Network meeting 2006:

“understanding the future”

For invasion biology session

BEYOND FILLING THE GAPS: ADVANCING THE SCIENCE OF INVASION ECOLOGY USING A NEW CONCEPTUAL FRAMEWORK

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Introduction

- Why a new conceptual framework?

- Biological invasions are increasing globally
- General rules for predicting potential invaders and susceptible habitats largely unsuccessful
- Disassociation between ‘invasion ecology’ and the ‘rest of ecology’

Introduction continued...

- two conceptual tools to incorporate the mechanisms of invasions
- to integrate across species, systems and scales.
- 1) a framework, and 2) a model template.

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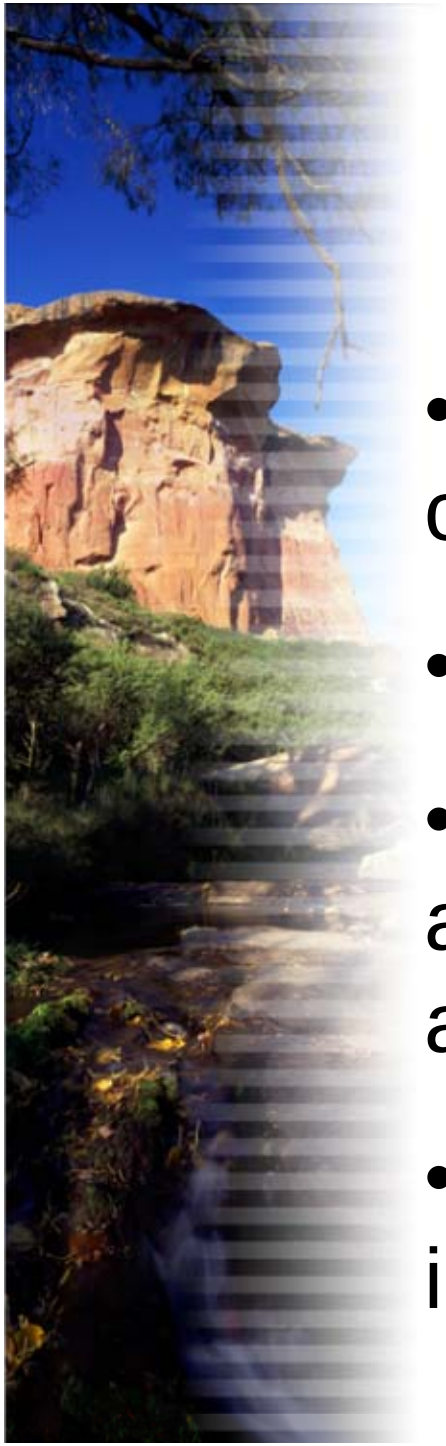

Richardson et al. 2000- the 'Barriers model'

- First model to try order the confusion in invasion ecology
- Primarily focused on terminology
- providing insight into the successful and successive establishment of an alien species,
- clearly articulating the net effects of invasions

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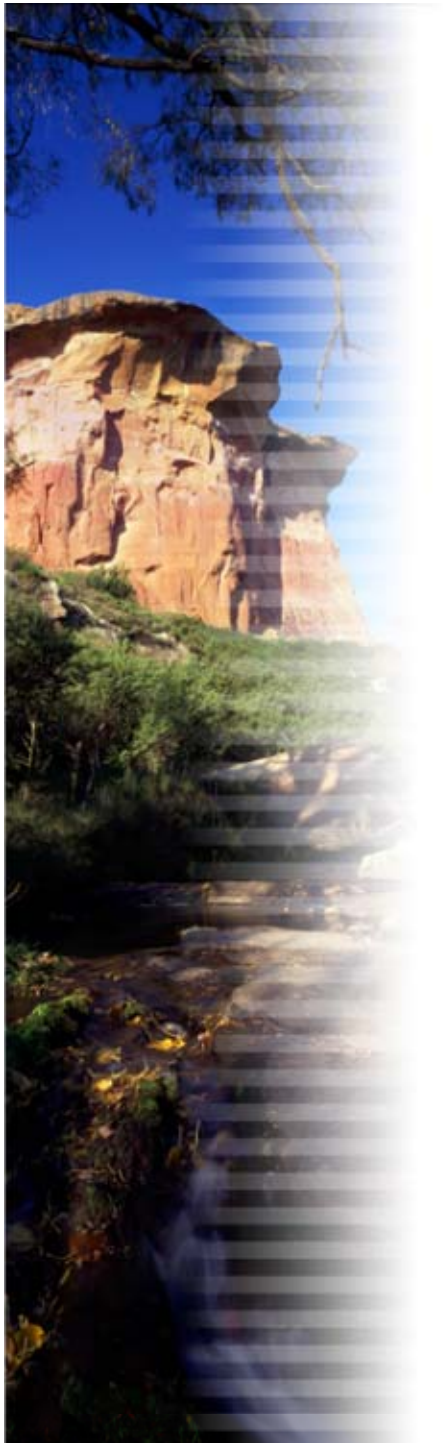
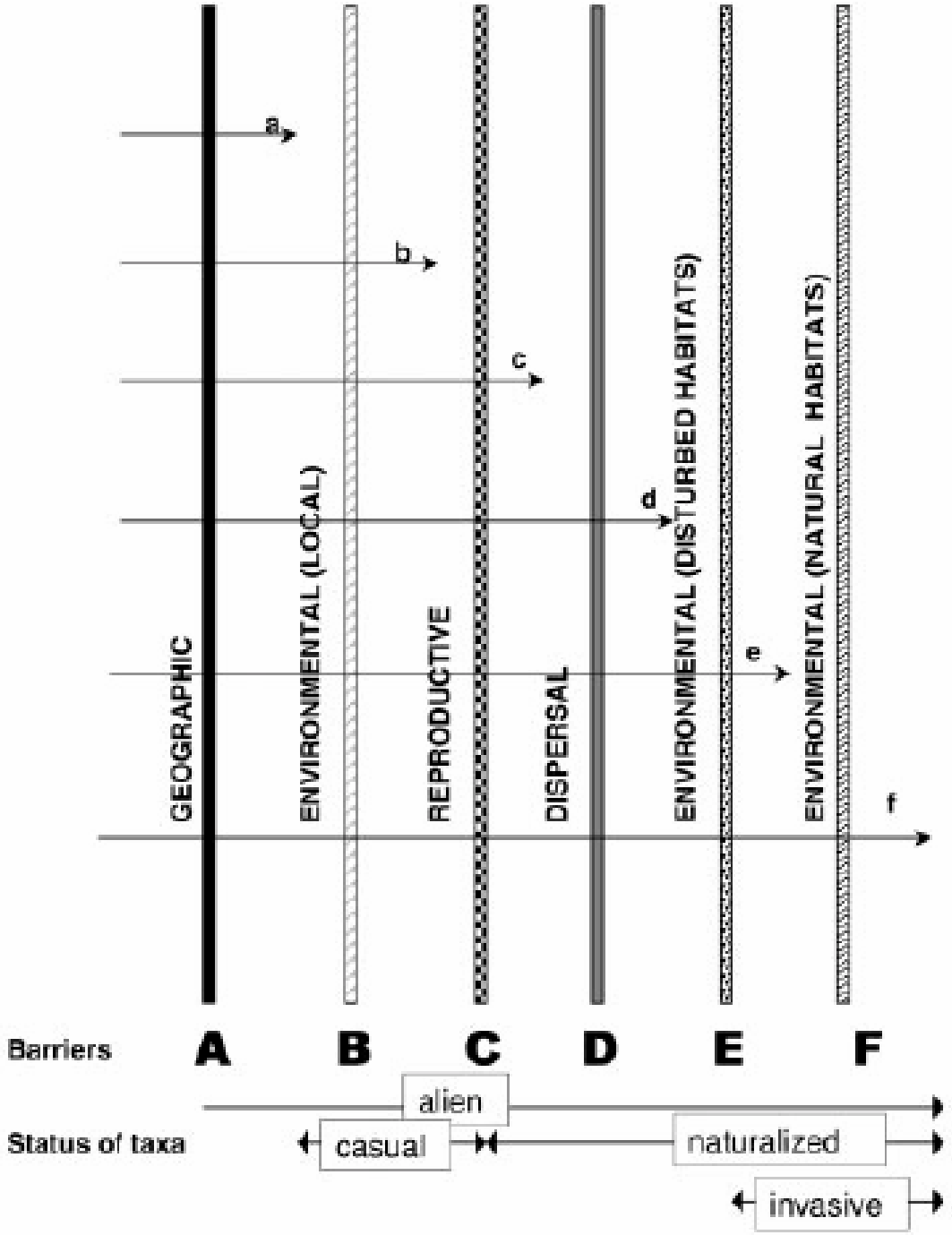
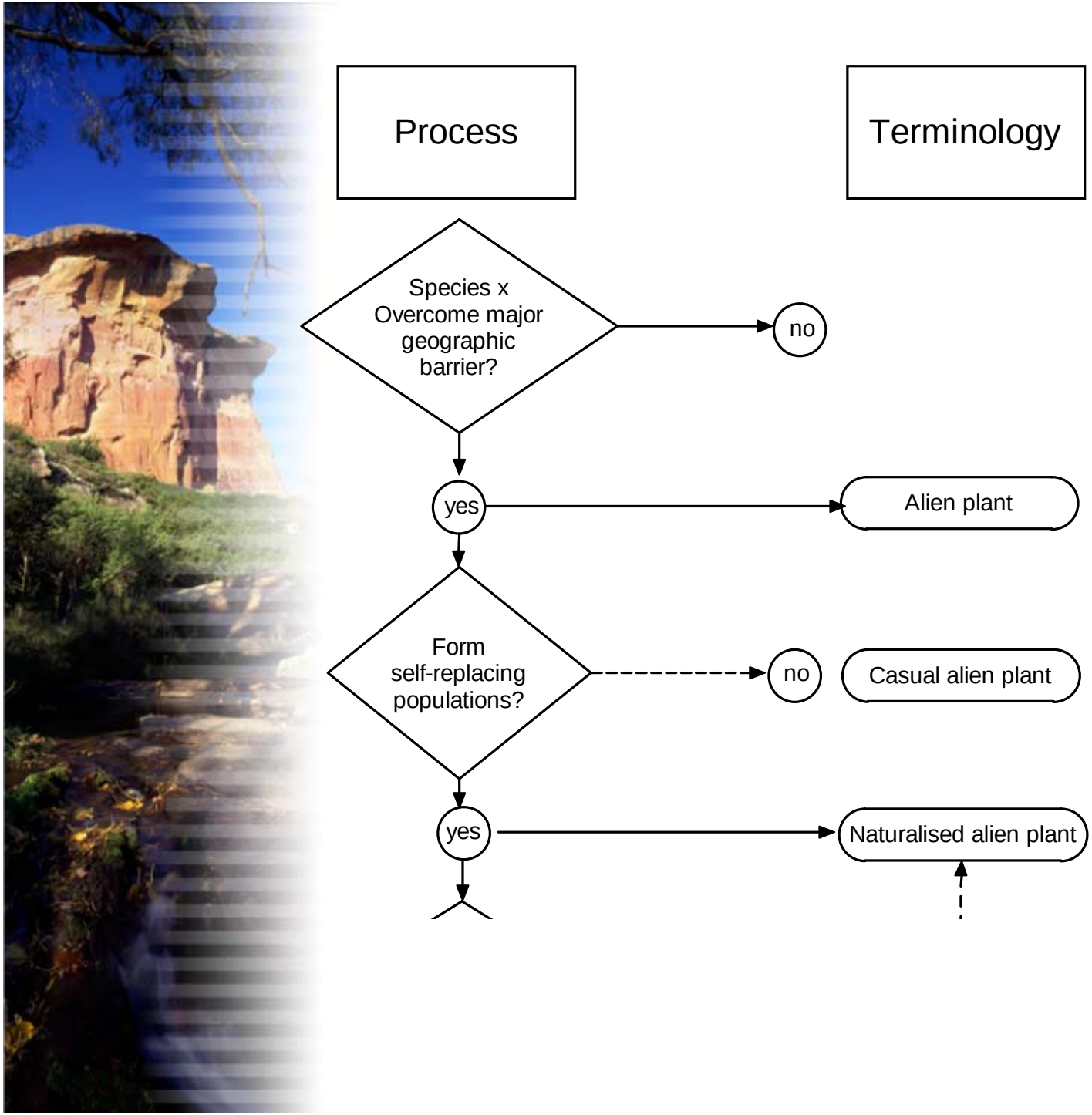
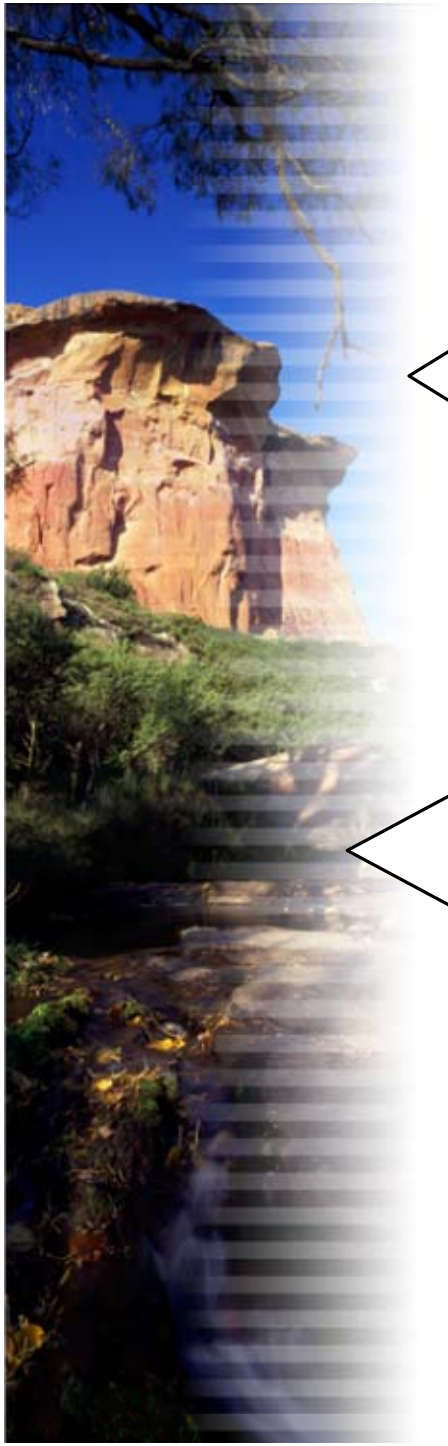
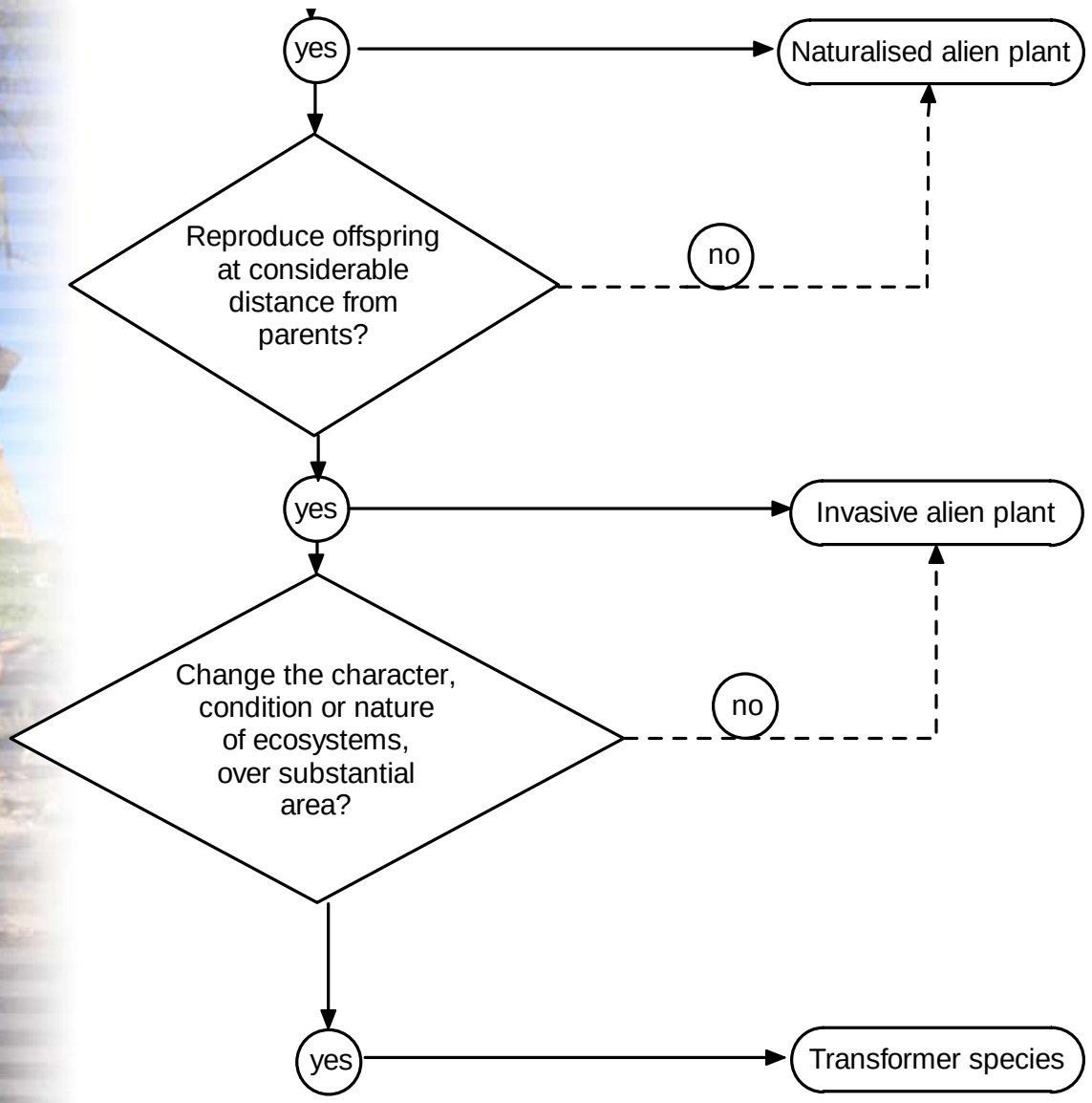



GEOGRAPHIC
ENVIRONMENTAL (LOCAL)
REPRODUCTIVE
DISPERSAL
ENVIRONMENTAL (DISTURBED HABITATS)
ENVIRONMENTAL (NATURAL HABITATS)
a
b
c
d
e
f
Barriers
A
B
C
D
E
F
Status of taxa
alien
casual
naturalized
invasive



Adapted from Richardson et al. 2000





Adapted from Richardson et al. 2000

A new framework for invasion ecology

- The goal of this framework is to understand the invasion of habitats by alien species
- These components, discussed in more detail later, represent the coarsest level contributors to the invasion process.

A new framework for invasion ecology continued...

- On the lowest hierarchical level, the elements of these three components are specified for a particular situation.

- The possible detailed variables would be drawn from other relevant theories, both general to ecology (e.g. succession theory) and other specific research areas (e.g. population ecology).

Invasion of habitats by alien species

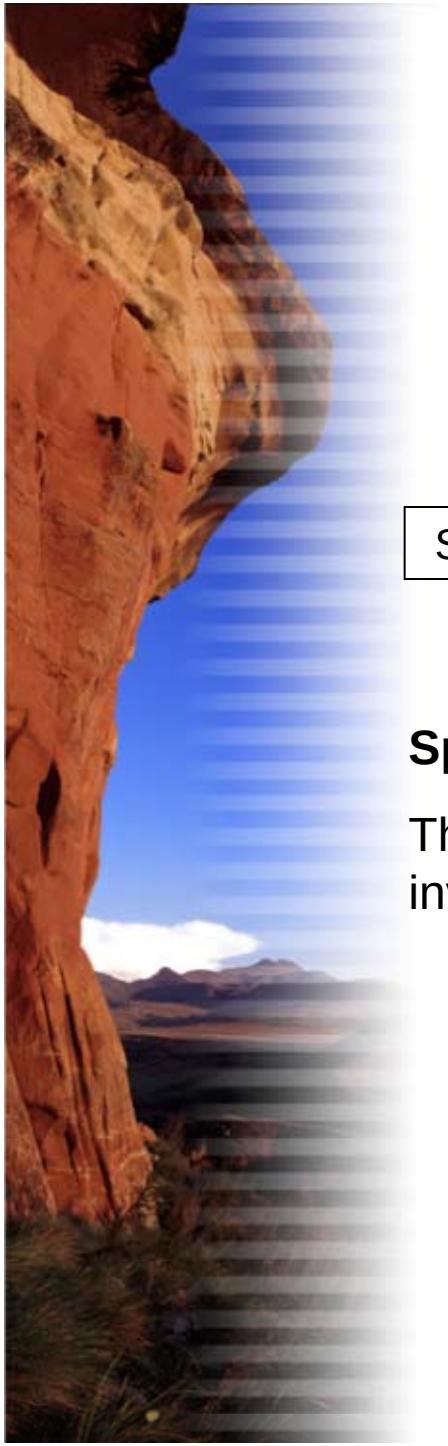
Define:

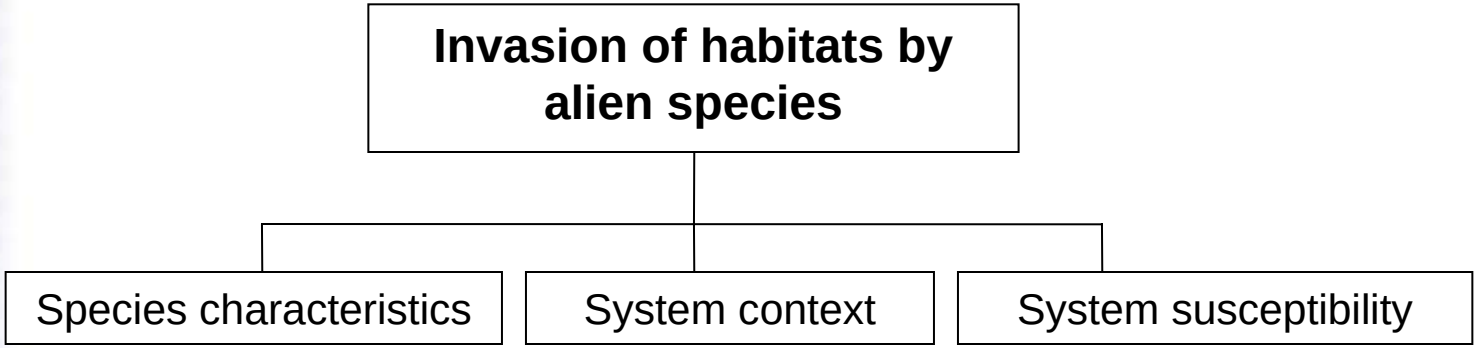
Your species of interest,

Area of interest,

Scale of investigation (spatial and temporal)

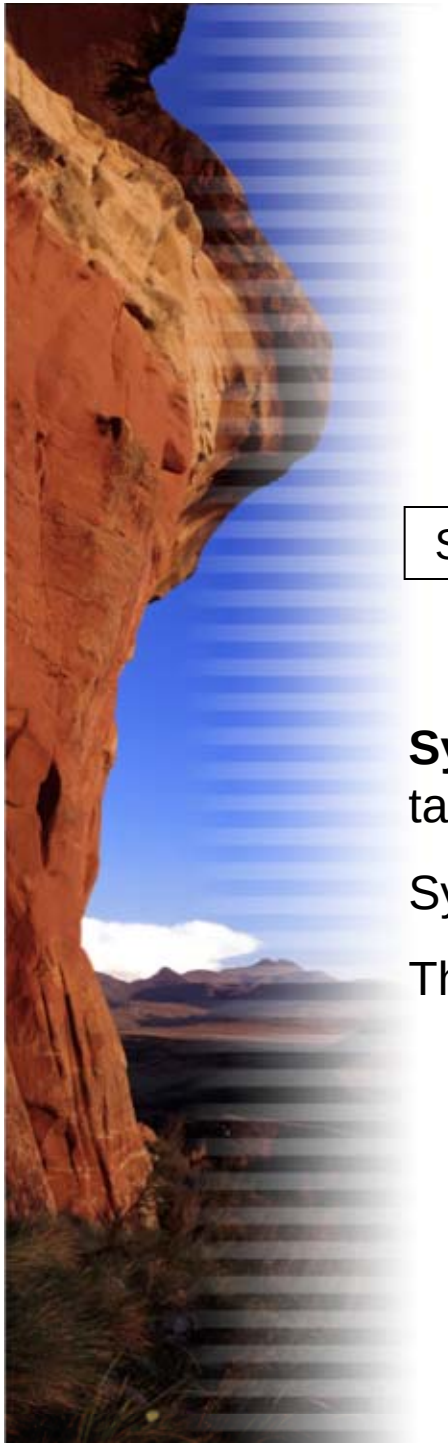
Others, be explicit..

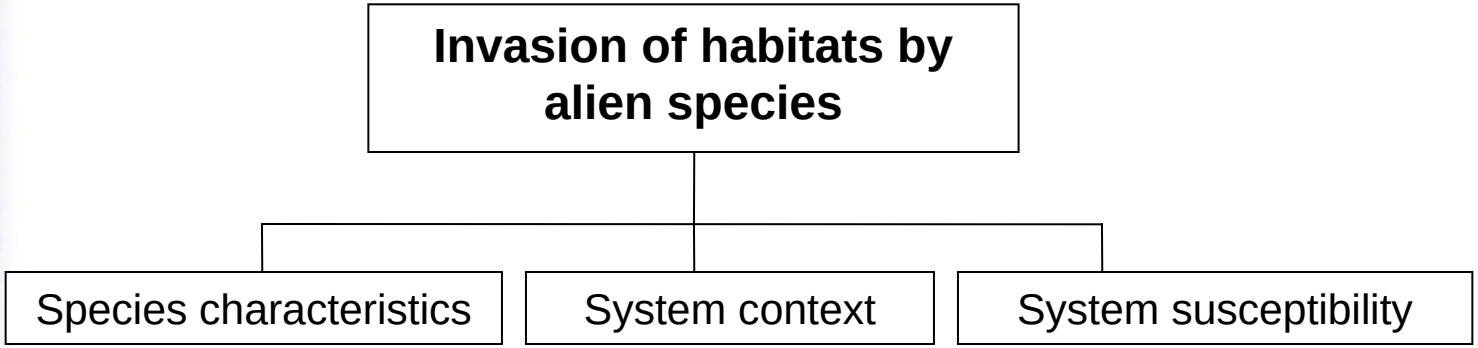




Species characteristics:

Those characteristics that predispose the species to higher invasion potential

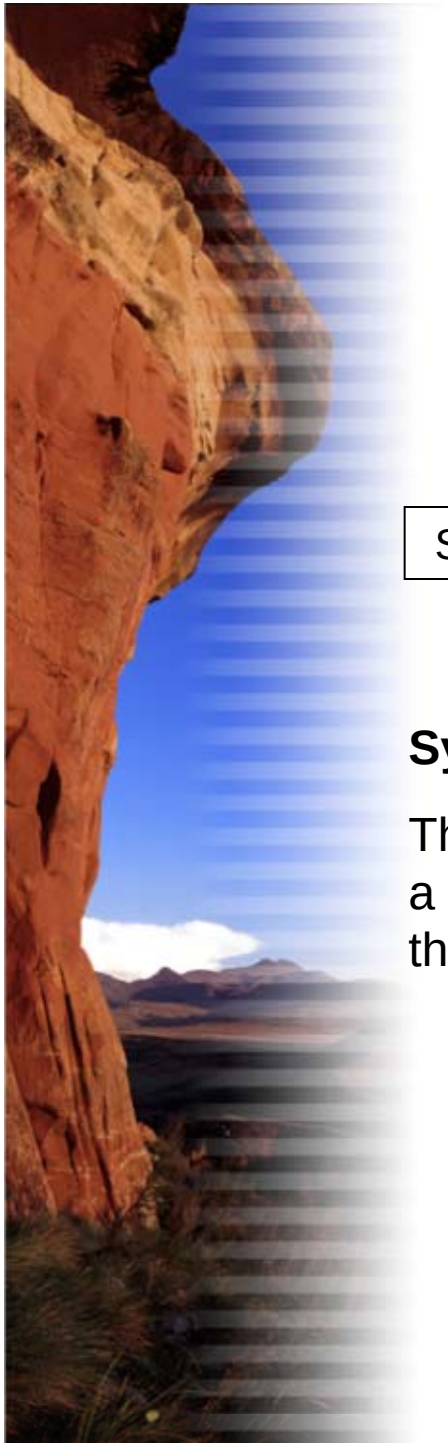


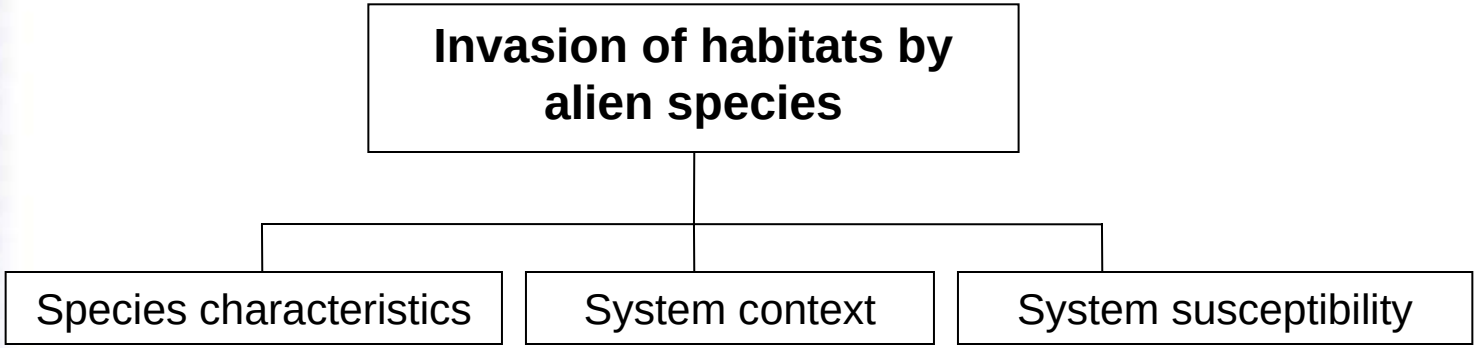


System context: context refers to the suite of things outside the target area

System context is considered at a coarser spatial scale.

The context provides the linkages between the various systems.





System susceptibility:

Those characteristics that predispose the area being invaded to a higher likelihood of being invaded- the features that exist within the system

Invasion of habitats by alien species

Species characteristics	System context	System susceptibility
1Propagule production 2Dispersal mode 3Defences 4Resource demand 5Competitiveness 6Seed-banking 7Seed size	1Connectivity 2Pathways Inc. number of repeat arrivals 3Vector efficacy 4Global climate change	1Local vector presence 2Predation / consumer pressure Inc. enemy release 3Resource availability Inc. disturbance regime, fire regime, empty niche 4Patchiness / gaps 5Bioclimatic suitability 6Native species richness

>60 references suggesting that the above are key issues in explaining invasions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Invasion of KNP by *Opuntia stricta*

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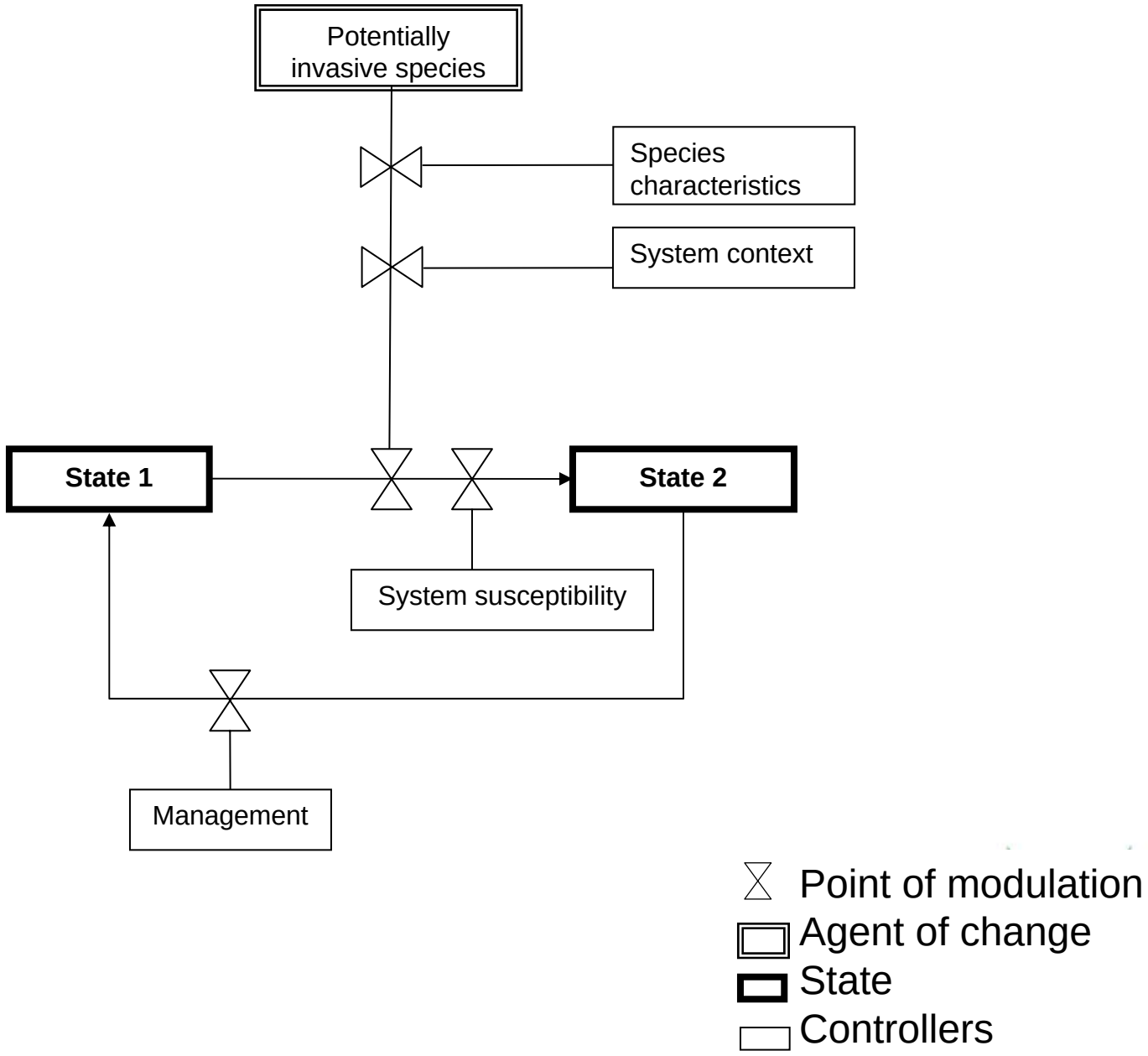
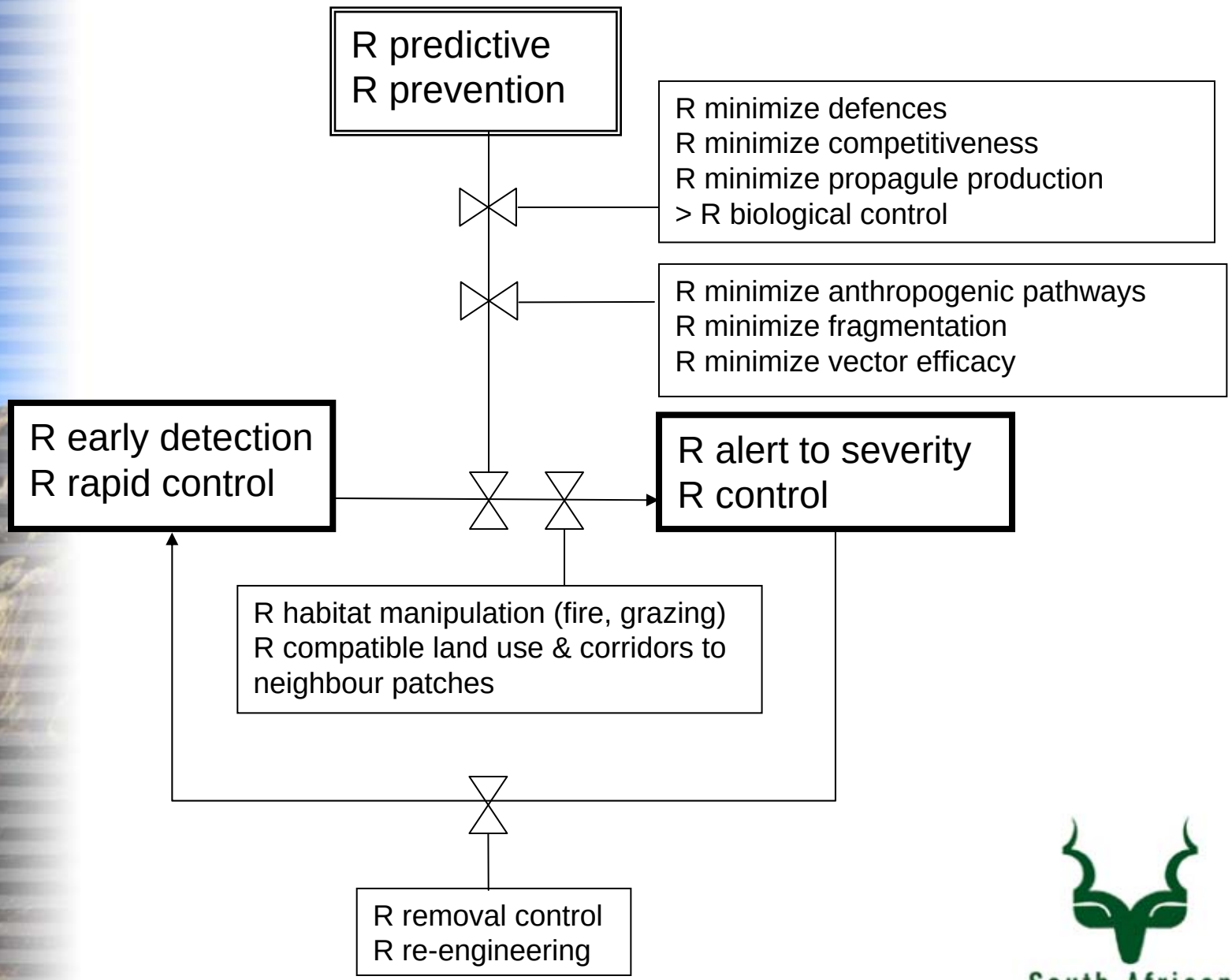
1Propagule production **2Dispersal mode** **3Defences** **4Resource demand** **5Competitiveness** 6Seed-banking **7Seed size**	1**Connectivity** 2**Pathways** Inc. number of repeat arrivals 3**Vector efficacy** 4Global climate change	1**Local vector presence** 2**Predation / consumer pressure Inc. enemy release** 3Resource availability Inc. disturbance regime, fire regime, empty niche 4Patchiness / gaps 5**Bioclimatic suitability** 6Native species richness


Potentially invasive species
Species characteristics
System context
State 1
State 2
System susceptibility
Management
Point of modulation
Agent of change
State
Controllers



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In summary:

- The framework allows us to synthesize across systems and scales
- Develop general rules that may be applicable to invasions
- Develop an understanding for the roles and impacts of various contributing factors in a particular invasion

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