Ministry of Natural Resources and Forestry

Post-fire Residual Forest Patterns in Boreal Forest Lake Watersheds

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Introduction

- The structure and dynamics of boreal forests are strongly influenced by natural disturbance, predominantly wildfire.
- Forest fires regularly modify forest structure within boreal watersheds.
- In shoreline (riparian) forests, forest fire may burn to the edge of water but also leaves areas of mature forest, potentially in area of higher soil moisture.
- Emulating natural disturbance patterns (END) through forest management requires a better understanding of these patterns within watersheds and shoreline forests.

Natural Disturbance Patterns within Watersheds and Shoreline Areas

- What proportion of lake watersheds are burned?
- How much shoreline is affected by fire?
- How much residual shoreline forest remains?
- Is shoreline residual associated with hydrologic connection areas?

Methods

- We used Ontario's eFRI imagery, collected between 2006 and 2009, to quantify fire disturbance in boreal lakesheds and shorelines.
- 26 wildfires (>40 ha in area) that burned within two years of image collection
- Lakesheds of 123 fire affected lakes (surface area ≥5 ha)

❖We used ArcGIS and Ontario's eFRI GIS data to digitize burn patterns associated with fires that intersected lakesheds within the study area

❖Burned and unburned residual polygons within lakesheds were digitized

❖The shorelines of burned lakes were generated from the eFRI polygon feature classes and burn patterns were digitized from imagery.

Fire Disturbance in Lakesheds

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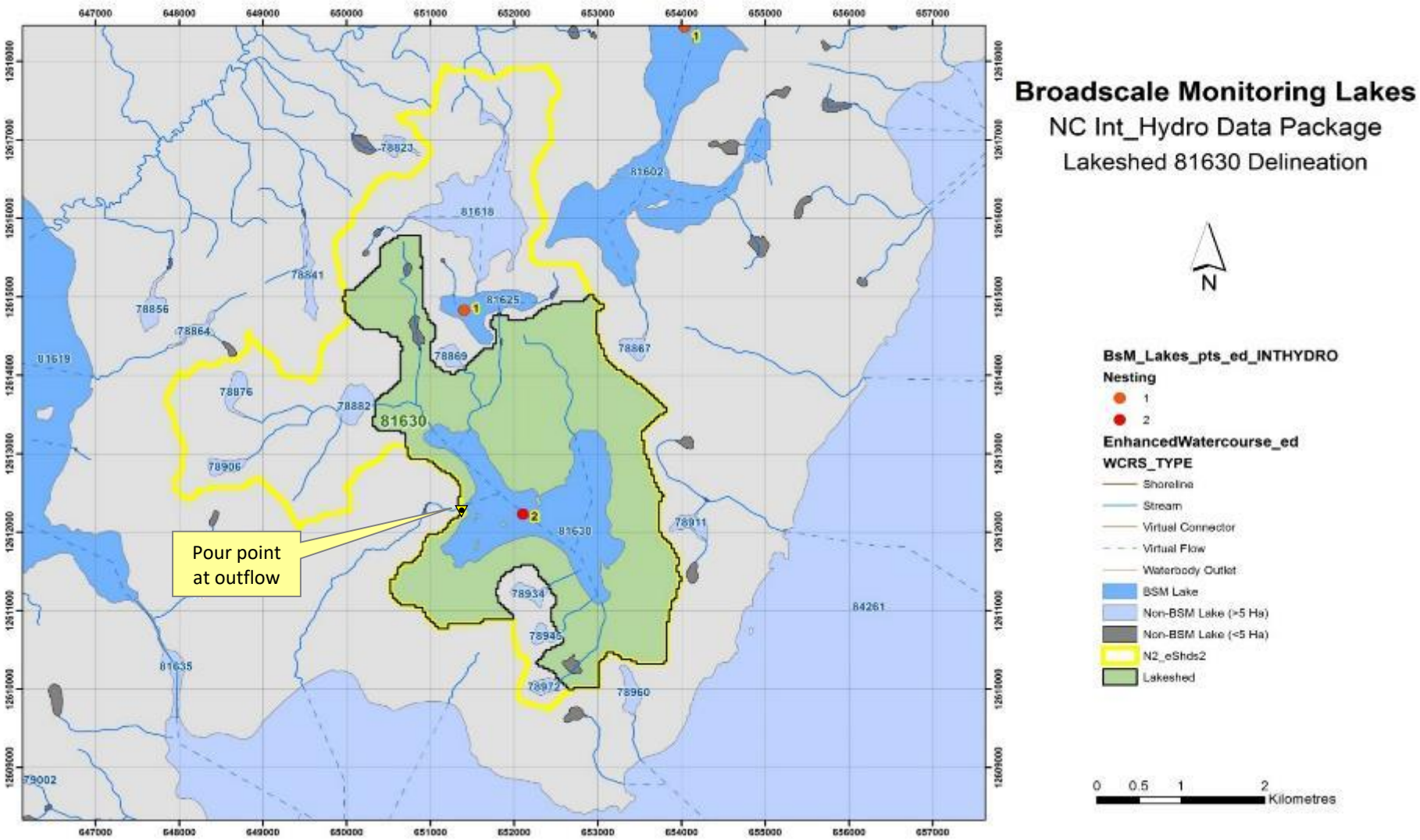
‘Lakeshed’ Delineation



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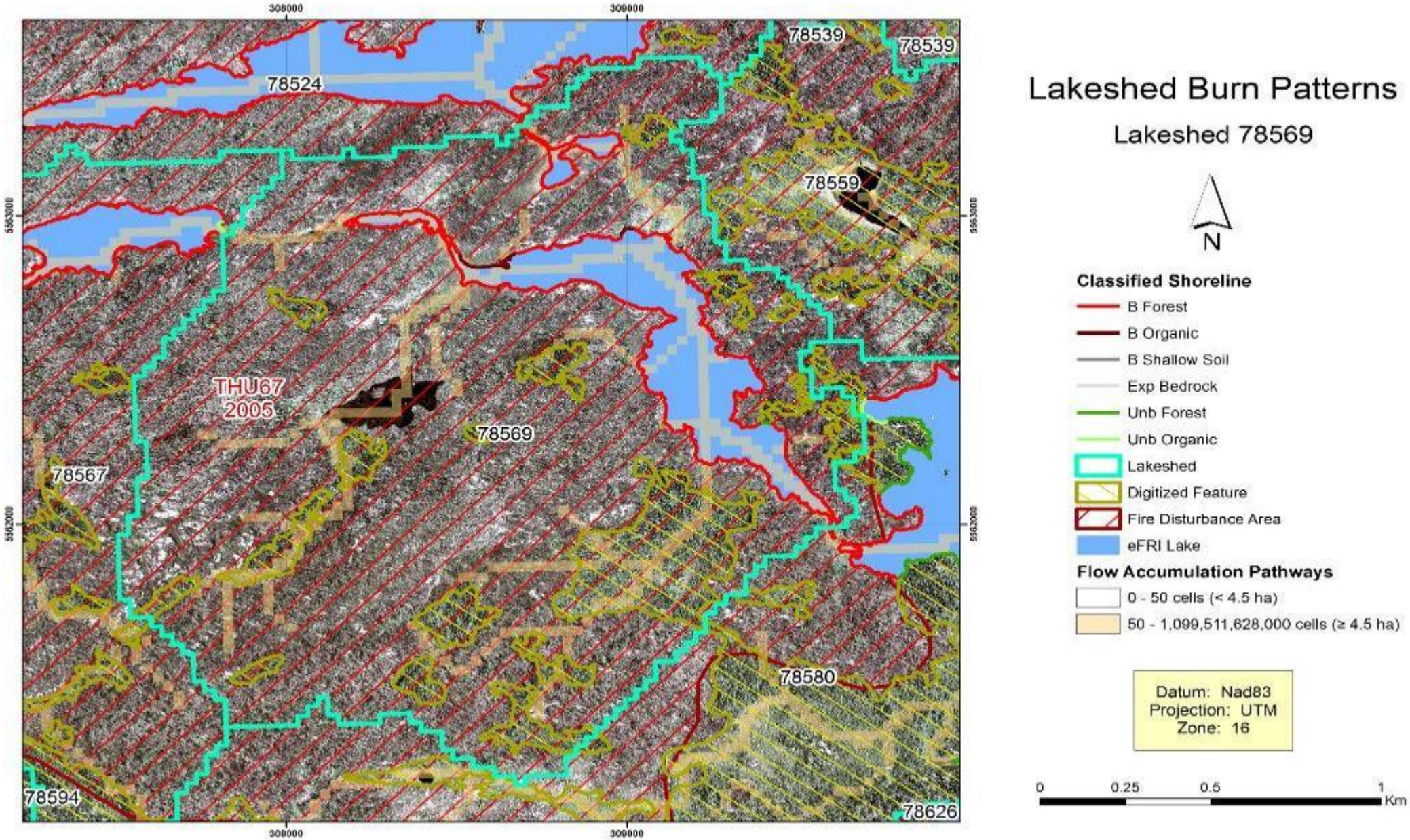
308000
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78539
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78559
THU67
2005
78569
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78580
78594
78626
5963000
5962000
Lakeshed Burn Patterns
Lakeshed 78569
N
Classified Shoreline
B Forest
B Organic
B Shallow Soil
Exp Bedrock
Unb Forest
Unb Organic
Lakeshed
Digitized Feature
Fire Disturbance Area
eFRI Lake
Flow Accumulation Pathways
0 - 50 cells (< 4.5 ha)
50 - 1,099,511,628,000 cells (≥ 4.5 ha)
Datum: Nad83
Projection: UTM
Zone: 16
0
0.25
0.5
1
Km

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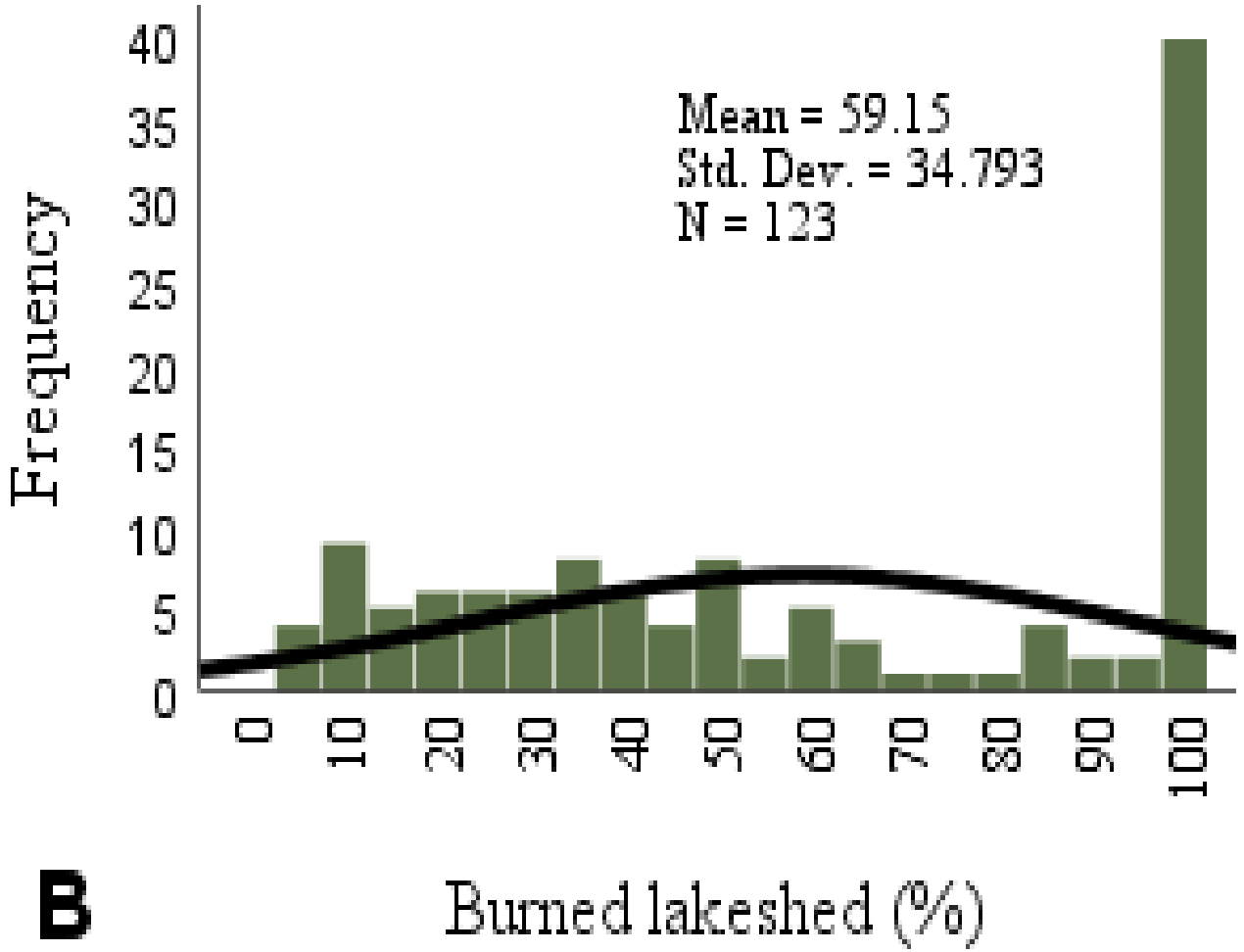
Lakeshed Area Burned



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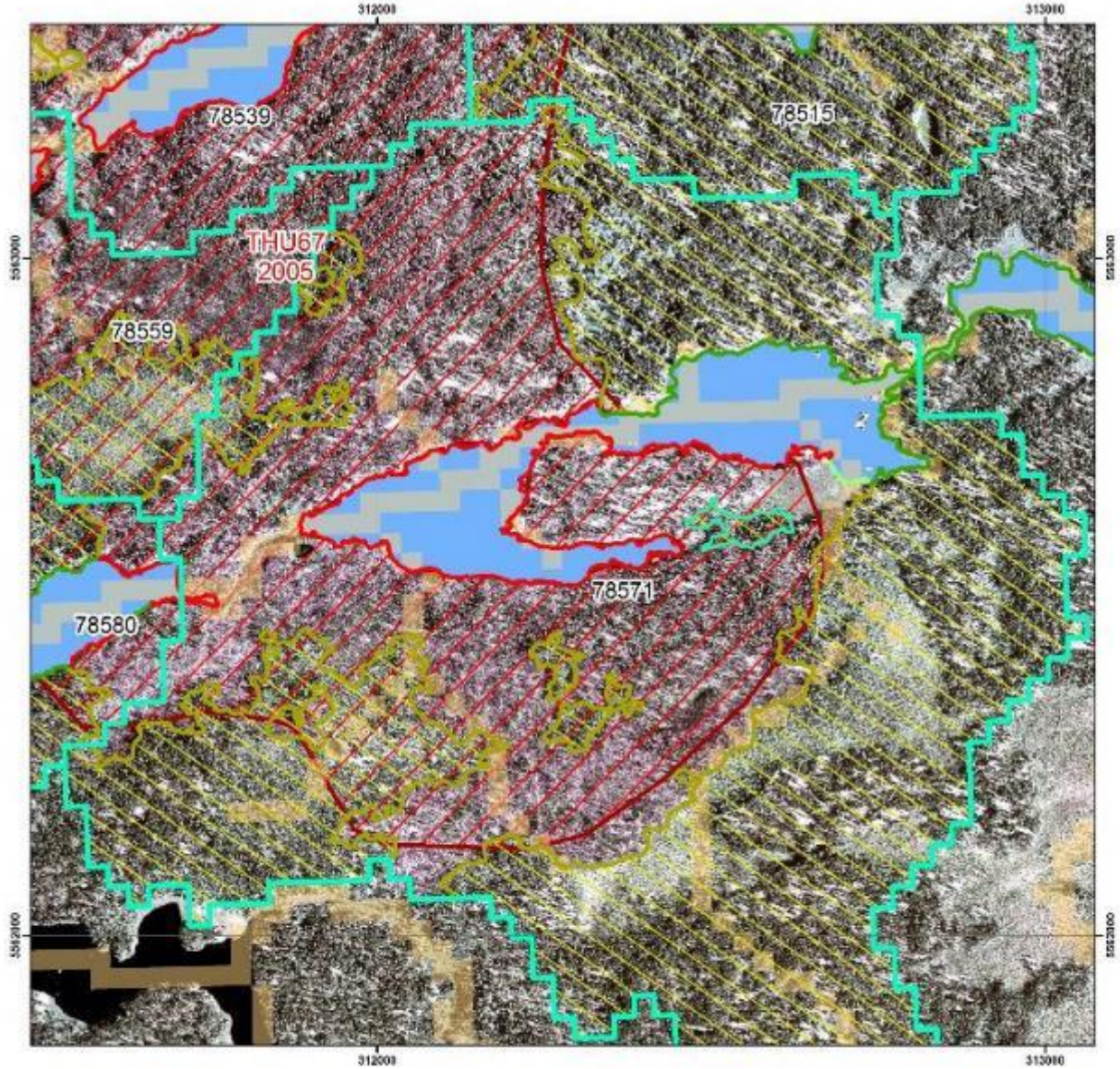

Lakeshed Burn Patterns

Lakeshed 78571

N

Classified Shoreline

- B Forest
- B Organic
- B Shallow Soil
- Exp Bedrock
- Unb Forest
- Unb Organic
- Lakeshed
- Digitized Feature
- Fire Disturbance Area

Flow Accumulation Pathways

- 0 - 50 cells (< 4.5 ha)
- 50 - 1,099,511,628,000 cells (≥ 4.5 ha)

Datum: Nad83
Projection: UTM
Zone: 16

0 0.125 0.25 0.5 Km

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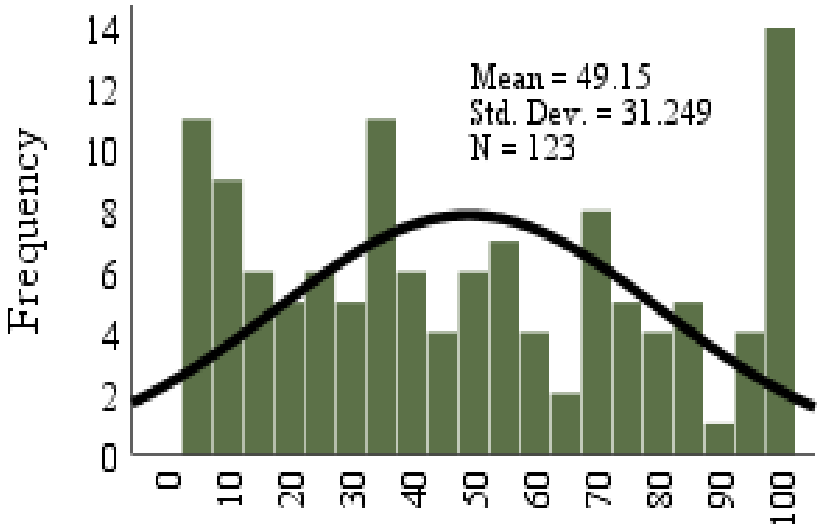
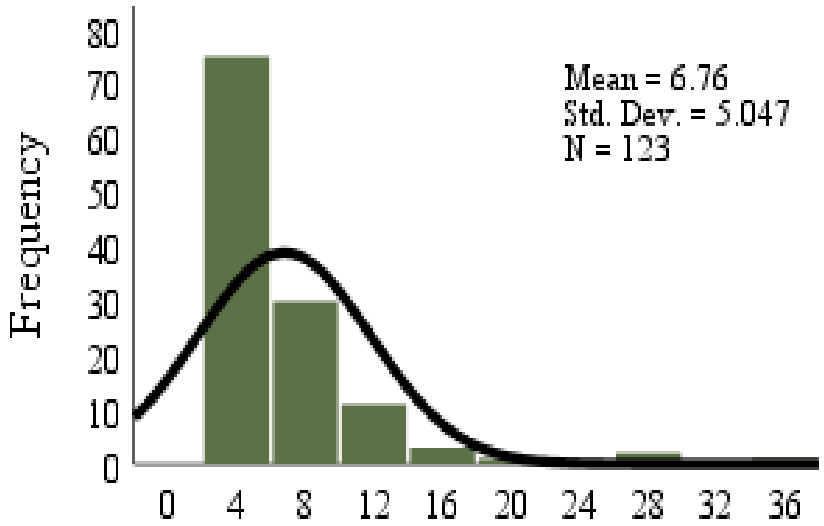
Lake Shoreline Burned



A



C

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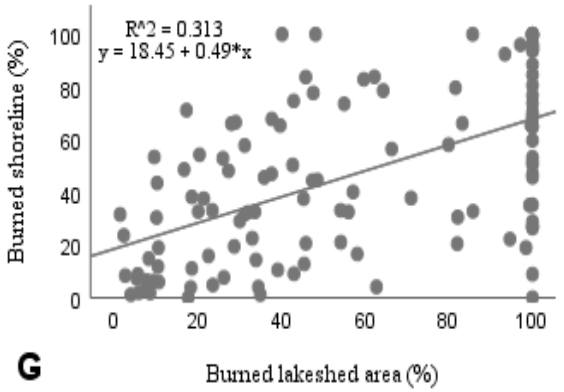
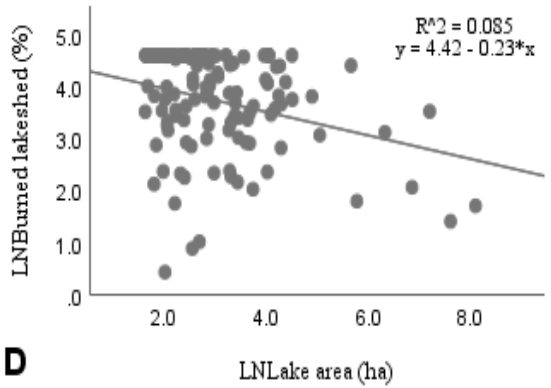
Lake and Lakeshed Size



G

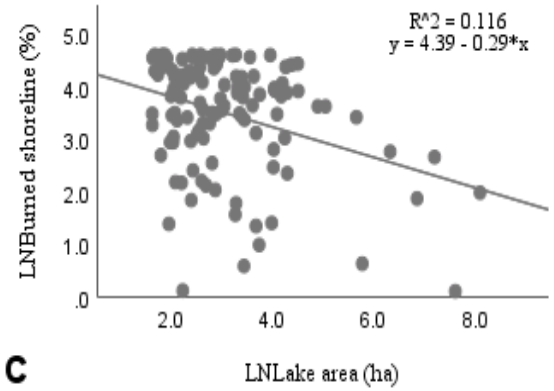
Shoreline disturbance is positively related to %lakeshed area burned



D

Larger lakes tend to have a lower percentage of their lakeshed burned

Larger lakes tend to have a lower percentage of their shoreline burned



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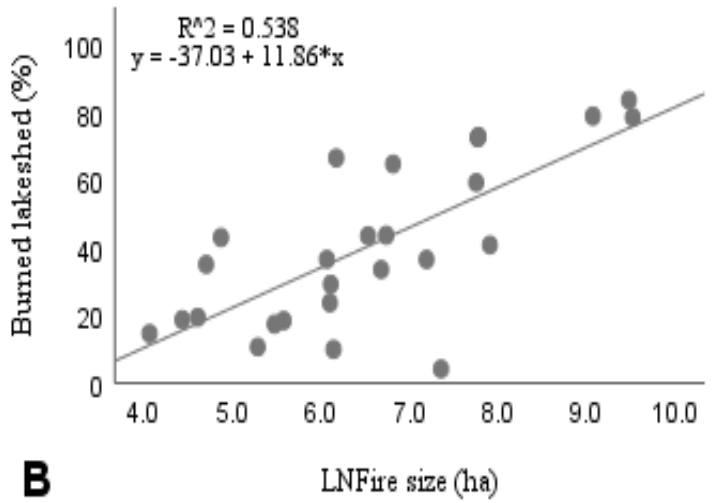
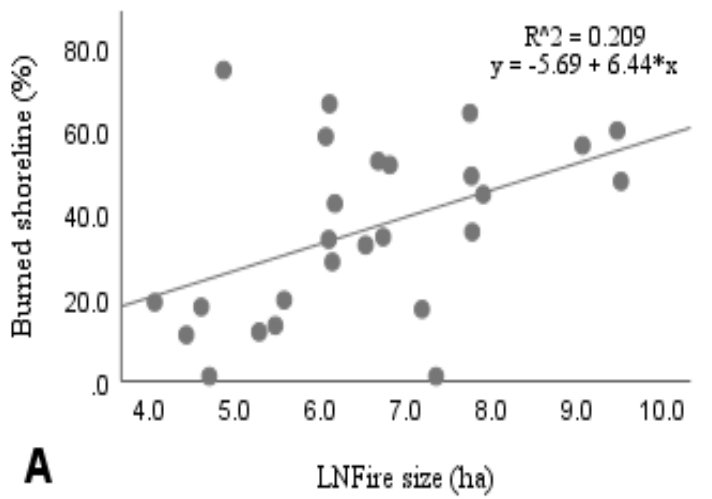
Fire Size



B

Larger fires burn greater percentage of lakesheds



A

Larger fires burn more shoreline area

12

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Shoreline forests

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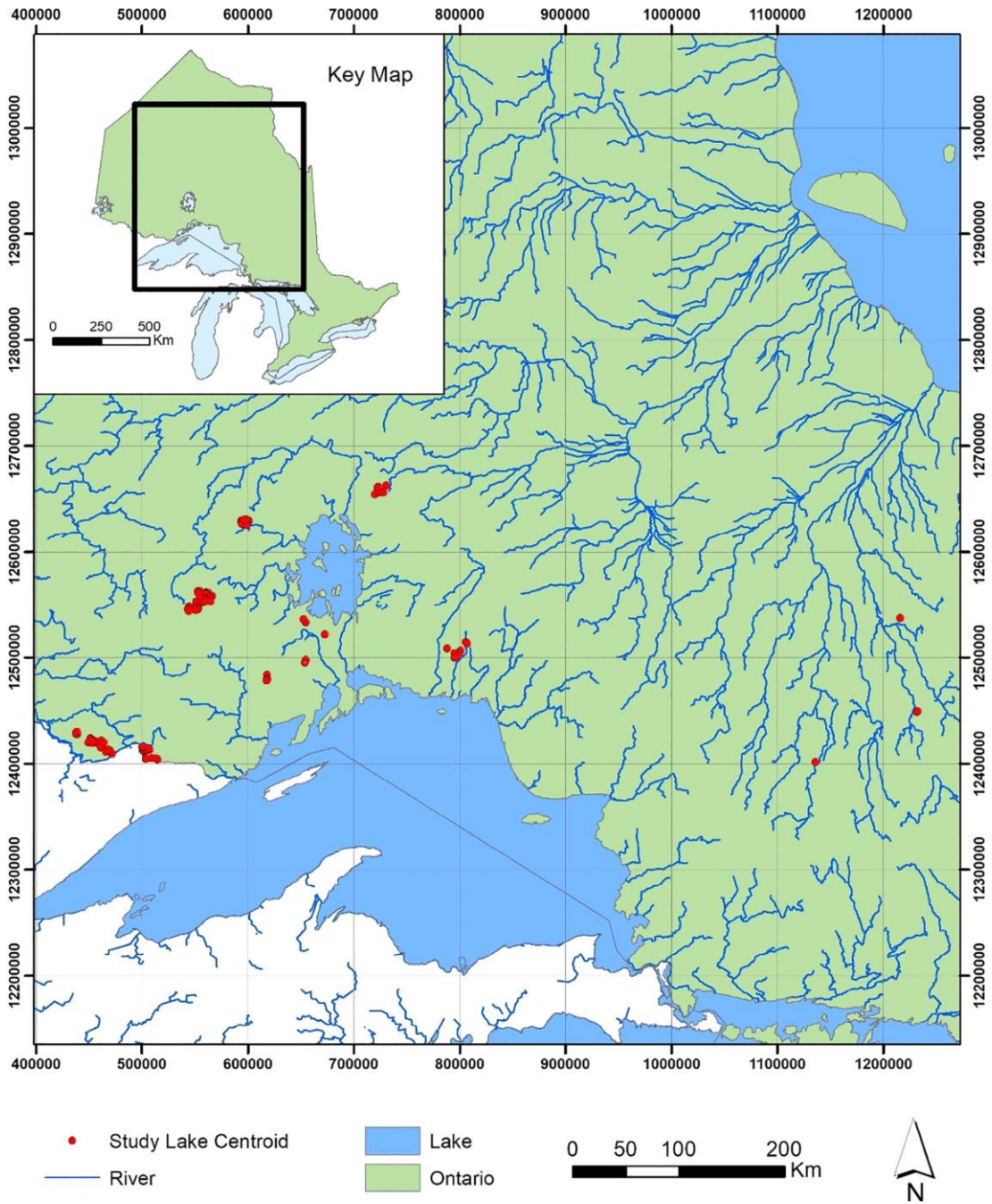
Shoreline Study Lakes (n=38)



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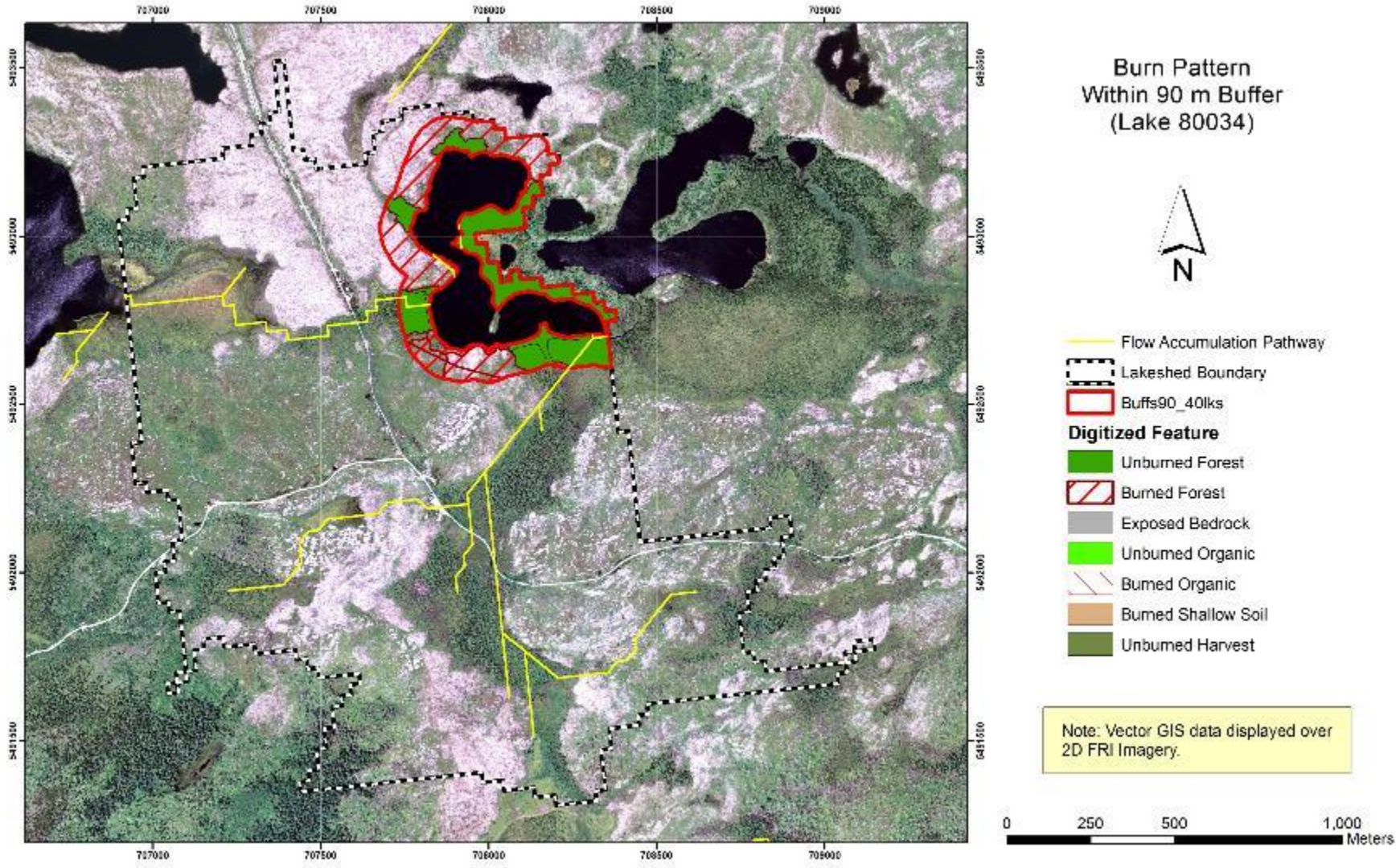
38 Lakes evaluated for Shoreline Residual Forest



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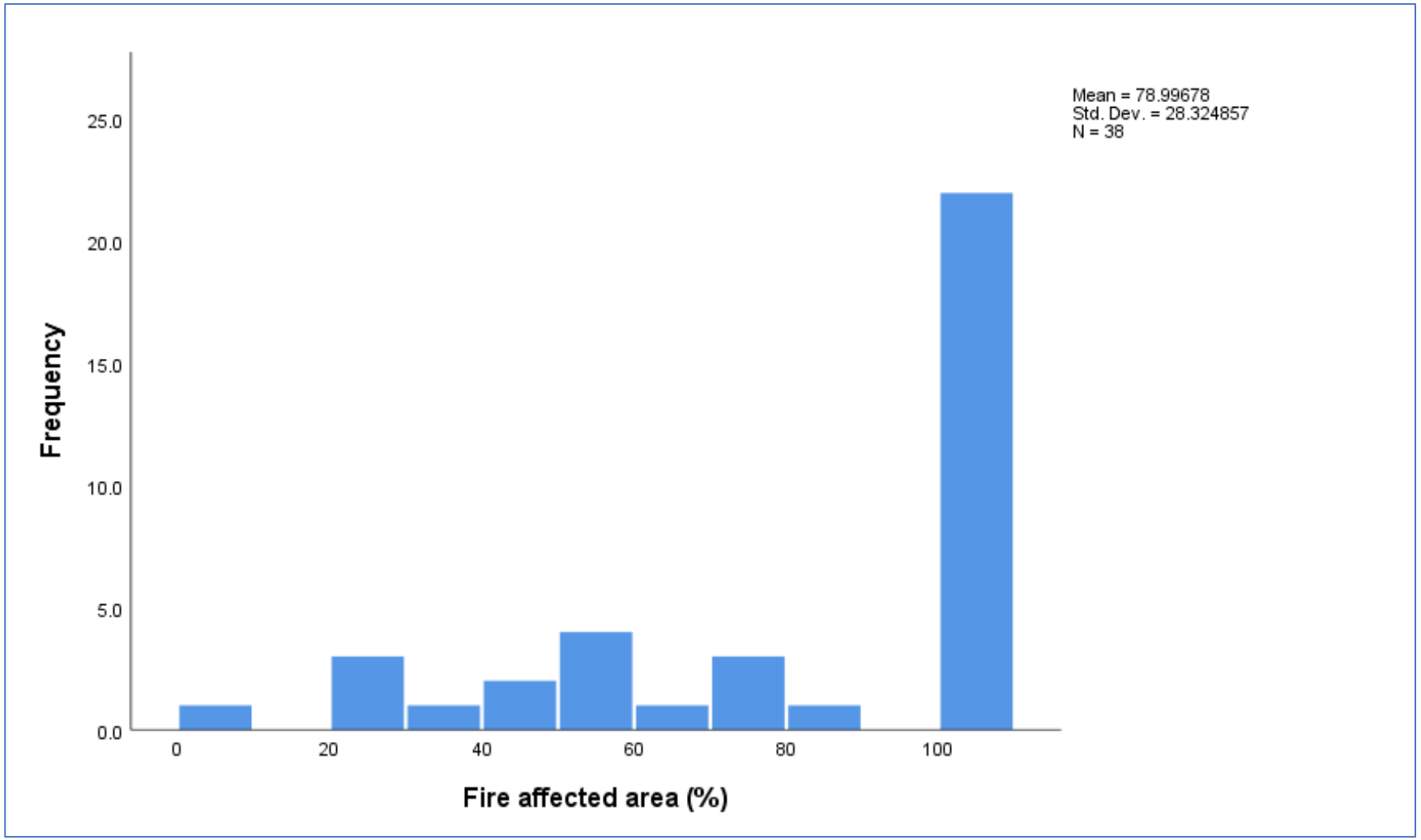
Shoreline Area Affected by Fire (%)



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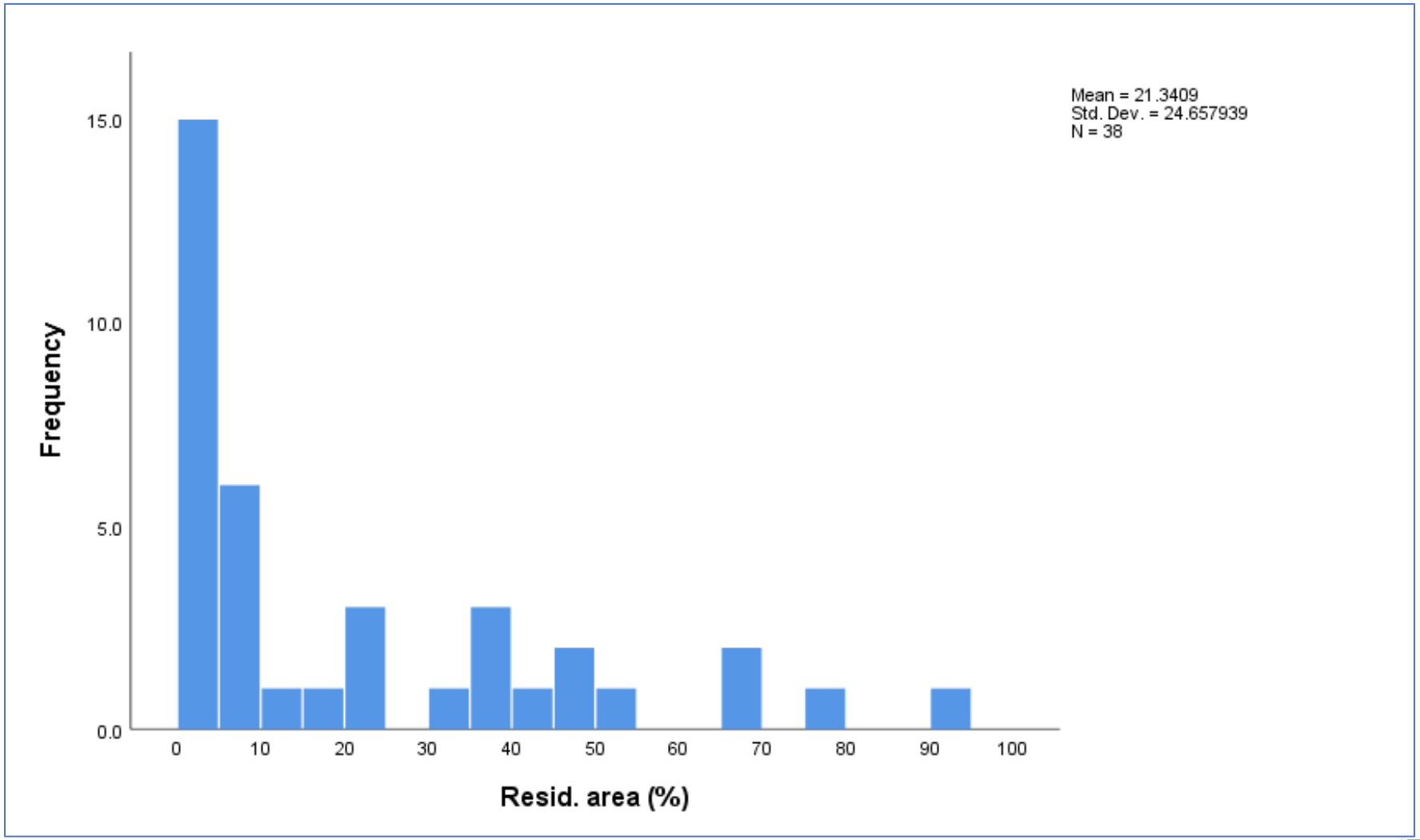
Residual Shoreline Forest within Fire Affected Area (%)



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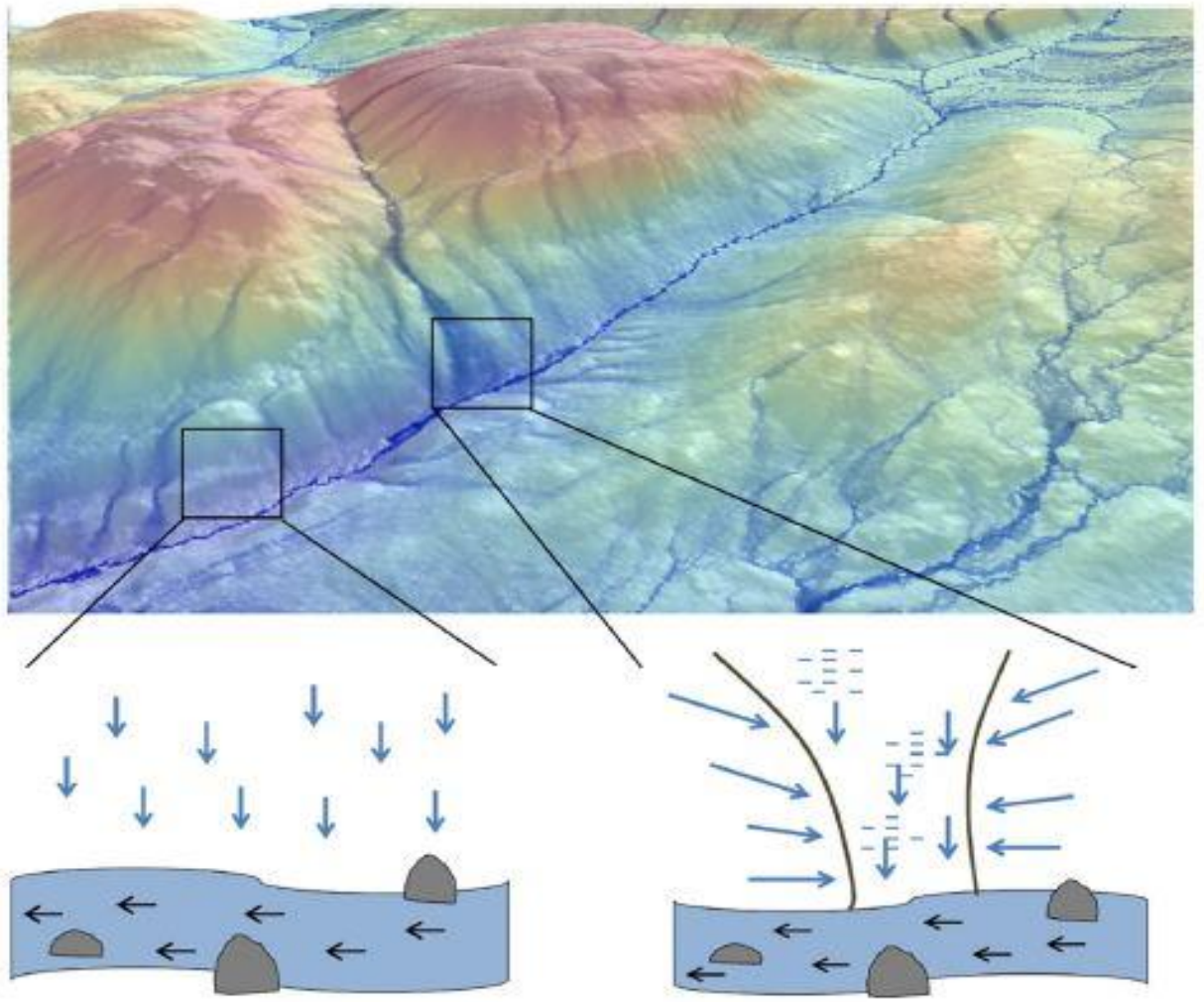
Hydrologic connection between terrestrial and aquatic stems

Hydrologic connection



From: Laudon et al. 2016 *Ambio*

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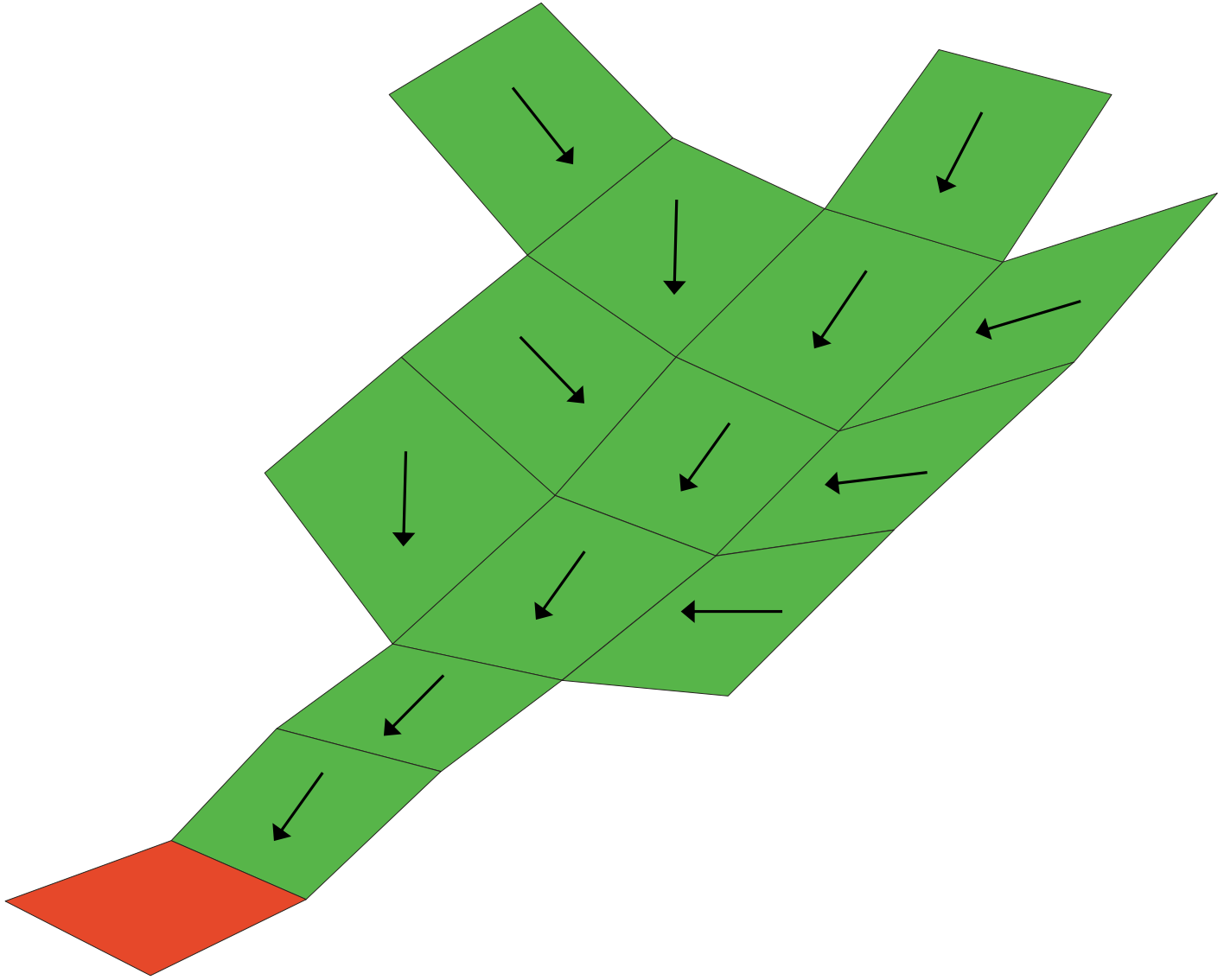
Flow Accumulation Model



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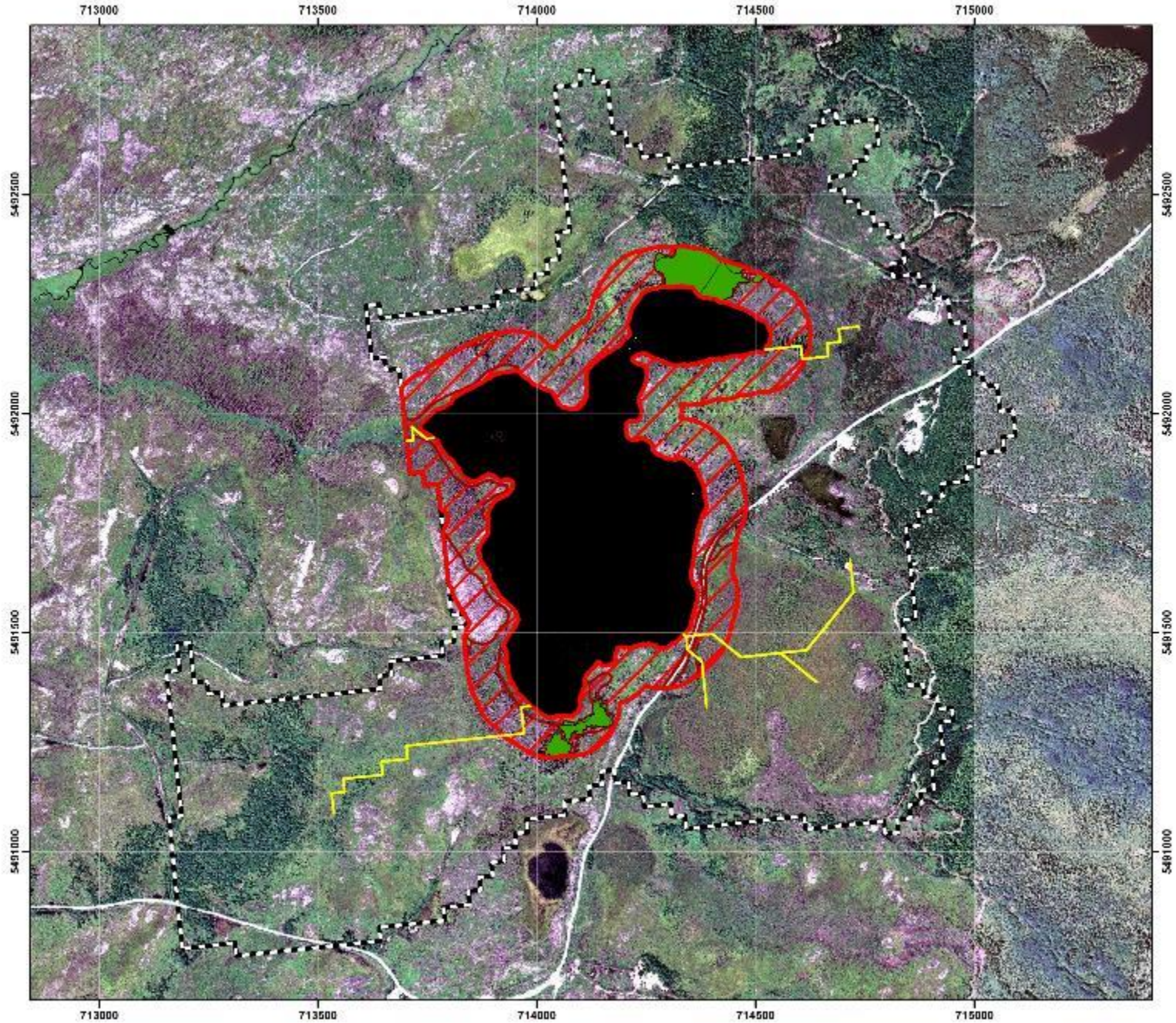


Burn Pattern Within 90 m Buffer (Lake 80060)

N

Flow Accumulation Pathway
Lakeshed Boundary
Buffs90_40lks

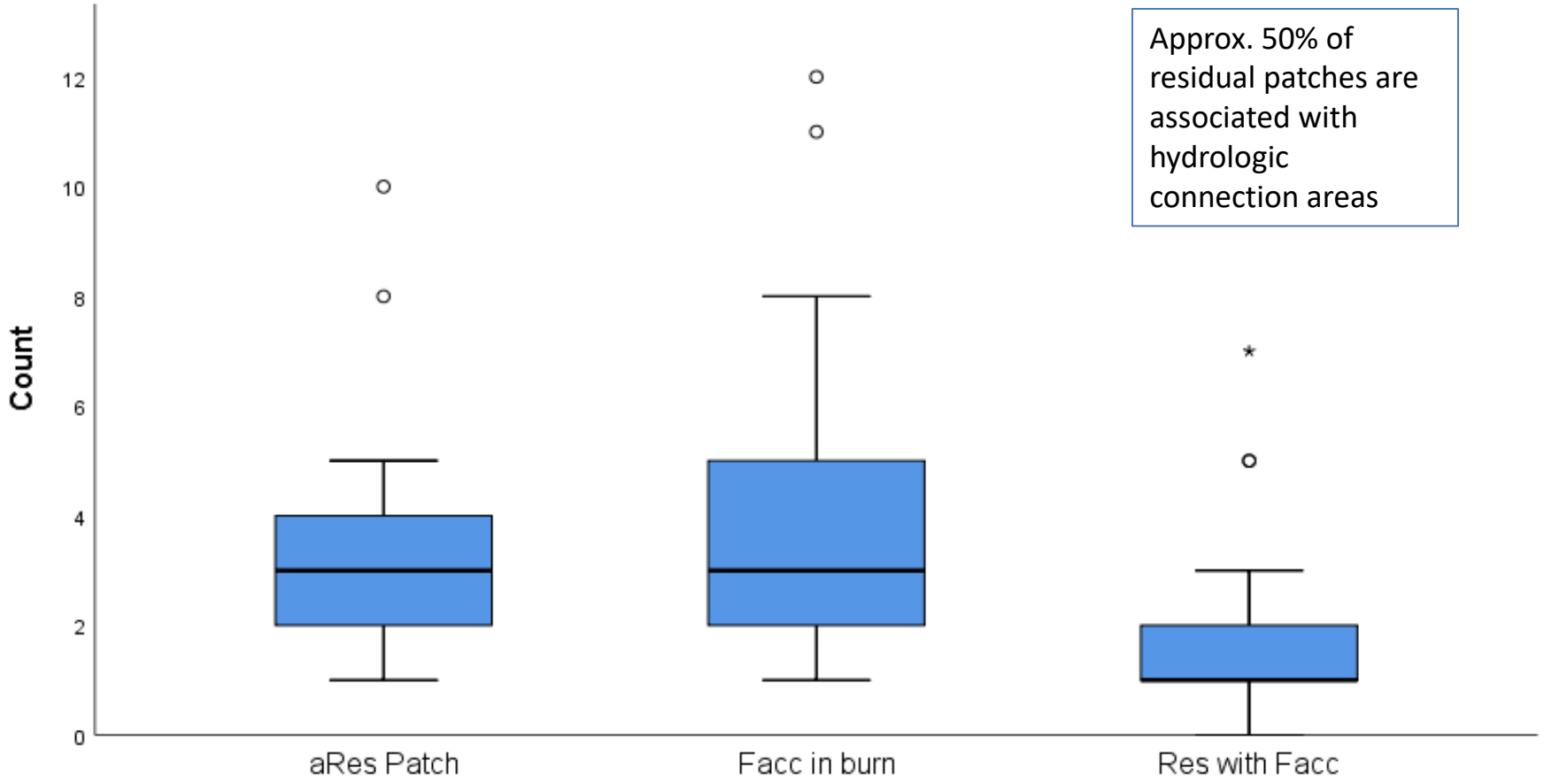
Digitized Feature

Unburned Forest
Burned Forest
Exposed Bedrock
Unburned Organic
Burned Organic
Burned Shallow Soil
Unburned Harvest

Note: Vector GIS data displayed over 2D FRI Imagery.

0 200 400 800
Meters

Residual Forest Associated with Hydrologic connections (n=35 lakes)



Approx. 50% of residual patches are associated with hydrologic connection areas

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Summary

- Proportion of lake watershed burned by wildfire is highly variable
- Lake shoreline forests are regularly disturbed by forest fire; proportion of shoreline disturbed is also highly variable
- Most disturbed shorelines retain residual forest patches
- Ongoing modelling work to predict location and size of shoreline residual patches

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How much boreal lake shoreline is burned by wildfire? Implications for emulating natural disturbance in riparian forest management

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Thanks

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Questions? Contact **Rob.Mackereth@Ontario.ca**