

Woody Biomass Resources and Opportunities in West Virginia

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Outline

- WV Forests and Forest Products Industry
- Logging and mill residues, the available resources & distribution as well as supply & demand of wood residues in West Virginia
- Biomass processing, harvesting technologies
- Biomass utilization opportunities, and potential biomass projects

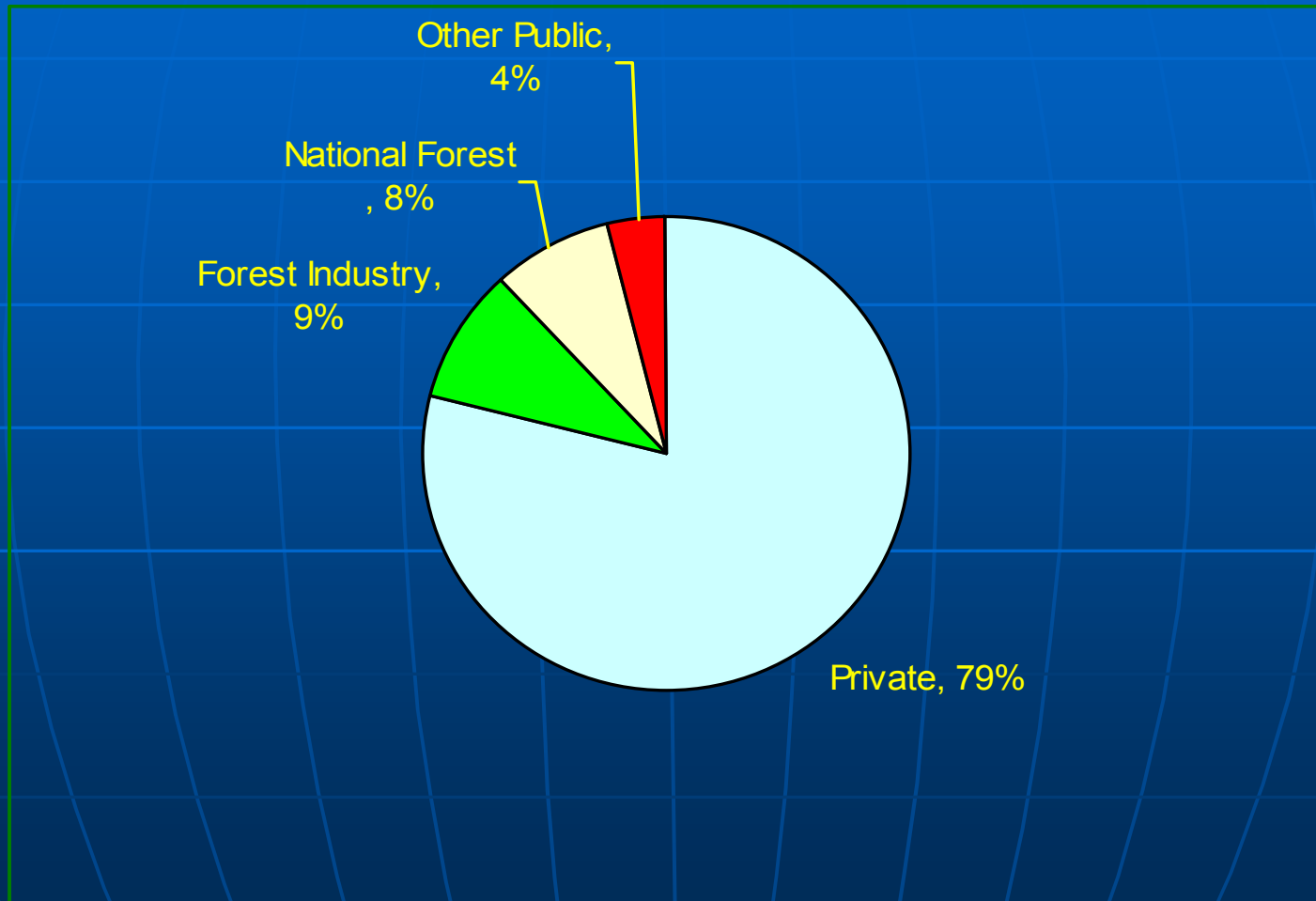
West Virginia's Forests

- Sustainable forestry (USDA Forest Service)
 - 7 million more acres of forestland than it did in 1910
 - 18 billion BF of sawtimber in 1949 to 76 billion BF in 1995
- 12 million acres of forestland or 78% of the State
- Ranks third in the nation (by %), behind Maine and New Hampshire
- 260,000 landowners
- Are at least 94% hardwood species including maple, oak, yellow-poplar, ...

(Source: USDA 2000, Griffith and Widmann 2003)

WV Timberland Ownership

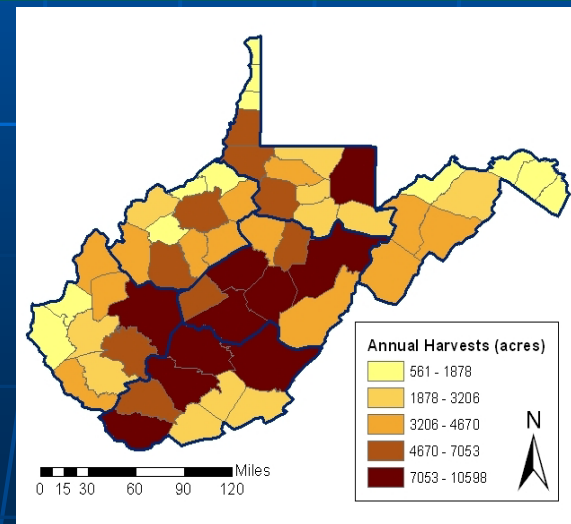
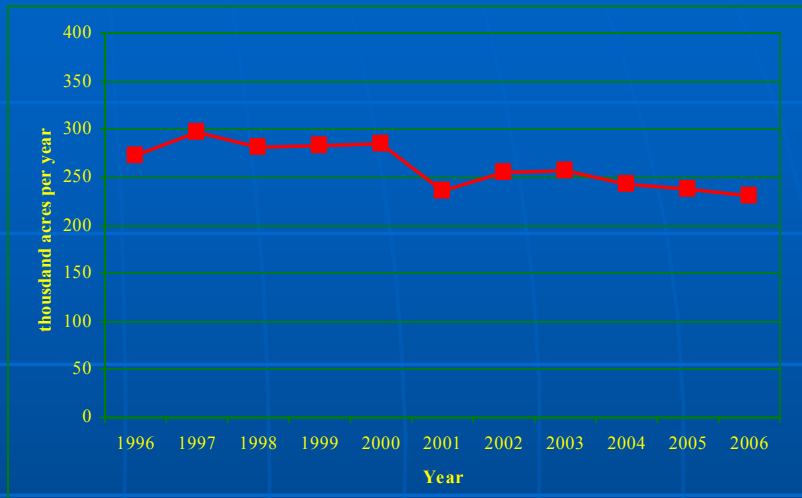
(% of total acres)



Forest Industry

Timber Harvesting

- 1000+ licensed loggers
- About 400 active logging firms
- Average crew size is 4 persons
- A crew operates on an average of 2.2 harvest sites per year
- Each site averaging 89.34 acres
- Average crew production is 633,833 bf
- 6000 bf per harvested acre
- Oak and yellow-poplar 68.9% of sawtimber

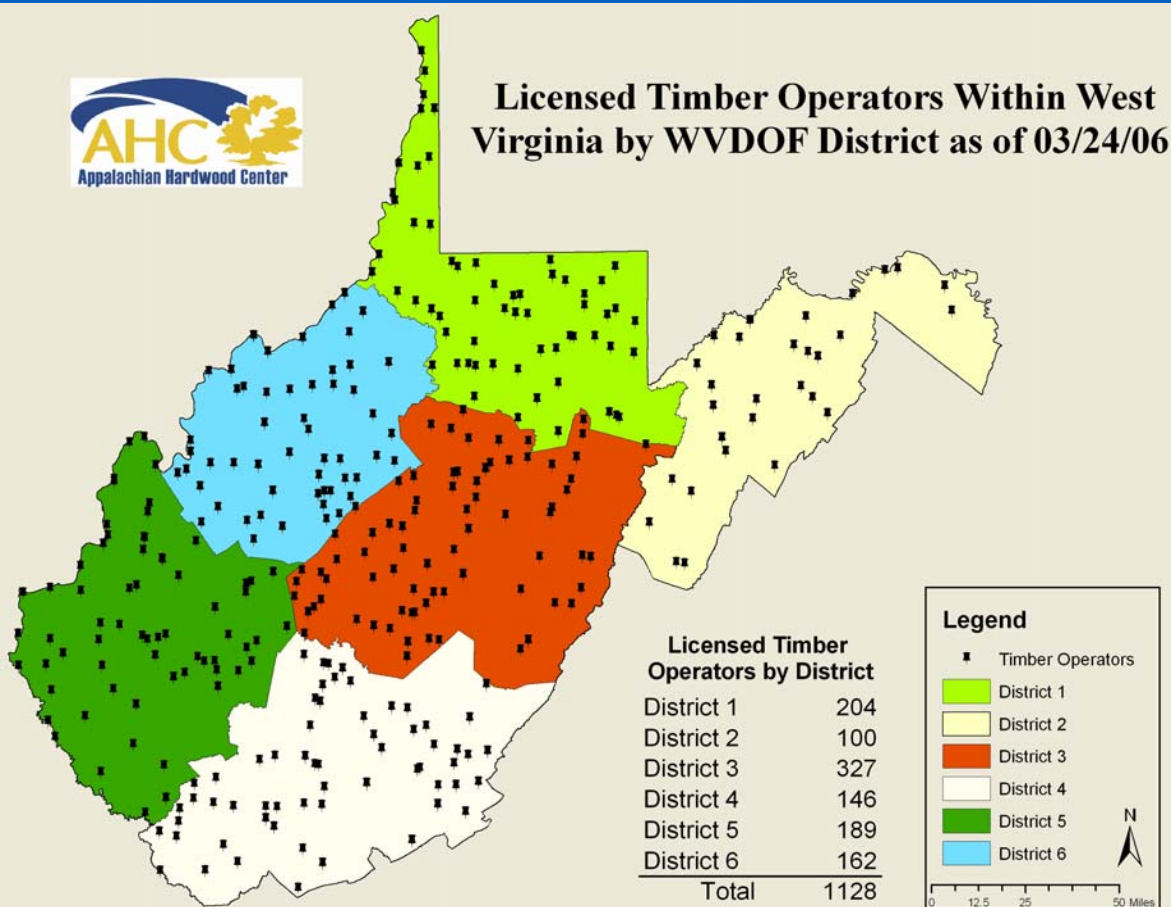


Forest Industry (Cont'd)

Timber Harvesting



Licensed Timber Operators Within West Virginia by WVDOF District as of 03/24/06



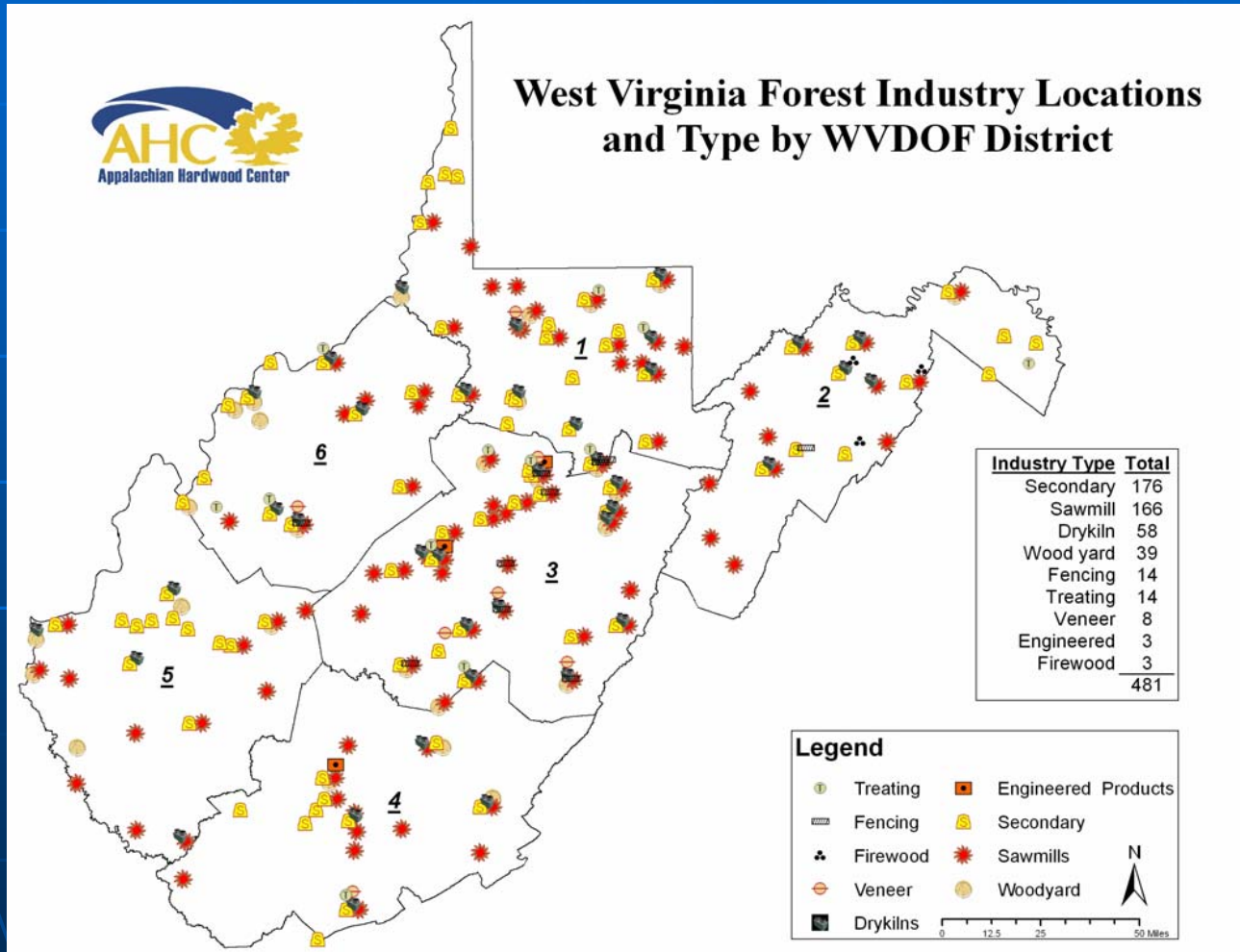
- Diameter limit 46%
- Selective cut 44%
- Clearcut 7%
- Not specified 3%

Forest Industry

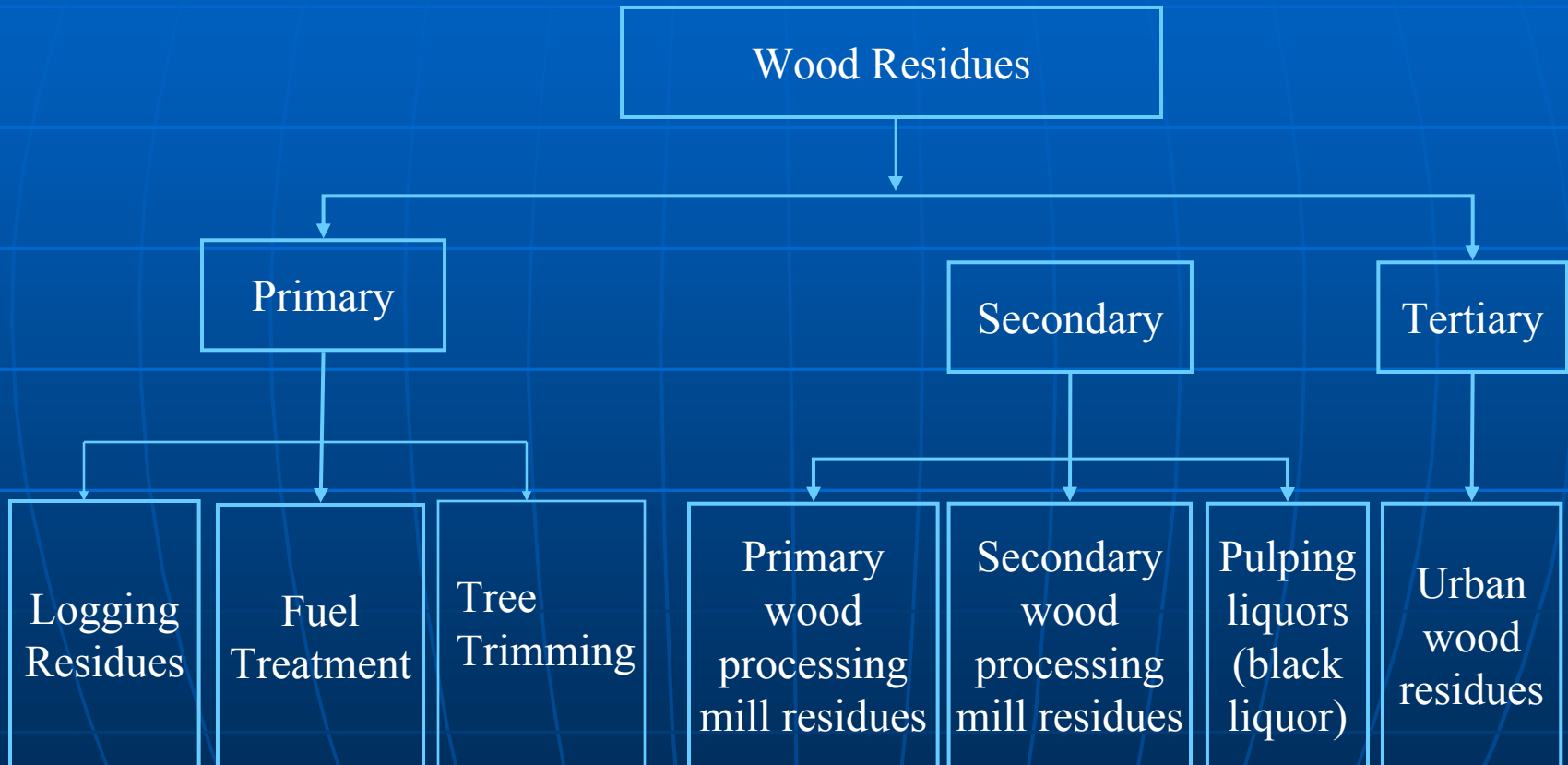
- WV has some of the most stringent forestry & logging regulations, such as LSCA
- Over 30,000 people in WV are employed in forest industries
- The only natural resource industry present in all 55 WV counties
- Forestry contributes \$4 billion annually to the WV economy
- WV sawmills annually produce 700 to 800 million BF

(Source: Childs 2005, WVDOF 2005)

Forest Industry (Cont'd)



Wood Residues



Logging Residue

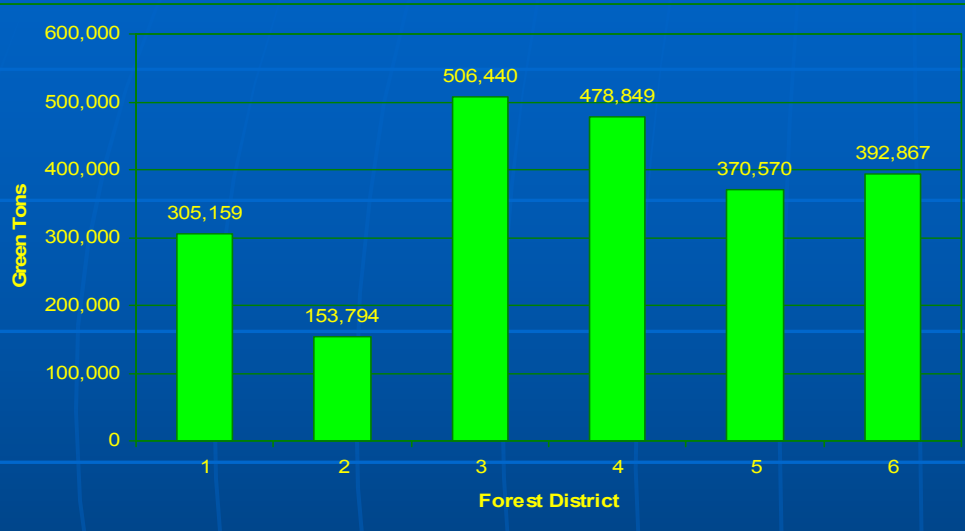
- Two surveys
 - 1995 and 2002
 - Appalachian Hardwood Center (AHC) at WVU
- Survey methods
 - Line intersect sampling (C.E. Van Wagner 1968)
- Assumptions
 - Residue pieces are cylindrical
 - Residue pieces are horizontal
 - Residue pieces are randomly oriented

Logging Residue

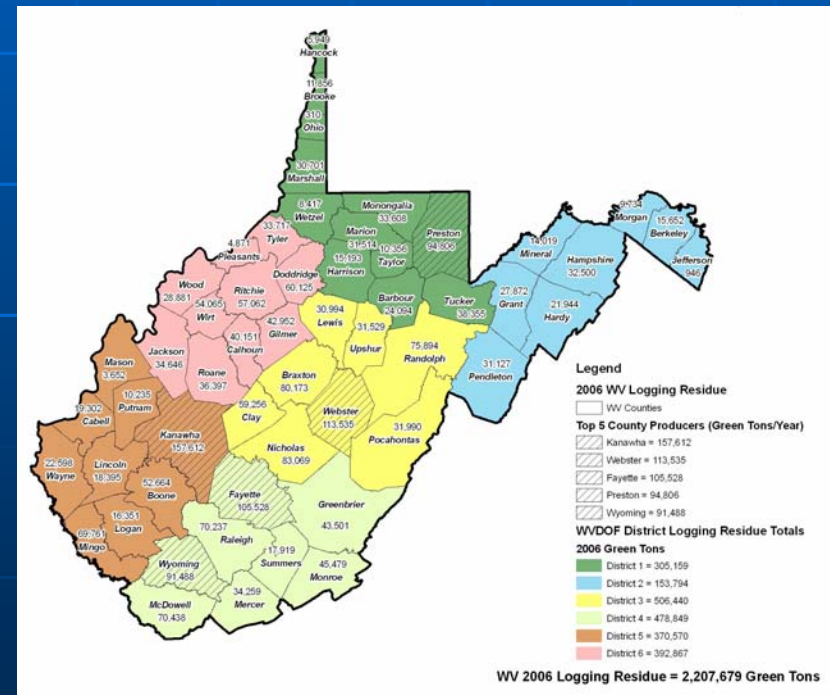
- 1995, statewide survey
 - 101 harvested sites sampled
 - 504 ft³/acre or 8.4 tons/acre
 - Average piece size 12.9 ft³
 - Mean diam. 7 inches
 - Pulp wood size residues – 86%
 - Sawlog size residues – 14%
 - Red oak, mixed hardwood, yellow-poplar, and soft-hardwood
- 2002, southern WV
 - 70 sites sampled
 - Average diam. 7.3 in. and length 20.4 ft.
 - 623.7 ft³/acre or 10.4 tons/acre
 - 24% higher than in 1995
 - Oak followed by miscellaneous hardwoods, yellow-poplar, and maple species



2006 Logging Residue



- Total 2.2 million green tons
- Total harvest 231,209 acres
- Top 5 counties
- Districts 3 and 4/Region 2



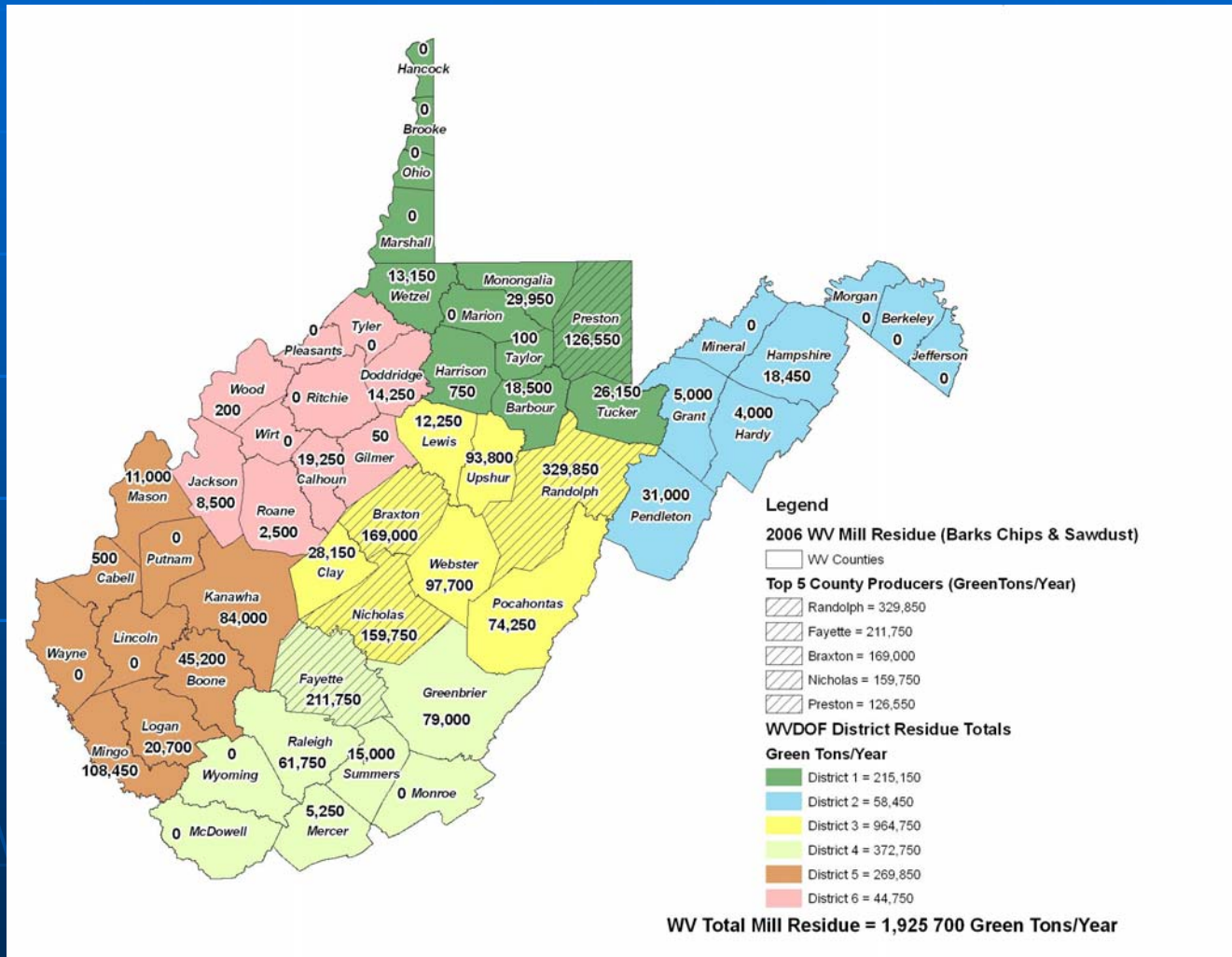
Mill Residues

- Mail surveys
 - Initial survey mailing
 - Follow-up mailing to non-respondents
 - Done by AHC for 10+ yrs (detailed data of 7 yrs)
- Survey data
 - Plant type
 - Plant location
 - Types/amount/species of residues generated
 - Types/amount/species of residues demanded

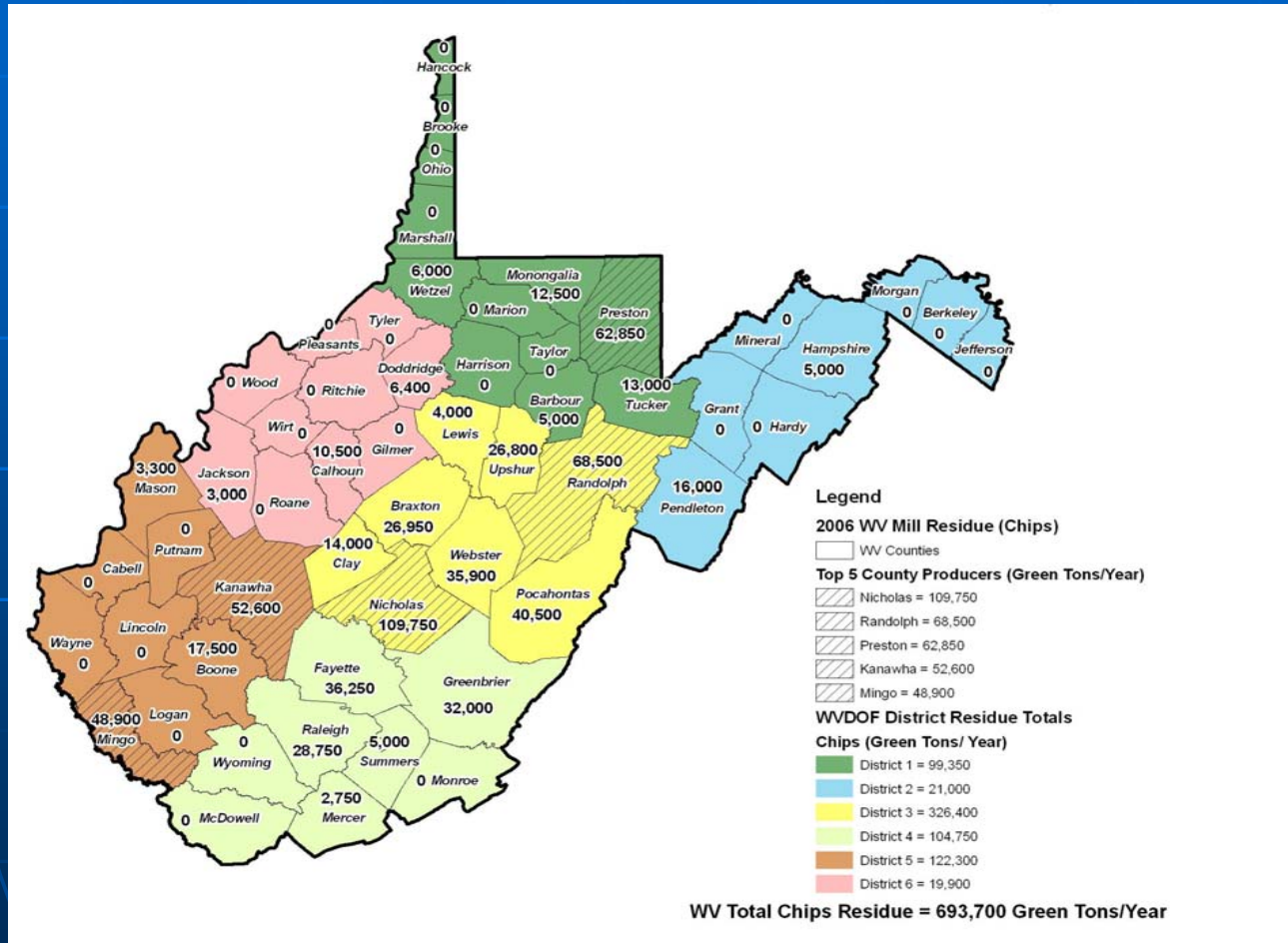
Mill Residue Survey

	Surveyed		Reponses	
	Manufactures	Potential users	Manufactures	Potential users
1999	365	238	91	28
2000	402	177	121	38
2002	394	98	121	38
2003	294	120	89	38
2004	352	111	73	23
2005	365	109	87	20
2006	342	193	103	28

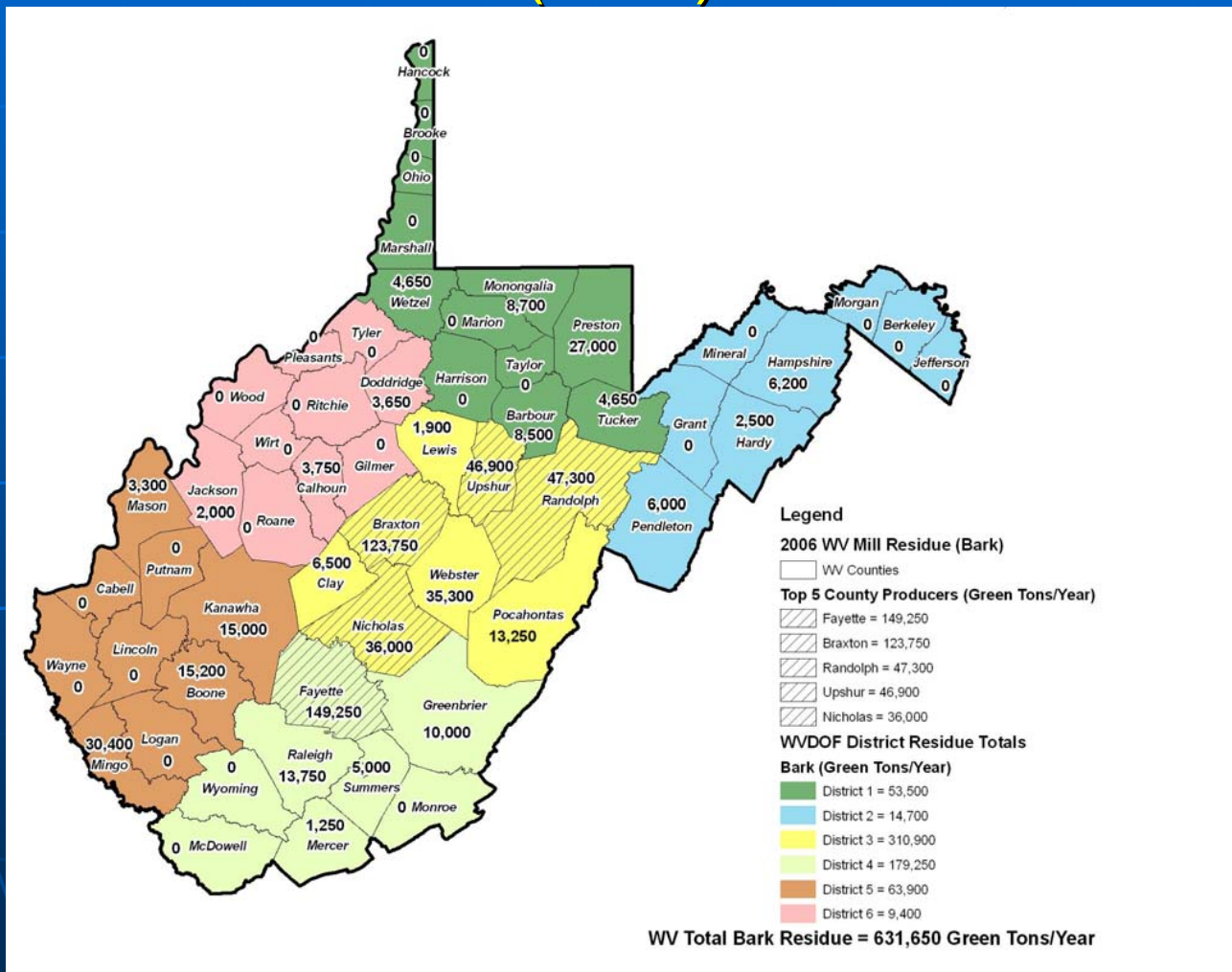
2006 WV Mill Residues



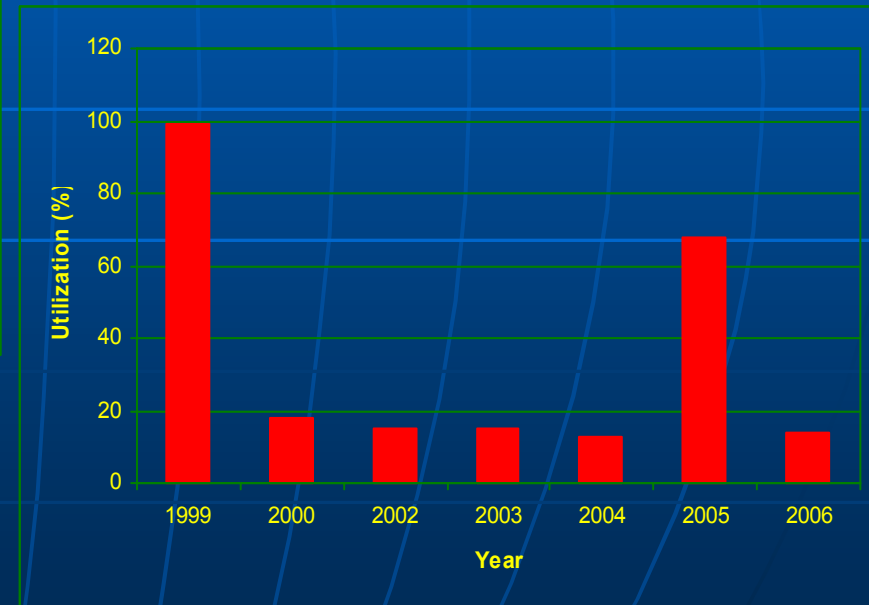
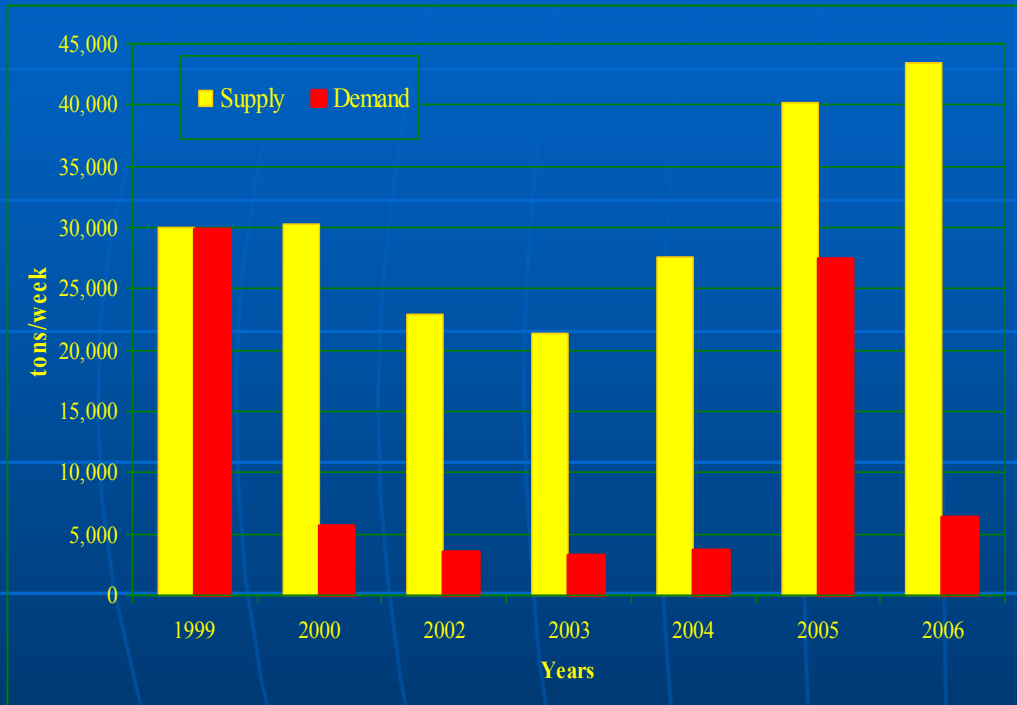
2006 Mill Residues (Chips)



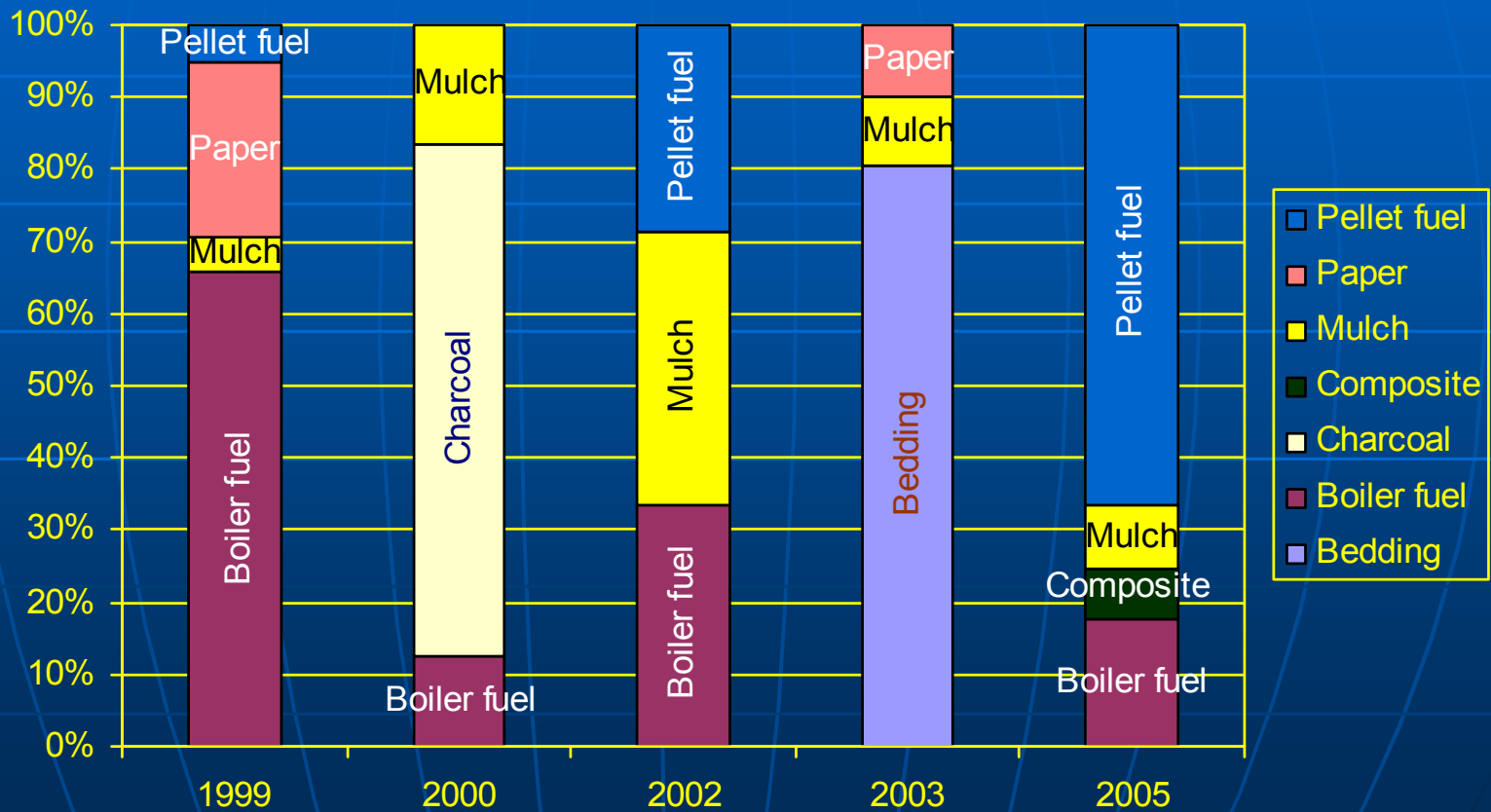
2006 Mill Residues (Bark)



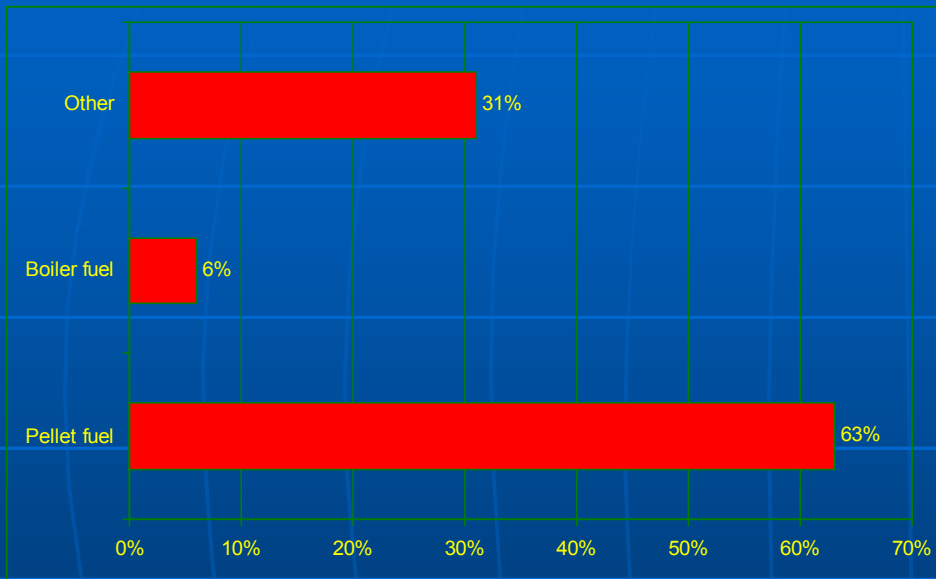
Total Mill Residue Supply/Demand 1999 – 2006



Major Utilization for the Wood Residues in WV

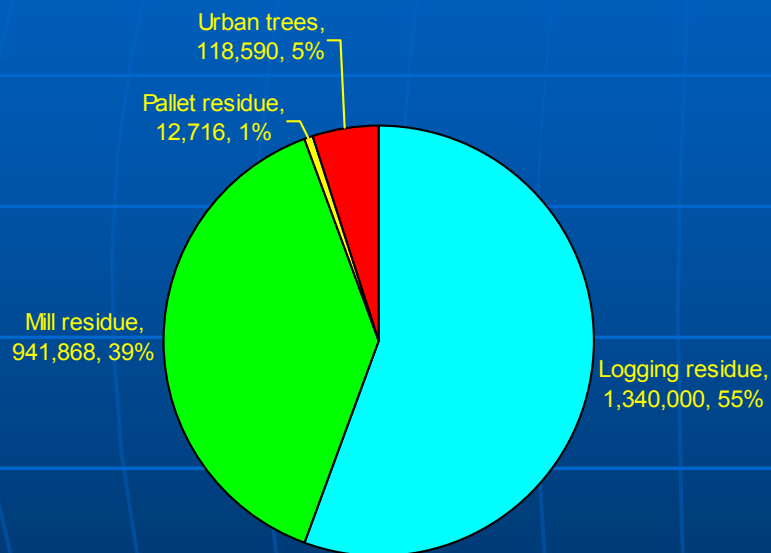


2006 Major Mill Residue Utilization



- 49% actively marketing their available byproducts
- 90% think the lack of markets for their available byproducts did not restrict their production
- 94% indicated that their companies' production had not been restricted due to cost of byproduct disposal
- Easiest byproduct to sell: chips (47%), bark (19%), sawdust (14%)
- Hardest byproduct to give away: bark (39%), sawdust (33%), dust (17%), and chips (11%)
- 82% users expressed that they have a reliable supply of wood byproducts

Total Annual Wood Residue Production



(In dry tons)

- 40,000+ green tons of mill residues weekly
 - 80% from sawmills and 20% from secondary manufacturers
 - 50% of chips, 30% of sawdust, and 20% of bark
- 2.2 million green tons of logging residues
- Total ~5 million green tons (2.41 million dry tons) of biomass per year
 - 36.07×10^{12} BTUs
 - 168.7 million gallons ETOH

Challenges and Opportunities

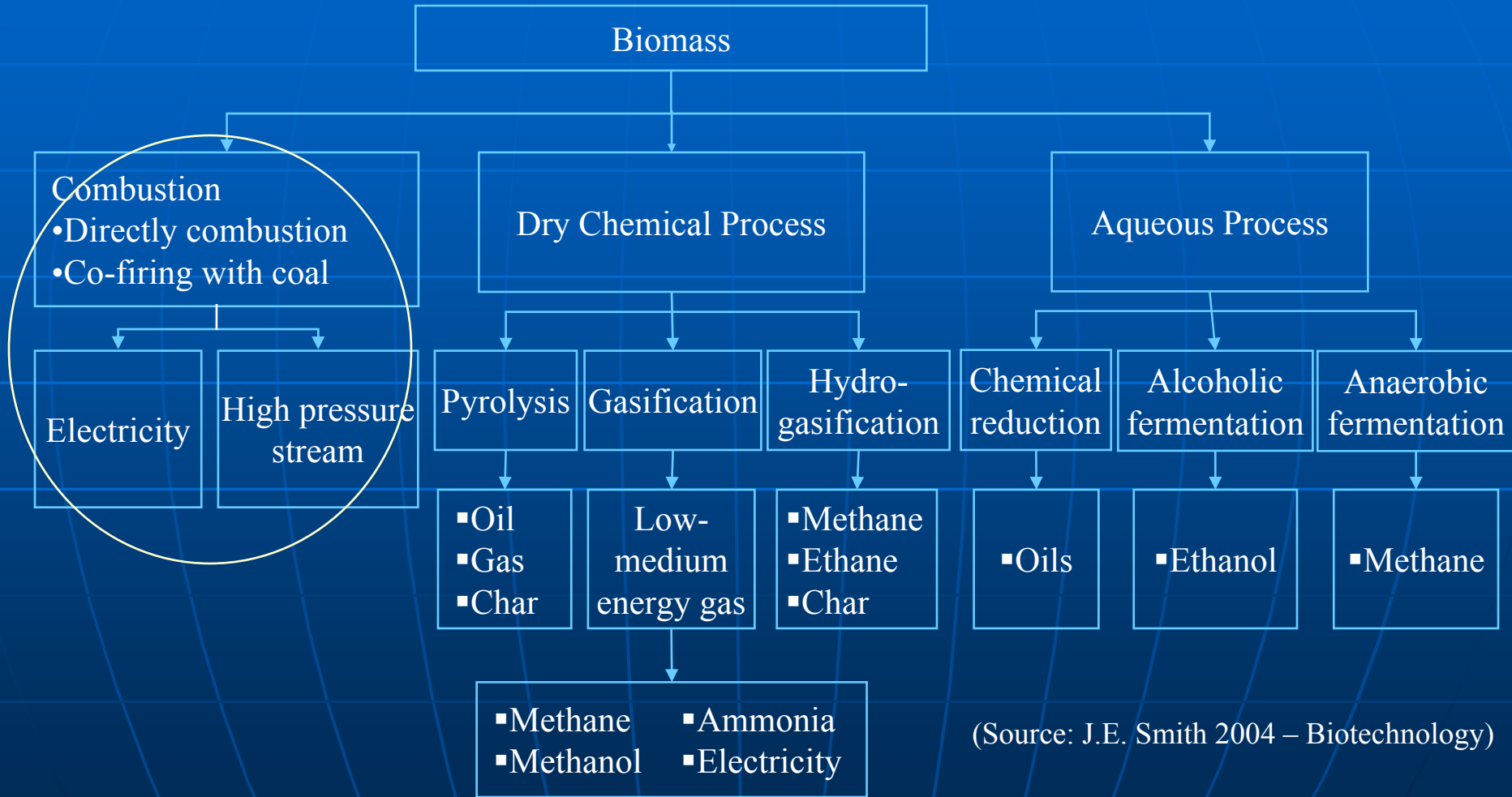
Residue Collection and Processing

- Conventional harvesting systems
- Other systems:
 - Slash bundling (6-10 ft. long, 2 ft. in diameter)
 - 68% UT
 - Chipping



Challenges and Opportunities

Biomass Conversion Technologies



(Source: J.E. Smith 2004 – Biotechnology)

Challenges and Opportunities

Biofuels

- Abundant Woody Biomass
- Better opportunities
- Linkages to industry and national efforts
- Sustainability and environmental impacts
- Competitions (international, others)
- Biofuels
 - Feedstock development
 - Conversion - recalcitrance
 - Commercialization

Bioenergy Development at West Virginia University

- The University Strategic Initiative - ***Advance technologies for bio-fuels and bio-products from renewable resources and reducing environmental liabilities***
- Biobased Materials Research Center
 - West Virginia Development office and other agencies
 - Multidisciplinary research team and collaborations
- Projects
 - Biomass availability
 - Economic and technical feasibilities
 - Biomass conversions to bio-fuels
 - Agencies, WVDO, WVEPSCOR, USDA, USDOE, NE SARE, NE Sun Grants
 - Regional Collaboration, SURA