TRACI 2.2 method documentation

Software version:	openLCA 2.2.0
Report version:	1
Date:	23rd September 2024

Authors: Sarah Serafini, Andreas Ciroth

GreenDelta GmbH

Alt-Moabit 130-131

10557 Berlin

gd@greendelta.com

Photo by Sarah Serafini

GreenDeLTa

openLCA

Content

1 New Impact Method – TRACI 2.2

The Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI) is a stand-alone program developed by the U.S. Environmental Protection Agency, designed with U.S.-specific input parameters. It supports site-specific data for many impact categories, with U.S. average values available when locations are unspecified.

TRACI helps assess environmental stressors with potential impacts such as ozone depletion, global warming, acidification, eutrophication, smog formation, ecotoxicity, human health effects (cancer and non-cancer), fossil fuel depletion, and land use. Originally created for life-cycle assessment (LCA), it is expected to have broader applications. TRACI focuses on midpoint-oriented assessments without aggregating across impact categories. It includes characterization and normalization.

1.1 Novelty of version 2.2:

- Fossil fuel characterization factors (CFs) and their references have been removed.
- Eutrophication CFs have been replaced with updated, spatially resolved CFs for both freshwater and marine eutrophication, based on the work of Henderson et al.

1.2 openLCA implementation

The newly added categories “Eutrophication: freshwater” and “Eutrophication: marine” categories are detailed in Table 1.

Table 1 – New TRACI 2.2 Impact Categories, Reference Unit and Spatial Resolution included in openLCA method package

NAME	REFERENCE UNIT	SPATIAL RESOLUTION
Eutrophication: freshwater	kg P eq	World countries and US states
Eutrophication: marine	kg N eq	World countries and US states

1.2.1 Activity likelihood

The activity likelihood data serve as weights that influence each native CF based on how likely it is that an activity (agricultural, non-agricultural, or general) occurs within a given area. For the openLCA implementation of the method, we used the general CFs when available, as these represent a combined likelihood of both agricultural and non-agricultural activities. If only agricultural or non-agricultural CFs were available, we utilized the provided data accordingly.

1.2.2 Flow mapping

The original CFs cover the key flows responsible for eutrophication: phosphorus for freshwater, and nitrogen, ammonia, and nitrogen oxides for marine eutrophication. To ensure a comprehensive flow mapping and full compatibility with all databases supported by the openLCA method package, we derived additional flows where needed, using conversion factors derived from the molecular weights of the compounds. This approach ensures complete coverage and prevents potential underestimation of environmental impacts.

1.2.3 Global and special locations CFs

The native emission data were aggregated by the original research team to derive final CFs for world countries, U.S. states, and U.S. counties. To achieve further aggregations needed for the implementation in openLCA, including a global generic value for activities in unknown locations and CFs for ecoinvent special locations, we analysed the distribution of the provided CFs for world countries and observed a significant right skew (see Figure 1). To mitigate the risk of underestimating impacts, we chose to use the mean rather than the median. This aggregation enabled us to generate additional CFs for specific locations, including global averages and ecoinvent special locations. For Rest-of-World location, since it's a dynamic concept, we used the same value obtained for the global average.

Additionally, we applied a 10% penalty to these averages to account for potential uncertainties. This penalty has been loaded as a category parameter for each aggregation we performed, allowing users to adjust it as needed.

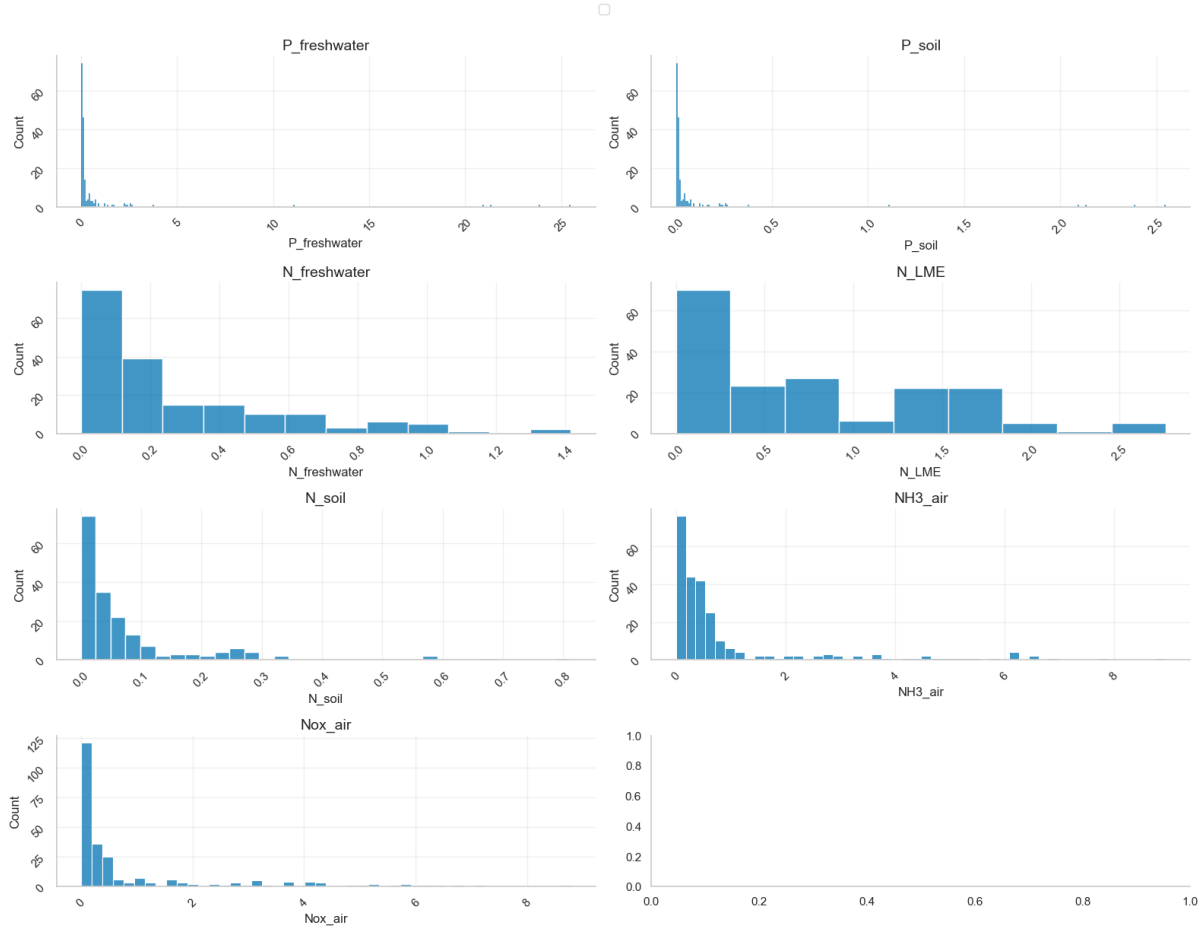

Figure 1 - Distribution graphs of the characterization factors (CFs) for world countries. The title of each graph indicates the specific flow along with the associated emission compartment

1.3 Get the new method TRACI 2.2 for openLCA

The method package is available in Nexus here: https://nexus.openlca.org/database/openLCA%20LCIA%20methods.

1.3.1 How to update the LCIA Methods in openLCA:

If you want to update the method package in a database that already contains the previous version, you have different options:

- Delete the current version of the method package (both methods and impact categories folders) and then import the latest one,

- Import the latest one and use the option “Update data sets with newer version”. This option will update the existing version of the method package with the newest one. At the end you will see the new folder and the old one, which will be empty and you can safely delete.

We recommend to make a copy or a backup of the database in use before making any changes. Moreover, it’s not possible to have different version of the method package within the same database. In that case, we advise to have two copies of the same database with different versions of the methods imported.

2 Support

For any feedback, inquiries regarding the implementation of TRACI 2.2, or related questions, please contact us.

GreenDelta GmbH, the developer of openLCA, offers prioritized and guaranteed professional support for openLCA users through the GreenDelta helpdesk: https://www.openlca.org/service-contracts/. Community-driven (support is also available at https://ask.openlca.org/.

Sarah Serafini, Andreas Ciroth

GreenDelta GmbH

Alt-Moabit 130-131, 10557 Berlin, Germany

serafini@greendelta.com, ciroth@greendelta.com

www.greendelta.com

3 Resources

Bare, J.; Gloria, T.; Norris, G. 2006. Development of the Method and U.S. Normalization Database for Life Cycle Impact Assessment and Sustainability Metrics. *Environmental Science & Technology*. 40(16): 5108-5115.

Bare, J.C.; Norris, G.A.; Pennington, D.W.; McKone, T. 2003. TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts. *Journal of Industrial Ecology*. http://mitpress.mit.edu/journals/pdf/jiec_6_3_49_0.pdf

Frischknecht, R.; Jungbluth, N.; Althaus, H.J.; Doka, G.; Dones, R.; Hischier, R.; Hellweg, S.; Humbert, S.; Margni, M.; Nemecek, T.; Spielmann, M. 2007. Implementation of Life Cycle Impact Assessment Methods: Data v2.0. *ecoinvent report No. 3*, Swiss Centre for Life Cycle Inventories, Dübendorf, Switzerland.

Henderson, A.D.; Niblick, B.; Golden, H.E.; Bare, J.C. 2021. Modeling Spatially Resolved Characterization Factors for Eutrophication Potential in Life Cycle Assessment. *The International Journal of Life Cycle Assessment*. 26(9):1832-1846. Associated dataset: https://doi.org/10.1007/s11367-021-01956-4

Ryberg, M.; Vieira, M.D.M.; Zgola, M.; Bare, J.; Rosenbaum, R.K. 2014. Updated US and Canadian Normalization Factors for TRACI 2.1. *Clean Technologies and Environmental Policy*. 16: 329-339.