1 Objectives

1.1 Generic framework for modelling of plant communities

1.2 The effect of phenotypic plasticity on plant community dynamics

Individual level

Community response to drought event

2 Literature review

2.1 Context: mountain grasslands and climate change

2.2 Existing solutions/approaches

Modelling vegetation - traits and strategies

traits & strategies
existing models: a gap to fill
coexistence processes

Understanding phenotypic plasticity

what is it and why is it important
cost and limits
effect on coexistence and community

3 Generic model for plant community dynamics

Paper 1:

3.1 Introduction

3.2 Strategy space and allocation pools

Leaf economic spectrum + Shipley

3.3 Model overview

pseudo-code and routine

allocation

mechanism and stochasticity
5 types of allocation

3.4 Plasticity: between species memory and individual experience

concepts

equilibrium, resource use, resource availability, condition estimation

comparison of different algorithms

the two sides of the performance/fitness: equilibrium and tissue efficiency
age vs biomass.

3.5 Parameter filtering and sensitivity analysis

Obj: give confidence in the model, demonstrate is able to reproduce simple growth pattern.
Obj2: have a beter idea of plasticity on growth. growth plastic and non plastic parameter filtering: can we distinguish species thanks to species specific parameters instead of shared parameters.
does plasticity make it easier ?
Impact of plasticity related parameters.

3.6 Community dynamics parametrisation

Obj: demonstrate that the model is able to reproduce community dynamics (as it was designed for).
Find parameters that allows coexistence (suggest plasticity should allow a diversity of strategy). SLA and height data. Phytosociology for 10m quadrats.

4 Model's properties and individuals response

(Related to the notions cited above, like performance decomposition)

4.1 Craft a trade-of and phenotypic map

Can memory be related to strategy and active/structural ratios in shoot and roots ?

4.2 Niche response

Obj1: understand how resource use mechanisms and allocation algorithms shape the environmental potential niche in the context of the model.
H1: strategy and memory affect niche in two ways if we suppose they are independent: shape and position. Strategy mostly affect shape (width and height) while memory (and so root:shoot ratio) affect mostly position.
H1': there is strong link between strategy and memory in the case of optimisation allocation that increase niche height and might reduce its width.
Obj2: understand the role of plasticity on the niche and if the effect in the same for all strategies/memories.
H2: the plasticity increase niche width but not height (as phenotype is optimum at the center of the niche where memory match the resource availability).

Stability and efficiency trade-off. Niche heigh and width and relationship with the strategy. How does plasticity affect that ? Does it increase the height and widen niches ? What does that mean for coexistence ?
Hopefully higher niche would go with unstable niche.

4.3 Transitivity and competition

1 vs 1 interactions
Is the resource competition transitive ? How does niche widening impact that, does plasticty change competition interaction. Is it related to the trait distance ? (don't think so)

5 The effect of phenotypic plasticity on plant community dynamics

Hypothesis on the cumulative effect on niche and interactions.

5.1 Individual resistance and resilience against drought events

Amplitude and length of the event :
- severity effect reduced by lower tau ?
- resistance versus resilience: H0: conservative strategy have higher resistance, H1 : low tau allows for re-equilibrium and increase resistance (low amplitude and long length. H2: high tau allow to avoid dead-end situation during short severe drought (high resilience)

5.2 Community response to drought event

coexistence effect vs resistance/resilience effect
uniform vs heterogenous (plasticity wise) community response H1: