Designing Sustainable Landscapes: Phase 5: what's new?

A project of the Landscape Ecology Lab, Department of Environmental Conservation, University of Massachusetts, Amherst

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With support from:

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

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Reference:

DeLuca WV, Compton BW, Plunkett EB, and McGarigal K. 2020. Designing sustainable landscapes Phase 5: what's new? Report to the US Fish and Wildlife Service, Northeast Atlantic-Appalachian Region.

Introduction

Phase 5 is primarily a data-improvement/bug-fix update of the Designing Sustainable Landscapes project. In working with the data and models and developing derived projects over the years, we and others have found a number of data errors. In this phase of the project, we were able to go back to the original steps of data correction and fix nearly all of the known errors in data derivation, and many of the errors in original source data. We were also able to update some of our original data sources.

We've used the revised data to rerun all species models for 2020, the index of ecological integrity (IEI) for 2020, and recreate the Nature's Network terrestrial cores and connectors. We have not rerun aquatic cores, the urban growth (SPRAWL) model, nor 2080 runs of species or IEI in this phase. An update of SPRAWL and future species and IEI are planned for future phases.

This phase also includes a new species model, for spotted turtle (*Clemmys guttata*). We used the new spotted turtle Landscape Capability model as a basis for a model of spotted turtle conservation cores, connectivity among cores, and a road vulnerability model. For details on the spotted turtle LC model, see dsl_documentation_clgu.pdf. Spotted turtle cores, connectors, and road vulnerability are described in dsl_documentation_phase5_spotted_turtle_lcd.pdf.

All documentation and data are available at McGarigal et al (2020). We've updated all of the documentation affected by the changes in this version; non-updated documents remain correct.

Changes to DSL data

Bring in Microsoft building footprints. Our previous versions used NLCD data to represent development. These data represented development extremely poorly, especially in rural areas, where are little as 5-10% of development was captured. Compounding this, NLCD mapped roads indistinguishably from buildings. As we needed to map roads separately, we deleted NLCD "development" based on roads, which required buffering the roads to catch stray road cells. The result is that much roadside development was lost. In this phase, we used the amazing Microsoft building footprint dataset (https://blogs.bing.com/maps/2018-06/microsoft-releases-125-million-building-footprints-in-the-us-as-open-data/) to represent development. We kept in NLCD development (which includes some non-structure development such as large parking lots and airport runways as well as agriculture, and seems to have very few false positives), and dropped Microsoft building footprints on top. The result is that we finally have a fairly accurate representation of development throughout the region.

Incorporate coastal resilience into the selection index for terrestrial cores in Nature's Network. We updated to version 2 of TNC's resilience assessment which uses

their new coastal resiliency (see https://conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/climate/CoastalResilience/Pages/Resilient-Coastal-Sites--for-Conservation-across-the-Northeast-and-Mid-Atlantic-Seaboard.aspx) into the core area selection algorithm and rebuilt Nature's Network cores and connectors.

Update NLCD to 2016 (from 2011). We used the newest version of NLCD for non-structure development and agriculture.

Fix stream errors. Our stream data, extensively edited from NHD linework, still had a large number of errors, including streams that didn't extend to the edge of the landscape, breaks in streams, upstream-pointing flow, flow loops, parallel flow lines in big rivers, and strange zig-zags in some areas. We discovered many of these errors when working on derived products in recent years. For this phase, we put a lot of effort into finding and fixing all known stream errors. We finally developed code that identified several different types of errors (broken snaps, stranded vectors, colliding vectors, divergences, and convergences). We rebuilt the flow direction grid and all flow-derived data.

Correct edge alignment and mask grids. Edge agreement among our large number of different data sources were inconsistent, which was been a constant source of complication and errors at the landscape edges. We've cleaned up edges, so all data layers now agree.

Update roads and railroads from Open Street Map. We updated roads and railroads to the latest on Open Street Map (OSM) as of November 13, 2018. In working with the data, we discovered that a large number of roads mapped as "tracks" were really hiking trails, mountain bike trails, and long-abandoned cart roads. We had been treating these as unpaved roads in previous versions, but the newer (greatly expanded) footprint of tracks led to massively overestimating road effects in many mostly natural areas. Although the tracks class includes many actual roads, such as logging roads in northern Maine and fracking facilities in the Marcellus Shale, we decided they were doing more harm than good and reluctantly dropped them. We updated the traffic data to match the new roads, and no longer reduce the road class when reducing traffic in protected land.

Rebuild culvert points and clean up duplicate culverts. We rebuilt culvert points and updated to the most recent NAACC crossing scores as of January 2, 2020.

Replace dam data. The dam data in our previous versions had a number of errors, including a dam in the Delaware River (which has none on its mainstem) at Philadelphia, a ghost dam in the lower Hudson River, dams in salt marshes, and dams that had been incorrectly moved from mainstems to tributaries. We replaced dams with a new dam layer from The Nature Conservancy, and did a lot of work to ensure that dams were not snapped to the wrong streams.

Add improved beach data. We updated beaches to include photo-interpreted beach linework from Tracey Rice.

Updated secured land coverage. We updated secured land (protected open space) to the latest version from The Nature Conservancy as of August 16, 2019.

Minor data errors. We fixed minor data errors in the salinity and calcium settings variables, the HUC6 layer and SPRAWL subregions, and the weights of classes in the substrate mobility and structure settings variables.

Change scaling of stream gradient and slope. Stream gradient is now log-scaled, as maximums are arbitrarily high, thus linear scaling is not appropriate. We also trimmed the highest values of both gradient and slope.

Fix aquatic connectedness bug. We fixed a bug in the scaling of aquatic connectedness.

Smooth fragmented stream classes. Stream gradient classes change from cell to cell, resulting in a crazy patchwork of stream classes that doesn't seem particularly useful. We used an three-cell minimum mapping unit to smooth stream classes.

Literature Cited

McGarigal K, Compton BW, Plunkett EB, DeLuca WV, and Grand J. 2020. Designing sustainable landscapes products, including technical documentation and data products. http://umassdsl.org/.