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Forest Carbon, Climate Change and the NYS Climate Act

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NYS DEC, Division of Lands and Forests

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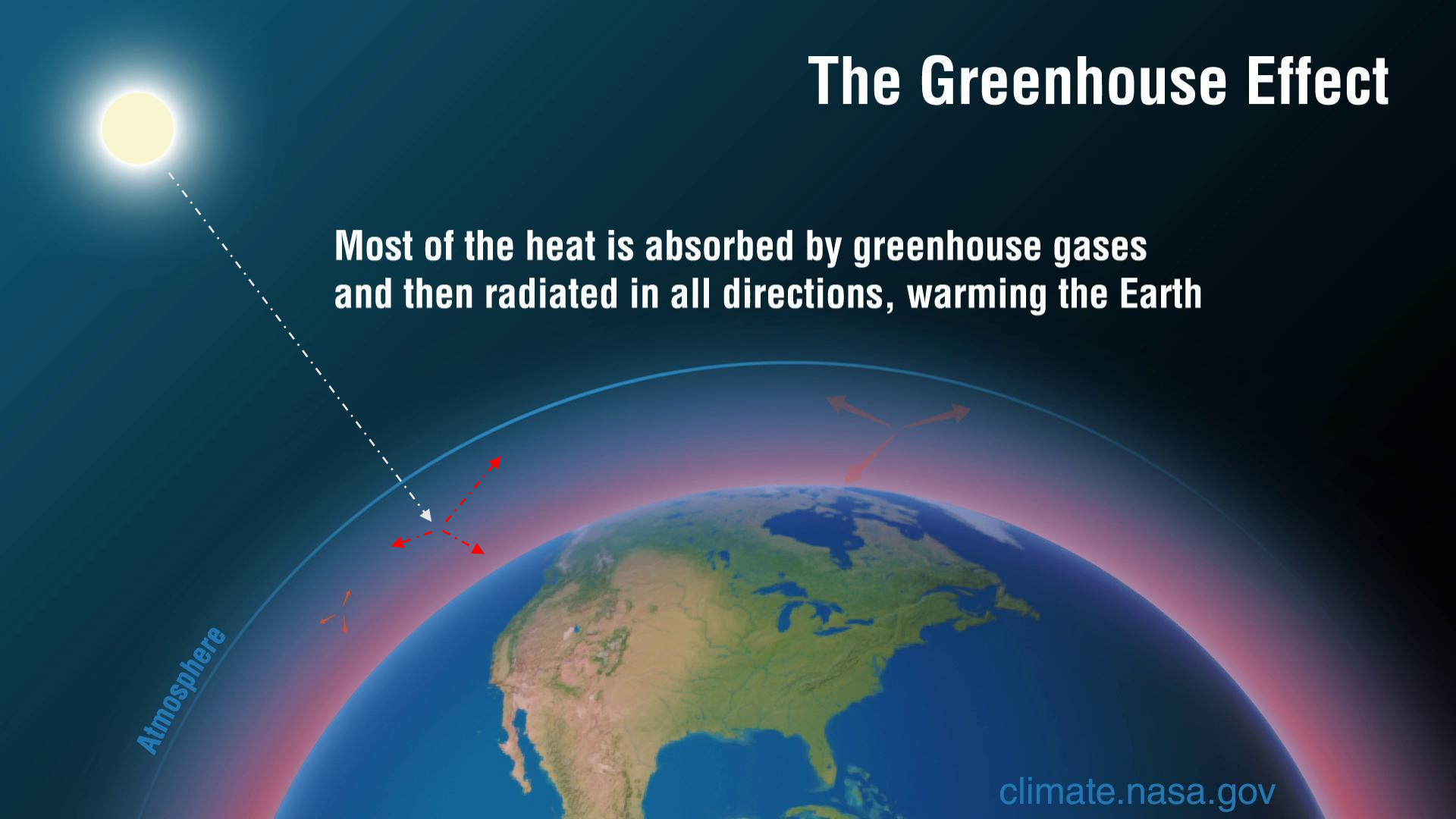
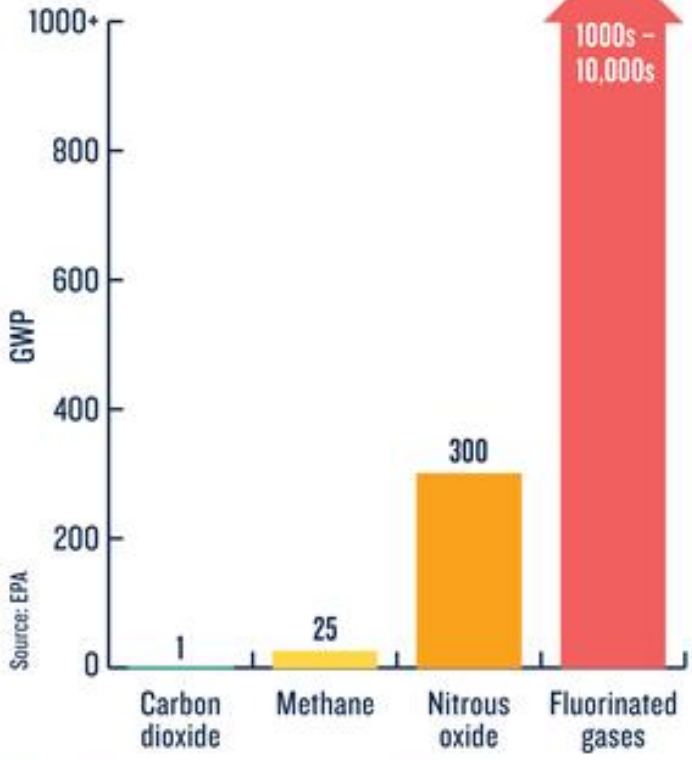
The Greenhouse Effect

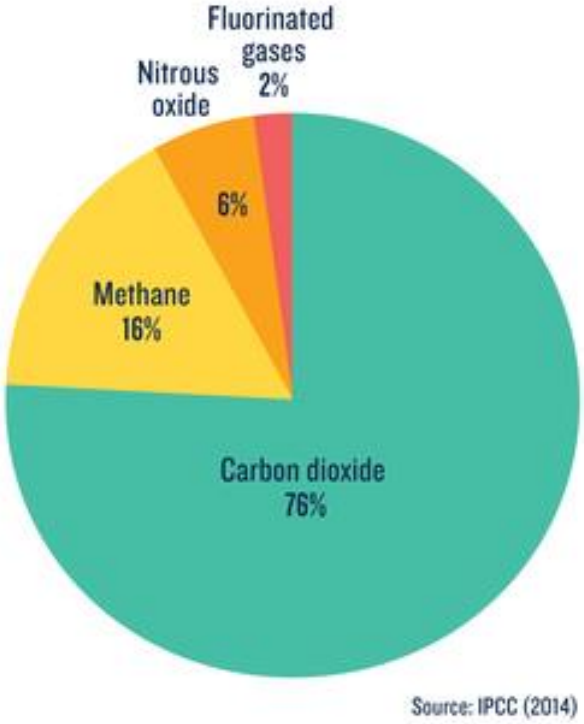
Most of the heat is absorbed by greenhouse gases
and then radiated in all directions, warming the Earth





The global warming potential (GWP) of human-generated greenhouse gases is a measure of how much heat each gas traps in the atmosphere, relative to carbon dioxide.

Image source: https://www.nrdc.org/stories/greenhouse-effect-101



How much each human-caused greenhouse gas contributes to total emissions around the globe.

Image source: https://www.nrdc.org/stories/greenhouse-effect-101

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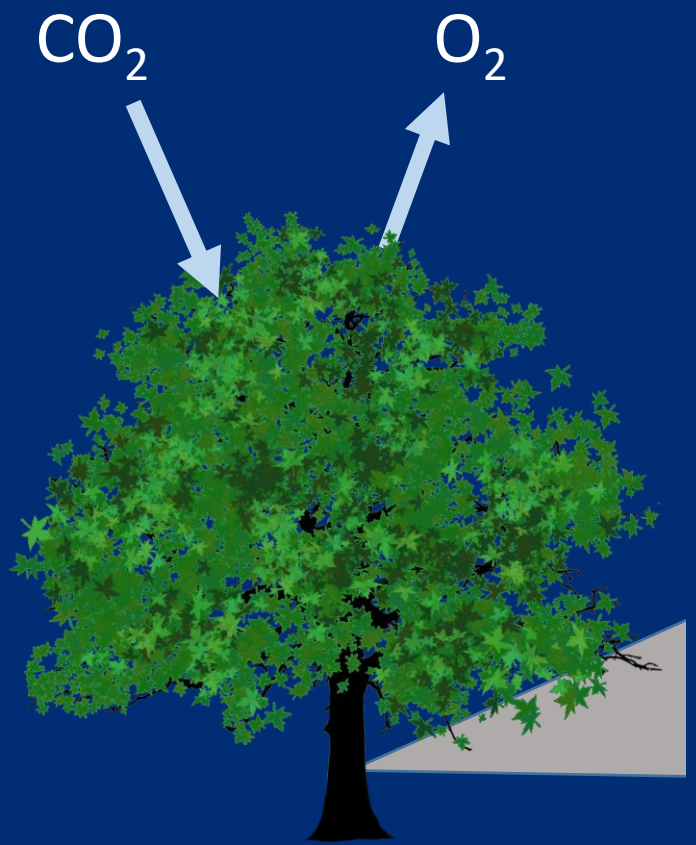

- Trees take in carbon dioxide from the air (carbon sequestration)
- Carbon is stored in wood, roots, leaves

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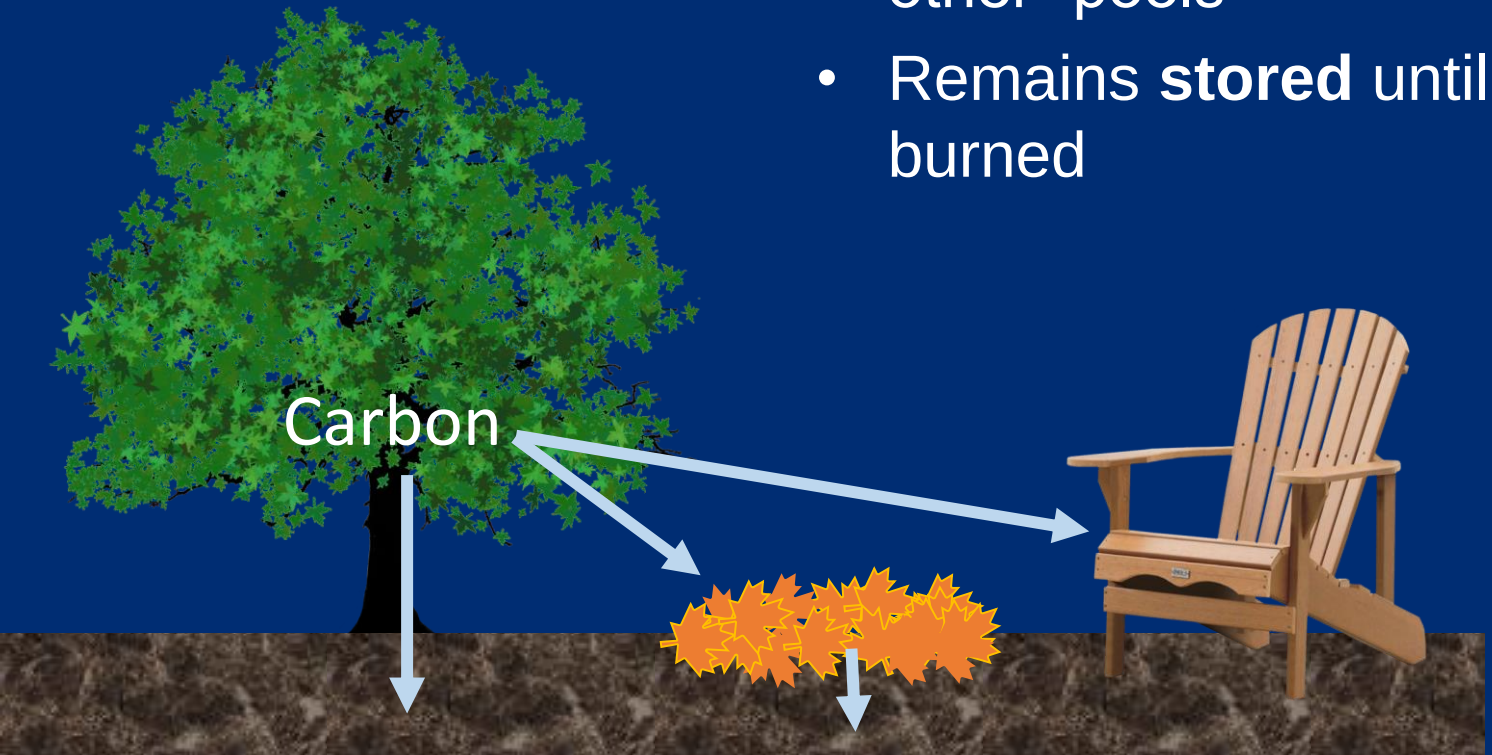
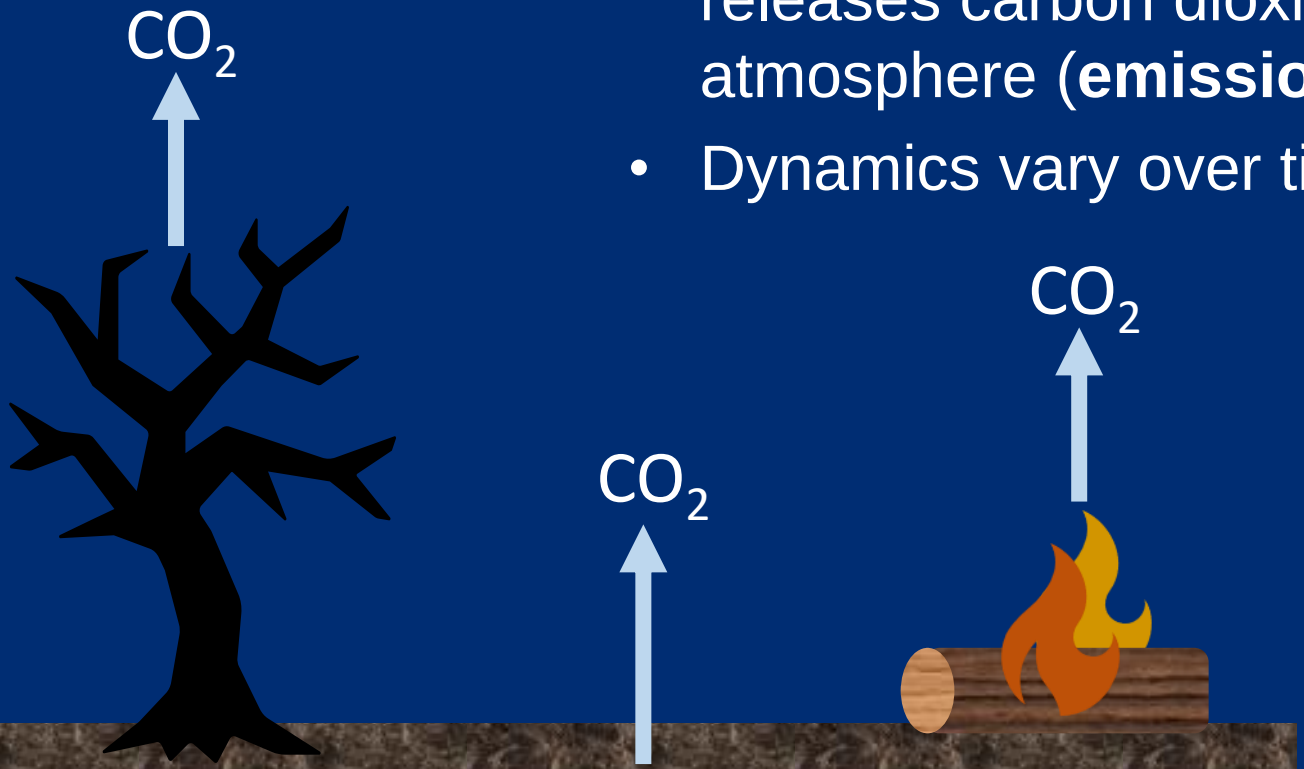
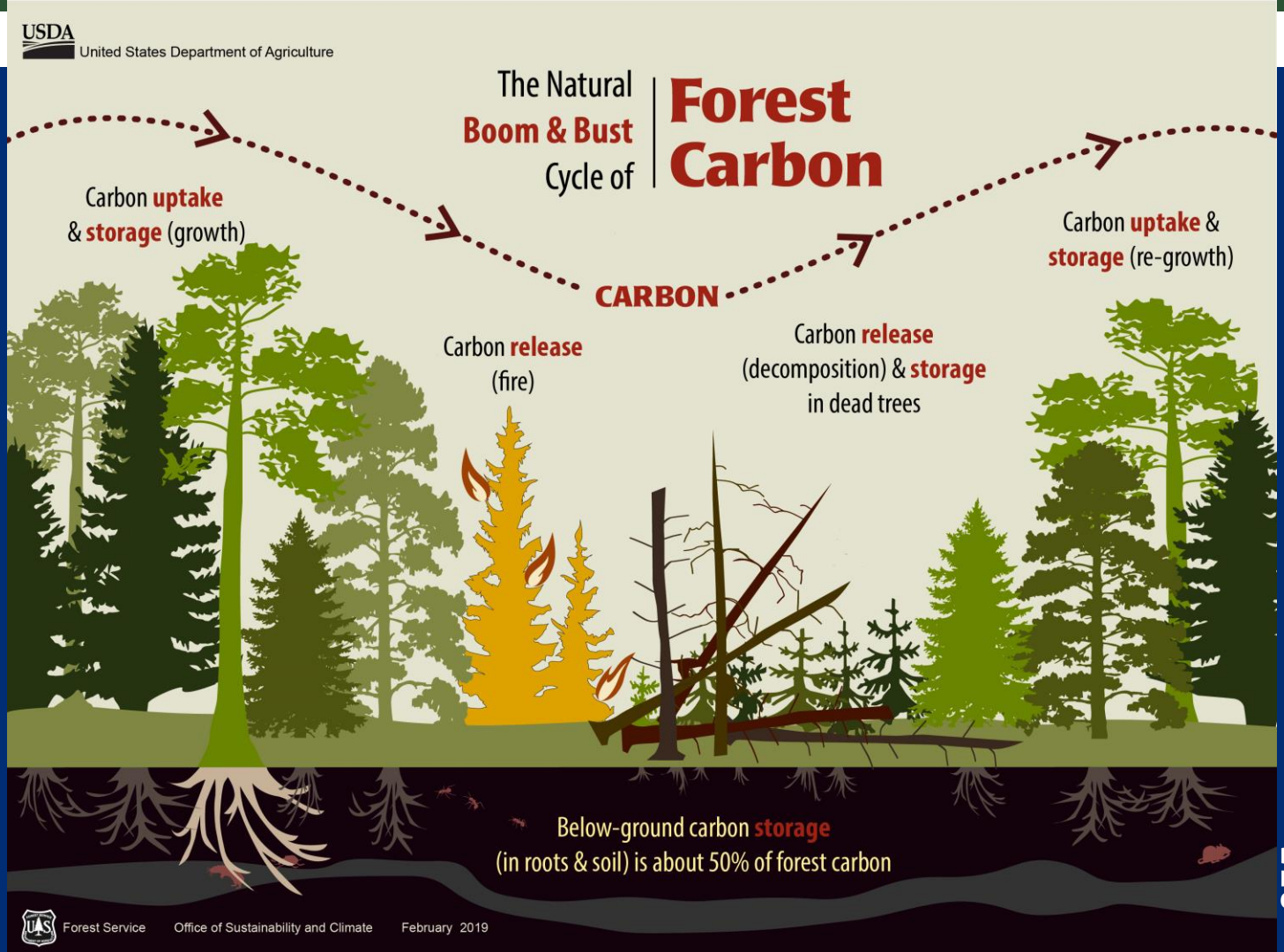
- Carbon from wood, leaves and roots stays in tree or may move to other “pools”
- Remains **stored** until decay or burned

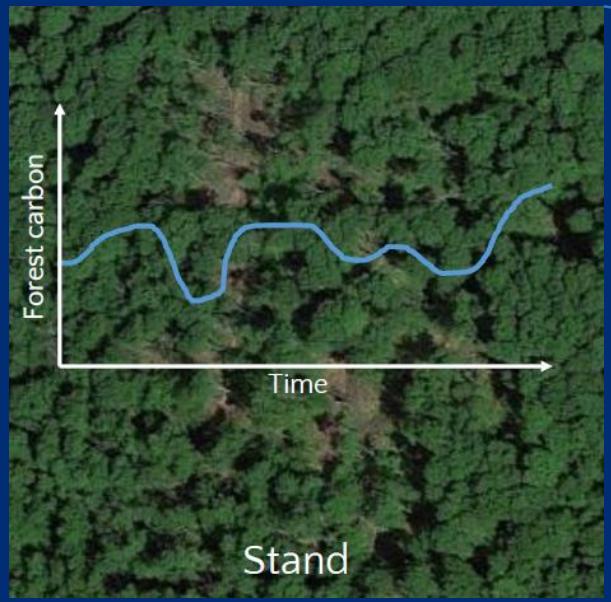


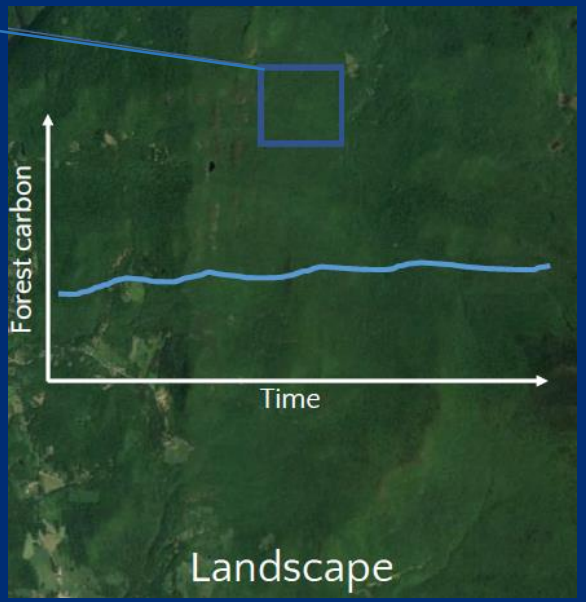
- Decay and burning eventually releases carbon dioxide back into atmosphere (**emissions**)
- Dynamics vary over time




USDA
United States Department of Agriculture
The Natural Boom & Bust Cycle of Forest Carbon
Carbon uptake & storage (growth)
CARBON
Carbon release (fire)
Carbon release (decomposition) & storage in dead trees
Carbon uptake & storage (re-growth)
Below-ground carbon storage (in roots & soil) is about 50% of forest carbon
Forest Service
Office of Sustainability and Climate
February 2019

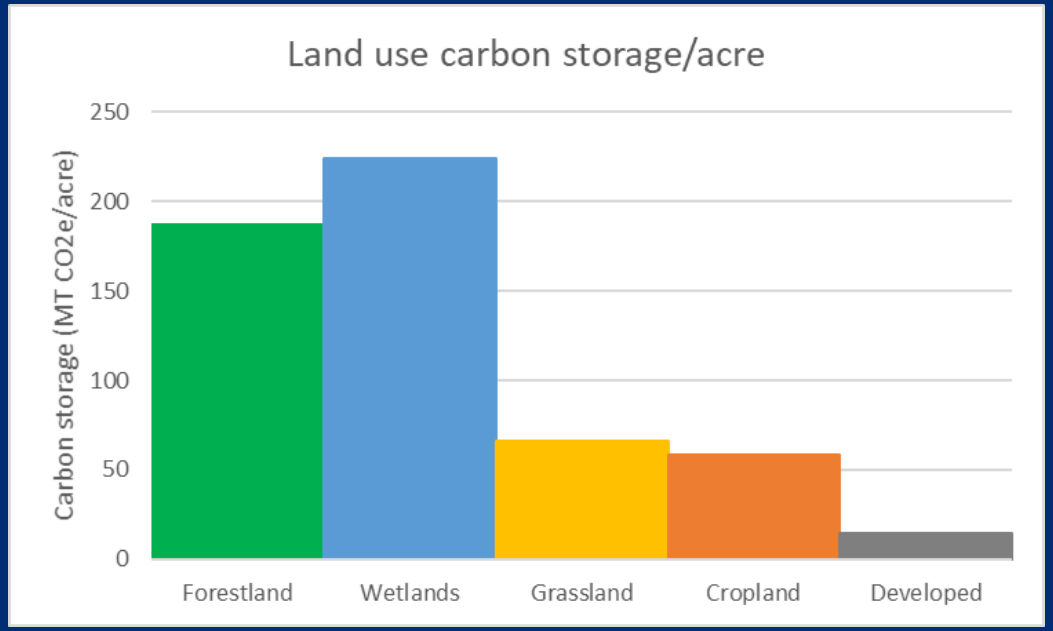
Carbon Dynamics Vary Over Landscape





What does this look like on the landscape?

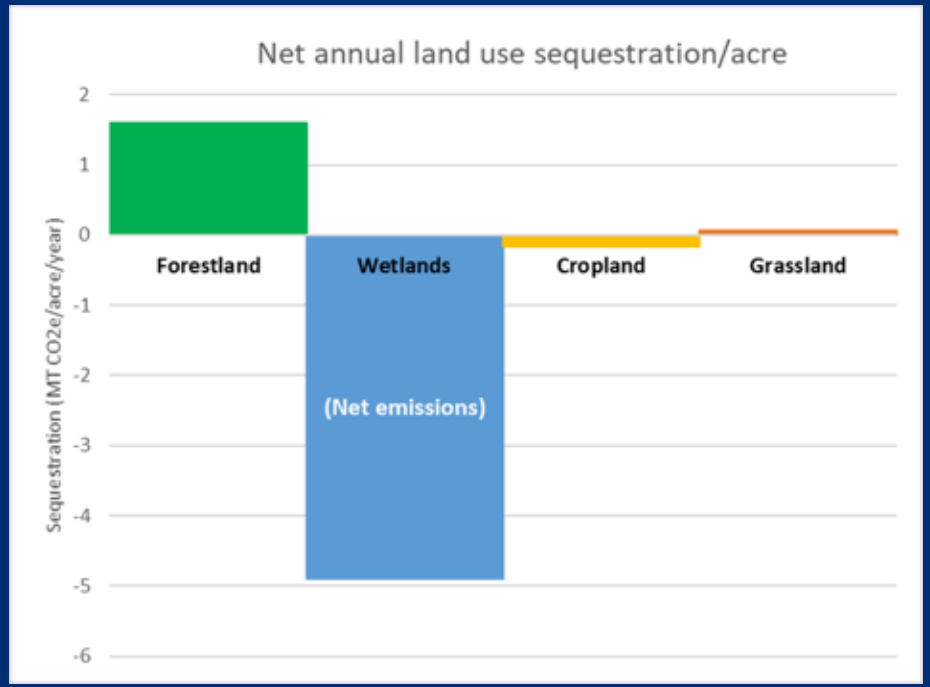
Landscape Carbon Storage



- Wetlands and forests hold the highest carbon/acre

Janowiak et al 2017: Considering Forest & Grassland Carbon in Land Management

Landscape Carbon Sequestration



- Forests absorb the highest annual carbon/acre

Data Source: NYS 2022 Statewide GHG Emissions Report

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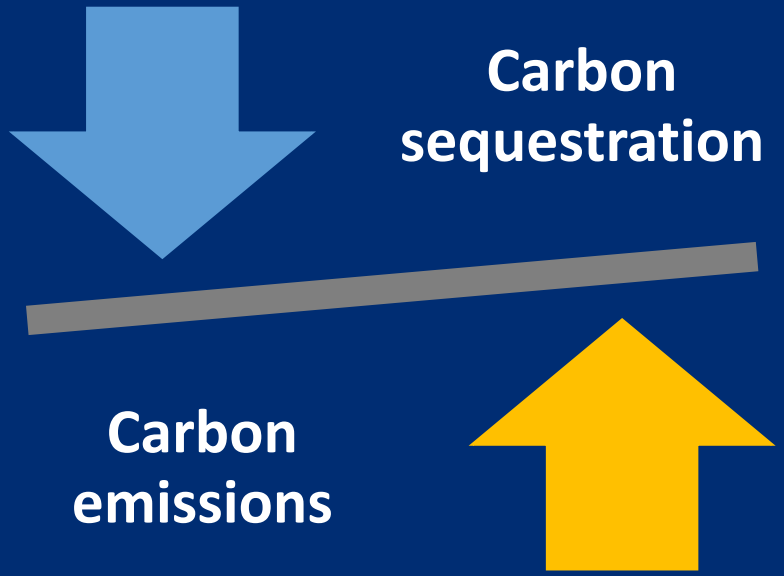
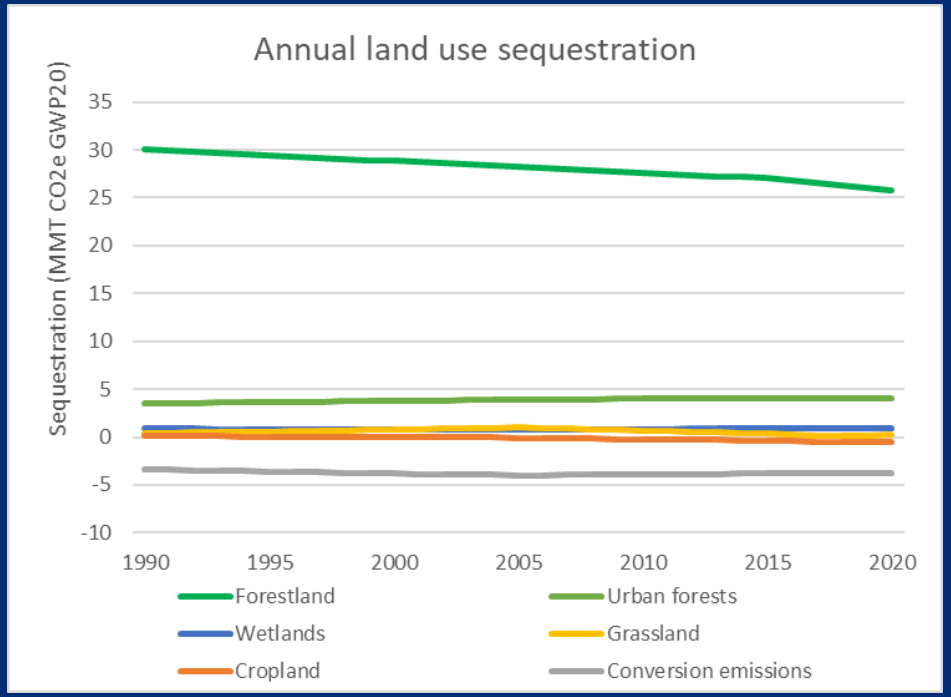
Climate Change Mitigation



- Depends on balance between uptake & release

NYS landscape sequestration trends



Data Source: NYS 2022 Statewide GHG Emissions Report

- Decreased sequestration
- Driven by forests:
  - Loss of forestland
  - Aging forests
  - Forest pests & invasive species

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Climate Act (CLCPA)

- Establishes Climate Action Council (CAC) to develop Scoping Plan to meet targets:
  - 70% renewable energy by 2030
  - 100% zero emissions from electricity generation by 2040
  - 85% reduction in GHG (from 1990) by 2050

- Goal of 100% **net zero emissions** by 2050
  - Sequestration “cancel out” remaining GHG (15%)

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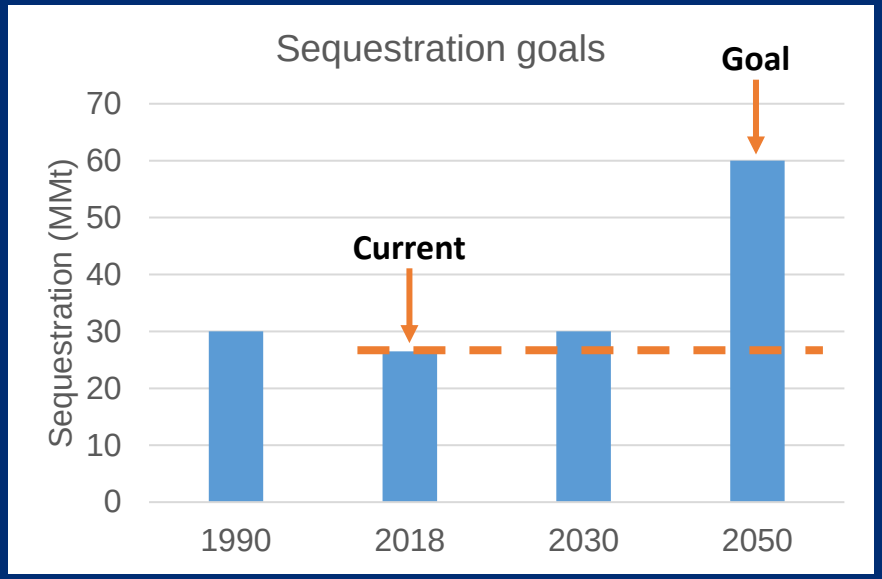
Net Zero Emissions Goal



- Total NY sequestration: ~28MMt CO_2
  - 92% forests
  - 5% wood products
- ~7% NY emissions
- Goal of 60MMt 2050

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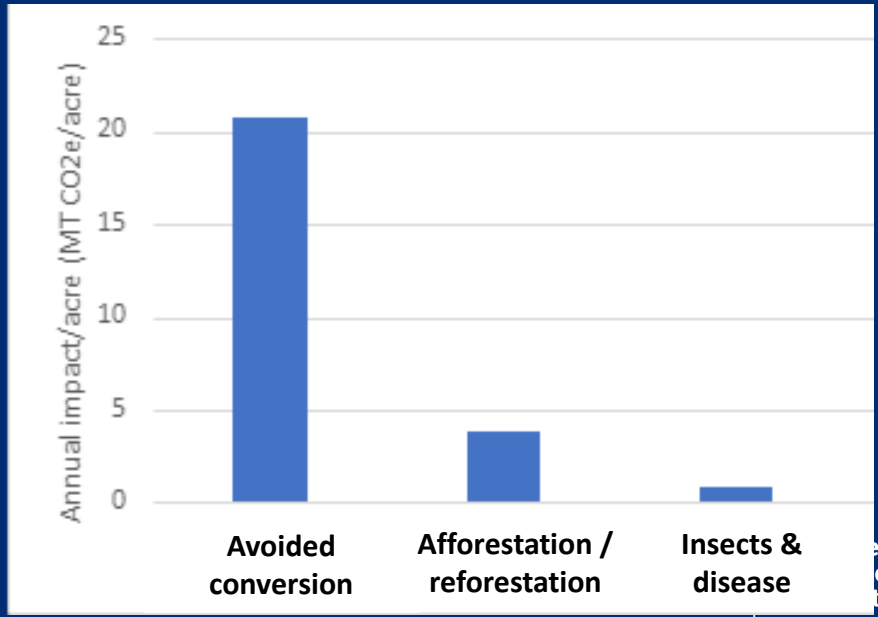
Forest Strategies

- Keep forests as forests
  - Acquisition, avoided conversion
- "Climate-smart" forest management
- Afforestation & reforestation
- Prevent & control forest pests, diseases, invasive spp.
- Urban forestry, municipal guidance
- Workforce & market development

Which strategies will have the most impact?

Per Acre

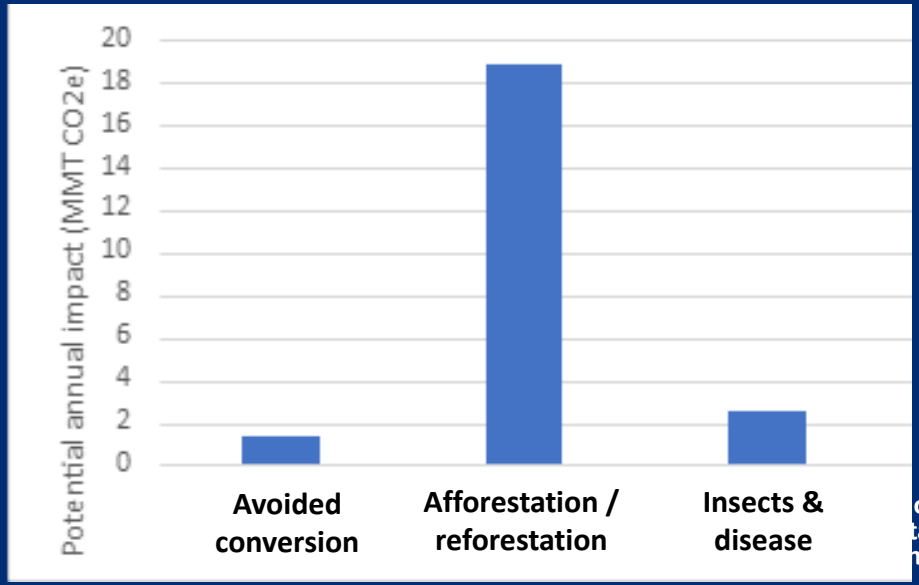
1. Avoided conversion
2. Afforestation, reforestation & natural regeneration
3. Follow forestry BMPs
4. Control & eradication of forest pests and disease



Which strategies will have the most impact?

Statewide Potential

1. Afforestation, reforestation, & natural regeneration
2. Use of long-lived wood products
3. Follow forestry BMPs
4. Avoided conversion
5. Control & eradication of forest pests and disease



Implementation Challenges

- Workforce, funding
- Competing land use
- Seed shortages, nursery infrastructure
- Seedling & tree production
- Future loss in productivity, regeneration

Consider future vulnerability

Current impacts	Next 30 years	By 2100
• ↑ invasive species, forest pests & diseases • ↑ drought, temperatures, flooding • ↓ seed production • Shorter cutting windows	• ↓ planting & regeneration success (deer, drought, temperatures, flooding) • ↑ storm damage	• Changes in species composition

Future climate vulnerabilities

- Coastal & riparian trees more vulnerable to flooding & storms
- Landscape warmer & drier

More vulnerable		Less vulnerable	
• Beech	• Eastern white pine	• Elms	• Eastern redcedar
• Larches	• Gray birch	• Hickories	• Eastern redbud
• Spruces	• Mountain maple	• Oaks***	• Flowering dogwood
• Am. mountain ash	• N. white cedar	• Black walnut	• Hackberry
• Balsam fir	• Paper birch	• Black willow	• Red mulberry
• Balsam poplar	• Pin cherry	• Black gum	• Sassafras
• Black ash	• Quaking aspen	• Cottonwood	• Sycamore
• Black maple	• Red maple		
• Eastern hemlock	• Tamarack		

Species “best” for carbon depends on site

- Best tree(s) for the site will provide the greatest benefits
  - Tree health
  - Longevity

- Consider future climate vulnerability

Climate Change Adaptation

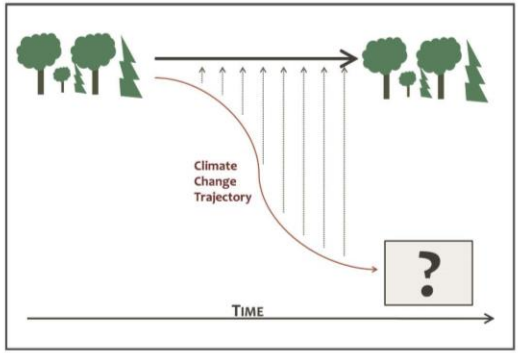
Manage for Persistence

Ecosystems are still recognizable as being the same system (character)

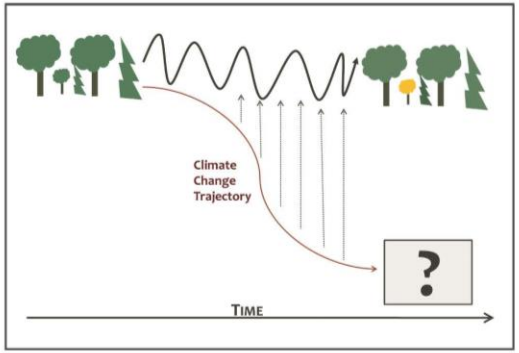
Manage for Change

Ecosystems have fundamentally changed to something different

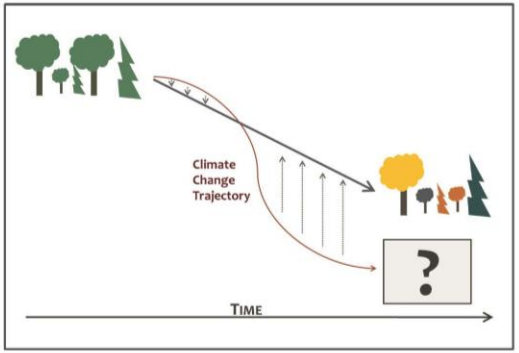
RESISTANCE



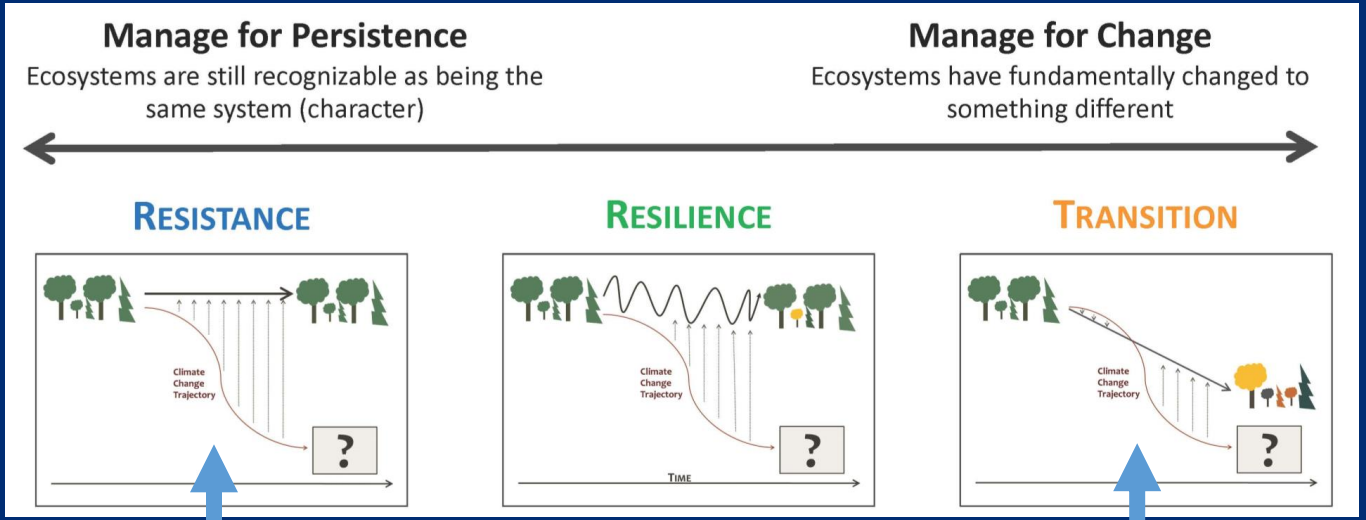
RESILIENCE



TRANSITION



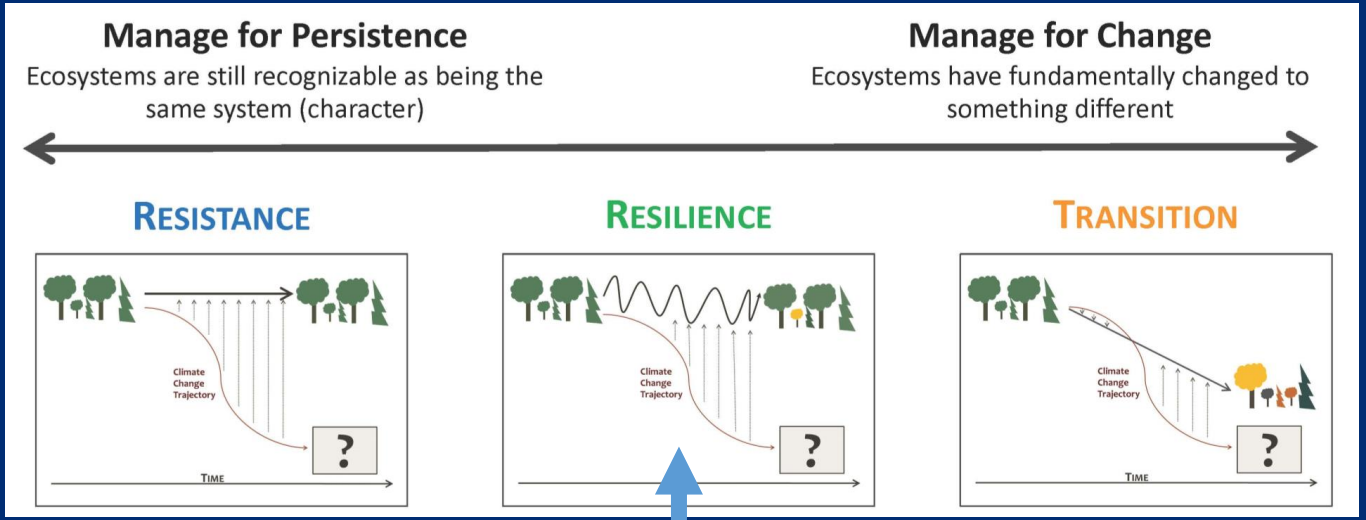
Climate Change Adaptation



Low vulnerability, high value forests

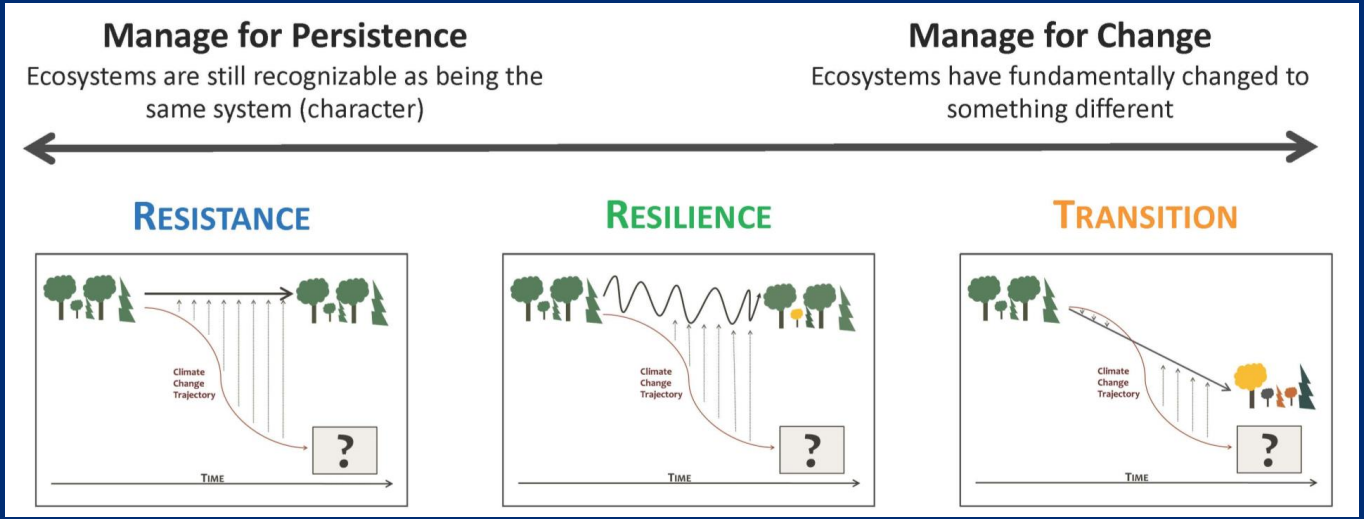
High vulnerability forests

Climate Change Adaptation



Most effective in short-term

Climate Change Adaptation



Long-term effectiveness

Low → High

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Resilience & transition approaches

- Increase forest structural, compositional, and functional diversity
- Promote species adapted to warmer, dryer climates
- Ensure adequate regeneration
  - Incorporate plantings or deer protection where needed
- Minimize soil disturbances – especially on sensitive soils

Forests and trees aren’t just carbon!

- Biodiversity
- Wildlife habitat
- Erosion control and prevention
- Nutrient retention
- Streamflow and flooding control
- Shading and heat control
- Water quality
- Reduced energy costs
- Recreation
- Aesthetics
- Human health benefits

Thank You

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