

EGU24-6353, updated on 12 Mar 2024

<https://doi.org/10.5194/egusphere-egu24-6353>

EGU General Assembly 2024

© Author(s) 2024. This work is distributed under the Creative Commons Attribution 4.0 License.



Biodiversity Data Cubes for Cross-Cutting Science and Policy

Lina M. Estupinan Suarez^{1,2}, Laura Abraham³, Tim Adriaens⁴, Lissa Breugelmans³, David A. Clarke⁵, Peter Desmet⁴, Shawn Dove^{6,7}, Katelyn T. Faulkner^{8,9}, Miguel Fernandez^{1,2,10}, Louise A. Hendrickx³, Cang Hui¹¹, Alexis Joly¹², Sabrina Kumschick⁸, Ward Langerhaert⁴, Matilde Martini¹⁴, Joe Miller¹⁵, Damiano Oldoni⁴, Henrique Pereira¹, Cristina Preda¹⁶, Quentin Groom³, and the Biodiversity Building Blocks for Policy Project*

¹German Center for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany (lina.estupinans@idiv.de)

²Martin Luther University Halle-Wittenberg, Halle, Germany

³Meise Botanic Garden, Meise, Belgium

⁴Research Institute for Nature and Forest (INBO), Brussels, Belgium

⁵Securing Antarctica's Environmental Future, School of Biological Sciences, Monash University, Victoria, Australia

⁶Department of Animal Ecology & Systematics, Justus-Liebig-Universität Gießen, Gießen, Germany

⁷Senckenberg Biodiversity and Climate Research Institute, Frankfurt am Main, Germany

⁸South African National Biodiversity Institute, Kirstenbosch Research Centre, Cape Town, South Africa

⁹Department of Zoology and Entomology, University of Pretoria, Pretoria, South Africa

¹⁰Department of Environmental Science and Policy, College of Science, George Mason University, Fairfax, VA, USA

¹¹Centre for Invasion Biology, Department of Mathematical Sciences, Stellenbosch University, Stellenbosch, South Africa

¹²Inria, Center of Côte d'Azur University, ZENITH team, LIRMM, University of Montpellier, France

¹⁴University of Bologna, Bologna, Italy

¹⁵Global Biodiversity Information Facility, Copenhagen, Denmark

¹⁶Ovidius University of Constanta, Constanta, Romania

*A full list of authors appears at the end of the abstract

Biodiversity and the Earth climate system are coupled through multiple biotic and abiotic feedbacks. Although there are clear links between the two systems, there is a lack of integrative research to evaluate them. One reason is that both systems operate on different scales, impacting integration efforts. In addition, the state of the art for each has evolved at different rates over recent decades. The growing number of satellite missions has made it possible to measure Earth system variables on a global scale and with great frequency. This enormous amount of data, captured even on an hourly basis, in tandem with a network of gauging stations, and open-access policies have boosted Earth system modeling and projections, and thus increased our understanding of one of the Earth's components (i.e. climate). Biodiversity data has also increased, albeit at a slower rate. Citizen science, along with the application of different technologies such as camera traps, phenocams, bioacoustics and, more recently, eDNA, are enabling scientists to obtain data more efficiently. However, there are still large gaps in geographic and taxonomic coverage. This is partially related to abrupt biodiversity gradients and insufficient explanatory variables that hinder modeling biodiversity as smooth gradients in climate systems. Another reason is the difference between data formats and approaches among fields; for example,

biodiversity data are often recorded as spatial points, in contrast to gridded satellite data. All these pose numerous challenges for a more coordinated and cross-cutting research. As a starting point, it is our task to reach other scientific communities and offer harmonized solutions for data integration and analysis. Specifically, in the Biodiversity Building Blocks for Policy project (B-Cubed) we are developing informatics workflows to facilitate the analysis of species occurrence information in a data cube format. We are using, though are not limited to, the world's largest biodiversity database, the Global Biodiversity Information Facility (GBIF), to provide species occurrence information in a more interoperable format. Furthermore, we are also leveraging the concept of data cubes to standardise access to biodiversity data using the Essential Biodiversity Variables framework. Currently, the implementation of species occurrence cubes is aimed at analyzing invasive species, improving species distribution modeling techniques, and developing effective indicators for informing policy. We strongly believe that data cubes will facilitate both data sharing and processing, and the co-development of tools and approaches between biodiversity and Earth sciences, which will undoubtedly benefit cross-cutting research. Synergies between biodiversity and Earth system sciences are urgently needed for better informing decision makers about feedbacks in both systems that can respond to adopted and upcoming policies.

Biodiversity Building Blocks for Policy Project: MEMBERS: Lina M. Estupinan-Suarez^{1,2}, Laura Abraham³, Tim Adriaens⁴, Lissa Breugelmans³, David A. Clarke⁵, Shawn Dove^{6,7}, Katelyn T. Faulkner^{8,9}, Miguel Fernandez^{1,2,10}, Peter Desmet⁴, Louise A. Hendrickx³, Cang Hui¹¹, Alexis Joly¹², Sabrina Kumschick^{8,13}, Ward Langerhaert⁴, Matilde Martini¹⁴, Joe Miller¹⁵, Damiano Oldoni⁴, Henrique Pereira^{1,2}, Cristina Preda¹⁶, Tim Robertson¹⁵, Duccio Rocchini^{14,17}, Maxime Ryckewaert¹², Hanno Seebens^{6,7}, Yanina V. Sica^{6,7}, Heliana Teixeira¹⁸, Maarten Trekels³, Toon Van Daele⁴, John R. Wilson^{8,13}, Tsungai Zengeya^{8,19}, Quentin Groom³. AFFILIATIONS: 1. German Center for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany. 2. Martin Luther University Halle-Wittenberg, Halle, Germany. 3. Meise Botanic Garden, Meise, Belgium. 4. Research Institute for Nature and Forest (INBO), Brussels, Belgium. 5. Securing Antarctica's Environmental Future, School of Biological Sciences, Monash University, Victoria, Australia. 6. Department of Animal Ecology & Systematics, Justus-Liebig-Universität Gießen, Gießen, Germany. 7. Senckenberg Biodiversity and Climate Research Institute, Frankfurt am Main, Germany. 8. South African National Biodiversity Institute, Kirstenbosch Research Centre, Cape Town, South Africa. 9. Department of Zoology and Entomology, University of Pretoria, Pretoria, South Africa. 10. Department of Environmental Science and Policy, College of Science, George Mason University, Fairfax, VA, USA. 11. Centre for Invasion Biology, Department of Mathematical Sciences, Stellenbosch University, Stellenbosch, South Africa. 12. Inria, Center of Côte d'Azur University, ZENITH team, LIRMM, University of Montpellier, France. 13. Centre for Invasion Biology, Department of Botany and Zoology, Stellenbosch University, Stellenbosch, South Africa. 14. UNIBO University of Bologna, Bologna, Italy. 15. Global Biodiversity Information Facility, Copenhagen, Denmark. 16. Ovidius University of Constanta, Constanta, Romania. 17. Czech University of Life Sciences, Prague, Czech Republic. 18. CESAM – Centre for Environmental and Marine Studies, Department of Biology, University of Aveiro, Aveiro, Portugal. 19. Centre for Invasion Biology, Department of Zoology and Entomology, University of Pretoria, Pretoria, South Africa.