

## **GeoHealth: A Transdisciplinary Science for Global Environmental and Human Health**

**GeoHealth addresses the compounding and intensifying challenges of climate change, geological hazards, environmental degradation, and socioeconomic vulnerabilities that affect global, local, and individual health.**

GeoHealth is a broad and emerging scientific field that integrates earth, environmental, health, and data sciences to advance our understanding of the complex interactions between physical, biological, and social systems. Transdisciplinary collaboration and equitable application enable GeoHealth researchers to better understand multiple overlapping health risks and develop tools that can address them, thereby enhancing societal resilience to geological and environmental change<sup>i</sup>.

Local hazards and vulnerabilities require GeoHealth's enhanced use of environmental information, integrating global through local observations to increase awareness and foster solutions<sup>i</sup>. Geospatial and other datasets may be difficult to combine with socioeconomic and health surveillance data, due to differences in spatio-temporal scales and other meaningful parameters, format, expertise, and vocabulary used by different disciplines. GeoHealth practitioners are particularly well suited to enhance capacity-sharing in data science and related tools to link disparate environmental and health datasets, with appropriate downscaling to ensure that global datasets can address local questions<sup>ii</sup>. This involves community engagement to understand health hazards faced by at-risk groups, as well as strong partnerships between different sectors (e.g., climate services, humanitarian agencies, and national institutes of health), that produce, tailor, and communicate information to build local resilience to environmental change<sup>iii</sup>.

GeoHealth requires multitiered approaches from institutions, funding agencies, data repositories, and practitioners to foster its development and application. This requires true co-production of science throughout the data life cycle with the communities that need the science the most. Recommended actions include:

- Funding entities should support research from affected communities and create opportunities for scientists, elected officials, and community groups to collaborate and share results under ethical data management plans. This includes long-term funding that supports building relationships with affected communities and equitable opportunities for researchers from lower- and middle-income countries<sup>iv</sup>.
- Academic and institutional structures should value affected communities not just as subjects but as essential contributors<sup>v</sup>, prioritizing community-based processes and impacts above traditional metrics (e.g., number of publications) when evaluating productivity and impact.
- Institutions and individual researchers should identify avenues to incorporate health data and local studies into geospatial analysis to share benefits with communities most affected by environmental and health disparities and create accessible community-informed tools.

- GeoHealth researchers must embody transparency, honesty, and humility particularly when working with affected communities, to build and maintain trust over time, identify issues most pressing, and determine measures of successful outcomes<sup>vi</sup>.
- Health equity should be a foundational research value, facilitated by using open data, Indigenous and Community Data Sovereignty<sup>vii</sup>, science communication, community engagement, and evaluation metrics that benefit affected communities in the short and long-term<sup>viii</sup>. In some cases, there will be a need to balance between open data and security for sensitive populations, especially in countries where they may be hostile towards that population (e.g., sexual and gender minorities).
- Research institutions should require training in data ethics, science co-production, community review processes, community engagement, consent, capacity-sharing building, and data accessibility<sup>ix</sup>.
- Funding agencies, departments, and academic institutions at the sub-national to international levels should recognize, incentivize, and strengthen GeoHealth research and education, with special emphasis on providing support for institutions serving marginalized people and developing countries, including local-level environmental studies in regions such as these in collaboration with regional educational institutions.
- Scientific societies and organizations should build vibrant and engaging GeoHealth communities to help develop new generations of GeoHealth scientists through workshops, conferences, research coordination networks, facilitated stakeholder meetings, and fellowships. Scientific societies and organizations can also recommend increased coordination of funding support from multiple funding agencies, which is currently a challenge because such coordinated funding could require approval from multiple Congressional authorization and appropriation committees.
- Educational, research, and funding institutions should create pathways – including funding and program support – especially for students and early-career researchers from marginalized communities affected by environmental injustice to advance in any career or field of study<sup>vi</sup>.

*Adopted by the American Geophysical Union September 2023.*

---

<sup>i</sup> Hess, J., Boodram, L. L. G., Paz, S., Ibarra, A. M. S., Wasserheit, J. N., & Lowe, R. (2020). Strengthening the global response to climate change and infectious disease threats. *BMJ*, 371. <https://doi.org/10.1136/bmj.m3081>

<sup>ii</sup> Fletcher, I. K., Stewart-Ibarra, A. M., García-Díez, M., Shumake-Guillemot, J., & Lowe, R. (2021). Climate services for health: from global observations to local interventions. *Med*, 2(4), 355-361. <https://doi.org/10.1016/j.medj.2021.03.010>

<sup>iii</sup> Neta, G., Pan, W., Ebi, K., Buss, D. F., Castranio, T., Lowe, R., ... & Balbus, J. (2022). Advancing climate change health adaptation through implementation science. *The Lancet Planetary Health*, 6(11), e909-e918. [https://doi.org/10.1016/S2542-5196\(22\)00199-1](https://doi.org/10.1016/S2542-5196(22)00199-1)

- 
- <sup>iv</sup> Joseph, N., Libunao, T., Herrmann, E., Bartelt-Hunt, S., Propper, C. R., Bell, J., & Kolok, A. S. (2022). Chemical toxicants in water: A GeoHealth perspective in the context of climate change. *GeoHealth*, 6, e2022GH000675. <https://doi.org/10.1029/2022GH000675>
- <sup>v</sup> Hayhow, C. M., Brabander, D. J., Jim, R., Lively, M., & Filippelli, G. M. (2021). Addressing the need for just GeoHealth engagement: Evolving models for actionable research that transform communities. *GeoHealth*, 5, e2021GH000496. <https://doi.org/10.1029/2021GH000496>
- <sup>vi</sup> Hoffman-Hall A, Gorris ME, Anenberg S, Bredder AE, Dhaliwal JK, Diaz MA, Fortner SK, McAdoo BG, Reano D, Rehr RC, Roop HA, Zaitchik BF(2022). A GeoHealth Call to Action: Moving Beyond Identifying Environmental Injustices to Co-Creating Solutions. *Geohealth*. 6(11):e2022GH000706. <https://doi.org/10.1029/2022GH000706>
- <sup>vii</sup> Rainie, S. C., Kukutai, T., Walter, M., Figueroa-Rodríguez, O. L., Walker, J., & Axelsson, P. (2019). In T. Davies, S. B. Walker, M. Rubinstein, & F. Perini (Eds.), *The State of Open Data: Histories and Horizons* (pp. 300–319). Cape Town and Ottawa: African Minds and the International Development Research Centre (IDRC). <https://idrc-crdi.ca/sites/default/files/openebooks/open-data/9781552506127.html#ch21>
- <sup>viii</sup> Barnard, M. A., Emani, S. R., Fortner, S. K., Haygood, L., Sun, Q., White-Newsome, J. L., & Zaitchik, B. (2022). GeoHealth perspectives on integrated, coordinated, open, networked (ICON) science. *Earth and Space Science*, 9, e2021EA002157. <https://doi.org/10.1029/2021EA002157>
- <sup>ix</sup> Jennings, L.L., Anderson, T., Martinez, A., Sterling, R., David Chavez, D., Garba, I., Hudson, M., Garrison, N., Russo Carroll, S. (Accepted). Applying the CARE Principles for Indigenous Data Governance to Ecology and Biodiversity Research. *Nature Ecology & Evolution*.