



Nibbling away: Cumulative effects and freshwater fish

OAI
Ontario Association for
Impact Assessment



WCSCanada
Dr. Cheryl Chetkiewicz

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Ontario's Far North

452,000 km²



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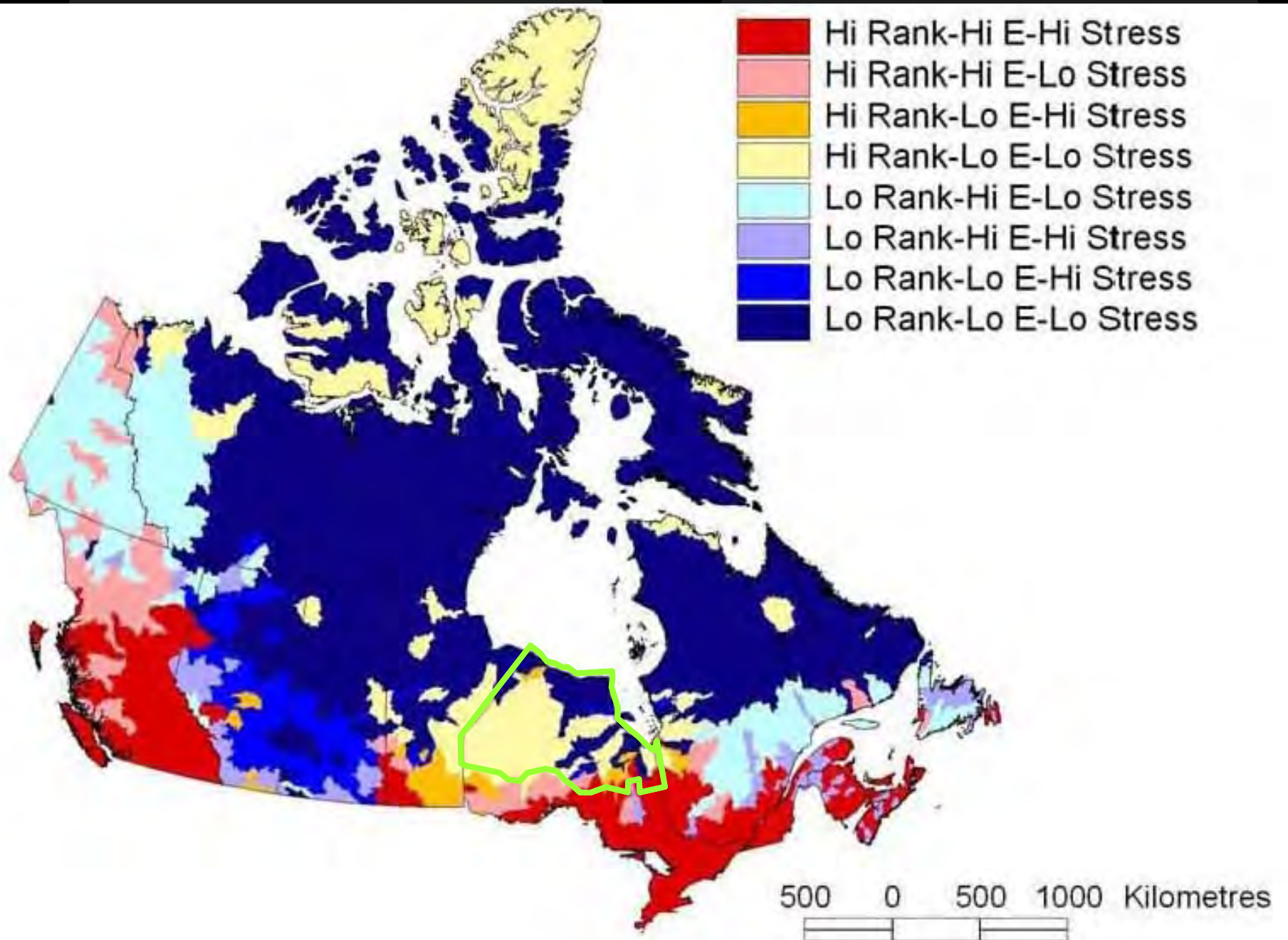


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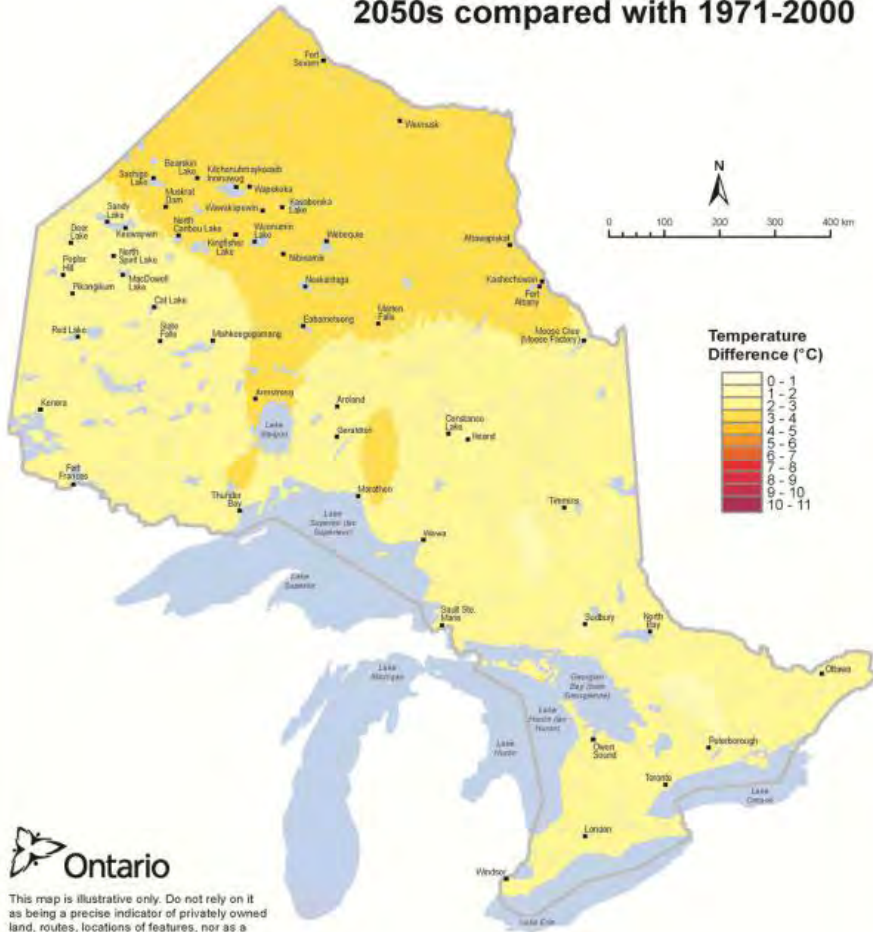
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Climate Change

Projected difference in average summer temperatures in the 2050s compared with 1971-2000

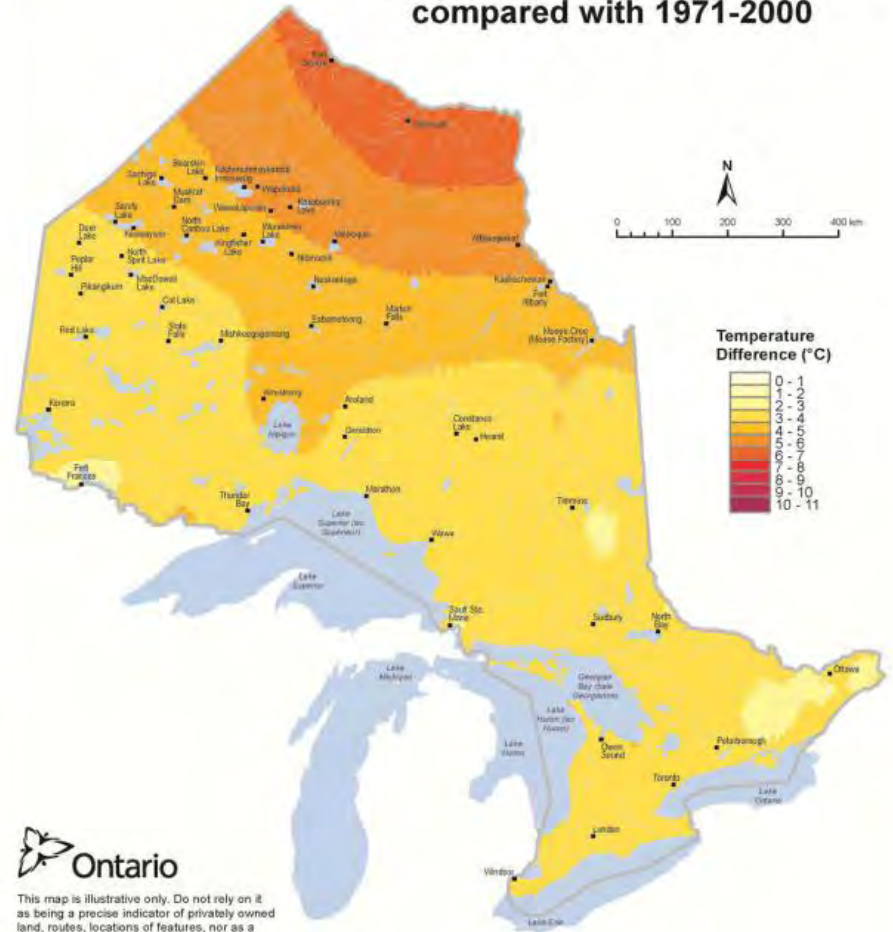


This map is illustrative only. Do not rely on it as being a precise indicator of privately owned land, routes, locations of features, nor as a guide to navigation. This map may also contain cartographic errors or omissions.

Projection: MNR Lambert Conformal Conic
Datum: North American 1983

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






Projected difference in average winter temperatures in the 2050s compared with 1971-2000



This map is illustrative only. Do not rely on it as being a precise indicator of privately owned land, routes, locations of features, nor as a guide to navigation. This map may also contain cartographic errors or omissions.

Projection: MNR Lambert Conformal Conic
Datum: North American 1983

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-  Far North Boundary
-  Major roads
- Ecozone**
-  Boreal Shield
-  Hudson Bay Lowlands
- Fish species occurrence data**
-  Royal Ontario Museum (1857 to 2014)
-  Aquatic Habitat Index (1968 to 1988)
-  Aquatic Resource Area (1997 to 2015)
-  Aquatic Resource Area (2009 to 2015)
-  Broadscale Monitoring (2012)



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0 50 100

QUEBEC

MANITOBA

Lake Nipigon

Lake Superior

Hudson Bay

James Bay

Severn R.

Winisk R.

Ekwan R.

Attawapiskat R.

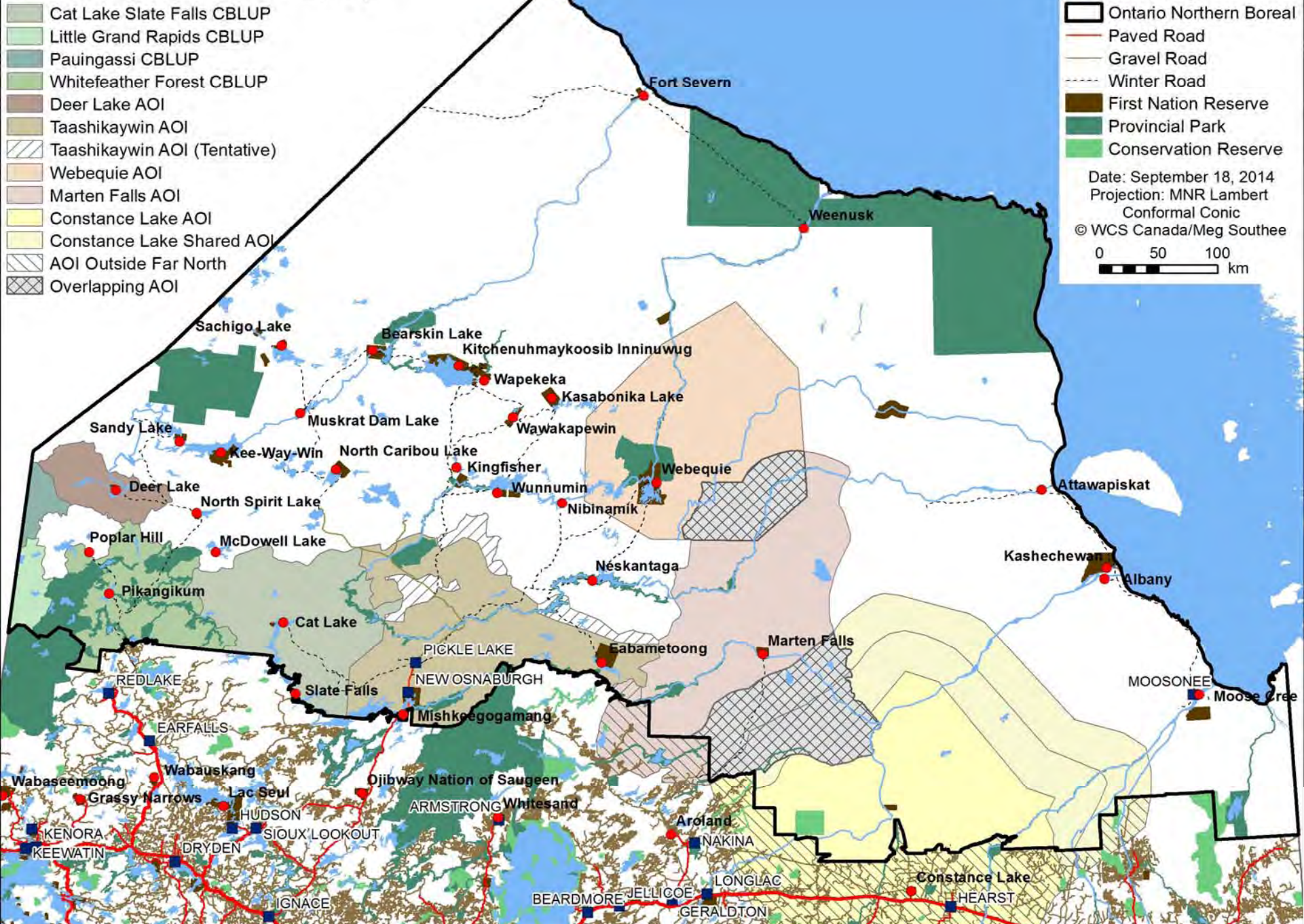
Albany R.

Moose R.

Community Based Land Use Plans (CBLUP) and Planning Areas of Interest (AOI)

- Cat Lake Slate Falls CBLUP
- Little Grand Rapids CBLUP
- Pauingassi CBLUP
- Whitefeather Forest CBLUP
- Deer Lake AOI
- Taashikaywin AOI
- Taashikaywin AOI (Tentative)
- Webequie AOI
- Marten Falls AOI
- Constance Lake AOI
- Constance Lake Shared AOI
- AOI Outside Far North
- Overlapping AOI

- First Nation Community
 - Community
 - Ontario Northern Boreal
 - Paved Road
 - Gravel Road
 - Winter Road
 - First Nation Reserve
 - Provincial Park
 - Conservation Reserve
- Date: September 18, 2014
 Projection: MNR Lambert Conformal Conic
 © WCS Canada/Meg Southee
- 0 50 100 km



Values



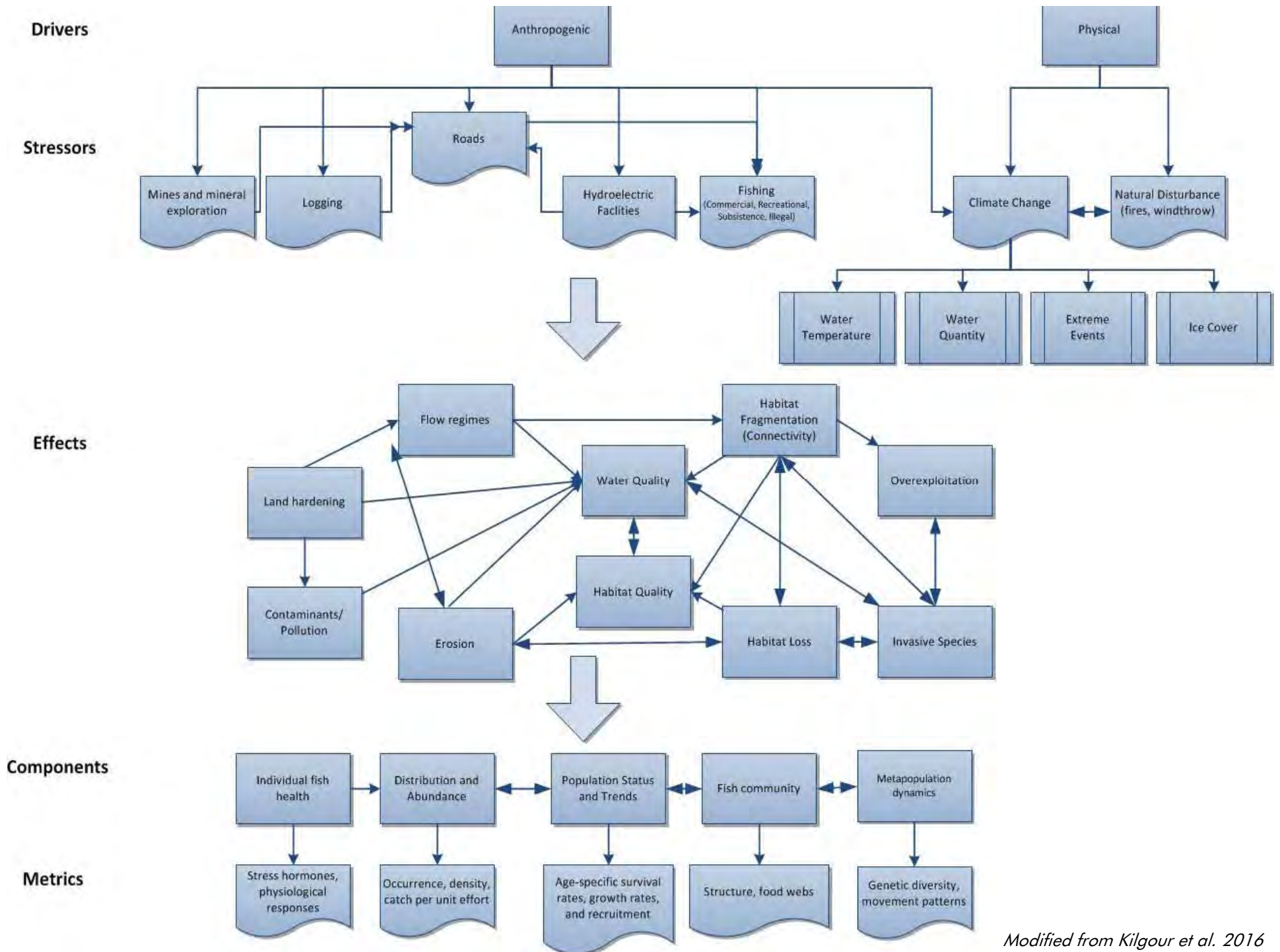
Social



Ecological



Economic

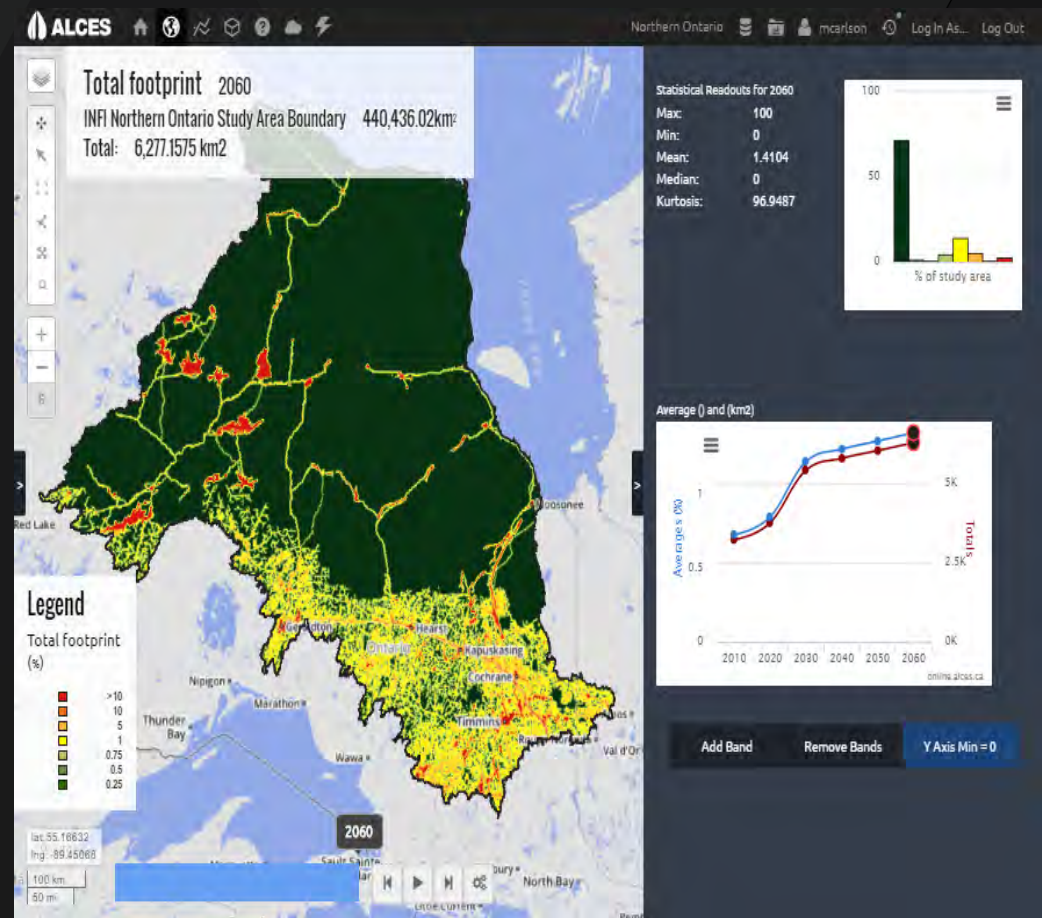


Modified from Kilgour et al. 2016

Considering cumulative effects



- Define land use and climate scenarios
- Simulate landscape dynamics
- Map species response



Study Area

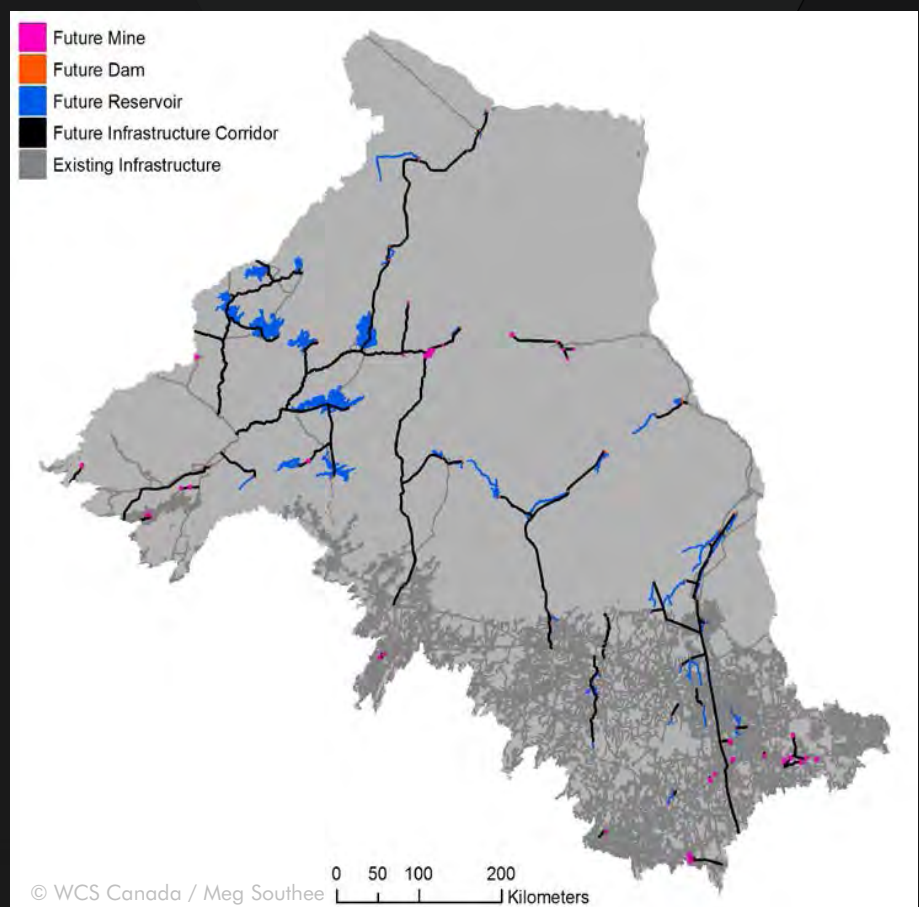
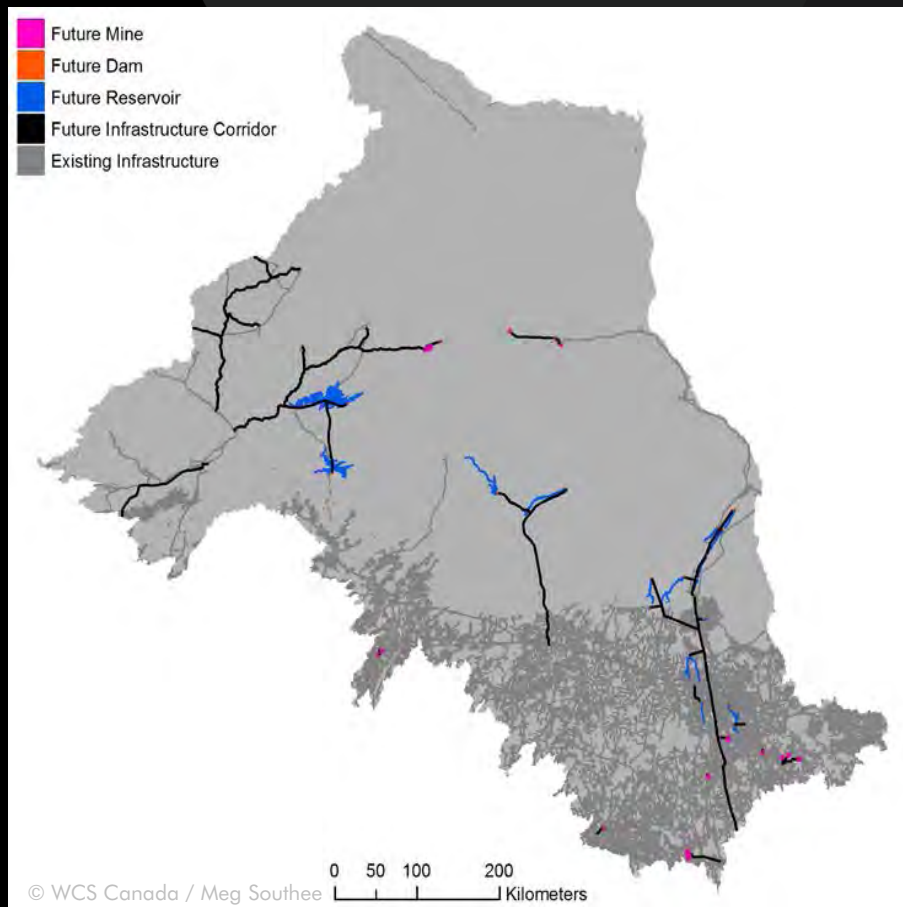


- Nine watersheds
- Five major rivers
- 440,000 sq. km

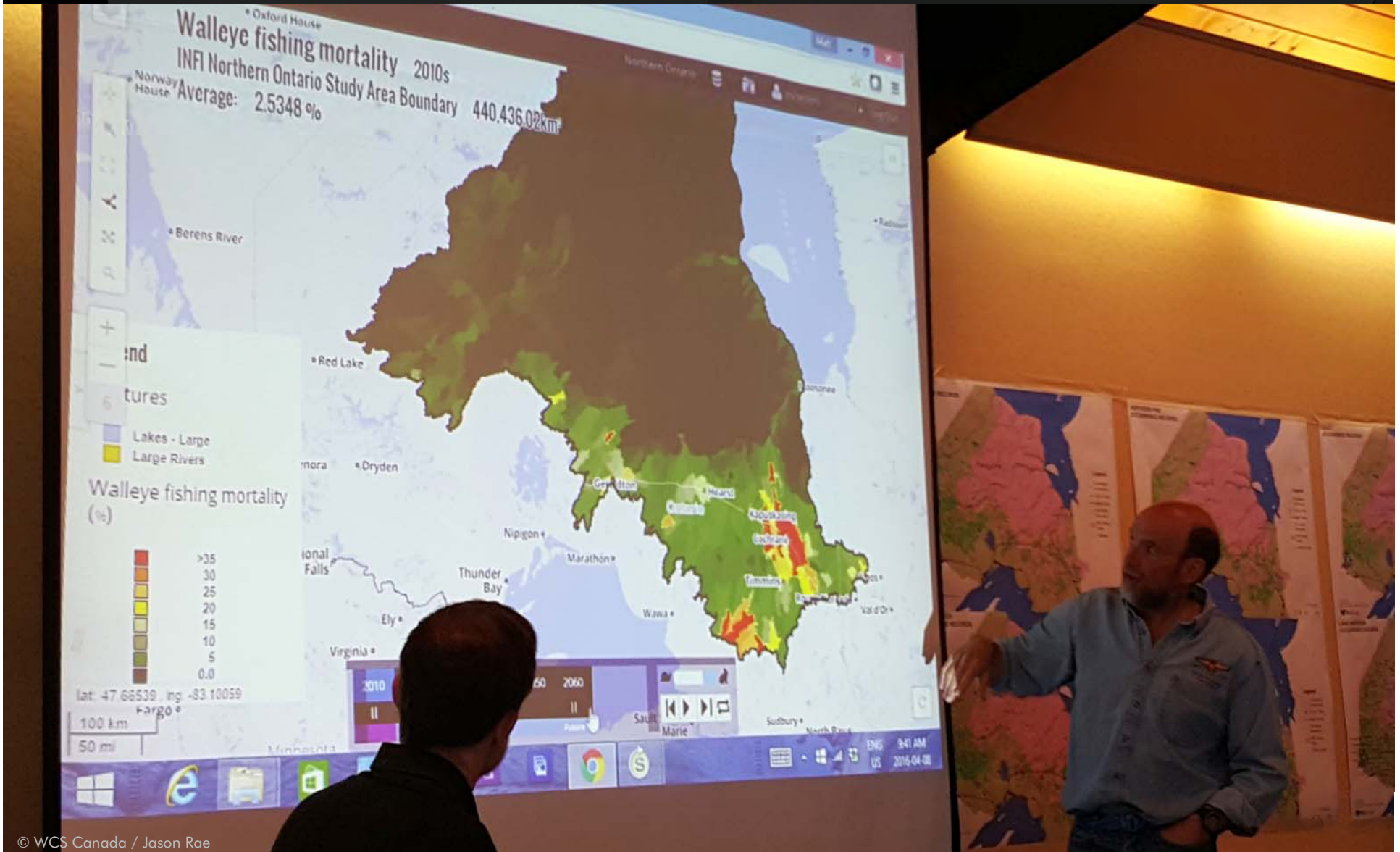
Land use scenarios

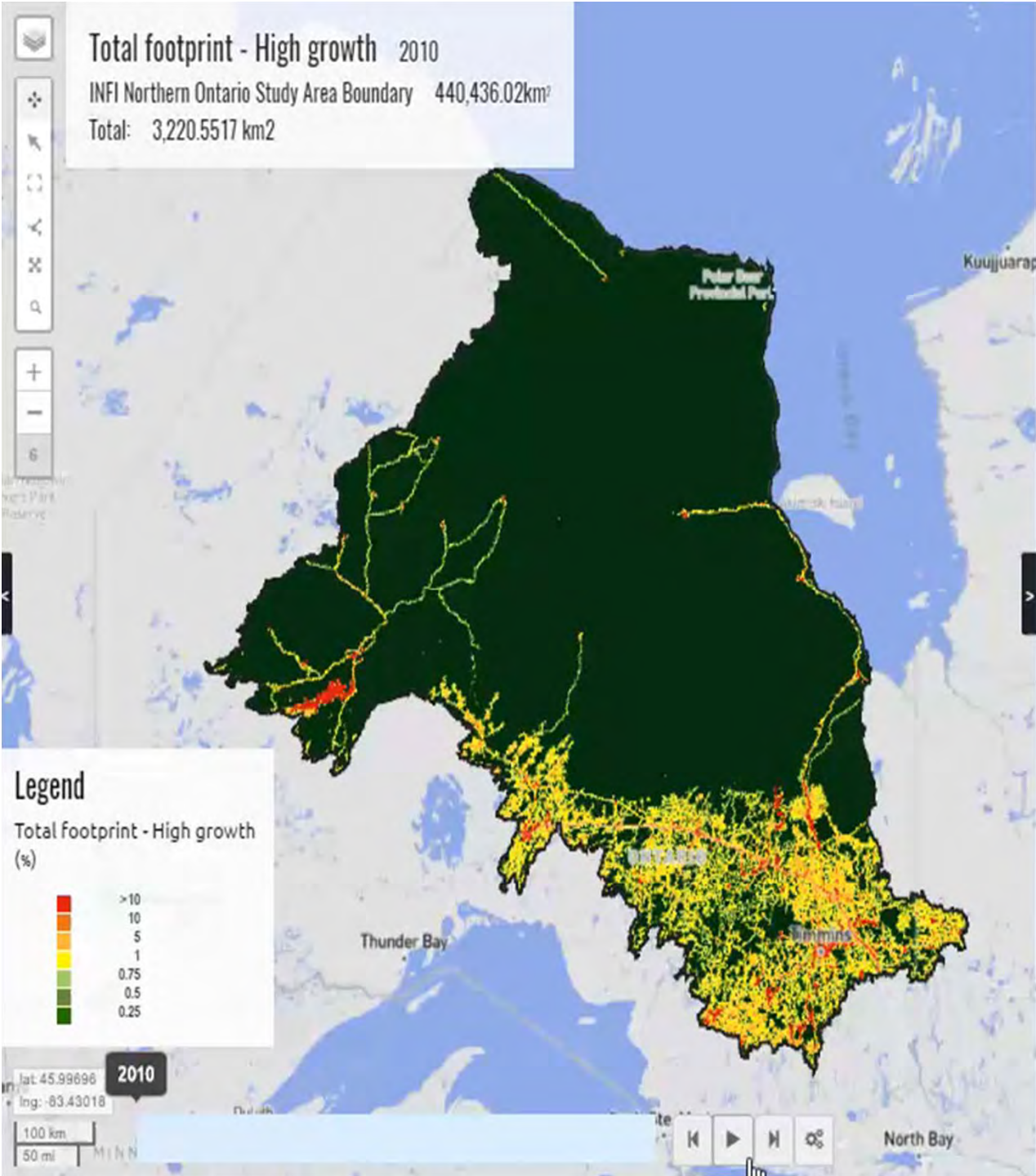
Low Growth Scenario
18 mines & 19 hydro developments

High Growth Scenario
39 mines & 54 hydro developments



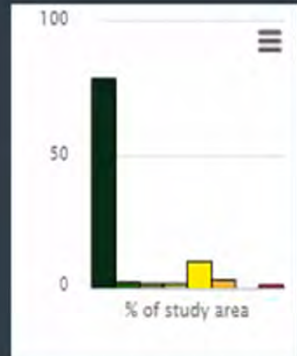
Freshwater fish



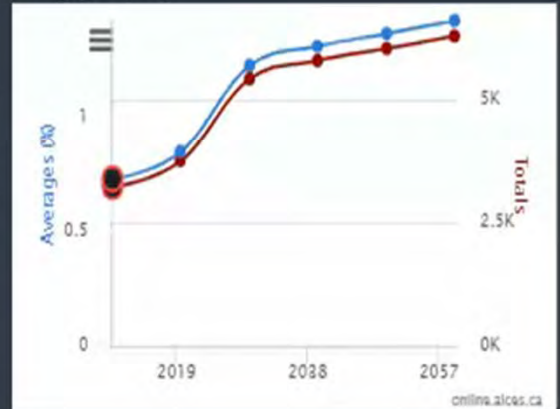


Statistical Readouts for 2010

Max: 100
 Min: 0
 Mean: 0.7232
 Median: 0
 Kurtosis: 230.6277



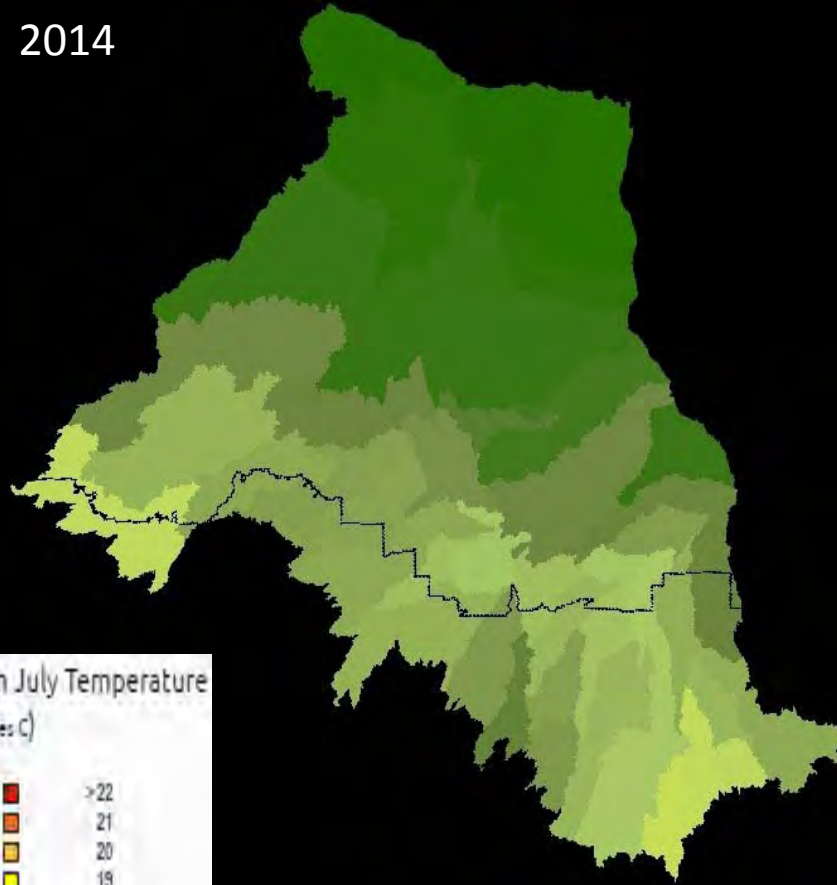
Average () and (km²)



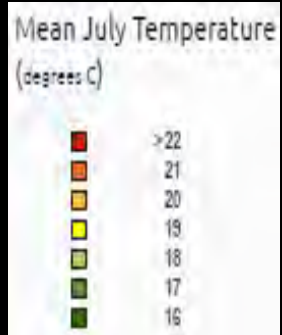
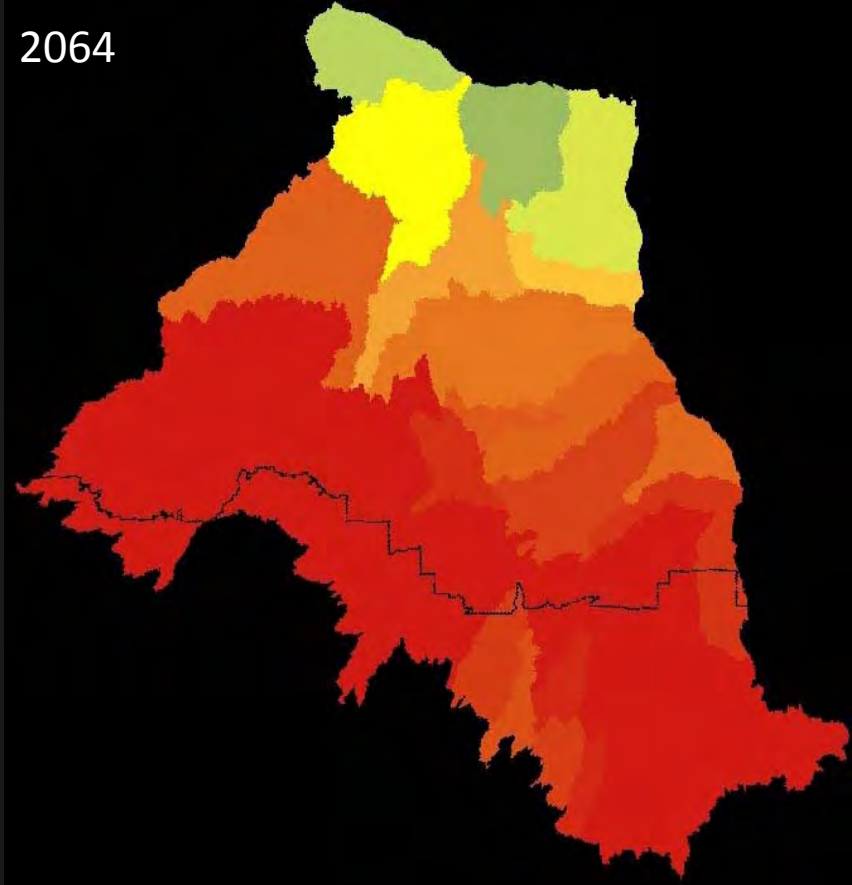
Add Band Remove Bands Y Axis Min = 0

Mean July temperatures

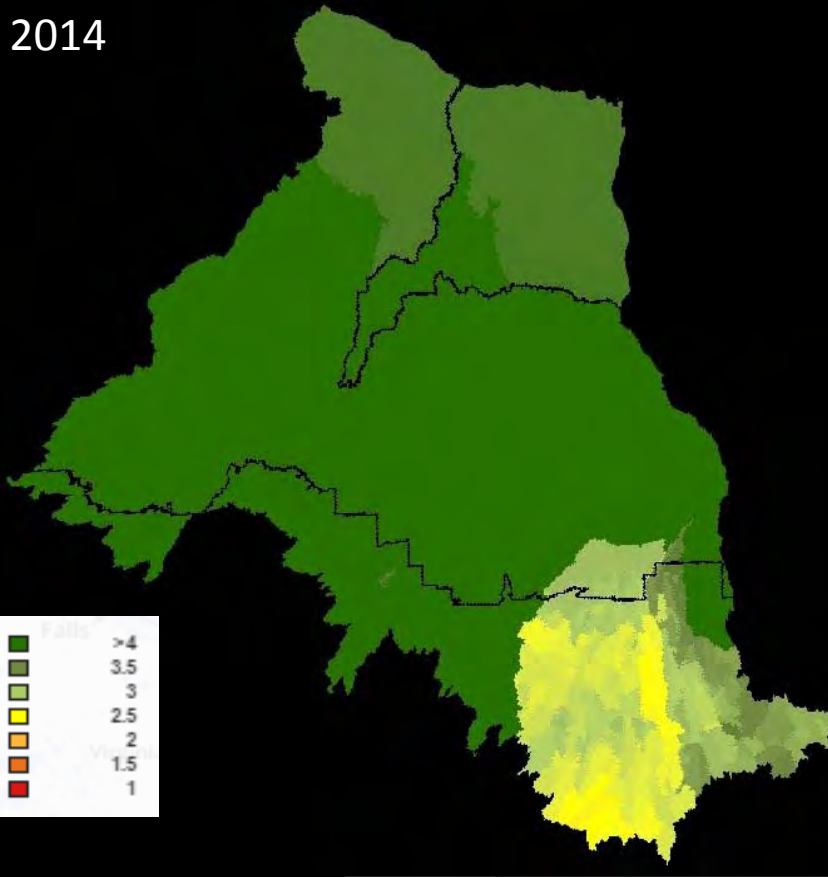
2014



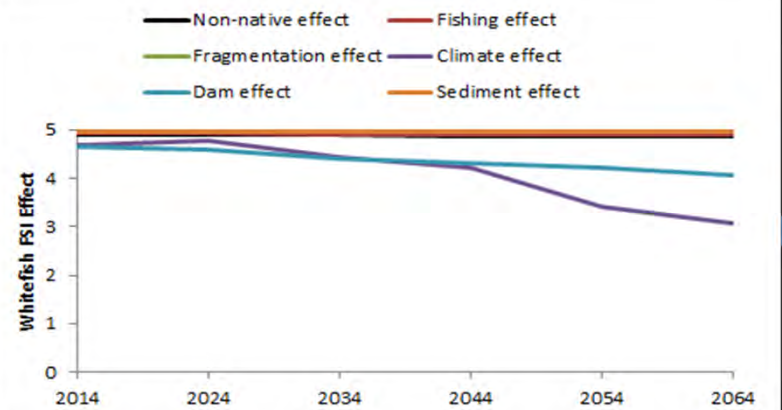
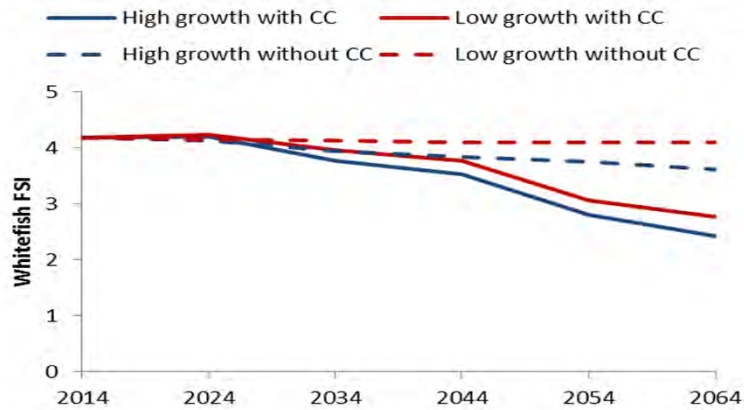
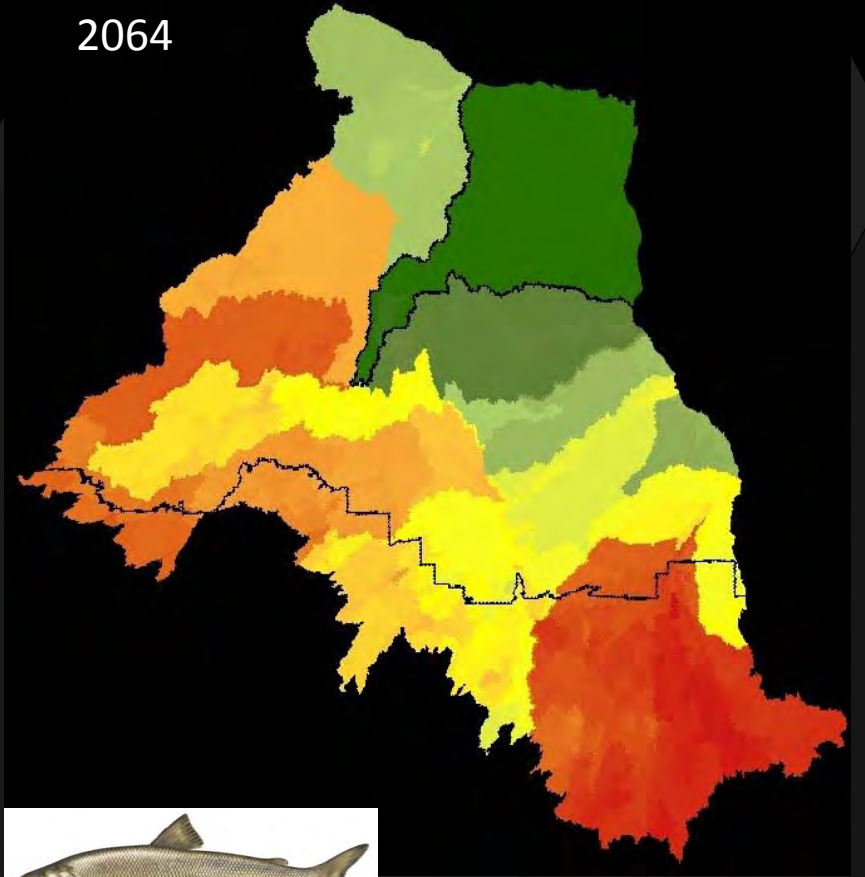
2064



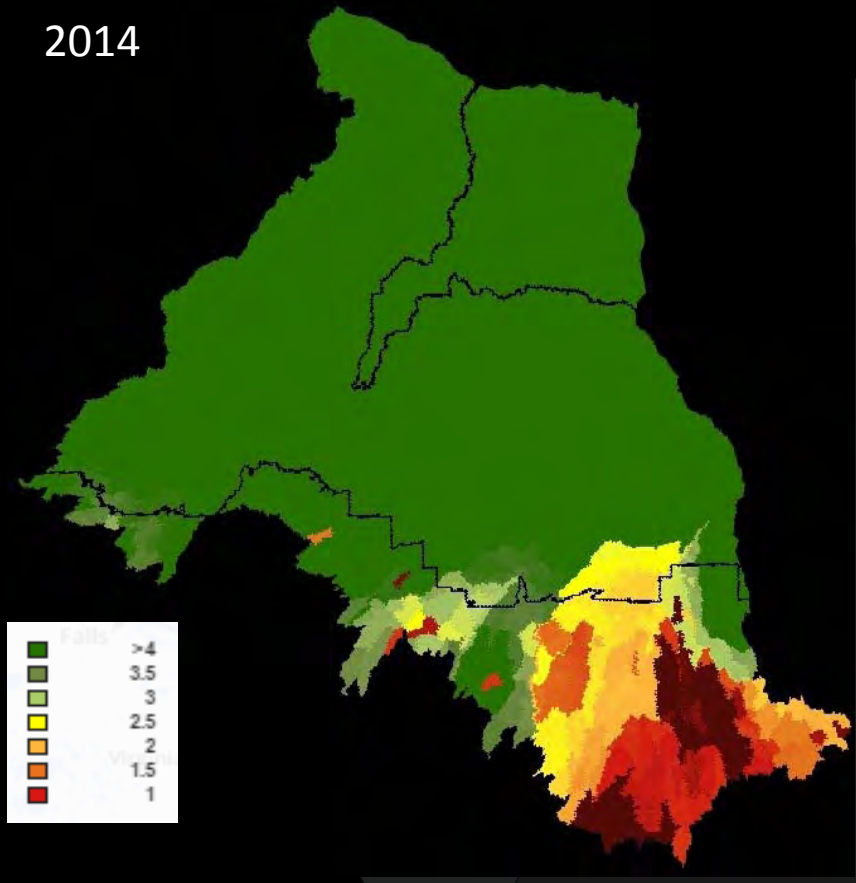
2014



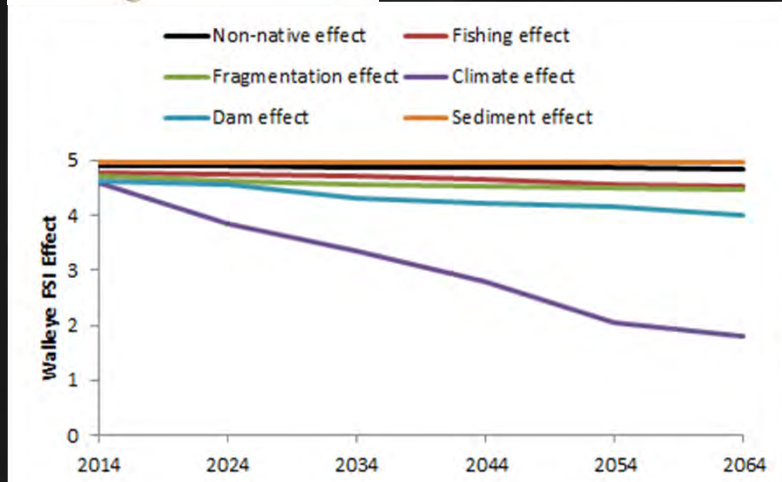
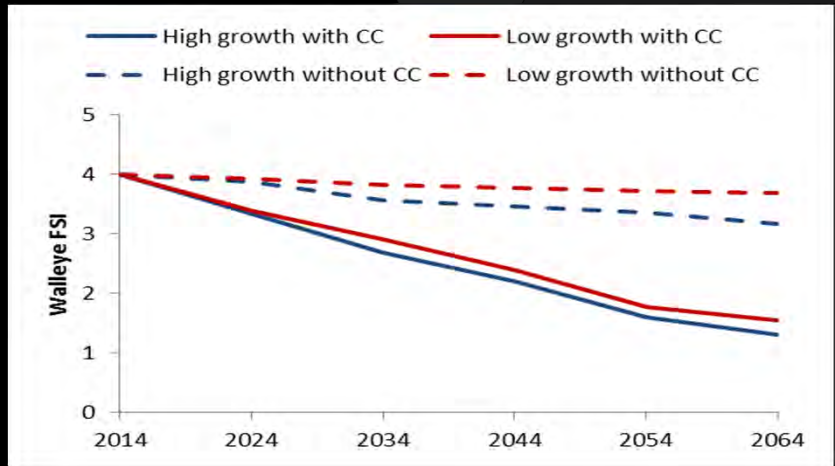
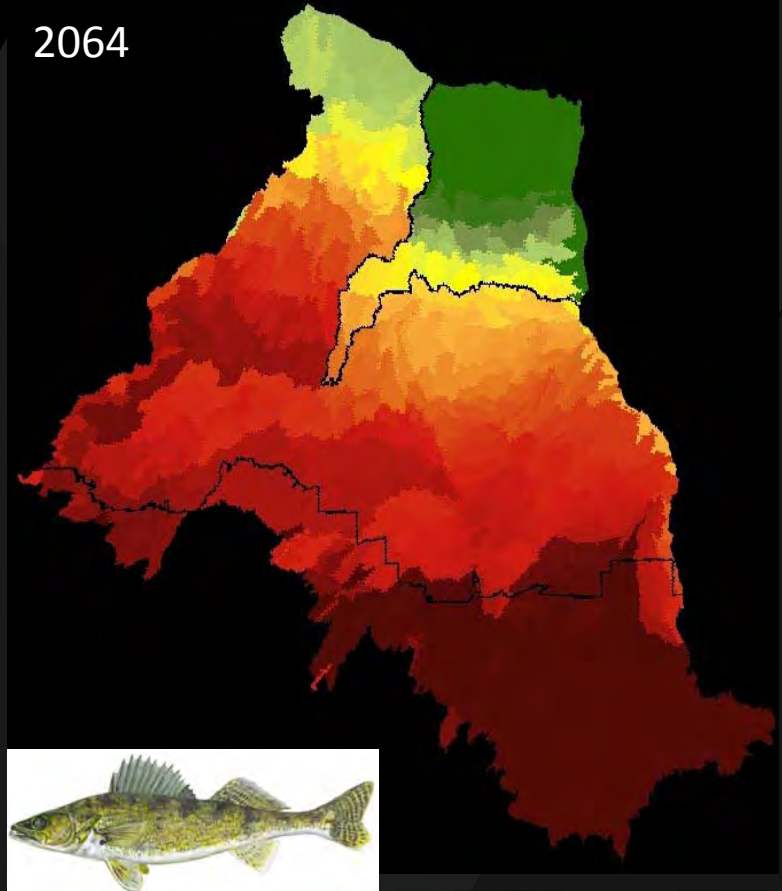
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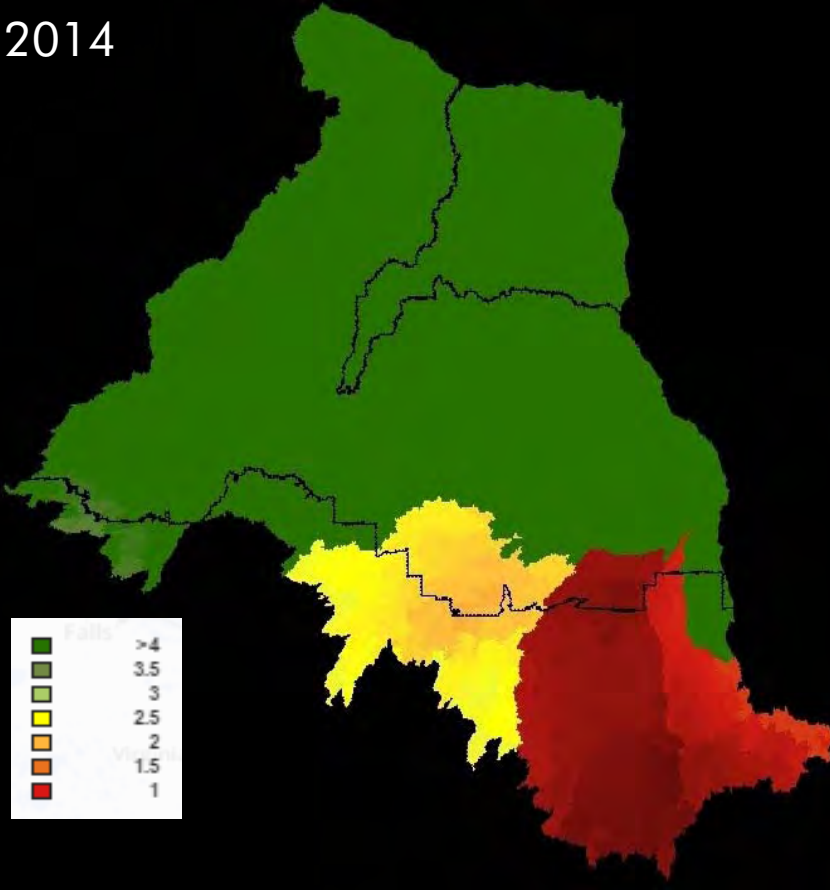
2014



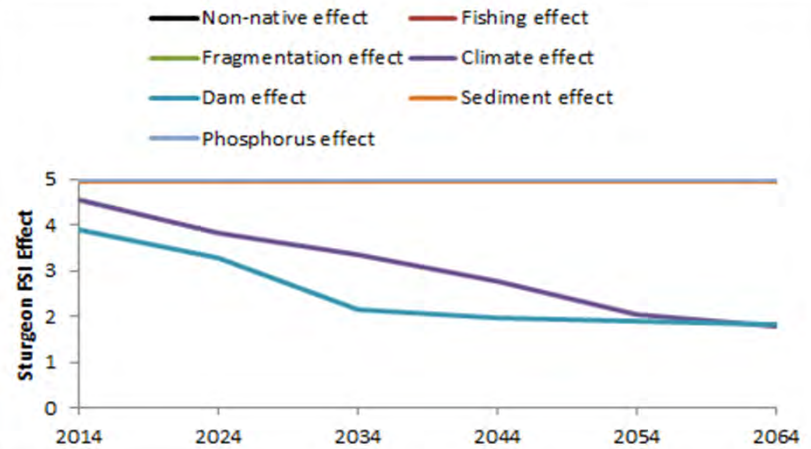
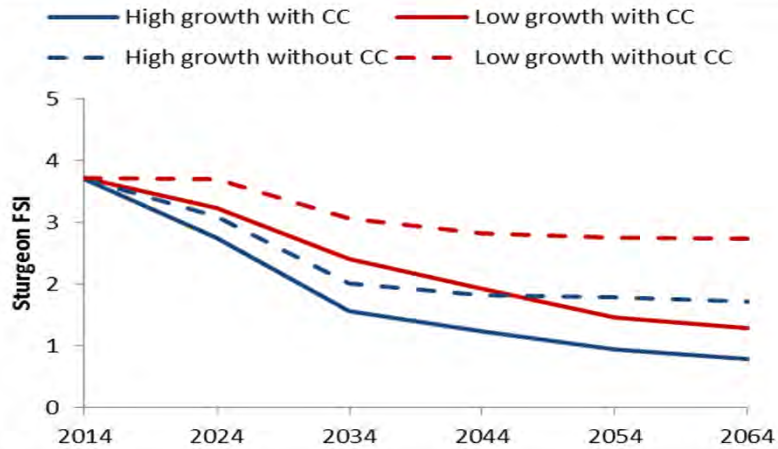
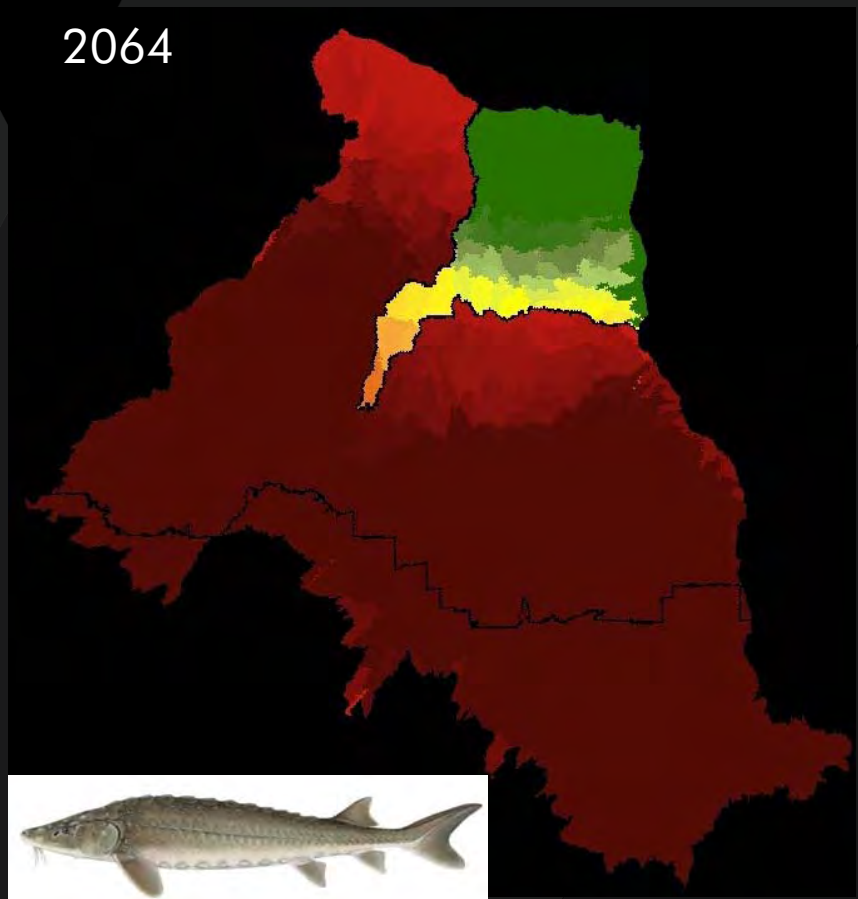
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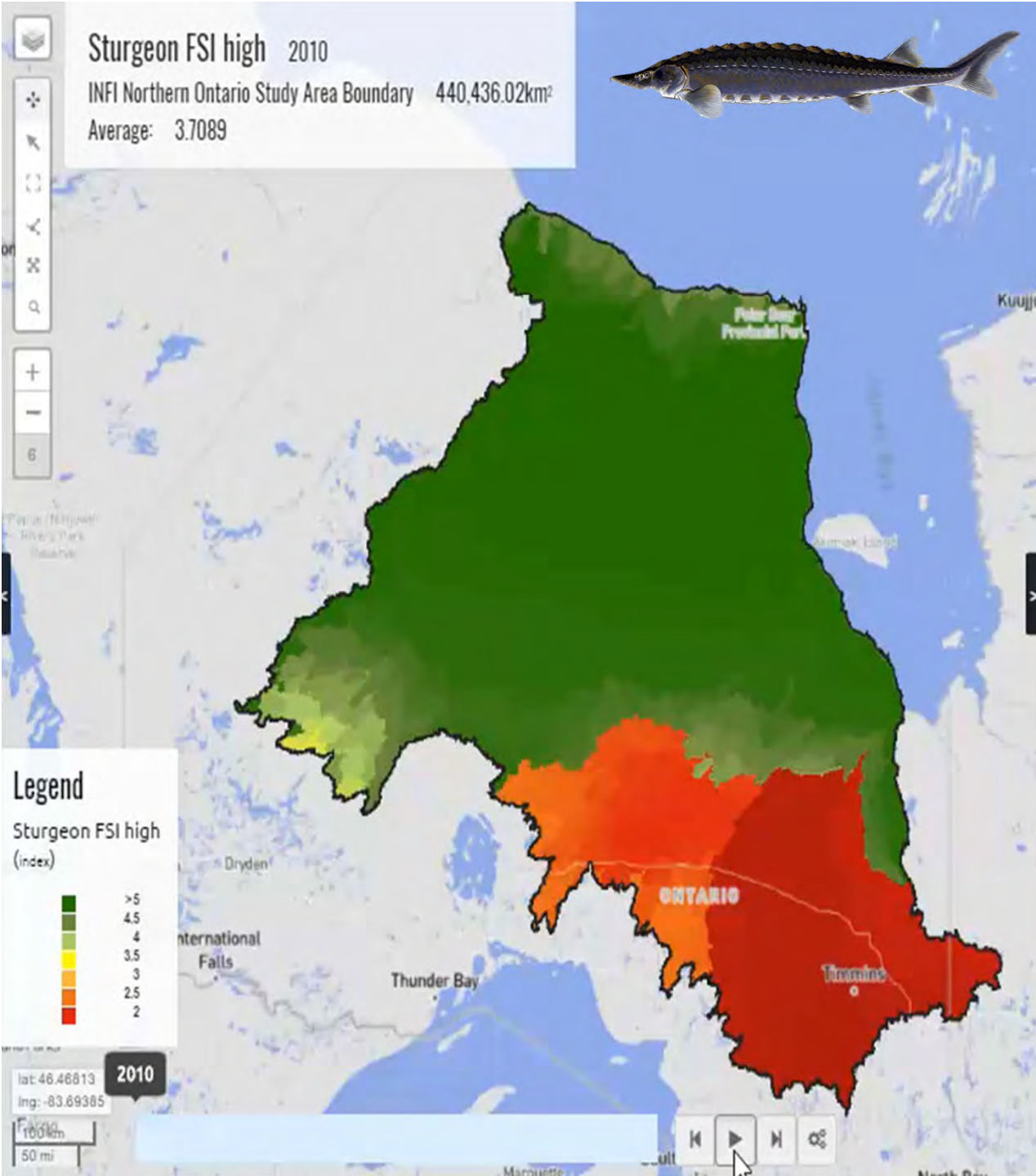


2014



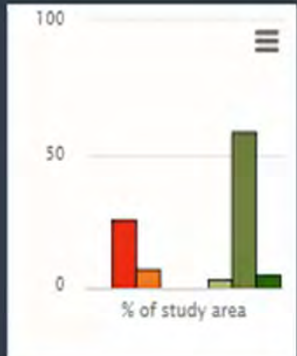
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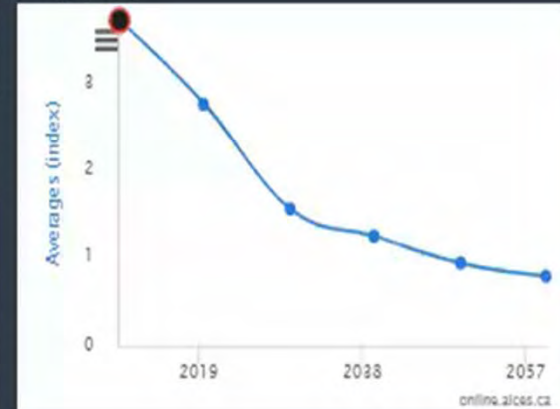


Statistical Readouts for 2010

Max: 5.0186
Min: 0.008
Mean: 3.7089
Median: 4.8692
Kurtosis: -0.9917



Average (index)



Add Band Remove Bands Y Axis Min = 0

Conclusions

- Illustrates how to consider cumulative effects in a proactive way at a large scale e.g., not project-scale
- Simulations and scenarios are useful for considering risks
- Overall, climate change was the most influential driver of change, followed by dams
- Monitoring and data are vital
- Our approach can bring in other kinds of knowledge in a participatory way



Thank you!

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