



Ecology in a Connected World MES ESS : Winter 2011



1. Recap of Tuesday....
2. The Peters' Prescripton: A Network of Networks

- Why?
- What? Which networks to network?
- How? One Example...a modest proposal....

The Peters' Prescripton: A Network of Networks Why?

But first, a quick recap of Tuesday....

What did we learn?

How ecological models are laid out – by grid
Iteration typically is by time step,
sometimes with new input, e.g., ?

how does grid size matter?

Were dominique's MC1 cells connected?
why or why not?

The Peters' Prescripton: A Network of Networks Why?

But first, a quick recap of Tuesday....

What did we learn?

1. Climate Model vs. Climate Impact Model
2. Models are built of sub-models
3. Why models aggregate
4. Where uncertainty comes from
5. Why grids in models might not "talk to each other"
6. Parameters vs. inputs
7. Recall
 - Hanson: on current cc model limitations
 - R&F: on need for better "modeling framework"



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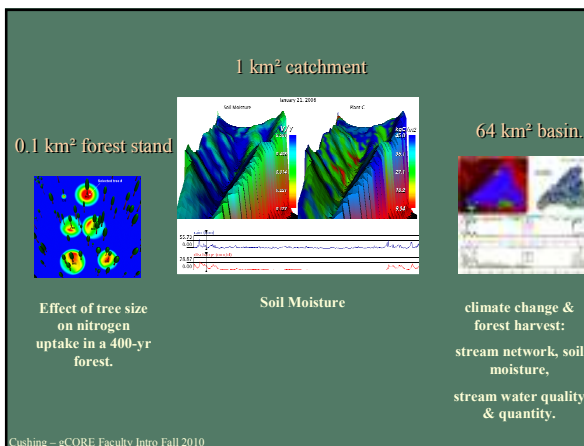


The Peters' Prescripton: A Network of Networks

1. Why?
2. What?
Which networks to network?
3. How?
One Example...a modest proposal....

The Peters' Prescripton: A Network of Networks Why?

Most ecology (modeling & samples) is confined to one spatial scale:
Plot, Stand, Hillslope, Catchment, Landscape, Basin, Region



Stand Level: Thousand Year Chronosequence (Ikes)



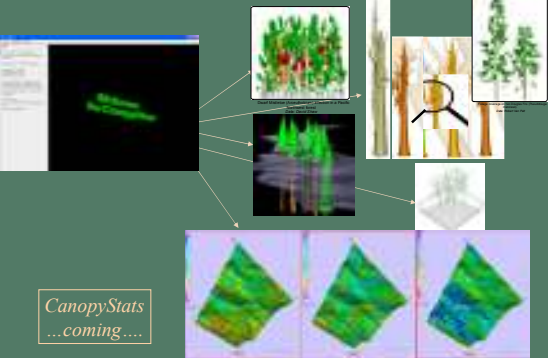


Image due to Bob Van Pelt



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CanopyView



CanopyStats
...coming....

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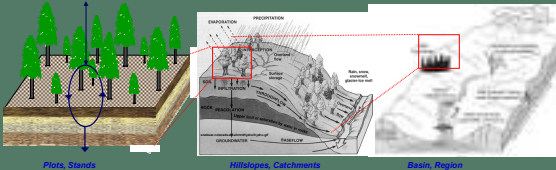
The Peters' Prescripton: A Network of Networks
Why?

Most ecology research is confined to one spatial scale:
Plot, Stand, Hillslope, Catchment, Landscape, Basin, Region

But, non-adjacent locations are connected!
For example?

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VISTAS
VISualization of Terrestrial-Aquatic Systems



Eco-hydrologic modeling:
Integrate & Scale Up Data from Plots to Region, from Days to Centuries

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The Peters' Prescripton: A Network of Networks
Why?

Most ecology research is confined to one spatial scale:
Plot, Stand, Hillslope, Catchment, Landscape, Basin, Region

But, non-adjacent locations are connected!
For example?

So:
How can we
Identify connections?
account for fluxes and flows of materials?

And determine consequences of connectivity,
at the global, and continental, regional & local scales?

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The Peters' Prescripton: A Network of Networks
What? Which networks to network?

Peters et al :

- LTET : Long Term Ecological Research Sites
- NEON : National Ecological Observatory Network
- EcoTrends

Hanson :

Dominique :
NCAR, IPCC, etc.

Why is connecting these a problem?

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The Peters' Prescription: A Network of Networks Why?

regions consist of spatial scales or geographic areas where

linear extrapolation is appropriate
OR

nonlinear relations between responses, environmental drivers, & the physical template determine dynamics across scales

Drivers: climate, landuse

Responses: plant production, species richness

Physical Template: soils, topography

How do we know which – linearity OR nonlinear dynamics?

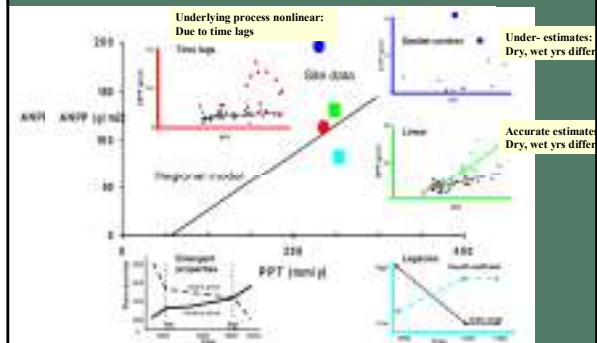
The Peters' Prescription: A Network of Networks Why?

Commonly used scaling approaches
For extrapolating from sites to regions
Often ignore spatial heterogeneity across a region.
So, aggregation errors result....

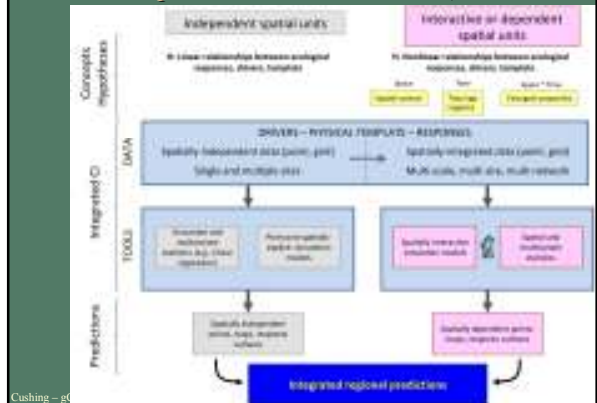
Alternatively, sites are considered independent....

Neither will work....

Example: Estimating ANPP from PPT



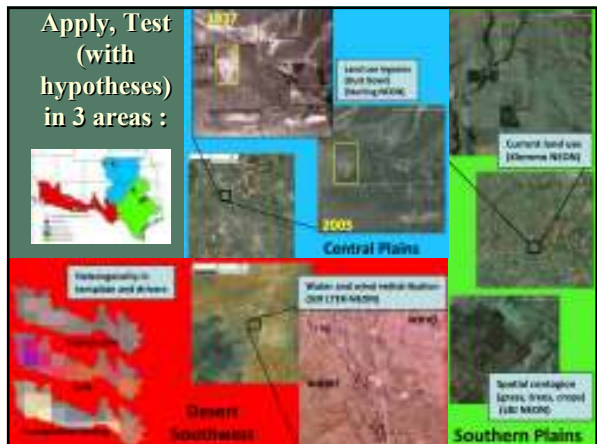
Linear extrapolation OK for some areas; not others!




The Peters' Prescription: A Network of Networks What?



1. Develop a research strategy (theory & analysis) For regional understanding & prediction blending linear & nonlinear extrapolation
2. Apply & Test (with hypotheses) in three areas: Desert Southwest, Southern Plains, Central Plains
3. Provide access to data, results, and models, with a cyberinfrastructure (CI) for accessing and translating information across scales

Apply, Test (with hypotheses) in 3 areas :





Desert Southwest

Hypothesis:
Heterogeneity in soils, vegetation, topography, and climate interact in nonlinear, but predictable, ways to generate spatial variation in ANPP

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Desert Southwest Hypothesis

Heterogeneity in soils, vegetation, topography, and climate interact in nonlinear, but predictable, ways to generate spatial variation in ANPP

How this will be approached, by whom, prior work



Ecotone, DAYCENT models

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Southern Plains

Hypothesis:
Current landuse patterns in the area surrounding a sample location influence spatial contagion processes by water that interact nonlinearly with soil to generate Spatial variation in ANPP

Southern Plains


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Southern Plains Hypothesis

Current landuse patterns in the area surrounding a sample location influence spatial contagion processes by water that interact nonlinearly with soil to generate Spatial variation in ANPP



How this will be approached, by whom, prior work

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Central Plains

Hypothesis:
Historic landuse patterns of a sample location result in legacy effects that influence seed dispersal & interact with soil & climate to generate spatial variation in ANPP

Central Plains

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Central Plains Hypothesis

Historic landuse patterns of a sample location result in legacy effects That influence seed dispersal & interact with soil & climate to generate spatial variation in ANPP

How this will be approached, by whom, prior work

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Hypotheses Summary

Response Variable: spatial variation in ANPP

Driver/Response Variable Interaction – nonlinear, but predictable!

Area	Drivers	Methods
Desert Southwest	Heterogeneity in soils, vegetation, topography, & climate	
Southern Plains	Current landuse patterns ... influence spatial contagion processes by water	
Central Plains	Historic landuse patterns ... result in legacy effects that influence seed dispersal & interact with soil & climate	

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How? Proposed Strategy

1. Determine where linear extrapolation works
2. Use spatial approaches (data, stats, simulation) elsewhere
3. Integrate linear & nonlinear analyses to predict macrosystem dynamics at regional scale.

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How? Proposed Computational Framework

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Computational Framework

How this will be approached, by whom,
prior work

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Peters' Prescription: Project Summary (4 years)

What	Who	Where	What	\$\$\$
Desert Southwest	Peters, Bestelmeyer, Dunaway, Monger, Rango 3 Postdocs 2 grad students	NMSU (Jornada LTER)		1,692,000
Southern Plains	Vivoni, grad student, postdoc Cook, undergrad, grad students	Arizona State Univ Midwestern State	tRIBS	634,486 316,000
Central Plains	Okin, postdoc McClaran? Parton Browning	UCLA Univ. AZ Colorado State Jornada		445,000
Cyber Infrastructure	Tweedie, postdocs Cushing, grad stud	UTEP Evergreen		935,000 178,000

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