

### Use of lake sediments to establish baseline and evaluate for pollution at the Peace-Athabasca Delta

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### Pollution of Aquatic Ecosystems



- Sediment quality monitoring → widely used to assess pollution.
- But, our ability to detect pollution is challenged because:
  - 1) Industrial activities are often located near natural sources of contaminants, and
  - 2) Monitoring usually begins too late, after onset of polluting human activities.

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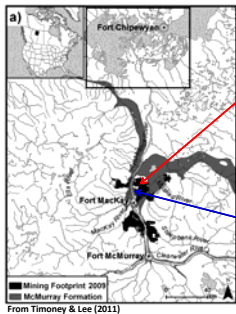
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### Athabasca Oil Sands Surface Mining



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**Concerns often center at the river's terminus:  
The Peace-Athabasca Delta**



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**Objectives:**

Use records preserved in lake sediment cores to:

- Determine pre-industrial (baseline) reference levels of contaminants.
- Assess if atmospheric transport is an important vector for deposition of metals and polycyclic aromatic compounds (PACs) to the delta.  
→ If so, have industrial emissions caused an increase?
- Assess if the Athabasca River and tributaries have been an important vector for downstream deposition of metals and PACs.  
→ If so, has industry increased contaminant deposition?

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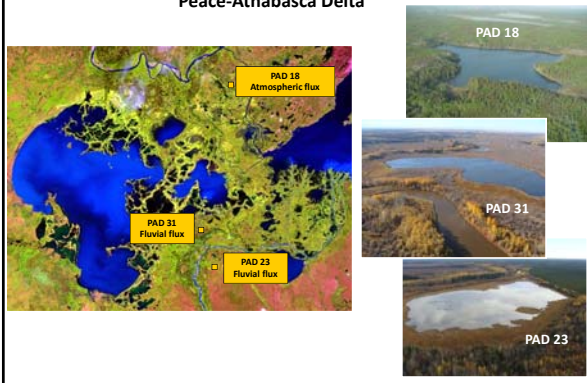
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**Lake Sediment Coring Sites (September 2010):  
Peace-Athabasca Delta**




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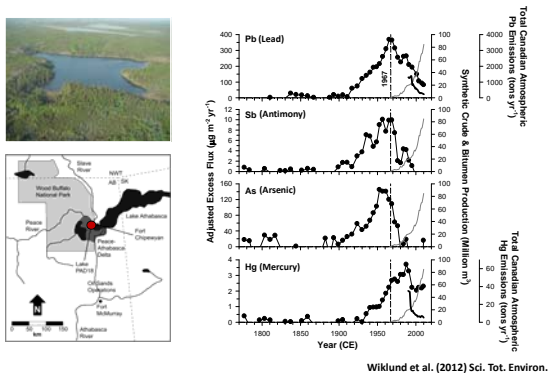
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**Metals via the air: PAD 18 Sediment Record**




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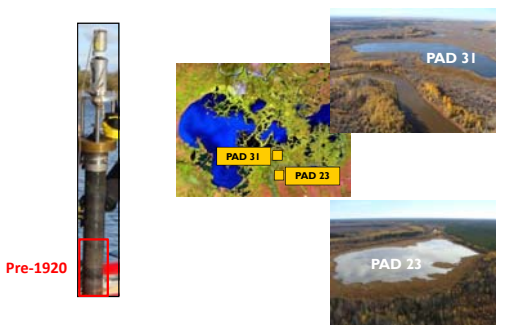
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**Assessing metal pollution of the Athabasca River:  
comparison against pre-industrial baseline**




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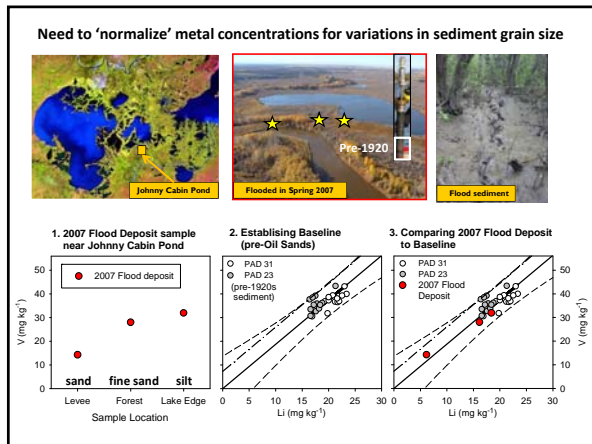
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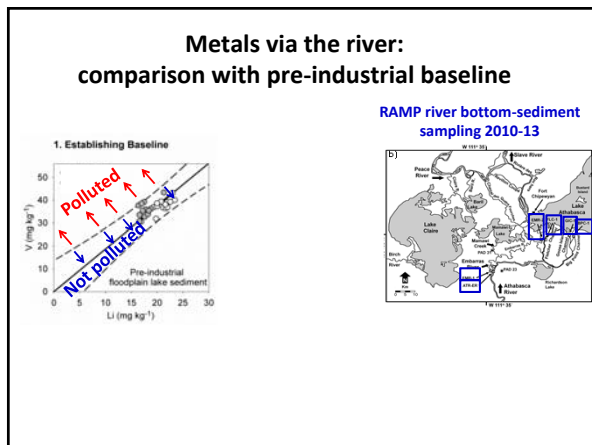
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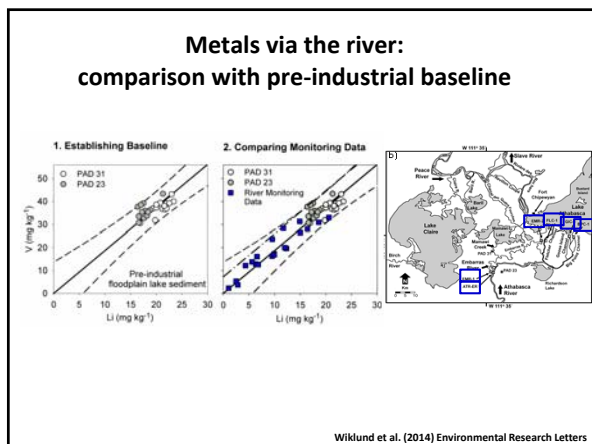
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Wiklund et al. (2014) Environmental Research Letters

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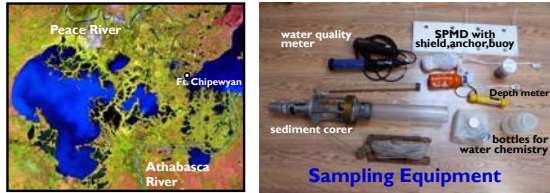
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**A new monitoring program to assess effects of multiple stressors on water quantity & water quality for lakes in the Peace-Athabasca Delta (sampling 2015-2016)**




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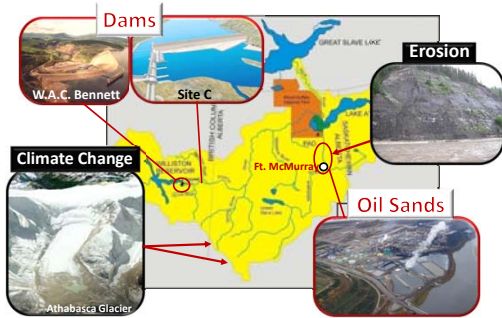
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**Addresses the Community Concern: What are effects of multiple stressors on lakes & rivers in the PAD?**




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**Perceived Threats to the Delta:**

**PETITION**  
TO THE WORLD HERITAGE COMMITTEE  
Requesting inclusion of Wood Buffalo National Park on the List of World Heritage in Danger



1. "industrial development of Alberta's oil sands ... are releasing contaminants ... and removing vast quantities of water from the Athabasca River"

2. "governments recently approved yet another hydro-electric dam on the Peace River [Site C] that could further impact the flow cycles and recharge mechanisms of the PAD and exacerbate the effects of climate change."

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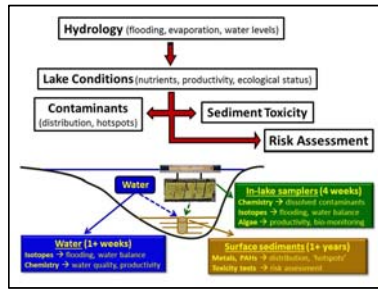
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## Approach



Develop an array of methods to:

1. Track relations between climate, river flow & lake hydrological conditions.
2. Link the distribution of contaminants (PAHs, metals) and their toxicity characteristics with hydrological pathways (i.e., floodwaters from the Athabasca & Peace Rivers, snowmelt, rain) and lake conditions.
3. Enable local monitoring agencies to continue the monitoring into the future ...

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## Sample Sites

- 60 lakes & 10 river sites [green = PADEMP Muskrat Survey lakes; black = rivers].
- Sites selected in consultation with PADEMP, Wood Buffalo National Park, First Nation Community-Based Monitoring Programs.
- The sites span the hydrologic gradients of the delta.




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## Acknowledgements

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