How to use the decision support tool

The decision support tool is meant to facilitate global or realm wise comparisons of protected areas based on macroecological datasets. The scale of the included datasets enables the user to compare a vast number of sites globally based on the six different objectives. Nevertheless, a couple of things need to be kept in mind when using the decision support tool and interpreting the evaluation results.

Firstly, due to the coarse resolution of most globally available datasets the decision support tool facilitates a first evaluation of the included protected areas but should not be used for local assessments. This means that for the selection of specific areas for conservation and the practical implementation of nature conservation on the ground requires further evaluation steps that the tool cannot cover. These steps should involve an on-site assessment based on additional parameters at a higher resolution (e.g. more detailed biological data acquired through surveys and observations). For a final decision, it is also crucial to consider non-biological characteristics, ranging from available infrastructure, NGO presence, political situation, access to the site and potential funding possibilities to socio-economic factors.

Secondly, the different conservation indicator datasets included within the six conservation objectives come with different levels of uncertainty and distinct error margins, which affects the resulting ranking. These varying error margins should be kept in mind when interpreting the results. For example, the ranking of sites resulting from the biodiversity objective alone is less prone to errors, because the global patterns of species richness and diversity are stable at the used scale, compared to the climatic stability objective which results from modelling exercises. ***We have therefore colour coded the sliders for the individual objectives based on the expected error margin, ranging from green (high certainty) to red (uncertain). An objective can be left out of the site evaluation by leaving its slider at 0.*** Below we briefly describe the underlying main sources of uncertainty that should be considered with each conservation objective.

Biodiversity objective: **Low error margin** This objective consists of three conservation indicators, species richness, endemism and evolutionary diversity. The base data for these indicators are globally available species range maps. Whilst the individual range maps and the used phylogeny are prone to omission and commission errors and uncertainties around the resolution of the phylogenetic tree respectively, the observed patterns are stable at the global scales and unlikely to introduce high amounts of uncertainty into the site evaluation. Nevertheless, it needs to be kept in mind that due to the coarse nature of the range maps, the resulting species numbers for the individual protected areas should be interpreted as the number of species occurring within the region the protected area is located in not as the exact number of species known to occur within the site.

Wilderness objective: ***Medium error margin*** The wilderness objective includes three conservation indicators the biodiversity intactness index (BII), the human footprint (HFP) and the change from biome to anthrome over the last 20 years. The BII is calculated based on modelled land-use pressures on

biodiversity and connects global land-use pressure estimates with local biodiversity data from the PREDICTS project. There are several sources of uncertainty associated with this modelling approach, including the quality of the underlying biodiversity data and the modelling approach itself, and the error margin for this conservation indicator is higher compared to the indicators included in the biodiversity or size objective. Details on the BII can be found in Newbold et al 2016 [1]. Estimates of the HFP within protected areas were derived using the data of Venter et al (2016) [2]. The standardised HFP provided by Venter et al. includes data on the extent of built environments, cropland, pasture land, human population density, night-time lights, railways, roads and navigable waterways. Data included in the footprint dates partially back to 2009 and might not reflect recent developments within and around PAs. Therefore, we consider the error margin for this indicator as well to be higher compared to the indicators included in the biodiversity or size objective. The biome to anthrome change is derived from satellite pictures and calculated as percentage change after classifying the image coverage into biome and anthrome classes [3] and is unlikely to introduce high amounts of uncertainty into the site evaluation.

Climatic stability objective: High error margin Both the projected change in biodiversity and the projected change in tree cover are based on modelled data. These models come with various sources of uncertainty, including the underlying biodiversity data, the chosen model type and the climatic drivers and associated models (details on the modelling methods, the included data and potential sources of uncertainty can be found here [4] REF LPJ-GUESS) . Furthermore, the projections are shown for a medium emission pathway (6.0) and associated level of warming and for the mid of the century. These projections give an estimate where the impacts of climate change are expected to be severe and which areas might be less affected but they come with high levels of uncertainty and we thus expect a relatively high error margin for the climatic stability objective compared to others.

Land-use stability objective: High error margin The land-use stability is based on modelled data similar to the conservation indicators included in the climatic stability objective. These models come with several sources of uncertainty and additionally depend on the applied assumptions of population growth and economic development (details on the methods and potential sources of uncertainty can be found here [5,6]). The projected changes in land-use give an indication where circumstances might be beneficial for a future increase in land-use potentially adding additional pressures on PAs, but they are highly uncertain. Additionally, the projections are only shown for a medium emission pathway (6.0) and associated level of warming and for the mid of the century. The expected error margin for the land-use stability is thus expected to be high.

Climate protection objective: Low error margin The climate protection objective consists of three different measures of carbon storage, baseline, vulnerable and irreplaceable carbon [7]. The baseline carbon estimates for this dataset have been derived from various sources and combine the best estimates

available. Whilst the amount of vulnerable and irrecoverable carbon strongly depend on the estimates of carbon lost through land conversion and recovery time, the overall spatial patterns of the carbon storage are likely to be stable. The expected error margin for the climate protection objective is thus expected to be comparably low contrary to the climatic and land-use stability objectives.

Size objective: ***Low error margin***. The size of the protected areas is directly calculated from the provided shapefiles and has an expected low error margin. Though the calculated size depends on the accuracy of the shapefiles and might therefore slightly affect the site evaluation for some included sites.

Literature

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