Designing Sustainable Landscapes:
Development settings variable
Hard development 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

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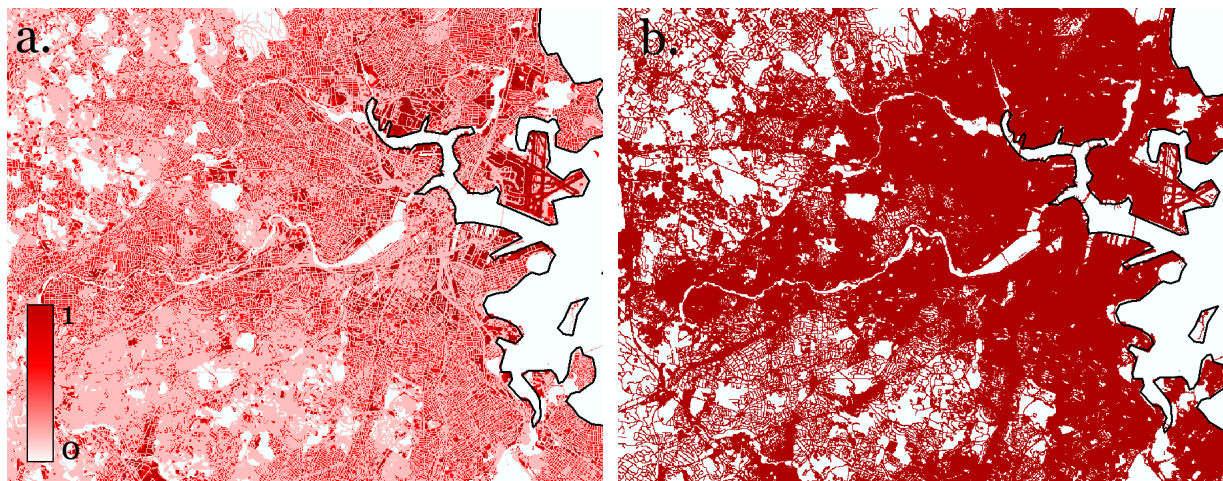- University of Massachusetts, Amherst

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General description

Development and hard development are two 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 2020). Development represents all development, scaled from 0 to 10 by development intensity. Hard development is a subset of development, with a value of 1 for very high intensity development only (**Fig. 1**). Both layers come from DSLland, the primary landcover map. These are dynamic settings variables, increasing with future urban growth.

Figure 1. The development (a) and hard development (b) layers for Boston.

Use and interpretation of this layer

These two ecological settings variables are used for the similarity and connectedness ecological integrity metrics. Separating hard development from all development allows it to be given considerably more weight for the ecological distance component of connectivity. In essence, this allows development to be treated as very dissimilar to all natural types, while hard development is treated as essentially infinitely dissimilar.

These layers carry the following assumptions:

- Development classes are well-distinguished, and completely and accurately mapped. Building footprints come from Microsoft, and generally do an excellent job of representing buildings. Other classes, such as pavement and agriculture, come from NLCD, and are reasonably well-mapped (see DSLland document, McGarigal et al 2020). Roads and railroads ultimately come from Open Street Map, which does a good job of representing roads for these purposes.

- The weights assigned to development classes are meaningful. As the weights were assigned by opinion rather than an empirical model, this assumption is difficult to assess, other than by noting that the resulting layers seem to pass a gut check.

Derivation of this layer

Data sources

- DSLland. Our integrated landcover layer (see DSLland document, McGarigal et al 2020, for details). Ultimate sources for development classes were:
    - ❖ National Land Cover Database (NLCD), 2011 (https://www.mrlc.gov/nlcd2011.php).
    - ❖ Microsoft building footprints (https://blogs.bing.com/maps/2018-06/microsoft-releases-125-million-building-footprints-in-the-us-as-open-data/). Building footprints were integrated into NLCD development.
    - ❖ Open Street Map (OSM). We used this open-source global map of roads (http://www.openstreetmap.org) as our source of linework for roads and railroads. Data were downloaded in November 2018.

Algorithm

These layers were assigned weights according to **Table 1**.

Table 1. Weights assigned to development classes.

Landcover	Development	Hard Development
Dam	10	1
Developed – high intensity	10	1
Developed – medium intensity	8	1
Developed – low intensity	5	0
Developed - open space	5	0
Roads	5	1
Trains	5	1
Culvert/bridge	5	1
Barren land	5	0
Pasture/hay	5	0
Cultivated crops	5	0

Future timesteps. Development and hard development were updated for land that is developed in future timesteps by the urban growth model (see technical document on urban growth, McGarigal et al 2017) using the same weights as above.

GIS metadata

These data products are distributed as geoTIFF rasters (30 m cells). The cell values for development range from 0 to 10, and hard development has values of 0 and 1. These data products can be found at McGarigal et al (2020).

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/.