REVIEW: Searching for resilience: addressing the impacts of changing disturbance regimes on forest ecosystem services

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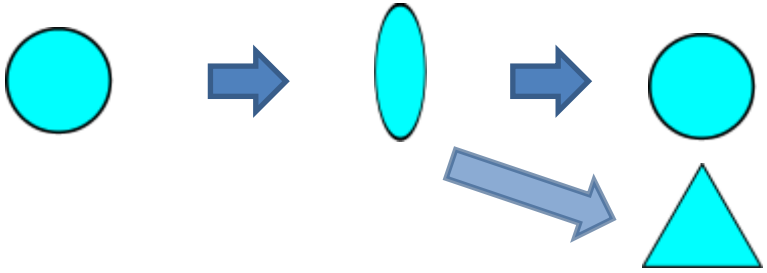
What is resilience?

- “recovery to a previous state”
  in engineering

- “remaining within the prevailing system domain through maintaining important ecosystem processes and functions or shifting to an alternative ecological domain”
  in ecology



Why resilience now?

NO IMAGE

Increasing global change

NO IMAGE

Increasing hardness
of maintaining ecosystem

Basin Model

Horizontal axis is a property that shows a state of system

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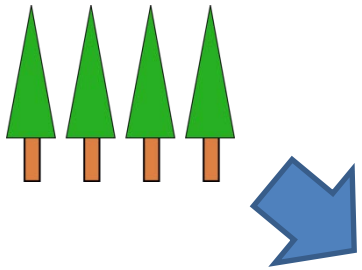


Explains basin and ball model showing resilience

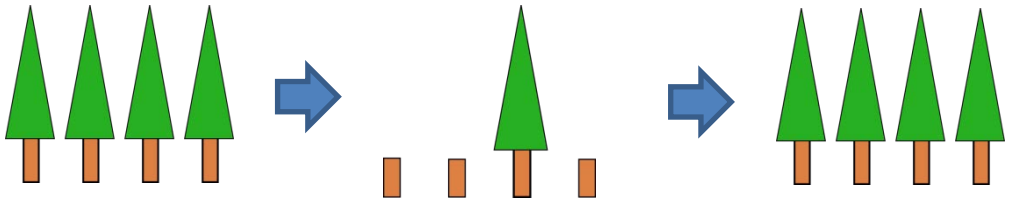
desert

forest

http://www.ecologyandsociety.org/vol17/iss4/art48/figure2.jpg

What we **REALLY** want to know

- The number of tree we can cut
  on condition that forest can recover itself



- The intensity of a certain environment
  that bring a catastrophic change to forest

Need Quantification! **NO IMAGE**

Example

- Based on a research of biological legacy

  ”Seidl *et al.* (2014) Disturbance legacies increase the resilience of forest ecosystem structure, composition, and functioning”

- Simulate forest state in the future

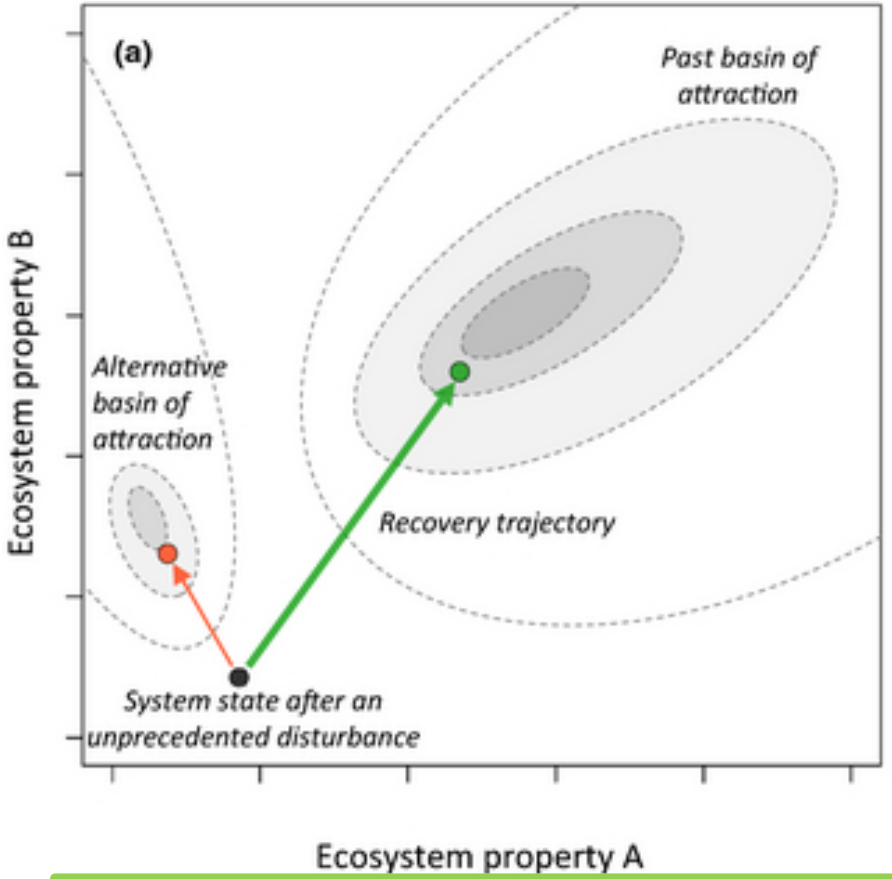
- Describe the boundary of the basin

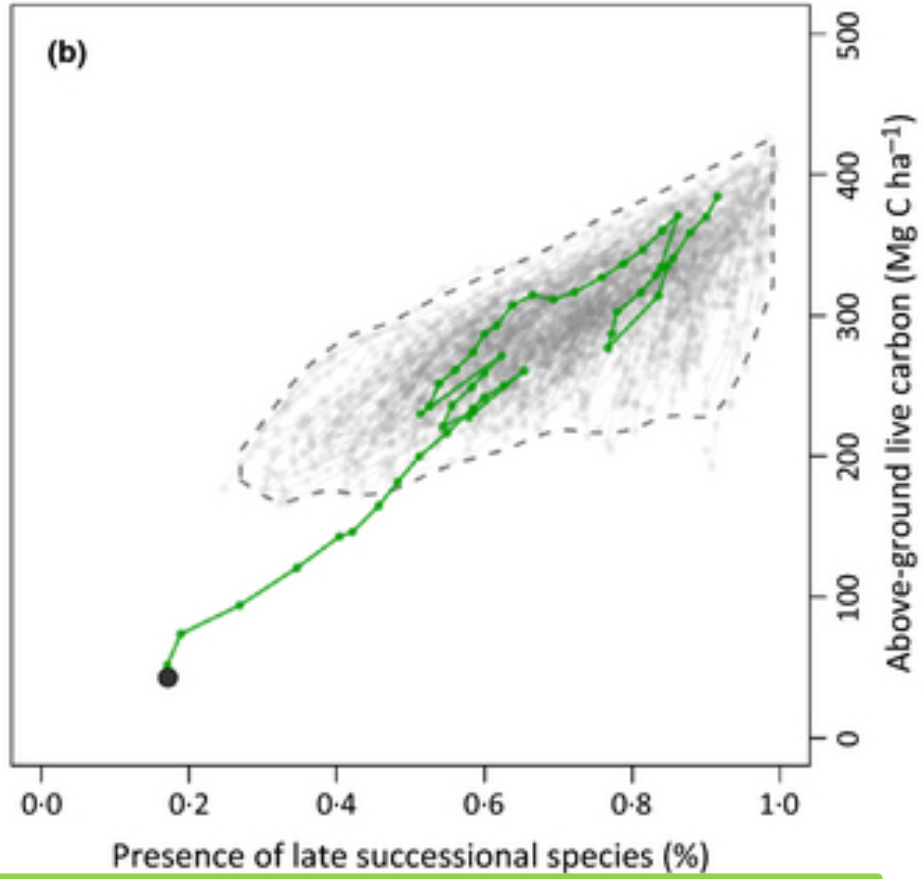
Material & Method

Site : experimental forest in western Oregon, USA
(had a big wildfire in the 1500s)

Properties to indicate forest state:
① % of late-seral species >4 m in height
② total ecosystem Carbon storage

Suppose a mega wildfire happens
and simulate 30,000 years in 10-year steps





Left : Conceptual resilience model with two ecosystem properties
Right : Result of simulation
Black circle → forest state just after wildfire
Green line → first 500 years trajectory forest state will follow
gray dots → all simulated forest state points

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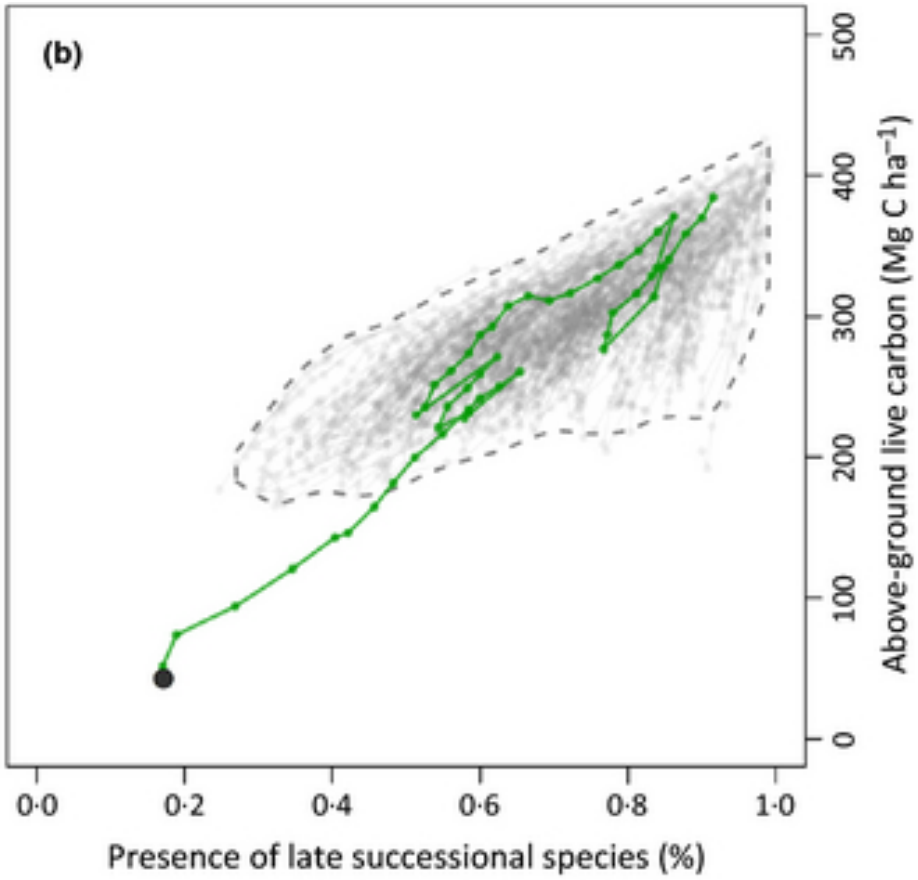

Forest state converges the area surrounded by dashed line

→ basin

In this simulation,
The distribution(wildfire) does not push forest to alternative stable state

→ resilience in engineering

Problems in quantification

- What property should be used to show system state

  → forest have lots of properties
  but we can get limited information

- Few examples to build a good model

  → ecosystem changes in very long temporal scale

Thank you for listening!