



































































































































































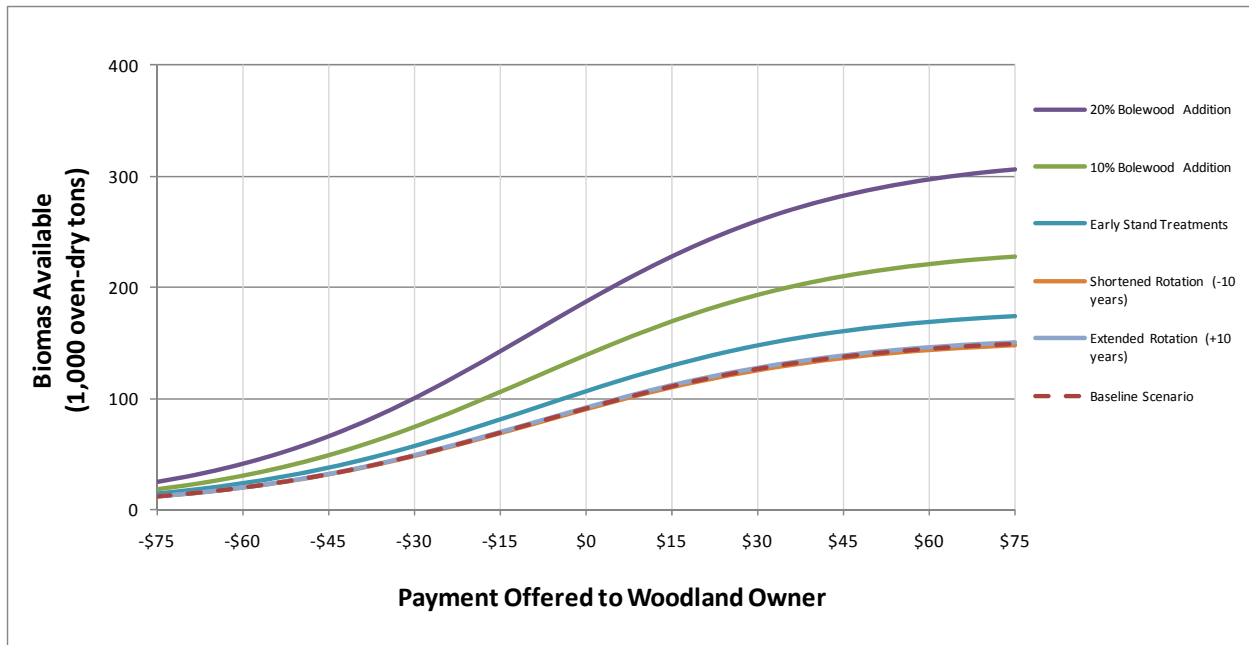


**Table B.5.** Northwest Minnesota annual ODT of residual biomass by ownership and forest management scenario (5.50 million cord harvest).<sup>1</sup>

Scenario	Description	----- Government -----			Private industrial <sup>2</sup>	Woodlands	Total
		Federal	State	Local			
0% Residual retention	Total physical availability	68,271	135,629	151,245	71,302	231,355	657,803
	+ 10% Bolewood	93,259	185,028	204,924	96,770	313,705	893,685
	+ 20% Bolewood	118,247	234,426	258,602	122,238	396,055	1,129,567
	Early stand treatments	82,284	163,146	181,235	83,105	271,306	781,077
	Shortened rotation (-10 yrs)	67,226	134,030	149,018	69,704	229,743	649,722
	Extended rotation (+10 yrs)	69,505	137,023	153,492	73,156	233,496	666,671
15% Residual retention	Operational maximum removal rate	58,030	115,285	128,559	60,607	196,652	559,133
	+ 10% Bolewood	83,018	164,683	182,237	86,075	279,002	795,015
	+ 20% Bolewood	108,007	214,082	235,915	111,542	361,352	1,030,897
	Early stand treatments	69,941	138,674	154,050	70,640	230,610	663,915
	Shortened rotation (-10 yrs)	57,142	113,926	126,666	59,249	195,282	552,264
	Extended rotation (+10 yrs)	59,079	116,470	130,468	62,182	198,471	566,671
33% Residual retention	MFRC biomass guidelines	45,742	90,871	101,334	47,772	155,008	440,728
	+ 10% Bolewood	70,730	140,270	155,013	73,240	237,358	676,610
	+ 20% Bolewood	95,718	189,669	208,691	98,708	319,708	912,492
	Early stand treatments	55,130	109,308	121,428	55,681	181,775	523,321
	Shortened rotation (-10 yrs)	45,041	89,800	99,842	46,702	153,928	435,314
	Extended rotation (+10 yrs)	46,569	91,805	102,839	49,014	156,442	446,670
50% Residual retention	Assumed current removal rate	34,136	67,815	75,623	35,651	115,678	328,902
	+ 10% Bolewood	59,124	117,213	129,301	61,119	198,027	564,784
	+ 20% Bolewood	84,112	166,612	182,979	86,586	280,377	800,666
	Early stand treatments	41,142	81,573	90,618	41,553	135,653	390,538
	Shortened rotation (-10 yrs)	33,613	67,015	74,509	34,852	114,872	324,861
	Extended rotation (+10 yrs)	34,753	68,512	76,746	36,578	116,748	333,336
75% Residual retention	Low utilization rate	17,068	33,907	37,811	17,826	57,839	164,451
	+ 10% Bolewood	42,056	83,306	91,489	43,293	140,189	400,333
	+ 20% Bolewood	67,044	132,704	145,168	68,761	222,538	636,215
	Early stand treatments	20,571	40,786	45,309	20,776	67,827	195,269
	Shortened rotation (-10 yrs)	16,806	33,508	37,255	17,426	57,436	162,431
	Extended rotation (+10 yrs)	17,376	34,256	38,373	18,289	58,374	166,668

<sup>1</sup> Residual biomass includes tops, limbs, branches and needles as defined by from the USDA Forest Service FIA biomass attributes.

<sup>2</sup> Includes corporate, nongovernmental conservation/natural resources organizations, unincorporated local partnerships/associations/clubs, and Native American timberlands.



**Figure B.5.** Estimated northwest Minnesota residual biomass supply from woodlands owners (5.50 million cord harvest; 33% on-site residual retention).



**Figure B.6.** Estimated northwest Minnesota residual biomass supply from woodlands owners (5.50 million cord harvest; 50% on-site residual retention).

## Appendix C. Aggregate Biomass Availability in East-central Minnesota

**Table C.1.** Estimated timberland area (acres) by FIA forest type group for east-central Minnesota (nonstocked areas not included).

Age Class	White-red-		Oak-pine	Oak-hickory	Elm-ash- cottonwood	Maple-	
	jack pine	Spruce-fir <sup>1</sup>				beech-birch <sup>2</sup>	Aspen-birch
0-10	2,824	2,309	0	32,631	18,881	27,787	77,861
11-20	9,480	2,964	4,529	21,180	7,582	11,464	41,907
21-30	12,292	11,588	4,795	28,239	24,170	14,164	91,035
31-40	8,859	7,012	0	51,917	39,285	17,274	79,910
41-50	20,507	8,046	9,789	122,946	63,701	27,397	72,332
51-60	3,079	25,608	5,413	145,464	59,893	45,679	73,583
61-70	4,414	13,437	4,289	180,677	71,263	70,793	58,034
71-80	0	16,912	3,079	159,620	43,284	40,975	20,190
81-90	5,934	774	1,601	130,093	18,793	43,962	13,546
91-100	2,757	2,423	0	74,244	14,582	27,354	2,852
100+	0	1,048	0	109,080	10,222	23,555	731

<sup>1</sup> Other exotic softwoods and Exotic softwoods were combined with the Spruce-fir forest type.

<sup>2</sup> Other hardwoods and Exotic hardwoods were combined with the Maple-beech-birch forest type.

**Table C.2.** Estimated living biomass (ODT) on timberland by stand attribute and ownership in east-central Minnesota (based on 3.47 million cord annual harvest).

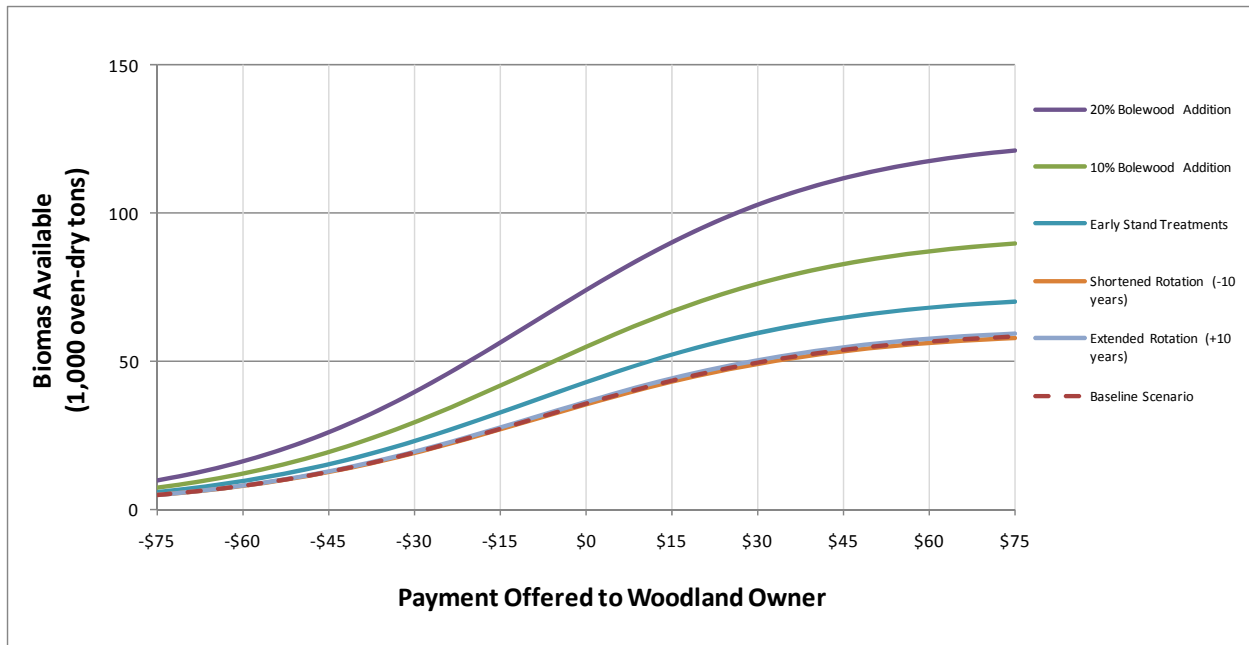
Biomass attribute	----- Government -----			Private		Total
	Federal	State	Local	industrial	Woodlands	
Bolewood	537,363	4,478,978	1,985,469	2,278,896	32,328,075	41,608,781
Tops and limbs	152,583	1,255,142	557,674	637,241	9,026,122	11,628,762
Stumps	33,828	272,778	120,776	139,174	1,965,653	2,532,209
Saplings	154,005	1,277,147	566,842	623,298	8,291,792	10,913,085
Belowground	180,193	1,520,188	674,554	765,192	10,649,781	13,789,909

**Table C.3.** East-central Minnesota annual ODT of residual biomass by ownership and forest management scenario (3.47 million cord harvest).<sup>1</sup>

Scenario	Description	----- Government -----			Private industrial <sup>2</sup>	Woodlands	Total
		Federal	State	Local			
0% Residual retention	Total physical availability	1,481	16,166	7,283	6,122	91,124	122,176
	+ 10% Bolewood	2,019	21,932	9,830	8,365	123,665	165,811
	+ 20% Bolewood	2,556	27,698	12,378	10,608	156,206	209,446
	Early stand treatments	1,802	19,816	8,874	7,168	109,299	146,958
	Shortened rotation (-10 yrs)	1,452	15,985	7,145	5,941	89,830	120,353
	Extended rotation (+10 yrs)	1,500	16,387	7,388	6,269	91,973	123,516
15% Residual retention	Operational maximum removal rate	1,259	13,741	6,190	5,204	77,456	103,849
	+ 10% Bolewood	1,796	19,507	8,738	7,446	109,996	147,485
	+ 20% Bolewood	2,334	25,273	11,286	9,689	142,537	191,120
	Early stand treatments	1,532	16,844	7,543	6,092	92,904	124,914
	Shortened rotation (-10 yrs)	1,235	13,587	6,073	5,050	76,355	102,300
	Extended rotation (+10 yrs)	1,275	13,929	6,279	5,329	78,177	104,989
33% Residual retention	MFRC biomass guidelines	992	10,831	4,880	4,102	61,053	81,858
	+ 10% Bolewood	1,530	16,597	7,427	6,345	93,594	125,493
	+ 20% Bolewood	2,068	22,363	9,975	8,587	126,135	169,128
	Early stand treatments	1,207	13,277	5,945	4,802	73,230	98,462
	Shortened rotation (-10 yrs)	973	10,710	4,787	3,980	60,186	80,636
	Extended rotation (+10 yrs)	1,005	10,979	4,950	4,200	61,622	82,756
50% Residual retention	Assumed current removal rate	740	8,083	3,641	3,061	45,562	61,088
	+ 10% Bolewood	1,278	13,849	6,189	5,304	78,103	104,723
	+ 20% Bolewood	1,816	19,615	8,737	7,547	110,644	148,358
	Early stand treatments	901	9,908	4,437	3,584	54,649	73,479
	Shortened rotation (-10 yrs)	726	7,992	3,572	2,970	44,915	60,176
	Extended rotation (+10 yrs)	750	8,193	3,694	3,135	45,986	61,758
75% Residual retention	Low utilization rate	370	4,042	1,821	1,530	22,781	30,544
	+ 10% Bolewood	908	9,808	4,368	3,773	55,322	74,179
	+ 20% Bolewood	1,446	15,574	6,916	6,016	87,863	117,814
	Early stand treatments	450	4,954	2,218	1,792	27,325	36,739
	Shortened rotation (-10 yrs)	363	3,996	1,786	1,485	22,457	30,088
	Extended rotation (+10 yrs)	375	4,097	1,847	1,567	22,993	30,879

<sup>1</sup> Residual biomass includes tops, limbs, branches and needles as defined by from the USDA Forest Service FIA biomass attributes.

<sup>2</sup> Includes corporate, nongovernmental conservation/natural resources organizations, unincorporated local partnerships/associations/clubs, and Native American timberlands.



**Figure C.1.** Estimated east-central Minnesota residual biomass supply from woodlands owners (3.47 million cord harvest; 33% on-site residual retention).



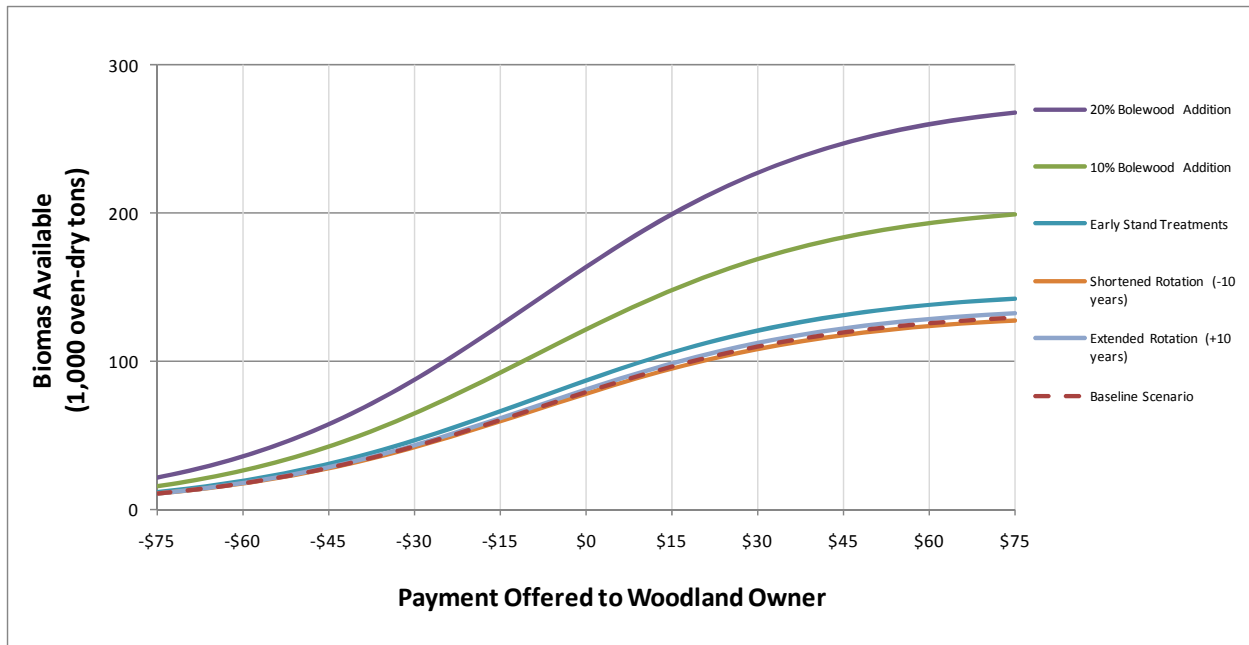
**Figure C.2.** Estimated east-central Minnesota residual biomass supply from woodlands owners (3.47 million cord harvest; 50% on-site residual retention).

**Table C.4.** East-central Minnesota annual ODT of residual biomass by ownership and forest management scenario (4.90 million cord harvest).<sup>1</sup>

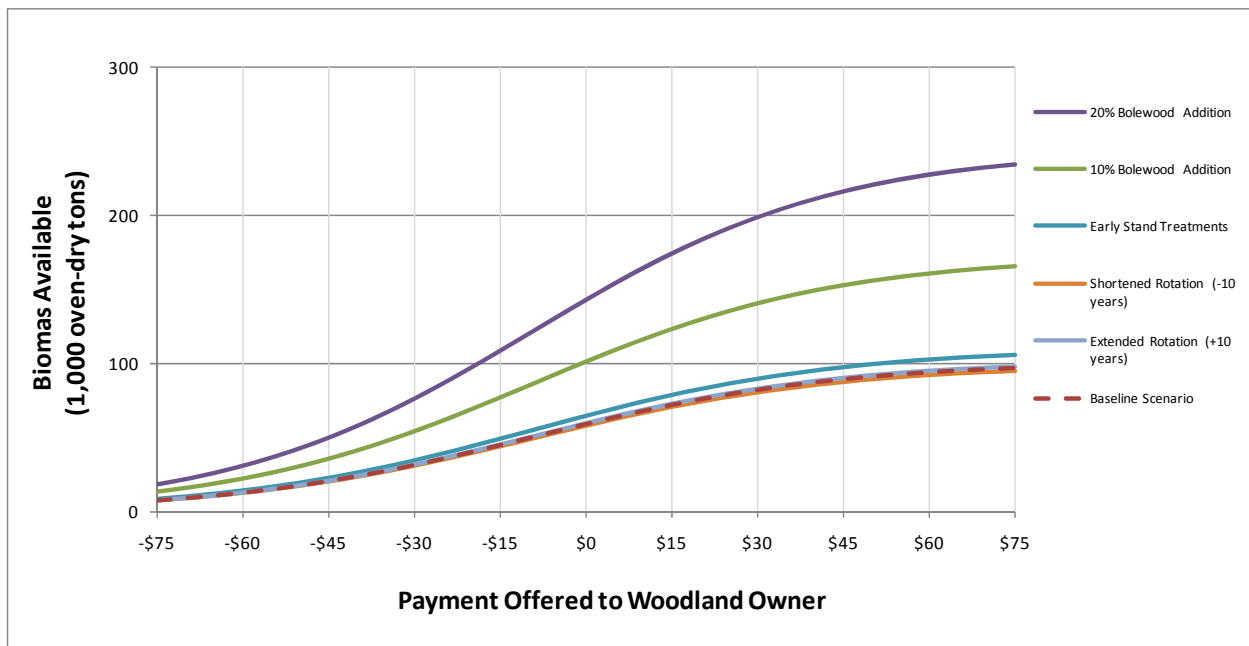
Scenario	Description	----- Government -----			Private industrial <sup>2</sup>	Woodlands	Total
		Federal	State	Local			
0% Residual retention	Total physical availability	3,352	32,874	14,804	14,899	202,002	267,931
	+ 10% Bolewood	4,552	44,573	20,032	20,259	273,850	363,266
	+ 20% Bolewood	5,752	56,272	25,260	25,619	345,698	458,601
	Early stand treatments	3,680	36,684	16,516	15,989	220,683	293,551
	Shortened rotation (-10 yrs)	3,284	32,333	14,536	14,508	198,650	263,311
	Extended rotation (+10 yrs)	3,400	33,407	15,009	15,218	205,311	272,345
15% Residual retention	Operational maximum removal rate	2,849	27,943	12,583	12,664	171,702	227,741
	+ 10% Bolewood	4,049	39,642	17,811	18,024	243,550	323,076
	+ 20% Bolewood	5,249	51,341	23,039	23,385	315,397	418,411
	Early stand treatments	3,128	31,181	14,039	13,590	187,581	249,519
	Shortened rotation (-10 yrs)	2,792	27,483	12,355	12,332	168,853	223,815
	Extended rotation (+10 yrs)	2,890	28,396	12,758	12,935	174,514	231,493
33% Residual retention	MFRC biomass guidelines	2,246	22,025	9,918	9,982	135,342	179,513
	+ 10% Bolewood	3,446	33,725	15,147	15,343	207,189	274,849
	+ 20% Bolewood	4,646	45,424	20,375	20,703	279,037	370,184
	Early stand treatments	2,465	24,578	11,066	10,712	147,858	196,679
	Shortened rotation (-10 yrs)	2,201	21,663	9,739	9,720	133,096	176,418
	Extended rotation (+10 yrs)	2,278	22,383	10,056	10,196	137,558	182,471
50% Residual retention	Assumed current removal rate	1,676	16,437	7,402	7,450	101,001	133,965
	+ 10% Bolewood	2,876	28,136	12,630	12,810	172,849	229,300
	+ 20% Bolewood	4,076	39,835	17,858	18,170	244,697	324,636
	Early stand treatments	1,840	18,342	8,258	7,994	110,342	146,776
	Shortened rotation (-10 yrs)	1,642	16,167	7,268	7,254	99,325	131,656
	Extended rotation (+10 yrs)	1,700	16,703	7,505	7,609	102,655	136,172
75% Residual retention	Low utilization rate	838	8,218	3,701	3,725	50,501	66,983
	+ 10% Bolewood	2,038	19,918	8,929	9,085	122,348	162,318
	+ 20% Bolewood	3,238	31,617	14,157	14,445	194,196	257,653
	Early stand treatments	920	9,171	4,129	3,997	55,171	73,388
	Shortened rotation (-10 yrs)	821	8,083	3,634	3,627	49,663	65,828
	Extended rotation (+10 yrs)	850	8,352	3,752	3,804	51,328	68,086

<sup>1</sup> Residual biomass includes tops, limbs, branches and needles as defined by from the USDA Forest Service FIA biomass attributes.

<sup>2</sup> Includes corporate, nongovernmental conservation/natural resources organizations, unincorporated local partnerships/associations/clubs, and Native American timberlands.



**Figure C.3.** Estimated east-central Minnesota residual biomass supply from woodlands owners (4.90 million cord harvest; 33% on-site residual retention).



**Figure C.3.** Estimated east-central Minnesota residual biomass supply from woodlands owners (4.90 million cord harvest; 50% on-site residual retention).

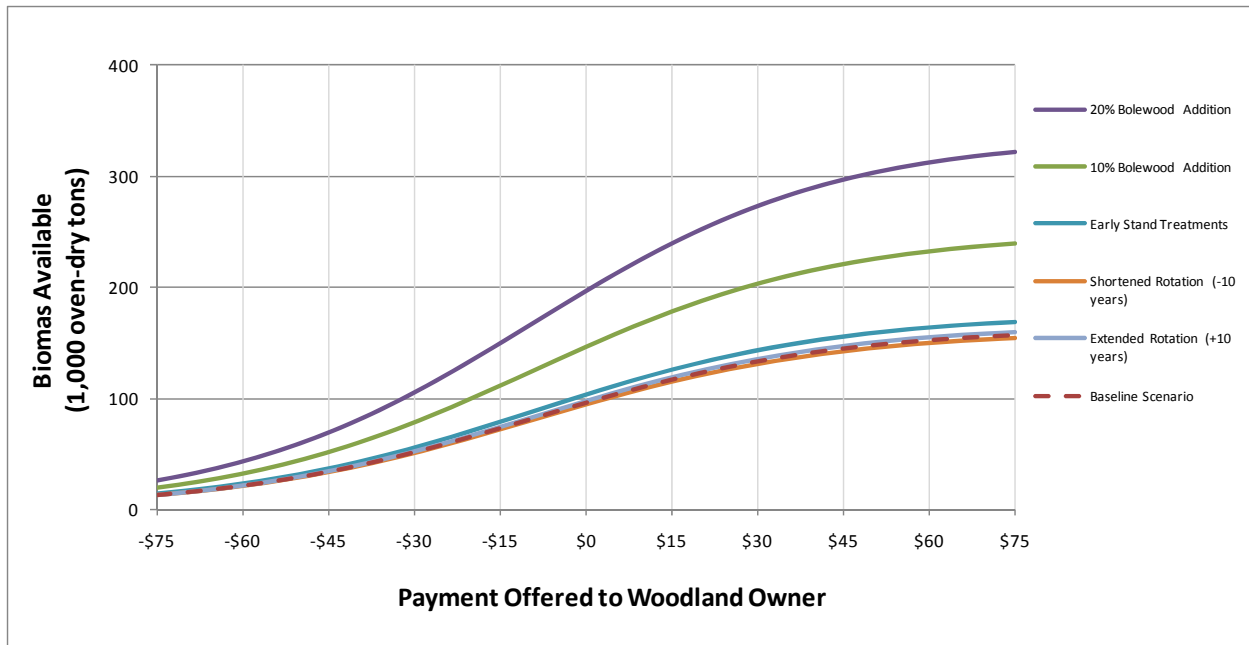


**Table C.5.** East-central Minnesota annual ODT of residual biomass by ownership and forest management scenario (5.50 million cord harvest).<sup>1</sup>

Scenario	Description	----- Government -----			Private industrial <sup>2</sup>	Woodlands	Total
		Federal	State	Local			
0% Residual retention	Total physical availability	4,269	39,340	17,361	16,932	243,918	321,821
	+ 10% Bolewood	5,766	53,258	23,484	22,964	330,229	435,702
	+ 20% Bolewood	7,263	67,177	29,606	28,997	416,540	549,582
	Early stand treatments	4,618	43,414	19,122	18,154	262,832	348,140
	Shortened rotation (-10 yrs)	4,200	38,797	17,086	16,531	239,938	316,553
	Extended rotation (+10 yrs)	4,325	39,857	17,582	17,257	247,647	326,669
15% Residual retention	Operational maximum removal rate	3,629	33,439	14,757	14,392	207,330	273,548
	+ 10% Bolewood	5,126	47,357	20,879	20,425	293,641	387,428
	+ 20% Bolewood	6,622	61,276	27,002	26,457	379,952	501,309
	Early stand treatments	3,925	36,902	16,254	15,431	223,407	295,919
	Shortened rotation (-10 yrs)	3,570	32,978	14,523	14,051	203,948	269,070
	Extended rotation (+10 yrs)	3,677	33,878	14,945	14,669	210,500	277,669
33% Residual retention	MFRC biomass guidelines	2,861	26,358	11,632	11,345	163,425	215,620
	+ 10% Bolewood	4,357	40,276	17,755	17,377	249,736	329,501
	+ 20% Bolewood	5,854	54,195	23,877	23,409	336,047	443,382
	Early stand treatments	3,094	29,087	12,812	12,163	176,098	233,254
	Shortened rotation (-10 yrs)	2,814	25,994	11,448	11,076	160,759	212,090
	Extended rotation (+10 yrs)	2,898	26,704	11,780	11,562	165,924	218,868
50% Residual retention	Assumed current removal rate	2,135	19,670	8,681	8,466	121,959	160,910
	+ 10% Bolewood	3,631	33,589	14,803	14,498	208,270	274,791
	+ 20% Bolewood	5,128	47,507	20,926	20,530	294,581	388,672
	Early stand treatments	2,309	21,707	9,561	9,077	131,416	174,070
	Shortened rotation (-10 yrs)	2,100	19,399	8,543	8,265	119,969	158,276
	Extended rotation (+10 yrs)	2,163	19,928	8,791	8,629	123,824	163,335
75% Residual retention	Low utilization rate	1,067	9,835	4,340	4,233	60,980	80,455
	+ 10% Bolewood	2,564	23,754	10,463	10,265	147,290	194,336
	+ 20% Bolewood	4,061	37,672	16,585	16,297	233,601	308,217
	Early stand treatments	1,154	10,853	4,781	4,538	65,708	87,035
	Shortened rotation (-10 yrs)	1,050	9,699	4,271	4,133	59,985	79,138
	Extended rotation (+10 yrs)	1,081	9,964	4,395	4,314	61,912	81,667

<sup>1</sup> Residual biomass includes tops, limbs, branches and needles as defined by from the USDA Forest Service FIA biomass attributes.

<sup>2</sup> Includes corporate, nongovernmental conservation/natural resources organizations, unincorporated local partnerships/associations/clubs, and Native American timberlands.



**Figure C.5.** Estimated east-central Minnesota residual biomass supply from woodlands owners (5.50 million cord harvest; 33% on-site residual retention).



**Figure C.6.** Estimated east-central Minnesota residual biomass supply from woodlands owners (5.50 million cord harvest; 50% on-site residual retention).

## Appendix D. Aggregate Biomass Availability in Northwest Wisconsin

**Table D.1.** Estimated timberland area (acres) by FIA forest type group for northwest Wisconsin (nonstocked areas not included).

Age Class	White-red-		Oak-pine	Oak-hickory	Elm-ash-	Maple-	Aspen-birch
	jack pine	Spruce-fir <sup>1</sup>			cottonwood	beech-birch <sup>2</sup>	
0-10	24,726	2,084	19,108	68,406	3,105	15,750	104,366
11-20	24,185	3,922	16,778	14,226	4,102	18,235	107,687
21-30	57,738	5,064	6,926	16,661	7,962	5,129	93,517
31-40	50,425	3,140	6,080	15,594	8,389	20,423	70,415
41-50	41,196	10,376	24,378	30,676	5,306	25,164	97,643
51-60	49,131	18,472	16,258	55,064	16,764	33,801	95,926
61-70	19,582	20,105	0	59,539	23,819	100,059	86,383
71-80	2,738	23,107	11,794	79,854	26,756	64,666	39,900
81-90	14,570	18,587	2,672	60,441	22,603	37,713	15,701
91-100	1,880	3,759	0	3,301	25,314	10,333	3,651
100+	0	17,707	1,253	12,562	12,113	2,659	0

<sup>1</sup> Other exotic softwoods and Exotic softwoods were combined with the Spruce-fir forest type.

<sup>2</sup> Other hardwoods and Exotic hardwoods were combined with the Maple-beech-birch forest type.

**Table B.2.** Estimated living biomass (ODT) on timberland by stand attribute and ownership in northwest Wisconsin.

Biomass attribute	----- Government -----			Private industrial	Woodlands	Total
	Federal	State	Local			
Bolewood	3,864,155	1,536,241	7,944,813	3,377,594	13,145,199	29,868,002
Tops and limbs	1,040,851	432,803	2,172,750	946,347	3,645,198	8,237,950
Stumps	239,933	95,686	494,288	208,598	808,581	1,847,086
Saplings	1,244,157	551,667	2,666,281	1,150,180	4,221,711	9,833,996
Belowground	1,376,733	558,194	2,850,079	1,217,230	4,646,325	10,648,561

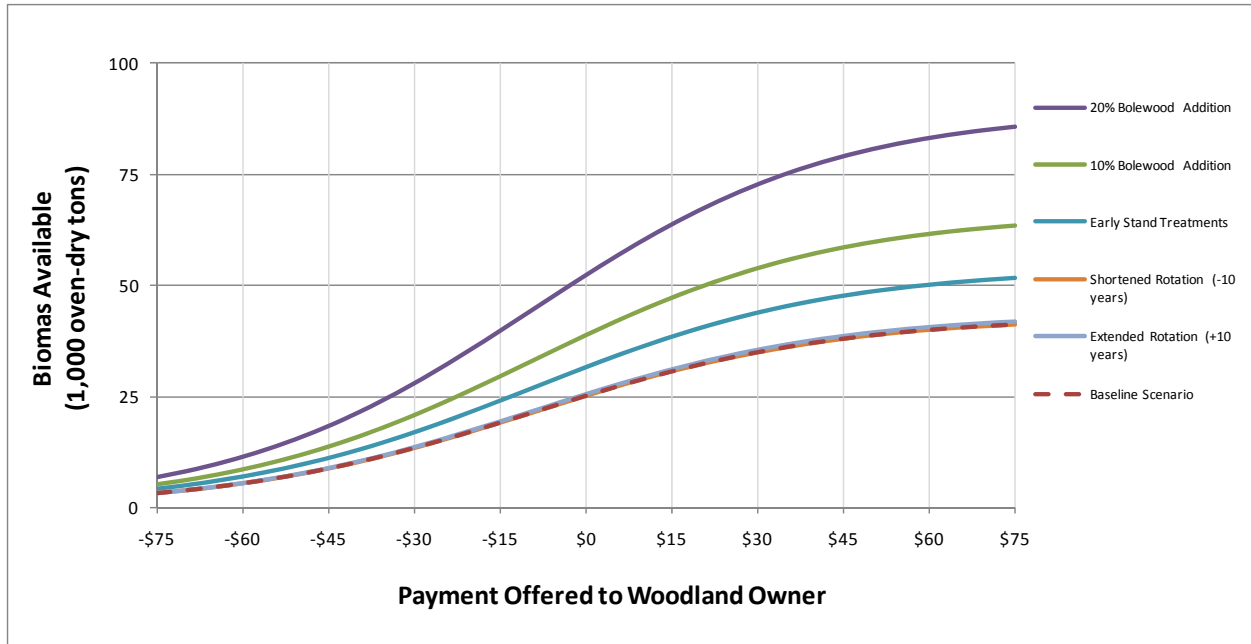
**Table D.3.** Northwest Wisconsin annual ODT of residual biomass by ownership and forest management scenario (3.47 million cord harvest).<sup>1</sup>

Scenario	Description	----- Government -----			Private industrial <sup>2</sup>	Woodlands	Total
		Federal	State	Local			
0% Residual retention	Total physical availability	19,180	8,233	38,793	13,273	64,041	143,521
	+ 10% Bolewood	26,592	11,190	53,288	18,154	87,251	196,476
	+ 20% Bolewood	34,004	14,146	67,783	23,036	110,462	249,431
	Early stand treatments	24,014	10,495	48,665	16,469	80,427	180,070
	Shortened rotation (-10 yrs)	18,742	8,040	37,984	12,859	64,069	141,694
	Extended rotation (+10 yrs)	19,508	8,375	39,305	13,636	64,908	145,732
15% Residual retention	Operational maximum removal rate	16,303	6,998	32,974	11,282	54,435	121,993
	+ 10% Bolewood	23,715	9,955	47,469	16,164	77,645	174,948
	+ 20% Bolewood	31,127	12,911	61,964	21,045	100,855	227,903
	Early stand treatments	20,412	8,921	41,365	13,998	68,363	153,060
	Shortened rotation (-10 yrs)	15,930	6,834	32,287	10,930	54,458	120,439
	Extended rotation (+10 yrs)	16,582	7,119	33,409	11,591	55,172	123,872
33% Residual retention	MFRC biomass guidelines	12,850	5,516	25,992	8,893	42,908	96,159
	+ 10% Bolewood	20,263	8,473	40,486	13,774	66,118	149,114
	+ 20% Bolewood	27,675	11,429	54,981	18,656	89,328	202,069
	Early stand treatments	16,090	7,032	32,605	11,034	53,886	120,647
	Shortened rotation (-10 yrs)	12,557	5,387	25,449	8,615	42,926	94,935
	Extended rotation (+10 yrs)	13,070	5,611	26,334	9,136	43,488	97,640
50% Residual retention	Assumed current removal rate	9,590	4,117	19,397	6,637	32,021	71,760
	+ 10% Bolewood	17,002	7,073	33,891	11,518	55,231	124,715
	+ 20% Bolewood	24,415	10,029	48,386	16,399	78,441	177,670
	Early stand treatments	12,007	5,248	24,332	8,234	40,214	90,035
	Shortened rotation (-10 yrs)	9,371	4,020	18,992	6,429	32,034	70,847
	Extended rotation (+10 yrs)	9,754	4,188	19,652	6,818	32,454	72,866
75% Residual retention	Low utilization rate	4,795	2,058	9,698	3,318	16,010	35,880
	+ 10% Bolewood	12,207	5,015	24,193	8,200	39,220	88,835
	+ 20% Bolewood	19,620	7,971	38,688	13,081	62,431	141,790
	Early stand treatments	6,004	2,624	12,166	4,117	20,107	45,018
	Shortened rotation (-10 yrs)	4,685	2,010	9,496	3,215	16,017	35,423
	Extended rotation (+10 yrs)	4,877	2,094	9,826	3,409	16,227	36,433

<sup>1</sup> Residual biomass includes tops, limbs, branches and needles as defined by from the USDA Forest Service FIA biomass attributes.

<sup>2</sup> Includes corporate, nongovernmental conservation/natural resources organizations, unincorporated local partnerships/associations/clubs, and Native American timberlands.

**Figure D.1.** Estimated northwest Wisconsin residual biomass supply from woodlands owners (3.47 million cord harvest; 33% on-site residual retention).



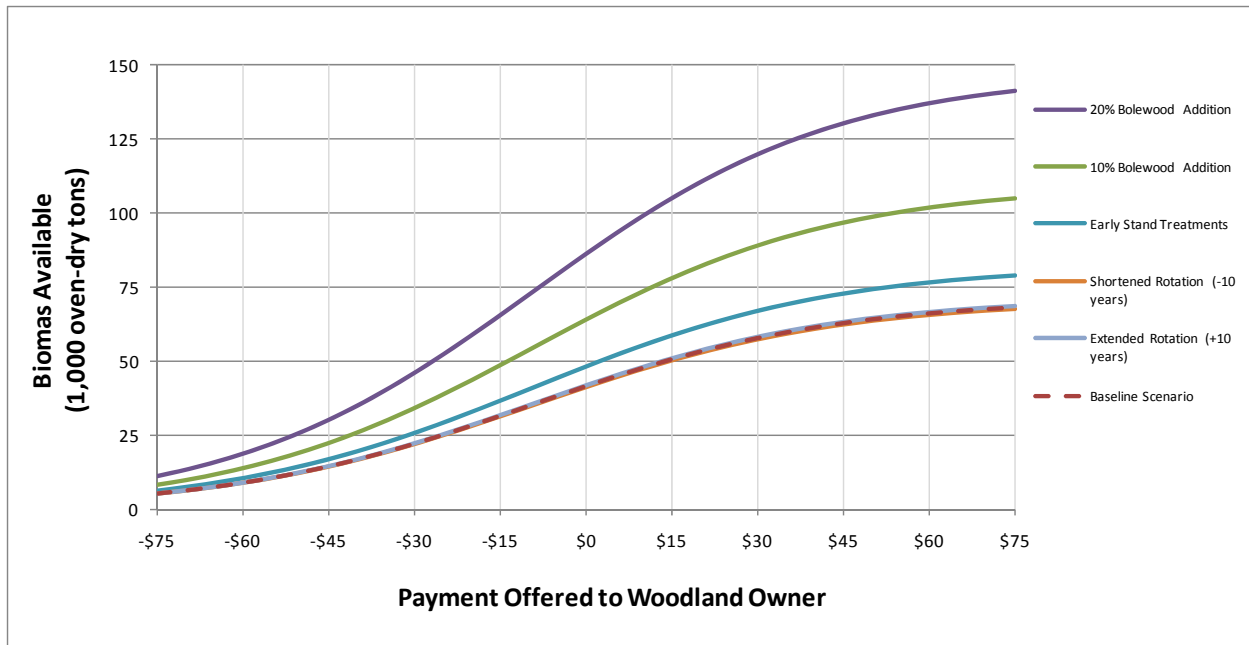
**Figure D.2.** Estimated northwest Wisconsin residual biomass supply from woodlands owners (3.47 million cord harvest; 50% on-site residual retention).

**Table D.4.** Northwest Wisconsin annual ODT of residual biomass by ownership and forest management scenario (4.90 million cord harvest).<sup>1</sup>

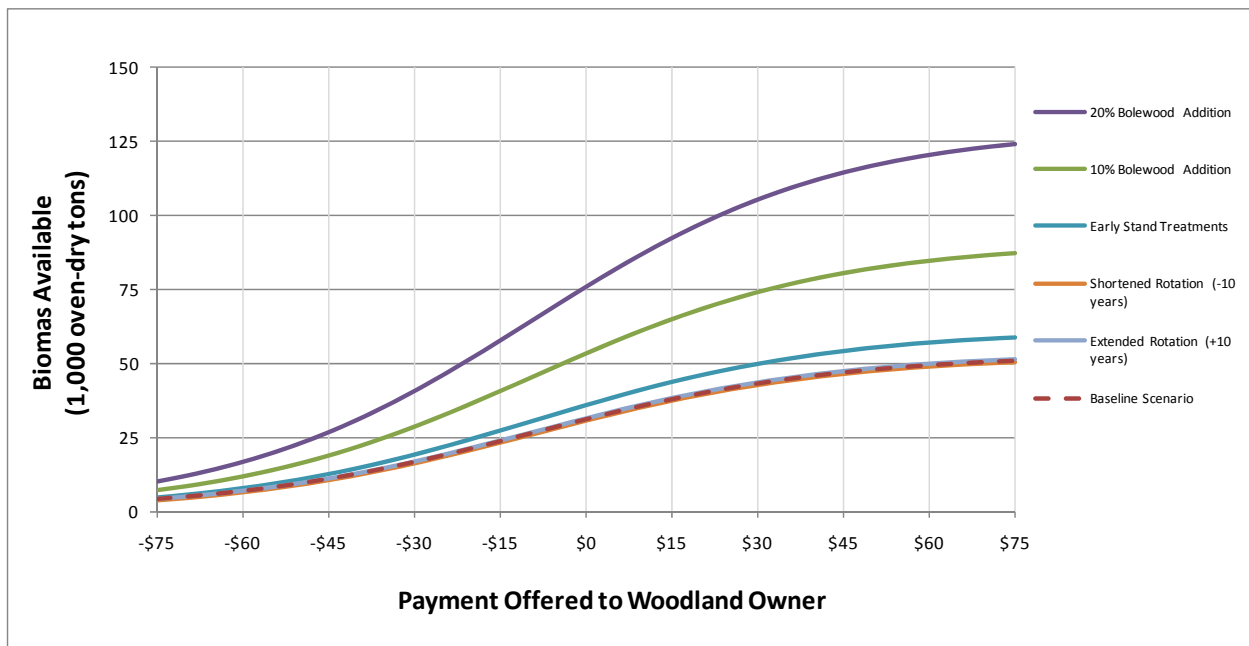
Scenario	Description	----- Government -----			Private industrial <sup>2</sup>	Woodlands	Total
		Federal	State	Local			
0% Residual retention	Total physical availability	29,151	13,030	61,032	23,300	105,997	232,510
	+ 10% Bolewood	40,158	17,661	83,482	31,712	144,173	317,187
	+ 20% Bolewood	51,166	22,291	105,932	40,124	182,350	401,863
	Early stand treatments	34,136	15,392	71,150	26,644	123,136	270,457
	Shortened rotation (-10 yrs)	28,453	12,734	59,819	22,579	105,177	228,762
	Extended rotation (+10 yrs)	29,674	13,229	62,079	23,860	107,102	235,943
15% Residual retention	Operational maximum removal rate	24,778	11,076	51,877	19,805	90,097	197,634
	+ 10% Bolewood	35,786	15,706	74,327	28,217	128,274	282,310
	+ 20% Bolewood	46,793	20,337	96,777	36,629	166,450	366,987
	Early stand treatments	29,016	13,083	60,478	22,647	104,665	229,888
	Shortened rotation (-10 yrs)	24,185	10,824	50,846	19,192	89,401	194,448
	Extended rotation (+10 yrs)	25,223	11,245	52,767	20,281	91,037	200,552
33% Residual retention	MFRC biomass guidelines	19,531	8,730	40,891	15,611	71,018	155,782
	+ 10% Bolewood	30,538	13,361	63,341	24,023	109,194	240,458
	+ 20% Bolewood	41,546	17,991	85,791	32,435	147,371	325,135
	Early stand treatments	22,871	10,312	47,671	17,851	82,501	181,206
	Shortened rotation (-10 yrs)	19,064	8,532	40,079	15,128	70,469	153,271
	Extended rotation (+10 yrs)	19,881	8,863	41,593	15,986	71,758	158,082
50% Residual retention	Assumed current removal rate	14,575	6,515	30,516	11,650	52,999	116,255
	+ 10% Bolewood	25,583	11,146	52,966	20,062	91,175	200,932
	+ 20% Bolewood	36,590	15,776	75,416	28,474	129,351	285,608
	Early stand treatments	17,068	7,696	35,575	13,322	61,568	135,228
	Shortened rotation (-10 yrs)	14,227	6,367	29,910	11,289	52,589	114,381
	Extended rotation (+10 yrs)	14,837	6,614	31,039	11,930	53,551	117,972
75% Residual retention	Low utilization rate	7,288	3,258	15,258	5,825	26,499	58,128
	+ 10% Bolewood	18,295	7,888	37,708	14,237	64,676	142,804
	+ 20% Bolewood	29,302	12,519	60,158	22,649	102,852	227,480
	Early stand treatments	8,534	3,848	17,788	6,661	30,784	67,614
	Shortened rotation (-10 yrs)	7,113	3,184	14,955	5,645	26,294	57,191
	Extended rotation (+10 yrs)	7,418	3,307	15,520	5,965	26,775	58,986

<sup>1</sup> Residual biomass includes tops, limbs, branches and needles as defined by from the USDA Forest Service FIA biomass attributes.

<sup>2</sup> Includes corporate, nongovernmental conservation/natural resources organizations, unincorporated local partnerships/associations/clubs, and Native American timberlands.



**Figure D.3.** Estimated northwest Wisconsin residual biomass supply from woodlands owners (4.90 million cord harvest; 33% on-site residual retention).



**Figure D.4.** Estimated northwest Wisconsin residual biomass supply from woodlands owners (4.90 million cord harvest; 50% on-site residual retention).

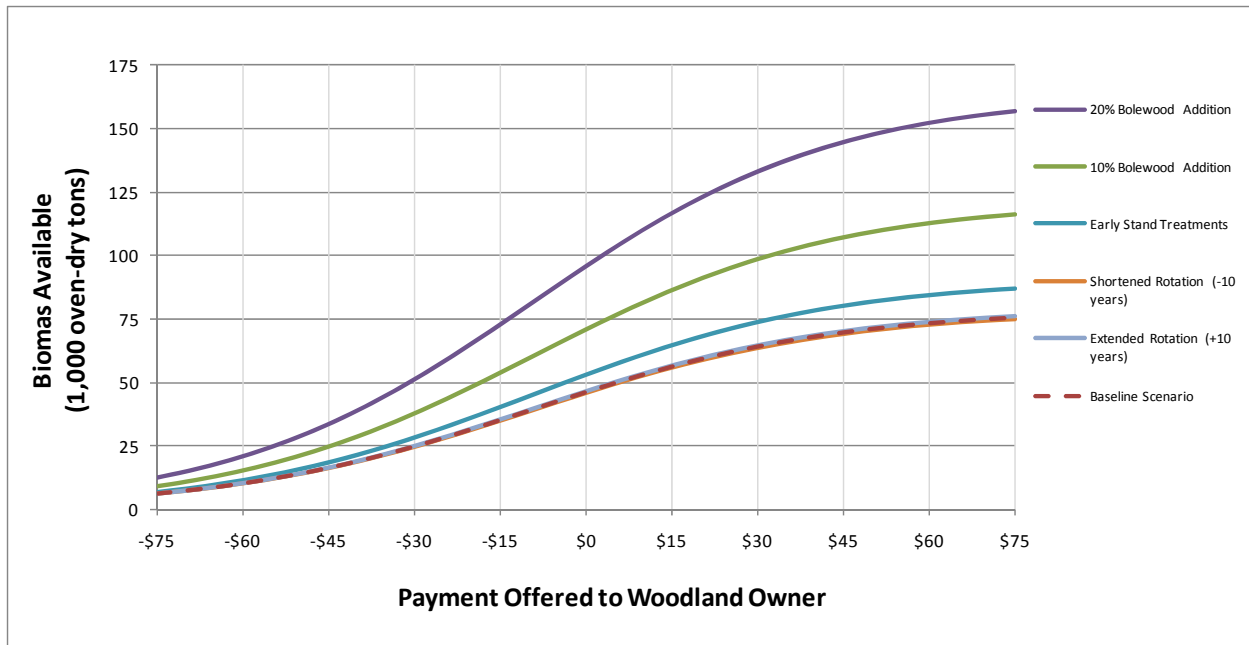
**Table D.5.** Northwest Wisconsin annual ODT of residual biomass by ownership and forest management scenario (5.50 million cord harvest).<sup>1</sup>

Scenario	Description	----- Government -----			Private industrial <sup>2</sup>	Woodlands	Total
		Federal	State	Local			
0% Residual retention	Total physical availability	33,089	14,473	68,795	25,714	117,559	259,630
	+ 10% Bolewood	45,524	19,606	93,991	34,940	159,816	353,877
	+ 20% Bolewood	57,958	24,739	119,187	44,166	202,074	448,124
	Early stand treatments	38,504	16,989	79,222	29,531	135,128	299,374
	Shortened rotation (-10 yrs)	32,470	14,215	67,581	24,977	116,655	255,898
	Extended rotation (+10 yrs)	33,643	14,665	69,861	26,275	118,702	263,146
15% Residual retention	Operational maximum removal rate	28,126	12,302	58,476	21,856	99,925	220,685
	+ 10% Bolewood	40,560	17,435	83,672	31,083	142,182	314,932
	+ 20% Bolewood	52,995	22,568	108,868	40,309	184,440	409,179
	Early stand treatments	32,729	14,441	67,339	25,101	114,859	254,468
	Shortened rotation (-10 yrs)	27,599	12,083	57,444	21,230	99,157	217,514
	Extended rotation (+10 yrs)	28,597	12,465	59,382	22,333	100,897	223,674
33% Residual retention	MFRC biomass guidelines	22,170	9,697	46,093	17,228	78,764	173,952
	+ 10% Bolewood	34,604	14,830	71,289	26,454	121,022	268,199
	+ 20% Bolewood	47,038	19,963	96,484	35,680	163,280	362,446
	Early stand treatments	25,798	11,383	53,079	19,785	90,536	200,580
	Shortened rotation (-10 yrs)	21,755	9,524	45,280	16,734	78,159	171,452
	Extended rotation (+10 yrs)	22,541	9,825	46,807	17,604	79,530	176,308
50% Residual retention	Assumed current removal rate	16,545	7,237	34,397	12,857	58,779	129,815
	+ 10% Bolewood	28,979	12,370	59,593	22,083	101,037	224,062
	+ 20% Bolewood	41,413	17,503	84,789	31,309	143,295	318,309
	Early stand treatments	19,252	8,494	39,611	14,765	67,564	149,687
	Shortened rotation (-10 yrs)	16,235	7,108	33,791	12,488	58,328	127,949
	Extended rotation (+10 yrs)	16,822	7,332	34,930	13,137	59,351	131,573
75% Residual retention	Low utilization rate	8,272	3,618	17,199	6,428	29,390	64,907
	+ 10% Bolewood	20,707	8,751	42,395	15,655	71,647	159,155
	+ 20% Bolewood	33,141	13,884	67,591	24,881	113,905	253,402
	Early stand treatments	9,626	4,247	19,805	7,383	33,782	74,843
	Shortened rotation (-10 yrs)	8,117	3,554	16,895	6,244	29,164	63,975
	Extended rotation (+10 yrs)	8,411	3,666	17,465	6,569	29,676	65,786

<sup>1</sup> Residual biomass includes tops, limbs, branches and needles as defined by from the USDA Forest Service FIA biomass attributes.

<sup>2</sup> Includes corporate, nongovernmental conservation/natural resources organizations, unincorporated local partnerships/associations/clubs, and Native American timberlands.





**Figure D.5.** Estimated northwest Wisconsin residual biomass supply from woodlands owners (5.50 million cord harvest; 33% on-site residual retention).



**Figure D.6.** Estimated northwest Wisconsin residual biomass supply from woodlands owners (5.50 million cord harvest; 50% on-site residual retention).

## Appendix E. Landowner Questionnaire

### Private Woodland Owner Survey of Residual Woody Biomass



Dear Woodland Owner,

The Department of Forest Resources at the University of Minnesota is conducting a study to better understand the attitudes and perceptions of woodland owners with respect to woody biomass harvesting.

You have been selected to complete this questionnaire because you own land that is classified for property tax purposes as woodland within a 26 county region in northern Minnesota and northern Wisconsin. This should take about 15 minutes and is entirely voluntary. All of the information you provide will be completely confidential and anonymous. No individual responses will be reported. When responding to the questions please consider the specific parcel that you own in

County:

Please return the questionnaire in the enclosed, self-addressed, postage-paid envelope within **ten days of receipt**. Once we receive your completed questionnaire, your name and any identifying information will be removed from our database.

If you have any questions or concerns about the survey, please contact me at 612-624-7286 or email at [drbecker@umn.edu](mailto:drbecker@umn.edu). Thank you in advance for participating in this important project.

Sincerely,

A handwritten signature in black ink that reads "Dennis R. Becker". The signature is written in a cursive, flowing style.

Dennis R. Becker, Ph.D.  
Project Leader



## Section I. Landowner and Property Profile

1. How many acres and number of individual woodland properties do you own in Minnesota or Wisconsin?

\_\_\_\_\_ Total acres owned in MN or WI    \_\_\_\_\_ Number of woodland properties owned in MN or WI

2. Whether you live on, beside, near, or far from your property, how often do you spend time at your woodland for any reason (for example, walking, hunting, snowmobiling, cutting firewood, etc.)?

*Please choose the one answer that best describes your experience over the past 12 months*

\_\_\_\_\_ Once or more per week

\_\_\_\_\_ Once or more per month

\_\_\_\_\_ Once or twice every three months

\_\_\_\_\_ Once or twice per year

\_\_\_\_\_ Less than once per year

3. Indicate how important each of the following reasons for owning your woodlands are to you. *Please circle the number corresponding with the level of importance for each reason*

Reason for woodland ownership	Not Important	Slightly Important	Moderately Important	Very Important
Produce timber for income	1	2	3	4
Produce agricultural products for income	1	2	3	4
Obtain firewood for personal use	1	2	3	4
Place for motorized recreation (ATV riding)	1	2	3	4
Place to hunt or fish	1	2	3	4
Place for hiking, skiing or camping	1	2	3	4
Enjoy solitude and quiet	1	2	3	4
View wildlife	1	2	3	4
Own as a financial investment	1	2	3	4
Pass on to future generations	1	2	3	4
Protect the forest from development	1	2	3	4

## Section II. Residual Woody Biomass

**DEFINITION: Residual woody biomass** is defined as the by-product of forest management activities including trees not used for timber production and tree limbs, treetops, needles and leaves. **Biomass utilization** is the use of residual woody biomass resulting in the production of electricity, thermal heating, biofuels, animal bedding, landscape materials, and related products. *Please answer the following questions using this definition.*

4. This question has two parts. First, indicate whether you have completed the following forest management activities on your woodland property in the past 10 years. Second, indicate whether you plan to complete the following forest management activities in the next 10 years. *Please circle the numbers corresponding to the appropriate response for each forest management activity.*

Forest management activity taken	Activity taken in <u>past 10 years</u>			Activity planned for the <u>next 10 years</u>		
	Yes	No	Don't Know	Yes	No	Don't Know
Harvest timber	1	2	9	3	4	9
Harvest firewood	1	2	9	3	4	9
Remove less desirable trees	1	2	9	3	4	9
Develop or maintain trails	1	2	9	3	4	9
Improve wildlife habitat	1	2	9	3	4	9
Prune trees	1	2	9	3	4	9
Remove dead or dying trees	1	2	9	3	4	9
Plant trees	1	2	9	3	4	9
Build roads	1	2	9	3	4	9
Remove invasive plants (e.g., buckthorn)	1	2	9	3	4	9

5. Please indicate how likely you would be to remove residual woody biomass after the following forest management activities if there were an opportunity? *Please circle the number which corresponds with your degree of likelihood.*

Forest management activity taken	Extremely Unlikely	Somewhat Unlikely	Somewhat Likely	Extremely Likely	Don't Know
Harvest trees other than for firewood	1	2	3	4	9
Remove less desirable trees	1	2	3	4	9
Harvest firewood	1	2	3	4	9
Develop or maintained trails	1	2	3	4	9
Improve wildlife habitat	1	2	3	4	9
Prune trees	1	2	3	4	9
Remove dead or dying trees	1	2	3	4	9
Plant trees	1	2	3	4	9
Built roads	1	2	3	4	9
Remove invasive plants (e.g., buckthorn)	1	2	3	4	9

### Section III. Opinions About Residual Woody Biomass

6. If you own additional woodland properties to the one considered in this survey, would you be more or less willing to harvest biomass on your other property(s)? Circle the response which best represents your willingness to harvest biomass on your other woodland properties.

Do Not Own Other Woodlands	Less Willing to Harvest Biomass	About the Same Willingness	More Willing to Harvest Biomass	Don't Know
1	2	3	4	9

7. Please indicate the extent to which you agree or disagree with the following statements. Please circle the corresponding number.

	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree	Don't Know
Utilization of residual woody biomass for energy could positively impact the local economy	1	2	3	4	9
Utilization of residual woody biomass for energy could positively impact United States energy independence	1	2	3	4	9
Utilization of residual woody biomass for energy could positively impact the United State's ability to address climate change	1	2	3	4	9
I know what steps to take to harvest residual woody biomass on my property	1	2	3	4	9
I would be willing to allow the removal of residual woody biomass on my property if I received <u>additional</u> payment for the material	1	2	3	4	9
I would be willing allow the removal of residual woody biomass on my property even if I received <u>no additional</u> payment for the material	1	2	3	4	9
I would be more willing to allow removal of residual woody biomass on my property if I knew it was to be used to produce energy as opposed to a non-energy use	1	2	3	4	9
I believe that residual woody biomass utilization is an important aspect of forest management	1	2	3	4	9
I am likely to include residual woody biomass removal in a future timber harvest	1	2	3	4	9
I would prefer that any future residual woody biomass resulting from forest management activities on my property be removed and utilized for any purpose	1	2	3	4	9
Leaving residual woody biomass in piles on my property is important to wildlife habitat	1	2	3	4	9
Removing residual woody biomass on my property depletes soil nutrient levels	1	2	3	4	9
I am likely to harvest timber from my property in the next 10 years	1	2	3	4	9

## Section IV. External Influences on Land Management

8. Many people other than yourself can influence the decisions you make regarding the use and management of your woodlands. Please indicate the degree to which each of these following influence your woodland use and management decisions. Please circle the number that corresponds with your experience.

	No Influence	Slight Influence	Moderate Influence	Considerable Influence	Not Applicable
Family	1	2	3	4	9
Friends	1	2	3	4	9
Neighbors	1	2	3	4	9
Other forest landowners I know	1	2	3	4	9
Professional forester or logger	1	2	3	4	9
Others who use your woodlands	1	2	3	4	9
Woodland or conservation organization	1	2	3	4	9
Newspapers, newsletters, media	1	2	3	4	9
Other (please specify): _____	1	2	3	4	9

9. Indicate the degree to which each of the following factors limits your ability to remove residual woody biomass from your woodlands. Please circle the number that corresponds with your experience.

Limiting Factors	Not Limiting	Slightly Limiting	Moderately Limiting	Very Limiting	Not Applicable
Don't know who to contact	1	2	3	4	9
Don't know how much to charge	1	2	3	4	9
Inadequate revenue will be generated	1	2	3	4	9
Opposed to timber harvesting	1	2	3	4	9
Don't like how forest would look afterwards	1	2	3	4	9
Depletion of nutrients in soil	1	2	3	4	9
Extra harvesting equipment needed	1	2	3	4	9
Opposition from friends or family	1	2	3	4	9
Lack of financial resources	1	2	3	4	9
Lack of interest from loggers	1	2	3	4	9
Woodlands are too small	1	2	3	4	9
Lack of control over harvest operations	1	2	3	4	9
Other (explain): _____	1	2	3	4	9

## Section V. Willingness to Harvest Woody Biomass Removal

PLEASE READ THE FOLLOWING SCENARIO AND ANSWER THE FOLLOWING QUESTION

10. Assume that you are planning to conduct a timber harvest on a portion of your woodlands. This harvest includes the removal of most trees 5-inches in diameter or greater in the area to be harvested in exchange for a payment. Before the harvest begins, the logger asks if you would like the residual woody biomass removed after the timber harvest is completed. He tells you this means bringing a wood chipper and a semi truck onto your land in order to remove all but one-third of the residual tree limbs, tops and other woody debris created from harvesting. If the residual woody biomass is not removed, the logger plans to leave this material scattered on the ground or in piles about your property.

**Would you accept the logger's offer to pay you an additional \$15/acre to remove the residual woody biomass after the commercial harvest is complete (in addition to the payment received from selling the timber)?** *Please check one response*

Yes       No       Don't Know (explain: \_\_\_\_\_)

11. Are there circumstances that may lead you to pay the logger to have the residual woody biomass removed from your woodlands? Please indicate your willingness to pay for its removal following each of these forest management activities. *Please circle the number corresponding with your willingness to pay to have woody biomass removed*

Forest management activity	Not Willing	Slightly Willing	Moderately Willing	Very Willing
Harvest timber	1	2	3	4
Harvest firewood	1	2	3	4
Remove less desirable trees	1	2	3	4
Develop or maintain trails	1	2	3	4
Improve wildlife habitat	1	2	3	4
Prune trees	1	2	3	4
Remove dead or dying trees	1	2	3	4
Build roads	1	2	3	4
Remove invasive plants (e.g., buckthorn)	1	2	3	4
Other (please specify): _____	1	2	3	4

**Section V. Additional Information**

**12. Since owning your woodlands, have you consulted with a professional forester?**

Yes       No       Don't Know

**13. Since owning your woodlands, have you participated in a forest landowner education program?**

Yes       No       Don't Know

**14. What is your gender? Check one**

Male       Female

**15. What year were you born? Write in year**

\_\_\_\_\_

**16. What is your employment status? Check one**

Employed full time                       Unemployed                       Student  
 Employed part time                       Retired                       Other

**17. Is your permanent home located on your woodlands? Check only one**

YES, my home is located on my woodland indicated in this survey  
 NO, I live within 10 miles from my woodlands  
 NO, I live between 11 and 50 miles from my woodlands  
 NO, I live between 51 and 151 miles from my woodlands  
 NO, I live more than 151 miles from my woodland

**18. Is there anything else you would like to share with us?**

\*\*\*\*\*

***Thank you for taking the time to complete this questionnaire.***

*Please return the questionnaire in the self-addressed stamped envelope included in this mailing.*

*Feel free to contact us if you have any questions.*

Dennis Becker, Department of Forest Resources, University of Minnesota  
1530 Cleveland Avenue North, St. Paul, MN 55108; 612-624-7286; [drbecker@umn.edu](mailto:drbecker@umn.edu)