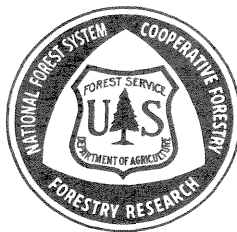


Value Loss of Hardwood Lumber During Air-Drying



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Abstract

Dry lumber prices were applied to green and air-dried lumber that was measured with a dry board rule. Values were summed by species, lumber grade, and thickness class. Differences between green and air-dried lumber value have been termed value losses and are given in dollars and in percentages. The percentages have been separated into loss due to shrinkage and loss due to degrade. Data for 10 hardwood species are included.

Value Loss of Hardwood Lumber During Air-Drying

Leland F. Hanks and
Margaret K. Peirsol

INTRODUCTION

In a recently reported study (*Gammon 1971*) the lumber volume loss and grade change during air-drying of 10 hardwood species was presented. We used the same basic data to determine the lumber value loss during air-drying.

These lumber volume and value loss figures should be useful to sawmill operators for estimating such losses at their mills. The figures may also be used as a standard with which to compare actual data on drying performance at individual mills.

STUDY METHODS

The data for this report were gathered in conjunction with studies of lumber yield in relation to log and tree grades conducted at sawmills throughout the East. Each board was measured with a dry board rule and graded by an inspector from the National Hardwood Lumber Association. This was done at the time of sawing and again when the lumber had been air-dried to approximately 20 percent moisture content. Green boards were numbered for future identifica-

tion. Thickness, surface measure, and board number were recorded at both green and dry gradings.

For each species, green grade, and thickness class, we calculated a potential value by applying dry lumber prices to the green lumber volumes. The Hardwood Market Report (*Lemsky*) for March 10, 1973 was the source for price information. Actual dry lumber value was determined by applying dry prices to the dry lumber volumes. The difference between the potential and actual dry value will be referred to as total value loss during air drying. Value loss per thousand board feet and percent loss were also determined.

RESULTS

Table 1 contains the value loss information by lumber grade and thickness for the 10 species. The results for northern red, scarlet, and black oak are also presented combined as these species are not separated in the lumber market.

The relationship between lumber thickness and value loss was determined by species (table 2).

Table 1.—Value loss during air-drying by species, lumber, grade, and thickness.

Lumber grade	Rough green		Potential value	Actual dry value	Value loss				
	Thick-ness	Volume			Total ^a	Per MBF ^a	Due to shrinkage	Due to ^b degrade	Total ^a
	<i>Inches</i>	<i>Fbm</i>	— — —	— — —	<i>Dollars</i>	— — —	— — —	<i>Percent</i>	— — —
BASSWOOD									
FAS	4/4	5789	1620.92	1524.09	96.83	16.73	4.6	1.4	6.0
	6/4	369	107.01	99.14	7.87	21.33	6.8	0.6	7.4
	Total	6158	1727.93	1623.23	104.70	17.00	4.7	1.4	6.1
SELECTS	4/4	5053	1339.04	1245.52	93.52	18.51	4.5	2.5	7.0
	6/4	668	183.70	167.34	16.36	24.49	6.1	2.8	8.9
	Total	5721	1522.74	1412.86	109.88	19.21	4.7	2.5	7.2
NO. 1C	4/4	10098	1868.13	1726.15	141.98	14.06	5.3	2.3	7.6
	5/4	219	41.61	37.18	4.43	20.23	8.2	2.4	10.6
	6/4	504	98.28	91.76	6.52	12.94	7.9	+1.3	6.6
	Total	10821	2008.02	1855.09	152.93	14.13	5.5	2.1	7.6
NO. 2C	4/4	13793	1379.30	1330.28	49.02	3.55	4.1	+0.5	3.6
	5/4	272	27.74	24.38	3.36	12.35	11.0	1.1	12.1
	Total	14065	1407.04	1354.66	52.38	3.72	4.2	+0.5	3.7
NO. 3C	4/4	3466	246.09	241.89	4.20	1.21	3.4	+1.7	1.7
Grand Total		40231	6911.82	6487.73	424.09	10.54	4.6	1.5	6.1
RED MAPLE									
FAS	4/4	3760	977.60	945.51	32.09	8.53	2.0	1.3	3.3
	5/4	1220	323.30	299.24	24.06	19.72	2.9	4.5	7.4
	6/4	1387	374.49	362.67	11.82	8.52	2.3	0.9	3.2
	8/4	2050	563.75	552.89	10.86	5.30	1.8	0.1	1.9
	Total	8417	2239.14	2160.31	78.83	9.37	2.1	1.4	3.5
FAS1F	4/4	3471	867.75	832.17	35.58	10.25	2.3	1.8	4.1
	5/4	1146	292.23	263.36	28.87	25.19	3.8	6.1	9.9
	6/4	955	248.30	234.83	13.47	14.10	2.6	2.8	5.4
	Total	5572	1408.28	1330.36	77.92	13.98	2.7	2.8	5.5
SELECTS	4/4	1558	373.92	351.52	22.40	14.38	3.2	2.8	6.0
	5/4	773	189.38	180.34	9.04	11.69	3.0	1.8	4.8
	6/4	277	69.25	65.89	3.36	12.13	3.6	1.3	4.9
	8/4	864	220.32	216.24	4.08	4.72	2.3	+0.4	1.9
	Total	3472	852.87	813.99	38.88	11.20	2.9	1.7	4.6
NO. 1C	4/4	6914	1382.80	1314.94	67.86	9.81	2.7	2.2	4.9
	5/4	2074	425.17	402.08	23.09	11.13	3.3	2.1	5.4
	6/4	1035	217.35	211.37	5.98	5.78	2.9	+0.1	2.8
	8/4	702	157.95	155.79	2.16	3.08	1.3	0.1	1.4
	Total	10725	2183.27	2084.18	99.09	9.24	2.8	1.7	4.5
NO. 2A	4/4	9608	1152.96	1121.18	31.78	3.31	2.6	0.2	2.8
	5/4	1934	235.95	230.62	5.33	2.76	3.5	+1.2	2.3
	Total	11542	1388.91	1351.80	37.11	3.22	2.8	+0.1	2.7
NO. 2B	4/4	7285	728.50	714.24	14.26	1.96	2.8	+0.8	2.0
	5/4	1738	177.28	177.20	.08	.05	2.5	+2.5	0.0
	Total	9023	905.78	891.44	14.34	1.59	2.7	+1.1	1.6
NO. 3A	4/4	1954	185.63	182.67	2.96	1.51	3.2	+1.6	1.6
	5/4	335	32.16	31.75	.41	1.22	5.1	+3.8	1.3
	Total	2289	217.79	214.42	3.37	1.47	3.5	+2.0	1.5
NO. 3B	4/4	861	77.49	76.62	.87	1.01	2.6	+1.5	1.1
Grand Total		51901	9273.53	8923.12	350.41	6.75	2.7	1.1	3.8

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Table 1.—Continued

Rough green			Potential value	Actual dry value	Value loss				
Lumber grade	Thick-ness	Volume			Total ^a	Per MBF ^a	Due to shrinkage	Due to ^b degrade	Total ^a
	<i>Inches</i>	<i>Fbm</i>	<i>Dollars</i>					<i>Percent</i>	
YELLOW BIRCH									
FAS	4/4	3734	1418.92	1298.13	120.79	32.35	4.1	4.4	8.5
	5/4	3028	1180.92	1121.37	59.55	19.67	4.1	0.9	5.0
	6/4	500	200.00	191.85	8.15	16.30	3.6	0.5	4.1
	Total	7262	2799.84	2611.35	188.49	25.96	4.1	2.6	6.7
FAS1F	4/4	2287	846.19	743.67	102.52	44.83	4.2	7.9	12.1
	5/4	1925	731.50	681.18	50.32	26.14	2.3	4.6	6.9
	6/4	608	237.12	225.62	11.50	18.91	4.4	0.4	4.8
	Total	4820	1814.81	1650.47	164.34	34.10	3.5	5.6	9.1
SELECTS	4/4	912	328.32	291.65	36.67	40.21	4.5	6.7	11.2
	5/4	309	114.33	108.26	6.07	19.64	2.6	2.7	5.3
	Total	1221	442.65	399.91	42.74	35.00	4.0	5.7	9.7
NO. 1C	4/4	9127	1962.30	1854.44	107.86	11.82	4.1	1.4	5.5
	5/4	3866	850.52	801.33	49.19	12.72	3.8	2.0	5.8
	6/4	712	181.56	176.28	5.28	7.42	3.1	+0.2	2.9
	Total	13705	2994.38	2832.05	162.33	11.84	3.9	1.5	5.4
NO. 2C	4/4	8328	999.36	966.15	33.21	3.99	3.8	+0.5	3.3
	5/4	3240	405.00	391.43	13.57	4.19	3.3	0.1	3.4
	6/4	287	38.74	38.72	.02	.07	2.8	+2.7	0.1
	Total	11855	1443.10	1396.30	46.80	3.95	3.6	+0.4	3.2
NO. 3AC	4/4	5518	562.84	536.16	26.68	4.84	3.8	0.9	4.7
	5/4	1312	135.14	131.58	3.56	2.71	3.0	+0.4	2.6
	Total	6830	697.98	667.74	30.24	4.43	3.6	0.7	4.3
NO. 3BC	4/4	4625	416.25	398.62	17.63	3.81	3.8	0.4	4.2
	5/4	669	60.88	57.82	3.06	4.57	2.2	2.8	5.0
	Total	5294	477.13	456.44	20.69	3.91	3.6	0.7	4.3
Grand Total		50987	10669.89	10014.26	655.63	12.86	3.5	2.6	6.1
SUGAR MAPLE									
FAS	4/4	896	268.80	250.44	18.36	20.49	2.5	4.3	6.8
	5/4	4410	1367.10	1256.60	110.50	25.06	4.4	3.7	8.1
	8/4	988	355.68	334.31	21.37	21.63	1.6	4.4	6.0
	Total	6294	1991.58	1841.35	150.23	23.87	3.7	3.8	7.5
FAS1F	4/4	795	230.55	213.12	17.43	21.92	2.3	5.3	7.6
	5/4	4622	1386.60	1262.99	123.61	26.74	3.4	5.5	8.9
	8/4	1878	657.30	618.94	38.36	20.43	1.5	4.3	5.8
	Total	7295	2274.45	2095.05	179.40	24.59	2.8	5.1	7.9
SELECTS	4/4	1210	338.80	293.78	45.02	37.21	2.1	11.2	13.3
	5/4	685	198.65	191.66	6.99	10.20	2.6	0.9	3.5
	Total	1895	537.45	485.44	52.01	27.45	2.3	7.4	9.7
NO. 1C	4/4	5615	1179.99	1087.05	92.94	16.55	2.7	5.2	7.9
	5/4	11053	2431.66	2218.40	213.26	19.29	3.6	5.2	8.8
	8/4	3288	838.44	760.17	78.27	23.80	1.5	7.8	9.3
	Total	19956	4450.09	4065.62	384.47	19.27	3.0	5.6	8.6
NO. 2C	4/4	6301	850.64	817.88	32.76	5.20	2.7	1.2	3.9
	5/4	7357	1007.91	956.70	51.21	6.96	3.7	1.4	5.1
	8/4	1664	232.96	236.28	+3.32	+2.00	1.3	+2.7	+1.4
	Total	15322	2091.51	2010.86	80.65	5.26	3.0	0.9	3.9
NO. 3AC	4/4	4943	568.44	542.72	25.72	5.20	2.5	2.0	4.5
	5/4	2301	269.22	225.25	43.97	19.11	3.8	12.5	16.3
	Total	7244	837.66	767.97	69.69	9.62	2.9	5.4	8.3
NO. 3BC	4/4	5827	524.43	513.24	11.19	1.92	2.5	+0.4	2.1
	5/4	1074	97.73	83.81	13.92	12.96	2.1	12.1	14.2
	Total	6901	622.16	597.05	25.11	3.64	2.4	1.6	4.0
Grand Total		64907	12804.90	11863.34	941.56	14.51	3.0	4.4	7.4

CONTINUED

Table 1.—Continued

Rough green			Potential value	Actual dry value	Value loss				
Lumber grade	Thick- ness	Volume			Total ^a	Per MBF ^a	Due to shrinkage	Due to ^b degrade	Total ^a
	<i>Inches</i>	<i>Fbm</i>	<i>Dollars</i>					<i>Percent</i>	
YELLOW-POPLAR									
FAS	4/4	1434	408.69	381.58	27.11	18.91	2.6	4.0	6.6
SELECTS	4/4	1511	415.52	364.10	51.42	34.03	3.0	9.4	12.4
	6/4	316	93.22	87.50	5.72	18.10	4.7	1.4	6.1
	Total	1827	508.74	451.60	57.14	31.28	3.3	7.9	11.2
SAPS	4/4	3836	1016.54	951.20	65.34	17.03	3.1	3.3	6.4
	6/4	845	240.82	227.42	13.40	15.86	3.7	1.9	5.6
	Total	4681	1257.36	1178.62	78.74	16.82	3.2	3.1	6.3
NO. 1C	4/4	24543	5276.74	4875.86	400.88	16.33	3.4	4.2	7.6
	6/4	4629	1064.67	1011.52	53.15	11.48	4.2	0.8	5.0
	Total	29172	6341.41	5887.38	454.03	15.56	3.8	3.4	7.2
NO. 2AC	4/4	27688	3876.32	3676.44	199.88	7.22	3.8	1.4	5.2
	6/4	2547	369.32	372.04	+2.72	+1.07	3.7	+4.4	+0.7
	Total	30235	4245.64	4048.48	197.16	6.52	3.8	0.8	4.6
NO. 2BC	4/4	17633	1763.30	1732.09	31.21	1.77	3.4	+1.6	1.8
NO. 3C	4/4	1843	165.87	157.80	8.07	4.38	2.8	2.1	4.9
Grand Total		86825	14691.01	13837.55	853.46	9.83	2.2	3.6	5.8
BLACK OAK									
FAS	4/4	580	176.90	168.45	8.45	14.57	1.7	3.1	4.8
	5/4	9506	2946.86	2822.76	124.10	13.05	2.4	1.8	4.2
	Total	10086	3123.76	2991.21	132.55	13.14	2.3	1.9	4.2
FAS1F	4/4	992	292.64	267.26	25.38	25.58	2.7	6.0	8.7
	5/4	6684	2005.20	1852.47	152.73	22.85	3.0	4.6	7.6
	Total	7676	2297.84	2119.73	178.11	23.20	3.0	4.8	7.8
SELECTS	4/4	297	84.64	74.46	10.18	34.28	5.4	6.6	12.0
	5/4	1016	294.64	272.10	22.54	22.19	3.3	4.4	7.7
	Total	1313	379.28	346.56	32.72	24.92	3.8	4.8	8.6
NO. 1C	4/4	7542	1546.11	1451.79	94.32	12.51	2.7	3.4	6.1
	5/4	14406	3169.32	3008.37	160.95	11.17	3.2	1.9	5.1
	Total	21948	4715.43	4460.16	255.27	11.63	3.0	2.4	5.4
NO. 2C	4/4	8791	1098.88	1043.94	54.94	6.25	2.4	2.6	5.0
	5/4	5225	658.35	646.65	11.70	2.24	4.0	+2.2	1.8
	Total	14016	1757.23	1690.59	66.64	4.75	3.0	0.8	3.8
SW	4/4	2067	237.70	228.92	8.78	4.25	3.1	0.6	3.7
	5/4	590	68.44	66.43	2.01	3.41	3.1	+0.2	2.9
	Total	2657	306.14	295.35	10.79	4.06	3.1	0.4	3.5
NO. 3AC	4/4	6420	738.30	706.11	32.19	5.01	2.0	2.4	4.4
	5/4	910	105.56	98.74	6.82	7.49	5.9	0.6	6.5
	Total	7330	843.86	804.85	39.01	5.32	2.5	2.1	4.6
NO. 3BC	4/4	2629	236.61	235.70	.91	.35	1.6	+1.2	0.4
Grand Total		67655	13660.15	12944.15	716.00	10.58	2.8	2.4	5.2

CONTINUED

Table 1.—Continued

Rough green			Potential value	Actual dry value	Value loss				
Lumber grade	Thick-ness	Volume			Total ^a	Per MBF ^a	Due to shrinkage	Due to ^b degrade	Total ^a
	<i>Inches</i>	<i>Fbm</i>	<i>Dollars</i>					<i>Percent</i>	
NORTHERN RED OAK									
FAS	4/4	8861	2702.60	2494.98	207.62	23.43	3.5	4.2	7.7
	5/4	28365	8793.15	8238.00	555.15	19.57	3.4	2.9	6.3
	6/4	5570	1782.40	1694.84	87.56	15.72	3.5	1.4	4.9
	Total	42796	13278.15	12427.82	850.33	19.87	3.4	3.0	6.4
FAS1F	4/4	7549	2226.96	1970.97	255.99	33.91	3.1	8.4	11.5
	5/4	11920	3576.00	3251.75	324.25	27.20	3.9	5.2	9.1
	6/4	1312	406.72	374.58	32.14	24.50	5.7	2.2	7.9
	Total	20781	6209.68	5597.30	612.38	29.47	3.7	6.2	9.9
SELECTS	4/4	2251	641.54	581.89	59.65	26.50	3.2	6.1	9.3
	5/4	2490	722.10	672.82	49.28	19.79	3.2	3.6	6.8
	Total	4741	1363.64	1254.71	108.93	22.98	3.2	4.8	8.0
NO. 1C	4/4	29404	6027.82	5591.62	436.20	14.83	3.4	3.8	7.2
	5/4	20386	4484.92	4157.19	327.73	16.08	4.3	3.0	7.3
	6/4	1132	271.68	243.62	28.06	24.79	7.6	2.7	10.3
	Total	50922	10784.42	9992.43	791.99	15.55	3.9	3.4	7.3
NO. 2C	4/4	28386	3548.25	3589.42	+41.17	+1.45	3.3	+4.5	+1.2
	5/4	4976	626.98	570.65	56.33	11.32	9.8	+0.8	9.0
	Total	33362	4175.23	4160.07	15.16	0.45	4.3	+3.9	0.4
NO. 3AC	4/4	16160	1858.40	1800.80	57.60	3.56	3.4	+0.3	3.1
	5/4	1099	127.48	108.09	19.39	17.64	11.7	3.5	15.2
	Total	17259	1985.88	1908.89	76.99	4.46	3.9	0.0	3.9
NO. 3BC	4/4	7698	692.82	701.28	+8.46	+1.10	3.2	+4.4	+1.2
	5/4	447	40.68	38.79	1.89	4.23	12.1	+7.5	4.6
	Total	8145	733.50	740.07	+6.57	+0.81	3.7	+4.6	+0.9
Grand Total		178006	38530.50	36081.29	2449.21	13.76	3.8	2.6	6.4
SCARLET OAK									
FAS	5/8	1288	315.56	288.02	27.54	21.38	5.0	3.7	8.7
	4/4	923	281.52	262.20	19.32	20.93	3.0	3.9	6.9
	5/4	1059	328.29	312.36	15.93	15.04	2.2	2.7	4.9
	Total	3270	925.37	862.58	62.79	19.20	3.5	3.3	6.8
FAS1F	5/8	808	189.88	168.86	21.02	26.01	5.4	5.7	11.1
	4/4	715	210.92	190.57	20.35	28.46	2.9	6.7	9.6
	5/4	760	228.00	198.70	29.30	38.55	2.6	10.3	12.9
	Total	2283	628.80	558.13	70.67	30.95	3.7	7.5	11.2
SELECTS	4/4	260	74.10	67.02	7.08	27.23	4.2	5.4	9.6
NO. 1C	5/8	5323	851.68	817.29	34.39	6.46	4.3	+0.3	4.0
	4/4	6247	1280.64	1153.71	126.93	20.32	2.7	7.2	9.9
	5/4	1535	337.70	318.16	19.54	12.73	2.5	3.3	5.8
	Total	13105	2470.02	2289.16	180.86	13.80	3.3	4.0	7.3
NO. 2C	5/8	1449	144.90	143.40	1.50	1.04	5.2	+4.2	1.0
	4/4	10496	1305.75	1293.26	12.49	1.19	2.7	+1.7	1.0
	Total	11945	1450.65	1436.66	13.99	1.17	3.0	+2.0	1.0
NO. 3AC	5/8	277	24.93	24.90	.03	0.11	4.7	+4.6	0.1
	4/4	11072	1273.28	1218.96	54.32	4.91	2.8	1.5	4.3
	Total	11349	1298.21	1243.86	54.35	4.79	2.9	1.3	4.2
NO. 3BC	4/4	7328	659.52	649.72	9.80	1.34	2.7	+1.2	1.5
Grand Total		49540	7506.67	7107.13	399.54	8.06	3.1	2.2	5.3

CONTINUED

Table 1.—Continued

Rough green			Potential value	Actual dry value	Value loss				
Lumber grade	Thick- ness	Volume			Total ^a	Per MBF ^a	Due to shrinkage	Due to ^b degrade	Total ^a
	<i>Inches</i>	<i>Fbm</i>	<i>Dollars</i>					<i>Percent</i>	
BLACK OAK, NORTHERN RED OAK, AND SCARLET OAK COMBINED									
FAS	5/8	1288	315.56	288.02	27.54	21.38	5.0	3.7	8.7
	4/4	10364	3161.02	2925.63	235.39	22.71	3.3	4.1	7.4
	5/4	38930	12068.30	11373.12	695.18	17.86	3.1	2.7	5.8
	6/4	5570	1782.40	1694.84	87.56	15.72	3.5	1.4	4.9
	Total	56152	17327.28	16281.61	1045.67	18.62	3.2	2.8	6.0
FAS1F	5/8	808	189.88	168.86	21.02	26.01	11.1	0.0	11.1
	4/4	9256	2730.52	2428.80	301.72	32.60	3.1	7.9	11.0
	5/4	19364	5809.20	5302.92	506.28	26.15	3.5	5.2	8.7
	6/4	1312	406.72	374.58	32.14	24.50	5.7	2.2	7.9
	Total	30740	9136.32	8275.16	861.16	28.01	3.5	5.9	9.4
SELECTS	4/4	2808	800.28	723.37	76.91	27.39	3.6	6.0	9.6
	5/4	3506	1016.74	944.92	71.82	20.48	3.2	3.9	7.1
	Total	6314	1817.02	1668.29	148.73	23.56	3.4	4.8	8.2
NO. 1C	5/8	5323	851.68	817.29	34.39	6.46	4.0	0.0	4.0
	4/4	43193	8854.57	8197.12	657.45	15.22	3.2	4.2	7.4
	5/4	36327	7991.94	7483.72	508.22	13.99	3.8	2.6	6.4
	6/4	1132	271.68	243.62	28.06	24.79	7.6	2.7	10.3
	Total	85975	17969.87	16741.75	1228.12	14.28	3.6	3.2	6.8
NO. 2C	5/8	1449	144.90	143.40	1.50	1.04	5.2	+4.2	1.0
	4/4	47673	5952.88	5926.62	26.26	.55	3.0	+2.6	0.4
	5/4	10201	1285.33	1217.30	68.03	6.67	6.8	+1.5	5.3
	Total	59323	7383.11	7287.32	95.79	1.61	3.7	+2.4	1.3
SW	4/4	2067	237.70	228.92	8.78	4.25	3.1	0.6	3.7
	5/4	590	68.44	66.43	2.01	3.41	3.1	+0.2	2.9
	Total	2657	306.14	295.35	10.79	4.06	3.1	0.4	3.5
NO. 3AC	5/8	277	24.93	24.90	.03	0.11	4.7	+4.6	0.1
	4/4	33652	3869.98	3725.87	144.11	4.28	2.9	0.8	3.7
	5/4	2009	233.04	206.83	26.21	13.05	9.1	2.1	11.2
	Total	35938	4127.95	3957.60	170.35	4.74	3.3	0.8	4.1
NO. 3BC	4/4	17655	1588.95	1586.70	2.25	.13	2.7	+2.6	0.1
	5/4	447	40.68	38.79	1.89	4.23	12.1	+7.5	4.6
	Total	18102	1629.63	1625.49	4.14	.23	3.0	+2.7	0.3
Grand Total		295201	59697.32	56132.57	3564.75	12.08	3.5	2.5	6.0

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Table 1.—Continued

Rough green			Potential value	Actual dry value	Value loss				
Lumber grade	Thick-ness	Volume			Total ^a	Per MBF ^a	Due to shrinkage	Due to ^b degrade	Total ^a
	<i>Inches</i>	<i>Fbm</i>	<i>Dollars</i>					<i>Percent</i>	
CHESTNUT OAK									
FAS	4/4	1205	361.50	320.11	41.39	34.35	6.3	5.1	11.4
	5/4	910	277.55	251.38	26.17	28.76	4.5	4.9	9.4
	6/4	1602	512.64	473.54	39.10	24.41	3.0	4.6	7.6
	Total	3717	1151.69	1045.03	106.66	28.70	4.4	4.9	9.3
FAS WHND	4/4	3230	629.85	577.64	52.21	16.16	4.6	3.7	8.3
	5/4	1645	353.68	324.82	28.86	17.54	5.2	3.0	8.2
	6/4	7823	1721.06	1622.00	99.06	12.66	3.8	2.0	5.8
	Total	12698	2704.59	2524.46	180.13	14.19	4.2	2.5	6.7
FAS1F	4/4	1140	330.60	305.08	25.52	22.39	3.7	4.0	7.7
	5/4	904	266.68	234.74	31.94	35.33	5.5	6.5	12.0
	6/4	2621	812.51	732.41	80.10	30.56	3.9	6.0	9.9
	Total	4665	1409.79	1272.23	137.56	29.49	4.2	5.6	9.8
FAS1F WHND	4/4	735	135.98	128.12	7.86	10.69	4.2	1.6	5.8
	5/4	540	110.70	109.27	1.43	2.65	3.0	+1.7	1.3
	6/4	1533	321.93	304.74	17.19	11.21	4.8	0.5	5.3
	Total	2808	568.61	542.13	26.48	9.43	4.3	0.4	4.7
SELECTS	4/4	436	122.08	109.62	12.46	28.58	4.4	5.8	10.2
	5/4	211	60.14	55.84	4.30	20.38	3.8	3.3	7.1
	Total	647	182.22	165.46	16.76	25.90	4.2	5.0	9.2
SEL WHND	4/4	201	35.18	34.87	.31	1.54	2.0	+1.1	0.9
NO. 1C	4/4	6000	1200.00	1101.90	98.10	16.35	4.8	3.4	8.2
	5/4	1973	414.33	383.71	30.62	15.52	5.6	1.8	7.4
	6/4	2823	649.29	607.20	42.09	14.91	2.8	3.7	6.5
	Total	10796	2263.62	2092.81	170.81	15.82	4.4	3.1	7.5
NO. 1C WHND	4/4	11154	1673.10	1565.96	107.14	9.61	4.1	2.3	6.4
	5/4	3398	560.67	530.23	30.44	8.96	4.2	1.2	5.4
	6/4	4146	746.28	712.37	33.91	8.18	3.5	1.0	4.5
	Total	18698	2980.05	2808.56	171.49	9.17	4.0	1.8	5.8
NO. 2C	4/4	9151	1143.88	1092.78	51.10	5.58	4.1	0.4	4.5
	5/4	574	77.49	67.73	9.76	17.00	11.8	0.8	12.6
	Total	9725	1221.37	1160.51	60.86	6.26	4.5	0.5	5.0
SW	4/4	11674	1400.88	1359.82	41.06	3.52	3.9	+1.0	2.9
	5/4	1712	222.56	216.57	5.99	3.50	5.5	+2.8	2.7
	6/4	733	98.96	102.32	+3.36	+4.58	3.5	+6.9	+3.4
	Total	14119	1722.40	1678.71	43.69	3.09	4.1	+1.6	2.5
NO. 3AC	4/4	14136	1625.64	1508.14	117.50	8.31	4.2	3.0	7.2
	5/4	377	47.12	38.17	8.95	23.74	14.9	4.1	19.0
	Total	14513	1672.76	1546.31	126.45	8.71	4.5	3.1	7.6
NO. 3BC	4/4	18562	1670.58	1622.28	48.30	2.60	3.7	+0.8	2.9
	5/4	552	50.23	42.58	7.65	13.86	14.1	1.1	15.2
	Total	19114	1720.81	1664.86	55.95	2.93	4.0	+0.7	3.3
Grand Total		111701	17633.09	16535.94	1097.15	9.82	4.2	2.0	6.2

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Table 1.—Continued

Lumber grade	Rough green		Potential value	Actual dry value	Value loss				
	Thick- ness	Volume			Total ^a	Per MBF ^a	Due to shrinkage	Due to ^b degrade	Total ^a
	<i>Inches</i>	<i>Fbm</i>	— — —	— — —	<i>Dollars</i> — — — — —	— — — — —	— — —	<i>Percent</i> — — —	— — —
WHITE OAK									
FAS	4/4	1595	478.50	431.46	47.04	29.49	3.8	6.0	9.8
	5/4	2768	844.24	740.64	103.60	37.43	4.3	8.0	12.3
	6/4	2076	664.32	622.88	41.44	19.96	3.2	3.0	6.2
	Total	6439	1987.06	1794.98	192.08	29.83	3.8	5.9	9.7
FAS WHND	4/4	297	57.92	56.48	1.44	4.85	2.4	0.1	2.5
FAS1F	4/4	1557	451.53	398.84	52.69	33.84	4.0	7.7	11.7
	5/4	2590	764.05	683.46	80.59	31.12	5.2	5.3	10.5
	6/4	2110	654.10	592.66	61.44	29.12	3.5	5.9	9.4
	Total	6257	1869.68	1674.96	194.72	31.12	4.3	6.1	10.4
SELECTS	4/4	560	156.80	143.31	13.49	24.09	2.7	5.9	8.6
	5/4	394	112.29	102.30	9.99	25.36	5.1	3.8	8.9
	6/4	364	109.20	100.84	8.36	22.97	4.7	3.0	7.7
	Total	1318	378.29	346.45	31.84	24.16	3.9	4.5	8.4
NO. 1C	4/4	10934	2186.80	1998.94	187.86	17.18	3.6	5.0	8.6
	5/4	9756	2048.76	1855.52	193.24	19.81	5.7	3.7	9.4
	6/4	3664	842.72	753.10	89.62	24.46	5.0	5.6	10.6
	Total	24354	5078.28	4607.56	470.72	19.33	4.7	4.6	9.3
NO. 1C WHND	4/4	2071	310.65	296.83	13.82	6.67	3.4	1.0	4.4
	5/4	464	76.56	70.88	5.68	12.24	5.4	2.0	7.4
	Total	2535	387.21	367.71	19.50	7.69	3.7	1.3	5.0
NO. 2C	4/4	13993	1749.12	1718.12	31.00	2.22	3.5	+1.7	1.8
	5/4	4852	655.02	602.02	53.00	10.92	8.7	+0.6	8.1
	6/4	527	73.78	70.00	3.78	7.17	6.1	+1.0	5.1
	Total	19372	2477.92	2390.14	87.78	4.53	4.9	+1.4	3.5
SW	4/4	5032	603.84	582.18	21.66	4.30	3.5	0.1	3.6
	5/4	1244	161.72	149.31	12.41	9.98	9.1	+1.4	7.7
	6/4	200	27.00	25.51	1.49	7.45	5.0	0.5	5.5
	Total	6476	792.56	757.00	35.56	5.49	4.6	+0.1	4.5
NO. 3AC	4/4	8551	983.36	926.26	57.10	6.68	4.0	1.8	5.8
	5/4	1051	131.38	106.85	24.53	23.34	15.4	3.3	18.7
	8/4	750	101.25	100.78	.47	.63	1.1	+0.6	0.5
	Total	10352	1215.99	1133.89	82.10	7.93	4.9	1.9	6.8
NO. 3BC	4/4	5551	499.59	494.18	5.41	.97	4.1	+3.0	1.1
	5/4	651	59.24	48.39	10.85	16.67	20.0	+1.7	18.3
	8/4	1298	120.71	124.81	+4.10	+3.16	1.8	+5.2	+3.4
	Total	7500	679.54	667.38	12.16	1.62	5.1	+3.3	1.8
Grand Total		84900	14924.45	13796.55	1127.90	13.29	4.6	3.0	7.6

^a A plus (+) sign indicates that dry value of this grade and thickness class was greater than green value because of upgrade; therefore, the value loss must be positive.

^b A plus (+) sign indicates that value loss due to shrinkage is greater than total value loss; therefore, value loss due to degrade must be positive.

Table 2.—Value loss during air-drying by species and lumber thickness

Rough green		Potential value	Actual dry value	Value loss				
Thick-ness	Volume			Total ^a	Per MBF ^a	Due to shrinkage	Due to ^b degrade	Total ^a
<i>Inches</i>	<i>Fbm</i>	— — — —	<i>Dollars</i> — — — —	— — — — —	— — — — —	— — — —	<i>Percent</i> — — — —	— — — —
BASSWOOD								
4/4	38199	6453.48	6067.93	385.55	10.09	4.5	1.5	6.0
5/4	491	69.35	61.56	7.79	15.87	9.8	1.4	11.2
6/4	1541	388.99	358.24	30.75	19.95	6.9	1.0	7.9
RED MAPLE								
4/4	35411	5746.65	5538.85	207.80	5.87	2.6	1.0	3.6
5/4	9220	1675.47	1584.59	90.88	9.86	3.2	2.2	5.4
6/4	3654	909.39	874.76	34.63	9.48	2.6	1.2	3.8
8/4	3616	942.02	924.92	17.10	4.73	1.8	0.0	1.8
YELLOW BIRCH								
4/4	34531	6534.18	6088.82	445.36	12.90	3.9	2.9	6.8
5/4	14349	3478.29	3292.97	185.32	12.92	3.4	1.9	5.3
6/4	2107	657.42	632.47	24.95	11.84	3.6	0.2	3.8
SUGAR MAPLE								
4/4	25587	3961.65	3718.23	243.42	9.51	2.6	3.5	6.1
5/4	31502	6758.87	6195.41	563.46	17.89	3.6	4.7	8.3
8/4	7818	2084.38	1949.70	134.68	17.23	1.5	5.0	6.5
YELLOW-POPLAR								
4/4	78488	12922.98	12139.07	783.91	9.99	3.5	2.6	6.1
6/4	8337	1768.03	1698.48	69.55	8.34	4.0	+0.1	3.9
BLACK OAK								
4/4	29318	4411.78	4176.63	235.15	8.02	2.4	2.9	5.3
5/4	38337	9248.37	8767.52	480.85	12.54	3.2	2.0	5.2
NORTHERN RED OAK								
4/4	100309	17698.39	16730.96	967.43	9.64	3.3	2.2	5.5
5/4	69683	18371.31	17037.29	1334.02	19.14	4.4	2.9	7.3
6/4	8014	2460.80	2313.04	147.76	18.44	4.4	1.6	6.0
SCARLET OAK								
5/8	9145	1526.95	1442.47	84.48	9.24	4.6	0.9	5.5
4/4	37041	5085.73	4835.44	250.29	6.76	2.8	2.1	4.9
5/4	3354	893.99	829.22	64.77	19.31	2.4	4.8	7.2
SCARLET, BLACK AND NORTHERN RED OAK								
5/8	9145	1526.95	1442.47	84.48	9.24	4.7	0.8	5.5
4/4	166668	27195.90	25743.03	1452.87	8.72	3.0	2.3	5.3
5/4	111374	28513.67	26634.03	1879.64	16.88	3.9	2.7	6.6
6/4	8014	2460.80	2313.04	147.76	18.44	4.4	1.6	6.0
CHESTNUT OAK								
4/4	77624	10329.27	9726.32	602.95	7.77	4.1	1.7	5.8
5/4	12796	2441.15	2255.04	186.11	14.54	5.9	1.7	7.6
6/4	21281	4862.67	4554.58	308.09	14.48	3.6	2.7	6.3
WHITE OAK								
4/4	50141	7478.11	7046.60	431.51	8.61	3.7	2.1	5.8
5/4	23770	4853.26	4359.37	493.89	20.78	7.1	3.1	10.2
6/4	8941	2371.12	2164.99	206.13	23.05	4.3	4.4	8.7
8/4	2048	221.96	225.59	+3.63	+1.77	4.3	+5.9	+1.6

^a A plus (+) sign indicates that dry value of this species and thickness class was greater than green value because of upgrade; therefore, the value loss must be positive.

^b A plus (+) sign indicates that value loss due to shrinkage is greater than total value loss; therefore, value loss due to degrade must be positive.

DISCUSSION

Previous research on the subject of seasoning degrade established unavoidable degrade losses for species groups in the Appalachian region (Cuppett 1965). Although our method of determining value loss differed from that used in the earlier report, the percentages of value lost due to degrade are very similar. By separating species, lumber grades, and thicknesses, we have provided additional information.

Differences between potential value and air-dry value of hardwood lumber can be attributed to two basic factors: shrinkage, which is unavoidable, and degrade. If 1,000 board feet of lumber decreases 4 percent in lumber volume as a result of shrinkage during air-drying, the potential value is also reduced by 4 percent. Any additional reduction in potential value results from reductions in grade of boards. In tables 1 and 2, the percentage value loss has been separated into that due to shrinkage and that due to degrade. In some instances boards are upgraded during air-drying with a resulting increase in the board's value. This occurs because certain defects (shake, wetwood, stain) are more difficult to evaluate in the green lumber than they are in the dry; therefore, the area and severity of these defects may be overestimated. It is also possible for lumber to increase in grade during air-drying because of shrinkage. If a board shrinks to a lower surface measure, the total requirements for clear cutting units are reduced, and the board may qualify for a higher grade. Significant upgrading was demonstrated for some combinations of species, lumber grade, and board size. As a result, the value of some lumber classes increased during air-drying.

We have shown the dollar loss per thousand board feet for emphasis rather than for future comparison. This value changes whenever lumber prices change and is not as useful as percentage value loss. By using lumber prices from 1962, 1967, and 1973 it was possible to compare percentage value loss over time. For these three dates, per-

centage value losses differed by no more than 0.1 percent. Therefore, it is likely that the percentages will be applicable in the future whether lumber prices increase or decrease.

The value losses presented here are averages of several drying operations. Since we selected only mills that followed good sawing and drying practices, we believe that the figures represent a goal to strive for. They may be used as is if one desires to estimate the dry value of green lumber. For this purpose dry prices should be applied to green boards that were measured with a dry board rule. The resulting potential value must then be reduced by the appropriate value loss as demonstrated below:

Potential value of 1,000 board feet of green 4/4-inch No. 2 Common basswood	\$100.00
No. 2 Common basswood	\$100.00
Value loss from table 1 (percent)	3.6
Value loss (dollars)	\$3.60
Estimated dry value	\$96.40

The value loss figures may also be used for comparison to check drying performance. If a sawmill operator cannot achieve comparably low drying losses, he should find out why.

We stated that lumber shrinkage during air-drying was unavoidable. However, improperly sawn lumber may shrink from one thickness class to a lower thickness class. This can be avoided if the sawmill equipment is carefully maintained and if the green boards are thick enough to allow for shrinkage.

Value loss due to degrade can also be minimized by following recognized air-drying practices. Because lumber price per board foot increases with thickness, extra care should be taken in drying heavier stock.

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