



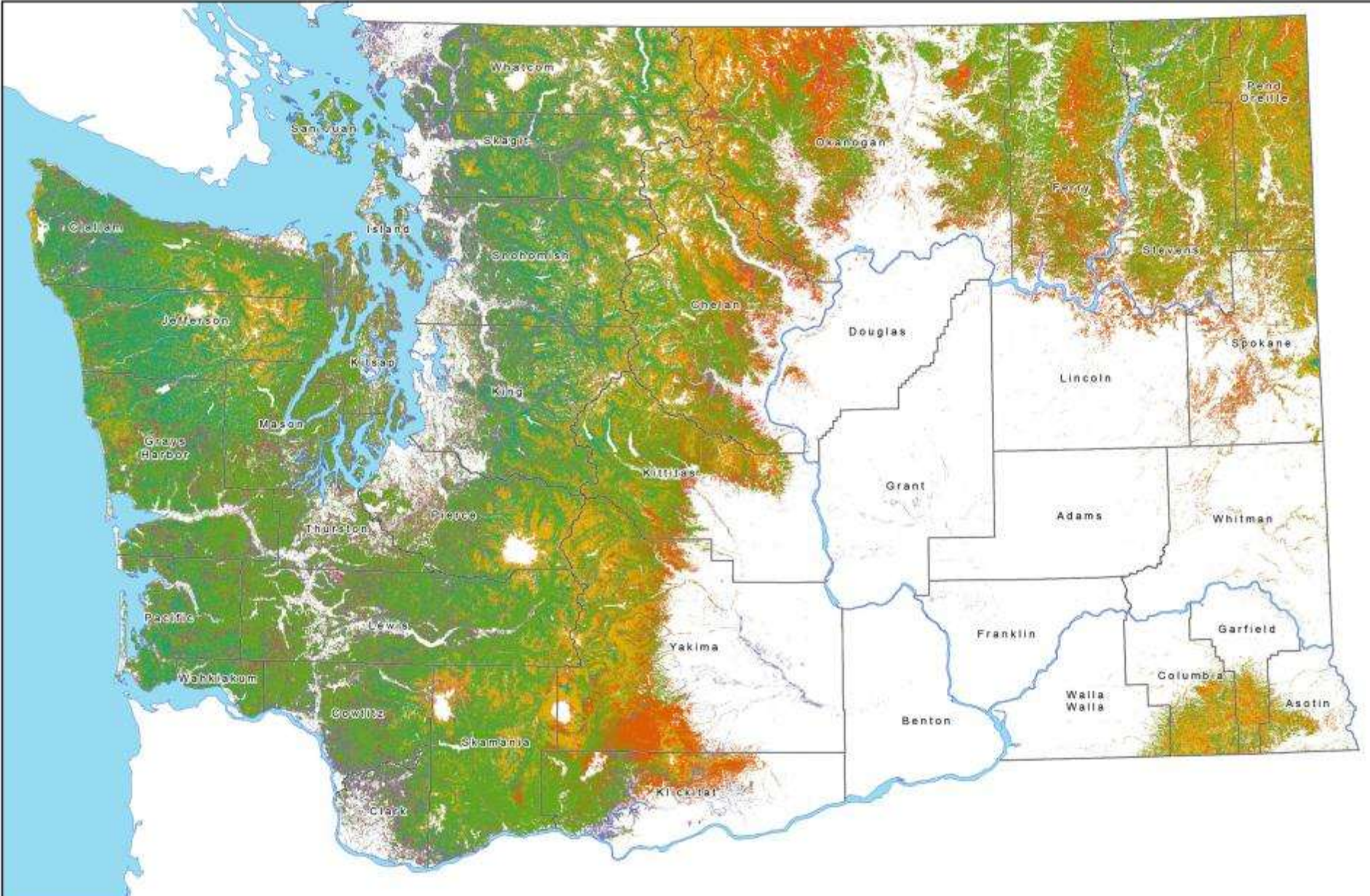
Calculating Biomass for Washington State from Forest Residuals

Luke Rogers
UW Forestry
Northwest Bioenergy Research
Symposium
November 13th, 2012

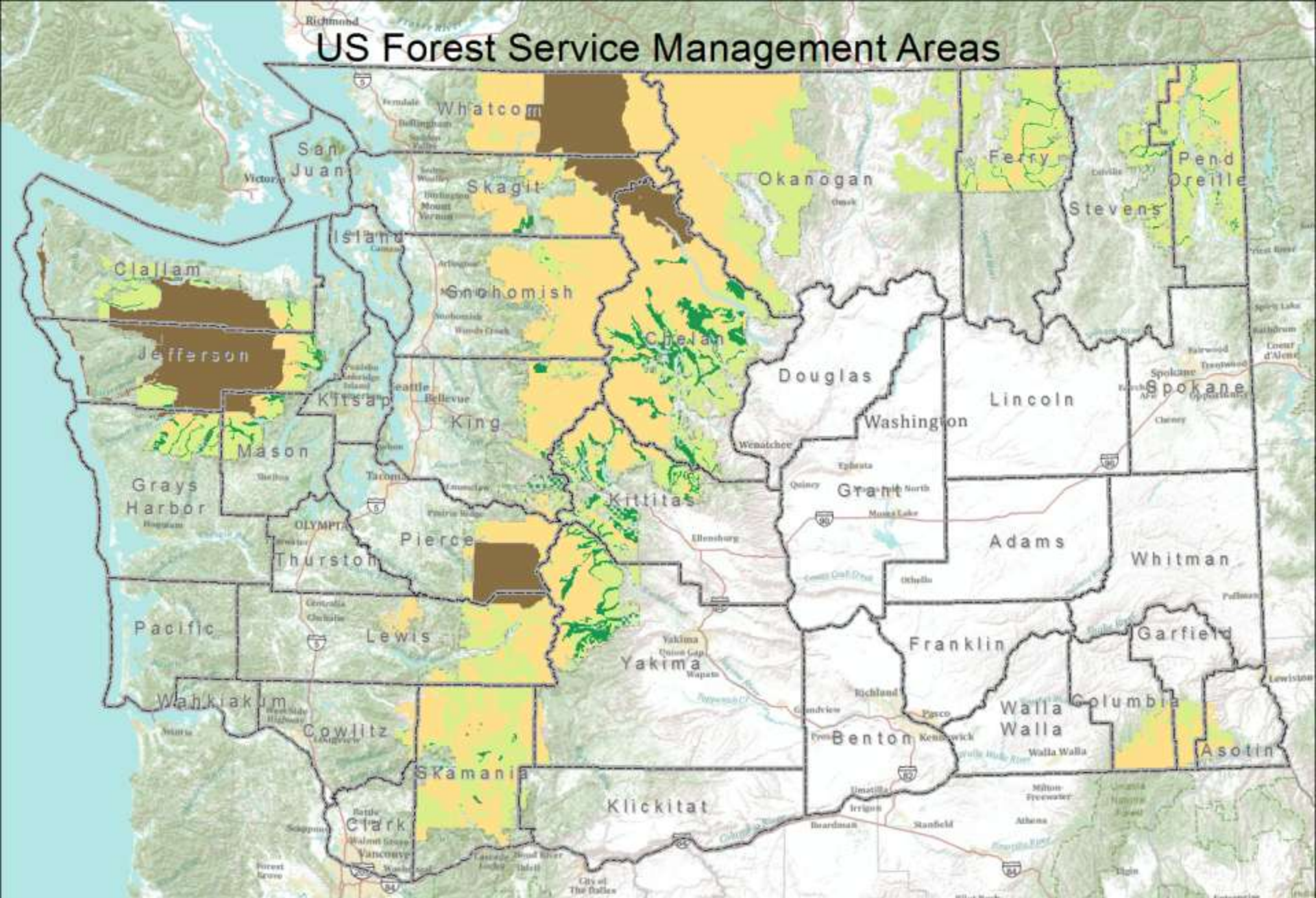
Aggregated Forest Ecosystem Types from GNN

Forest Ecosystem Types



 TF/MC	 Regen	 DF
 RA	 PP	 WH

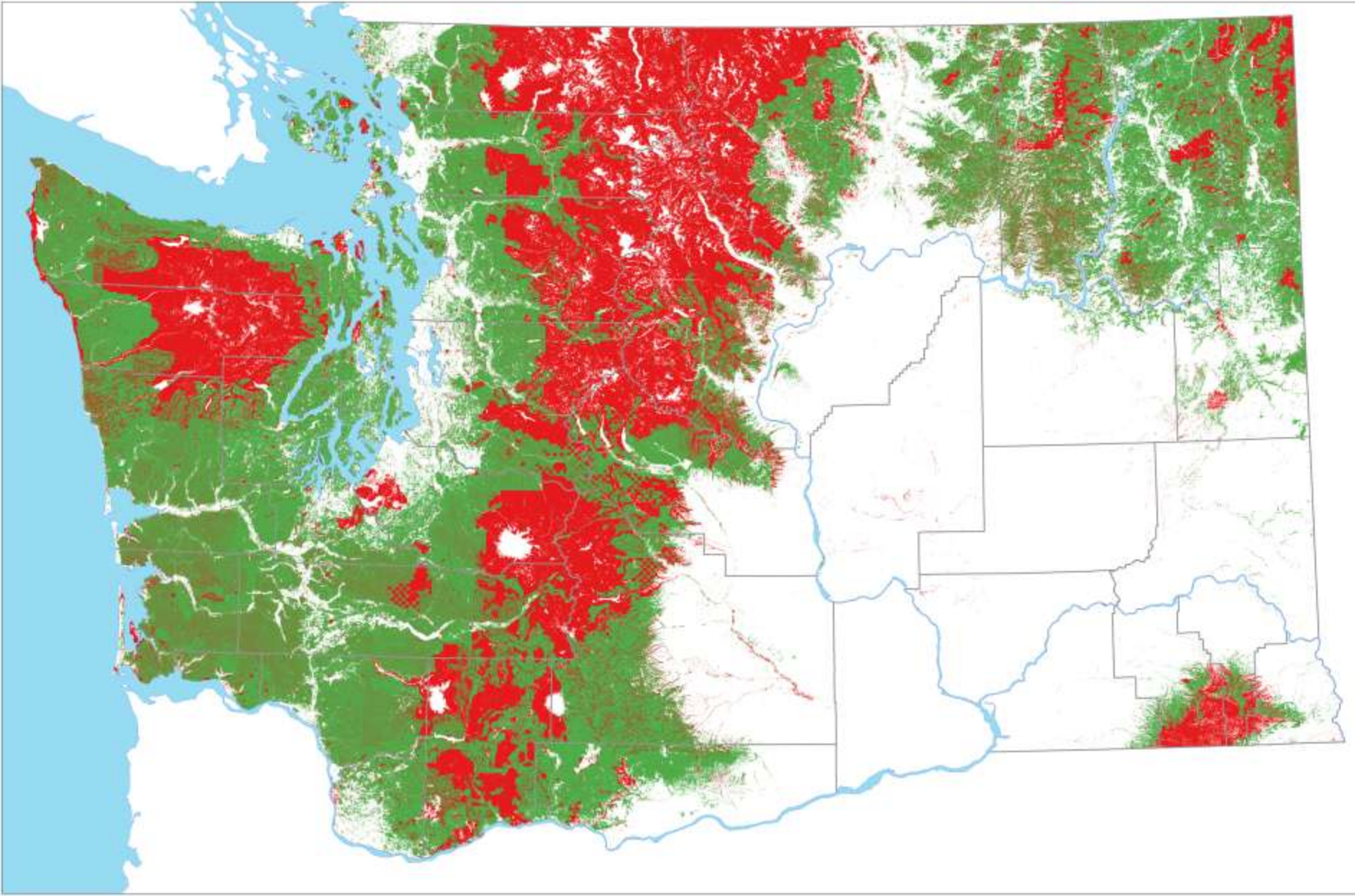


US Forest Service Management Areas

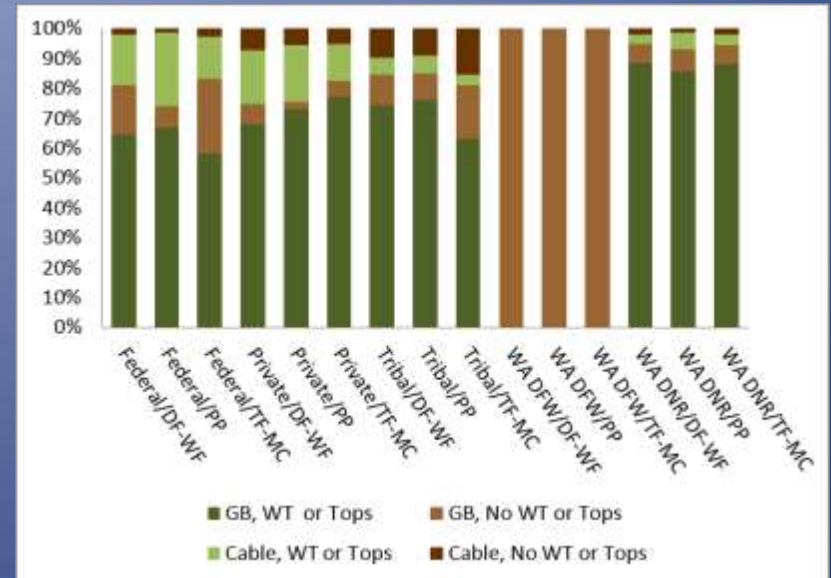
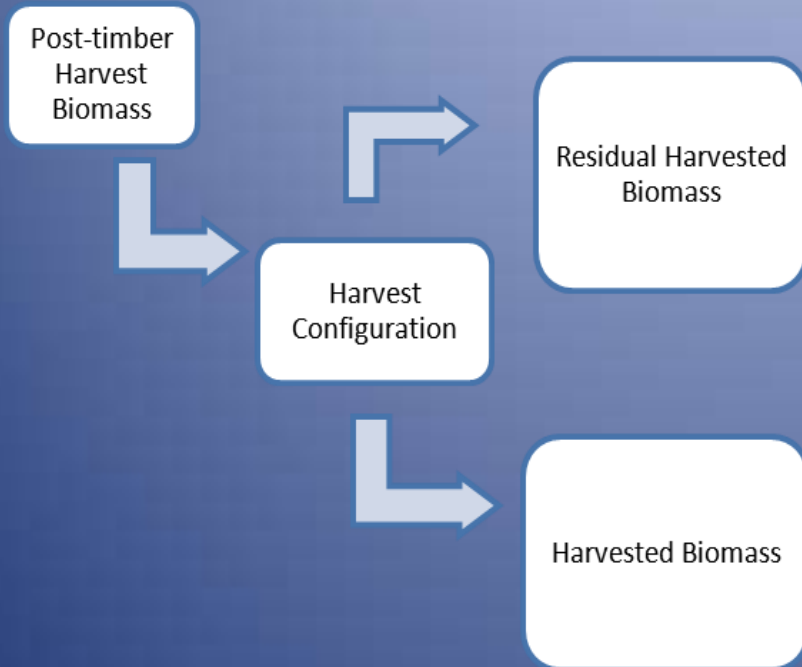


Reserved and Unreserved Acres from the Washington State Biomass Database

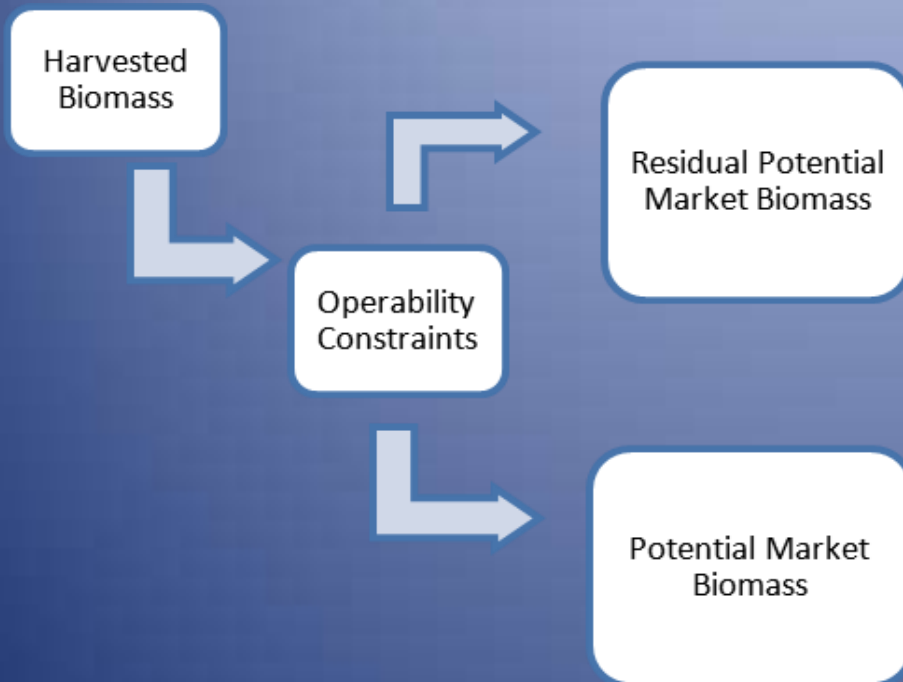
-  Unreserved Acres
-  Reserved Acres



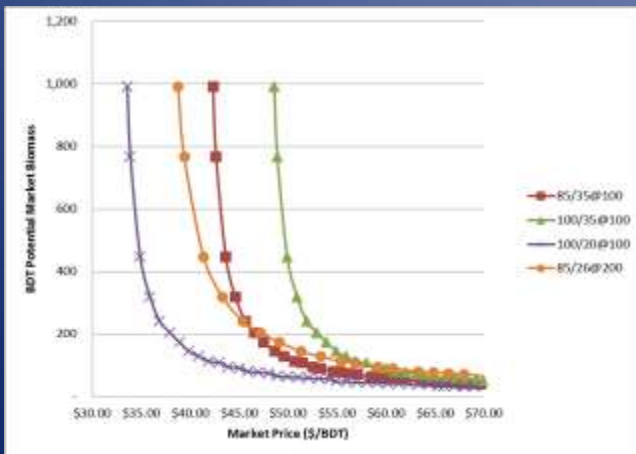
Harvest Configuration Filter



Operability Constraints



Cost/Transportation/Price Assessment

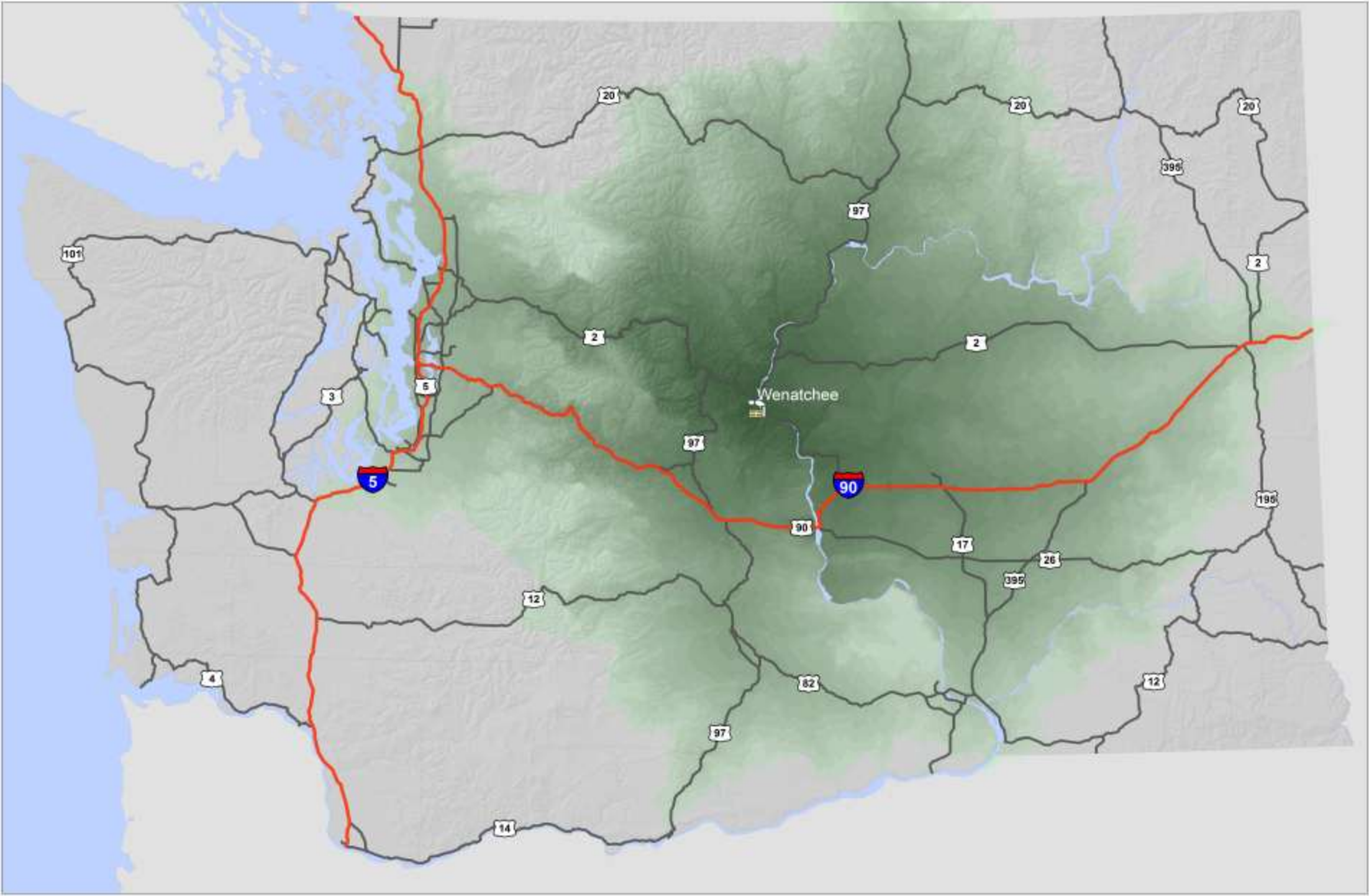


EQUIPMENT	LOW RANGE	HIGH RANGE
Skidder	\$75	\$95
Excavator	\$125	\$150
Grinder	\$300	\$400
Road Grader	\$75	\$100
Water Truck	\$65	\$85
Low Bed (conventional)	\$110	\$120
Low Bed (heavy loads)	\$125	\$140
D5 or D6 CAT Dozer	\$75	\$95

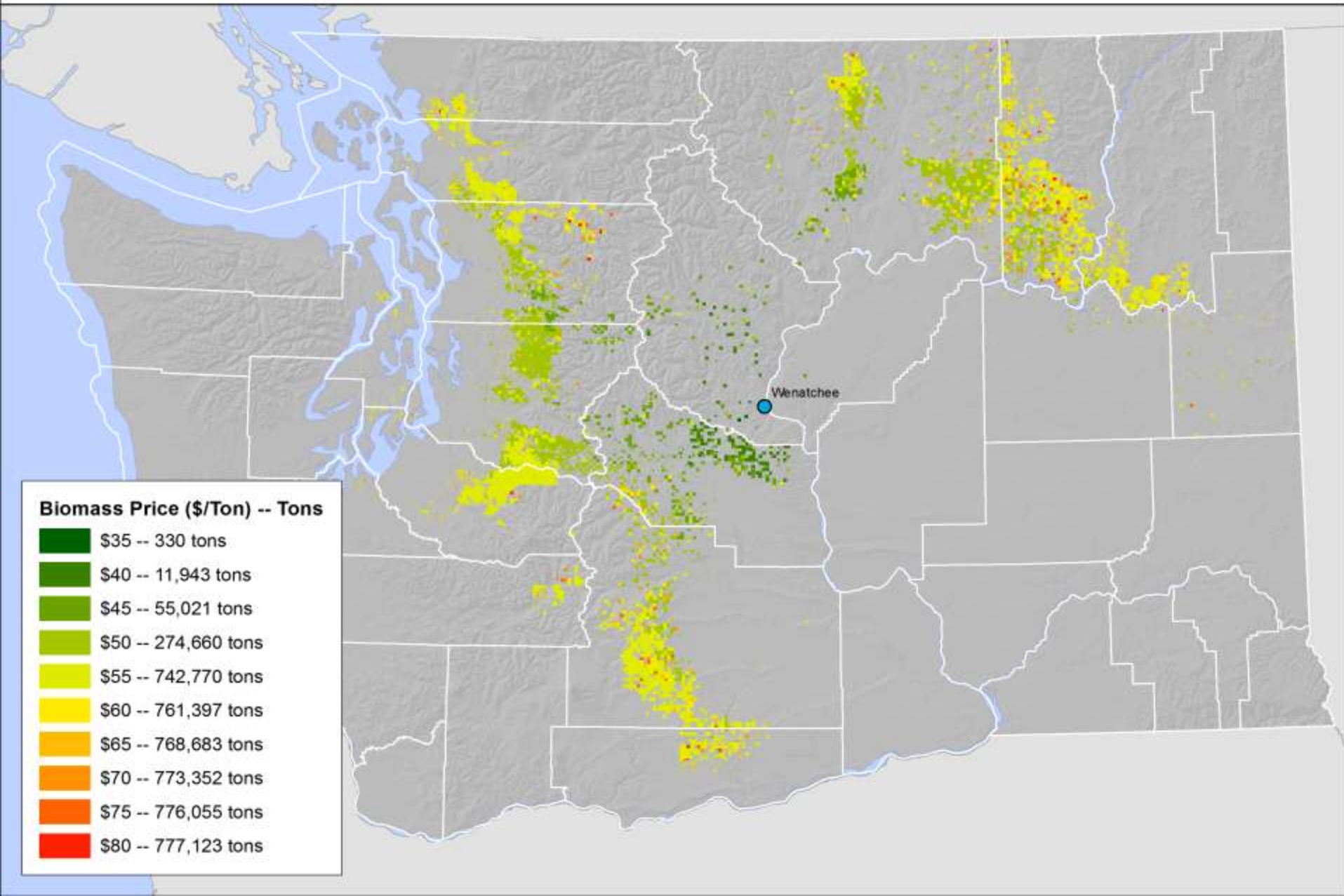
Wenatchee Transportation Analysis

4 Hour Drive Time Service Area

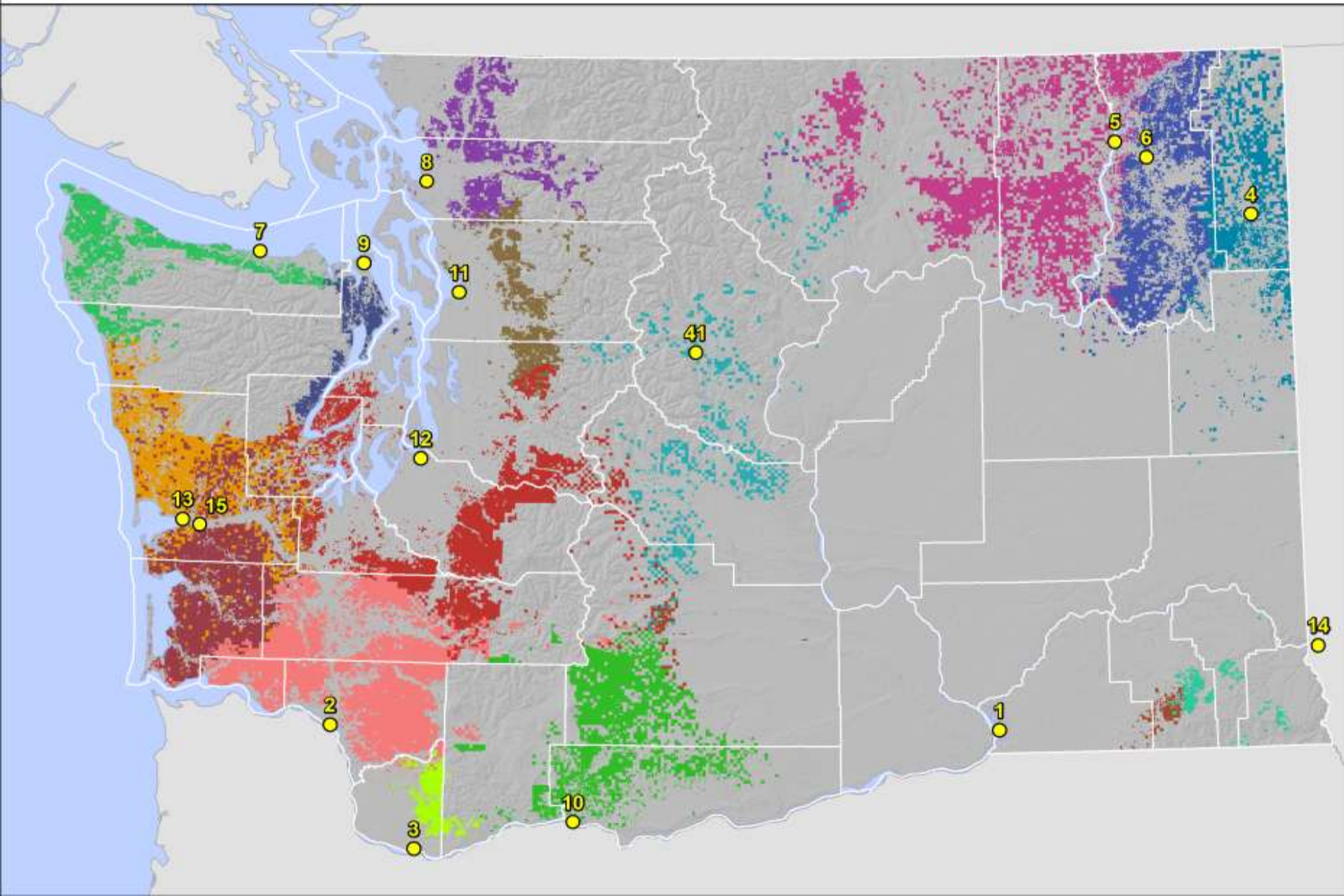
- Facilities
- Interstates
- Highways



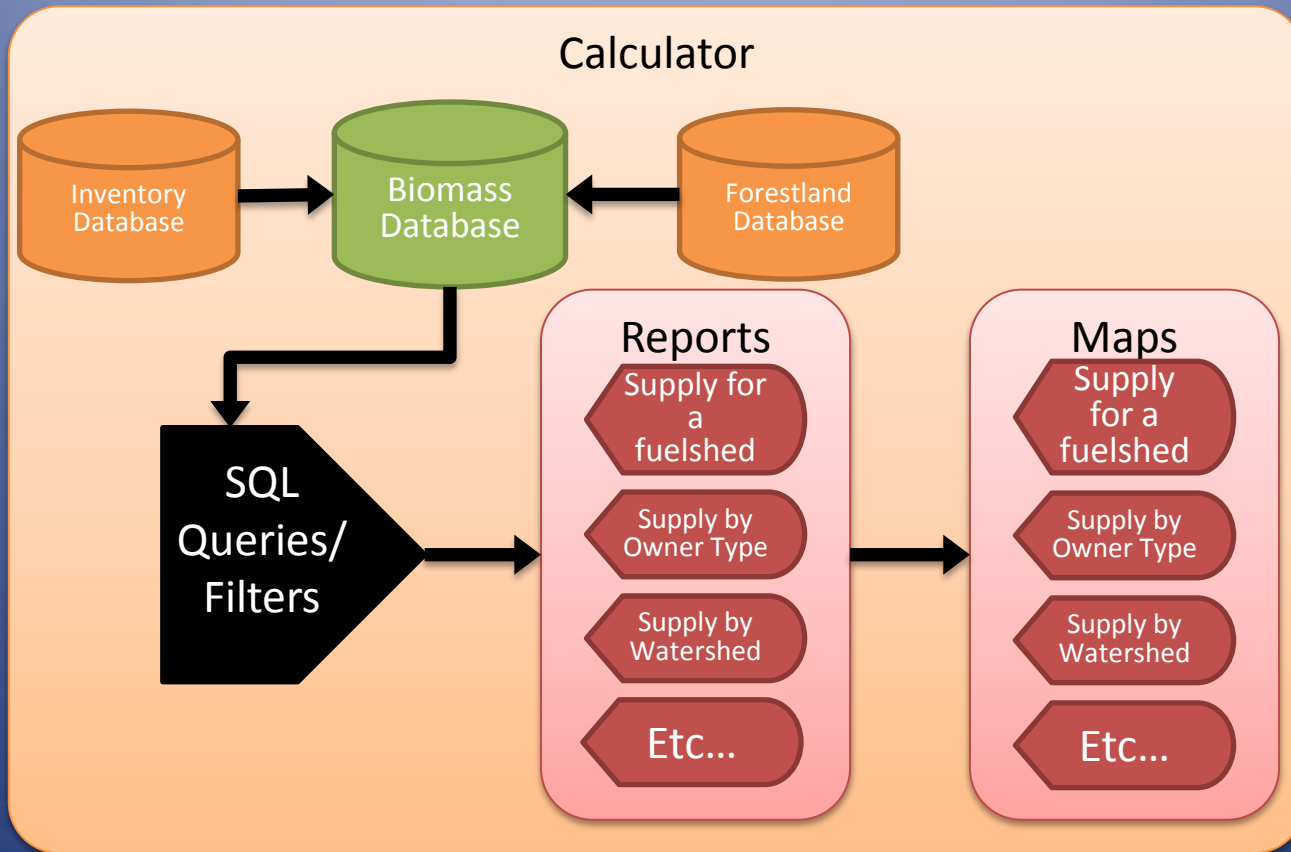
2030 Wenatchee Biomass Supply



Biomass Fuelsheds in 2010 at \$80 Per Ton



Develop Calculator



Washington State Biomass

[Biomass Calculator](#)

<http://wabiomass.cfr.washington.edu/>

Biomass Calculator



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Harvest Model [Geography](#) [Facilities](#) [Costs & Prices](#) [Options](#) [Results](#)

[Help](#) [About](#)

Select Harvest Model and Year [?](#)

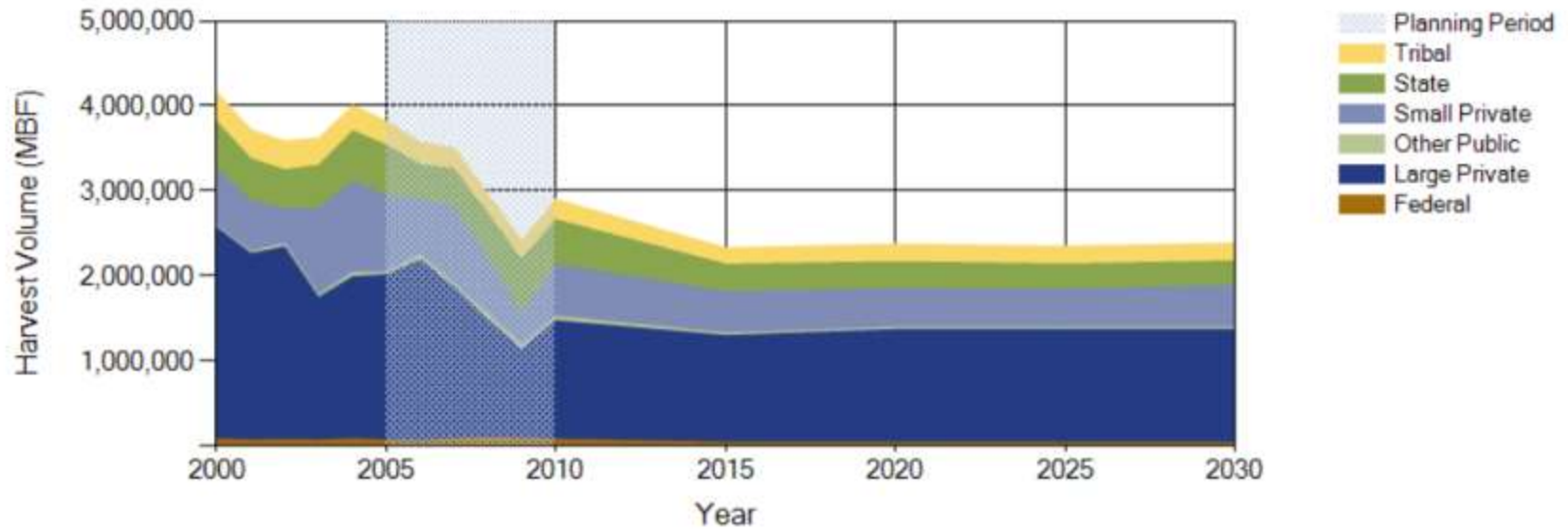
Harvest Model

Conservative Statewide Harvest

Planning period [?](#)

5 year period ending:

Timber Harvest Levels



Next

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Harvest Model **Geography** Facilities Costs & Prices Options Results

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Select a geographic area to calculate biomass [?](#)

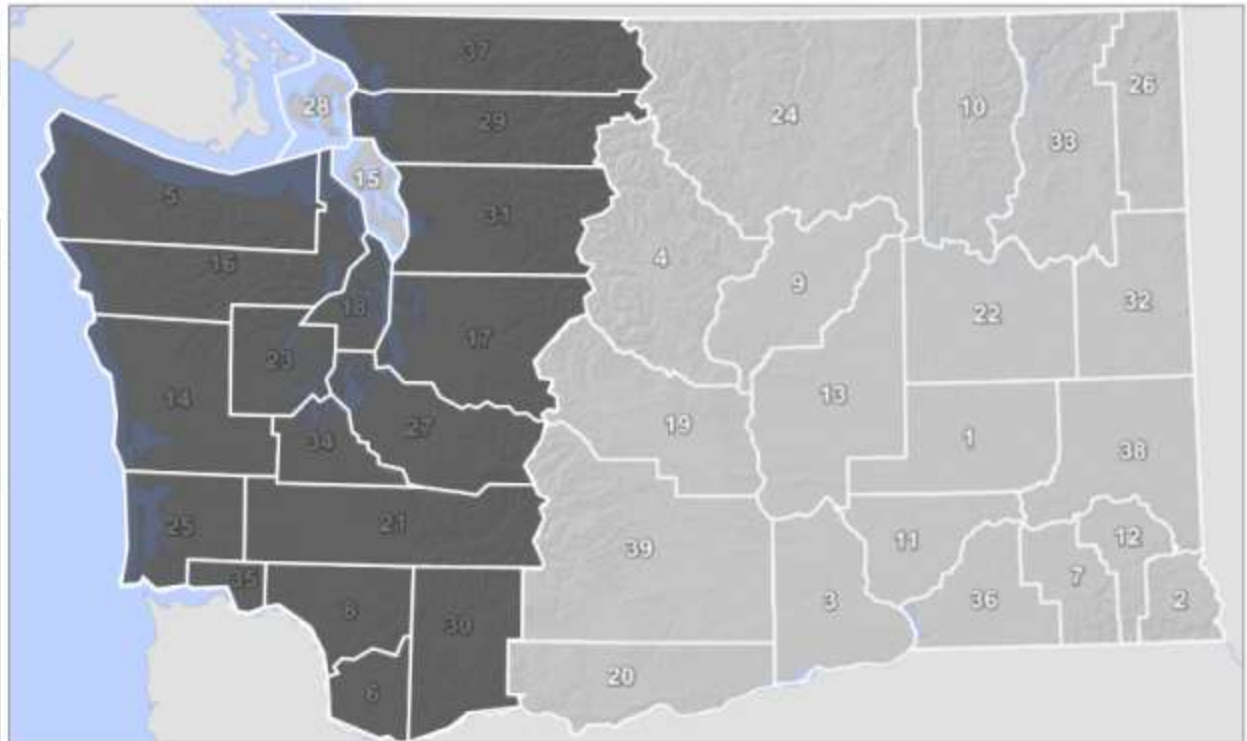
Type of area [?](#)

County

Specific location [?](#)

County: 17 selected.

- Asotin (2)
- Chelan (4)
- Clallam (5)
- Clark (6)
- Columbia (7)
- Cowlitz (8)
- Douglas (9)
- Ferry (10)
- Garfield (12)
- Grays Harbor (14)
- Island (15)
- Jefferson (16)
- King (17)
- Kitsap (18)
- Kittitas (19)
- Klickitat (20)
- Lewis (21)
- Lincoln (22)



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Harvest Model Geography **Facilities** Costs & Prices Options Results

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Select facilities to include in the analysis ?

Quick pick groups ?

Existing Proposed Hypothetical All Clear

Selected Facilities competing for forest biomass ?

- | | | | |
|--|--|---|---|
| <input type="checkbox"/> Aberdeen: Hypothetical | <input type="checkbox"/> Forks: Hypothetical | <input type="checkbox"/> Naselle: Hypothetical | <input checked="" type="checkbox"/> Tacoma: Existing |
| <input type="checkbox"/> Amboy: Proposed | <input type="checkbox"/> Goldendale: Hypothetical | <input type="checkbox"/> Olympia: Proposed | <input type="checkbox"/> Taholah: Proposed |
| <input checked="" type="checkbox"/> Bingen: Existing | <input checked="" type="checkbox"/> Hoquiam: Existing | <input type="checkbox"/> Omak: Proposed | <input type="checkbox"/> Usk: Existing |
| <input checked="" type="checkbox"/> Camas: Existing | <input type="checkbox"/> Kettle Falls: Existing | <input type="checkbox"/> Pe Ell: Hypothetical | <input type="checkbox"/> Vancouver: Proposed |
| <input type="checkbox"/> Centralia: Hypothetical | <input type="checkbox"/> Kulzer: Proposed | <input type="checkbox"/> Peshastin: Hypothetical | <input type="checkbox"/> Vancouver: Hypothetical |
| <input type="checkbox"/> Chehalis: Hypothetical | <input type="checkbox"/> Lewiston: Existing | <input checked="" type="checkbox"/> Port Angeles: Existing | <input checked="" type="checkbox"/> Wallula: Existing |
| <input type="checkbox"/> Colville: Existing | <input checked="" type="checkbox"/> Longview: Existing | <input checked="" type="checkbox"/> Port Townsend: Existing | <input type="checkbox"/> Wenatchee: Hypothetical |
| <input checked="" type="checkbox"/> Cosmopolis: Existing | <input type="checkbox"/> Longview West: Proposed | <input type="checkbox"/> Raymond: Hypothetical | <input type="checkbox"/> White Swan: Proposed |
| <input type="checkbox"/> Ellensburg: Proposed | <input type="checkbox"/> Longview East: Proposed | <input type="checkbox"/> Shelton Airport: Proposed | <input checked="" type="checkbox"/> Winton: Existing |
| <input type="checkbox"/> Entiat: Hypothetical | <input type="checkbox"/> Morton: Hypothetical | <input type="checkbox"/> Shelton Waterfront: Proposed | <input type="checkbox"/> Yakima: Proposed |
| <input checked="" type="checkbox"/> Everett: Existing | <input checked="" type="checkbox"/> Mount Vernon: Existing | <input type="checkbox"/> Spokane: Hypothetical | |

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Biomass Calculator



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Harvest Model Geography Facilities **Costs & Prices** Options Results

[Help](#) [About](#)

Select costs and prices ?

Biomass harvest costs ?

Cost model:

Forest health cost (\$/BDT): \$45.00
Mobilization cost (\$/hr): \$120.00
Load/unload cost (\$/BDT): \$26.00
Haul cost (\$/hr): \$95.00

Biomass price paid at facility ?

Biomass price (\$/BDT):

Note that higher biomass prices increase the run-time of the calculator so please be patient

Biomass Calculator



WASHINGTON STATE DEPARTMENT OF
Natural Resources

- Harvest Model
- Geography
- Facilities
- Costs & Prices
- Options**
- Results

[Help](#) [About](#)

Summary Options [?](#)

Biomass trucking restrictions [?](#)

Maximum Haul Filter: Enabled Disabled
Maximum Haul (hours):

Reporting fields [?](#)

Summary Fields:

- County
- Stumpage Value Area
- Timbershed
- Watershed (WRIA)
- Facility
- Owner Class
- Haul Time

Field options [?](#)

Use Names or IDs in Results Table:

- Names
- ID Numbers

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Biomass Calculator



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Natural Resources

Harvest Model Geography Facilities Costs & Prices Options **Results**

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Results (5 year planning period totals)

Hide Run Parameters

Run: Conservative Statewide Harvest

Year: 2010

Geography: County

Geographies: Clallam (5), Clark (6), Cowlitz (8), Grays Harbor (14), Jefferson (16), King (17), Kitsap (18), Lewis (21), Mason (23), Pacific (25), Pierce (27), Skagit (29), Skamania (30), Snohomish (31), Thurston (34), Wahkiakum (35), Whatcom (37)

Facilities: Bingen: Existing, Camas: Existing, Cosmopolis: Existing, Everett: Existing, Hoquiam: Existing, Longview: Existing, Mount Vernon: Existing, Port Angeles: Existing, Port Townsend: Existing, Tacoma: Existing, Wallula: Existing, Winton: Existing

Cost: Medium

Price: \$50

Max Haul Time To Facility: 240 minutes

Reporting Fields: County, Facility, Owner Class

Field Options: Names

Back

Run!

Biomass Calculator



Harvest Model | Geography | Facilities | Costs & Prices | Options | **Results**

[Help](#) [About](#)

Results (5 year planning period totals)

Hide Run Parameters

Run: Conservative Statewide Harvest

Year: 2010

Geography: County

Geographies: Clallam (5), Clark (6), Cowlitz (8), Grays Harbor (14), Jefferson (16), King (17), Kitsap (18), Lewis (21), Mason (23), Pacific (25), Pierce (27), Skagit (29), Skamania (30), Snohomish (31), Thurston (34), Wahkiakum (35), Whatcom (37)

Facilities: Bingen: Existing, Camas: Existing, Cosmopolis: Existing, Everett: Existing, Hoquiam: Existing, Longview: Existing, Mount Vernon: Existing, Port Angeles: Existing, Port Townsend: Existing, Tacoma: Existing, Wallula: Existing, Winton: Existing

Cost: Medium

Price: \$50

Max Haul Time To Facility: 240 minutes

Reporting Fields: County, Facility, Owner

Field Options: Names



Utilizing forest slash responsibly takes time, please be patient while we evaluate options for transporting residual forest biomass to market over the next few minutes...

[◀ Back](#) [Run!](#)

Biomass Calculator



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Natural Resources

Harvest Model Geography Facilities Costs & Prices Options **Results**

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Results (5 year planning period totals) ?

+ Show Run Parameters

Download results

Download parameters

Download lookup tables

County	Facility	Owner Class	Scattered Biomass (BDT)	Roadside Biomass (BDT)	Market Biomass (BDT)	Residual Value (\$)
Skamania	Bingen:Existing (10)	Federal	20,312	6,548	19,467	\$154,328.08
Lewis	Bingen:Existing (10)	Private	352	449	464	\$1,151.84
Skamania	Bingen:Existing (10)	Private	20,354	23,160	20,151	\$226,231.56
Clark	Camas:Existing (3)	Private	26,540	31,301	26,680	\$242,516.89
Skamania	Camas:Existing (3)	Private	7,476	7,052	6,126	\$56,458.40
Clark	Camas:Existing (3)	State	72,454	63,381	33,830	\$395,638.88
Skamania	Camas:Existing (3)	State	367	373	201	\$1,507.31
Grays Harbor	Cosmopolis:Existing (15)	Municipal	15,272	24,897	19,325	\$220,139.38
Pacific	Cosmopolis:Existing (15)	Municipal	2,177	2,100	1,636	\$19,256.77
Grays Harbor	Cosmopolis:Existing (15)	Private	164,432	247,102	199,631	\$2,165,995.94
Jefferson	Cosmopolis:Existing (15)	Private	4,221	7,687	5,932	\$33,712.50
Lewis	Cosmopolis:Existing (15)	Private	17,901	17,250	18,211	\$125,348.46
Mason	Cosmopolis:Existing (15)	Private	49,737	53,197	58,065	\$495,012.18
Pacific	Cosmopolis:Existing (15)	Private	323,291	445,068	356,702	\$2,881,021.53
Thurston	Cosmopolis:Existing (15)	Private	2,147	2,622	2,454	\$19,349.92
Wahkiakum	Cosmopolis:Existing (15)	Private	865	991	763	\$2,382.60

Conservative_State_Harvest_2010_Medium_50_County_20120811_163352.csv - Microsoft Excel

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Clipboard: Paste, Cut, Copy, Format Painter

Font: Calibri, 11, Bold, Italic, Underline, Text Color, Background Color

Alignment: Wrap Text, Merge & Center

Number: General, \$, %, .00, .00

Styles: Conditional Formatting, Format as Table, Cell Styles

Cells: Insert, Delete, Format

Editing: AutoSum, Fill, Clear, Sort & Filter, Find & Select

	A	B	C	D	E	F	G	H	I	J
1	County	Facility	OwnerClass	ScatteredBiomassTons	RoadsideBiomassTons	MarketBiomassTons	ResidualValueDollars			
2	Skamania	Bingen:Existing (10)	Federal	20,312	6,548	19,467	\$ 154,328.08			
3	Lewis	Bingen:Existing (10)	Private	352	449	464	\$ 1,151.84			
4	Skamania	Bingen:Existing (10)	Private	20,354	23,160	20,151	\$ 226,231.56			
5	Clark	Camas:Existing (3)	Private	26,540	31,301	26,680	\$ 242,516.89			
6	Skamania	Camas:Existing (3)	Private	7,476	7,052	6,126	\$ 56,458.40			
7	Clark	Camas:Existing (3)	State	72,454	63,381	33,830	\$ 395,638.88			
8	Skamania	Camas:Existing (3)	State	367	373	201	\$ 1,507.31			
9	Grays Harbor	Cosmopolis:Existing (15)	Municipal	15,272	24,897	19,325	\$ 220,139.38			
10	Pacific	Cosmopolis:Existing (15)	Municipal	2,177	2,100	1,636	\$ 19,256.77			
11	Grays Harbor	Cosmopolis:Existing (15)	Private	164,432	247,102	199,631	\$ 2,165,995.94			
12	Jefferson	Cosmopolis:Existing (15)	Private	4,221	7,687	5,932	\$ 33,712.50			
13	Lewis	Cosmopolis:Existing (15)	Private	17,901	17,250	18,211	\$ 125,348.46			
14	Mason	Cosmopolis:Existing (15)	Private	49,737	53,197	58,065	\$ 495,012.18			
15	Pacific	Cosmopolis:Existing (15)	Private	323,291	445,068	356,702	\$ 2,881,021.53			
16	Thurston	Cosmopolis:Existing (15)	Private	2,147	2,622	2,454	\$ 19,349.92			
17	Wahkiakum	Cosmopolis:Existing (15)	Private	865	991	763	\$ 2,382.60			
18	Grays Harbor	Cosmopolis:Existing (15)	State	31,829	25,132	18,391	\$ 172,871.54			
19	Lewis	Cosmopolis:Existing (15)	State	11,694	13,294	8,297	\$ 48,462.68			
20	Pacific	Cosmopolis:Existing (15)	State	177,668	106,342	111,218	\$ 990,739.61			
21	Thurston	Cosmopolis:Existing (15)	State	17,508	16,250	9,289	\$ 79,389.95			
22	Grays Harbor	Cosmopolis:Existing (15)	Tribal	4,386	4,111	9,433	\$ 68,425.73			
23	King	Everett:Existing (11)	Federal	797	420	192	\$ 498.00			
24	Snohomish	Everett:Existing (11)	Federal	1,220	621	300	\$ 495.25			
25	King	Everett:Existing (11)	Municipal	560	710	859	\$ 9,960.56			
26	Snohomish	Everett:Existing (11)	Municipal	989	882	889	\$ 5,069.25			
27	King	Everett:Existing (11)	Private	19,230	19,747	20,429	\$ 170,164.83			
28	Skagit	Everett:Existing (11)	Private	4,587	8,709	3,514	\$ 9,077.05			
29	Snohomish	Everett:Existing (11)	Private	65,392	70,505	78,465	\$ 830,209.22			
30	King	Everett:Existing (11)	State	22,687	24,528	13,005	\$ 123,887.30			
31	Skagit	Everett:Existing (11)	State	9,635	11,265	2,795	\$ 21,001.06			
32	Snohomish	Everett:Existing (11)	State	116,231	137,686	69,636	\$ 728,774.98			
33	Grays Harbor	Hoquiam:Existing (13)	Municipal	59,186	83,075	62,278	\$ 771,986.31			
34	Grays Harbor	Hoquiam:Existing (13)	Private	240,127	399,872	304,492	\$ 3,153,718.67			
35	Jefferson	Hoquiam:Existing (13)	Private	19,558	33,010	30,474	\$ 154,306.10			
36	Lewis	Hoquiam:Existing (13)	Private	5,901	6,273	6,398	\$ 40,167.18			
37	Mason	Hoquiam:Existing (13)	Private	42,883	46,936	51,184	\$ 451,131.64			
38	Pacific	Hoquiam:Existing (13)	Private	21,879	30,738	24,735	\$ 196,702.39			
39	Thurston	Hoquiam:Existing (13)	Private	657	772	848	\$ 7,343.67			

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perjohm:
This is the volume that is left in the woods due to economics and breakage assumptions (i.e., not brought to the landing or roadside)

perjohm:
This is the volume that can be brought to market at a specified price.

County	Scattered Biomass Tons	Roadside Biomass Tons	Market Biomass Tons	Residual Value Dollars
Clallam	375,051	205,893	769,914	\$ 5,691,224
Grays Harbor	627,617	884,940	705,530	\$ 7,059,515
Jefferson	183,681	145,715	326,692	\$ 2,879,616
Kitsap	37,646	42,984	42,067	\$ 380,681
Mason	275,137	292,227	285,934	\$ 2,177,290

perjohm:
This volume is unmarketable due to process costs and logistic assumptions

perjohm:
This is the residual value to the landowner (price minus grinding and hauling costs) Only roadside biomass with positive residual value is brought to market

Average_Statewide_Harvest_2015_Medium_50_County_20121909_120132 - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells Editing

Calibri 11 A A

General

Conditional Formatting Format as Table Cell Styles

Insert Delete Format

AutoSum Fill Clear Sort & Filter Find & Select

	A	B	C	D	E	F	G	H	I
10									
11									
12									
13									
14	County	Scattered Biomass Tons	Roadside Biomass Tons	Market Biomass Tons	Residual Value Dollars				
15	Clallam	375,051	205,893	769,914	\$ 5,691,224				
16	Grays Harbor	627,617	884,940	705,530	\$ 7,059,515				
17	Jefferson	183,681	145,715	326,692	\$ 2,879,616				
18	Kitsap	37,646	42,984	42,067	\$ 380,681				
19	Mason	275,137	292,227	285,934	\$ 2,177,290				
20									
21		Annual Basis							
22	Clallam	75,010	41,179	153,983	\$ 1,138,245				
23	Grays Harbor	125,523	176,988	141,106	\$ 1,411,903				
24	Jefferson	36,736	29,143	65,338	\$ 575,923				
25	Kitsap	7,529	8,597	8,413	\$ 76,136				
26	Mason	55,027	58,445	57,187	\$ 435,458				
27									
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31									
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34									
35									

Acknowledgements:

We wish to thank Peter Goldmark, Commissioner of Public Lands and Aaron Everett, State Forester, for securing Forest Service funds that were awarded to complete the project. We thank the many people who contributed their time and insights throughout the assessment. In particular we thank Craig Partridge, Rachael Jamison, and Jeff Linnquist from the Washington Department of Natural Resources, attendees at 4 public meetings, those who took our calls and answered our emails in our pursuit to clarify information. We are also indebted to the technical review team for their insights and constructive comments submitted on the draft versions of the report.

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