Effects of global change on the emission, fate, effects and risks of chemicals in aquatic ecosystems





SHORT TITLE: COORDINATOR: ORGANISATION: TOPIC: PROJECT NUMBER: ECORISK2020 Prof Dr Paul van den Brink Wageningen University H2020-MSC_ITN 2018 813124

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 813124

Deliverable: D 3.1 Global climate/land use/agronomic management and emission scenarios

Contributing:

Wageningen University, Paul van den Brink

Utrecht University, Stefan Dekker

Content

- 1. Background data and explanation of scenarios
- 2. Populations projections per scenario
- 3. Gross domestic product
- 4. Landcover
- 5. Emmisions
- 6. Agricultural Indicators

1. Background data and explanation of scenarios

For the ecorisk2050 project it is important to use a variety of climate and socio-economic scenarios, that are drivers for the chemical emissions and the fate in the environment. To have harmonization in the project, this deliverable is a starting document with data that to be used by all ESRs.

The following data are now freely accessible and are partly provided by our partner in the EcoRisk2050 project, PBL. We will use the model scenarios from the IMAGE model, the Integrated Model to assess the Global Environment (see: <u>https://models.pbl.nl/image/index.php/Download)</u>.

During the project we will use the following harmonized and standard scenarios(van Vuuren *et al.*, 2011; Riahi *et al.*, 2017):

SSP1 Sustainability – Low challenges to mitigation and adaptation

The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. Management of the global commons slowly improves, educational and health investments accelerate the demographic transition, and the emphasis on economic growth shifts toward a broader emphasis on human well-being. Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Consumption is oriented toward low material growth and lower resource and energy intensity.

SSP2 Middle of the Road - Medium challenges to mitigation and adaptation

The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations. Global and national institutions work toward but make slow progress in achieving sustainable development goals. Environmental systems experience degradation, although there are some improvements and overall the intensity of resource and energy use declines. Global population growth is moderate and levels off in the second half of the century. Income inequality persists or improves only slowly and challenges to reducing vulnerability to societal and environmental changes remain.

SSP3 Regional Rivalry – High challenges to mitigation and adaptation

A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues. Policies shift over time to become increasingly oriented toward national and regional security issues. Countries focus on achieving energy and food security goals within their own regions at the expense of broader-based development. Investments in education and technological development decline. Economic development is slow, consumption is material-intensive, and inequalities persist or worsen over time. Population growth is low in industrialized and high in developing countries. A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions.

Data-availability

During the project we mainly use the scenarios by IMAGE. These data are now available at:

- The Royal Netherlands Meteorological Institute (KNMI) Link: <u>https://data.knmi.nl/datasets?q=ssp</u>
- 2. Netherlands Environmental Assessment Agency (PBL) Link: ftp://ftp.pbl.nl/image/public/Data/SSPs/

Many of these data are gridded in 30 arc minutes and will be further used as input of the models to be developed during the project to estimate the emissions and fate of chemicals originated from urban, industrial or agricultural use.

In case of sensitivity analyses of input, also scenarios developed with other Integrated Assessment Models (IAMs) can be used. These data are available at:

 International Institute for Applied Systems Analysis (IIASA) Link: <u>https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=40</u>

In the rest of this document we will show some data, that makes it clear how the scenarios are different from each other

2. Population Projections

Population projections are important as they are the main driver for chemical use, such as medicines and industrial production. But also population is the driver for food demand and as a result for land use change, pesticide and biocide use and veterinary medicine use.



3. Gross domestic product

The development of gross domestic product at national and regional level is also one of the most important drivers for industrial production.



4. Landcover

From the SSP scenarios, demand in all kind of land use is calculated.



a. Built-up Area

b. Crop land











5. Emissions



Emissions|CO 1000 -World - AIM/CGE - SSP3-34 -World - AIM/CGE - SSP3-45 -World - AIM/CGE - SSP3-60 900 World - AIM/CGE - SSP3-Baseline World - IMAGE - SSP1-19 800 World - IMAGE - SSP1-26 World - IMAGE - SSP1-34 World - IMAGE - SSP1-45 700 World - IMAGE - SSP1-45 World - IMAGE - SSP1-8aseline World - MESSAGE-GLOBIOM - SSP2-26 World - MESSAGE-GLOBIOM - SSP2-34 World - MESSAGE-GLOBIOM - SSP2-34 600 Mt CONT 500 -World - MESSAGE-GLOBIOM - SSP2-Baseline 400 300 200 100 0 2000 2020 2040 2060 2080 2100 © SSP Public Database (Version 2.0) generated: 2019-09-23 11:50:30

b. Carbon monoxide



c. Total Carbon dioxide



i. Carbon dioxide emissions from Fossil fuels and Industry



ii. Carbon dioxide emissions from landuse

Emissions|N20 25000 World - AIM/CGE - SSP3-34 World - AIM/CGE - SSP3-45 World - AIM/CGE - SSP3-60 World - AIM/CGE - SSP3-Baseline World - IMAGE - SSP1-19 20000 World - IMAGE - SSP1-26 World - IMAGE - SSP1-34 World - IMAGE - SSP1-45 World - IMAGE - SSP1-Baseline 15000 World - MESSAGE-GLOBIOM - SSP2-26 World - MESSAGE-GLOBIOM - SSP2-34 kt N2O/yr World - MESSAGE-GLOBIOM - SSP2-45 World - MESSAGE-GLOBIOM - SSP2-Baseline 10000 5000 0+ 2000 2020 2040 2060 2100 2080 © SSP Public Database (Version 2.0) generated: 2019-09-23 11:53:20

e. Volatile organic carbon





f. Ammonia

g. Organic Carbon



h. Sulfur







6. Agricultural Indicators

The agricultural indicators are very useful to estimate the trends in pesticides, biocides and veterinary medicine use (livestock).



a. Agricultural demand -Crops



b. Agricultural demand -Livestock

c. Agricultural Production-Energy crops









e. Agricultural Production-Livestock