

ESRM 441 Landscape Ecology

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Website:
<http://courses.washington.edu/esrm441>

What is a landscape?



Landscape:

an area composed of multiple
distinct elements that create pattern



What is landscape ecology?

the study of both the causes of
ecological pattern and the effects
of pattern on ecological processes

-J. A. Wiens

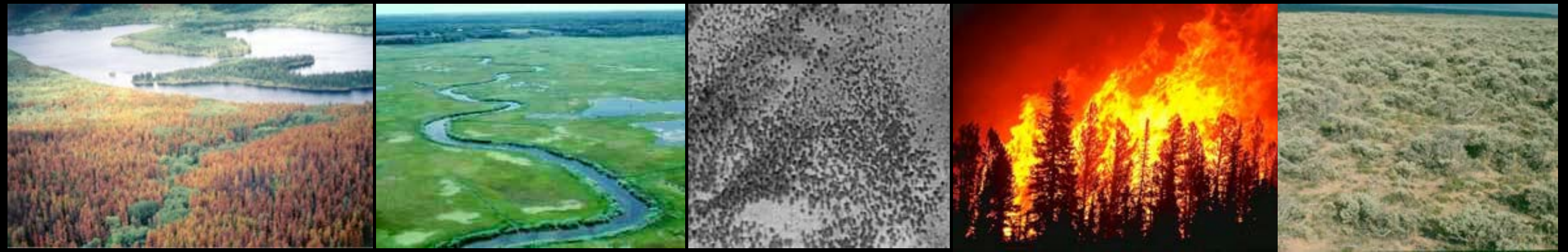
Landscape ecology
emphasizes broad spatial
scales and the ecological
effects of the spatial
patterning of ecosystems.

-M. G. Turner

Landscape ecology focuses explicitly on spatial patterns. Specifically... the development and dynamics of spatial heterogeneity, spatial and temporal interactions and exchanges across heterogeneous landscape, influences of spatial heterogeneity on biotic and abiotic processes, and management of spatial heterogeneity.

-P. G. Risser

A new paradigm



Space, pattern, and heterogeneity matter

A broader approach to ecology

Emphasis on scale

Issue of scale is profound!

- Ecological understanding assumed an ability to extrapolate over spatial areas
- Studies attempted to predict phenomena without considering its size or position

The roots of landscape ecology



Classification of Major
Plant Associations

von Humboldt 1807

Ecosystems

Tansley 1935

Geography

Troll 1939

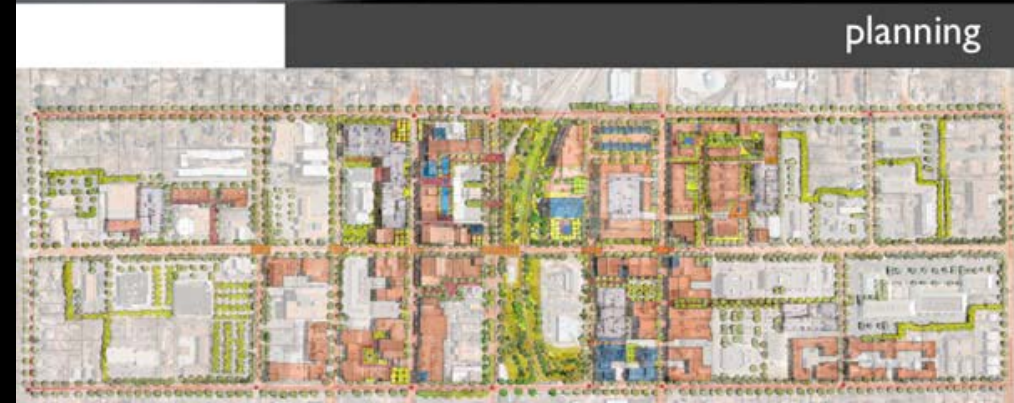
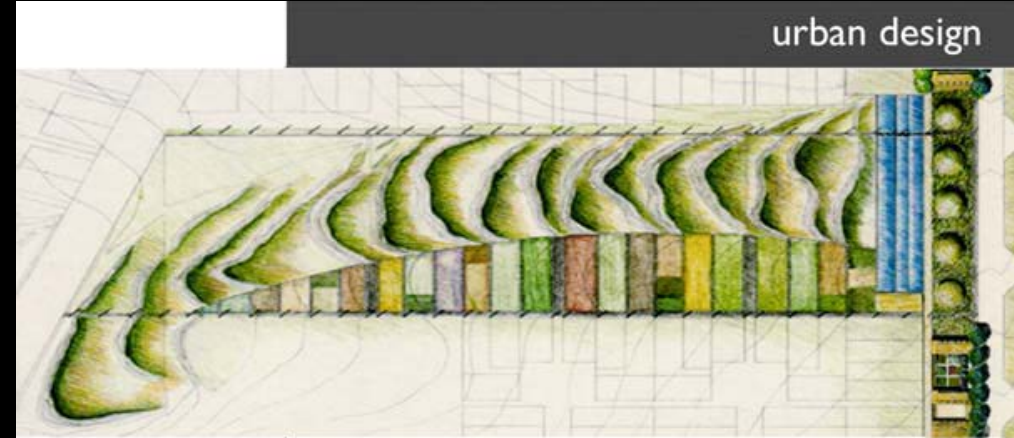


The European School

Altered and managed environments

Human element

Landscape architecture and design



The American school

Island biogeography

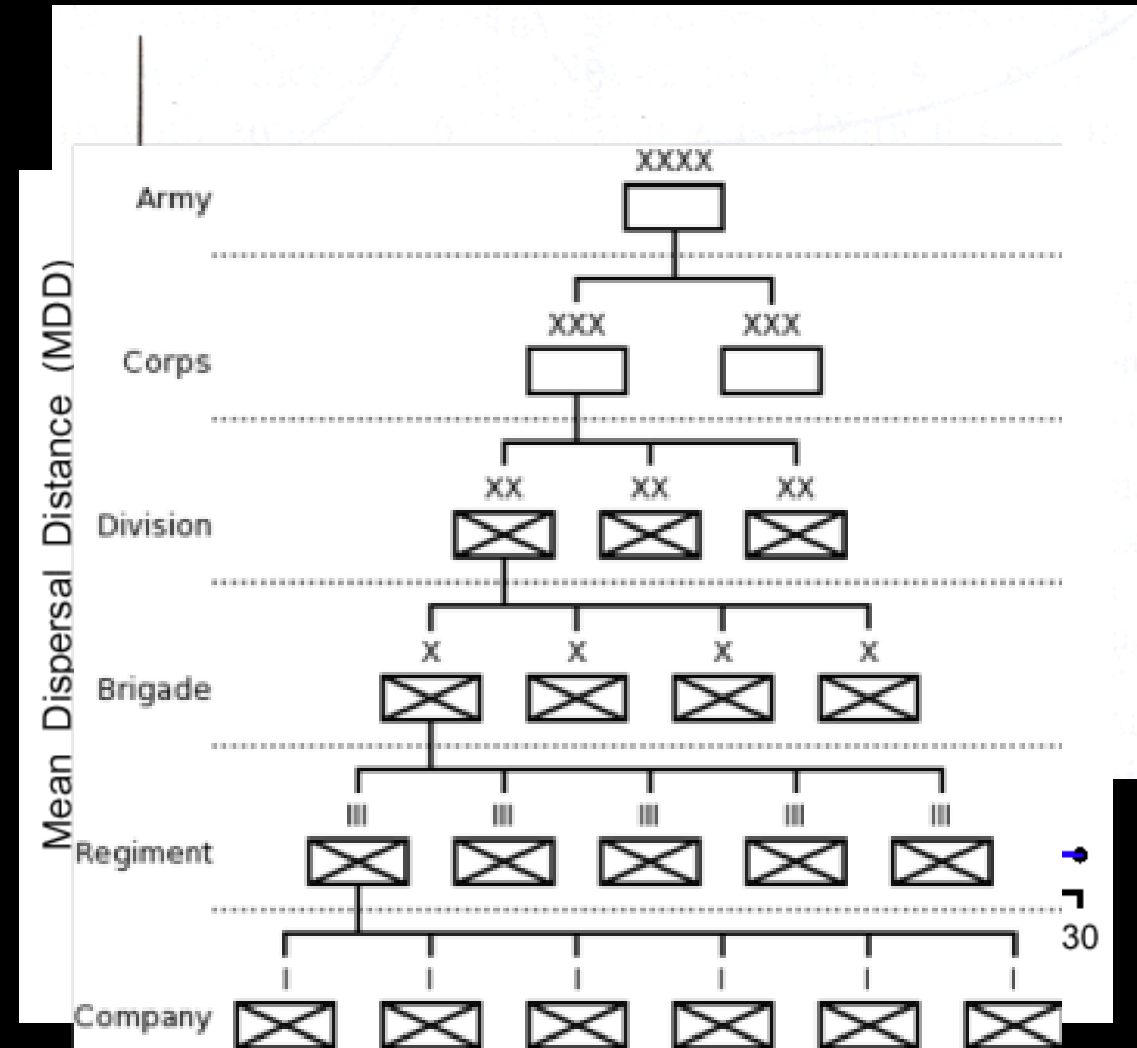
MacArthur and Wilson 1967

Spatial ecology

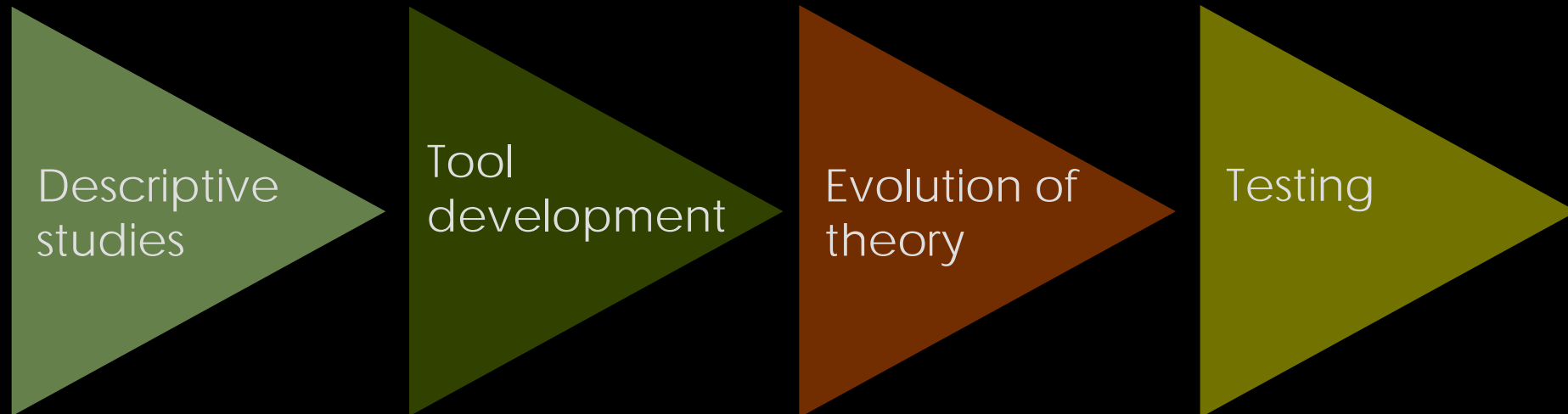
Kareiva et al. 1980's

Hierarchy theory

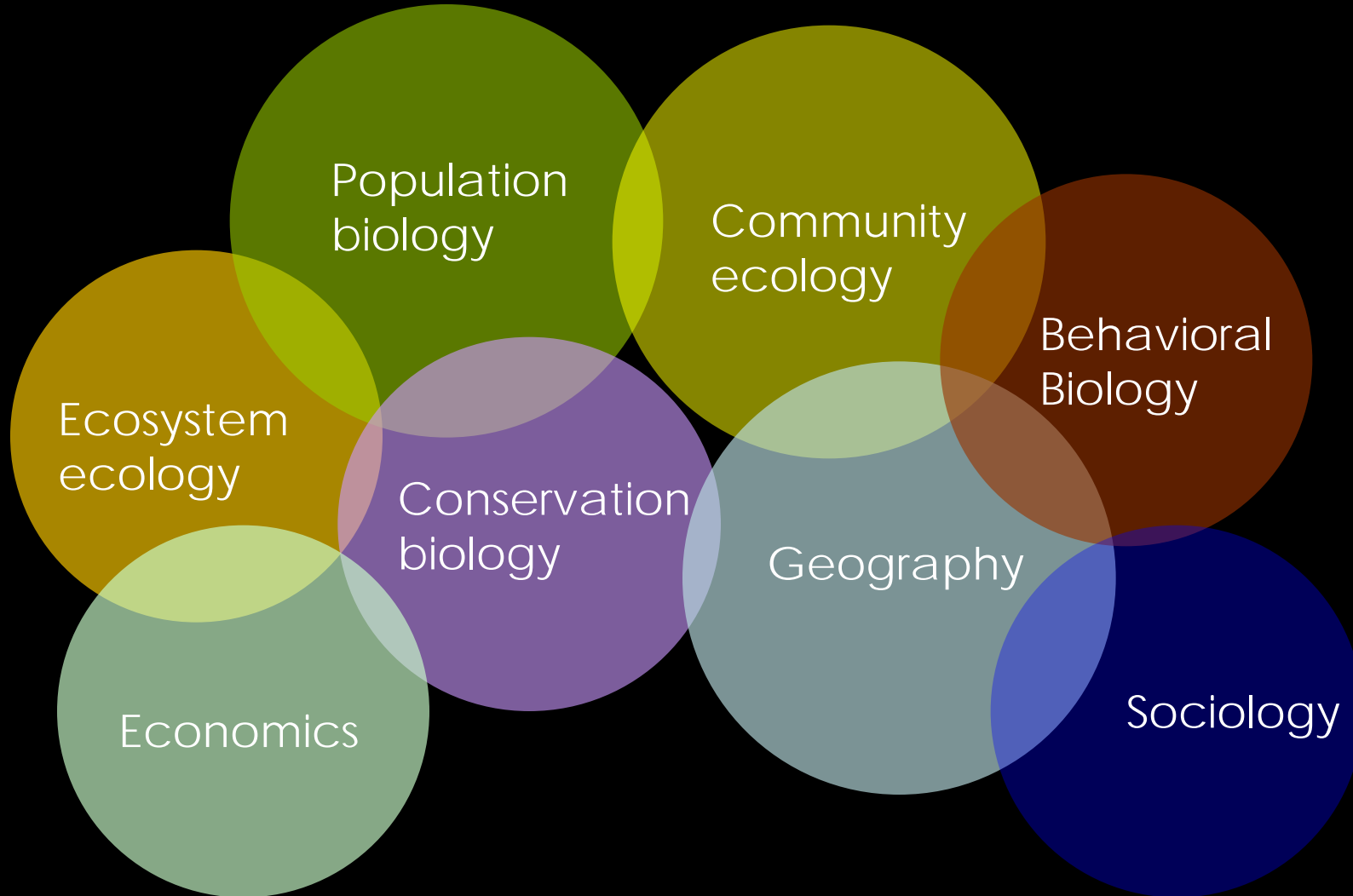
Allen and Starr 1982



A young, evolving discipline



An integrated discipline



Definitions

Heterogeneity:

consisting of distinct elements



Landscape:

an area composed of multiple distinct elements that create pattern



Definitions

Scale:

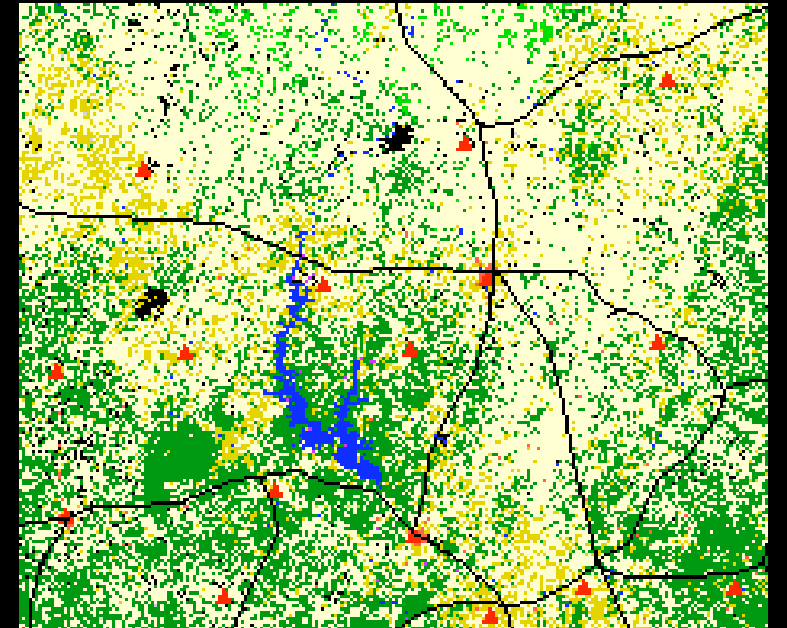
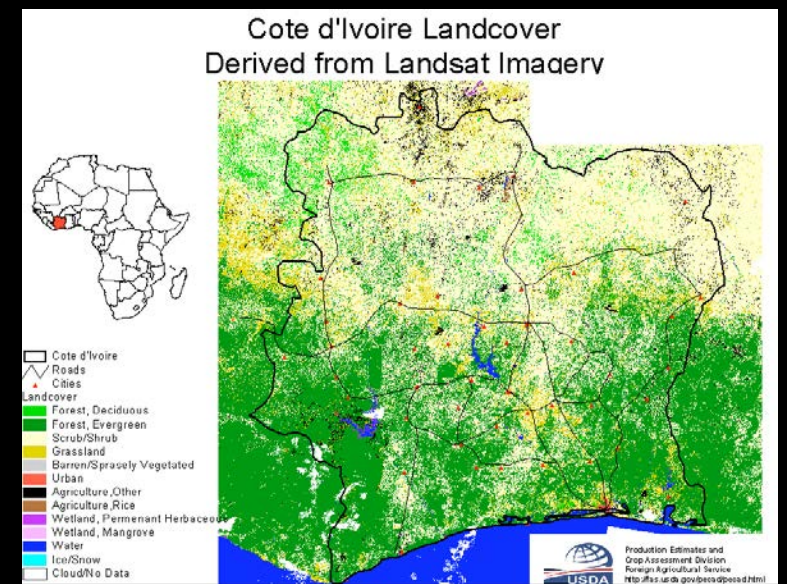
spatial and temporal dimensions

Grain:

finest level of resolution possible

Extent:

total area or duration



Definitions

Patch:

an area that differs from its surroundings



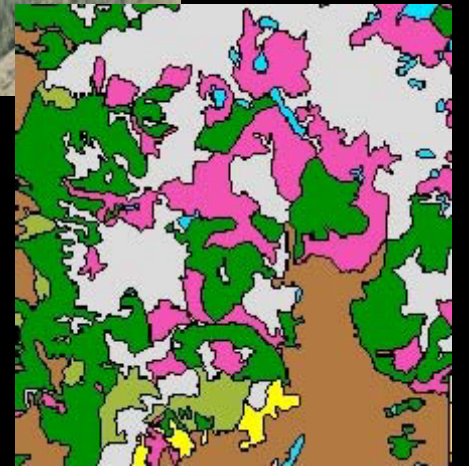
Matrix:

the background, not all landscapes have a matrix



Composition:

a quantitative or qualitative description of the elements that make up the landscape



Definitions

Fragmentation:

breaking a landscape up into disconnected patches

Configuration:

the spatial arrangement of a landscape

Connectivity:

Continuity in a particular element of the landscape



Definitions

Edge:

the portion of one landscape element that abuts another



Corridor:

landscape element that connects two or more patches



Topics Covered

Approaches to landscape ecology

Drivers of pattern

Scale

Measuring patterns

Effects of pattern on process

Models

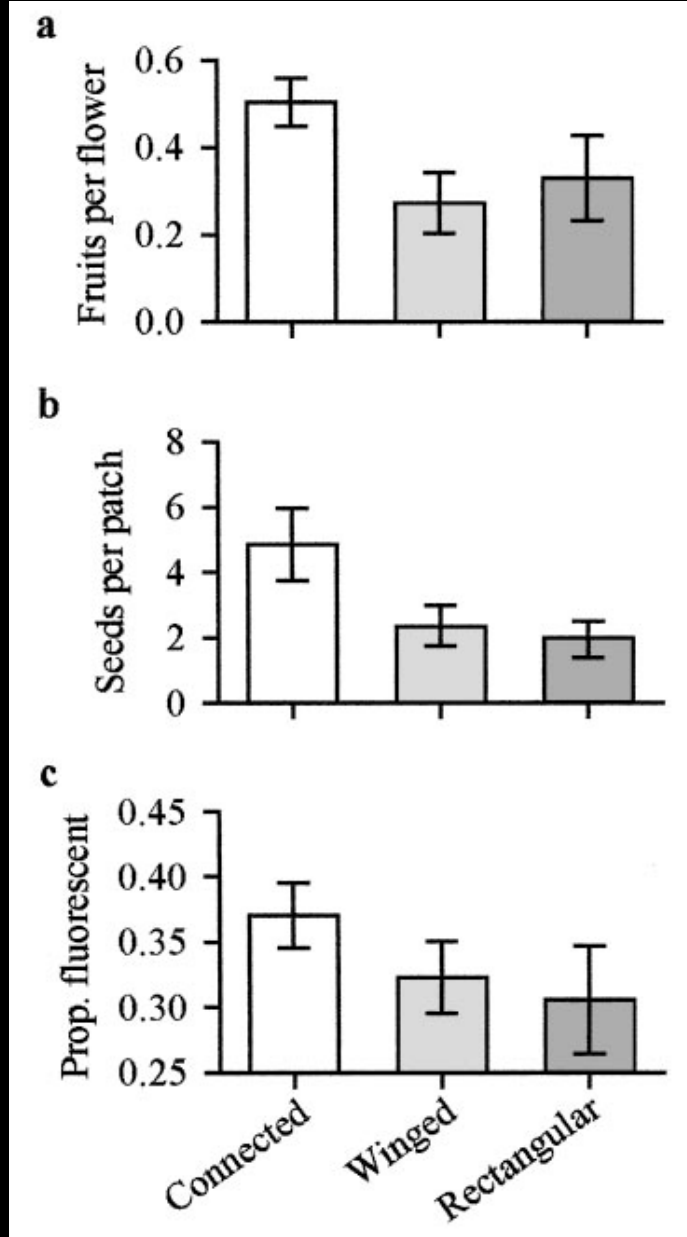
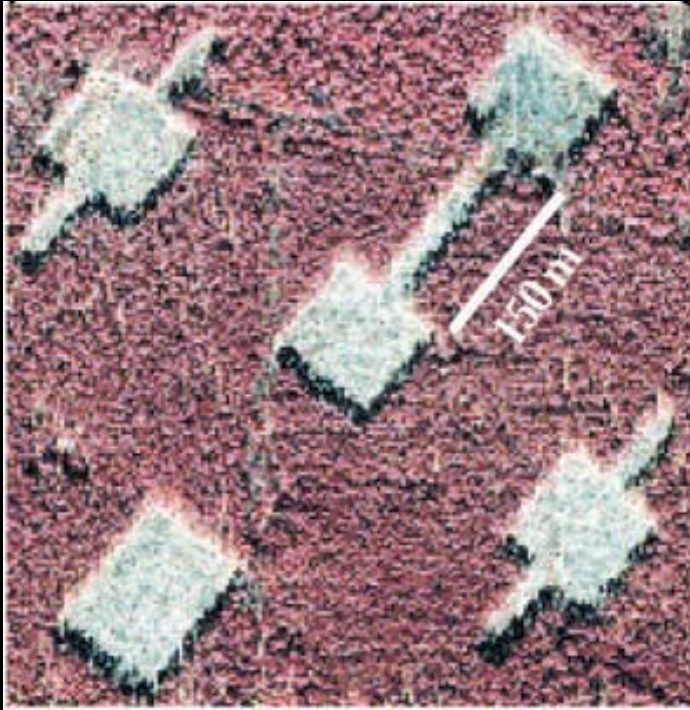
Applied landscape ecology

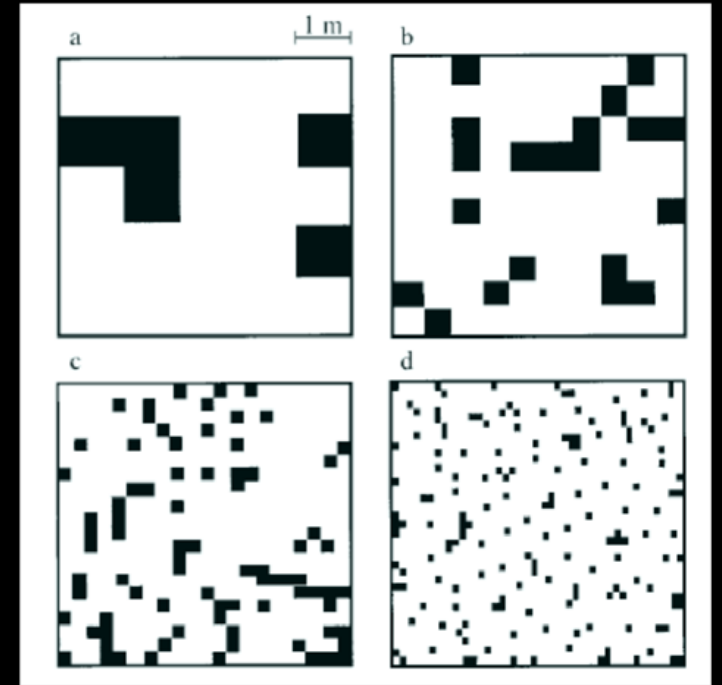
Approaches to landscape ecology

(Landscape ecology and the scientific method)

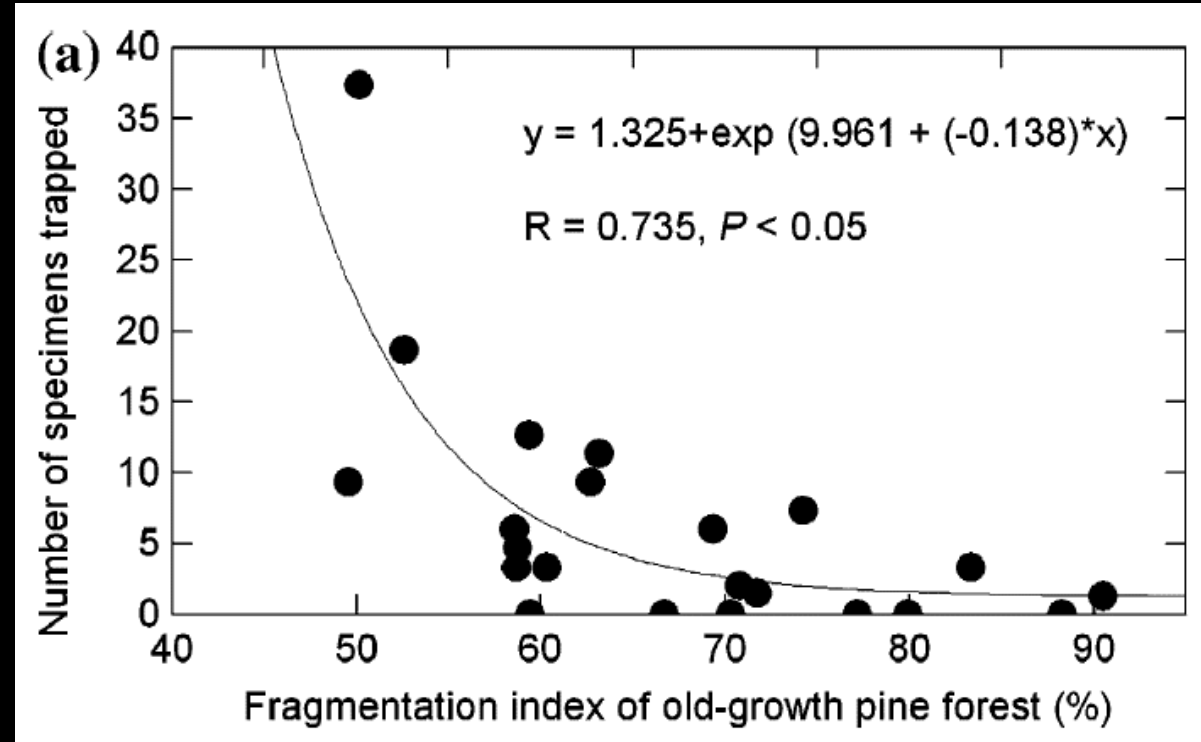
Experiment Observation Model system Modeling







McIntyre and Wiens 1999



Ecke et al. 2006

The causes of landscape pattern

Topography

Hydrology

Climate

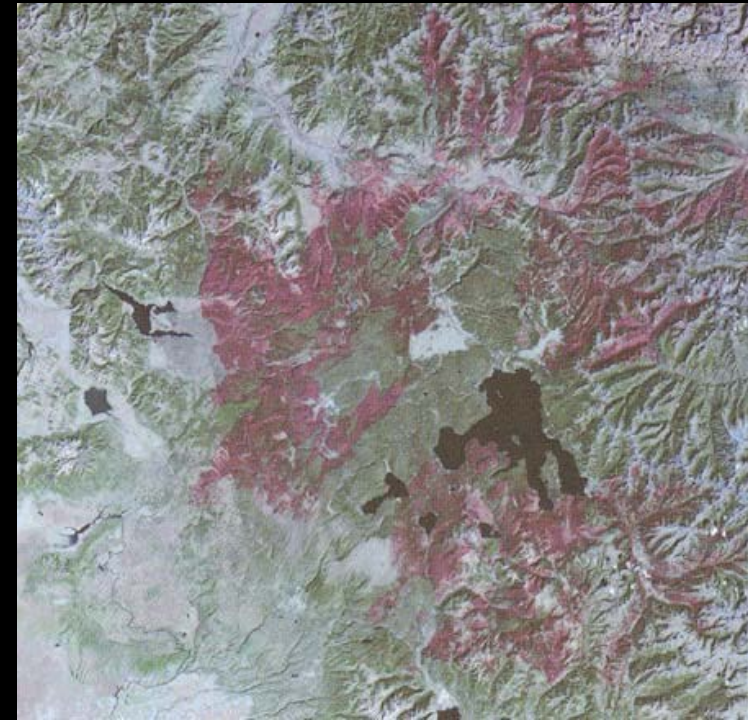
Geology

Disturbance

Ecosystem processes

Interspecific interactions

Human activities



Scale



Hierarchy
theory

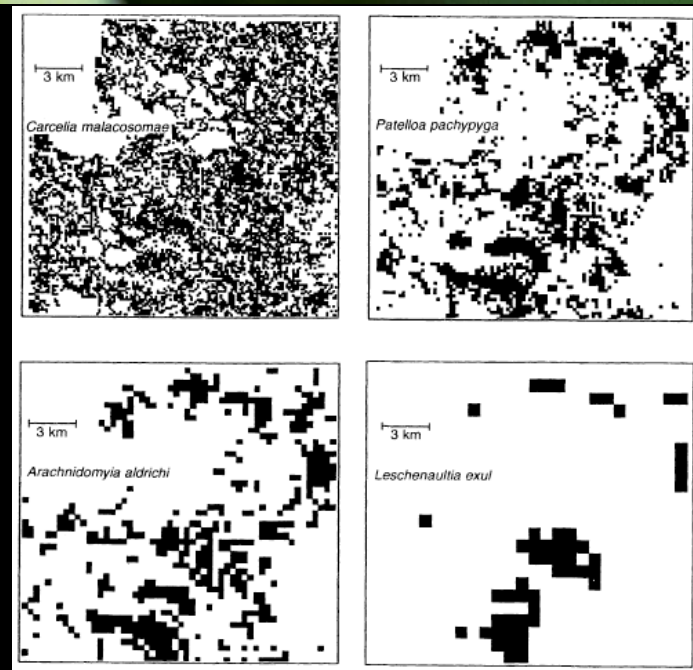
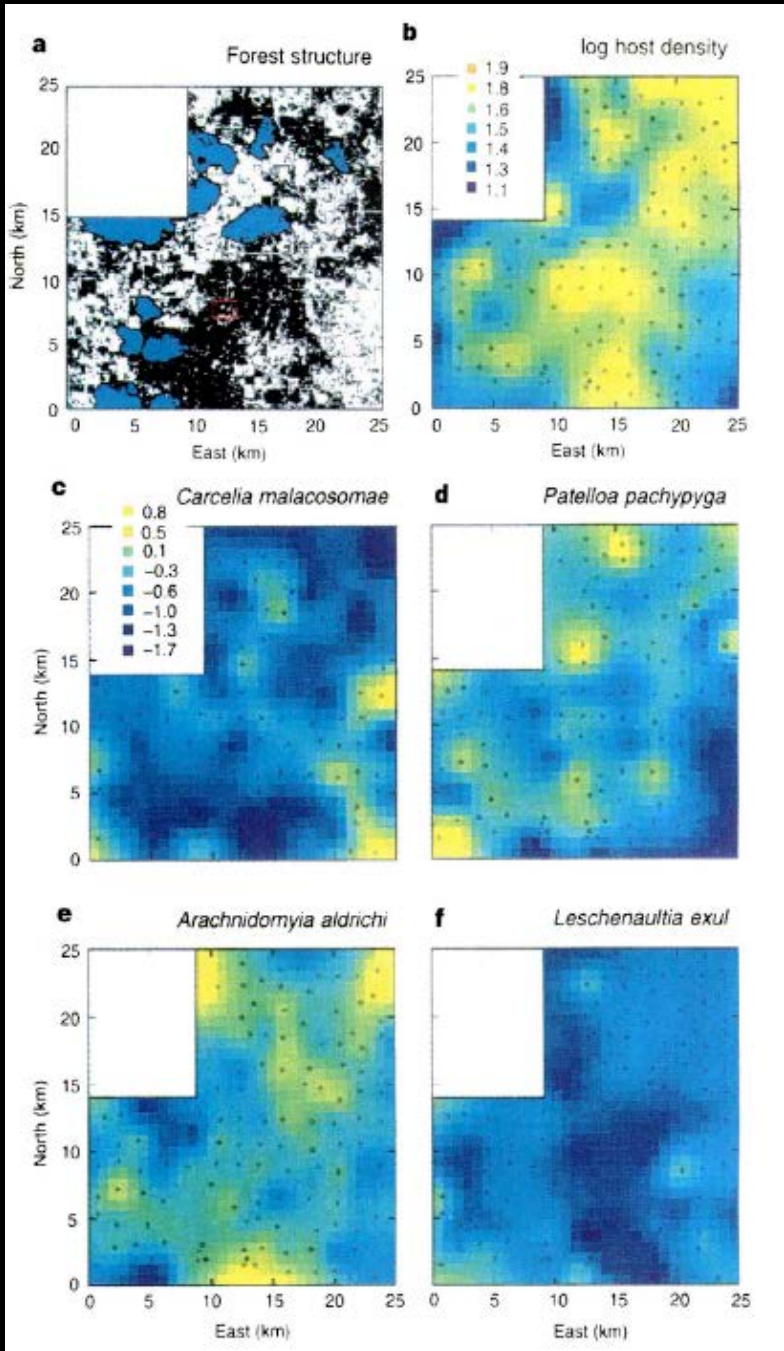


Scaling in
ecological
systems



Incorporating
scale into
ecological studies





Roland and Taylor 1997

Measuring pattern

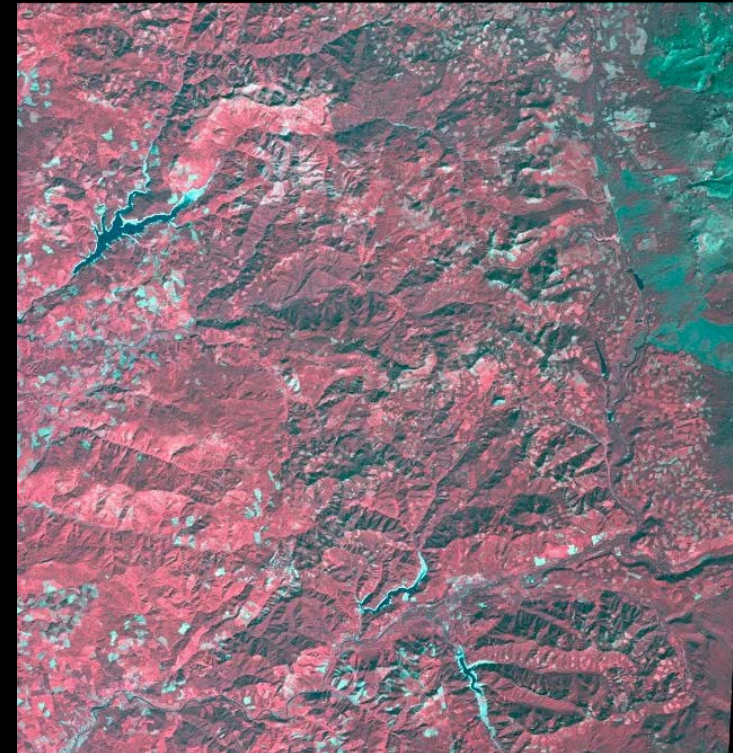
Mapping landscapes

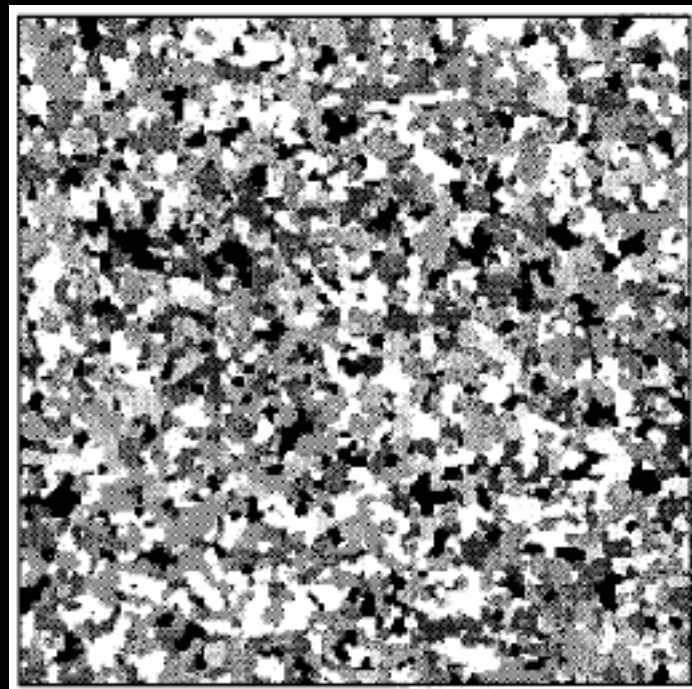
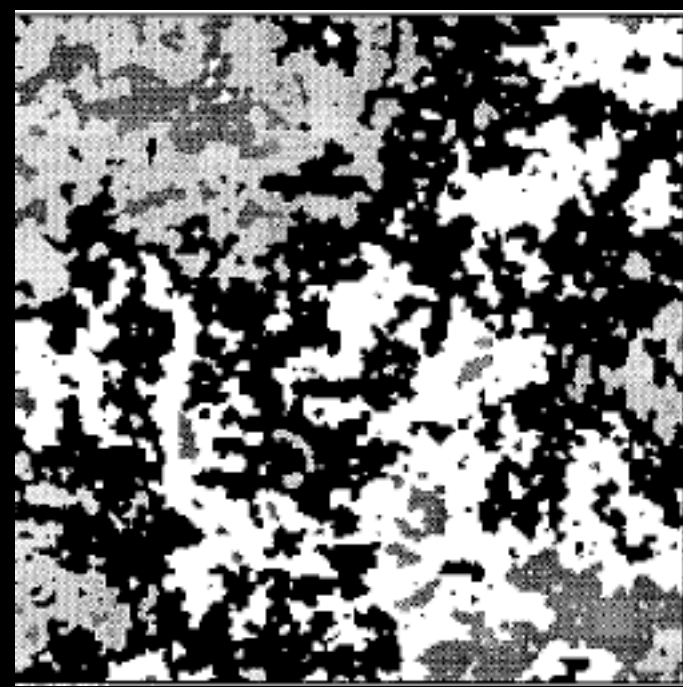
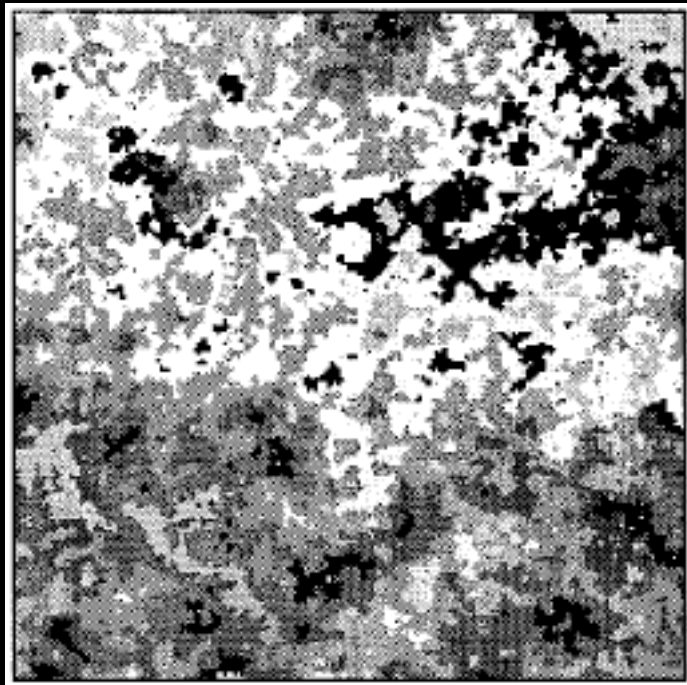
-remote sensing

-GIS

Pattern metrics

Spatial statistics





Effects of pattern on process

Ecosystem
processes



Community
structure

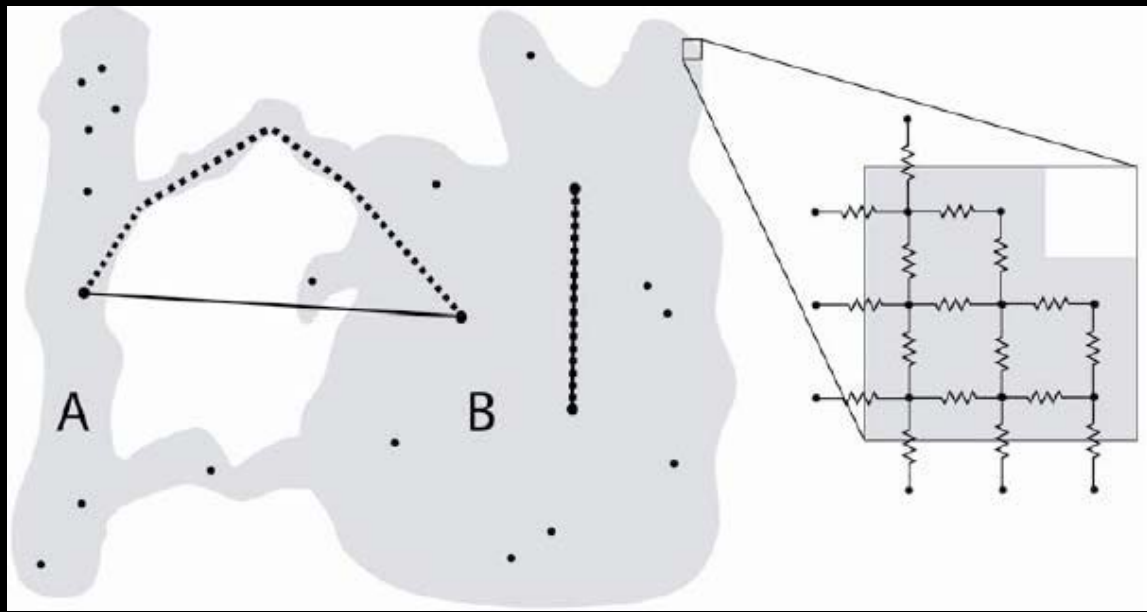


Population
dynamics



Behavior



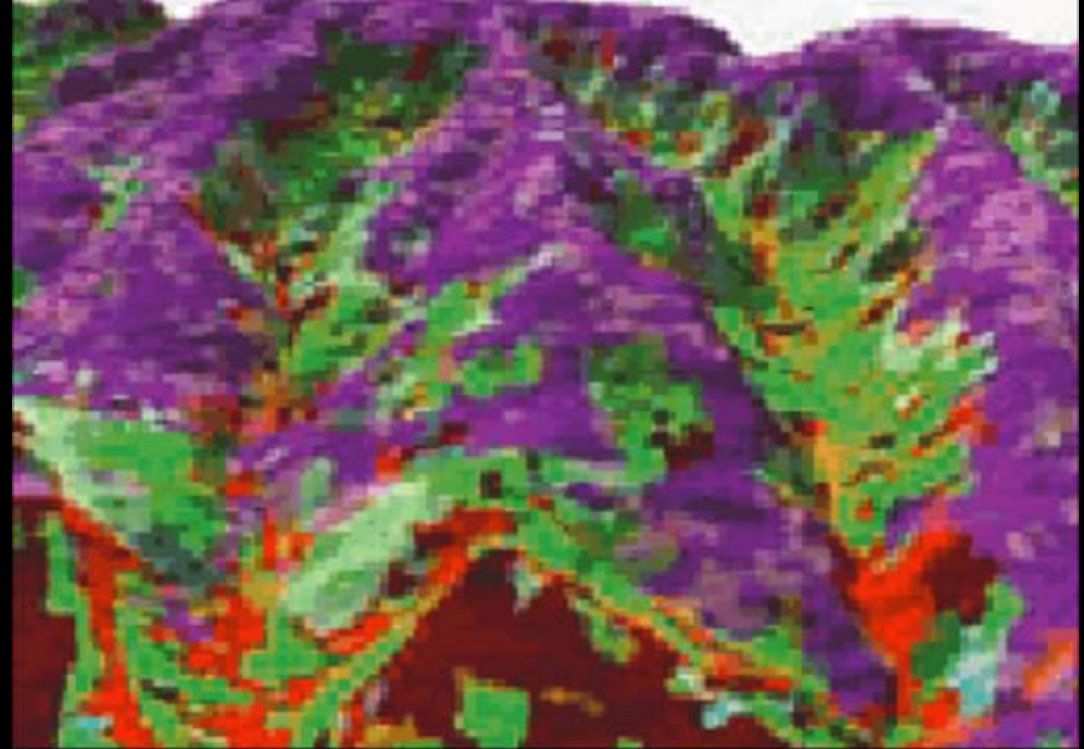
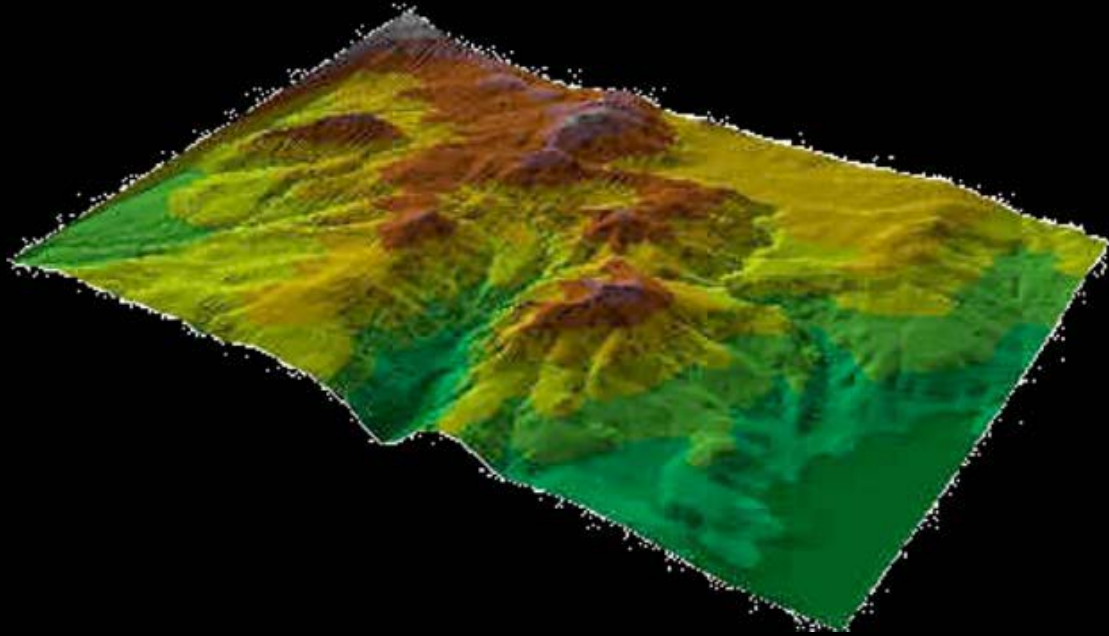


McRae 2004





Modeling landscape processes



Null
models

Ecosystem
models

Spatially explicit
population
models

Dynamic
vegetation
models

Pre-EuroAmerican Scenario ca. 1851



Land Use and Land Cover 1990



Hulse et al. 2002

Applied landscape ecology

Fragmentation

Connectivity

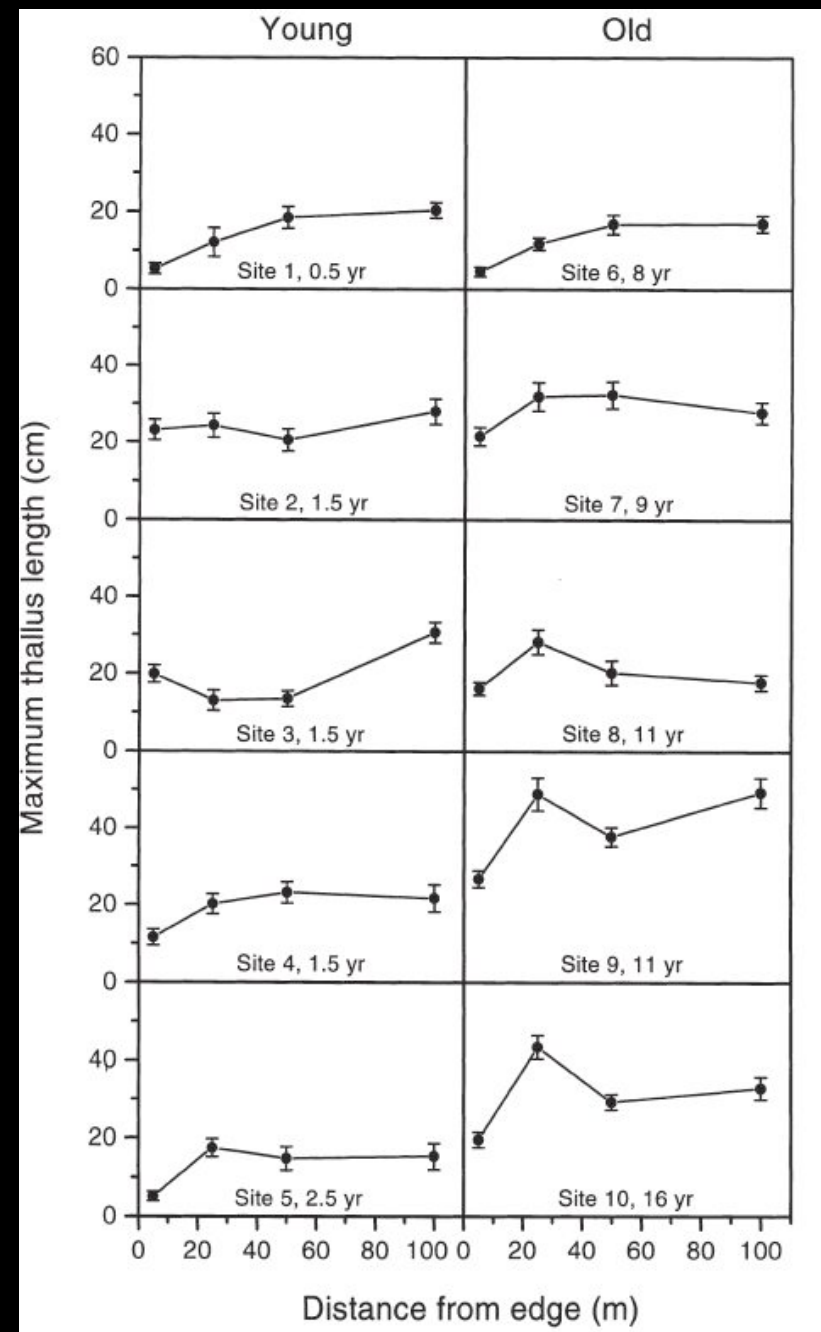
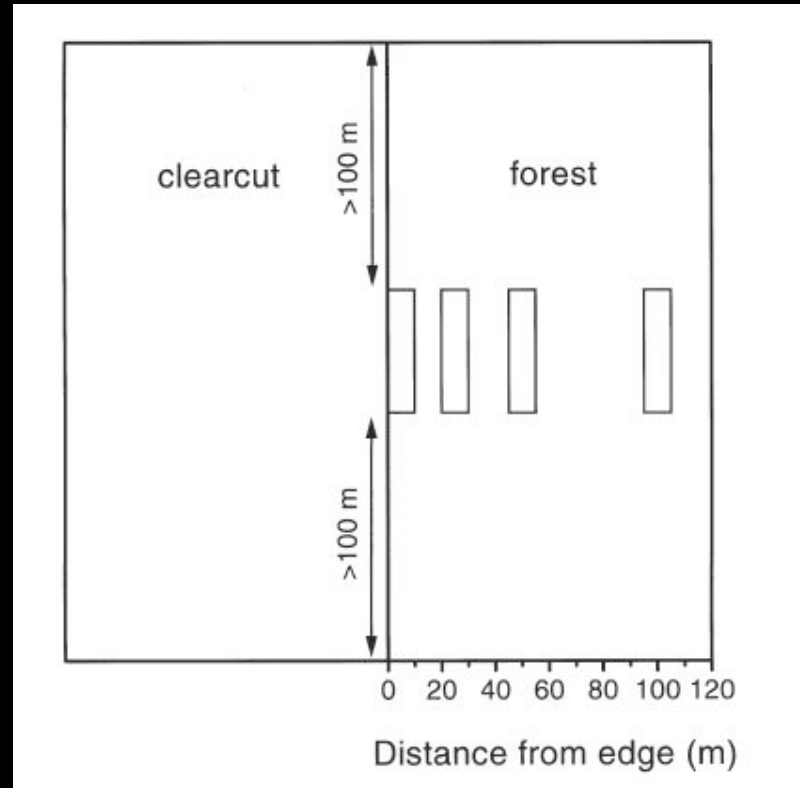
Corridors

Reserve design

Reserve selection

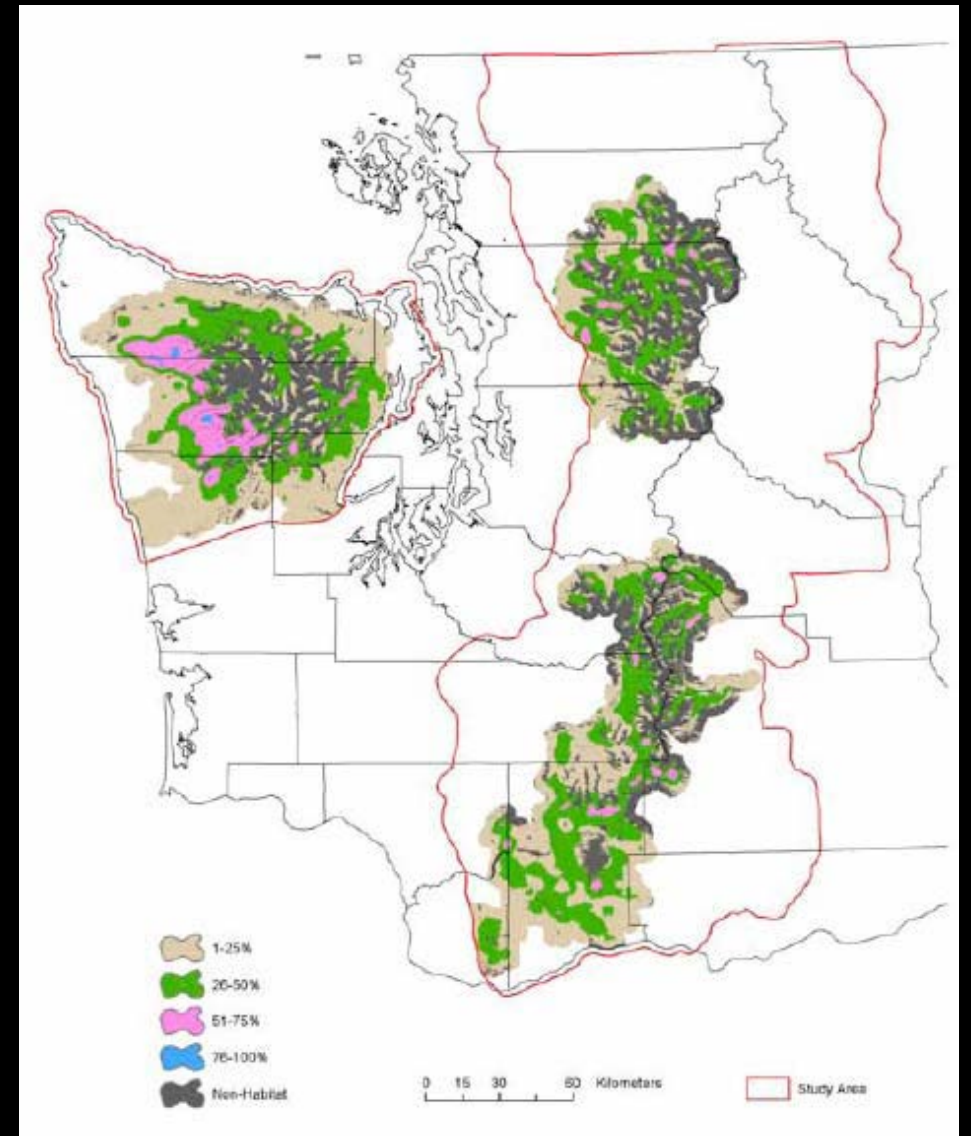
Disturbance





Esseen and Renhorn 1998

Fisher reintroduction study, Washington



Lewis and Hayes 2004

Landscape Ecology

Lecture/Discussion	Tues 9:30-11:20 (WFS 107) Thurs 1:30-3:20 (WFS 107)
2-3 labs	during scheduled class time Bloedel Hall 261
Readings	Turner et al. Text & papers
Short papers	2, 5 pages, double spaced & 1 field trip report
Presentations	5 minutes on paper #2

Landscape Ecology

Midterm exam:

In class midterm exam

Final exam:

Take-home exam assigned last week of class and due Wednesday of finals week

Field trip:

Fri, October 4 to Sun, October 6
(weather permitting)

Landscape Ecology

Grading

Papers	30%
Midterm	20%
Participation	20%
Final exam	30%