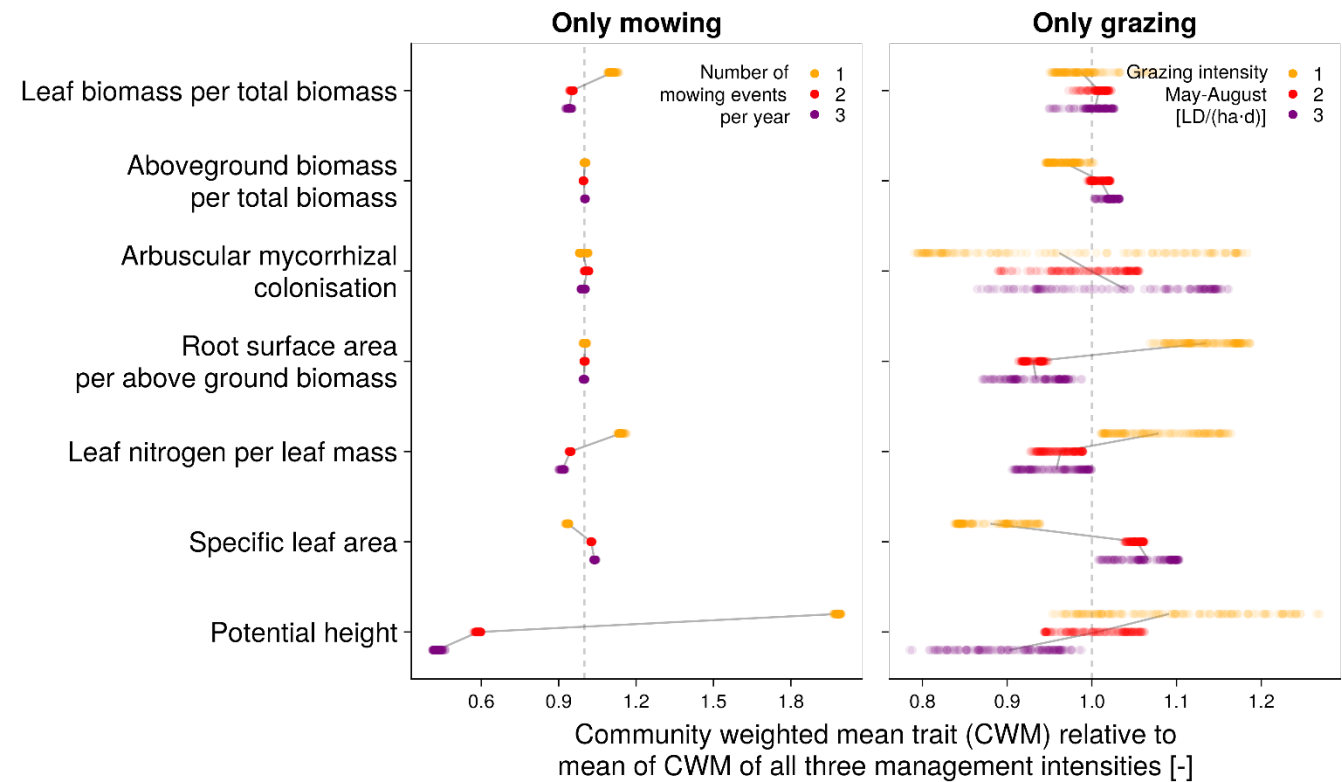

Thanks for all contributors for the validation data!

Outlook

Do case studies with the model 2024-2026

For example:
- Effects of mowing and grazing on plant community composition

Thanks for listening!

Cooperation with Sensing Biodiversity Across Scales (SEBAS),
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