Sawmill Energy Use and Emissions in California

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Forest Industry Research Program

- State level harvest & industry analyses
- Logging utilization studies
- West-wide timber product output (TPO) reporting
- Annual & quarterly Montana information
- Annual logging & hauling costs for FS Northern Region
- Other forest economics & timber related projects

California TPO Activities

Mill Surveys

- 2000, 2006, 2012 – published through PNW Station
- **2016 – out for review**
- >1.4 BBF Scribner of timber harvest annually
- >70 active facilities
- >$1.4 Billion in sales
- ~1.9 BBF of lumber

California Logging Utilization: 2004

Todd A. Morgan and Timothy P. Spoelma

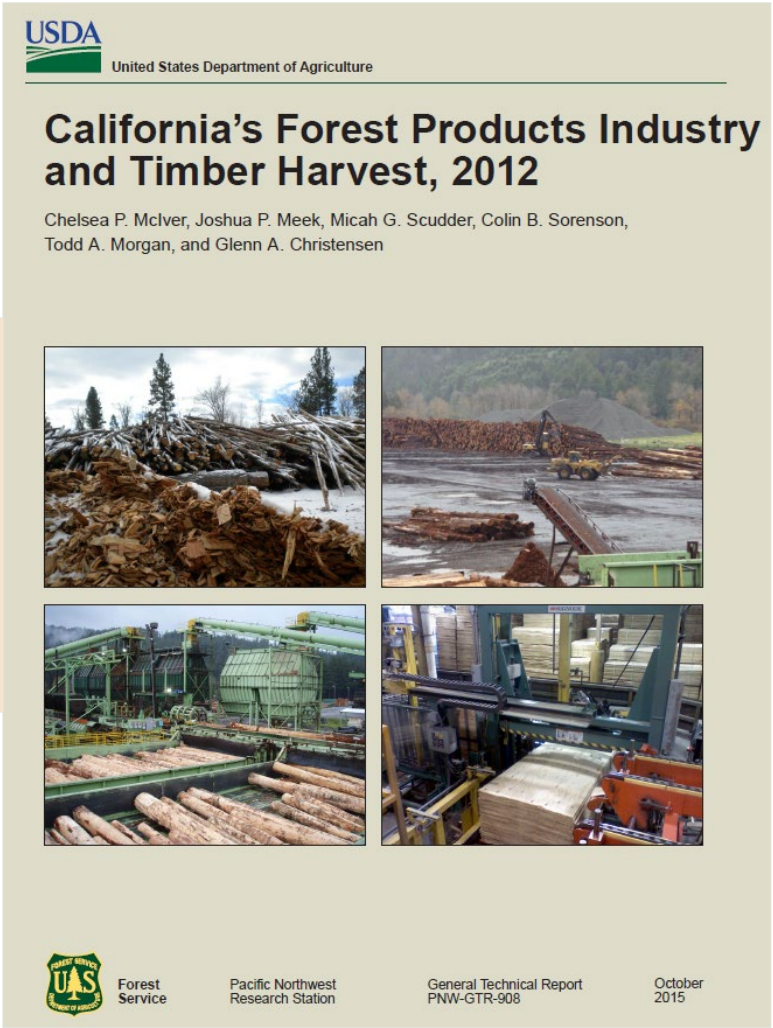
ABSTRACT

A study of logging activities conducted during 2004 provided utilization data and information on timber harvesting operations in California. A nested and stratified sampling scheme was used to produce a sample of felled trees with distributions of geographic area, ownership class, tree species, and tree size representative of California's recent sawlog and veneer log harvest. Results of the study indicated that about 50% of the harvested trees were less than 16.5-in.dbh, but these trees produced just 15% of the volume. About 50% of the harvested volume came from trees less than 24.5-in. dbh, and about two-thirds of the volume was from trees less than 30-in. dbh. Removals factors, quantifying impacts on growing stock, revealed that 1,051.4 ft^3 of growing-stock volume was removed for every thousand cubic feet delivered to mills, with just 61.5 ft^3 left in the forest as logging residue. Periodic reevaluations of logging utilization in California would make it possible to evaluate impacts of technology, market conditions, and policy changes on logging operations and utilization factors in the state.

Keywords: growing-stock removals, logging residue, removals factors, timber harvest

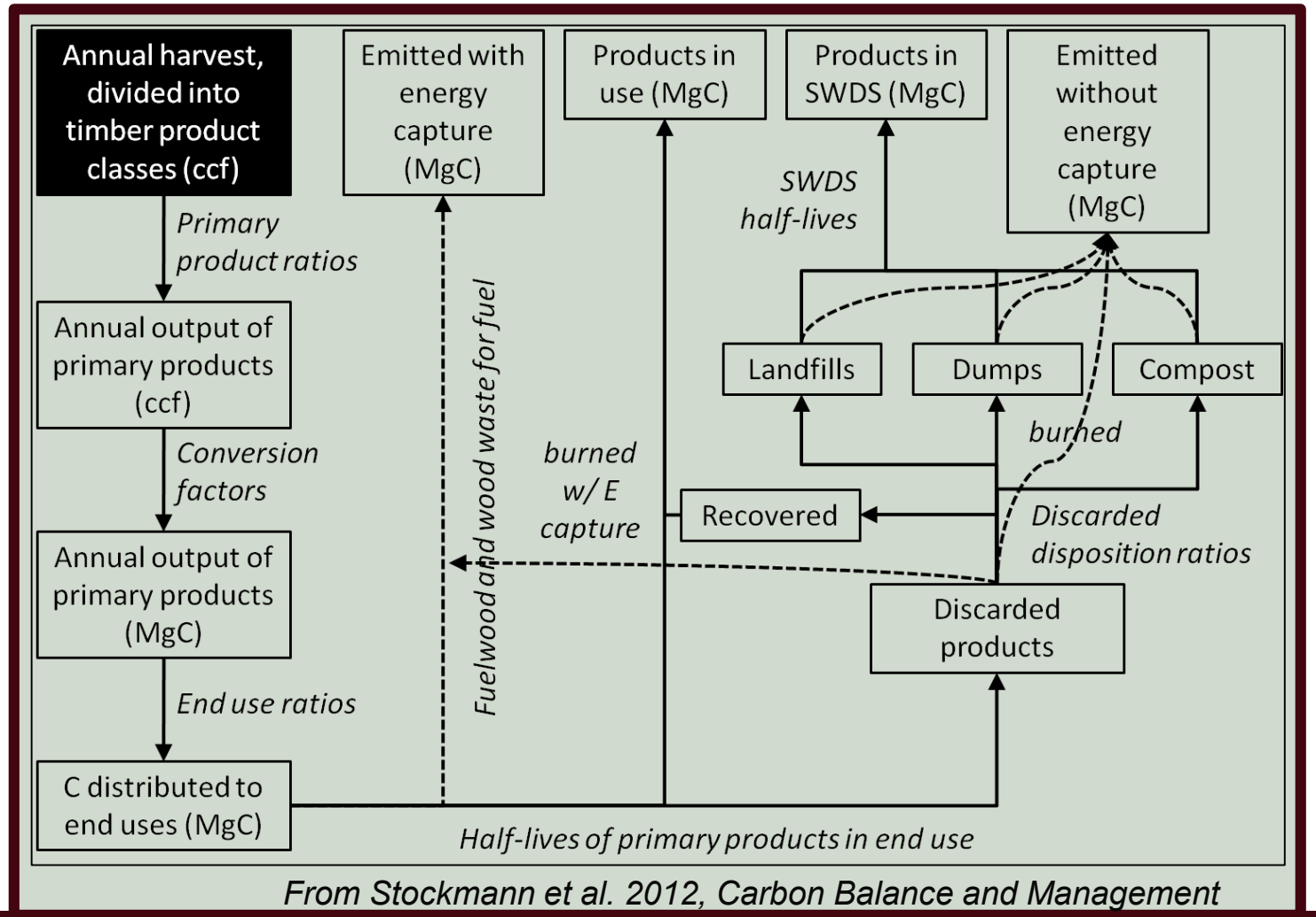
Logging Residue

- 2004 study published in WJAF
- **Ongoing 2018-2021 data collection**
- Dead tree analysis for CalFire



Harvested Wood Products (HWP) Carbon Storage

- Carbon storage estimates for HWP from California forests
- Use IPCC production accounting approach to quantify carbon storage
- 1) timber harvest time series 2) timber products info 3) primary products info
- Oregon and Washington, and …



From Stockmann et al. 2012, Carbon Balance and Management 7:1.

Introduction

- **Sawmills account for ~½ of US wood products energy demand (EIA 2013)**
- **Wood & bark residuals are common sources of energy for mills**
- **65% of wood product industry energy from wood bioenergy (EPA 2007)**
- **58% of energy for softwood lumber from wood bioenergy (AWC 2013)**

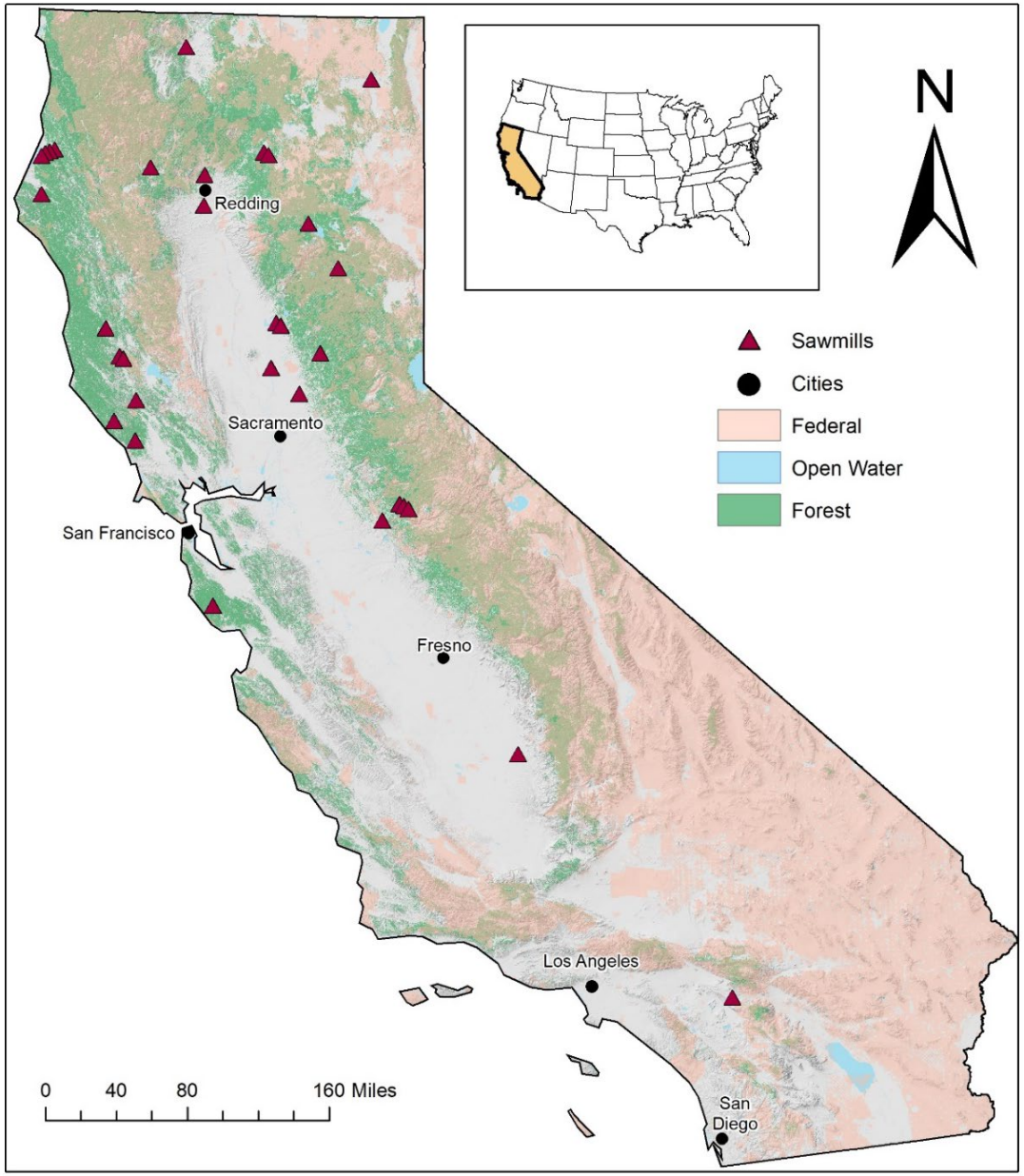
California:

31.7 million acres of forest

**80 active timber processors,
32 sawmills (2016)**

>1.5 billion board feet Scribner of harvest (2016)

>80% of harvest used by sawmills



Methods

- **TPO mill census (2016)**
- **Sawmill energy consumption questionnaire**
- **Logging utilization/residue info**
- **Energy contents & emission factors**

Methods

On-site energy consumption questionnaire

- **Fuels used for equipment**
- **Non-electric heat & steam**
- **Electricity – grid vs. on-site**
- **Renewable vs. non-renewable**

Methods

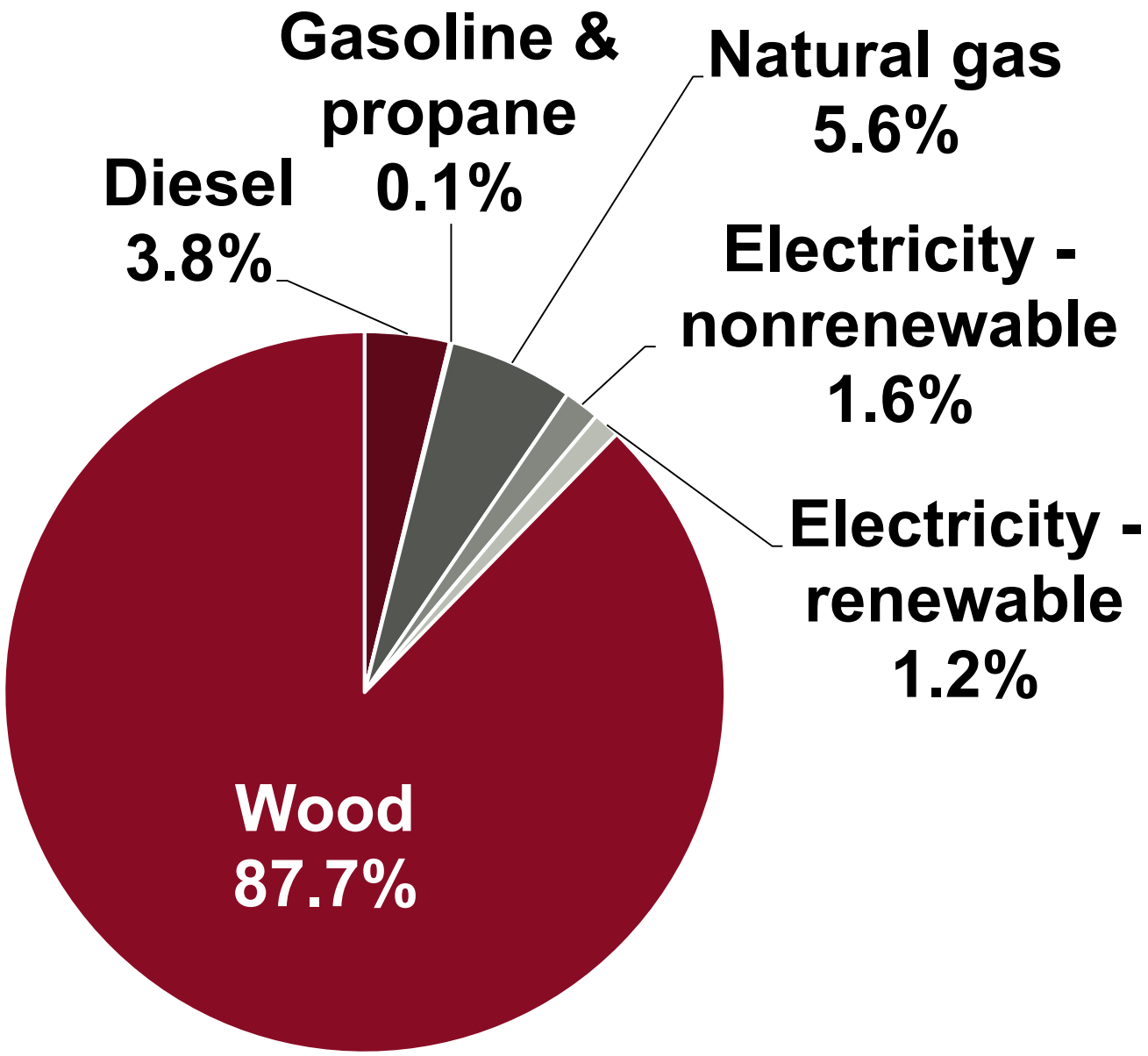
Mill-level estimates

- **Electrical utility portfolios of fuels**
- **Energy contents & emissions**
  - **BTU per unit of fuel**
  - **Pounds of CO2, CH4, NOX, SOX, PM10**
- **Logging utilization/residue info**
  - **~ 2 tons per MBF Scribner**

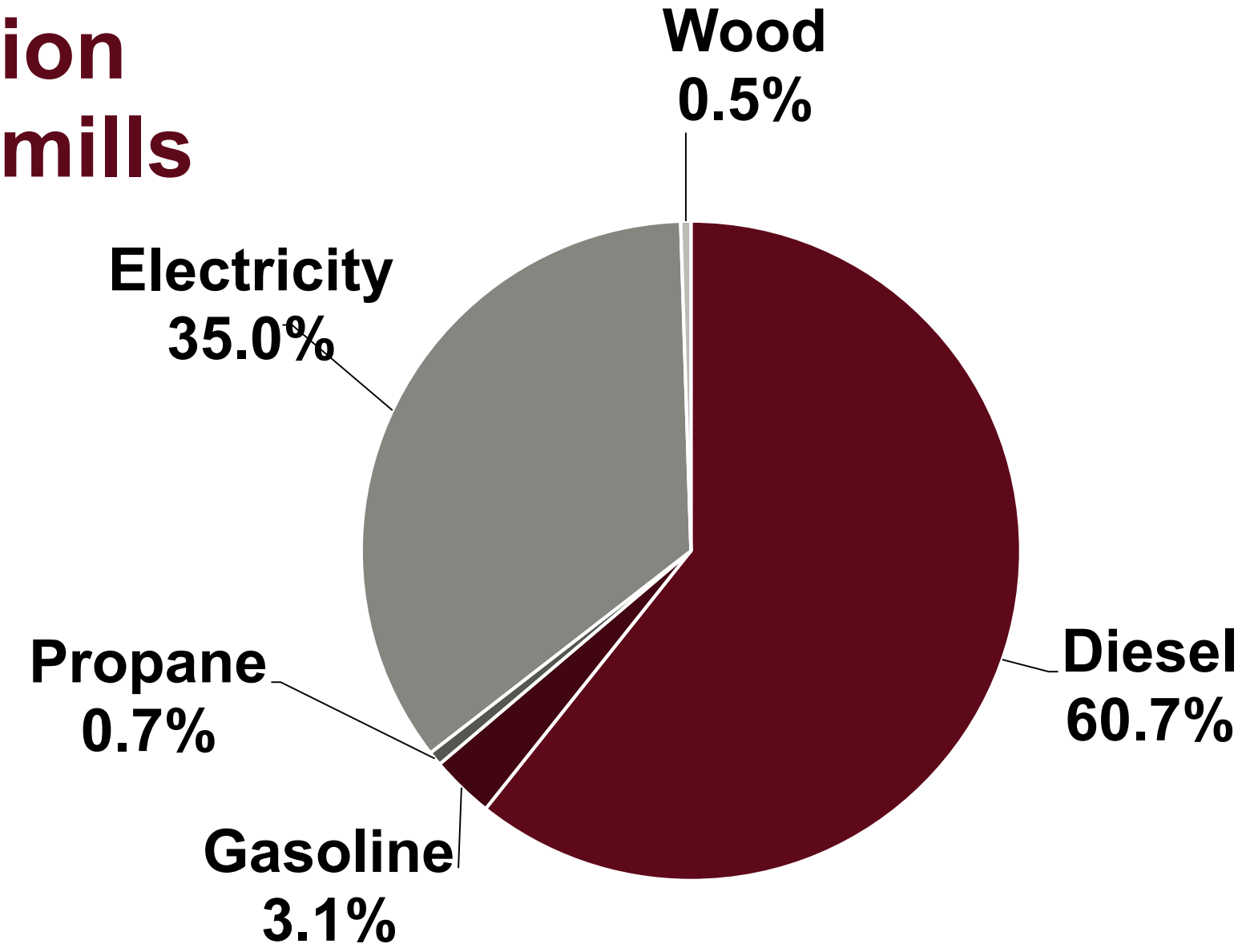
Results

- **16 of 32 sawmills provided energy info**
- **Accounted for 92% of CA 2016 lumber production**
- **Used 1,120 MMBF Scribner of timber**
- **All mills used diesel fuel and electricity**
- **8 mills burned wood for heat & steam and used electricity generated on-site**

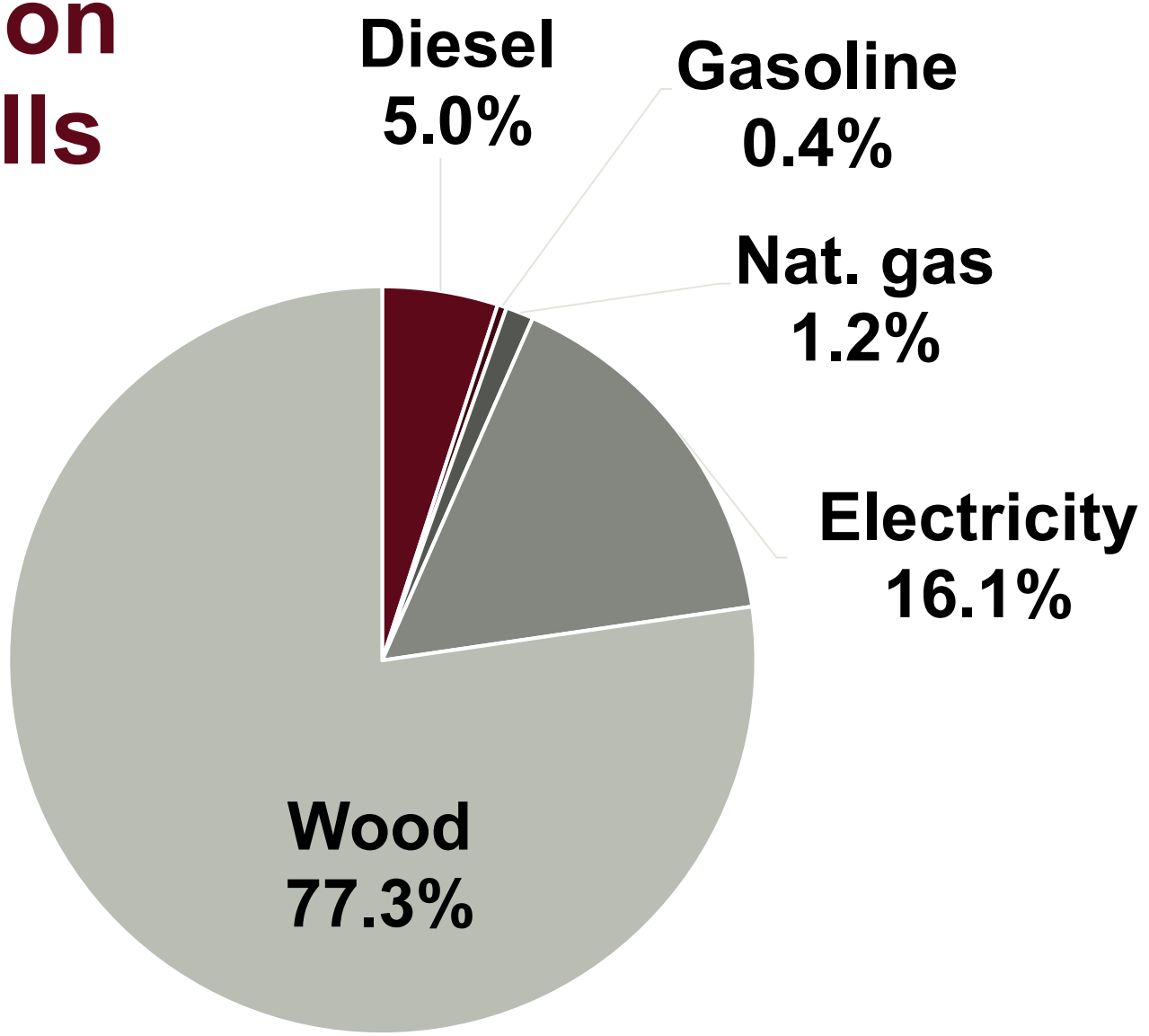
Energy consumption of California sawmills



Energy consumption of Southwest sawmills



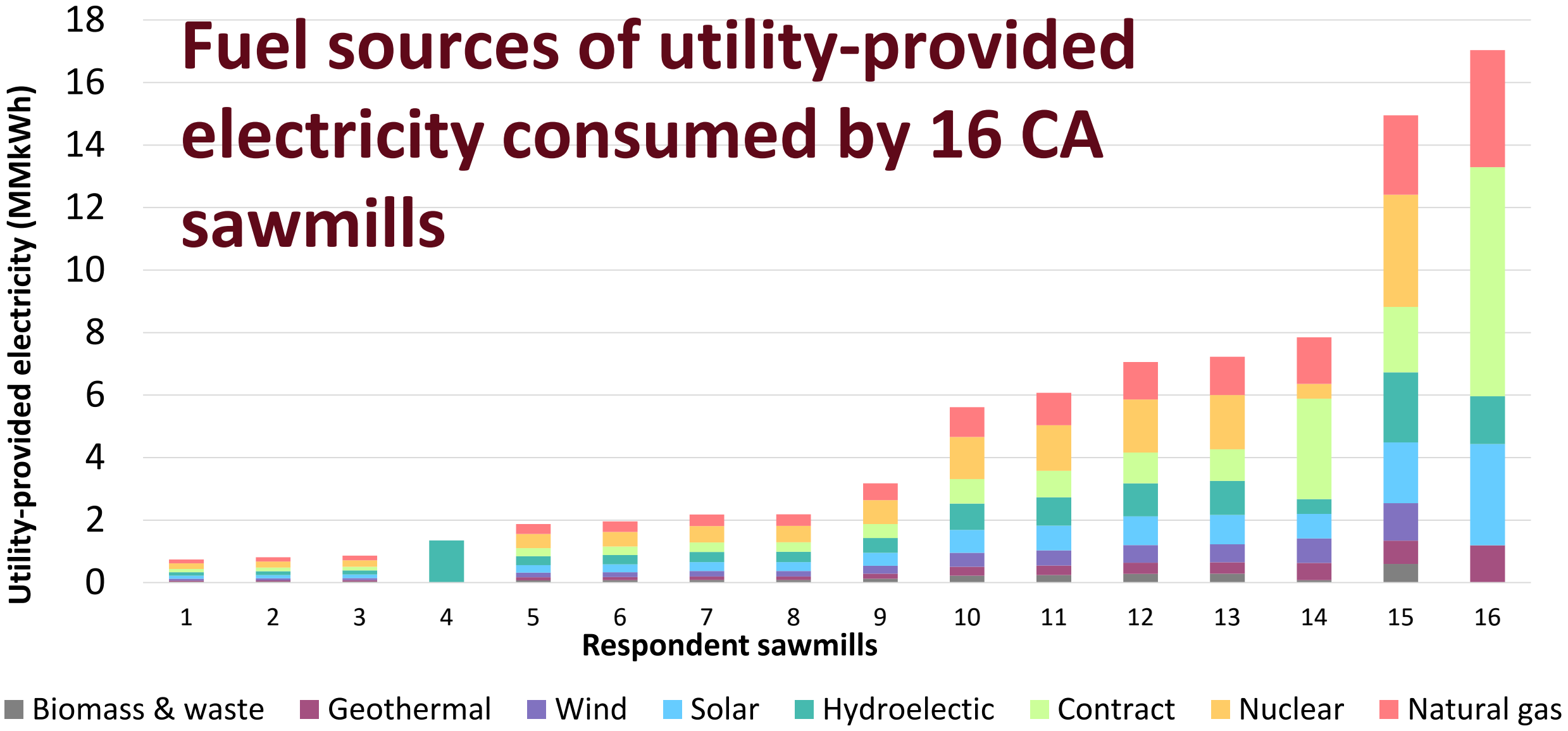
Energy consumption of Montana sawmills



On-site energy consumption MMBtu per MMBF of lumber

Fuel	California	Southwest	Montana
Diesel	**202**	673	192
Gasoline	**4**	35	16
Propane	**2**	8	8
Natural gas	**297**	n/a	39
Electricity	**148**	387	616
Wood & bark	**4,615**	5	2,958
Total	**5,267**	1,108	3,829

Fuel sources of utility-provided electricity consumed by 16 CA sawmills



Why do Southwest sawmills have such relatively low energy use per MBF and such high proportions of non-renewable energy?

- **Most don't operate dry kilns**
- **Don't use mill residue for on-site energy**
- **Electricity mostly from non-renewables**

Estimated emissions from on-site energy consumption by CA sawmills, 2016

Emissions	Total tons	Pounds per MBF
CO2	909,099	976
PM10	380	0.4
CH4	88	0.1
NOX	2,990	3.2
SOX	163	0.2

Estimated CO_2 emissions from on-site energy consumption by CA sawmills, 2016

- Wood approx. 92% of surveyed sawmill CO_2 emissions; fossil fuels approx. 8%
- 2017 Forest Ecosystem and HWP Carbon Sequestration rate = 27.9 MMT CO_2 /yr
- Wood emissions approx. 2.7% of total CO_2 sequestered by forests; fossil fuel emissions approx. 0.2%

- **~906,985 BDT of logging residue associated with timber used by mills**
- **Emissions *if* all this residue is burned**

Emissions	Tons
CO2	986,451
PM10	3,741
CH4	3,437
NOX	1,764
SOX	1,066

Total on-site energy use per MBF of lumber

1.1 MMBtu per MBF = Southwest ave (2012)

3.8 MMBtu per MBF = Montana ave (2009)

5.3 MMBtu per MBF = California ave (2016)

3.1 to 7.6 MMBtu per MBF = National ave (2014, 2010)

Key Points

Regional/state differences are important.

California sawmills:

- **Have relatively high energy use per MBF of lumber**
- **Most sawmill energy is from renewables (i.e., wood)!**
- **Not all mills operate dry kilns, not all kilns are wood-fueled.**

Key Points

- **Wood is the major emissions source: 92% of total emissions, 87% of total energy.**
- **Substantial logging residue is associated with the timber used by mills.**
- **Emissions from burning slash could be reduced with more biomass utilization.**
- **CA electricity portfolio ~35% renewables.**

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