

## Mapping Wilderness using Crowdsourcing

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The large and ever increasing influence of humans on the Earth's ecosystems is acknowledged as an important driver of environmental change. To quantify this influence, Sanderson et al. (2002) developed a spatially explicit human influence index using four categories of input data: gridded population density, land transformation (based on existing maps of land cover, built up areas and settlements), accessibility (based on access to roads, rivers and coastlines) and presence of electricity infrastructure (determined through remotely sensed data on night time lights). The human influence index is based on the concept of 'remoteness' from existing anthropogenic influences, which is commonly used in determining areas of wilderness. Sanderson et al. (2002) then normalized the human influence index to account for the presence of different biomes and produced a spatial distribution of the human footprint on a scale from 0 to 100. Based on this map, the last of the wild areas left on Earth were identified. The downside of this approach is that it heavily depends on the quality of existing global datasets, some of which show large variation from one country to another, particularly in developing countries.

This paper takes a different approach to mapping the human footprint. Using Geo-Wiki, which is a crowdsourcing tool for the validation of land cover (Fritz et al., 2012), volunteers were asked to identify the degree of human impact (on a scale from 0 to 100) which is visible from Google Earth imagery. Examples illustrating the concept of human impact across the full spectrum (from areas devoid of influence to urbanized areas with large impervious surfaces) were provided to the volunteers as part of online training materials. Through different Geo-Wiki crowdsourcing competitions, more than 100,000 validation samples of human impact were collected globally. By interpolating these sample points and by using a simplified remoteness concept – which is distance to visible human influence - a map of human impact has been produced (Figure 1).

Comparing the crowdsourced map of human impact with version 2 of the human footprint by Sanderson et al. (2002), there are large differences primarily in areas of agriculture and some desert regions, where human impact is visible from space but which is not picked up using the methodology of Sanderson et al. (2002). This paper will undertake a systematic comparison of the two products, use the crowdsourced data to validate the Sanderson map and consider the advantages and disadvantages of a crowdsourcing approach for creating maps of wilderness. Recommendations for how the method can be improved in the future will also be presented.

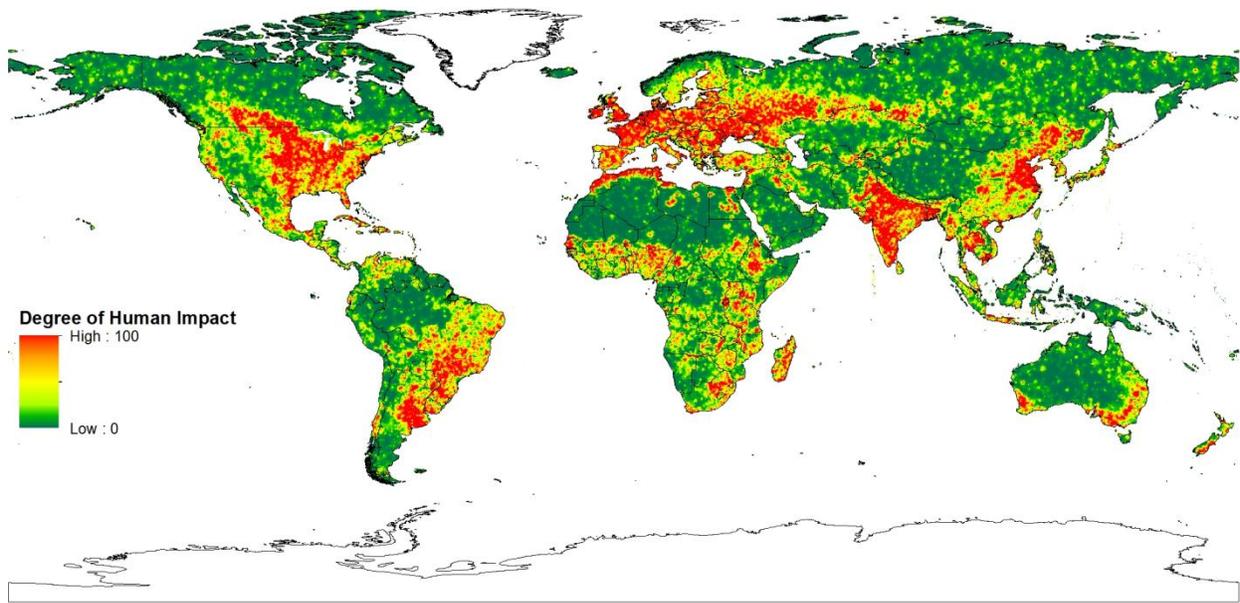


Figure 1: Human impact interpolated from pixels interpreted by the crowd using Google Earth

## References

- Fritz, S., McCallum, I., Schill, C., Perger, C., See, L., Schepaschenko, D., Van der Velde, M., Kraxner, F. and Obersteiner, M. (2012). Geo-Wiki: An online platform for improving global land cover. *Environmental Modelling and Software*, 31, 110-123.
- Sanderson, E.W., Jaiteh, M., Levy, M.A., Redford, K.H., Wannebo, A.V. and Wollmer, G. (2002). The human footprint and the last of the wild. *BioScience*, 52(10), 891-904.