



BOOTS ON THE GROUND: WOLF CREEK RESEARCH BASIN

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1 – McMaster University, School of Geography and Earth Science

2 – Government of Yukon, Water Resource Branch

3 – University of Saskatchewan, Centre for Hydrology

Tyler de Jong, MSc
Field researcher/technician

Wolf Creek Research Basin History

- Research project initiated in 1992 by Ric Janowicz and INAC
 - Early pioneers: Sean Carey and John Pomeroy (University of Saskatchewan)
 - Hydrometeorology focus
 - Grew to incorporate vegetation, wildlife, fisheries (Wolf Creek Salmon Passage way)



WOLF CREEK
RESEARCH BASIN
HYDROLOGY, ECOLOGY,
ENVIRONMENT



Proceedings of a Workshop held in
Whitehorse, Yukon, 5-7 March 1998

Editors J.W. Pomeroy and R.J. Granger





GLOBAL WATER FUTURES

SOLUTIONS TO WATER THREATS IN AN ERA OF GLOBAL CHANGE

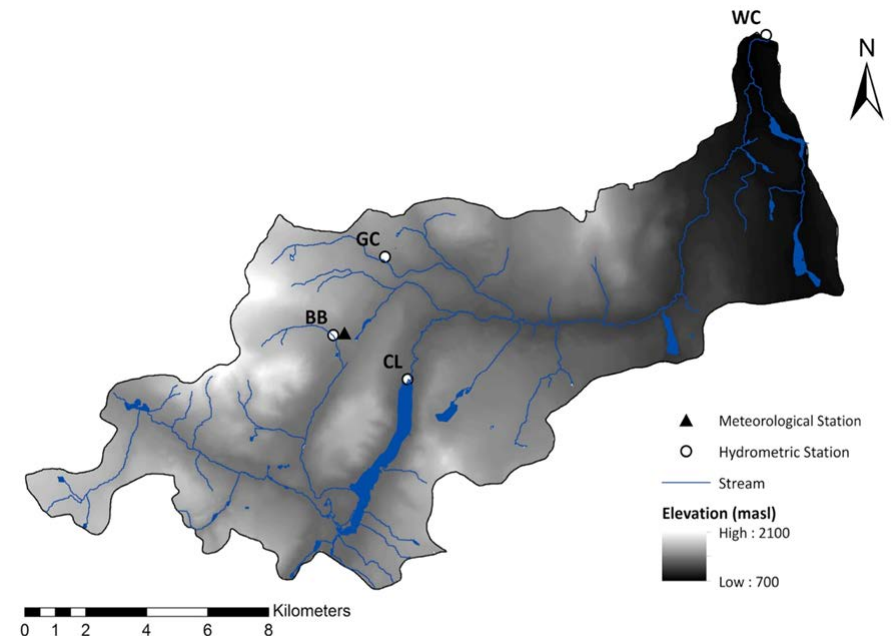
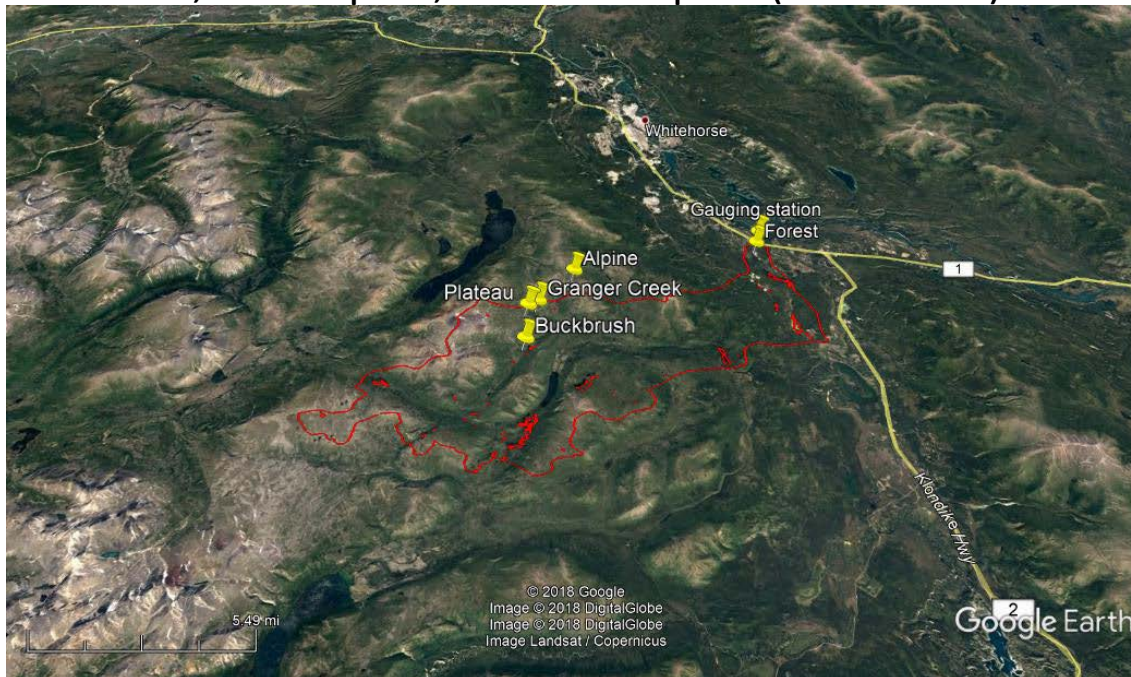
GWF funding has allowed two YEAR
ROUND full-time field researcher positions
in Whitehorse: myself, and this hard
working guy (Dave Barrett) →

David Barrett stats:
10 years in environmental consulting
82 mph slap shot
Size 13 foot
Speaks Inuktitut



Wolf Creek Location

- Approx. 200 km²
- ~ 1300m elevation range
- Vegetation type: boreal forest, sub-alpine taiga, and alpine tundra
- 300-500 mm/yr precip (40% snow)
 - Hamilton: ~835 mm
- -3 mean annual air temperature
- 22% Forest, 20% Alpine, 58% Sub-alpine (Buckbrush)





Meteorological sites



***Forest:
Above & below canopy***



Buckbrush: Sub-alpine



Plateau

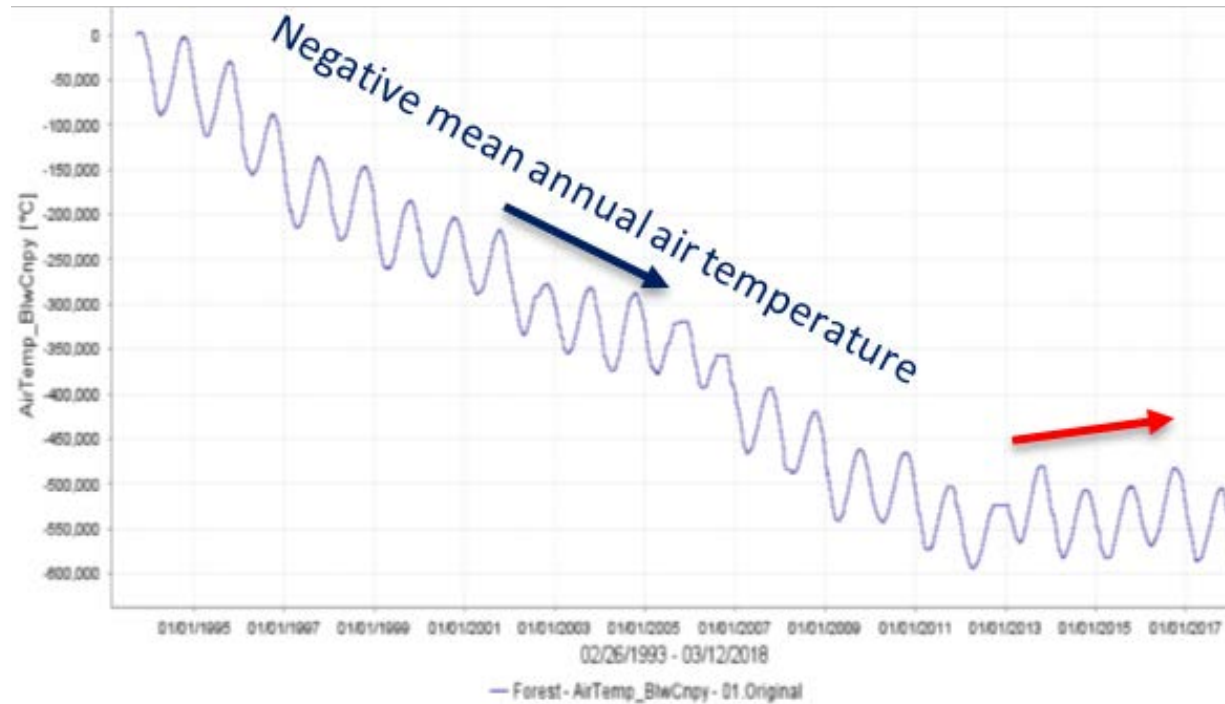


Alpine

<http://giws.usask.ca/KistersWeb/main.php>



25 years of continuous data!





Hydrometric sites

1. Lower Wolf Creek (Wolf at the highway, near Yukon River)
 2. Granger Creek
 3. Buckbrush Creek (Upper Wolf Creek)
 4. Coal Lake outlet
- Level loggers
 - Conductivity loggers
 - Discharge measurements (every ~2 weeks)
 - Flowtracker acoustic doppler velocimeter
 - Salt dilution (QuicQuac)
 - Rating curve development





Water Quality

- Water sampling:
 - Isotope
 - DOC
 - DOM
 - Ions
- Specific Conductivity
- pH
- Dissolved Oxygen



Source: Nadine Shatilla

Snow surveys

- 25 years on record
- Monthly surveys
 - SWE and snow depth
- Forest
- Alpine
- Plateau
- Granger (80 point)
- Buckbrush
 - Around SWE sensors
- Snow pits
 - Stratigraphy
 - Isotope sampling



Winter precipitation measurements

Buckbrush site:

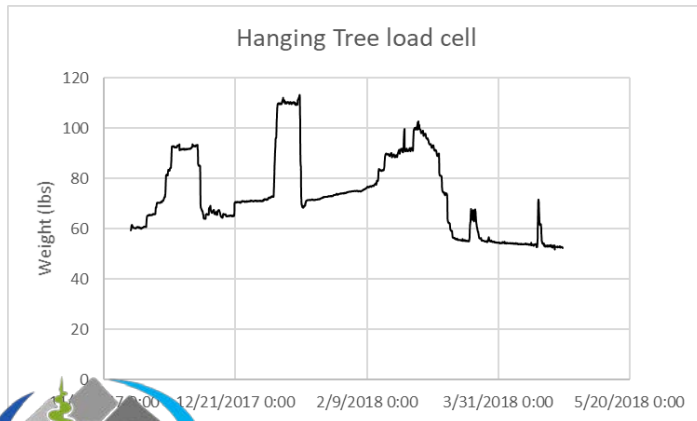
- Geonor
- Pluvio (2)
- SSG Snow scale
- Snow pillow
- 2kr triangular snow scale
- CS passive gamma radiation SWE
- Sommer Snow Pack Analyzer
- To be installed:
 - HydrolInnova CRS/Snowfox
 - 2kr Snow pillow
- 10 SWE instruments in total



Winter precipitation measurements

Interception: hanging tree
(Hedstrom & Pomeroy, 1997)

HydroInnova's Cosmic Ray Sensor
& snowfox for SWE
-Attenuation of cosmic rays by
hydrogen (snow)



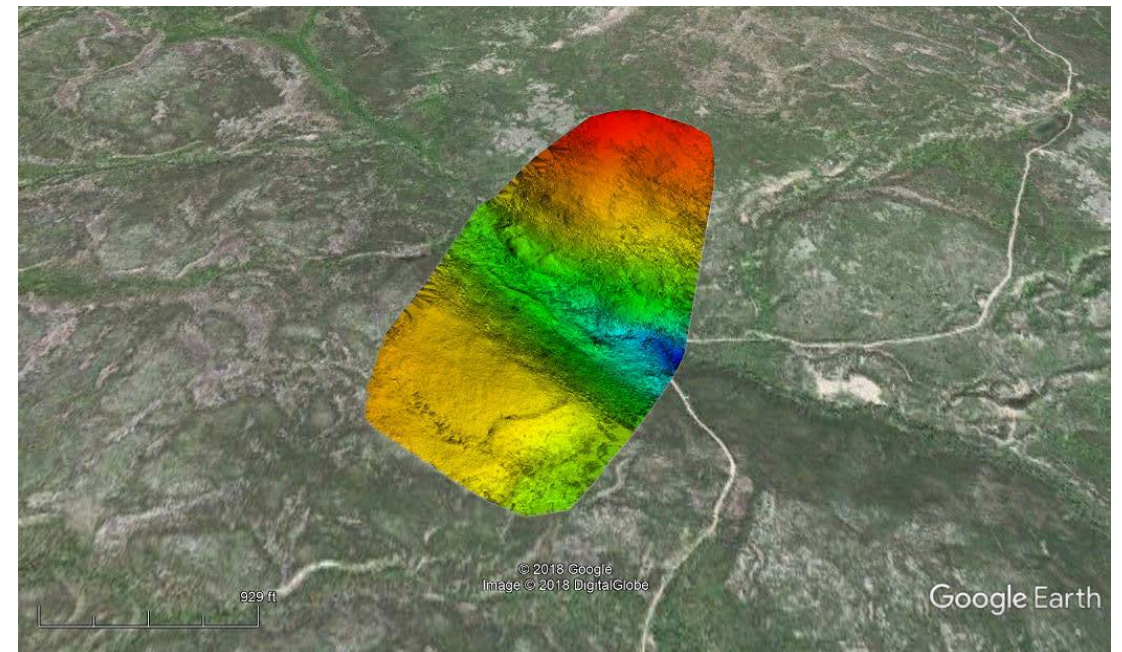
Remote sensing: UAV

- RTK GPS UAV (EbeeRTK) with base station and GCPs
- Structure from motion technique to create 3D Digital Surface Model (DSM)
 - centimeter resolution
- Bareground LiDAR subtracted from DSM to obtain snow depth (Harder et al). Shrubs are masked out.

$\text{Snow surface DSM} - \text{Bareground LiDAR} = \text{Snow depth}$

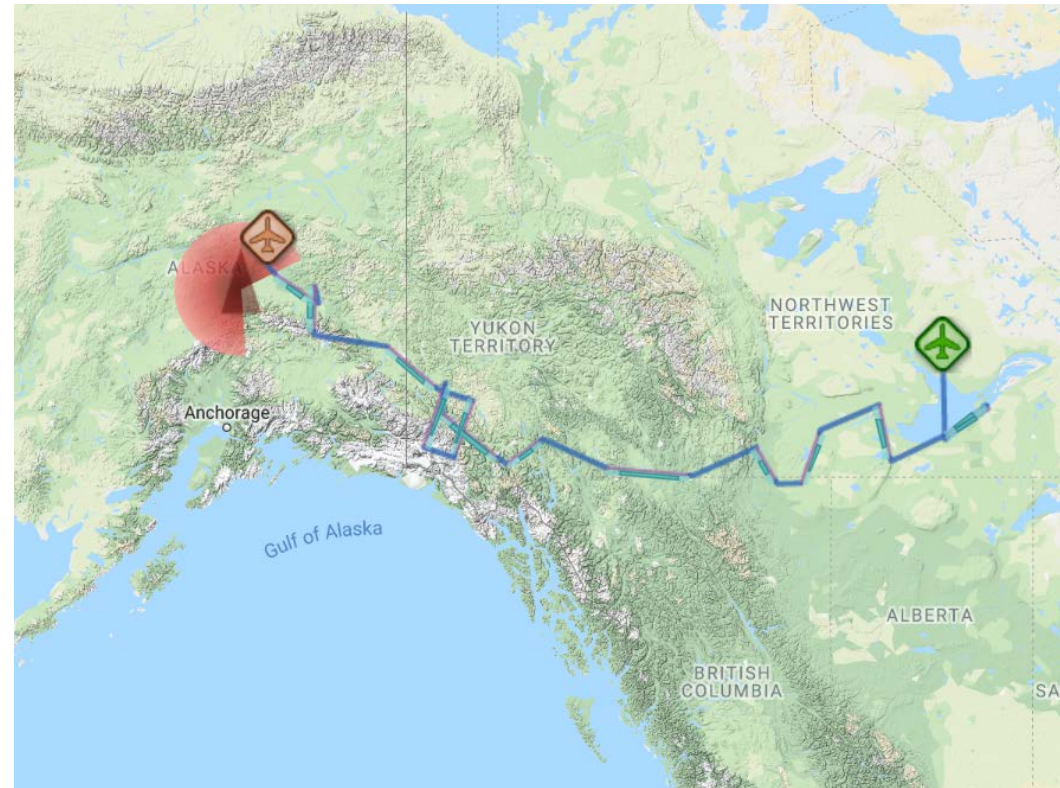
- LiDAR to be flown in July 2018
- Goal to better improve permafrost models in Granger Basin

Acknowledgments: Phillip Harder & John Pomeroy. Brian Menounos



Remote sensing: NASA ABoVE

- RADARSAT2 acquisitions fine-wide quad-pol
 - Summer imagery (2017-2018)
- UAVSAR (Airborne RADAR)
 - L-band, P-band, Ka-band



Eddy Covariance towers

Locations:

- Buckbrush (Subalpine)
- Plateau (Alpine)
- Forest (Above canopy, year-round)
- Forest (Sub-canopy)
 - Sap-flow sensors to be installed

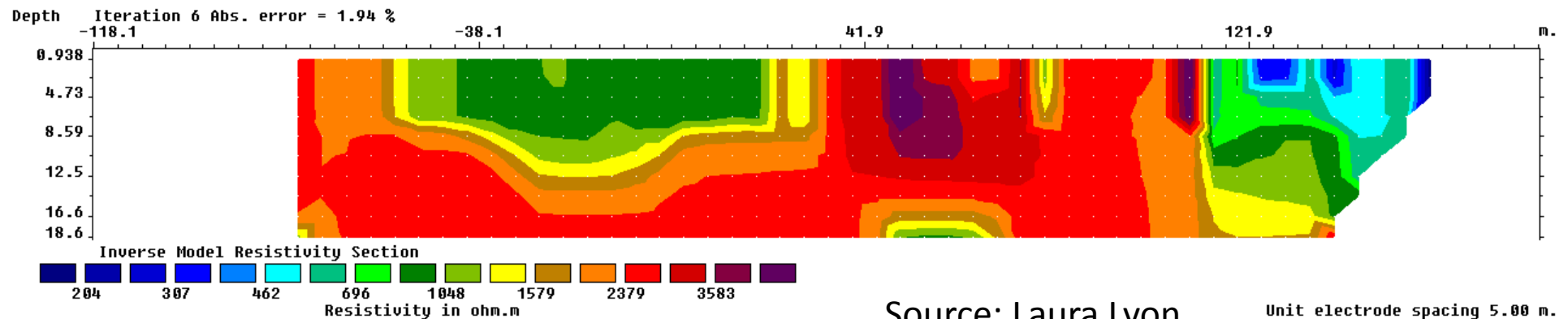
Acknowledgements: Mike Treberg and Erin Nichols



Supporting other research projects

McGill University: Laura Lyon, Jeff McKenzie, Greg Langston

- March 2018
- Resistivity mapping with OhmMapper to look at water table / permafrost depths



Source: Laura Lyon

Unit electrode spacing 5.00 m.



Other Yukon projects

- Eddy Covariance
 - Faro (former mine, reclamation site)
 - 3 sites:
 1. Over old waste rock
 2. Over former barrow pit
 3. Over drained water reservoir
 - Coupled with net radiation, and ground sensors to get a sense of the water balance at the former mine site

Acknowledgments: IEG Consulting, SRK Consulting, and Mike Treberg



Other Yukon Projects

Winter isotope sampling for base flow measurements

- From Yukon Stikine Highlands ecoregions to Eagle Plains (Boreal Mountains and Plateau, Yukon Southern Lakes, Yukon Plateau Central, Yukon Plateau North, Klondike Plateau, McKenzie Mountains, North Ogilvie Mountains)





Acknowledgements

- Sean Carey, David Barrett, Ric Janowicz, John Pomeroy, Nadine Shatilla, Erin Nichols, Mike Treberg, Gord Drewit, Phillip Harder, Laura Lyon, Greg Langston, and Government of Yukon Water Resource Branch
- Interested in Wolf Creek? Contact: tyler.dejong@mcmaster.ca



Cheers to Ric!

GWF Meeting Abstract

Boots on the Ground: Wolf Creek Research Basin

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The Wolf Creek Research Basin in southern Yukon has been a highly researched basin with global recognition for over 25 continuous years. As a result, the basin is data rich and heavily instrumented, yet remains an intact representative watershed in close proximity to the city of Whitehorse. Global Water Futures funding has allowed an increase in monitoring and research support in the Wolf Creek watershed enabling consistent field data collection, which include, but are not limited to, stream flow measurements, water quality sampling, snow surveys, and meteorological towers measurements. In collaboration with the Government of Yukon, GWF researchers have the available infrastructure and support to conduct high levels of research. Field data from Wolf Creek Basin is ultimately used to develop enhanced northern hydrological models and help improve the understanding of hydrometeorological processes.

Projects:

1-Wolf Creek Location/stats

2-Regular data collection

-Summer/Winter

3-Specific Projects in Wolf Creek

4-Other projects in Yukon

-Winter precip instruments

-Remote Sensing:

-NASA ABoVE

-UAV Phillip Harder/John Pomeroy

-LiDAR

-Eddy Co – Mike Treberg, Erin Nichols

-Groundwater/permafrost – Jeff McKenzie, Laura Lyon, Greg Langston

-Snow Surveys

-Water Quality, Isotopes, fDOM, DOC, Ions, SpC – Nadine Shatilla -Water discharge, level loggers, salt dilution, flowtracker, rating curve

-Met

-hanging tree – Ric Janowicz

-Gov’mt snow pillows, highways met, CRS/Snowfox

Other locations in Yukon -Faro – Integral Ecology Group, SRK Consulting... Dempster Highway