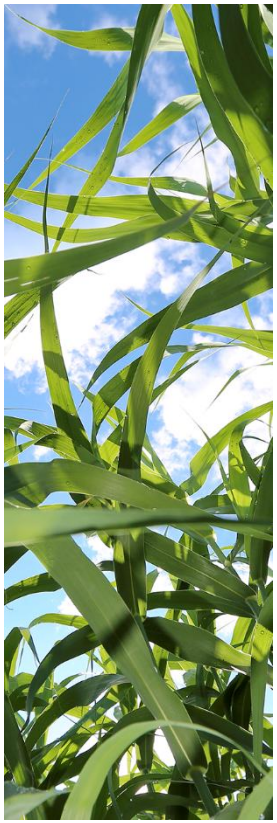
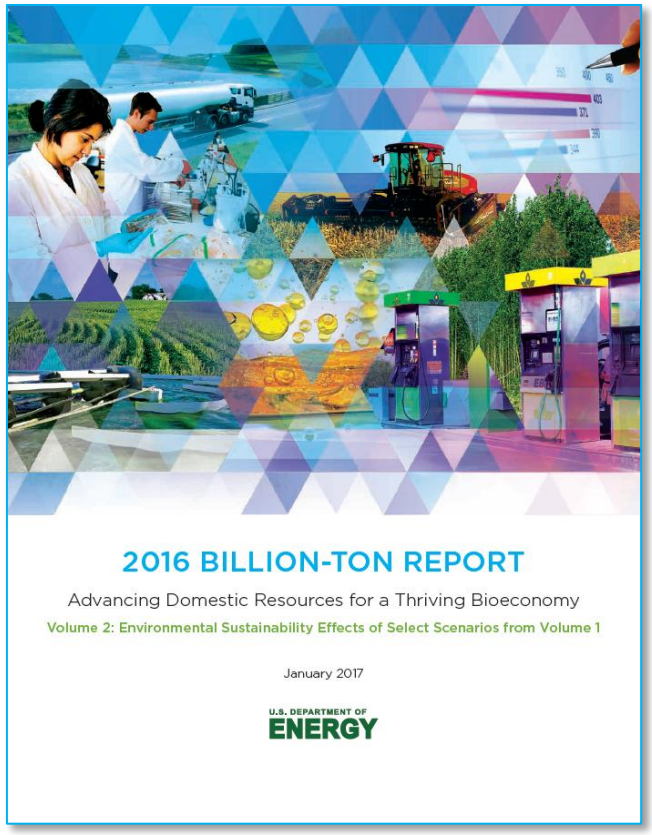


Forest Biodiversity and Woody Biomass Harvesting – a review

2016 Billion-Ton Report, Volume 2: Environmental Sustainability Effects of Select Scenarios from Volume 1

July, 2017



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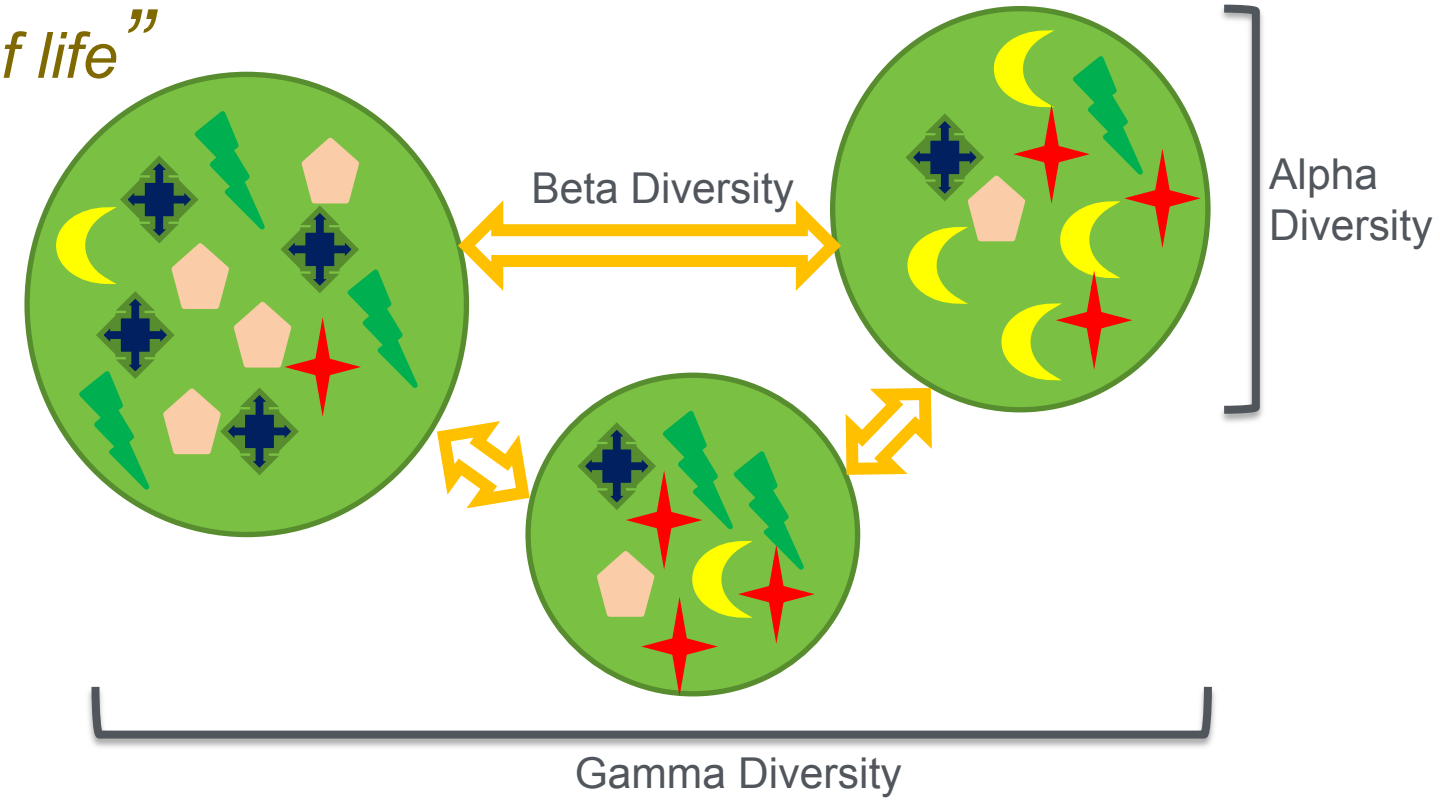
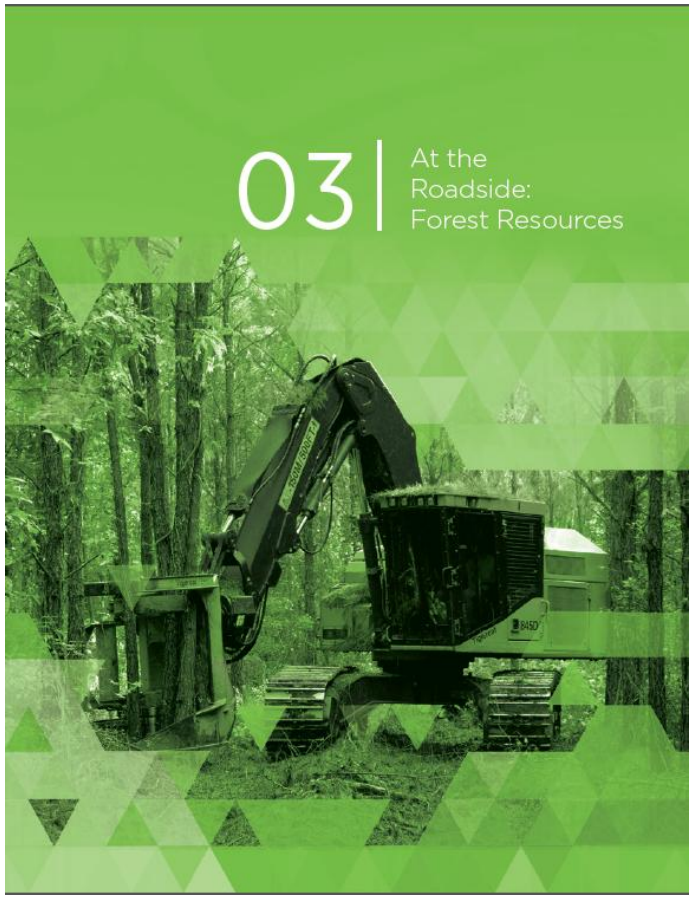
Biodiversity is multi-faceted not easily measured

"variety of life"



Genetic, population, species, community, ecosystem-levels

Scope of Assessment

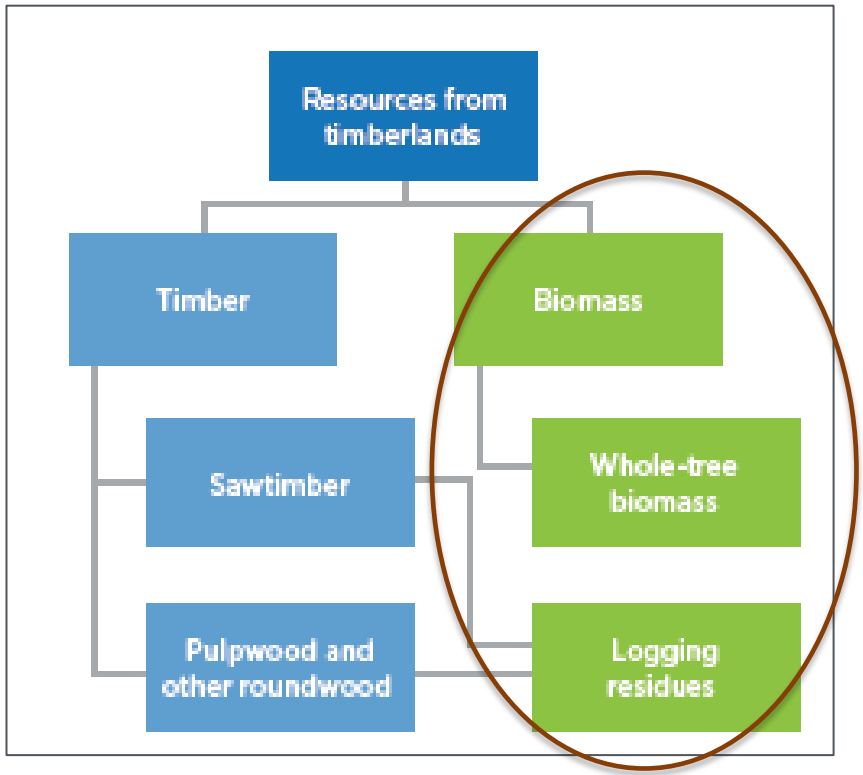


- **Forestland**—Land at least 120 ft wide and 1 acre in size with at least 10% cover (or equivalent stocking) by live trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated.
- **Timberland**—Forestland that is producing, or is capable of producing, in excess of 20 ft^3 per acre per year of industrial wood and not withdrawn from timber utilization by statute or administrative regulation.

Forestland	623 million acres
Timberland	475 million acres

Scope of Assessment - selected ForSEAM models

Forest Sustainable and Economic Analysis



Scenario	Growth in housing starts	Growth in woody biomass demand for energy
Moderate housing–low wood energy (baseline), ML	Returns to long-term average by 2025	Increases by 26% by 2040
High housing–high wood energy, HH	Adds 10% to baseline in 2025	Increases by 150% by 2040

Mechanisms by which biomass harvesting may affect biodiversity

Decreased dead wood on forest floor

- Fine woody debris (tops and branches)
- Coarse woody debris (≥ 10 cm)

Fewer residue piles

Modifying forest age-class distribution

- Potential increase young forests

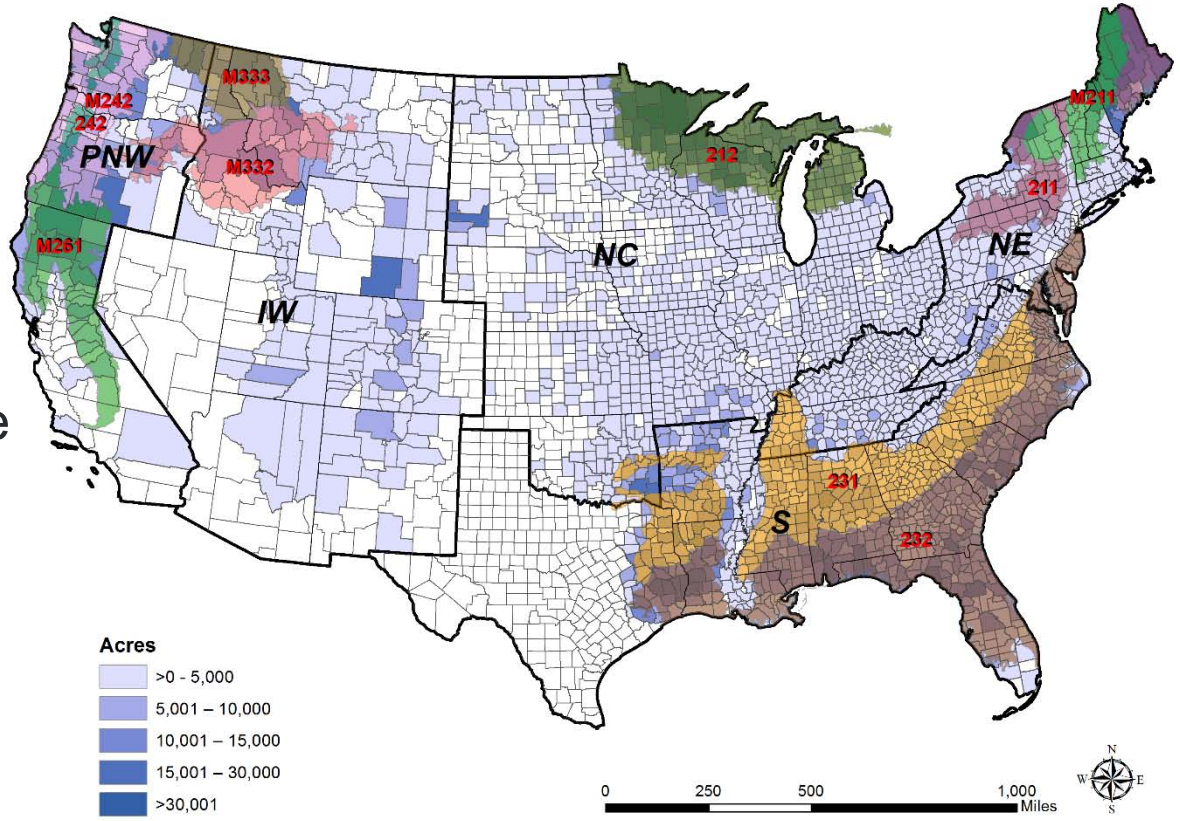
ForSeam assumptions most relevant to biodiversity

- Forest cover type remained constant (no land use change)
- Stands < ¼ mile of an existing road available for biomass
- >30% of logging residues left on-site to provide structure
- No removal on slopes > 40% except in PNW
- Model solved for conventional timber demands generating logging residues first
  - whole-tree biomass harvests did not occur unless demand for woody biomass not met by logging residues
- Availability of biomass declined through time because land was available for harvest only once during duration of models compared

Approach and Methods

Biodiversity Indicators - taxa of special concern

1) Rare
2) Keystone
3) Bioindicator
4) Commercial value
5) Cultural importance
6) Recreational value



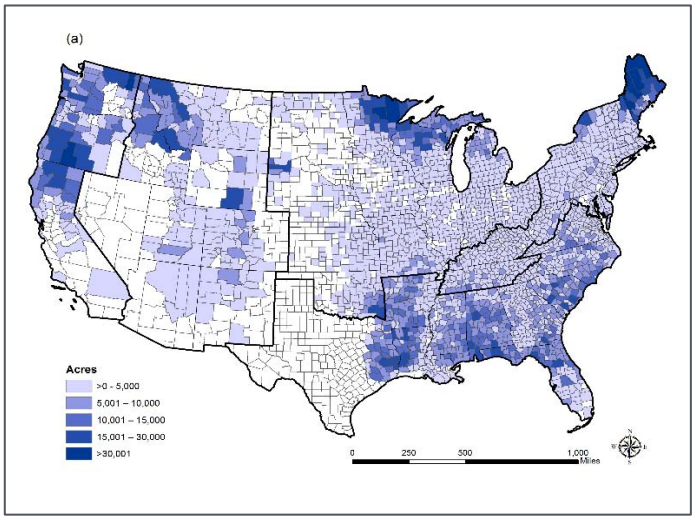
From *Indicators to support environmental sustainability of bioenergy systems* (McBride et al. 2011)

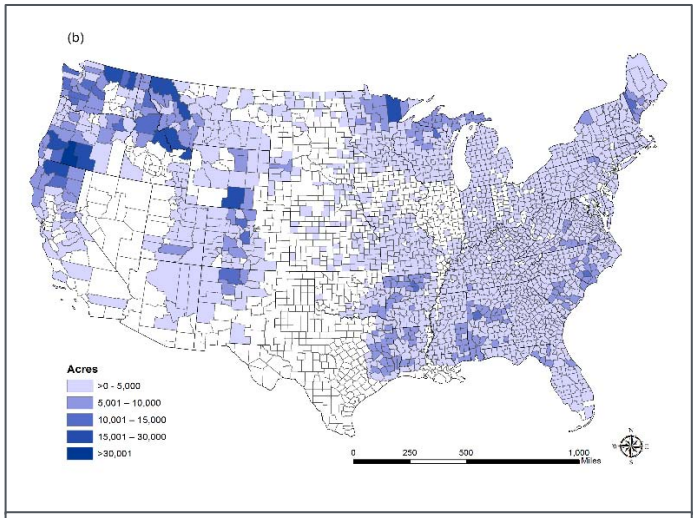
USFS National Hierarchical Framework of Ecological Units (Cleland et al. 2007)

Results – conterminous United States

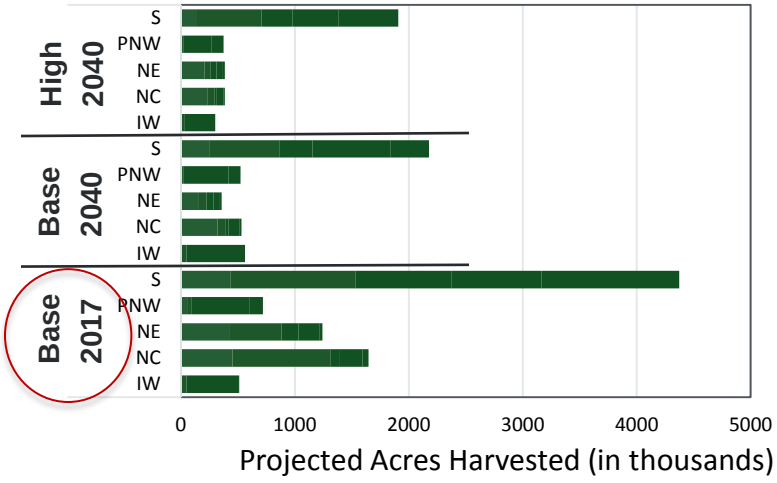
2017

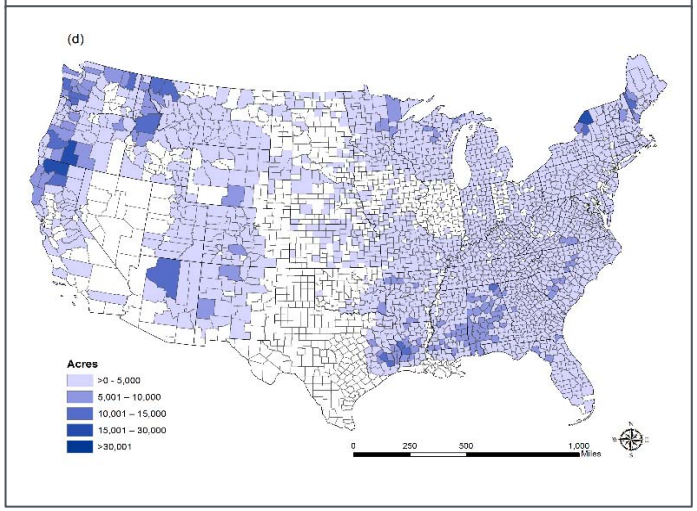
2040





Baseline





High-yield

Case study: Lungless Salamanders - Bioindicators

Number of lungless salamander species

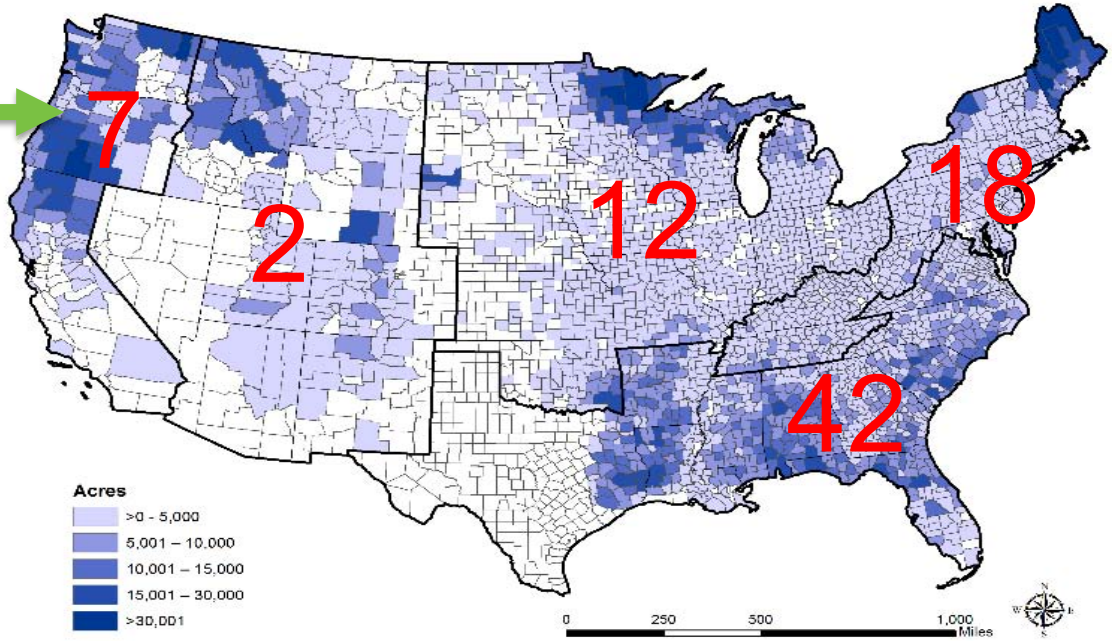
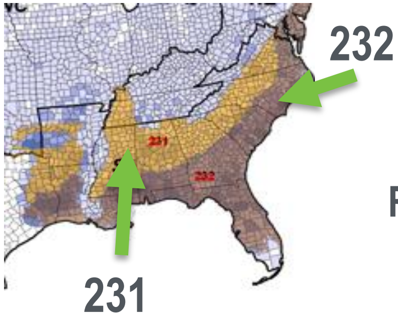


Photo Credits: Erik Wild (left, right), Sara Viernum (center)

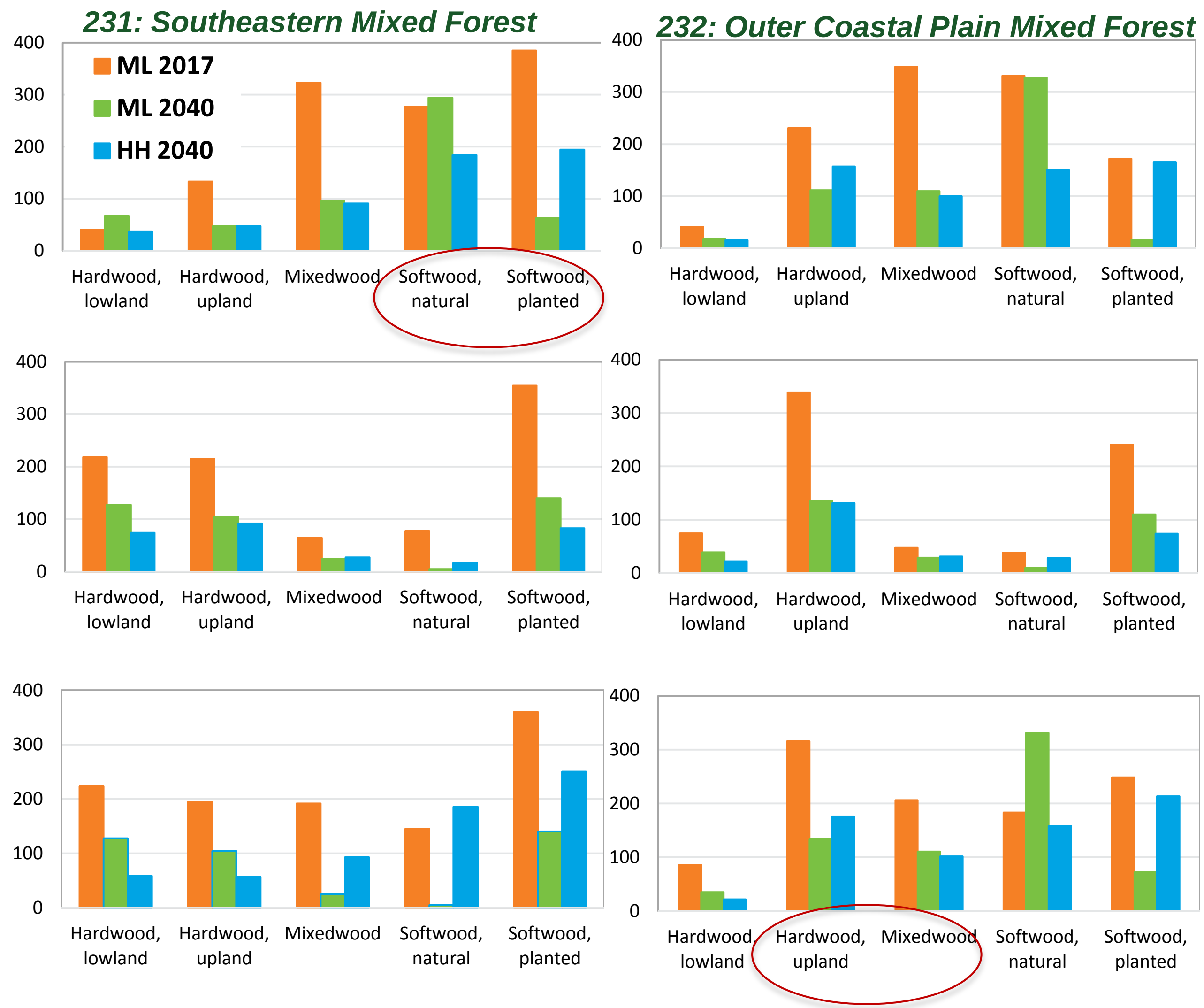
Results – Southern Region



Logging Residues

Whole-tree Biomass

Young Forests



Case Study: Gopher Tortoise – Keystone Species

Photo Credit – Randy Browning/USFWS

Results – Brief Summary Other Regions

- North Central Region
  - logging residues from lowland and upland hardwoods
  - Case studies: American Marten – species of cultural importance, Golden-winged warbler – species of concern

- Northeast Region
  - Whole-tree biomass from lowland and upland hardwoods and natural softwoods under baseline (ML) 2017
  - Logging residues lowland hardwoods and natural softwoods under 2040 scenarios.
  - Case studies: American woodcock – recreational species, Canada Lynx – rare native

Results – Brief Summary Other Regions

- Pacific Northwest Region
  - Natural softwoods whole-tree harvests baseline 2017; logging residues 2040 scenarios
  - Young forests dominated under all scenarios
  - Case study: Northern flying squirrel – keystone species

- Inland West Region
  - Lowest potential total acres harvested for woody biomass
  - Whole-tree biomass from lowland hardwoods and natural softwoods under all scenarios

Key Findings

- Regional variation in available woody biomass potential; Southern Region contains nearly half
  - Depends on forest types sourcing feedstock
- Impact to biodiversity? ***It depends***
  - Potential changes beneficial for some species, while negative for others
- Impacts must be assessed within context of broader processes
  - Loss of forest cover, economics, urbanization, and fire risk
- By describing potential biomass production regionally, results can be **used in conjunction with finer-scale biodiversity assessments**
  - State Wildlife Action plans to identify species that may be vulnerable to expected changes

Recommendations for Future Research

- **Conduct more manipulative studies that vary amounts of coarse and fine woody materials retained across gradients in forest cover and forest types**
  - *Help determine when the responses are due to forest-harvest treatment itself or the additive effect of removing dead and downed wood.*

- **Continue established studies over longer time periods to better understand the effects of wood biomass removal after second- and third-rotation harvests**
  - *Outstanding questions remain on critical threshold amounts across a variety of forest types and regions to help determine resilience of forest systems to potential harvest intensification.*

Next Steps – simulating base landscape

- Maine chosen for initial landscape.
- Spatial distribution of lands identified as potential source of biomass feedstock (green) given ForSEAM assumptions
- Cumulative effects: only 5% of each of the 3 POLYSIS regions would be harvested in any one year.
- Initial results show acreage estimates were within 1% of ForSEAM estimates.
- Case species – early succession species