Pacific Institute for Climate Solutions

ANNUAL REPORT 2022 – 2024

COLLABORATION AS A RESPONSE TO CLIMATE CHANGE

University of Victoria

THE UNIVERSITY OF BRITISH COLUMBIA

SFU SIMON FRASER UNIVERSITY ENGAGING THE WORLD

UNBC UNIVERSITY OF NORTHERN BRITISH COLUMBIA

Contents

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Cover image: *Fireweed (Chamaenerion angustifolium) growing among forest fire tree snags in Kootenay National Park, British Columbia, Canada. iStock*

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Message from the Executive Director

Recent years have marked a new era of climate impacts and realities.

The 2021 heat dome and the subsequent fires and floods brought devastating losses of life and destruction of homes, territory, and communities, which put British Columbia on the frontlines of this global issue. Communities across B.C. then experienced record-breaking wildfire in 2023 whereby thousands of hectares of forests burned, which precipitated evacuations and significant effects on human and ecological health. These climate impacts are happening in tandem with other crises in affordability and health care, and in the ongoing context of colonization, injustice, and marginalization.

The Pacific Institute for Climate Solutions (PICS) was created in 2008 to amplify B.C.'s climate leadership. Since that time, the climate context has evolved significantly as have the actions of Nations, governments, communities, and a diversity of organizations. What remains more pressing than ever is the importance of PICS as an independent research institute focused on solutions in service of society.

This report reflects on the achievements of PICS and its larger community of researchers and partners between 2022 and 2024. A theme throughout this work is deep collaboration and co-production, which we believe is central to thoughtful development, meaningful implementation, and the durability of climate solutions. The report explores the depths and breadths of this work, as well as how we have mended disconnections and reconfigured solution pathways.

Over this reporting period, the PICS team also engaged in realignment, reflection, and renewal that focused on how the institute can best serve the needs of the lands, waters, communities, and Nations across the territories making up the province called B.C. This process included conversation, collaboration, and feedback from diverse collaborators including our four-university network, executive committee, and the broader community that we aim to serve. Arising from this is our new 2024 and Beyond Strategic Plan, which refreshed our organizational values, goals, and strategy to support greater agility, ambition, and action through a strengths-based and solution-focused approach. This plan affirms PICS' commitment to principles of justice, equity, diversity, and inclusion, and to advancing truth and reconciliation through decolonizing practices.

While B.C. is on the frontlines of the climate crisis, it is also at the forefront of developing climate solutions, and that makes B.C. a beacon for navigating this complex era — regionally, nationally, and internationally. As this journey unfolds, PICS will mobilize and catalyze our collective capacity to act.

WHILE B.C. IS ON THE FRONTLINES OF THE CLIMATE CRISIS, IT IS ALSO AT THE FOREFRONT OF DEVELOPING CLIMATE SOLUTIONS, AND THAT MAKES B.C. A BEACON FOR NAVIGATING THIS COMPLEX ERA — REGIONALLY, NATIONALLY, AND INTERNATIONALLY. AS THIS JOURNEY UNFOLDS, PICS WILL MOBILIZE AND CATALYZE OUR COLLECTIVE CAPACITY TO ACT.

DR. IAN MAURO
PICS Executive Director

Who We Are

Our work is made possible by a talented team of staff and an extensive network of partners across B.C.

DANIEL ARBOUR
Partnerships and Grants Specialist

CHRISTY ASCIONE
Communications Specialist

STEPHANIE CAIRNS
Senior Director, Strategy and Foresight

DYLAN CLARK
Director of Research Mobilization

ALYSSA HILL
Research Lead

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Finance Assistant

KATHLEEN LAIRD
Assistant to the Executive Director

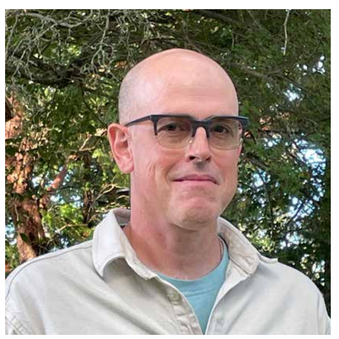
VANESSA LUECK
Researcher-in-Residence, Coastal Adaptation

CINDY MACDOUGALL
Communications Manager

EMILY MACNAIR
Director of Programs and Partnerships

DR. IAN MAURO
Executive Director

CAROLINE MERNER
Project Manager



JEREMY RIISHEDE
Administrative Manager

JANNA WALE
Indigenous Research and Partnerships Lead

Staff

Our team has diverse experience that supports collaborative and engaging approaches to climate action. Our staff are located on Lək̓ʷəŋən (Songhees and Esquimalt) and W̱SÁNEĆ territories in Victoria and across territories throughout British Columbia.

Thank you to former PICS staff (2022-24)

NASTENKA CALLE DELGADO
Program Manager,
Simon Fraser University

CHRISTOPHER KENNEDY
Associate Director

SHAUNA MACKINNON
Engagement Lead

CARLY MADGE
Program Manager,
University of Northern British Columbia

SARA MUIR
Program Manager,
University of British Columbia

CARLY PHILLIPS
Researcher-in-Residence,
Wildfire and Carbon

SYBIL SEITZINGER
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RENE SUŠA
Researcher-in-Residence,
Climate Education

DEVIN TODD
Researcher-in-Residence,
Negative Emissions Technologies

BUILDING ON PICS' DEEP ROOTS, WE ARE CONTINUING TO EVOLVE TO MEET THE NEEDS OF COMMUNITIES AND DECISIONMAKERS ACROSS B.C. OUR 2024 STRATEGIC PLAN ACTS AS OUR GUIDE IN THE YEARS AHEAD.

Network

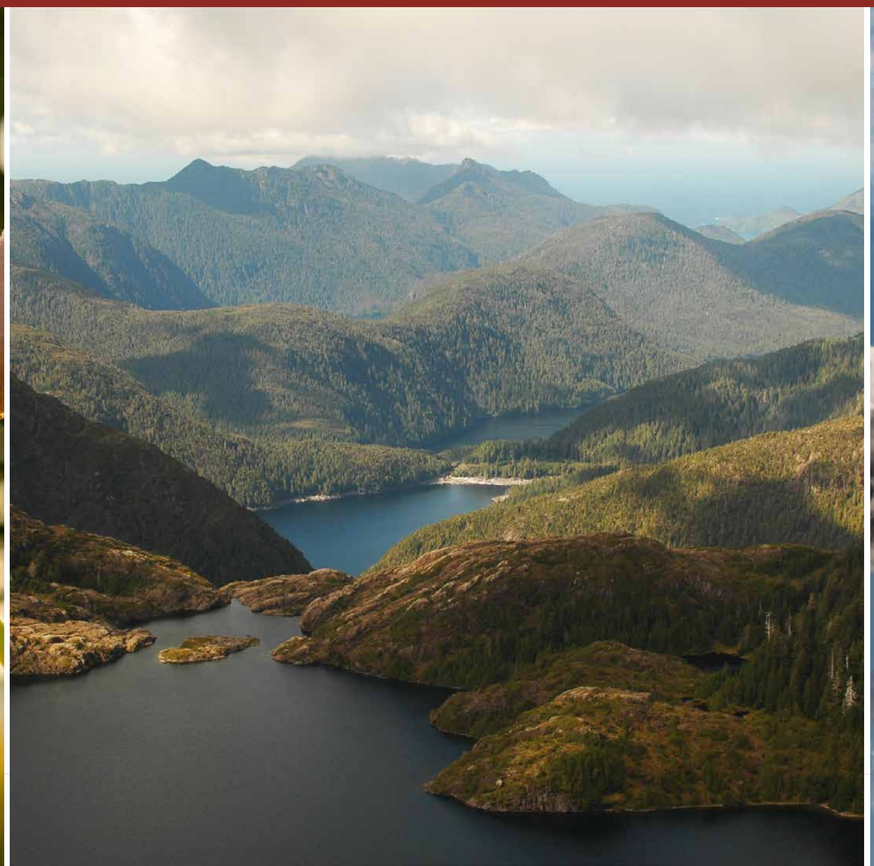
PICS brings together the research strengths and capacity of our four-university network to advance transformative and collaborative climate solutions. Our network is our unique strength and includes the University of Victoria (UVic), University of Northern British Columbia (UNBC), Simon Fraser University (SFU), and the University of British Columbia (UBC).

Exploring Depths

Exploring Depths focuses on deep, specialized research into the practices and technologies that will shape future systems. In these projects, researchers collaborate with communities, decision makers, and other partners who have deep knowledge to contribute to the development of innovations that can be integrated into operations and practice.

TELLURIUM BOOSTED LI-S BATTERIES FOR ZERO-EMISSION VEHICLES

TURNING THE TIDE: EXPLORING CLEAN MARINE PROPULSION IN COASTAL INDIGENOUS COMMUNITIES



DECARBONIZATION OF B.C.'S ENERGY SYSTEM

PICS OPPORTUNITIES PROJECT

Developing the next generation of lithium batteries

UBC team works to improve the safety and strength of the technology driving clean transportation

A

RESEARCHERS

Jian Liu
Wei Qu

PARTNERS

Fenix Advanced Materials
GLABAT Solid-State Battery Inc.
University of British Columbia

STATUS

Complete

Improvements in lithium battery technology have dramatically changed the capabilities of e-bikes and electric vehicles. Improved batteries are critical to meeting net-negative emissions targets.

Researchers at UBC received a PICS Opportunities grant in zero-emission vehicles, sponsored by the B.C. Ministry of Energy, Mines, and Low-Carbon Innovation (EMLI), to develop a new generation of lithium batteries.

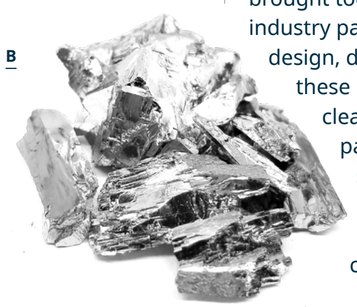
The main goal of the project was to develop a new solid-state lithium tellurium-sulfur battery that is safer and capable of holding even more energy than contemporary lithium-ion technology.

This new, solid-state battery promises to be twice as powerful, smaller, safer, and cheaper to manufacture. The project brought together local academic and industry partners in a joint effort to design, develop, and manufacture these new batteries to facilitate the clean energy transition. Academic partners contributed foundational science, while industry partners brought their insights into large-scale manufacturing and commercialization.

The project directly led to the inception of the UBC Battery Innovation Cluster, which combines engineering, chemistry, management, business, and policy-making expertise to design and manufacture solid-state batteries and understand their environmental, economic, and social impact in Canada.

It also led to new connections with non-profit organizations and governments, including Metal Tech Alley, the Innovative Clean Energy (ICE) program at EMLI, the B.C. Centre for Innovation and Clean Energy (CICE), and Innovate BC.

Overall, the project supports electrification and helped build B.C.'s battery technology and manufacturing expertise. The team continues to work towards a local battery supply chain from raw materials to finished cells.



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THIS NEW, SOLID-STATE BATTERY PROMISES TO BE TWICE AS POWERFUL, SMALLER, SAFER, AND CHEAPER TO MANUFACTURE.

C

A. *PhD candidate Yue Zhang (left) and Dr. Jian Liu (right) examine high-purity tellurium metal and a tellurium-based battery made at UBC. Provided by: Jian Liu*

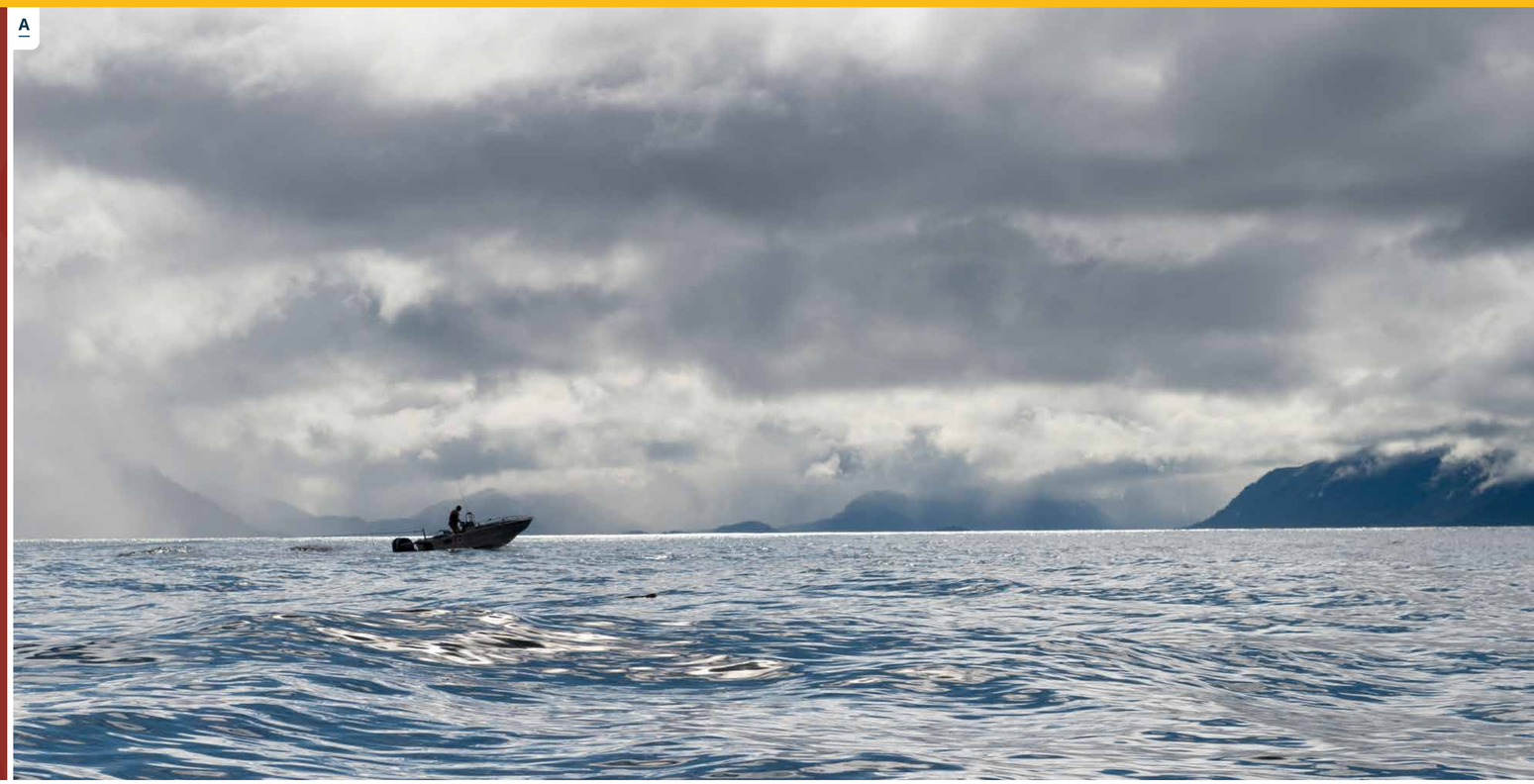
B. *Tellurium metal. Credit iStock*

C. *Dr. Jian Liu is holding (left) tellurium metal produced in B.C. and (right) a coin cell made of tellurium. Provided by: Jian Liu*

PICS OPPORTUNITIES PROJECT

Reducing fossil fuel use on the sea

Coastal Indigenous Nations and researchers look at how to bring cleaner transportation to seaside communities



A

RESEARCHERS

Clifford Atleo

Zuomin Dong

PARTNERS

Nuu-chah-nulth Tribal Council

Skidegate Band Council

Tseshaht First Nation

Hupacasath First Nation

Maaqutusiis Hahoulthee Stewardship Society

Ha'oom Fisheries Society

Ahousaht First Nation

Tla-o-qui-aht First Nation

Old Masset Village Council

Council of the Haida Nation

Simon Fraser University

University of Victoria

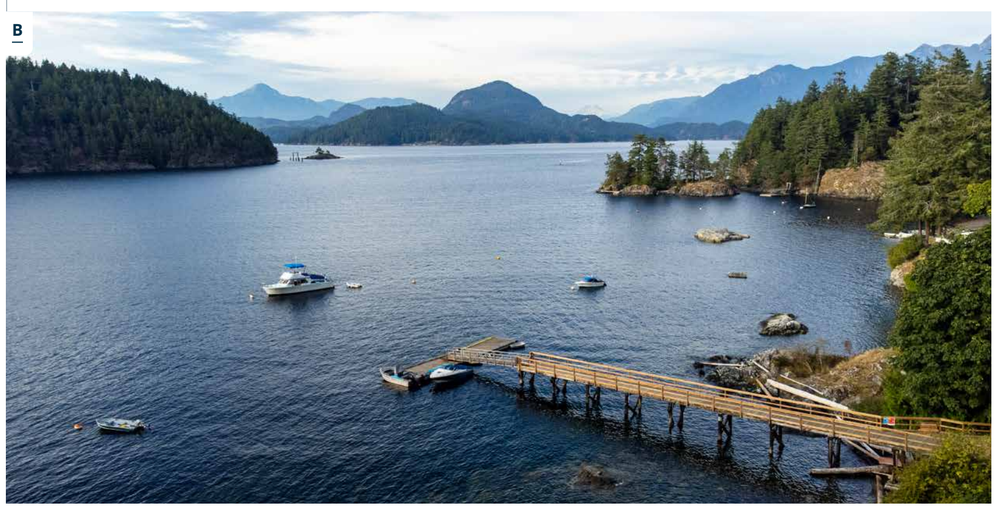
STATUS

Ongoing

Travel by sea is essential to culture, commerce, and basic services in many coastal communities. Yet nearly all marine vessels rely on fossil fuels.

Increasing temperatures and the attendant sea level rise represent an existential threat to coastal Indigenous communities, their ways of life, livelihoods, and local marine life. While communities are developing climate action strategies and establishing net zero plans, the search is on for alternatives to fossil fuels for boating.

In partnership with the Nuu-chah-nulth Tribal Council on Vancouver Island and the Skidegate Band Council on Haida Gwaii, along with eight other Indigenous communities and organizations, researchers at SFU and UVic received a PICS Opportunities grant to explore alternative power options for small and medium-size marine vessels.



B

The project includes technological considerations, but also draws from the knowledges, needs, and understandings of Indigenous peoples and communities who are intimately connected with the marine environment and lifeways.

The project is building an inventory and analysis of current fleets and facilitating community conversations and research about zero- and low-carbon challenges and opportunities for marine vessels. The team has developed relationships with communities to identify community priorities around transition, including safety, reliability, cost, and self-sufficiency. Community relationships and insights have shaped research priorities.

Through community partnership, the project will craft clear action plans to guide marine electrification, which will be an example for other coastal communities. The project will also contribute to recommendations to federal and provincial governments on how to support First Nations communities in these efforts.

C

A. *Pacific Rim National Park Reserve, Tofino, B.C. Credit: Adobe Stock*

B. *Bowen Island in the Gulf Islands of B.C. Credit: iStock*

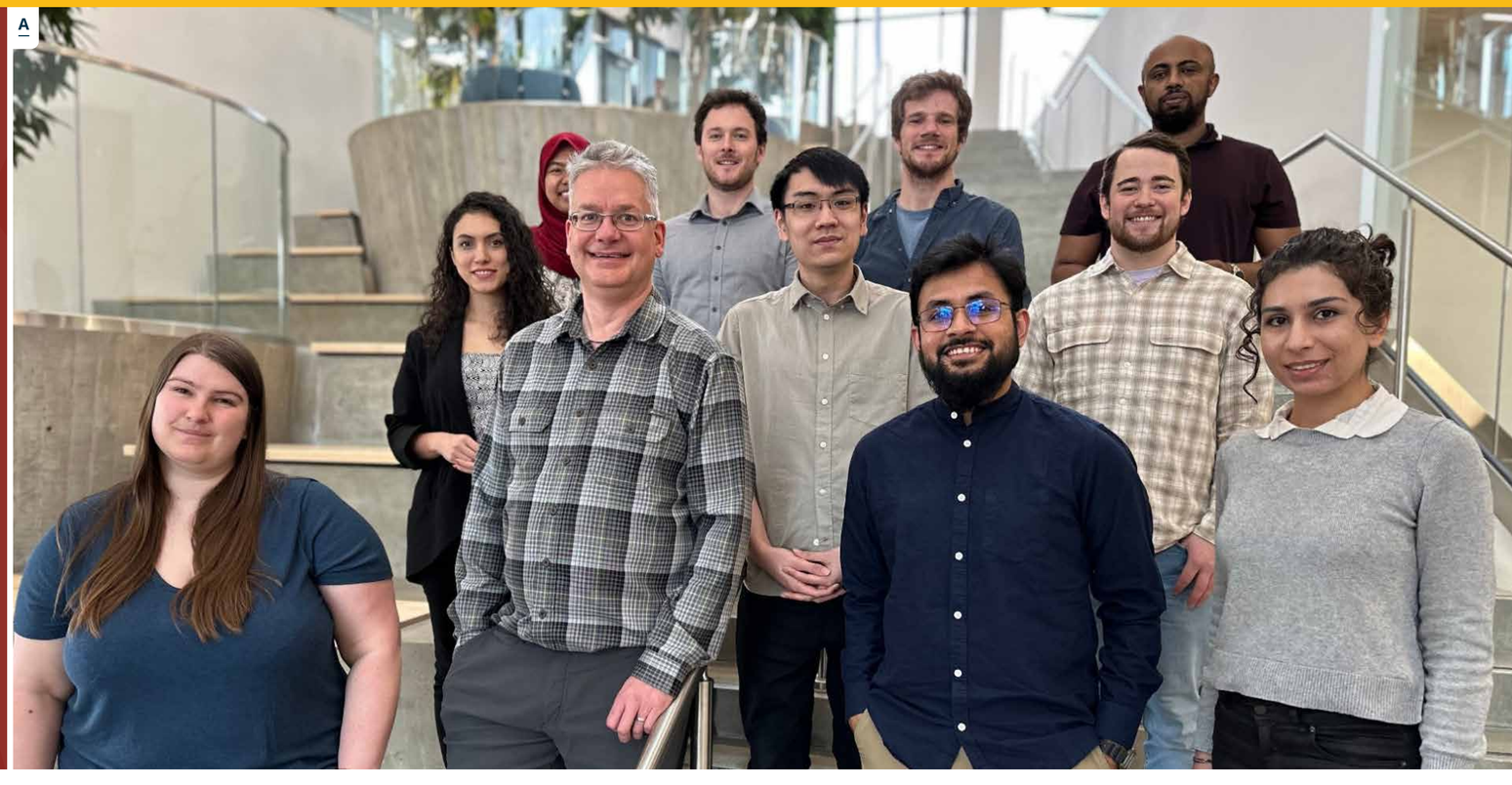
C. *Aerial view of Haida Gwaii, B.C. Credit: iStock*

THROUGH COMMUNITY PARTNERSHIP, THE PROJECT WILL CRAFT CLEAR ACTION PLANS TO GUIDE MARINE ELECTRIFICATION, WHICH WILL BE AN EXAMPLE FOR OTHER COASTAL COMMUNITIES.

PICS OPPORTUNITIES PROJECT

Building pathways to a future powered by low-carbon electricity

Research develops tools to explore resilient, green power sources in B.C.



A

RESEARCHERS

Taco Niet

PARTNERS

Renewable Hydrogen Canada Corp.

B.C. Hydro

B.C. Ministry of Energy, Mines and Low Carbon Innovation

Simon Fraser University

STATUS

Ongoing

B.C.'s ambitious emission reduction targets rely heavily on increasing electrification.

However, shifting to technologies like electric vehicles and heat pumps increase demand on the electrical system, which necessitates a substantial expansion of the low-carbon electricity supply and system. Strategies to reliably integrate power sources like wind, solar, and expanded hydro must be considered. Power sources also need to be resilient to droughts, severe weather, and wildfires.

Researchers at SFU received a PICS Opportunities grant to imagine pathways for resilient, low-carbon, and carbon-free electricity in B.C. The pathways comprise different generating infrastructure options, backed by analyses of their advantages and trade-offs — including impacts to water, food, and land use — to support policy and investment decisions.

The project team, led by the ΔE+ Research Group, brings together policymakers, public infrastructure, and industry participants to co-develop these models. Key questions partners are exploring include optimal generation and storage mixes, the sequencing of system expansion, and the implications of expanding cross-border transmission.

Research is ongoing and the project has made substantial progress. B.C. Nexus is an energy expansion model created through the project with results published in Renewable and Sustainable Energy Transitions. Other modelling completed in 2023 has been applied to a preliminary study of electric vehicle (EV) integration using varying charging strategies and EV use levels.

In its final year, the project will focus on extending modelling to explore trade and coordination with neighbouring provinces. Ultimately, the project aims to design comprehensive decision-making tools for an electrified B.C., addressing electricity generation, policy incentives for electrified use-cases, and integrated planning of energy, water, land, and climate systems to support a holistic and sustainable path to decarbonization.

> THE PROJECT BRINGS TOGETHER POLICYMAKERS, PUBLIC INFRASTRUCTURE, AND INDUSTRY PARTICIPANTS TO CO-DEVELOP THESE MODELS.

A. *The ΔE+ Research Group at SFU. Provided by: Taco Niet*

B. *High tension electricity power transmission lines high above Shuswap lake in the interior of B.C. Credit: iStock*

B

Exploring Breadths

Exploring Breadths is about research that bridges disciplines to investigate future systems. These projects bring together researchers and partners whose disciplines might not otherwise find themselves working together, allowing for fresh perspectives and helping to uncover new opportunities and challenges.

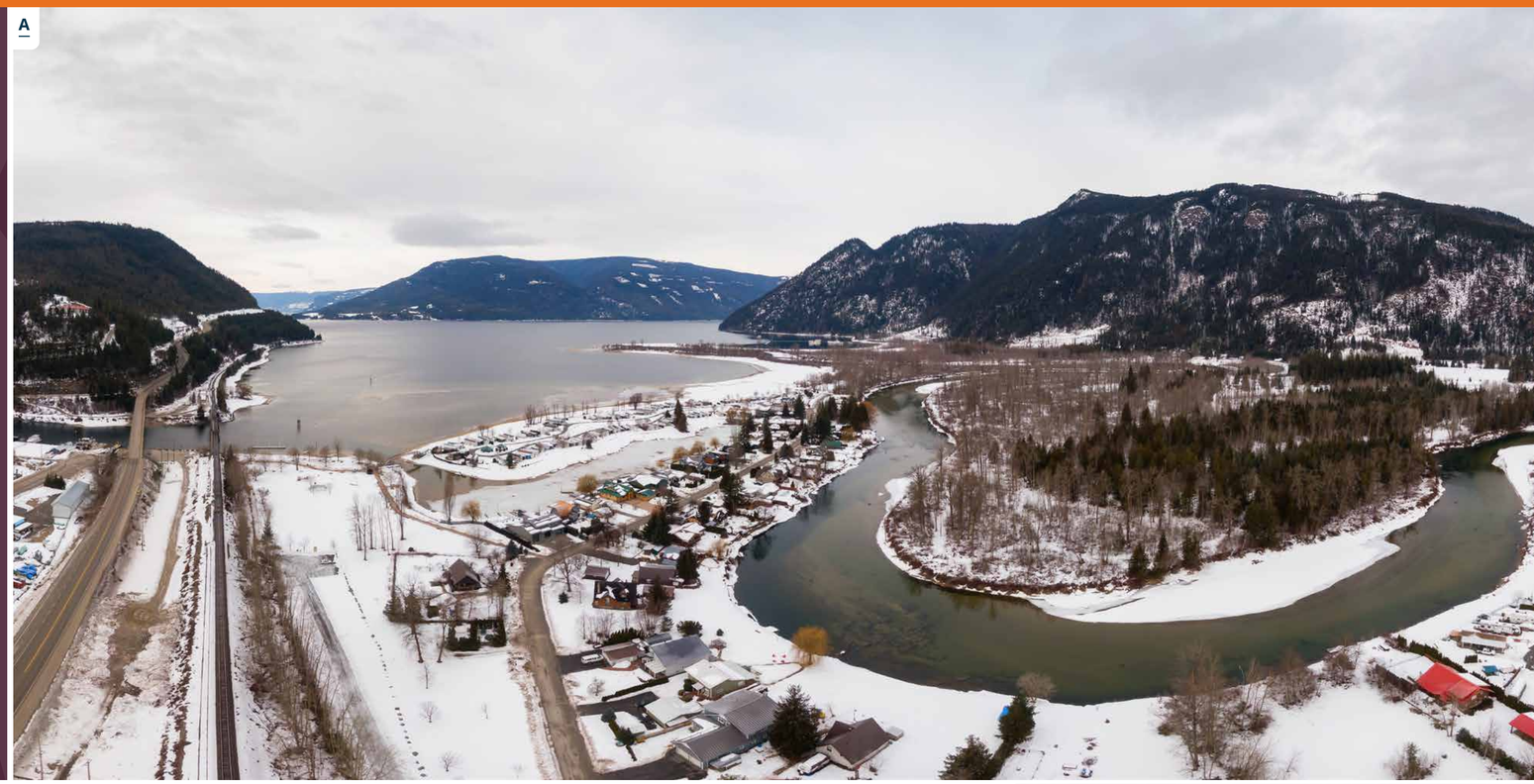
SERVING RURAL & REMOTE COMMUNITIES

EVIDENCE-BASED GUIDANCE ON INTEGRATING RESEARCH INTO CLIMATE CHANGE RISK ASSESSMENTS IN B.C.

PICS THEME PARTNERSHIP

Planning climate resilient solutions for rural and remote B.C.

Rural, remote, and Indigenous communities co-develop innovative solutions for better housing and safer equipment in changing climates



A

RESEARCHERS

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David Bristow

PARTNERS

First Nations Housing and Infrastructure Council
B.C. Housing and Technical Safety B.C.
Simon Fraser University
University of Victoria
University of Waterloo
University of Washington
University of Calgary

STATUS

Ongoing

Communities across B.C. experience climate change differently. Floods, storms, extreme heat, fire, and drought are just a few of the events that communities are increasingly likely to face.

These events intersect with how communities are built, organized, and supported, shaping different experiences. Rural, remote, and Indigenous communities are especially sensitive to climate change.

A multi-institutional research team led out of SFU has received a PICS Theme Partnership grant to address the confluence of climate change, housing, infrastructure safety, and community resilience for rural and remote communities. The project aims to weave place-based and Indigenous Knowledges with academic research to co-develop solutions that lead to greater community health, safety, and resiliency.

In its first year, the project expanded its team, started research on key themes, and took a community-centred approach to host workshops and build trust and respectful relationships with First Nations communities. Severe weather and wildfires affected the team's ability to meet with partner organizations and communities throughout the province.

A major outcome of the project is a Fire Resilience Handbook co-created with First Nations communities. The team hosted a Wildfire Resilience workshop, showcasing the handbook and gathering valuable feedback from communities and practitioners, which has since been integrated into their work. The team has planned additional workshops with community partners emerging in 2025.

The project's work is already influencing initiatives, such as Technical Safety B.C.'s (TSBC) inventory of infrastructure risks. Through a collaborative process, the team has helped to develop a more detailed and organized database for these risks. By contributing valuable research and insights, the project is helping to shape TSBC's approach to managing technical risks across the province.

THE PROJECT AIMS TO WEAVE PLACE-BASED AND INDIGENOUS KNOWLEDGES WITH ACADEMIC RESEARCH TO HELP COMMUNITIES CO-DEVELOP SOLUTIONS THAT LEAD TO GREATER HEALTH, SAFETY, AND RESILIENCY.

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A. *Aerial panoramic view of Sicamous, a small town in the interior of B.C. Credit: iStock*

B. *Bearskin Bay, Haida Gwaii Islands. Credit: iStock*

DR. NANCY OLEWILER
Director and Professor,
School of Public Policy, SFU

DR. DAVID BRISTOW
Professor,
Civil Engineering, UVic

Enhancing climate risk assessment

As B.C. recovers from consecutive climate change events, PICS has gathered experts to map future risks and impacts

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D

E

RESEARCHERS

Dylan Clark
Caroline Merner
Alyssa Hill
Emily MacNair
Ian Mauro

PARTNERS

B.C. Ministry of Emergency Management and Climate Readiness (EMCR)

STATUS

Ongoing

Effective risk assessments are crucial for protecting communities and ecosystems from climate-related emergencies like floods, droughts, heatwaves, and wildfires. Those assessments, however, must be based on current evidence and diverse perspectives.

As climate-related risks continue to evolve, so too should the tools used to measure and evaluate the risks. It is especially important that new research and knowledge support communities in planning for long-term resilience.

In 2023, the Pacific Institute for Climate Solutions (PICS) began providing guidance to the Ministry of Emergency Management and Climate Readiness (EMCR), specifically regarding incorporating evidence-based climate change research into provincial risk assessments. PICS, guided by an academic advisory group with members from across B.C., is identifying research gaps and priorities, and uncovering the best ways to integrate research into climate risk assessments.

The Climate Risk and Resilience Academic Advisory group's 14 members are experts in wide-ranging subjects, including wildfire, drought, flooding, extreme heat, health, climate justice, knowledge systems, cascading risks, hydrological sciences, forestry, engineering, and emergency management. Many of the members are from PICS universities.

Throughout 2024, the project team continues to gather insights from a wide range of experts through interviews, workshops, advisory group guidance, and a comprehensive literature review that will be shared with EMCR. Workshops have focused on wildfire, extreme heat, drought, and flood and sea level rise. A research and knowledge mobilization agenda and recommendations are being developed for the province on how to strengthen climate risk and resilience assessments. This work supports informed decision-making and increased community resilience.

THROUGHOUT 2024, THE PROJECT TEAM CONTINUES TO GATHER INSIGHTS FROM A WIDE RANGE OF EXPERTS THROUGH INTERVIEWS, WORKSHOPS, ADVISORY GROUP GUIDANCE, AND A COMPREHENSIVE LITERATURE REVIEW WILL BE SHARED WITH EMCR.

A – C. *The Integrated Research into Risk and Resilience Assessments Wildfire Hazards Workshop on Syilx territory (Kelowna). June 3, 2024*

D. *PICS Climate Risk and Resilience Academic Advisory Group meeting, March 26, 2024*
Credit: Jason Guille

E. *Caroline Merner of the Integrated Research into Risk and Resilience Assessments project at the wildfire hazards workshop on Syilx territory (Kelowna) on June 3, 2024.*

Mending Disconnections

Mending Disconnections explores the inseparable connection between humans and the natural world. Researchers look beyond typical distinctions between “human systems” and “natural systems,” focusing on how we can foster healthier relationships as we confront climate change.

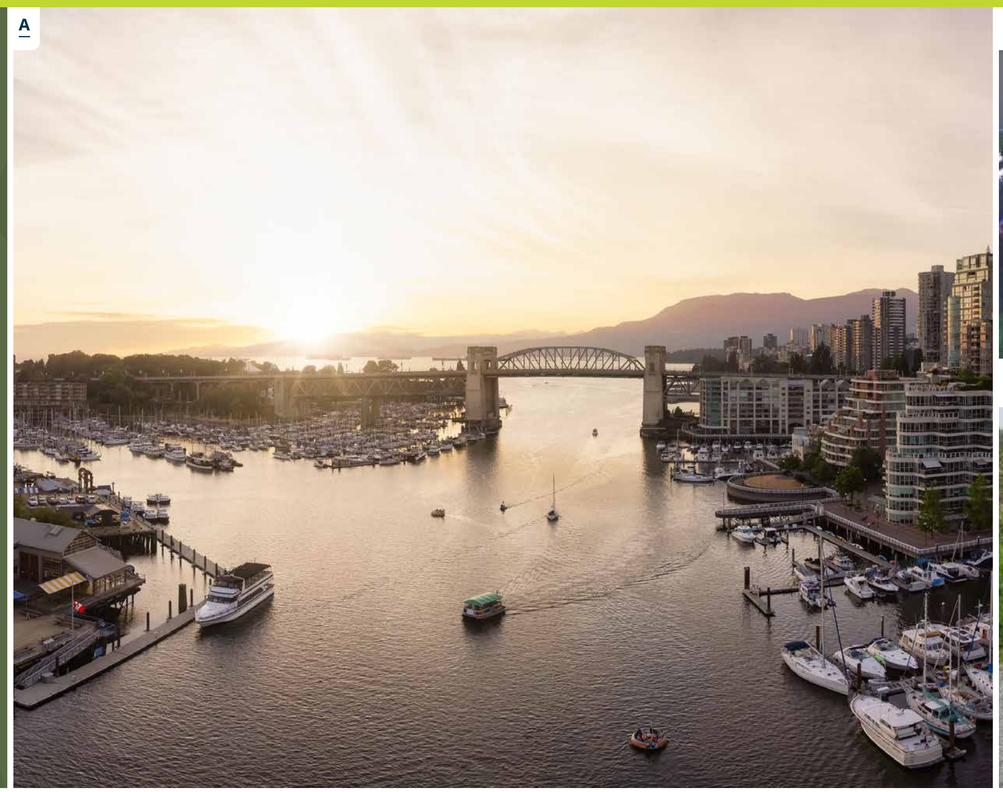
LIVING WITH WATER

DROUGHT AND DELUGE: INFORMED WATER ALLOCATION DECISION-MAKING IN A WORLD OF INTENSIFYING HYDROLOGIC EXTREMES

PICS THEME PARTNERSHIP

Adapting to sea level rise and flooding

How do communities on B.C.'s South Coast learn to live with water?



A

B

C

D

RESEARCHERS

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Stephanie Chang
Maggie Low
Andréanne Doyon
Brent Doberstein
Jantsje van Loon-Steensma
Vanessa Lueck
Deborah Carlson

PARTNERS

Sḵwx̱wú7mesh Nation
səlilwətaɬ
City of Vancouver
City of Surrey
District of Squamish
Ministry of Water, Land and Resource Stewardship
South Coast Conservation Program
Ducks Unlimited Canada
Nature Force
West Coast Environmental Law
University of British Columbia
Simon Fraser University
University of Waterloo
Wageningen University & Research

STATUS

Ongoing

Water has always been an integral part of life on the South Coast of B.C. With sea levels rising and floods occurring more frequently and powerfully, the Living with Water Theme Partnership project inspires, supports, and encourages communities to work with the water to build resilience through collaboration.

Living with Water is a four-year project which:

- uses values-based adaptation approaches focusing on foregrounding Indigenous and local perspectives,
- works on broadening the solution space for flood risk management, and
- develops foundations for alternative and collaborative governance arrangements.

Over the past two years, Living with Water has contributed to each of its focus areas, with an emphasis on decision-support tools for broadening the solution space for flood risk and documents and workshops supporting alternative governance arrangements. All Living with Water activities and outcomes are interconnected and interrelated.

Six students completed reports on nature-based and decolonial perspectives to flooding and three students produced multimedia story maps about the Sturgeon Bank Sediment Enhancement Pilot Project and the Surrey and Delta Living Dike Pilot. Several students wrote journal articles and multiple members produced two reports for the Province of B.C., including a report on managed retreat. In addition, four members contributed to the Canadian guidelines for nature-based infrastructure.

These activities, in combination with continuing values-based adaptation research and workshops, support alternative and collaborative governance. Living with Water members worked on evaluating equity and justice in urban coastal adaptation planning, parsing regulatory barriers to nature-based flood solutions, exploring how to implement integrated floodplain management planning in B.C. and participatory governance research activities and workshops.

LIVING WITH WATER'S RESEARCH IS GROUNDED IN THE PROJECT'S GUIDING VALUES: FOREGROUNDING RECONCILIATION, EMBRACING MULTIPLE WAYS OF KNOWING AND DOING, AND RESTORING RELATIONSHIPS BETWEEN LAND, WATER, AND PEOPLE.

To share its work, Living with Water has invested in knowledge mobilization through its website, social media presence on LinkedIn and Instagram, and the start of a podcast series highlighting Living with Water research. PICS also produced a short film on the Living with Water project.

A. *False Creek, a small inlet on the edge of English Bay is one area with a lot at stake. Credit: iStock*

B. *Decolonization work never stops.Continuing education at Living with Water 2024 annual workshop. Credit: Vanessa Lueck*

C. *Site visit to Living Dike at Living with Water 2022 annual workshop. Credit: Devon Jones*

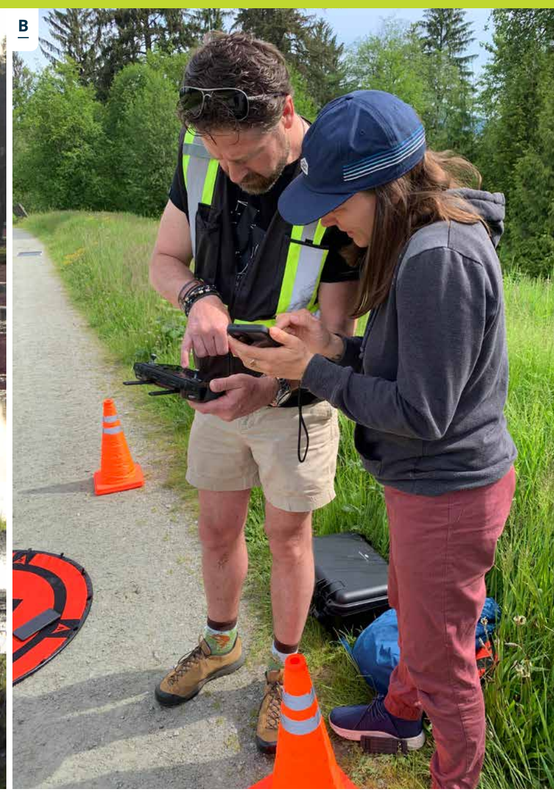
D. *Description: Piloting participatory flood governance mapping at LWW 2023 annual workshop. Credit: Maggie Low*

PICS OPPORTUNITIES PROJECT

Decision-making tools in the face of water extremes

Researchers consider how climate change affects water resources and their management

A



B

C

RESEARCHERS

Diana Allen

Jesse Halm

PARTNERS

B.C. Ministry of Forests

B.C. Ministry of Water, Land and Resource Stewardship

B.C. River Forecast Centre

Pacific Salmon Foundation

Simon Fraser University

STATUS

Ongoing

Climate change disrupts hydrological systems by changing temperatures and precipitation patterns, which in turn affect water quantity and quality.

Heavy rainfall and prolonged droughts are altering how, when, and how much water recharges aquifers and flows through streams.

Fully understanding these impacts is essential for informed water management, especially in maintaining sustainable watersheds and adhering to B.C.'s Water Sustainability Act.

Researchers in the hydrological sciences at SFU received a PICS Opportunities grant to study the impacts of extreme hydrological events in the North Alouette/Blaney watershed in the city of Maple Ridge. The project aims to co-develop decision-support tools and inform water management policies that consider the effects of climate extremes.

The overall project, co-funded by the B.C. Ministry of Forests, focuses on three watersheds: North Alouette/Blaney (which received PICS funding), Bertrand Creek in the Fraser Valley, and Windermere Creek in the Interior. These watersheds are unique because they cross various landscapes, including forests, bogs, agricultural areas, and urban-rural regions.

THE PROJECT FOCUSES ON THREE WATERSHEDS—NORTH ALOUETTE/BLANEY AND BERTRAND CREEK IN THE FRASER VALLEY, AND WINDERMERE CREEK IN THE INTERIOR.

The research involves fieldwork, laboratory analysis, remote sensing, and modeling to explore how climate extremes affect the partitioning of precipitation between surface water and aquifers; how this water contributes to stormflows and baseflows; and how different land uses influence water quantity and quality as well as its temperature.

All images provided by Diana Allen

A. *Cranberry fields in the Fraser Valley the day after the Nov 17, 2021 atmospheric river*

B. *Drone survey flight, June 2022*

C. *North Alouette River in late summer drought, Sep 2022*

The project's components tackle distinct but related questions and supporting outcomes that can be applied in different ways:

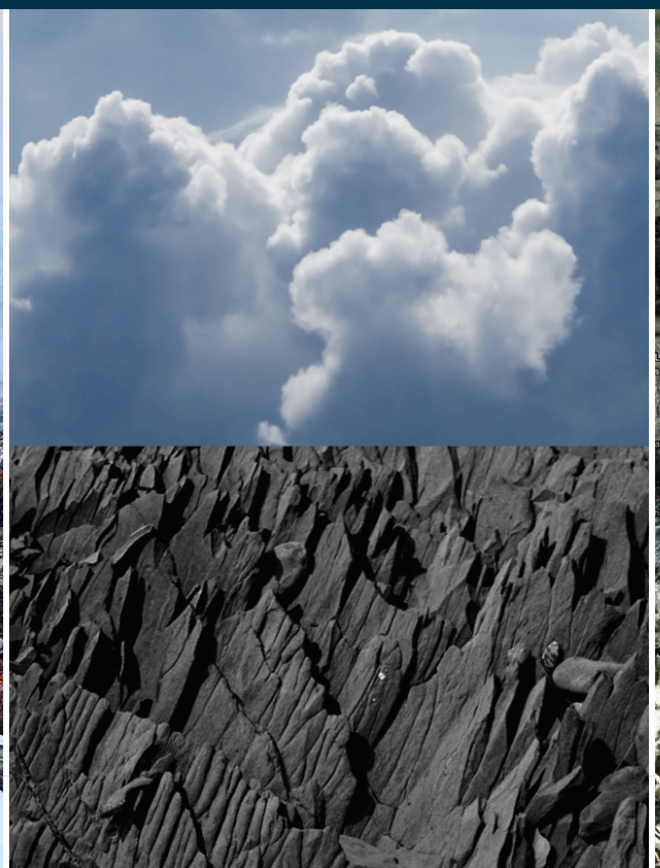
- Fieldwork captured both typical conditions and extreme events, such as the atmospheric rivers in November 2021 and the extended drought in summer 2022. In the lab, researchers found that atmospheric river precipitation has a slightly different isotopic composition than regular rainfall, but the difference isn't large enough to track atmospheric river water in the river directly. The analysis also suggests that water from mountain areas plays an important role in maintaining streamflow during the summer. This information helps decision-makers understand how mountain headwaters contribute to sustained streamflow, especially during long dry spells.
- Analysis of historical and extreme groundwater levels in the Fraser Valley revealed different aquifers respond differently based on their connection to the Fraser River. This has important implications for drought management: heavily developed aquifers without river connections require priority intervention, while connected aquifers are more resilient to drought.

Reconfiguring Paths

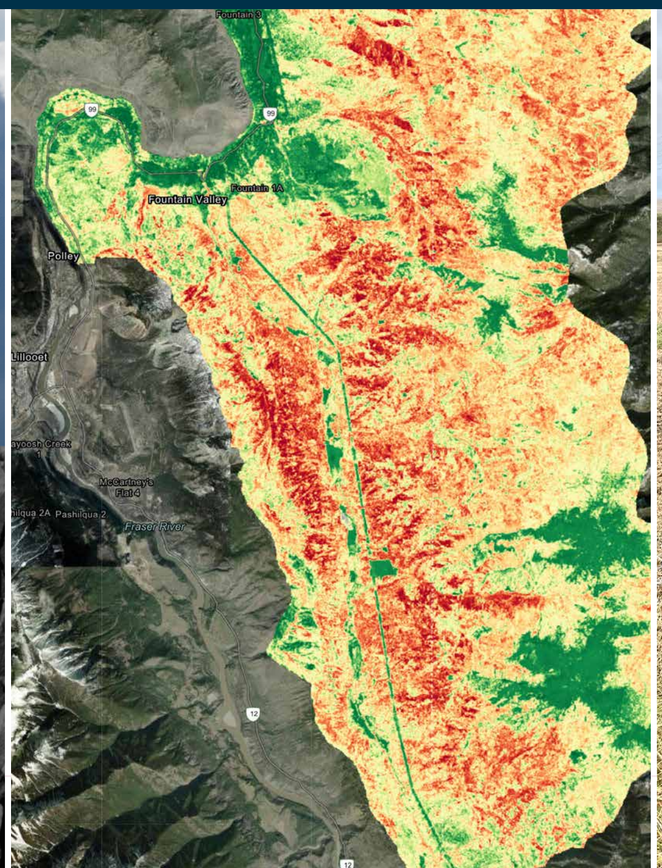
Reconfiguring Paths is about the long paths that led us to the climate change of today, and the long paths we might walk into the future. These projects bring together those familiar with the technologies and practices of the past, and those exploring the possibilities of the future, aiming to reconfigure these forces to create pathways toward climate repair.

WILDFIRE AND CARBON

SOLID CARBON



HIGH-RESOLUTION WILDFIRE-FUEL MAPPING

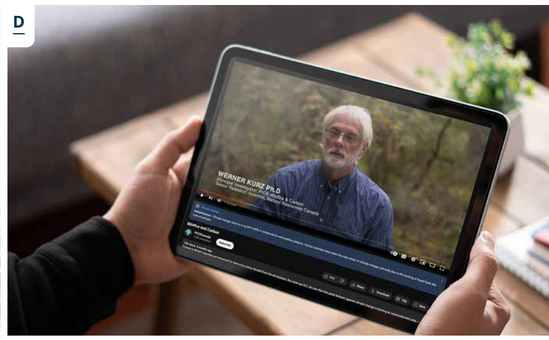


TRASH IS CASH: OPTIMIZATION AND BENEFIT QUANTIFICATION OF INPUT-OUTPUT BIOMASS-TO-BIOPRODUCT CONVERSION PROCESSES

PICS THEME PARTNERSHIP

Improving forest management to reduce fire risk

Wildfire and Carbon develops strategies to reduce emissions from fires and enhance forest carbon sinks



A. *Prescribed fire implemented as a fuel reduction treatment to reduce subsequent fire behaviour and carbon emissions in southeastern B.C. Credit: Jen Baron*

B. *First WFC in-person group meeting, visiting the Okanagan Region in October 2022. Credit: Werner Kurz*

C. *Burning slash piles produced through forest thinning treatments in advance of a prescribed fire in southeastern British Columbia. Credit: Jen Baron*

D. *A clip from the Wildfire and Carbon short film*

RESEARCHERS

Werner Kurz
Lori Daniels
Paul Hessburg
Dominik Roeser
Carolyn Smyth

PARTNERS

U.S. Forest Service
Natural Resources Canada
B.C. Wildfire Service
Parks Canada
University of British Columbia
University of Washington

STATUS

Complete

Record-breaking wildfire seasons over the past decade have highlighted the urgent need for solutions to B.C.'s wildfire crisis.

Modern forest management practices, fire suppression, and the exclusion of cultural burning have disrupted fire regimes that naturally shaped landscapes for millennia. Combined with a warming and drying climate, this has intensified wildfires and droughts.

THE TEAM DEVELOPED A PROTOTYPE WILDFIRE AND CARBON ANALYSIS TO EXAMINE POST-FIRE RESTORATION AND CONSERVATION SCENARIOS.

A research team from the Canadian Forest Service and UBC received a PICS Theme Partnership grant to explore climate change mitigation and forest adaptation solutions that could reduce wildfire emissions and strengthen B.C.'s forest-based bioeconomy.

Studies across western North America show that more low- and moderate-severity fires result in fewer severe ones. The Wildfire and Carbon team proposed solutions including:

- introducing more controlled fires;
- removing potential wildfire fuel, and using it for the bioeconomy; and
- restoring fire as a natural ecological process.

The team developed a prototype wildfire and carbon analysis to examine post-fire restoration and conservation scenarios. Their integrated fire, carbon, and bioeconomy interaction model evaluates forest and fuel management strategies to reduce future fire severity and stabilize the forest's ability to act as a carbon sink. This analysis has been shared with provincial carbon offset program managers.

Additionally, the team created a tool for analyzing carbon trade-offs from fire management and identified data limitations in B.C. around fire behavior and carbon accounting.

The assessment of potential fuel and the use of biomass lays the groundwork for exploring innovative strategies such as:

- mitigating fire risks for remote off-grid communities;
- establishing a resilient supply chain for communities; and
- transporting biomass to centralized facilities near transportation hubs.

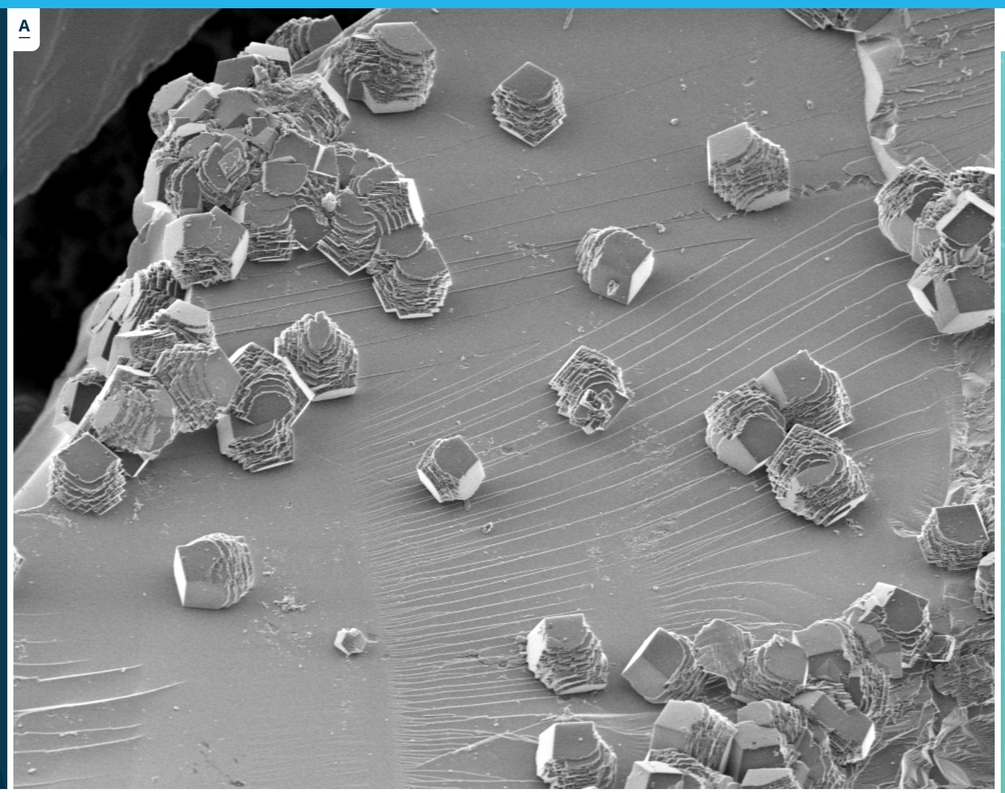
Insights from this project are already being implemented in a new fire mitigation project in the East Kootenays, aimed at developing a modeling tool for the First Nations Emergency Services Society.

The team delivered more than 100 presentations, including to B.C. policymakers, the Canadian Parliamentary Committee on Natural Resources, and the Canadian Council of Forest Ministers. The team also worked with PICS this year to produce a short film on the project.

PICS THEME PARTNERSHIP

Removing carbon from the atmosphere

Innovative team shows it is possible to funnel atmospheric carbon dioxide under the ocean floor, where it will turn to rock



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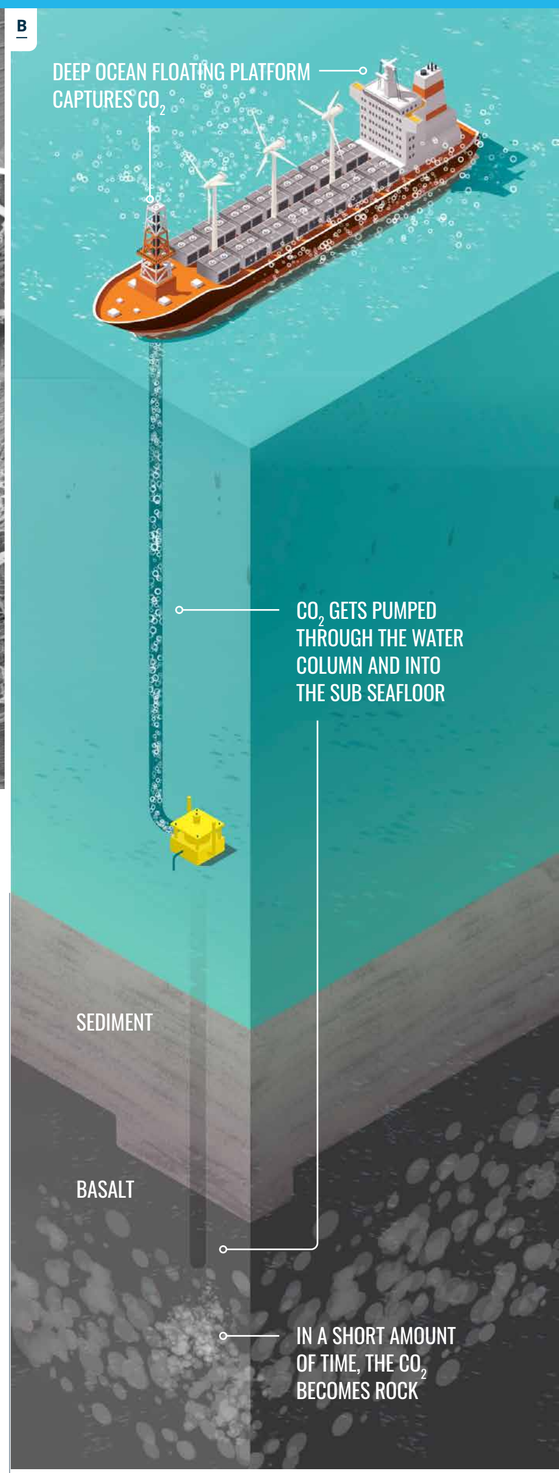


B

RESEARCHERS

Kate Moran
Terre Satterfield
Curran Crawford

PARTNERS

Ocean Networks Canada
University of Victoria
University of British Columbia
Columbia University
University of Calgary
University of Washington
GEOMAR Helmholtz Centre for Ocean Research

STATUS

Complete

Countries and industries worldwide are shifting towards renewable energy and more efficient energy use — but these decarbonization measures will not be enough to maintain carbon dioxide (CO_2) in the atmosphere at a level safe for human life on Earth.

Researchers at UVic, Ocean Networks Canada, and other partners received a PICS Theme Partnership grant to research the feasibility of pulling CO_2 from the air and injecting it into basalt rock beneath the seafloor — permanently transforming it into harmless rock.

The Solid Carbon team aimed to study the idea's feasibility, build capacity, and establish British Columbia as the international hub for this technology.

Solid Carbon integrates six proven technologies into a system to extract CO_2 from the atmosphere. This system would use B.C.-based Carbon Engineering's CO_2 air capture technology on a deep ocean floating platform, powered by ocean-based wind and solar energy. The extracted CO_2 would then be injected into sub-seafloor basalt, where it would turn solid through a proven reaction with the rock formation.

Researchers evaluated the feasibility of offshore CO_2 direct capture, including integrating offshore wind energy with direct capture technology. A global analysis also identified offshore areas with the right type of basalt and sufficient wind capacity to power direct air capture and CO_2 injection.

Research published in 2023 showed that injecting CO_2 in deep ocean basalt has less than a one per cent risk of triggering seismic activity, and that 15 years of the world's current emissions could be captured in one location alone — the Cascadia Basin off the coast of B.C. Furthermore, scaling the technology up to more locations could see about 10 gigatons of CO_2 safely injected per year by 2050, which is almost half of the atmospheric reductions necessary to keep the planet habitable for people.

Numerical modeling confirmed the durability of CO_2 sequestration at the basin, and a fully robotic solution was developed for a future test injection.

Solid Carbon also aimed to understand the social, regulatory, and investor acceptance needs for such a project in the Cascadia Basin. Project values were developed through public workshops, resulting in a commitment to partnering only with industries aligned with the Paris Agreement and dedicated to reducing global emissions.

Investors also showed interest; however, it became clear a research demonstration is necessary to show the solution can work practically. A demonstration is the team's next step.

RESEARCH PUBLISHED IN 2023 SHOWED THAT INJECTING CO_2 IN DEEP OCEAN BASALT HAS LESS THAN A ONE PER CENT RISK OF TRIGGERING SEISMIC ACTIVITY, AND THAT 15 YEARS OF THE WORLD'S CURRENT EMISSIONS COULD BE CAPTURED IN ONE LOCATION ALONE — THE CASCADIA BASIN OFF THE COAST OF B.C.

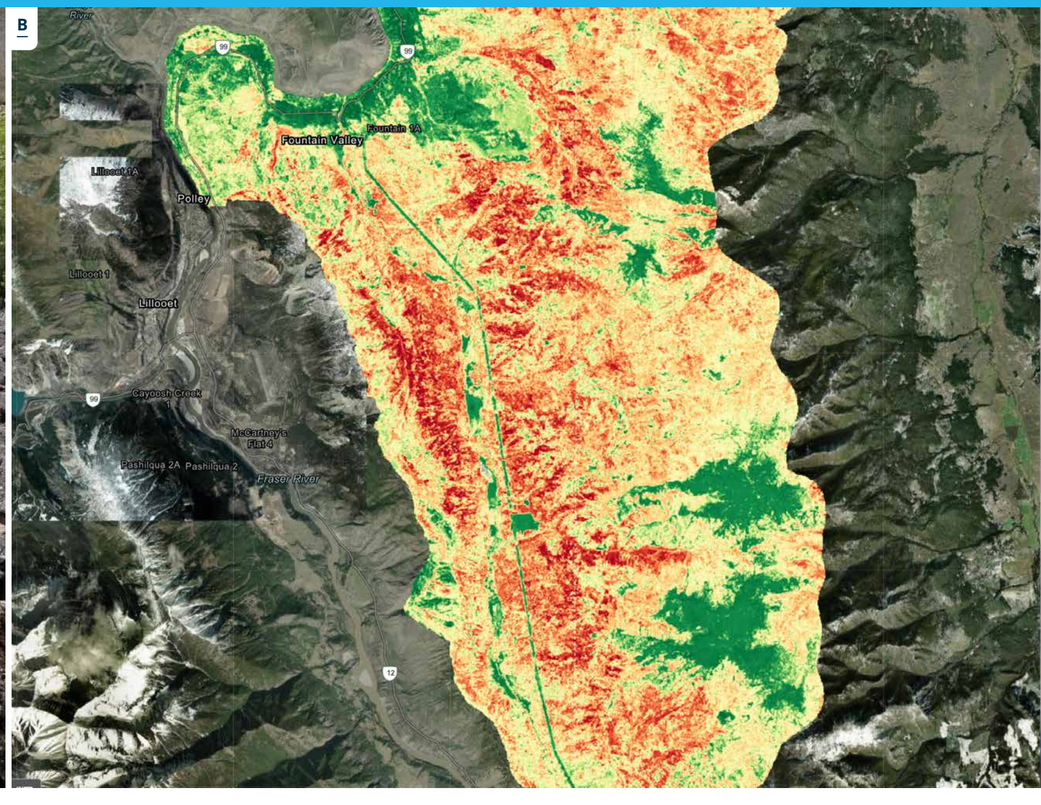
A. *Lab experiments, conducted by the University of Calgary's Reactive Transport Group, show a magnesite crystal growing on a grain of labradorite in a high CO_2 (450 mmol/kg) seawater experiment. This shows how CO_2 injected into basalt can be converted from a gas into a mineral form (mineral carbonation). Credit: John Byng*

B. *How the Solid Carbon project works. Provided by: Solid Carbon team*

PICS FAST TRACK PROJECT

Building community-based fire resilience

Xaxli'p forestry staff gain wildfire autonomy through mapping and management tools



Images provided by Scott Green and Che Elkin

A. *Xaxli'p and UNBC collaborators measuring fuel loading in the field.*

B. *A screenshot of the wildfire fuel mapping tool created by the Xaxli'p and UNBC researchers.*

C. *Xaxli'p territory near Lillooet, B.C.*

RESEARCHERS

Scott Green
Che Elkin

PARTNERS

Xáxli'p Community Forest Corporation
District of Lillooet
University of Northern British Columbia

STATUS

Complete

Centuries of fire suppression and climate change have left many communities across B.C. vulnerable to devastating wildfires. Remote communities often rely heavily on external consultants for wildfire mitigation analysis, management, and implementation, rather than in-community expertise.

A research partnership between UNBC researchers and the Xaxli'p community near Lillooet, B.C. received a PICS grant to develop a wildfire fuel mapping system to support the community in managing its own forests to reduce wildfire risks.

Using recent LiDAR (Light Detection and Ranging) sampling, data layers were created to represent various spatial aspects of forest fuel structure in Xaxli'p traditional territory. These high-resolution layers contrast sharply with current provincial and national forest-fuel databases, which are lower resolution and differ substantially from these modeled fuels.

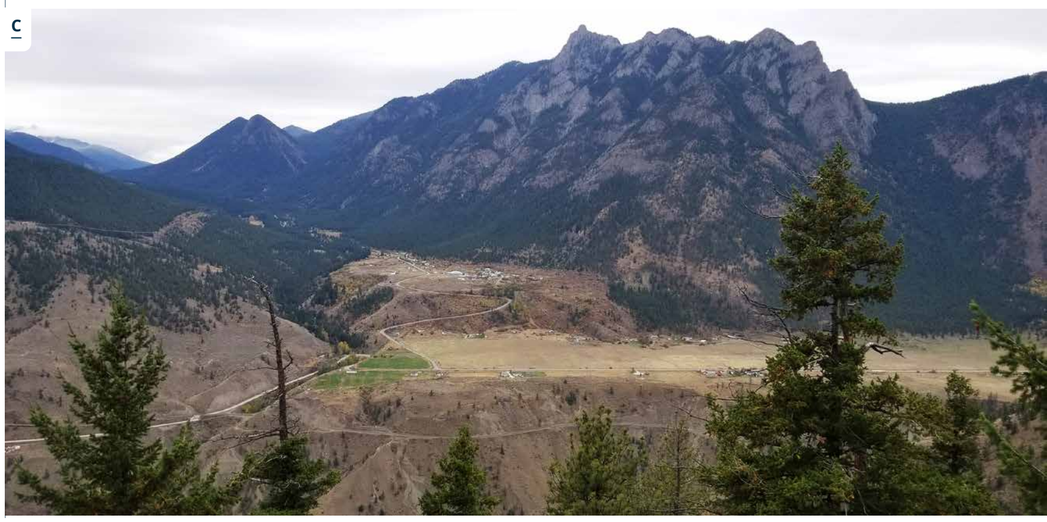
Cutting-edge remote-sensing technology was used to calibrate and develop data layers for forest structure and wildfire fuels, landscape and topography, hydrology, and ecological classification.

A user-friendly web-based data management program was also created to support local forest management and community land-use planning. The administration and implementation of these tools have been transferred to the community, with researchers providing training and advice during the transition.

> THE NEW DATA AND MANAGEMENT TOOLS ARE BEING USED TO PLAN AND IMPLEMENT A PROJECT TO ENHANCE COMMUNITY WILDFIRE PROTECTION.

The new data and management tools are being used to plan and implement a project to enhance community wildfire protection. This transfer substantially reduces the community's dependence on external consultants, marking a game-changing advance in local forest management.

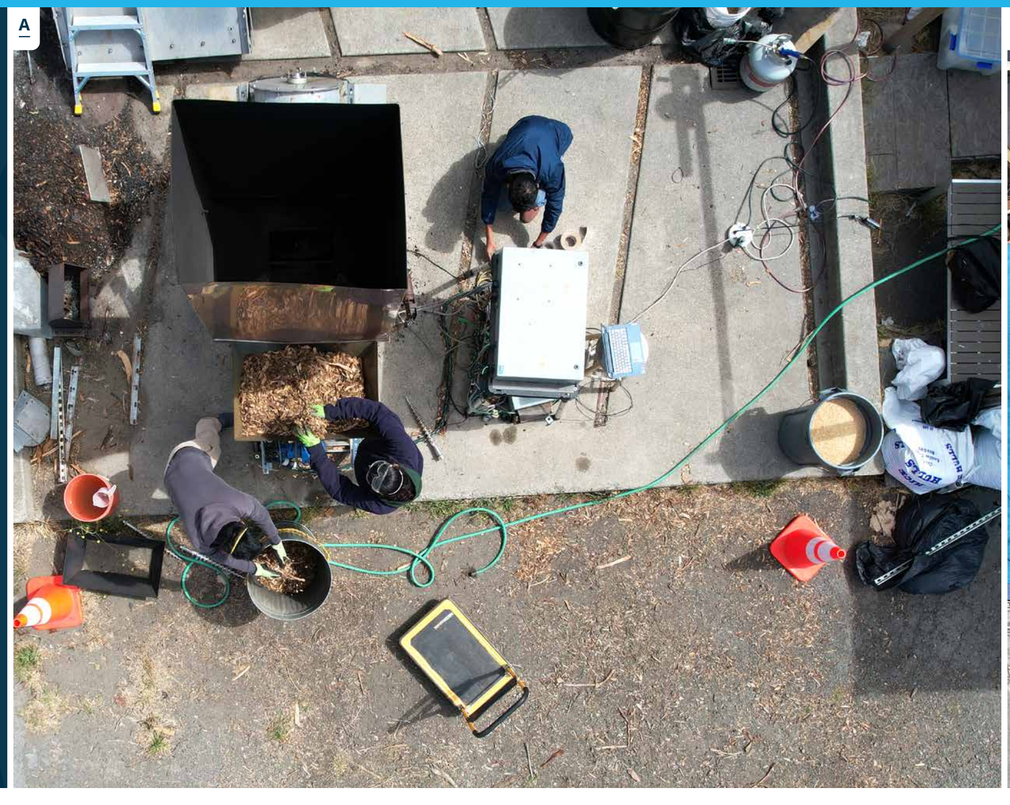
The initiative has empowered the community to take control of their wildfire risk mitigation efforts, strengthening local resilience in the face of increasing climate challenges.



PICS OPPORTUNITIES PROJECT

Reusing forestry waste

Instead of burning bio waste, project finds ways to put it to work



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B

RESEARCHERS

Yankai Cao

Shahabaddine Sokhansanj

PARTNERS

Takachar Ltd.

University of British Columbia

STATUS

Ongoing

Billions of tonnes of biomass generated worldwide through forestry and farming are burned every year. This biomass is treated as a waste product and burned because it is difficult to collect and infrastructure for processing is lacking (and therefore it doesn't generate profit).

But biomass can be converted into biochar, which enriches soil quality and sequesters carbon. Since the carbon in biochar was originally removed from the atmosphere by plants, it can constitute a negative emission.

Researchers at UBC received a PICS Opportunities grant to overcome barriers to wider biomass use.

The approach uses oxygen-lean torrefaction, a process that "cooks" biomass using its own heat energy to produce biochar. The project focuses on partner Takachar's low-cost and portable torrefaction reactor, which can be attached to tractors and pick-up trucks. The goal is to make the reactor smart, automated, and adaptable to different biomass types.

C

The project is comprised of two parts. Field and laboratory experiments collect essential data. This dataset is then used to develop machine learning models to control the complex reaction processes and assess and quantify the carbon benefits.

The project unites researchers and industry to co-develop the technology. Takachar, an Earthshot Prize winner, is already operating, and gathering data from, similar systems in agriculture across India, Kenya, and in California in the United States. This project helps refine these systems and provides a foothold for expanding into the B.C. forestry sector.

A prototype reactor, equipped with instruments, was brought to the Lil'wat, Ulkatcho, and Esk'etemc First Nations as part of a collaborative partnership. Local industries in these communities were invited to process their forestry biomass using the reactor and provide feedback on design requirements and the realities of field operations, ensuring the project aligned with community needs.

Preliminary analysis for small-scale B.C. forestry shows promise for reducing waste and generating revenue from biochar and carbon credits. Three computational modules are in process: a real-time visual smoke detection framework that adjusts the conditions of the reactor process; a fault detection algorithm that intervenes before shutdowns; and a visual classification algorithm that distinguishes different types of biomass.

Since the project's start, the team has secured more than $500,000 in additional funding through New Frontiers in Research Fund and Mitacs grants.

D

All images provided by Yankai Cao

A. *Drone view of the Takavator reactor in use*

B. *Field testing in the Chilcotin Highlands in B.C.*

C. *The new Takavator 1000 reactor under testing*

D. *Biochar produced by the reactor*

THE APPROACH USES OXYGEN-LEAN TORREFACTION, A PROCESS THAT "COOKS" BIOMASS USING ITS OWN HEAT ENERGY, TO PRODUCE BIOCHAR.

Sharing Climate Knowledge

Sharing Climate Knowledge centres on new ways of understanding and addressing climate change. These projects involve building networks and tools for knowledge sharing, which create supportive environments that enable widespread climate action.

PICS CLIMATE INSIGHT COURSE

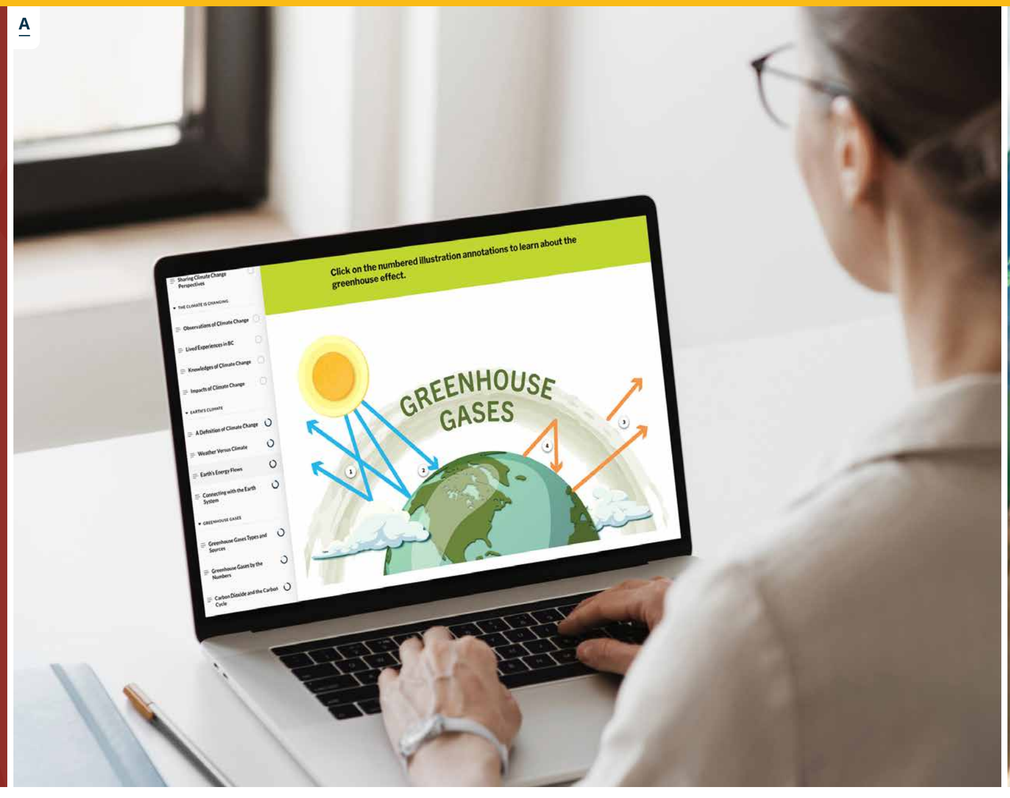
INFUSING CLIMATE EDUCATION INTO THE B.C. CURRICULUM

CLIMATE FINANCE

TECHNICAL INNOVATION AND CLIMATE POLICY SOLUTIONS TO ACHIEVE NET ZERO EMISSIONS BY 2050

Deepening climate knowledge… and sharing what can be done about it

PICS launches free Climate Insights Course



A

RESEARCHERS

Devin Todd
Vanessa Lueck
Rene Suša
Jade Chicorelli
Adriaan Bogaard

PARTNERS

Government of British Columbia

STATUS

Complete

As climate science and knowledge evolves, staying informed becomes crucial. However, sorting through all the information can be tough, especially for those new to the issue.

The Climate Insights Course, developed by PICS with financial support from the Government of British Columbia, is an interactive e-learning course designed to equip professionals with foundational knowledge on climate change. The course is specifically aimed at professionals affected by climate change in their work, helping them integrate climate knowledge into their decision-making.

Each of the course's four modules covers distinct aspects of climate change, including the critical relationships between people, the environment, and each other.

As part of creating the course, PICS brought together a group of 12 people who contributed a range of perspectives and ways of knowing. This group included voices from youth, Indigenous, community, low-income, and systemic perspectives, to ensure the course reflected a broad and inclusive understanding of climate change. The group members' perspectives greatly influenced the final product.

The B.C. government recommends the Climate Insights Course as a foundational training for all public servants. The course was also featured at the B.C. Provincial Forest Carbon and Climate Workshop in early 2024, underscoring its relevance and applicability.

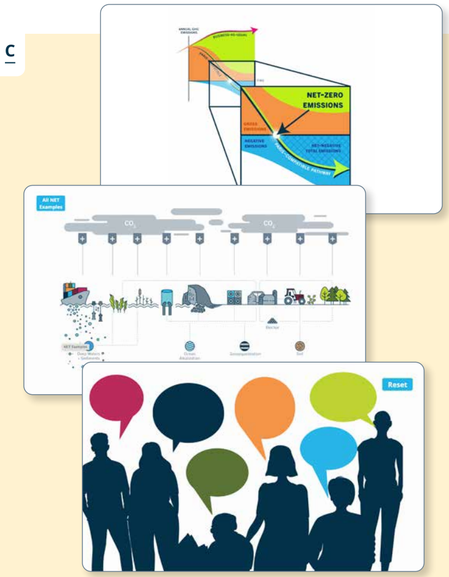
Released to the public in June 2024, the course quickly became one of the most frequented pages on PICS' website.

B

"CLEARLY UNDERSTANDING HOW CLIMATE CHANGE IS AFFECTING OUR EVERYDAY LIFE, AND UNDERSTANDING HOW WE ADAPT TO THIS CHALLENGE, IS VITAL. THE CLIMATE INSIGHTS COURSE TAKES YOU STEP BY STEP THROUGH THE ISSUES SURROUNDING CLIMATE CHANGE. MANY OF THE TOOLS OUTLINED IN THE COURSE ARE REFLECTED IN PROGRAMS WE DELIVER, AS WE MAKE THE NECESSARY CHANGES TO TURN THIS MOUNTING THREAT INTO AN OPPORTUNITY FOR INNOVATION, AND TO IMPROVE OUR FORESTRY PRACTICES."

Shane Berg,
Chief Forester, B.C. Ministry of Forests

C



A. *Interactive e-learning helps integrate climate knowledge into decision-making*

B. *Diverse perspectives on climate adaptation that are presented in the course*

C. *Examples of greenhouse gas pathways, negative emission technologies, and interactive learning content used in the course*

PICS OPPORTUNITY PROJECT

Bringing climate change to the classroom

Project integrates latest western science and Indigenous Knowledges on climate into materials and teacher training

A

B

C

D

E

All images provided by David Zandvliet

A. *Teachers take part in activities during teacher professional development workshops at Hiellen Village Longhouses, Naikoon Provincial Park*

B. *Flag of the Council of the Haida Nations*

C. *Teacher inquiry during professional development workshops on North Beach, Naikoon Provincial Park*

D. *Welcome poles at Hiellen Village Longhouses, Naikoon Provincial Park*

E. *Indigenous Knowledge embodied in a Haida canoe (Skidegate)*

RESEARCHERS

David B. Zandvliet

Shannon Leddy

PARTNERS

B.C. Ministry of Education and Child Care

B.C. Ministry of Environment and Climate Change Strategy

Simon Fraser University

University of British Columbia

STATUS

Ongoing

The study of the environment can be a thread that runs through a student's learning experience. However, environmental learning for B.C. students in kindergarten to Grade 12 has relied on an interdisciplinary guide developed in 2007.

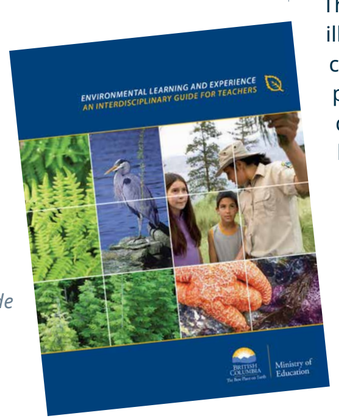
Researchers at SFU and UBC received a PICS Opportunities grant to renew the foundations of environmental learning for today's context with a special emphasis on climate change and Indigenous Knowledges.

The project goals are to: revise the guide; illustrate how environmental concepts can weave throughout education; and provide educators with the professional development to implement it. The project brings together a team of researchers, educators, and organizations to co-create the renewed foundational framework.

The current teaching guide is being updated through comparative benchmarking and a wide consultative process, along with the gathering of resources to support environmental education across various subjects. Curriculum mapping is being undertaken to identify where the guide's concepts can be integrated into the K-12 curriculum.

The framework document, *What is Environmental Learning?* is nearly complete after extensive consultation. It focuses on three overlapping themes: environmental seeing, environmental thinking, and environmental communication/action. The final version will include ideas from the project's professional development workshops. Multiple and overlapping perspectives will also help teachers to facilitate students' ideas about the environment.

With supplemental funding from PICS, at least four professional development events are being hosted across B.C. These events will include local and provincial-level partners and will take the form of mini-conferences with workshops and speakers that showcase the research results and focus on local interpretations of the curriculum framework.



B.C.'s current Environmental Learning and Experience Guide for Teachers

THE FRAMEWORK DOCUMENT *WHAT IS ENVIRONMENTAL LEARNING?* FOCUSES ON THREE OVERLAPPING THEMES: ENVIRONMENTAL SEEING, ENVIRONMENTAL THINKING, AND ENVIRONMENTAL ACTING. IT WILL INCLUDE IDEAS FROM THE PROJECT'S PROFESSIONAL DEVELOPMENT WORKSHOPS.

PICS OPPORTUNITIES PROJECT

Climate-proofing investment portfolios

Asset owners and investment managers' investment choices play an important role in the shift to a low emissions economy

RESEARCHERS

Basma Majerbi

PARTNERS

British Columbia Investment Management Corporation (BCI)

University of Victoria

STATUS

Ongoing

The finance and investment sector has a crucial role in climate solutions. Investing in companies and projects that support a low-carbon future can offer significant gains for investors, but there remain barriers to unlocking this potential — including a lack of expertise and research in climate finance.

Large asset owners such as the B.C. Investment Management Corporation (BCI), Canada's fourth largest pension fund manager, can harness market forces to accelerate the shift to a low-carbon economy. However, these large-scale investors cannot make long-term, strategic choices without an investment framework that integrates climate change and financial analysis.

Researchers at UVic received a PICS Opportunities grant in partnership with BCI to address these barriers, clarify research needs, and expand on new tools for integrating climate change into BCI's investments. Insights from this research will also help other asset owners and managers in B.C. and beyond.

This project aims to collaborate with BCI on:

- measuring the transition risks associated with climate change;
- assessing the sensitivity of investment portfolios to climate transition risk under various scenarios; and
- identifying low-carbon and climate resilient investment opportunities in a structured, consistent, and repeatable way.

Building on BCI's existing climate change scenario risk analysis and valuation framework, the project's team explored the best available academic and applied research to improve the current framework by incorporating additional climate scenarios from the Network for Greening the Financial System.

During the first two years of the project, the team completed work on scenario analysis based on the network's data in addition to incorporating new scenario data from the International Energy Agency. In February 2022, the project team released the Scenario Explorer Dashboard, a tool that helps visualize projected macroeconomic variables consistent with a given emissions pathway under various scenarios and integrated assessment models.

Background research completed through the project also highlights that climate solutions companies working on mitigation are often riskier investments because they are generally young and need high capital investment for research and development. Out of this, the project team developed and shared recommendations for improving BCI's ESG (environmental, social and governance impact investing) Risk and Opportunity Framework. Additional knowledge mobilization initiatives are underway and consist of developing educational resources including current discussions to offer micro-credential certificates in climate finance through UVic.

BACKGROUND RESEARCH COMPLETED THROUGH THE PROJECT ALSO HIGHLIGHTS THAT CLIMATE SOLUTIONS COMPANIES WORKING ON MITIGATION ARE OFTEN RISKIER INVESTMENTS BECAUSE THEY ARE GENERALLY YOUNG AND NEED HIGH CAPITAL INVESTMENT FOR RESEARCH AND DEVELOPMENT.

DR. BASMA MAJERBI
Associate Professor of Finance, Gustavson School of Business, UVic

PICS OPPORTUNITIES PROJECT

Improving effectiveness of carbon mitigation policies

SFU-led project works to discourage Canadian industry from moving emissions to other jurisdictions

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B

C

D

RESEARCHERS

Mark Jaccard
Elicia Maine

PARTNERS

MANIXXIUM Vancouver Consulting Group
Foresight Canada
Simon Fraser University

STATUS

Ongoing

Replacing fossil fuels in industry with renewable or zero-emission technologies is challenging and expensive. This poses a significant barrier, especially for industries competing in international markets where price is key, and there is a risk of "carbon leakage" (e.g. export of industrial processes to jurisdictions without emissions regulation).

Researchers at SFU received a PICS Opportunities grant to develop pathways for transitioning emissions intensive and trade exposed (EITE) sectors to net zero or better by 2050, while avoiding carbon leakage and creating future economic opportunities for B.C. and Canada. The project aims to assess the potential impact of solutions in early-stage research and development, the innovation policies needed to implement them, and the safeguards required to prevent emissions and economic opportunities from being lost.

The project has three components that integrate knowledge from various disciplines, including science, technology, business innovation, energy economics, and trade.

- First, the project team has compiled a database of technology roadmaps. The database details the costs, timelines, and domestic expertise for each EITE sector.
- Second, an energy technology-economy model was developed to estimate technology adoption, emissions outcomes, and trade flows under different policy scenarios.
- Finally, researchers are engaging with stakeholders to create "what-if" scenarios and identify options to accelerate industrial strategy.

This project unites policymakers, industry, and researchers to co-develop these strategic tools. Two of the three project components are complete, with the third still in progress. The 2050 Technology Roadmap for EITE sectors has been developed, outlining a series of actions to be taken in the short-term (2020-2025), medium-term (2025-2030), and long-term (2030 and beyond), based on the best available technologies and their readiness levels.

The energy-technology-economy model, called CIMS, has been upgraded, and now has the capability to represent industrial processes, the deployment of decarbonization technologies, and the effects of innovation and climate policies. It is already helping guide the B.C. government and the B.C. Climate Solutions Council as they consider reforms to the province's climate policy framework, including the potential introduction of an output-based pricing system.

> THE PROJECT IS ALREADY HELPING GUIDE THE B.C. GOVERNMENT AND THE B.C. CLIMATE SOLUTIONS COUNCIL AS THEY CONSIDER REFORMS TO THE PROVINCE'S CLIMATE POLICY FRAMEWORK, INCLUDING THE POTENTIAL INTRODUCTION OF AN OUTPUT-BASED PRICING SYSTEM.

A. *Decommissioned natural gas pipeline segments. Credit iStock*

B. *Coal power plant. Credit iStock*

C. *Crude oil seen separated from sand for collection. Near Fort McMurray, Alberta. Credit iStock*

D. *Industrial paper mill. Credit iStock*

Building Capacity in B.C.

Building Capacity in B.C. focuses on supporting the next generation of climate leaders and empowering communities engaged in climate action. Through initiatives such as internships and events, this work brings together students, organizations, and communities to build skills, share knowledges, and strengthen climate action efforts across the province.

CLIMATE INTERNSHIP PROGRAM

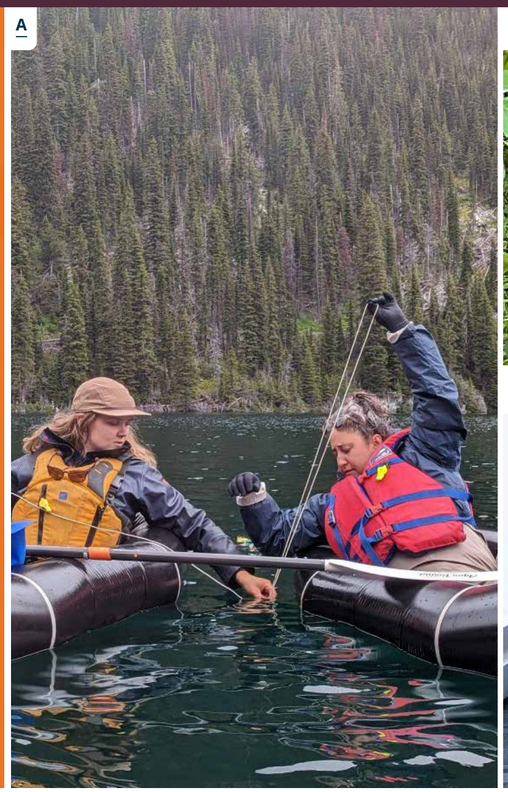
PICS EVENTS

FAST TRACK PROGRAM

CLIMATE INTERNSHIP PROGRAM

Empowering tomorrow's climate leaders

PICS internships are fueling climate action across B.C.



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A. *Jacqueline Van Horne and PICS Intern Jessica Warll doing high elevation work on Shannon Lake. Credit: PJ Butler of Living Lakes Canada*

B. *Mission Creek depth measurements. Credit: Marcela Faralhi Daolio*

C. *Frack Free B.C. Gathering attended by PICS Intern Juliana Janot and her host organization West Coast Climate Action. Credit: Juliana Janot*

D. *Dr. Anne Marie Nicol and research assistants Matthew Edwards (PICS Intern) and Sameen Fatima at CBC Vancouver Studios in May 2024 with a DIY Air Cleaner prior to Dr. Nicol's feature on CBC Radio. Credit: CBC Radio*

E. *PICS Intern Marcela Faralhi Daolio fishing off the coast of Haida Gwaii with friend Matthew Peck. Credit: Marcela Faralhi Daolio*

F. *PICS Intern Juliana Janot and her supervisor Tara Shushtarian at a Frack Free B.C. Gathering. Credit: Juliana Janot*

STATUS

Ongoing

"IT WAS SO GREAT TO HAVE [OUR INTERN] LEARN ABOUT THE IMPORTANCE OF HOW CLIMATE CHANGE IMPACTS OUR TRADITIONAL FOOD SYSTEMS, TO HAVE HER HAVE A REAL HANDS-ON EXPERIENCE TO HELP WITH THE RESEARCH AND TO HELP WITH THE DROUGHT MITIGATION FOR OUR SALMON CREEK T'AM GANDLAAY. SHE HELPED WITH THE SALMON ENHANCEMENT TEAM TO DEEPEN POOLS, INSTALL SHADE COVERS AND TO CATCH FRY AND MOVE THEM."

MICHELLE MACDONALD
Skidegate First Nation (Host Organization)

The PICS Climate Internship Program supports organizations B.C. in reaching their climate goals, while giving students in climate-related fields a chance to use their skills and acquire work experience. The program offers $12,000 to $15,000 to hire a student to contribute towards climate action projects.

For selected students from the PICS university network, the internship program provides an extraordinary chance to connect directly to real-world work experience at a formative time in their educations and early professional development.

Between 2022 and 2024, PICS funded 56 internships, many of which showcased groundbreaking climate action across diverse communities and sectors. Many host organizations have shared that the program's funding and support made it possible for their projects to go ahead.

In 2024, Coast Capital Savings generously provided a $100,000 contribution to the program, helping to fund record-breaking 25 grants to host organizations addressing a wide-ranging set of climate priorities.

The work of PICS climate interns supports long-term shifts in policy, the development of new programs, and/or the deepening of knowledges of key climate issues facing communities.

"AS SOMEONE COMING STRAIGHT OUT OF ACADEMIA, IT WAS NICE TO SEE HOW EMERGENCY MANAGEMENT AND CLIMATE-RELATED WORK IS INCORPORATED INTO PRACTICE. THIS WAS MY FIRST GOVERNMENT/CORPORATE EXPERIENCE, AND I GAINED SO MUCH CONFIDENCE IN MY ABILITY TO CARRY OUT WORK AND IN MYSELF. I HAD A SUPPORTIVE TEAM OF MENTORS WHO SHARED CAREER AND PERSONAL ADVICE WITH ME THAT I WILL CARRY WITH ME AS I WRITE MY MASTER OF PUBLIC HEALTH THESIS — AND INTO MY FUTURE PUBLIC HEALTH CAREER."

SIMRAN BADYAL (Intern)
Provincial Health Services Authority

EVENTS

Fostering climate action through impactful events

PICS Events Program offers structured funding to support climate resilience, knowledge mobilization, and community-led solutions

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The PICS Events Program has been a critical avenue for supporting climate-related events across B.C. Between 2019 and 2023, program parameters and intakes were flexible with most PICS-funded events originating from the network universities.

These events spanned a range of topics, from human health to the built environment to climate policy, and kept climate content and (virtual) conversations going throughout the pandemic.

In 2023, the program underwent significant changes to enhance its reach, aiming to increase participation beyond PICS campuses and emphasizing community benefit, alignment with climate justice and reconciliation principles, and climate action. Two application intakes engaged a wide range of groups, including nongovernmental organizations, Indigenous organizations, educational institutions, and community groups.

With the 2023 relaunch, almost $80,000 was granted to 17 successful applicants for their community climate action events. These events addressed critical climate issues such as community energy transitions, wildfire resilience, and Indigenous Knowledges related to climate change. During the period of November 2022 to August 2024, the program funded more than 30 climate events.

Based on lessons learned during the 2023 pilot phase, in 2024 PICS introduced two new funding streams to continue supporting climate-focused events in British Columbia:

1. **The University Climate Knowledge Mobilization Events Program** offers up to $2,500 to groups, organizations, departments, and institutes at PICS network universities (UBC, SFU, UNBC, UVic) to host events that promote climate change research, education, and knowledge sharing.
2. **The Community Climate Action Events Program** provides between $2,500 to $5,000 to non-profit organizations, Indigenous organizations, and First Nations hosting events that drive tangible climate action.

Both streams can fund diverse topics, such as energy transition, ecosystem health, sustainable food systems, and wildfire resilience. The program also prioritizes events that emphasize climate justice and reconciliation.

PICS Events

PICS also hosted four events throughout this report's timeframe:

- **November 2022:** PICS offered a series of public and private briefings on the PICS Report *Survive and Thrive: Why B.C. Needs a CO_2 Removal Strategy Now*, which reached more than 100 policymakers and decision makers, including provincial deputy ministers in the climate space.
- **December 2022:** the institute co-hosted a sold-out post-COP 27 panel discussion with SFU and UBC's Sustainability offices. *COP27 and the politics of power, people, and place* featured opening remarks by PICS Executive Director Ian Mauro, keynote by UBC faculty delegate Pasang Sherpa, and a panel discussion with UBC and SFU students who had attended COP 27.
- **May 2023:** PICS hosted a talk by Myles Allen, "the physicist behind net zero" at UVic, where an enthusiastic crowd heard from Allen on the concept of Geological Net Zero.
- **November 2023:** Jonathan Foley of Project Drawdown joined PICS and UVic's Coastal Climate Solutions Leaders, along with several UVic co-sponsors, for a packed event to discuss *The Drawdown Roadmap, a science-based strategy to accelerate climate action*.

A. *A Living Canvas: Bridging Art and Restoration in Climate Action, hosted by the Gorge Waterway Action Society, March 2024. Provided by Gorge Waterway Action Society*

B. *Dr. Jonathan Foley of Project Drawdown speaks at a PICS-sponsored event at the University of Victoria*

C. *The crowd at the PICS-sponsored Jonathan Foley event socializes before the speaker presentation*

D. *Dr. Myles Allen presents on the concept of Geological Net Zero*

WITH THE 2023 RELAUNCH, ALMOST $80,000 WAS GRANTED TO 17 SUCCESSFUL APPLICANTS FOR THEIR COMMUNITY CLIMATE ACTION EVENTS.

FAST TRACK PROGRAM

Rapid research to catalyze climate action

Mobilizing climate action through start-up style projects

STATUS

Complete

The Fast Track Program funded short-term, stand-alone climate solutions projects designed to seed larger initiatives. Some of these projects included:

- **The Climate Action Planning Microcertificate (UBC):**
  PICS funded two student hires to support the microcertificate's implementation and evaluation for its first two years. The microcertificate focuses on helping planners, policymakers, Indigenous leaders, and community changemakers acquire the knowledges and tools they need to influence and create climate action in their work and communities.
- **Building Leadership: Achieving Deep Reductions in B.C.'s Public Building Emissions (Climate Action Secretariat, Province of B.C.):**
  For this project, PICS funded an intern to research optimization of energy performance for existing buildings in the B.C. public sector. The intern focused on energy performance and occupant comfort through improvements to heating, cooling, and ventilation systems. The intern also interviewed stakeholders and hosted workshops that identified how best to improve buildings, and the challenges surrounding that work.
- **Building Curriculum in Support of Indigenous-Led Climate Solutions (UVic):**
  This project focused on developing and delivering a curriculum for UVic's Certificate in Transformative Climate Action that addresses Indigenous needs and priorities. It aimed to make the curriculum accessible and inclusive for Indigenous students while equipping non-Indigenous students with the skills to engage respectfully with Indigenous communities in climate solutions.
- **Justice, Equity, Decolonization and Intersectionality (JEDI) Primer (SFU)**:
  This project helped develop the JEDI primer for a non-credit, online Climate Action Certificate for mid-career professionals. The overall micro-credential focuses on on Indigenous perspectives, climate justice, and leadership in climate solutions. The program supports learners in building community resilience and motivating others toward climate action.
- **Sustainability Ambassadors-Climate Cohort (UBC):**
  This project expanded UBC's Sustainability Ambassadors program by creating a new climate-focused cohort. The cohort engages students in climate solutions, emphasizing climate education and interdisciplinary approaches to addressing the climate emergency.
- **Connecting Communities for Climate Change and the Environment (UNBC):**
  This project provided UNBC faculty with seed funding to develop collaborations with partner organizations on environmental, sustainability, natural resource, and climate change initiatives. The seed-grants aimed to foster community-driven research in Northern B.C., advance knowledge exchange, and increase UNBC's capacity for solutions-oriented research. This project also led to the development of the Northern B.C. Climate Action Network (NorthCAN), a hub that aims to identify and celebrate opportunities for climate action that work for northern B.C., encourage regional innovation and identify funding opportunities. In 2023, NorthCAN released a report showcasing their highlights and opportunities as a network.
- **Sustainability and PICS Scholars Professional Development Workshops (UBC):**
  This project helped deliver a "Decolonizing Your Research" workshop for PICS-connected scholars and their community partners. The workshop covered the history and ongoing impacts of colonization, ethical research methodologies, and best practices for engaging with Indigenous communities, and aimed to equip participants with skills for co-creating Indigenous, community-based research.

A. *The UBC Sustainability Ambassadors Program offers an enriching learning and leadership experience for students passionate about sustainability. Credit: UBC*

B. *Workshop attendees and CEA facilitator Katherine Pearce. Credit: Rob van Adrichem*

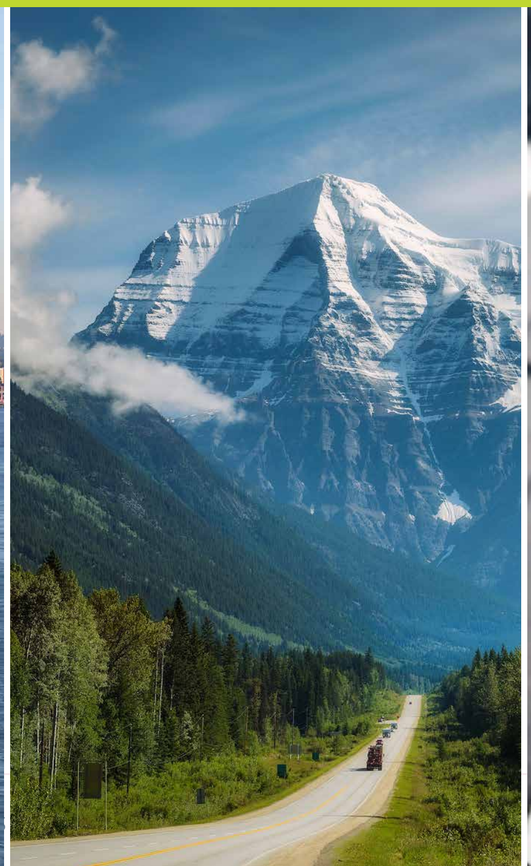
C. *The Transformative Climate Action certificate is designed for those passionate about sustainability, social justice, and environmental protection. Credit: UVic*

Newly Initiated

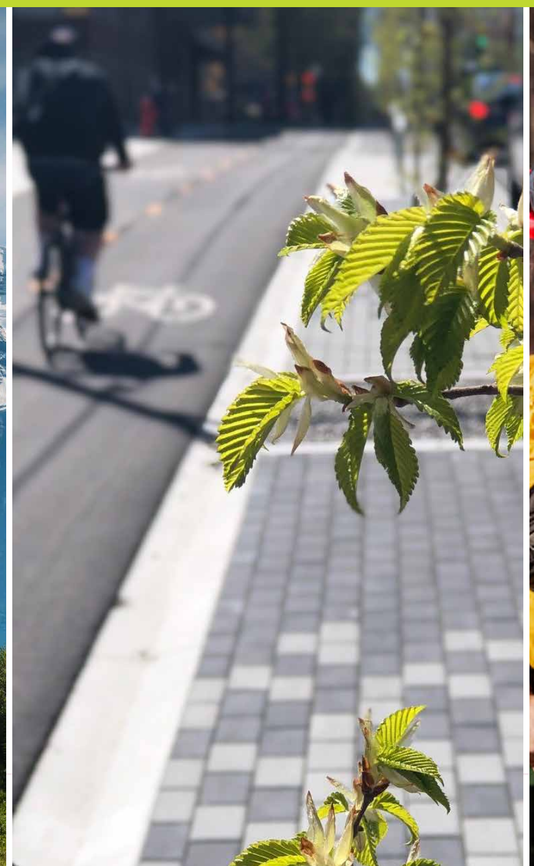
Newly Initiated focuses on new PICS projects with innovative approaches to climate solutions. These projects bring together researchers and partners to tackle emerging challenges and opportunities. By exploring new ideas and applying creative solutions, these collaborations aim to make meaningful contributions to our evolving understanding of climate resilience and adaptation.

SAFE PASSAGE: B.C. GREEN SHIPPING CORRIDORS ASSESSMENT

MOUNTAIN COMMUNITY ADAPTATION TO CHANGING SNOWPACKS AND GEOHAZARDS

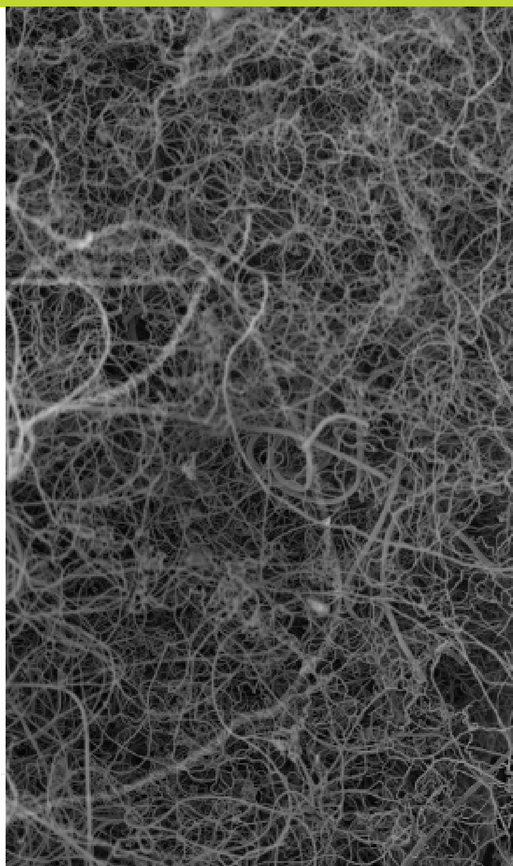


COOLING WITH TREES: URBAN TREE SOLUTIONS FOR TEMPERING CLIMATE EXTREMES



FIGHTING FIRE WITH FOOD

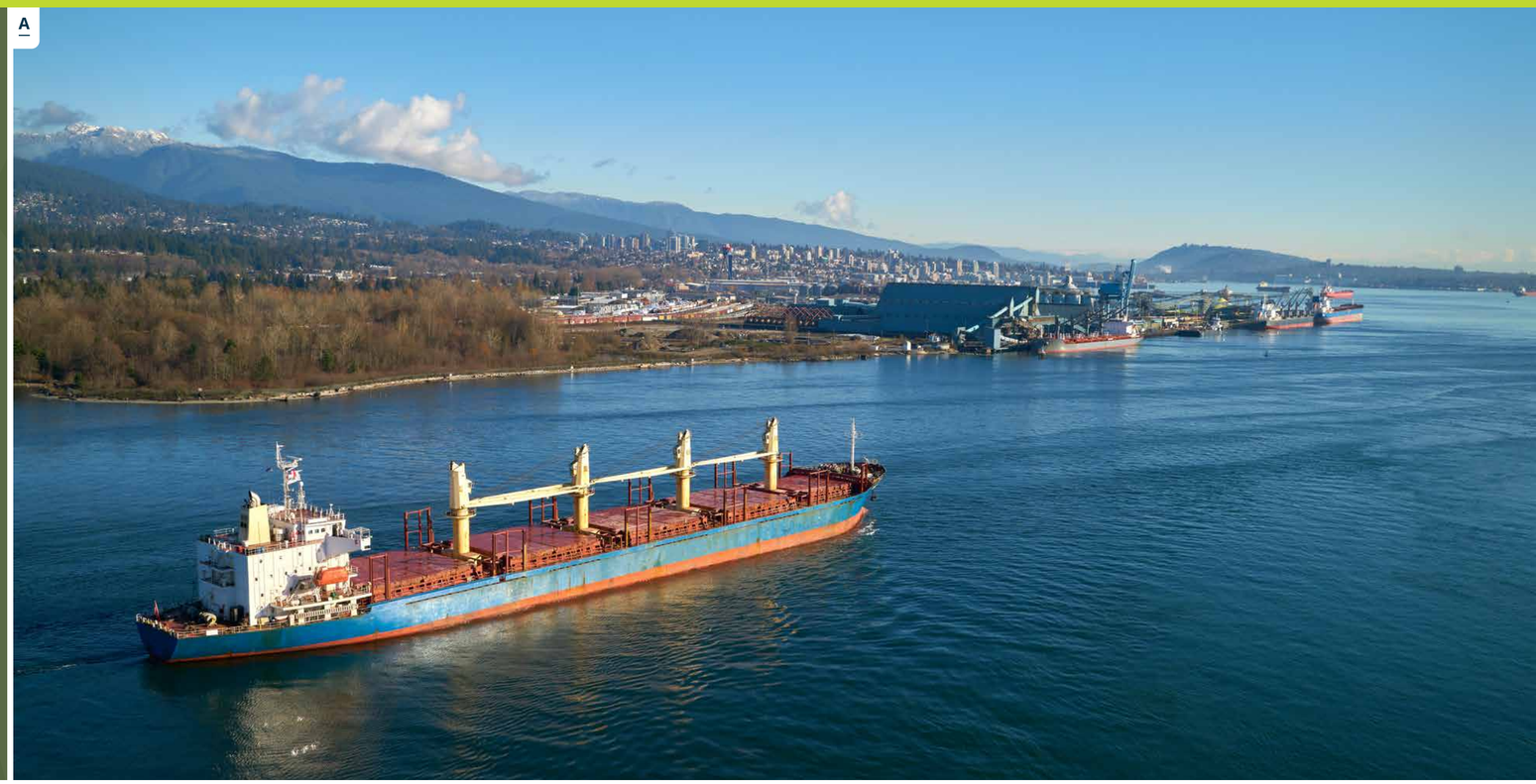
WASTE TO WANT: CONVERTING CO_2 TO FUELS AND FIBRES



PICS OPPORTUNITIES PROJECT

Decarbonizing the shipping industry

Can maritime shipping be the next low-carbon industry?



RESEARCHERS

Curran Crawford

Zuomin Dong

PARTNERS

Vancouver Maritime Centre for Climate (VMCC)

Oceans North

American Bureau of Shipping

University of Victoria

STATUS

Ongoing

DR. CURRAN CRAWFORD
Engineering Professor, UVic

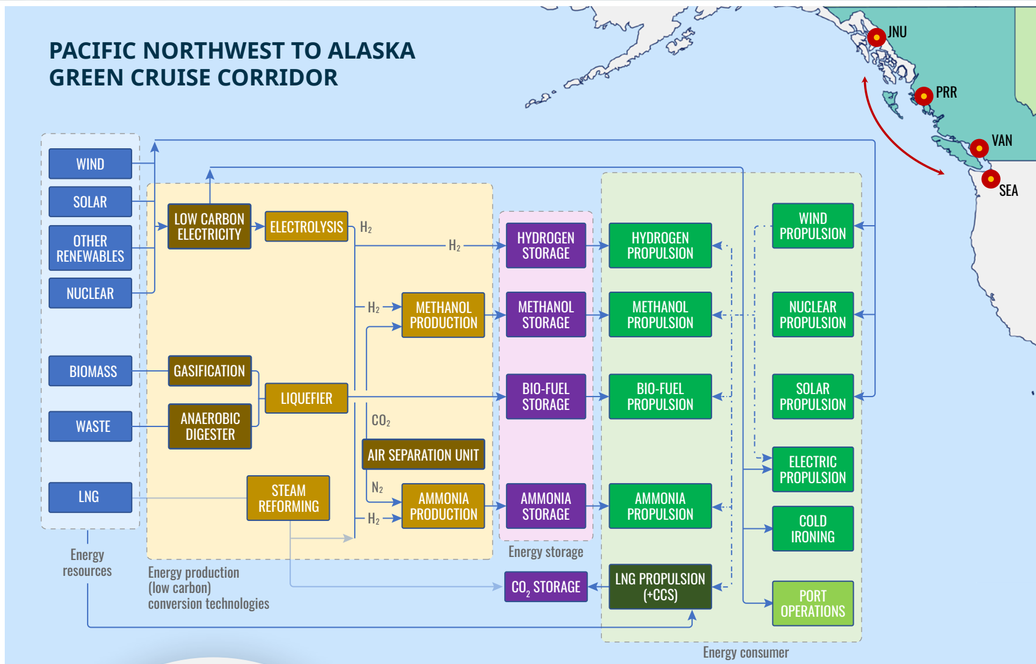
International maritime shipping is a major contributor (~three per cent) to global greenhouse gas emissions. To change that, the shipping sector needs alternatives to fossil fuels to power its ships.

Researchers at UVic received a PICS Opportunities grant in zero emission vehicles, sponsored by the B.C. Ministry of Energy, Mines, and Low Carbon Innovation. The project explores Green Shipping Corridors, maritime routes and ports that support zero-emissions technologies for international vessels operating in Canadian waters and calling at B.C. ports.

The primary goal is to map out pathways, termed Green Shipping Corridors, for ships and the supporting infrastructure that could use B.C.'s available energy sources. By leveraging B.C. low-carbon energy potential, the research focuses on evaluating fuel supply options, analyzing the technical feasibility of zero- or low-carbon energy solutions, and identifying the necessary infrastructure to support these transitions across the supply chain in the B.C. context.

As the first project to explore the viability of Green Shipping Corridors in Canada, this project marks a significant step in driving maritime decarbonization. This project aligns with Canada's commitment under the Clydebank Declaration, signed at COP26 in 2021, to establish at least six Green Shipping Corridors globally by 2025. With its skilled team and strategic position, the project is well-positioned to develop a decarbonized maritime shipping sector supported by a local green energy industry.

> THE PRIMARY GOAL IS TO MAP OUT PATHWAYS, TERMED AS GREEN SHIPPING CORRIDORS, FOR SHIPS AND THE SUPPORTING INFRASTRUCTURE THAT COULD USE B.C.'S AVAILABLE ENERGY SOURCES.



Project objectives and engagement:

A. *Assessing and quantifying both the existing and potential availability of zero / low carbon emission energy sources in B.C.*

B. *Assessing and quantifying the existing and future projected market demand in B.C.*

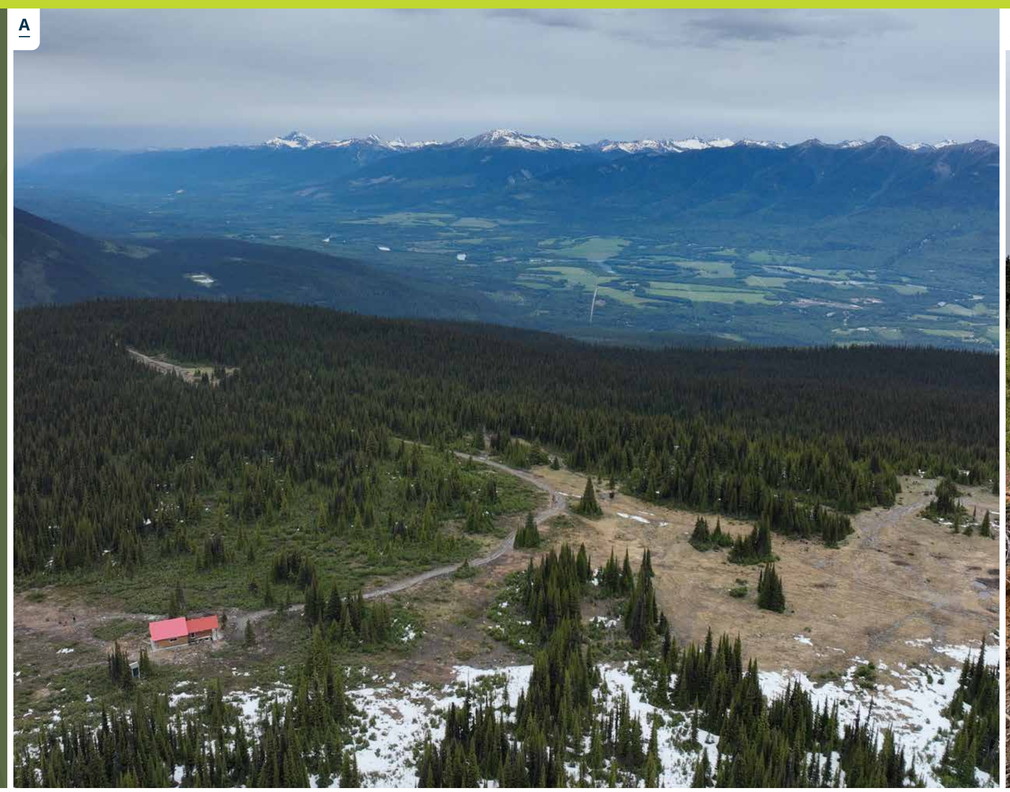
C. *Implementation plan including technical, financial, environmental, and regulatory considerations*

Provided by: Saeid Hassankhani Dolatabadi

PICS OPPORTUNITIES PROJECT

Reducing landslide, rockfall, and flood risks

Mountain communities are teaming up with researchers to adapt to changing snowpacks and geohazards



A

B

C

D

RESEARCHERS

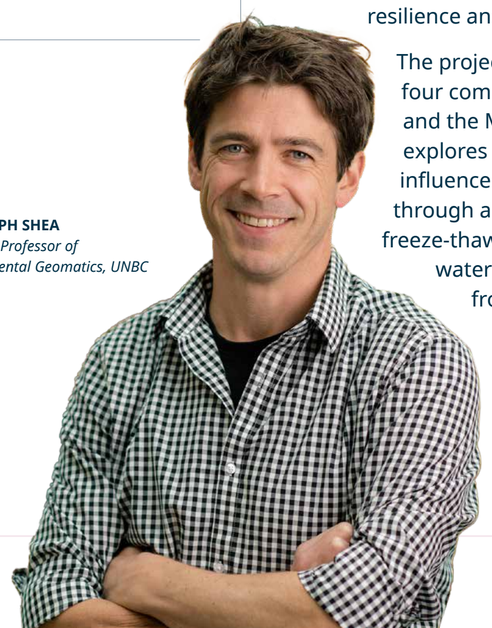
Joseph Shea

PARTNERS

Village of Valemount
Regional District of Fraser-Fort George
Dunster Community Forest
Valemount Community Forest
B.C. Ministry of Forests
University of Northern British Columbia

STATUS

Ongoing



DR. JOSEPH SHEA
Associate Professor of Environmental Geomatics, UNBC

Mountain communities are used to managing geohazards like rockfalls, landslides, mudslides, and floods. However, climate change is amplifying these hazards in profound and unpredictable ways.

Researchers at UNBC received a PICS Opportunities grant to help mountain communities with timely and useful information on current and projected geohazards and conditions. Communities can then use this information for their resilience and adaptation plans.

The project, which includes four community partners and the Ministry of Forests, explores climate change's influence on geohazards through altered ground freeze-thaw cycling, and water dynamics arising from precipitation, snowpack, and alpine permafrost and glacier thaw. Extreme heat and wildfire are also considered. The team is developing five components:

1. a geoinformation database linking to real-time sensors, condition maps, and forecasts;
2. a model that can explain local current and future melt water timing and quantities;
3. a network of real-time sensors to monitor the cryosphere (or those parts of the planet's surface where water is frozen) and climate conditions in the local area;
4. a rapid response tool that combines hazard modelling, sensor data, and remote imagery to detect and monitor unfolding geological events; and
5. building capacity to connect geohazards with climate change scenarios and understand new risks for adaptation and resource management decisions.

By understanding the impacts of climate change on geohazards, communities can make informed decisions to increase their safety and sustainability.

All images provided by Joseph Shea

A. *Lucille Mountain cabin and Robson Valley*

B. *Mackenzie Ostberg and Samiullah Sofizada, UNBC students, in front of the weather station installed at the future Valemount Community ski hill*

C. *PICS project team and knowledge seekers after the project's first meeting in Valemount, June 2023*

D. *Toe of the Swift Creek landslide, with Swift Creek in the bottom of the valley below*

E. *Dinner and public Q&A at Dunster community school*

THE PROJECT EXPLORES CLIMATE CHANGE'S INFLUENCE ON GEOHAZARDS THROUGH ALTERED GROUND FREEZE-THAW CYCLING, AND WATER DYNAMICS ARISING FROM PRECIPITATION, SNOWPACK, AND ALPINE PERMAFROST AND GLACIER THAW.

E

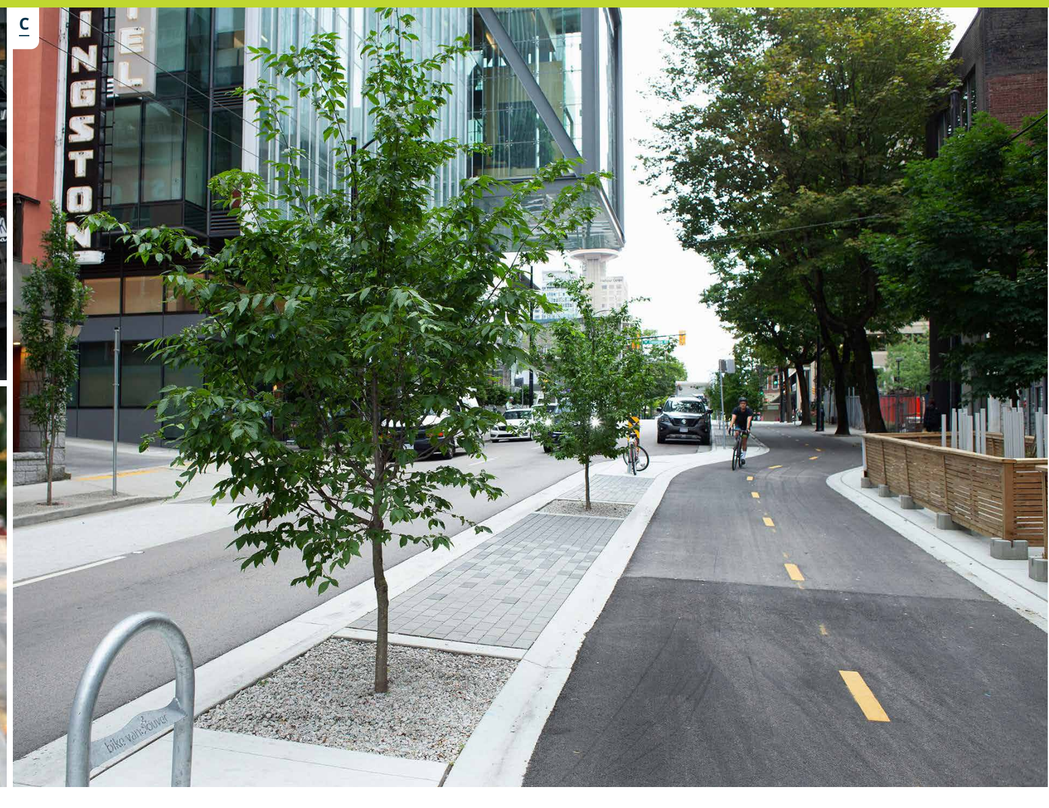
PICS OPPORTUNITIES PROJECT

Cooling the city through trees

How can urban trees be used to minimize urban heat islands?

A

B



C

RESEARCHERS

Caterina Valeo
C. Peter Constable
Rishi Gupta
Phalguni Mukhopadhyaya
Jennifer He
Angus Chu

PARTNERS

City of Vancouver
University of Victoria
University of Calgary

STATUS

Ongoing

DR. CATERINA VALEO
Professor of Mechanical Engineering, UVic

Climate change brings more frequent and severe heatwaves, which are amplified by the built environment—creating urban heat islands.

One way to combat this is by establishing treed green spaces. However, not all trees provide the same benefits. The effectiveness depends on the type of tree, the location, and whether it can even survive the stresses of the urban environment and climate change.

Researchers at UVic received a PICS Opportunities grant to develop soil and tree-planting expertise aimed at maximizing cooling potential.

The goal is to inform policies and guidelines for municipalities and practitioners to integrate cooling trees within existing low-impact development stormwater management. Rainwater tree trenches help manage stormwater while providing trees with a home and water. These trenches rely on structural soils, which can incorporate recycled concrete aggregate, improving water retention and repurposing construction waste.

Cooling with Trees explores urban tree cooling's potential in three parts: modelling of neighborhood heat and moisture changes in response to rainwater tree trenches; modelling of soil-vegetation-water dynamics featuring recycled aggregates; and developing deployment scenarios to address urban heat islands in current and future climates.

The project brings together researchers and municipal infrastructure practitioners to co-develop this knowledge. The City of Vancouver is providing several pre-existing rainwater tree trenches installations to facilitate learning and model calibration. As a prospective knowledge user, the city aims to expand tree-based infrastructure through its Rain City Strategy. This project addresses the implementation challenge of creating evidence-based standards that draw on research and experience to facilitate greater uptake.

The team anticipates developing design and maintenance guidelines for rainwater tree trenches, including those incorporating recycled aggregate, creating implementation maps and strategies for neighborhood and city-scale urban heat island reduction, and to reduce construction waste.

This project provides urban planners with the tools and knowledge to create healthy connections among trees, infrastructure, and people.

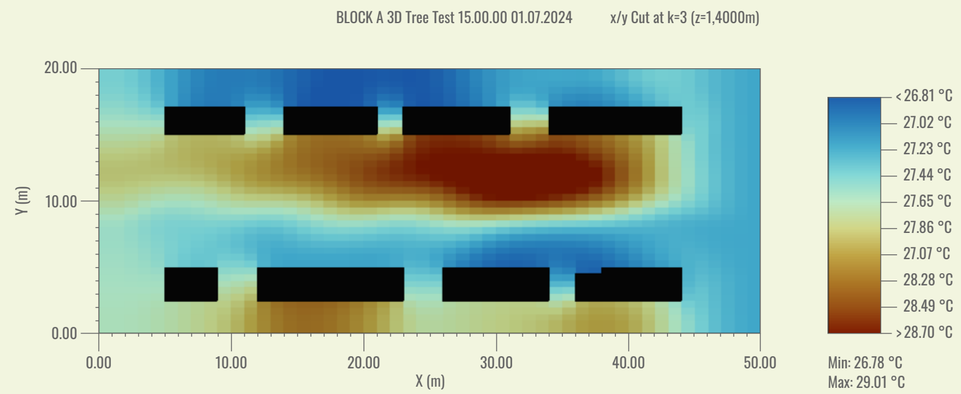
All images provided by Caterina Valeo

A. + B. *MASc student Esther Zhao taking meteorological measurements as well as information on tree characteristics at the Richards Street Rain water Tree Trench (RTT).*

C. *Rainwater tree trenches (RTT) installed along Richards Street in Vancouver.*

D. *A temperature map (from above) of Richards Street. One can see the heat next to buildings at the top of the street but buildings in the bottom row show a cooler region on the inner side of the buildings (between the buildings where the trees are) than the buildings on the other side.*

D



PICS OPPORTUNITIES PROJECT

Fighting fire with food

Indigenous fire stewardship can increase biodiversity, buffer against climate change, and protect cultural values


A


B


C


D


E

RESEARCHERS

Lori Daniels
Kira Hoffman

PARTNERS

Gitanyow Nation
Gitanyow Lax'yip Stewardship Guardians
University of British Columbia

STATUS

Ongoing

Fire is integral to healthy ecosystems in B.C. But a history of suppressing good fire — combined with climate change — has led to more frequent and disruptive wildfires.

Planting, tending, and burning fire-resistant vegetation increases the biodiversity of ecosystems, buffers against a rapidly changing climate, and protects cultural, ecological, and social values while lowering wildfire risk.

Researchers at UBC, in collaboration with the Gitanyow Lax'yip Guardians, received a PICS Opportunities grant to restore cultural fire regimes and ecosystem-based management to the territory.

In the Gitanyow Nation, areas surrounding important cultural sites were foodscapes managed with fire to support an abundance of berry patches, root gardens, and orchards. However, Indigenous fire stewardship practices were largely banned early last century, and much of the knowledges related to burning for plants and medicines has suffered lost.

The project identifies and revitalizes fire-reliant places and their interlinked cultural practices by weaving historical (photographs, tree rings, and fire scars) and contemporary fire data (remote sensing) together with Indigenous science and expertise recorded through oral histories and ecological legacies.

The project aims to:

- establish a network of plots before and after cultural fires and in control areas;
- work with Elders to record their knowledge of propagating and harvesting traditional foods and their connection to cultural burning; and
- facilitating community discussions about the importance of food and medicine harvesting, and documenting knowledge of historically fire-managed areas for restoration prioritization.

DR. KIRA HOFFMAN
NSERC Postdoctoral Fellow, UBC

For the Gitanyow Lax'yip Stewardship Guardians, one of the project's partners, this research supports their work to build up more food and medicinal plant knowledge, learn more about adaptive ecosystem management, conduct wildlife surveys and monitoring, and practise applied fire stewardship.

A. – E. *Kira Hoffman, Gitanyow Elder Darlene Vegh, and members of the B.C. Wildfire Service perform a Gitanyow-led cultural burn at Xsit'ax (Kitwanga River) on Wilp Gwaas Hlaam lands in northwest B.C. Credit: Marty Clemens*

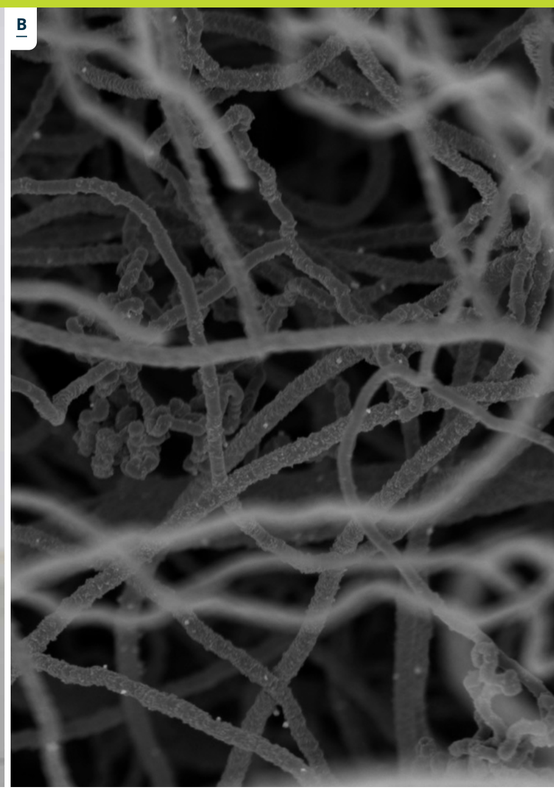
> THE PROJECT IDENTIFIES AND REVITALIZES FIRE-RELIANT PLACES AND THEIR INTERLINKED CULTURAL PRACTICES BY WEAVING HISTORICAL AND CONTEMPORARY FIRE DATA, TOGETHER WITH INDIGENOUS SCIENCE AND EXPERTISE.

PICS OPPORTUNITIES PROJECT

Converting carbon dioxide to fuels and fibres

Can captured greenhouse gases become useful products like fuel or bike frames?

A



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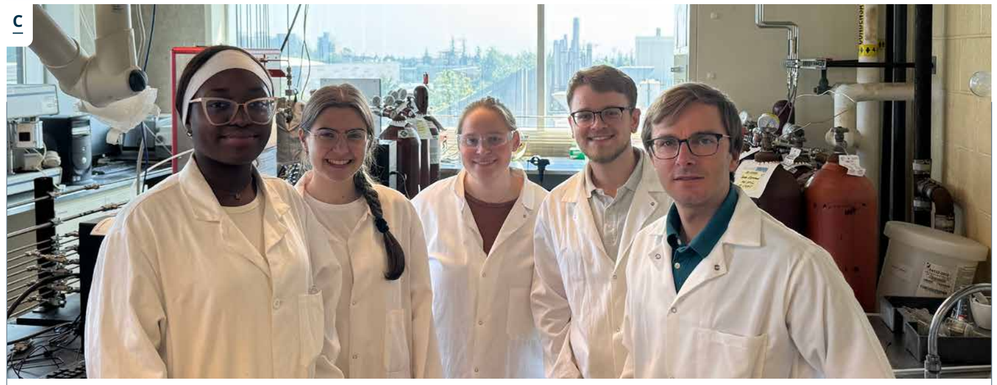


C

A. *Carbon fibre prosthesis. Credit: FG Trade Latin*

B. *Carbon fibers produced using a newly developed catalyst. Credit: Chester Upham*

C. *From left to right: Maryam Buraimoh, Justyna Podmokly, Natascha Miederhoff, Sawyer d'Entremont, and Chester Upham in one of their labs at UBC. Provided by Chester Upham*

RESEARCHERS

Chester Upham
Xiaotao (Tony) Bi

PARTNERS

Catalyst Agri-Innovations Society
Exaer Carbon
Paper Excellence
University of British Columbia

STATUS

Ongoing

Many industries produce biodegradable wastes that can be converted into biogas — a mix of mostly methane and carbon dioxide. The methane can be used as renewable natural gas, but what if the carbon could also be used by converting it to liquid fuels and carbon fibres?

The first step is to create a well-designed reactor that can break the biogas down to methane gas and carbon fibres. Those fibres can be used to manufacture various products, like bike frames or sporting equipment.

Researchers at UBC received a PICS Opportunities grant to develop a syngas and carbon fibre production process that uses a molten metal catalyst in a bubble column reactor.

> THE PROJECT BRINGS TOGETHER INDUSTRY PROFESSIONALS AND UNIVERSITY RESEARCHERS TO DEVELOP THE TECHNOLOGY.

The project has three goals:

- demonstrate a scaled-up reactor;
- demonstrate upgrading of carbon fibres; and
- develop the economic and environmental arguments for scale-up.

The project builds towards these goals in four interconnected parts: small scale reactor experimentation; materials testing to understand carbon fibre properties; building and operating a scaled-up bubble column reactor; and performing technoeconomic and lifecycle analyses for B.C. biogas.

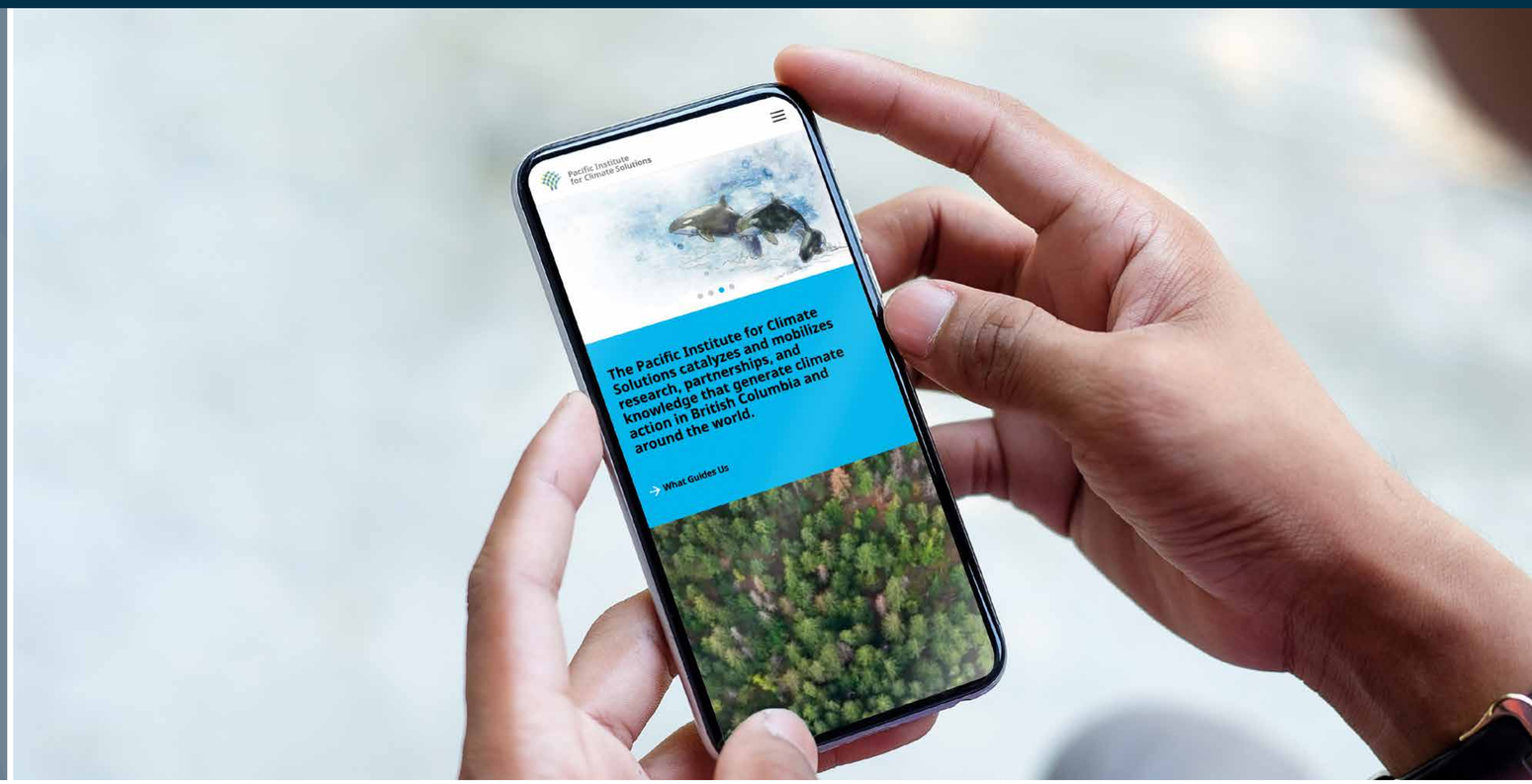
The project brings together industry professionals and university researchers to develop and refine the technology. Exaer Carbon will apply their expertise to upgrade the process' microscopic fibres into larger fibres suitable for creating products. They will also lead materials testing. Meanwhile, Paper Excellence and Catalyst Agri-Innovations Society will provide data and strategic guidance.

DR. CHESTER UPHAM
Assistant Professor, Chemical & Biological Engineering, UBC

DR. XIAOTAO (TONY) BI
Professor, Chemical & Biological Engineering, UBC

Performance Snapshot

A quick look at PICS' impact, by the numbers

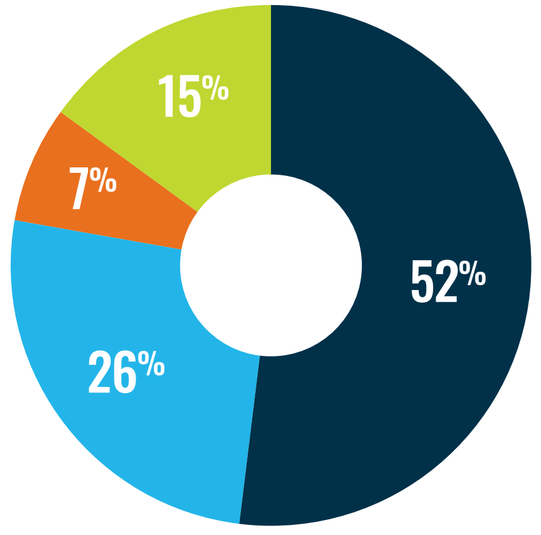


PROJECT NUMBERS

23 PROJECTS INITIATED	95 STUDENT RESEARCHERS FUNDED
17 PROJECTS COMPLETED	19 POSTDOC
57 PARTNER ORGANIZATIONS	28 PHD
34 COMMUNITY EVENTS	28 MASTERS
56 INTERNSHIPS (INCL. SUMMER 2022)	25 UNDERGRAD

2022 – 2024 EXPENDITURES

ENDOWMENT RESEARCH SUPPORT	$5,095,045
NON-ENDOWMENT RESEARCH SUPPORT	$1,419,926
OPERATIONS/ADMINISTRATION	$2,523,001
KNOWLEDGE MOBILIZATION	$655,026
TOTAL	$9,692,998



Pacific Institute
for Climate Solutions

The PICS main office is located at the University of Victoria campus. We acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory UVic stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

pics.uvic.ca pics@uvic.ca Subscribe