Practical Considerations for Implementing Species Distribution Essential Biodiversity Variables

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Abstract

Species Distribution Essential Biodiversity Variables (SD EBVs; Pereira et al. 2013, Kissling et al. 2017, Jetz et al. 2019) are defined as measurements or estimates of species' occupancy along the axes of space, time and taxonomy. In the "ideal" case, additional stipulations have been proposed: occupancy should be characterized contiguously along each axis at grain sizes relevant to policy and process (i.e., fine scale); and the SD EBV should be global in extent, or at least span the entirety of the focal taxa's geographical range (Jetz et al. 2019). These stipulations set the bar very high and, unsurprisingly, most operational SD EBVs fall short of these ideal criteria. In this presentation, I will discuss the major challenges associated with developing the idealized SD EBV. I will demonstrate these challenges using an operational SD EBV spanning ~6000 species in the United Kingdom (UK) over the period 1970 to 2019 as a case study (Outhwaite et al. 2019). In short, this data product comprises annual estimates of occupancy for each species in all sampled 1 km cells across the UK; these are derived from opportunistically-collected species occurrence data using occupancy-detection models (Kéry et al. 2010). Having discussed which of the "ideal" criteria the case study satisfies, I will then touch on what are, in my view, two underappreciated challenges when constructing SD EBVs: dealing with sampling biases in the underlying data and the difficulty in evaluating the extent to which they bias the final product. These challenges should be addressed as a matter of urgency, as SD EBVs are increasingly applied in important settings such as underpinning national and international biodiversity indicators (see e.g., https://geobon.org/ebvs/indicators/).

Keywords

ideal vs minimal requirements, bias

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Presented at

TDWG 2021

Hosting institution

UK Centre for Ecology and Hydrology

Conflicts of interest

References

- Jetz W, McGeoch MA, Guralnick R, Ferrier S, Beck J, Costello MJ, Fernandez M, Geller GN, Keil P, Merow C, Meyer C, Muller-Karger FE, Pereira HM, Regan EC, Schmeller DS, Turak E (2019) Essential biodiversity variables for mapping and monitoring species populations. Nature Ecology & Evolution 3 (4): 539-551. https://doi.org/10.1038/s41559-019-0826-1
- Kéry M, Gardner B, Monnerat C (2010) Predicting species distributions from checklist data using site-occupancy models. Journal of Biogeography https://doi.org/10.1111/j.1365-2699.2010.02345.x
- Kissling WD, Ahumada JA, Bowser A, Fernandez M, Fernández N, García EA, Guralnick RP, Isaac NJB, Kelling S, Los W, McRae L, Mihoub J, Obst M, Santamaria M, Skidmore AK, Williams KJ, Agosti D, Amariles D, Arvanitidis C, Bastin L, De Leo F, Egloff W, Elith J, Hobern D, Martin D, Pereira HM, Pesole G, Peterseil J, Saarenmaa H, Schigel D, Schmeller DS, Segata N, Turak E, Uhlir PF, Wee B, Hardisty AR (2017) Building essential biodiversity variables (EBVs) of species distribution and abundance at a global scale. Biological Reviews of the Cambridge Philosophical Society 93 (1): 600-625. https://doi.org/10.1111/brv.12359
- Outhwaite CL, Powney GD, August TA, Chandler RE, Rorke S, Pescott O, Harvey M, Roy HE, Fox R, Walker K, Roy DB, Alexander K, Ball S, Bantock T, Barber T, Beckmann BC, Cook T, Flanagan J, Fowles A, Hammond P, Harvey P, Hepper D, Hubble D, Kramer J, Lee P, MacAdam C, Morris R, Norris A, Palmer S, Plant C, Simkin J, Stubbs A, Sutton P, Telfer M, Wallace I, Isaac NJ (2019) Annual estimates of occupancy for bryophytes, lichens and invertebrates in the UK (1970-2015). NERC Environmental Information Data Centre https://doi.org/10.5285/0ec7e549-57d4-4e2d-b2d3-2199e1578d84
- Pereira HM, Ferrier S, Walters M, Geller GN, Jongman RHG, Scholes RJ, Bruford MW, Brummitt N, Butchart SHM, Cardoso AC, Coops NC, Dulloo E, Faith DP, Freyhof J, Gregory RD, Heip C, Höft R, Hurtt G, Jetz W, Karp DS, McGeoch MA, Obura D, Onoda Y, Pettorelli N, Reyers B, Sayre R, Scharlemann JPW, Stuart SN, Turak E, Walpole M, Wegmann M (2013) Essential biodiversity variables. Science (New York, N.Y.) 339 (6117): 277-8. https://doi.org/10.1126/science.1229931