

GIS and Forest Biomass Inventory for Energy Potential Analysis

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PSU School of Forest Resources

College of Agricultural Sciences

The Question

- How much (softwood, hardwood, sawtimber, pulpwood, excess, harvested, non-harvested, available, small-diameter, low-use) wood is available within x miles of this (city, county, potential site, existing mill, school district, community, hospital), what is the (current, historical, future) drain of this wood, who is harvesting it, and what will it cost me?

The Answer

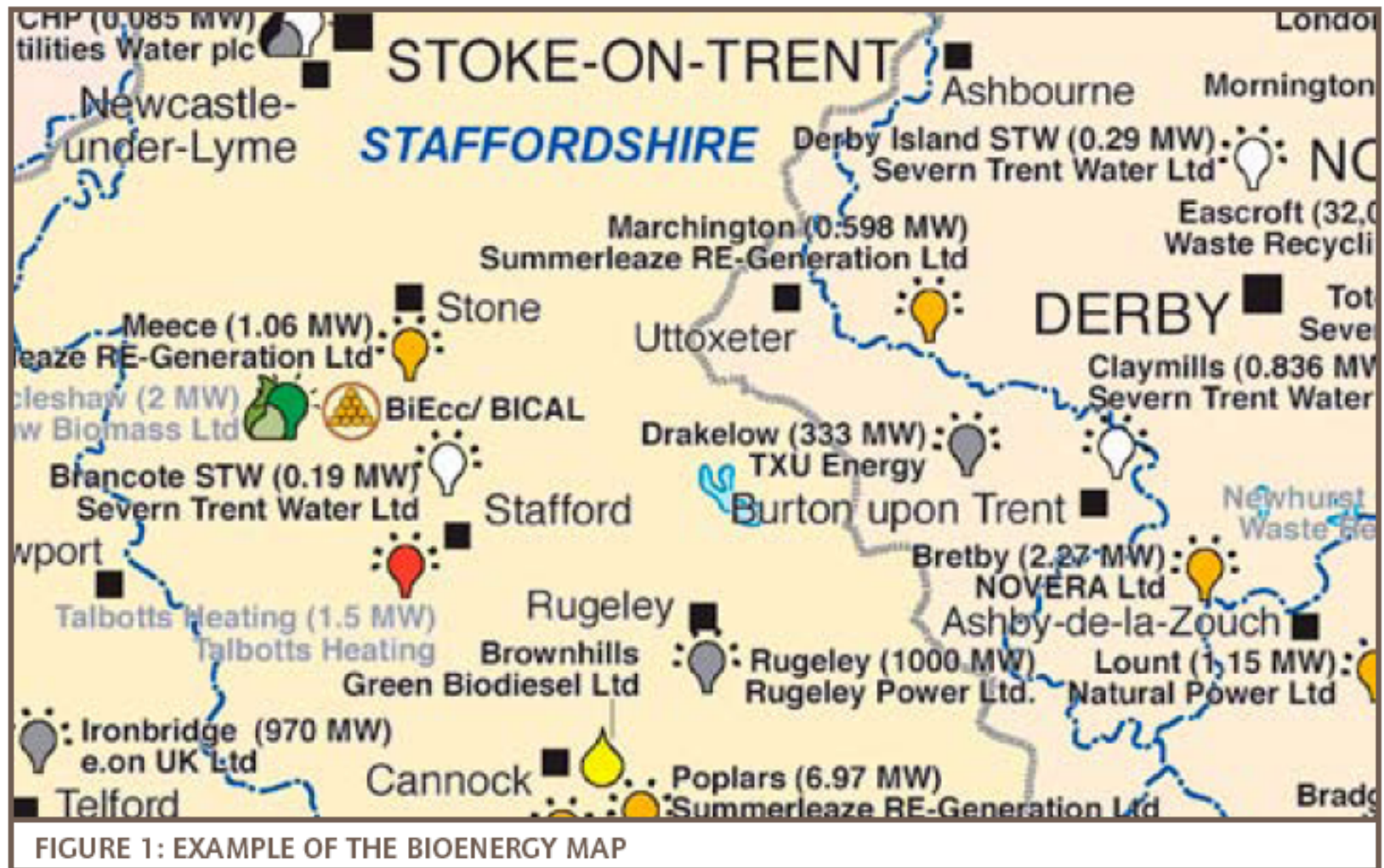
- (Prolonged stunned silence)
- giving way to
- (deep maniacal laughter)

United Kingdom

- Emphasis on energy crops, conservation, and recovery



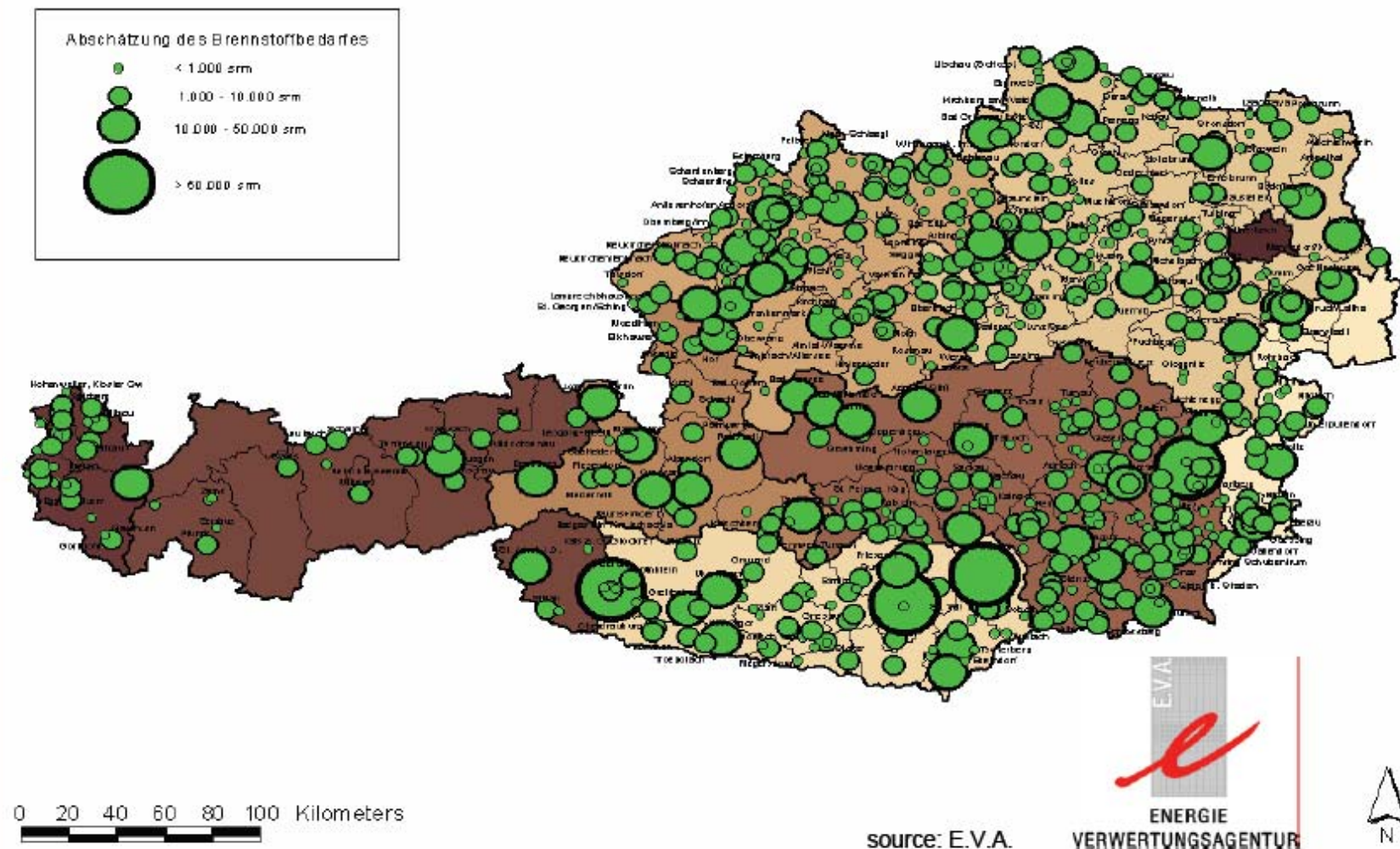
Renewable Energy Association (UK)



Biomass district heating plants in Austria



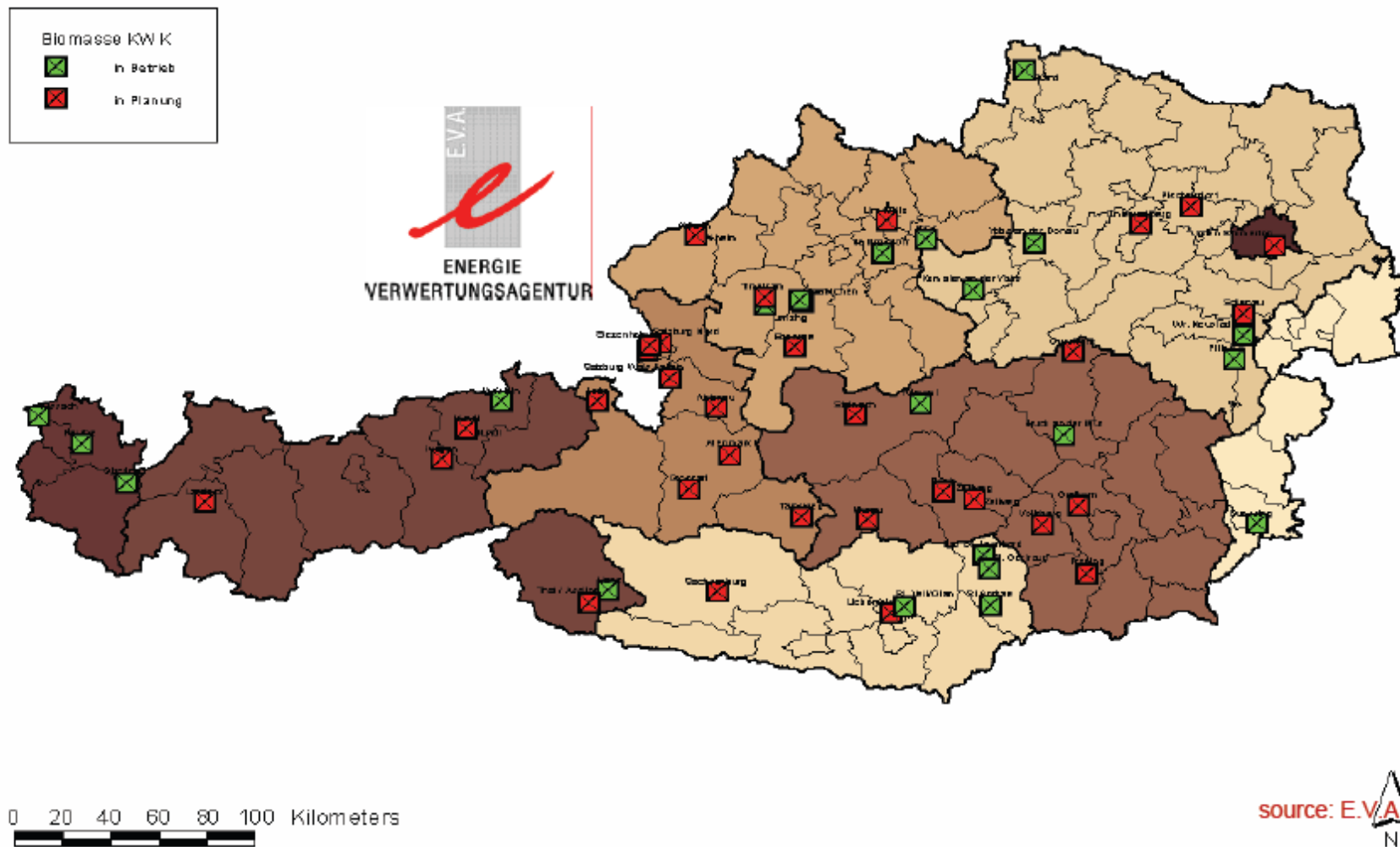
Biomasseheizwerke in Österreich



Biomass-CHP plants in Austria



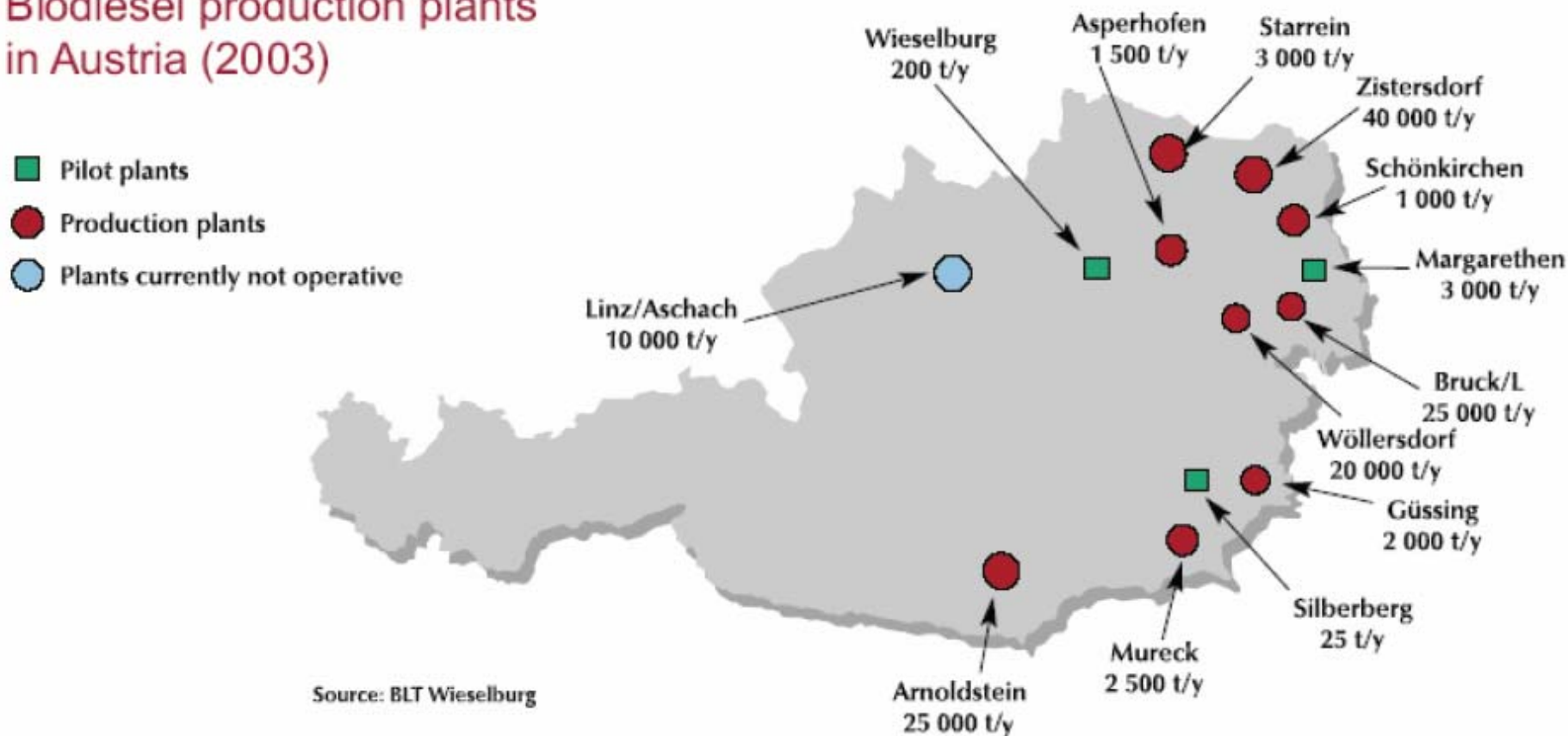
Biomasse KWK Anlagen bzw. Projekte



Biodiesel production plants in Austria



Biodiesel production plants in Austria (2003)



Forest Inventory and Analysis National Program

(enter query)

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Forest Inventory & Analysis

National Office
USDA Forest Service
1601 North Kent Street,
Suite 400
Arlington, VA 22209
(703) 605-4177

http://fia.fs.fed.us

Welcome to our site

We are the Nation's Forest Census



The Forest Inventory and Analysis (FIA) Program of the U.S. Department of Agriculture (USDA) Forest Service provides the information needed to assess America's forests.

As the Nation's continuous forest census, our program projects how forests are likely to appear 10 to 50 years from now. This enables us to evaluate whether current forest management practices are sustainable in the long run and to assess whether current policies will allow the next generation to enjoy America's forests as we do today.

FIA reports on status and trends in forest area and location; in the species, size, and health of trees; in total tree growth, mortality, and removals by harvest; in wood production and utilization rates by various products; and in forest land ownership.

The Forest Service has significantly enhanced the FIA program by changing from a periodic survey to an annual survey, by increasing our capacity to analyze and publish data, and by expanding the scope of our data collection to include soil, under story vegetation, tree crown conditions, coarse woody debris, and lichen community composition on a subsample of our plots.

FIA is managed by the Research and Development organization within the USDA Forest Service in cooperation with State and Private Forestry and National Forest Systems. FIA has been in operation under various names (Forest Survey, Forest Inventory and Analysis) for some 70 years. We cover forests on all forest lands within the US.

[2007 RPA Resource Tables for Public Review](#)

[FIA 1999-2008 Performance Summary \(19 kb PDF\)](#)

Big Change has arrived to FIA Data!!

FIADB 3.0, has been released. Documentation, data and tools for displaying the data are now available.[more>>](#)

Try our new tool!

NEW

FIDO
Forest Inventory Data Online

Surf forest inventory data using the FIDO on-line tool!! Create your own forest inventory tables



USFS FIA

- Historical data and future projections
 - Species, size, and health of trees
 - Total tree growth, mortality, and removals
 - Wood production and utilization rates
 - Forest land ownership
- Recently expanded to annual surveys and to include data on:
 - Soil
 - Understory vegetation
 - Tree crown conditions
 - Coarse woody debris
 - Lichen community composition

FIDO II -- Standard Reports

Report Options

Type in a title to display on report

Refresh

Report Display

(The color of each estimated value represents its percent sampling error (pse); if estimate is **black**, pse is less than or equal to 25%; if estimate is **green**, pse is greater than 25% and less than or equal to 50%; if estimate is **red**, pse is greater than 50%)

Inventory -- Pennsylvania: 2000-2004 area/volume

County	Stand-size class				Total
	Large Diameter (1)	Medium Diameter (2)	Small Diameter (3)	Nonstocked (5)	
Adams (1)	75,740	21,974	8,507	--	106,222
Allegheny (3)	85,079	60,691	4,166	--	149,936
Armstrong (5)	122,090	80,016	31,475	--	233,581
Beaver (7)	60,641	38,908	9,867	--	109,415
Bedford (9)	237,150	122,566	30,507	--	390,223
Berks (11)	96,221	66,746	16,056	1,421	180,444
Blair (13)	139,899	57,638	11,215	--	208,752
Bradford (15)	210,371	146,188	64,244	3,761	424,563
Bucks (17)	52,325	34,367	4,654	--	91,345
Butler (19)	118,609	60,143	34,877	3,725	217,355
Cambria (21)	159,623	62,791	49,406	--	271,820
Cameron (23)	138,456	64,198	17,150	--	219,803
Carbon (25)	19,406	122,646	12,019	--	154,071
Centre (27)	273,229	188,467	49,865	--	511,561
Chester (29)	78,602	15,205	--	--	93,807
Clarion (31)	116,800	71,843	59,770	--	248,413
Clearfield (33)	249,076	166,645	120,089	1,524	537,335
Clinton (35)	273,749	143,369	24,331	--	441,449
Columbia (37)	121,543	26,854	2,571	2,411	153,378
Crawford (39)	161,355	133,558	22,863	9,799	327,575
Cumberland (41)	72,073	37,817	13,420	--	123,311
Dauphin (43)	102,647	36,011	20,997	--	159,656
Delaware (45)	6,176	--	--	4,435	10,611
Elk (47)	318,995	68,108	69,268	6,453	462,823
Erie (49)	157,226	48,142	27,484	7,648	240,499
Fayette (51)	159,884	104,416	27,879	1,858	294,037
Forest (53)	189,282	37,834	35,681	--	262,797

FIDO II Wizard

Here is where you can see the results of your report selections. Presently only tabular output is supported. It may take a while to generate your report, especially if there is a lot of demand, so please be patient. Clicking "Submit" multiple times can cause significant delays in generating your report. **If you have made changes since generating a report, you must click "Submit" again to display the new data.**

Area of Interest: Pennsylvania (42)

Filter Options: - No selections made -

Survey Years: 2004

Reports: Tree biomass reports , Tree removals reports , Area reports , Tree volume reports

☐ Hide Wizard

Submit

- Home
- Run the standard reports by selecting from the list of options to your right.
- Define Area of Interest
- Set Filter Options
- Select Survey Years
- Choose Reports
- Submit/View Retrieval

FIDO II -- Standard Reports

Report Options

Type in a title to display on report

Refresh

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(The color of each estimated value represents its percent sampling error (pse); if estimate is **black**, pse is less than or equal to 25%; if estimate is **green**, pse is greater than 25% and less than or equal to 50%; if estimate is **red**, pse is greater than 50%)


Inventory -- Pennsylvania: 2000-2004 area/volume


Pennsylvania (42) --Net tree volume (in cubic feet)


County	Grouping of species into 4 major classes				Total
	Pine (1)	Other Softwoods (2)	Soft hardwoods (3)	Hard hardwoods (4)	
Adams (1)	14,210,717	1,616,600	32,416,339	100,635,171	148,878,828
Allegheny (3)	1,791,898	--	117,989,644	95,195,768	214,977,310
Armstrong (5)	5,574,057	11,446,308	199,907,919	151,071,458	367,999,743
Beaver (7)	14,536,943	1,245,219	73,704,620	71,984,480	161,471,261
Bedford (9)	49,761,512	10,212,123	149,572,316	386,290,065	595,836,016
Berks (11)	952,469	2,731,473	151,577,000	196,969,289	352,230,232
Blair (13)	18,903,993	1,579,015	129,497,219	204,646,493	354,626,721
Bradford (15)	41,481,635	73,001,966	192,372,900	340,489,459	647,345,961
Bucks (17)	2,287,799	3,485,683	52,642,326	110,103,058	168,518,867
Butler (19)	13,985,768	4,421,130	191,922,249	106,010,541	316,339,688
Cambria (21)	2,694,089	43,777,109	237,360,513	177,770,721	461,602,432
Cameron (23)	19,490,077	4,443,007	172,417,347	317,418,020	513,768,451
Carbon (25)	6,970,974	20,809,081	81,292,228	110,198,608	219,270,891
Centre (27)	50,216,515	29,410,051	255,480,080	515,099,349	850,205,995
Chester (29)	5,119,901	827,306	126,489,968	112,270,125	244,707,300
Clarion (31)	20,250,462	64,931,203	155,394,393	171,318,807	411,894,865
Clearfield (33)	44,680,621	56,365,739	342,001,586	375,500,534	818,548,479
Clinton (35)	37,307,980	44,364,743	226,921,856	496,386,182	804,980,761
Columbia (37)	31,549,253	25,206,926	75,890,752	172,906,869	305,553,800
Crawford (39)	10,591,483	41,085,168	313,752,566	227,065,080	592,494,298
Cumberland (41)	25,055,233	--	19,720,146	159,402,001	204,177,380
Dauphin (43)	5,428,180	13,469,787	74,538,469	169,738,151	263,174,587
Delaware (45)	--	--	114,586	5,222,827	5,337,413
Elk (47)	5,328,951	79,506,068	623,227,530	355,280,680	1,063,343,230
Erie (49)	7,541,439	31,382,073	276,971,193	198,350,370	514,245,075
Fayette (51)	2,239,669	8,555,904	311,140,792	178,879,933	500,816,298
Forest (53)	11,875,528	60,276,333	314,090,501	237,879,504	624,121,866


FIDO II Wizard

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☐ Hide Wizard Submit

Home

Run the standard reports by selecting from the list of options to your right.

 **Define Area of Interest**

 **Set Filter Options**

 **Select Survey Years**

 **Choose Reports**

 **Submit/View Retrieval**

Case study – “Low-Use Wood” in Pennsylvania from FIA data

- “LUW” – Low-use wood, defined by Luppold and Bumgardner (2003) as wood material that is underutilized, usually of poor form, size, quality, and value.
- McWilliams and Frieswick (2007) – identify 57% of Pennsylvania’s 1.145 billion tons as LUW (658 million tons)
- 71% of this (469 million tons) is available under defined operability constraints

Pennsylvania's Forests – 16 million acres of biological “solar panels” storing carbon energy!

- 658 million tons of our forest is in “under-utilized small diameter” stems; 469 million tons are potentially available for harvest
- This volume of forest wood will sustainably yield about 6 million dry tons per year in perpetuity

6 Million Dry Tons Per Year is Equivalent to:

600 District Energy Projects



475 - 500 million gallons of #2 heating oil (Karakesh, 2007)



300 Million 40 lb bags of wood pellets

3 million homes

10 Wood Ethanol Plants



480-600 million gals ethanol



HardwoodTrader Residue Search Engine

You are currently searching residue data from 2006!

Search results for bark within 50 miles of Morgantown on 1/24/2007. - results based on 2006 data

17 residue producers with a total of 5198.92 green tons, 0 dry tons, and 0 cubic yards were found in your search.
The minimum straight-line distance is 18.2 miles to Taz Hardwoods Co., Inc. in Bruceton Mills.

Mill Creek Builders Supply

Straight-line distance from Morgantown is 42.1 miles

Contact Name:	Charles R. Bell, Sr.	Phone:	304/335-4851
Address:	HC 58 Box 25A	Fax:	304/335-4871
City:	Mill Creek	Web:	
State & Zip:	WV 26280-9604	Email:	
<u>Residue Type</u>	<u>Species</u>	<u>Volume</u>	<u>Expiration</u>
Bark	RO, WO, YP, HM, SM, BC, HK, MX,	100 Green Tons	7/31/2006

Comments

Myles Lumber Co., Inc.

Straight-line distance from Morgantown is 48.7 miles

Contact Name:	David S. Mullenax	Phone:	304/636-3149
Address:	PO Box 1274	Fax:	304/636-2180
City:	Elkins	Web:	
State & Zip:	WV 26241-1274	Email:	
<u>Residue Type</u>	<u>Species</u>	<u>Volume</u>	<u>Expiration</u>
Bark	WO, SM,	80 Green Tons	7/31/2006

Comments

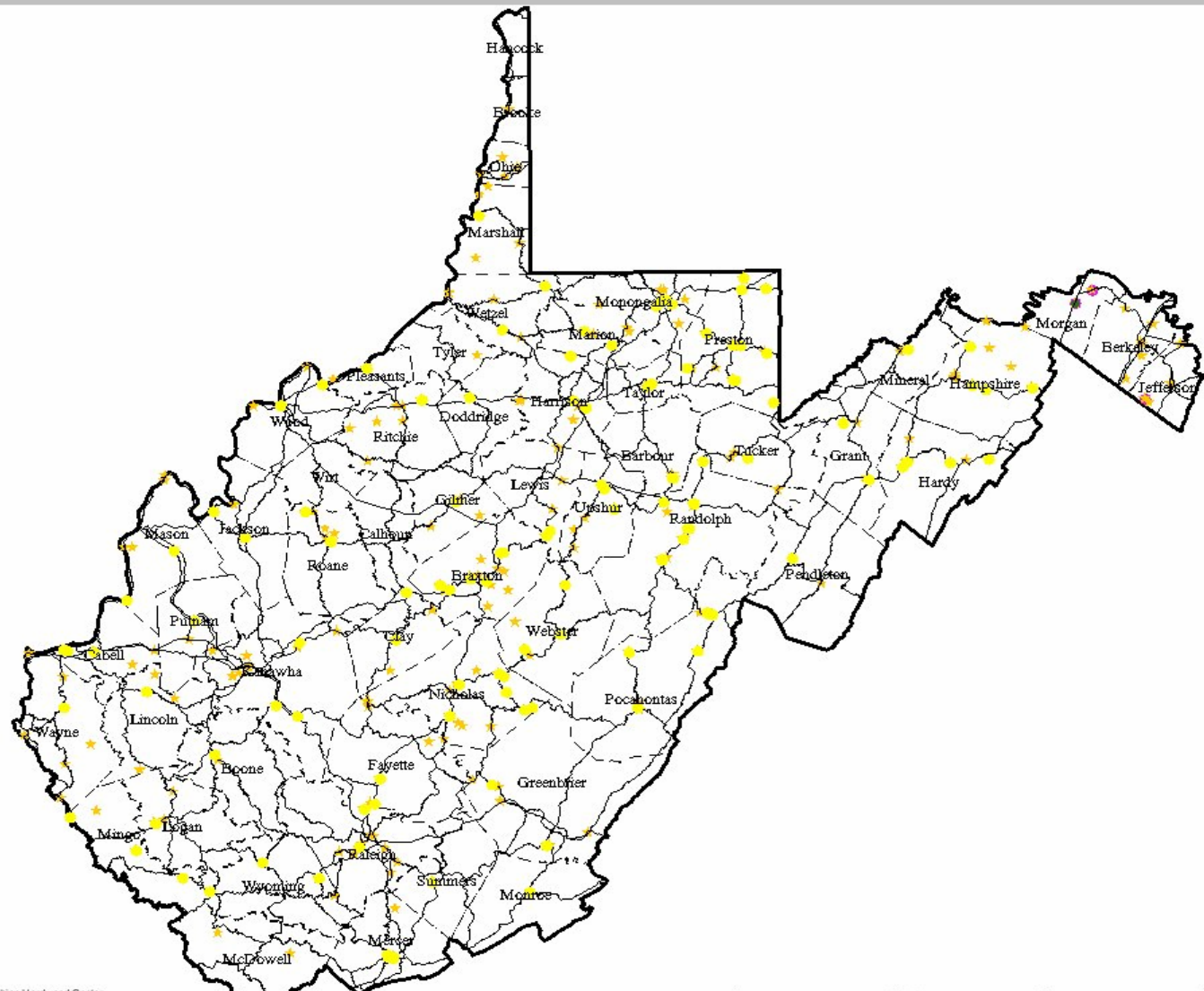
Ricottilli Lumber Co.

Straight-line distance from Morgantown is 41.5 miles

Contact Name:	Carlo Ricottilli	Phone:	304/478-3713
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WV Wood Residue Finder



- ### Layers
- Visible Active
- ☒ ☐ WV
 - ☒ ☐ Highways
 - ☒ ☐ 2005Residue
 - ☒ ☐ 2006Residue
 - ☒ ☐ Forest
 - ☒ ☐ Products
 - ☒ ☐ Industry
 - ☒ ☒ All Residue
 - ☒ ☐ WV State
 - ☒ ☐ Boundary
 - ☒ ☐ County
 - ☒ ☐ Boundaries

Refresh Map

Quick Sets...



Map created by the Appalachian Hardwood Center

	12	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002
11	12	2002	Sawdust	2	Green Tons	Springfield	Hampshire	Adams Sawmill	304/492-5295	698602.4028	
12	12	2004	Sawdust	1	Green Ton	Springfield	Hampshire	Adams Sawmill	304/492-5295	698602.4028	
13	1302	2002	Sawdust	80	Green Tons	Petersburg	Grant	Allegheny Dimension LLC	304/257-9513	662376.6840	

Select Rectangle



Pennsylvania Biomass

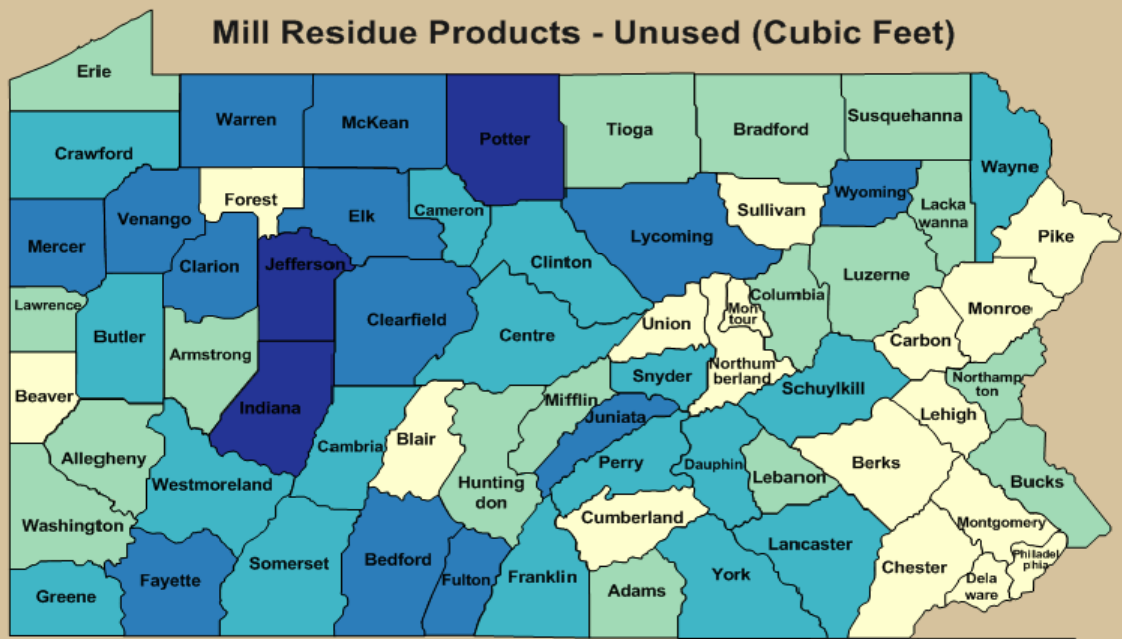
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Agricultural Resources

Forestry & Wood Resources

- ◊ Timberland- National Forests
- ◊ Timberland- State Owned
- ◊ Timberland- Private Land
- ◊ Timberland- Total
- ◊ Timberland Stand Size- Large Diameter
- ◊ Timberland Stand Size- Medium Diameter
- ◊ Timberland Stand Size- Small Diameter
- ◊ Timberland Growing Stock- Hardwood
- ◊ Timberland Growing Stock- Softwood
- ◊ Timberland Growing Stock- Total
- ◊ Logging residue- Hardwood
- ◊ Logging residue- Softwood
- ◊ Mill Residue, Total
- ◊ Mill Residue Products, Fiber

Mill Residue Products - Unused (Cubic Feet)



Data Source:
 Timber Products Output Mapmaker Version 1.0. Pennsylvania 2002 RPA Year.
 Volume of Mill Residues by Residue Product. As of April 2006.
http://ncrs2.fs.fed.us/4801/fiadbrpa_tpo/wc_rpa_tpo.asp

Color	Count	Cubic Feet
Lightest Yellow	17	0 to 5,116
Light Green	17	5,117 to 72,025
Medium Green	17	72,026 to 197,872
Dark Green	13	197,873 to 436,353
Dark Blue	3	697,185 to 1,992,345

Mill Residue Products - Unused (Cubic Feet)

10 November 2007



Pennsylvania Biomass

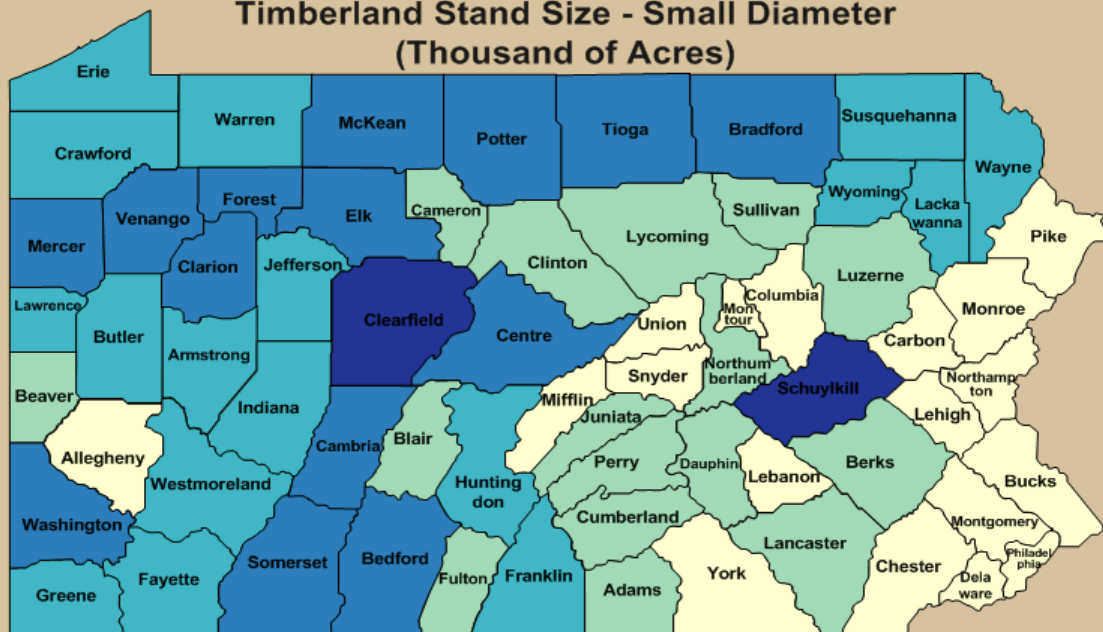
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- ◊ Timberland Growing Stock- Softwood
- ◊ Timberland Growing Stock- Total
- ◊ Logging residue- Hardwood
- ◊ Logging residue- Softwood
- ◊ Mill Residue, Total
- ◊ Mill Residue Products, Fiber

Timberland Stand Size - Small Diameter (Thousand of Acres)



Data Source:
Forest Inventory Mapmaker Version 2.1: Pennsylvania 2003 (Table 2)
as of April 2006.
<http://www.ncrs2.fs.fed.us/4801/fiadb/fim21/wcfim21.asp>

Color	Count	Thousand of Acres
	18	0 to 7
	16	8 to 21
	17	22 to 37
	14	38 to 83
	2	87 to 135

Timberland Stand Size - Small Diameter (Thousands of Acres)

Looking for [hay for sale in Pennsylvania?](#)

Your Account:
You are not currently logged in.

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Now on AgMap:

Search for [Penn State Cooperative Extension publications!](#)

Selected Businesses:



Options:

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Search AgMap

Search for: wood in Businesses Submit

☐ In County, PA

☒ Within 50 miles of zip code 16801

Search Results

79 matches found for "wood" in Businesses within 50 miles of zip code 16801.

Results 1 - 10 of 79

Sort by: Name

[Advantage Forestry](#)

Broadtop, Huntingdon County, PA

~46 mi

I have been in the Logging, Forestry and Arborist business for 30 years. My former business name was Raystown Select Hardwoods. I am sole proprietor and choose to keep my business small, managable and as uncomplicated as possible to help my valued customers. ...

Last updated: 12/19/2005

[Alpha Spring Farm](#)

Mill Hall, Clinton County, PA

~27 mi

Alpha Spring Farm operates a seasonal intensive grazing cow/calf herd, with the offspring sold as feeder cattle, or finished and sold as freezer beef. Small grains are raised in rotation to renovate hay land, and produce the straw that we market. Grains ...

Last updated: 03/19/2007

[americas heat/lm.f. mfg.](#)

Lock Haven, Clinton County, PA

~27 mi

LMF Manufacturing produces the America's Heat furnaces. By burning shelled corn, a renewable commodity, the furnaces produce an ecologically safe home heating system while benefiting the local economy by generating business for farmers. Your home's ...

Your Account:

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logged in.

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- [Create An Account](#)
- [Add Your Business](#)

Bingaman & Son Lumber Inc

Snyder County, Pennsylvania

Business Information:

Bingaman & Son Lumber Inc
1195 Creek Mountain Road
PO Box 247
Kreamer, PA 17833

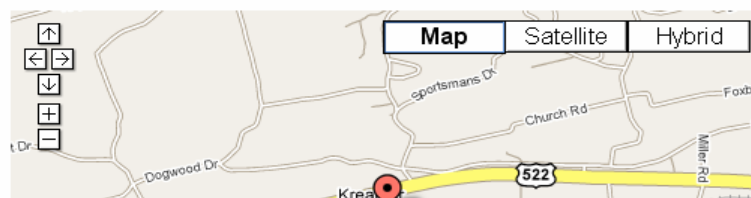
About Us:

Bingaman & Son Lumber, Inc. supplies kiln-dried Appalachian hardwoods for a wide variety of uses. Incorporated in 1968, the company is now comprised of a main lumber yard in Kreamer, an additional yard in Clarendon, and a sawmill in Mill Hall. All of our company's facilities are located in the heart of the Appalachian Mountains of Pennsylvania, a region known worldwide for the color and texture of its hardwoods.

The BING label now assures customers around the globe that they are receiving consistent Bingaman & Son quality.

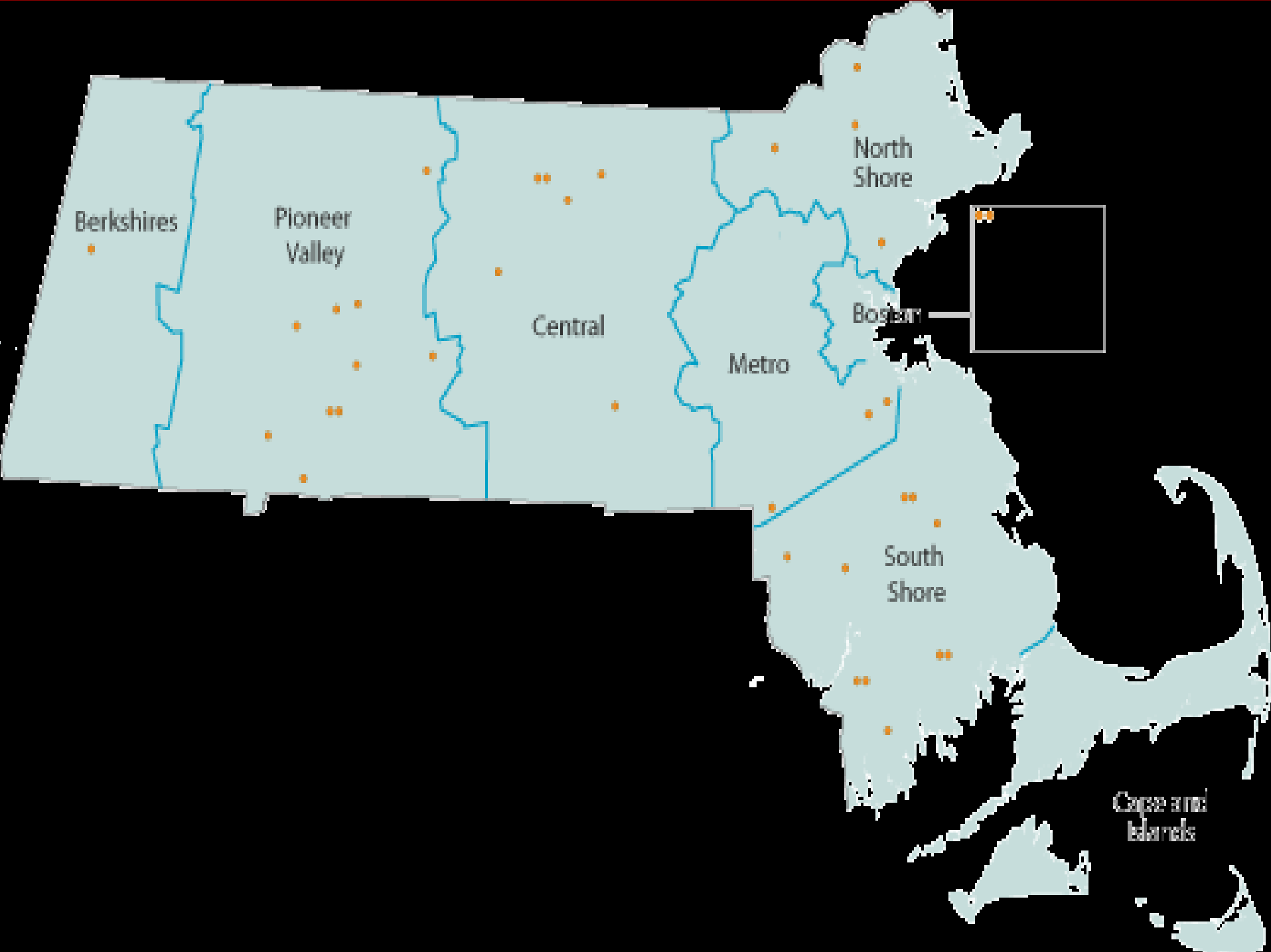
Bingaman carries an inventory over 4 million board feet of kiln-dried lumber in 12 different species: Ash, Aspen, Basswood, Birch, Cherry, Hard Maple, Hickory, Poplar, Red Oak, Soft Maple, Walnut, and White Oak. This selection gives Bingaman's customers many options and enables the company to meet special requests for mixed thicknesses, grades, and species of lumber.


Bingaman also offers surfacing and ripping services and moulder ready components made to your exact specifications.

Location Map:

List Your Pennsylvania
Ag Business For Free!


Join **AgMap** Today





NEW YORK STATE

DEPARTMENT OF ENVIRONMENTAL CONSERVATION



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Facility Name	Permit ID	Issued Date	Expiration Date
23RD AND 3RD PLANT	2-6102-00482/00006 (368KB PDF file) Permit Review Report (144KB PDF file)	Oct 15 2005	Oct 14 2010
3M TONAWANDA	9-1464-00164/00117 (379KB PDF file) Permit Review Report (122KB PDF file)	Sep 6 2005	Jun 4 2007
ACME STEEL CO-513 PORTER AVE	2-6101-00020/00020 (183KB PDF file) Permit Review Report (103KB PDF file)	Jul 31 2007	Jul 30 2012
ADCHEM CORPORATION	1-4730-00001/00011 (249KB PDF file) Permit Review Report (111KB PDF file)	Jun 26 2006	Jun 25 2011
AES CAYUGA	7-5032-00019/00016 (323KB PDF file) Permit Review Report (102KB PDF file)	Dec 6 2001	Dec 6 2006
AES GREENIDGE LLC	8-5736-00004/00013 (302KB PDF file) Permit Review Report (148KB PDF file)	Nov 5 2007	Nov 4 2012

Fuel Usage

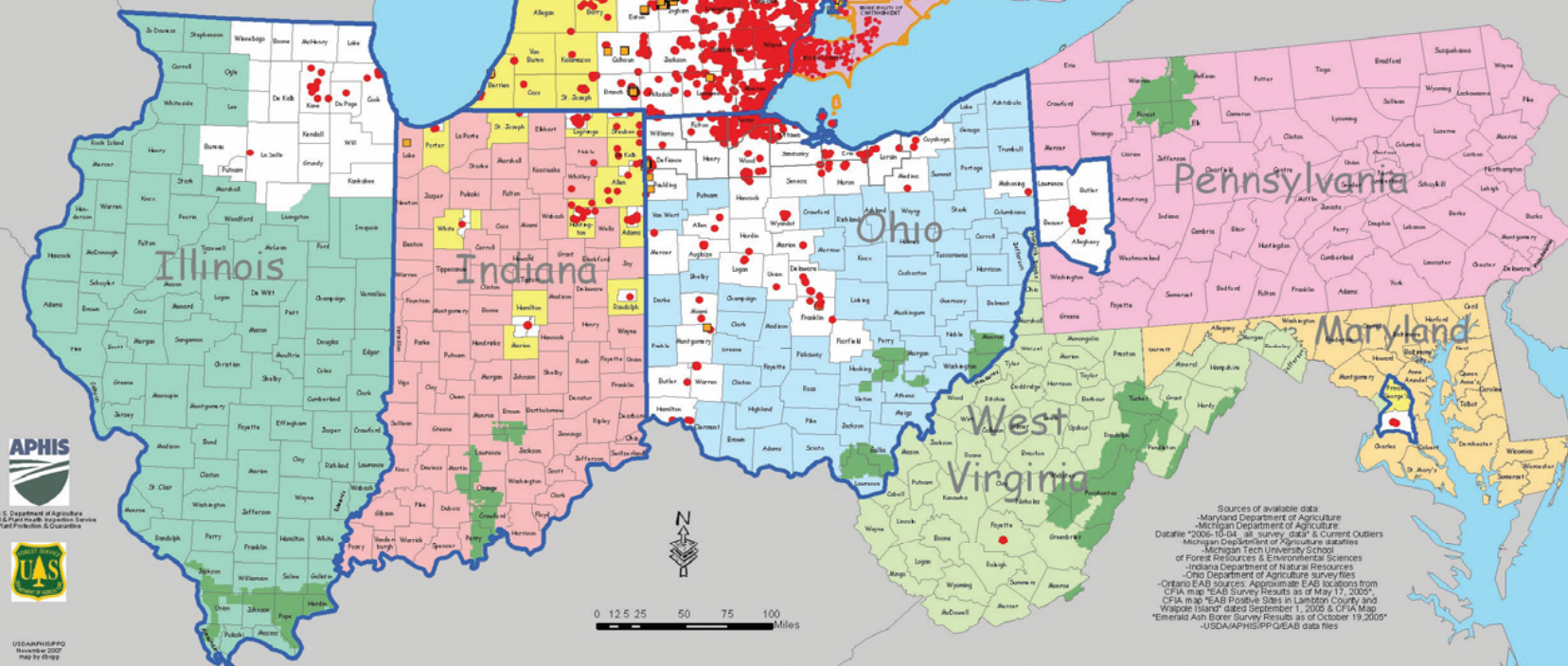
Cooperative Emerald Ash Borer Project

EAB locations in Illinois, Indiana, Michigan,
Maryland, Ohio, Pennsylvania, West Virginia
and southwest Ontario, Canada

November 1, 2007

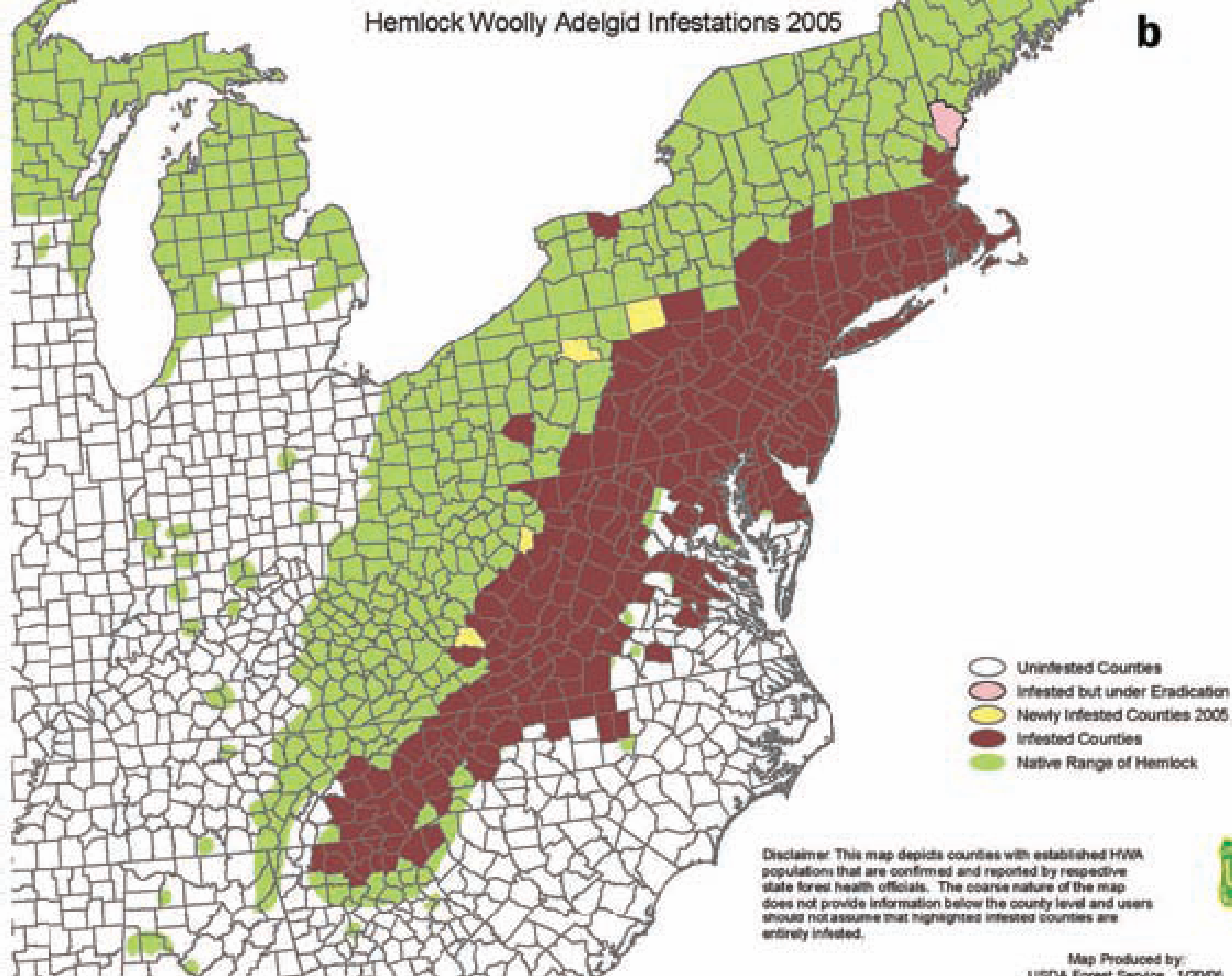
Map Key

- EAB positive
- Site under evaluation (symptoms, found in firewood, or eradicated)
- ◆ Federal EAB quarantine boundaries
- State quarantine—generally infested area
- State quarantine
- National Forests
- Canadian EAB quarantine

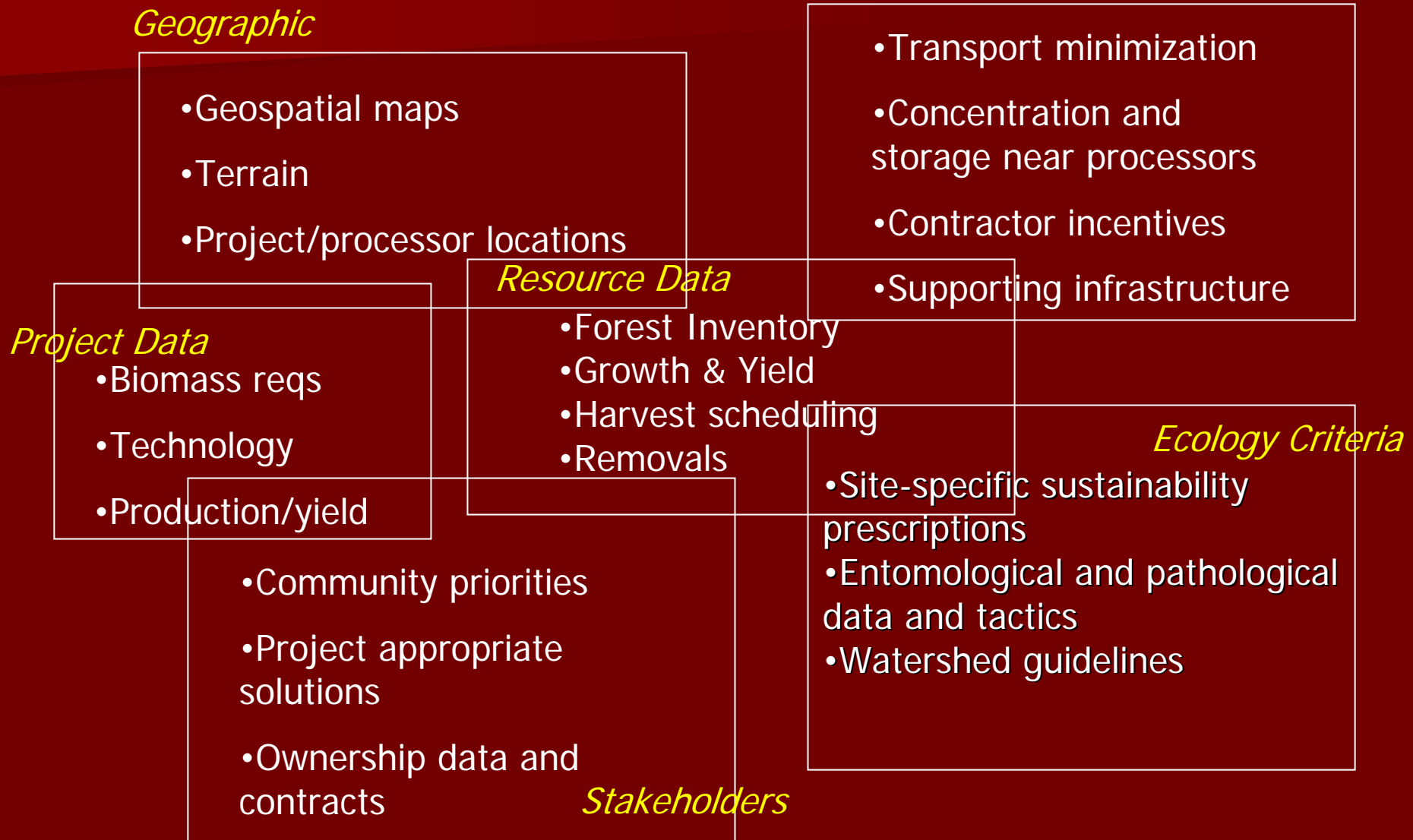


Hemlock Woolly Adelgid Infestations 2005

b



GIS Layers for Biomass Project Analysis and Policy



Conclusions

- There is a public groundswell for small localized energy production
- There is private interest in medium and large biomass energy ventures
- Sustainable harvest of available PA LUW will yield tremendous amounts of energy...and offer the opportunity for improving forest health
- Alternative biomass scenarios are evident

Conclusions

- Current state-based tools have “border effect” limitations, are limited to occasional data collection, and are not normalized or standardized
- GIS and data limitations appear to be the single largest constraint on progress of biomass utilization efforts
- We need dynamic regional biomass utilization and flow databases for project planning, economic and infrastructure development, and landowner assistance
- The time to collaborate is now!

USFS Overview of Woody Biomass Initiatives

- Penn State PI, with USFS and academic collaboration
- 13 Northeastern States
- Compilation and reporting of wood energy research, pilot projects, commercial projects, current production, and status of wood residue information networks
- To be completed by June 1, 2008
- He-eeeeelp!