



Impacts and Challenges of Drought in the Northwest Territories

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May 2, 2018

Northwest Territories

Environment and
Natural Resources

Outline

1. Background on Northwest Territories (NWT)
2. 2014-15 Drought Impacts
(in forested portion of NWT)
 - Forest Fires
 - Marine Transportation
 - Hydroelectricity
3. 2014-15 Drought Costs



Where is the Northwest Territories?





Whitehorse

Dawson City

Yukon

B.C.

Alberta

Saskatchewan

Great Bear Lake

Great Slave Lake

Great Slave Lake

Fort McPherson

Fort Good Hope

Human Lake

Tuna

Deline

Wagay

Fort Simpson

Jean Marie River

Nahanni Butte

Fort Liard

Tipu Lake

Fort Providence

Iskate

Enterprise

White

Leif Erickson

Wetaskiwin

Somerville

McBride

White

Leif Erickson

Wetaskiwin

Delish

Carroll

Fort Providence

Iskate

Hay River

Fort Resolution

Fort Smith

Whitehorse

Fort McPherson

Teisonton

Conklin Lake

Deline

Wagay

Fort Simpson

Jean Marie River

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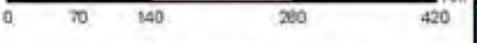
Fort Smith



Drought up upper portions of watershed in BC, Alberta and Saskatchewan impacts NWT

Treeline in NWT

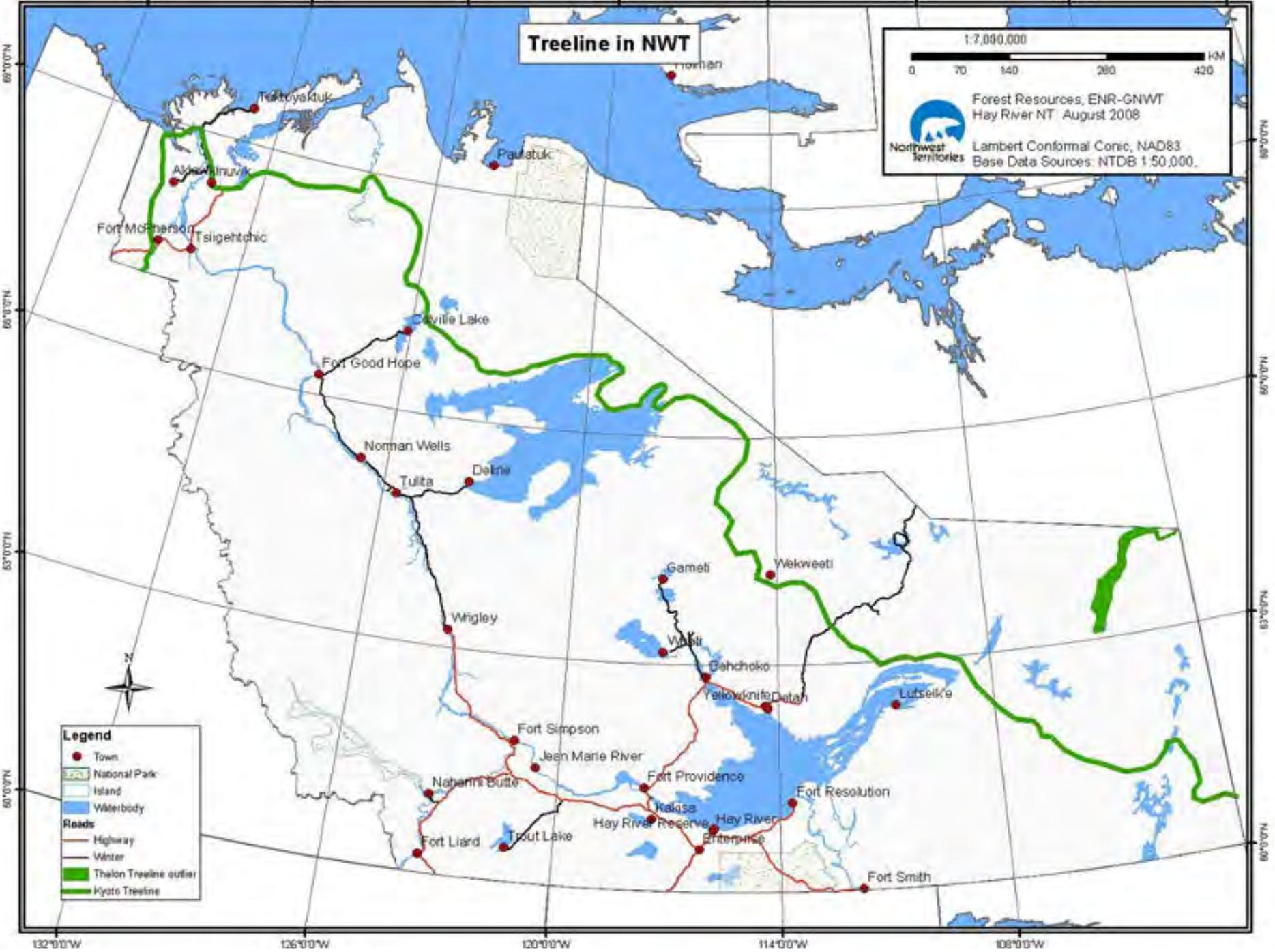
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Forest Resources, ENR-GNWT
Hay River NT, August 2008



Lambert Conformal Conic, NAD83
Base Data Sources: NTDB 1:50,000.



Legend

- Town
- National Park
- Island
- Waterbody
- Roads**
- Highway
- Winter
- Thelon Treeline outlier
- Kyoto Treeline

Northwest Territories (NWT)



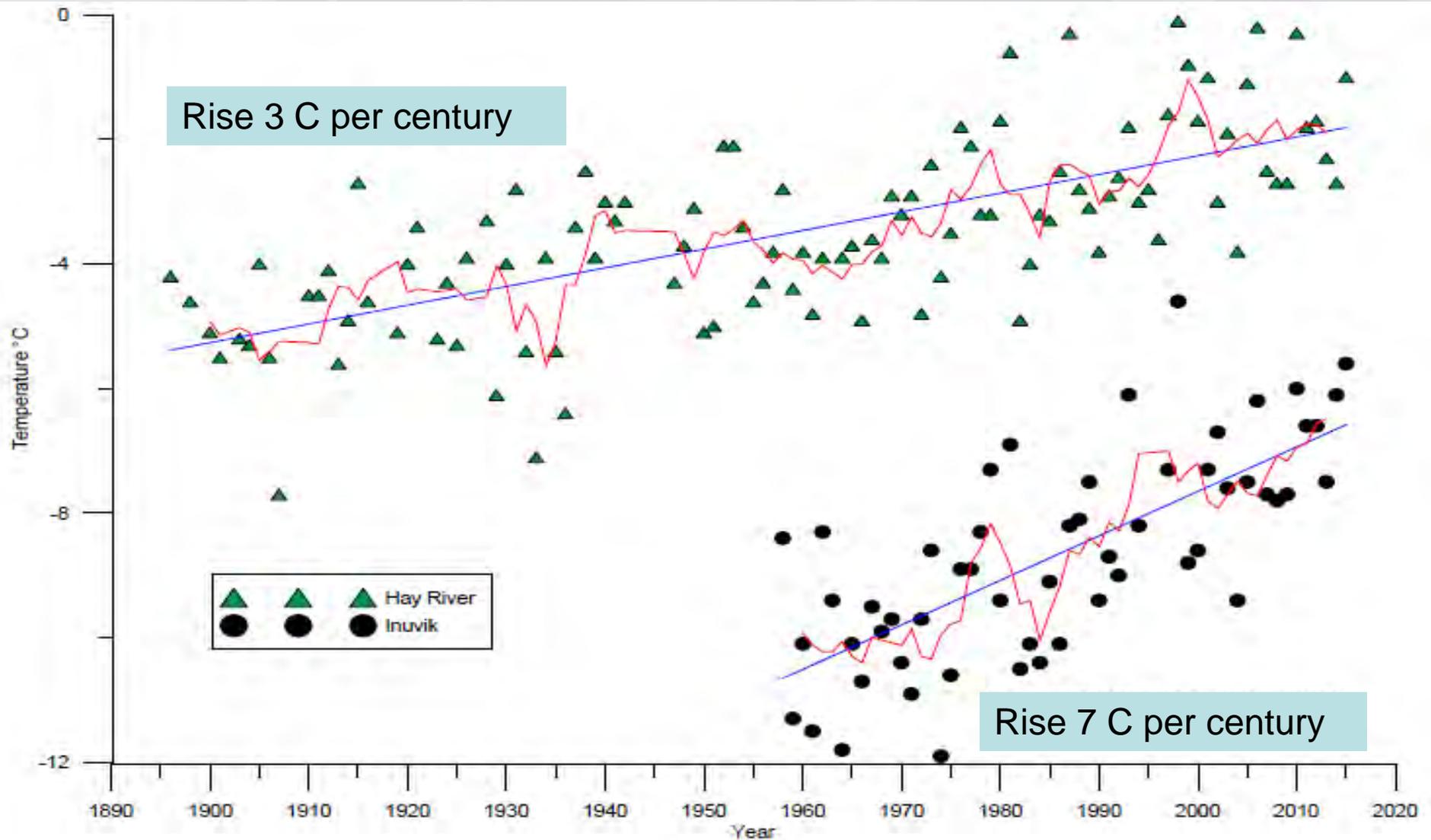
- Population: 44,597 - **small tax base**
- 11 Official Languages
- Land 1.2 million square km
- 33 communities, many small remote communities without all season roads - **air and water**
- In small communities, 50 % of protein derived from country foods - **little traditional agriculture**
- Major industries: diamond mining, oil & gas
- All season highways link southern NWT to Alberta and BC, and northern NWT to Yukon

Climate Change Impacts

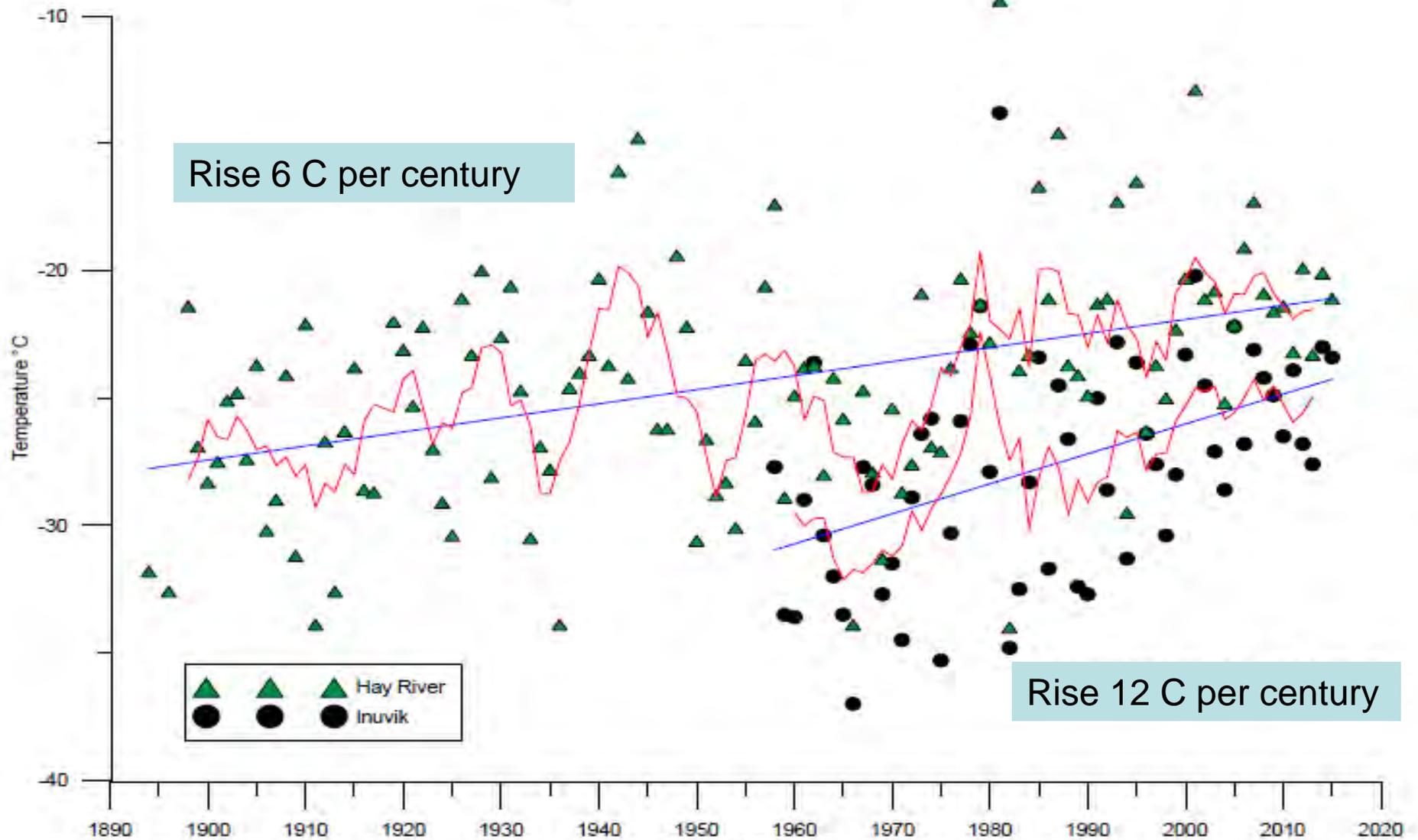
The NWT is warming much faster than other regions of the world



Hay River & Inuvik Mean Annual Temp



Hay River & Inuvik Mean Jan Temp





Drought Impacts: Forest Fires





Whati, Summer 2014



Forest Fires

Number of Fires

- Typically 245 fires a year (20 year average),
- 2014, 385 fires

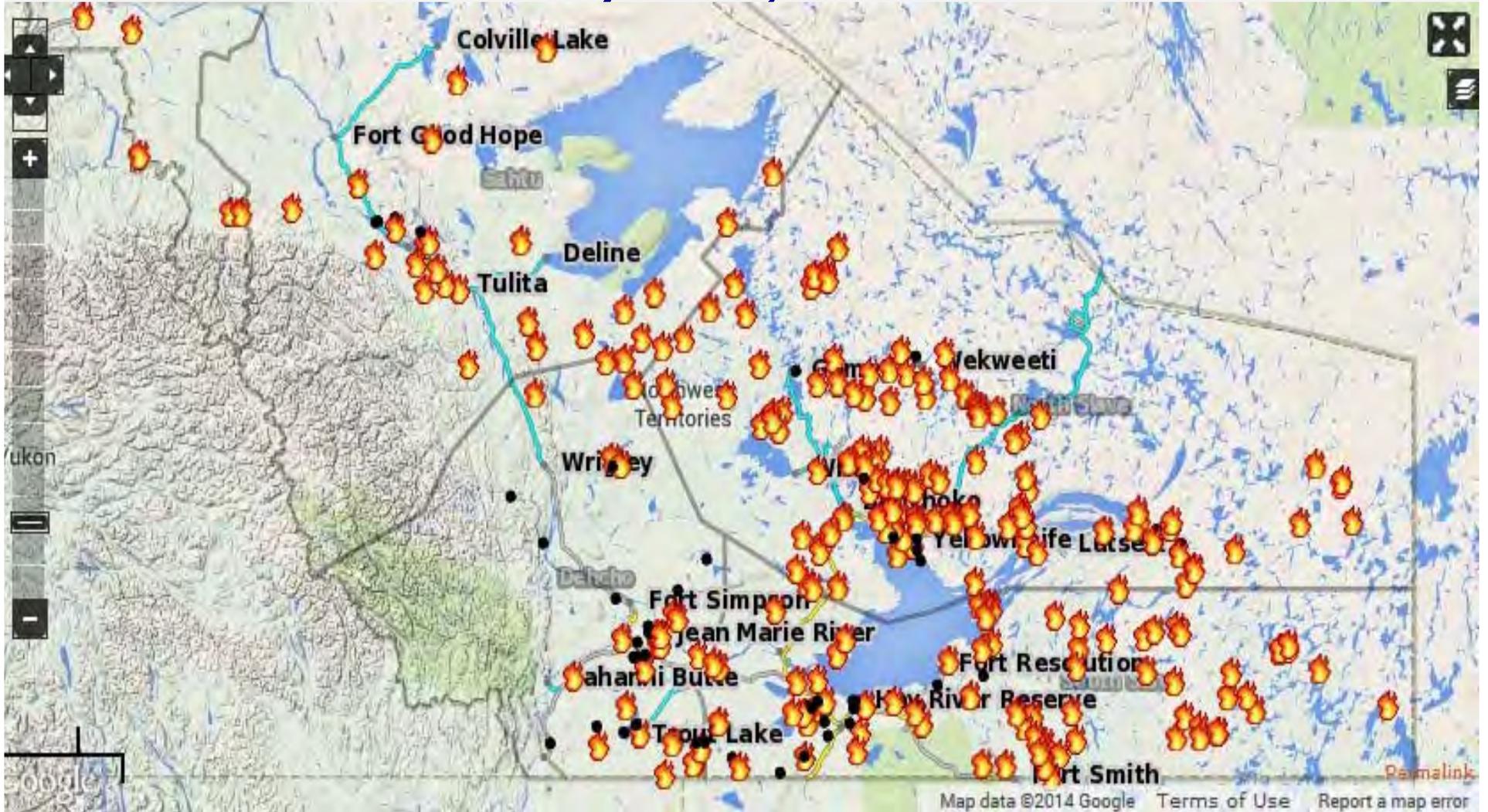
Area Burned

- Typically 570,000 hectares a year (20 year average
- 2014, 3.4 million hectares burned (more than any previous year)
- For reference 2.5 million ha burn in Canada annually

- 11 communities put at risk, many evacuated

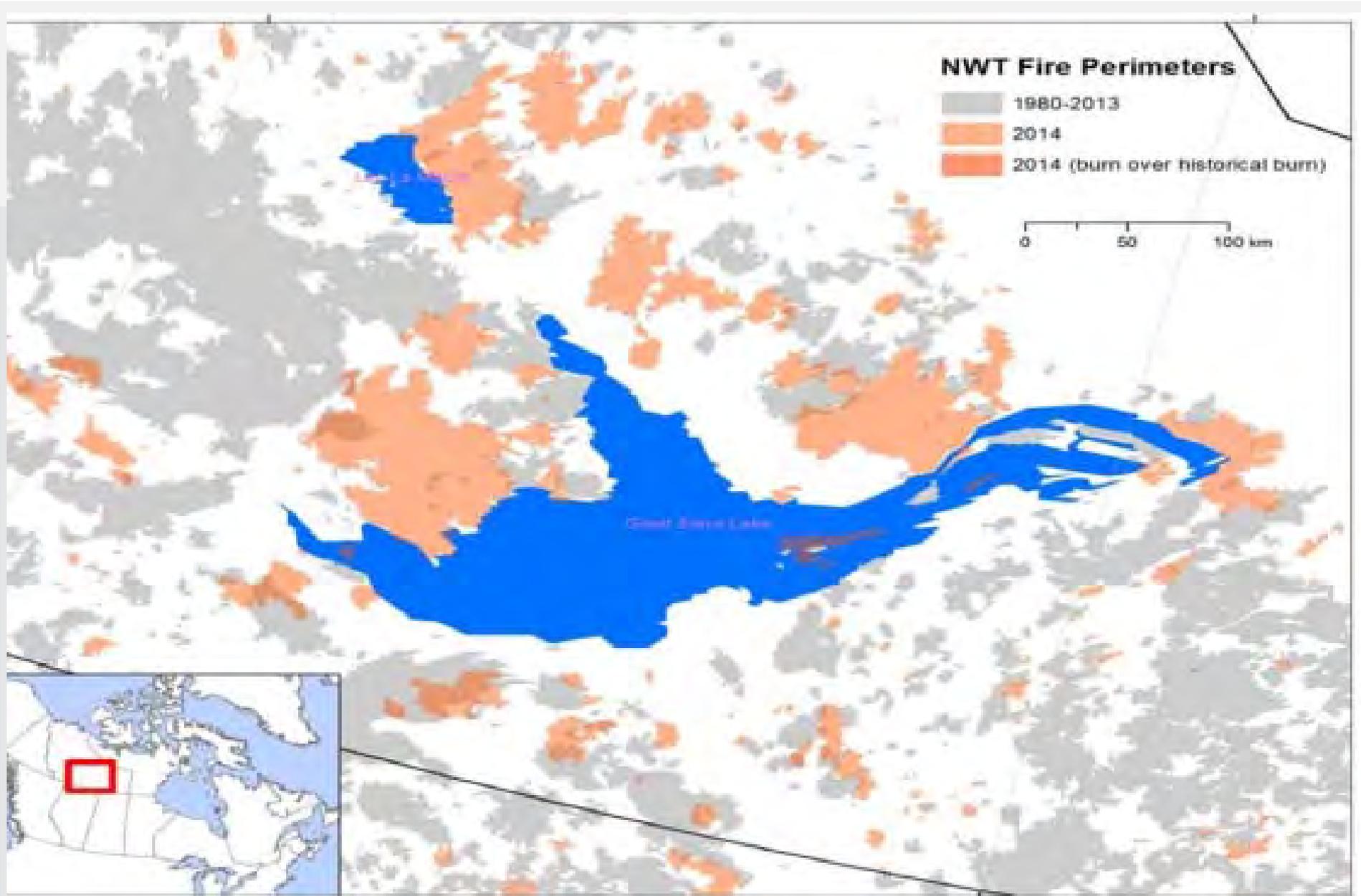


July 30, 2014



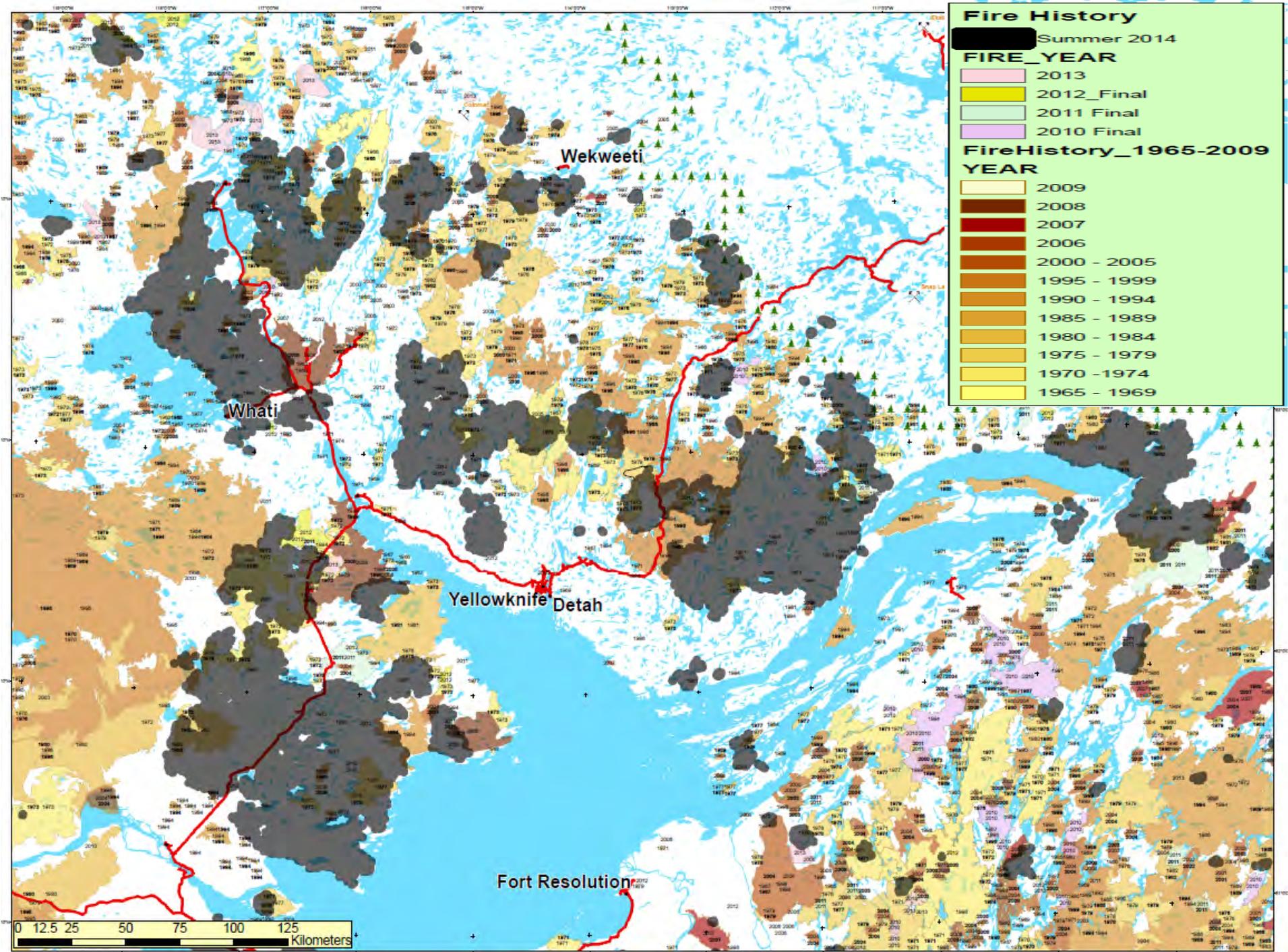
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Map NRCan Northern Forestry Centre, Dr. Marc-André Parisien

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Drought Code

The Canadian Forest Fire Weather Index (FWI) System

Level of moisture in deep forest fuels

Function of temperature and precipitation

In July 2014, DC reached over 900 in North and South Slave



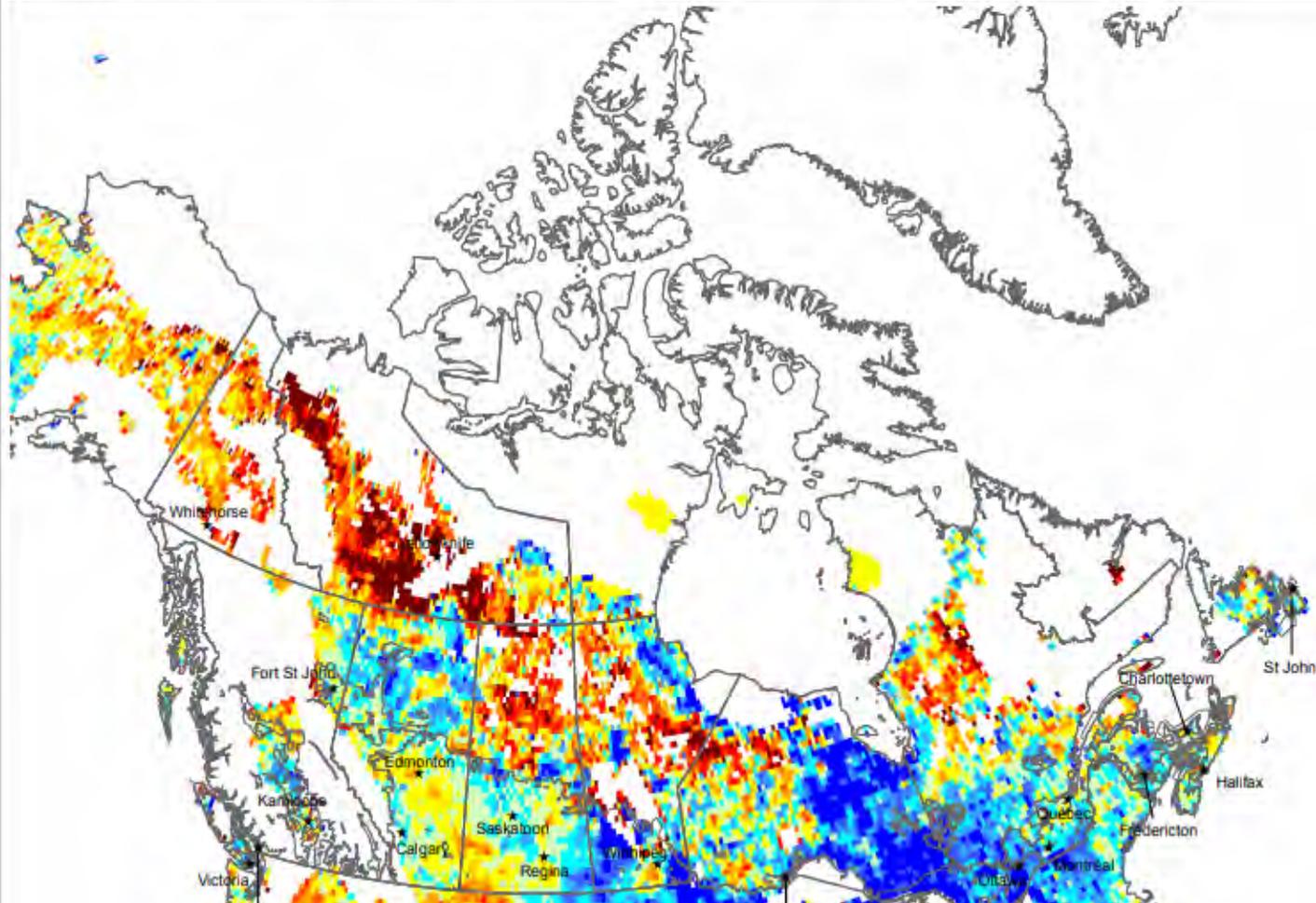


Agriculture and
Agri-Food Canada

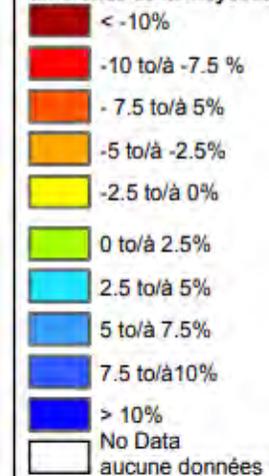
Agriculture et
Agroalimentaire Canada

Difference from Long Term Average, Percent Saturated Surface Soil Moisture from SMOS Satellite
Pourcentage de saturation en eau de la surface du sol obtenu des données satellite SMOS,
la différence entre les conditions actuelles et la moyenne

Week 20 and 21 (May 12 - May 25), 2014 / Semaine 20 et 21 (12 mai au 25 mai), 2014



Soil Moisture Difference from Average
Humidité du sol
différence de la moyenne historique



This map represents the volumetric soil moisture (percent saturated soil) difference from the five year satellite data record for the surface layer (<5 cm), averaged for the two week period. The map is produced from passive microwave satellite data collected by the Soil Moisture and Ocean Salinity (SMOS) satellite and converted to soil moisture using version 6.20 of the SMOS soil moisture processor and gridded to a resolution of 0.25 degrees. This product is still in the development phase and should be used as such.

Cette carte présente la différence entre la moyenne

Extremely useful product in the North where there are few high quality climate stations

Drought Impacts

Fire Smoke



Forest Fire Smoke



**Yellowknife, August 16,
2014**



Smoke

- 6 weeks of smoke
- Hospital operations cancelled
- Pharmacists – 3 x use of puffers
- Raining ash
- Could not see shore when on lake,
- Indigenous fishers had to use GPS to find way back for first time



Particulate and Air quality

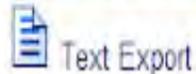


NWT Air Quality Monitoring Network

Northwest Territories Environment and Natural Resources

- Maps
- Current Air Quality**
- GNWT Stations
- Giant Mine Fenceline Stations
- Giant Mine Community Stations
- Giant Mine Roaster Perimeter Stations
- Giant Mine Filter Samples
- Giant Mine Met

Current Air Quality - GNWT Stations



Station	Date And Time	SO ₂	H ₂ S	NO _x	NO ₂	NO	O ₃	CO	PM _{2.5}	PM ₁₀
		ppb	ppb	ppb	ppb	ppb	ppb	ppm	ug/m3	ug/m3
Fort Smith	6/21/2014 2:00 AM	2.2		5.5	4.9	0.7	44.2		38.0	51.0
Inuvik	6/21/2014 2:00 AM			1.2	1.3	0.0	16.9	0.140	3.0	9.0
Norman Wells	6/21/2014 2:00 AM	0.8	1.2	0.0	0.0	0.0	30.9		6.0	26.0
Yellowknife	6/21/2014 2:00 AM	1.17		2.6	2.2	0.4	22.9	0.815	116.0	172.0

Hourly PM2.5 up to 700



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Marine Transportation

River and Lake





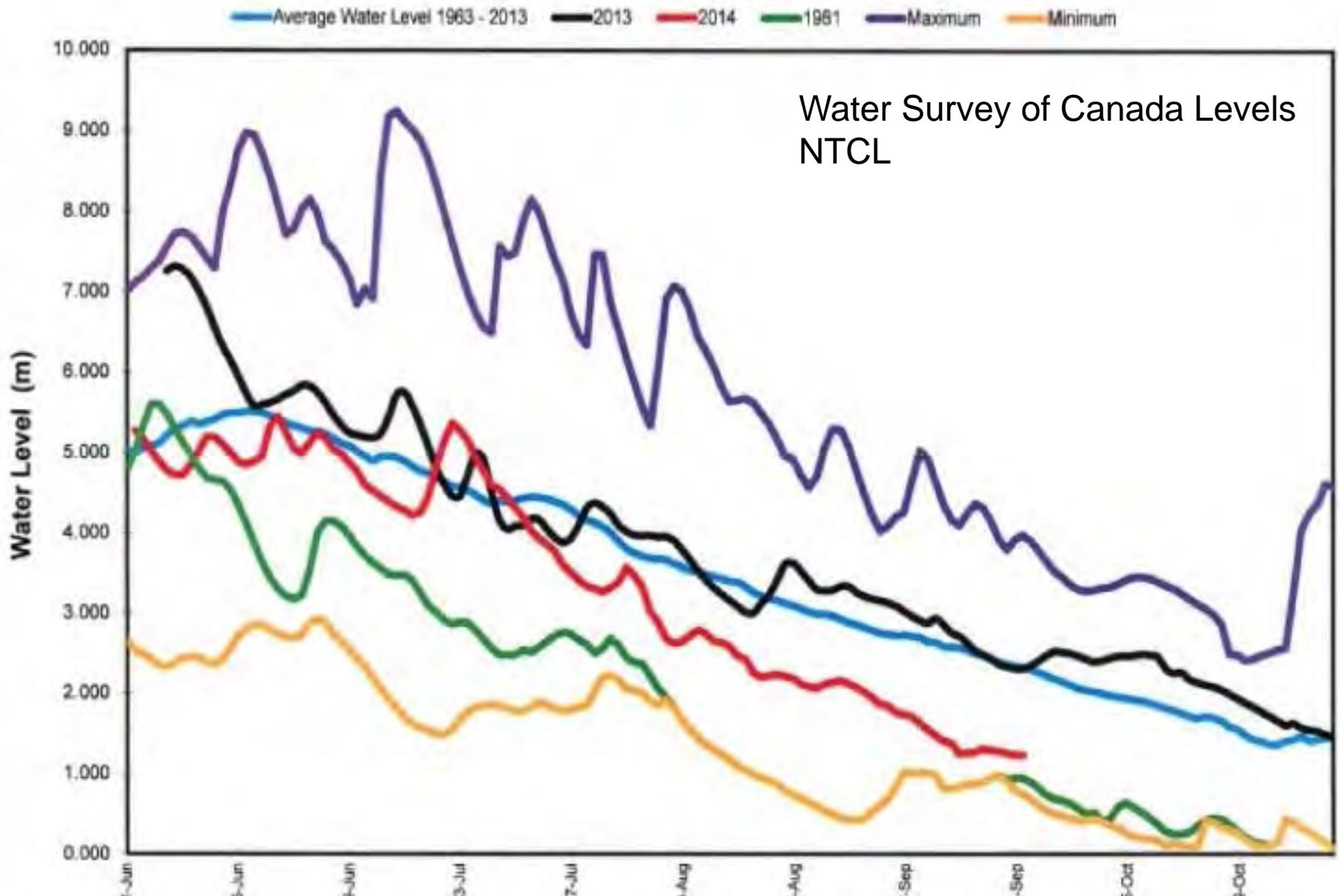


Low water

- 10 communities resupplied in NWT by barge
- 2014 barge cancellations due to low water (season ended one month early)
- Adaption - Spreading loads over more barges (cost, less cargo can be moved)
- In 2014, Barges to Inuvik Fort Good Hope and Tuktoyaktuk were cancelled



Mackenzie River @ Fort Good Hope

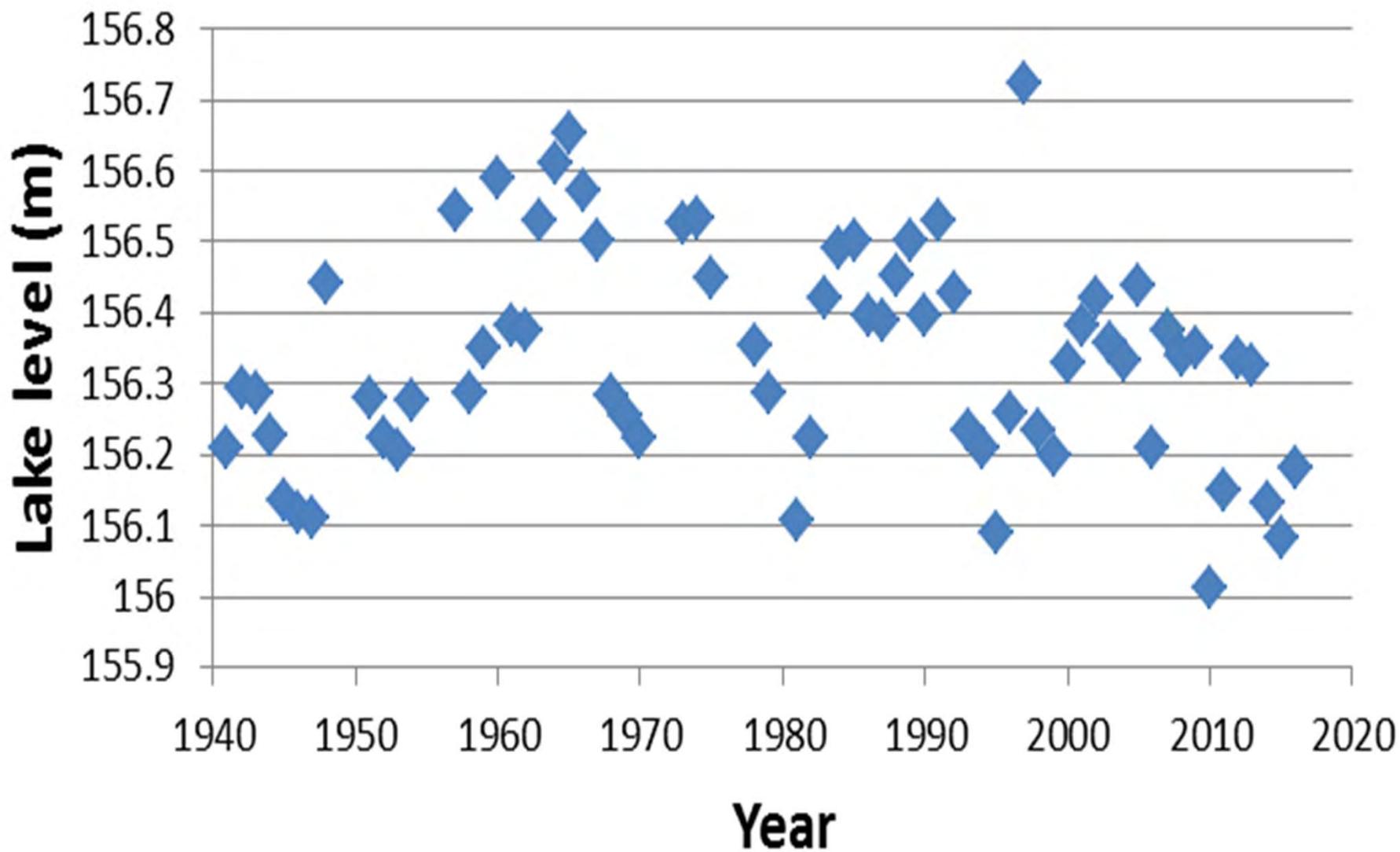


2014 Water Levels approached 1981 levels



- **Volvo Stern Drive – typically 4 are destroyed each year in the East Arm of Great Slave Lake due to collisions with the bottom, \$5000**
- **2014-15 Over 60 were destroyed due to low water**

Great Slave Lake Minimum Levels



Impact of warming temperature on lake levels

Longer ice
Free season → more
evaporation → lower
water levels



Hydroelectricity



Hydro

- NWT is not on North American Power Grid
- 90 % of electricity is hydro in capital, Yellowknife
- How do you adapt to low water levels?

Diesel Generation



Snare Reservoir, June 2015



Colin Steed, NTPC

Snare Rapids Head Gate and Intake, June 2015



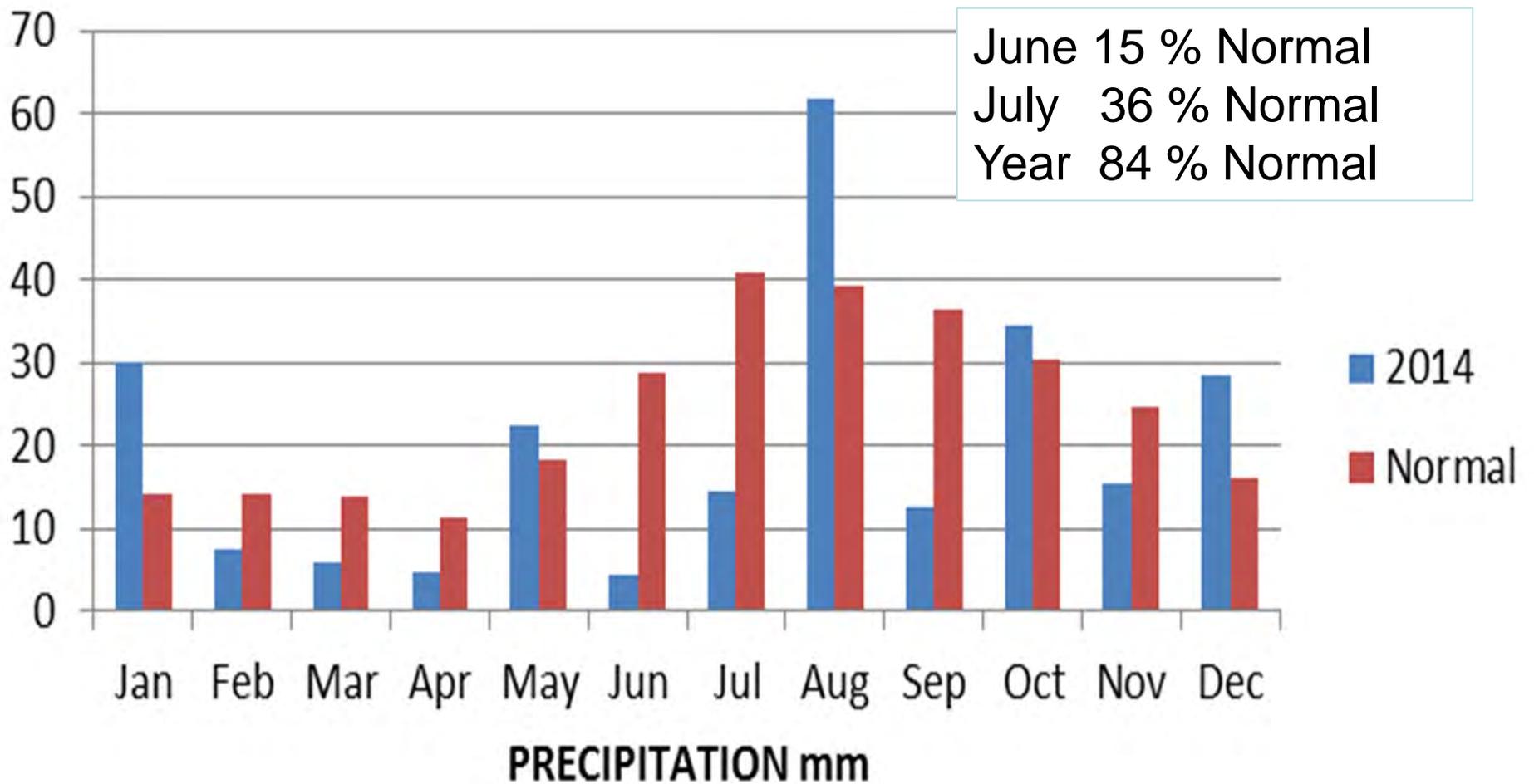
Colin Steed, NTPC

Precipitation

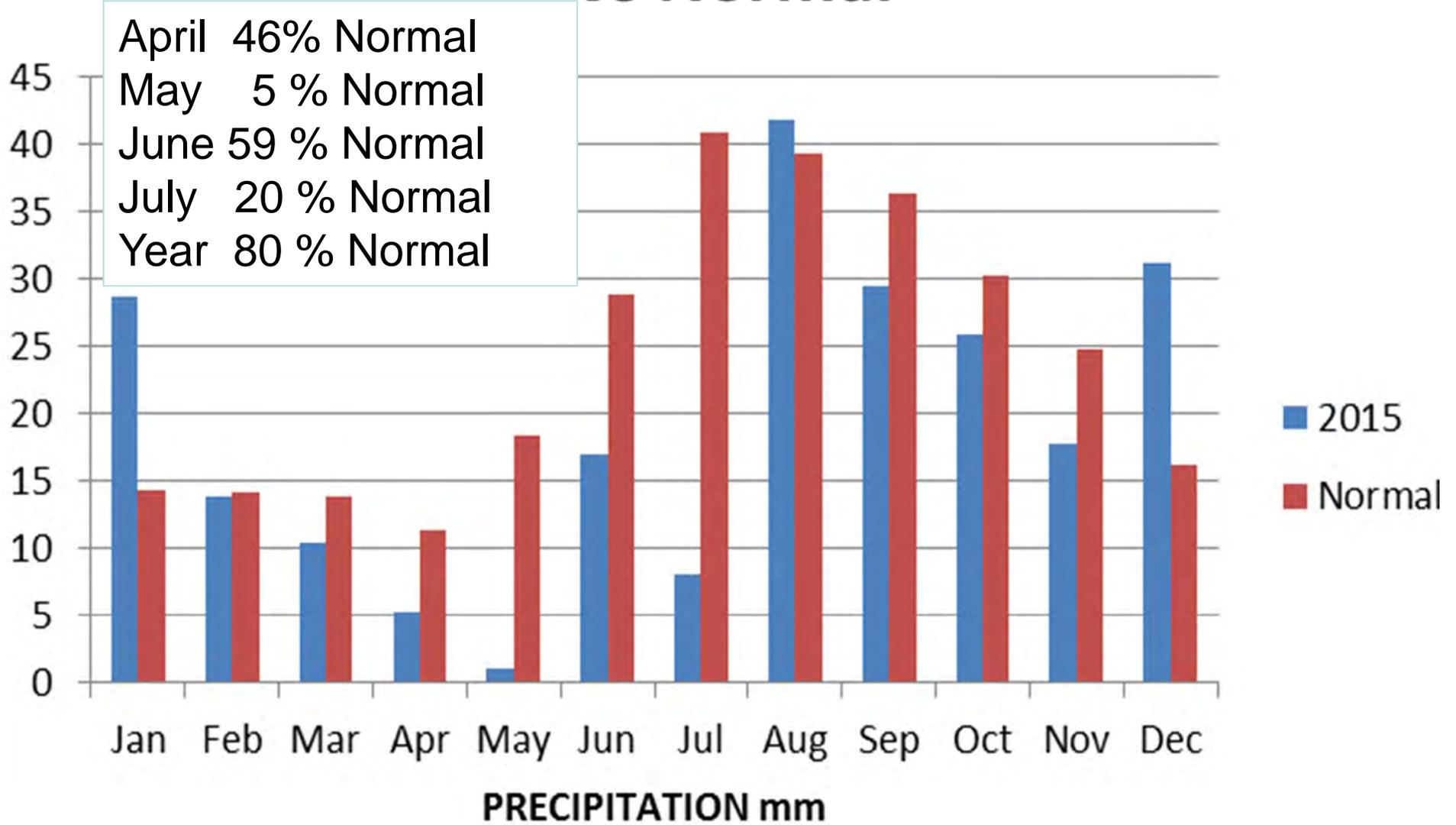
- 2013 precipitation at Yellowknife (year before) was about 60% of normal
- Bluefish SWE in 2014 was 69 mm relative to 82 mm average, 15% below normal



2014 Yellowknife Precipitation vs Normal



2015 Yellowknife Precipitation vs Normal



Other Impacts

Death of pine trees, loss of whooping crane habitat, and turbidity



Estimate of Costs of 2014 – 2015 Drought

- \$56 million dollars fire fighting costs in 2014,
- \$33 million dollars fire fighting costs in 2015,
(normal about \$8 million)
- \$15 million was required for diesel electricity generation
- \$5 million in evacuations in 2014 (estimate)

About 76 million dollars (ignoring 2015 fire costs)



Epilogue

- Lack of climate monitoring hampered drought decision making
- As a result of the drought, there are now precipitation measurements in the watersheds that supply hydroelectricity to Yellowknife
- Dendrochronology studies are underway to place the 2014-15 drought in context
- Electric resiliency study



Thank you

Questions?

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