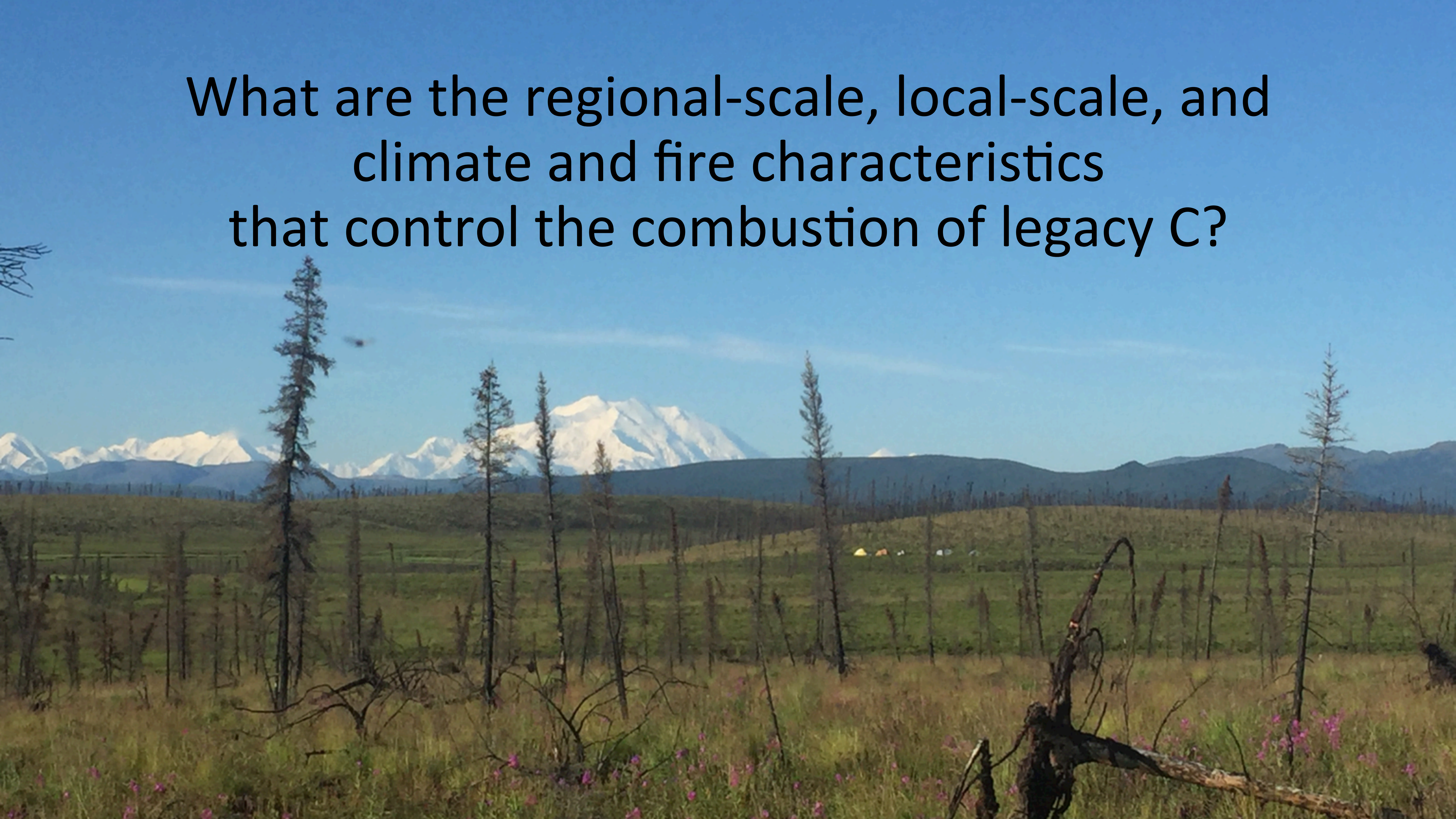
Increasing fire severity and the loss of legacy carbon


What are the regional-scale, local-scale, and
climate and fire characteristics
that control the combustion of legacy C?

What are the consequences of legacy C loss?

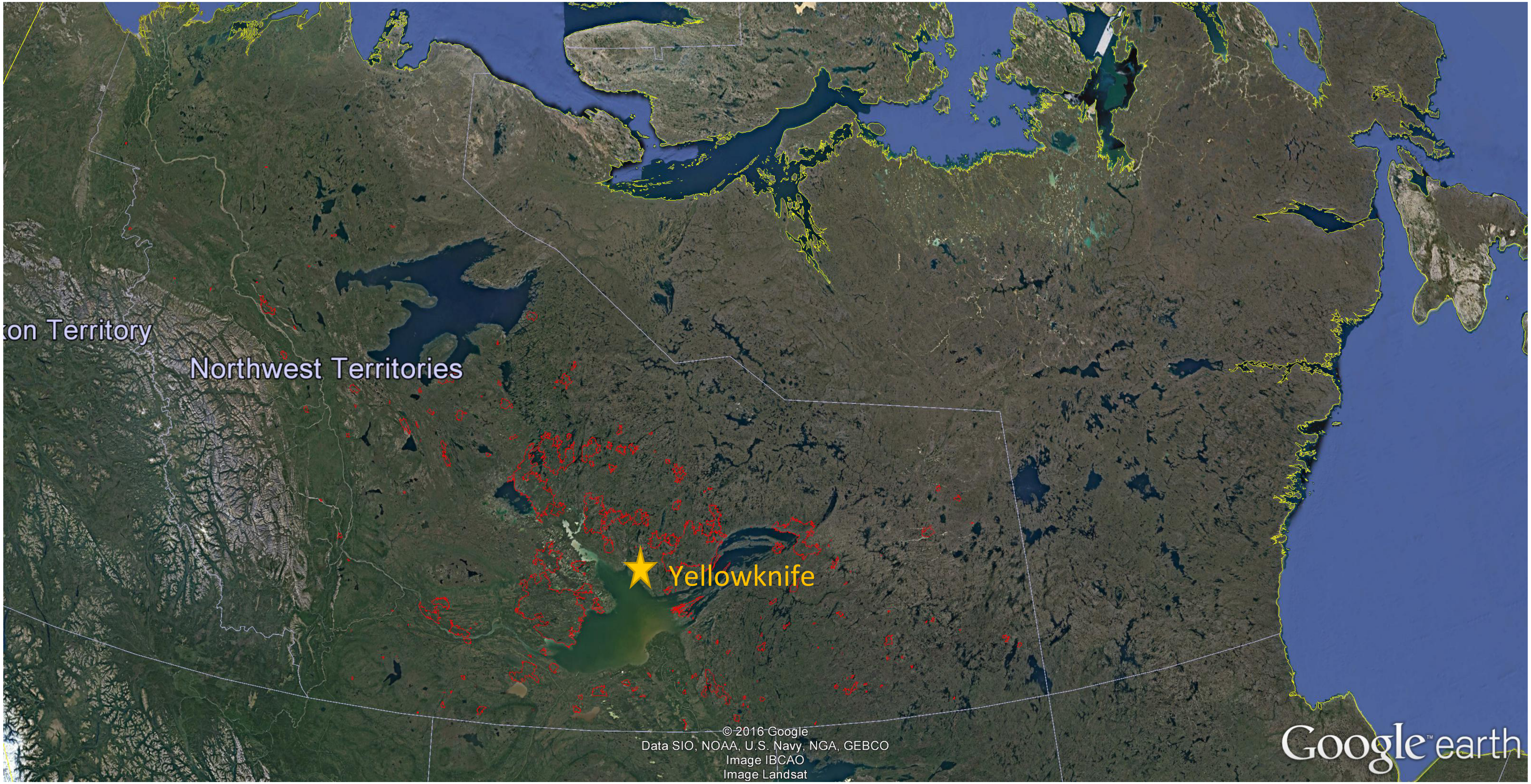
Northwest Territories

2016 Field Season – 36 unburned sites

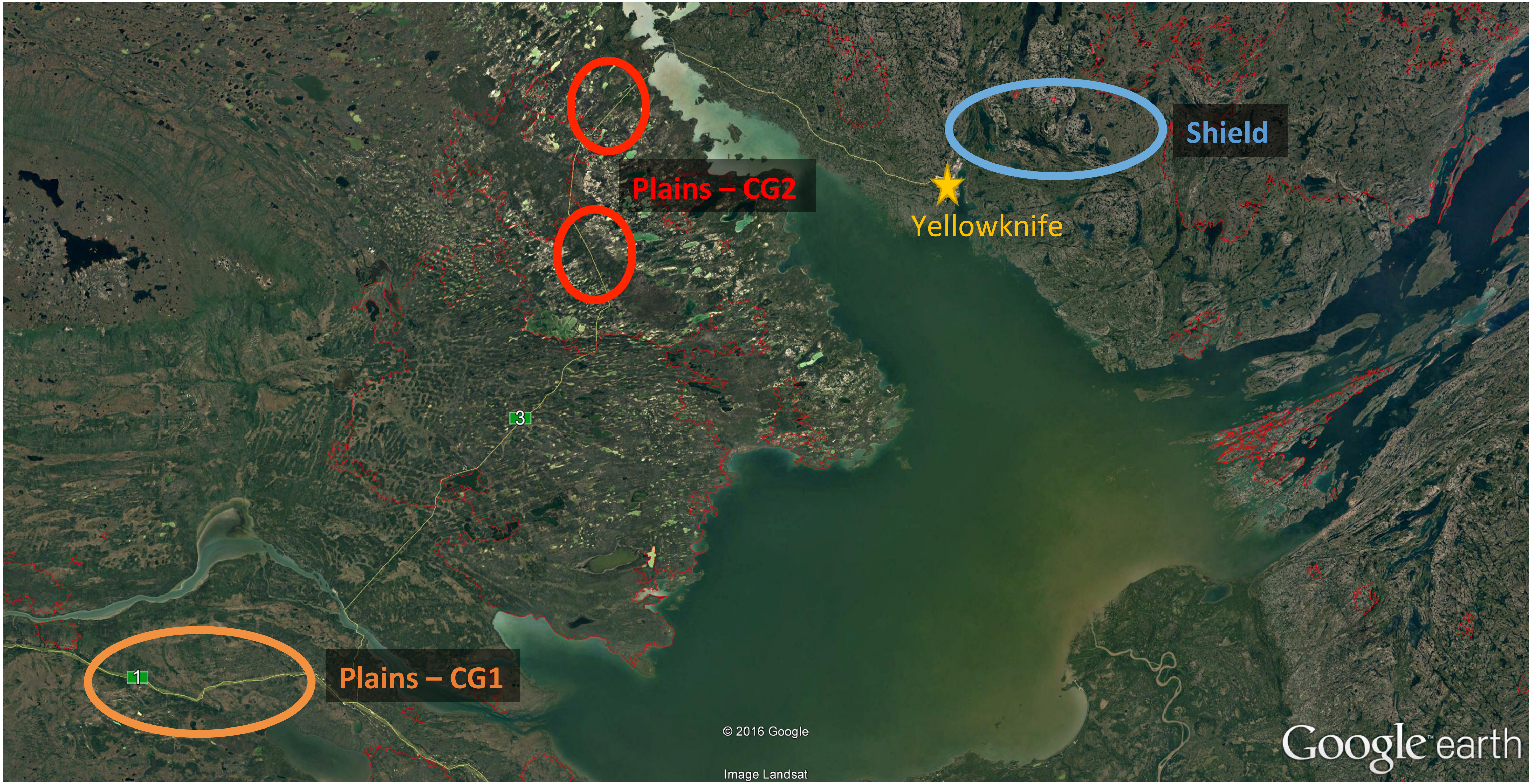
- 18 sites in the Plains
  - spatially separated into two control groups (CG)
  - representative of conifer density (sparse, low, medium, mixed-low)

- 18 sites in the Shield
  - 6 sites per conifer density class (sparse, low, medium)

Northwest Territories



Northwest Territories



General Site Data

- Two 30 m parallel transects
- Location (lat, long)
- Elevation (m.a.s.l)
- Slope
- Aspect
- Moisture classification
  (sub-hygric to xeric)

Stand Data

Age

Five cores taken from trees of each dominant species

Density

Species and Diameter at Breast Height (DBH) recorded for each individual with 30 m x 2 m belt transect

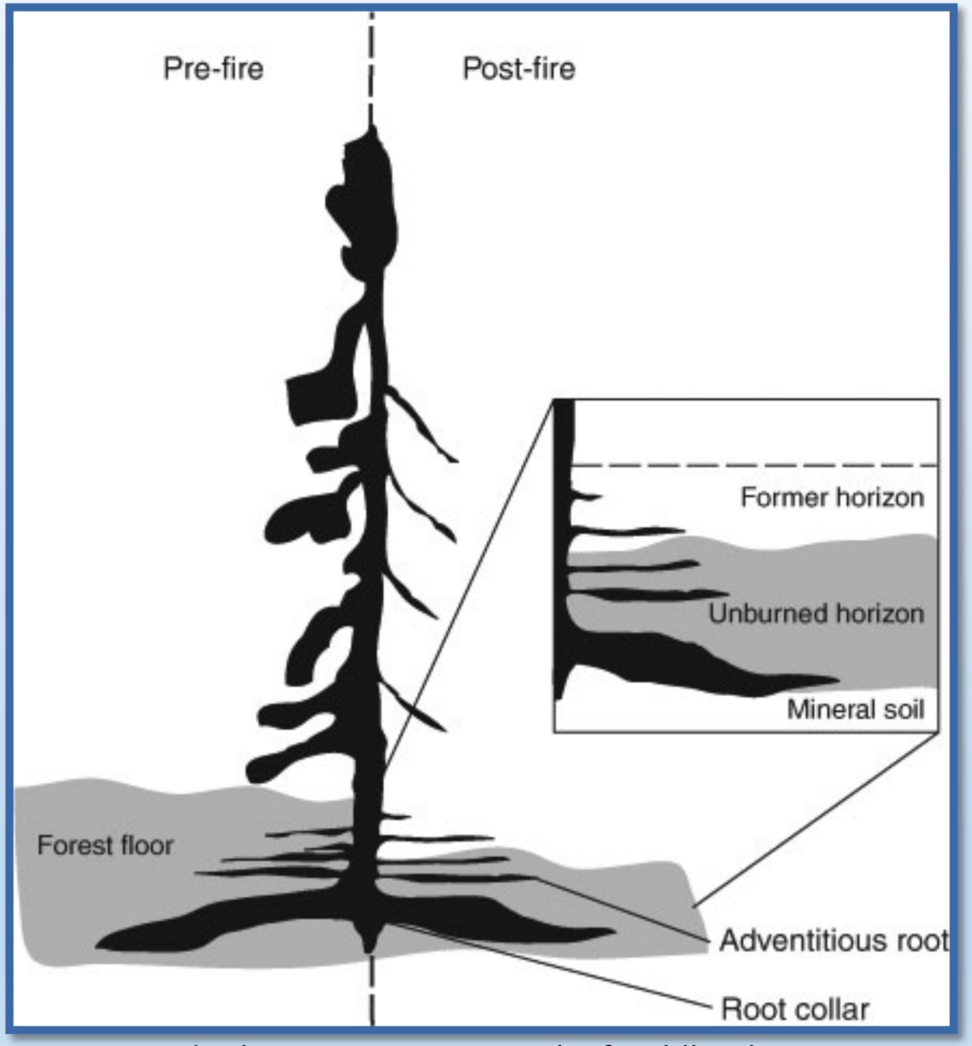
Foliage Samples

Foliage collected from five individual trees of each dominant species per site for C:N

Soil Sampling

5 organic soil profiles per site for C:N and bulk density
3 mineral soil samples for texture

Calibration of Adventitious Root Measurements



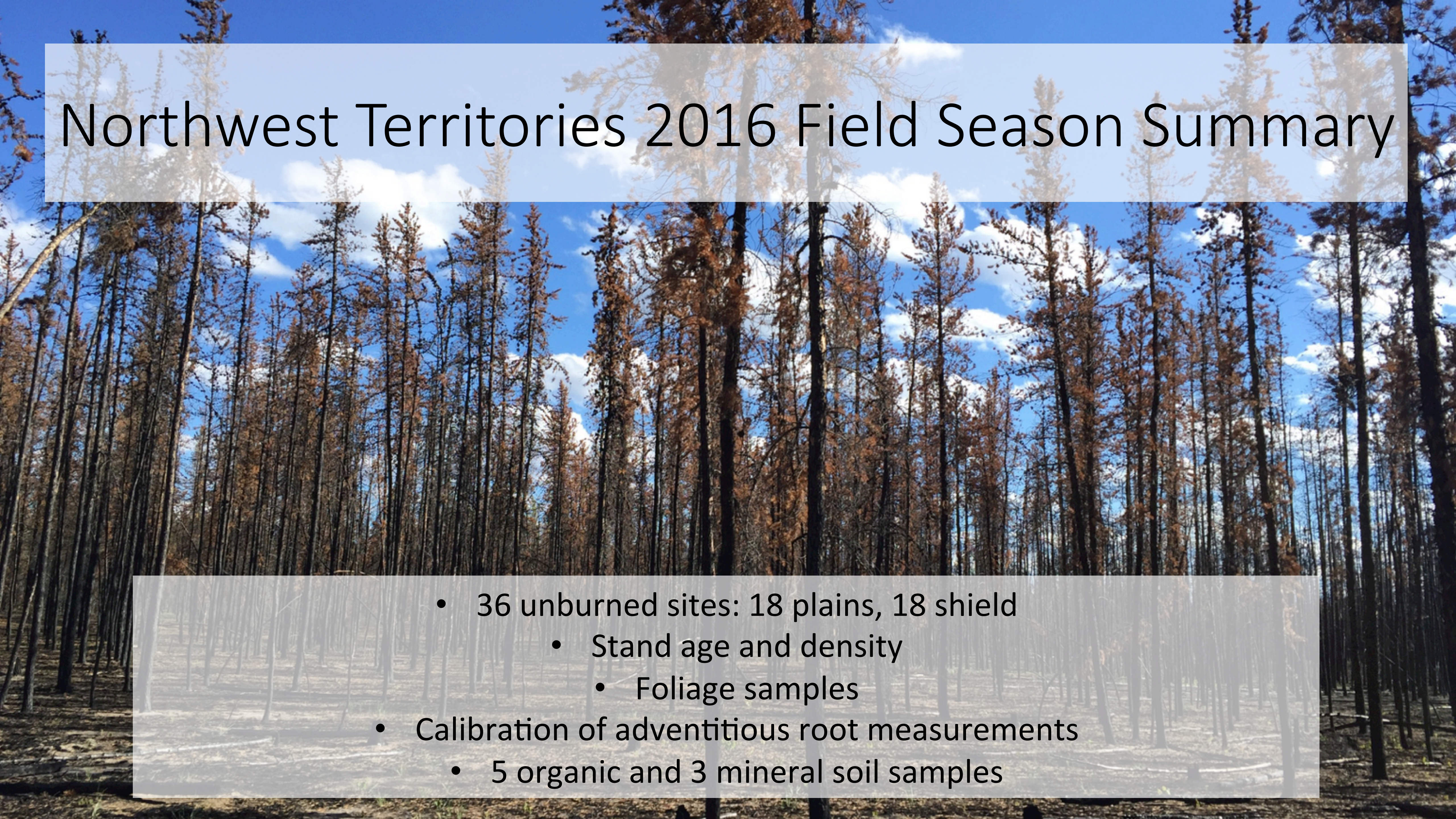
Brown and Johnstone 2011 Journal of Wildland Fire

Pre-fire SOL = Adventitious Root Height + Residual SOL

Calibration of Adventitious Root Measurements

Depth of adventitious roots below the moss surface – 10 trees/site

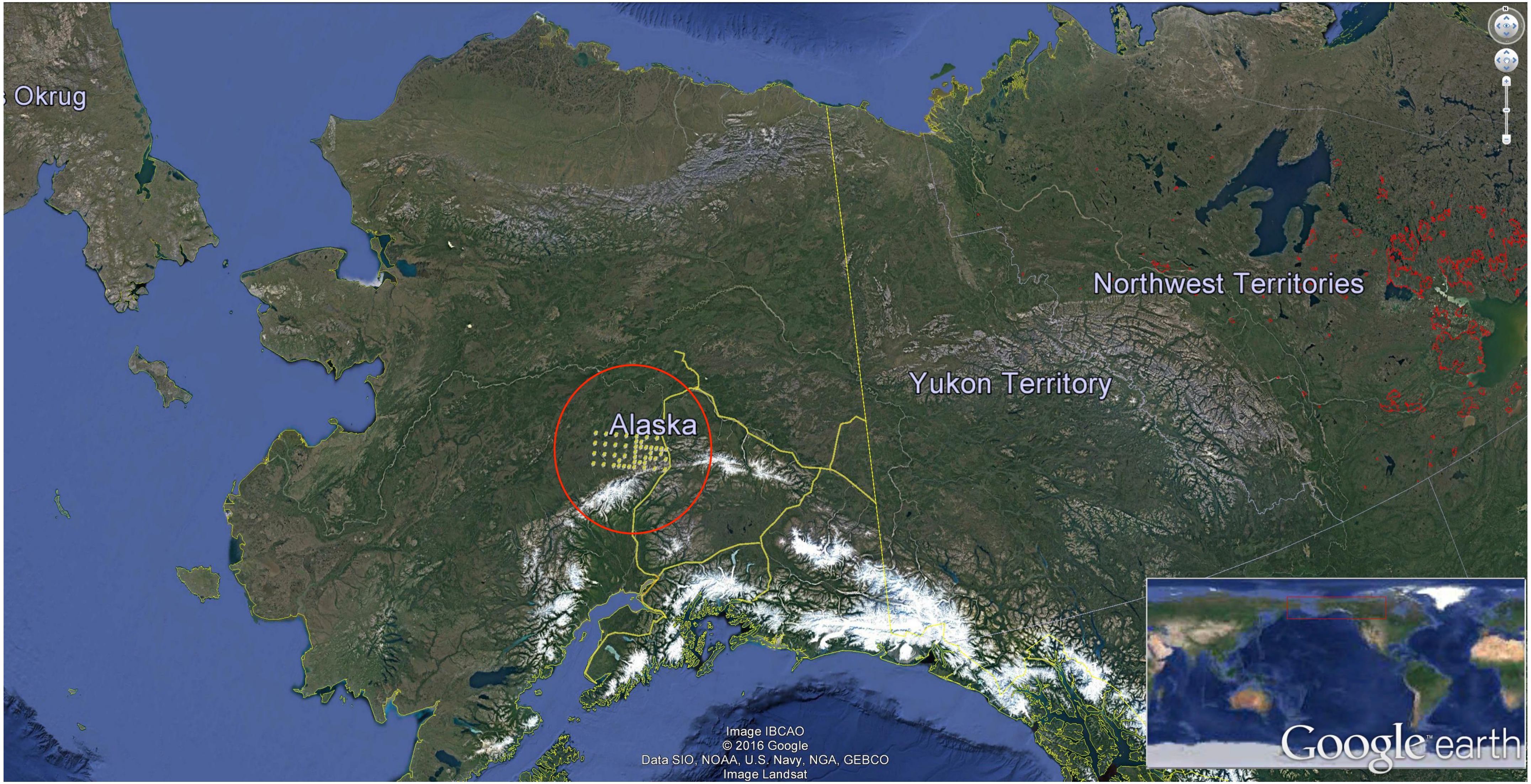
Northwest Territories 2016 Field Season Summary



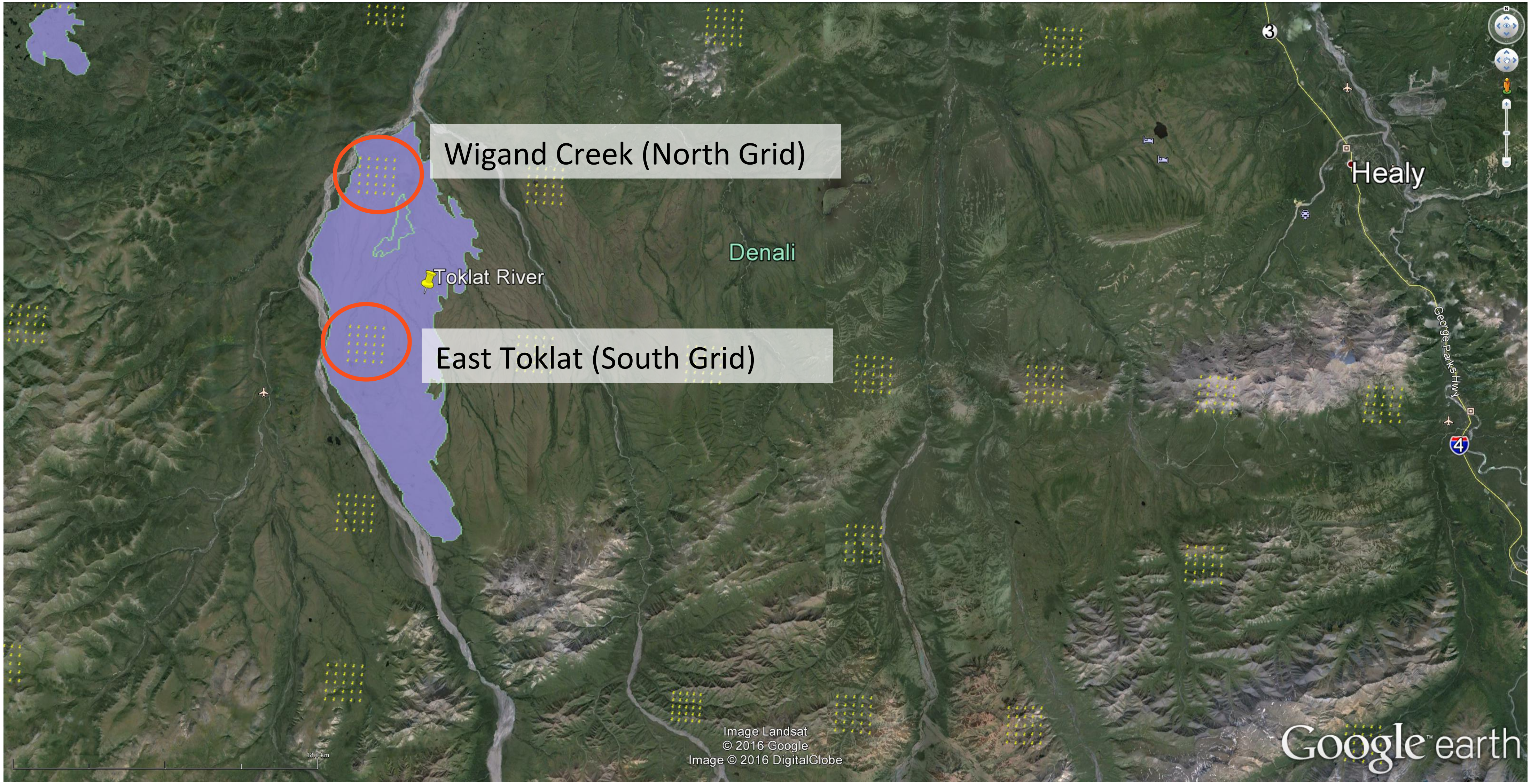
- 36 unburned sites: 18 plains, 18 shield
- Stand age and density
- Foliage samples
- Calibration of adventitious root measurements
- 5 organic and 3 mineral soil samples

Denali National Park

2013 Toklat Fire



2013 Toklat Fire



2016 Field Season – 48 burned sites

25 sites in East Toklat (South Grid)

23 sites in Wigand Creek (North Grid)

General Site Data

- 16 m diameter circular plot
- Location (lat, long)
- Elevation (m.a.s.l)
- Slope
- Aspect
- Moisture classification
  (sub-hygric to xeric)

Stand Data

Density and Canopy Consumption

Species, Diameter at Breast Height (DBH), and canopy consumption index (0-3) recorded for each individual tree

Stand Data

Age at time of burn

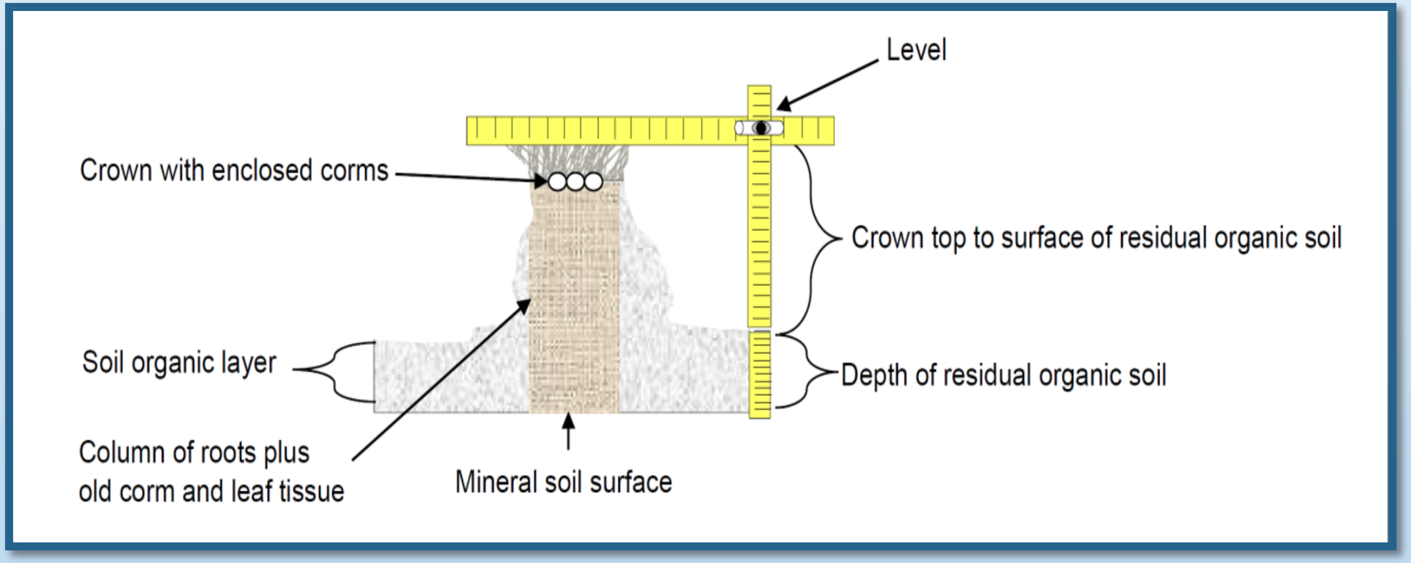
Basal cores taken from four black spruce trees per plot (absent from East Toklat Grid)

Soil Sampling

4 organic soil profiles per site for C:N and bulk density
1 mineral soil samples for texture and pH

Depth of Burn – Tussock Tundra Method

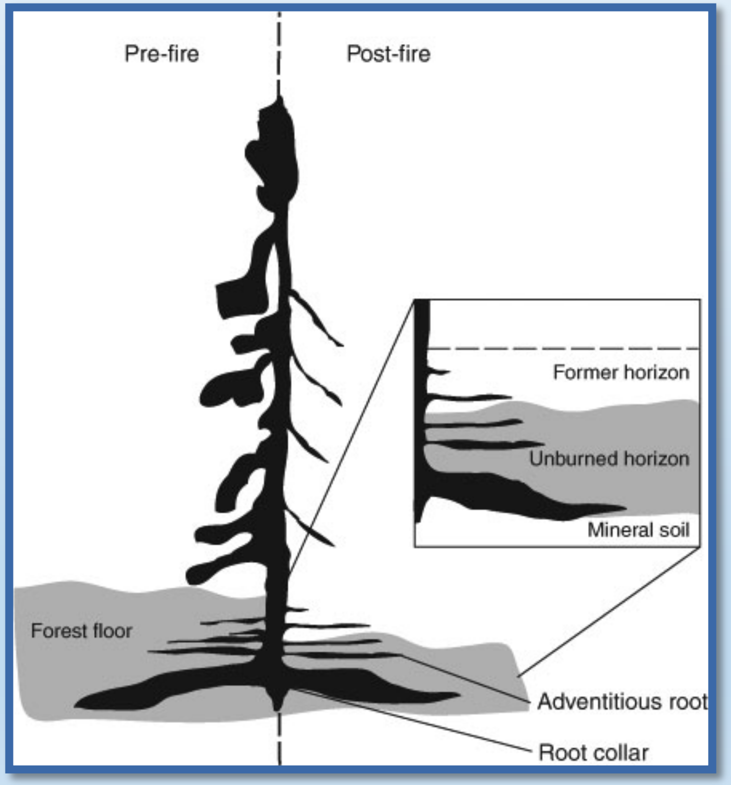
Measured crown top to surface of residual organic soil on up to 20 tussocks/site (5 per SOL sample)



Mack et al 2011 - Nature

Depth of Burn – Adventitious Roots

Measured adventitious root height above residual organic soil on up to 20 trees/site (5 per SOL sample)



Brown and Johnstone 2011 Journal of Wildland Fire

Vegetation Sampling

Quantify vegetation cover using point-intercept:

- every 50 cm along N → S transect
- every 50 cm from 0-6 m and 10-16 m along E → W transect

Vegetation Sampling

- Percent cover of functional groups estimated in four 4 m^2 quadrats
- Vascular species identified in four 4 m^2 quadrats
- Non-vascular species identified in four 1 m^2 quadrats

Seeding Experiment

- 12 sites: 3 burned sites within each grid and 3 unburned control sites approx. 5km east of each grid

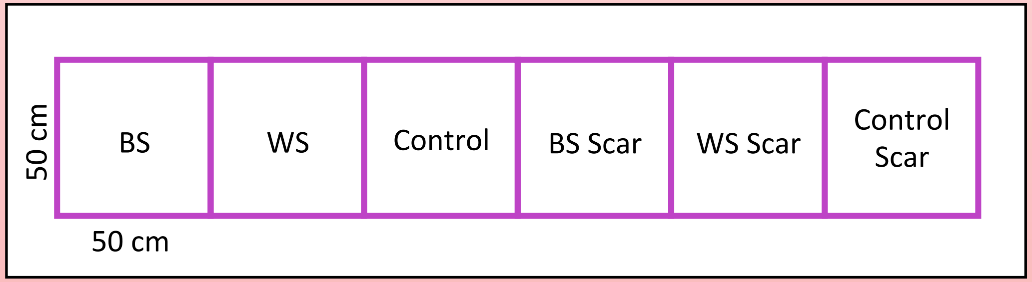
- Early to mid-July: 10 seed traps/ site to assess natural seed rain

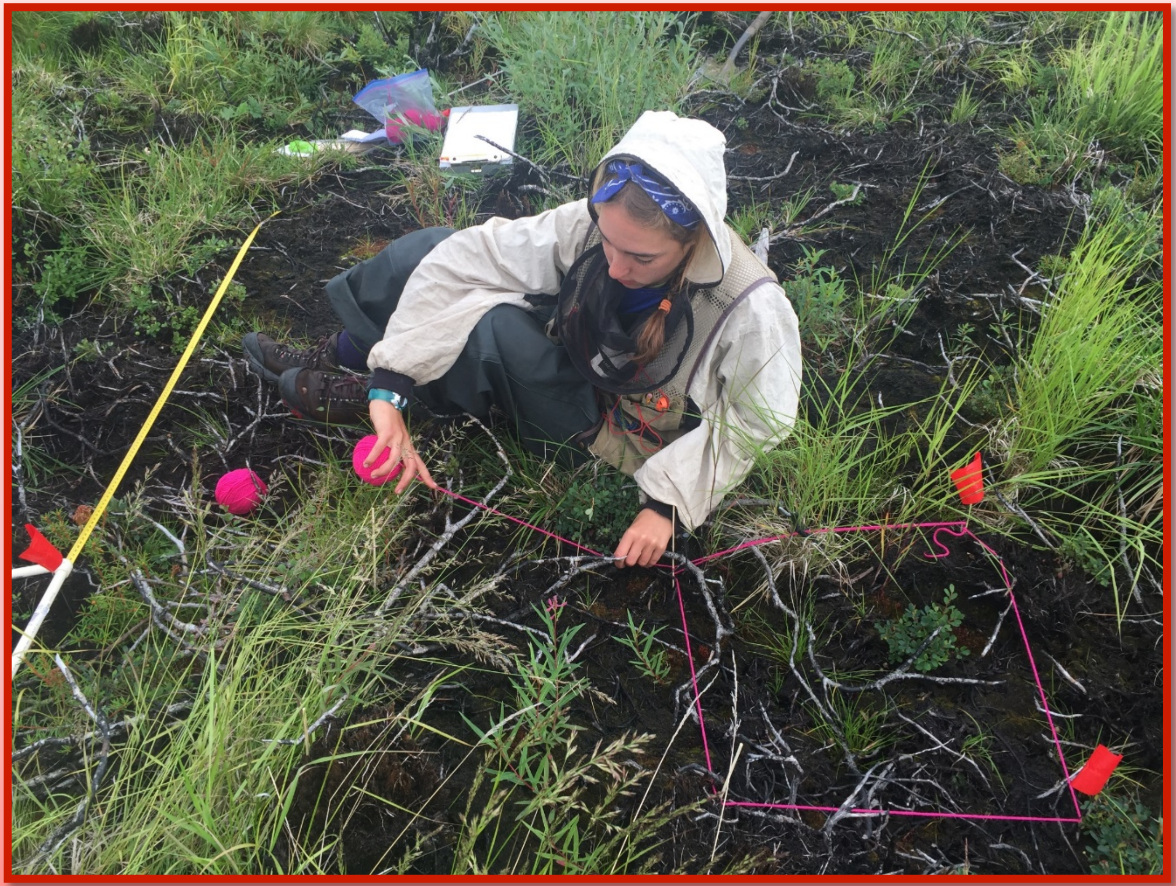
Seeding Experiment

Early June and July: Cones collected within 5km of sites
Germination trials conducted at UAF

Seeding Experiment

- 5 blocks/site
- Block = 6 seeding treatments
- Mid-August: Black spruce seeded





Denali National Park 2016 Field Season Summary

- 48 burned sites: 25 in East Toklat, 23 in Wigand Creek
- Stand age, density, canopy consumption
- Depth of burn using adventitious roots or tussocks
- 4 organic and 1 mineral soil samples per site
- Vegetation cover using point-intercept and quadrats
- Seeding experiment (3 burned and 3 unburned sites per grid)

Thanks!

ABoVE
ARCTIC BOREAL VULNERABILITY EXPERIMENT

NATIONAL PARK SERVICE

NORTHERN ARIZONA UNIVERSITY

LAURIER *Inspiring Lives.*

NWT Fire Research Update

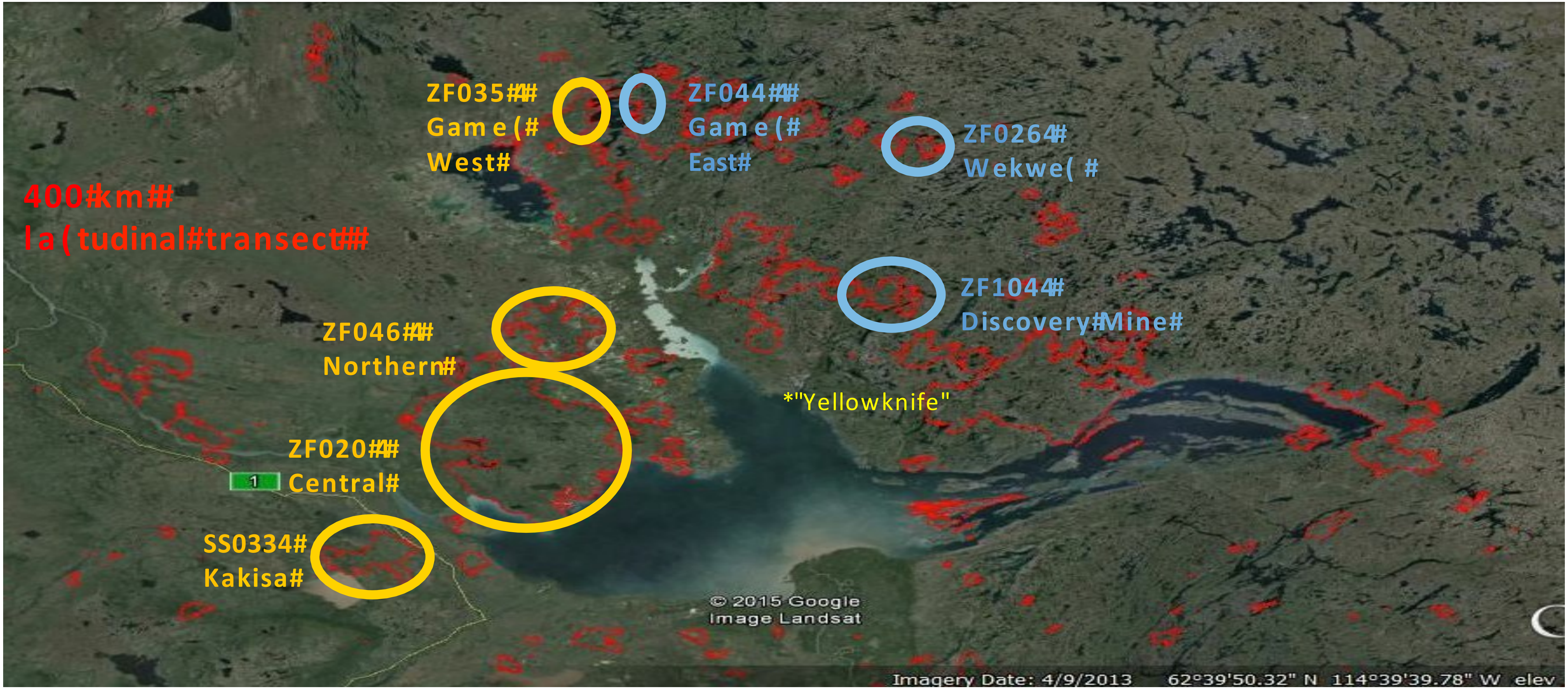
PIs: J. Baltzer, S. Cumming, J. Johnstone, A. Lewkowicz, M. Mack, M. Turetsky

PDFs: N. Day, C. Dieleman, X. Walker Graduate students: J. Holloway, K. Reid, A. White

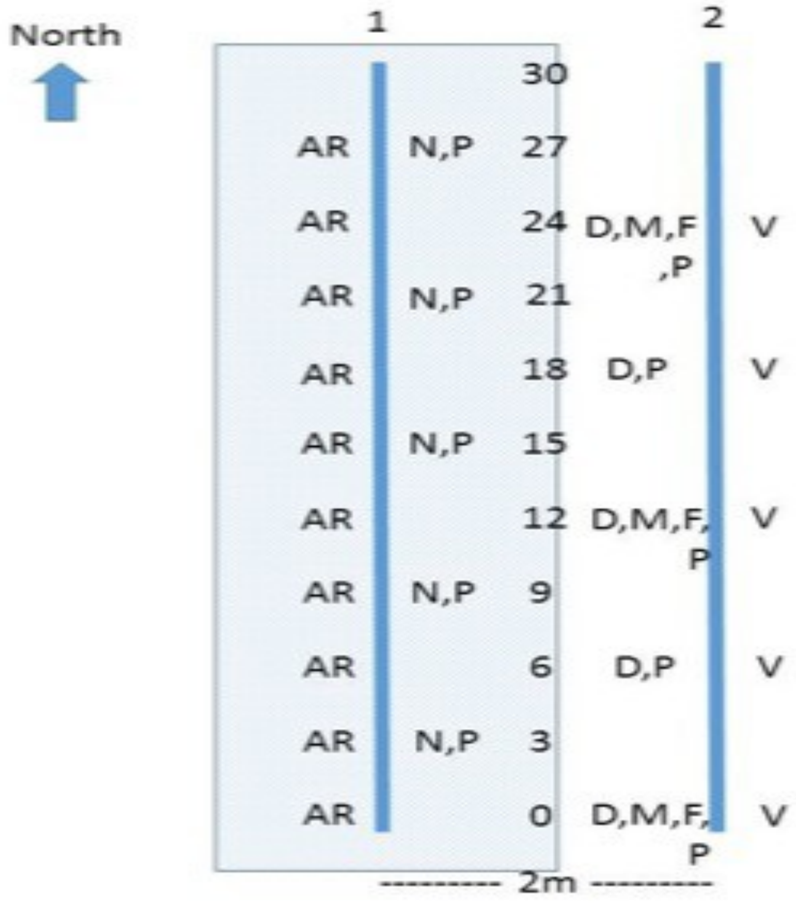
2015 Sampling Recap

- 214 transects in 2014 burns
- 7 burns: 4 on plains, 3 on shield
- 3 land cover classes with early burns, late burns, and reburns represented where occurred
  - LCC05 7: conifer-med
  - LCC05 9: conifer-low
  - LCC05 20: sparse conifer – only on shield
- Sampling across moisture categories

2015 Sampling Locations



2015 sampling design



V = vegetation quadrat

D = destructive organic soil sample

M = mineral soil sample

F = soil sample for fungi

N = non-destructive organic soil depth

AR = adventitious root with paired organic soil depth

Pre-fire stand composition, density, and age measured along Transect #1

P = frost probe

2016 Field Season Overview

<u>2014 burns</u>:

- Established additional plots and remeasured vegetation
- Collected and re-established seed traps
- Established seeding and decomposition experiments
- Permafrost remeasurements and coring

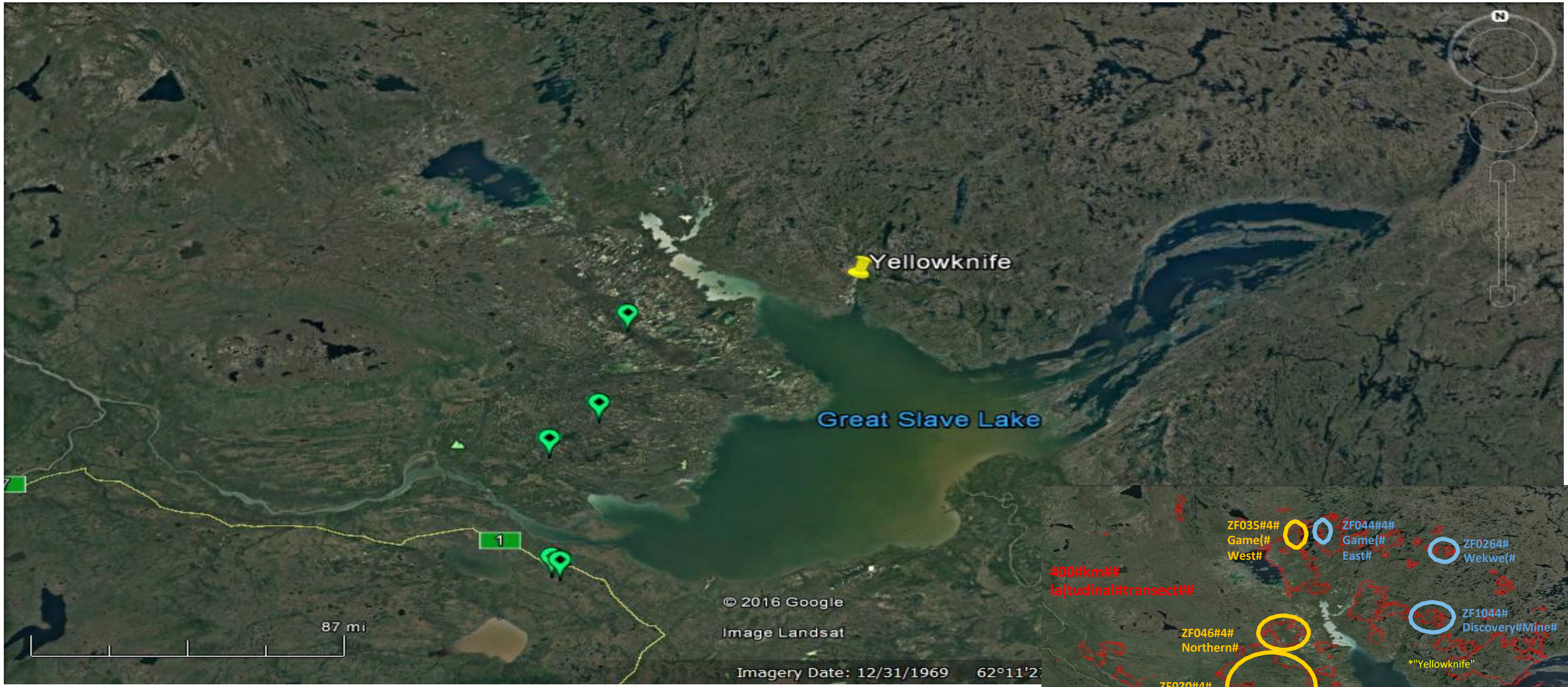
<u>Chronosequence</u>

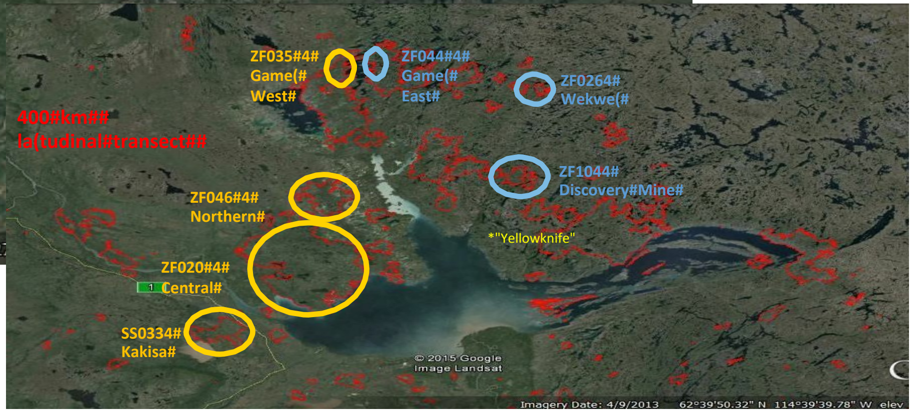
- Established unburned controls and some intermediate age stands

2016 measurements in 2014 burns

- Established 12 additional plots
  - sparse conifer (LCC05 class 20) represented on Plains
- Remeasurement of all 2014 burn plots
  - Seedling establishment and understory vegetation for years 1 and 2 postfire
  - Permafrost remeasurements – ERT and probing
  - Permafrost coring to convert post-fire changes in thaw depth to soil carbon volume estimates
- Seed traps established in June 2015 in black spruce- dominated stands
  - seed rain for 1^{st} and 2^{nd} summers, and 2^{nd} winter postfire
  - Collect again in June 2017

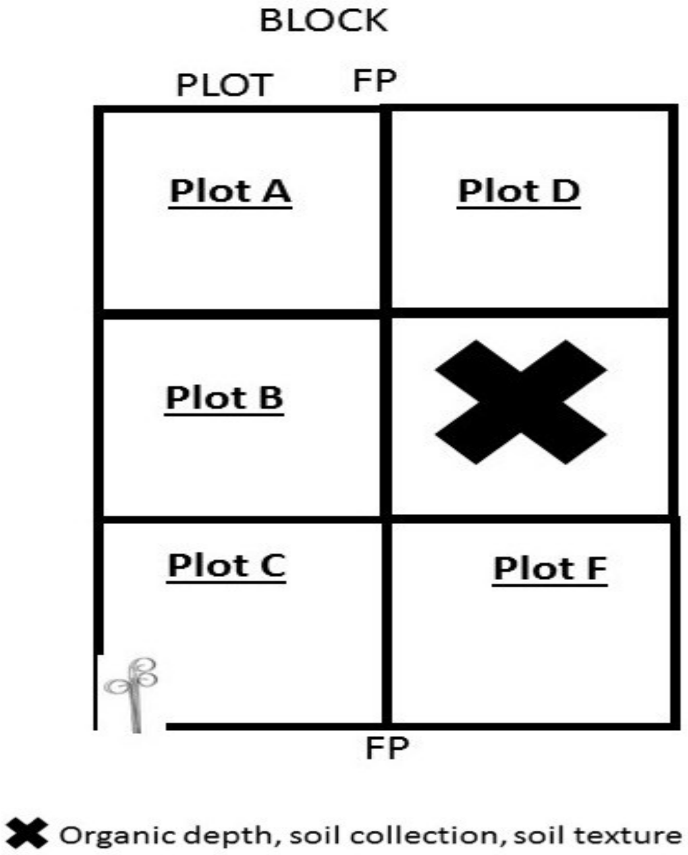
Locations of new LCC05 20 plots





2016: Experiments in 2014 burns

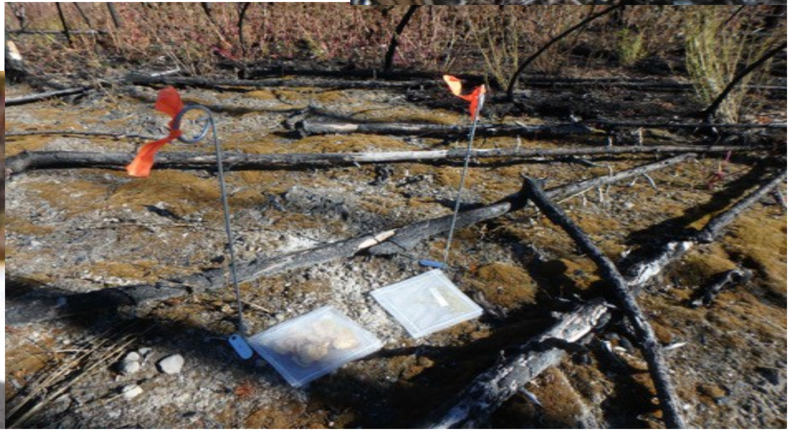
- Established seed-addition experiment in June (n=30) across gradients of burn severity and organic matter depth
- 5 blocks adjacent to main transect
  - Seed treatments randomly assigned
  - Conifers: *P. banksiana, P. mariana*
  - Deciduous: *P. tremuloides, B. neoalaskana*
  - Unseeded control
- Destructive plot
  - organic depth, bulk density, texture
- 6th block at 17 sites
  - Molecular characterisation of soil fungal communities and mycorrhizas on seedlings



2016: Experiments in 2014 burns

2016: Experiments in 2014 burns

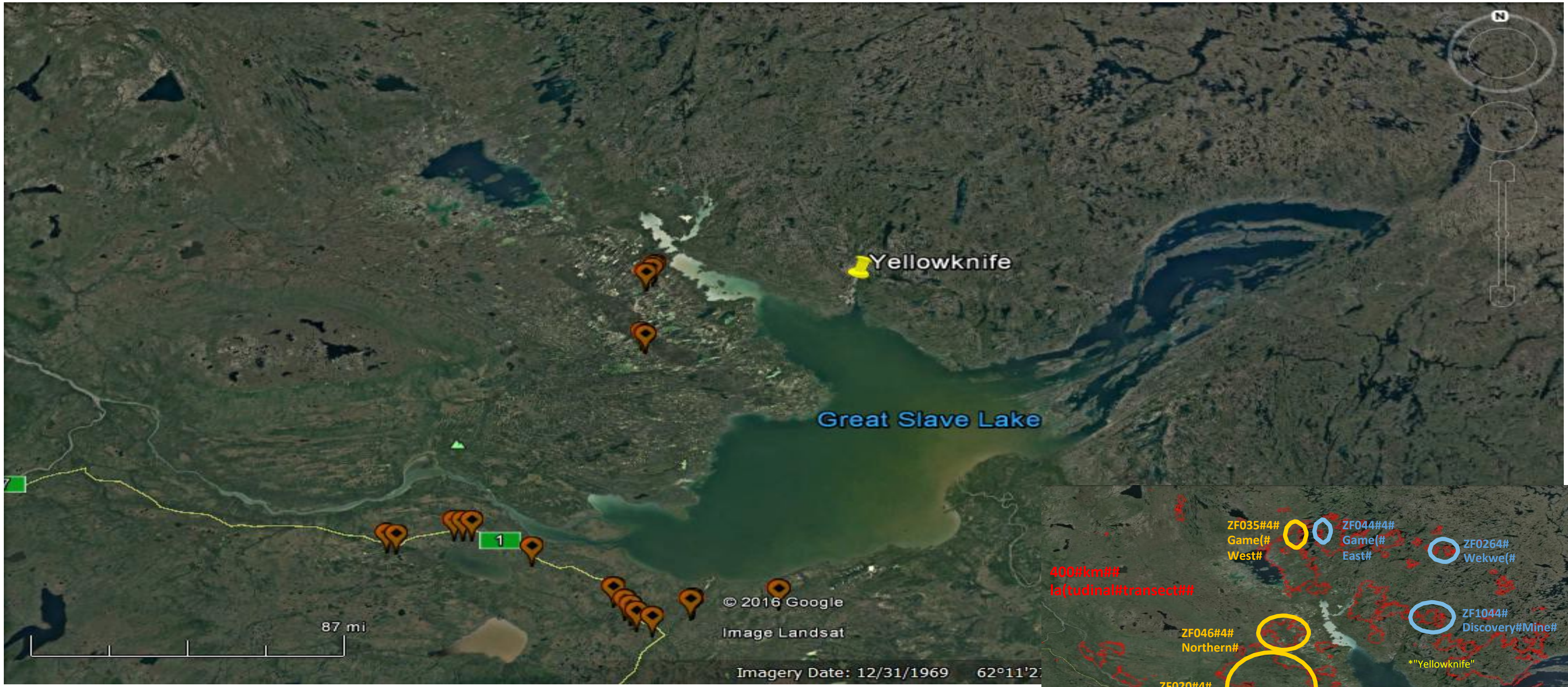
- Decomposition trials at all seeding experiment sites to assess recovery of ecosystem services and soil fungal communities in relation to burn severity and litter type
- Established August-September
- Litter bags to allow fungal decomposition
- 5 bags at each site, adjacent to blocks
  - Deciduous: *B. neoalaskana*
  - Conifer: *P. mariana*

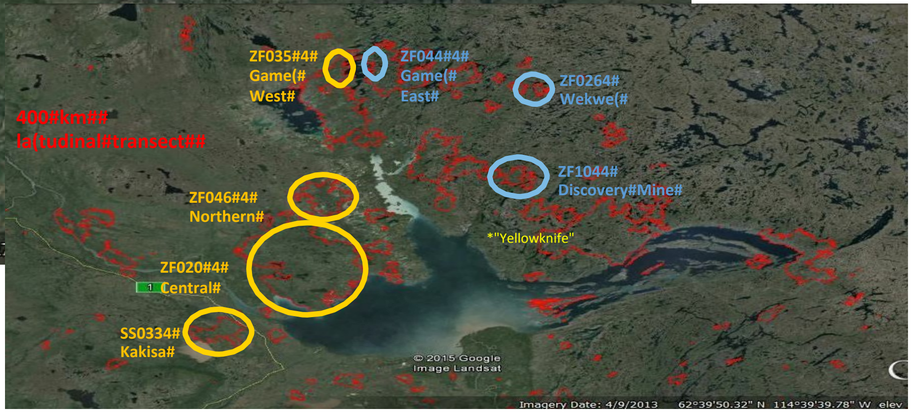


2016: Chronosequence sampling

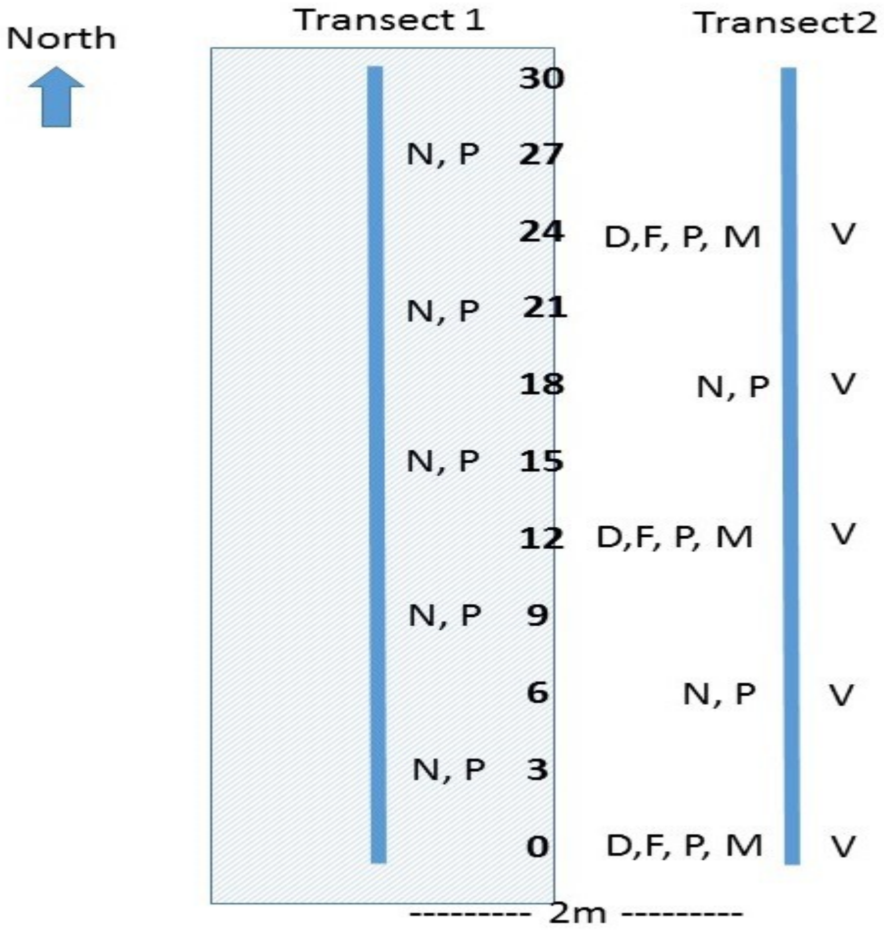
- 4 land cover classes, all on plains
  - – LCC05 7: conifer-med
  - – LCC05 9: conifer-low
  - – LCC05 20: sparse conifer
  - – LCC05 13: mixed conifer, low density
- –No record of burn (controls): 49 plots
  - 1971 burn: 6 plots
  - 1972: 9 plots
  - 1980: 3 plots

Chronosequence sampling locations





2016: Chronosequence sampling



V = vegetation quadrat

D = destructive organic soil sample

N = non-destructive organic soil depth

M = record texture and sample of mineral soil

F = soil sample for fungi (selected plots)

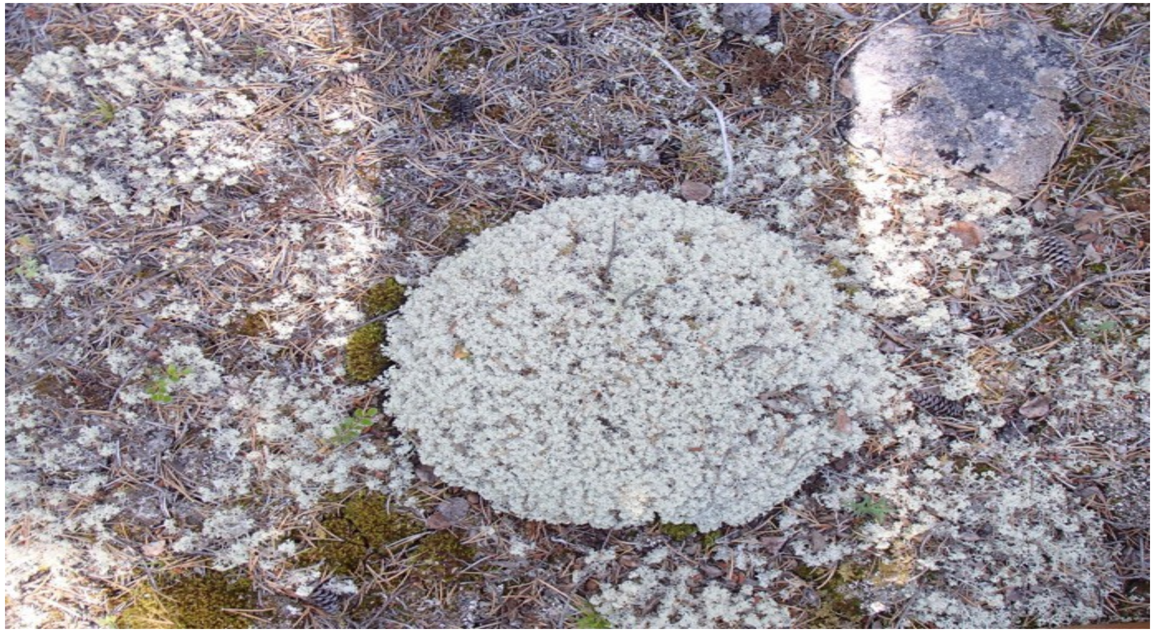
P = frost probe

Stand composition, density, age, and arboreal lichens measured along Transect #1

Lichen biomass collections outside the plot area at one in 3 plots

2016: Chronosequence sampling

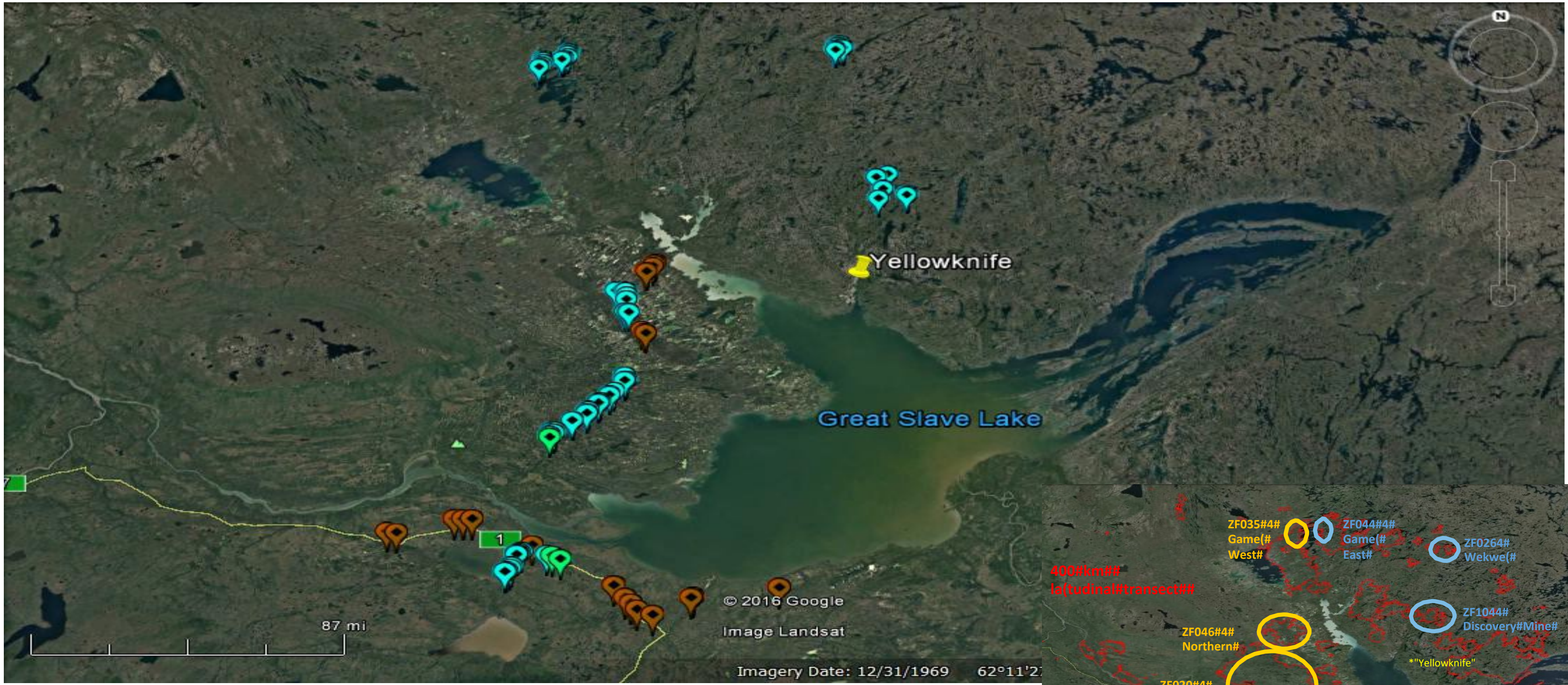
- Collected terrestrial lichens to develop allometric equations for biomass

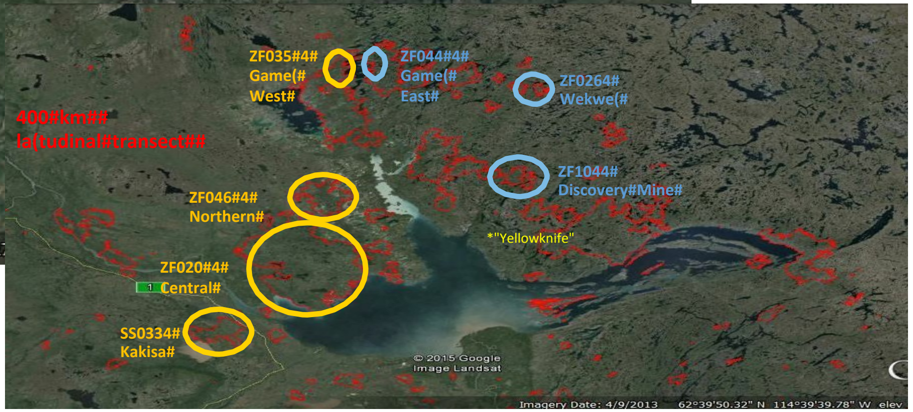


Examples of control stands

Arboreal lichens in control sites

Sampling sites to date

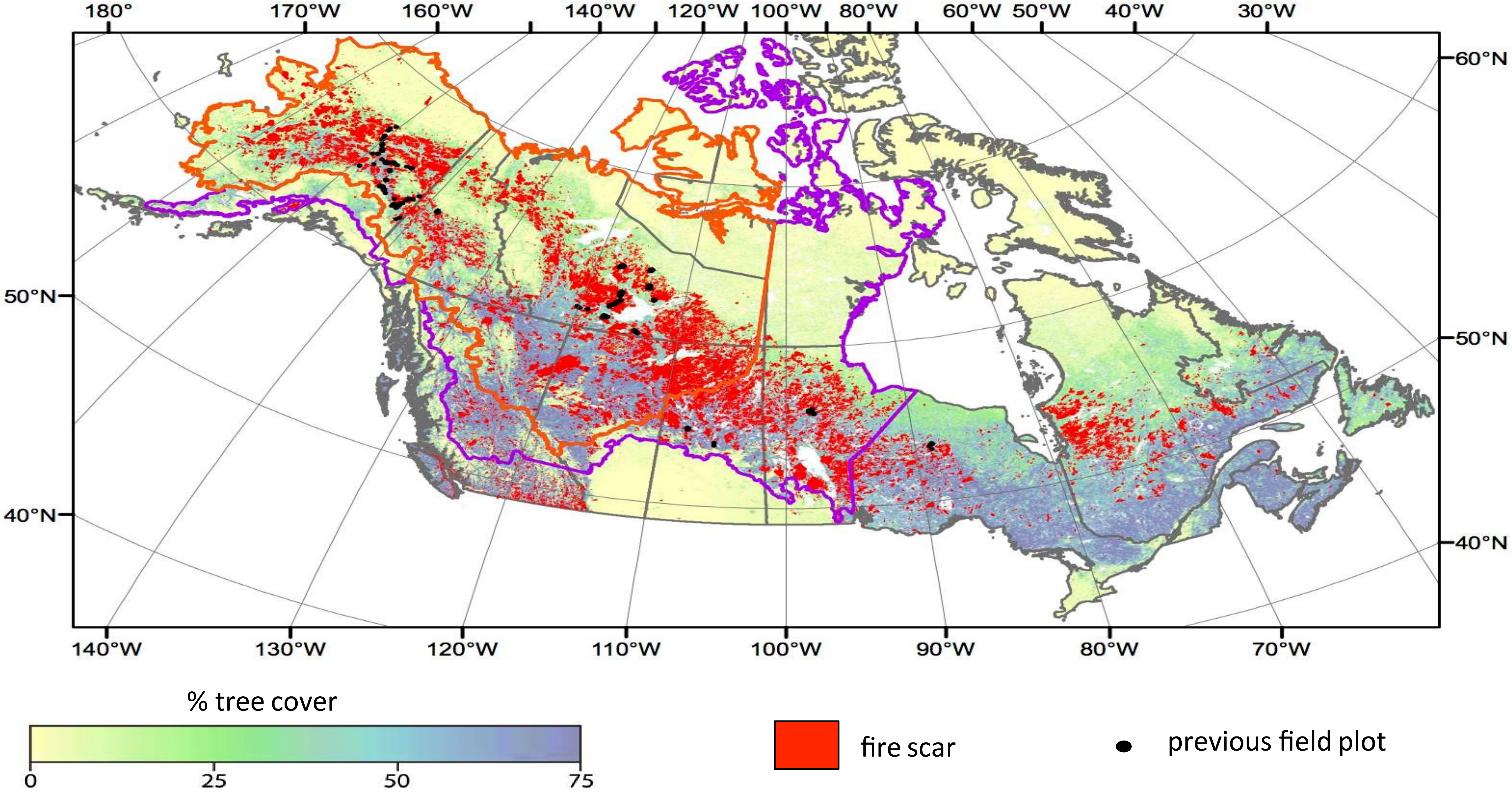




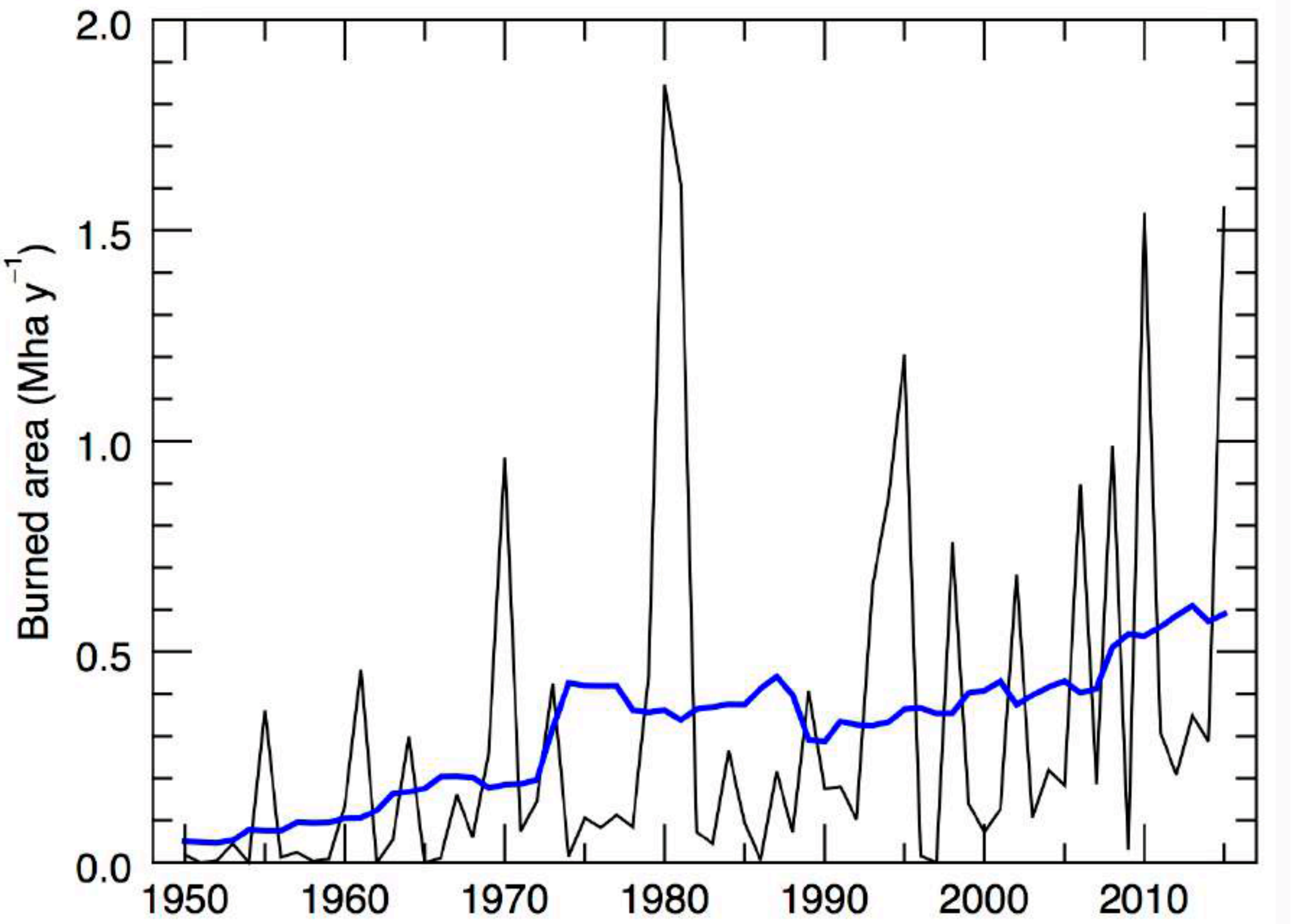
People and outreach

Rogers field campaign 2016: Saskatchewan

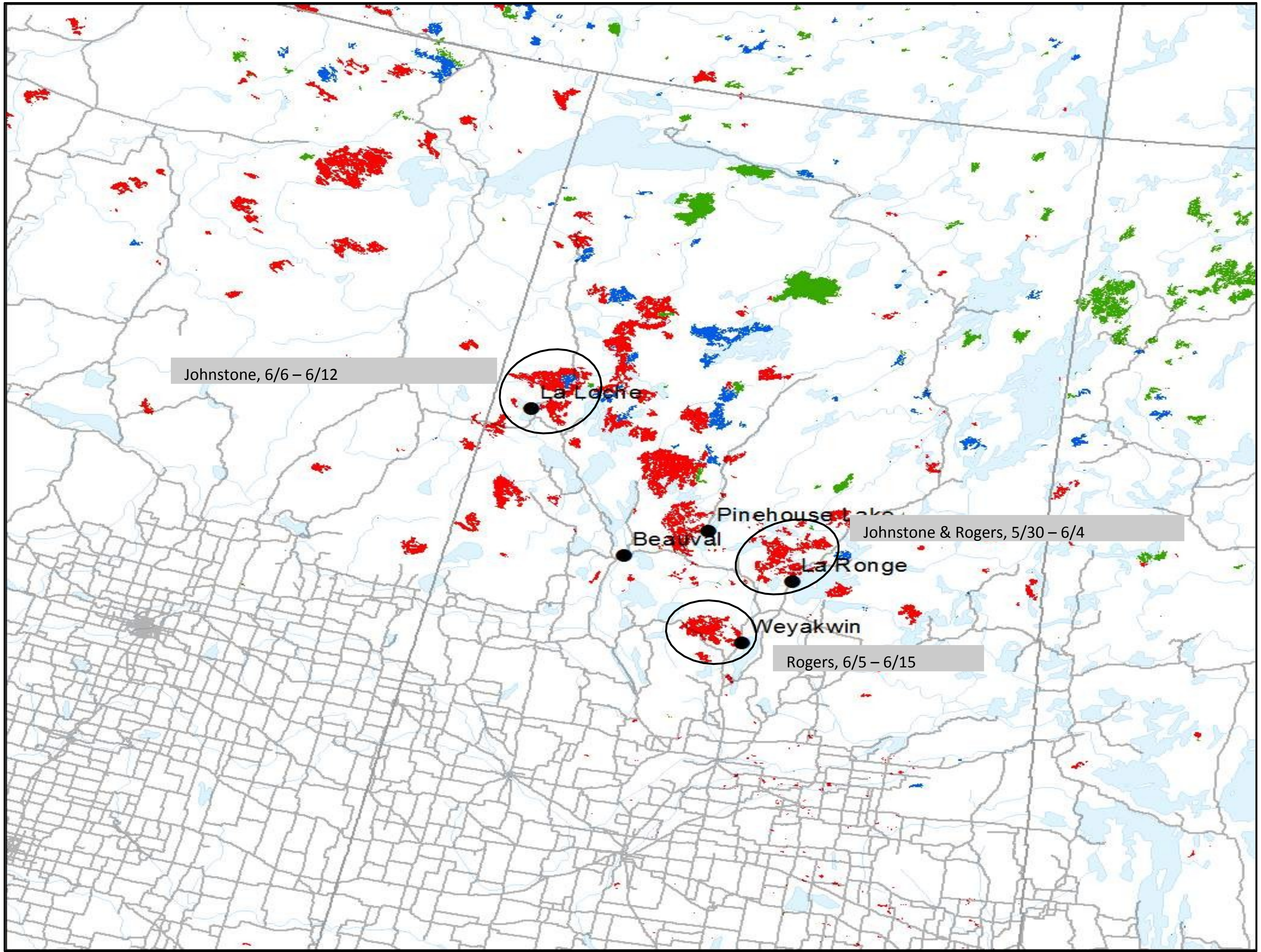
Boreal NA burning patterns



Increasing burned area in Saskatchewan (and southern boreal)



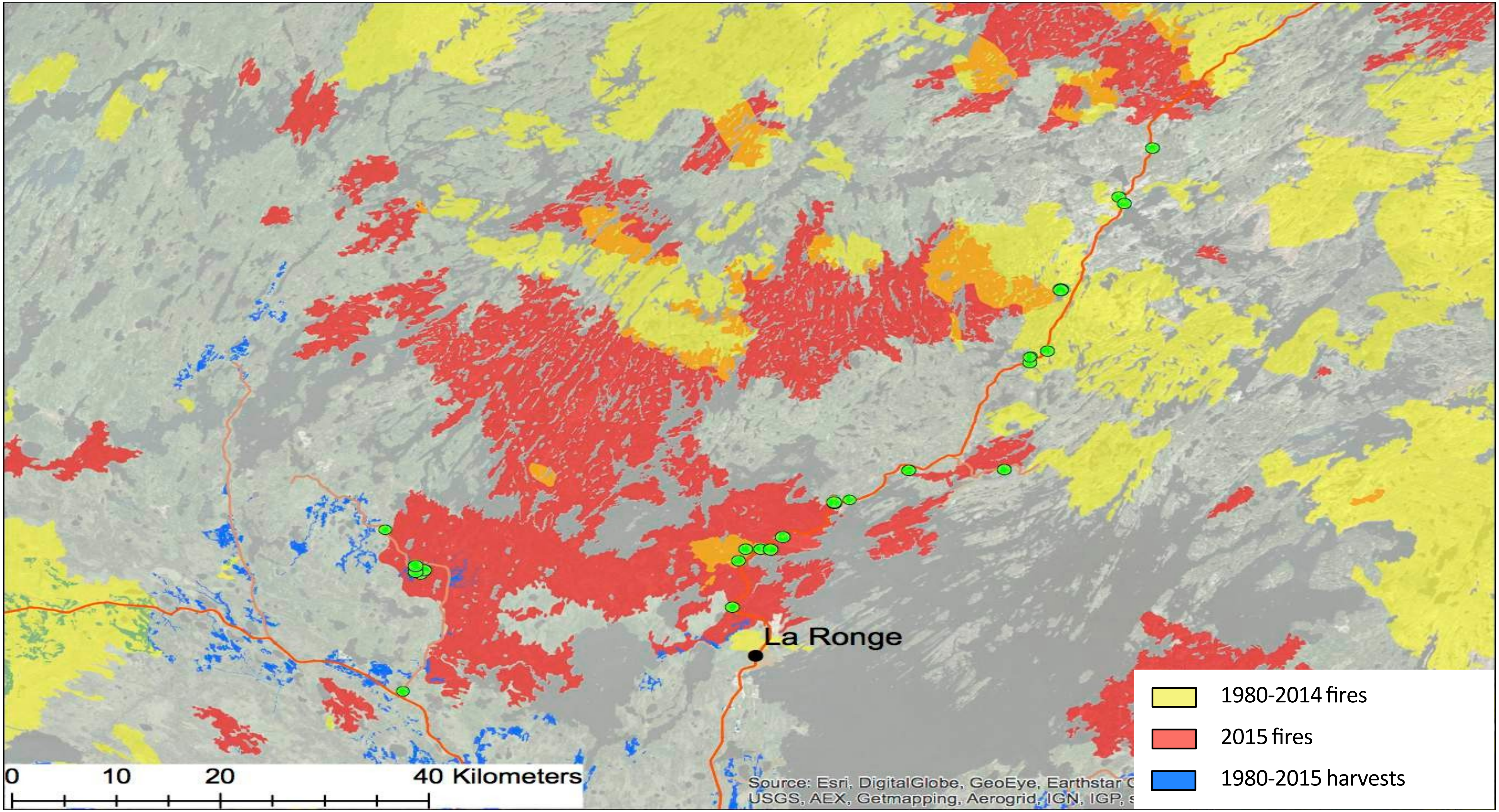
Locations and timing

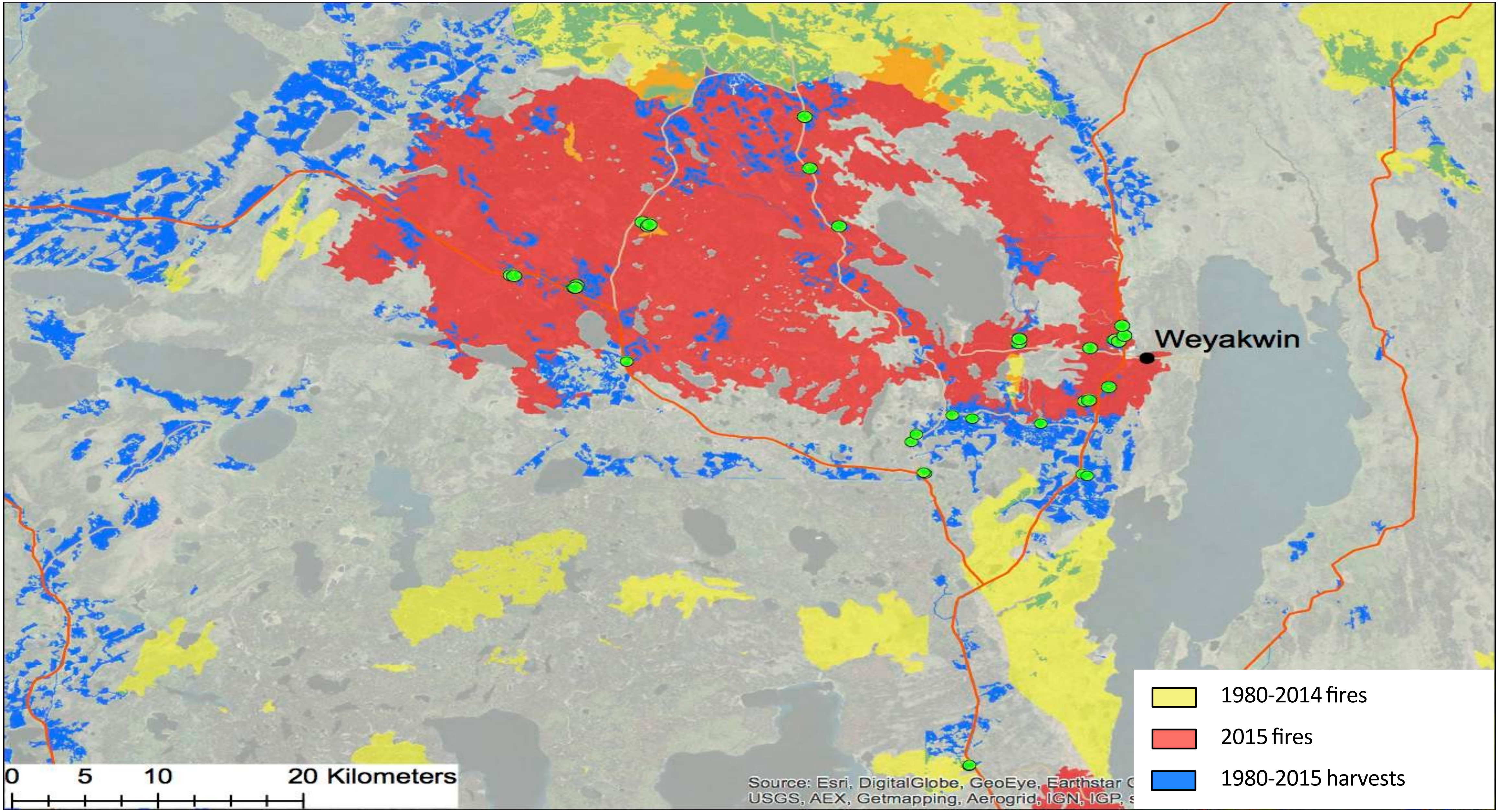


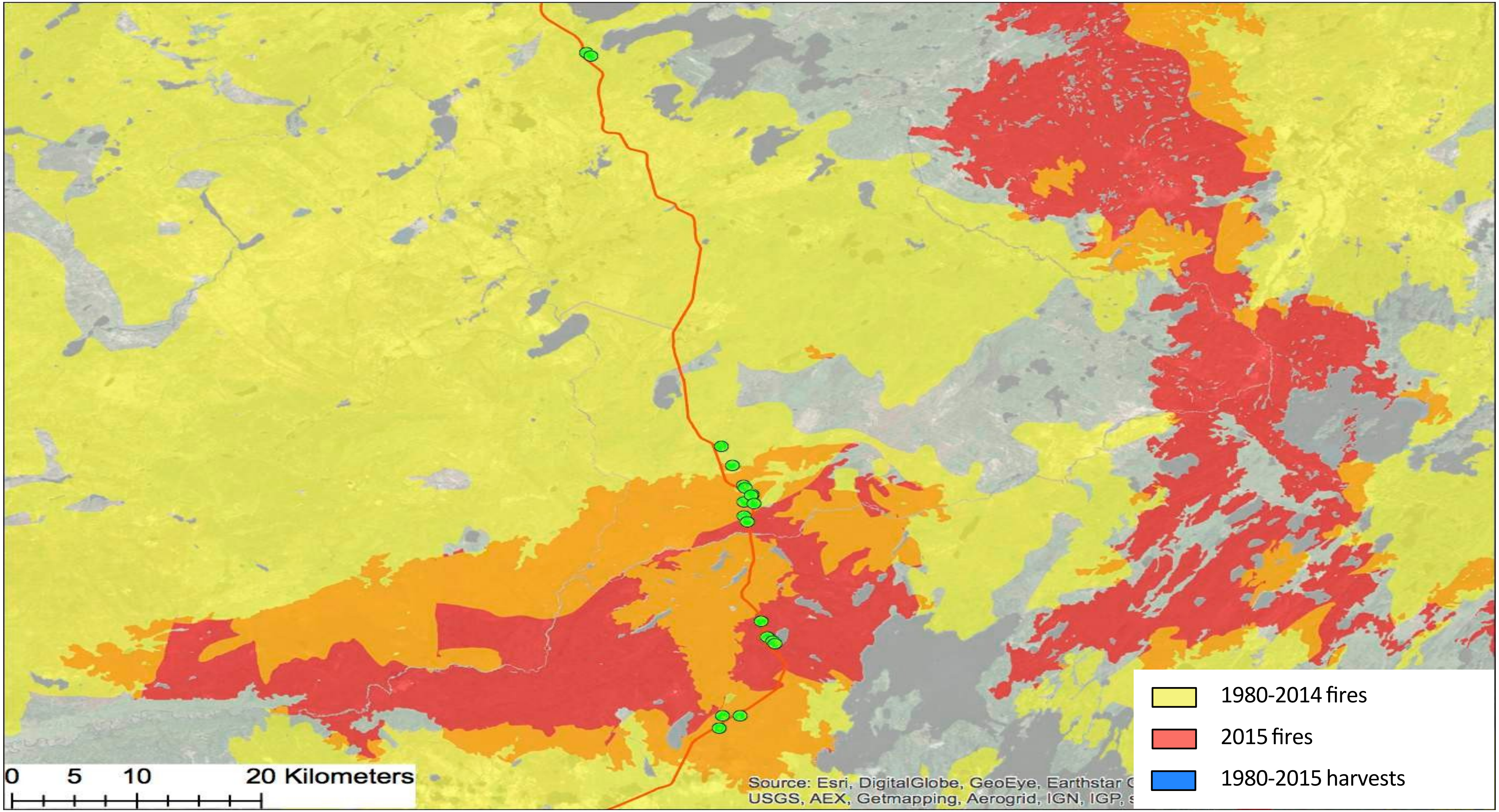
2013 fires

2014 fires

2015 fires


La Ronge
1980-2014 fires
2015 fires
1980-2015 harvests
0 10 20 40 Kilometers
Source: Esri, DigitalGlobe, GeoEye, Earthstar
USGS, AEX, Getmapping, Aerogrid, IGN, IGP,


Weyakwin
1980-2014 fires
2015 fires
1980-2015 harvests
0 5 10 20 Kilometers
Source: Esri, DigitalGlobe, GeoEye, Earthstar
USGS, AEX, Getmapping, Aerogrid, IGN, IGP,


1980-2014 fires
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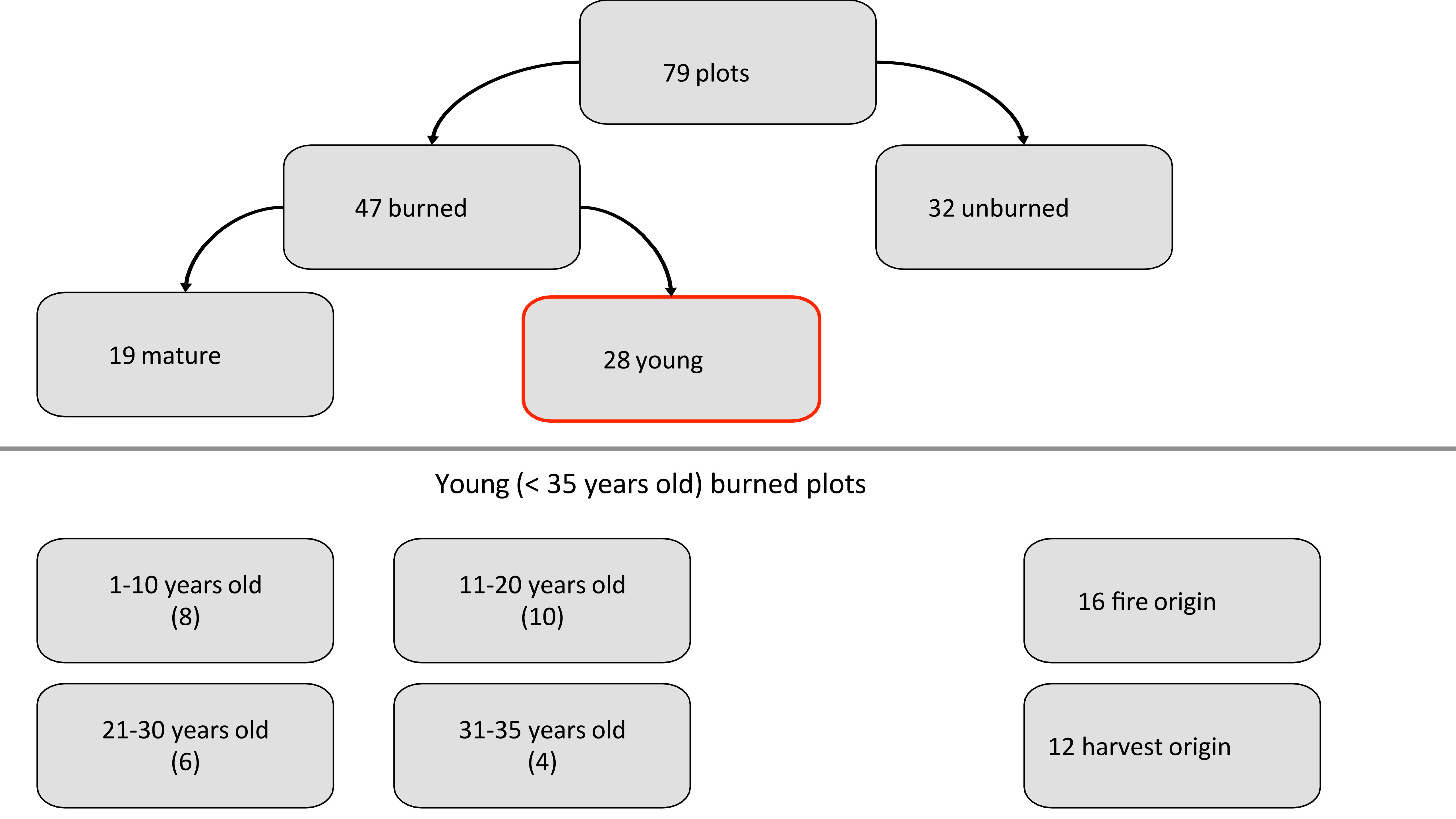
0 5 10 20 Kilometers
Source: Esri, DigitalGlobe, GeoEye, Earthstar
USGS, AEX, Getmapping, Aerogrid, IGN, IGP,


79 plots
47 burned
32 unburned
19 mature
28 young
Young (< 35 years old) burned plots
1-10 years old
(8)
11-20 years old
(10)
16 fire origin
21-30 years old
(6)
31-35 years old
(4)
12 harvest origin

Plots and variables measured

- Focus on combustion as affected by (i) stand age and (ii) stand origin (harvest vs. fire). But also large effects of site moisture and species
- Plots: mix of random stratification and opportunistic. 2 x 30m transects in N-S direction. Satellite pixels (30m Landsat) in mind when selecting = 'homogeneous heterogeneity'. Record canopy cover, species, age & origin, site moisture class, GPS accuracy

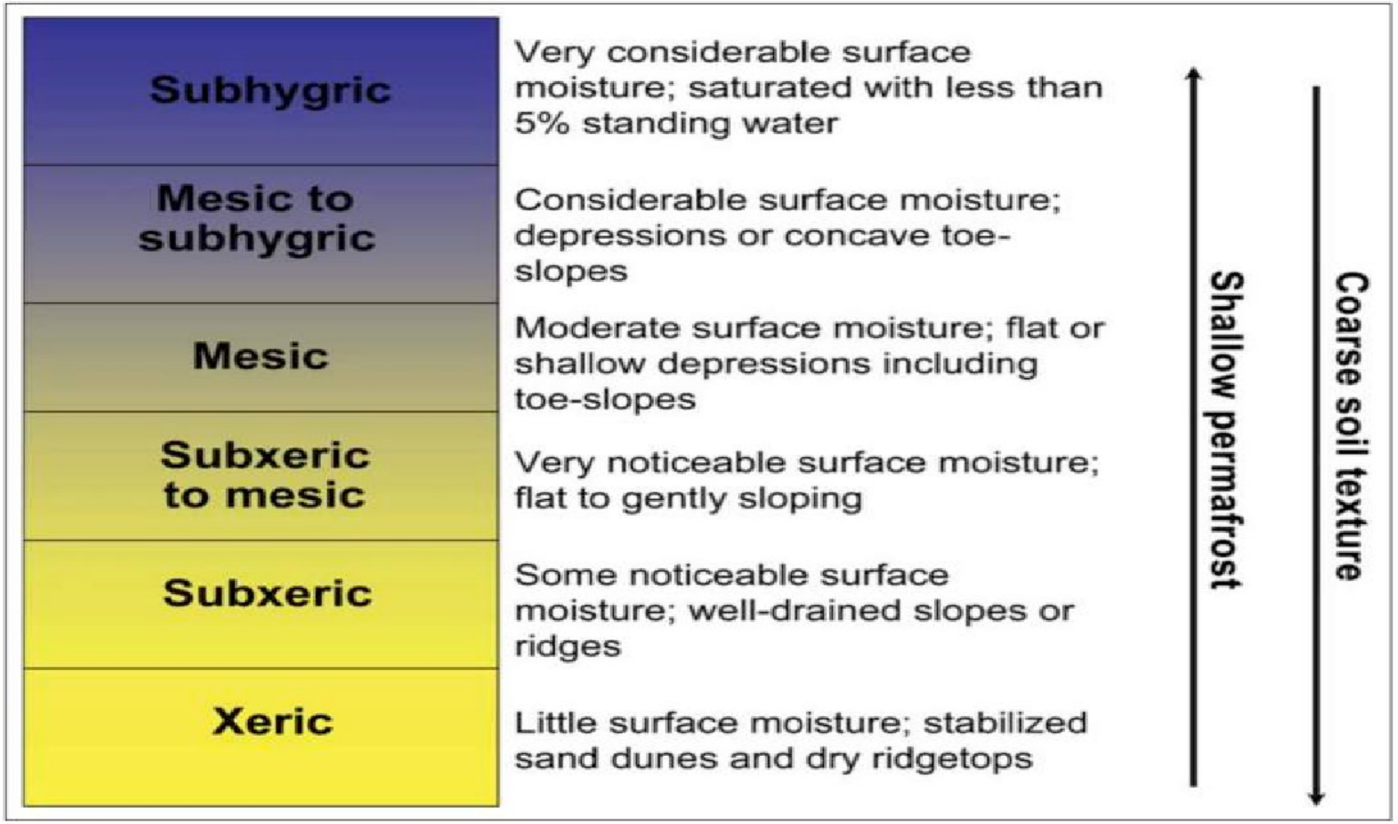


Figure 1—Pictographic key to classifying the potential site moisture of black spruce stands in interior Alaska.

Plots and variables measured

- Focus on combustion as affected by (i) stand age and (ii) stand origin (harvest vs. fire). But also large effects of site moisture and species
- Plots: mix of random stratification and opportunistic. 2 x 30m transects in N-S direction. Satellite pixels (30m Landsat) in mind when selecting = 'homogeneous heterogeneity'. Record canopy cover, species, age & origin, site moisture class, GPS accuracy
- Soil cores: 5 destructive and 5 non-destructive, alternating every 3 m outside W side of transect. Dug by hand. Record area, total depth to mineral (or water/ ice), height of individual layers, and distance to trees. Also % rock exposure or % duff consumption in 6 m increments if applicable.
- Adventitious roots: up to 10 additional soil profiles (non-destructive) on either side of spruce trees w/adventitious roots.
- Trees: DBH or basal diameter of every tree, species, status, distance along transect. For burned, consumption on scale of 0 – 6. For spruce in transect, distance b/n top adventitious roots and top of organic layer.

<u>Canopy Consumption:</u>
1. No consumption
2. Low consumption, with many brown needles and most small twigs remaining;
3. Low to moderate, with few needles but most small twigs remaining;
4. Moderate, with few small twigs remaining but many branches;
5. Moderate to high, with most small twigs and many branches consumed; and
6. High, with most of the aboveground canopy except the central trunk and branch stubs consumed
7. Severe, with significant fraction of bole consumed (give overall %)

Plots and variables measured

- Focus on combustion as affected by (i) stand age and (ii) stand origin (harvest vs. fire). But also large effects of site moisture and species
- Plots: mix of random stratification and opportunistic. 2 x 30m transects in N-S direction. Satellite pixels (30m Landsat) in mind when selecting = 'homogeneous heterogeneity'. Record canopy cover, species, age & origin, site moisture class, GPS accuracy
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- Adventitious roots: up to 10 additional soil profiles (non-destructive) on either side of spruce trees w/adventitious roots.
- Trees: DBH or basal diameter of every tree, species, status, distance along transect. For burned, consumption on scale of 0 – 6. For spruce in transect, distance b/n top adventitious roots and top of organic layer
- CWD: E side of transect used as 1-D cross-sample. Record decay class and 2 diameters of any CWD whose smallest diameter > 5 cm. For burned plots, estimate overall % consumption
- Tree cores/cookies. Mostly for stand age. At least 2-3 cores per dominant species and oldest looking trees. More for secondary cohorts if applicable
- CBI: modified for boreal forests as in Kasischke et al. (2008) and Rogers et al. (2014).
- Vegetation and & regeneration (only in Shield plots). 5, 1 x 1m quadrants along transect. Record % cover (OM, mineral soil, litter, charcoal, ash, water, scorched moss & lichen, rock, woody debris, other), and species regenerating.





STEADICAM

Tundra Fire Girls and Tony

Field data collection campaign in tussock tundra

Noatak River Basin

July 21 – August 6, 2016

Primary research goals

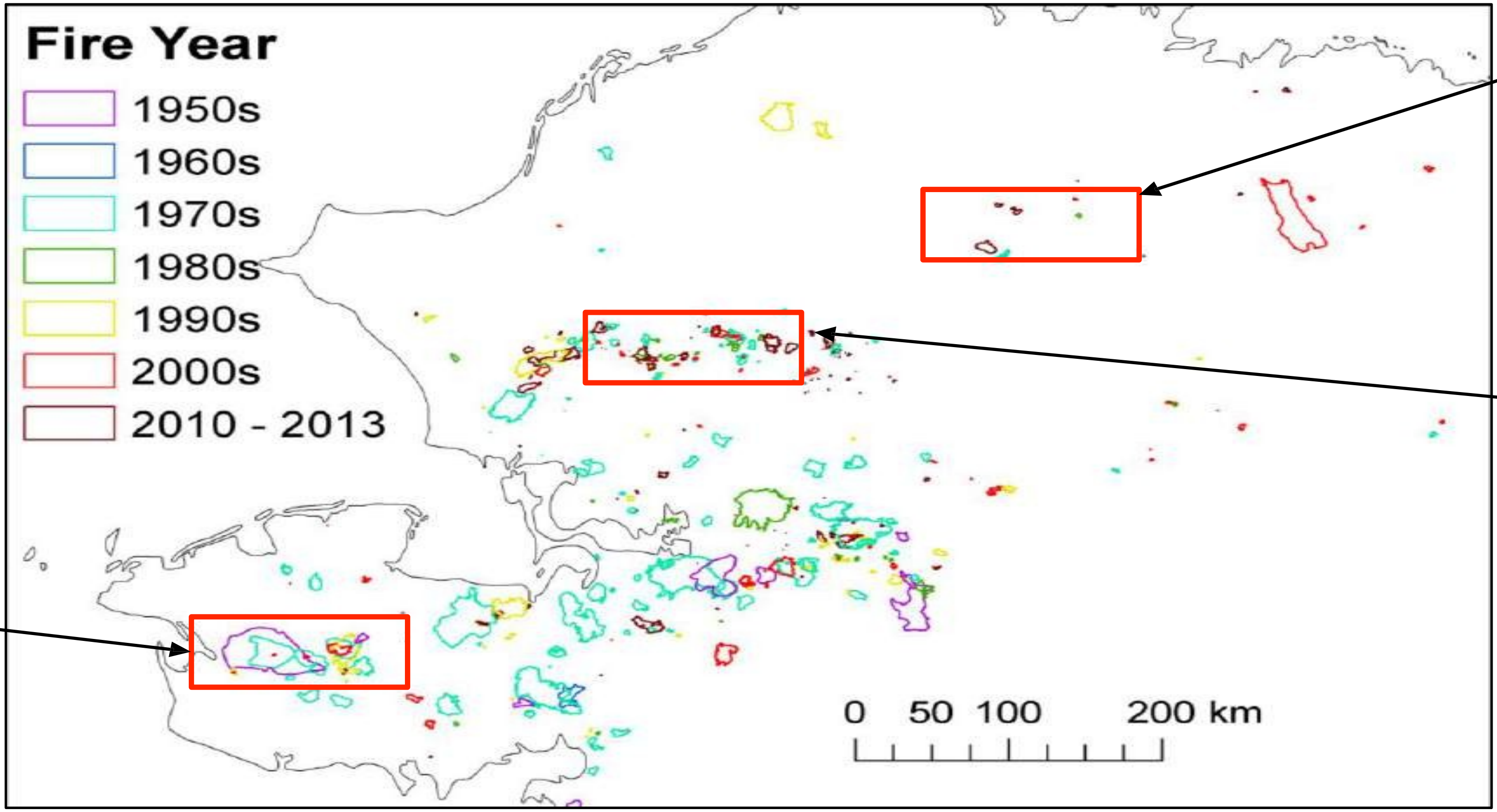
- <u>Major goal:</u> Quantify the short- and long-term impacts of wildfire occurrence on Alaskan tussock and shrub- tundra
  - active layer depth
  - soil moisture content
  - soil temperature
  - composition and characteristics of above ground vegetation
  - thickness of upper horizons of organic layer unaffected by permafrost

as a function of:

- time since the occurrence of the most recent wildfire event,
- fire return interval
- burn severity in recent fire events.

Primary research goals

- <u>Sub-goal:</u> quantify variability of fire-induced changes in tundra ecosystem functioning across three tundra ecoregions with substantial differences in fire regimes:



North Slope Foothills tundra ecoregion) - lowest rate of fire occurrence over time

the Noatak River valley (Brooks Range tundra ecoregion) –a robust recent and paleo-record of small overlapping fires

Seward Peninsula tundra ecoregion –a long record of large and moderate-sized overlapping fire events

Specific field measurements

- GPS location and GPS-linked photos in each cardinal direction and nadir
- Depth to frozen ground/Active layer depth
- Soil moisture at 6 cm and 12 cm
- Soil temperature at 6 cm
- Depth of SOL (unaffected by permafrost): exposed soil profile.
- Ocular assessment of above ground vegetation within a 10 m square plot:
    - Fractional cover of woody vegetation, herbaceous vegetation, mosses, and lichens
- Above ground biomass estimates:
    - Tussock core measurements
    - Uncompacted tussock crown measurement
    - Woody stem count and diameter within a 1 m square plot

Preparatory, collection, and analytical stages of field campaign

1) Preparatory stage: Image analysis to identify and map various strata for sampling

Randomized sample generation

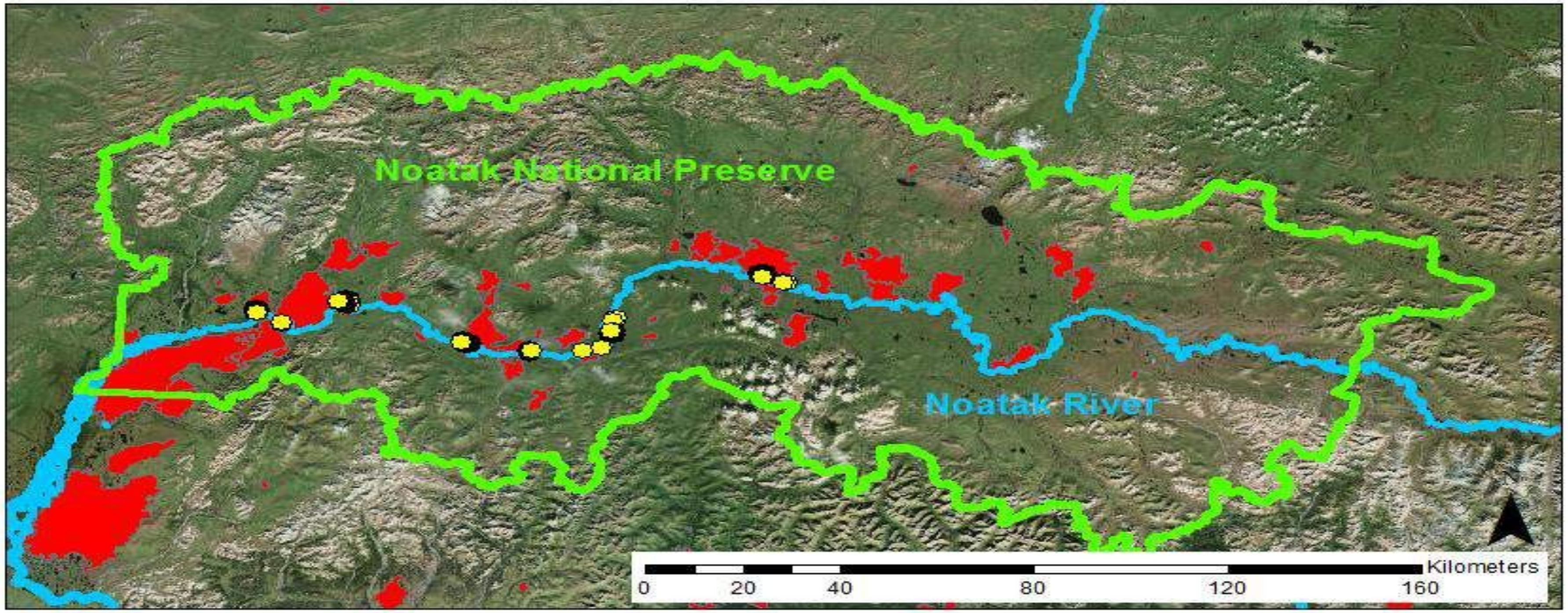
2) Field collection stage: Image analysis to identify and map various strata for sampling

3) Post-collection analytical stage: Field and image analysis to quantify relationships with previously defined and identify new landscape variables to consider

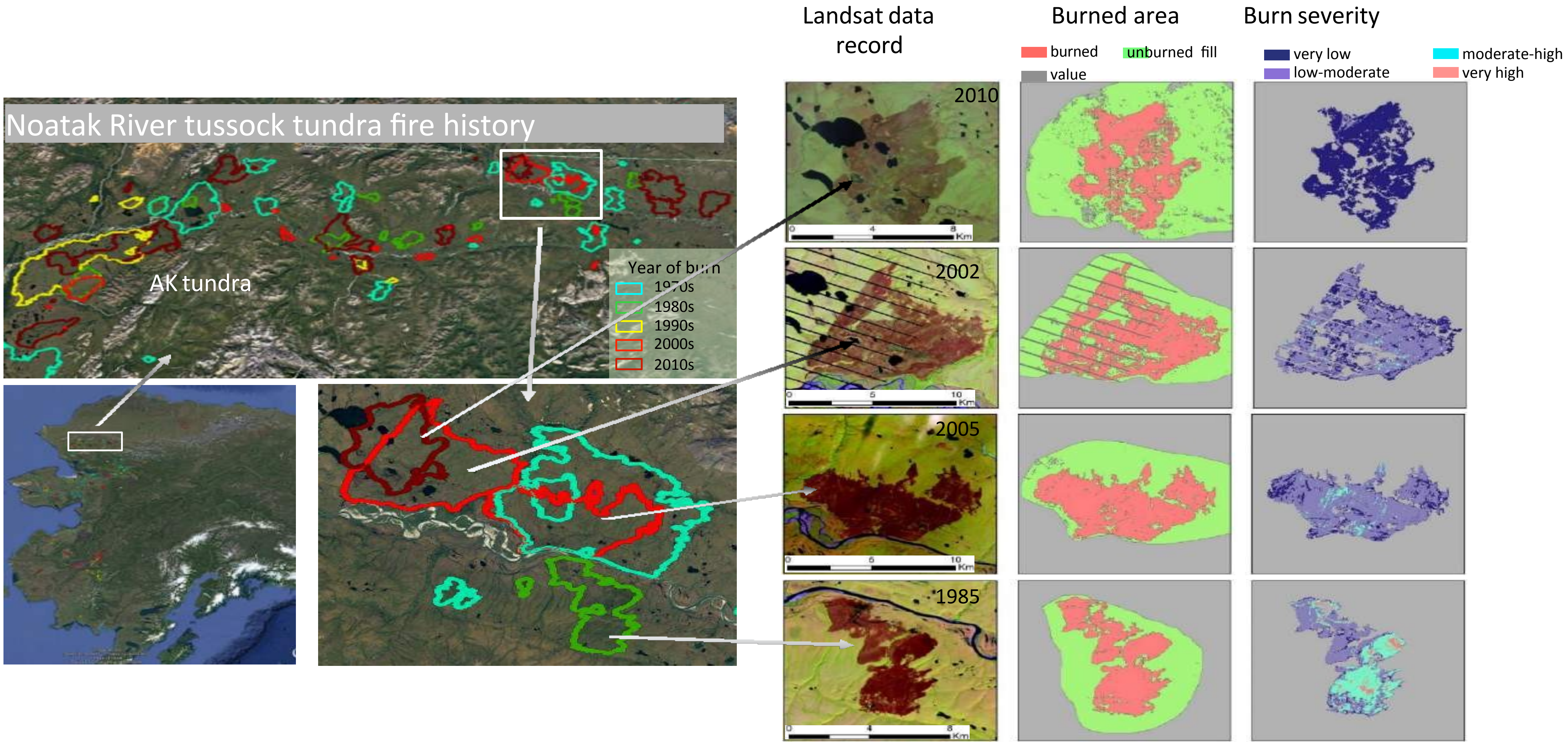
Develop maps of landscape conditions as a function of fire occurrence

2016 Field campaign: location

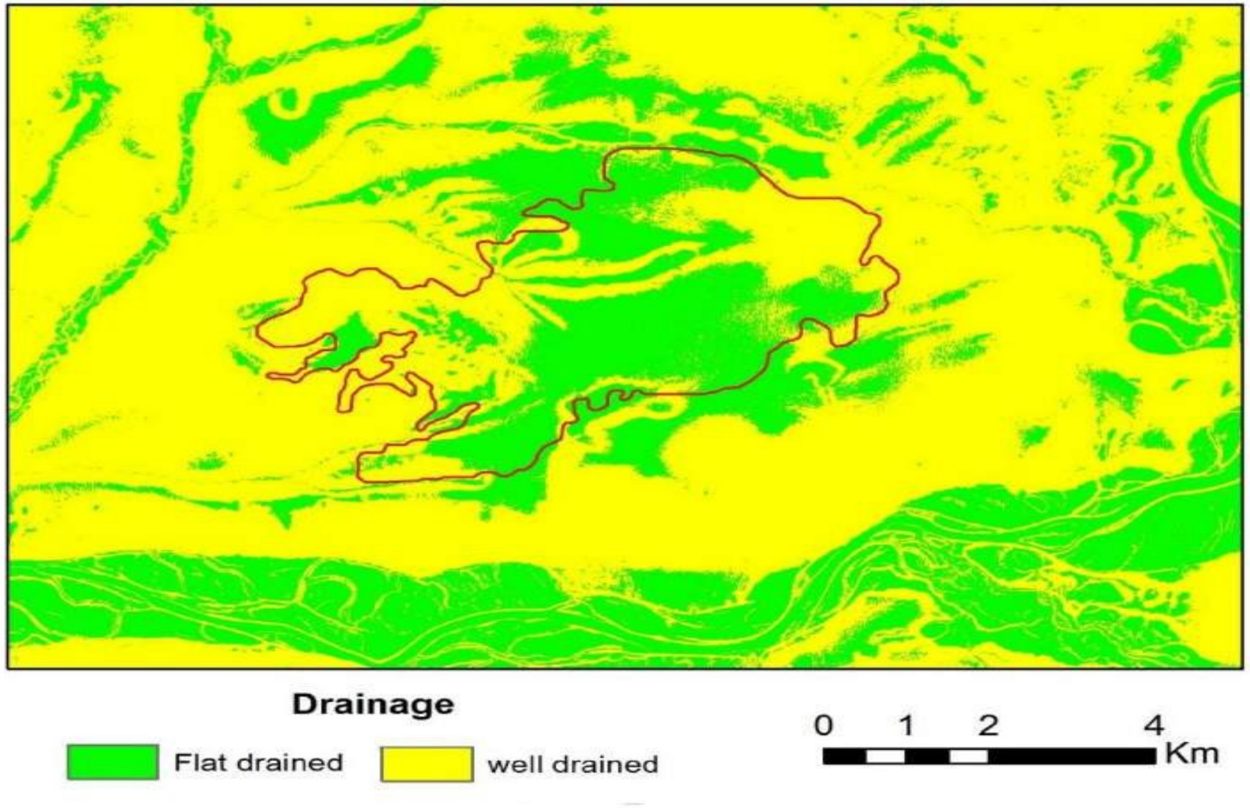
- Noatak National Preserve, fires along the Noatak River
  - Area of high historical fire activity
  - Rich dataset in terms of fire year, repeated burned areas, and burn severity



Planning stage: Landsat preparatory data processing and analysis



Planning stage: extraction of drainage classes



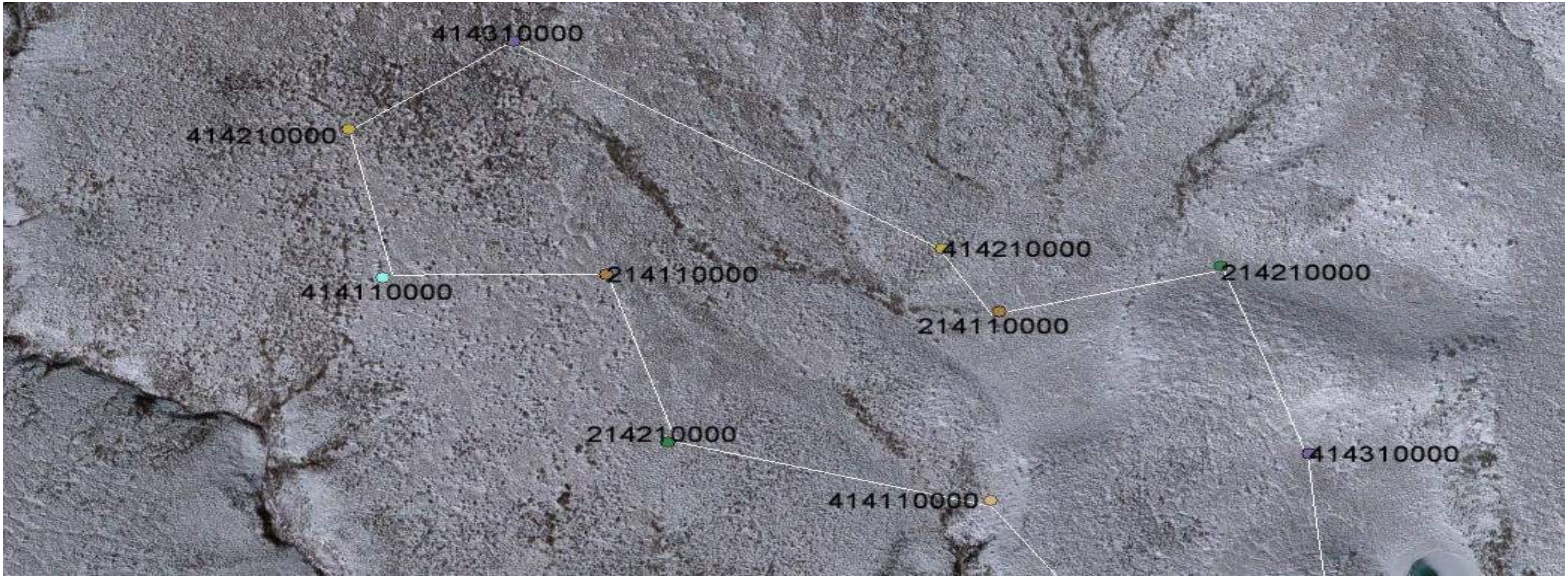
Drainage classes based on Alaska IfSAR DEM

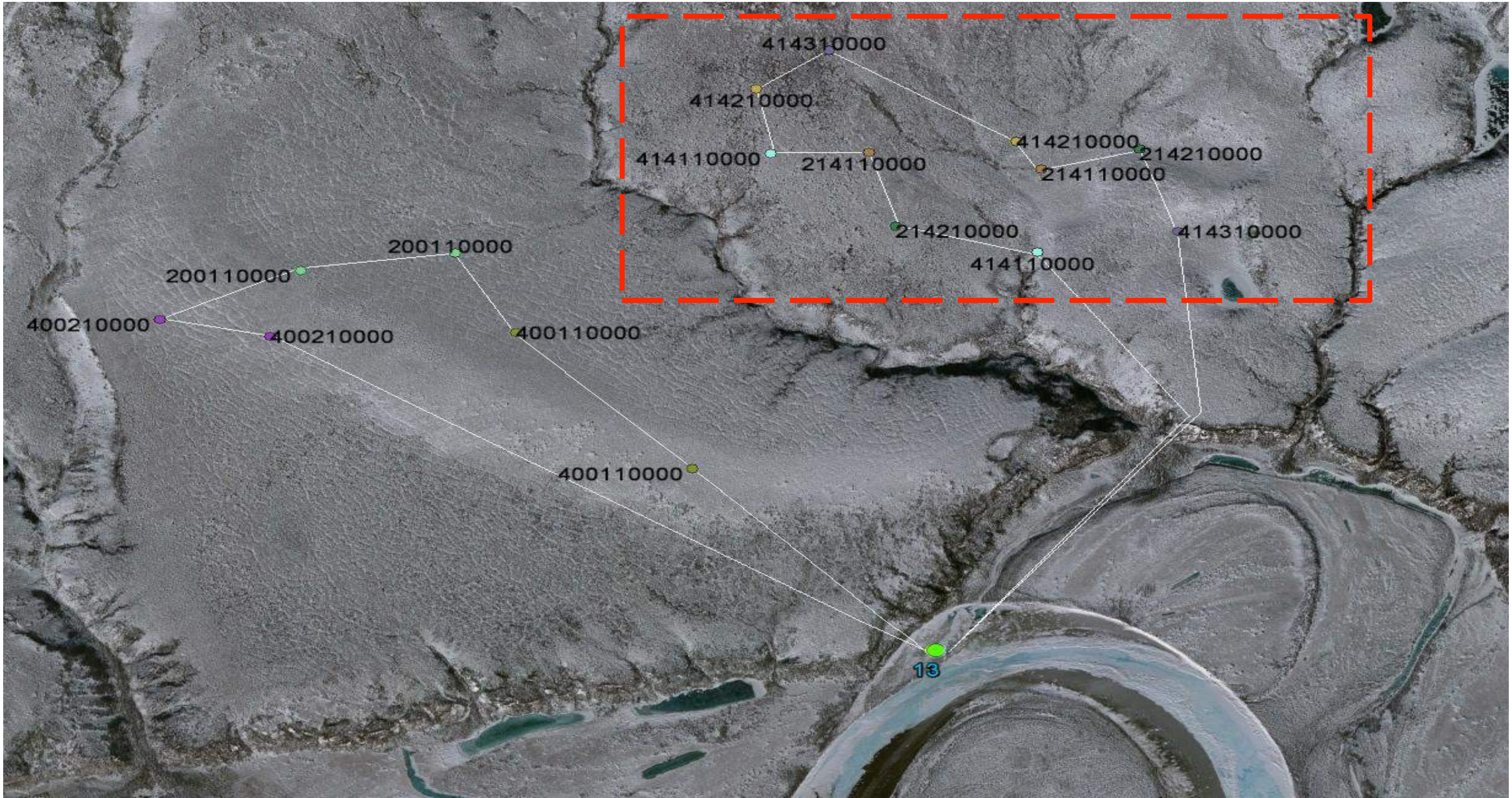
1) flat poorly drained, where (slope < 2°) and (flow accumulation > 0);
2) flat drained (slope < 2°) and (flow accumulation = 0);
3) moderately-drained , where (slope >= 2 °) and (flow accumulation > 0);
4) well-drained, where (slope >= 2°) and (flow accumulation = 0).

Stratified randomized sampling

4 1 4 3 1 0 0 0 0

drainage class | last burn year | last burn severity | last burn priority | prev burn year | prev burn severity | prev burn priority





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13

Planning stage: accessibility constrains

- landing sites along the river
- hike in to the burn distance/conditions
- distance between randomized site locations
- terrain/hydrologic feature constrains on transect walkability between proposed sites

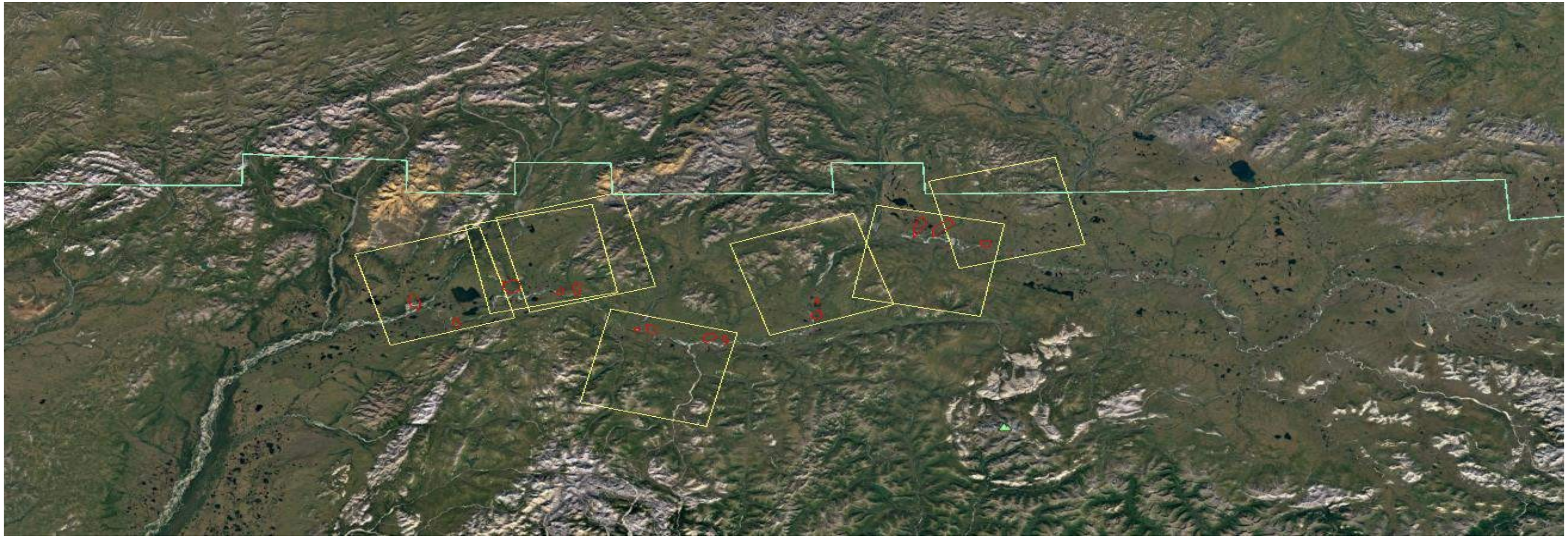
We really wanted to sample these 2 landings but 9.6 km and 7.5 km routes with dense willow/alder bushwhacking from the river corridor and stream crossings made these sites prohibitive for foot-based sampling

Planning stage: permits

- Extensive permitting processes for working in the National Parks
- Application submitted winter 2016 followed by lengthy review and Q&A with park managers, and approval granted several weeks before trip departure
- Strict guidelines to follow while in the field (more stringent than is required of commercial guides operating in the Parks)
- Comprehensive cultural resources training required for avoidance of cultural and archeological sites

Planning stage: coincidental imaging

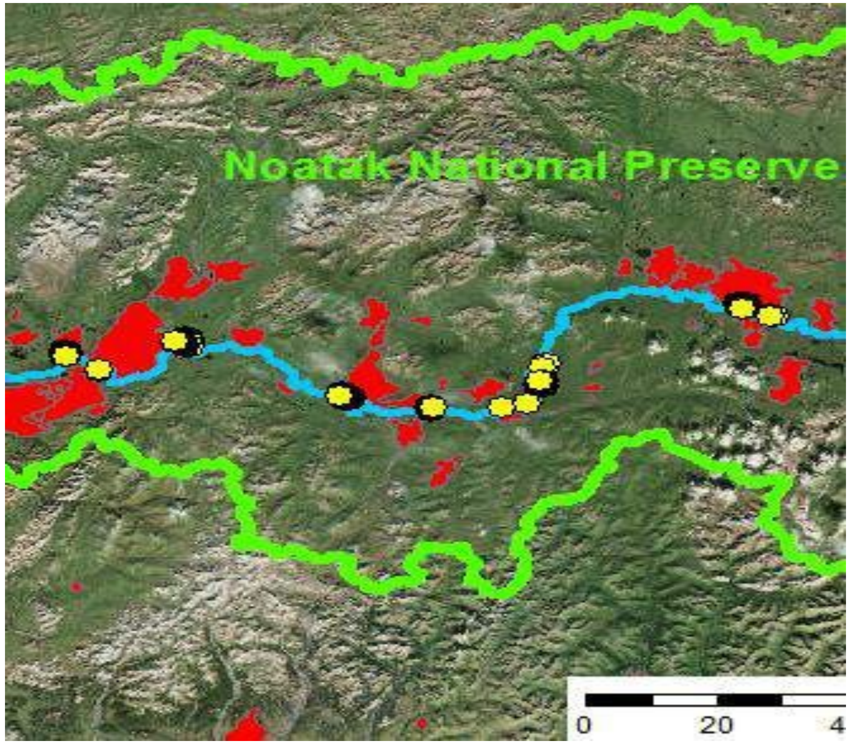
- Radarsat-2 satellite tasking based on planned site landings, estimated dates at each location, and satellite incidence angle/mode available given these constraints
- Submitted 7 scene requests and received 6 Radarsat-2 FQ scenes (fully polarimetric)



Data collection stage: Field campaign 2016

2016 Field campaign: the plan

- Float down the Noatak River to gain access to a large number of single and repeated burns in the Noatak Basin
- Sample preset randomized locations on foot



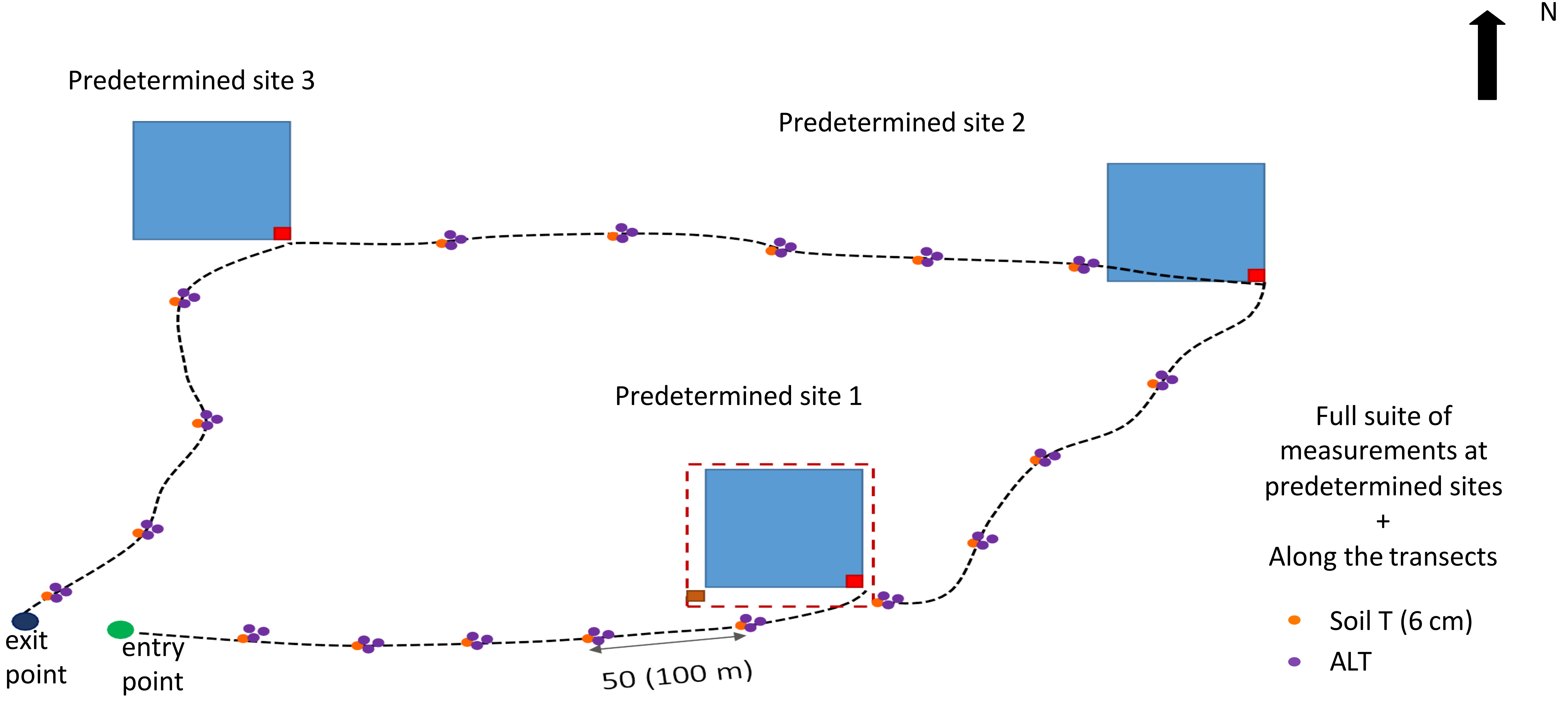
2016 Field campaign: logistics

- Garrett Jones (Arctic River Guides LLC) – our river guide and camp spouse.
- Bush plane site access +
- 16-days out without resupplying imposes substantial stress on field logistics
  - food
  - communal gear

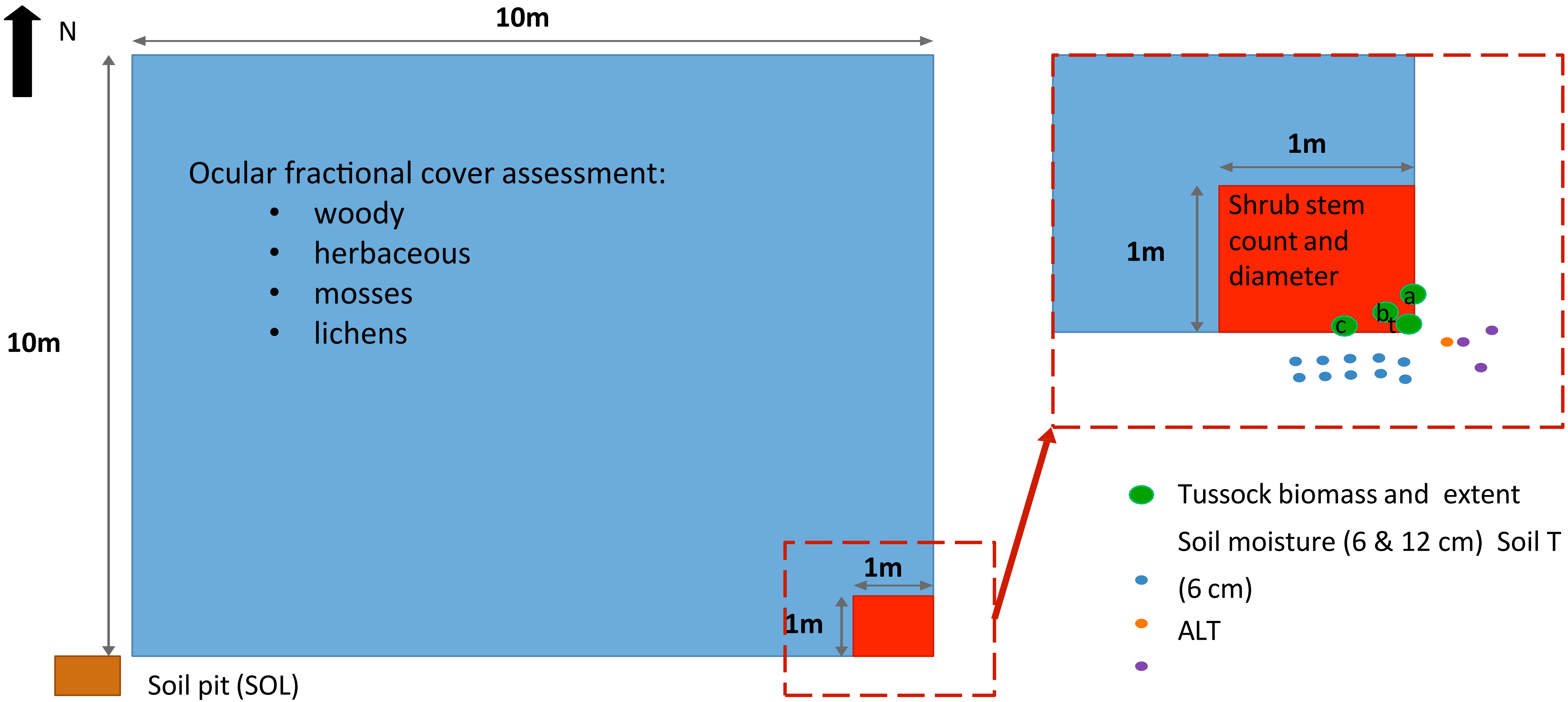
  (bear fence, bear barrels, water pun etc.)
  - backup equipment
  - personal gear

Sampling protocol

Schematic layout for sampling



Schematic plot layout



2016 Field campaign: outcomes

- 101 miles/163 km of Noatak River covered
- ~43 km of tundra hiked/bushwhacked
- 13 burns visited
  - We found a "unknown" fire (not in the Alaska Large Fire Database)!
- Total collected measurements:
  - 72 full suites in burned plots
  - 9 full suites of data in unburned plots
  - 419 point measurements for soil T and ALT along transects
  - Brought out 3 soil samples to calibrate soil moisture probe measurements.

2016 Field campaign: animal count

- 6 Musk-Ox
- ~7 bears including one in the water ~30 meters from the boat
- Wolf pups
- Moose w calf
- Many golden eagles
- Many hawks
- Many ospreys
- Many owls
- 1 frog (weird, right?)
- NO caribou!

2016 Field campaign: challenges

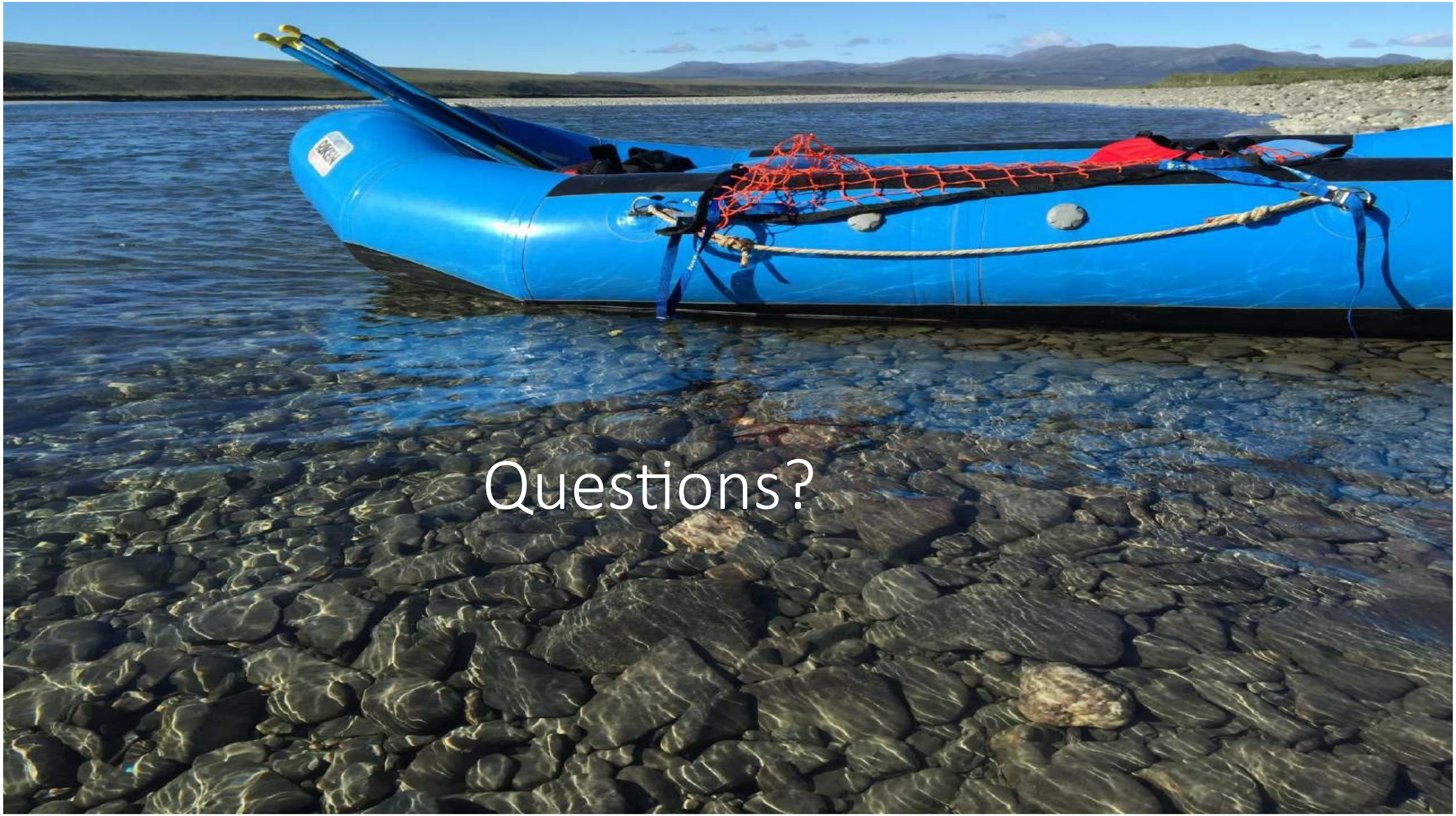
- Extensive sampling is very hard on the instruments (lost 2 soil T probes – were able to fix 1 with duct tape)
- “Wear and tear” on researchers
  - physical strain
  - food
  - prolonged continuous exposure to the elements

2016 Field campaign: lessons learned

- Length of working day must be limited to <10 hours and < 8 km of (~5 km preferred) bushwhacking to ensure crew safety and ability to carry out a field season.
- A short ("weekend") trip to the civilization is highly recommended (if conditions allow) to resupply and recharge
- There are interesting sites within a reasonable proximity to the river that are extremely difficult to access without the helicopter (we had to abandon several)
- Careful and early planning is key for collecting a representative sample

Future campaigns

- 2017 field season – Seward Peninsula
  - Road access from the Kougarok Rd/Nome-Taylor Highway
- 2018 field season – TBD:
  - originally planned North slope – but fires are very small and few and far apart.
  - possibly return to Noatak to sample more intensively a smaller area where particularly interesting findings emerged from 2016 season.


Questions?

Michigan Tech Research Institute

Overview of Northwest Territories Field Collection 2015-2016

PI: Laura Bourgeau-Chavez, PhD

Co-Is: N.H. French, Evan Kane, S.L. Endres, E.Serocki, E. Ernst

Michigan Tech Research Institute

www.mtri.org

Project Goals and Objectives:

Focus 2014-15 NWT Wildfires

- GOAL: improve our understanding
- of the controls and impacts of climate change o
ecosystems

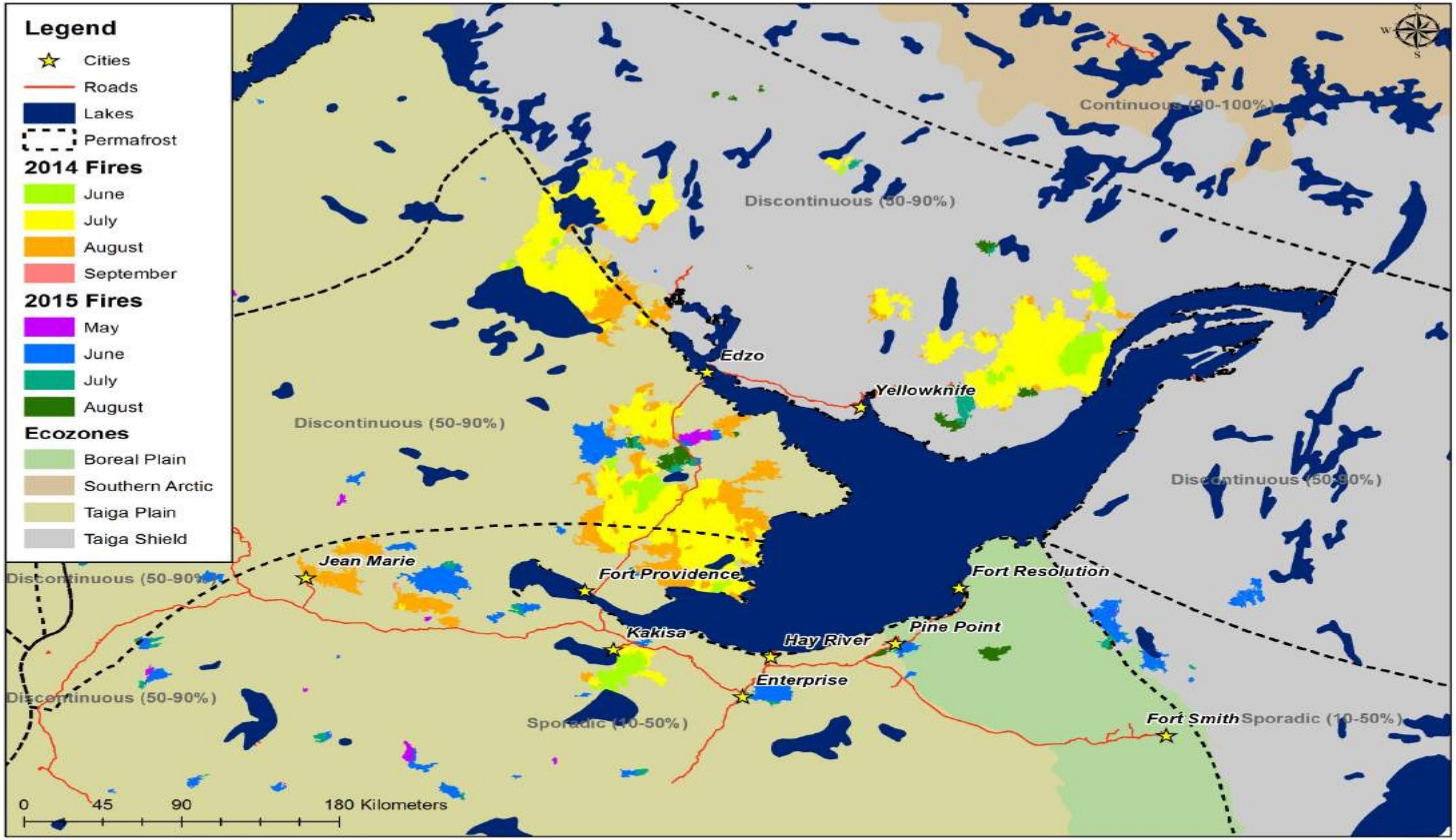
Summer 2014 photo of fire in NWT showing the diverse lowland landscape. *Photo from Environment and Natural Resources – GNWT*

- We aim to understand how fire severity is distributed and how pre-season moisture can be used to predict fire patt

- To do this, we are working to map a host of fac
and remote sensing data, including burn se
revegetation, and land cover.

Summer 2015 photo of fire in NWT from Hearne Lake

NWT Study Area – 2014-2015 Wildfires by month of burn



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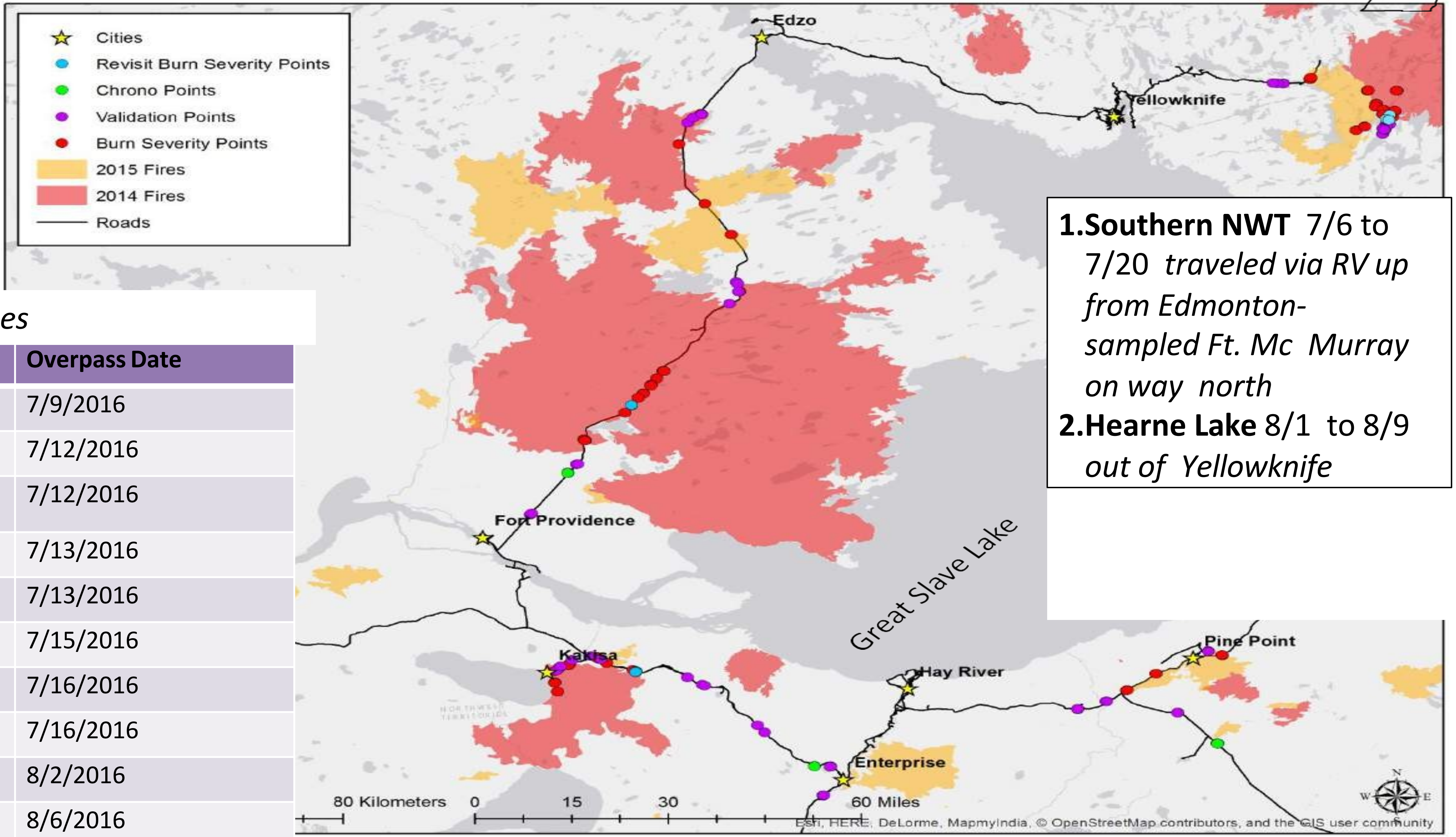
Timing and location of 2015- 2016 field work



Radarsat-2 Overpasses

Wildfire	Overpass Date
ZF20	7/9/2016
ZF2	7/12/2016
SS81 (West)	7/12/2016
SS28	7/13/2016
SS81 (East)	7/13/2016
SS27	7/15/2016
SS3	7/16/2016
SS50	7/16/2016
Hearne Lake	8/2/2016
Hearne Lake/Road	8/6/2016

1. **Southern NWT** 7/6 to 7/20 *traveled via RV up from Edmonton- sampled Ft. Mc Murray on way north*
2. **Hearne Lake** 8/1 to 8/9 *out of Yellowknife*

Types of Sites and Measurements

- Burned sites
  - Includes burn severity sampling, soil profile, soil moisture, depth to frozen and regrowth (2015-2016), tree aging (cookies)
  - Revisited some 2015 sites in 2016 to measure growth

- Ecosystem Validation sites (unburned)
  - 2016 sites included biophysical, soil moisture sampling and soil sample harvesting for fuel loading estimation (2x5x1 cm samples)
- Chronosequence (2016) – sampled a few older burns for regrowth and soil moisture

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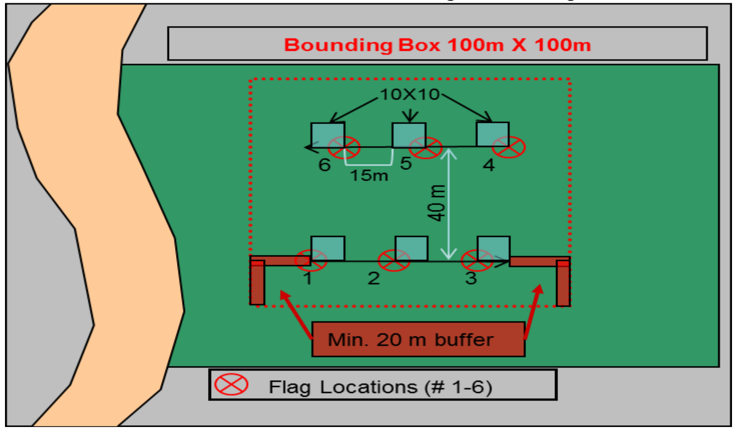
Methods used for assessing impacts of fire on soil organic layer

- Five classes of BSI for ground burn severity
  - Ocular assessment
  - % area in each class
  - Within each 10 x 10 m plot

General Overview of Study Site Layout



Uplands

The burn classes are based on those defined by Dyrness and Norum (1983) for boreal uplands which range from 1 to 5 and are described as:

1. unburned moss
2. singed moss
3. light burn, moss layer burned down to humus with no moss regrowth
4. moderate burn, surface burned almost to mineral soil with some moss regrowth
5. severe burn, mineral soil exposed

Peatlands

Modified Dyrness and Norum (1983) for peatlands :

1. unburned moss
2. singed moss, little consumption
3. light burn, some consumption, moss layer burned a few centimeters
4. moderate burn, surface burned to moderate depth
5. severe burn, deep burn with lots of char and ash

- Adventitious Roots
  - Measure depth from unburned surface to adventitious root. Take 3 measurements/tree, 5 per 10 x 10m plot, 6 plots per 100 m x 100 m site
- Measure depth of organic layer, soil moisture and temperature

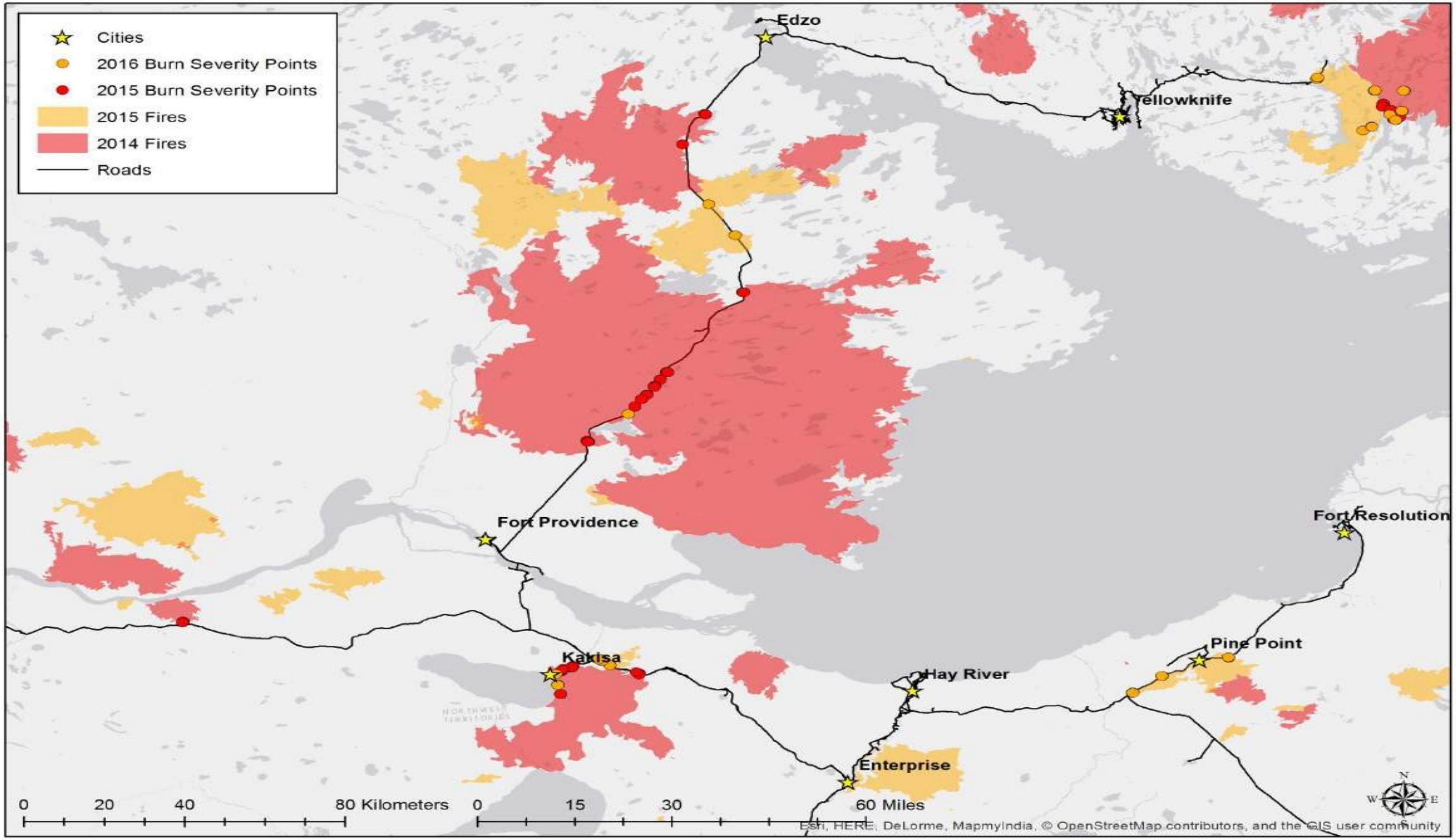
Burn Sites Data Collected

- Data collected
  - Burn Severity to each layer (canopy, shrub, ground)
  - Biophysical Information –pre burn biomass
  - Regrowth 1x1 plots
  - Soil Moisture Information
  - Depth of consumption - Adventitious roots
  - Depth to frozen ground
- 2015
  - 17 sites with all measurements
    - 7 Taiga Shield
    - 10 Taiga Plains
  - 13 additional sites collected without soil moisture or biophysical data
- 2016
  - 26 sites
    - 12 Taiga Shield
    - 14 Taiga Plains

Ecosystem Distribution
Burn Sites Sampled in 2015 & 2016

Year	Ecosystem	Number of Sites
2015	Bog	4
	Lowland Conifer	14
	Open/Shrubby Fen	6
	Treed Fen	2
	Upland Conifer	3
	Upland Deciduous	1
2016	Bog	9
	Lowland Conifer	6
	Open/Shrubby Fen	2
	Treed Fen	7
	Upland Conifer	2

Burn Severity Points



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Comparing Burn Severity in Adjacent Black Spruce – Tamarack sites Hearne Lake 2015 fire - ZF14

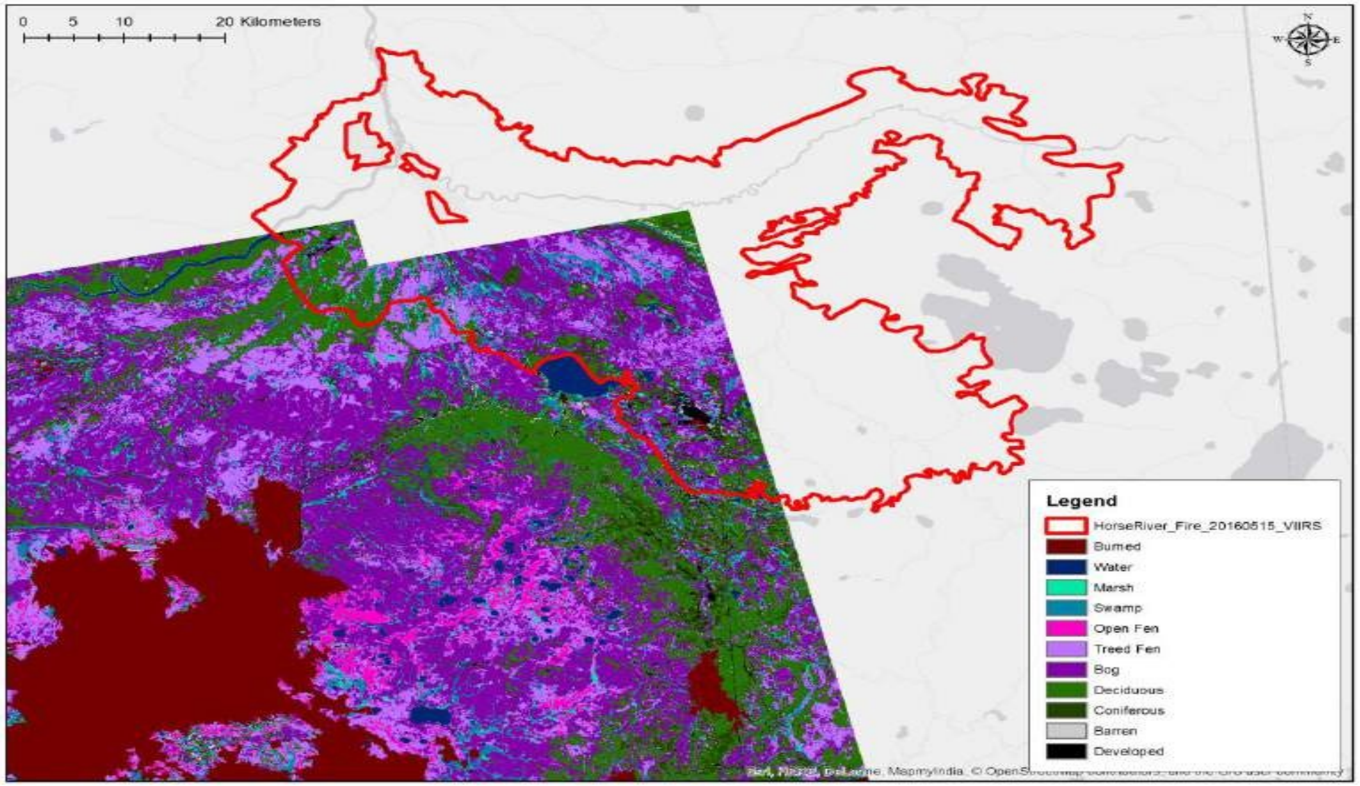
Severe Burn

Moderate Burn

Light Burn

2016 Fort McMurray Burned Sites

- 5 Sites in the area of the 2016 burn
- Burn severity and biophysical data only, no soil moisture



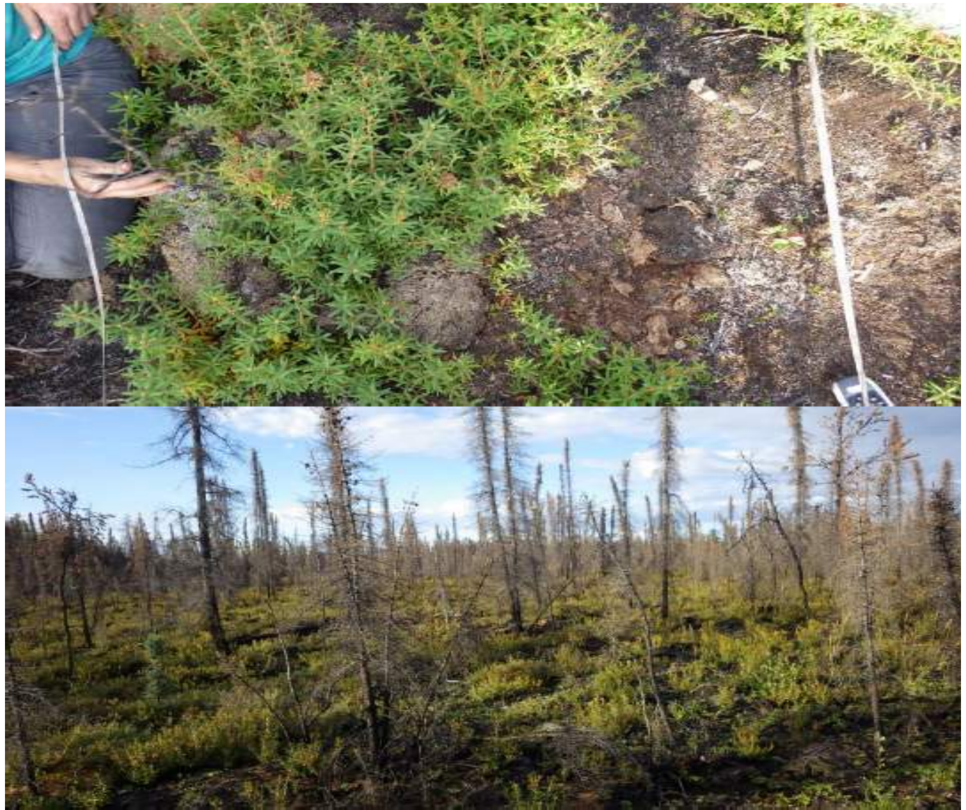
- Peatland mapping from previous project will be extended to entire burn

Revisit Burn Sites – year 1 and 2 post-fire

- 3 sites in Taiga Plains
  - 2 Shrub Fens,1 Open Fen
- 3 sites in Taiga Shield
  - 2 Bogs,1 Treed Fen

2015

2016



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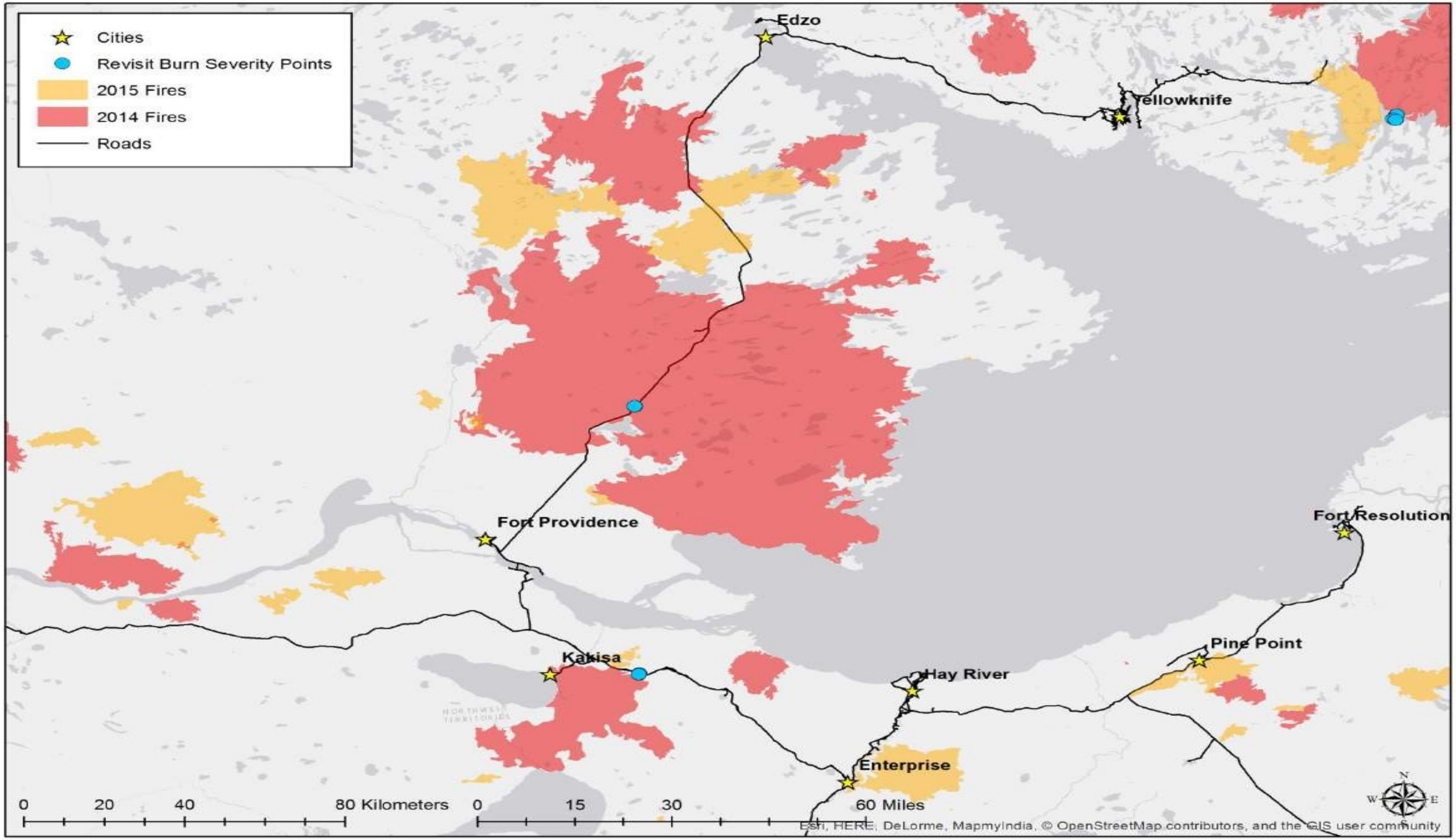
Revisited Burn Severity Points



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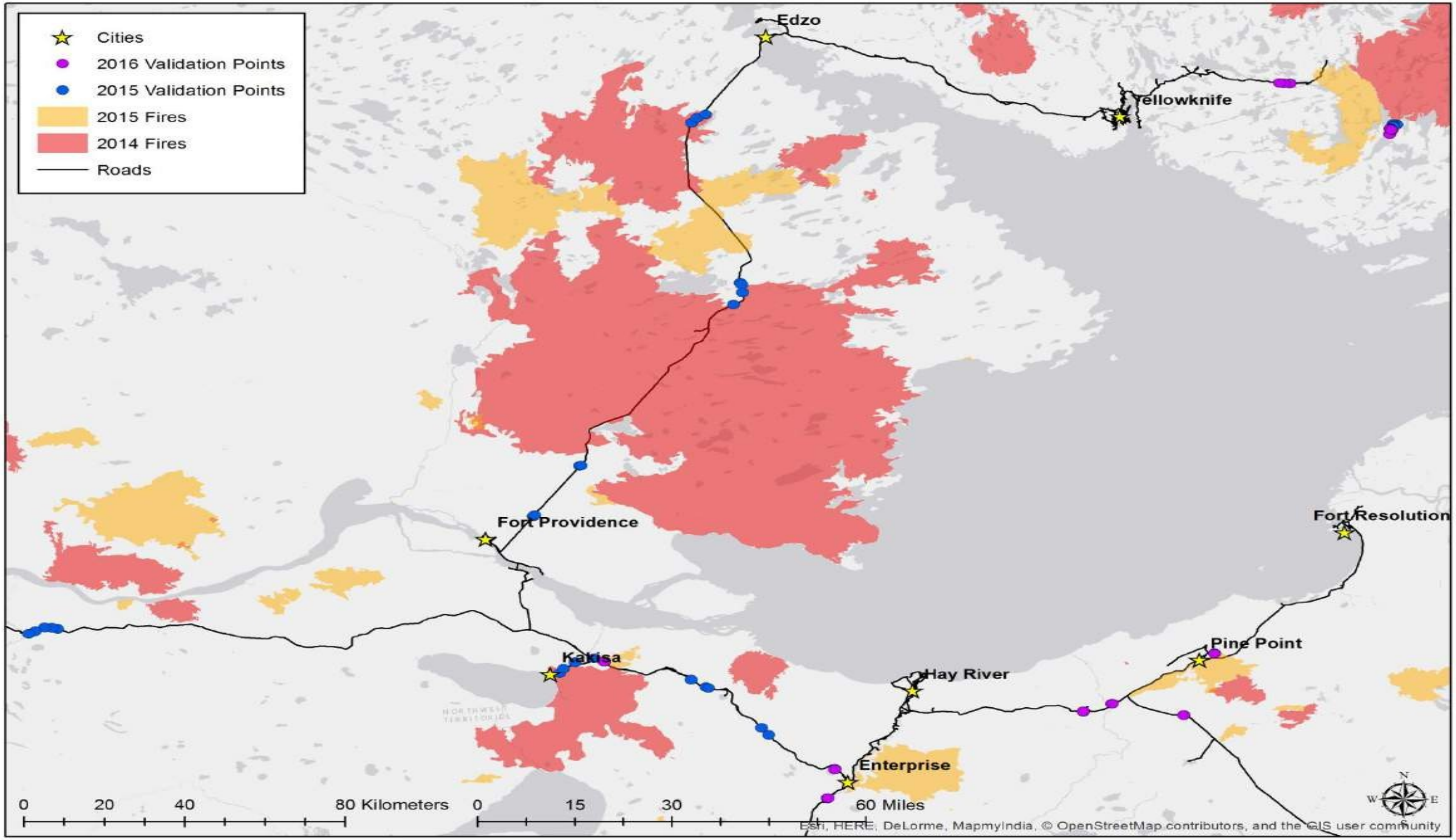
Ecosystem Validation Data

- Includes:
  - Cover types
  - Soil Information
  - Species List
  - Soil Moisture collected at 2016 sites
- 2015
  - 43 sites
    - 38 Taiga Plains
    - 5 Taiga Shield
- 2016
  - 13 Sites
    - 7 Taiga Plains
    - 6 Taiga Shield

Ecosystem Validation Sites



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Ecosystem Distribution Validation Data

Year	Ecosystem	Number of Sites
2015	Bog	11
	Lowland Conifer	9
	Lowland Deciduous Shrub	5
	Shrubby Fen	9
	Treed Fen	4
	Upland Conifer	4
	Upland Deciduous	1
2016	Bog	8
	Fen	4
	Lowland Conifer	1

- 2015 and 2016 data for training the peatland/land cover map classifier
- 13 Sites with soil moisture and soil samples harvested (2016 only) for soil moisture algorithm development from SAR and fuel loading database

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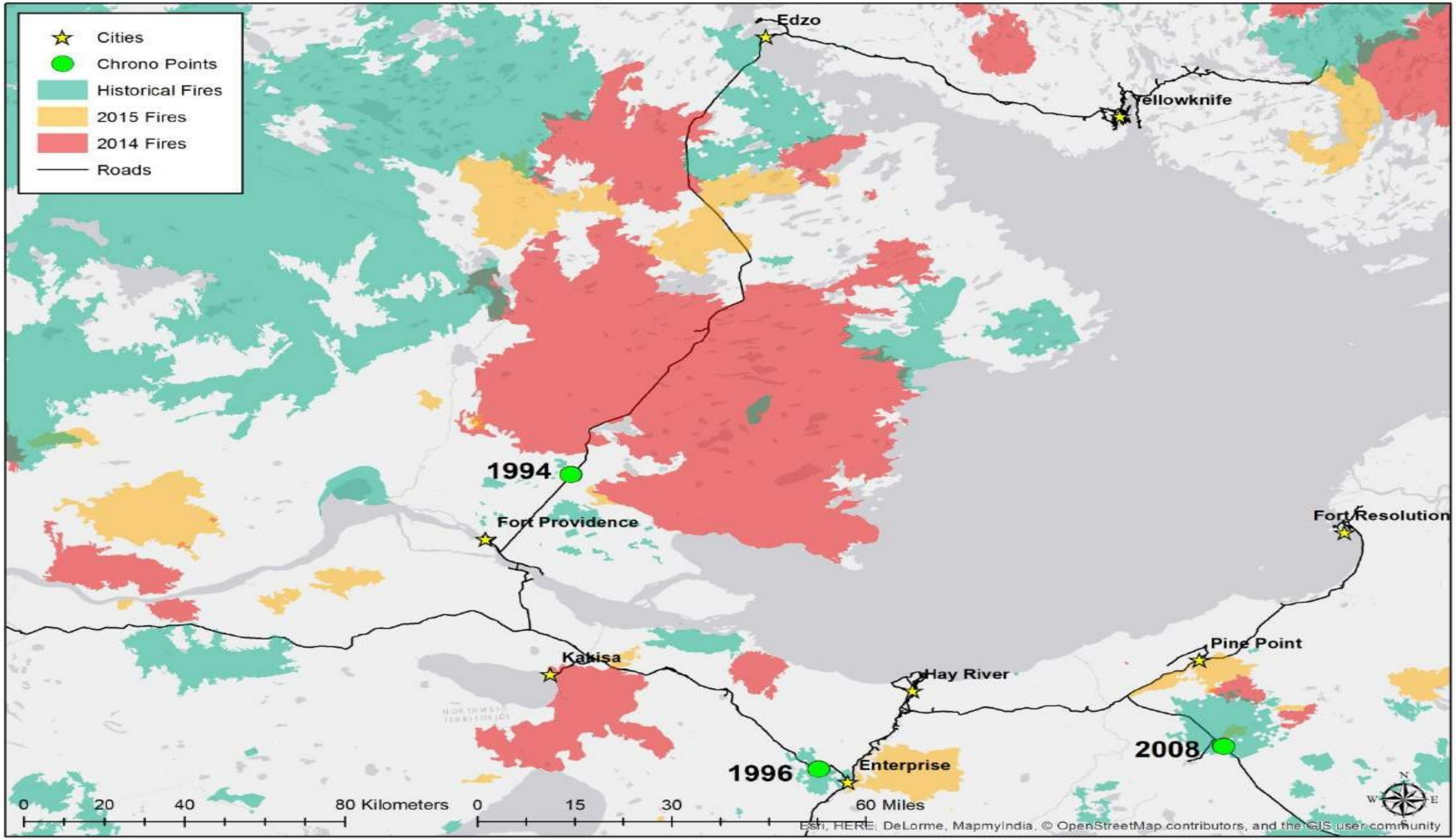
Older Burn (Chronosequence) Data

- 3 Sites on the Taiga Plains
  - 1994, 1996, 2008
- Includes:
  - Biophysical Data
  - Seedling Sprouting
  - Soil Moisture

2016 Older Burn Sample Sites



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Next Steps

- All data are entered – QAQC'ing data before analysis
- Assessing where we have data gaps (types of sites/permafrost zone/ecozone that are of low number)
- Travel to Canadian Forest Service in Sault St. Marie to meet with collaborators on project status, needs, and retrieve tree cookies that were shipped there temporarily.
- Calculate field burn severity indices for training and validation of Landsat peatland burn severity algorithm
  - Landsat data from all fires pre- and post-fire are ready for analysis
- Large bucket samples harvested will be used to calibrate the new probes and the old Hydrosense probes to the organic soils of the NWT study sites.
  - Calibrated in situ moisture will be used to develop SAR soil moisture retrieval algorithms for the burn and non-burned sites
- Field validation data will be used for the peatland mapping
- Biophysical and soil profile harvested samples will be used for fuel loading database development for CanFIRE fire emissions modeling