

CL Mapper Tool Dataset Information

Background

The CL Mapper Tool is a joint project supported by the United States (U.S.) Environmental Protection Agency (EPA), USDA Forest Service (USFS), and the National Park Service (NPS) to make information more accessible on the effects from atmospheric deposition of nitrogen (N) and sulfur (S). The CL Mapper Tool is an interactive tool that enables decision makers, researchers, and the public to easily access information for the conterminous U.S. on:

- 1) atmospheric deposition of N and S through time (1850-2100) for different air quality models,
- 2) critical loads (CLs) for terrestrial and aquatic ecosystems,
- 3) CL exceedances, defined as deposition minus the CL,
- 4) the spatial distribution of these data across the conterminous U.S., and
- 5) data summaries by geographical overlays, defined as land units including Federal Administrative Areas, Class I Areas, and Wilderness Areas.

Locations where atmospheric deposition is higher than a CL (i.e., positive value indicating CL exceedance) denote potential vulnerability of the sensitive element of the environment (i.e., specific biological indicator) to atmospheric deposition. Thus, the CL Mapper Tool helps users better understand local and regional vulnerability to atmospheric pollution, and how pollution levels and ecosystem effects may have changed through time.

The main purpose of this document is to provide information about the deposition, CL, CL exceedance, and overlay datasets that are included in and can be downloaded from the CL Mapper Tool. It is divided into two main sections: Datasets Included in CL Mapper Tool and Downloadable Datasets.

Datasets Included in CL Mapper Tool

The CL Mapper Tool contains data from a variety of pre-existing deposition, CL, and overlay datasets. See **Table 1** for descriptions of these datasets, and refer to the individual dataset metadata for additional information regarding the derivation and development of the pre-existing data. All CL exceedance estimates and several other datasets are not directly from pre-existing datasets and were calculated for the Tool. See the Metadata sub-section for a description of these data.

Table 1. Datasets included in the CL Mapper Tool. NOTE, “CL MAPPER TOOL DATASET NAME” corresponds to the names of the datasets listed in Data Options within the CL Mapper Tool.

CL MAPPER TOOL DATASET NAME	SOURCE DATABASE NAME	DESCRIPTION	VERSION	YEAR PRODUCED	GIS PROJECTION (DATUM)	RESOLUTION	UNITS	DATE OF ACQUISITION (FOR TOOL)	SOURCE	METADATA
TDEP (2000-2018)	Total Deposition	TDEP consists of wet deposition measurements from the NADP National Trends Network (NTN) and estimates of dry deposition using a method that combines ambient air monitoring data with output from the Community Multiscale Air Quality (CMAQ) modeling system. TDEP 2013 and 2017 do not have complete coverage in Southern Texas due to absence of data at two monitoring sites.	v 2018.02	2019	GRS_1980_Albers (Datum GRS 1980)	4-km (4.134-km actual distance)	kg N ha ⁻¹ yr ⁻¹ and kg S ha ⁻¹ yr ⁻¹	01/2020	ftp://newftp.epa.gov/casinet/tdep/grids/	Total_Deposition_Documentation_current.pdf (re-formatted and downloaded as TDEP_metadata.pdf from CL Mapper Tool)
CMAQ (2002-2011)	Community Multiscale Air Quality (CMAQ) deposition	Annual wet (adjusted) and dry deposition for the continental U.S. based on Community Multiscale Air Quality (CMAQ) modeling system run using the bidirectional flux option.	October 2013_v2 using CMAQ v5.0.2 with bi-directional NH3 air-surface exchange	2013	User_Defined_Lambert_Conformal_Conic (User defined Datum)	12-km (14.352-km actual distance)	kg N ha ⁻¹ yr ⁻¹ and kg S ha ⁻¹ yr ⁻¹	2/3/2015	https://www.epa.gov/cmaq/cmaq-data#CMAQ-data-files	ftp://newftp.epa.gov/exposure/CMAQ/V5_0_2/deposition_shapefiles/conus
CMIP5	NS_Dep.gdb	Historical (1850-2000) wet and dry deposition based on RETRO (1960-2000) and EDGAR-HYDE (1890-1990) emissions and future deposition (2001-2100) according to Intergovernmental Panel on Climate Change (IPCC) AR5 Scenarios (RCP 4.5 and 8.5) using global Community Atmosphere Model (CAM) v. 3.5.	no version indicated; see manuscripts	2014	GCS_WGS_1984 (Datum WGS 1984)	200-km (0.12 decimal degrees)	kg N ha ⁻¹ yr ⁻¹ and kg S ha ⁻¹ yr ⁻¹	3/27/2014	dataset not available online; available on request from Jean-Francois Lamarque	Lamarque et al. (2010, 2011)
Aquatic Acidification CL	NCLD_SW_12 202016.gdb	Modelled CL of aquatic acidification to protect the biological integrity of stream reaches and lakes; CLs are from multiple studies.	US_CL_Data base_2015_v2.5 (but CLID lat/long and CLs averaged by LOCID)	2016	USA_Contiguous_Albers_Equal_Area_Conic_USGS_version (Datum NAD 83)	point	eq ha ⁻¹ yr ⁻¹	12/22/2016	dataset available on request from NADP-CLAD NCLD manager (Jason Lynch); v3.1 of dataset available on request from NADP-CLAD (http://nadp.slh.wisc.edu/committees/clad/db/)	NCLD_SW_GIS_Metadata_v2.5.pdf (re-formatted and downloaded as Critical_Loads_metadata.pdf from CL Mapper Tool)

CL MAPPER TOOL DATASET NAME	SOURCE DATABASE NAME	DESCRIPTION	VERSION	YEAR PRODUCED	GIS PROJECTION (DATUM)	RESOLUTION	UNITS	DATE OF ACQUISITION (FOR TOOL)	SOURCE	METADATA
Forest Acidification CL	NCLD_FE_McNulty_v3_NoTables.gdb	Modelled (Simple Mass Balance model) CL of forest acidification to protect forest ecosystems; CLs are from McNulty et al. (2007) updated in 2013.	US_CL_Data base_2017_v3.0	2017	USA_Contiguous_Albers_Equal_Area_Conic_USGS_version (Datum NAD 1983)	1-km	eq ha ⁻¹ yr ⁻¹	7/25/2017	dataset available on request from NADP-CLAD NCLD manager (Jason Lynch); v3.1 of dataset available on request from NADP-CLAD (http://nadp.slh.wisc.edu/committees/clad/db/)	NCLD_FS_GIS_Metadata_McNulty_v3.pdf (re-formatted and downloaded as Critical_Loads_metadata.pdf from CL Mapper Tool)
Forest Ecosystems CL	10-19-2016_Pardo.gdb	Empirical CL (from Pardo et al., 2010) based on studies evaluating relationships between deposition and water/soil chemistry and biological response; based on a limited number of studies extrapolated to Level I Ecoregion; min and max values based on the minimum and maximum values of a range of CLs, if available; CL values assigned to entire Ecoregion (i.e., not restricted to land-cover types).	US_CL_Data base_2015_v2.5 (note—dataset is same as that in US_CL_Data base_2017_v3.0, but with a different projection)	2016	Sphere_ARC_INF O_Lambert_Azimuthal_Equal_Area (Datum Sphere_ARC_INF O)	Varies; Ecoregion Level I polygon area	kg N ha ⁻¹ yr ⁻¹	10/19/2016	dataset available on request from NADP-CLAD NCLD manager (Jason Lynch); v3.1 of dataset available on request from NADP-CLAD (http://nadp.slh.wisc.edu/committees/clad/db/)	NCLD_EMP_Metadata_Pardo_v2.5.pdf (re-formatted and downloaded as Critical_Loads_metadata.pdf from CL Mapper Tool)
Herbaceous Plants and Shrubs CL	10-19-2016_Pardo.gdb	Empirical CL (from Pardo et al., 2010) based on studies evaluating relationships between deposition and water/soil chemistry and biological response; based on a limited number of studies extrapolated to Level I Ecoregion; min and max values based on the minimum and maximum values of a range of CLs, if available; CL values assigned to entire Ecoregion (i.e., not restricted to land-cover types).	US_CL_Data base_2015_v2.5 (note—dataset is same as that in US_CL_Data base_2017_v3.0, but with a different projection)	2016	Sphere_ARC_INF O_Lambert_Azimuthal_Equal_Area (Datum Sphere_ARC_INF O)	Varies; Ecoregion Level I polygon area	kg N ha ⁻¹ yr ⁻¹	10/19/2016	dataset available on request from NADP-CLAD NCLD manager (Jason Lynch); v3.1 of dataset available on request from NADP-CLAD (http://nadp.slh.wisc.edu/committees/clad/db/)	NCLD_EMP_Metadata_Pardo_v2.5.pdf (re-formatted and downloaded as Critical_Loads_metadata.pdf from CL Mapper Tool)

CL MAPPER TOOL DATASET NAME	SOURCE DATABASE NAME	DESCRIPTION	VERSION	YEAR PRODUCED	GIS PROJECTION (DATUM)	RESOLUTION	UNITS	DATE OF ACQUISITION (FOR TOOL)	SOURCE	METADATA
Mycorrhizal fungi CL	10-19-2016_Pardo.gdb	Empirical CL (from Pardo et al., 2010) based on studies evaluating relationships between deposition and water/soil chemistry and biological response; based on a limited number of studies extrapolated to Level I Ecoregion; min and max values based on the minimum and maximum values of a range of CLs, if available; CL values assigned to entire Ecoregion (i.e., not restricted to land-cover types).	US_CL_Data base_2015_v2.5 (note—dataset is same as that in US_CL_Data base_2017_v3.0, but with a different projection)	2016	Sphere_ARC_INF O_Lambert_Azimuthal_Equal_Area (Datum Sphere_ARC_INF O)	Varies; Ecoregion Level I polygon area	kg N ha ⁻¹ yr ⁻¹	10/19/2016	dataset available on request from NADP-CLAD NCLD manager (Jason Lynch); v3.1 of dataset available on request from NADP-CLAD (http://nadp.slh.wisc.edu/committees/clad/db/)	NCLD_EMP_Metadata_Pardo_v2.5.pdf (re-formatted and downloaded as Critical_Loads_metadata.pdf from CL Mapper Tool)
Herbaceous Species Richness (plot) CL	NCLD_EMP_pts_Simkin_v3 in NCLD_EMP_GIS_Simkin_v3.gdb	Empirical CL (from Simkin et al., 2016) based on a meta-analysis of the relationships between herbaceous species richness and N deposition, soil pH, annual precipitation, and annual temperature. The CL value is based on no decrease in species richness. There are separate CLs for plant communities in open and closed canopy systems. This dataset consists of CLs at the plot level (i.e. the locations where the field measurements of plants and/or soil were made).	US_CL_Data base_2017_v3.0	2018	USA_Contiguous_Albers_Equal_Area_Conic_USGS_version (Datum NAD 83)	point	kg N ha ⁻¹ yr ⁻¹	3/15/2018	dataset available on request from NADP-CLAD NCLD manager (Jason Lynch); v3.1 of dataset available on request from NADP-CLAD (http://nadp.slh.wisc.edu/committees/clad/db/)	NCLD_EMP_Metadata_Simkin_v3.pdf (re-formatted and downloaded as Critical_Loads_metadata.pdf from CL Mapper Tool)
Herbaceous Species Richness (Ecoregion) CL	NCLD_EMP_Eco3_Simkin_v3.1 and NCLD_EMP_Eco4_Simkin_v3.1 in NCLD_EMP_GIS_Simkin_v3.1.gdb	Empirical CL (from Simkin et al., 2016) based on a meta-analysis of the relationships between herbaceous species richness and N deposition, soil pH, annual precipitation, and annual temperature. The CL value is based on no decrease in species richness. There are separate CLs for plant communities in open and closed canopy systems. This dataset consists of CLs summarized at Ecoregion Level III or IV. The CL values are the 5 th percentile of all plot-level CLs that occur within the specified Ecoregion.	US_CL_Data base_2019_v3.1	2019	USA_Contiguous_Albers_Equal_Area_Conic_USGS_version (Datum NAD 83)	Varies; Ecoregion Level III or IV polygon area	kg N ha ⁻¹ yr ⁻¹	9/21/18	dataset available on request from NADP-CLAD (http://nadp.slh.wisc.edu/committees/clad/db/)	NCLD_EMP_Metadata_Simkin_v3.1.pdf (re-formatted and downloaded as Critical_Loads_metadata.pdf from CL Mapper Tool)
Not a dataset in CL Mapper Tool; used to produce Land-Cover Mask	National Land Cover Dataset (NLCD)	National Land Cover Database (NLCD) 2011 is national land cover produced by the Multi-Resolution Land Characteristics (MRLC) Consortium. NLCD 2011 uses a 16-class land cover classification scheme (same as earlier versions) applied across the U.S. States at a spatial resolution of 30 m. NLCD 2011 is based primarily on a	version 4	2011	USA_Contiguous_Albers_Equal_Area_Conic_USGS_version (Datum NAD 83)	30 m	NA	7/9/2014	https://www.mrlc.gov/nlcd11_data.php	https://www.mrlc.gov/nlcd2011.php

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		<p>classification of Landsat satellite data.</p> <p>The NLCD was used (with Streams and Water Bodies of the United States – see below) to produce four Land-Cover Mask datasets; ContUSmask1, ContUSmask2.338, ContUSmask2.338hsreroc, and ContUSmask2.338hsrercc. These masks were applied to the appropriate terrestrial CLs to remove 2.338-km cells with land covers that are not suitable for/applicable to terrestrial CLs and shouldn't have CL values.</p> <p>ContUSmask1 was applied to Forest Acidification CLs, and ContUSmask2.338 was applied to Empirical CLs for Forest Ecosystems, Herbaceous Plants and Shrubs, and Mycorrhizal Fungi. ContUSmask2.338hsreroc and ContUSmaskhsrercc were applied to Empirical CLs for Herbaceous Species Richness – Open Canopy (Ecoregion) and Herbaceous Species Richness – Closed Canopy (Ecoregion), respectively.</p> <p>The NLCD land covers included in all four Land-Cover Masks are:</p> <ul style="list-style-type: none"> 11 – Water 12 – Perennial Ice/Snow 21 – Developed, open space 22 – Developed, Low Intensity 23 – Developed, Medium Intensity 24 – Developed, High Intensity 31 – Barren Land 81 – Pasture/Hay 82 – Cultivated Crops <p>Additional land covers included in the ContUSmask2.338hsreroc mask include $\leq 5\%$ of the 2.338-km cell area as:</p> <ul style="list-style-type: none"> 52 – Shrub/Scrub 71 – Grassland/Herbaceous 								

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		Additional land covers included in the ContUSmask2.338hsrerc mask include ≤5% of the 2.338-km cell area as: 41 – Deciduous Forest 42 – Evergreen Forest 43 – Mixed Forest								
Not a dataset in CL Mapper Tool; used to produce Land-Cover Mask	Streams and Waterbodies of the United States	This map layer shows areal and linear water features of the United States, Puerto Rico, and the U.S. Virgin Islands. The original file was produced by joining the individual State hydrography layers from the 1:2,000,000-scale Digital Line Graph (DLG) data produced by the USGS. This map layer was formerly distributed as Hydrography Features of the United States. The Streams and Waterbodies of the United States dataset was used (with NLCD – see above) to produce the four Land-Cover Masks. Waterbodies included in the Mask are: 1 – Lake 2 – Lake intermittent 3 – Reservoir 4 – Reservoir intermittent 5 – Streams	no version indicated	2003	USA_Contiguous_Albers_Equal_Area_Conic_USGS_version (Datum NAD 83)	NA	NA	2/13/2017	http://pubs.usgs.gov/of/2003/of03-001/data/basemaps/usa/water/hydroply.zip	Waterbodies_LC_mask_metadata.txt
Level 1-3 Ecoregion	EPA Ecoregions of North America	Geographical classification system that groups similar ecosystems; ecoregions denote areas of similarity in the mosaic of biotic, abiotic, terrestrial, and aquatic ecosystem components with humans being considered as part of the biota. Environmental Protection Agency (EPA) Ecoregion framework is derived from Omernik (1987) and consists of four levels, with three being included in the CL Mapper Tool: Level I (15 Ecoregions), Level II (50 Ecoregions), and Level III (182 Ecoregions).	no version indicated; website last updated on 11/12/16	2010	Lambert Azimuthal Equal Area (Arc Info Sphere)	NA	NA	2/6/2015	https://www.epa.gov/eco-research/ecoregions-north-america	ftp://newftp.epa.gov/EPADataCommons/ORD/Ecoregions/cec_na/metadata.htm

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Federal Administrative Areas - NPS	Administrative Boundaries of National Park System Units	National Park Service (NPS) unit boundaries.	no version indicated; title of dataset dated 09/30/17	2017	Geographic NAD83 (GRS80)	NA	NA	8/9/2016	https://irma.nps.gov/DataStore/Reference/Profile/2224545?Inv=True	no metadata provided
Federal Administrative Areas - USFS	Administrative Forest Boundaries	This dataset describes lands administered by the U.S. Forest Service (USFS).	no version indicated; publication date of 10/23/2017	2017	Geographic NAD83 (GRS80)	NA	NA	8/9/2016	https://data.fs.usda.gov/geodata/edw/datasets.php	http://data.fs.usda.gov/geodata/edw/edw_resources/meta/S_USA.Administrative.Forest.xml
Federal Administrative Areas - FWS	FWS Interest Simplified	This dataset describes lands administered by the U.S. Fish and Wildlife Service (FWS).	no version indicated; publication date of 08/21/2017	2017	Geographic NAD83 (GRS80)	NA	NA	8/9/2016	https://catalog.data.gov/dataset/fws-interest-simplified22a41	https://catalog.data.gov/harvest/object/0ec72113-a555-411a-b42c-88f7dca2c4de/html/original
Class I Areas - NPS, USFS, FWS, BIA	Class1_FederalAreas.gdb	This dataset describes Mandatory Class 1 Federal Area polygons and Mandatory Class 1 Federal Area labels in the U.S. It was developed by EPA's Office of Air Quality Planning and Standards (OAQPS) based on features originating from several data sources, including EPA, USFS, FWS, NPS and Bureau of Indian Affairs (BIA).	no version indicated; publication date of 09/22/2015	2015	North America Albers Equal Area Conic, datum of NAD83(GRS80)	NA	NA	8/9/2016	https://edg.epa.gov/data/public/OAR/OAQPS/Class1/Class1Areas.zip	https://catalog.data.gov/harvest/object/60a3c5eb-0670-40fa-a723-1a2dee836004/html/original
Wilderness Areas - NPS	Wilderness/Wilderness Feature Service	This data layer describes areas that have been designated as a National Wilderness in the National Wilderness Preservation System and administered by the National Park Service (NPS).	unknown	Unknown	Geographic WGS84, datum of WGS84	NA	NA	8/9/2016	https://mapservices.nps.gov/arcgis/rest/services/Wilderness	https://irma.nps.gov/DataStore/Reference/Profile/2223517
Wilderness Areas - USFS	National Wilderness Areas	This data layer describes areas that have been designated as a National Wilderness in the National Wilderness Preservation System and administered by the US Forest Service (USFS).	no version indicated; publication date of 10/23/2017	2017	Geographic NAD83 (GRS80)	NA	NA	6/6/2016	https://data.fs.usda.gov/geodata/edw/datasets.php	http://data.fs.usda.gov/geodata/edw/edw_resources/meta/S_USA.Wilderness.xml

CL MAPPER TOOL DATASET NAME	SOURCE DATABASE NAME	DESCRIPTION	VERSION	YEAR PRODUCED	GIS PROJECTION (DATUM)	RESOLUTION	UNITS	DATE OF ACQUISITION (FOR TOOL)	SOURCE	METADATA
Wilderness Areas - FWS	Special Designation	This data layer describes areas that have been designated as a National Wilderness in the National Wilderness Preservation System and administered by the U.S. Fish and Wildlife Service (FWS).	no version indicated; publication date of 08/15/2017	2017	Geographic NAD83 (GRS80)	NA	NA	8/9/2016	https://catalog.data.gov/dataset?q=Realty&sort=none&metadata_type=geospatial&organization=fws-gov&ext_location=&ext_bbox=&ext_prev_extent=-142.03125%2C8.754794702435605%2C-59.0625%2C61.77312286453148	https://catalog.data.gov/harvest/object/8dc8eb0e-418c-455b-ae72-18af137b05bf/html/original
Conterminous U.S. – 1-km, 2.338-km, with and without land-cover masks	USA_adm0.shp	Administrative boundary for the U.S. at the country level (GADM level= 0). All of the continental U.S. is included in this dataset except for sections of the southern-most extension of the Florida keys.	no version indicated; publication date of 11/04/2015	2015	Geographic WGS84, datum of WGS84	NA	NA	2/2/2018	http://gadm.org/country	no metadata provided

Downloadable Datasets

This section describes the datasets that can be downloaded from the CL Mapper Tool. These datasets are the versions of the data that are displayed in the Tool and used in the CL exceedance calculations and statistics presented in the Summary Tables for selected land units (Class 1 Areas, Wilderness Areas, and Federal Administrative Areas)¹. These datasets consist of pre-existing data (described in the preceding section) and datasets calculated for the Tool. The following sub-sections describe how the original, source datasets were reformatted and used to produce the CL Mapper Tool datasets (Metadata) and provide an inventory of the downloadable datasets (Datasets).

Metadata

All data included in the CL Mapper Tool were standardized to a common format, units, and number of years. Due to the different resolutions, datums, and projections of the pre-existing datasets used in the CL Mapper Tool, all data were converted from their source parameters to a common 2.338-km (or 1-km for Forest Acidification CLs² and Conterminous U.S. – 1-km) grid cell using the nearest neighbor ArcGIS function and the same projection and datum as National Atmospheric Deposition Program deposition datasets (**Table 2**). NADP deposition were include in previous versions of the CL Mapper Tool. Through this dataset standardization, most of the data were converted to raster file format and are downloadable as geoTIFF files. The only two datasets maintained as point layers within geodatabases were the Aquatic Acidification CLs and the Empirical CLs for Herbaceous Species Richness (plot) (and their associated CL exceedance datasets). The only six datasets maintained as shapefiles were: Class I Areas, Federal Administrative Areas, Ecoregions Level 1, Ecoregions Level 2, Ecoregions Level 3, and Wilderness Areas. However, similar to the raster format files, the shapefiles and spatial data layers within the geodatabases were converted to the same standard NADP projection. All deposition, Empirical CLs (Forest Ecosystems, Herbaceous Plants and Shrubs, Mycorrhizal Fungi, and Herbaceous Species Richness), and Empirical CL Exceedance datasets were also prepared in two formats, $\text{kg ha}^{-1} \text{yr}^{-1}$ and $\text{eq ha}^{-1} \text{yr}^{-1}$, according to the conversions outlined in **Table 3**. Forest and Aquatic Acidification CLs and associated CL Exceedances were only prepared in $\text{eq ha}^{-1} \text{yr}^{-1}$ due to the CLs being associated with N, S, or N+S deposition (N and S have different atomic masses). Deposition and CL exceedance datasets were prepared as 3-Year (TDEP and CMAQ) or 10-Year (CMIP5) Average datasets (labelled for the end

¹ This statement applies to all the datasets except the following:

- The spatial extent of the displayed and downloadable versions of Forest Acidification CL and Empirical CLs for Forest Ecosystems, Herbaceous Plants and Shrubs, and Mycorrhizal Fungi CLs are not identical due to an early error in the development of the Tool. The data displayed in the Tool have greater coverage than the downloadable datasets. However, the downloadable data are the recommended version for use; the spatial extents are correct, and the downloadable data are internally consistent with other datasets in the Tool.
- Empirical CLs for Herbaceous Species Richness (plot), which consists of two versions. One version of the dataset contains “fuzzed” latitude/longitude coordinates (due to confidentiality agreements); this dataset is displayed and downloadable from the Tool. The second version of the dataset has “non-fuzzed” coordinates. This dataset is not publicly available, but in the interest of maximizing accuracy, is used in the calculations and summary statistics presented in the Summary Tables for selected land units (Class 1 Areas, Wilderness Areas, and Federal Administrative Areas).

² The 1-km resolution of the original source Forest Acidification CL dataset was maintained.

year of the 3- or 10-year period) to minimize the influence of inter-annual variation on the deposition and exceedance estimates. The TDEP and CMAQ 3-Year Averages were calculated for all years with 3-years of data (i.e., 2002-2018 for TDEP and 2004-2011 for CMAQ). The CMIP5 10-Year Averages were calculated for each decade (i.e., 1860, 1870, 1800, ..., 2000 for CMIP5hist and 2010, 2020, 2030, ..., 2100 for CMIP5rcp45 and CMIP5rcp85).

Table 2. Standardized, common projection used for all data in the CL Mapper Tool.

USA_Contiguous_Albers_Equal_Area_Conic_USGS_version	
Projection: Albers	Geographic Coordinate System: GCS_North_American_1983
False_Easting: 0.00000000	Datum: D_North_American_1983
False_Northing: 0.00000000	Prime Meridian: Greenwich (0.0)
Central_Meridian: -96.00000000	Angular Unit: Degree (0.0174532925199433)
Standard_Parallel_1: 29.50000000	Spheroid: GRS_1980
Standard_Parallel_2: 45.50000000	Semimajor Axis: 6378137.0
Latitude_of_Origin: 23.00000000	Inverse Flattening: 298.257222101
Linear_Unit: Meter (1.0)	

Table 3. Unit conversions used in CL Mapper Tool.

ELEMENT/ MOLECULE	MOLAR / MOLECULAR MASS	MULTIPLIER TO CONVERT FROM MOLECULE TO KG N OR S	MULTIPLIER TO CONVERT FROM KG N OR S TO EQ	MULTIPLIER TO CONVERT FROM MOLECULE TO EQ
N	14.01	N/A	71.38	N/A
S	32.07	N/A	62.36	N/A
NO ₃ ⁻	62.01	0.2259	71.38	16.12
NH ₄ ⁺	18.04	0.7766	71.38	55.43
SO ₄ ²⁻	96.07	0.3338	62.36	20.82

Some of the CL Mapper Tool datasets required additional formatting (i.e., in addition to converting to a common projection, datum, units, and number of years), and some unique datasets were produced for the Tool. **Table 4** describes the additional formatting that was conducted on the pre-existing source datasets to produce the CL Mapper Tool data. Unique datasets and the methods used to create these datasets are described further below.

Table 4. Additional formatting and calculations applied to pre-existing datasets included in the CL Mapper Tool.

CL MAPPER TOOL DATASET NAME	SOURCE DATABASE NAME	DESCRIPTION
TDEP (2000-2018)	Total Deposition	<ul style="list-style-type: none"> TDEP coverage is incomplete along the U.S. – Canada border and U.S. coastline. Therefore, in locations without TDEP estimates, TDEP deposition was estimated/extrapolated using the nearest neighbor value to extend coverage to match the spatial extent of the CMAQ deposition dataset (and cover the continental U.S. and all CL values). However, extrapolation was not applied to areas missing TDEP 2013 and 2017 estimates in southern Texas. In addition, similar to the USA_adm0.shp used to define the spatial extent of the continental U.S. (see Table 1), the TDEP dataset in the CL Mapper Tool does not cover sections of the southern-most extensions of the Florida keys.
CMAQ (2002-2011)	CONUS BiDi-CAFO CMAQ (CMAQAnnualDep_adjusted)	<ul style="list-style-type: none"> No additional changes were made to CMAQ datasets. However, similar to the USA_adm0.shp used to define the spatial extent of the continental U.S. (see Table 1), the CMAQ datasets in the CL Mapper Tool does not cover sections of the southern-most extensions of the Florida keys.
CMIP5	NS_Dep.gdb	<ul style="list-style-type: none"> No additional changes were made to CMIP5 datasets. However, similar to the USA_adm0.shp used to define the spatial extent of the continental U.S. (see Table 1), the CMIP5 datasets in the CL Mapper Tool does not cover sections of the southern-most extensions of the Florida keys.
Aquatic Acidification CL	NCLD_SW_12202016.gdb	<ul style="list-style-type: none"> Nothing was done to the Aquatic Acidification CL dataset; used source data "as is".
Forest Acidification CL	NCLD_FE_McNulty_v3_NoTables.gdb	<ul style="list-style-type: none"> Applied Land-Cover Mask (ContUSmask1) to remove 1.0-km cells with land covers not suitable for/applicable to Forest Acidification CLs.
Forest Ecosystems CL	10-19-2016_Pardo.gdb	<ul style="list-style-type: none"> Calculated "mid" CL value by taking the average of minimum and maximum CL values. Applied Land-Cover Mask (ContUSmask2.338) to remove 2.338-km cells with land covers not suitable for/applicable to Empirical CLs for Forest Ecosystems, Herbaceous Plants and Shrubs, and Mycorrhizal Fungi.

CL MAPPER TOOL DATASET NAME	SOURCE DATABASE NAME	DESCRIPTION
Herbaceous Plants and Shrubs CL	10-19-2016_Pardo.gdb	<ul style="list-style-type: none"> • Calculated "mid" CL value by taking the average of minimum and maximum CL values. • Applied Land-Cover Mask (ContUSmask2.338) to remove 2.338-km cells with land covers not suitable for/applicable to Empirical CLs for Forest Ecosystems, Herbaceous Plants and Shrubs, and Mycorrhizal Fungi.
Mycorrhizal fungi CL	10-19-2016_Pardo.gdb	<ul style="list-style-type: none"> • Calculated "mid" CL value by taking the average of minimum and maximum CL values. • Applied Land-Cover Mask (ContUSmask2.338) to remove 2.338-km cells with land covers not suitable for/applicable to Empirical CLs for Forest Ecosystems, Herbaceous Plants and Shrubs, and Mycorrhizal Fungi.
Herbaceous Species Richness (plot) CL	NCLD_EMP_pts_Simkin_v3 in NCLD_EMP_GIS_Simkin_v3.gdb	<ul style="list-style-type: none"> • Nothing was done to the Empirical CLs for Herbaceous Species Richness (plot) dataset; used source data "as is".
Herbaceous Species Richness (Ecoregion) CL	NCLD_EMP_Eco3_Simkin_v3.1 and NCLD_EMP_Eco4_Simkin_v3.1 in NCLD_EMP_GIS_Simkin_v3.1.gdb	<ul style="list-style-type: none"> • Applied Land-Cover Masks (ContUSmask2.338hsrerc and ContUSmask2.338hsrerc) to remove 2.338-km cells with land covers not suitable for/applicable to Empirical CLs for Herbaceous Species Richness – Open Canopy (Ecoregion) and Herbaceous Species Richness – Closed Canopy (Ecoregion).
Level 1-3 Ecoregions	EPA Ecoregions of North America	<ul style="list-style-type: none"> • No additional changes were made to Ecoregion datasets.
Federal Administrative Areas – NPS	Administrative Boundaries of National Park System Units	<ul style="list-style-type: none"> • Combined with other Federal Administrative Areas datasets (i.e., USFS and FWS) to produce a single Federal Administrative Areas dataset.
Federal Administrative Areas – USFS	Administrative forest boundaries	<ul style="list-style-type: none"> • Combined with other Federal Administrative Areas datasets (i.e., NPS and FWS) to produce a single Federal Administrative Areas dataset.
Federal Administrative Areas – FWS	FWS Interest Simplified	<ul style="list-style-type: none"> • Combined with other Federal Administrative Areas datasets (i.e., NPS and USFS) to produce a single Federal Administrative Areas dataset.
Class I Areas - NPS, USFS, FWS, BIA	Class1_FederalAreas.gdb	<ul style="list-style-type: none"> • No additional changes were made to Class I Areas datasets.
Wilderness Areas – NPS	Wilderness/Wilderness Feature Service	<ul style="list-style-type: none"> • Combined with other Wilderness Areas datasets (i.e., USFS and FWS) to produce a single National Wilderness Areas dataset.
Wilderness Areas – USFS	National Wilderness Areas	<ul style="list-style-type: none"> • Combined with other Wilderness Areas datasets (i.e., NPS and FWS) to produce a single National Wilderness Areas dataset.

CL MAPPER TOOL DATASET NAME	SOURCE DATABASE NAME	DESCRIPTION
Wilderness Areas - FWS	Special Designation	<ul style="list-style-type: none"> Combined with other Wilderness Areas datasets (i.e., USFS and NPS) to produce a single National Wilderness Areas dataset.
Conterminous U.S. - 1-km and 2.338-km	USA_adm0.shp	<ul style="list-style-type: none"> Removed 1.0-km or 2.338-km cells with land cover not suitable to terrestrial CLs to create four Land-Cover Mask datasets: ContUSmask1, ContUSmask2338, ContUSmask2.338hsreroc, and ContUSmask2.338hsrercc (see Table 9).

Proportion of wet N deposition, proportion of oxidized N deposition, CL exceedances, and Land-Cover Masks are the data that were created for the CL Mapper Tool.

Proportion of wet N deposition was calculated by first dividing wet N deposition by wet+dry N deposition for each year, followed by averaging to produce 3-Year Average estimates. Proportion of oxidized N deposition was calculated by dividing oxidized N deposition by oxidized+reduced N deposition to produce 3-Year Average estimates. Proportions of wet and oxidized N were only determined for TDEP and CMAQ.

Critical load exceedance (Ex) is calculated by subtracting the CL from deposition (D) (i.e., $Ex = D - CL$). It represents a condition where N and/or S deposition (D) equals or exceeds the CL, and the sensitive element of the environment is anticipated to be negatively impacted, according to current knowledge (Nilsson and Grennfelt, 1988). Nitrogen deposition is used to determine exceedances of the Empirical CLs for Forest Ecosystems, Herbaceous Plants and Shrubs, Mycorrhizal Fungi, and Herbaceous Species Richness. Nitrogen and/or S deposition can be used to determine the exceedance of Forest and Aquatic Acidification CLs (i.e., $Ex = N \text{ deposition} - CL_{maxN}$; $Ex = N+S \text{ deposition} - CL_{maxN}$; or $Ex = S \text{ deposition} - CL_{maxS}$). However, in situations where N deposition is less than the combined amount of N immobilized in the soil, denitrified, and taken up by trees in managed forest ecosystems (i.e., $N \text{ deposition} < CL_{minN}$), only S deposition can result in an exceedance (i.e., $Ex = S \text{ deposition} - CL_{maxS}$).

Within the CL Mapper Tool, CL exceedances were calculated for all possible CL–deposition dataset combinations using 3-Year (TDEP and CMAQ) or 10-Year (CMIP5) Average deposition estimates. All exceedances, except Forest Acidification, were calculated using the re-projected 2.338-km CL and deposition datasets; Forest Acidification CL exceedances were calculated using the datasets at 1-km grid cell resolution.

The four Land-Cover Mask datasets (ContUSmask1, ContUSmask2.338, ContUSmask2.338hsreroc, and ContUSmask2.338hsrercc) were created to remove area with land covers not suitable for/applicable to terrestrial CLs. These mask datasets were prepared using the Conterminous U.S. (1.0-km and 2.338-km) raster files and non-suitable land covers identified by the 2011 National Land-Cover (NLCD) and Streams and Waterbodies of the U.S. databases. Refer to Table 1 for a listing of the specific land cover and water body classes/features from each dataset that are included in the Masks. All four Land-Cover Mask datasets were produced by aggregating 30-m cells from the NLCD dataset into the Conterminous U.S. 1-

km and 2.338-km grid cells; resultant grid cells with greater than 50% non-suitable land cover were classified as "mask" cells. Grid cells (1-km and 2.338-km) were also classified as "mask" if their centroids intersected a water body in the Streams and Waterbodies of the U.S. data layer. These two sets of "masks" were combined spatially to produce the ContUSmask1 and ContUSmask2.338 Land-Cover Mask datasets³. ContUSmask2.338hsreroc and ContUSmask2.338hsrercc masks were created by adding additional land-cover restrictions to ContUSmask2.338; ContUSmask2.338hsreroc also masks 2.338-km cells with $\leq 5\%$ of cell area classified as shrub/scrub or grassland/herbaceous, and ContUSmask2.338hsrercc masks 2.338-km cells with $\leq 5\%$ of cell area classified as deciduous forest, evergreen forest, or mixed forest⁴. The ContUSmask1 data layer was applied to the Forest Acidification CL dataset to "mask" land covers not applicable to the CLs, and is used to calculate *Total Land Area (ha)* for Forest Acidification CLs in the Summary Tables generated for U.S. Class I, Federal Administrative, and Wilderness Area land units displayed in the CL Mapper Tool. The ContUSmask2.338 data layer was applied to the Empirical CLs for Forest Ecosystems, Herbaceous Plants and Shrubs, and Mycorrhizal Fungi to "mask" land covers not suitable for the CLs, and is used to estimate *Total Land Area (ha)* for the three CLs in the Summary Tables. The ContUSmask2.338hsreroc and ContUSmask2.338hsrercc data layers were applied to the Empirical CLs for Herbaceous Species Richness – Open Canopy (Ecoregion) and Herbaceous Species Richness – Closed Canopy (Ecoregion), respectively, to remove land covers not applicable to the CLs, and are used to estimate *Total Land Area (ha)* for the two CLs in the Summary Tables. No Land-Cover Masks were applied to the Empirical CLs for Herbaceous Species Richness (plot); these data were already assigned to the correct land covers. Although not displayed as maps within the CL Mapper Tool, the four Land-Cover Mask datasets can be downloaded from the CL Mapper Tool.

Datasets

The CL Mapper Tool datasets are downloadable in GeoTIFF, geodatabase, or shapefile format. All deposition and most terrestrial CL and associated CL exceedance datasets are single files in raster format (GeoTIFF files)⁵. Aquatic Acidification CLs, Empirical CLs for Herbaceous Species Richness (plot), and associated CL exceedance datasets are downloadable as geodatabases. The overlays are raster

³ There are minor differences between the "non-suitable land cover" masks applied the Empirical CL for Herbaceous Species Richness (Ecoregion) and the Empirical CLs for Forest Ecosystems, Herbaceous Plants and Shrubs, and Mycorrhizal Fungi due to differences in the processing of land cover classifications. However, this difference accounts for $< 5\%$ change in masked vs. non-masked designation of 2.338-km grid cells and is not expected to impact the range and extent of critical load and exceedance values in federal land units.

⁴ As creation of the ContUSmask2.338hsreroc and ContUSmask2.338hsrercc masks involved including additional land cover restrictions to the pre-existing ContUSmask2.338 mask, cells that have $>50\%$ of land cover as non-suitable covers (see Table 1) but $\geq 5\%$ of cover as open (shrub/scrub or grassland/herbaceous) or closed (deciduous forest, evergreen forest, or mixed forest) canopy covers, will not have a CL value. However, this situation typically occurs in locations where the landscape has been modified by human activity (e.g., agriculture or urban areas), and it is not anticipated to create a problem with the representation of the Herbaceous Species Richness CLs (Ecoregion).

⁵ Although Forest Acidification CL exceedances were calculated using 1-km deposition and CL datasets, and are downloadable in the 1-km grid cell resolution, the 3-Year and 10-Year Average deposition data used to calculate the exceedances are only downloadable as 2.338-km datasets.

(GeoTIFF) files or shapefiles. This sub-section describes the standardized convention used to name each of these downloadable datasets.

All the downloadable deposition, CL, and exceedance datasets in raster format adhere to the following standardized naming convention that describes the content of each dataset:

Label 1: Data_#Year_CL_Deposition_Variable_Unit_Year

where,

'Data' corresponds to the data type (deposition, CL, or CL exceedance); '#Years' indicates 3- or 10-year average; 'CL' is the CL type (ta, aa, hsrpt, etc.); 'Deposition' is the deposition dataset (cmaq, tdep, CMIP5hist, etc.); 'Variable' is additional information for the CL type (CLmaxN, CLminN, or CLmaxS) or the form of deposition (totalN, totals, totalns); 'Unit' refers to the unit of the data ($\text{eq ha}^{-1} \text{yr}^{-1}$ or $\text{kg ha}^{-1} \text{yr}^{-1}$); and 'Year' is the end year of the 3- or 10-year range of data/measurement years (e.g., 2010 deposition corresponds to 2008-2010 (for CMAQ and TDEP) and 2001-2010 (for CMIP5) average deposition; 2010 CL exceedance corresponds to the exceedance of a CL by 2008-2010 (for CMAQ or TDEP) and 2001-2010 (for CMIP5) average deposition). Note, not all elements are included in each name. For example, '#Year', 'Deposition', and 'Year' are not included in the CL dataset names because the CLs are steady-state (i.e., don't change over time), not affiliated with a specific year, and are not deposition data. Similarly, 'CL' is not included in the deposition dataset names because CLs are not deposition data.

Table 5 details the components of the naming convention and can be used to determine the content of each downloadable dataset. Below are examples of the naming convention for deposition, CL, and exceedance raster (GeoTIFF) files.

- **Dep_3yr_cmaq_totaln_eq_2006**, is 2004-2006 3-year average CMAQ total N deposition in $\text{eq ha}^{-1} \text{yr}^{-1}$
- **CL_NCLD_ta_CLmaxN_eq**, is Forest Acidification CLmaxN (CL of N+S or N deposition) in $\text{eq ha}^{-1} \text{yr}^{-1}$
- **CL_NCLD_hpsmid_totaln_kg**, is Empirical CLs for Herbaceous Plants and Shrubs (mid-point value) in $\text{kg ha}^{-1} \text{yr}^{-1}$
- **Ex_10yr_ta_cmip5hist_totaln_eq_2000**, is Forest Acidification CL exceedance by 1991-2000 10-year average CMIP5 historical total N deposition in $\text{eq ha}^{-1} \text{yr}^{-1}$

Table 5. Naming convention of datasets downloadable from the CL Mapper Tool.

DATA		#YEAR		CL		DEPOSITION		VARIABLE		UNIT		YEAR	
Label	Description	Label	Description	Label	Description	Label	Description	Label	Description	Label	Description	Label	Description
Dep	Deposition	3yr	3-year average value	ta	Forest Acidification CL	cmaq	Deposition dataset	oxredn	Proportion of oxidized N deposition (i.e., oxidized N/total N). Not available as 10yr datasets.	kg	unit of data in kg ha ⁻¹ yr ⁻¹	1850-2100	Measurement / estimation year of data (labelled as end year of 3- or 10-year average period)
CL_NCLD	Critical load	10yr	10-year average value	aa	Aquatic Acidification CL	tdep	Deposition dataset	wetdryn	Proportion of wet N deposition (i.e., wet N/total N). Not available as 10yr datasets.	eq	unit of data in eq ha ⁻¹ yr ⁻¹		
Ex	Critical load exceedance			formin	Empirical CL for Forest Ecosystems (minimum CL value)	cmip5hist	Deposition dataset	totaln	Total N deposition	pp	proportion of total N		
				formid	Empirical CL for Forest Ecosystems (mid-point CL value)	cmip5rcp45	Deposition dataset	totals	Total S deposition				
				hpsmin	Empirical CL for Herbaceous Plants and Shrubs (minimum CL value)	cmip5rcp85	Deposition dataset	totalns	Total N + S deposition				
				hpsmid	Empirical CL for Herbaceous Plants and Shrubs (mid-point CL value)			CLmaxN	CL of N or N+S deposition (for forest or aquatic acidification CLs)				
				mfmin	Empirical CL for Mycorrhizal Fungi (minimum CL value)			CLminN	Minimum CL of N deposition (for forest or aquatic acidification CLs)				
				mfmid	Empirical CL for Mycorrhizal Fungi (mid-point CL value)			CLmaxS	CL of S deposition (for forest or aquatic acidification CLs)				
				hsrpt	Empirical CL for Herbaceous Species Richness (plot)								
				hsreroc	Empirical CL for Herbaceous Species Richness – Open Canopy (Ecoregion)								
				hsrercc	Empirical CL for Herbaceous Species Richness – Closed Canopy (Ecoregion)								

The geodatabase datasets adhere to the same naming convention as the shapefile and raster (GeoTIFF) format datasets, with only relevant elements of this convention being applied to the geodatabase names and the spatial data layers within each geodatabase (Label 1; Table 5). For example, the CL exceedance geodatabases do not contain ‘Year’ in their titles because all exceedance years (for the specified deposition dataset) are included as fields in the spatial data layer in the geodatabases. Below are examples of the naming convention for CL and CL exceedance geodatabases.

- **CL_NCLD_hsrpt** is Empirical CLs for Herbaceous Species Richness (plot). This geodatabase contains a spatial data layer for the CL, with separate fields for eq ha⁻¹ yr⁻¹ and kg ha⁻¹ yr⁻¹.
- **Ex_3yr_aa_cmaq** is Aquatic Acidification CL exceedance by 3-year CMAQ deposition. This geodatabase contains a spatial data layer with a field for each deposition variable, unit, and year (e.g., totaln_eq_2002).
- **Ex_10yr_aa_cmip5rcp45** is Aquatic Acidification CL exceedance by 10-year average CMIP5 RCP 4.5 deposition. This geodatabase contains a spatial data layer with a field for each deposition variable, unit, and year (e.g., totaln_eq_2010).

The geodatabases for Aquatic Acidification CLs and Empirical CLs for Herbaceous Species Richness (plot) are CL_NCLD_aa.gdb and CL_NCLD_hsrpt.gdb, respectively, and the spatial data layers within each geodatabase have the same titles. See **Tables 6** and **7** for descriptions of the fields in each spatial data layer.

Table 6. Aquatic Acidification CLs spatial data layer fields.

FIELD	DESCRIPTION
OBJECTID	
SHAPE	
LOID_u	Unique (!) identifier. Location ID for a waterbody. LOID_u is the same as LOCID in the NADP CLAD NCLD.
Lat_LOID	Average latitude for each LOID (decimal degrees).
Lon_LOID	Averaged longitude for each LOID (decimal degrees).
nANCcrit	Average ANC leaching term for the SSWC model for each waterbody associated with a LOID_u.
CLmaxS	Average CL of S deposition for each waterbody associated with a LOID_u (eq ha ⁻¹ yr ⁻¹)
CLminN	Average minimum CL of N deposition for each waterbody associated with a LOID_u. CLminN is equivalent to N immobilization + denitrification + uptake (by the forest in harvested systems) (eq ha ⁻¹ yr ⁻¹).
CLmaxN	Average CL of N+S or N deposition for each waterbody associated with a LOID_u. CLmaxN is calculated by adding average CLminN and average CLmaxS (eq ha ⁻¹ yr ⁻¹).
nANC50	Calculated value equal to CLmaxN (eq ha ⁻¹ yr ⁻¹).
CLmaxSpositive	Calculated value equal to CLmaxS (eq ha ⁻¹ yr ⁻¹).
CLunit	Critical load unit (eq ha ⁻¹ yr ⁻¹).

Table 7. Empirical CLs for Herbaceous Species Richness (plot) spatial data layer fields.

FIELD	DESCRIPTION
OBJECTID	
SHAPE	
CLID	Unique(!) identifier for the CL. CLID is the same as in the NADP CLAD NCLD.
LOCID	Unique(!) identifier. Location ID for the plot. LOCID is the same as in the NADP CLAD NCLD.
LatDD	Latitude for each LOCID (decimal degrees).
LongDD	Longitude for each LOCID (decimal degrees).
Canopy	closed or open canopy.
EcoRegionI	Ecoregion Code Level I.
EcoRegionII	Ecoregion Code Level II.
EcoRegionIII	Ecoregion Code Level III.
EcoRegionIV	Ecoregion Code Level IV.
EcoNameI	Ecoregion Name Level I.
EcoNameII	Ecoregion Name Level II.
EcoNameIII	Ecoregion Name Level III.
EcoNameIV	Ecoregion Name Level IV.
CLN_pt	Empirical CL of N for plot location ($\text{kg ha}^{-1} \text{yr}^{-1}$).
CLN_pt_CI2_5	The 2.5% confidence interval of the CL at the plot location ($\text{kg ha}^{-1} \text{yr}^{-1}$).
CLN_pt_CI97_5	The 97.5% confidence interval of the CL at the plot location ($\text{kg ha}^{-1} \text{yr}^{-1}$).
CLN_pt_eq	Empirical CL of N for plot location ($\text{eq ha}^{-1} \text{yr}^{-1}$).
CLN_pt_CI2_5_eq	The 2.5% confidence interval of the CL at the plot location ($\text{eq ha}^{-1} \text{yr}^{-1}$).
CLN_pt_CI97_5_eq	The 97.5% confidence interval of the CL at the plot location ($\text{eq ha}^{-1} \text{yr}^{-1}$).

The CL exceedances for the Aquatic Acidification CLs and Empirical CLs for Herbaceous Species Richness (plot) are also downloadable as geodatabases (**Table 8**). Each geodatabase contains a single spatial data layer file for the specified ‘#year’ – CL – deposition dataset combination. The fields within the spatial data layer file consist of the CL fields (Table 6 or 7) and all potential combinations of exceedance ‘year’ (as 3- or 10-year average) and N and/or S deposition. The CL and CL exceedances in the Aquatic Acidification data layers are reported in $\text{eq ha}^{-1} \text{yr}^{-1}$, and the CL and CL exceedances in the Empirical CLs for Herbaceous Species Richness (plot) data layers are reported in $\text{kg ha}^{-1} \text{yr}^{-1}$ and $\text{eq ha}^{-1} \text{yr}^{-1}$.

Table 8. CL exceedance geodatabases downloadable from the CL Mapper Tool.

GEODATABASE	DESCRIPTION
Ex_3yr_aa_cmaq	Aquatic Acidification CL exceedance by 3-year average CMAQ deposition
Ex_3yr_aa_tdep	Aquatic Acidification CL exceedance by 3-year average TDEP deposition
Ex_10yr_aa_cmip5hist	Aquatic Acidification CL exceedance by 10-year average CMIP5 historical deposition
Ex_10yr_aa_cmip5rcp45	Aquatic Acidification CL exceedance by 10-year average CMIP5 RCP 4.5 deposition
Ex_10yr_aa_cmip5rcp85	Aquatic Acidification CL exceedance by 10-year average CMIP5 RCP 8.5 deposition
Ex_3yr_hsrpt_cmaq	Empirical CL for Herbaceous Species Richness (plot) CL exceedance by 3-year average CMAQ deposition
Ex_3yr_hsrpt_tdep	Empirical CL for Herbaceous Species Richness (plot) CL exceedance by 3-year average TDEP deposition
Ex_10yr_hsrpt_cmip5hist	Empirical CL for Herbaceous Species Richness (plot) CL exceedance by 10-year average CMIP5 historical deposition
Ex_10yr_hsrpt_cmip5rcp45	Empirical CL for Herbaceous Species Richness (plot) CL exceedance by 10-year average CMIP5 RCP 4.5 deposition
Ex_10yr_hsrpt_cmip5rcp85	Empirical CL for Herbaceous Species Richness (plot) CL exceedance by 10-year average CMIP5 RCP 8.5 deposition

The overlay datasets are downloadable as raster format (GeoTIFF) files or shapefiles. **Table 9** outlines these downloadable datasets.

Table 9. Overlay datasets downloadable from the CL Mapper Tool.

DATASET	DESCRIPTION	FORMAT
Federal_Administrative_Areas	Federal Administrative Areas in conterminous U.S.	Shape file (re-projected to CL Mapper Tool common projection/datum)
Class_I_Areas	Class I Areas in conterminous U.S.	Shape file (re-projected to CL Mapper Tool common projection/datum)
Wilderness_Areas	Wilderness Areas in conterminous U.S.	Shape file (re-projected to CL Mapper Tool common projection/datum)
Level_1_Ecoregions	Level 1 Ecoregions in the conterminous U.S.	Shape file (re-projected to CL Mapper Tool common projection/datum)
Level_2_Ecoregions	Level 1 Ecoregions in the conterminous U.S.	Shape file (re-projected to CL Mapper Tool common projection/datum)
Level_3_Ecoregions	Level 1 Ecoregions in the conterminous U.S.	Shape file (re-projected to CL Mapper Tool common projection/datum)
ContUS1	Conterminous U.S. - 1-km resolution	Raster file (common CL Mapper Tool projection/datum)
ContUS2.338	Conterminous U.S. - 2.338-km resolution	Raster file (common CL Mapper Tool projection/datum)
ContUSmask1	Conterminous U.S. with Land-Cover Mask - 1-km resolution	Raster file (common CL Mapper Tool projection/datum)
ContUSmask2.338	Conterminous U.S. with Land-Cover Mask - 2.338-km resolution	Raster file (common CL Mapper Tool projection/datum)
ContUSmask2.338hsreroc	Conterminous U.S. with Land-Cover Mask for Empirical CLs for Herbaceous Species Richness – Open Canopy (Ecoregion) – 2.338-km resolution	Raster file (common CL Mapper Tool projection/datum)
ContUSmask2.338hsrerc	Conterminous U.S. with Land-Cover Mask for Empirical CLs for Herbaceous Species Richness – Open Canopy (Ecoregion) – 2.338-km resolution	Raster file (common CL Mapper Tool projection/datum)

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