

Xander Huggins

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Research appointments

Inst. for Resources, Environment, & Sustainability, UBC Vancouver, Canada Killam, NSERC, and Canadian Space Agency Postdoctoral Research Fellow UBC profile: https://ires.ubc.ca/xander-huggins/	2024 -
High Meadows Environmental Institute, Princeton University Princeton, USA Postdoctoral Research Associate Princeton profile: https://slevin.princeton.edu/people/xander-huggins-phd	2024 -
International Institute for Applied Systems Analysis Vienna, Austria Researcher, Water Security Research Group	2023

Education

PhD – University of Victoria Victoria, Canada Department of Civil Engineering Supervisors: Tom Gleeson, James S. Famiglietti External examiner P.A. Ty Ferré Groundwater-connected systems: A social-ecological framing, global data-driven applications, and sustainability implications https://hdl.handle.net/1828/17590 Recipient of the Governor General's Gold Medal	2018-2024
BEng – University of Guelph Guelph, Canada Water Resources Engineering <i>with Distinction</i> , Co-operative stream	2013-2018

Publications

14. **Huggins, X.**, Gleeson, T., Famiglietti, J.S., Reinecke, R., Zamrsky, D., Wagener, T., Taylor, R.G., Konar, M., Lindersson, S., Wada, Y., Bierkens, M.F.P., Pokhrel, Y., Rocha, J., Di Baldassarre, G., Kummerow, M., Ferguson, G., Mukherjee, A., Lo, M.-H., Scanlon, B.R., Johnson, M.S., & Zheng, C. (2025). A review of open data for studying global groundwater in social-ecological systems. In revision with *Environmental Research Letters*.
13. Sacco, M., **Huggins, X.**, Martinez, A., Reinecke, R. (2025). Collaborative science for groundwater biodiversity conservation. *Groundwater*. In press. DOI: 10.1111/gwat.13495
12. **Huggins, X.**, Gleeson, T., Villholth, K.G., Rocha, J.C., Famiglietti, J.S. (2024). Groundwaterscapes: A global classification and mapping of groundwater's large scale socioeconomic, ecological, and Earth system functions. *Water Resources Research* 60(10), e2023WR036287.
11. Jaramillo, F. et al. (including **Huggins, X.**). The potential of hydrogeodesy to address water related problems and sustainability challenges. *Water Resources Research* 60(11), e2023WR037020.
10. Rohde, M.M., Albano, C.M., **Huggins, X.**, et al. (2024). Groundwater-dependent ecosystem map exposes global dryland protection needs. *Nature* 632, 101-107.

9. Curran, D., Gleeson, T., **Huggins, X.** (2023). Applying a science-forward approach to groundwater regulatory design. *Hydrogeology Journal* 31, 853-871.
8. Xu, L., Ferris, D., **Huggins, X.**, Wong, J.S., Mohan, C., Sadri, S., Chandanpurkar, H.A., Sanyal, P., Famiglietti, J.S. From coarse resolution to practical solution: GRACE as a science communication and policymaking tool for sustainable groundwater management. *Journal of Hydrology* 623, 129845.
7. **Huggins, X.** Gleeson, T., Castilla-Rho, J.C., Holley, C., Re, V., Famiglietti, J.S. (2023). Groundwater connections and sustainability in social-ecological systems. *Groundwater* 61(4), 463-478.
6. Curran, D., Gleeson, T., **Huggins, X.** (2023). Applying a science-forward approach to groundwater regulatory design. *Hydrogeology Journal* 31, 853-871.
5. **Huggins, X.**, Gleeson, T., Serrano, D., Zipper, S., Jehn, F., Rohde, M.M., Abell, R., Vigerstol, R., Hartmann, A. (2023). Overlooked risks and opportunities in groundwatersheds of the world's protected areas. *Nature Sustainability* 6, 855-864.
4. Mohan, C., et al. (including **Huggins, X.**). (2022) Poor correlation between large-scale environmental flow violations and freshwater biodiversity: implications for water resource management and the water planetary boundary. *Hydrology and Earth Systems Sciences*. 26, 6247–6262.
3. **Huggins, X.**, Gleeson, T., Kummu, M., Zipper, S.C., Troy, T.J., Wada, Y., Famiglietti, J. (2022). Hotspots for social and ecological impacts from freshwater stress and storage loss. *Nature Communications* 13, 439.
2. Diggle, R., Tait, D., Maher, D., **Huggins, X.**, Santos, I. (2019). The role of porewater exchange as a driver of CO₂ flux to the atmosphere in a temperate estuary (Squamish, Canada). *Environmental Earth Sciences* 78, 1-13.
1. **Huggins, X.** Gleeson, T., Eckstrand, H., Kerr, B. (2018). Streamflow Depletion Modeling: Methods for an Adaptable and Conjunctive Water Management Decision Support Tool. *Journal of the American Water Resources Association* 54, 1-15.

Manuscripts in preparation

5. Kummu, M., **Huggins, X.**, et al. Unveiling global humanscapes: harmonised subnational socio-economic datasets for understanding societal changes and enhancing risk assessments.
4. Bätthge, A., et al. (including **Huggins, X.**). GROW: A Global Time Series Dataset for Large-Sample Groundwater Studies.
3. Re, V. (including **Huggins, X.**). Socio-Hydrogeology – A transdisciplinary approach to groundwater science.
2. Gleeson, T., **Huggins, X.** et al. Strengthening our wings of equity to help students navigate our challenging world: embedding anti-racism, environmental justice and sustainability science across an undergraduate civil engineering program.
1. **Huggins, X.**, Gleeson, T., Moore, M.-L., Villholth, K., & J.S. Famiglietti. Empirical mapping of groundwater riskscape reveals the complexity and diversity of global water security and sustainability challenges.

Chapters and reports

2. **Huggins, X.** (2022). Global archetypes of groundwater interactions in social-ecological systems. IIASA Young Scientist Summer Program Fellowship Report.
Recipient of the IIASA YSSP Mikhalevich Award.
1. Gleeson, T., **Huggins, X.**, Connor, R., Arrojo-Agudo, P., Vázquez Suñé, E. (2022). Groundwater and Ecosystems, Chapter 6 of *UNESCO Water Development Report 2022*: “Groundwater: Making the invisible visible”.

Funding history (all values in CAD; total to date: \$428,500)

Canadian Space Agency Postdoctoral Supplement (\$20,000)	2024-2026
Awarded to 5 NSERC PDF award holders who are “involved in a promising research project that is aligned with and that will contribute to the priorities outlined in the Space Strategy for Canada”.	
Killam Postdoctoral Research Fellowship (\$120,000) – <i>held in name only</i>	2024-2026
University of British Columbia Fellowship awarded to those “likely to contribute to the advancement of learning or to win distinction in a profession. A Killam scholar should not be a one-sided person... Special distinction of intellect should be founded upon sound character.”	
Postdoctoral Fellowship (NSERC PDF) Award (\$140,000)	2024-2026
Natural Sciences and Engineering Research Council of Canada (NSERC). Funding provided to “a core of the most promising researchers”.	
President’s Research Scholarships (\$15,000, \$5,000/year awarded)	2021-2023
University of Victoria	
Alexander Graham Bell Canada Graduate Scholarship – Doctoral (\$105,000)	2021-2024
Natural Sciences and Engineering Research Council of Canada (NSERC) Federal funding to reward and retain high-calibre doctoral students at Canadian institutions, and awarded through a national competition.	
Alexander Graham Bell Canada Graduate Scholarship – Masters (\$17,500)	2018
Natural Sciences and Engineering Research Council of Canada (NSERC) Master’s degree funding awarded to students demonstrating a high standard of achievement in undergraduate and early graduate studies.	
Undergraduate Student Research Award (\$6,000)	2015
Natural Sciences and Engineering Research Council of Canada	

Awards and recognition

Governor General’s Gold Medal	2025
University of Victoria “The Governor General's Gold Medal is awarded for outstanding academic excellence at the graduate level and is the most prestigious award that students in Canadian schools can receive”	
Mikhalevich Award (~\$8,000)	2023
International Institute for Applied Systems Analysis Awarded to best mathematically and methodologically oriented PhD fellowship report	

Outstanding Student Presentation Award (\$250) American Geophysical Union Fall Meeting Awarded to top 5% of student presentations at the largest Earth science conference in the world	2019
Professor Ross W. Irwin Scholarship in Water Resources (\$1,000) University of Guelph Awarded for active involvement in water conservation issues and academic excellence.	2018
Raymond Theodore Guther Memorial Scholarship (\$2,000) University of Guelph Awarded for extra-curricular work in water conservation and water resources.	2018

Conference sessions organized

2. Open meeting of the Global Freshwater Resilience Workshop. <i>EGU General Assembly</i> . Vienna, Austria. Co-organized with Vili Virkki.	2025
1. People and Groundwater in the Anthropocene - Socio-hydrogeology for addressing human-groundwater relationships in a changing world. <i>World Groundwater Congress</i> . Davos, Switzerland. Co-chaired with Viviana Re.	2024

Conference presentations

17. Huggins, X. , & Rohde, M.M. Groundwater-dependent ecosystem map highlights global dryland protection needs. <i>EGU General Assembly</i> . Vienna, Austria. (Invited Oral)	2025
16. Kumm et al. (including Huggins, X.). Unveiling global humanscapes: harmonised subnational socio-economic datasets for understanding societal changes and enhancing risk assessments. <i>EGU General Assembly</i> . Vienna, Austria. (Oral)	2025
15. Bätthge et al. (including Huggins, X.). GROW: A Global Time Series Dataset for Large-Sample Groundwater Studies. <i>EGU General Assembly</i> . Vienna, Austria.	2025
14. Huggins, X. et al. A review of open data for studying global groundwater in social-ecological systems. <i>EGU General Assembly</i> . Vienna, Austria. (Oral)	2025
13. Huggins, X. Groundwaterscapes & risks: Early empirical approaches to understand global groundwater in social-ecological systems. <i>Critical Transitions in Socio-Ecological Systems Workshop</i> . Princeton, USA. (Oral flash talk).	2025
12. Huggins, X. , Gleeson, T., Villholth, K.G., Rocha, J.C., Famiglietti, J.S. Groundwaterscapes: A global application of a new conceptual framing to understand groundwater systems as social-ecological systems. <i>World Groundwater Congress</i> . Davos, Switzerland. (Oral)	2024
11. Huggins, X. , Gleeson, T., Villholth, K.G., Rocha, J.C., Famiglietti, J.S. Global groundwater system archetypes: a data-driven typology of social, ecological, and Earth system interactions with groundwater at the global scale. <i>6th International Research Workshop on Archetypes in Sustainability Research</i> . Lund, Sweden. (Oral)	2023
10. Huggins, X. , Gleeson, T., Villholth, K.G., Rocha, J., Famiglietti, J.S. Global groundwater archetypes: a new typology of groundwater interactions with social and ecological systems and an outlook for sustainable development. <i>EGU General Assembly</i> . Vienna, Austria. (Highlighted oral)	2023
9. Xu, L., Famiglietti, J.S., Ferris, D., Huggins, X. , Mohan, C., Sadri, S., Sanyal, P. From coarse resolution to realistic resolution: GRACE as a science communication	2023

and policymaking tool for sustainable groundwater management. *EGU General Assembly*. Vienna, Austria. (Oral)

8. **Huggins, X.**, Gleeson, T., Serrano, D., Zipper, S., Jehn, F., Rohde, M.M., Abell, R., Vigerstol, R., Hartmann, A. Overlooked risks and opportunities for global protected areas revealed by mapping groundwatersheds. *World Water Week*. Stockholm, Sweden. (Solicited oral) **2022**
7. **Huggins, X.**, Gleeson, T., Kummu, M., Zipper, S.C., Troy, T.J., Wada, Y., Famiglietti, J.S. Vulnerable basins for global prioritisation: Hotspots for social and ecological impacts from freshwater stress and freshwater storage loss. *EGU General Assembly*. Vienna, Austria. (Invited oral) **2022**
6. **Huggins, X.** Gleeson, T., Castilla-Rho, J.C., Holley, C., Re, V., Famiglietti, J.S. (2022). Groundwater in complex adaptive social-ecological systems. Canadian Water Resources Association National Conference. Canmore, Canada. (In-absentia poster). **2022**
5. **Huggins, X.**, Gleeson, T., Famiglietti, J. (2021). An open-access interdisciplinary database to facilitate data science on cross-cutting global groundwater sustainability challenges. Delft International Conference on Sociohydrology. (Oral, online). Delft, the Netherlands **2021**
4. Gleeson, T., **Huggins, X.**, & T. Froese. Teaching human- and sustainability-centered design: A civil engineering design spine supported by sustainability muscles and a heart of anti-racism, equity, diversity, and inclusion. (Pre-recorded oral). Let's Talk About Teaching. **2021**
3. **Huggins, X.**, Gleeson, T., Kummu, M., Zipper, S.C., Troy, T.J., Wada, Y., Famiglietti, J. (2020). Sustainability hotspots of changing global freshwater availability. Invited lighting talk at the American Geophysical Union Fall Meeting. (Invited oral, online). San Francisco, USA. **2020**
2. **Huggins, X.**, Gleeson, T., Zipper, S.C., Troy, T.J., Wada, Y., Famiglietti, J.S. Human dimensions of changing global freshwater availability. *AGU Fall Annual Meeting*. San Francisco, CA. (Oral). Awarded outstanding student presentation award. **2019**
1. **Huggins, X.**, Gleeson, T., Eckstrand, H., Kerr, B. Streamflow depletion modeling: Methods for an adaptable and conjunctive water management decision support tool. *Canadian Water Resources Association Annual Conference*. Victoria, Canada (Oral) **2018**

Invited talks

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| 14. Hydrological Systems Analysis Research Group, University of Potsdam,
Potsdam, DEU | 2025 |
| 13. Conversations on Environment, Responsible Energy, and Life (CEREAL), High Meadows Environmental Institute, Princeton University Princeton, USA | 2025 |
| 12. Land Use and Global Environment Lab, University of British Columbia
Vancouver, Canada | 2025 |
| 11. Department of Earth Sciences Seminar, Uppsala Universitet Uppsala, Sweden | 2025 |
| 10. Water Resilience Colloquium, Stockholm Resilience Centre Stockholm, Sweden | 2025 |
| 9. Maxwell Research Group, Princeton University Princeton, USA | 2024 |
| 8. Water and Development Research Group, Aalto University Espoo, Finland | 2024 |
| 7. International Groundwater Resources Assessment Centre Delft, the Netherlands | 2023 |
| 6. Geographisches Institut, Johannes Gutenberg University Mainz Mainz, Germany | 2023 |
| 5. Graduate Hydrogeology Course, Arizona State University Tempe, USA | 2023 |

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| 4. Global Groundwater Group, The Nature Conservancy (online) | 2022 |
| 3. Water and Development Research Group, Aalto University Espoo, Finland | 2022 |
| 2. Water Security Research Group, IIASA Vienna, Austria (online) | 2022 |
| 1. Water Research Roundup, POLIS Water Sustainability Project , Victoria, Canada | 2022 |

Workshops

Creative Water Connections Workshop. Victoria, BC, Canada.	4/2025
Workshop on Critical Transitions in Socio-Ecological Systems. Princeton Center for Theoretical Science. Princeton, USA.	2/2025
Environmental Data Science Summit. Participant. Santa Barbara, USA. (<i>in absentia</i>)	2/2024
6 th Workshop on Archetypes in Sustainability Research. Lund, Sweden	6/2023
Lakes, peatlands and wetlands: Functions and fate. Participant. Tovetorp, Sweden.	5/2023
I co-lead the Global Freshwater Systems Science Workshop : a semi-annual meeting of a multi-institutional collective of large-scale water resilience scientists with support and collaboration from the Stockholm Resilience Centre, Aalto University, University of Eastern Finland, and the Potsdam Institute for Climate Impact Research (PIK).	1/2025 6/2024 11/2023 5/2023

Student advising

Bhattacharjee Viriyaraj: DSc, <i>Aalto University</i> . Thesis advisor/committee member.	2025 -
Sukshith P H: MS, <i>IISER Pune</i> . Co-advisor.	2025 -
Bilal Bartaai, summer undergraduate research assistant, <i>University of British Columbia</i> .	2025

Curriculum development

Learn and teach green, people-centered civil engineering 2020-2022

Department of Civil Engineering, University of Victoria.

I co-led this initiative to integrate core sustainability science, environmental justice, environmental racism, and EDI concepts across the undergraduate civil engineering curriculum at the University of Victoria. I led targeted curriculum development for several courses, including lecture slides, in-class activities, and assignments. In total, the initiative generated and provides >20 lecture decks, and 8 in-class breakout activities to teach how these core sustainability, environmental justice, and EDI concepts interrelate and relative to engineering design and professional engineering practice.

Example resources:

1. **Huggins, X.**, and Gleeson, T. Sustainability Fundamentals for Groundwater Hydrologists (*Lecture slides*)
2. Gleeson, T., and **Huggins, X.** Groundwater Resources and Global Change. (*Lecture slides*)
3. Gleeson, T., Mohan, C., Okibe, S., Horoscoe, N., **Huggins, X.**, Ng, C., Jacoby, A. Environmental Justice Fundamentals for Groundwater Hydrologists. (*Lecture slides*)

Initiative webpage: <https://oac.uvic.ca/civelearningandteaching/>

Teaching assistant positions

Groundwater Hydrology (CIVE 445/545). University of Victoria.	2020, 2021
Hydrology and Hydraulics (CIVE 440/540). University of Victoria.	2020
Fluid Mechanics (CIVE 345). University of Victoria.	2019, 2020
Sustainable Water Resources (CIVE 340). University of Victoria.	2019
<i>Mean teaching assistant effectiveness score of 9.5/10 (n=47 student evaluations)</i>	

Guest teaching lectures

Sustainability science fundamentals. <i>Groundwater Hydrology (CIVE 445)</i> . University of Victoria.	2025
Groundwater ecohydrogeology: core concepts. <i>Ecohydrology of watersheds and water systems (ENVR 420)</i> . University of British Columbia.	2025
Open channel flow, routing, and flooding. <i>Sustainable Water Resources (CIVE 340)</i> . University of Victoria.	2023
Groundwater sustainability in social-ecological systems. <i>Groundwater Hydrology (CIVE 445/545)</i> . University of Victoria.	2023
Engineering for sustainability in a complex world. <i>Capstone Engineering Design (CIVE 400)</i> . University of Victoria.	2022
Open channel flow. <i>Hydrology and Hydraulics (CIVE 440)</i> . University of Victoria.	2019
Groundwater hydrology. <i>Sustainable Water Resources (CIVE 340)</i> . University of Victoria.	2019

Media coverage

2024

- Groundwater is key to protecting global ecosystems. *World Bank – The Water Blog*. ([Link](#))
- Mapping groundwater-dependent ecosystems shows the need for more protection globally. *Nature Research Briefing*. ([Link](#))
- Groundwater is Key to Protecting Global Ecosystems. *Desert Research Institute News*. ([Link](#))

2023

- Why protected areas must consider what's beneath the surface. *TNC Science Brief*. ([Link](#))
- USask-led research: Majority of world's protected ecosystems vulnerable to groundwater degradation. *USask news*. ([Link](#))
- Groundwater and biodiversity: A new study reveals global gaps in the protection of nature reserves. *Smart Water Magazine*. ([Link](#))
- Exceptional young scientists awarded. *IIASA news*. ([Link](#))

2022

- The US is losing some of its biggest freshwater reserves. *Popular Science*. ([Link](#))
- When we run out of water. *The Tyee*. ([Link](#))
- Global water basin hotspots prioritize areas under threat: USask research. *USask news*. ([Link](#))
- Global hotspots mapped out in new water study. *UVic news*. ([Link](#))

Science outreach

Science Meets Parliament BC – declined invitation due to schedule conflict Event designed to strengthen the connection between the science and policy communities in British Columbia, bringing scientists to the provincial Legislative Assembly for extensive engagements with MLAs.	2025*
Water Day on the Hill Inaugural event to bring scientists from across Canada to meet with parliamentarians and senior federal officials to raise awareness around water security in Canada.	2020
Water availability stripes data visualization A science communication tool to bring awareness to recent trends in water availability in the major basins of the world. The initiative was based on and inspired by Ed Hawkins's global warming stripes data visualization. The water availability stripes have been accessed by tens of thousands of people online, and the initiative is archived here .	2020
waterunderground blog Managing editor of the groundwater blog “waterunderground” which is hosted by both the European Geosciences Union and American Geophysical Union’s respective blogospheres.	2016-2021

Writing for a public audience

- Huggins, X. (November 2, 2022). Ripple effect: As global freshwater basins dry up, the threat to ecosystems and communities grows. *Conversation Canada*. ([Link](#))
- Huggins, X, T. Gleeson & J.S. Famiglietti. (April 29, 2020). Perspective: How does the coronavirus crisis compare to the global groundwater crisis? *Circle of Blue*. ([Link](#))

Journal reviews

I have performed peer review for the following journals:

Nature Communications	Ecology and Society
Environmental Research Letters	Hydrogeology Journal
Groundwater	Geophysical Research Letters
Water Resources Research	Global Sustainability
Journal of Hydrology	

Competencies

Programming Languages:	R, Python, Google Earth Engine, Bash
Software:	Visual MODFLOW, ArcGIS, QGIS, Affinity Designer, Inkscape
Languages:	English (<i>native</i>), French (<i>intermediate</i>)

Open science

GitHub Repositories

Code repository for the Water availability stripes data visualization initiative. [\[GitHub link\]](#)

Code for: Hotspots for social and ecological impacts from freshwater stress and storage loss. [\[GitHub link\]](#)

Code for: Overlooked risks and opportunities in groundwatersheds of the world's protected areas. [\[GitHub link\]](#)

Code for: Global groundwater system archetypes. [\[GitHub link\]](#)

Groundwaterscapes code repository [\[GitHub link\]](#)

Data depositions:

Data from: Hotspots for social and ecological impacts from freshwater stress and storage loss. *Borealis*. <https://doi.org/10.5683/SP3/SLR3GF>

Data from: Overlooked risks and opportunities in Groundwatersheds of the world's protected areas. *Borealis*. <https://doi.org/10.5683/SP3/P3OU3A>

Data and code from: Groundwaterscapes: A global classification and mapping of groundwater's large-scale socioeconomic, ecological, and Earth system functions. *Borealis*. <https://doi.org/10.5683/SP3/MFYCWV>

Preprints (associated paper)

Huggins et al. 2020. [\[link\]](#) (#3)
Huggins et al. 2022a. [\[link\]](#) (#5)
Huggins et al. 2022b. [\[link\]](#) (#7)
Huggins et al. 2023. [\[link\]](#) (#10)
Huggins et al. 2024. [\[link\]](#) (#12)
Huggins et al. 2025. [\[link\]](#) (#13)

Other professional experience

Stockholm Resilience Centre Stockholm, Sweden	2023
Visiting PhD researcher	
International Institute for Applied Systems Analysis Vienna, Austria	2022
Young Scientist Summer Program PhD Fellowship	
Global Institute for Water Security Saskatoon, Canada	2020 - 2023

Graduate student member	
City of Hamilton Hamilton, Canada	2017
Student Groundwater Technician	
City of Ottawa Ottawa, Canada	2016
Water Resources Engineering Intern	
G360 Groundwater Research Institute, University of Guelph Guelph, Canada	2015
Undergraduate student research assistant	

References

Tom Gleeson

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 Civil Engineering, University of Victoria (Canada)
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note: PhD supervisor

James S. Famiglietti

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note: PhD co-supervisor

Matti Kummu

Professor
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matti.kummu@aalto.fi
note: frequent collaborator

Mark S. Johnson

Professor
 Institute for Resources, Environment, and Sustainability, Univ. of British Columbia (Canada)
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note: Postdoctoral host/supervisor at UBC