Forests, Water and People

Drinking water supply and forest lands in Vermont

USDA Forest Service
Northeastern Area
State and Private Forestry

Project Description

In the Northeast and Midwest United States, forests are critically important to the supply of clean drinking water. Protecting and managing forests in source watersheds is an essential part of future strategies for providing clean safe drinking water that citizens can afford. The Forests, Water and People analysis identified private forests that are most important for drinking water supply and most in need of protection from development pressure. This fact sheet gives the results of the analysis for the State of Vermont. For more detailed description of methods, and results for the Northeast and Midwest United States, see the **full report**.

The Process

Through a 4 step GIS-based overlay analysis, four indices were developed for each watershed (see Figure 1).

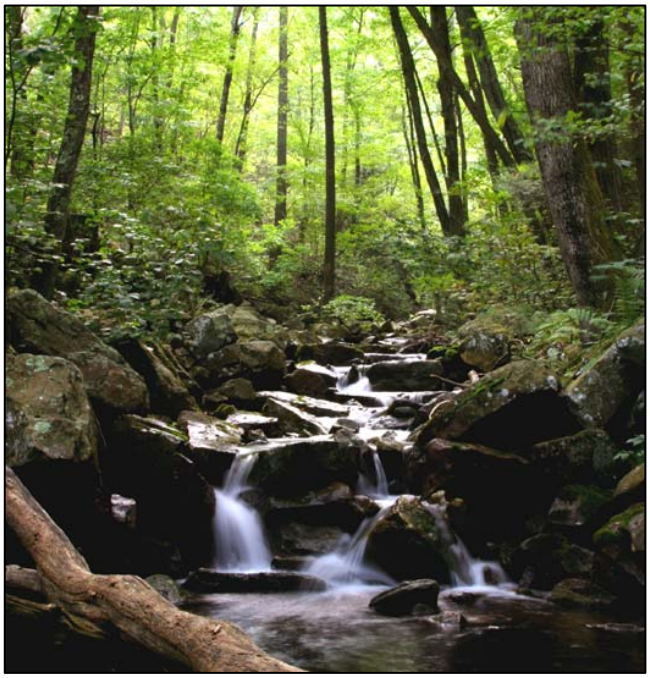
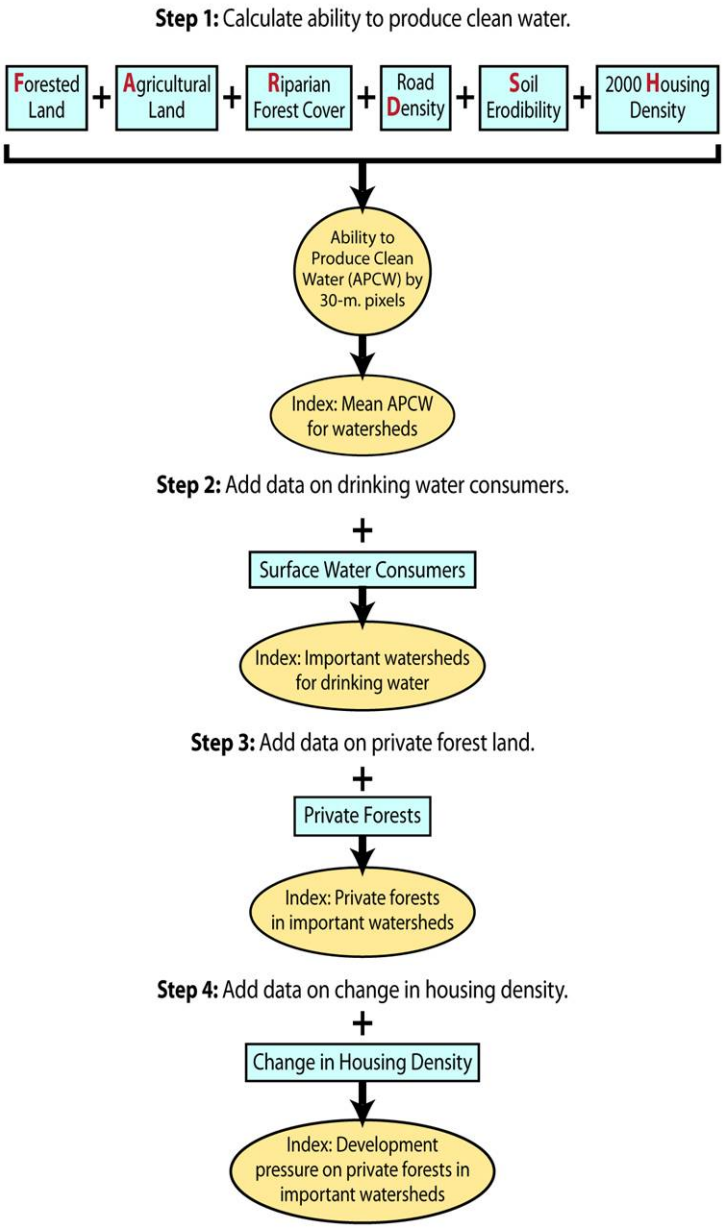


Photo by Michael Land.

"Water, in all its uses and permutations, is by far the most valuable commodity that comes from the forest land that we manage, assist others to manage, and/or regulate."
Policy Statement, National Association of State Foresters

Figure 1. *Nine layers of GIS data (boxes) were combined in stepwise fashion, to produce four indices (ovals) of watershed importance for drinking water supplies and the need for private forest management to protect those supplies.*



Vermont Results

Highlights

- Most of Vermont's watersheds scored well in each step of the analysis, particularly steps 1, 3 and 4 due to its large percent of privately owned forest (80 percent), high percent forest land use, and development pressure, especially around Montpelier.
- Most of Vermont's watersheds ranked well in their ability to produce clean water (step 1) because of Vermont's high percent forested land – at least half of most watersheds and up to 80 percent of some watersheds are private forest lands. The highest ranking watersheds in step 1 are the Ausable and Upper Connecticut watersheds; both received the highest possible score.
- In the ability of watersheds to provide drinking water to the most people (step 2), the Middle Connecticut and Winooski watersheds scored the highest. Except in southern Vermont, scores were not as high because Vermont is not as densely populated as some other States in the study area.
- In the ability of watersheds to provide drinking water on private lands (step 3), most of Vermont scored well because the State has nearly 80 percent privately owned forest land. Again, the two highest scoring watersheds are the Middle Connecticut and Winooski watersheds.
- Many areas of Vermont, especially the area around Montpelier, scored well in step 4, which ranked watersheds based on their development pressure and land ownership status (private lands ranked higher because they are subject to conversion). The two highest scoring watersheds were the Winooski and Middle Connecticut watersheds. These watersheds averaged in the top three percent of the study area's watersheds.

Table 1. Watershed results for Vermont

Watershed Name	Hydrologic Unit Code	Mean APCW for watersheds	Surface drinking water consumers	% private forest in watershed	% watershed with housing density increase	Index: Development pressure on private forests important for drinking water supply Score (Step 4)	Rank (Step 4)
Winooski	02010003	8 of 10	142,074	65 %	13 %	34 of 40	10 of 540
Middle Connecticut	01080201	9 of 10	147,821	65 %	8 %	33 of 40	19 of 540
Upper Connecticut-Mascoma	01080104	9 of 10	52,151	74 %	9 %	32 of 40	34 of 540
Lamoille	02010005	8 of 10	22,057	64 %	17 %	31 of 40	50 of 540
Deerfield	01080203	9 of 10	23,300	65 %	4 %	30 of 40	61 of 540
Hudson-Hoosic	02020003	7 of 10	172,918	58 %	6 %	29 of 40	76 of 540
White	01080105	9 of 10	12,000	68 %	4 %	28 of 40	88 of 540
West	01080107	9 of 10	2,800	77 %	6 %	28 of 40	88 of 540
Waits	01080103	9 of 10	2,015	77 %	5 %	28 of 40	88 of 540
Passumpsic	01080102	9 of 10	4,950	72 %	4 %	28 of 40	88 of 540
Lake George	02010001	7 of 10	51,491	64 %	3 %	27 of 40	109 of 540
Black-Ottauquechee	01080106	8 of 10	3,000	70 %	6 %	27 of 40	109 of 540
Great Chazy-Saranac	02010006	9 of 10	29,576	53 %	2 %	27 of 40	109 of 540
Ausable	02010004	10 of 10	14,242	59 %	2 %	26 of 40	126 of 540
Otter	02010002	7 of 10	21,901	47 %	9 %	26 of 40	126 of 540
Missiquoi	02010007	8 of 10	3,750	65 %	6 %	26 of 40	126 of 540
Upper Connecticut	01080101	10 of 10	30,136	68 %	1 %	26 of 40	126 of 540
St. Francois	01110000	8 of 10	4,252	63 %	3 %	24 of 40	169 of 540

Average or total value for all watersheds listed in Table 1

Mean APCW for watersheds:	8.5	of 10
Important watersheds for drinking water composite score:	13.4	of 20
Private forests in important watersheds composite score:	22.4	of 30
Development pressure on private forests in important watersheds composite score:	28.3	of 40
Forested Land (acres):	8,809,880.7	
Private Forest (acres):	7,065,377.6	
Private Forest Land under Development Pressure by 2030 (acres):	446,674.8	
(% private forest land):	6.3%	

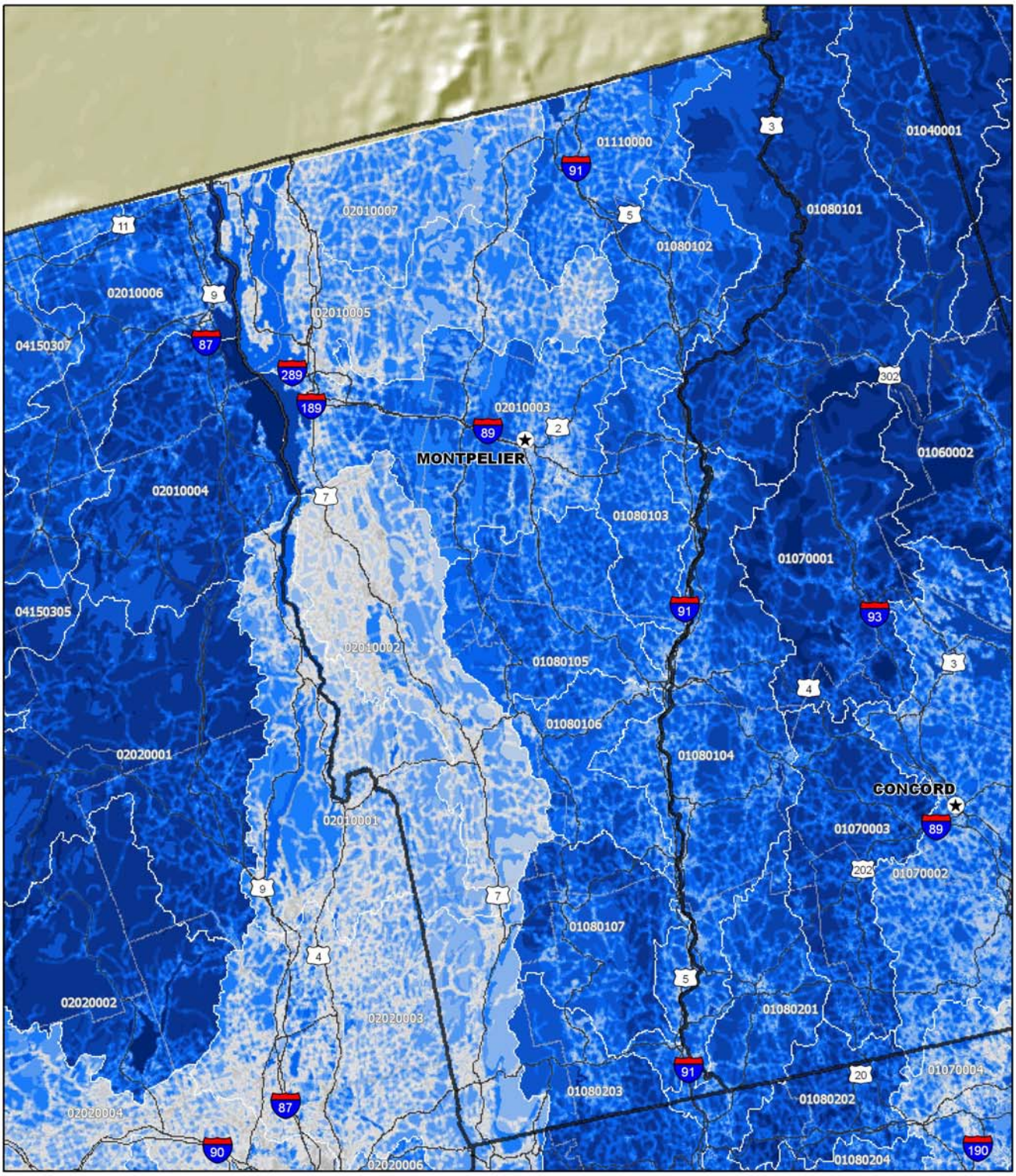
Note: If a watershed fell partially in Vermont, the whole watershed was considered for this project. State results reflect the total acreage for all watersheds that impact that State (this may account for a higher acreage figure than if only lands within State boundaries were considered).

Maps

The following maps depict the results of each step in the Forests, Water and People analysis. Each watershed is labeled with the eight-digit HUC and the watershed composite score for the analysis step. (Note: the APCW, 30-m. pixel view does not have a watershed score)

All of the maps were produced by Rebecca Whitney Lilja, Office of Knowledge Management, Northeastern Area State and Private Forestry.

Ability to Produce Clean Water (APCW) (Step 1), 30-m View - Vermont



STEP 1 COMPOSITE SCORE, 30-m VIEW

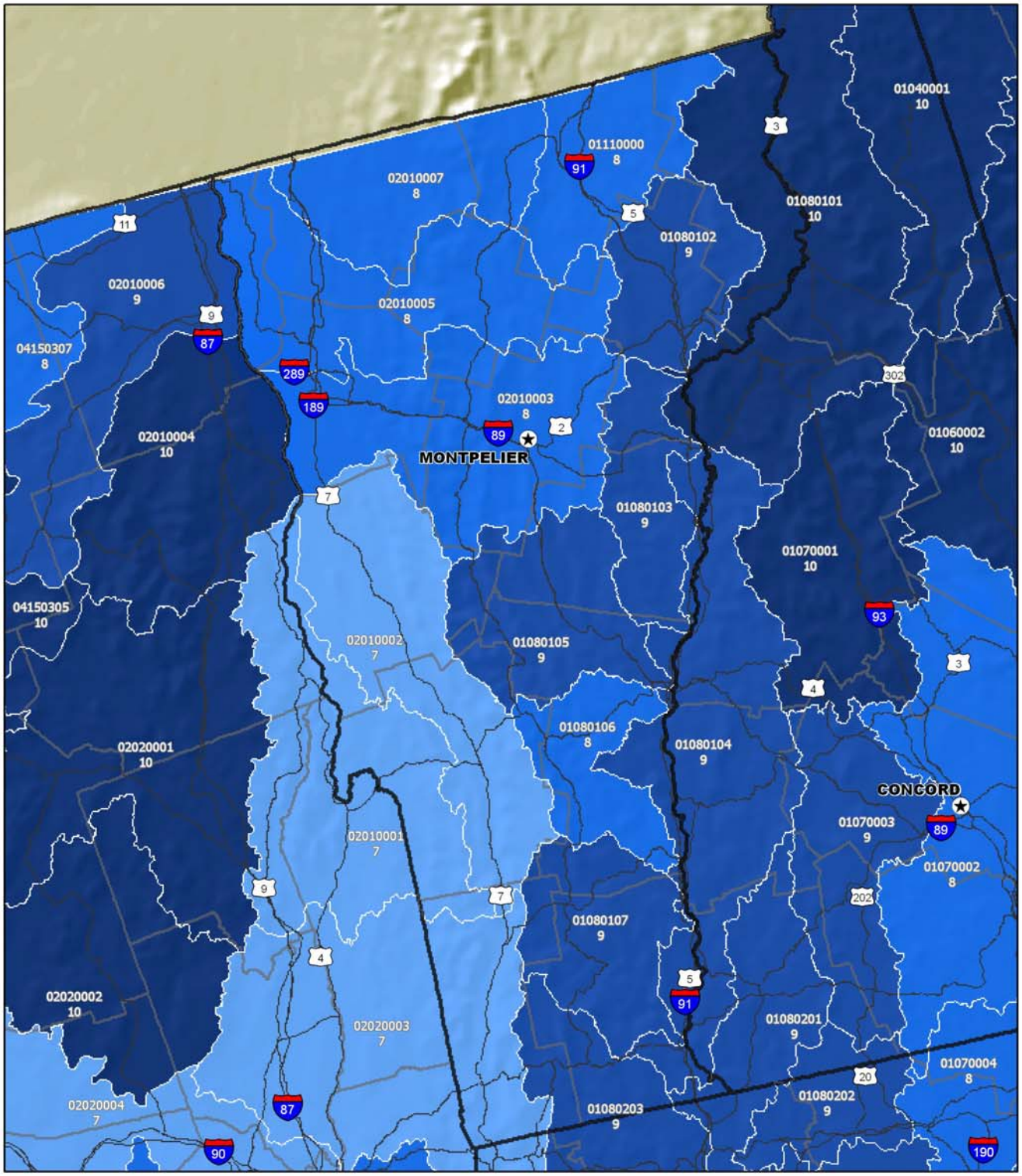
6 (Low APCW) 10 15 20 24 (High APCW)

Projection: Albers

Watershed labels describe the 8-digit hydrologic unit code (HUC)

0 3.757.5 15 Miles

Mean Ability to Produce Clean Water (APCW) by Watershed (Step 1, Continued) - Vermont



STEP 1 COMPOSITE SCORE

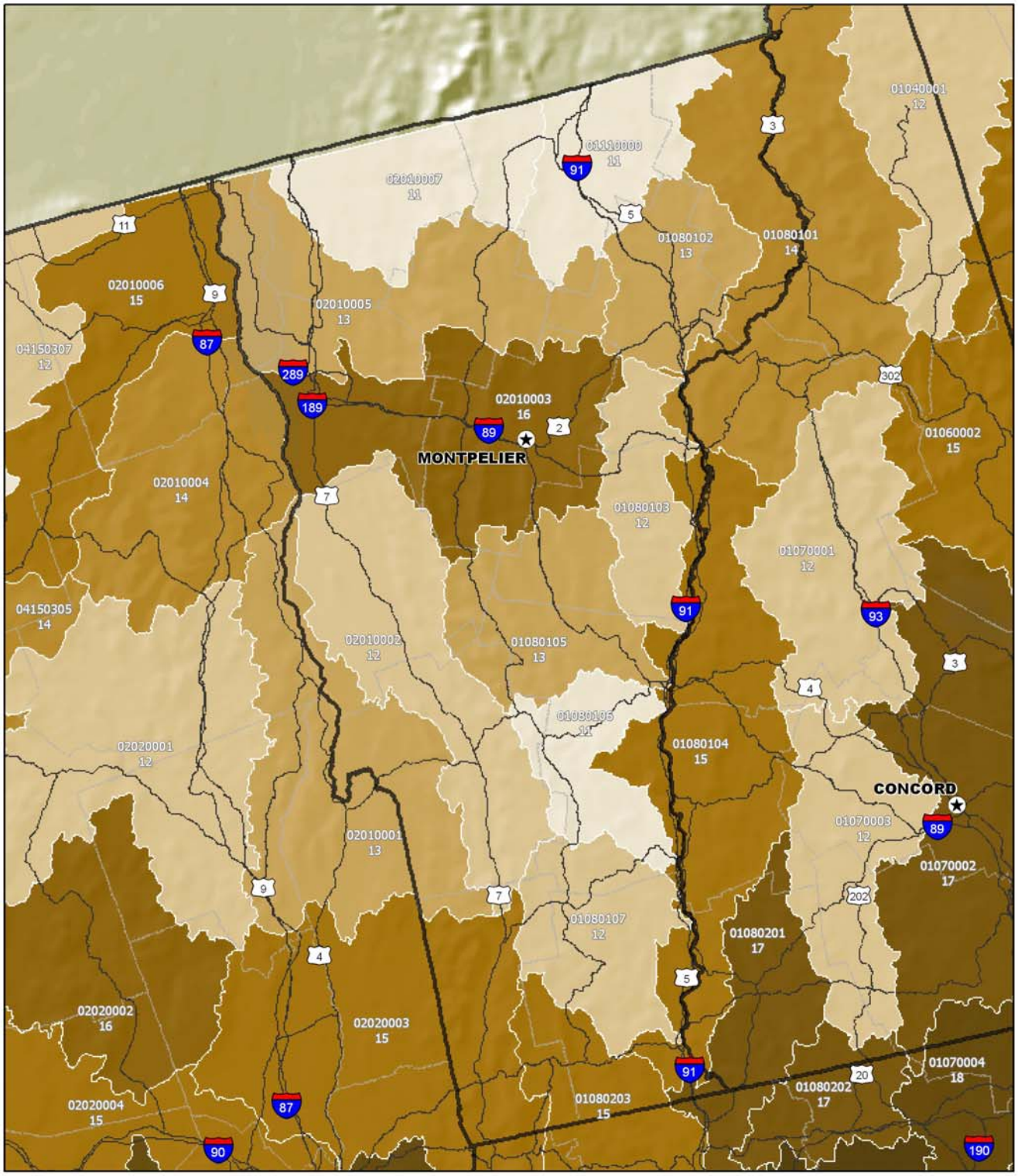
1 (Low APCW) 5 10 (High APCW)

Projection: Albers

Watershed labels describe the 8-digit hydrologic unit code (HUC) and watershed composite score

0 3.757.5 15 Miles

Importance of watersheds for drinking water supply (Step 2) - Vermont



STEP 2 COMPOSITE SCORE

2 5 10 15 19

(Low APCW and Small number of water consumers) (High APCW and Large number of water consumers)

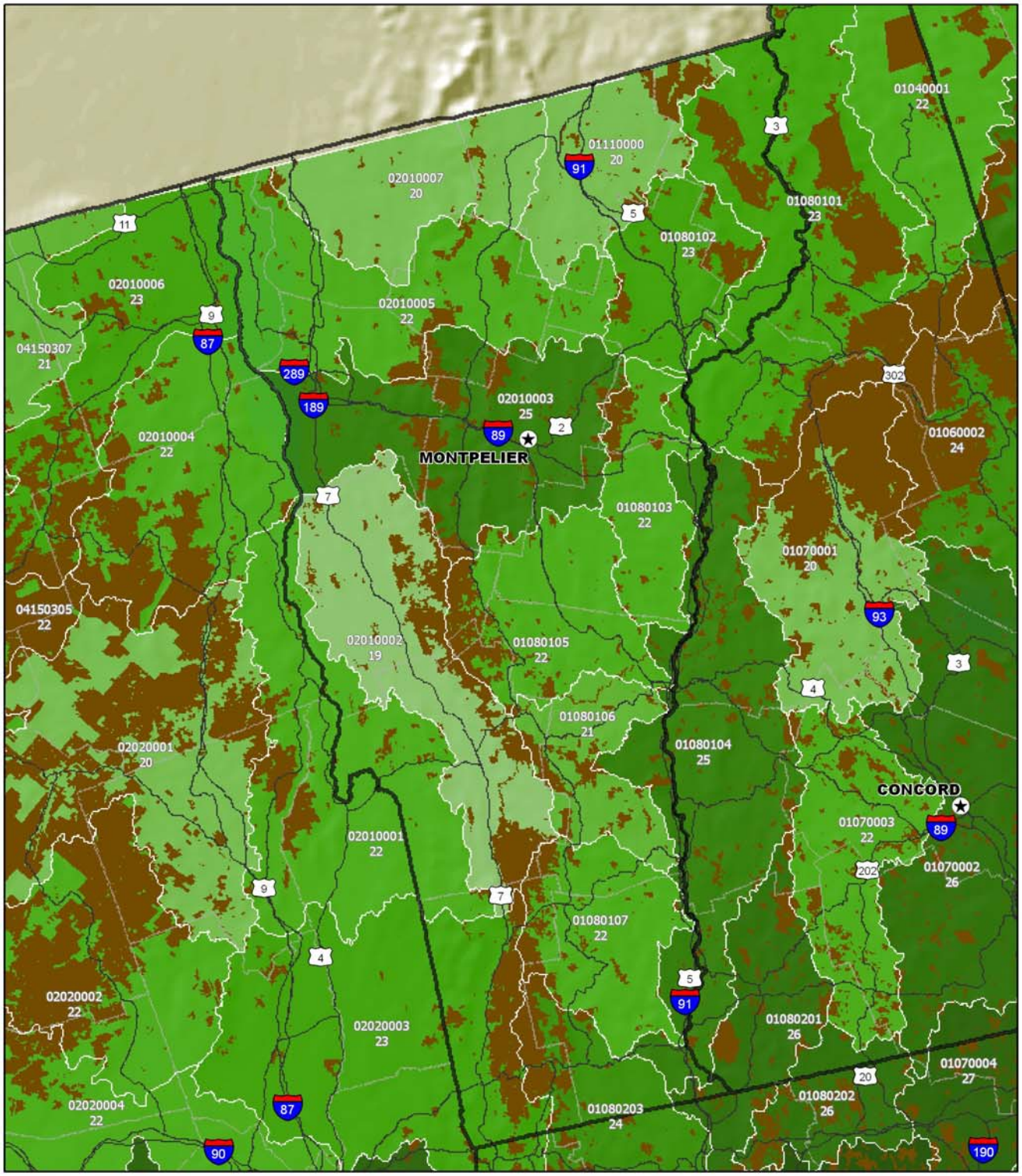
N W E S

Projection: Albers

Watershed labels describe the 8-digit hydrologic unit code (HUC) and watershed composite score

0 3.5 7 14 Miles

Importance of watersheds and private forest for drinking water supply (Step 3) - Vermont



STEP 3 COMPOSITE SCORE

3 5 10 15 20 25 29

(Low APCW; Small number of water consumers; and Low % private forest)

(High APCW; Large number of water consumers; and High % private forest)

Protected Land

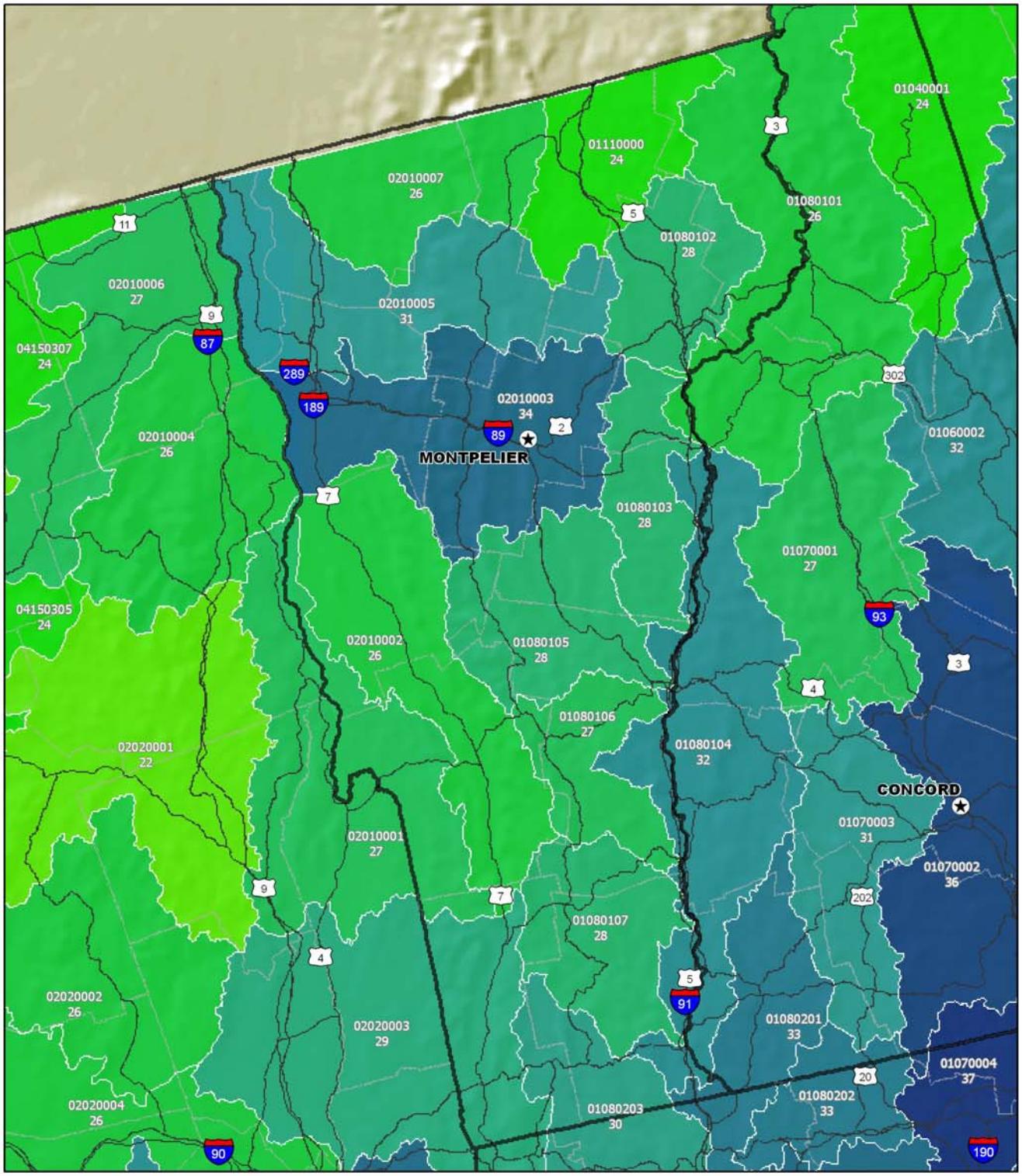
N W E S

Projection: Albers

Watershed labels describe the 8-digit hydrologic unit code (HUC) and watershed composite score

0 3.757.5 15 Miles

Development pressure on private forests in drinking water supply watersheds (Step 4) - Vermont



STEP 4 COMPOSITE SCORE

5 10 15 20 25 30 37

(Low APCW; Small number of water consumers; Low % private forest; and Low development pressure)

(High APCW; Large number of water consumers; High %private forest; and High development pressure)

N W E S

Projection: Albers

Watershed labels describe the 8-digit hydrologic unit code (HUC) and watershed composite score

0 3.757.5 15 Miles

References

Table 2. Datasets used in the Forests, Water and People Analysis

Attribute	Dataset	Source*
Forest land	1992 National Landcover Dataset	U.S. Geological Survey 1999
Agricultural land by watershed	1992 National Landcover Dataset	U.S. Geological Survey 1999
Riparian forest cover by watershed	1:100,000-scale National Hydrography Dataset, buffered to 30 meters	Hatfield 2005
Road density	2002 Bureau of Transportation Statistics (BTS) Roads	U.S. Department of Transportation 2002
Soil erodibility	STATSGO Soil Dataset, kffact	Miller and White 1998
Housing density by watershed	Housing density in 2000	Theobald 2004
Surface drinking water consumers per unit area	Public Drinking Water System (PWS) Consumers by eight-digit HUC; City Drinking water consumers for New York City, Philadelphia, St. Louis, St. Paul, and Washington DC	U.S. Environmental Protection Agency 2005
Private forest by watershed	Protected Areas Database, Version 4; Wisconsin Stewardship Data	Conservation Biology Institute 2006; U.S. Geological Survey, Upper Midwest Environmental Sciences Center 2005
Development pressure per unit area	Housing density in 2000 and 2030	Theobald 2004

*Note: See the **full report** for complete reference citations.

Watershed Resources

Northeastern Area Watershed— http://www.na.fs.fed.us/watershed

Forest-to-Faucet Partnership—http://www.wetpartnership.org/index.html

Trust for Public Land Source Water Stewardship Project—http://www.tpl.org/

Forests on the Edge—http://www.fs.fed.us/openspace/fote/index.html

American Water Works Association—Professional and Technical Resources—
http://www.awwa.org/Resources/index.cfm?&navItemNumber=1416

Source Water Collaborative—http://www.protectdrinkingwater.org/

Environmental Protection Agency—Surf Your Watershed—http://cfpub.epa.gov/surf/locate/index.cfm

Environmental Protection Agency—Safe Drinking Water Information System—

http://www.epa.gov/enviro/html/sdwis/sdwis_ov.html

This project was a collaborative effort between the Northeastern Area and Dr. Paul K. Barten, Associate Professor, University of Massachusetts-Amherst and Co-director of the Forest-to-Faucet Partnership.

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June 2009