Development of a Global Wetland Sustainability Index for comprehensive land use planning

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1. Introduction

Allocation of nature reserves for conservation of ecosystem functions and services is a multi-dimensional task. Conservation programs act from local to regional or national scales, and some efforts involve entire continents. Globally, several international environmental agreements have been established which include conservation issues. Examples are the Convention on Biological Diversity, the Convention on Migratory Species of Wild Animals, the UN Framework Convention on Climate Change, and the Ramsar Convention on Wetlands. A common aim of most initiatives is the protection and restoration of valuable natural sites by providing a functional network of sites. The planning of protected habitat networks to safeguard global biodiversity requires substantial knowledge on exposure, services, and functions of ecosystems. Further, the complex spatial relationships between humans and the environment under consideration of costs and land use competition have to be determined. Often such analyses are hindered by lack of data.

2. Methodology

Main impacts on wetlands are due to climatic or hydrological changes, to land use changes, or to other human impacts. In this study these three fields are represented by compilation of the dynamic wetland extent scheme (Stacke 2011; Fig. 1 I) with the wetland sustainability index (explained below) and GLOBIOM (Schneider et al. 2011). We developed a global index that ranks sites for wetland protection according to its wetland quantity, wetland quality and pressure upon the wetland sites (see Fig.2). Each of the three parts is based on several spatial-ecological datasets that contain important information for the adequate assessment of spatial economic and ecologic interdependencies (Fig.3). Applying cluster analyses and ecological decision trees the data are combined and results are translated to the final index and expressed per simulation unit for integration into the Global Biomass Optimization Model GLOBIOM (Fig.1 II). This global recursive dynamic partial equilibrium model integrates the agricultural, bio energy and forestry sectors with the aim to provide policy analyses on global issues concerning land use competition between the major land-based production sectors. The knowledge helps to set conservation priorities which in turn may have influence on land use and human impacts (Fig. 1 III).

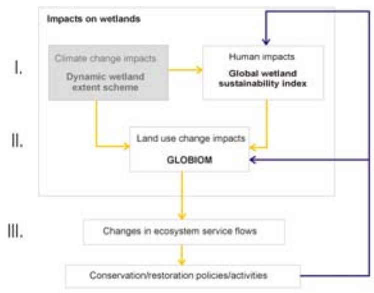


Fig. 1. Overview of the study

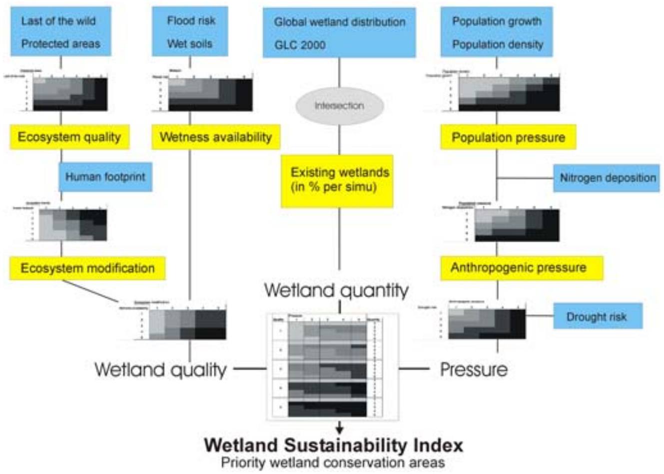


Fig. 2. Model structure and input data

3. First Results

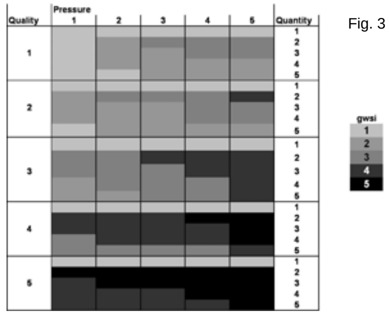
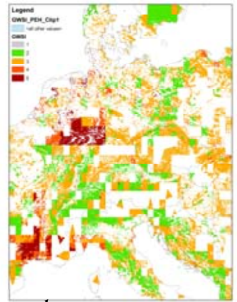


Fig. 3 The GWSI structure



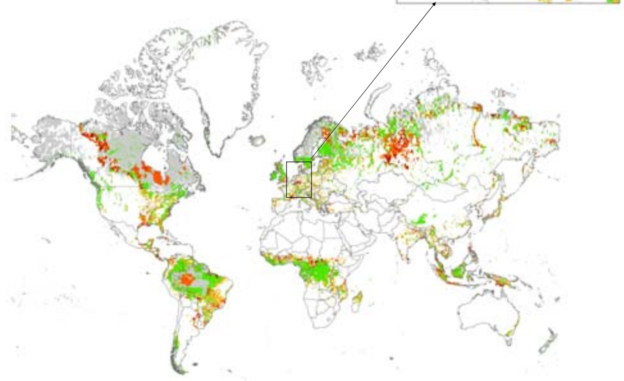


Fig. 4. spatial examples

4. Conclusion

Results not only show the most vulnerable wetland areas to nature loss and the most valuable wetland areas for biodiversity protection under certain land use scenarios. Moreover, costs of protection are estimated and the results give recommendations for action by illustrating wetland conservation areas in need for conservation. Often wetlands provide numerous ecosystem services to society, such as water retention, flood control, water purification, to name only a few. The sustainable conservation of wetland sites, especially in highly human dominated landscapes, is therefore an important global but still underestimated objective.

For further information

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