Designing Sustainable Landscapes:
Stream temperature settings variable

A project of the University of Massachusetts Landscape Ecology Lab

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- North Atlantic Landscape Conservation Cooperative (US Fish and Wildlife Service, Northeast Region)
- Northeast Climate Science Center (USGS)
- University of Massachusetts, Amherst

Reference:

McGarigal K, Compton BW, Plunkett EB, DeLuca WV, and Grand J. 2017. Designing sustainable landscapes: stream temperature settings variable. Report to the North Atlantic Conservation Cooperative, US Fish and Wildlife Service, Northeast Region.

General description

Stream temperature is one of several ecological settings variables that collectively characterize the biophysical setting of each 30 m cell at a given point in time (McGarigal et al 2017). Several fish species (e.g., brook trout) can only survive in coldwater streams, which have higher levels of dissolved O_2, while other fish species are adapted to warmer streams. At the same time, ectotherms such as aquatic insects and fish can develop more quickly in warmer streams. Stream temperature (**Fig. 1**) is a coarse classification of streams by mean annual temperature.

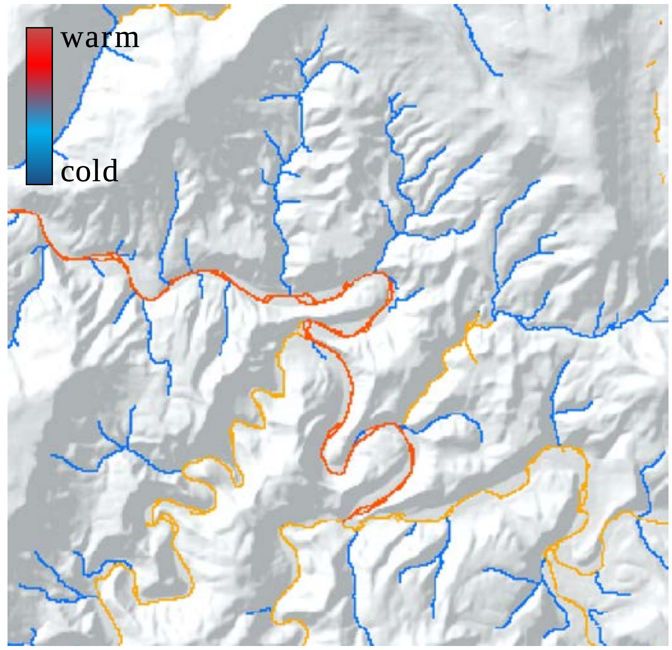

Figure 1. Stream temperature in eastern West Virginia.

Use and interpretation of this layer

This ecological settings variable is used for the similarity and connectedness ecological integrity metrics.

This layer carries the following assumptions:

- TNC's stream temperature classes are properly assigned, and values were correctly carried over to our higher-resolution stream network.
- Mean annual temperature (as opposed to, say, maximum annual temperature) is the primary determinant of temperature effects on aquatic organisms.
- These stream temperature classes are not dynamic, so we are unable to assess the effect of climate change on stream ecosystems in future timesteps.

Derivation of this layer

Data source

- The Nature Conservancy's aquatic classification.
- DSL streams grid, classified by size.

Algorithm

We assigned TNC's stream temperature classes, which were based on 1:100,000 NHD+ streams to our stream network, based on 1:24,000 NHD streams. This presented some difficulties, as many streams in the high-resolution NHD network are not represented in NHD+. We used nearest-neighbor interpolation to create a continuous surface of temperature classes from the TNC dataset for each of four size classes (headwaters/creeks, small, medium, and large rivers). We then sampled from this surface for each of four sizes classes in our data. This prevented misclassifying stream temperature classes at confluences, and allowed us to reasonably fill in temperatures for headwater streams that were not represented in TNC's data.

GIS metadata

This data product is distributed as a geoTIFF raster (30 m cells). The cell values fall in the following classes: 1 = cold, 2 = transitional cool, 3 = transitional warm, 4 = warm. This data product can be found at McGarigal et al (2017).

Literature Cited

McGarigal K, Compton BW, Plunkett EB, DeLuca WV, and Grand J. 2017. Designing sustainable landscapes products, including technical documentation and data products. https://scholarworks.umass.edu/designing_sustainable_landscapes/