



Kepler Prototype Projects in Biodiversity

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January 4, 2005





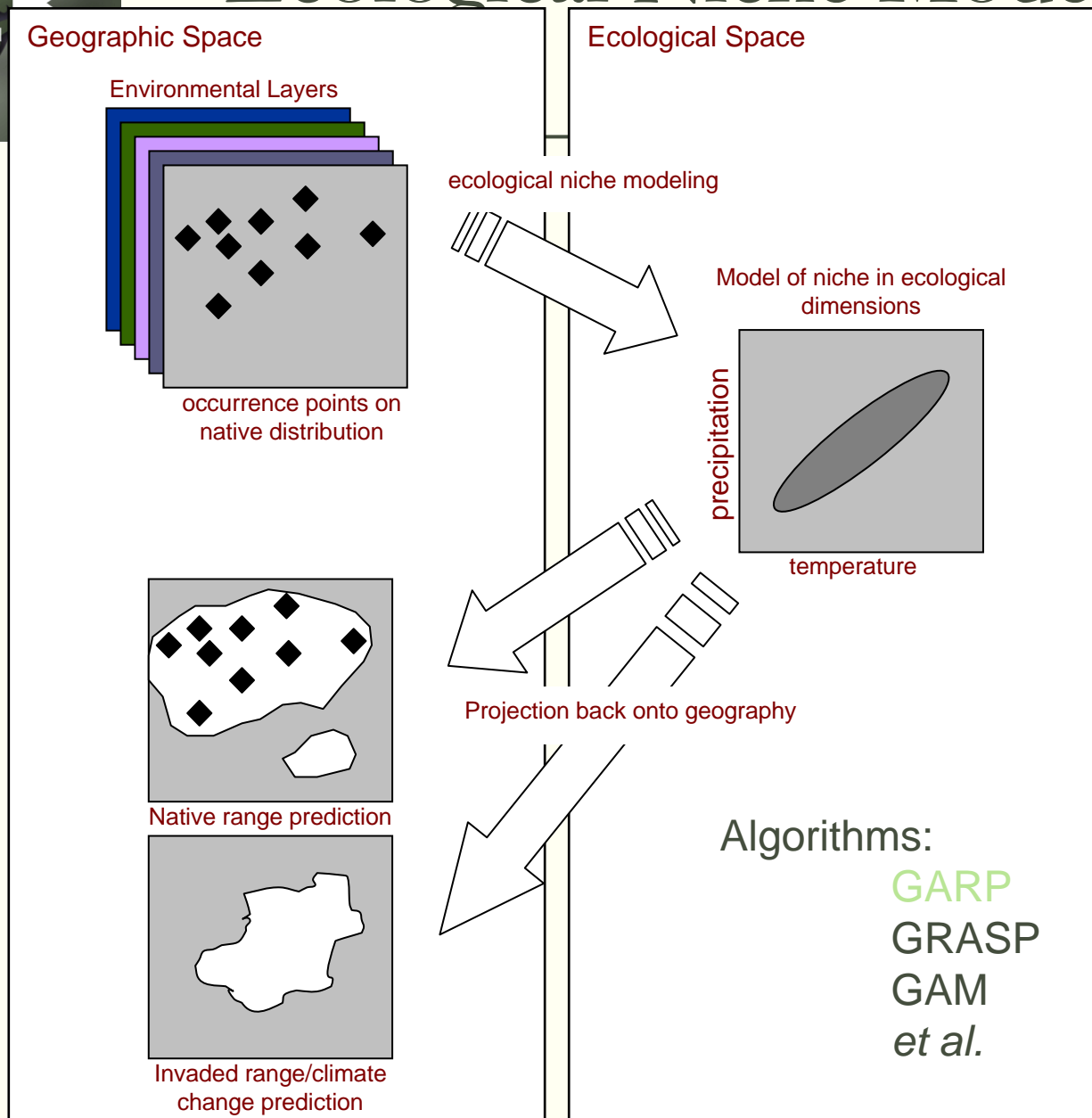
Projects

1. Species distributions: ecological niche modeling
2. Biodiversity, productivity & scale: integrating field data
3. Taxonomic change: name resolution





Ecological Niche Models





Species prediction map

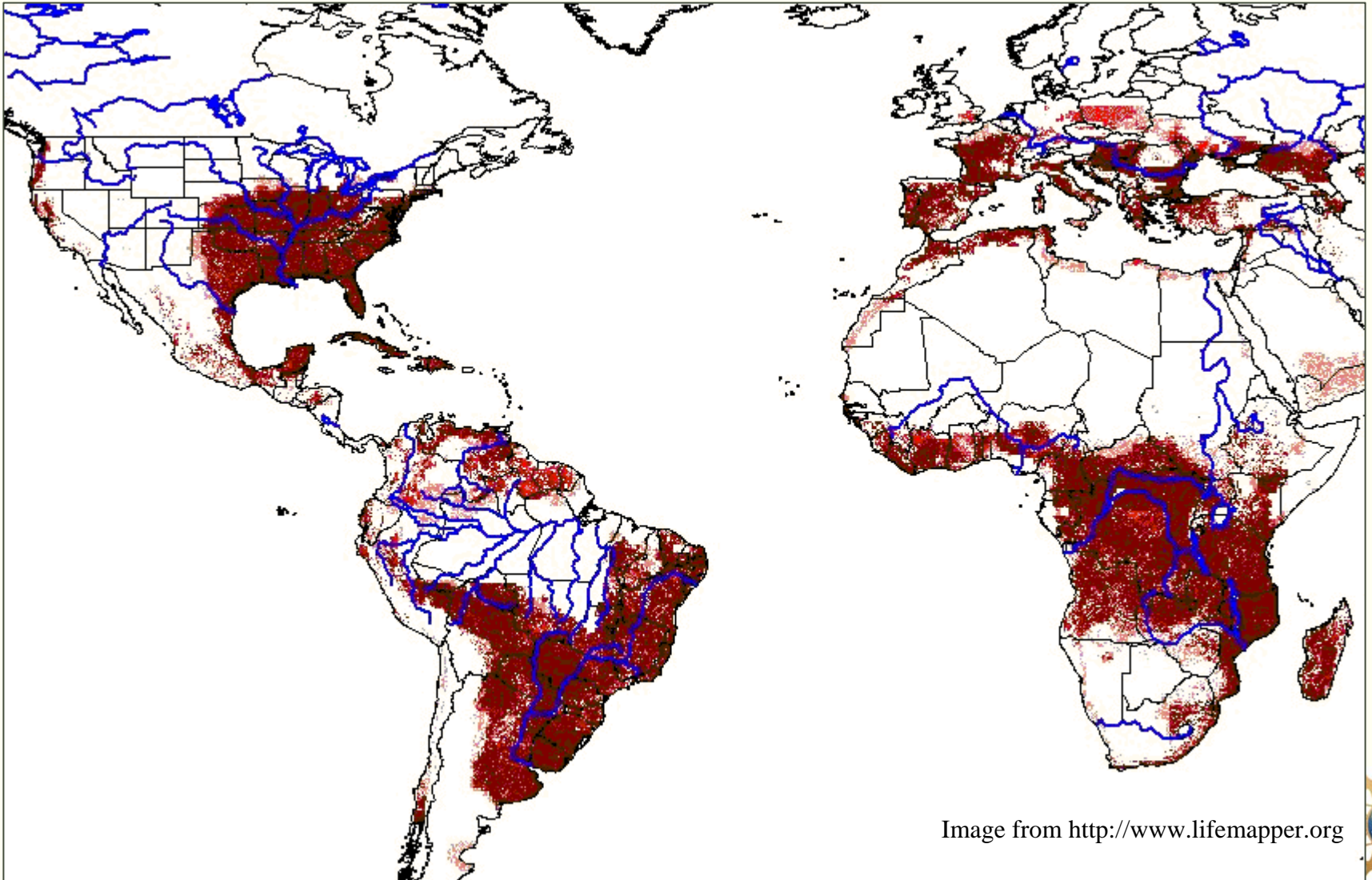
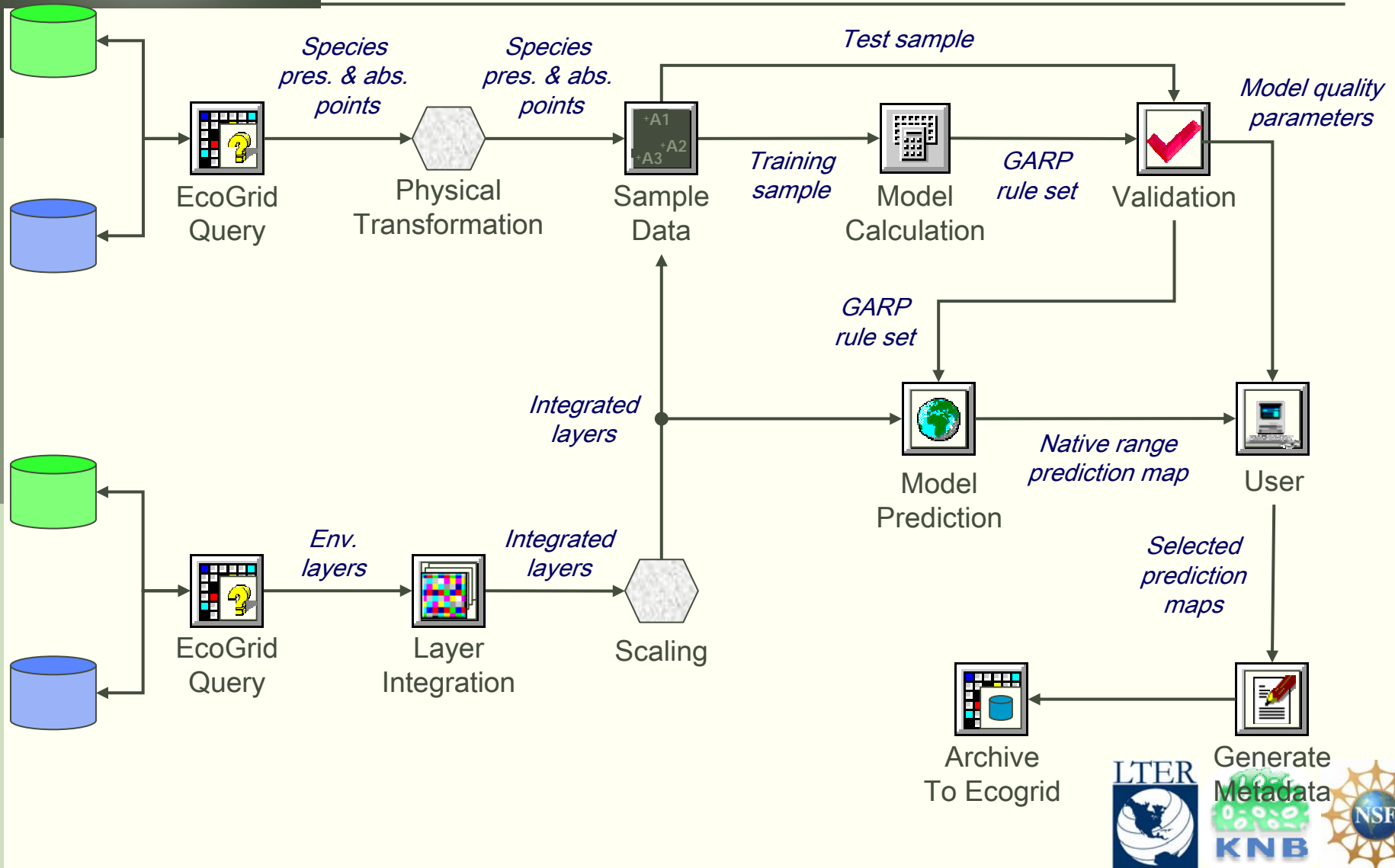


Image from <http://www.lifemapper.org>



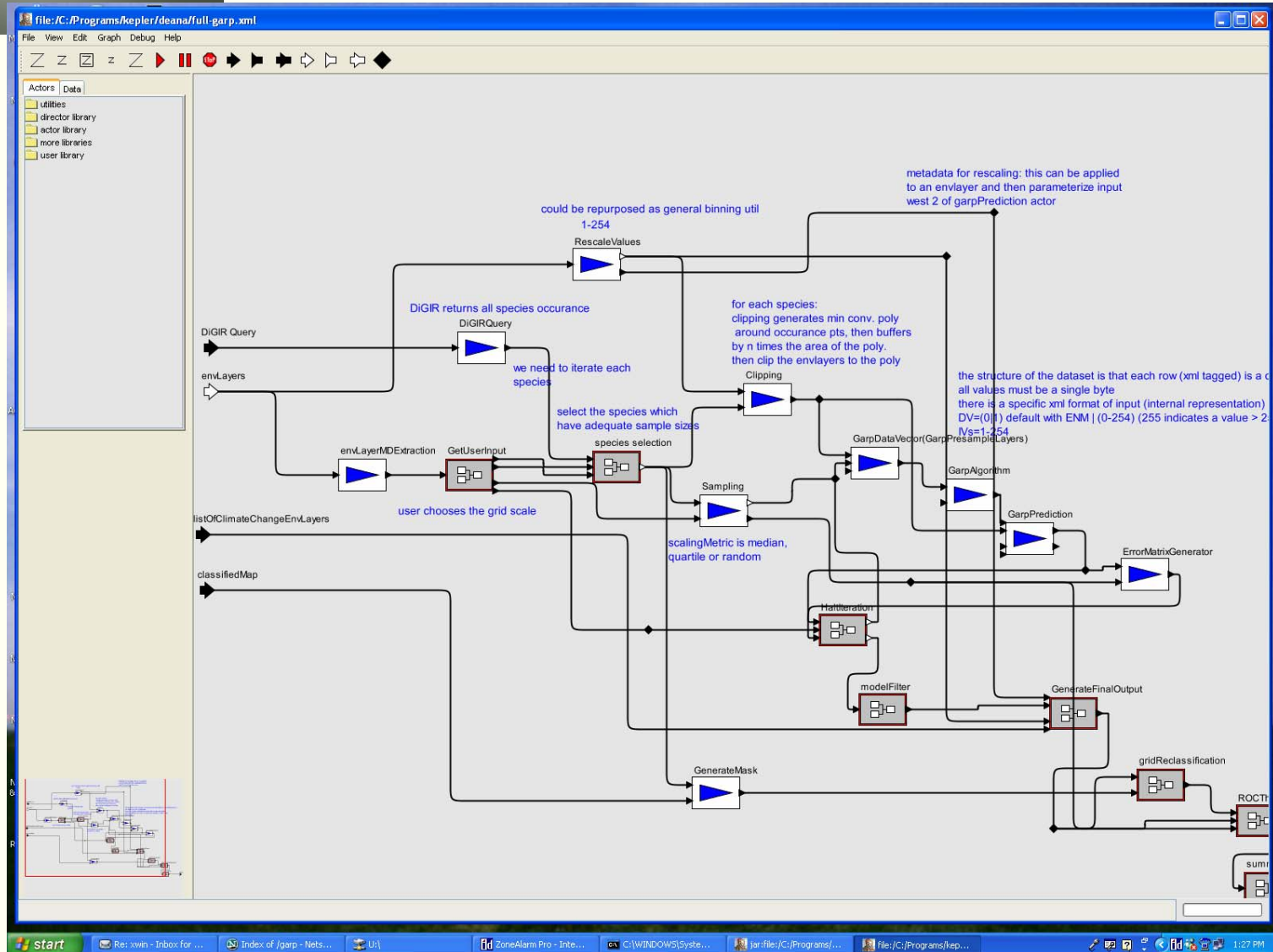


Abstract Workflow





Executable Workflow





Mammal project

- 2000-3000 species
- 2 algorithms
- 100+ models/species/algorithm
- 500,000 – 1,000,000 models
- Test large-scale implementation of Kepler
- Provide a hemisphere-wide view of mammal diversity
- Provide a massive comparison of CC implications as function of
 - region
 - clade
 - scenario
- Enable many other parallel apps

2-3 dispersal scenarios

2 major evolutionary-computing algorithms (GA and NN)

15-20 GCM scenarios, including all IPCC scenarios





Remaining functionality

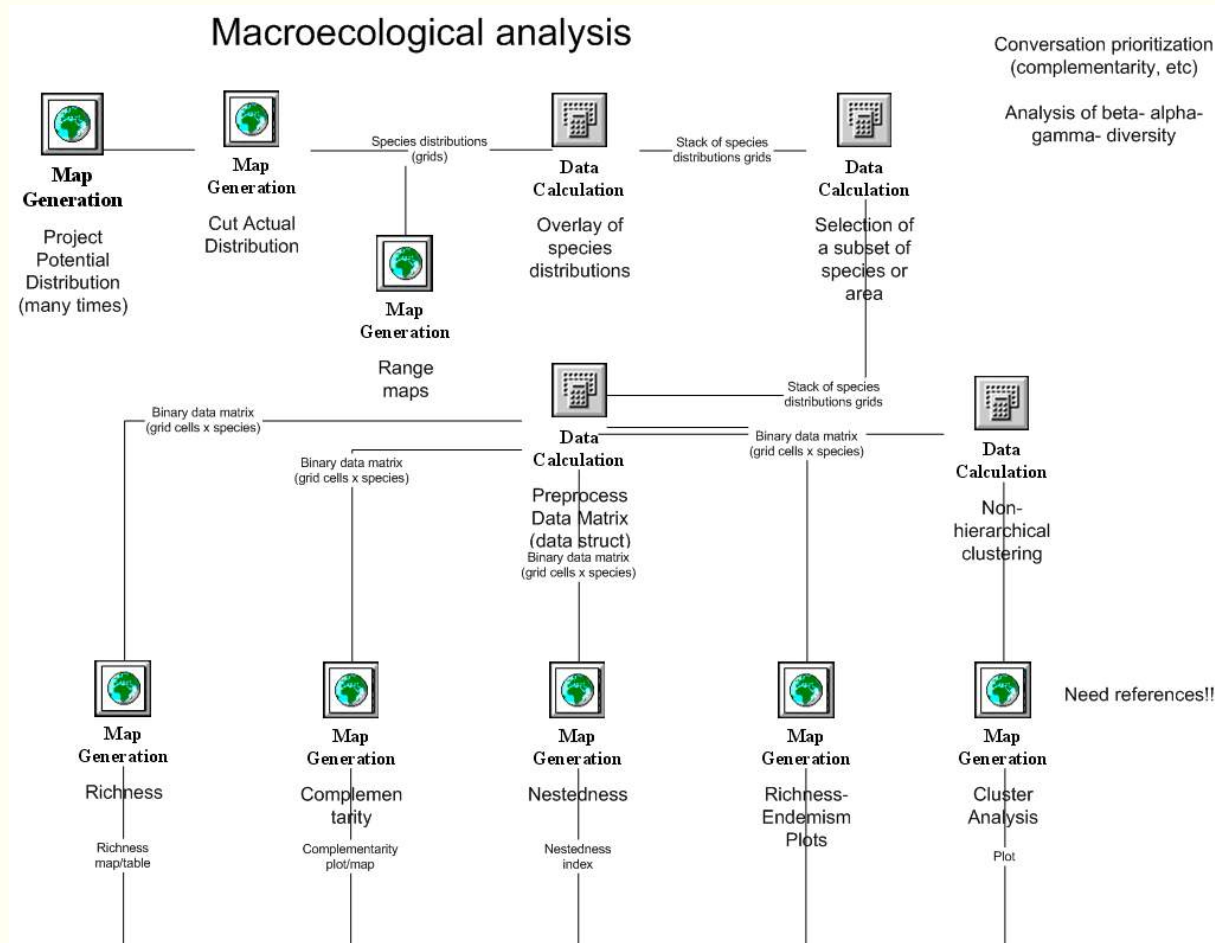
1. Multiple models/species..."Best Models"
2. Parallelization
3. Present/future comparisons
 1. Disperse-all, none, contiguous

New functionality: pending resources





Macroecological analysis





Dispersal analyses

1. Percolation analyses

Patch analyses

Connectivity measures

MRM minimum range measures (future refugia)

Graph theory

2. Time-based dispersal

Cellular automata

Random walks (paths)

Chain analysis (corridors)





Data Exploration/Reduction

- Classification/clustering algorithms
- Spatial statistics
- Principle components
- Visualization tools (GeoVista)





ENM: Pros & Cons for SEEK

□ Pros:

Interested, excited, international community

Strong procedural approach => high impact from automation

Focus on Kepler development

□ Cons:

Few data integration needs

New Project Criteria:

1. Require semantic integration of field data
2. Link with ecological niche modeling project
3. Involve a different set of domain scientists





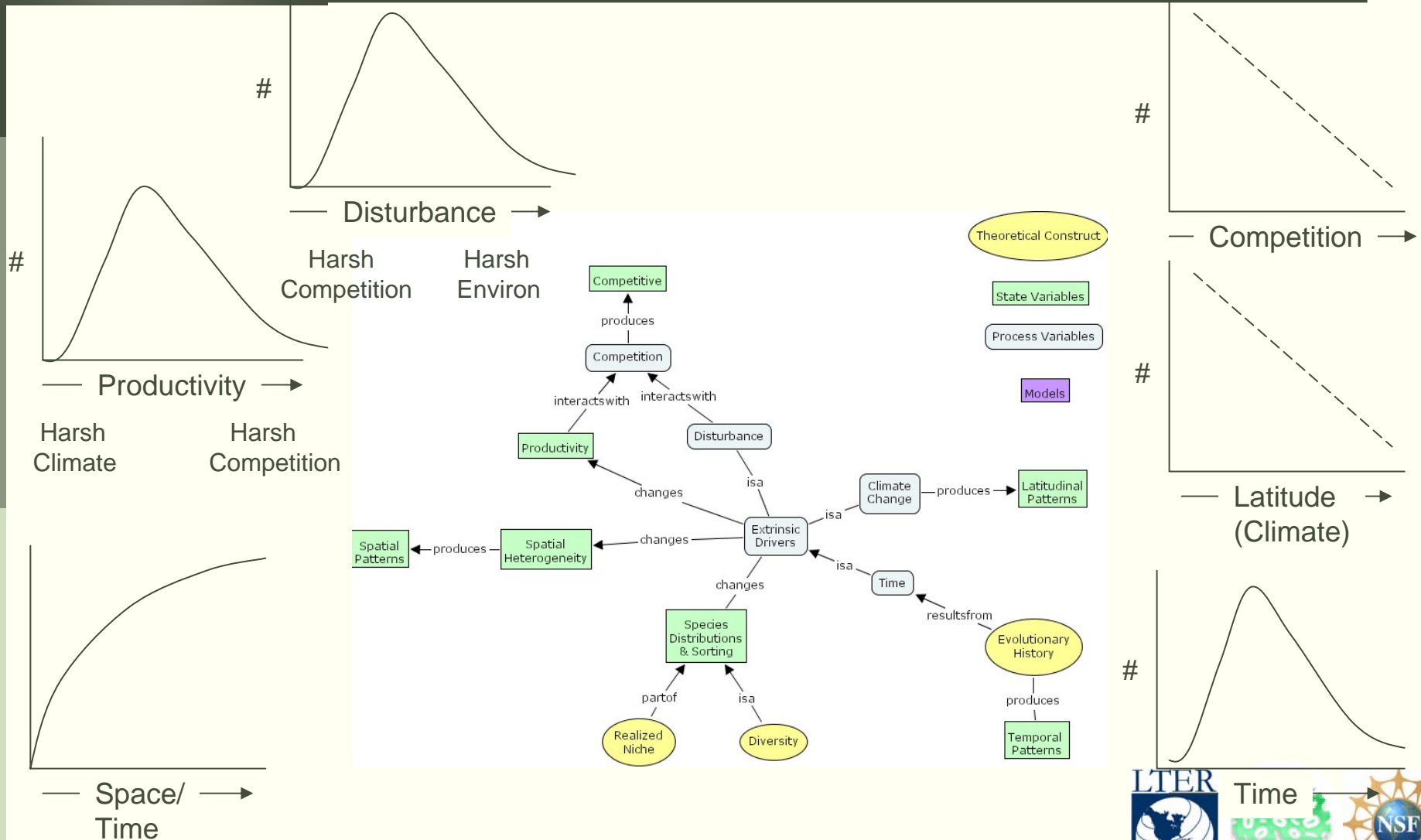
Biodiversity/Productivity

- ❑ Core components of field data
- ❑ Prior NCEAS working group: experience
- ❑ Prior illustrations (proposal, presentations)
- ❑ Large, diverse community
- ❑ Links w/ENM project





Biodiversity Concepts

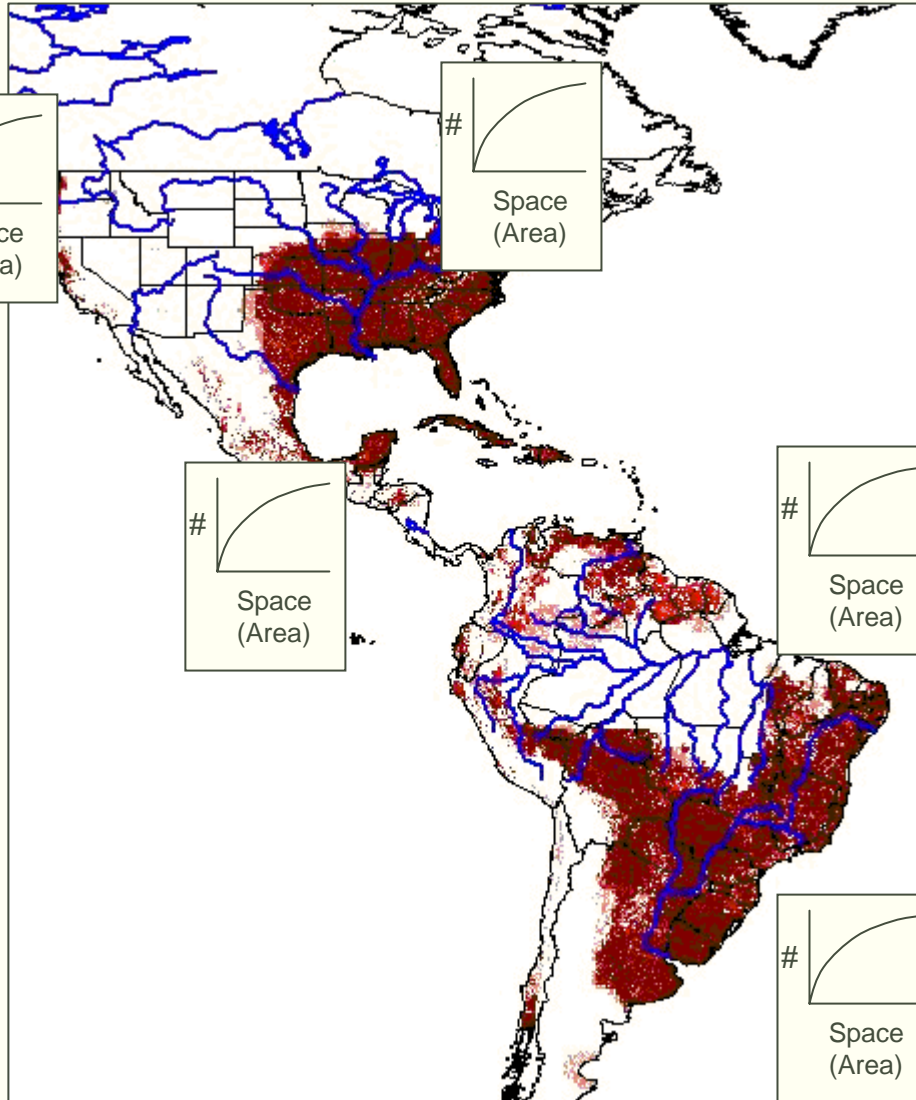


Time

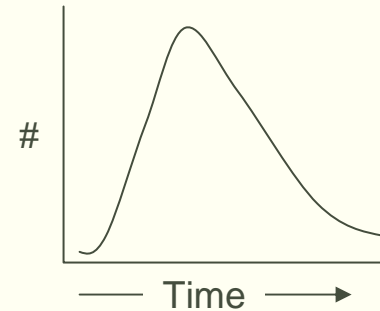




ENM Mammals Project / Biodiversity Project Link



North America:
ENM prediction \sim Field data prediction



South America
ENM prediction \gg Field data prediction



RCN: Functional and mechanistic approaches to understanding the productivity-diversity relationship

1. Quantify plant traits and relate these traits to species responses to understand the complexity of the productivity-diversity relationship
2. Analytical modeling, multivariate approaches and meta-analyses to identify patterns and clarify mechanisms underlying the productivity-diversity relationship

Site 1

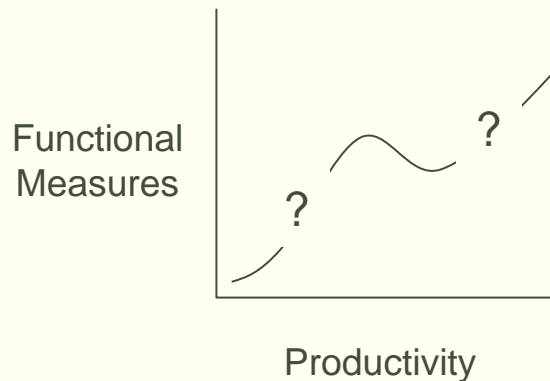
Species A
Species B
Species C

Functional
Substitutes

Site 2

Species A
Species B
Species D

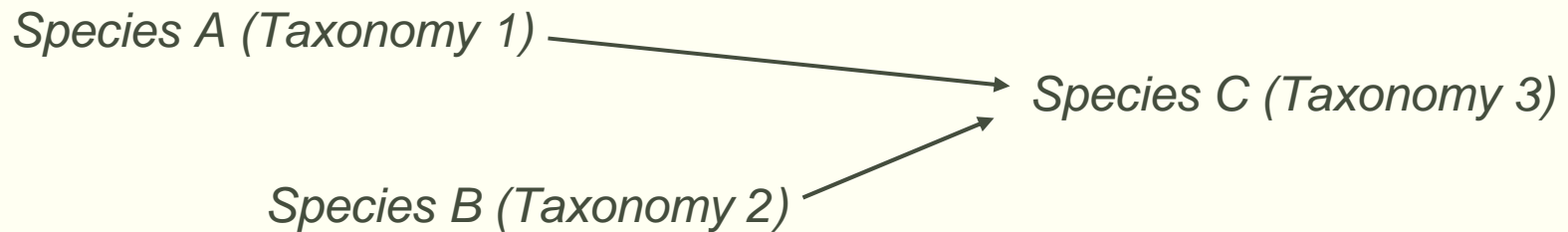
Growth form
Life history
Relative height
Clonality
Origin (native, non-)



TAXON? “functional group classification and its relationship with taxonomic diversity”

- Analysis and expansion of existing databases of species response to experimental addition of nitrogen
- Analytical modeling (Lotka-Volterra)
- Cross-site (distributed) graduate course through teleconference technology

Concept-based naming of organisms



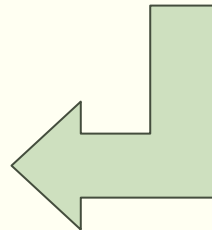
Dataset 1
Species A

Dataset 2
Species B

Dataset 3
Species C

Integrated dataset:

Old name	New name
Species A	Species C
Species B	Species C
Species C	Species C



Bats!

