Minnesota Forestry Research Notes

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

August 2021 No. 312

Ecological Classification Systems: A Definition Crosswalk for Minnesota

John M. Zobel, Alan R. Ek, Tyler S. Gifford[1]

Background

Ecological classification systems attempt to aggregate and map geographic areas based on similar physical and biological characteristics, including climate, geology, hydrology, and vegetation. Boundaries between ecoregions identify significant shifts in ecological attributes, and wildlife population dynamics often differ between each region. Classification typically follows a hierarchical scale, identifying large areas with common, broad ecological features, then dividing these regions into smaller and smaller homogeneous units based on an increasing level of detail. Terminology for state and local forest planning includes Province, Section, Subsection, Land Type Association, Land Type, and Land Type Phase, in decreasing order of size (Cleland et al. 1997; Hanson and Hargrave 1996).

A growing level of environmental awareness in the late 1980s and early 1990s led to the development of several classification systems. As a component of the Minnesota Generic Environmental Impact Statement on Timber Harvesting and Forest Management (GEIS), up to nine ecoregions were proposed (at the Section level) that divided the state by predominant ecological features (Jaakko Pöyry Consulting, Inc. 1992a; Jaakko Pöyry Consulting, Inc. 1992b). Shortly after, the U.S. Forest Service refined existing schemes at the Section level (Bailey 1976; Bailey 1980; Bailey et al. 1994; McNab and Avers 1994) and began compiling independently-created subsection maps into a single collection based on the new national system of classification (Cleland et al. 1997; ECOMAP 2007). Concurrently, the Minnesota Department of Natural Resources (MNDNR) developed a classification structure in conjunction with the Forest Service, including a subsection map (MNDNR 1999) and detail at the Land Type Phase level (Hanson and Hargrave 1996). Finally, a common national classification system was released by the Forest Service for Subsections (USDA 2007), with a detailed map (Cleland et al. 2007) and subsection descriptions (McNab et al. 2007).

Purpose and Results

Ecological regions defined by these three classification systems often overlap. Still, many retain unique properties such as level of detail (Section versus Subsection) and/or naming convention. In addition, although the Forest Service and MNDNR methodologies are widely accepted in Minnesota, some forestry professionals and forestry applications depend on the GEIS ecoregions (e.g., Frelich et al. 2012; Zobel and Ek 2014; Zobel et al. 2021). Therefore, this research created a crosswalk between the GEIS, Forest Service, and MNDNR approaches to allow for the interchangeable use of the three systems (see Table 1).

[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. Ecological classification system definition crosswalk between the GEIS, Forest Service (FS), and MNDNR approaches. Comparisons based on Jaakko Pöyry Consulting, Inc. (1992a), Cleland et al. (2007), and MNDNR (1999).

GEIS Code	FS Code	MNDNR Code	GEIS Name	FS Name	MNDNR Name
1	212Ma	212Ma	Glacial Lake Plains	Littlefork-Vermillion Uplands	Littlefork-Vermillion Uplands
1	212Mb	212Mb	Glacial Lake Plains	Agassiz Lowlands	Agassiz Lowlands
2	212La	212La	Border Lakes	Border Lakes	Border Lakes
3	212Lb	212Lb	Lake Superior Highlands	North Shore Highlands	North Shore Highlands
4	212Ya	212Ja	Central Pine-Hardwood Forests	Superior-Ashland Clay Plain	Glacial Lake Superior Plain
4	212Qa	212Jd	Central Pine-Hardwood Forests	St. Croix Moraine	St. Croix Moraine
4	212Kb	212Kb	Central Pine-Hardwood Forests	Mille Lacs Uplands	Mille Lacs Uplands
4	212Lc	212Lc	Central Pine-Hardwood Forests	Laurentian Highlands	Nashwauk Uplands
4	212Ld	212Ld	Central Pine-Hardwood Forests	Toimi Uplands	Toimi Uplands
4	212Le	212Le	Central Pine-Hardwood Forests	Laurentian Highlands	Laurentian Uplands
4	212Na	212Na	Central Pine-Hardwood Forests	Chippewa Plains	Chippewa Plains
4	212Nb	212Nb	Central Pine-Hardwood Forests	St. Louis Moraines	St. Louis Moraines
4	212Nc	212Nc	Central Pine-Hardwood Forests	Pine Moraine and Outwash Plains	Pine Moraines and Outwash Plains
4	212Nd	212Nd	Central Pine-Hardwood Forests	Toimi Uplands	Tamarack Lowlands
5	222Ma	222Ma	Western Prairie/Forest Transition Zone	Alexandria Moraine-Hardwood Hills	Hardwood Hills
5	222Mb	222Mb	Western Prairie/Forest Transition Zone	Big Woods Moraines	Big Woods
5	222Mc	222Mc	Western Prairie/Forest Transition Zone	Anoka Sand Plain	Anoka Sand Plain
6	222Lc	222Lc	Eastern Prairie/Forest Transition Zone	Mississippi-Wisconsin River Ravines	Blufflands
6	222Lf	222Lf	Eastern Prairie/Forest Transition Zone	Western Paleozoic Plateau	Rochester Plateau
6	222Md	222Md	Eastern Prairie/Forest Transition Zone	Rosemont Baldwin Plains and Moraines	St. Paul Baldwin Plains and Moraines
6	222Me	222Me	Eastern Prairie/Forest Transition Zone	Oak Savannah Till and Loess Plains	Oak Savanna
6	251Be	222Me	Eastern Prairie/Forest Transition Zone	Southern Des Moines Lobe	Oak Savanna
7	251Ba	251Ba	Western Prairies	Upper Minnesota River-Des Moines Lobe	Minnesota River Prairie
8	251Bb	251Bb	Western Corn Belt Plains	Outer Coteau des Prairies	Coteau Moraines
8	251Bd	251Bc	Western Corn Belt Plains	Northwest Iowa Plains	Inner Coteau
9	222Na	223Na	Red River Valley	Aspen Parklands	Aspen Parklands
9	251Aa	251Aa	Red River Valley	Lake Agassiz Plain	Red River Prairie

Note that the geographic borders between the Forest Service and MNDNR subsections are essentially identical (with some additional naming differences). Also, although the larger GEIS ecoregions do not match groups of units in the other approaches exactly, they do show close agreement. Thus any observed deviations were considered negligible, but users of the crosswalk may want to recognize these differences.

Literature Cited and References

Bailey, R.G. 1976. Ecoregions of the United States (map). Presentation scale 1:7,500,000, colored. Ogden, UT: USDA Forest Service, Intermountain Region.

Bailey, R.G. 1980. Description of the ecoregions of the United States. Misc. Pub. 1391. Washington, DC: USDA Forest Service.

Bailey, R.G., Avers, P.E., King, T., and McNab, W.H., eds. 1994. Ecoregions and subregions of the United States (map). Presentation scale 1:7,500,000, colored. Wash., DC: USDA Forest Service.

Cleland, D.T., Avers, P.E., McNab, W.H., Jensen, M.E., Bailey, R.G., King, T., and Russell, W.E. 1997. National hierarchical framework of ecological units. *In*: Boyce, M.S., and Haney, A., eds., Ecosystem management applications for sustainable forest and wildlife resources. New Haven, CT: Yale University Press, pp. 181-200.

Cleland, D.T., Freeouf, J.A., Keys, J.E., Nowacki, G.J., Carpenter, C.A., and McNab, W.H. 2007. Ecological subregions: sections and subsections for the conterminous United States (map). Presentation scale 1:3,500,000, colored. Gen. Tech. Rep. WO-76D [CD-ROM] (Sloan, A.M. cartographer). Washington, DC: USDA Forest Service.

ECOMAP. 2007. Delineation, peer review, and refinement of subregions of the conterminous United States. Gen. Tech. Rep. WO-76A. Washington, DC: USDA Forest Service.

Frelich, L.E., Ek, A.R., Zobel, J.M., and Page, K. 2012. Forest wildlife habitat description and data for Minnesota species. Staff Paper Series No. 219. St. Paul, MN: University of Minnesota, Department of Forest Resources. Available online at https://conservancy.umn.edu/handle/11299/170665.

Hanson, D.S., and Hargrave, B. 1996. Development of a multilevel ecological classification system for the state of Minnesota. *Environmental Monitoring and Assessment* 39:75-84.

Jaakko Pöyry Consulting, Inc. 1992a. Forest wildlife: A technical paper for a generic environmental impact statement on timber harvesting and forest management in Minnesota. Tarrytown, NY: Jaakko Pöyry Consulting, Inc. Prepared for the Minnesota Environmental Quality Board, St. Paul, MN. Available online at https://conservancy.umn.edu/handle/11299/169578.

Jaakko Pöyry Consulting, Inc. 1992b. Maintaining productivity and the forest resource base: A technical paper for a generic environmental impact statement on timber harvesting and forest management in Minnesota. Tarrytown, NY: Jaakko Pöyry Consulting, Inc. Prepared for the Minnesota Environmental Quality Board, St. Paul, MN. Available online at https://conservancy.umn.edu/handle/11299/169578.

McNab, W.H., and Avers, P.E. 1994. Ecological subregions of the United States: Section descriptions. WO-WSA-5. Washington, DC: USDA Forest Service.

McNab, W.H., Cleland, D.T., Freeouf, J.A., Keys, J.E., Nowacki, G.J., and Carpenter, C.A., comps. 2007. Description of ecological subregions: Sections of the conterminous United States [CD-ROM]. Gen. Tech. Report WO-76B. Washington, DC: USDA Forest Service.

Minnesota Department of Natural Resources (MNDNR). 1999. Ecological subsections (map). St. Paul, MN: Minnesota Department of Natural Resources, Division of Forestry. Available online at http://files.dnr.state.mn.us/natural_resources/ecs/subsection.pdf.

U.S. Department of Agriculture (USDA). 2007. Ecological subregions: Sections and subsections of the conterminous United States [CD-ROM]. Gen. Tech. Rep. WO-76. Washington, DC: USDA Forest Service.

Zobel, J.M., and Ek, A.R. 2014. The Wildlife Habitat Indicator for Native Genera and Species (WHINGS): Methodology and application. Staff Paper Series No. 231. St. Paul, MN: University of Minnesota, Department of Forest Resources. Available online at https://conservancy.umn.edu/handle/11299/170677.

Zobel, J.M., Ek, A.R., and Edgar, C.B. 2021. Assessing the impact of 41 years of forest management on native wildlife habitat in Minnesota, USA. *Journal of Forestry* 119(2):164-176.