

The IUCN Microbial Conservation Specialist Group (MCSG): A Global Framework for Safeguarding Microbial Biodiversity

Jack A Gilbert^{#,*}

Scripps Institution of Oceanography, University of California San Diego, La Jolla, USA; Applied Microbiology International, Cambridge, UK

Raquel Peixoto^{#,*}

International Society for Microbial Ecology (ISME), Arnhem, the Netherlands; International Coral Reef Society (ICRS), Tavernier, FL, USA; King Abdullah University of Science and Technology, Thuwal, Saudi Arabia

Amber Hartman Scholz

Leibniz Institute DSMZ German Collection of Microorganisms and Cell Cultures, Inhoffenstrasse 7B, Braunschweig, Germany

Maria Gloria Dominguez Bello

Department of Biochemistry and Microbiology, Rutgers University, New Brunswick, NJ, USA; Department of Anthropology, Rutgers University, New Brunswick, NJ, USA

Lise Korsten

Department of Plant and Soil Sciences, University of Pretoria, Hatfield, Pretoria 0028, South Africa; Department of Science and Innovation-National Research Foundation Centre of Excellence Food Security, Pretoria 0001, South Africa

Gabriele Berg

Graz University of Technology, Environmental Biotechnology, Graz, Austria; Leibniz Institute for Agricultural Engineering and Bioeconomy Potsdam and University of Potsdam, Germany

Brajesh Singh

Hawkesbury Institute for the Environment, Western Sydney University, Penrith, 2751, NSW, Australia.

Antje Boetius

Monterey Bay Aquarium Research Institute, Moss Landing, California 95039

Fengping Wang

International Center for Deep-Life Investigation, School of Oceanography, Shanghai JiaoTong University

Chris Greening

Department of Microbiology, Biomedicine Discovery Institute, Monash University, Australia; Securing Antarctica's Environmental Future, Monash University, Australia

Kelly Wrighton

Department of Soil and Crop Sciences, Colorado State University, Fort Collins, CO, USA

Seth Bordenstein

One Health Microbiome Center, Huck Institutes of the Life Sciences, Pennsylvania State University, University Park, Pennsylvania, USA; Department of Biology, The Pennsylvania State University, University Park, Pennsylvania, USA; Department of Entomology, The Pennsylvania State University, University Park, Pennsylvania, USA

Janet Jansson

Pacific Northwest National Laboratory, Richland, WA, USA (retired); Chair of The Soil Stars, Applied Microbiology International, UK

Jay T. Lennon

Indiana University, Bloomington, IN, USA; American Society for Microbiology; American Academy of Microbiology

Valeria Souza

Departamento de Ecología Evolutiva, Instituto de Ecología, Universidad Nacional Autónoma de México, Ciudad de México, 04510, México; Centro de Estudios del Cuaternario de Fuego-Patagonia y Antártica (CEQUA), Punta Arenas, 6200000, Chile

Torsten Thomas

Centre for Marine Science and Innovation & School of Biological, Earth and Environmental Sciences, The University of New South Wales, Sydney, NSW 2052, Australia

Don Cowan

Centre for Microbial Ecology and Genomics, Department of Biochemistry, Genetics and Microbiology, University of Pretoria, Pretoria, South Africa

Tom Crowther

Institute of Integrative Biology, ETH Zürich, Zürich 8092, Switzerland

Nguyen Nguyen

American Academy for Microbiology, DC, USA

Lucy Harper

Applied Microbiology International, Cambridge, UK.

Louis-Patrick Haraoui

Department of Microbiology and Infectious Diseases, Faculty of Medicine and Health Sciences, Université de Sherbrooke, Québec, Canada; Centre de recherche Charles-Le Moyne, CISSS Montérégie-Centre, Greenfield Park, Québec, Canada; Humans & the Microbiome Program, Canadian Institute for Advanced Research, Toronto, Ontario, Canada.

Suzanne L Ishaq

Department of Animal and Veterinary Sciences, University of Maine, Orono, ME, USA; Microbes and Social Equity working group, Orono, ME, USA.

Kent Redford, Archipelago Consulting, Portland, Maine, USA

#These authors contributed equally

*Corresponding Authors: Jack Gilbert, gilbertjack@gmail.com; Raquel Peixoto, raquel.peixoto@kaust.edu.sa

Despite its importance ^{1,2} microbial life is largely absent from global conservation frameworks. The MCSG convenes a coalition of microbiologists, ecologists, traditional knowledge experts, and conservation leaders to develop and advocate for conservation tools, strategies, and policies that explicitly integrate microbiology into global biodiversity governance.

What the MCSG will do first

First, build a global network including experts from low- and middle-income countries and Indigenous communities, to advise on conservation targets and build evaluation schema for assessing the conservation priorities. Second, map these conservation priorities by compiling and visualizing global data on microbial ecosystems that are currently threatened by habitat destruction and anthropogenic activity ⁶. Third, develop microbe specific Red List criteria, which may include microbial features like metabolic and ecological resilience rather than individual species abundance as more common with macroorganisms' Red List criteria. Finally, map existing microbial conservation projects, such as microbe-assisted coral restoration ⁷ and soil microbiome rewilding ⁸, and develop criteria to optimize their application and assess their success. Throughout, we will integrate microbial experts into other IUCN SSC groups, to ensure that specific microbiological considerations are consistently represented wherever conservation decisions are made. These deliverables create the foundation - data, tools, success stories, and people - that we will build on over the next 5 years.

Long-term vision

A key objective of the MCSG is to embed microbial criteria into the IUCN Red List and the Red List of Ecosystems, ensuring that microbial life is assessed and protected. We will also develop robust risk assessment frameworks to guide the responsible use of probiotics, engineered, or transplanted microbes in conservation efforts, balancing innovation with ecological safety. To elevate microbial perspectives within international environmental policy, the MCSG will actively engage with and communicate to a tailored network of international conventions and forums. Through targeted policy briefs and participation in key events, we will ensure that microbial biodiversity is recognized as a foundational component of ecosystem health and resilience and encourage policies that are supportive of microbial conservation. In parallel, we aim to establish sustained funding to support the implementation of microbial conservation strategies and assessment. By 2030, our goal is for microbial metrics to stand alongside those of charismatic

megafauna in every major habitat monitoring and restoration plan, signaling a profound shift in how biodiversity is measured, valued, and protected.

How you can get involved today

The MCSG is currently supported by funding from the Gordon & Betty Moore Foundation, and administrative and financial support from the International Society for Microbial Ecology (ISME) and Applied Microbiology International (AMI). This enables coordination and administration, conservation hotspot mapping, pilot risk assessments, and cataloging existing microbial conservation efforts. Additional proposals are currently in development. We invite the global scientific and conservation communities to participate in this transformative initiative by:

- Joining as an SSC member or collaborator, sign-up details are at *IUCNSSCWEBSITE*
- Sharing data on threatened microbial habitats, biobanking and/or culture collection resources.
- Sharing information on microbe or microbiology-informed conservation projects.
- Advocate through social media, traditional press, government, academia, industry and beyond to support the mission.

Protecting microbial life is no longer a niche interest; it is a planetary necessity. This is more than a policy milestone. It is a paradigm shift that will elevate microbial science, enrich conservation strategies, and ultimately help secure a livable planet. Whether you study methanogens in permafrost, track gut symbionts in humans or endangered frogs, or craft policy in your nation's environment ministry, your expertise belongs at the conservation table. The IUCN SSC program has been wildly successful in protecting global ecosystems and macroscopic species from extinction⁵. We will enhance this success by integrating microbiology into conservation programs, and ensure that microbial conservation⁹ has the international support and visibility required to ensure success.

References

1. Peixoto, R. S. *et al.* Harnessing the microbiome to prevent global biodiversity loss. *Nat. Microbiol.* **7**, 1726–1735 (2022).
2. Peixoto, R. *et al.* Microbial solutions must be deployed against climate catastrophe. *Nat. Microbiol.* **9**, 3084–3085 (2024).
3. Crowther, T. W. *et al.* Scientists' call to action: Microbes, planetary health, and the Sustainable Development Goals. *Cell* **187**, 5195–5216 (2024).
4. Demozzi, T., Oberč, B. P., Prieto López, A., Larbodièrè, L. & Borges, M. A. *Sustainable Agriculture and Nature-Based Solutions*. (IUCN, International Union for Conservation of Nature, 2024).
5. IUCN 2024 : International Union for Conservation of Nature annual report. *IUCN* <https://portals.iucn.org/library/node/52417> (2025).
6. Dominguez-Bello, M. G. *et al.* The microbiota vault initiative: safeguarding Earth's microbial heritage for future generations. *Nat. Commun.* **16**, 5373 (2025).

7. Delgadillo-Ordoñez, N. *et al.* Probiotics reshape the coral microbiome in situ without detectable off-target effects in the surrounding environment. *Commun. Biol.* **7**, 434 (2024).
8. Beattie, G. A. *et al.* Soil microbiome interventions for carbon sequestration and climate mitigation. *mSystems* e0112924 (2024).
9. Dominguez-Bello, M. G. *et al.* The microbiota vault initiative: safeguarding Earth's microbial heritage for future generations. **16**, 1–6 (2025).