Thirst
Volume 2, 2025
Foreword by Kerry Black
with
Artists Jer thorp and Ben Rubin:
Herald/Harbinger
and
Doreen Barrie
Ignacio Aguirre Belmar
Masaki Hayashi
Juhi Huda
Guillaume Lhermie
Sharon Mascher
Bernhard Mayer
Katherine Reece

ABOUT THIRST

We are establishing a platform showcasing transdisciplinary scholarship in water research including knowledges from outside the university through theoretical and creative approaches to societal issues, using interviews, portfolios, and in future case studies, and articles that are exemplary in their impact on the field, and relevant to today's reader.

Thirst is a semiannual magazine with the goal of increasing visibility of water scholarship in all its forms at the local, regional, national, and international level.

Guest editor: Kerry Black

Editors: Martyn Clark, and Marjan Eggermont

Design: Marjan Eggermont

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Cover image: *Bow Glacier, Bow Pond, Bow Lake.* | Photo by Shah Selbe.
Page 8: *Bow Glacier cirque lake* | Photo: M. E. Sanseverino, 2013 | Flickr cc.

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LETTER FROM THE EDITORS

At the foot of the Canadian Rockies and the confluence of prairie rivers, thirst is more than a sensation; it is a shared purpose. At the University of Calgary, our water community is driven to observe, interpret, and act. We follow snow to stream, sensor to dataset, model to decision, and story to change.

Thirst turns measurements into meaning. We collect data to close gaps in understanding, linking observations with models and models with choices that matter. The magazine gathers voices from across disciplines and communities: scholars and students; practitioners and scientists; engineers and artists—all asking how we thrive amid droughts, floods, and changes in our climate, our land, and our water.

In these pages, we highlight people who convert evidence into action: researchers, community partners, and decision-makers working side by side. Their stories chart the route from field notes to forecasts and from lived experience to policy, showing how fieldwork powers models, how models steer decisions, and how effective decisions build resilience to change.

Happy reading!

Martyn, and Marjan

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Foreword by Kerry Black

Kerry Black for **Thirst**.

Water connects us all, across disciplines, landscapes, and generations. At the University of Calgary, we are home to a vibrant community of researchers, educators, and innovators who are deeply committed to advancing water sustainability in Canada and around the world.

Water has always been more than a research focus for me, it's also a personal passion. Living and working near the mountains and working alongside communities who live with water's abundance and scarcity, I've come to see water as both a connector and a catalyst. It shapes our landscapes, our cultures, and our futures.

At the University of Calgary, I'm fortunate to work with an extraordinary group of faculty who share this deep commitment. In this issue of *Thirst*, we shine a light on some of the brilliant minds driving water research and innovation across our campus. It's a look at some of the inspiring work of our faculty, students, and researchers who are advancing water knowledge across disciplines.

From policy and law to hydrology and agriculture, their contributions reflect the depth and diversity of our collective commitment to water sustainability. You'll meet voices like **Doreen Barrie, Ignacio Aguirre Belmar, Masaki Hayashi, Juhi Huda, Guillaume Lhermie, Sharon Mascher, Bernhard Mayer and Katherine Reece**; each bringing unique perspectives and expertise to the challenges we face.

This is also a moment of transformation. We are thrilled to share that we are building a new Water Institute, a bold initiative that will bring together interdisciplinary talent, foster collaboration, and amplify our impact on water challenges locally and globally. This institute will serve as a hub for innovation, education, and engagement, and will position the University of Calgary as a leader in water research and sustainability.

Bio:
I am an Associate Professor in Civil Engineering at the University of Calgary and hold the Canada Research Chair in (Re)Engineering Sustainable Communities.

My work centers on developing sustainable infrastructure solutions, particularly in Indigenous communities across Canada. I focus on community-based participatory approaches, combining engineering with social, economic, and cultural considerations to address pressing issues like water and wastewater management.

← *Kerry Black (right)*
Photo courtesy of Kerry Black.

Jer Thorp
Ben Rubin
Herald/ Harbinger

Jer Thorp for **Thirst**.

Herald/Harbinger is located at the corner of 7th Ave SW & 1st St. SW in Calgary Alberta. It is open to the public 24 hours a day, 365 days a year. The artwork was commissioned by Brookfield and supported by Calgary's Public Art Program. Special thanks go out Parks Canada, and Simpson's Num-ti-jah Lodge.

Inside the lobby, the glacier's real-time perturbations are visually juxtaposed against the aggregated trajectories of nearby pedestrians and vehicles in a sequence of overlapping visualizations, while outside on the plaza the glacier's ceaseless activity is made visible and audible, creating a visceral public presence for this restless complex of ice, rock, and water.

An excerpt from '*Sounding the Bow* How we moved a vanishing glacier to the center of Canada's fastest growing city':

"[In 2017] a helicopter flew a low half circle over the Bow Glacier before touching down on a deep patch of snow just a few metres from a rocky outcropping. We unpacked our ice axes and crampons and a half-dozen neatly packed Pelican cases, and over the next three days we built a seismic observatory along the edge of the ice. Data from the station is now relayed four kilometres via radio bridge to the Num-Ti-Jah lodge at the edge of Bow Lake, then uploaded via satellite. Within five minutes the cracks and shifts of the ice are translated into sound, and sent out of a set of sixteen speakers, filling the plaza in front of Brookfield Place, a shiny 56 story office building which opened in the fall.

In the building's entrance, a tall set of seven LED arrays represent the same data as distortions in a field of light. At night the light casts out onto the stone in plaza, some 7000 unique pieces of granite, cut to depict to the geological forces of the glacier's ice field. In the winter the sound and light are muted by freshly fallen snow.

This morning, the Bow Glacier is talking to the city, and the city is talking back. The ice burbles and cracks and pops. Calgary responds with the sounds of the eastbound CTrain passing by on 7th Avenue, with the rumble of a full garbage truck, with the clattering steps of the well-heeled shoes of a commuter crossing the pavement. On the LED arrays, traffic patterns from around the city and pedestrian paths through the plaza share space with data from the glacier, in a conversation that never quite stops. For a long stretch in the late afternoon the glacier falls quiet, its whispered signal barely heard behind the noise of rush hour. Tonight, when the city is quiet, the plaza will come suddenly alive, an ice fall 180km away echoing out into the street...

Bio:
Jer Thorp is an artist, writer and teacher living in New York City. He is best known for designing the algorithm to place the nearly 3,000 names on the 9/11 Memorial in Manhattan. Jer was the New York Times' first Data Artist in Residence, is a National Geographic Explorer, and in 2017 and 2018 served as the Innovator in Residence at the Library of Congress. Jer is one of the world's foremost data artists, and is a leading voice for the ethical use of big data.

Ben Rubin is a media artist and designer based in New York City. He is best known for his data-driven media installations and public artworks, including Listening Post and Moveable Type, both created in collaboration with statistician and journalism professor Mark Hansen. Since 2015, Rubin has served as the director of the Center for Data Arts at The New School, where he is an associate professor of design.

← *Ben Rubin, Dr. Jeffrey Kavanuagh, and Jer Thorp*
Photo by Shah Selbe.

Herald/Harbinger is a constant signal that you are never really apart from nature. A reminder that, although your view of the mountains might be blocked by fifty six stories of gleaming glass, you are still connected to them through the water you drink and the air you breathe.

Herald/Harbinger is a living wake. In fifty years or so the Bow Glacier will have receded up to the level of our seismic station. In the years after that, the signal from the mountain will start to grow quiet. Eventually the sounds of the ice will fade, and the plaza will again sound only with the sounds of our footsteps and the thrum of our vehicles.

Until then, the Bow has a voice in the city."

See https://vimeo.com/250393598 for a great visual summary.

Herald/Harbinger is located at the corner of 7th Ave SW & 1st St. SW in Calgary Alberta. It is open to the public 24 hours a day, 365 days a year. The artwork was commissioned by Brookfield and supported by Calgary's Public Art Program. Special thanks go out Parks Canada, and Simpson's Num-ti-jah Lodge.

Artists: Ben Rubin & Jer Thorp

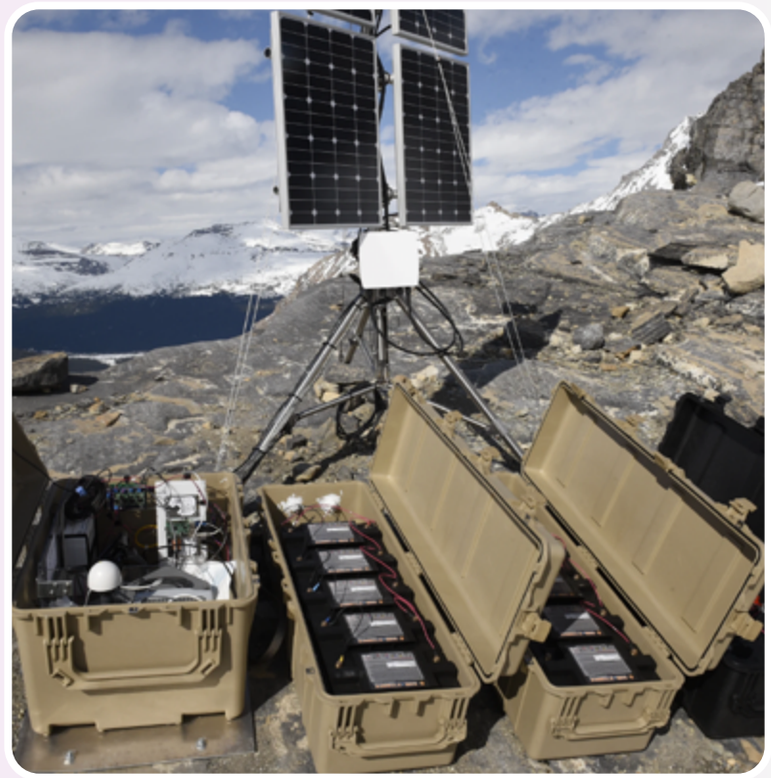
Consulting Glaciologist: Dr. Jeff Kavanaugh

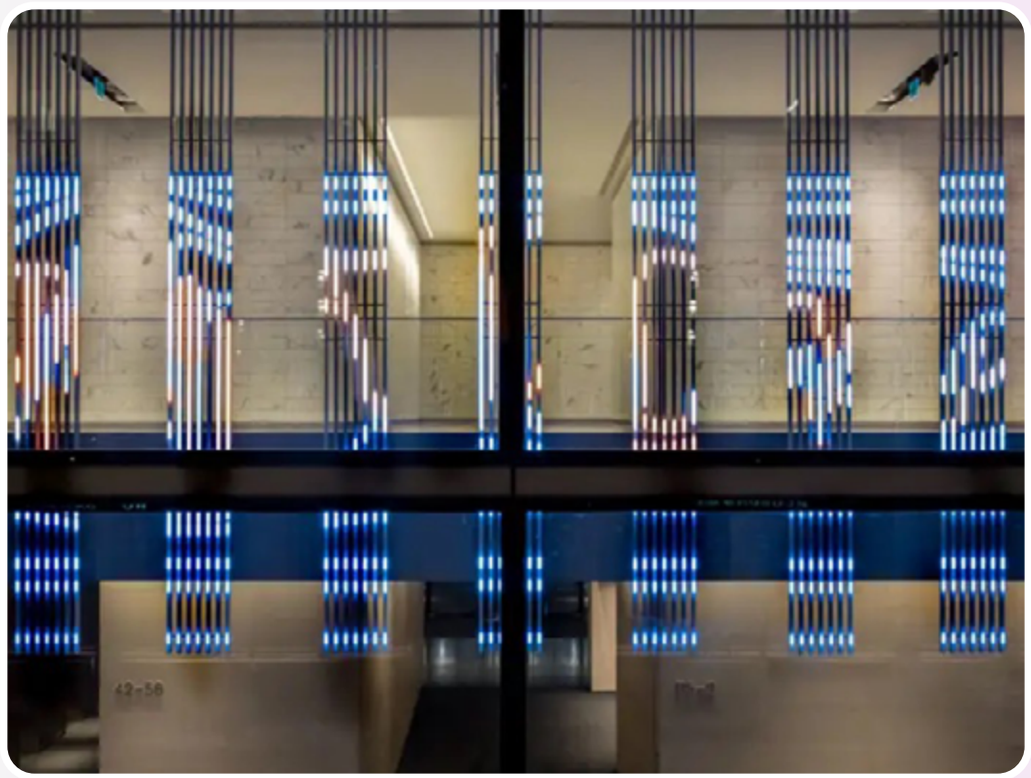
Sensor Station Design & Installation: Shah Selbe & Jacob Lewallan, Conservify.org

Special Thanks to Rina Greer, Noa Younse, Kate Rath, Brian House, Matt Thorp, Michele Gorman, David Hotson and Michael Konow

Medium article: https://blprnt.medium.com/sounding-the-bow-628f92beb0b7

↑ → *Bow Glacier, Bow Pond, Bow Lake.*
Photo by Shah Selbe.
→ *The Bow Glacier in 1924.*
Photo by Harmon Byron.
→ → *Video still Herald/Harbinger.*





↑ → *The Bow Glacier in 1902 (left) and 2002 (right)* | Photos by the Vaux Family.
→ *Seismic Lab* | Photo by Shah Selbe.
→ → *The LED array* | Video still Herald/Harbinger.

Doreen Barrie

Adjunct Assistant Professor

Doreen Barrie interviewed by **Thirst**.

The Murray-Darling Basin now has a thriving water market which is considered a role model for others contemplating a move in this direction. Since Alberta has a water market, it will be interesting to observe how it will evolve.

Thirst: What are your impressions of the current state of water in your area of expertise?

Doreen: Misconceptions about the availability of water abound. Canada is water-rich but much of the water is located far from heavily populated areas. For example, in Alberta we have only 2.2% of Canada's fresh water but approximately 70% of the country's irrigation takes place here. The province is presently expanding irrigation by 20%, putting a strain on dwindling supplies.

T: What do you see as the biggest challenges?

Fragmentation is an enormous challenge in this area. Being a federal state, all three levels of government have some responsibility on this file. Compounding the problem is the fact that within governments, responsibility for water is dispersed among departments which do not consult or collaborate with each other.

Because the provinces have jurisdiction over natural resources, each province legislates in this area. As a consequence, Canada does not have a National Water Policy nor do we have national standards for safe drinking water.

T: What areas should we be focusing on to advance the field?

There is an urgent need to encourage greater coordination and consultation on a resource that flows across political boundaries.

An encouraging development is the establishment of the Canada Water Agency. Its mandate is to improve freshwater management. The new Agency aims for a different way of thinking about water governance in Canada. Its goal is to move away from siloed management to a collaborative model with improved coordination and collaboration between Ottawa, the provinces, territories, and Indigenous Peoples.

T: What are you working on right now?

To advance water literacy, I am working on a primer/guide to water. I'm aiming for an accessible style of writing so that it isn't intimidating. From the reaction to my talks and webinars, I've come to realize that there is an appetite for this knowledge. Calgary's water main break this

Bio:
I'm an Adjunct Assistant Professor in the Department of Political Science. I specialize in Canadian Politics but my recent focus is the Politics of Water.

As a firm believer that an informed public is an essential building block of democracy, my primary interest is in political literacy around water. To this end I have conducted webinars and in-person talks for the general public. The opening sentence: "There's a saying in the American West that water flows uphill towards money" grabs their attention right away.

← *Doreen Barrie*
Photo courtesy of Doreen Barrie.

summer, was a wake-up call for Calgarians so we are more water-aware than people elsewhere.

T: How did you get started in in your field?

I was interested in federal systems which feature divided sovereignty and present particular challenges where environmental issues are involved. Because ecosystems do not respect political boundaries, collaboration and cooperation with neighbouring jurisdictions is necessary if they have a shared resource.

Water being a resource that flows across borders, I decided to explore how the Murray-Darling Basin in Australia handled environmental protection and compare it with the Mackenzie Basin in Canada. The former has a sophisticated governance structure while provinces and Territories in the Mackenzie Basin at that time, were negotiating an Agreement.

T: Which work/direction/innovation have you seen recently that really excited you?

The Murray-Darling Basin now has a thriving water market which is considered a role model for others contemplating a move in this direction. Since Alberta has a water market, it will be interesting to observe how it will evolve.

T: What is the last book you enjoyed?

Alexei Navalny's memoir.

T: Who do you admire? Why…

I admire Greta Thunberg and all the children and young people who are trying to save this beautiful planet.

T: What's your favorite motto or quotation?

I have two:

Water is the ink that writes the poetry of life. - Alexandra Cousteau, film maker and granddaughter of Jacques Cousteau.

A river is the report card for its watershed. - Alan Levere, Connecticut Department for Environmental Protection

T: What is your idea of perfect happiness?

Curling up with a book in front of a fire while it's snowing and 30 below outside!

T: If not a researcher/educator, who/what would you be?

Perhaps a playwright.

→ *What We Are Learning This Week with Dr. Doreen Barrie!*
Photos courtesy of U of C.

Ignacio Aguirre Belmar PhD Student

Ignacio Aguirre Belmar interviewed by **Thirst**.

Scientists struggle to communicate their findings and insights to society. I believe we need to enhance scientists' ability to communicate their results to diverse audiences by tailoring their language to meet the needs of these audiences.

Thirst: What are your impressions of the current state of water in your area of expertise?

Ignacio: My impression is that the discipline is moving faster and getting new exciting results. The hydrologic community is becoming increasingly diverse, focusing on making tools, models, and datasets more accessible while trying to understand problems with a broader lens by integrating multiple ways of knowing.

However, I think we need to focus more on improving the quality of our results rather than their quantity. We need to focus on gaining a deeper understanding of all the underlying processes in the hydrologic cycle to obtain the correct answers for the right reasons.

T: What do you see as the biggest challenges?

From my perspective, there are three key challenges in the discipline today. First, we lack observations of various processes, such as evapotranspiration, groundwater dynamics, and the relationship between groundwater and the surface. This lack of observations is not only relevant from a process perspective but also from a spatial perspective, as we lack observations of many biomes, countries, and different conditions (e.g., coasts, deserts). It is crucial to enhance our observation capabilities, particularly in arid environments and wetlands.

Second, scientists struggle to communicate their findings and insights to society. I believe we need to enhance scientists' ability to communicate their results to diverse audiences by tailoring their language to meet the needs of these audiences. Science communication in hydrology needs to incorporate the concepts of uncertainty and acknowledge the range of possible predictions for a given problem. In this way, the results may not always be binary (e.g., yes or no), and we might need to express them in terms of probabilities. In that case, communities will have all the information to prepare for multiple scenarios.

Third, a key challenge is capturing human changes in the basins into our models to assess their impacts and predict their consequences. As a society, we build wells to extract groundwater, divert rivers, construct reservoirs, create irrigation structures (e.g., small ponds and channels), and construct greenhouses; however, hydrologists and water

Bio:
I'm Ignacio Aguirre Belmar, a PhD student at the Schulich School of Engineering working on uncertainty in hydrological models with Professor Martyn Clark. I was born in Chile, and I have always been fascinated by exploring diverse environments, which led me to travel from the arid extremes of the Atacama Desert to the humid extremes of Patagonia. Visiting all these places sparked my curiosity to understand and represent the hydrological processes associated with them.

I studied geography for my BSc, where I learned about these processes in a transdisciplinary way, combining insights from social and natural sciences. After that, I worked on consultancy projects, using hydrological models to answer questions about future impacts and incorporating societal considerations. My curiosity about uncertainty led me to earn an MSc at the University of Saskatchewan, and I am now pursuing a PhD. During these steps, I have strived to leverage computing resources to resolve questions and facilitate these tools so others can also use them (tools, models, and datasets) in their quest to understand the world.

← *Ignacio Aguirre Belmar*
Photos courtesy of Ignacio Aguirre Belmar.

scientists struggle to quantify the impacts of these changes and incorporate these structures into their analyses, hindering our estimations. There has been significant progress in this challenge, but capturing these changes in many places globally remains a key challenge.

T: What areas should we be focusing on to advance the field?

In my opinion, we need to integrate social and natural sciences into our understanding of the basins. We need to combine the insights of socio-hydrology, water policy, water management, and knowledge from the social sciences with knowledge from the natural sciences (e.g., hydrology, hydrometeorology, ecology) to address societal needs. This new approach to hydrology, characterized by a more transdisciplinary perspective, is expected to influence training (e.g., offering more diverse courses), research projects, consultancy services, and public policy, thereby providing long-term solutions to complex and challenging problems.

At the same time, we should focus on reducing the uncertainties within our estimations. Narrowing uncertainty is not an easy task and requires enhancing our observational capabilities, conducting systematic evaluations of modeling hypotheses, exploring the importance of different modeling decisions (e.g., how to solve numerical equations), and learning how to capture spatial heterogeneity better. This challenge exceeds the capabilities of a single person and entire research groups and should be conducted from a community perspective to provide more accurate environmental predictions. By doing this, we would be able to provide more realistic and accurate predictions that work for both average and extreme conditions.

T: What are you working on right now?

I am working on understanding, quantifying, and reducing uncertainties in evapotranspiration simulations. Evapotranspiration, which encompasses transpiration from vegetation and evaporation from the soil, is the largest component of the terrestrial water budget, playing a crucial role in the water, energy, and carbon cycles. However, despite their importance and magnitude, current simulations have large uncertainties, hindering the information they provide to society. These uncertainties can stem from the input data (e.g., the precipitation), the equations used to represent the processes, and the parameters in those equations.

Recently, Yi Wu and colleagues showed that most uncertainties in modeling are attributed to the equations and parameters of the models, utilizing CMIP5 and CMIP6 outputs. In this context, I am focusing on reducing these kinds of uncertainty to improve our simulations.

The uncertainty that stems from the equations can be explained by considering that in hydrology and Earth System Sciences, multiple competing hypotheses exist to represent different processes. These hypotheses are translated into equations to develop computational models. Each hypothesis has its assumptions, nuances, and limitations. Following Lieke Melsen, we know that model developers often choose

↑ → With my siblings, Joaquin, Lourdes, and Rafael
→ → *Hiking in Colorado*
Photos courtesy of Ignacio Aguirre Belmar.

one equation over another because it is more famous or suggested by their supervisors (i.e., legacy) rather than its adequacy.

I am working on systematically testing multiple possible modeling hypotheses for evapotranspiration using flux towers to provide better guidance to model users. In this regard, model users, such as those running models for forecasting, climate change, and drought, can benefit from guidance to support their decisions, leading to better information for society and communities. If we choose more robust representations of the system, we can trust them more to accurately represent a broad range of conditions, especially extreme scenarios that often fall outside their training data, such as flooding and drought.

T: How did you get started in your field?

Since I was young, I have been fascinated by computer science and nature, particularly trees and rivers, and I am incredibly curious about how we can combine these two fields to address societal needs. In that way, during my undergraduate studies, I was invited to work on a hydroinformatics project led by Pedro Sanzana, and I enrolled in courses in computer science and geography. The project involved GIS work, time series analysis, modeling, and uncertainty, which are the same topics I am still working on. From that experience, I have become invested in the computational hydrology field, conducting research and consultancy, which has been translated into various tools, manuals, and training materials, focusing on making modeling easier, more efficient, and less uncertain.

From this experience, I have observed that many modeling decisions are made by model developers using legacy arguments rather than adequacy, which results in substantial uncertainties in our simulations. In that regard, I have been focused on quantifying and reducing these uncertainties, providing tools, workflows, and guidance to enable future simulations that can further reduce their uncertainty.

T: Which work/direction/innovation have you seen recently that really excited you?

Recently, I have come across two novel works that have truly taken my breath away.

First, a new method to estimate parameters in models that leverage the insights and know-how from machine learning and AI to process-based models. This approach, developed by Guoqiang Tang, Andrew Wood, and Sean Swenson, enables us to find optimal solutions by learning from multiple study sites simultaneously. It is faster, computationally inexpensive, and can be used to estimate parameters in sites with no observations by using similar sites.

Second, the release of the website for model evaluation (https://modelevaluation.org/), which provides free access to hydrological data, enabling a deeper understanding across multiple models and observations. Gab Abramowitz and his team recently released this platform, which allows users to create plots, conduct analysis, and download models and observations from various large projects. This website is great news because, in the past, obtaining models and observations for analysis was daunting and time-consuming; now, all interested researchers can access the files with just a few clicks. This website represents a significant step forward in building an open science, which is a key priority for the discipline and for me.

T: What is the last book you enjoyed?

I read *Seeing the Forest for the Trees* by Gordon Bonan, which was a genuinely fascinating book that tells the history of how society has come to understand the relationship between forests and climate. The book begins with a historical perspective on how people believed that planting trees could alter the climate, and it proceeds to present the scientific basis for understanding and representing the relationship between climate and forests. The book is a transdisciplinary masterpiece, as it integrates multiple perspectives and sheds light on why societies have made certain decisions regarding forests and streams.

Also, for fun, I have been reading *Bonsai* by Chilean poet Alejandro Zambra. This short novel begins with the conclusion of the story: "In the end Emilia dies and Julies does not die. The rest is literature." From there, Zambra starts telling the tale, intertwining literature and life itself. It portrays the grey area between expectations and reality, and how people attempt to navigate in this area, while not accepting the facts.

T: Who do you admire? Why…

I admire people who think about societal challenges as they strive to move forward and solve them. People who shed light on how we can address key needs and create a better world using science, diplomacy, and empathy. People who try to combine different ideas, sciences, friends, and collaborations to advance the quality of life. Those who do not conform to the current situation and the status quo attempt to think and act about these challenges to improve the quality of life for all people. People who uphold justice and ethical ideals above all others and share their knowledge with people to enhance the global community.

T: What's your favorite motto or quotation?

One of my favorite quotes is from Jorge Luis Borges and Adolfo Bioy Casares: "All sciences, all purely descriptive or informative work, presupposes the splendid and perhaps foolish hope that in the distant

→ → *Presenting at the 2025 AGU Conference*
Photo courtesy of Ignacio Aguirre Belmar.

future, people like us, but more lucid, will infer from the data we leave them some useful conclusion or some admirable generalization" (personal translation). This quote reflects that a lot of the science, and the work that we do, although it may seem small and does not fit into the big picture right away, still plays a key role and contributes to improving our understanding of the world.

I also often find myself reflecting on this quote from Gabriela Mistral: "Where there is a tree to plant, plant it yourself. Where there is a mistake to correct, correct it yourself. Where there is an effort that everyone avoids, do it yourself. Be the one who removes the stone from the path" (personal translation). Gabriela Mistral was a famous educator who was critical and disruptive. This quote highlights the significance of making a positive impact in various aspects of life and helping others (e.g., being the one who removes the stone), even if the benefits are not immediate, as it contributes to a better future.

T: What is your idea of perfect happiness?

My idea of perfect happiness is to utilize my abilities to make the world a better place. A better world is fair, embracing knowledge, diversity, and empathy. I believe that my PhD in environmental prediction can shed light on reducing uncertainty within simulations, generating more accurate guidelines to assess the impacts of hazards, such as drought and floods.

As we share this information with communities, we contribute to building a better and fairer future. A future characterized by the opportunity for everyone to thrive, providing support for science, health, and justice. Overall, I am happy.

T: If not a researcher/educator, who/what would you be?

I would like a job where I can help people solve real-world problems by combining creativity, logic, and a wide range of tools or disciplines. I enjoy looking at problems from different angles, combining various sources of information, and working to make the world a better place.

↑ → Atacama Desert: *Icy Penitents on Chajnantor*
→ *Atacama Desert: A Visible and Infrared Survey Telescope for Astronomy Before Sunset*
Photos: ESO/B. Tafreshi, 2012 | Wikimedia Commons.

Masaki Hayashi Professor Earth, Energy, and Environment

Masaki Hayashi interviewed by **Thirst**.

I worked as a volunteer in a small village in Africa, where the sole source of water supply was hand-dug wells. That got me interested in groundwater hydrology, and since then I have stayed in this field for my entire career.

Thirst: What are your impressions of the current state of water in your area of expertise?

Masaki: My area of expertise is groundwater hydrology, which is a study of groundwater in relation to the hydrologic cycle. In many parts of the world, groundwater is the sole source of water supply, particularly in dry areas, where river water is not readily available. Overuse of groundwater has caused major problems in some parts of the world, where groundwater is heavily used for irrigation, or for industrial and domestic water supply. In these areas, overuse has resulted in substantial drawdown of water level in aquifers, disappearance of springs, land subsidence, and other problems over a large region. Fortunately, we have not had regional-scale overuse of groundwater in Alberta, primarily because we do not use it for irrigation. However, there have been notable cases of groundwater overuse in rural municipalities. Therefore, it is prudent to establish science-based approach for managing groundwater in a sustainable manner in anticipation of increasing groundwater use in the coming decades and centuries.

T: What do you see as the biggest challenges?

Groundwater is a renewable resource, which can be used perpetually if managed properly. It is particularly important to see groundwater as part of the hydrologic cycle, whereby groundwater is recharged by rain and snowmelt, and it comes back to the ground surface to feed springs and headwater streams. Most of the water flowing through the Bow River and Elbow River in Calgary originates in thousands of small headwater springs in the mountains. The water pumped from wells in rural Alberta are recharged by rain and snowmelt in grasslands and farm fields not very far from the wells. Given the dependence of groundwater on rain and snowmelt, which in turn are affected by overall meteorological conditions, it is not hard to imagine that climate change will likely have an influence on groundwater resources in Alberta. Climate scientists have shown that temperature and precipitation will both increase in Alberta, but we do not really understand how they will affect groundwater. Will climate change have positive or negative effects on groundwater, or will it have no noticeable effects? In my mind, that is one of the biggest challenges in groundwater hydrology, not only for Alberta but also for the rest of the world.

Bio:
I am a professor in the Department of Earth, Energy, and Environment. I received my B.Sc. and M.Sc. in earth sciences from Waseda University and Chiba University, respectively, in Japan and Ph.D. in earth sciences from the University of Waterloo.

My main research interests are in the connection among groundwater, surface water, and atmospheric moisture in various environments ranging from the prairies to the mountains.

← *Masaki Hatashi*
Photo courtesy of Masaki Hayashi.

T: What areas should we be focusing on to advance the field?

To understand how groundwater responds to changes in meteorological conditions over various time scales (e.g., months, years, decades), we need to have long-term data collected by carefully designed network of monitoring wells and other instruments. Compared to meteorological and river-flow data, we have much fewer long-term data on groundwater levels. As a result, there is a tendency to rely on computer models for predictions, but it is difficult to validate these models without reliable field data. I believe that some of us need to focus on conducting carefully designed field studies by establishing and maintaining long-term monitoring networks, so we can start understanding the climate-change effects on groundwater.

T: What are you working on right now?

Broadly speaking I have two on-going hydrological research projects, one in the alpine headwaters of the Canadian Rockies, and another in the prairies of Alberta. In the alpine hydrology project, I am trying to understand and quantify the role of groundwater in sustaining the flow of mountain rivers (e.g., Bow River) during the low flow period starting from August and lasting until May of each year. In the prairie hydrology project, I am trying to understand the mechanism of groundwater recharge in the prairies and how they are affected by meteorological variability at different time scales. Both are long-term projects that I started more than 20 years ago.

T: How did you get started in in your field?

After obtaining a B.Sc. degree in geology in the mid-1980s, I worked as a volunteer in a small village in Africa, where the sole source of water supply was hand-dug wells. That got me interested in groundwater hydrology, and since then I have stayed in this field for my entire career.

T: Which work/direction/innovation have you seen recently that really excited you?

My latest Ph.D. student used an uncrewed aerial vehicle (UAV) for his study of alpine aquifers in the Canadian Rockies, and I was very impressed by its capability. The data acquired by UAV are limited to the information of ground surface, because UAV cannot see underground. However, there are innovative ways one can use the surface information to infer the subsurface (i.e. underground) conditions. I think that UAV has a great potential for groundwater research.

T: What is the last book you enjoyed?

Meditations by Marcus Aurelius. About ten or so years ago, I listened to a podcast about stoic philosophy, which resonated with me. At the time I had a high stress level

→ *A snowmelt pond in a typical prairie farm in Wheatland County. These ponds are important sources of groundwater recharge.*
Photo courtesy of Masaki Hayashi.

caused by heavy workload, and stoic philosophy helped me cope with the stress. *Meditations* is one of the classics of stoic philosophy based on personal notes of Roman Emperor, Marcus Aurelius, written during his field campaigns. I was on a research leave at Roma Tre University in Rome for five months in 2023 and four months in 2024. On one of my morning-run routes was a hilltop square with a large statue of Marcus Aurelius on horseback. I made a habit of stopping in front of the statue for a few minutes and reflect on my work and life. I recently re-read Meditations and found it helpful in reminding me that I should focus on what I have under my control instead of worrying about things that I cannot control.

T: Who do you admire? Why…

I admire those who conduct scientific research that make real and long-lasting societal impacts. My M.Sc. thesis supervisor, Shizuo Shindo was like that. He did not publish too many scientific papers in so-called high-impact journals, but he led research projects that directly contributed to solving water-management problems in local communities. When I was starting out as a young professor, I allowed myself to fall into a trap of 'publish-or-perish' paradigm. As I grow older and mature as a scientist, I have come to believe that making real impacts is far more important than adding another paper to one's CV.

T: What's your favorite motto or quotation?

This is not a quotation, but there is something I have been telling all my graduate students when they start their program with me. It goes like this. We are in a privileged position to generate new knowledge and add it to the giant edifice called science that humanity has been building for a very long time. Most of us make a tiny contribution, like one small brick in a tall building, but a faulty brick can cause the entire building to collapse. Each of us has the responsibility to ensure that our small brick fits in so that others can build on it. I did not come up with this, though the brick metaphor is my invention. It is a paraphrased version of what I got from my Ph.D. supervisor, Bob Farvolden in Waterloo when I started my program many years ago.

T: What is your idea of perfect happiness?

I am not sure if I believe in the notion of 'perfect' happiness. Our lives are always imperfect, but I think that we can find happiness in small things if we cherish them. For example, I always find a small piece of happiness when I am conducting field work with my students. I suppose this is in line with the writing of Marcus Aurelius.

T: If not a researcher/educator, who/what would you be?

I went into the M.Sc. program in Japan thinking that I would become a groundwater expert working for an international aid agency, like those affiliated with the United Nations. Had I not been sidetracked into academia; I may have ended up working for an international aid organization.

→ *The Lake O'Hara watershed in Yoho National Park, where our group has been conducting alpine hydrological studies since 2004.*
Photos courtesy of Masaki Hayashi.

Juhi Huda Research Associate Simpson Centre

Juhi Huda interviewed by **Thirst**.

Water crises are increasingly being recognized as governance crises because the challenges that come with water management are not just about issues such as scarcity, pollution, or accessibility but are rooted in issues such as policies, regulations, and administrative functions that govern the use of water.

Thirst: What are your impressions of the current state of water in your area of expertise?

Juhi: Across the globe we have water crises unfolding at varying scales for varying reasons – climate change, increase in population, increase in water use, land use changes, geopolitical reasons, etc. These water crises are increasingly being recognized as governance crises because the challenges that come with water management are not just about issues such as scarcity, pollution, or accessibility but are rooted in issues such as policies, regulations, and administrative functions that govern the use of water.

T: What do you see as the biggest challenges?

How best to adapt current policies in the face of changing water availability worldwide?

Within Alberta - How best to communicate to the public this change in water availability especially given that Alberta is in a multi-year drought?

T: What areas should we be focusing on to advance the field?

I think that we need to focus on a multidisciplinary and transdisciplinary effort by bringing together relevant groups from multiple disciplines and sectors; and groups that have different needs need to come together and work on solutions.

T: What are you working on right now?

One of my current projects involves leading a policy lab on water sustainability in Alberta's agriculture through digitalization. My research primarily explores the role of stakeholder communication in the policy process. So, with this lab, we bring together diverse stakeholders to work toward charting a roadmap for water sustainability while leveraging digital tools and envisioning what kind of policy changes are required to leverage digitalization for water sustainability in Alberta's agriculture.

Bio:
Juhi Huda is an environmental policy, governance, and communication scholar with interdisciplinary training in environmental studies. Her broad research focus has been on the role of stakeholder communication in the policy process. Her recent research has primarily focused on food systems and water governance, although her interest ranges across environmental policy issues related to disaster and hazards, climate change policy, and urban governance.

Juhi is currently a Research Associate at the Simpson Centre for Food and Agricultural Policy at the University of Calgary where she is leading a Policy Lab on Water Sustainability in Alberta's Agriculture through Digitalization bringing together diverse stakeholders to shape innovative policies that leverage digitalization to ensure a sustainable water future for Alberta's agriculture. She is also leading an agricultural literacy project that aims to tackle misinformation in agriculture through controversy mapping. Before joining the Simpson Centre, she was an Assistant Professor of Environmental Studies at FLAME University, Pune, India. She has also worked as a Postdoctoral Researcher at NASA Jet Propulsion Laboratory (JPL) and California Institute of Technology where her research examined socioeconomic dimensions of freshwater availability in connection to tracking and quantifying human impacts on the water cycle. As a doctoral student at the University of Colorado, Boulder, USA, she examined the role of information in stakeholder communication and the role of evidence and risk perception in the agricultural biotechnology policy process in India. She holds a Ph.D. in Environmental Studies from the University of Colorado, Boulder, an M.A. in English (Literature and Environment emphasis) from University of Nevada, Reno, and a B.A. and M.A. in English Literature from University of Pune, India.

← *Juhi Huda*
Photo courtesy of Juhi Huda.

T: How did you get started in your field?

I have always been interested in language and communication. No matter what field or discipline you are in, communication is important and crucial. I started out as a literature student while pursuing my undergraduate degree and then specialized in environmental literature with a focus on environmental justice issues. But seeing how narratives and stories influence the policy process, I chose to pursue a doctoral degree in a broader field - environmental studies with a focus on policy. Narratives and communication still remain at the core of my research.

T: Which work/direction/innovation have you seen recently that really excited you?

The move toward transdisciplinary scholarship is something that I am excited about, although at the moment, I find it remains a token gesture. However, I am happy that it is at least being talked about. To move toward sustainability, I think we will need a truly interdisciplinary approach that draws not just from the natural sciences, but also from the social sciences and humanities.

T: What is the last book you enjoyed?

I love to read and always have multiple books in my e-reader that I am reading. So, to choose one book is difficult. A non-fiction book that I recently read and enjoyed was *Braiding Sweetgrass: Indigenous Knowledge, Scientific Wisdom and the Teaching of Plants* by Robin Wall Kimmerer. A couple of fiction books that I enjoyed recently were *Piranesi* by Susanna Clark and *The Warm Hands of Ghosts* by Katherine Arden.

T: Who do you admire? Why…

I admire folks who are kind and humble. With so much injustice and darkness around us at times, it can be hard to find a reason to be kind and humble. And yet if one can find it in themselves to be kind and humble despite the circumstances, I think that is truly admirable.

T: What's your favorite motto or quotation?

With the current geopolitical situation being what it is, I keep going back to the following quote from Elie Wiesel:

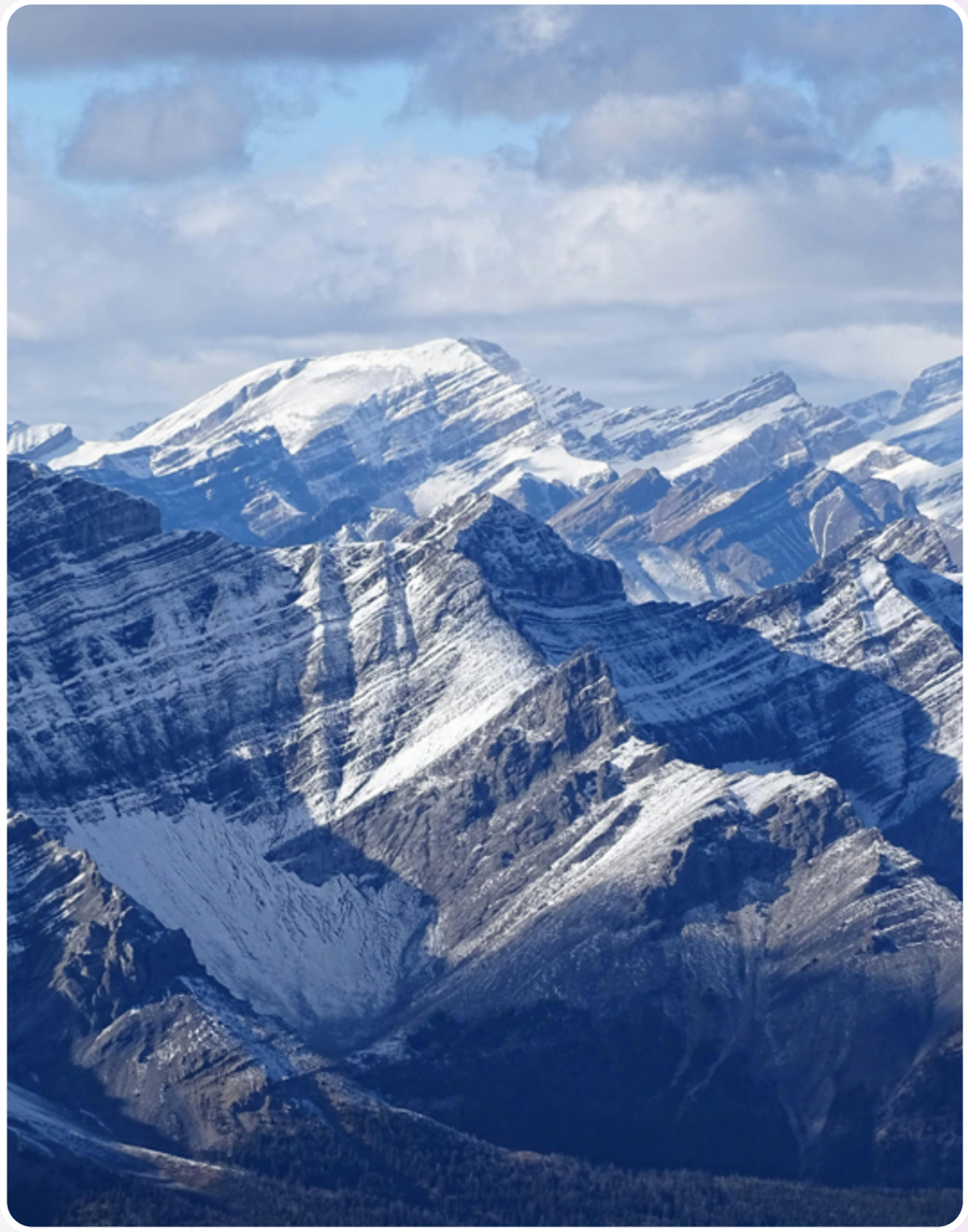
"We must take sides. Neutrality helps the oppressor, never the victim. Silence encourages the tormentor, never the tormented."

T: What is your idea of perfect happiness?

Ah, this is a tricky one. Running on mountain trails with my husband, seeing my children play in nature carefree and happy, having my cats curl up around me while I sit on the couch reading a book, hiking up snow-covered trails in the Rockies with my family. Rather than looking for that one elusive moment of perfect happiness, I'd rather focus on the little things that bring me joy.

T: If not a researcher/educator, who/what would you be?

I love being outdoors, I would have tried to find a career that would take me outdoors – may be a trail runner!



→ *AB, Canada*
Photo: Pixabay, 2016.

Guillaume Lhermie Director Simpson Centre

Guillaume Lhermie interviewed by **Thirst**.

Strong sustainability is an approach to environmental and resource management that emphasizes the need to maintain the integrity of natural systems and the sustainable use of resources in a way that respects ecological limits.

Thirst: What are your impressions of the current state of water in your area of expertise?

The current state of water in agriculture is marked by increasing challenges of water scarcity, inefficiency, and contamination. Many regions face water shortages due to overuse and climate change impacts, such as unpredictable rainfall and droughts. Agriculture, being the largest water consumer globally, struggles with inefficient irrigation systems and pollution from runoff containing pesticides and fertilizers. In addition, water scarcity is exacerbated by rising demand for food production, especially in arid regions. To address these issues, there is a growing push toward water-efficient technologies, sustainable farming practices, and better water management to ensure long-term food security.

T: What do you see as the biggest challenges?

Animal agriculture faces specific water-related challenges, as water is essential not only for the livestock but also for growing their feed. The pressing water challenges in this sector are multifaceted:

1. High Water Consumption: Animal agriculture is water-intensive. It requires significant amounts of water for drinking, feed crop irrigation, and meat processing. For instance, producing 1 kilogram of beef can require up to 15,000 liters of water due to the water-intensive feed crops like alfalfa and corn. This demand puts a strain on local water resources, especially in areas where water is already scarce.

2. Water Scarcity: As with crop agriculture, regions with limited freshwater resources are heavily affected. Animal farming, particularly intensive livestock operations, exacerbates water scarcity because of the high volumes needed to sustain large herds or flocks. This competition for water can lead to conflicts between agricultural sectors, municipalities, and ecosystems.

3. Water Pollution: Animal waste, antibiotics, and chemicals from feed can contaminate local water sources through runoff, leading to water pollution. This runoff can harm aquatic ecosystems, reduce water quality, and pose risks to human health. Nutrient overloads in water bodies can lead to algal blooms and the destruction of aquatic life.

Bio:
Guillaume Lhermie is the Director of the Simpson Centre for Agricultural and Food Policy, located at the University of Calgary, School of Public Policy. Guillaume Lhermie also holds an appointment as Professor of Animal Health Economics and Policy at the Faculty of Veterinary Medicine at the University of Calgary.

Dr. Lhermie' s research interests are in One Health and Infectious Diseases challenges, specifically the interface between animal agriculture and human health. His research focuses on the economics of antimicrobial use and resistance, the sustainability of livestock systems, and in political science on controversies in agriculture and the governance of health systems.
Guillaume obtained a Doctoral degree in Veterinary Medicine at Ecole Nationale Vétérinaire de Toulouse (2005), a Master's degree in Agricultural Economics at Montpellier Supagro (2010), a Political Sciences diploma at Sciences Po Toulouse (2010) and a PhD. in Pharmaco-epidemiology and Innovation at Université de Nantes (2015). Dr. Lhermie currently serves as expert in animal health economics for international organizations (FAO, OIE, WHO), national agencies and NGOs.

← *Guillaume Lhermie*
Photo courtesy of
Creative Desctruction Lab.

4. Inefficiency in Water Use: Many livestock operations still rely on traditional methods of water management, which can lead to significant waste. Lack of efficient water systems, such as automated drinkers and water-saving technologies, leads to unnecessary water losses.

5. Climate Change: As weather patterns change, livestock operations are increasingly affected by droughts, altered rainfall patterns, and temperature extremes, all of which impact water availability and animal health. These conditions can lead to reduced productivity and increased costs for water and feed.

T: What areas should we be focusing on to advance the field?

The most important challenge is the interdependence between many of the grand challenges our world is facing. Our efforts should focus on providing solutions integrating social and environmental justice, which means that we need to re-create conditions of dialogues across communities, in a society that looks more like an archipelago, than a continent.

T: What are you working on right now?

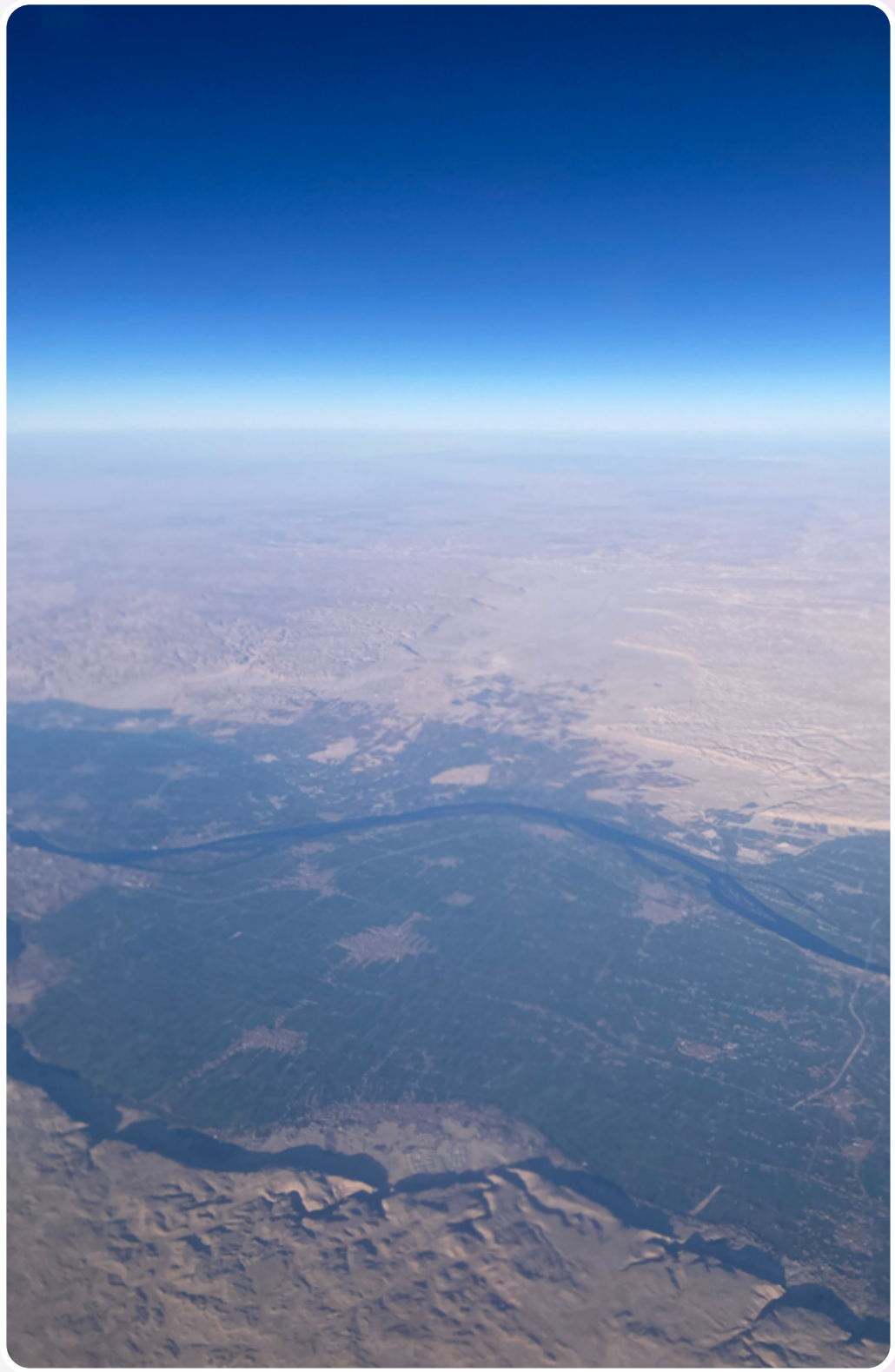
Scientific knowledge alone is not enough to drive significant impact, which has inspired the Simpson Centre to spend more time exploring stakeholder knowledge and opinion. In other words, there is a demand for firsthand experience from stakeholders in the agricultural industry to create better policy. my team at the Simpson Centre is currently planning and hosting 3 sessions of a Policy Lab over the next two years. A policy lab is an initiative designed to foster the development, experimentation, and implementation of innovative public policies. The idea behind hosting a policy lab is to bring together diverse stakeholders to co-create a roadmap toward better water sustainability through digitalization in agriculture. We expect to fill knowledge gasp and foster dialogues between producers, government, industry and academia, identify the bottlenecks in moving towards sustainable water management for food production (e.g. in which stages: planning and production, transportation, consumption) ; and design Policy innovation for water management in Alberta.

T: How did you get started in in your field?

In one word: opportunistically.

T: Which work/direction/innovation have you seen recently that really excited you?

Strong sustainability is an approach to environmental and resource management that emphasizes the need to maintain the integrity of natural systems and the sustainable use of resources in a way that respects ecological limits. It argues that certain forms of natural capital (e.g., ecosystems, biodiversity, and water resources) are irreplaceable and cannot be substituted by human-made capital, such as technology or infrastructure. In my opinion, it is a key concept that needs to be embraced by a larger scientific community, and thereafter by the civil society.



→ *Untitled.*
Photo courtesy of Guillaume Lhermie.

T: What is the last book you enjoyed?

Blanc by Sylvain Tesson. It is a tale of 2/3 guys touring the alps for 4 winters.

T: Who do you admire? Why…

Fabien Galthié, head coach of French national rugby team: for his capacity to reinvent himself, his strategic vision and leadership, and resistance under pressure

T: What's your favorite motto or quotation?

The day idiots will be flying in orbit, you won't be done turning around.

T: What is your idea of perfect happiness?

The Capacity to absorb difficult moments and move forward

T: If not a researcher/educator, who/what would you be?

Physician, politician, and given that I enjoy excellent food, maybe Pacman.

→ *Untitled.*
Photos courtesy of Guillaume Lhermie.

Sharon Mascher

Dean and Adjunct Professor

Sharon Mascher interviewed by **Thirst**.

Many western water law regimes continue to struggle with setting limits, addressing cumulative impacts and putting in place integrated and enforceable planning mechanisms to allow for evidence-based decision making.

Thirst: What are your impressions of the current state of water in your area of expertise?

Sharon: From a legal perspective, the current state of water is deeply tied to challenges confronting (over) consumption and use limits, managing cumulative impacts, and respecting the current and future needs of other beings and functioning ecosystems. With climate change exacerbating cycles of drought and flooding, regulatory regimes need to be flexible and adaptable to meet these challenges.

T: What do you see as the biggest challenges?

Many western water law regimes continue to struggle with setting limits, addressing cumulative impacts and putting in place integrated and enforceable planning mechanisms to allow for evidence-based decision making.

T: What areas should we be focusing on to advance the field?

I think we need to continue to work in multi-disciplinary teams, across disciplines and jurisdictions to share learnings and solutions to addressing complex problems. We also need to clear space for Indigenous nations to manage resources and exercise rights of self-determination in accordance with section 25 of the UN Declaration on the Rights of Indigenous Peoples.

T: What are you working on right now?

As the Dean of the University of Western Australia Law School, an important part of my current work is supporting an amazing group of legal academics to advance their own high impact research. My own research largely focuses on public and private responsibility for climate related harms. Initially this research adopted a preventative focus, as clarifying legal responsibility should drive behavior change. However, increasingly it is much more pragmatically focused on liability and remediation, as the consequences associated with severe climate related events – including floods and droughts – intensifies.

T: How did you get started in in your field?

I took a circuitous route (perhaps why I like the saying 'not all who wander are lost'). I left the practice of law to pursue post-graduate studies with the intention

Bio:
Professor Sharon Mascher is the Dean and Head of School at School of Law, University of Western Australia. She is also an adjunct professor at the University of Calgary.

Sharon's research focuses on climate change and the intersections between property law, environmental law, water law and Aboriginal land rights.

← *Sharon Mascher*
Photo courtesy of UWA.

of returning to practice after giving academics a bit of a try. I took a 2-year appointment at the University of Western Australia to work on a project jointly sponsored by the Centre for Commercial and Resources Law and Water and Rivers Commission of Western Australia comparing different legislative approaches to facilitate and inform water law reform in Western Australia. The goal of the reform was, as set out in accordance with the Council of Australian Governments ('COAG') undertakings on water reform, to 'achieve the highest and best value of the limited resource for community benefit whilst ensuring that use of the resources is ecologically sustainable". That project gave me my first real taste of working with an interdisciplinary team in a very applied manner. It also taught me the value of asking how other jurisdictions tackle a problem and working in comparative spaces.

T: Which work/direction/innovation have you seen recently that really excited you?

The current proceedings before the International Court of Justice should be a game changer. The International Court of Justice has been asked to clarify what legal obligations international law places on States to protect the climate system and other parts of the environment from human-caused emissions of greenhouse gases for present and future generations; and the legal consequences under these obligations for States who, by their acts or omissions, have caused significant harm. It is hoped that the resulting decision will provide a new set of legal tools to drive meaningful solutions.

T: What is the last book you enjoyed?

I have just finished reading *The Unruly Ocean: Law and Justice in the World's Oceans, Seas and Shorelines* by my colleague Professor Erika Techera and her co-author Joy McCann. It is written to not only introduce non-specialist readers to the complex web of treaties and laws governing the world's oceans, seas and shorelines, but to bring a multi-disciplinary lens to contextualize historical developments and offer solutions reimagine a new way forward. It sounds like a 'work read' but actually, it was the book I picked up at the end of the day.

T: Who do you admire? Why…

There are many people I admire, both personally and professionally. But, since the focus is water, I have to say my mother. She lived on a farm in southern Saskatchewan during the 1930s drought and she instilled in us a deep understanding that water is precious.

T: What's your favorite motto or quotation?

Not all those who wander are lost.

→ *Photo with my colleagues after intervening in a court challenge of the federal Impact Assessment Act. L to R: Professors David Wright, Shaun Fluker, Sharon Mascher and Martin Olszynski*
Photo courtesy of UCalgary News.

T: What is your idea of perfect happiness?

Being outside in a quiet, beautiful place, whether alone with the sound of birds and the wind, or sharing a laugh in the company of friends and family. Either way, perfectly happy.

T: If not a researcher/educator, who/what would you be?

If I hadn’t taken the turn towards legal academics, I would have continued as a practicing lawyer. Hopefully I would have found my way to an environmental not-for-profit organization, using the law as a tool to drive environmental solutions.

→ *Kayaking at the Weaselhead*
Photo courtesy of Sharon Mascher.

← ↑ *At the Glasgow UNFCCC COP*
Photos courtesy of Sharon Mascher.

Bernhard Mayer Professor Earth, Energy, & Environment

Bernhard Mayer interviewed by **Thirst**.

The problem with water on planet Earth is that no new water is created. Hence, we have to be very careful in using what is available to us.

Thirst: What are your impressions of the current state of water in your area of expertise?

Bernhard: My current research is focused on the quality of groundwater with special focus on nutrients and contaminants. While one of the focus areas of our research group is Alberta, we also conduct collaborative projects with partners elsewhere in North America, Europe and Asia. The current state of surface water and groundwater with respect to impact from nutrients and contaminants varies greatly in various countries and provinces depending on land use and many other factors. In Alberta, we are for the most part blessed with very good quality of surface waters. Groundwater quality is somewhat more variable due to natural factors and in some cases anthropogenic impacts.

T: What do you see as the biggest challenges?

Globally speaking, one of the biggest challenges is how to feed more than 8 billion inhabitants of planet Earth while safeguarding the quality of surface water and groundwater resources. Historically, the over-use of synthetic and organic (e.g., manure) fertilizers in agriculture has been a key concern since it can result in excessive concentrations of nitrate in surface waters and groundwater making them unfit for drinking water purposes. One of the big unknows is the transit time of N-containing pollutants between agricultural soils and receiving groundwater bodies, which can vary depending on site characteristics from months to several decades. Beyond this issue, there are numerous emerging contaminants that include pesticides, pharmaceuticals, and compounds colloquially termed “forever chemicals” (per- and polyfluoroalkyl substances, PFAS) that require the attention of scientists now and in the future.

T: What areas should we be focusing on to advance the field?

For investigations of surface water contamination, it is in my view of key importance to use a holistic, transdisciplinary approach, that investigates sources, transport pathways, and occurrence of contaminants, but also their fate in lakes, rivers, and other surface water bodies. For instance, surface water – groundwater interactions are often a key driver of contaminant addition or removal, that is frequently overlooked. For groundwater studies, access to high quality samples through properly constructed and installed groundwater monitoring wells if often a serious limitation, that should be addressed to advance the field.

Bio:
Dr. Bernhard Mayer is an internationally known isotope geochemist and a professor in the Department of Earth, Energy, & Environment at the University of Calgary (Alberta, Canada).
He received his PhD in Geochemistry in 1993 from the Ludwig-Maximilians University of Munich (Germany). After an 18 months stint as postdoctoral fellow at the University of Calgary (Department of Physics & Astronomy), he returned to Germany as an Assistant in the Department of Sedimentary and Isotope Geology at the Ruhr-University Bochum (1994-1997). In September 1997, Dr. Mayer accepted a professorial appointment as Associate Professor at the University of Calgary.

Dr. Mayer’s Applied Geochemistry research group combines aqueous, gas and isotope geochemical approaches to determine the sources, the transport and the fate of nutrients and contaminants in surface and subsurface systems on our continents. He has (co-)authored more than 200 papers in international refereed journals and 17 book chapters on a wide variety of geochemical topics including the quality of groundwater and surface waters on several continents, shale gas development, geologic CO_2 sequestration, oilsands recovery, and the environmental impact of fossil fuel development. Dr. Mayer has successfully obtained research funds from a wide range of international, federal, and provincial peer-reviewed granting agencies (NSERC, CFI, NRCan, Environment Canada, Alberta Innovates, Alberta Environment & Protected Areas etc.) and from a number of industry partners.

Dr. Mayer is an elected fellow of the International Association of Geochemistry (IAGC) and he was awarded an Annual Killam Professorship in 2017-18. Previously, he has served as assistant scientific director of Carbon Management Canada Inc. (2009-2013), was appointed to a national scientific review panel on shale gas extraction coordinated by the Council of Canadian Academies (2012-2014) and contributed to research initiatives supported by the STUDIUM Loire Valley Institute for Advanced Studies (France) and the United Nations SCOPE Nitrogen group. At the University of Calgary, Dr. Mayer served as the head of the Department of Geoscience from 2016-2020 and as the interim dean of the Faculty of Science from 2020-2021.

← *Bernhard Mayer*
Photo courtesy of Bernhard Mayer.

T: What are you working on right now?

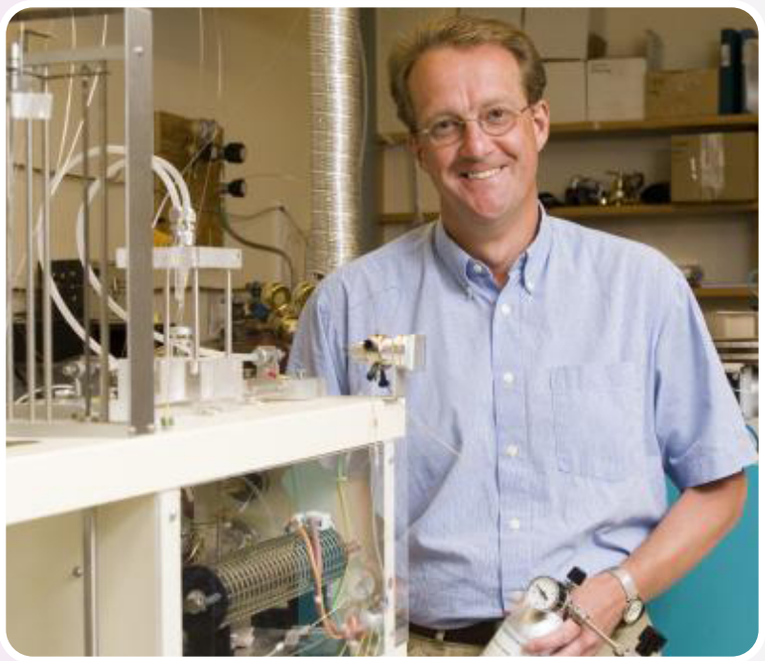
While my research group works on numerous case studies around the world, a current major focus is to advance the current knowledge of groundwater quality in Alberta. This involves not only the creation of a province-wide database of all publicly available groundwater quality information, but also the development of an understanding of the naturally occurring processes that govern the evolution of groundwater quality in the subsurface, and the key anthropogenic impacts that affect groundwater quality.

T: How did you get started in in your field?

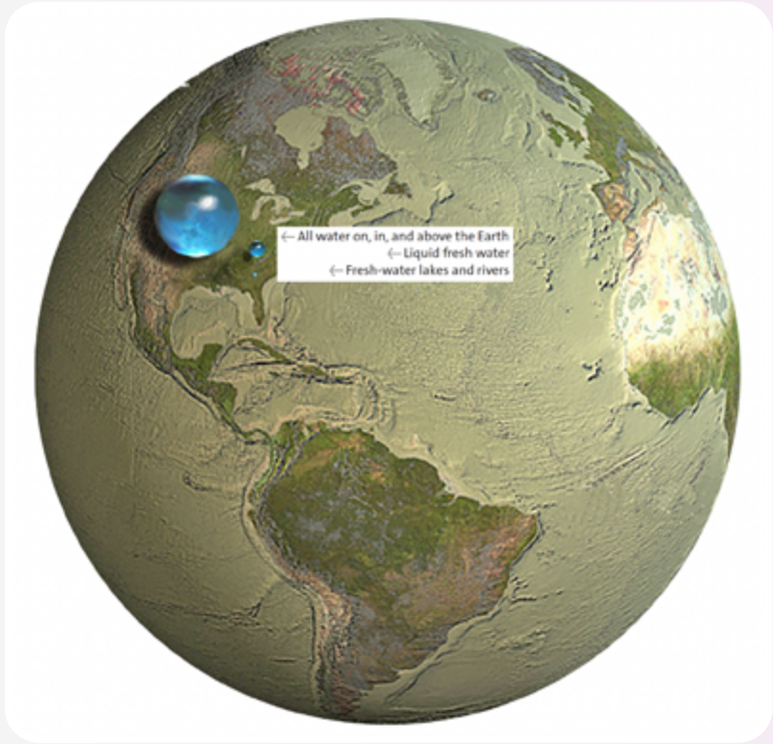
I had an inspiring professor as supervisor of my Master project, who showed me how geologic, hydrogeolocic and hydrochemical technqiues can be combined to solve a local environmental problem. This experience encouraged me to pursue a PhD program in a large German governmental research institute, where I obtained specialized knowledge in isotope geochemistry. The expertise gathered during my Masters and PhD programs prepared me well for a future career in water science.

T: Which work/direction/innovation have you seen recently that really excited you?

In my view, a really exciting development is the use of advanced microbiological techniques including metagenomics to investigate not only which microoragisms occur in surface waters and groundwater, but alsoprovide insights on how active they are, and what biogeochemical reactions they sustain. This exiting new research direction has already revealed that there is more diverse microbial life in Alberta groundwater than most of us previously assumed.



→ *Bernhard Mayer*
Photo courtesy of Bernhard Mayer.



T: What is the last book you enjoyed?

If I can mention two books: Lynn Martel's *Stories of Ice* and I also immensely enjoyed reading recently *Underland – a Deep Time Journey* by Robert Macfarlane.

T: Who do you admire? Why…

Stephen Lewis, Canadian politician and activist. I admire him for his broad knowledge, his exceptional communication skills, and his tireless humanitarian efforts to improve the lives of disadvantaged groups on planet Earth.

T: What's your favorite motto or quotation?

The problem with water on planet Earth is that no new water is created. Hence, we have to be very careful in using what is available to us.

T: What is your idea of perfect happiness?

A good work-life balance composed of impactful research with innovative graduate students that ensures access to clean water for all, a harmonious family life, an active circle of friends, and 50 cm fresh powder snow each weekend in the mountains.

T: If not a researcher/educator, who/what would you be?

Possibly a school teacher with a strong preference for instructing Science and Sport.

↑ *All of Earth's water, liquid fresh water, and water in lakes and rivers.*
Illustration: Jack Cook, WHOI.

Katherine Reece PhD Candidate

Katherine Reece interviewed by **Thirst**.

There is no limit to what you can accomplish if you don't care who gets the credit.

Thirst: What are your impressions of the current state of water in your area of expertise?

Katherine: I primarily model wildfire behaviour, and while that may seem removed from traditional hydrology it is all connected, after all trees are about 70% water. This intrinsic relationship means that predicting fire behaviour is, in many ways, a form of applied hydrology. Fires are fundamentally governed by moisture conditions in vegetation and soil, and understanding those dynamics is essential to anticipating ignition risk and fire spread.

Beyond prediction, my work also intersects with hydrology through the study of post-fire watershed responses. Wildfires dramatically alter hydrological regimes: the removal of vegetation reduces interception and evapotranspiration, while heat can create hydrophobic soils that repel water. This leads to increased runoff, higher peak flows, and a greater risk of flash flooding. In mountainous regions, these changes can trigger mass movements such as debris flows and landslides due to the destabilization of slopes once anchored by roots.

Water quality also suffers post-fire. Ash, heavy metals, and sediment can be mobilized into streams and reservoirs, degrading ecosystems and posing risks to drinking water infrastructure. As climate change increases fire frequency and severity, these water-related consequences are becoming more pronounced and widespread.

In sum, the current state of water in my area of expertise is one of growing vulnerability. Fires are not just destructive to land and air, they leave lasting and often underappreciated legacies on hydrological systems. Understanding and mitigating these effects is a crucial frontier for both fire science and water management.

T: What do you see as the biggest challenges?

The biggest challenge is the inherent difficulty of predicting wildfire behaviour. Fire is a highly dynamic, non-linear process influenced by a complex interplay of fuels, weather, and topography. A major limitation is the lack of high-resolution, up-to-date fuel data information about the type, amount, and moisture content of vegetation. Fuels are the energy source for fire, yet our ability to measure and monitor them at scale remains limited. Satellite observations are helpful, but they often lack the granularity or real-time updates necessary for precise forecasting.

Another challenge is the randomness of ignitions. Whether started by lightning or human activity, ignitions are often

Bio:
Katherine Reece is a PhD Candidate in Civil Engineering at the University of Calgary, where her research focuses on wildfire prediction in Western Canada. Her doctoral work integrates machine learning and spatial modelling to improve risk forecasting and operational response in wildfire-prone regions.

She holds a Bachelor of Science in Geology from the University of the West Indies, Mona Campus and a Master of Science in Water Science, Policy, and Management from the University of Oxford. With this interdisciplinary foundation, she brings a systems-level approach to understanding environmental hazards, grounded in both natural science and policy perspectives.
Katherine has presented her work at international conferences including the AGU Fall Meeting and the CatIQ Connect Conference, and was recognized with the AGU Outstanding Student Presentation Award in 2024. She serves as a Graduate Student Representative on the United Nations University (UNU) Water Hub Steering Committee, where she helps shape programming, organizes student-led initiatives, and has moderated high-level dialogues on global water and climate challenges. Her leadership in this space reflects a strong commitment to trans-disciplinary collaboration and knowledge mobilization. In addition to her academic work, Katherine is a proud committee member of the University of Calgary's Gender and Sexuality Alliance (GSA²). She is passionate about creating inclusive spaces and building awareness.

← ← *A site visit to the Brahmaputra River Basin*
Photo courtesy of Katherine Reece.

unpredictable in time and location. This randomness makes proactive planning and early warning especially difficult, even when broader fire weather conditions are well understood.

Finally, fire spread across diverse landscapes is highly sensitive to local topography and microscale variations in vegetation. Two adjacent valleys might experience vastly different fire behaviours due to subtle shifts in slope, wind patterns, or vegetation structure. Capturing that spatial complexity in models is computationally intensive and fraught with uncertainty.

Together, these challenges hinder our ability to deliver accurate, timely fire forecasts, particularly in the face of climate change, which is amplifying extremes and pushing existing models beyond their tested limits.

T: What areas should we be focusing on to advance the field?

To meaningfully advance wildfire science and response, we have to start critically examining the values embedded in our current models and decision-making frameworks. The wildfire prediction landscape has historically been biased toward protecting physical infrastructure, such as homes, roads, and utilities, because these are tangible assets that are easily quantified in economic terms. While this is understandable, it often overlooks the intangible but deeply important values that communities place on cultural landmarks, traditional lands, spiritual sites, and ecological integrity, none of which are easily captured in cost-benefit analyses.

This infrastructure-centric lens also tends to prioritize protection for affluent or well-resourced communities, sidelining those that are historically more vulnerable, including Indigenous communities, rural populations, and those with limited political representation. These communities may be more exposed to risk and have fewer resources to recover, yet they are often underrepresented in risk assessments and planning processes.

To move forward, we should invest in community-centred fire risk mapping, participatory planning processes, and the incorporation of Indigenous knowledge systems, which offer rich insights into landscape stewardship and fire ecology. We must also enhance our predictive models not just to improve where and when fires occur, but to better understand who is most impacted, how, and why.

Additionally, advancing real-time data integration, especially for fuels and fire behaviour, as well as developing probabilistic models that convey uncertainty to decision-makers, will be critical. However, equally important is a shift in focus, from protecting what is merely “high-value” to protecting what is highly valued by both people and ecosystems.

T: What are you working on right now?

Right now, I’m focused on developing the right questions to ask communities about their needs and priorities when it comes to wildfire prediction. Predictive models and fire science are only as useful as they are relevant to the people they serve. That means understanding not just the technical aspects of fire behaviour, but also what information communities actually want and need to make decisions before, during, and after fire events.

I’m especially interested in engaging with communities to learn what kinds of predictions matter most to them. Is it knowing how fast a fire could reach their homes? Understanding evacuation timelines? Anticipating post-fire flooding or water contamination? These aren’t just scientific questions they’re social ones too.

In parallel, I’m also working on setting up a probabilistic wildfire modelling framework to combine the outputs with community-driven questions. I hope to build fire prediction tools that are both scientifically rigorous and socially meaningful.

↑ → *My first time seeing a glacier in Alaska, USA*
→ → *Fieldwork in Rio Pantaleo*
Photos courtesy of Katherine Reece.

T: How did you get started in in your field?

My journey into this field began in high school in Jamaica, during a severe drought that led to the closure of schools and offices due to a lack of running water. That experience left a lasting impression and ignited, pun intended, my curiosity about Earth systems. I followed that interest into a Geology major for my undergraduate studies, where I discovered a particular passion for hydrology over other subfields like sedimentology.

After graduating, I began working as a hydrogeologist in the Jamaican government, focusing on groundwater systems. When I later moved to Canada, the devastating wildfires of 2024 raised a new and urgent question for me: How do these fires impact water systems? That question marked a turning point.

I reached out to Professor Clark, who welcomed me into his research group to explore post-fire hydrological response. Since then, I've fallen in love with wildfire modeling. My work now centers on improving operational workflows for fire prediction and risk assessment, especially where fire and water systems intersect.

T: Which work/direction/innovation have you seen recently that really excited you?

I'm excited to see the wildfire modelling space increasingly embrace machine learning algorithms. Traditionally, fire behaviour models have relied heavily on physics-based or empirical approaches, but the integration of machine learning is opening new possibilities, particularly for pattern recognition. These models are helping us better account for the non-linear interactions between fuels, weather, and topography, and they offer the flexibility to adapt to data-rich or data-sparse environments.

Innovations that explore the intersection of the science and policy, such as incorporating governance structures into models of fire spread, are helping to bridge disciplinary divides in meaningful ways. These advances are pushing fire science to become more adaptive, interdisciplinary, and centred on human and ecological needs, which is exactly the direction the field must go.

T: What is the last book you enjoyed?

The Six Wives of Henry VIII by Alison Weir is my favourite among Tudor-era books, and it's the first title that comes to mind when I think about truly enjoying a book. I've long been fascinated, some might say obsessed, with the lives of Henry VIII's six wives, and this book captivated me so much I could re-read about them all day.

More recently, I found myself deeply moved by the Tao Te Ching, a book that challenged and expanded my sense of what it means to understand something. It offered a completely different way of thinking, quiet, paradoxical, and profoundly reflective, that left a lasting impression.

↑ → *In my office in the WaterHub at the University of Calgary*
→ → *Collecting sediments at the Pacific Coast of Guatemala*
Photos courtesy of Katherine Reece.

T: Who do you admire? Why…

Beyoncé is my pop-culture icon because she exemplifies what it means to be deeply committed to one's craft while also redefining excellence within a field. Her dedication, discipline, and ability to evolve artistically over time have made her not just a performer but a cultural force. Watching her career unfold has shown me how mastery is not just about talent, but about relentless growth and vision.

Attending her Renaissance World Tour was a turning point for me. It wasn't just a concert, it was an immersive celebration of creativity, identity, and purpose. In the wake of that experience, I found myself reflecting deeply on my own path. I asked myself: What is my gift? What unique contribution can I offer to the world? That line of questioning stayed with me for weeks.

Through that process of introspection, I came to a clear realization: returning to school would be the most impactful way for me to grow, contrib-

ute, and serve the planet. Pursuing further education has allowed me to sharpen my skills, deepen my knowledge, and align my work with the environmental and social challenges I care about most. Beyoncé's influence reminded me that greatness starts with purpose, and that our best work comes when we commit fully to developing and sharing our unique gifts.

T: What is your idea of perfect happiness?

Perfect happiness, for me, is being on a beach with the sound of waves in the background, reggae music filling the air, and my family by my side. It's the feeling of warmth, rhythm, and connection all coming together in one peaceful moment.

T: If not a researcher/educator, who/what would you be?

If I weren't a researcher, I'd probably be a Sims YouTuber. I've been playing The Sims for nearly 20 years, and it's a hobby that's brought me both creativity and joy. If I didn't already have my hands full with research, I'd seriously consider turning that passion into content creation, maybe even building a channel around storytelling, gameplay challenges, and community engagement.

→ → *Taking groundwater levels across wells in Santa Lucia Cotzumalguapa, Guatemala*
Photos courtesy of Katherine Reece.

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