Water Quality Blueprint: Nature-based Solutions for Clean Water in Lake Champlain

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The Nature Conservancy of Vermont

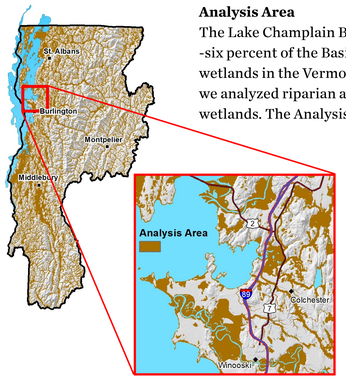
Background and Introduction

Natural systems are increasingly regarded as practical, cost-effective solutions to water quality problems, providing multiple ecological co-benefits. In the State's 2014 report, Vermont's Clean Water Initiative, natural infrastructure—which includes river corridors, floodplains, wetlands and forests—was listed as a critical priority to improve water quality. **The Water Quality Blueprint is a publicly accessible online web map tool designed by The Nature Conservancy (TNC) to help watershed managers and conservation practitioners make use of natural and restorable areas to achieve water quality and conservation goals in the Vermont portion of the Lake Champlain Basin.** Benefits are not limited to progress on clean water. **Nature-based solutions also support habitat for plants and animals, improve flood resiliency, and increase recreational opportunities.**

The Water Quality Blueprint includes **two independent prioritizations** of floodplains and other areas associated with rivers, lakes and wetlands: a map layer that highlights natural assets that would benefit from protection and restoration (**Conservation Value**) and a map layer that highlights locations that are impaired, at risk of impairment or that may attenuate sources of pollution (**Water Quality Impact Value**). These prioritizations are raster-based, weighted combinations of multiple component datasets that represent important habitats, natural processes, and impairments. The component datasets, as well as other **supporting datasets, are included in the web-map** to help users understand patterns related to ecology, pollution, restoration potential, and fluvial processes at the site, watershed, and basin scales. **The results of the Water Quality Blueprint have been incorporated into the Clean Water Roadmap for Vermont**, an online tool designed to support the VT Department of Environmental Conservation's efforts to reduce phosphorous pollution in the Lake Champlain Basin.

The final prioritizations are not intended to be prescriptive. Field work and direct knowledge of the landscape are essential to making good conservation decisions.

Analysis Area and General Methodology



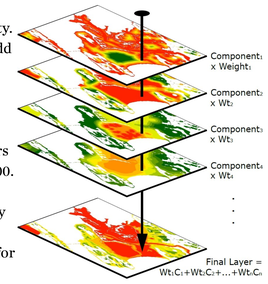
Analysis Area

The Lake Champlain Basin includes parts of Vermont, New York, and Canada. Fifty-six percent of the Basin is in Vermont. We analyzed only riparian areas and wetlands in the Vermont portion of the Lake Champlain Basin. Within this area, we analyzed riparian areas in the broadest sense as well as existing and converted wetlands. The Analysis Area was defined as the union of 8 datasets:

- River, Lake and Wetland-Associated Natural Communities[1]
- River Corridors[2]
- Riparian Connectivity (wildlife habitat)[1]
- Floodable Soils[4]
- Wetlands[2]
- Potential Wetland Restoration Sites[6]
- Valley Walls[2]
- Valley Bottom Land-Type[8]

General Methodology

The major final data products—**Conservation Value** and **Water Quality Impact**—are weighted combinations of multiple geographic data layers, the "components." Component weights were chosen, based on professional judgment, to represent their relative importance to ecology or water quality. Weights for each final data product add to 100. To create the components, source datasets were rasterized and processed in GIS. Most components required further analysis. The resolution of the products is 30 meters and rescaled to vary between 0 and 100.

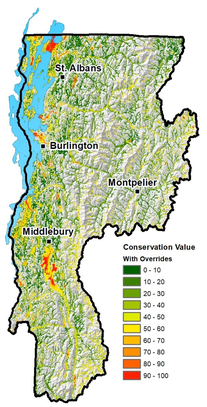


Our method allows users to assess any area (a parcel, or buffer area for example) for its relative importance for conservation or water quality.

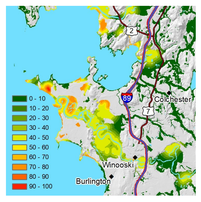
Conservation Value

The **Conservation Value** layer highlights natural assets that would benefit from protection and restoration. This layer is a weighted average of the 13 components shown at right. Weights add to 100 and are shown in red in the captions. The first six components continuously vary from 0 to 100. The last seven presence/absence components have values of 0 or 100.

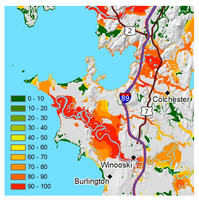
Override Components: Certain rare and irreplaceable, fine scale elements and their 300' buffer areas were given minimum (override) scores based on their relative rarity. To visualize the extent of those override scores, compare the final maps with and without overrides.



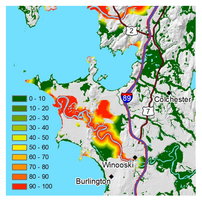
Conservation Value with Overrides



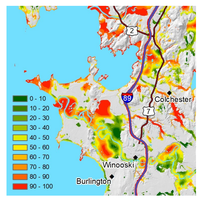
Proximity to water-related Natural Heritage community occurrences[1] **Weight=15**



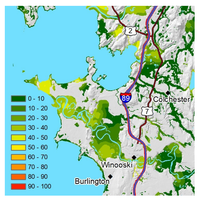
Proximity to water-related Natural Heritage rare and uncommon species[1] **15**



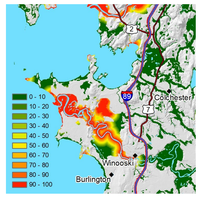
Proximity to water-related TNC terrestrial portfolio[8] **15**



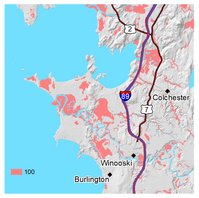
Percentage natural land cover[8,9] **7**



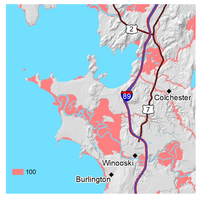
Proximity to conserved land[8] **7**



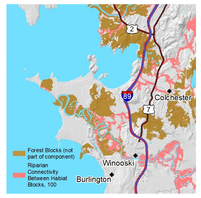
Proximity to TNC freshwater portfolio[8] **7**



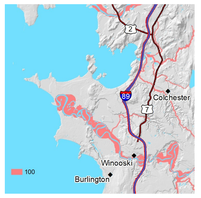
Wetlands[2] **7**



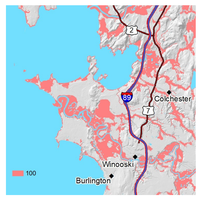
Valley walls[2] **6**



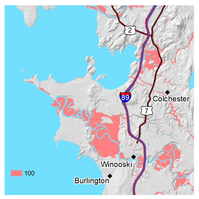
Riparian connectivity between habitat blocks [1,8] **6**



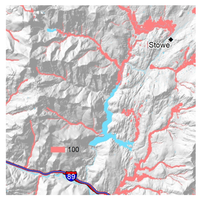
River corridors [2] **5**



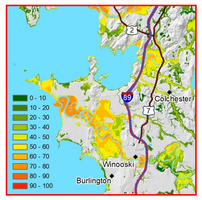
Riparian connectivity [1] **4**



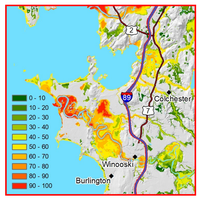
Floodable soils[4] **3**



Healthy brook trout catchments[3] **3**



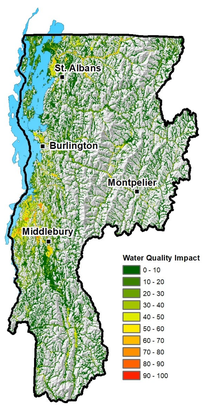
Final Conservation Value without overrides



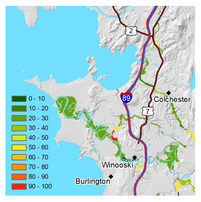
Final Conservation Value with overrides

Water Quality Impact

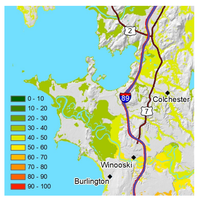
The **Water Quality Impact** layer highlights locations that are impaired, at risk of impairment, or that may attenuate sources of pollution. This layer is a weighted average of 4 or 5 components, shown at right. Source datasets for the fluvial process metric were not available for all streams in the Analysis Area. Where this was the case, the component was not included in the combination, and weights for the four remaining components are all 25. Weights add up to 100 and are shown in red in the captions. Component values vary from 0 to 100, except for the Impaired and Stressed Water Source and Abatement Areas component, which contains values of 0 or 100 points.



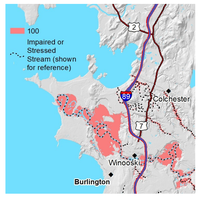
Water Quality Impact



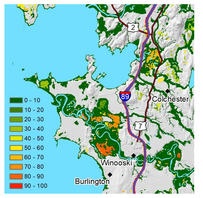
Fluvial process metric (Floodplain Restoration Potential)[2,8] **Weight: 30 or 0**



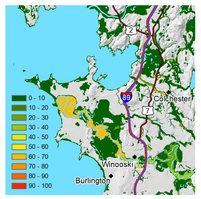
Modeled phosphorous yields[5] **20 or 25**



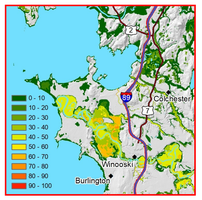
Possible impaired and stressed water source and abatement areas[2] **20 or 25**



Potential wetland restoration sites[6] **20 or 25**



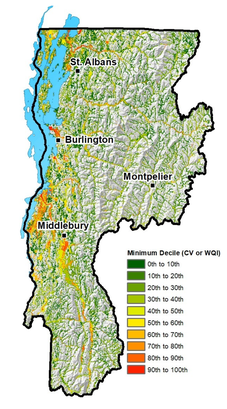
VT River Sensitivity Coarse Screen[7] **10 or 25**



Final Water Quality Impact Value

Combined Layer

We combined the **Water Quality Impact** and **Conservation Value** layers into one layer to highlight locations where there are opportunities both to address water quality problems as well as to protect important habitat. The **Conservation Value** and **Water Quality Impact** values were each divided into 10 equal quantiles (deciles), and grid cells were assigned a value from 1 (lowest decile) to 10 (highest decile). The value of the **Combined Layer** is the lower of the two decile scores. For instance, if the **Conservation Value** for a grid cell is within the 3rd quantile, and the **Water Quality Impact** value for that same grid cell is within the 8th quantile, the cell in the **Combined Layer** was assigned a value of 3.



Combined Layer

Online Planning Web Map Tool

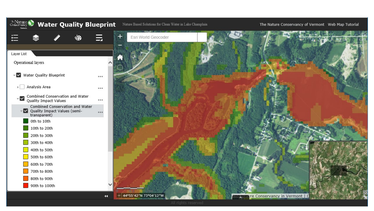
The Water Quality Blueprint web map tool is available at:

www.nature.org/vtcleanwater

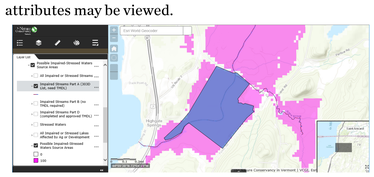
The web map tool is intended for watershed managers, conservation practitioners, landowners, and others to view and interact with the results of the Water Quality Blueprint.

Final products as well as source and intermediate datasets are included to help users understand how the values in final products were produced.

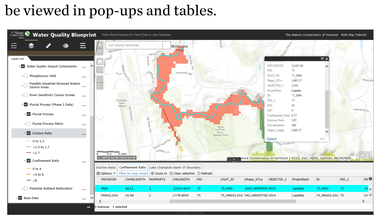
Basemaps include aerial photos and topographic maps.



Geographic data of various formats (.shp, csv, kml . . .) and sources (desktop, web service, ArcGIS Online) may be uploaded to the map for reference and their attributes may be viewed.



Source data sets include multiple attributes, which can be viewed in pop-ups and tables.



Acknowledgements and Data Sources

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Tim Clear (DEC)
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Todd Redder (LimnoTech)
Wendy Larson (LimnoTech)

Data Sources:

[1]VT Department of Fish and Wildlife
[2]VT Department of Environmental Conservation
[3]Eastern Brook Trout Joint Venture
[4]National Resources Conservation Service
[5]Environmental Protection Agency
[6]VT Department of Parks, Forests, and Recreation
[7]Milone and MacBroome for Vermont Land Trust
[8]The Nature Conservancy
[9]Multi-Resolution Land Characteristics Consortium