

## Filtration of surface water by ecosystem types - Flow

### General description:

InVEST “Nutrient Delivery Ratio (NDR)” model, specifically focusing on nitrogen. The model uses a mass balance approach, which describes the movement of a mass of nutrients through space. Unlike more sophisticated nutrient models, the present approach does not represent the details of the nutrient cycle but rather represents the long-term, steady-state flow of nutrients through empirical relationships. A detailed description of the model can be found at:

<http://data.naturalcapitalproject.org/nightly-build/invest-users-guide/html/ndr.html>

### Input Data

- Land use map
- Biophysical table with data on specific coefficients regarding Land cover/land use (LULC) type, nutrients and water (listed in Table 1 of this document).
- Nutrient runoff proxy, a raster dataset with the yearly average amount of precipitation
- LAU2 boundaries

### Calculation process

#### (1) Prepare Input data for InVEST NDR model

To run the model both raster and shapefile data are required. To avoid errors, it is advised to harmonize the data using the same projection, linear units, and cell size and then snapping the rasters to the DEM.

To obtain the results at the municipal level the Eurogeographics LAU2 Boundary Map was used instead of a watershed shapefile.

#### (2) Calculate the parameters required in the biophysical table

The biophysical table is a .csv table with information on LULC classes and specific nutrient and water coefficients used in the model. For some land uses these parameters have been refined using specific values (either modelled or based on a literature review) for the different regions in the Alpine Space, while for other coefficients the default values provided by InVEST have been used (See **Table 1**).

**Table 1:** default and recalculated parameters used in the Biophysical table

| Parameter                                                                        | Field name    | Used value                          |
|----------------------------------------------------------------------------------|---------------|-------------------------------------|
| Nutrient load for each land use                                                  | <i>load_n</i> | Recalculated for agricultural areas |
| The maximum retention efficiency for each LULC class, varying between zero and 1 | <i>eff_n</i>  | Default                             |

|                                                                                                                                                              |                                                                  |                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------|
| <font 14px/inherit;;inherit;;inherit>The distance after which it is assumed that a patch of LULC retains nutrient at its maximum capacity (in meters)</font> | <font 14px/14px;;inherit;;inherit>crit_len_n</font>              | <font 14px/inherit;;inherit;;inherit>Default</font> |
| <font 14px/inherit;;inherit;;inherit>The proportion of dissolved nutrients over the total amount of nutrients, expressed as ratio between 0 and 1</font>     | <font 14px/14px;;inherit;;inherit>proportion_subsurface_n</font> | <font 14px/inherit;;inherit;;inherit>Default</font> |

<font 14px/inherit;;inherit;;inherit>For the agricultural areas in the LULC map, the N input for the dedicated field of the biophysical table is calculated in kg/ha/year by summing up inputs from the following data sources:</font>

- <font 14px/inherit;;inherit;;inherit>**Manure fertilization**: values calculated using zonal statistics on the basis of the data from JRC (JRC, 2012).</font>\*
- <font 14px/inherit;;inherit;;inherit>**Wet and dry deposition**: values calculated using zonal statistics on the basis of the data from the Norwegian Meteorological Institute (Norwegian Meteorological Institute, 2016).</font>
- <font 14px/inherit;;inherit;;inherit>**Biological nitrogen fixation**: proxy value taken from (Vries et al., 2011).</font>

<font 14px/inherit;;inherit;;inherit>For all other LULC classes (i.e. urban fabric, forests...) the default values provided by InVEST were used.</font>

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