Management of Tropical Forest Landscapes

- We are interested here in landscapes that have substantial forest cover but a mixture of land uses

- Although Forest Stands have typically been the focus of study, landscapes are increasingly becoming the scale of management

  - to derive all values from Forest Ecosystems, Stand integrity and diversity should be maintained across the landscape. (Include *reserves, plantations, community forests, agro-forestry systems*,…)

  - human/individual decisions regarding one unit typically influence other units

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Landscape management approach:

- The range of forest structures need to be maintained through time

- Creating and maintaining Stand structures within a landscape could ensure the diversity of forest values (*habitats, wood products, non-timber products, water, soil,…*)

- Stand structure: species diversity, and spatial arrangements of trees, stems, branches, and leaves within a stand

  - Autogenic factors: *growth, mortality, and recruitment* (*seed dispersal, shade tolerance, maximum growth rate*)
  - Allogenic factors: *climate change, disturbance, pest attack*,…

Management of Tropical Forest Landscapes

Managing Stand structures:

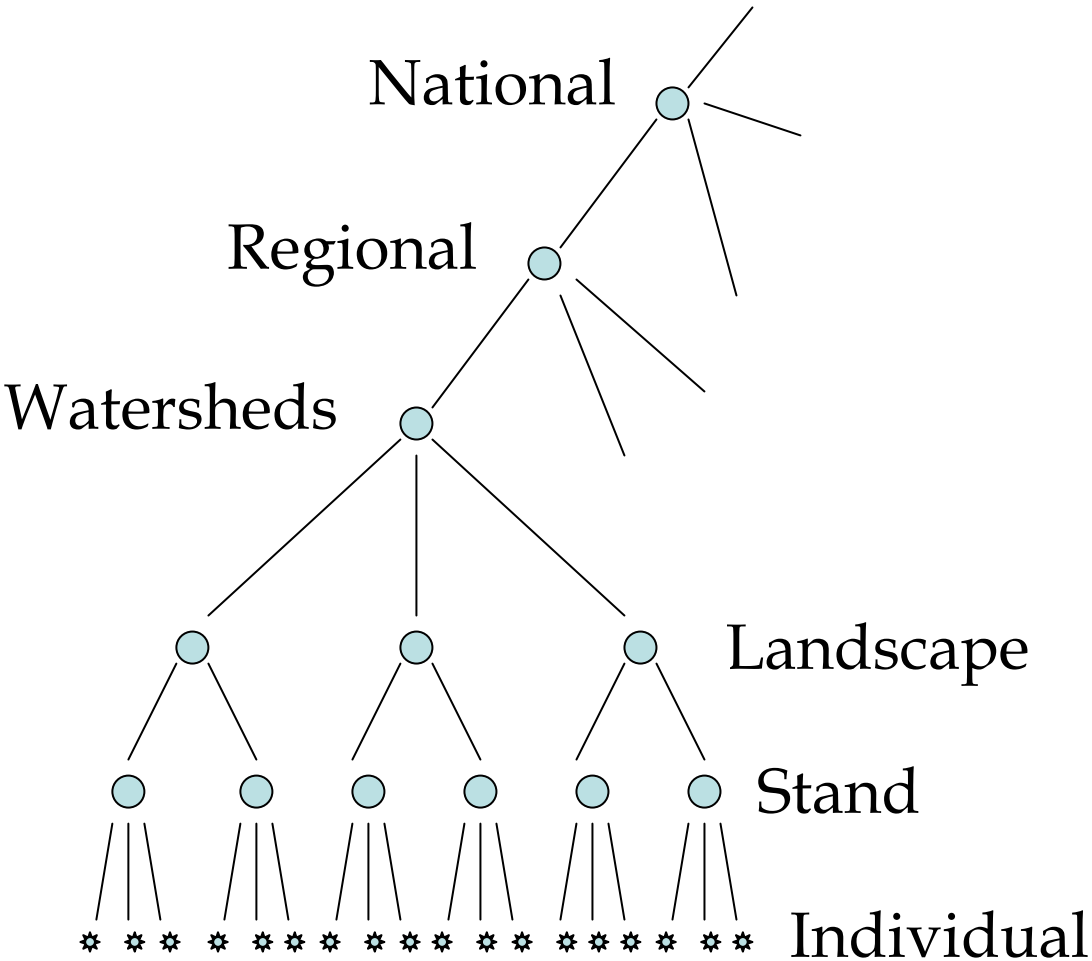
- Avoiding or Recovering from disturbance
  - assessing susceptibility, preventive management, aiding/accelerating recovery

- Practices to derive specific goods and services

  - harvesting, pruning, site preparation, prescribed burning, and planting

Management of Tropical Forest Landscapes

Scales of management within the landscape approach:



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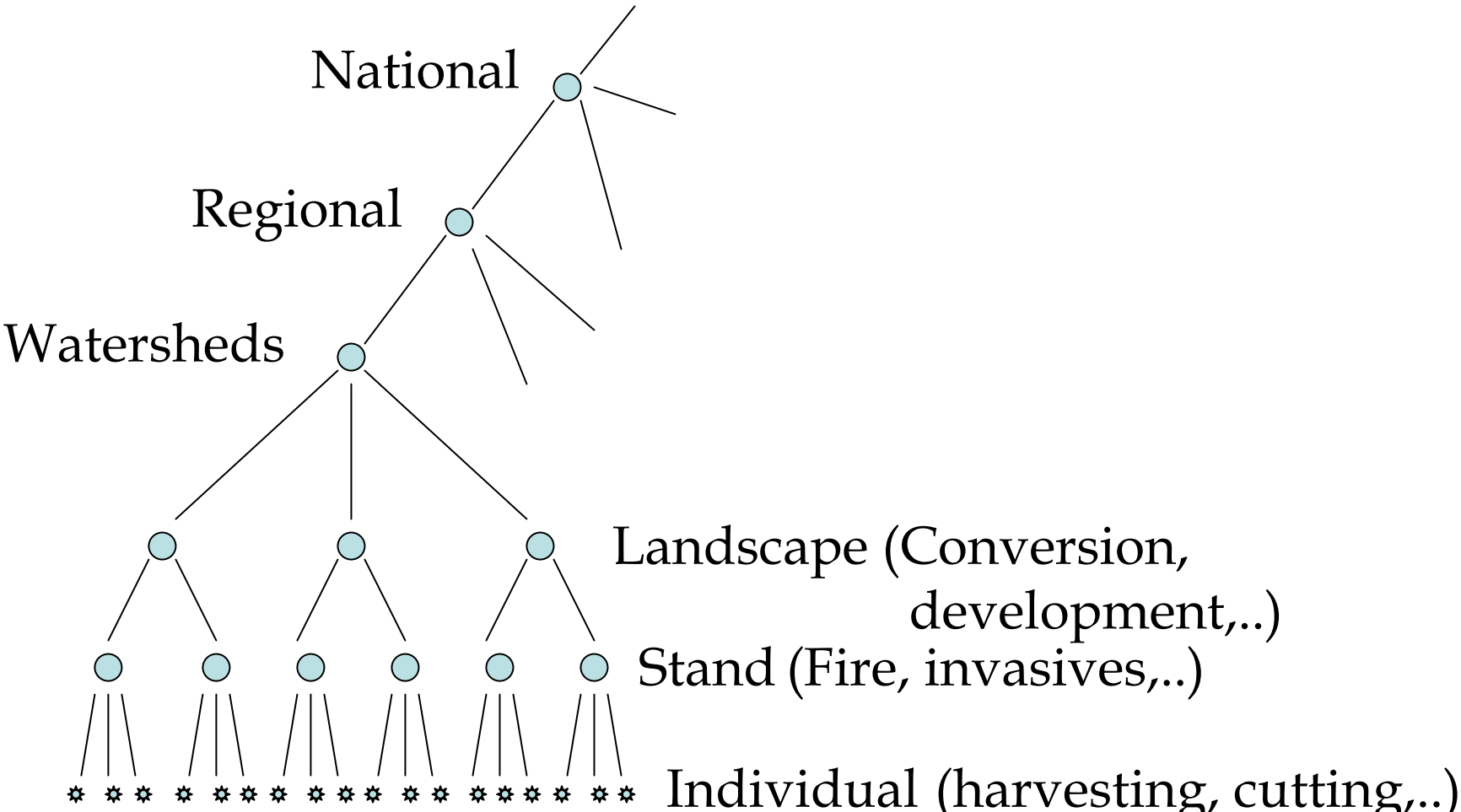


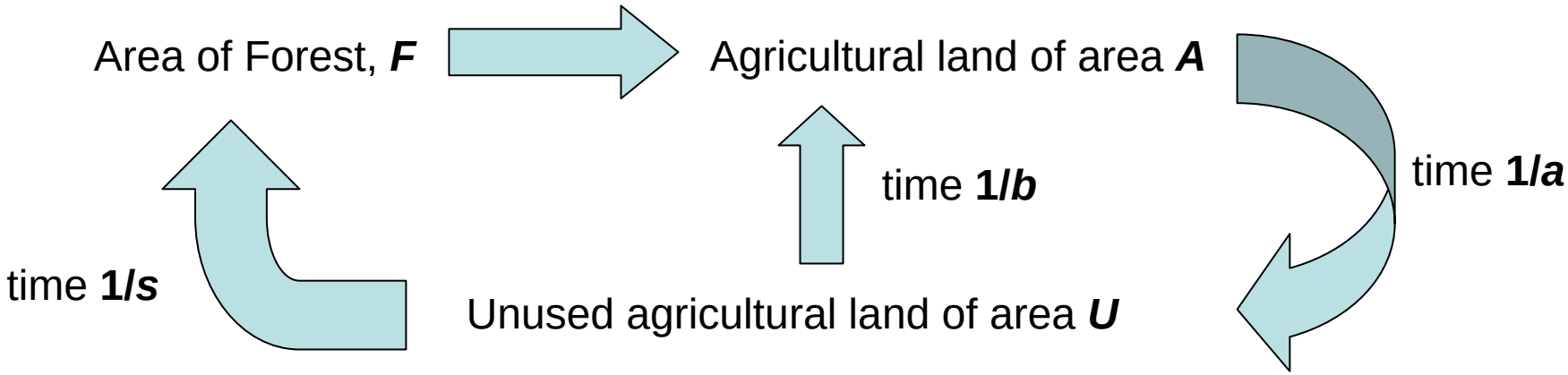
Forest Degradation and Loss

Three main responses:

- Expand the network of areas under protection, and employ various systems of Governance
- Improve agricultural productivity on abandoned lands to improve livelihoods of communities living in these areas
- Some form of reforestation

Analytical frameworks for studying land-use dynamics

Dobson et al. Science 1997.



Rates of habitat conversion a simple function of human population (***P***) ~ ***f*(*P*)**

Human population growth modeled as a simple logistic function with carrying capacity given by the minimum amount of land required to support a single individual ***h***

Loss of biodiversity can be modeled, say, by a simple power-law species-area relationship $S = cA^z$

Analytical Frameworks for studying land use dynamics

Dobson et al. Science 1997.

Coupled differential equations:

$$\frac{dF}{dt} = sU - dPF$$

$$\frac{dA}{dt} = dPF + bU - aA$$

$$\frac{dU}{dt} = aA - (b + s)U$$

$$\frac{dP}{dt} = rP\frac{A - hP}{A}$$

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What is needed is a coupling of socioeconomic and ecological processes underlying landscape change

Analytical Frameworks for studying land use dynamics

1. Empirical-statistical models: generalized linear models
   (e.g., Mertens and Lambin 1997, Müller and Zeller 2002)

2. Stochastic models: e.g., Markov chains governed by simple transition probabilities
   (e.g., Baker 1989, Thornton and Jones 1998, Cuarón 2000, Satake and Iwasa 2006)

3. Optimization models
   (e.g., von Thünen 1966)

4. Dynamic simulation models: simulate biophysical and socioeconomic processes
   (e.g., Boserup 1981)