

Minnesota Forestry Research Notes

Published by the Department of Forest Resources, University of Minnesota, St. Paul

September 2021

No. 313

Forest type definition crosswalk between Forest Inventory and Analysis and Minnesota Department of Natural Resources

John M. Zobel, Alan R. Ek, and Tyler S. Gifford¹

Background

Forestry and related natural resource analyses can benefit from a crosswalk between different definitions of forest attributes. In particular, federal labels of forest type through the U.S. Forest Service, Forest Inventory and Analysis (FIA) program (USDA 2021a) and state labels of cover type through the Department of Natural Resources (DNR) (MNDNR n.d.) closely resemble each other, yet with many differences. Here we describe a crosswalk that addresses these differences.

Methods

For detailed information on how forest types/cover types are defined and applied in the field by FIA and DNR, see USDA (2021a) and MNDNR (n.d.), respectively. In terms of definition details, FIA includes more diverse forest types, while the DNR includes subdivisions within a main cover type (e.g., oak vs. offsite oak). A version of the crosswalk is included in the FIA EVALIDator program (USDA 2021b), but this map represents a more general comparison and lacks detail. Our research attempted to improve upon the existing crosswalk by adding more detail through comparing the full suite of forest type definitions under both systems and examination of plot and tree level data. Additional details such as physiographic class and site index were utilized to improve the parallel of mapped forest types. For those DNR types that reference broad groups (e.g., other hardwoods), the individual tree data within FIA was consulted to determine the most prolific species within that FIA forest type. The associated DNR cover type then mirrored the dominant tree species.

Results and Discussion

In addition to the existing map, Table 1 includes the independently created crosswalk, including the addition of details such as physiographic class and site index when determining the appropriately mapped forest type. The cover types in the DNR proposed column under the category “Other” represent forest types encountered in Minnesota FIA data that did not directly correspond to a DNR cover type.

¹ John Zobel (jzobel@umn.edu), Alan Ek (aek@umn.edu), and Tyler Gifford (giffo071@umn.edu) are with the Department of Forest Resources, University of Minnesota. Research supported by the Department of Forest Resources, the Interagency Information Cooperative through the MNDNR, and the Minnesota Agricultural Experiment Station.

Table 1. Forest type definition crosswalk between U.S. Forest Service, Forest Inventory and Analysis (FIA) and Minnesota Department of Natural Resources (DNR) approaches. Under the DNR heading, the *Current* column represents the DNR cover types used in the existing crosswalk within the FIA EVALIDator program, while the *Proposed* column represents the improved crosswalk.

Forest Inventory and Analysis (FIA)				Minnesota Department of Natural Resources (DNR)					
Forest Type	Code	Additional Criteria		Acres (2008-2012)	Proposed		Current		Acres (2008-2012)
		Phys. Class	SI		Cover Type	Code	Cover Type	Code	
Jack pine	101			337,641	Jack pine	53	Jack pine	53	100,011
Red pine	102			494,090	Norway pine	52	Red pine	52	122,582
Eastern white pine	103			142,945	White pine	51	White pine	51	22,692
Balsam fir	121			494,425	Balsam fir	62	Balsam fir	62	57,883
White spruce	122			146,532	White spruce	61	White spruce	61	51,116
Black spruce	125	24, 25, ≥30	≥23	1,239,843	Black spruce, Lowland	71	Black spruce	N/A	461,046
Black spruce	125	≤23, 29		105,224	Black spruce, Upland	74	Black spruce	N/A	9,348
Black spruce	125	24, 25, ≥30	<23	198,819	Stagnant spruce	75	Black spruce	N/A	407,838
Tamarack	126	24, 25, ≥30	≥23	982,339	Tamarack	72	Tamarack	72	369,560
Tamarack	126	≤23, 29		25,443	Upland larch	70	Tamarack	72	46
Tamarack	126	24, 25, ≥30	<23	99,817	Stagnant tamarack	76	Tamarack	72	159,676
Northern white-cedar	127		≥23	461,582	N. White cedar	73	N. White-cedar	73	159,169
Northern white-cedar	127		<23	159,394	Stagnant cedar	77	N. White-cedar	73	129,680
Fraser fir	128			0	Other	100	Other	N/A	1,760,025
Eastern redcedar	171			24,621	Red cedar	81	Other	N/A	614
Ponderosa pine	221			0	Ponderosa pine	55	Other	N/A	5
Scotch pine	381			8,913	Scotch pine	54	Other softwoods	N/A	120
Norway spruce	384			0	Norway spruce	64	Other	N/A	83
Oak / pine group	400			0	Other	100	Red pine	52	"
E. white pine / n. red oak / white ash	401			76,870	Other	100	White pine	51	"
Eastern redcedar / hardwood	402			26,020	¹ Red cedar	81	Red cedar	81	"
Other pine / hardwood	409			221,169	Other	100	Red pine	52	"
Oak-hickory	500			0	Central hardwoods	40	Oak	30	4,411
White oak / red oak / hickory	503		≥40	798,389	Oak	30	Oak	30	132,813
White oak / red oak / hickory	503		<40	31,823	Offsite oak	79	Oak	30	11,098
White oak	504		≥40	16,686	Oak	30	Oak	30	"
White oak	504		<40	2,073	Offsite oak	79	Oak	30	"
Northern red oak	505		≥40	263,538	Oak	30	Oak	30	"
Northern red oak	505		<40	4,292	Offsite oak	79	Oak	30	"
Bur oak	509		≥40	320,358	Oak	30	Oak	30	"
Bur oak	509		<40	85,418	Offsite oak	79	Oak	30	"
Black walnut	512			11,485	Walnut	25	Other	N/A	2,285
Black locust	513			1,599	Central hardwoods	40	Other	N/A	"
Cherry / white ash / yellow-poplar	516			2,364	Central hardwoods	40	Other	N/A	"
Elm / ash / black locust	517			244,258	Central hardwoods	40	Other	N/A	"
Red maple / oak	519			25,741	² Northern hardwoods	20	Norther Hardwoods	20	140,703
Mixed upland hardwoods	520			369,341	Northern hardwoods	20	Norther Hardwoods	20	"
Elm / ash / cottonwood group	700			0	Lowland hardwoods	9	Lowland hardwoods	9	35,929
Black ash / American elm / red maple	701			1,020,712	³ Ash	1	Lowland Hardwoods	9	134,892
River birch / sycamore	702			22,505	Lowland hardwoods	9	Birch	13	"
Cottonwood	703			52,696	Cottonwood	15	Cottonwood/Willow	N/A	2,204
Willow	704			54,999	Willow	6	Cottonwood/Willow	N/A	1,122
Sycamore / pecan / American elm	705			12,377	Lowland hardwoods	9	Lowland Hardwoods	9	"
Sugarberry / hackberry / elm / green ash	706			371,129	Lowland hardwoods	9	Lowland Hardwoods	9	"
Silver maple / American elm	707			64,507	Lowland hardwoods	9	Lowland Hardwoods	9	"
Red maple/Lowland	708	24, 25, ≥30		40,659	Lowland hardwoods	9	Lowland Hardwoods	9	"
Cottonwood / willow	709			5,018	⁴ Cottonwood	15	Cottonwood/Willow	N/A	"
Maple / beech / birch group	800			0	Northern hardwoods	20	Northern hardwoods	20	"
Sugar maple / beech / yellow birch	801			507,393	Northern hardwoods	20	Northern Hardwoods	20	"
Black cherry	802			2,921	Northern hardwoods	20	Other	N/A	"
Hard maple / basswood	805			586,677	Northern hardwoods	20	Northern Hardwoods	20	"
Red maple/Upland	809	≤23, 29		107,121	Northern hardwoods	20	Northern Hardwoods	20	"
Aspen / birch group	900			0	Other	100	Aspen	12	"
Aspen	901		≥35	4,802,296	Aspen	12	Aspen	12	1,099,507
Aspen	901		<35	115,976	Offsite aspen	78	Aspen	12	4,833
Paper birch	902			1,048,223	Birch	13	Birch	13	73,271
Balsam poplar	904			448,152	Balm of Gilead	14	Balsam poplar	14	42,210
Pin cherry	905			21,040	Other	100	Other	N/A	"
Other hardwoods	962			282,559	Other	100	Other	N/A	"
Other exotic hardwoods	995			10,214	Other	100	Other	N/A	"
Nonstocked	999			215,112	Non stocked	Various	Non stocked	N/A	"
Other	1000			0	Other	100	Other	N/A	"

1 - Eastern redcedar comprises 60.0% of the basal area on conditions (plots) with the Eastern redcedar / hardwood FIA forest type (n = 15)

- 2 - Red maple comprises 85.7% of the basal area on conditions (plots) with the Red maple / oak FIA forest type (n = 35); all upland physiographic classes
- 3 - Black ash comprises 74.6% of the basal area on conditions (plots) with the Black ash/American elm/red maple FIA forest type (n = 1184)
- 4 - Eastern cottonwood comprises 77.8% of the basal area on conditions (plots) with the Cottonwood / Willow FIA forest type (n = 9)

The proposed crosswalk bridges the gap of disjointed definitions of forest type and cover type between FIA and DNR. For example, the DNR recognizes three cover types for black spruce: “Black spruce, Lowland”, “Black spruce, Upland”, and “Stagnant spruce.” The simplified EVALIDator crosswalk currently in use maps a single FIA forest type (“Black spruce”) to a single DNR cover type (“Black spruce”), rather than to the three separate black spruce types. However, physiographic class and site index information in FIA can be leveraged to better match black spruce conditions between definitions. Plots or conditions with more hydric physiographic classes (codes 24, 25, ≥ 30) in FIA will map to lowland black spruce, while more mesic to xeric classes (codes ≤ 23 and 29) will map to upland black spruce (Table 1). In addition, stagnant black spruce will map to FIA plots or conditions with lowland physiography and with site indices < 23 ft, matching the criterion for stagnancy used by the DNR (Table 1; MNDNR n.d.). With these added criteria, the three cover types can now be matched cleanly back and forth. Similar rationale applies to tamarack, northern white-cedar, oak, red maple, and aspen.

The strength of this work is that it allows for applications (e.g., EVALIDator) that rely on FIA definitions to report in DNR definitions, and vice versa. Ultimately, the crosswalk will facilitate research and applications that jointly or comparatively use FIA and DNR forest inventory data.

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