The Journal of Open Source Software

wdpar: Interface to the World Database on Protected Areas

Jeffrey O. Hanson[1]

1 Department of Biology, Carleton University, Ottawa, Canada

DOI:

Software

- Review
- Repository
- Archive

Submitted:
Published:

Summary

The `wdpar` `R` package provides an interface to data available on Protected Planet (https://www.protectedplanet.net). It can be used to access the World Database on Protected Areas (WDPA) and the World Database on Other Effective Area-Based Conservation Measures (WDOECM). Additionally, it provides data cleaning procedures to prepare these databases for analysis. These data cleaning procedures are essential for ensuring correct results when using the databases. As a software package for the `R` statistical computing environment, it can easily be integrated into work flows and spatial analyses. The package has applications for conservation research. For example, it has been used to help assess the performance of existing protected area systems and account for existing protected areas when identifying priority areas for conservation efforts.

Statement of need

Area-based conservation measures are crucial for safeguarding biodiversity (Watson et al. 2014; Dudley et al. 2018). Examples of such measures include protected areas, marine reserves, and other effective area-based conservation measures (OECMs). Protected Planet is a key resource for area-based conservation measures, providing the World Database on Protected Areas (WDPA) and the World Database on Other Effective Area-Based Conservation Measures (WDOECM) (UNEP-WCMC and IUCN 2022). These publicly available databases contain standardized data for over 270,000 protected areas and over 700 OECMs worldwide (UNEP-WCMC and IUCN 2022). They are regularly updated by the UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), in collaboration with governments, non-governmental organizations, and other data providers (UNEP-WCMC 2019). By providing data on the designation, establishment, management, and spatial boundaries of area-based conservation measures (UNEP-WCMC 2019), these databases play a vital role in monitoring biodiversity conservation and prioritizing future conservation efforts (Butchart et al. 2015; Bingham et al. 2019).

The WDPA and WDOECM require data cleaning procedures to prepare them for analysis (Butchart et al. 2015; Protected Planet 2021). For example, these procedures include repairing invalid geometries in protected area boundaries, excluding areas that have yet to be fully implemented, excluding areas that are no longer designated, excluding UNESCO Biosphere Reserves (Coetzer, Witkowski, and Erasmus 2014), accommodating areas represented by point localities (Visconti et al. 2013), and removing overlapping areas (Deguignet et al. 2017). Although these procedures are critical to ensure correctness when calculating coverage of area-based conservation measures (Protected Planet 2021), they can be challenging to implement—especially given the size of the databases. By providing an interface to the databases and automated data cleaning procedures, the `wdpar` `R` package helps facilitate their use without specialized knowledge.

Research applications

The `wdpar R` package has applications for conservation research. For example, it has been used to assess the performance of existing protected areas in Colombia, Greece, and South Asia (Chowdhury et al. 2021; Panitsa et al. 2021; Kougioumoutzis et al. 2021; Gonzalez, Brook, and Martin 2022). It has also been used to examine the potential implications of climate change on conservation efforts (Kougioumoutzis, Kaloveloni, and Petanidou 2022; Mothes, Howell, and Searcy 2020). Additionally, it has been used to account for existing protected areas when identifying priority areas for biodiversity conservation (Hanson et al. 2020). Furthermore, it has been used to help understand how protected area management by Indigenous Peoples can reduce deforestation (Sze et al. 2022).

Availability

The `wdpar R` package is available on the Comprehensive R Archive Network (CRAN) (Hanson 2021). Developmental versions of the package are available through an online code repository (https://github.com/prioritizr/wdpar). Documentation for the package is also available online (https://prioritizr.github.io/wdpar).

Acknowledgments

The author thanks the many people that have contributed to the package by submitting bug reports and providing suggestions to improve functionality. The author is also grateful to Joseph Bennett for feedback on a draft of the manuscript. JOH was supported by Environment and Climate Change Canada (ECCC) and Nature Conservancy of Canada (NCC).

Conflict of interest

The author declares no conflict of interest.

References

Bingham, Heather C, Diego Juffe Bignoli, Edward Lewis, Brian MacSharry, Neil D Burgess, Piero Visconti, Marine Deguignet, et al. 2019. "Sixty years of tracking conservation progress using the World Database on Protected Areas." *Nature Ecology and Evolution* 3 (5): 737–43. https://doi.org/10.1038/s41559-019-0869-3.

Butchart, Stuart H. M., Martin Clarke, Robert J. Smith, Rachel E. Sykes, Jörn P. W. Scharlemann, Mike Harfoot, Graeme M. Buchanan, et al. 2015. "Shortfalls and solutions for meeting national and global conservation area targets." *Conservation Letters* 8 (5): 329–37. https://doi.org/10.1111/conl.12158.

Chowdhury, Shawan, Shofiul Alam, Mahzabin Muzahid Labi, Nahla Khan, Md Rokonuzzaman, Dipto Biswas, Tasmia Tahea, Sharif A Mukul, and Richard A Fuller. 2021. "Protected areas in South Asia: Status and prospects." *Science of the Total Environment*, 152316. https://doi.org/10.1016/j.scitotenv.2021.152316.

Coetzer, Kaera L, Edward T F Witkowski, and Barend F N Erasmus. 2014. "Reviewing biosphere reserves globally: Effective conservation action or bureaucratic label?" *Biological Reviews* 89 (1): 82–104. https://doi.org/10.1111/brv.12044.

Deguignet, Marine, Andy Arnell, Diego Juffe-Bignoli, Yichuan Shi, Heather Bingham, Brian MacSharry, and Naomi Kingston. 2017. "Measuring the extent of overlaps in protected area designations." *PloS One* 12 (11): e0188681. https://doi.org/10.1371/journal.pone.0188681.

Dudley, Nigel, Holly Jonas, Fred Nelson, Jeffrey Parrish, Aili Pyhälä, Sue Stolton, and James E M Watson. 2018. "The essential role of other effective area-based conservation measures in achieving big bold conservation targets." *Global Ecology and Conservation* 15: e00424. https://doi.org/10.1016/j.gecco.2018.e00424.

Gonzalez, Baltazar, Federico Brook, and Gabriel M Martin. 2022. "Updated distribution and conservation perspectives of marmosine opossums from Colombia." *Hystrix, the Italian Journal of Mammalogy* In press. https://doi.org/10.4404/hystrix-00489-2021.

Hanson, Jeffrey O. 2021. *wdpar: Interface to the World Database on Protected Areas.* https://CRAN.R-project.org/package=wdpar.

Hanson, Jeffrey O, Adam Marques, Ana Veríssimo, Miguel Camacho-Sanchez, Guillermo Velo-Antón, Íñigo Martínez-Solano, and Silvia B Carvalho. 2020. "Conservation planning for adaptive and neutral evolutionary processes." *Journal of Applied Ecology* 57 (11): 2159–69. https://doi.org/10.1111/1365-2664.13718.

Kougioumoutzis, Konstantinos, Aggeliki Kaloveloni, and Theodora Petanidou. 2022. "Assessing climate change impacts on island bees: The Aegean archipelago." *Biology* 11 (4): 552. https://doi.org/10.3390/biology11040552.

Kougioumoutzis, Konstantinos, Ioannis P Kokkoris, Maria Panitsa, Arne Strid, and Panayotis Dimopoulos. 2021. "Extinction risk assessment of the Greek endemic flora." *Biology* 10 (3): 195. https://doi.org/10.3390/biology10030195.

Mothes, Caitlin C, Hunter J Howell, and Christopher A Searcy. 2020. "Habitat suitability models for the imperiled wood turtle (*Glyptemys insculpta*) raise concerns for the species' persistence under future climate change." *Global Ecology and Conservation* 24: e01247. https://doi.org/10.1016/j.gecco.2020.e01247.

Panitsa, Maria, Ioannis P Kokkoris, Konstantinos Kougioumoutzis, Anna Kontopanou, Ioannis Bazos, Arne Strid, and Panayotis Dimopoulos. 2021. "Linking taxonomic, phylogenetic and functional plant diversity with ecosystem services of cliffs and screes in Greece." *Plants* 10 (5): 992. https://doi.org/10.3390/plants10050992.

Protected Planet. 2021. "Calculating protected and OECM area coverage." https://www.protectedplanet.net/en/resources/calculating-protected-area-coverage.

Sze, Jocelyne S, L Roman Carrasco, Dylan Childs, and David P Edwards. 2022. "Reduced deforestation and degradation in Indigenous Lands pan-tropically." *Nature Sustainability* 5 (2): 123–30. https://doi.org/10.1038/s41893-021-00815-2.

UNEP-WCMC. 2019. *User Manual for the World Database on Protected Areas and world database on other effective area-based conservation measures: 1.6.* Cambridge, UK: UNEP-WCMC. http://wcmc.io/WDPA_Manual.

UNEP-WCMC, and IUCN. 2022. "Protected Planet: The World Database on Protected Areas (WDPA) and World Database on Other Effective Area-based Conservation Measures (WD-OECM)." Cambridge, UK: UNEP-WCMC; IUCN. www.protectedplanet.net.

Visconti, P, M Di Marco, J G Álvarez-Romero, S R Januchowski-Hartley, R L Pressey, R Weeks, and C Rondinini. 2013. "Effects of errors and gaps in spatial data sets on assessment of conservation progress." *Conservation Biology* 27 (5): 1000–1010. https://doi.org/10.1111/cobi.12095.

Watson, James E M, Nigel Dudley, Daniel B Segan, and Marc Hockings. 2014. "The performance and potential of protected areas." *Nature* 515 (7525): 67–73. https://doi.org/10.1038/nature13947.