

Final Report
Phase 2, Year 4

Integrated Watershed Research Group

UNBC

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in conjunction with
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Introduction

The Integrated Watershed Research Group (IWRG) of the University of Northern British Columbia (UNBC) was initiated in response to the growing recognition of the environmental, socio-economic and health implications of watershed dynamics. This led to the application for an initial phase of research (Phase 1: 2014-2017), which was supported by matched funds from NEEF. Our experience with Phase 1 has reinforced our awareness of the demand for watershed research, monitoring and evaluation frameworks that integrate a range of relevant information, knowledge and perspectives to better understand and respond to interrelated issues in the Nechako River Basin (NRB), and contribute to enhanced decision-making at the basin scale.

Informed by the insights and outcomes from Phase 1 research, we secured a further ~ \$1 million worth of funding to explore important issues regarding the NRB over the course of five years (Phase 2: 2018-2022). The Nechako Environmental Enhancement Fund Society (NEEFS) approved a second ~\$500,000 grant from the Nechako Environmental Enhancement Fund (NEEF) through the NEEF Management Committee, with the other half of the research investment coming in the form of matching funds from other sources.

Dr. Stephen Déry, NSERC/Rio Tinto Industrial Research Chair, Forest Renewal BC Chairs in Landscape Ecology Dr. Philip Owens and Dr. Ellen Petticrew and Dr Margot Parkes make use of the funds to further examine issues ranging from water security in a changing climate, riverine fine sediment sources and developing tools to help inform integrated understanding and decision-making in the watershed. In addition to conducting research, the group are using the funds to retain the services of a project manager, train research associates as well as undergraduate and graduate students. The results of the research are being made available through public workshops as well as academic conference presentations, posters and publications.

Timeline

The IWRG at UNBC applied for a second phase of funding from the NEEFs in October of 2017. This second phase of funding was approved on November 22nd, 2017, and the final funding agreement was signed on March 15th, 2018, thereby allowing the team to continue its second phase of research in the NRB without interruption. The report that follows summarizes the work that was completed between January 1st and December 31st, 2021.

COVID-19 continues to have significant implications for work during this time period. COVID-19 has led to the cancellation and/or significant modification of outreach events and meetings and has delayed and/or modified field work. Despite these effects, we are continuing to partake in outreach events and meetings, as well as executing our research in accordance with the recommendations that have been brought forth by the Province and by UNBC Risk and Safety.

Overall Project Management

Presentations, meetings, and outreach with project partners:

- The IWRG Research Team presented a ‘virtual’ update of their research on February 23rd, 2021. A recording of this presentation can be found [here](#);
- Stephen continues to participate in the monthly meetings on the Main Table of the Water Engagement Initiative and in the bi-weekly meetings of the Technical Working Group of the Water Engagement Initiative;
- As part of the collective contributions of the IWRG, we have also continued our collaborative work with the Nechako Watershed Roundtable (NWR) partners, both from a project and a governance perspective, in ways that complement efforts across all three themes. Our work in this area included the following:
 - Margot Parkes remains as co-chair of the Core Committee of the NWR;
 - Several members of the IWRG team attended the virtual NWR Spring Annual Meeting on February 24th, 2021¹ the NWR Technical Meeting on May 26th, 2021² and the Annual Meeting on November 17th, 2021³.

Research maintenance:

- Field work and data collection continue within each theme, and as a result, each theme continues to train Highly Qualified Personnel (HQP);
- We continue to collate documents and existing knowledge (published reports, journal articles, books, etc.) pertaining to work in the NRB. These documents will feed directly into Theme 3;
- We continue to maintain the IWRG website that features work done under the auspices of this research program/grant.

Theme Updates

Theme 1 – Water security and climate change (Déry, staff and students)

- We continue to work on research related to climate change and water security in the NRB. This has included:
 - Ongoing operation of instrumentation in the Nechako watershed including regular maintenance and data collection from the Mt Sweeney and Tatuk lake climate stations, the network of 9 tipping bucket rain gauges between the aforementioned stations, and the array of 25 river temperature probes;

¹ Team members attending: Barry Booth, Stephen Déry, Margot Parkes, Ella Parker, Tavia McKinnon

² Team members attending: Barry Booth, Stephen Déry, Margot Parkes, Ella Parker, Tavia McKinnon, Makayla Skrlac

³ Team members attending: Barry Booth, Jordan Cranmer, Stephen Déry, Diana Kutzner, Jeremy Morris, Margot Parkes, Tavia McKinnon

- All data for 2021 have been collected and are going through quality assurance processing prior to use in research;
- Our team intends to adopt the use of the Nechako Portal for our river temperature, rain gauge, and climate station data. Testing of the platform is currently underway;
- The Tahtsa Ranges Atmospheric Experiment (TRARE) successfully occurred in September and October of 2021. Six researchers were stationed in the Upper Nechako with a variety of atmospheric monitoring equipment to record atmospheric river storm events in the region;
- Two new undergraduate field personnel were trained as HQP in climate research.

Outreach, knowledge exchange and extension

- Public presentations
 - Stephen delivered a talk titled "Climate change and water security research at UNBC" to the Main Table of the Water Engagement Initiative on February 10th;
 - On May 26th, Stephen provided an update on IRC research at the Nechako Watershed Roundtable's Spring Technical Meeting;
 - On April 12th, Stephen presented to the Terrace City Council about his research on Atmospheric Rivers (AR).
- Community Outreach
 - Collaborated with Tl'azt'en Nation and Nak'azdli Whut'en on river temperature monitoring sites in the Stuart Basin;
 - Presented the river temperature research to Binche Whut'en Chief and Council on 6 July 2021;
 - On May 14th, Stephen, Kelly Hurley, Derek Gilbert & Spencer Woyke met with James Rakochy and Mike Robertson from the Cheslatta Carrier Nation to discuss our ongoing relationship and upcoming fieldwork plans;
 - On April 7th, a youth intern from the Lheidli T'enneh Nation joined the team to learn about weather stations, climate change, and our work in the Nechako. The intern also helped us set up a complete weather station that was used to test our instruments;
 - On August 24th, Stephen provided an overview and progress update on the Industrial Research Chair research to the Nechako First Nations.
 - Jeremy delivered a "Lunch and Learn" presentation to Environmental Dynamics (EDI) in Prince George outlining Nechako Hydrology research and an overview of Atmospheric Rivers, November 17th;
 - Stephen presented on TRARE to the Water Engagement Initiatives main table, November 24th.
- Media engagement
 - The Prince George Citizen reported on the TRARE Field Campaign. <https://www.princegeorgecitizen.com/local-news/field-work-will-see-unbc-researchers-study-storm-impact-on-nechako-river-watershed-4302806>, September 3;

- The Tahtsa Ranges Atmospheric River Experiment (TRARE), Daybreak North, CBC Radio. <https://www.cbc.ca/listen/live-radio/1-109-daybreak-north/clip/15869122-researching-pineapple-express>, September 28th;
- What are Atmospheric Rivers?
<https://www.youtube.com/watch?v=Pq6zda71Zp0>;
- Nechako Watershed temperature monitoring
<https://www.facebook.com/UNBC/videos/1518337441861206/>.

Theme 2 – Sediment sources and dynamics (Owens, Petticrew, staff and students)

- We continued to work on research related to sediment sources and sediment quality in the Nechako Watershed:
 - Suspended sediment sampling at Tatsutnai, Ormond, and Nine Mile Creeks as well as at three sites along the Nechako began in April, with samples being collected every two weeks. These are samples that are focused on tracking the Shovel Lake wildfire and continued throughout the fall;
 - All samples from 2018 -2020 from soil and sediment sites were analysed for colour at the University of Manitoba and the results are currently being analysed. These samples will help to trace the wildfire using an inexpensive, simple technique (funded by a UNBC Research Project Award). These samples were also analysed for particle size at UNBC;
 - Samples that were collected throughout 2020 from the aforementioned sites plus Murray, Stoney and Smith Creeks are being processed for analysis by NALS at UNBC for geochemistry and loss on ignition (%Organic matter). These samples aim to add to the work undertaken by Dr. David Gateuille (a former post-doc at UNBC) in the Nechako Basin in 2015 to determine contemporary and historical sources of sediment to the Nechako River. This work is specifically addressing the contributions from agriculture, channel bank erosion and forested landscapes (including wildfires).

Outreach, knowledge exchange and extension:

- Public presentations/guest lectures:
 - Kieta, K.A., Owens, P.N., and Petticrew, E.L. Tracing the 2018 Shovel Lake wildfire using polycyclic aromatic hydrocarbons, UNBC Research Week (online), 5 March 2021;
 - Kieta, K.A. Insights into the cumulative effects of multiple disturbances on sediment in the Nechako River basin – 1 October 2021. Guest Lecture, UNBC.
- Conference presentations:
 - Kieta, K.A. Tracing the 2018 Shovel Lake wildfire using polycyclic aromatic hydrocarbons, presented at the Canadian Institute of Forestry’s Master’s Night (online), 16 April 2021;

- Kieta, K.A., Owens, P.N., and Petticrew, E.L. Using polycyclic aromatic hydrocarbons to determine post-wildfire contamination and sediment sources in a large watershed in central British Columbia, Canada. European Geophysical Union General Assembly 2021, online, 19–30 Apr 2021, EGU21-10491, <https://doi.org/10.5194/egusphere-egu21-10491>, 2021;
- Kieta, K.A., Owens, P.N., and Petticrew, E.L. Post-wildfire sediment and contaminant transport in the Nechako River Basin. Canadian Association of Geographers Annual Conference, Prince George, BC, 11 June 2021;
- Kieta, K.A., Owens, P.N., and Petticrew, E.L. Utilizing polycyclic aromatic hydrocarbons as an indicator of post-wildfire contamination and as a tracer for source apportionment in a large watershed in central British Columbia, Canada, American Geophysical Union Fall Meeting (online), 14 December 2021.

Theme 3 –Tools for integration in watershed management and governance (Parkes, staff and students)

The spatially referenced watershed portal tool continues to be a focus for Theme 3: We are developing and expanding this as a key tool for integration in watershed management and governance and creating a platform to bring together existing knowledge and new watershed research. Our ongoing development of the portal is responsive to the needs of our partners for sharing information and linking this to decision-making needs. Development of the watershed portal can be summarized as follows:

- We are maintaining and expanding our Zotero library of material relating to the Nechako watershed. This includes regular searching for articles, reports, etc. through Google Scholar and other search tools. This library is the central storage place for managing items before they are submitted into the portal. We continue to add ‘grey’ literature (e.g., professional reports, books) to the Zotero.
- IWRG team members continue to support Ella Parker’s master’s research by helping to make connections with watershed partners and communicate initiatives in the watershed. Ella is now writing up her thesis and is anticipating defending her thesis in June 2022;
- We continue to refine watershed portal tools to create a platform to bring together existing knowledge and new watershed research. Development of the watershed portal included:
 - The latest iteration of the portal can be found at <http://iwrgeis.unbc.ca/>, and includes opportunities for a variety of users to interact with and learn about the portal;
 - Ongoing partnered development of [Portal YouTube Videos](#) to help with training new portal users, including IWRG partners, and connections with other research networks, such as the ECHO Network;
 - Continuation of trials using geo-paparazzi and SMASH apps for data collection in association with the Koh-learning in our Watersheds Project, and Ella Parker’s Master’s research;
 - Team members continue to work with partners involved with the Nechako Watershed Roundtable (NWR) and the ‘Koh-learning in our Watersheds’ Project to develop and refine more maps to describe activities in the watershed;

- Continuation of work with partners in School District 91 to resource materials to be entered into the Nechako IWRG portal;
 - Ongoing development of portal interface and function for improved usability and function;
 - Development of a system to upload continuous monitoring data to the portal, ongoing work to get datasets and groups ready to start storing monitoring data on portal;
 - Working with Stephen Déry to house Theme 1 river temperature, rain gauge, and climate station data on the portal;
 - Continuation of our work related to Ella Parker’s master research to encourage way to share School-based monitoring data via the portal with research partners and participants.
 - In partnership with the Environment, Community, Health Observatory (ECHO) Network (<https://www.echonetwork-reseaecho.ca/>) lessons from the Nechako Watershed Portal have been applied to develop a version of the portal to explore connections with other watershed projects in Canada and internationally.
- In keeping with the overall emphasis on ‘Tools for integration in watershed management and governance’ and ongoing partnerships with the Nechako Watershed Roundtable and the ECHO Network, another focus for Theme 3 in 2021 has been contributing to a multi-partner collaboration focused on researching, planning and design of surveys to inform watershed planning. IWRG team members contributed to the following collaborative activities:
 - Along with Theme lead Margot Parkes, IWRG Team members Katie Cornish and Ella Parker worked with ECHO Research Manager Diana Kutzner, and NWR team Strategic Planning Secretariat members Joan Chess and Kim Menounos, to discuss the design and planning for a watershed survey in the Nechako;
 - Katie Cornish undertook a literature review to identify integrative approaches to watershed-related survey design that connect environment, community and health concerns;
 - Examples of survey tools and questions were identified and discussed, with recommendations made for incorporation of questions relevant to the Nechako;
 - IWRG members worked with NWR Strategic Planning Secretariat and ECHO Network members to undertake a targeted analysis of some survey questions to inform the development of the NWR Strategic Plan.
 - IWRG members continue to provide ongoing support to NWR-related initiatives including the Youth Engagement Working Group (e.g., NWR youth video project), and the Saik’uz restoration initiative.

Outreach, knowledge exchange and extension:

- Margot published the following paper:
 - Parkes MW (2021) River conversations: A confluence of lessons and emergence from the Taieri River and the Nechako River. River Research and Applications. Special Issue Paper. <https://doi.org/10.1002/rra.3907>
- IWRG Team members delivered several portal demonstrations including:
 - During the IWRG’s Evening on the Nechako Virtual Event, February 23rd, 2021;

- “Into the Portal of Experiential Education” at the Koh-learning Winter Festival. February 25th, 2021 as part of the NWR’s Spring Technical Meeting, May 26th, 2021.
- **Margot Parkes**, Lars Hallstrom, **Aita Bezzola**, Christiana Onabola, Stacy Jupiter, Aaron Jenkins (speakers). (2021) Health in Watersheds Exploring Connections and Data Complexities. ECHO Pulse Day 3. (November 23, 2021). <https://www.echonetwork-reseaecho.ca/echo-pulse-resources#Watersheds>
- IWRG Team members contributed to background survey information that contributed to the development of the NWR Strategic Plan:
 - NWR (2021). Nechako Watershed Roundtable Strategic Plan 2022-2026. November 2021. <https://bit.ly/3IzBDTf>