Critical Loads of Acidity Database

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Database Overview

This database was created to provide a resource for critical loads of acidity research in the United States. Articles that were not specific to the United States, but which reported on generalized ecosystem critical loads of acidity, were also included.

Several types of articles were included in this database: articles that directly modeled or calculated critical loads of acidity, articles that derived a critical load of acidity through empirical observations, articles that linked symptoms of ecosystem acidification to N or S deposition levels, and articles that reported on ecosystem acidification as a result of N or S fertilization. The critical load provided in the database is an estimate, especially for the articles that did not directly calculate the critical load of acidity. The accuracy of the critical load value depends on several factors. Assessments of reliability of a particular CL estimate can be made by looking at the method used (method name), the certainty reported in the publication (CL certainty level), whether the empirical critical load in the database is expected to be equal to, greater than, or less than the "actual" critical load for that site (critical loads code), and other information about the site or method (critical loads comment). These are described in more detail in the database parameters sections below.

Articles were obtained using online search engines and the National Agricultural Library's resources. The database is as comprehensive as possible. However, some articles concerning critical loads of acidity could not be included, as the information provided was not specific enough to conform to database parameters. In addition, some relevant articles may have been omitted unintentionally. These will be added to the database as they are discovered.

Database Tables

The database was created to enhance the ways in which data could be analyzed. General article information and citation information can be found in the *Citation Table.* The methods used are coded in the *Citation Table;* a more complete description can be found in the *Methods Table.* Specific site information, such as latitude, longitude, deposition, and ecosystem, are entered into the *Study Site Table*. Multiple sites may be linked to one citation in the *Citation Table*; the same site may be included in several citations. The *Study Site Table* is linked to the *Geographic Sub Area Table,* which provides more general geographic information, including mountain range and state. The *Geographic Sub Area Table* is linked to the *Region Table.* The *Critical Loads Table* contains the critical load for N, S, and N+S (acidity), as well as other information relevant to the critical load, including chemical criteria, biological criteria, response parameter, and a code that explains the critical value. Multiple critical loads may be linked to one site; as critical loads may have been calculated based on different chemical or biological criteria.

Database Structure

Citation Table- author and publication information.
Critical Loads Table- reported critical load data and related impact information for all study sites; links to the *Critical Loads Codes Table, Study Site Table* and the *Method Table*.
Critical Loads Codes Table- codes explaining critical loads values.
Geographic Sub Area Table- coarser scale geographic information, including state, mountain range, and sub-region; links to the *Region Table*.
Methods Table- codes for and descriptions of all methods used and comments on specific method application.
Region Table- codes and descriptions of geographic regions in the United States; links to the *Geographic Sub Area Table*.
Study Site Table- site specific information, including geographic coordinates, elevation, deposition, and ecosystem type; links to the *Deposition Codes Table,* the *Geographic Sub Area Table* and the *Citation Table.*

Links between the tables enable the use of queries to extract data from specific groups of publications or for all critical loads values for a specific geographic area. The parameters within each table are described below.

Critical Loads of Acidity in the United States Database Description:

Citation Table

- Pub ID: Unique identification number.
- Authors: lists all contributing authors to article in order as reported
- Title: title of article
- Citation: citation information for article
- Publication Date: date of publication; for internet websites, if no publication date was reported, the date the article was accessed is reported
- Terrestrial or Aquatic: noted by "T" or "A" respectively; if article includes both ecosystem types it is reported as "A & T"
- CL type: nutrient or acidity, or both
- Publication scale: Scale of entire study (regional, national park, etc.)
- Method ID: code for the method used
- Method uncertainty analysis: notes any uncertainty assessment conducted on the methods used
- Comments: Comments on paper and method
- Related Publications: lists related publications

Critical Loads Table

- CL ID: Unique identification number
- Study Site ID: links to Study Site Table

- CL for S: critical load for sulfur
- CL for S + N: critical load for acidity (reported as for sulfur and nitrogen)
- CL for N: critical load for nitrogen
- CL units: units of reported critical load and form of deposition where other than total (e.g. NO_3^- vs. total N)
- CL dep type: type of deposition (wet, dry, throughfall, etc).
- CL code: links to Critical Loads Codes Table
- CL pg: page on which critical load data are reported
- CL Comments: comments on critical loads values
- CL Method ID: links to the Method Table
- Chemical Criteria: chemical criteria used to determine deposition level that is critical load (e.g. ANC, stream nitrate concentration)
- Critical Value: value at which damage occurs; used to identify critical load in empirical work (e.g. ANC<0)
- Biological Criteria: biological criteria used to determine deposition level that is critical load (foliar N, microbial biomass N,etc)
- Critical Biological Value: value at which damage occurs; used to identify critical load in empirical work
- Additional Qualitative Effects: additional parameters listed as chemical criteria for ecosystem damage but with no specific associated numerical value (e.g. increased foliar N)
- Response Parameter: the detrimental ecosystem response to critical load exceedance (e.g. vegetation injury)
- CL Status: status of critical load exceedance by site
- Response Status Comments: additional information regarding current state of deposition (e.g. reports values of chemical criteria for comparison to the critical value parameter)
- Criteria response pg: page on which criteria and response information can be located
- Criteria comments: comments on criteria parameters
- CL Certainty level: reported level of certainty associated with the critical load value
- CL for S kg/ha/y: critical load for sulfur in kilograms per hectare per year
- CL S and N kg/ha/y: critical load for acidity (reported as for sulfur and nitrogen) in kilograms per hectare per year
- CL N kg/ha/y: critical load for nitrogen in kilograms per hectare per year
- CL for S eq/ha/y: critical load for sulfur in equivalents per hectare per year
- CL S and N eq/ha/y: critical load for acidity (reported as for sulfur and nitrogen) in equivalents per hectare per year
- CL N eq/ha/y: critical load for nitrogen in equivalents per hectare per year
- Follow-up comments: unresolved issues with CL or criteria values.

- Method Name
- Method ID

Critical Loads Codes Table

- CL Code: Unique identification number
- CL Code description: explains the significance of the critical load code

Geographic Sub Area Table

- Geographic Sub Area ID: unique identification number
- Study Area: watershed, wilderness, experimental forest, park, or specific mountain range if available; if not, information at the Geographic Area level (Resolution: coarser than study site and finer than geographic area).
- Forest: name of forest, if appropriate
- Park: name of park (national, state, or other), if appropriate
- Geographic_Area: Mountain range, plateau, basin.
- Sub_state: location within a state, i.e., northwest or central
- State: Two letter postal code of study state
- Region ID: links to Region Table
- Comments: comments on site location or scale.

Methods ID Table

- Method ID: code for method type used
- Method name: name of the method used; includes specific model name, steady-state mass balance (SSMB), other mass balance (MB) and/or empirical approaches.
- Comments: comments on method functions, etc.

Regional ID Table

- Region ID: Unique identification number
- Region Name: name of region
- Region Comment: states included within region

Study Site Table

- Study Site ID: Unique identification number.
- Geographic Sub Area ID: Links to Geographic Sub Area Table
- Pub ID: links to Citation Table
- Specific Site Location: identifying name
- Terrestrial or Aquatic: ecosystem type; noted by “T” or “A” respectively; if article includes both ecosystem types it is reported as “A & T”
- Latitude: reported in decimal degrees (all N, where available)
- Longitude: reported in decimal degrees (all W, where available)
- N dep kg/ha/yr: N deposition in kilograms per hectare per year.
- S dep kg/ha/yr: S deposition in kilograms per hectare per year.

- N and S dep kg/ha/yr: N and S deposition in kilograms per hectare per year
- Deposition Type: reports if deposition is wet, dry, cloud, or other
- Deposition Code: reports if deposition is measured or experimental
- Deposition Pg: page on which deposition is reported.
- Site area: area in hectares of study site
- Elevation: elevation in meters
- Site scale: scale of individual sites within a study (watershed, plot, stand, etc.)
- Ecosystem Description: includes relevant information reported within article; may include site size, climate information, bedrock and soil information, site classification (e.g. Class I), associated study (e.g. IFS), vegetation information, notes on site sensitivity to acidic deposition, etc.
- Stand Type: major vegetation type of study sites (e.g. deciduous, coniferous, mixed)
- sample location number: number of sampling sites assessed
- sample locations comments: more information about sample locations
- Time Period Start: time span of research/critical load assessment
- Time Period Finish: time span of research/critical load assessment
- Comments: includes relevant comments on sites assessed

Citation Table
Pub_ID
authors
title
citation
Pub. Date
Terr_Aq
CL_type
publication scale
Method_ID
Method uncertainty
analysis
comments

Study Site Table
Study_Site_ID
Geographic_Sub_Area_ID
Pub_ID
Specific site location
Terr_or_Aq
latitude_dd
longitude_dd
N_dep_kg_ha_y
S_dep_kg_ha_y
N_and_S_dep_kg_ha_y
depostion_type
deposition_code
depostion_pg (pg # on which deposition is reported)
site area ha
elevation m
site scale
Ecosystem description
stand type
sample location number
sample locations comments
time period start
time period finish
comments

Geographic Sub Area Table
Geographic_Sub_Area_ID
Study_Area
Forest
Park
Geographic Area
Sub_state
State
Region ID
Comments

Region Table
Region ID
Region Name
Region Comment

CL Table
CL ID
Study_Site_ID
CL_S
CL_S_and_N
CL_N
CL_units
CL_code
CL_dep_type
CL_pg (pg # on which CL is reported)
CL_comments
CL_Method_ID
chemical_criteria
critical value
Biological criteria
Critical biological value
additional qualitative effects
response parameter
CL status
response status comments
criteria_response_pg (pg # on which criteria are reported)
Criteria comments
CL certainty level
CL_S_kg_ha_y
CL_S_and_N_kg_ha_y
CL_N_kg_ha_y
CL_S_eq_ha_y
CL_S_and_N_eq_ha_y
CL_N_eq_ha_y
Method_ID
Method Name

Method ID Table
Method_ID
Method Name
Method comments

Critical Loads Code Table
CL Code
CL code description