



**Velocys Bayou Fuels**  
**tcbiomass, April 20<sup>th</sup> 2022**

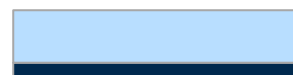
# Bayou Fuels: Waste Wood to Sustainable Aviation Fuel

# Decarbonizing air travel requires cellulosic SAF

World Economic Forum/ McKinsey study<sup>1</sup>

## 1<sup>st</sup> Generation (HEFA<sup>2</sup>)

- In production today
- Lowest cost but...
- Limited sustainable feedstock supply
- Feedstock sufficient for 7-26 billion gallons SAF (5-20% of 2030 jet demand)



Waste and vegetable oils

## 2<sup>nd</sup> Generation (mainly Gasification/Fischer-Tropsch and Alcohol-to-Jet)

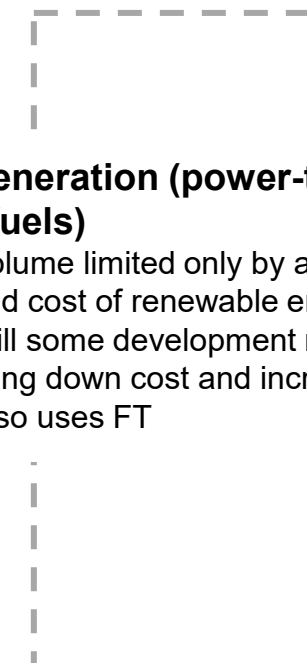
- First plants under construction
- Feedstocks include Municipal Solid Waste, woody biomass, crop residues
- Feedstock sufficient for 90-132 billion gallons SAF (67-98% of 2030 jet demand)



Solid feedstocks

## 3<sup>rd</sup> Generation (power-to-liquids or e-fuels)

- Volume limited only by availability and cost of renewable energy
- Still some development needed to bring down cost and increase scale
- Also uses FT



CO2 & renewable energy

■ Wastes ■ Cover crops ■ Atmosphere

<sup>1</sup> <https://www.weforum.org/reports/clean-skies-for-tomorrow-sustainable-aviation-fuels-as-a-pathway-to-net-zero-aviation>

<sup>2</sup> Hydrogenated Esters and Fatty Acids



# Woody Biomass Potential

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\*On behalf of many (see contributors slide)

ABFA  
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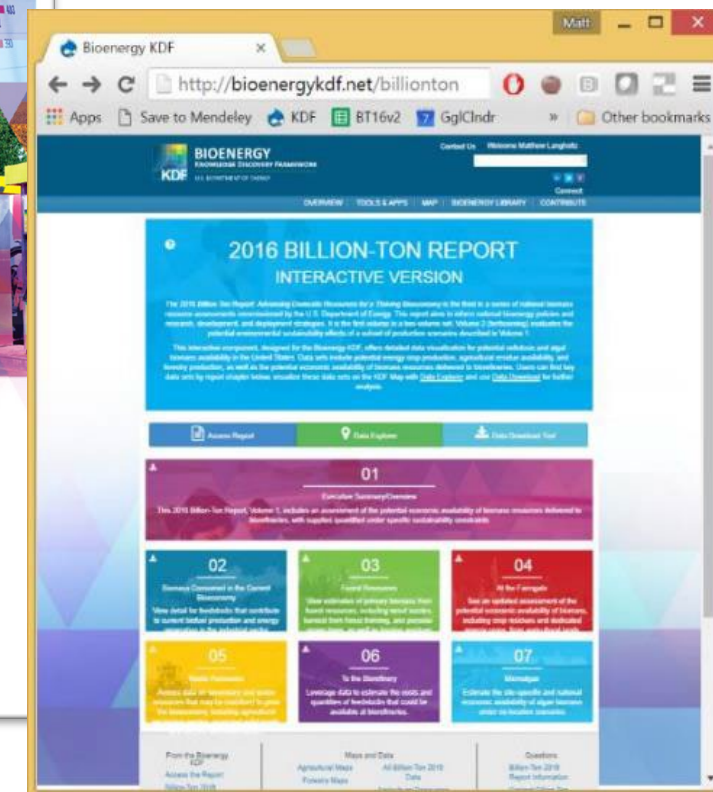
# Biomass Supply and BECCS Analysis



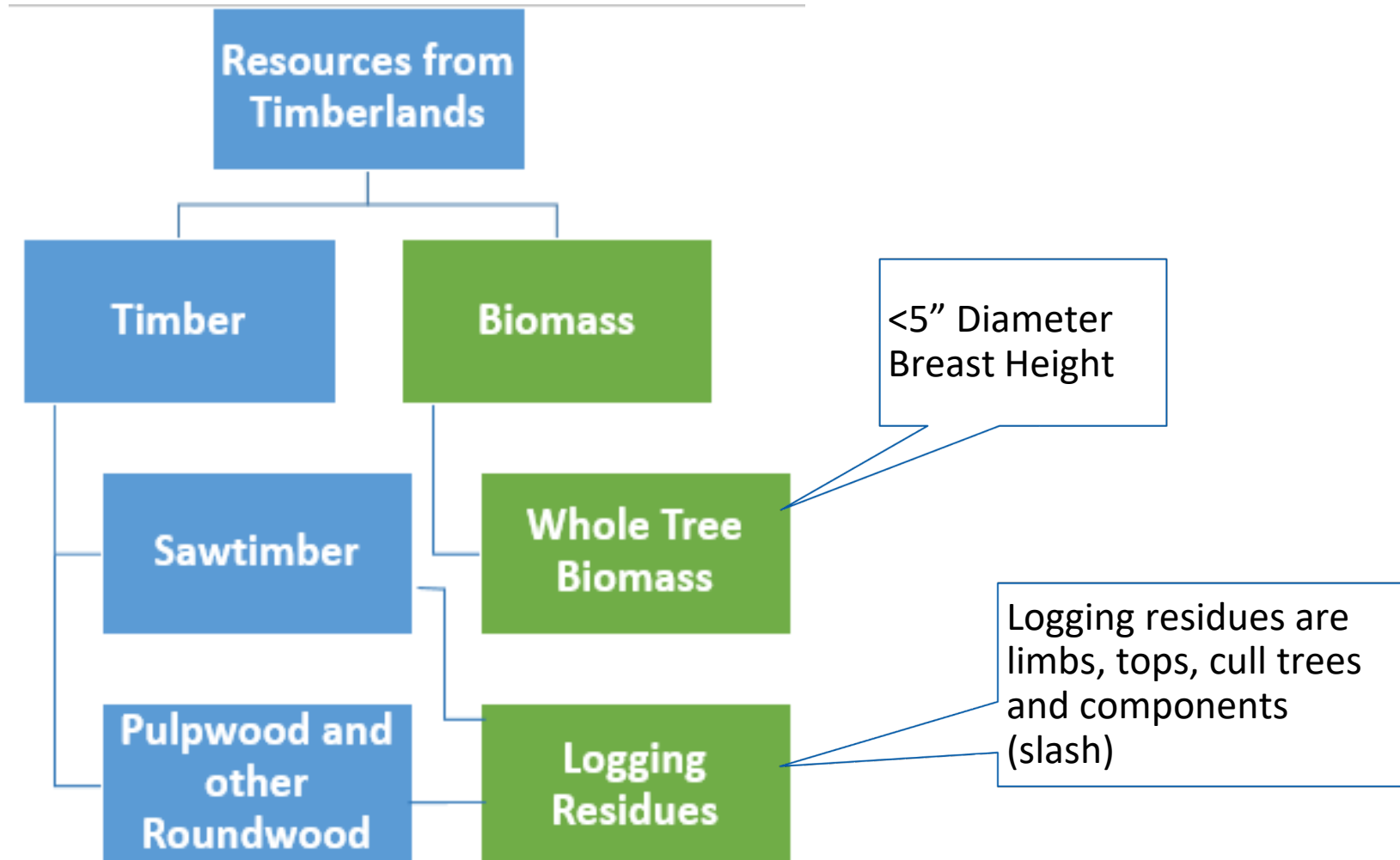
Article

## The Economic Accessibility of CO<sub>2</sub> Sequestration through Bioenergy with Carbon Capture and Storage (BECCS) in the US

Matthew Langholtz <sup>1,\*</sup>, Ingrid Busch <sup>2</sup>, Abishek Kasturi <sup>3</sup>, Michael R. Hilliard <sup>2</sup>, Joanna McFarlane <sup>4</sup>, Costas Tsouris <sup>5</sup>, Srijib Mukherjee <sup>6</sup>, Olufemi A. Omitaomu <sup>7</sup>, Susan M. Kotikot <sup>8</sup>, Melissa R. Allen-Dumas <sup>9</sup>, Christopher R. DeRolph <sup>10</sup>, Maggie R. Davis <sup>11</sup> and Esther S. Parish <sup>1</sup>



# Forest Resources Scope



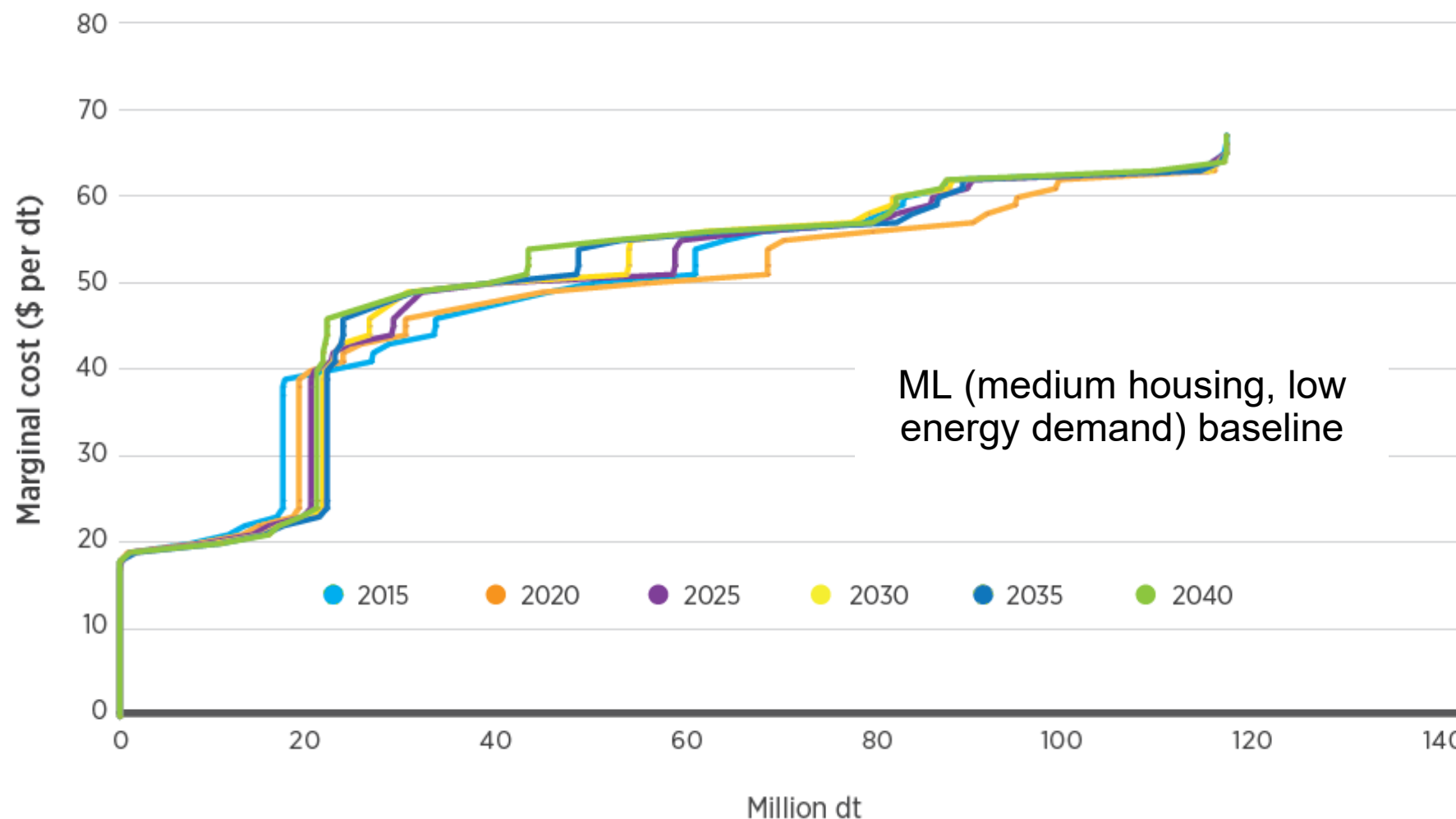
## Forestry resources, near-term\* (>100 million dry tons/year)

- **Sources**
  - Logging residues
  - Small-diameter trees (<13 cm DBH)
- **Benefits**
  - Reduced fire risk
  - Improved stand health
  - Improved profitability
  - Established forest industry
- **Constraints**
- **Removals < growth**
  - ~0.5% of forest inventory (USDA 2014)
  - Standard forest Best Management Practices



Photo source: US Forest Service

# Woody biomass has attractive cost structure for biorefineries



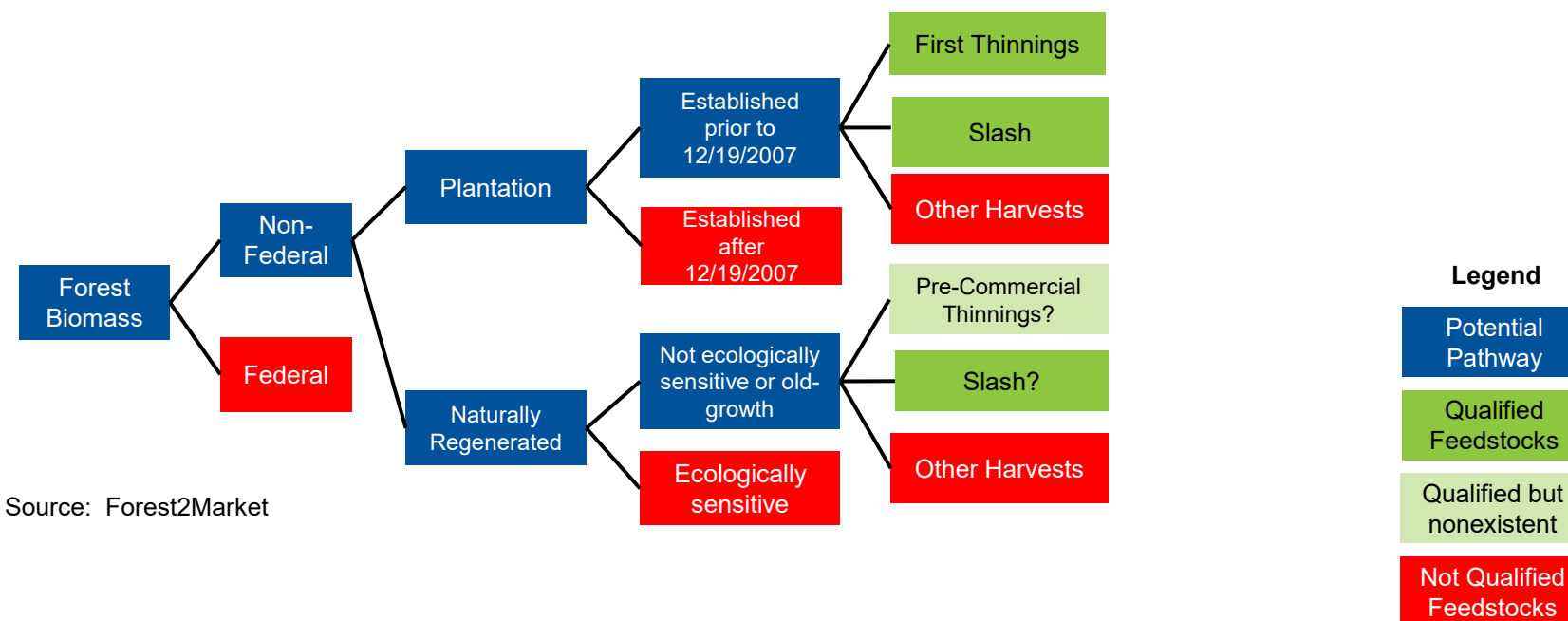


## Good news

- **Sufficient low value woody biomass being generated sustainably to support ~200 SAF biorefineries in the US**
  - Over 4BGY SAF potential
  - These biorefineries would not compete lumber production or other key markets
  - Feedstock production costs are acceptable and fairly stable

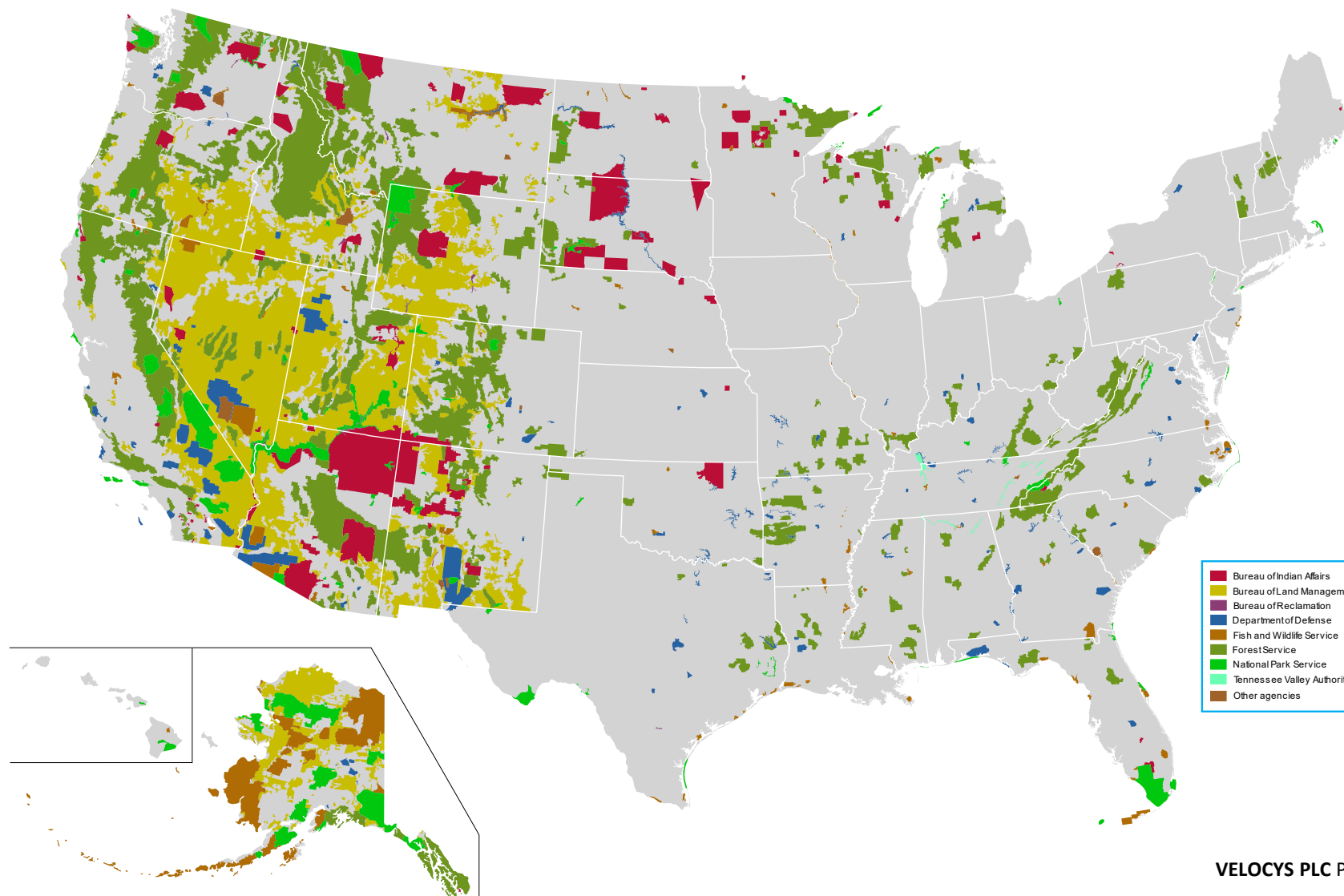
# RIN Regulations greatly limit the amount of woody biomass that can be utilized

- RINs are essential to biorefinery economics. To secure RINs, the facility must use qualified feedstocks, convert them through a qualified process, and produce qualified fuels.
- The RFS definition of qualified feedstock is much more restrictive than any of the existing standards for sustainable forestry.

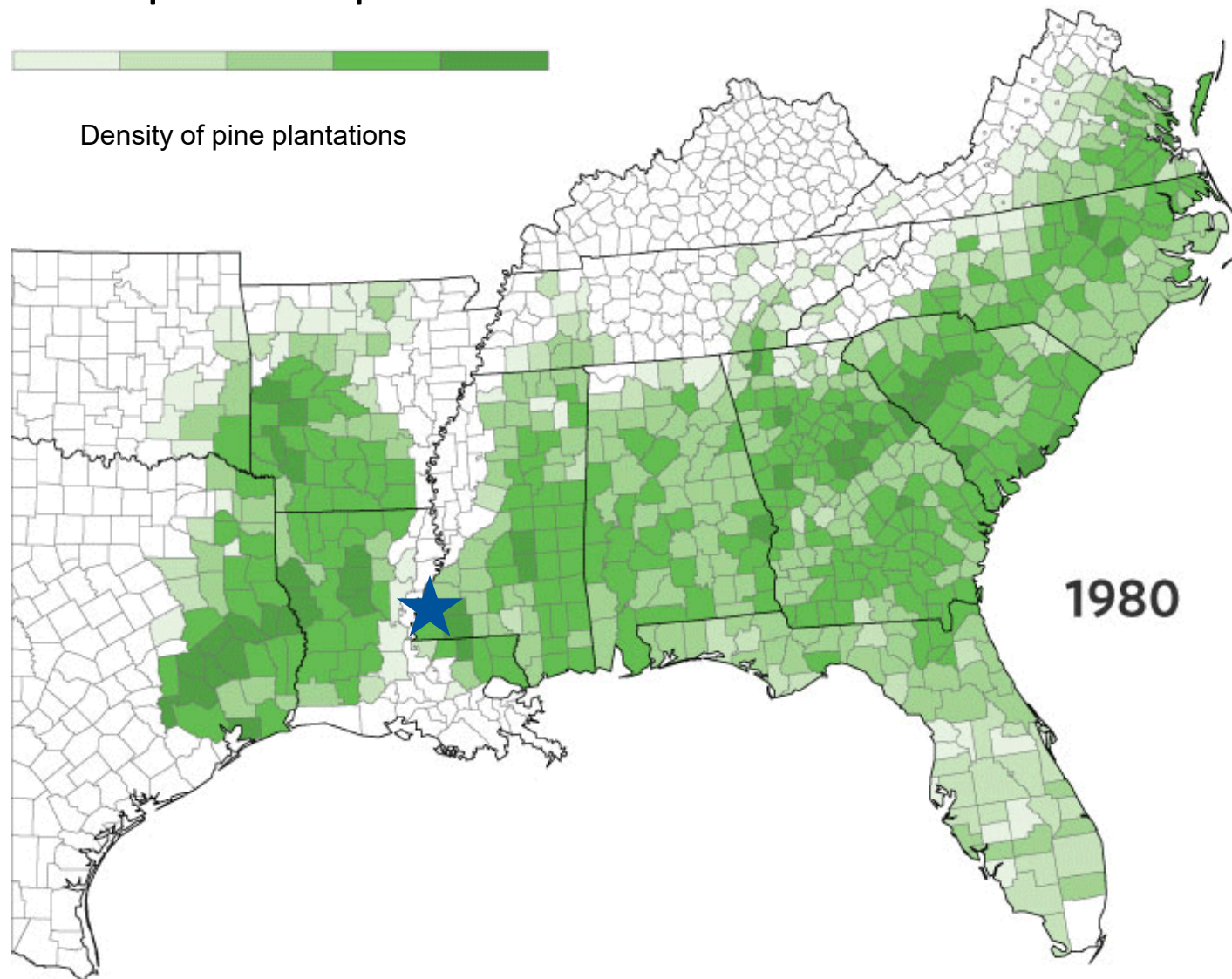


Source: Forest2Market

# Federal lands represent a large portion of Western US lands



# Southeast US has ample RFS-qualified feedstock

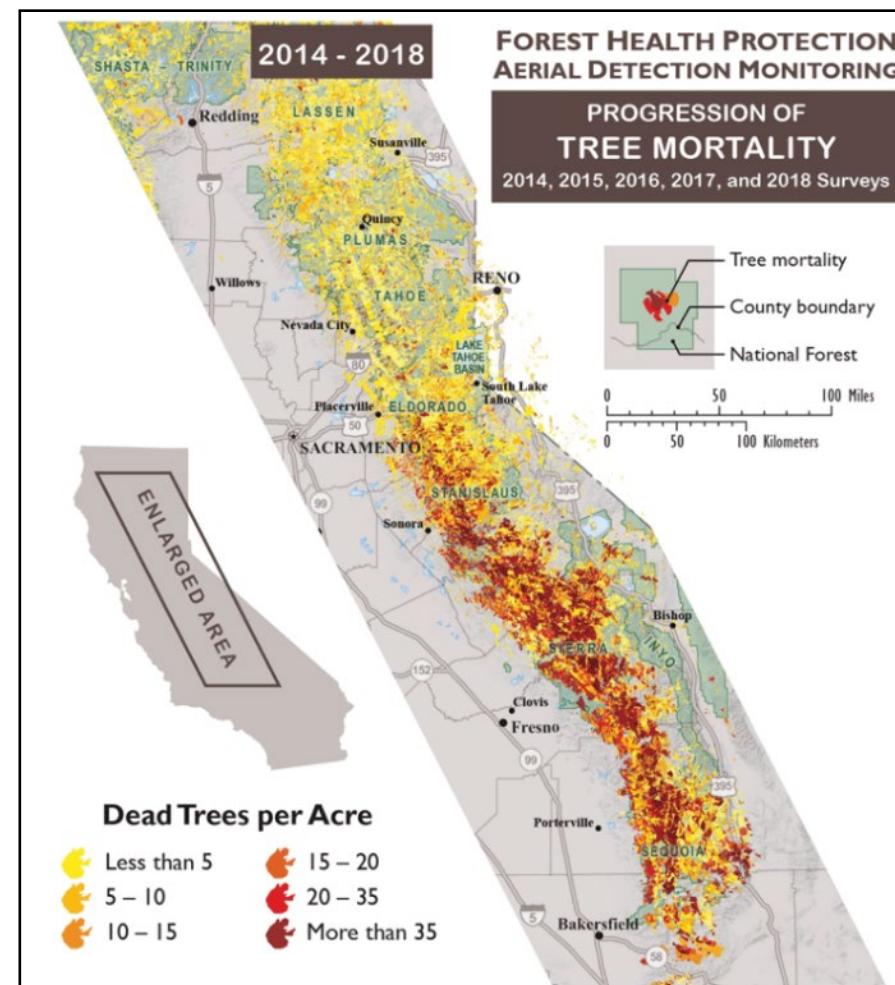


## Real example of regulatory constraints



# 149 Million Reasons to Change RFS Policy

- California has 149 million dead trees and this inventory is growing at an accelerating pace
- Enough biomass to feed a few biorefineries
- However, the RFS excludes all woody biomass from federal lands, including dead trees.
- Despite the large and increasing supply of dead pine in California and other Western states, biorefinery development is constrained by this limitation



Source: US Forest Service

## California Woody Biomass Policy Consortium Recommendations

1. Update California State Policy - The California Air Resources Board in concert with CalFire to utilize its existing regulatory authority to modify the Low Carbon Fuel Standard to recognize that the massive release of greenhouse gas and criteria pollutant emissions now resulting from California wildfires, prescribed burns, and citizen open burning, and to take action to reduce those emissions by providing avoided GHG emission credits within the CA-GREET model for fuels produced from qualifying woody biomass gathered from areas at risk of wildfire and open burn areas.
2. Support Improved Federal Policy - The U.S. Environmental Protection Agency (EPA) to utilize its existing regulatory authority to modify the Renewable Fuel Standard (RFS) to recognize the peril of wildfires in the National Forests of the western U.S., and to take action in concert with the U.S. Forest Service to reduce that peril by authorizing RFS credit generation for fuels produced from qualifying woody biomass gathered from areas at risk of wildfire.
3. Simplify State Permitting - The California Legislature to pass legislation to facilitate state agency coordination and priority review of permits for facilities that produce fuels from qualifying woody biomass.
4. Make Appropriations - The California and federal governments to appropriate matching funds throughout the 2020's totaling one billion dollars to place the industry on track to create demand for 20 million bone dry tons of woody biomass in California by 2030.



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**tcbiomass 2022**

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