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STANDARD TERMS FOR DESCRIBING WOOD

Abstract

Presents series of standard terms for describing specific gravity, shrinkage, bending and compressive strength, hardness, shock resistance, and stiffness of the various species of wood as developed by the U. S. Forest Products Laboratory.

STANDARD TERMS FOR DESCRIBING WOOD[1]

By

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In discussing the properties and characteristics of different species of wood, it is often desirable to describe them broadly by means of descriptive terms, rather than by quoting precise numerical strength values. The practice of using general descriptive terms is well established in forest tree literature. Not so well established, however, is any uniformity in the use of descriptive terms; nor are the terms used nearly so closely correlated with the actual mechanical properties as is possible from existing knowledge. Thus, one book on trees describes American elm as "heavy, hard, strong, . . ." and describes red oak with the same words. This gives an impression of far closer equality of properties than really exists and fails to bring out the exceptional characteristics of each species.

In order to obviate the confusion that often arises from indiscriminate use of descriptive terms or the lack of properly correlated terms, the U. S. Forest Products Laboratory has developed a series of standard terms for describing wood. Ten terms have been set up for each property, thus giving a relatively wide range of expression. At the same time, the adoption of 10 terms permits.. the use of a corresponding decimal scale of numbers for each property in lieu of the descriptive terms, if so desired. Compare the greater precision of the standard terms in differentiating between American elm and red oak in the following example, as against the description previously quoted: (numbers in parentheses indicate the respective properties in the decimal scale).

American elm has large shrinkage (7), is moderately heavy (6), moderately strong in bending (6), moderately weak in compression (5), moderately stiff (6), moderately hard (6), and high in shock resistance (7).

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[1] Originally written in 1936 as Forest Products Laboratory Report No. 1169 under the same title, by L. J. Markwardt and G. E. Heck; last major revision in 1956 by J.A. Liska and J.T. Drow. Issued without change in 1967 as U.S. Forest Service Research Note FPL-0171.

[2] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

Northern red oak has moderately large shrinkage (6), is heavy (7), strong in bending (7), moderately strong in compression (6), stiff (7), hard (7), and high in shock resistance (7).

From the descriptions presented with this more precise yardstick, it is very evident that American elm, for its weight has a relatively large shrinkage and is unusually shock resistant; these are two of its particularly characteristic properties.

The various descriptive terms for six important properties are listed in table 1. Each descriptive term for each property embraces a given numerical classification range with definite numerical limits. The figures making up the classification limits are known as comparative strength values and are derived from specific numerical test data by means of reduction and weighing factors as explained in U.S. Department of Agriculture Technical Bulletin 158.[3]

Table 2 presents comparative strength values and corresponding descriptive terms for 178 species of wood grown in the United States. The descriptive terms are abbreviated in table 2, but the complete term can be readily ascertained by referring to table 1. For example, in table 2, the comparative figure for hardness of red alder is 48. Table 1 shows that the descriptive term corresponding to this hardness value is "moderately soft," which is abbreviated to "MS" in table 2.

When the results of standard test data on small clear specimens of any species are available, the required comparative strength values can be readily computed by the detailed procedure presented in Technical Bulletin 158. Conversely, when standard strength data are not available for a species, it is impossible to assign descriptive terms under the system presented here. For this reason, not all species listed in table 2 are fully described.

This system of standard descriptive terms was first developed by the U.S. Forest Products Laboratory around 40 years ago, and it has been revised and expanded several times. It is believed that the general use of standard terms will result in more precise evaluation of the various important physical properties of wood and eliminate the confusion resulting from the use of indiscriminate or uncorrelated terms.

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[3] Comparative Strength Properties of Woods Grown in the United States, U.S. Dept. of Agr., Tech. Bull. 158.

Table 1.--Classification of comparative terms used in describing the properties[1] of the various species

Index figure	Specific gravity[2] or weight: Classification limits	Specific gravity[2] or weight: Descriptive terms	Shrinkage: Classification limits	Shrinkage: Descriptive terms	Bending and compressive strength: Classification limits: Bending strength	Bending and compressive strength: Classification limits: Compressive strength	Bending and compressive strength: Classification limits: Combined bending and compressive strength	Bending and compressive strength: Descriptive terms
1	Below 0.20	Extremely light	Below 53	Extremely small	Below 29	Below 36	Below 40	Extremely weak
2	From .20 to 0.25	Exceedingly light	From 53 to 66	Exceedingly small	From 29 to 38	From 36 to 44	From 40 to 50	Exceedingly weak
3	From .25 to .30	Very light	From 66 to 80	Very small	From 38 to 48	From 44 to 53	From 50 to 60	Very weak
4	From .30 to .36	Light	From 80 to 95	Small	From 48 to 60	From 53 to 64	From 60 to 72	Weak
5	From .36 to .42	Moderately light	From 95 to 111	Moderately small	From 60 to 73	From 64 to 75	From 72 to 84	Moderately weak
6	From .42 to .50	Moderately heavy	From 111 to 132	Moderately large	From 73 to 91	From 75 to 89	From 84 to 100	Moderately strong
7	From .50 to .60	Heavy	From 132 to 159	Large	From 91 to 114	From 89 to 107	From 100 to 120	Strong
8	From .60 to .72	Very heavy	From 159 to 191	Very large	From 114 to 143	From 107 to 128	From 120 to 144	Very strong
9	From .72 to .86	Exceedingly heavy	From 191 to 228	Exceedingly large	From 143 to 179	From 128 to 153	From 144 to 172	Exceedingly strong
10	Above .86	Extremely heavy	Above 228	Extremely large	Above 179	Above 153	Above 172	Extremely strong

Index figure	Hardness: Classification limits	Hardness: Descriptive terms	Shock resistance: Classification limits	Shock resistance: Descriptive terms	Stiffness: Classification limits	Stiffness: Descriptive terms
1	Below 7.7	Extremely soft	Below 18	Extremely low	Below 60	Extremely limber
2	From 7.7 to 13.5	Exceedingly soft	From 18 to 28	Exceedingly low	From 60 to 75	Exceedingly limber
3	From 13.5 to 21	Very soft	From 28 to 40	Very low	From 75 to 90	Very limber
4	From 21 to 34	Soft	From 40 to 58	Low	From 90 to 108	Limber
5	From 34 to 50	Moderately soft	From 58 to 79	Moderately low	From 108 to 126	Moderately limber
6	From 50 to 76	Moderately hard	From 79 to 111	Moderately high	From 126 to 150	Moderately stiff
7	From 76 to 120	Hard	From 111 to 160	High	From 150 to 180	Stiff
8	From 120 to 190	Very hard	From 160 to 230	Very high	From 180 to 216	Very stiff
9	From 190 to 295	Exceedingly hard	From 230 to 329	Exceedingly high	From 216 to 258	Exceedingly stiff
10	Above 295	Extremely hard	Above 329	Extremely high	Above 258	Extremely stiff

[1] For reduction and weighing factors see table 4, U. S. D. A. Technical Bulletin 158.

[2] The specific gravity is based on weight when ovendry and volume when green.

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms

Common and botanical name	Number of trees tested	Properties							
		Specific gravity[1]	Volumetric shrinkage[2]	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
HARDWOODS									
Alder, red	6	0.37	123	76	81	78	139	48	72
(Alnus rubra)		ML	ML	MS	MS	MW	MS	MS	ML
Apple	10	.61	170	85	75	81	138	119	154
(Malus pumila)		VH	VL	MS	MS	MW	MS	H	H
Ash:									
Black	11	.45	144	75	70	73	126	64	124
(Fraxinus nigra)		MH	L	MS	MW	MW	MS	MH	H
Blue	5	.53	113	108	107	108	138	118	145
(Fraxinus quadrangulata)		H	ML	S	VS	S	MS	H	H
Green	10	.53	122	107	106	107	157	106	116
(Fraxinus pennsylvanica)		H	ML	S	S	S	S	H	H
Oregon	3	.50	129	88	87	88	143	94	125
(Fraxinus latifolia)		H	ML	MS	MS	MS	MS	H	H
Pumpkin	3	.48	113	85	85	85	117	103	87
(Fraxinus profunda)		MH	ML	MS	MS	MS	ML	H	MH
White	28	.54	130	111	105	108	166	106	146
(Fraxinus americana)		H	ML	S	S	S	S	H	H
Aspen:									
Bigtooth	10	.35	116	66	70	68	129	38	62
(Populus grandidentata)		L	ML	MW	MW	W	MS	MS	ML
Quaking	11	.35	111	62	57	60	112	31	68
(Populus tremuloides)		L	ML	MW	W	W	ML	S	ML
Basswood, American	8	.32	158	61	62	61	123	30	53
(Tilia americana)		L	L	MW	W	W	ML	S	L
Beech, American	17	.56	162	102	94	99	168	96	134
(Fagus grandifolia)		H	VL	S	S	MS	S	H	H
Birch:									
Alaska paper	10	.49	166	88	87	88	160	61	126
(Betula papyrifera var. humilis)		MH	VL	MS	MS	MS	S	MH	H
Gray	5	.45	147	61	52	57	85	52	149
(Betula populifolia)		MH	L	MW	VW	VW	VL	MH	H
Paper	10	.48	158	78	66	73	137	58	156
(Betula papyrifera)		MH	L	MS	MW	MW	MS	MH	H
Sweet	10	.60	154	116	105	111	206	104	157
(Betula lenta)		VH	L	VS	S	S	VS	H	H
Yellow	17	.55	166	106	99	103	174	87	172
(Betula alleghaniensis)		H	VL	S	S	S	S	H	VH
Black-mangrove	6	.83	157	127	123	125	186	191	155
(Avicennia nitida)		Exc. H	L	VS	VS	VS	VS	Exc. H	H
Buckeye, yellow	5	.33	118	58	56	57	111	31	53
(Aesculus octandra)		L	ML	W	W	VW	ML	S	L
Buckthorn, cascara	5	.50	77	71	78	74	93	85	143
(Rhamnus purshiana)		H	VS	MW	MS	MW	L	H	H

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties						
		Specific gravity[1]	Volumetric shrinkage[2]	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Bustic, willow	1	0.86			128		230		
(Dipholis salicifolia)		Ext. H			Exc. S		Exc. S		
Butterbough	2	.73	184	123	111	118	182	180	153
(Exothea paniculata)		Exc. H	VL	VS	VS	S	VS	VH	H
Butternut	10	.36	99	64	69	66	114	40	80
(Juglans cinerea)		ML	MS	MW	MW	W	ML	MS	MH
Button-mangrove	7	.69	144	92	107	98	159	124	88
(Conocarpus erectus)		VH	L	S	VS	MS	S	VH	MH
California-laurel	5	.51	116	71	74	72	88	105	146
(Umbellularia californica)		H	ML	MW	MW	MW	VL	H	H
Catalpa, northern	15	.38	73	63	60	62	110	43	96
(Catalpa speciosa)		ML	VS	MW	W	W	ML	MS	MH
Cherry:									
Black	5	.47	113	93	98	95	150	72	112
(Prunus serotina)		MH	ML	S	S	MS	S	MH	H
Pin	5	.36	129	62	62	62	116	41	78
(Prunus pensylvanica)		ML	ML	MW	W	W	ML	MS	ML
Chestnut:									
American	10	.40	111	67	69	68	111	50	69
(Castanea dentata)		ML	ML	MW	MW	W	ML	MH	ML
Japanese	5	.54	125	128	97	115	147	75	125
(Castanea crenata)		H	ML	VS	S	S	MS	MH	H
Chinkapin, golden	5	.42	128	82	76	79	125	62	95
(Castanopsis chrysophylla)		MH	ML	MS	MS	MW	ML	MH	MH
Cottonwood:									
Black	5	.32	123	60	59	60	119	28	59
(Populus trichocarpa)		L	ML	MW	W	W	ML	S	ML
Eastern	5	.37	138	61	63	62	122	36	72
(Populus deltoides)		ML	L	MW	W	W	ML	MS	ML
Cucumbertree	5	.44	137	89	87	88	174	56	103
(Magnolia acuminata)		MH	L	MS	MS	MS	S	MH	MH
Dogwood:									
Flowering	5	.64	194	98	93	96	123	152	190
(Cornus florida)		VH	Exc. L	S	S	MS	ML	VH	VH
Pacific	5	.58	168	86	93	89	142	114	159
(Cornus nuttallii)		H	VL	MS	S	MS	MS	H	H
Doveplum	5	.77	145	114	116	115	184	184	115
(Coccoloba diversifolia)		Exc. H	L	VS	VS	S	VS	VH	H
Elder, blueberry	5	.46	149	71	76	73	115	68	112
(Sambucus glauca)		MH	L	MW	MS	MW	ML	MH	H
Elm:									
American	12	.46	143	84	74	80	129	66	126
(Ulmus americana)		MH	L	MS	MW	MW	MS	MH	H
Cedar	7	.59	160	96	83	90	140	99	192
(Ulmus crossifolia)		H	VL	S	MS	MS	MS	H	VH

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties: Specific gravity[1]	Volumetric shrinkage[2]	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Elm:									
Rock	10	0.57	137	106	97	102	147	104	190
(Ulmus thomasii)		H	L	S	S	S	MS	H	VH
Slippery	6	.48	138	92	89	91	139	72	158
(Ulmus rubra)		MH	L	S	S	MS	MS	MH	H
Winged	10	.60	159	101	84	94	150	106	224
(Ulmus alata)		VH	VL	S	MS	MS	S	H	VH
Eucalyptus, Tasmanian blue	5	.62	226	133	144	138	232	131	136
(Eucalyptus globulus)		VH	Exc. L	VS	Exc. S	VS	Exc. S	VH	H
Eugenia, redberry	3	.81	140	154	149	152	210	230	165
(Eugenia confusa)		Exc. H	L	Exc. S	Exc. S	Exc. S	VS	Exc. H	VH
False-mastic	5	.89	123	112	127	118	183	211	96
(Sideroxylon foctidissimum)		Ext. H	ML	S	VS	S	VS	Exc. H	MH
Fig, Florida strangler	1	.44	.....	61	65	63	66	56	65
(Ficus aurea)		MH	.....	MW	MW	W	Exc. L	MH	ML
Gumbo-limbo	5	.30	77	39	38	39	66	30	32
(Bursera simaruba)		L	VS	VW	Exc. W	Ext. W	Exc. L	S	VL
Hackberry	6	.49	138	76	71	74	108	74	145
(Celtis occidentalis)		MH	L	MS	MW	MW	ML	MH	H
Hawthorn, pear	2	.62	.....	89	79	85	107	126	162
(Crataegus calpodendron)		VH	.....	MS	MS	MS	L	VH	VH
Hickory:									
Bitternut	11	.60	.....	126	132	129	169	.....	227
(Carya cardiformis)		VH	.....	VS	Exc. S	VS	S	.....	VH
Mockernut	19	.64	182	134	124	130	184	.....	271
(Carya tomentosa)		VH	VL	VS	VS	VS	VS	.....	Exc. H
Nutmeg	5	.56	.....	110	107	109	147	.....	215
(Carya myristicaeformis)		H	.....	S	VS	S	MS	.....	VH
Pignut	60	.66	182	143	130	137	195	.....	308
(Carya glabra)		VH	VL	Exc. S	Exc. S	VS	VS	.....	Exc. H
Shagbark	24	.64	170	132	122	128	185	.....	258
(Carya ovata)		VH	VL	VS	VS	VS	VS	.....	Exc. H
Shellbark	19	.62	195	126	103	116	164	.....	308
(Carya laciniosa)		VH	Exc. L	VS	S	S	S	.....	Exc. H
Water	2	.61	.....	126	115	121	185	.....	190
(Carya aquatica)		VH	.....	VS	VS	VS	VS	.....	VH
Holly, American	5	.50	155	76	70	73	101	85	120
(Ilex opaca)		H	L	MS	MW	MW	L	H	H
Honeylocust	6	.60	108	111	109	110	153	154	145
(Gleditsia triacanthos)		VH	MS	S	VS	S	S	VH	H
Hophornbeam, eastern	5	.63	183	100	98	99	149	124	169
(Ostrya virginiana)		VH	VL	S	S	MS	MS	VH	VH

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties						
		Specific gravity[1]	Volumetric shrinkage[2]	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Hornbeam, American	12	0.58	184	77	67	73	114	117	290
(Carpinus caroliniana)		H	VL	MS	MW	MW	ML	H	Exc. H
Leadwood	4	1.04	125	157	159	158	256	.....	104
(Krugiodendron ferreum)		Ext. H	ML	Exc. S	Ext. S	Exc. S	Exc. S	.....	MH
Locust, black	3	.66	103	157	165	160	219	160	167
(Robinia pseudoacacia)		VH	MS	Exc. S	Ext. S	Exc. S	Exc. S	VH	VH
Madrone, Pacific	6	.58	174	85	87	86	116	112	101
(Arbutus menziesii)		H	VL	MS	MS	MS	ML	H	MH
Magnolia:									
Fraser	5	.40	126	76	73	75	141	50	81
(Magnolia fraseri)		ML	ML	MS	MW	MW	MS	MH	MH
Southern	2	.46	122	81	71	77	136	80	141
(Magnolia grandiflora)		MH	ML	MS	MW	MW	MS	H	H
Mangrove	4	.89	158	178	156	169	270	247	174
(Rhizophora mangle)		Ext. H	L	Exc. S	Ext. S	Exc. S	Ext. S	Exc. H	VH
Maple:									
Bigleaf	5	.44	113	82	85	83	131	72	77
(Acer macrophyllum)		MH	ML	MS	MS	MW	MS	MH	ML
Black	1	.52	140	93	89	91	149	96	132
(Acer nigrum)		H	L	S	S	MS	MS	H	H
Red	14	.49	128	93	86	90	155	79	111
(Acer rubrum)		MH	ML	S	MS	MS	S	H	H
Silver	5	.44	114	68	70	69	106	64	92
(Acer sacoharinum)		MH	ML	MW	MW	W	L	MH	MH
Striped	4	.44	121	78	72	75	135	59	99
(Acer pensylvanicum)		MH	ML	MS	MW	MW	MS	MH	MH
Sugar	22	.56	147	114	104	110	178	115	137
(Acer sacchorum)		H	L	VS	S	S	S	H	H
Mountain-laurel	5	.62	144	97	90	94	110	142	114
(Kalmia latifolia)		VH	L	S	S	MS	ML	VH	H
Oak:									
Black	8	.56	142	98	90	95	142	103	127
(Quercus velutina)		H	L	S	S	MS	MS	H	H
Bur	5	.58	129	82	81	82	103	112	111
(Quercus macrocarpa)		H	ML	MS	MS	MW	L	H	H
California black	10	.51	115	69	71	70	94	98	76
(Quercus kelloggii)		H	ML	MW	MW	W	L	H	ML
Canyon live	3	.70	158	109	124	115	158	179	132
(Quercus chrysolepis)		VH	L	S	VS	S	S	VH	H
Cherrybark	3	.61	163	131	122	127	215	123	163
(Quercus falcota var. pagodaefolia)		VH	VL	VS	VS	VS	VS	VH	VH
Chestnut	5	.57	162	101	92	97	166	89	106
(Quercus prinus)		H	VL	S	S	MS	S	H	MH

(Sheet 4 of 9)

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties						
		Specific gravity[1]	Volumetric shrinkage[2]	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Oak:									
Gambel	3	0.62	121	69	65	67	78	137	138
(Quercus gambelii)		VH	ML	MW	MW	W	VL	VH	H
Laurel	5	.56	173	93	89	91	169	98	121
(Quercus laurifolia)		H	VL	S	S	MS	S	H	H
Live	5	.81	152	142	129	136	228	240	148
(Quercus virginiana)		Exc. H	L	VS	Exc. S	VS	Exc. S	Exc. H	H
Northern red	33	.56	131	99	88	94	164	103	141
(Quercus rubra)		H	ML	S	MS	MS	S	H	H
Oregon white	10	.64	133	86	88	87	107	152	126
(Quercus garryana)		VH	L	MS	MS	MS	L	VH	H
Overcup	7	.57	167	90	79	85	136	87	133
(Quercus lyrata)		H	VL	MS	MS	MS	MS	H	H
Pin	5	.58	143	96	92	94	167	111	147
(Quercus palustris)		H	L	S	S	MS	S	H	H
Post	10	.60	160	98	89	94	143	122	132
(Quercus stellata)		VH	VL	S	S	MS	MS	VH	H
Scarlet	5	.60	140	115	107	112	181	120	174
(Quercus coccinea)		VH	L	VS	VS	S	VS	VH	VH
Southern red	4	.52	153	83	76	80	152	86	84
(Quercus falcata)		H	L	MS	MS	MW	S	H	MH
Swamp chestnut	4	.60	180	100	95	98	171	103	131
(Quercus michauxii)		VH	VL	S	S	MS	S	H	H
Swamp white	1	.64	172	123	116	120	185	122	164
(Quercus bicolor)		VH	VL	VS	VS	VS	VS	VH	VH
Water	5	.56	154	110	95	104	195	100	140
(Quercus nigra)		H	L	S	S	S	VS	H	H
White	20	.60	153	102	97	100	153	108	127
(Quercus alba)		VH	L	S	S	S	S	H	H
Willow	2	.56	175	95	85	91	166	106	116
(Quercus phellos)		H	VL	S	MS	MS	S	H	H
Osage-orange	1	.76	89	...	...	...	...	...	...
(Maclura pomifera)		Exc. H	S	...	...	...	...	...	...
Palmetto, cabbage	5	.37	250	40	39	40	54	25	52
(Sabal palmetto)		ML	Ext. L	VW	Exc. W	Exc. W	Ext. L	S	L
Paradise-tree	4	.33	82	41	44	42	85	32	21
(Simarauba glauca)		L	S	VW	VW	Exc. W	VL	S	Exc. L
Pecan	5	.60	137	109	104	107	161	140	157
(Carya illinoensis)		VH	L	S	S	S	S	VH	H
Persimmon, common	5	.64	183	120	115	118	171	159	135
(Diospyros virginiana)		VH	VL	VS	VS	S	S	VH	H

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties: Specific gravity[1]	Volumetric shrinkage[2]	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Poisontree, Florida	4	0.51	115	69	56	63	99	56	48
(Metopium taxiferum)		H	ML	MW	W	W	L	MH	L
Poplar, balsam	10	.30	104	48	48	48	94	25	43
(Populus balsamifera)		L	MS	W	VW	Exc. W	L	S	L
Rhododendron, roseboy	5	.50	158	75	84	79	100	103	105
(Rhododendron maximum)		H	L	MS	MS	MW	L	H	MH
Sassafras	5	.42	103	71	70	71	102	60	97
(Sassafras albidum)		MH	MS	MW	MW	W	L	MH	MH
Serviceberry, downy	5	.66	183	120	113	117	181	130	185
(Amelanchier arborea)		VH	VL	VS	VS	S	VS	VH	VH
Silverbell, Carolina	5	.42	122	74	72	73	133	53	81
(Halesia carolina)		MH	ML	MS	MW	MW	MS	MH	MH
Sourwood	5	.50	152	93	86	90	159	83	106
(Oxydendrum arboreum)		H	L	S	MS	MS	S	H	MH
Sugarberry	5	.47	126	74	74	74	102	82	116
(Celtis laevigata)		MH	ML	MS	MW	MW	L	H	H
Sumac, staghorn	5	.45	.....	73	74	73	94	64	117
(Rhus typhina)		MH	.....	MS	MW	MW	L	MH	H
Sweetbay	4	.45	129	82	77	80	164	51	85
(Magnolia virginiana)		MH	ML	MS	MS	MW	S	MH	MH
Sweetgum	25	.46	160	85	78	82	148	61	106
(Liquidambar styraciflua)		MH	VL	MS	MS	MW	MS	MH	MH
Sycamore, American	10	.46	137	74	76	75	129	64	79
(Platanus occidentalis)		MH	L	MS	MS	MW	MS	MH	MH
Tamarisk	3	.62	145	97	91	94	126	110	119
(Tamarix sp.)		VH	L	S	S	MS	MS	H	H
Tanoak	.....	.56	171	126	128	127	186	.....	.....
(Lithocarpus densiflorus)		H	VL	VS	Exc. S	VS	VS	.....	.....
Tupelo:									
Black	5	.46	133	82	77	80	117	76	76
(Nyssa sylvatica)		MH	L	MS	MS	MW	ML	H	ML
Water	6	.46	123	82	86	84	127	77	80
(Nyssa aquatica)		MH	ML	MS	MS	MS	MS	H	MH
Walnut:									
Black	5	.51	116	111	111	111	167	87	125
(Juglons nigra)		H	ML	S	VS	S	S	H	H
Little	1	.53	101	91	85	88	118	.....	127
(Juglons microcarpa)		H	MS	S	MS	MS	ML	.....	H
Willow									
Black	20	.35	127	57	52	55	95	39	99
(Salix nigra)		L	ML	W	VW	VW	L	MS	MH
Pacific	5	.39	132	66	61	64	126	50	106
(Salix lasiendra)		ML	L	MW	W	W	MS	MH	MH

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties						
		Specific gravity[1]	Volumetric shrinkage[2]	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Witch-hazel	5	0.56	188	107	86	98	129	105	171
(Hamamelis virginiana)		H	VL	S	MS	MS	MS	H	VH
Yellow-poplar	19	.40	122	76	72	74	151	44	76
(Liriodendron tulipifera)		ML	ML	MS	MW	MW	S	MS	ML
SOFTWOODS									
Baldcypress	26	.42	103	79	93	85	139	52	72
(Taxodium distichum)		MH	MS	MS	S	MS	MS	MH	ML
Cedar:									
Alaska	8	.42	91	80	85	82	136	52	94
(Chamaecyparis nootkatensis)		MH	S	MS	MS	MW	MS	MH	MH
Atlantic white	10	.31	83	53	60	56	93	35	51
(Chamaecyparis thyoides)		L	S	W	W	VW	L	MS	L
Eastern redcedar	5	.44	78	67	87	76	80	82	115
(Juniperus virginiana)		MH	VS	MW	MS	MW	VL	H	H
Incense	8	.35	80	68	83	74	107	50	54
(Libocedrus decurrens)		L	S	MW	MS	MW	L	MH	L
Northern white	5	.29	69	50	52	51	77	30	46
(Thuja occidentalis)		VL	VS	W	VW	VW	VL	S	L
Port-Orford	14	.40	106	81	90	85	168	48	81
(Chamaecyparis lawsoniana)		ML	MS	MS	S	MS	S	MS	MH
Southern redcedar	5	.42	67	87	108	96	109	76	62
(Juniperus silicicola)		MH	VS	MS	VS	MS	ML	H	ML
Western redcedar	15	.31	76	60	75	66	108	38	52
(Thuja plicata)		L	VS	MW	MS	W	ML	MS	L
Cypress, Arizona	10	.51	99	87	91	89	92	101	80
(Cupressos arizonica)		H	MS	MS	S	MS	L	H	MH
Douglas-fir:									
Coast type	67	.45	122	90	104	96	185	58	86
(Pseudotsuga menziesii)		MH	ML	MS	S	MS	VS	MH	MH
Intermediate type	15	.41	113	81	91	85	161	56	72
(Pseudotsuga menziesii)		ML	ML	MS	S	MS	S	MH	ML
Rocky Mountain type	10	.40	103	75	83	78	142	52	66
(Pseudotsuga menziesii var. glauca)		ML	MS	MS	MS	MW	MS	MH	ML
Fir:									
Balsam	5	.34	103	58	66	61	117	30	49
(Abies balsamea)		L	MS	W	MW	W	ML	S	L
California red	17	.37	117	73	77	75	146	45	68
(Abies magnifica)		ML	ML	MS	MS	MW	MS	MS	ML
Corkbark	10	.28	92	51	57	54	104	27	38
(Abies lasiocarpa var. arizonica)		VL	S	W	W	VW	L	S	VL
Grand	10	.37	105	72	80	76	156	42	73
(Abies grandis)		ML	MS	MW	MS	MW	S	MS	ML
Noble	9	.35	126	73	78	75	155	39	68
(Abies procera)		L	ML	MS	MS	MW	S	MS	ML

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties						
		Specific gravity[1]	Volumetric shrinkage[2]	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Fir:									
Pacific silver	6	0.35	142	70	76	73	146	36	71
(Abies amabilis)		L	L	MW	MS	MW	MS	MS	ML
Subalpine	5	.31	92	50	59	54	95	34	34
(Abies lasiocarpa)		L	S	W	W	VW	L	MS	VL
White	20	.35	97	72	73	72	127	42	58
(Abies concolor)		L	MS	MW	MW	MW	MS	MS	ML
Hemlock:									
Eastern	20	.38	97	72	79	75	121	51	67
(Tsuga canadensis)		ML	MS	MW	MS	MW	ML	MH	ML
Mountain	10	.43	115	81	87	84	130	64	99
(Tsuga mertensiana)		MH	ML	MS	MS	MS	MS	MH	MH
Western	18	.38	120	74	85	79	145	50	73
(Tsuga heterophylla)		ML	ML	MS	MS	MW	MS	MH	ML
Juniper:									
Alligator	3	.48	73	63	76	69	60	107	79
(Juniperus deppeana)		MH	VS	MW	MS	W	Exc.L	H	MH
Rocky Mountain	10	.40	68	72	77	74	65	64	84
(Juniperus scopulorum)		ML	VS	MW	MS	MW	Exc.L	MH	MH
Utah	10	.47	83	85	89	87	81	84	93
(Juniperus osteasperma)		MH	S	MS	S	MS	VL	H	MH
Larch, western	33	.51	138	97	106	101	179	63	107
(Larix occidentalis)		H	L	S	S	S	S	MH	MH
Pine:									
Eastern white	26	.34	82	62	66	64	117	33	54
(Pinus strobus)		L	S	MW	MW	W	ML	S	L
Jack	35	.40	103	72	76	74	123	45	79
(Pinus banksiana)		ML	MS	MW	MS	MW	ML	MS	MH
Jeffrey	5	.37	103	68	70	69	116	43	63
(Pinus jeffreyi)		ML	MS	MW	MW	W	ML	MS	ML
Limber	2	.37	80	69	68	69	106	39	54
(Pinus flexilis)		ML	S	MW	MW	W	L	MS	L
Loblolly	56	.47	123	87	92	89	162	57	94
(Pinus taeda)		MH	ML	MS	S	MS	S	MH	MH
Lodgepole	28	.38	114	67	72	69	128	41	60
(Pinus contorta)		ML	ML	MW	MW	W	MS	MS	ML
Longleaf	54	.54	123	103	115	108	186	71	109
(Pinus palustris)		H	ML	S	VS	S	VS	MH	MH
Pitch	10	.45	110	80	76	78	146	56	94
(Pinus rigida)		MH	MS	MS	MS	MW	MS	MH	MH
Pond	5	.50	115	88	102	94	154	63	92
(Pinus serotina)		H	ML	MS	S	MS	S	MH	MH
Ponderosa	31	.38	98	64	69	66	113	41	57
(Pinus ponderosa)		ML	MS	MW	MW	W	ML	MS	L

Table 2.--Properties of woods grown in the United States as represented by comparative figures and descriptive terms (continued)

Common and botanical name	Number of trees tested	Properties						
		Specific gravity[1]	Volumetric shrinkage[2]	Bending strength	Compressive strength	Combined bending and compressive strength	Stiffness	Hardness	Shock resistance
Pine:									
Red	15	0.41	112	74	76	75	148	42	79
(Pinus resinosa)		ML	ML	MS	MS	MW	MS	MS	ME
Sand	5	.45	104	85	89	87	134	63	85
(Pinus clausa)		MH	MS	MS	S	MS	MS	MH	MH
Shortleaf	42	.46	122	87	92	89	161	56	96
(Pinus echinata)		MH	ML	MS	S	MS	S	MH	MH
Slash	25	.54	124	105	114	109	186	76	115
(Pinus elliottii)		H	ML	S	VS	S	VS	H	H
South Florida slash	5	.70	133	121	122	121	198	108	97
(Pinus elliottii var. densa)		VH	L	VS	VS	VS	VS	H	MH
Sugar	9	.35	81	64	70	67	112	37	53
(Pinus lambertiana)		L	S	MW	MW	W	ML	MS	L
Table-Mountain	5	.49	107	90	93	91	150	63	90
(Pinus pungens)		MH	MS	MS	S	MS	S	MH	MH
Virginia	26	.45	118	88	87	88	141	60	114
(Pinus virginiana)		MH	ML	MS	MS	MS	MS	MH	H
Western white	14	.36	117	68	76	72	145	34	66
(Pinus monticola)		ML	ML	MW	MS	MW	MS	MS	ML
Pinyon	13	.48	100	65	65	65	93	53	74
(Pinus edulis)		MH	MS	MW	MW	W	L	MH	ML
Redwood (old growth)	16	.38	69	82	102	91	136	54	66
(Sequoia semperuirens)		ML	VS	MS	S	MS	MS	MH	ML
Spruce:									
Black	5	.38	112	68	69	68	143	40	82
(Picea mariana)		ML	ML	MW	MW	W	MS	MS	MH
Engelmann	18	.32	108	60	62	61	114	33	51
(Picea engelmannii)		L	MS	MW	W	W	ML	S	L
Red	11	.38	117	72	77	74	138	41	69
(Picea rubens)		ML	ML	MW	MS	MW	MS	MS	ML
Sitka	25	.37	116	72	76	74	144	45	76
(Picea sitchensis)		ML	ML	MW	MS	MW	MS	MS	ML
White	15	.37	129	68	71	69	120	39	68
(Picea glauca)		ML	ML	MW	MW	W	ML	MS	ML
Tamarack	5	.49	128	84	94	88	147	53	83
(Larix laricina)		MH	ML	MS	S	MS	MS	MH	MH
Yew, Pacific	5	.60	96	115	113	114	120	136	165
(Taxus brevifolia)		VH	MS	VS	VS	S	ML	VH	VH

[1] Based on volume when green and weight when ovendry.

[2] Shrinkage from green to ovendry condition based on dimensions when green.

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