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Terrestrial Corridors
Connectivity & Connectedness

State of the Art, Existing knowledge & Gaps

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Alpine SPACE
EUROPEAN TERRITORIAL COOPERATION
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- **Different modelling approaches : objectives, data, resolution & scale issues**
- **Identify key differences in between connectedness (continuum approach) and connectivity**
- **How to set the right thresholds values that have ecological meaning from the populations point of view**

Issues regarding different modelling approaches

- methods of graph construction have a decisive impact on results of landscape connectivity assessments
- differences between ‘centroid’ models and ‘patch’ models Vs. ‘Euclidean’ and ‘cost’ models
  - polygon-to-point transformation vs distance metrics
- cost models vs Euclidean models
  - **functional connectivity**
  - hypothesis to be tested against real-world data (species movement across landscapes)
    - Migration
    - Natural vs artificial barriers

- **Data availability in the Alps and other mountain regions (within the framework of the implementation of the European Directive, Natura 2000, LTER sites, fauna-flora-habitat directive)**

- **Data quality**

- **Harmonization**

- **Scaling issues**

- **Species data – Guilds – Key species (warning: lack of vegetation spp)**

When to invest conservation efforts in connecting elements?

- Not for species with very low or large dispersal.
- Especially for species with intermediate dispersal abilities (relative to the habitat spatial pattern).

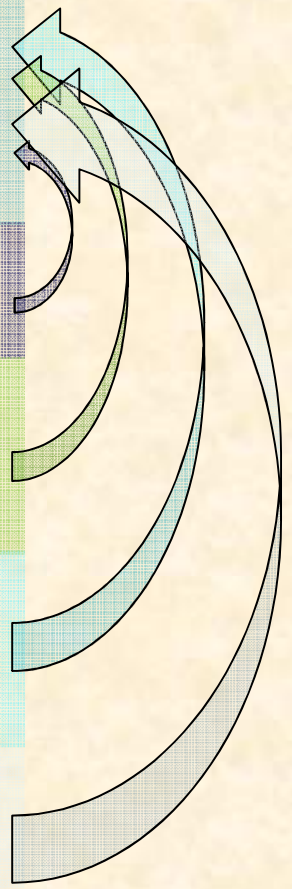
By using habitat availability metrics:

- There is no risk of overweighting connectivity considerations in the final conservation plan.
- No need to define *a priori* if conn. is important or not
- They provide a common currency / integrated analytical framework for both alternatives.

Saura & Rubio (2009) *Ecography* (in press)

Summary of available relevant tools and their integration possibilities

- Conefor Sensinode: prioritizing landscape elements by their contribution to connectivity (fractions to be implemented soon).
- PathMatrix: connections as least cost paths.
- Corridor Designer: corridors as wide low cost bands and frictions from habitat models.
- Circuitscape: accounts for multiple paths to assess connection strength (circuit theory).
- Guidos: identification and mapping of spatial patterns and structural connectors.



GUIDOS: MSPA products

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Joint Research Centre
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DATA

Please select one of the following links to access full resolution datasets or Google Earth overlays produced by the Forest Action at the JRC:

Forest
Cover Maps

European Forest cover maps derived from high resolution satellite data.

MSPA
Pattern Maps

Morphological Spatial Pattern (MSPA) maps based on the Forest Cover maps.

Google Earth
Overlays

Overlays of Forest Cover and MSPA maps for display in Google Earth.

- Gaps in knowledge and research needs
  - Link with services -monetary and non monetary value- (help dialog w. Policy makers)
  - Temporal framework
  - Climate Change
- Transferring knowledge into policy - innovative approaches

WHY Spatial Pattern ?

Ecological Processes (functional)

Local

Regional

Continental

Spatial Pattern (structural)

complex system & different fields of interests/issues

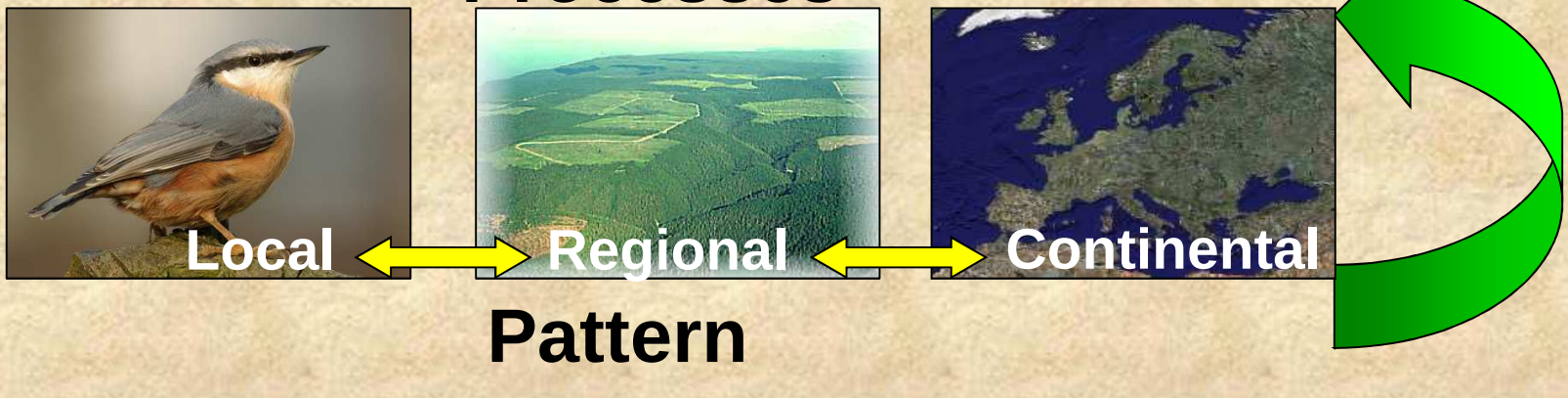
1. Data selection & preparation: **EXPERT**

2. Processing: Analysis of image components: **MSPA**

3. Interpretation: **EXPERT**

Aim: Toolbox for a generic description of spatial pattern

Patterns into Processes

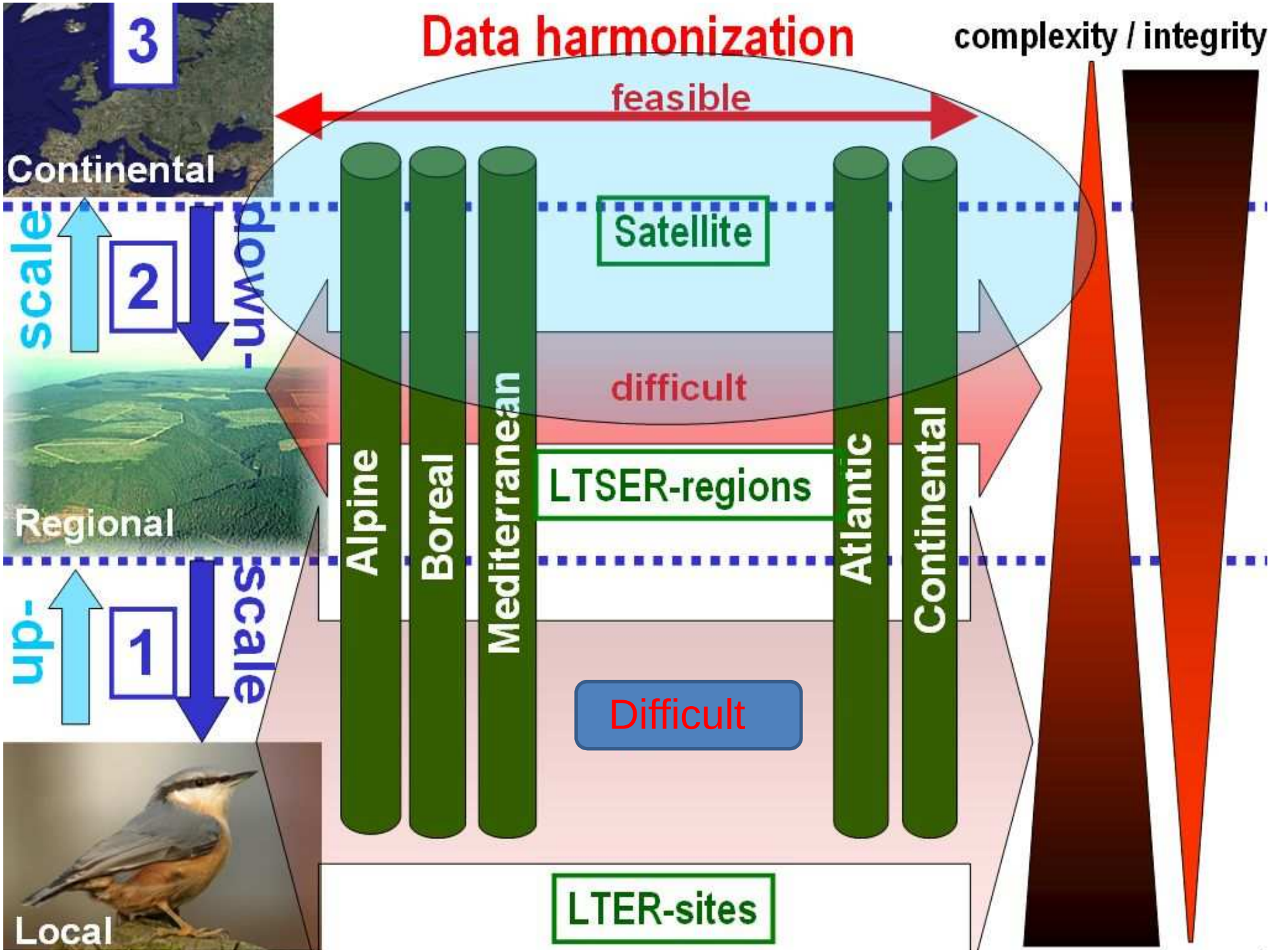


upscale

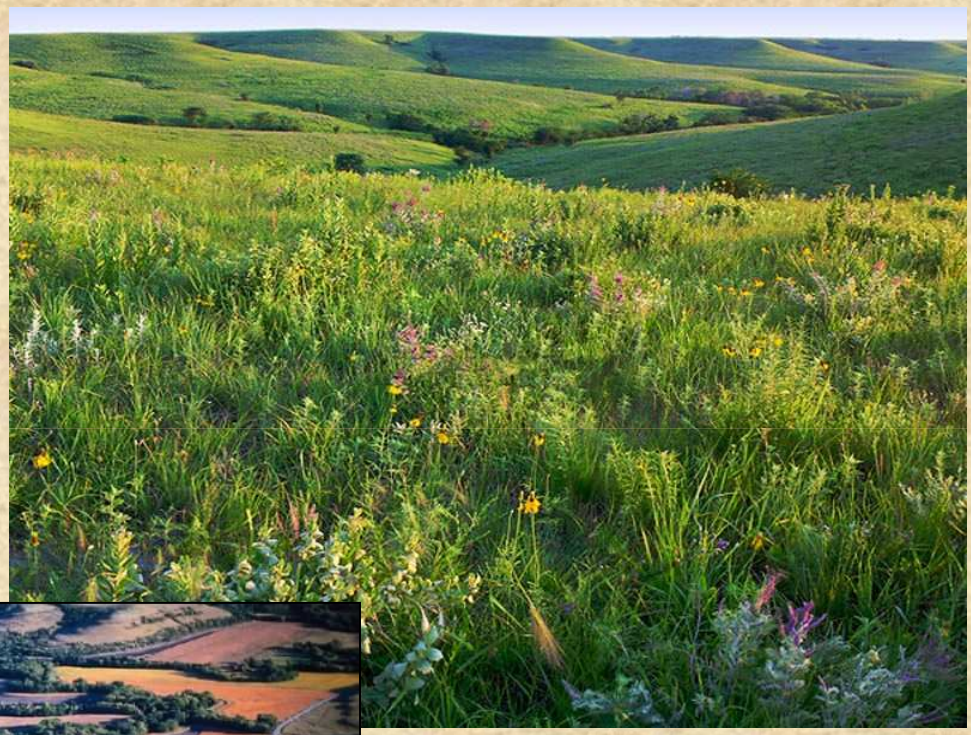
downscale

Complex & more realistic models

Scaling
Dynamics
Interactions


Data harmonization
complexity / integrity
feasible
difficult
Satellite
LTSER-regions
LTER-sites
Difficult
Alpine
Boreal
Mediterranean
Atlantic
Continental
3
Continental
2
scale-down
Regional
up-scale
1
Local

Landscape = a spatially heterogeneous area…..



Landscape/
Land cover
Land-use

Effects of habitat loss or degradation cannot always be mitigated by simply managing or restoring connectivity

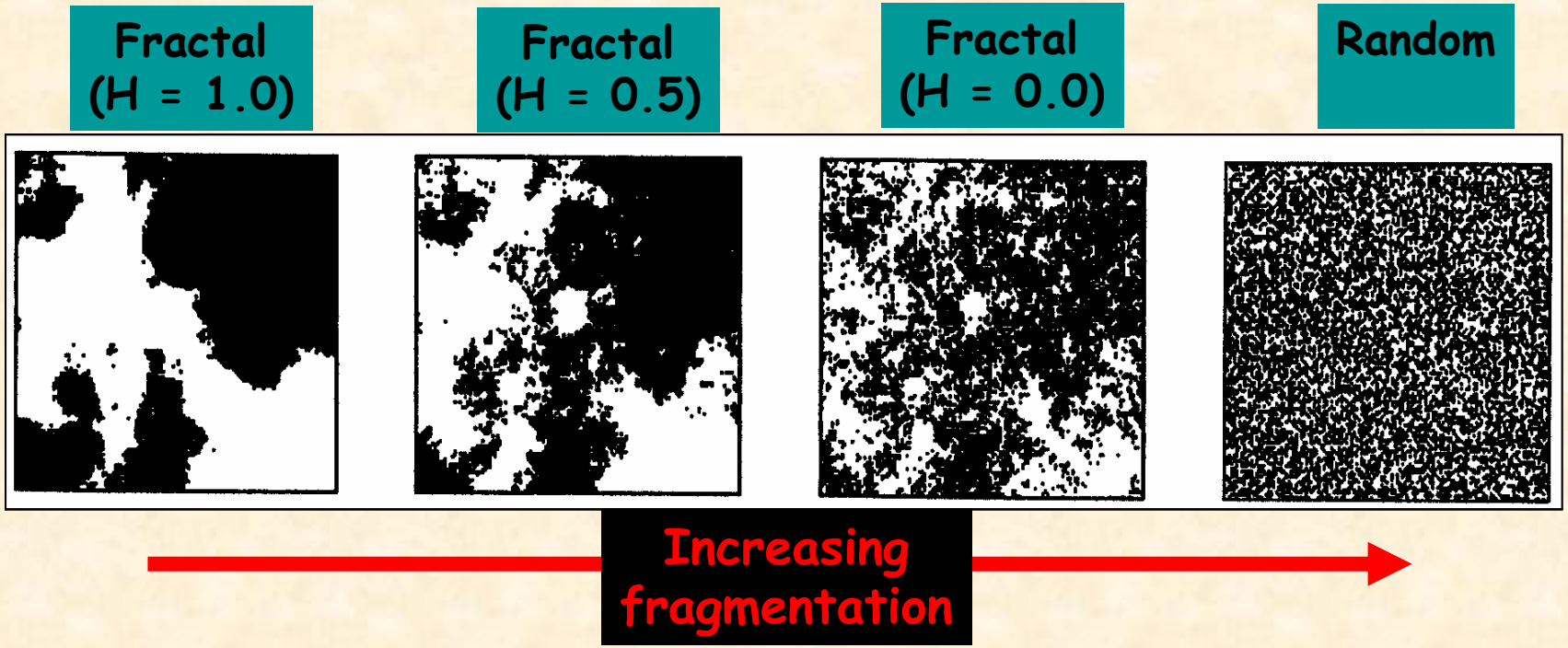
2. Landscape Connectivity is Vital

Connectivity is a vital element of landscape structure

(Taylor et al. 1993—*Oikos*)

Connectivity is affected by the amount and spatial arrangement of habitat on the landscape

When is spatial pattern important?



Connectivity has consequences for ecological flows and spatial processes on the landscape:

Inherently a gauge of landscape function

Functional connectivity is the key

Dispersal
Gene flow
Invasive spread
Disease spread
Spread of disturbances (e.g, fire)
Metapopulation dynamics and persistence
Source-sink nutrient dynamics

Landscape Function

Connectivity has consequences for ecological flows and spatial processes on the landscape:

Inherently a gauge of landscape function

Functional connectivity is the key

If a little connectivity is a good thing,
more must be better!

Therefore, shouldn't we try to maximize connectivity?

That depends…..

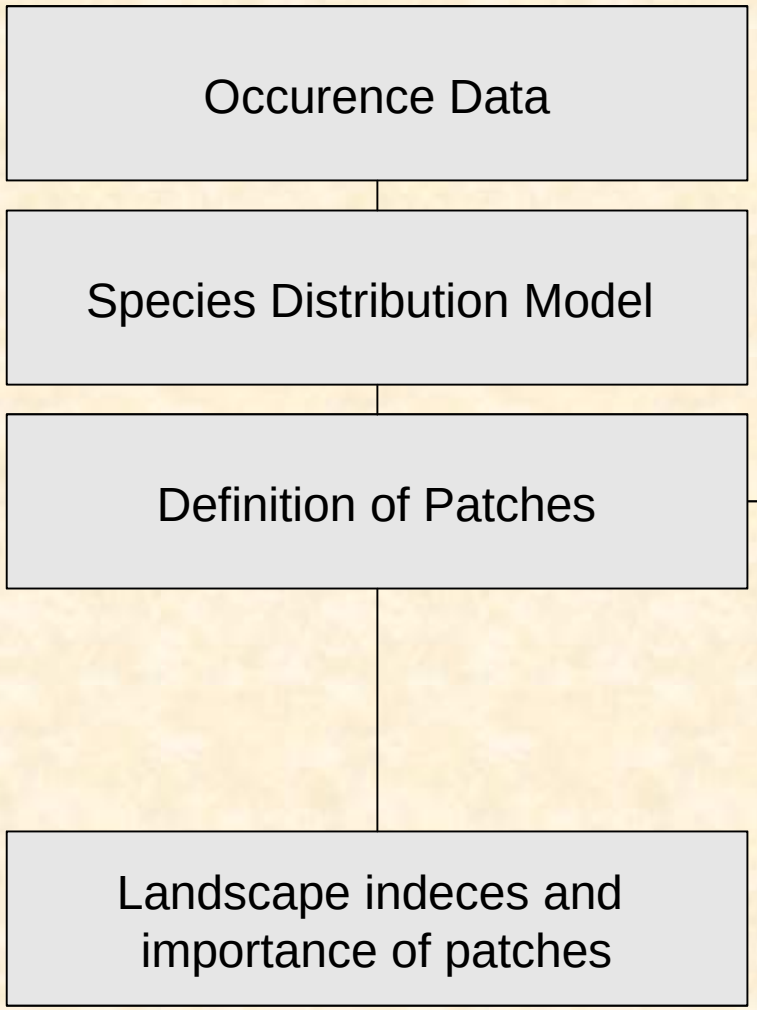
Integrating connectivity in landscape planning…

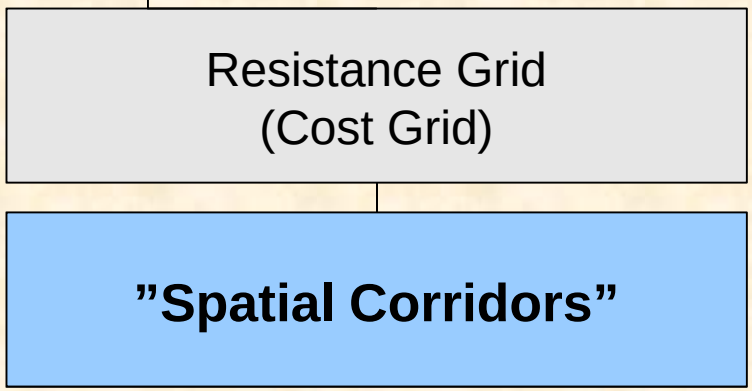
1) Which main approaches are available?
2) Should we measure only connectivity between habitat patches?
3) Is connectivity always the best conservation strategy?
4) *Which operational tools are available?*

To integrate connectivity in landscape planning…

1) Think of the landscape as a network of habitat units connected by links (graphs but not only).
2) Consider both intrapatch & interpatch connectivity (habitat availability) and the different roles of landscape elements.
3) Place connectivity within a broader context of planning and conservation alternatives.
4) Be aware of the scarcity of empirical information to model the landscape network and feed your connectivity analysis: use more complex models with care and rely in adaptable approaches if possible.
5) Test and use recent tools for integrating connectivity in landscape planning and ecological network design.

Workflow (Johannes Signer)





- Least Cost Algorithm
- Implemented in GISs, Pathmatrix
- Electrical Circuit Theory
- Implemented in Circuitscape (www.circuitscape.org)

(McRae et al. 2008)