Wetland Extent Index

Key messages

1. The Wetland Extent Index measures trends in wetland area over time, enabling the rate of loss of wetland area to be estimated and giving an indication of the status of wetlands globally.
2. The analysis is based on a database containing over 1,000 wetland extent time-series and a methodology was developed to identify and account for thematic and geographic gaps and conversely, over-representation in the data.
3. Preliminary results show an average decline in area of 40 % for both inland and marine/coastal wetlands between 1970 and 2008. When weighted to account for biases in the data, the rate of decline is reduced to about 25-30 %.
4. In contrast to natural wetlands, human-made wetlands are on average increasing in extent.
5. Preliminary results show that natural wetlands have declined across five Ramsar regions and by as much as 60 % in Europe and Asia.

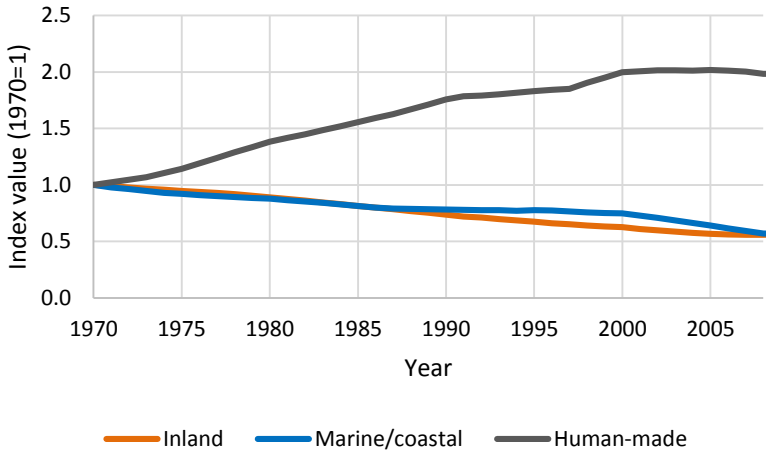

Figure 1. Global average marine/coastal, inland and human-made wetland extent trends relative to extent in 1970 and up until 2008. A decrease in the index means that wetland extent has declined on average while a constant index represents no overall change in wetland extent or that gains and declines cancel each other out.

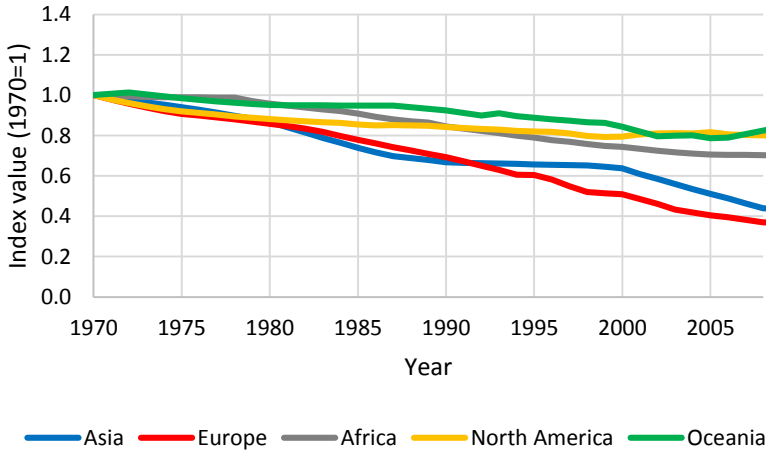

Figure 2. Global average trends in natural wetland extent, which is the aggregation of equally weighted marine/coastal and inland wetland trends, relative to 1970 and up until 2008. An accurate trend for the Neotropics could not be calculated due to there being insufficient data.

Foreword

Wetland ecosystems are of huge value both in terms of their biodiversity and the vital ecosystem services they provide us with. Unfortunately, studies done to assess the status of wetlands suggest that these important habitats are declining in extent in regions around the world.

The Wetland Extent Index is a proof-of-concept for a novel method that can estimate broad trends in habitat extent for habitats with incomplete and heterogeneous data. The Index estimates the average rate of change in wetland extent in the recent period of 1970 to 2008 using a variation of the Living Planet Index methodology to combine extent trend data from the wetland literature.

Methodology

Wetland extent change time-series data from 170 source references were entered into a database. Each record was tagged with its Ramsar region (Africa, Asia, Europe, North America, Neotropics and Oceania), subregion, wetland characteristic data (*e.g.*, wetland type: marine/coastal, inland or human-made) and source reference. Full details of the database construction including an explanation of what constitues each wetland type can be seen in the **Technical notes**.

Time-series collated so far are unevenly distributed both geographically and thematically *i.e.,* there are more studies of wetlands in North America than in the Neotropics and more extensive datasets for mangrove than lagoons. The Neotropics were particularly underrepresented, which will be partly the result of conducting the literature review in English. A methodology was developed account for these biases.

Data on individual wetlands trends were first sorted into the six Ramsar regions and three Ramsar wetland types, making 18 groups. To account for geographical unevenesss, the data were then further subdivided into 126 subregions and 20 wetland classes (*i.e.* sub-types), making a matrix of 2,520 possible combinations. The average trend in wetland extent was then calculated for all wetlands in each cell of the matrix for which one or more time-series were available, making 1,100 average trends in total (1,420 cells had no data). The matrices can be found in the **Technical notes Appendices 9** to **12**.

To generate the indices, the average trends for individual subregion-wetland class combinations (matrix cells) were then aggregated, giving each cell equal weight, and analysed using the Living Planet Index methodology (Collen *et al*., 2009; Loh *et al*., 2005). The analysis was run from 1970 to 2008 because the amount of data available decreased sharply either side of that time period. The index therefore does not show the change in wetland extent that happened before 1970, which was extensive in some regions such as Europe where there is a long history of wetland drainage.

The three wetland type indices, each including all six regions of the world and the six regional natural wetland extent indices, each including only natural (*i.e.*, not human-made) wetland types, are shown below, in **Figure 1** and **2** respectively. The indices were not weighted due to a lack of knowledge on the extent of specific wetland classes within regions. Further indices which represent different cuts of the data as well as details of data quality and distribution are included in the **Technical notes Appendices**.

Wetland type trends

The indices show the average trend in wetland extent change relative to 1970, which is given a value of 1. A decrease in the index means that wetland extent has declined on average, which could be due to conversion to another wetland type or conversion to a non-wetland state. A constant index represents no overall change in wetland extent or that gains and declines over the assessed period cancel each other out.

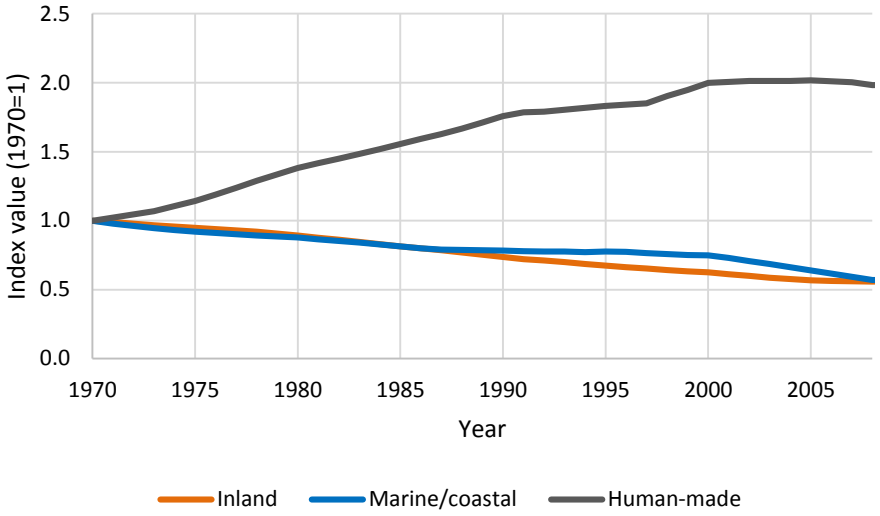

Figure 1. Global average marine/coastal, inland and human-made wetland extent trends relative to extent in 1970 and up until 2008.

Preliminary results for the average trends in each of the three wetland types are shown above. **Figure 1** above shows that on average, inland and marine/coastal wetlands have declined to a similiar extent over the 38 year period, about a 40 % reduction. In contrast, human-made wetlands have doubled in extent. These are average trends – the relative rates of declines of classes within the wetland types (*e.g.* intertidal wetlands and lagoons) vary in magnitude.

As conversion of wetland to non-wetland (wetland 'loss') was not discriminated from conversion of one form of wetland to another during data collection due to time constraints, there is currently insufficent information in the database to associate the rise in human-made wetland with conversion from natural wetland, although this is a possible scenario. Some data sources did contain this infromation and with further work the discrimination would be possible. Individual graphs of the three wetland types with plotted confidence intervals can be found in supplementary **Technical notes Appendix 5**. Note that there has been no weighting applied to these preliminary wetland type indices due to a lack of knowledge of the global distribution of specific wetland classes.

Regional natural wetland trends

The preliminary results in **Figure 2** below shows that there has been a decline in natural wetland extent across five of the Ramsar regions.Unfortunately there were insufficient data to calculate an accurate index for the Neotropics. For the graphs of each region's natural index (including the Neotropics) and the regional indices for all wetland types (*i.e.,* including human-made) see supplementary **Technical notes Appendix 6** and **7** respectively.

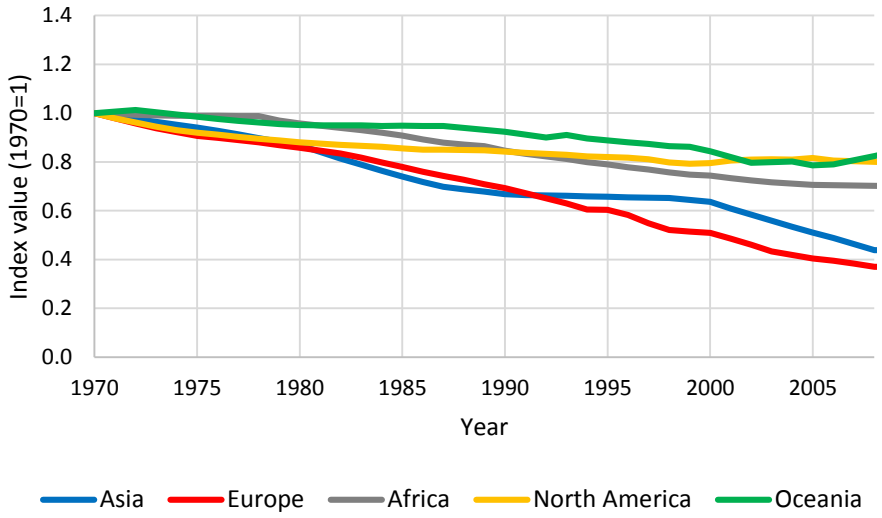

Figure 2. Global average trends in natural wetland extent, which is the aggregation of equally weighted marine/coastal and inland wetland trends, relative to 1970 and up until 2008. An accurate trend for the Neotropics could not be calculated due there being to insufficient data.

The preliminary results above indicte that the greatest declines of natural wetland extent are in Europe and Asia, about a 60 % decline reduction in both cases. In comparison, about a 20 % reduction is shown in North America and Oceania, with approximately a 30 % decline in Africa. Note that there has been no weighting applied to these preliminary regional natural indices due to a lack of knowledge of the global distribution of specific wetland classes.

Implications and recommendations

The work presented here demonstrates a methodology for assessing landcover extent trends. The results shown are an example of two of the ways in which indices can be created from the wetland data matrix with additional indices included in the **Technical notes**. While further work is required to address thematic and geographic gaps in the database and weight the data, a robust methodology has been developed and the preliminary results suggest rapid rates of wetland extent decline.

The broad conclusions of the Wetland Extent Index are supported by alternative methods being used to estimate wetland area change. For example, a recent analysis by Davidson (n.d., pers. comm) examining trends over hundreds of years found a decline in both natural wetland types, the rate of which has accelerated in the 20th century. Given the importance of wetland ecosystems, work must continue to

assess the state of the world's wetlands so that this decline can be monitored and appropriate action can be taken to protect them.

References

Collen, B., Loh, J., Whitmee, S., McRae, L., Amin, R., & Baillie, J. E. M. (2009). Monitoring change in vertebrate abundance: the Living Planet Index. *Conservation Biology*, *23*(2), 317–327. doi:10.1111/j.1523-1739.2008.01117.x

Davidson, N. (n.d.). *Trends in wetland area and their impacts on shorebird populations.* Unpublished manuscript. Personal commmunication, December 2013.

Finlayson, C. M., & Spiers, A. G. (1999). *Global review of wetland resources and priorities for wetland inventory*. Canberra.

Lehner, B., & Döll, P. (2004). Development and validation of a global database of lakes, reservoirs and wetlands. *Journal of Hydrology*, *296*(1-4), 1–22. doi:10.1016/j.jhydrol.2004.03.028

Loh, J., Green, R. E., Ricketts, T., Lamoreux, J., Jenkins, M., Kapos, V., & Randers, J. (2005). The Living Planet Index: using species population time series to track trends in biodiversity. *Philosophical Transactions: Biological Sciences*, *360*(1454), 289–295.