Designing Sustainable Landscapes: $CaCO_3$ content settings variable

A project of the University of Massachusetts Landscape Ecology Lab

Principals:

- Kevin McGarigal, Professor
- Brad Compton, Research Associate
- Ethan Plunkett, Research Associate
- Bill DeLuca, Research Associate
- Joanna Grand, Research Associate

With support from:

- 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: $CaCO_3$ content settings variable. Report to the North Atlantic Conservation Cooperative, US Fish and Wildlife Service, Northeast Region.

General description

Calcium carbonate ($CaCO_3$) content 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). $CaCO_3$ buffers acidity in soil and water, increasing nutrient uptake by plants, and providing a ready source of calcium for organisms such as aquatic insects. $CaCO_3$ content (**Fig. 1**), affects the composition of natural communities both directly and indirectly, such that areas with high calcium have increased species richness and support a number of unique species.

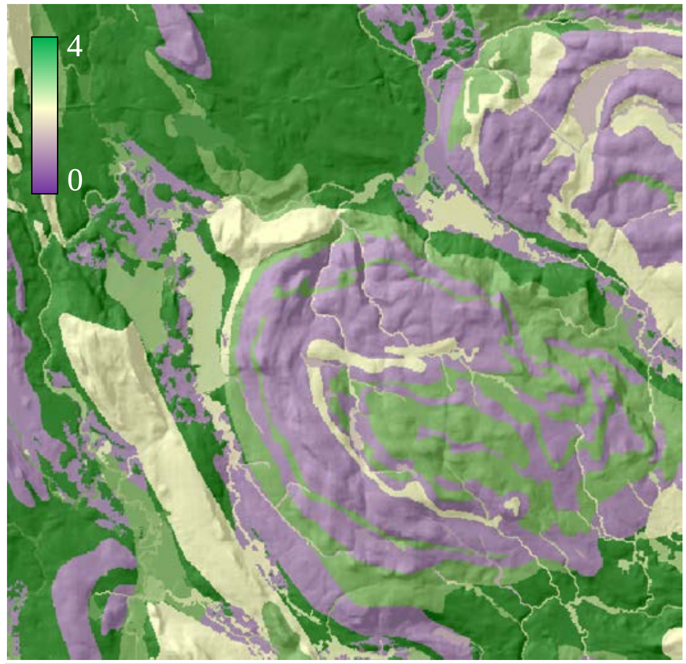

Figure 1. $CaCO_3$ content in the Berkshires of western Massachusetts.

Use and interpretation of this layer

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

This layer carries the following assumptions:

- Lithology is mapped accurately. Lithology is mapped at scales ranging from 1:100,000 to 1:500,000, so fine details and smaller inclusions are omitted, and spatially accuracy is poor.
- The proportion of a watershed with calcareous bedrock determines the calcium content of streams, wetlands, and waterbodies.
- Norton's buffering capacity classes are scaled linearly.

Derivation of this layer

Data source

- Lithology layer from The Nature Conservancy.
- Flow direction grid, derived from National Elevation Dataset's (NED) elevation grid, National Hydrography Dataset (NHD) 1:25,000 flow lines, and custom editing and processing.

Algorithm

We reclassified TNC's lithology according to Norton's buffering capacity classes (Norton 1982). We used these values directly for terrestrial cells. For aquatic and wetland cells, we use the flow direction grid to calculate the mean buffering capacity for all cells in each cell's watershed. We took the mean value across each basin for wetlands and lentic waterbodies. Off-centerline stream cells are assigned the value of the nearest centerline cell.

Table 1. Norton buffering capacity classes (Norton 1982).

Value	Class
1	Low to no acid-neutralizing capacity (e.g., granitic gneiss, quartz sandstones)
2	Medium to low acid-neutralizing capacity (e.g., metamorphic felsic to intermediate volcanic rocks, intermediate igneous rocks, calc-silicate gneisses, non-calcareous clastic sedimentary rocks)
3	High to medium acid-neutralizing capacity (e.g. slightly calcareous rocks, metamorphic intermediate to mafic volcanic rocks, ultramafic rocks)
4	"Infinite" acid-neutralizing capacity (e.g. carbonate rocks: limestones, dolostones and marble)

GIS metadata

This data product is distributed as a geoTIFF raster (30 m cells). The cell values range from 0 (low buffering capacity) to 4 (high buffering capacity). This date product can be obtained 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/

Norton, S.A. 1982. Distribution of surface waters sensitive to acidic precipitation: a state-level atlas. National Atmospheric Deposition Program. Technical Report IV, N.C. State University.