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Summary
At the 1st joint session of the Steering Body to the EMEP and the Working Group on Effects (Geneva, 14-18 September 2015) the Coordination Centre for Effects was requested to issue a Call for Data in the autumn of 2015 with a deadline in 2017.

The aims of the Call for Data were to; (1) Derive nitrogen and sulphur critical load functions taking into account their impact on biodiversity (critical loads for biodiversity); (2) Present plans and preliminary results of the assessment of critical loads for biodiversity at the ICP M&M meetings in Dessau (19-22 April 2016) (3) offer the possibility to NFCs to update their national critical load data on acidity and eutrophication, the latter consisting of (the minimum of) the critical load of nutrient nitrogen and the empirical critical load at a site.

The Swedish NFC answers point three of the call. The submission consists of the newly calculated critical loads for acidity and the previously (2015) reported empirical critical loads for nutrient nitrogen established in 2014 by Swedish habitat experts at 3798 Swedish Natura 2000 sites.

For acidity the calculations are based on lakes and apply for both lakes and their catchments, in the same way as in earlier data submissions in 2012, 2014 and in 2015. In this submission an updated methodology regarding the critical load calculations and more recent data has been used. A database with the results of the new calculations is submitted simultaneously.

Introduction

In Sweden the impact of air pollution on ecosystems is of major concern, both with respect to acidification and eutrophication of soils and waters. In response to the Call for data Swedish NFC reports critical loads for acidity calculated on lakes and empirical critical loads at Natura 2000 areas at the $0{,}10^0 \times 0{,}05^0$ degrees longitude and latitude grid. The submitted critical loads reflect our view on acceptable level of air pollution which – if not exceeded – provides sufficient level of protection of Swedish ecosystems from harmful effects of acidification and eutrophication due to N deposition. Due to limited availability of resources, the response does not address the part of the Call concerned with assessment of critical loads for biodiversity.

Critical loads for acidity

In 2016 Sweden revised the calculations of critical loads for acidity in surface waters. The changes in calculations consist of four adjustments: 1) the use of BC^*_0 (1860) as BC^*_0, instead of the earlier used BC^*_0 (2100), which is more in line with the common methodology described in the Mapping Manual, 2) In cases where historical ANC_0 is very low, restrictions (e.g. lowest ANC_{limit} set to 0 µeq/l) is used to avoid setting a negative ANC_{limit}. For ANC_{limit} an upper threshold is set for pH 6.2, which means that for high pH lakes the maximum demanded target pH is 6.2, and 3) The MAGIC library is used in the critical loads calculations to set the ANC_{limit} for individual lakes and to provide the base cations at steady state (BC^*_0). In 2015-2016 there was a major update of the entire MAGIC library catalogue of model runs, including a new forestry scenario. 4) The way N deposition is treated in critical loads calculations was also adjusted compared to previous submissions. N immobilisation was set to 2 kg N/ha/yr in forest soils and non-acidifying leaching of organic nitrogen has also been accounted for in the critical load calculation. Deposition in access of the sum of these two terms is considered acidifying according to the precautionary principle. Changes in the used methodology and the MAGIC library update resulted in adjustments in the calculated critical loads for acidity compared to previous submissions towards slightly less exceedance of critical loads with a given emission scenario (preliminary calculations).

The ecosystem area of each grid is treated in the same way as in the 2015 submission (Slootweg et al., 2015) which means that the submitted ecosystem area (EcoArea) for critical loads for acidity is the area of Sweden reduced by the area of the nine largest Swedish lakes along with densely populated areas and agricultural land. Thus the EcoArea for critical loads of acidification (395 226 km^2) is 88% of the total area of Sweden (449 964 km^2).

Critical loads for acidity are based on updated calculations on the 5084 lakes described in CCE Status Report 2014 (Slootweg et al., eds., 2014). For the grid cells with no assessed lakes in it we have used inverse distance weighting interpolation (IDW). IDW determines cell values using a linearly weighted combination of a set of sample points. The weight is a function of inverse distance. This method assumes that the variable being mapped decreases in influence with distance from its sampled location. Between 3 and 10 lakes within 30 km radius were considered for interpolation for each grid. For the grid cells with several

assessed lakes in it we have used the average critical loads at these lakes. The geographical distribution of the areas most sensitive to acidification follows the same pattern as observed in the previous CL submissions.

Critical loads on eutrophication

Empirical critical loads are used for CLeut. The empirical critical loads were established at 82 relevant habitats represented in 3798 Natura 2000 areas covering 58 688 km^2 (Figure SE-1). The calculations are identical to the 2015 submission (Slootweg et al., 2015). EcoArea for CLeut is significantly lower than the EcoArea used for CLacid. In both cases, however, the EcoAreas are relevant to the long term goal of non-exceedance of critical loads for acidity and for eutrophication respectively. If achieved, then the most sensitive Swedish ecosystems will be protected from further damage due to air pollution.

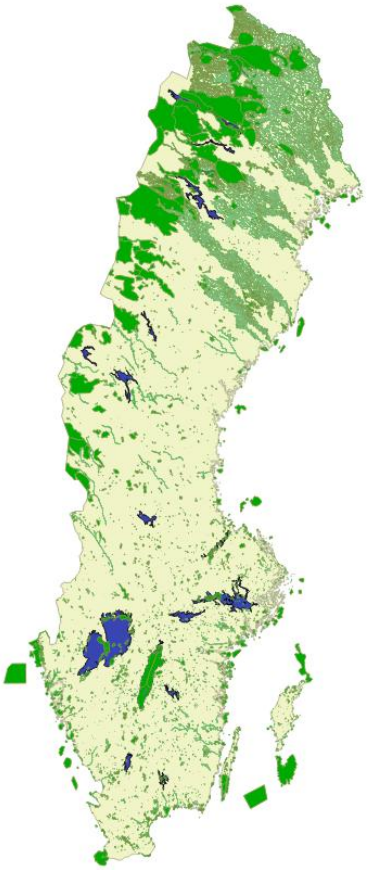

Figure SE-1. Map of Sweden showing geographical location of Natura 2000 areas in green.

References

Slootweg J., Posch M., Hettelingh J.-P., Mathijssen L., (eds), 2014. Modelling and Mapping the impacts of atmospheric deposition on plant species diversity in Europe: CCE Status Report 2014. Coordination Centre for Effects, RIVM, Bilthoven; www.wge-cce.org

Slootweg J., Posch M., Hettelingh J.-P. (eds), 2015. Modelling and mapping the impacts of atmospheric deposition of nitrogen and sulphur: CCE Status Report 2015. Coordination Centre for Effects, RIVM, Bilthoven; www.wge-cce.org