



Table S1: The full list of FIA species groups in the eastern U.S.

FIA Species Groups	
Code	Softwood
1	Longleaf and slash pines
2	Loblolly and shortleaf pines
3	Other yellow pines
4	Eastern white and red pines
5	Jack pine
6	Spruce and balsam fir
7	Eastern hemlock
8	Cypress
9	Other eastern softwoods
Code	Hardwood
25	Select white oaks
26	Select red oaks
27	Other white oaks
28	Other red oaks
29	Hickory Eastern
30	Yellow birch
31	Hard maple
32	Soft maple
33	Beech
34	Sweetgum
35	Tupelo and blackgum
36	Ash
37	Cottonwood and aspen
38	Basswood
39	Yellow-poplar
40	Black walnut
41	Other eastern soft hardwoods
42	Other eastern hard hardwoods
43	Eastern noncommercial hardwoods

Species groups are defined in (Burrill et al., 2018)



Table S2: Total forest volume and Volume/area estimates by each species group and survey unit. Only species groups with statistically significant models (i.e., standard errors \leq 20%) are shown. Gray shading indicates the NAIP strata maps with the highest gains in efficiency relative to the stratified estimates based on tree canopy cover data.

Tennessee

UNIT	Species group	Plot S	SPGRPC D	TN - Total Volume				Plot gain/loss	TN - Vol/Area				Plot gain/loss
				PS _{DS}	PS _{SCH}	PS _{SCHM+F}	Diff		PS _{DS}	PS _{SCH}	PS _{SCHM+F}	Diff	
				M	M	T			M	M	T		
Central	Other eastern softwoods	216	9	1.05	1.14	1.64	0.64	138	1.16	1.17	1.72	0.72	155
Central	Select white oaks	253	25	1.05	1.09	1.02	0.09	24	1.08	1.08	1.04	0.08	20
Central	Select red oaks	99	26	0.97	1.00	1.02	0.02	2	1.00	1.00	1.05	0.05	5
Central	Other white oaks	82	27	0.97	0.99	1.01	0.01	1	1.01	0.99	1.03	0.03	3
Central	Other red oaks	137	28	1.03	1.06	1.03	0.06	9	1.06	1.07	1.06	0.07	9
Central	Hickory	301	29	1.04	1.05	1.09	0.09	26	1.06	1.05	1.09	0.09	28
Central	Hard maple	222	31	1.04	1.04	1.04	0.04	10	1.06	1.05	1.05	0.06	14
							-						
Central	Soft maple	80	32	0.94	0.97	0.97	0.03	-2	0.98	0.98	1.00	0.00	0
Central	Beech	107	33	1.10	1.12	1.13	0.13	14	1.13	1.12	1.14	0.14	15
Central	Sweetgum	56	34	0.99	1.01	1.03	0.03	2	1.02	1.02	1.05	0.05	3
Central	Tupelo and blackgum	94	35	1.01	1.04	1.00	0.04	3	1.05	1.04	1.02	0.05	4
							-						
Central	Ash	228	36	0.97	0.98	0.98	0.02	-4	1.03	1.00	1.01	0.03	6
Central	Yellow-poplar	180	39	1.14	1.16	1.17	0.17	30	1.17	1.17	1.20	0.20	36
							-						
Central	Black walnut	133	40	0.94	0.96	0.99	0.01	-2	0.99	0.98	1.02	0.02	2
Central	Other eastern soft hardwoods	418	41	0.94	0.95	1.01	0.01	4	0.98	0.96	1.03	0.03	11
Central	Other eastern hard hardwoods	167	42	0.96	0.99	1.00	0.00	-1	1.00	1.00	1.02	0.02	3
							-						
Central	Eastern noncommercial hard-woods	232	43	0.96	0.99	0.98	0.01	-2	1.01	1.01	1.01	0.01	3
East	Loblolly and shortleaf pines	122	2	0.99	1.00	1.05	0.05	6	1.05	1.02	1.08	0.08	10
East	Other yellow pines	216	3	0.96	0.97	1.09	0.09	20	1.03	1.01	1.13	0.13	27
East	Eastern white and red pines	113	4	0.95	0.97	1.04	0.04	5	1.00	0.98	1.06	0.06	7

UNIT	Species group	Plot s	SPGRPC D	TN - Total Volume					TN - Vol/Area				
				PS _{DS}	PS _{CH}	PS _{CHM+F}	Diff	Plot gain/loss	PS _{DS}	PS _{CH}	PS _{CHM+F}	Diff	Plot gain/loss
				M	M	T			M	M	T		
East	Other eastern softwoods	120	9	0.99	0.99	1.03	0.03	4	1.04	1.01	1.05	0.05	6
East	Select white oaks	265	25	1.02	1.02	1.01	0.02	5	1.06	1.04	1.03	0.06	16
East	Select red oaks	182	26	0.97	0.98	1.03	0.03	6	1.01	1.00	1.05	0.05	10
East	Other white oaks	325	27	1.00	1.01	1.02	0.02	6	1.06	1.03	1.03	0.06	19
East	Hickory	347	29	1.01	1.03	1.07	0.07	25	1.05	1.04	1.10	0.10	35
East	Hard maple	145	31	0.95	0.97	1.01	0.01	2	1.00	0.98	1.03	0.03	4
East	Soft maple	367	32	1.01	1.03	1.07	0.07	24	1.05	1.03	1.07	0.07	27
East	Beech	99	33	1.01	1.02	1.00	0.02	2	1.05	1.02	1.01	0.05	5
East	Sweetgum	79	34	1.09	1.11	0.98	0.11	9	1.13	1.12	0.99	0.13	11
East	Tupelo and blackgum	223	35	1.00	1.01	0.98	0.01	3	1.05	1.03	0.99	0.05	11
East	Ash	105	36	0.96	0.97	1.01	0.01	1	1.00	0.97	1.02	0.02	2
East	Yellow-poplar	340	39	1.13	1.14	1.10	0.14	48	1.16	1.14	1.11	0.16	53
East	Black walnut	62	40	0.99	1.00	0.98	0.00	0	1.04	1.01	1.00	0.04	2
East	Other eastern soft hardwoods	374	41	1.02	1.04	1.02	0.04	15	1.05	1.03	1.03	0.05	19
East	Other eastern hard hardwoods	212	42	0.96	0.97	1.10	0.10	21	1.01	0.98	1.12	0.12	25
East	Eastern noncommercial hard-woods	363	43	0.96	0.96	0.99	0.01	-4	1.01	0.98	1.00	0.01	4
Plateau	Loblolly and shortleaf pines	77	2	1.05	1.06	1.25	0.25	19	1.07	1.06	1.25	0.25	19
Plateau	Other yellow pines	115	3	1.01	1.02	1.04	0.04	5	1.03	1.02	1.04	0.04	4
Plateau	Select white oaks	319	25	1.03	1.04	1.02	0.04	13	1.05	1.03	1.02	0.05	15
Plateau	Select red oaks	87	26	0.99	1.00	1.01	0.01	1	0.99	0.98	1.00	0.00	0
Plateau	Other white oaks	231	27	0.97	0.99	0.99	0.01	-2	0.99	0.98	0.98	0.01	-2
Plateau	Other red oaks	255	28	1.04	1.06	1.01	0.06	14	1.05	1.03	1.00	0.05	13
Plateau	Hickory	282	29	1.07	1.09	1.10	0.10	29	1.08	1.07	1.08	0.08	23
Plateau	Hard maple	144	31	1.03	1.04	1.05	0.05	7	1.04	1.03	1.03	0.04	5
Plateau	Soft maple	342	32	1.01	1.03	0.97	0.03	11	1.03	1.01	0.97	0.03	9
Plateau	Beech	60	33	0.97	0.98	0.99	0.01	-1	0.98	0.97	0.98	0.02	-1

Plateau	Tupelo and blackgum	180	35	0.96	0.96	1.01	0.01	3	0.97	0.95	1.00	0.00	0
Plateau	Ash	93	36	1.00	1.01	1.00	0.01	1	1.01	0.99	0.99	0.01	1
Plateau	Yellow-poplar	282	39	1.06	1.06	1.08	0.08	23	1.05	1.04	1.06	0.06	17
							-					-	
Plateau	Other eastern soft hardwoods	237	41	0.98	0.99	0.98	0.01	-3	0.99	0.99	0.97	0.01	-3
							-					-	
Plateau	Other eastern hard hardwoods	105	42	0.94	0.95	0.98	0.02	-3	0.95	0.94	0.97	0.03	-3
							-					-	
Plateau	Eastern noncommercial hard-woods	299	43	0.97	0.98	0.97	0.02	-6	0.98	0.97	0.98	0.02	-6
West	Loblolly and shortleaf pines	127	2	0.91	0.94	1.50	0.50	64	0.95	0.96	1.56	0.56	71
							-					-	
West	Other eastern softwoods	105	9	0.94	0.94	0.98	0.02	-2	0.97	0.96	1.02	0.02	2
West	Select white oaks	151	25	0.95	0.98	1.01	0.01	2	0.98	0.99	1.06	0.06	9
							-					-	
West	Select red oaks	98	26	0.97	0.98	0.96	0.02	-2	0.99	1.01	1.00	0.01	1
							-					-	
West	Other white oaks	86	27	0.91	0.93	0.92	0.07	-6	0.94	0.95	0.96	0.04	-3
West	Other red oaks	188	28	1.14	1.18	0.91	0.18	34	1.16	1.19	0.94	0.19	37
							-					-	
West	Hickory	166	29	0.96	0.98	0.94	0.02	-3	0.98	1.00	0.97	0.00	0
West	Soft maple	170	32	0.98	1.01	1.04	0.04	8	1.00	1.01	1.08	0.08	13
West	Sweetgum	265	34	1.07	1.05	0.99	0.07	18	1.10	1.10	1.03	0.10	27
West	Ash	104	36	0.99	1.01	1.07	0.07	8	1.01	1.03	1.11	0.11	12
West	Yellow-poplar	142	39	1.01	1.05	0.98	0.05	7	1.03	1.07	1.03	0.07	11
West	Other eastern soft hardwoods	349	41	0.95	0.95	1.00	0.00	-1	0.99	0.99	1.05	0.05	19
							-					-	
West	Other eastern hard hardwoods	92	42	0.96	0.97	0.93	0.03	-3	0.98	0.98	0.96	0.02	-2
							-					-	
West	Eastern noncommercial hard-woods	89	43	0.97	1.00	0.91	0.00	0	1.00	1.01	0.95	0.01	1
West Central	Loblolly and shortleaf pines	93	2	0.98	1.00	1.19	0.19	18	1.02	0.99	1.22	0.22	21
West Central	Select white oaks	268	25	1.10	1.13	1.13	0.13	36	1.15	1.11	1.17	0.17	44

West Central	Select red oaks	67	26	1.11	1.11	1.05	0.11	8	1.16	1.09	1.08	0.16	11
West Central	Other white oaks	168	27	0.96	0.99	0.95	-	-1	1.00	0.98	0.97	0.00	0
West Central	Other red oaks	155	28	0.95	0.96	1.02	0.02	3	1.00	0.96	1.05	0.05	8
West Central	Hickory	232	29	0.98	1.02	1.05	0.05	11	1.03	1.01	1.08	0.08	19
West Central	Hard maple	125	31	1.03	1.05	1.05	0.05	7	1.05	1.03	1.07	0.07	9
West Central	Soft maple	101	32	0.95	0.99	0.97	-	-1	0.99	0.97	0.99	0.01	-1
West Central	Beech	90	33	1.04	1.06	1.11	0.11	10	1.07	1.03	1.13	0.13	12
West Central	Sweetgum	142	34	1.09	1.09	1.04	0.09	13	1.12	1.07	1.06	0.12	17
West Central	Tupelo and blackgum	133	35	0.94	0.97	1.03	0.03	4	0.99	0.95	1.06	0.06	8
West Central	Ash	83	36	1.02	1.03	1.08	0.08	6	1.05	1.01	1.09	0.09	8
West Central	Yellow-poplar	181	39	0.96	0.97	1.04	0.04	7	0.99	0.96	1.07	0.07	13
West Central	Other eastern soft hardwoods	218	41	1.01	0.96	1.10	0.10	23	1.02	0.96	1.11	0.11	24
West Central	Other eastern hard hardwoods	55	42	0.99	1.01	1.04	0.04	2	1.02	0.99	1.06	0.06	3
West Central	Eastern noncommercial hardwoods	191	43	0.97	1.00	1.02	0.02	4	1.01	0.99	1.04	0.04	7

SPGRPCD: Species group code.

Virginia

UNIT	Species group	Plot s	SPGRPC D	Total Volume				Plot gain/loss	Volume/Area				Plot gain/loss
				PS _{DS}	PS _{CH}	PS _{CHM+}	Diff		PS _{DS}	PS _{CH}	PS _{CHM+}	Diff	
				M	M	FT			M	M	FT		

Coastal Plain	Loblolly and shortleaf pines	495	2	0.89	0.92	1.13	0.13	66.35	0.99	0.99	1.18	0.18	91
							-					-	
Coastal Plain	Other yellow pines	86	3	0.92	0.94	0.91	0.06	-4.82	0.98	0.97	0.91	0.02	-2
Coastal Plain	Other eastern softwoods	57	9	1.03	1.03	1.04	0.04	2.03	1.09	1.07	1.04	0.09	5
Coastal Plain	Select white oaks	270	25	1.01	1.01	1.07	0.07	18.16	1.07	1.05	1.07	0.07	19
Coastal Plain	Select red oaks	82	26	0.98	0.99	1.00	0.00	-0.21	1.04	1.02	1.01	0.04	3
Coastal Plain	Other red oaks	335	28	0.97	0.98	1.01	0.01	2.42	1.02	1.01	1.01	0.02	7
Coastal Plain	Hickory	153	29	1.00	1.00	1.07	0.07	10.28	1.06	1.03	1.08	0.08	12
Coastal Plain	Soft maple	354	32	0.95	0.96	1.17	0.17	58.90	1.02	1.01	1.18	0.18	64
Coastal Plain	Beech	139	33	0.95	0.96	1.03	0.03	3.92	1.01	0.99	1.03	0.03	5
Coastal Plain	Sweetgum	430	34	1.12	1.09	1.12	0.12	53.63	1.17	1.15	1.13	0.17	75
Coastal Plain	Tupelo and blackgum	187	35	0.98	1.01	1.14	0.14	26.14	1.04	1.04	1.15	0.15	27
Coastal Plain	Yellow-poplar	345	39	1.16	1.10	1.18	0.18	60.85	1.20	1.15	1.17	0.20	69
Coastal Plain	Other eastern soft hardwoods	204	41	1.00	1.00	0.92	0.00	0.87	1.06	1.03	0.92	0.06	13
Coastal Plain	Other eastern hard hard-												
Coastal Plain	woods	241	42	0.95	0.96	1.01	0.01	3.28	1.00	0.99	1.02	0.02	5
Coastal Plain	Eastern noncommercial hard-												
Coastal Plain	woods	122	43	1.00	0.98	1.02	0.02	2.40	1.04	1.01	1.02	0.04	5
Northern Moun-													
tain	Other yellow pines	182	3	0.99	0.99	1.19	0.19	34.14	1.00	1.00	1.23	0.23	42
Northern Moun-													
tain	Eastern white and red pines	142	4	1.11	1.10	1.52	0.52	73.50	1.11	1.12	1.60	0.60	85
Northern Moun-													
tain	Select white oaks	208	25	1.02	1.05	0.98	0.05	10.64	1.06	1.08	1.02	0.08	18
Northern Moun-													
tain	Select red oaks	192	26	1.10	1.11	1.07	0.11	20.34	1.12	1.13	1.11	0.13	25
Northern Moun-													
tain	Other white oaks	332	27	0.90	0.94	0.90	0.06	-20.44	0.96	0.96	0.97	0.03	-11

Northern Moun- tains	Other red oaks	260	28	0.98	1.01	0.97	0.01	2.07	1.04	1.05	1.03	0.05	12
Northern Moun- tains	Hickory	218	29	1.05	1.06	1.08	0.08	17.35	1.08	1.09	1.11	0.11	25
Northern Moun- tains	Soft maple	284	32	1.03	1.06	1.04	0.06	18.28	1.05	1.09	1.07	0.09	27
Northern Moun- tains	Tupelo and blackgum	197	35	0.93	0.94	0.90	0.06	-12.47	0.96	0.96	0.94	0.04	-7
Northern Moun- tains	Ash	73	36	1.00	0.99	0.99	0.00	0.04	1.01	1.01	1.01	0.01	1
Northern Moun- tains	Yellow-poplar	124	39	1.15	1.13	1.10	0.15	18.11	1.15	1.14	1.13	0.15	19
Northern Moun- tains	Other eastern soft hardwoods	147	41	1.05	1.04	1.06	0.06	8.52	1.04	1.03	1.06	0.06	9
Northern Moun- tains	Other eastern hard hard- woods	130	42	1.00	0.98	1.00	0.00	-0.39	1.00	1.01	1.02	0.02	3
Northern Moun- tains	Eastern noncommercial hard- woods	145	43	0.96	0.94	0.95	0.04	-5.40	0.97	0.95	0.98	0.02	-3
Northern Pied- mont	Loblolly and shortleaf pines	93	2	0.93	0.96	0.87	0.04	-4.02	1.04	1.06	0.96	0.06	5
Northern Pied- mont	Other yellow pines	149	3	0.93	0.94	1.01	0.01	1.67	1.03	1.04	1.09	0.09	14
Northern Pied- mont	Other eastern softwoods	92	9	0.95	0.95	0.91	0.05	-4.58	1.04	1.04	0.98	0.04	4
Northern Pied- mont	Select white oaks	209	25	1.06	1.07	1.00	0.07	13.87	1.12	1.15	1.08	0.15	32
Northern Pied- mont	Select red oaks	132	26	0.94	0.96	0.93	0.04	-4.91	1.03	1.06	1.02	0.06	7

Northern Pied-							-						
mont	Other white oaks	129	27	0.93	0.93	0.92	0.07	-9.46	1.03	1.02	1.00	0.03	4
Northern Pied-							-						
mont	Other red oaks	187	28	0.98	0.98	0.93	0.02	-3.03	1.05	1.05	0.99	0.05	10
Northern Pied-							-						
mont	Hickory	239	29	0.98	0.99	0.96	0.01	-3.56	1.10	1.08	1.05	0.10	24
Northern Pied-							-						
mont	Soft maple	257	32	0.94	0.96	0.92	0.04	-9.92	1.02	1.05	1.00	0.05	12
Northern Pied-							-						
mont	Beech	94	33	0.97	0.98	0.93	0.02	-1.48	1.05	1.07	1.00	0.07	6
Northern Pied-							-						
mont	Tupelo and blackgum	124	35	0.98	0.99	0.99	0.01	-0.78	1.07	1.09	1.06	0.09	11
Northern Pied-							-						
mont	Ash	87	36	0.89	0.86	0.98	0.02	-1.84	1.00	0.96	1.07	0.07	6
Northern Pied-													
mont	Yellow-poplar	291	39	1.14	1.11	1.13	0.14	42.05	1.29	1.24	1.22	0.29	84
Northern Pied-													
mont	Black walnut	48	40	0.93	0.88	1.09	0.09	4.41	1.05	0.99	1.20	0.20	9
Northern Pied-													
mont	Other eastern soft hardwoods	173	41	0.99	0.98	1.03	0.03	4.33	1.09	1.09	1.12	0.12	20
Northern Pied-							-						
mont	Other eastern hard hard-	122	42	0.93	0.92	0.97	0.03	-3.25	1.03	1.02	1.06	0.06	8
Northern Pied-							-						
mont	Eastern noncommercial hard-	122	43	0.91	0.92	0.93	0.07	-8.12	1.02	1.02	1.02	0.02	3
Southern Moun-							-					-	
tains	Other yellow pines	79	3	0.91	0.93	0.94	0.06	-4.38	0.94	0.92	0.95	0.05	-4
Southern Moun-													
tains	Eastern white and red pines	136	4	0.97	0.97	1.19	0.19	25.31	0.98	0.96	1.19	0.19	25

Southern Moun- tains	Select white oaks	182	25	1.03	1.04	1.02	0.04	7.33	1.05	1.02	1.01	0.05	9
Southern Moun- tains	Select red oaks	185	26	1.03	1.04	1.06	0.06	11.83	1.04	1.02	1.05	0.05	9
Southern Moun- tains	Other white oaks	239	27	0.94	0.96	0.98	0.02	-4.53	0.97	0.95	0.97	0.03	-7
Southern Moun- tains	Other red oaks	218	28	0.96	0.98	0.99	0.01	-3.18	1.00	0.97	0.99	0.00	-1
Southern Moun- tains	Hickory	267	29	1.01	1.03	1.04	0.04	9.77	1.04	1.02	1.03	0.04	12
Southern Moun- tains	Hard maple	182	31	1.01	1.02	1.02	0.02	4.06	1.02	1.00	1.01	0.02	4
Southern Moun- tains	Soft maple	377	32	1.04	1.05	1.00	0.05	20.16	1.05	1.03	0.99	0.05	19
Southern Moun- tains	Beech	102	33	1.00	1.02	1.00	0.02	1.68	1.02	1.00	0.99	0.02	2
Southern Moun- tains	Tupelo and blackgum	140	35	0.97	0.99	0.98	0.01	-1.28	0.99	0.97	0.97	0.01	-1
Southern Moun- tains	Ash	118	36	0.95	0.96	1.03	0.03	3.72	0.97	0.95	1.02	0.02	2
Southern Moun- tains	Basswood	61	38	1.05	1.07	1.07	0.07	4.24	1.06	1.04	1.05	0.06	4
Southern Moun- tains	Yellow-poplar	309	39	1.10	1.12	1.07	0.12	36.12	1.12	1.10	1.06	0.12	39
Southern Moun- tains	Other eastern soft hardwoods	313	41	0.95	0.97	0.99	0.01	-3.90	0.98	0.96	0.97	0.02	-5
Southern Moun- tains	Other eastern hard hard- woods	233	42	0.97	0.99	0.91	0.01	-2.79	0.99	0.97	0.90	0.01	-2

Southern Moun- tains	Eastern noncommercial hard- woods	303	43	0.99	1.00	1.03	0.03	7.86	1.01	0.99	1.01	0.01	4
Southern Pied- mont	Loblolly and shortleaf pines	315	2	1.02	1.04	1.39	0.39	123.44	1.04	1.04	1.38	0.38	119
Southern Pied- mont	Other yellow pines	244	3	1.02	1.02	1.02	0.02	5.59	1.02	1.02	1.00	0.02	4
Southern Pied- mont	Other eastern softwoods	122	9	1.02	1.03	0.97	0.03	3.42	1.03	1.02	0.95	0.03	4
Southern Pied- mont	Select white oaks	291	25	1.09	1.11	1.12	0.12	36.15	1.09	1.11	1.11	0.11	33
Southern Pied- mont	Select red oaks	120	26	1.07	1.09	1.12	0.12	14.58	1.08	1.08	1.11	0.11	13
Southern Pied- mont	Other white oaks	145	27	1.00	1.02	1.05	0.05	7.26	1.00	1.01	1.04	0.04	6
Southern Pied- mont	Other red oaks	278	28	1.07	1.09	1.01	0.09	24.94	1.06	1.07	0.99	0.07	21
Southern Pied- mont	Hickory	250	29	1.08	1.09	1.07	0.09	22.78	1.09	1.09	1.06	0.09	23
Southern Pied- mont	Soft maple	372	32	1.06	1.07	1.05	0.07	24.22	1.06	1.06	1.03	0.06	23
Southern Pied- mont	Beech	126	33	1.09	1.11	1.02	0.11	14.38	1.09	1.09	1.01	0.09	12
Southern Pied- mont	Sweetgum	226	34	1.04	1.04	1.02	0.04	8.95	1.05	1.05	1.01	0.05	10
Southern Pied- mont	Tupelo and blackgum	155	35	1.01	1.03	1.06	0.06	9.31	1.01	1.02	1.05	0.05	7
Southern Pied- mont	Ash	84	36	0.99	1.00	0.87	0.00	-0.12	1.00	0.99	0.86	0.00	0

Southern Pied-													
mont	Yellow-poplar	430	39	1.28	1.21	1.16	0.28	119.91	1.28	1.24	1.15	0.28	122
Southern Pied-	Other eastern soft hardwoods	275	41	1.06	1.04	1.07	0.07	18.41	1.06	1.04	1.05	0.06	16
Southern Pied-	Other eastern hard hard-												
mont	woods	105	42	1.04	1.04	1.04	0.04	4.68	1.04	1.03	1.03	0.04	5
Southern Pied-	Eastern noncommercial hard-												
mont	woods	260	43	1.05	1.06	1.13	0.13	34.84	1.05	1.05	1.12	0.12	32

SPGRPCD: FIA species group code