NHDPlusV2 Catchment scale Curve Number and NDVI Dataset

Authors

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Dataset Location: ftp://newftp.epa.gov/exposure/CurveNumberNDVI

This folder contains NHDPlus v2.1, i.e., National Hydrography Dataset Plus version 2.1, catchment level 16-day resolution Curve Number (CN) and Normalized Difference Vegetation Index (NDVI) data for 17 years (2001-2017). All data are in Comma Separated Values (CSV) format zipped files. The folder has three zip files for each NHDPlus region of conterminous United States (CONUS) as shown in the following map (Figure 1).

Files are named as [RegionNumber]-[RegionName]-[DataType].zip. For example, Region 01 has three files: 01-Northeast-CN.zip, 01-Northeast-NDVI.zip, and 01-Northeast-CN-AVG.zip. There are three data types:

CN - Curve Number

CN-AVG - Average Curve Number

NDVI - Normalized Difference Vegetation Index

Please note that a value of -1 means missing data because we were unable to calculate the value.

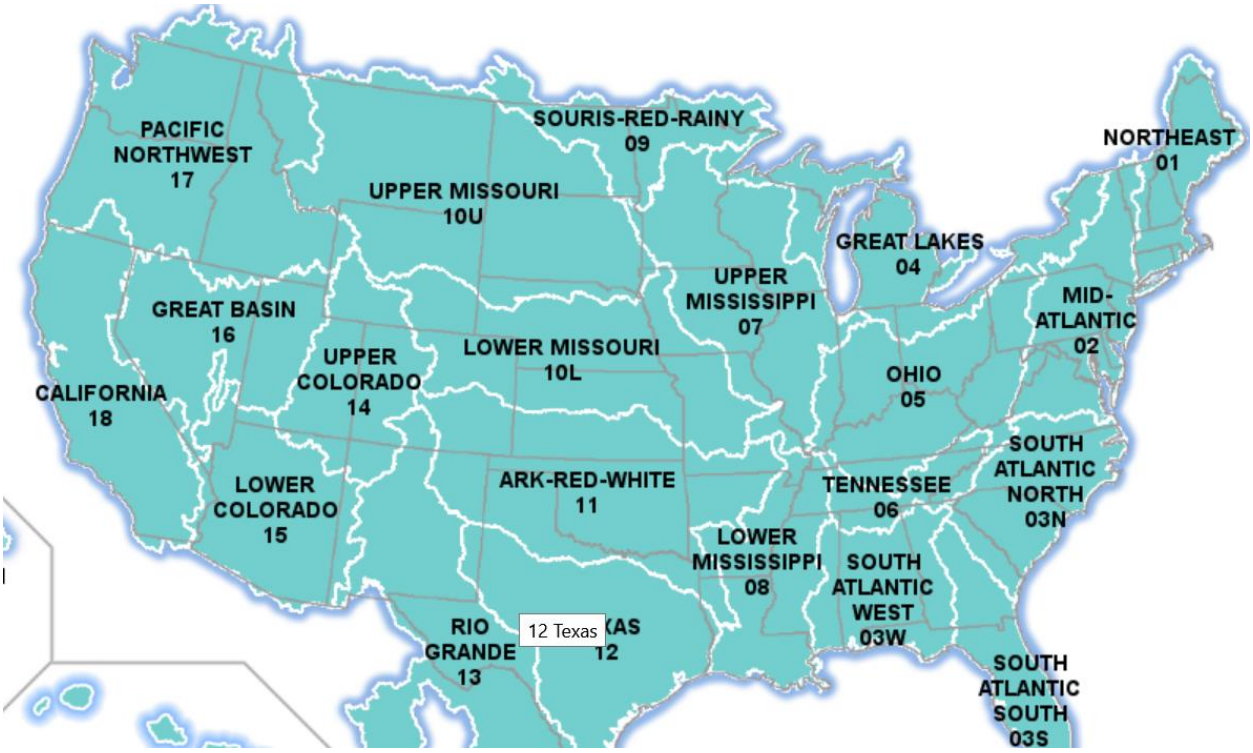

Figure 1. NHDPlus Regions of conterminous United States (CONUS)

Column headings in [RegionNumber]-[RegionName]-CN.csv and [RegionNumber]-[RegionName]-NDVI.csv files represent dates except the last COMID column which represents NHDPlus Catchment ID. Values contained in the date heading columns are CN for [RegionNumber]-[RegionName]-CN.csv and NDVI for [RegionNumber]-[RegionName]-NDVI.csv. The methodology to calculate the values is described in the "Curve Number Methodology" section below.

The column headings in [RegionNumber]-[RegionName]-CN-AVG.csv represent day of the year except the first COMID column which represents NHDPlus Catchment ID. Values are registered at 16-day interval. For example, in "01-Northeast-CN-AVG.csv" CN00 represents January 01; CN01 represents January 17; and so on to CN22 represents December 19. Values contained in the day of the year heading columns are average CN.

A value of blank -1 in the csv files indicate that we were unable to calculate the value.

Curve Number Development Methodology

The primary challenge in automating the generation of runoff time series using the Curve Number method is the selection of the hydrologic condition. The hydrologic condition functions as a categorical variable taking into consideration several possible influencing factors mainly related to land-cover type at the time of precipitation event. The customary approach to specifying hydrologic condition requires site specific expert analysis that hinders scaling the approach to larger areas. Remote

sensing data has been shown to be a viable alternative that overcomes the limitation and allows for broad, site-specific data to be used in the determination of an area of interest CN value. The MODIS NDVI product provides vegetation change data which we can use as an indicator for an area's hydrologic condition (Muche et al. 2019a, 2019b). In our calculation of CN, 250-meter resolution MODIS NDVI satellite raster data was aggregated by NHDPlusV2 catchment by using spatially weighted approach in order to calculate the mean NDVI value for each 16-day timestep of the data, from 2001 through 2017. The mean NDVI values were then used to determine the hydrologic condition being Poor, Normal or Good for their corresponding timespans, for the NLCD land-cover types and NDVI ranges specified in Table 1. The spatially weighted aggregations of the NDVI raster data for approximately 2.65 million CONUS catchments were performed using Google Earth Engine.

We used the EPA StreamCat dataset (Hill et al. 2016) to obtain catchment level NLCD 2011 landcover data. We also used StreamCat dataset to obtain catchment level STATSGO derived sand and clay soil composition percentages; these were used to determine the hydrologic soil group (HSG) of each catchment. Using the land cover, hydrologic soil group, and 16-day timestep hydrologic condition values we determined 16-day timestep CN for each CONUS catchment for 2001 through 2017 from USDA's Soil Conservation Service curve number tables.

In order to use these CN values for time spans outside the NDVI data range, we averaged each 16-day period over the 17 years to have CN values resulting in 23 values for each catchment. The average CN at 16-day interval for a catchment can be obtained from https://qed.epa.gov/hms/rest/api/info/catchment?cn=true&comid=COMID, where COMID is the NHDPlus catchment ID.

Table 1. Hydrologic condition classification based on NDVI value and NLCD 2011 land cover class.

Land Cover Class	Poor	Normal	Good
41 - Deciduous Forest	NDVI < 6500	6500 <= NDVI <= 7500	NDVI > 7500
42 - Evergreen Forest	NDVI < 6500	6500 <= NDVI <= 7500	NDVI > 7500
43 - Mixed Forest	NDVI < 6500	6500 <= NDVI <= 7500	NDVI > 7500
52 - Shrub/Scrub	NDVI < 5500	5500 <= NDVI <= 6500	NDVI > 6500
71 - Grassland/Herbaceous	NDVI < 5000	5000 <= NDVI <= 6000	NDVI > 6000
81 - Pasture/Hay	NDVI < 5000	5000 <= NDVI <= 6000	NDVI > 6000
82 - Cultivated Crops	NDVI < 4000	4000 <= NDVI <= 5000	NDVI > 5000

References

Hill, R.A., Weber, M.H., Leibowitz, S.G., Olsen, A.R. and Thornbrugh, D.J., 2016. The Stream-Catchment (StreamCat) Dataset: A database of watershed metrics for the conterminous United States. JAWRA Journal of the American Water Resources Association, 52(1), pp.120-128.

Muche, M.E., Hutchinson, S.L., Hutchinson, J.S. and Johnston, J.M., 2019a. Phenology-adjusted dynamic curve number for improved hydrologic modeling. Journal of Environmental Management, 235, pp.403-413.

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