Designing Sustainable Landscapes:

Total annual precipitation and growing season precipitation settings variables

A project of the University of Massachusetts Landscape Ecology Lab

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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. 2022. Designing sustainable landscapes: precipitation settings variables. Report to US Fish and Wildlife Service, Northeast Region.

General description

These two precipitation variables are among 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). The amount of rainfall and depth of snowpack affects species composition, as well as ecological processes such as nutrient cycling. We've chosen two variables to represent precipitation. Both variables have future versions that incorporate climate change via General Circulation Models (GCMs) (as described in the technical document on climate, McGarigal et al 2017).

Total annual precipitation (**Fig. 1a**) measures the mean precipitation in a year. In the northeast, where there is little seasonal variation in precipitation, it is a good indicator of how moist an area is likely to be.

Growing season precipitation (**Fig. 1b**) gives the summed precipitation to the growing season, May through September.

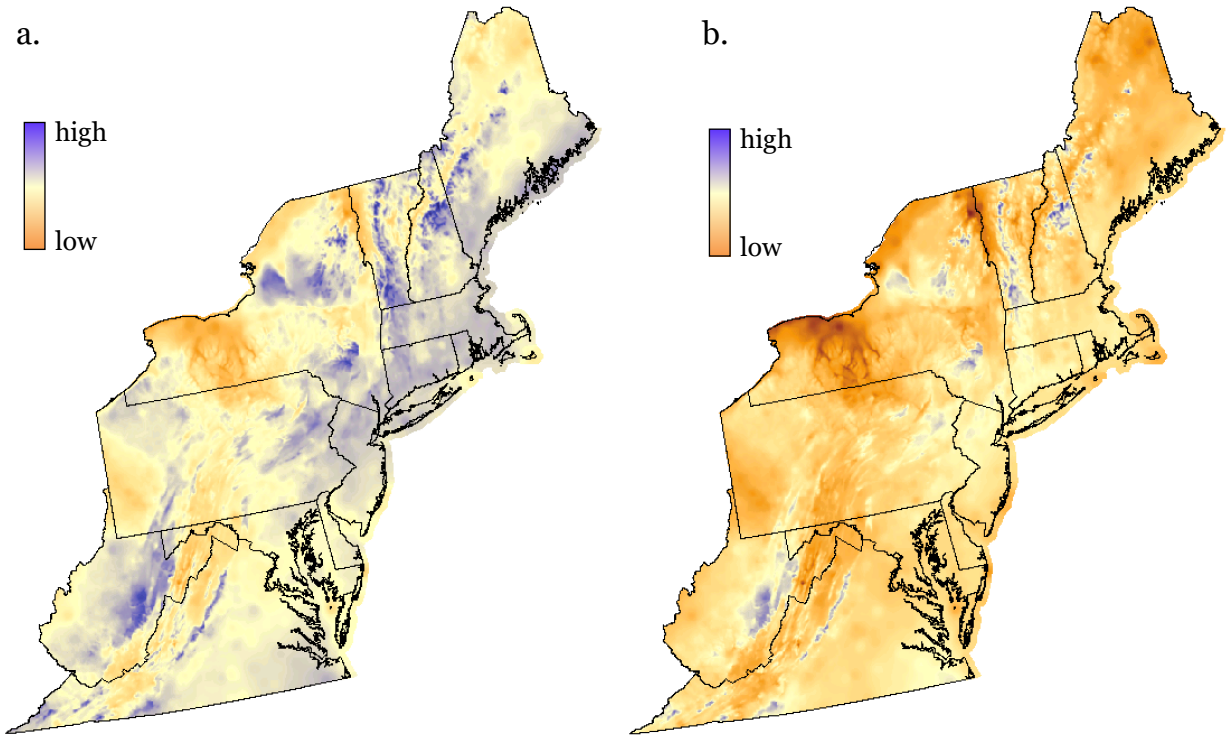

Figure 1. Precipitation settings variables for the northeast: (a) Total annual precipitation, and (b) Growing season precipitation.

Version 5 update

Version 5 climate variables exclude a GCM runs that performed poorly in the Northeast Region (Karmalkar et al. 2019) reducing the set to 13. Additionally RCP 4.5 was dropped so version 5 is based solely on RCP 8.5. The prior version of the package included the climate data for years 2010 and 2080, while version 5 includes 2020 (the new "current" year), 2040 and 2080.

Use and interpretation of these layers

These ecological settings variables are used for some of the representative species models.

These layers carry the following assumptions:

- PRISM precipitation data (used for downscaling the GCM data) are accurate.
- GCM predictions for 2080 are correct.
- Geographical downscaling (from 800 m for PRISM data, and from 12 km for GCM data) don't introduce errors.
- Source data are monthly means, and thus give coarse estimates of these variables.
- Data are based on 30-year normals, and thus remove annual variation in precipitation.

See the DSL climate document referenced above for a more complete list of assumptions and limitations of these data.

Derivation of these layers

Data source

- DSL climate grids, based on 800 m PRISM data, as modified by an ensemble of GCMs for future timesteps under Representative Concentration Pathways (RCP) 8.5.
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Algorithm

Both variables are based on a 30-year normal centered on the date of interest (2020, 2040, or 2080). Precipitation is based on an ensemble of 13 GCMs downscaled to 800 m PRISM data using the delta method (in the case of precipitation, the delta is actually a ratio), calculated for RCP 8.5. These variables are calculated as follows:

Total annual precipitation: Total precipitation for the year. The sum of the daily values across all days.

Growing season precipitation: Sum of daily precipitation for days in May through September.

For details on how these data were derived, see the DSL climate document referenced above.

GIS metadata

These data products are distributed as geoTIFF rasters (30 m cells) and can be found at McGarigal et al (2017). Each raster is distributed in three versions: (1) 2020, (2) 2040 and (3) 2080, all under RCP 8.5.

Total annual precipitation (PRECIP; units: mm/year × 100).

Growing season precipitation (PRECIPGS; units: mm/year × 100).

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

Karmalkar AV, Thibeault JM, Bryan AM, and Seth A. 2019. Identifying credible and diverse GCMs for regional climate change studies—case study: Northeastern United States. Climatic Change. 154. 10.1007/s10584-019-02411-y.