

Yale SCHOOL OF THE ENVIRONMENT  
*The Forest School*

# Mature Forest Habitat: Benefits and Enhancement

Laura Green | Research & Extension Forester – Yale Forests

RIFCO Woodland Owner Workshop

February 21, 2026

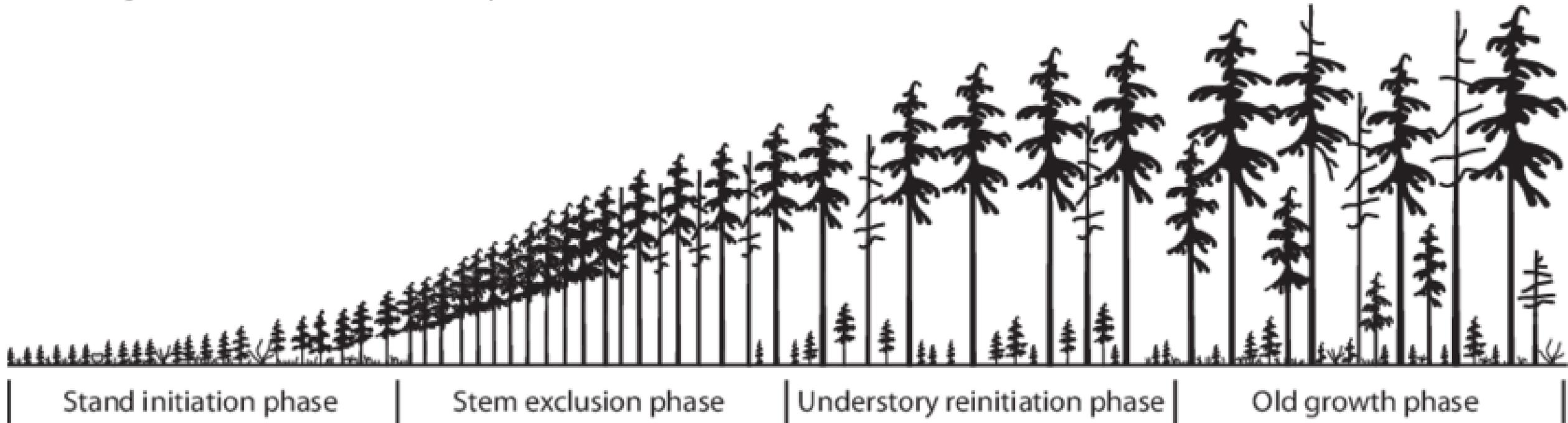
# Agenda

- How forests develop (or: Forest stand dynamics in 5min or less!)
- What is “mature”?
- Mature forests & wildlife
- Focal species
- Enhancing & sustaining mature forests

# How Forests Develop



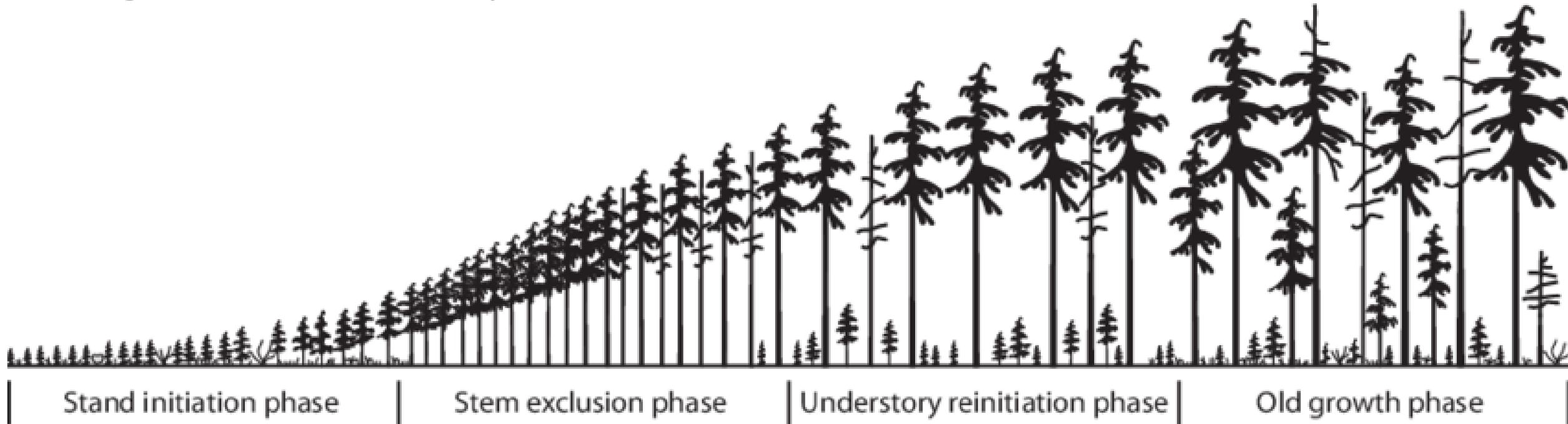
# Stages of forest development



*J.P. Kimmins*

- New cohort of trees begins to grow

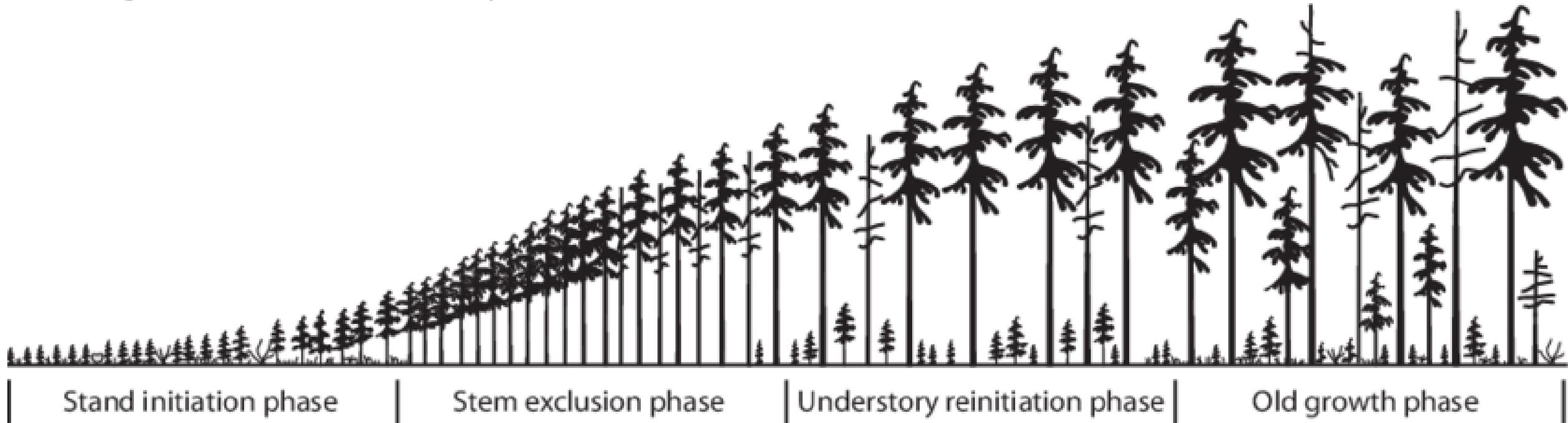
# Stages of forest development



*J.P. Kimmins*

- Young trees compete with each other for resources (light & water)
- Weaker trees die
- Stronger trees get bigger

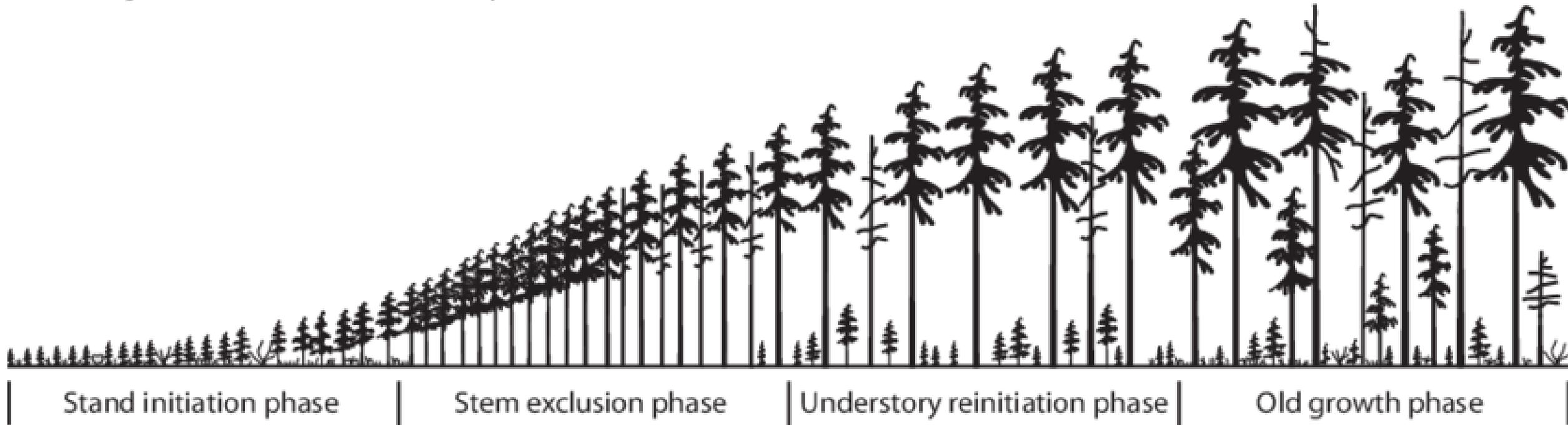
# Stages of forest development



*J.P. Kimmins*

- As more canopy trees die, new baby trees begin to grow underneath
- Multi-aged forest

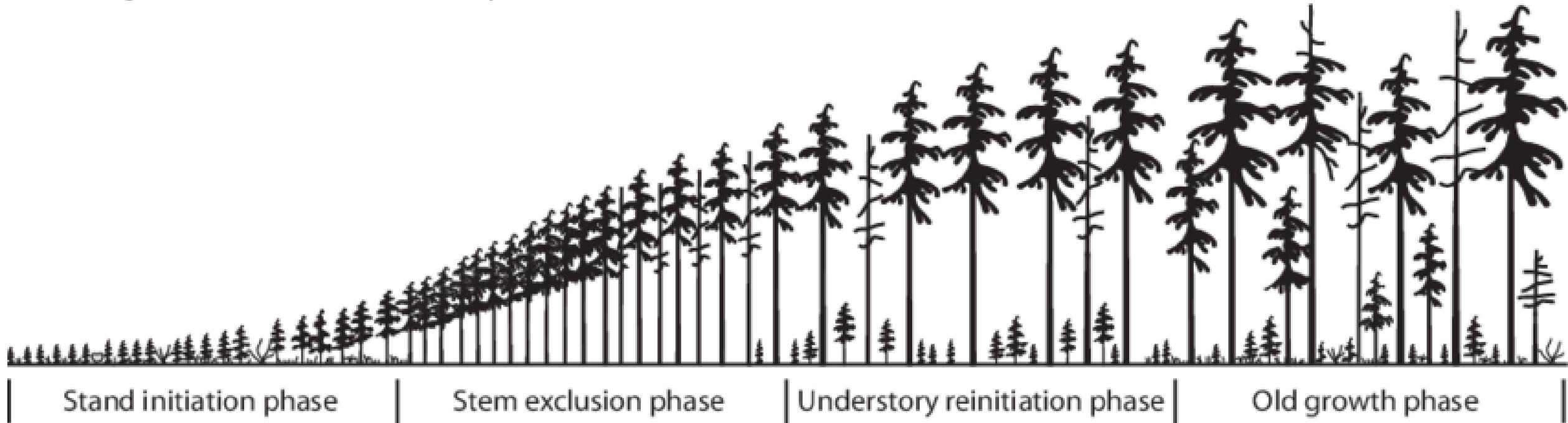
# Stages of forest development



*J.P. Kimmins*

- New cohort of trees reaches the canopy
- Most or all of original cohort is dead
- Multi-aged forest

# Stages of forest development

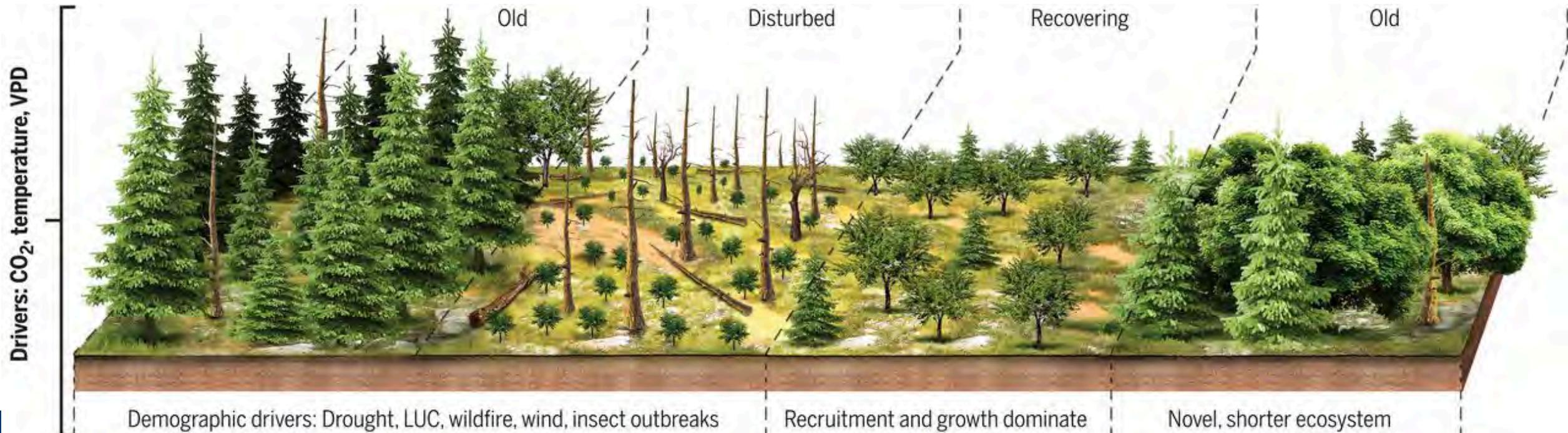
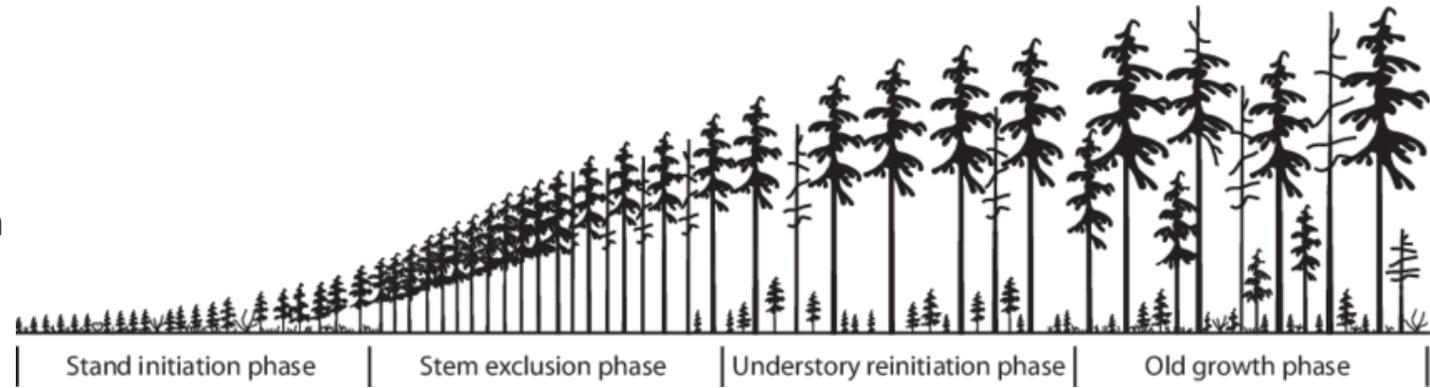


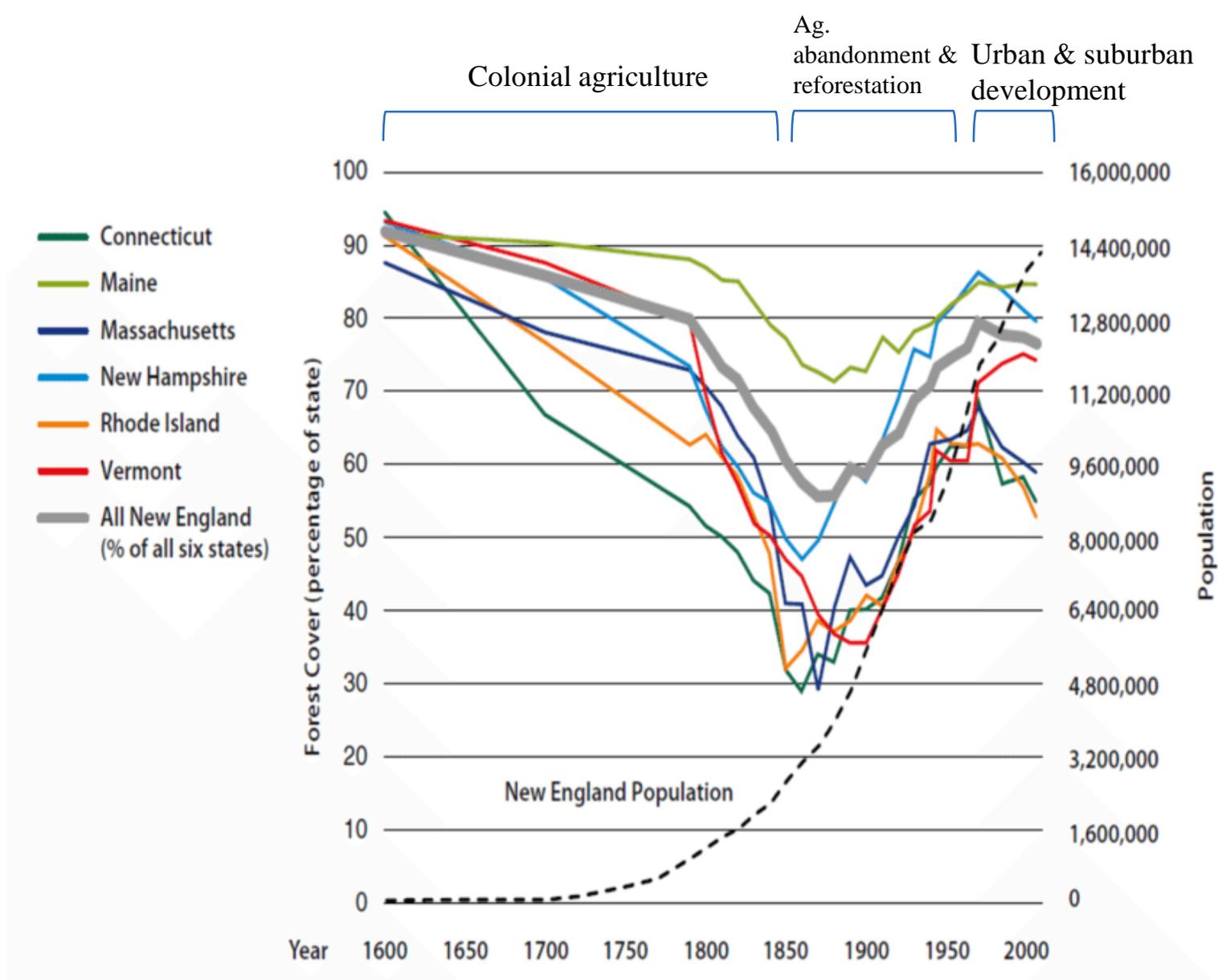
*J.P. Kimmins*

“All models lie”  
So, what’s missing?

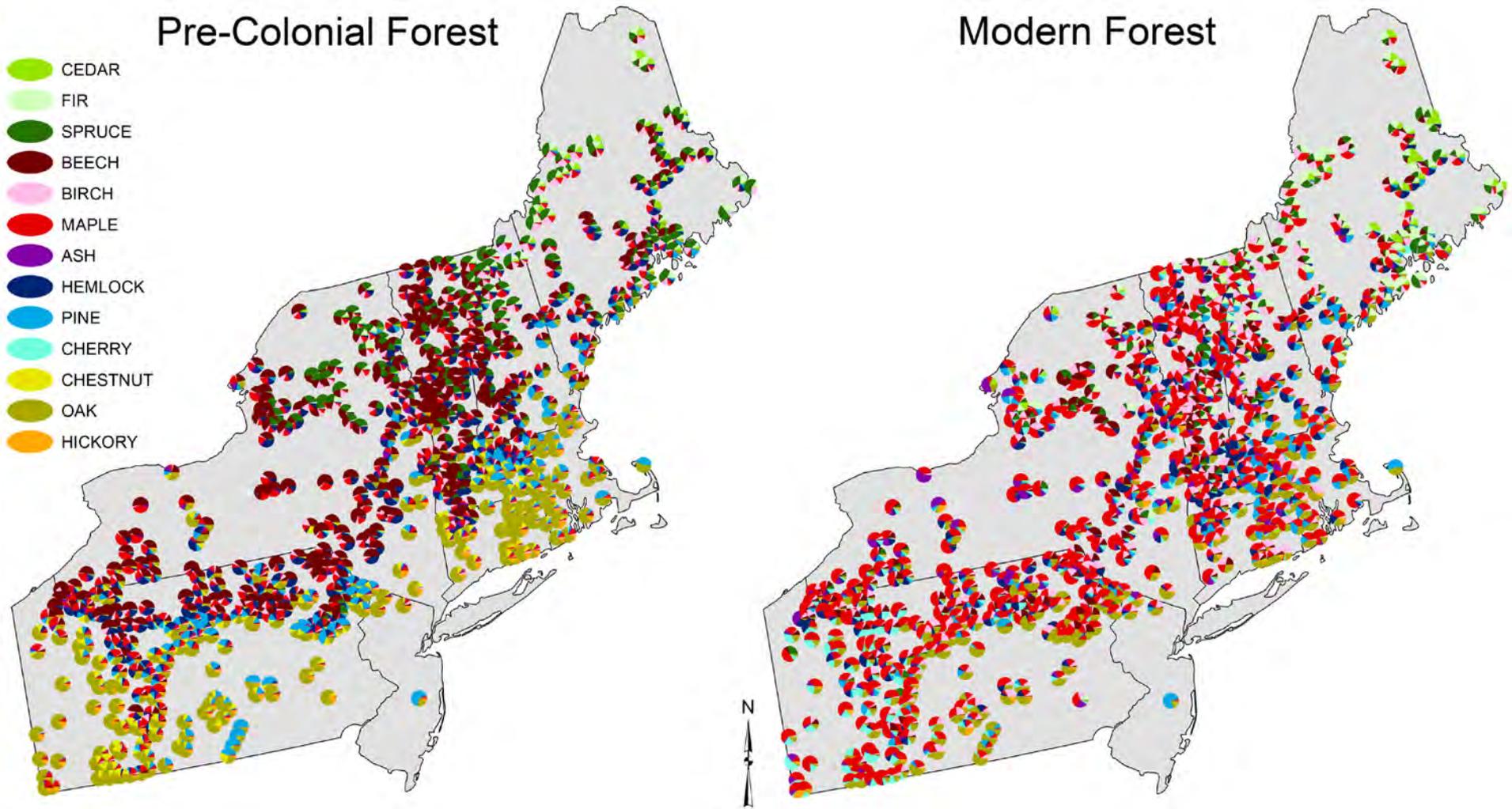
# Stages of forest development

- So, what's missing?
- **Disturbance** – from natural sources & humans – often re-sets the timeline
- What grows back may be different



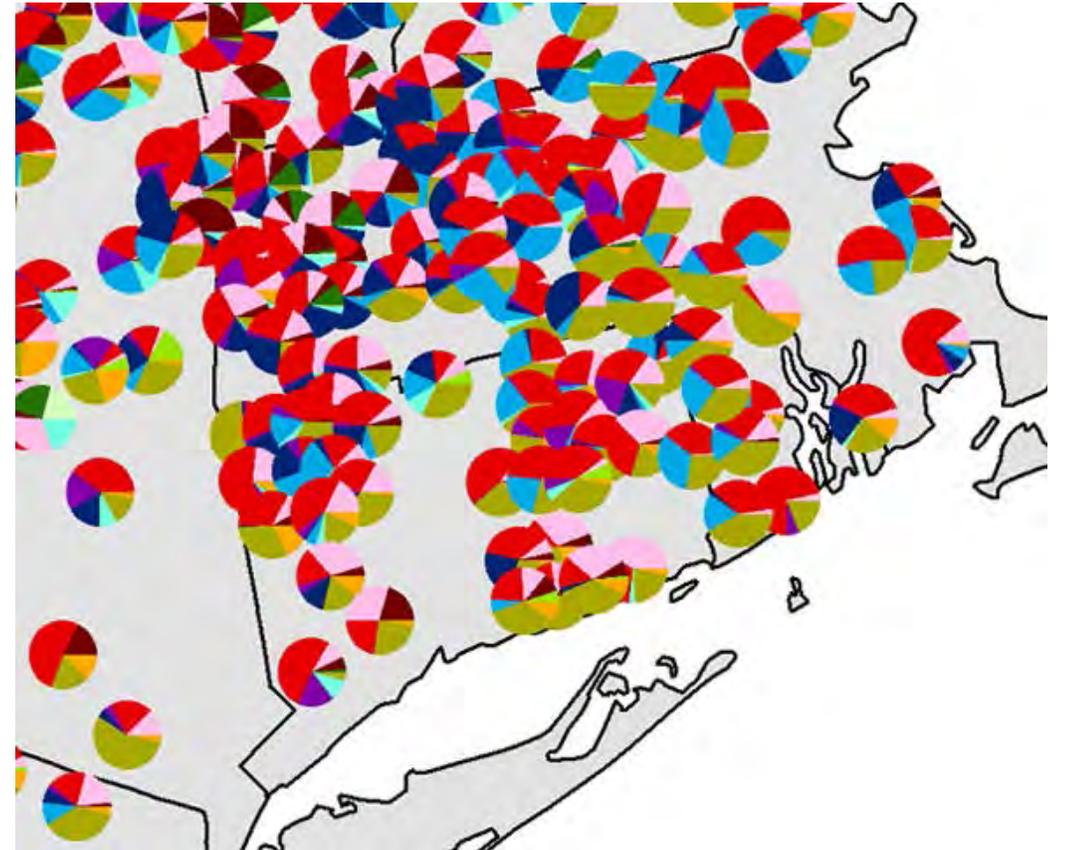


Source: Foster D. R., et al. 2010. *Wildlands and Woodlands: A Vision for New England Landscape*. Harvard Forest, Harvard University.



Source: Thompson JR, Carpenter DN, Cogbill CV, Foster DR (2013) Four Centuries of Change in Northeastern United States Forests. PLOS ONE 8(9): e72540. <https://doi.org/10.1371/journal.pone.0072540>

# Forest Present



Source: Thompson JR, Carpenter DN, Cogbill CV, Foster DR (2013) Four Centuries of Change in Northeastern United States Forests. PLOS ONE 8(9): e72540. <https://doi.org/10.1371/journal.pone.0072540>

What is “mature”?



# What is a mature forest?

- Depends on where you are & who you ask!

# What is a mature forest?

- Depends on where you are & who you ask!
  - “The forest has reached it’s maximum financial value & it’s time to harvest” -Financial timber resource perspective

# What is a mature forest?

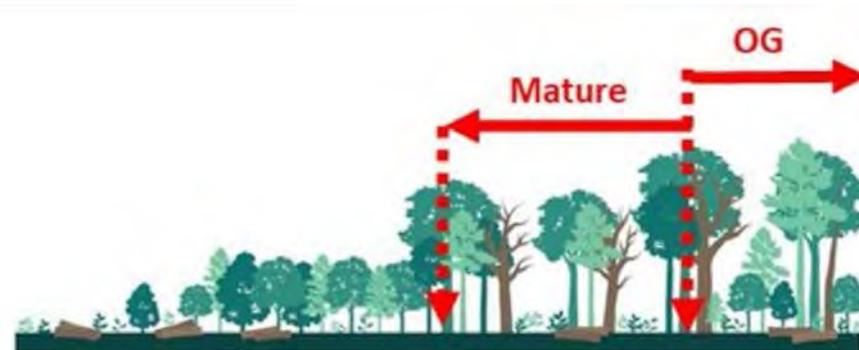
- Depends on where you are & who you ask!
  - “The forest has reached it’s maximum financial value & it’s time to harvest” - Financial timber resource perspective
  - “The forest is old and has lots of big trees” – Common public perception

# What is a mature forest?

- Depends on where you are & who you ask!
  - “The forest has reached it’s maximum financial value & it’s time to harvest” - Financial timber resource perspective
  - “The forest is old and has lots of big trees” – Common public perception
  - “Looks like a good place for me to live” – A wood thrush

# What is a mature forest?

- Depends on where you are & who you ask!
  - “The forest has reached it’s maximum financial value & it’s time to harvest” - Financial timber resource perspective
  - “The forest is old and has lots of big trees” – Common public perception
  - “Looks like a good place for me to live” – A wood thrush
  - “Mature forests are delineated ecologically as the stage of forest development immediately before old growth. Mature forests exhibit **structural characteristics** that are lacking in earlier stages of forest development and may contain some but not all the structural attributes in old-growth forests.” – US Forest Service & BLM



Eastern Hardwoods development following land use change and/or large scale stand replacement disturbance

# What makes a mature forest?

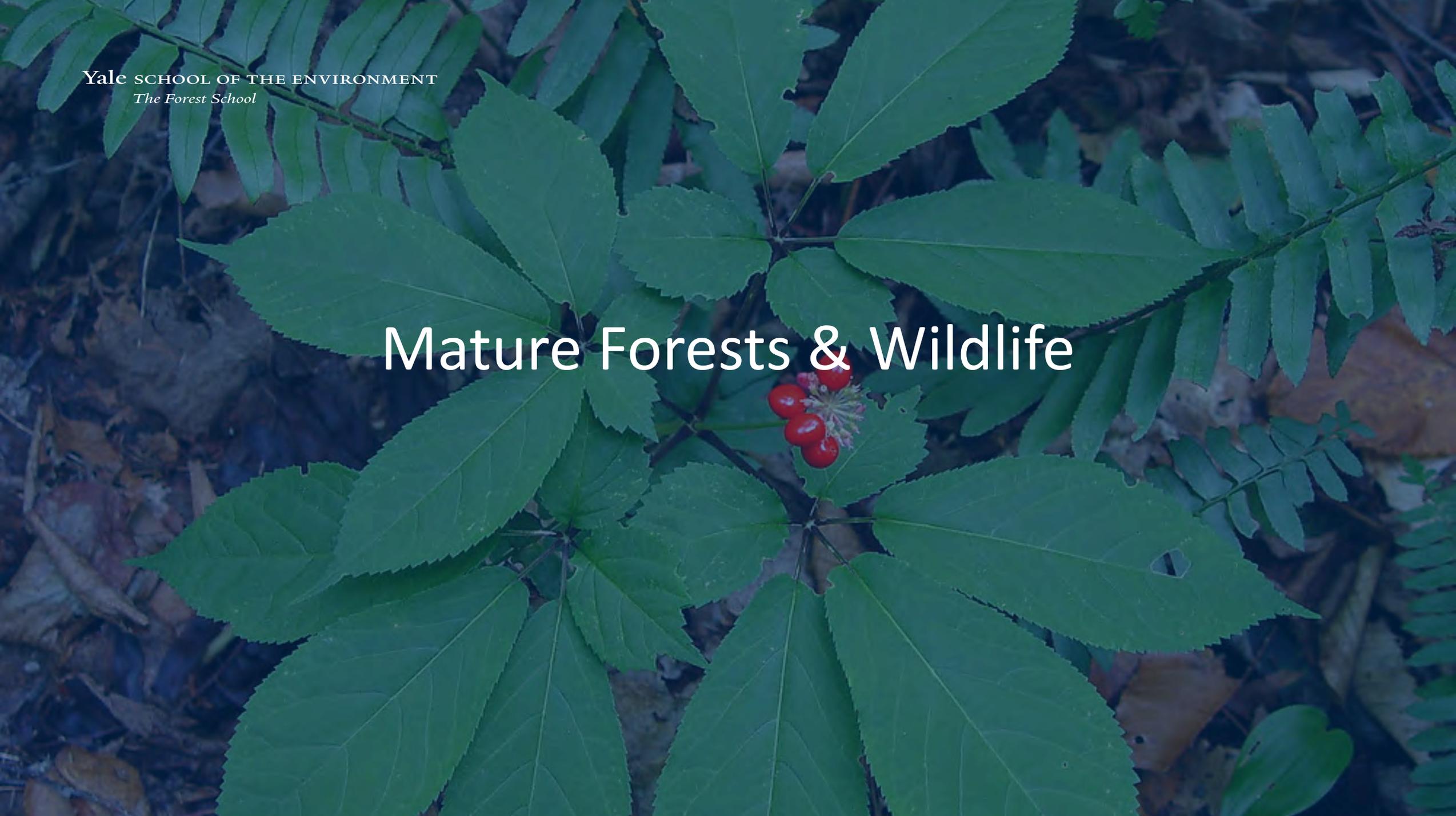
- **Large trees** (20+ in diameter at breast height),
- **Tall trees,**
- **Relatively old trees** (150+ years is a good start for our region & forest types)
- Also **young trees**
- **Wide range of stem diameters** (i.e.: both young, small-diameter trees & old, large-diameter trees)
- **Patchiness**, canopy gaps & openings of varying sizes
- Lots of **snags & downed trees at varying stages of decay**
- **Stratification or layers in the canopy** of trees & shrubs of different heights
- **Indicator species** (will also depend on forest type)



Diagram from “Restoring Old Growth-Characteristics to New England’s and New York’s Forests,” by Tony D’Amato & Paul Catanzaro

Yale SCHOOL OF THE ENVIRONMENT  
*The Forest School*

# Mature Forests & Wildlife



# Mature Forests & Wildlife

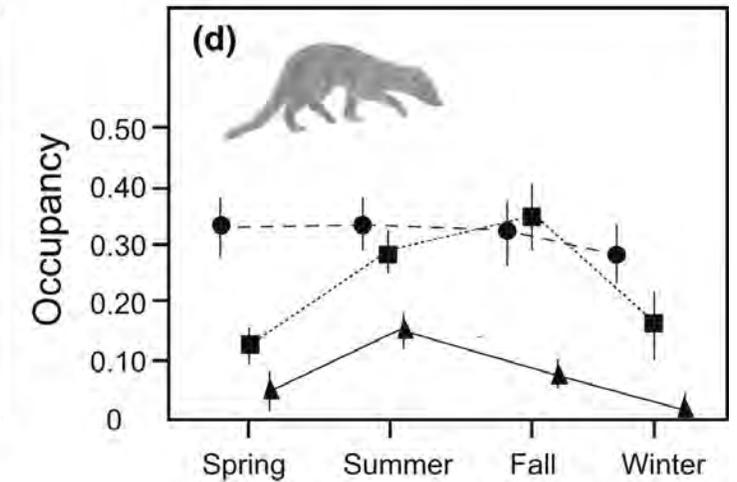
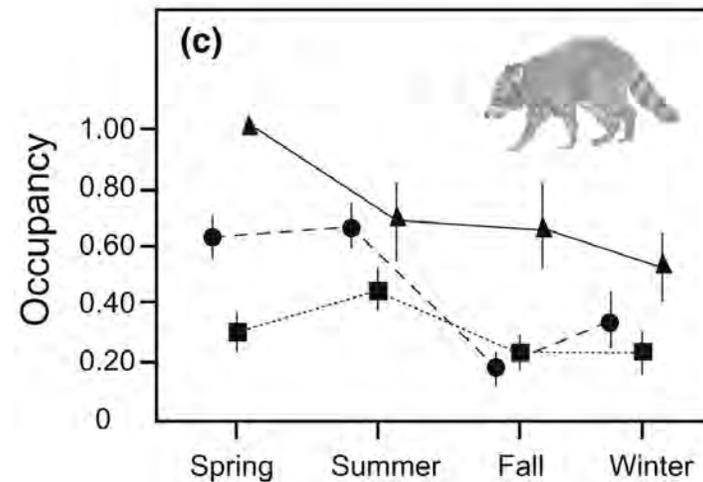
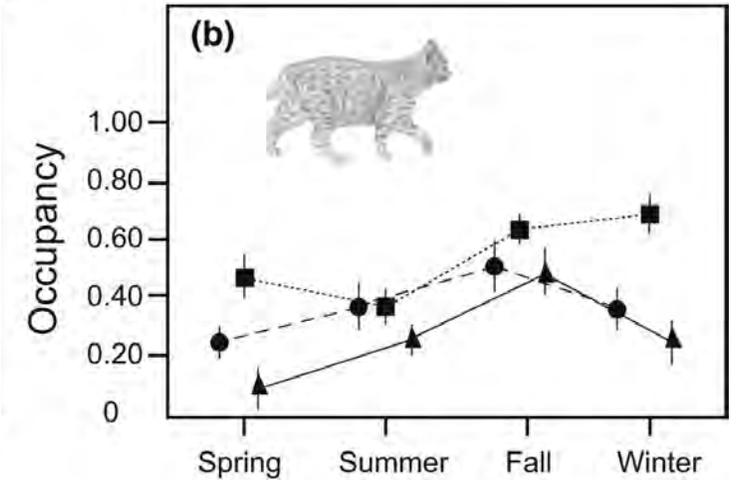
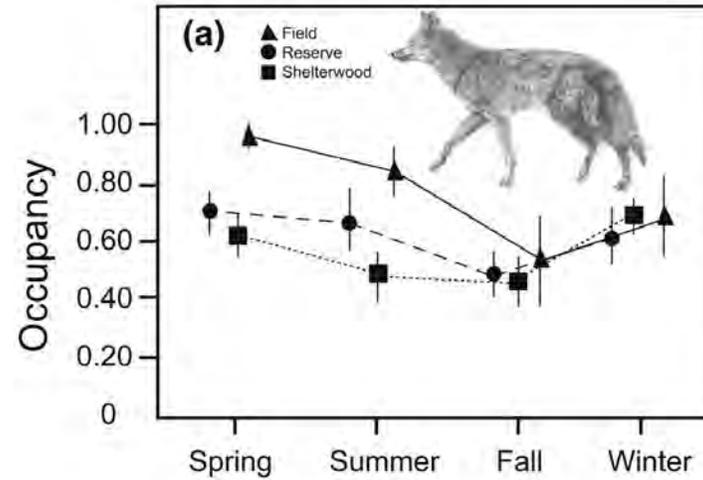
- In our region, mature forests are often synonymous with unmanaged forests
- Unfortunately, our unmanaged forests generally have **lower wildlife diversity** compared to similar managed forests
  - We have data on this for birds, bees, and mammals

# Mesocarnivores

**Fishers** had higher occupancy in reserve stands (80-120 years old),

**All other species** used younger forest stands at higher rates

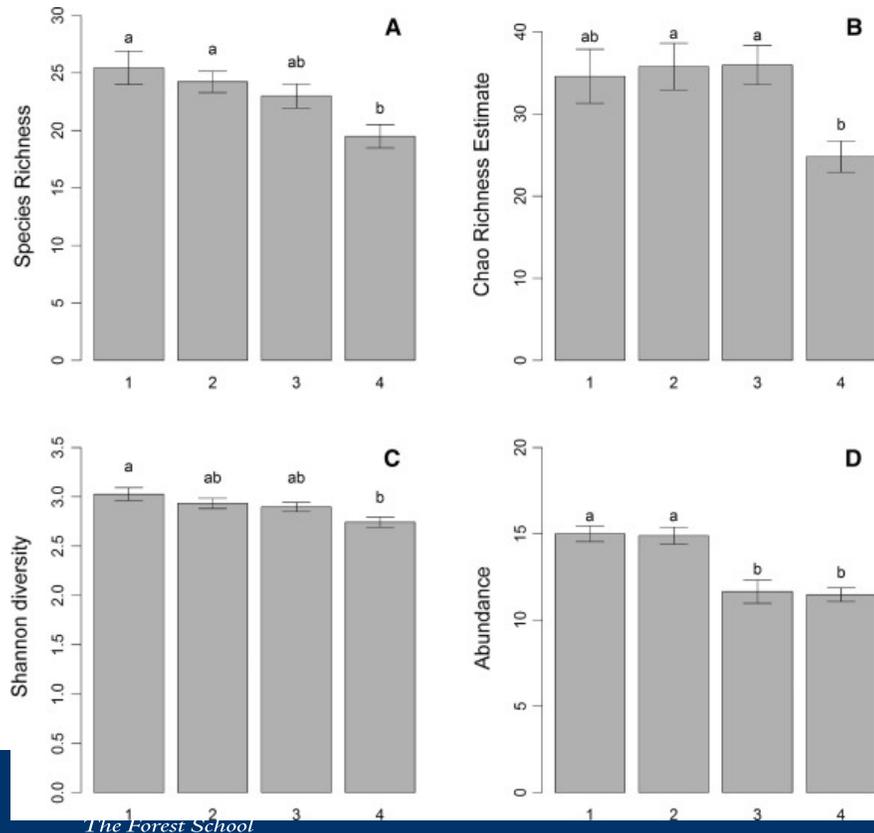
Human land-use effects on mammalian mesopredator occupancy of a northeastern Connecticut landscape



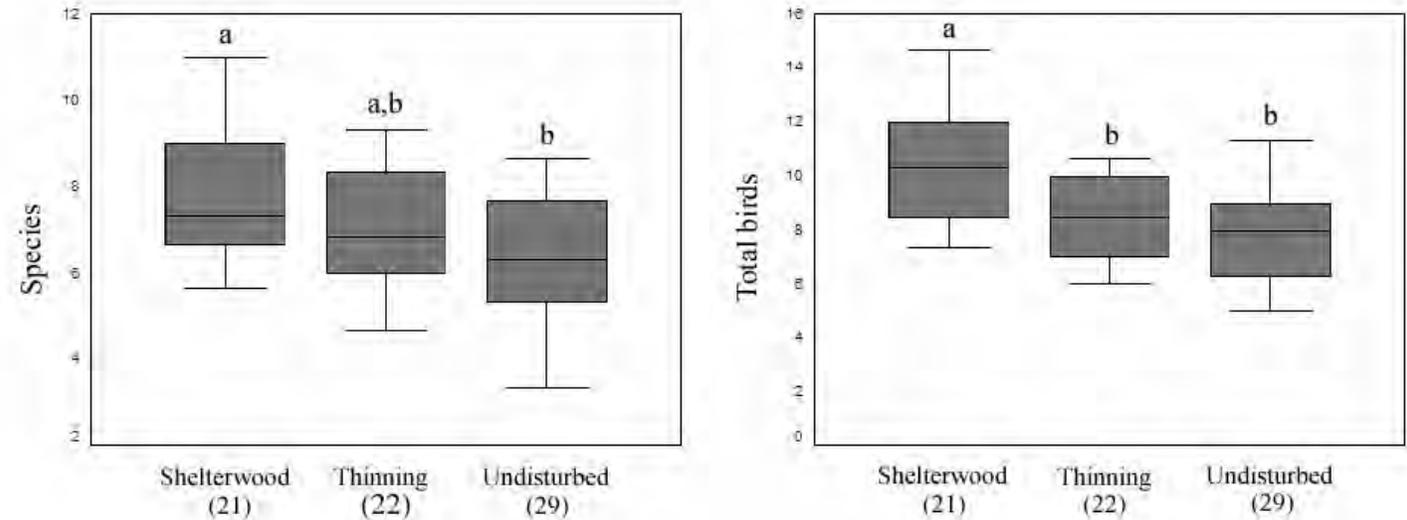
# Breeding Birds

Bird diversity and abundance are **highest** in regenerating stands (shelterwood harvests) and **lowest** in the mature stands.

Duguid et al., For.Ecol.Mgt., 2016



Goodale et al., For.Ecol.Mgt., 2009



$F_{2,69} = 4.06, P < .021$

$F_{2,69} = 9.03, P < .001$

# Mature Forests & Wildlife

- In our region, mature forests are often synonymous with unmanaged forests
- Unfortunately, our unmanaged forests generally have **lower wildlife diversity** compared to similar managed forests of different ages
  - We have data on this for **birds, bees, and mammals**
  - **Why??** These forests **lack critical resources** for many organisms
    - **Less light & lower plant species diversity** leads to:
      - Fewer floral resources for bees,
      - Lack of appropriate plant material for specialist insects (not just bees), lowering insect diversity
  - Mature forests in our region are often **more homogeneous** – lacking beneficial variation in structure used by wildlife

# Mature Forests & Wildlife

- In our region, mature forests are often synonymous with unmanaged forests
- Unfortunately, our unmanaged forests generally have **lower wildlife diversity** compared to similar managed forests of different ages
- **But** some species absolutely rely on mature forests, especially **large, contiguous tracts of mature forest**
- Animals that use mature forests often need **specific habitat elements**

# Focal Species for Mature Forests



# Focal Mammal: Fisher

- **Habitat requirements:**
  - **Closed-canopy coniferous or mixed forests**
  - **Large diameter trees with cavities** for denning & rest
  - **Logs, brush piles, and burrows** provide shelter for rest
  - Fishers (especially males) may **travel long distances** – up to 18 miles in a single day – and **prefer to stay under canopy** cover while travelling
  - Primarily **carnivorous**, feeding on small & medium-sized mammals, and birds. Will also eat berries.



*Washington DNR*

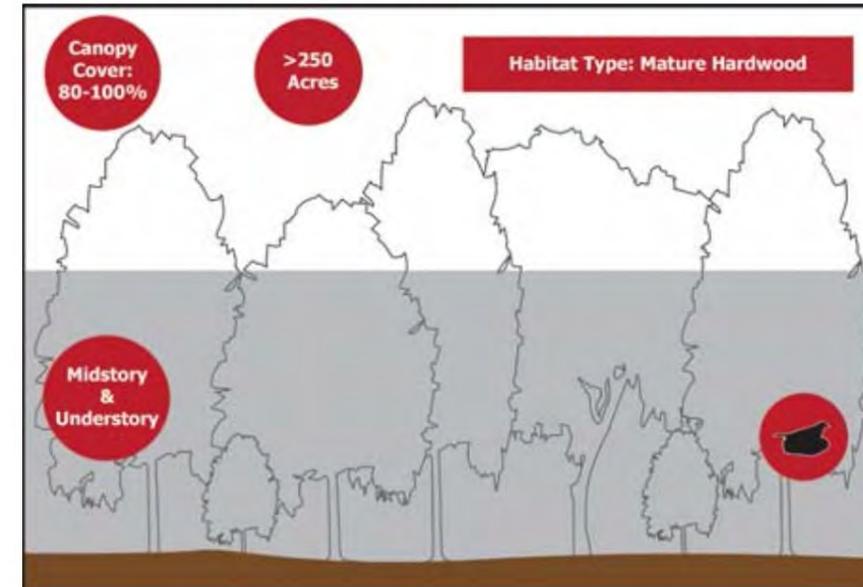
# Focal Birds: Wood Thrush

- **Habitat**

- **Closed-canopy** hardwood or mixed forest
- Prefers forest blocks of at **least 200 acres** (250+ to breed)
- Nests in **shrubs or low tree branches**, ~10 ft off the ground
- Primarily eats **soil invertebrates**; forages on the forest floor in **leaf litter**
- Best habitat has **mid-story cover & diverse shrub layer**
- <https://birdsoftheworld.org/bow/species/woothr/cur/introduction>
- <https://macaulaylibrary.org/asset/404005>



Figure 12: Wood Thrush Habitat Diagram

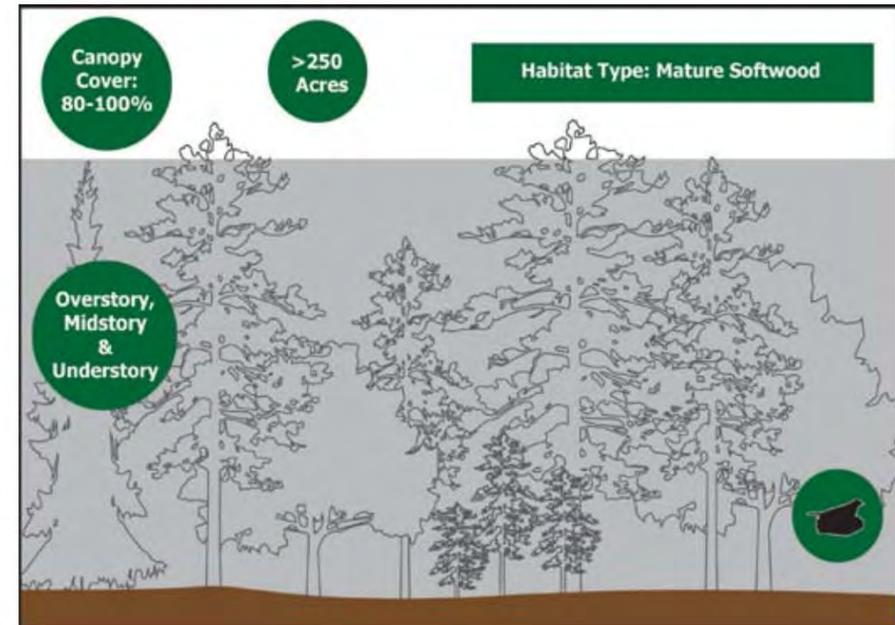


# Focal Birds: Black-throated Green Warbler

- **Habitat:**
  - **Closed-canopy** conifer or mixed forest
  - Prefers forest blocks of at **least 250 acres**
  - Nests in **shrubs or low tree branches**, ~10 ft off the ground
  - Primarily eats **insects** off of tree **branches & foliage**,
  - Strong association with **hemlock**
- [https://www.allaboutbirds.org/guide/Black-throated Green Warbler/sounds](https://www.allaboutbirds.org/guide/Black-throated%20Green%20Warbler/sounds)



Figure 3: Black-throated Green Warbler Habitat Diagram

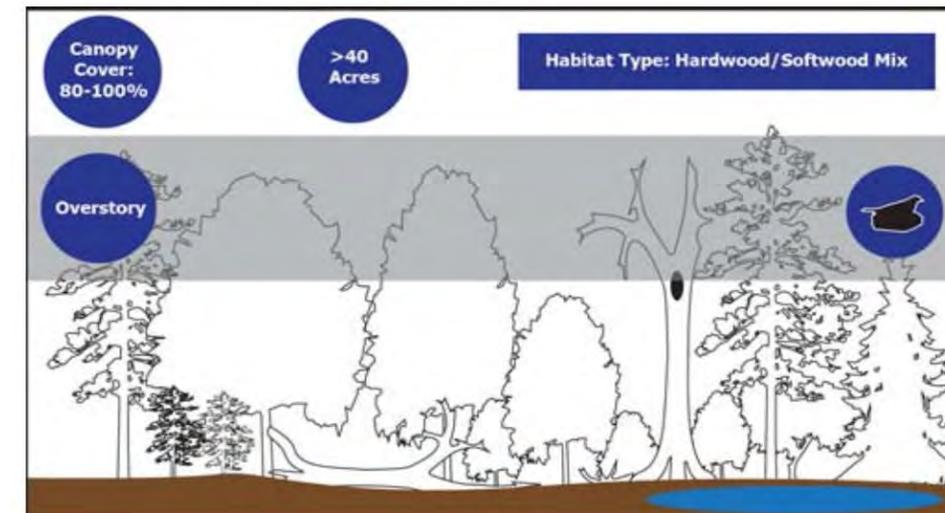


# Focal Birds: Pileated Woodpecker

- **Habitat:**
  - **Closed-canopy** hardwood or mixed forest
  - Prefers forest blocks of at **least 250 acres**
  - Nests **high up** in **cavities in snags**,
  - Primarily eats **insects** (especially carpenter ants) & will **excavate dead trees** to find them
  - **High snag density & large trees (>28" DBH)** are beneficial
  - **Abandoned holes provide shelter** to many other birds, bats, and other mammals
- <https://macaulaylibrary.org/asset/441448>



Figure 7: Pileated Woodpecker Habitat Diagram



# Focal Fish: Eastern Brook Trout

- **Habitat:**
  - **Cold, clear, well-oxygenated freshwater streams (<68°F)**
  - **Shaded stream corridors** help keep streams cool & water levels higher in summer
    - **Hemlock** in stream corridors provides **deep shade** to regulate temperatures
  - **Falling leaves** provide food for stream invertebrates – food for fish
  - **Wood in streams** provide cover & structure
  - **Fragmentation** (dams, roads) is a major hurdle



*Vermont Fish & Wildlife*



*Brook trout stream, Scott Cornett/NYSDEC, Public Domain, <https://www.fws.gov/media/brook-trout-stream>*

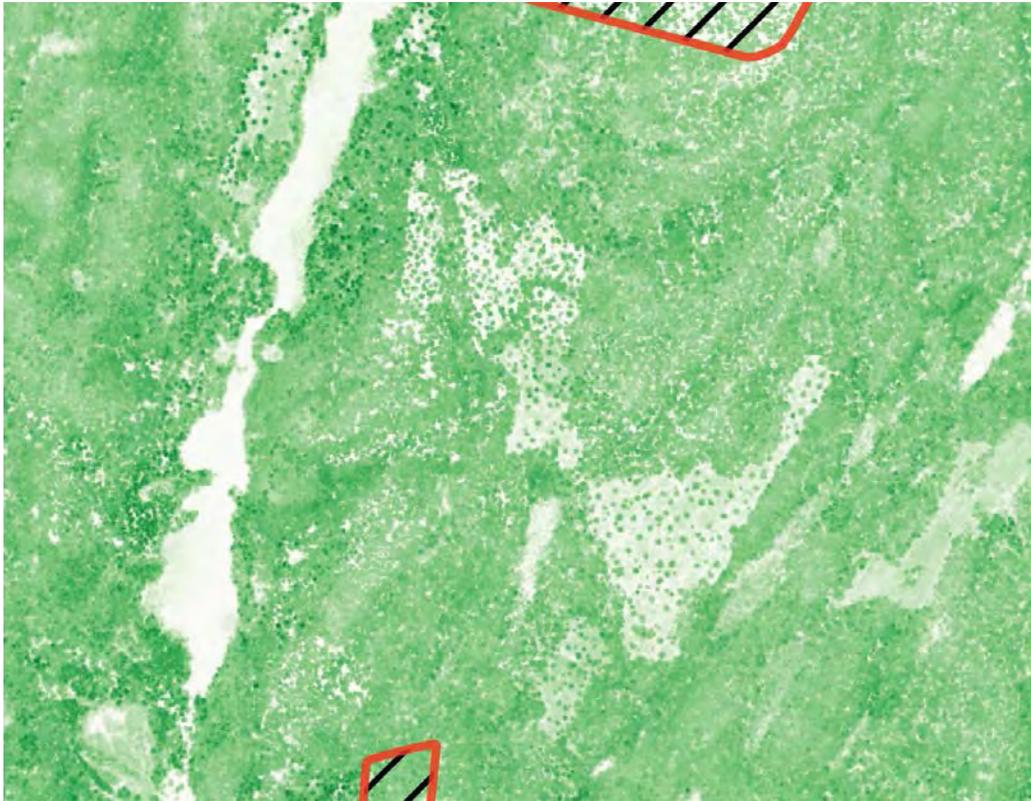
Yale SCHOOL OF THE ENVIRONMENT  
*The Forest School*

# Enhancing & Sustaining Mature Forests

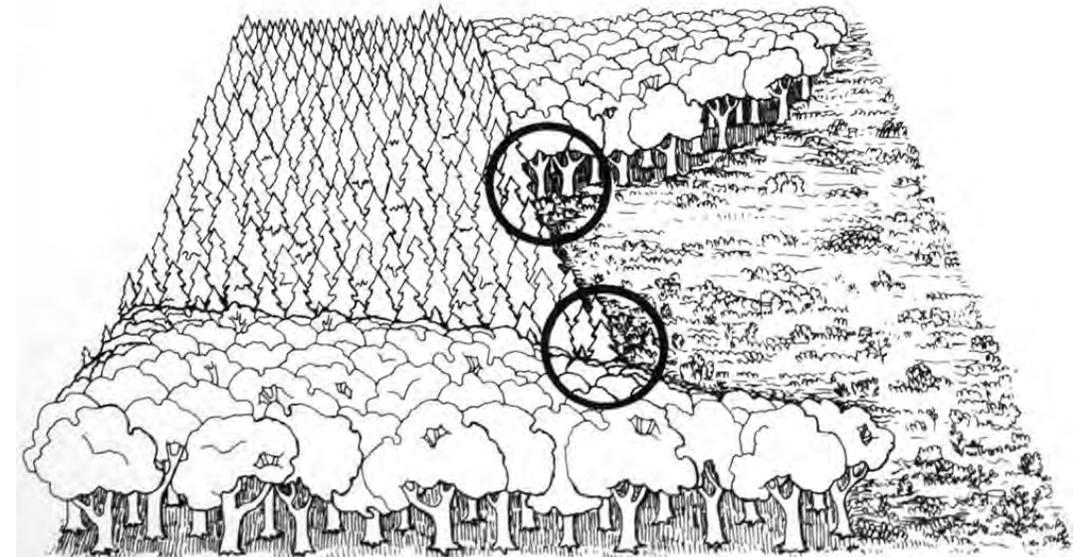


# Enhancing Mature Forests: What's in the neighborhood?

- **Context matters** – juxtaposition of different habitat types enriches the overall value of the landscape



## COVERTS



# Enhancing Mature Forests: What's in the neighborhood?

- **Context matters** – juxtaposition of different habitat types enriches the overall value of the landscape
- **Consider scale** – a small patch of mature forest may not support the full suite of mature forest specialist species



# Enhancing Mature Forests: What's in the neighborhood?

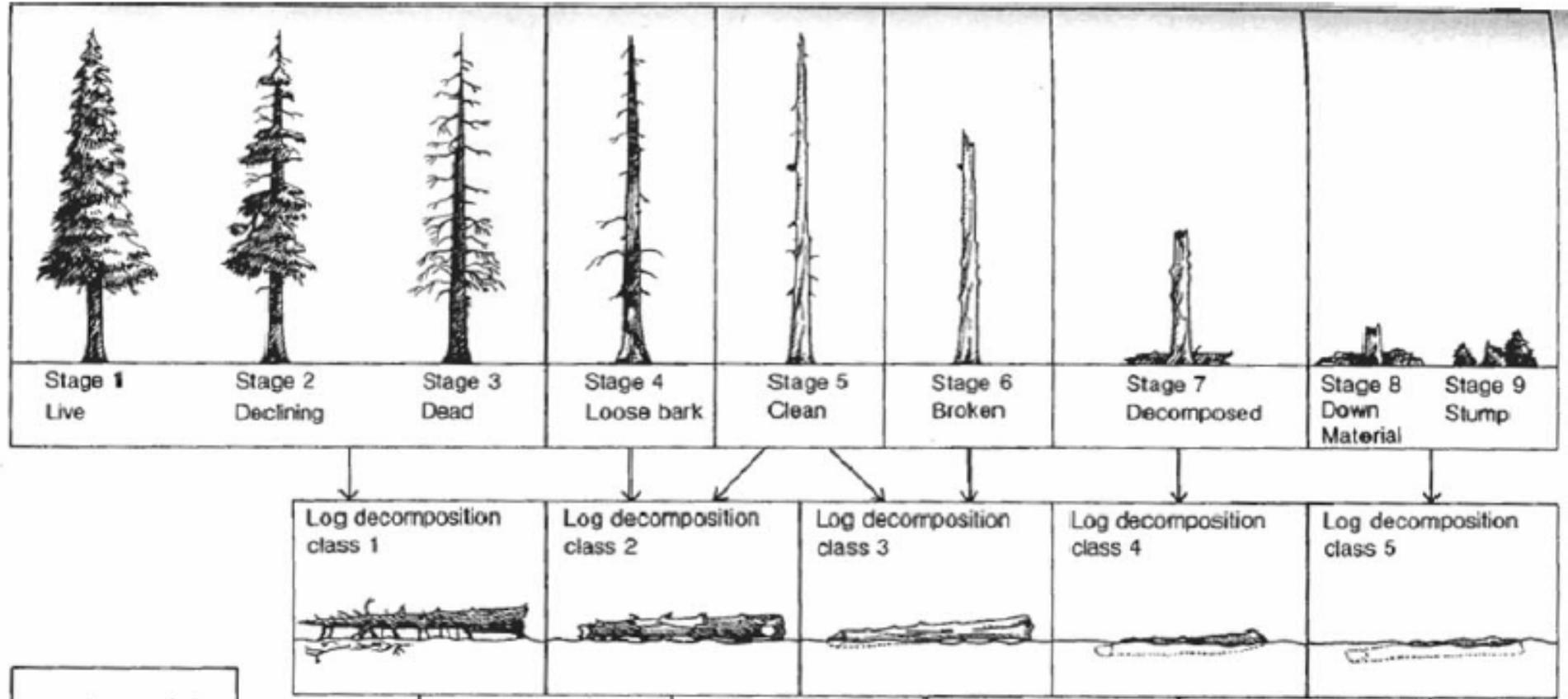
- **Context matters** – juxtaposition of different habitat types enriches the overall value of the landscape
- **Consider scale** – a small patch of mature forest may not support the full suite of mature forest specialist species
- **Connection matters** – smaller patches may sustain species with large habitat requirements IF they are connected to other patches of appropriate habitat; think about corridors & how animals move



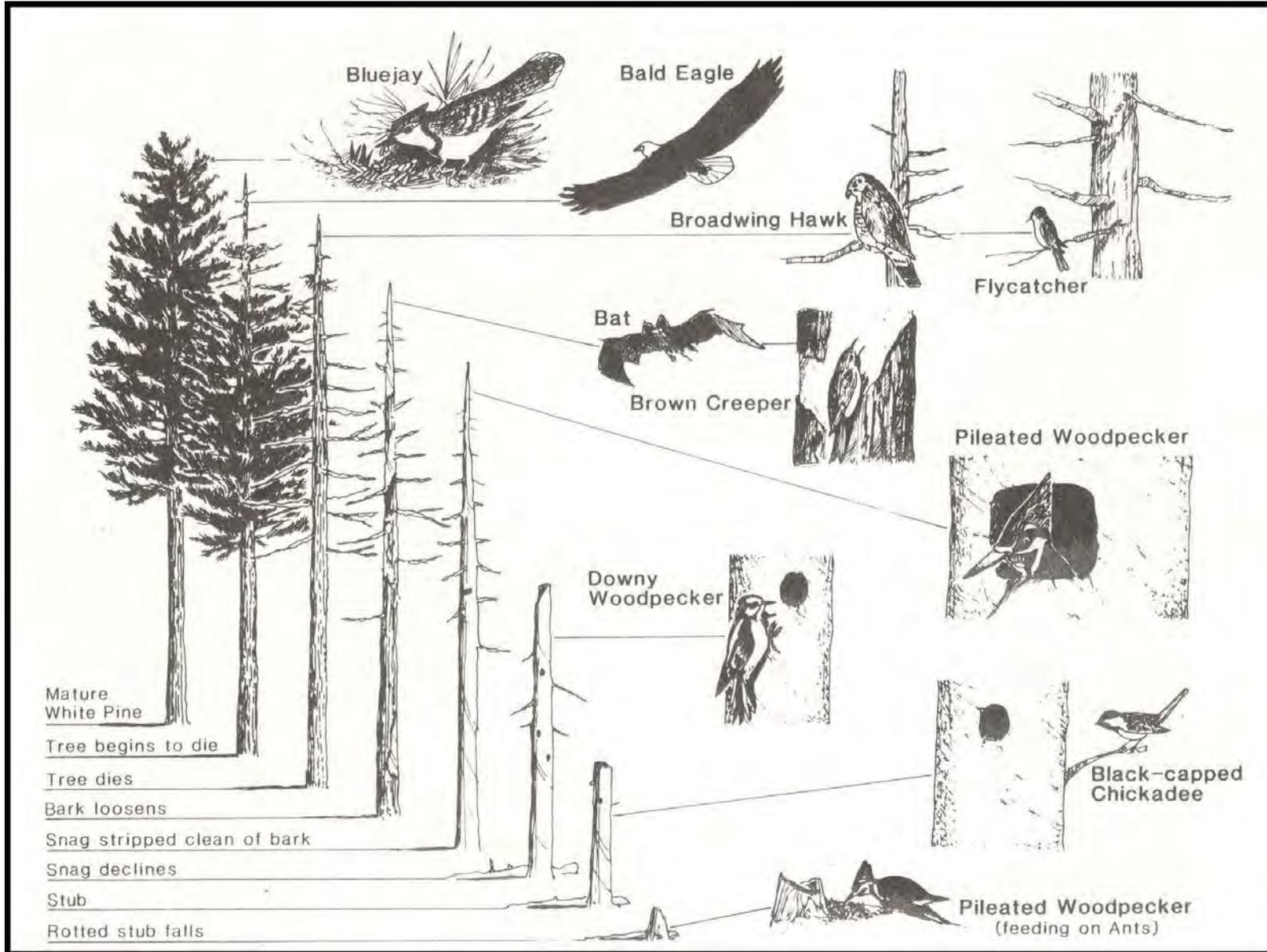
# Enhancing Mature Forests: Add Structure!

- **Dead wood is good –**
  - **Leave downed trees & snags** in place (as long as they don't threaten people or buildings)
  - Bigger is better - **BIG snags** are key!
  - If the forest doesn't have enough dead wood, consider **adding more** by girdling trees to create snags, or felling & leaving whole trees

# Not all snags are equal...



# Or support the same species...



# Enhancing Mature Forests: Add Structure!

- **Dead wood is good –**
  - **Leave downed trees & snags** in place (as long as they don't threaten people or buildings)
  - Bigger is better - **BIG snags** are key!
  - If the forest doesn't have enough dead wood, consider **adding more** by girdling trees to create snags, or felling & leaving whole trees

# Enhancing Mature Forests: Add Structure!

- **Dead wood is good –**
  - **Leave downed trees & snags** in place (as long as they don't threaten people or buildings)
  - Bigger is better - **BIG snags** are key!
  - If the forest doesn't have enough dead wood, consider **adding more** by girdling trees to create snags, or felling & leaving whole trees
- More **layers of vegetation** mean more places for different critters to live
  - Creating **small gaps** in your forest canopy promotes understory vegetation
  - Deer make this difficult

# Enhancing Mature Forests: Add Structure!

- **Dead wood is good –**
  - **Leave downed trees & snags** in place (as long as they don't threaten people or buildings)
  - Bigger is better - **BIG snags** are key!
  - If the forest doesn't have enough dead wood, consider **adding more** by girdling trees to create snags, or felling & leaving whole trees
- More **layers of vegetation** mean more places for different critters to live
  - Creating **small gaps** in your forest canopy promotes understory vegetation
  - Deer make this difficult
- **Help big trees get bigger**
  - **Releasing large, healthy trees** from competition will help them get bigger, faster

# Enhancing Mature Forests: Closing Thoughts

- **You can't please everyone**
  - A single forest won't be optimal habitat for all species - even all that share broad habitat requirements
- **Diversity begets diversity**
  - The more diverse our forests are – in species, age, structure - at the landscape scale, the greater diversity of wildlife we will enjoy in our state!

# Enhancing Mature Forests: Closing Thoughts

- **Resources**

- [\*“Restoring Old Growth-Characteristics to New England’s and New York’s Forests,” by Tony D’Amato & Paul Catanzaro\*](#)
- [\*Forestry for Rhode Island Birds: A Guide for Foresters and Landowners to Manage Woodlots “With Birds in Mind”\*](#)
- [\*Silviculture with Birds in Mind: Birder’s Dozen Pocket Guide for Rhode Island Foresters\*](#)

Yale SCHOOL OF THE ENVIRONMENT  
*The Forest School*

Thank you!

Laura Green - [laura.green@yale.edu](mailto:laura.green@yale.edu)

[forests.yale.edu](http://forests.yale.edu)

# Species-Habitat Associations

- Shelterwoods – Baltimore oriole, chestnut sided-warbler, eastern towhee, common yellowthroat
- Thinning – ovenbird, black-throated blue, downy woodpecker
- Reserves – tanager, black-throated green