CLÉMENT VIGUIER

PHD THESIS

CONTENTS

INTRODUCTION

1

MOUNTAIN GRASSLANDS

Message here ?

1.1 Photograph of mountain grasslands

1.2 Mountain grasslands, source of services

1.3 Mountain grasslands under climate change

2

Modelling ecological systems

Message here ?

2.1 Models as understanding and testing tools

"Physicien de la biologie"

Justify the modelling approach - what's a model ? simplification of reality

Long subject refer to models in ecosystem sciences. Different classes of model, and different objectives. Mechanistic models: understanding and testing hypothesis.

Model as understanding tools: how does modelling help us understanding the system we are modelling.

The need for mechanistic model and emergent properties of models. Process-based models vs statistical model (what happen outside the data (example of flickering tails of regression models), similar to bayesian approach, the model is constrained by our understanding of processes.)

2.2 Modelling plant communities

2.2.1 Different levels of modelling

2.2.2 Processes

2.2.3 Agent-based models

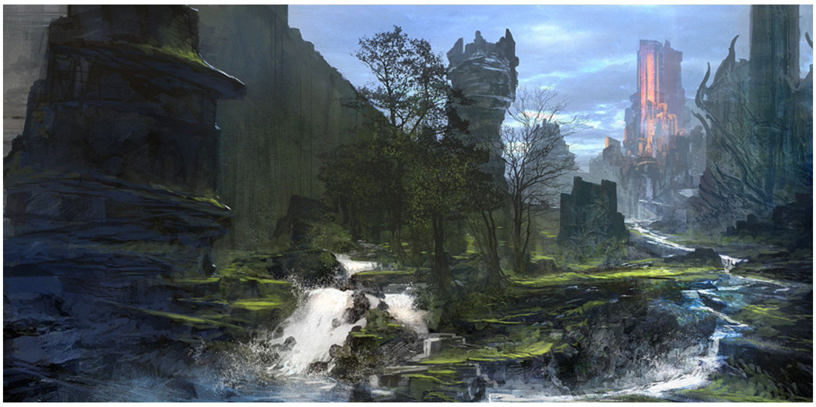
2.3 Modelling coexistence

Message here ?

2.3.1 What is diversity?

2.3.2 The concept of niche

2.3.3 Coexistence mechanisms



3

Phenotypic plasticity of organisms

Message here ?

3.1 Stability and plasticity

3.2 Costs and limits of plasticity

I

EXTEND MOUNTGRASS

This section is meant to include thoughts and ideas on how to extend mountgrassbut that could not be included in the first versions of the model for various reasons. Despite not being included, these extensions are interesting from a scientific or technical point of view, and I hope these notes can be useful to anyone interested in mountgrassor individual based vegetation modelling.

4

INCLUDE NITROGEN: SOURCE OF TRADE-OFF

As seen previously in chapter , the emergence of trade-of in growth strategy in the actual framework actually rely on a strong genetic constraint over plant plasticity. Indeed, without plasticity cost and low reactivity there would be a high rate of phenotypic convergence of individuals from different species. This is explained by the existence of optimum carbon partitioning (for a given size) in a stable environment. The coexistence of different resource use strategies (exploitative vs conservative) is allowed only through temporal variations and non equilibrium state. This is quite common since a lot of models will predict rapid dominance of one entity in case of equilibrium (need references here).
Multiple questions arise from this observation: are the conclusions of this work still interesting in the understanding of the coexistence mechanisms? (I hope I did convince you in the dedicated part of this document, see .. for more details), is it possible to see coexistence of multiple strategies in a temporally stable environment? how can we produce trade-off by including only one more resource?

In the following paragraphs I try to answer these questions with theoretical arguments and suggestions on how to integrate them in MOUNTGRASS.

4.1 Stable coexistence: the need for a resource dependent tissue efficiency

Coexistence mechanisms are listed and detailed in the introduction of this thesis (see chapter **??**). Here I focus on the efficiency of tissues... Nitrogen based, why coexistence ? different phenotype correspond to different limiting resources and for different resource availabilities, different phenotype will optimize the return cost of tissues. WUE versus NUE.