

Research and monitoring activities and needs related to ABoVE and POLAR activities

Sean K. Carey, Professor

Representing the CCRN Network and Wolf Creek YT

McMaster University, School of Geography and Earth Sciences

May 16, 2016

CCRN: Changing Cold Regions Network

Funded by the Natural Science and Engineering Research Council,
Climate Change and Atmospheric Research initiative : 2013-2018

*“This Network aims to **understand, diagnose and predict** interactions amongst the cryospheric, ecological, hydrological, and climatic components of **the changing Earth system** at multiple scales with a geographic focus on **Western Canada’s rapidly changing cold interior.**”*

Network Development

- CCRN has developed a large, multi-disciplinary team of researchers
 - 42 investigators and 136 students, post-doctoral fellows, and other HQP from 8 Canadian universities and 4 federal government agencies
 - International collaboration includes 18 scientists from Germany, France, the U.S., U.K., and China
- Linked to GEWEX, CLiC, GEO, NCAR, NASA, and more
 - In December 2014, the World Climate Research Program endorsed CCRN as a GEWEX Regional Hydroclimate Project

List of CCRN Participants

Network Co-Investigators and Collaborators

- Vivek Arora (Env. Can.)
- Jenifer Baltzer (Wilfrid Laurier U.)
- Alan Barr (Env. Can.)
- Paul Bartlett (Env. Can.)
- Aaron Berg (U. Guelph)
- Andy Black (U. British Columbia)
- Barrie Bonsal (Env. Can.)
- **Sean Carey (McMaster U.)**
- Garry Clarke (U. British Columbia)
- Mike Demuth (Nat. Resources Can.)
- John Diiwu (AB Env. and Sus. Res. Dev.)
- Vincent Fortin (Env. Can.)
- John Hanesiak (U. Manitoba)
- Masaki Hayashi (U. Calgary)
- Warren Helgason (U. Sask.)
- **Al Howard (Ag. and Agri-Food Can.)**
- Dave Hudak (Env. Can.)
- Andrew Ireson (U. Sask.)
- Richard Janowicz (Yukon Environment)
- Ed Johnson (U. Calgary)
- Jill Johnstone (U. Sask.)
- Bob Kochtubajda (Env. Can.)
- Yanping Li (U. Sask.)

- **Murray MacKay (Env. Can.)**
- **Phil Marsh (Wilfrid Laurier U.)**
- Sean Marshall (U. Calgary)
- Jeff McDonnell (U. Sask.)
- **Al Pietroniro (Env. Can.)**
- **John Pomeroy (U. Sask.)**
- **William Quinton (Wilfrid Laurier U.)**
- Garry Scrimgeour (Parks Can.)
- Chris Spence (Env. Can.)
- Craig Smith (Env. Can.)
- Saman Razavi (U. Sask.)
- **Ron Stewart (U. Manitoba)**
- Kit Szeto (Env. Can.)
- Julie Thériault (U. Québec à Montréal)
- **Merritt Turetsky (U. Guelph)**
- Garth van der Kamp (Env. Can.)
- **Howard Wheeler (U. Sask.; CCRN PI)**
- Daqing Yang (Env. Can.)
- Xuebin Zhang (Env. Can.)

Board of Directors

- Ming-Ko (Hok) Woo (McMaster U.,

- ret., BOD Chair)
- Jim Bruce (Env. Can., ret.)
- Wayne Dybvig (SK WSA)
- Ken Greenway (AB Env. & Sus. Res. Dev.)
- Michel Jean (Env. Can.)
- Donna Kirkwood (Nat. Resources Can.)
- David Livingstone (Gov. NWT, ret.)
- Denis Petitclerc (Ag. and Agri-Food Can.)

International Advisory Panel

- Don Cline (National Oceanic and Atmospheric Administration)
- Richard Harding (UK Centre Ecology and Hydrology)
- Larry Hinzman (U. Alaska)
- Eric Kasischke (U. Maryland; NASA ABoVE)

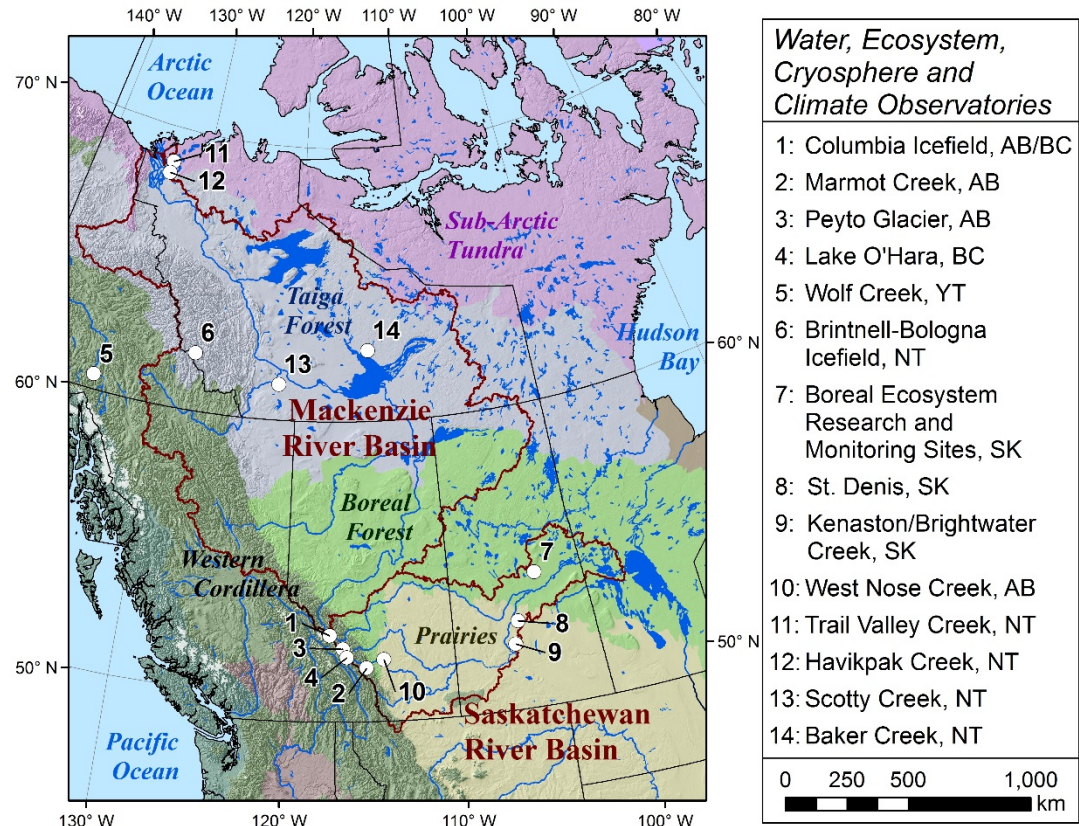
Secretariat (@ GIWS, U. Sask.)

- Chris DeBeer (CCRN Project Manager)
- Meagan Hinthier (Communications Specialist)
- Michelle Martel-Andre (Executive Assistant)
- Sherry Olauson (Clerical Assistant)
- Graham Strickert (Outreach Coordinator)
- Tim Zagozewski (Finance Officer)
- Branko Zdravkovic (Database Manager)

CCRN Research Program:

Geographic Focus / Water, Ecosystem, Cryosphere and Climate (WECC) Observatories

- A network of WECC Observatories combine meteorological, hydrological, ecosystem, and cryospheric observations with multi-scale coupled models from the surface to the atmosphere.
- Observatories contain long-term legacy data sets, including hydro-meteorological variables, remote sensing observations, LiDAR topography, and soils, geology, and vegetation characterization



CCRN Thematic Components

The CCRN's research program and its objectives are organized based on 5 inter-related and inter-dependent Themes:

- A. Observed Earth System Change in Cold Regions—Inventory and Statistical Evaluation;
- B. Improved Understanding and Diagnosis of Local-Scale Change;
- C. Upscaling for Improved Atmospheric Modelling and River Basin-Scale Prediction;
- D. Analysis and Prediction of Regional and Large-Scale Variability and Change; and
- E. User Community Outreach and Engagement

Ongoing research and monitoring *Related to ABoVE and POLAR activities*



Changing Cold Regions Network Study Domain

Water, Ecosystem, Cryosphere and Climate Observatories

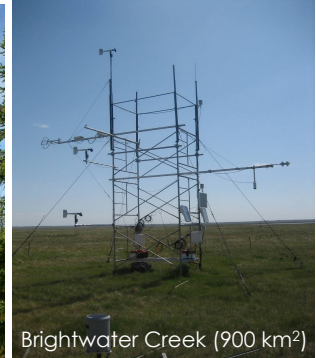
- **Western Cordillera**
 - 1: Columbia Icefield, AB
 - 2: Marmot Creek Research Basin, AB
 - 3: Wapta Icefield/Peyto Glacier, AB
 - 4: Lake O'Hara, BC
 - 5: Wolf Creek Research Basin, YT
 - 6: Brintnell-Bologna Icefield, NWT
- **Boreal Forest**
 - 7: Boreal Ecosystem Research and Monitoring Sites (BERMS), White Gull Creek, SK
- **Prairie**
 - 8: St. Denis National Wildlife Area, SK
 - 9: Kenaston/Brightwater Creek Mesonet Site, SK
 - 10: West Nose Creek, AB
- △ **Sub-Arctic Lowlands**
 - 11: Trail Valley Creek, NWT
 - 12: Havikpak Creek, NWT
 - 13: Scotty Creek, NWT
 - 14: Baker Creek, NWT

Ecoregions and Landcover

Glaciers	Northwestern Forested Mountains
Tundra	Marine West Coast Forest
Taiga	Great Plains
Hudson Plains	North American Deserts
Boreal Forest	

0 250 500 km

Source Data: The North American Environmental Data & Information Infrastructure (NAEDII) Database. Publication: 1/28/2010. NAED 1983. Created by: Chris Delaney.



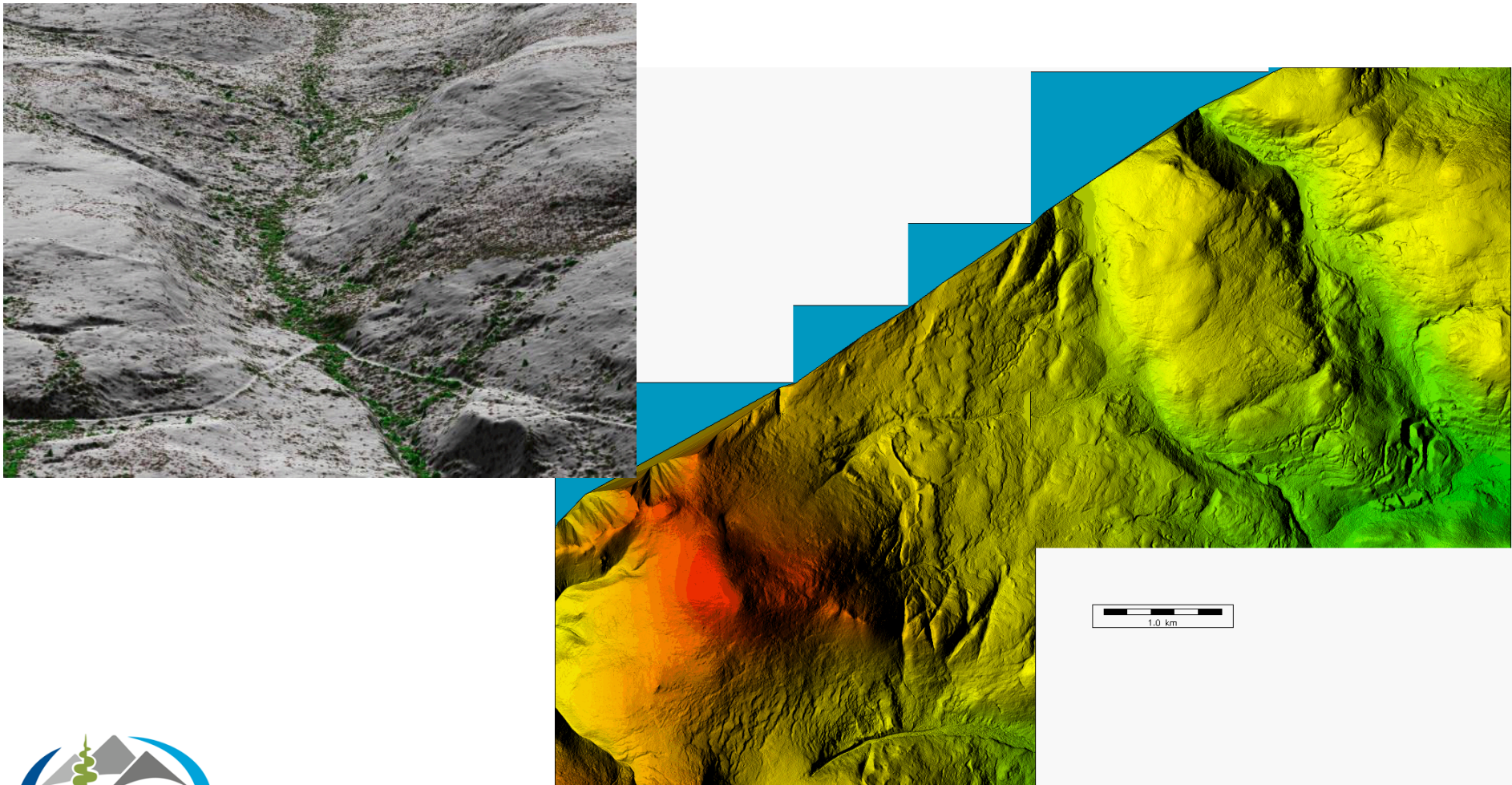
Ongoing research and monitoring *Related to ABoVE and POLAR activities*

- ⇒ WOLF CREEK WECC
- ⇒ Intense measurement campaigns: Eddy Covariance, Isotopes, Geochemistry, Snow Surveys, Streamflow, Soil Moisture, etc....
- ⇒ Current Projects: : Stable isotope vegetation-soil-stream linkages (ERC collaboration), DOC quantity and quality, stream temperature and surface-groundwater interaction, frozen soil infiltration, shrub characterization and water use, etc.

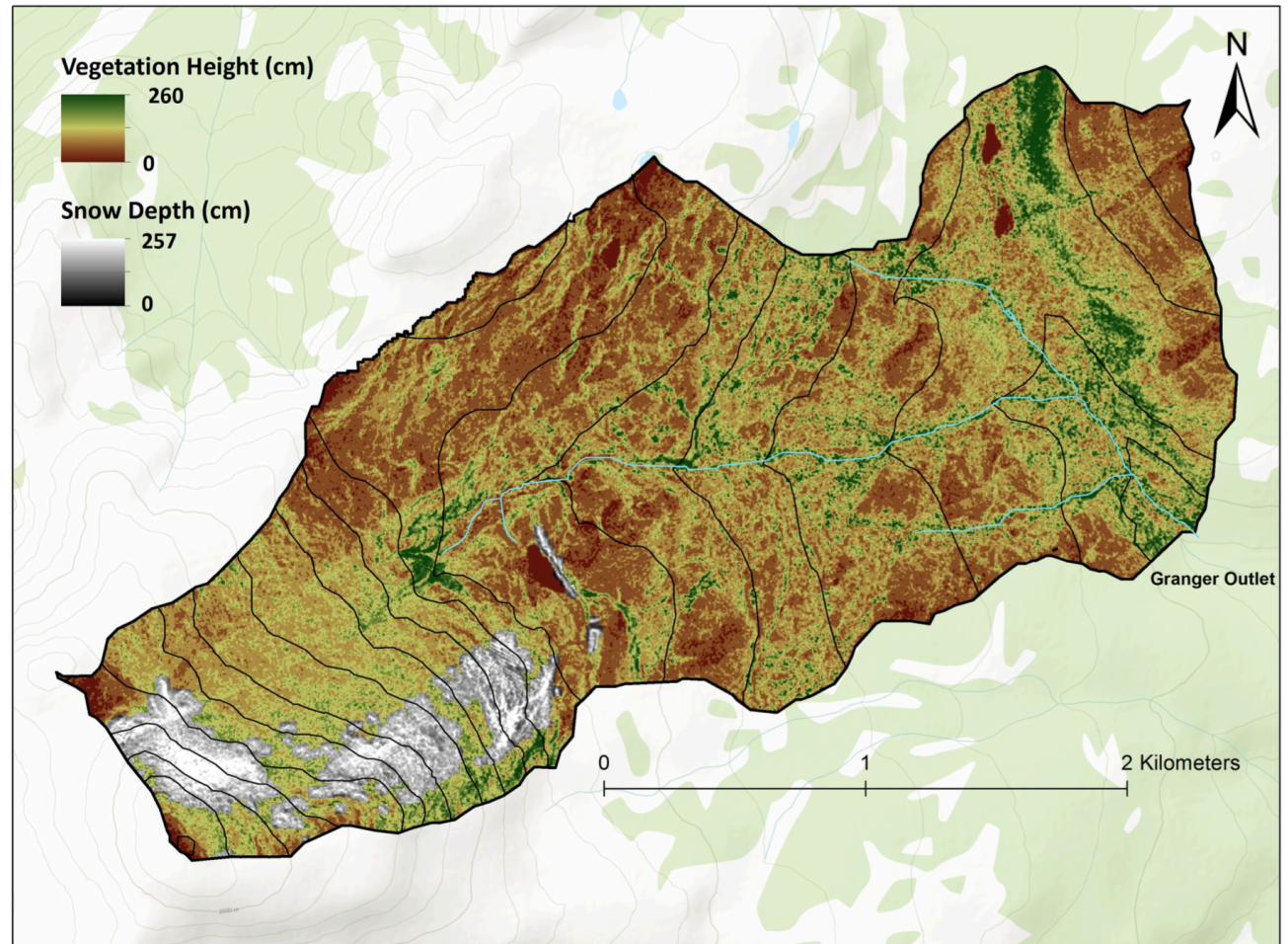


Ongoing research and monitoring *Related to ABoVe and POLAR activities*

➤ Historical Remote Sensing and vegetation characterization



Ongoing research and monitoring *Related to ABoVE and POLAR activities*



Ongoing research and monitoring *Related to ABoVE and POLAR activities*

Plateau Eddy Covariance Tower
Short Shrubs (birch, some willow)



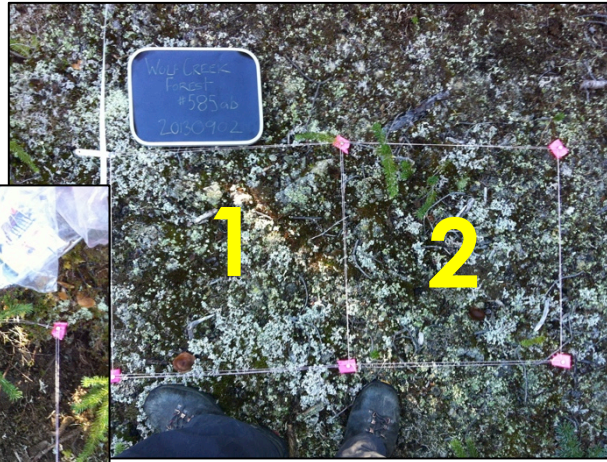
Ongoing research and monitoring *Related to ABoVE and POLAR activities*

Buckbrush Eddy Covariance Tower

Taller Willow and Birch shrubs



G-TREE



Alpine



Shrub



Forest



Shrub cut

Four treatments:

1. Control
2. Seeded
3. Scarified
4. Scarified & seeded

Planned research and monitoring

Related to ABoVE and POLAR activities

- *Continued monitoring of WECC observatories through 2018*
- *Planning already in place to continue their long-term sustainability. These are Canada's long-term legacy.*
- *Continued international engagement (Europe, USA, etc).*

Management related research & monitoring needs

Related to ABoVe and POLAR activities

- *CCRN researchers would like to continue to engage ABoVE and POLAR programs as fully as possible.*
- *CCRN has data management and data facility (WISKI) along with support staff*
- *Wolf Creek has a 20+ year legacy*

Opportunities for ABoVE/POLAR for engagement, education, outreach

- *With respect to Yukon, we have long-term collaboration with YG, and see an increased potential to liaise with Yukon College.*
- *Graham Strickert (UofS) has been developing 'socio-hydrological' linkages in Yukon.*

Recommendations for ABoVE/POLAR for engagement, education, outreach

- *Yukon appears to be less engaged than NT in terms of collaboration.*
- *Considerable historical and existing infrastructure and data exists that would be beneficial for ABoVE.*
- *Existing networks exist providing the opportunity for joint meetings, outreach and education initiatives.*