Algal Bloom TRACKER

Introducing Algalbloomtracker.ca: A tool for monitoring algal blooms in Alberta's lakes

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ALMS Alberta Lake Management Society

Photo: Fiona Gregory

What are harmful algal blooms?

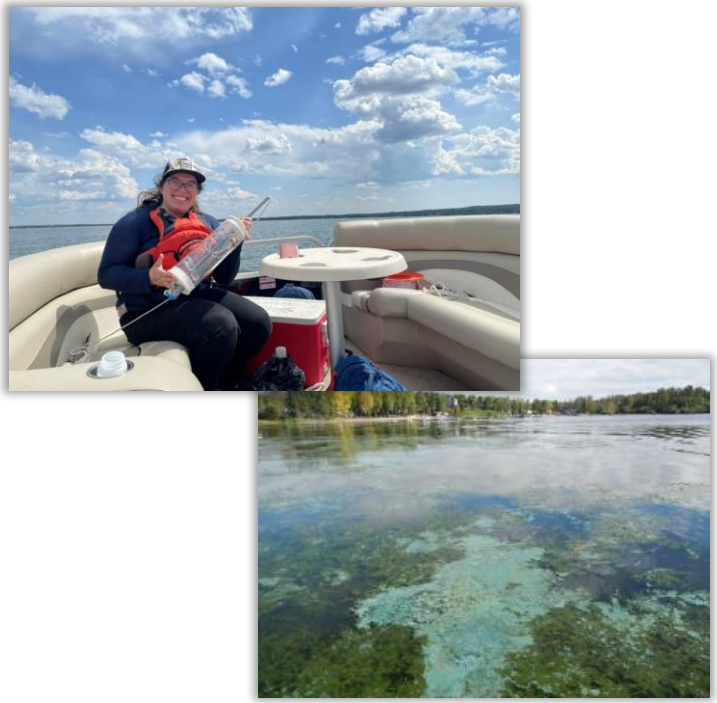
Photos: ALMS & cbc.ca

- High lake concentrations of cyanobacteria (blue-green algae), which can produce harmful toxins
  - Liver toxins, neurotoxins, and oxygen depletion when they decompose
- Growth triggered by warm temperatures, and fueled by nutrients (e.g., phosphorus)
- Common in Alberta's warm, shallow lakes
  - 35+ algal bloom-related lake advisories in 2026 so far (Alberta Health Services)

ABMI UNIVERSITY OF ALBERTA ALMS

Monitoring harmful algal blooms in Alberta

- Long history of water quality sampling in Alberta
  - Government of Alberta, Alberta Lake Management Society (ALMS), Alberta Health Services, Primary and Preventative Health Services
  - **Chlorophyll a (chl-*a*)** levels are a proxy for concentrations of cyanobacteria
- Sampling is limited in space and time by logistics and costs
- Recent work has focused on developing **satellite-based monitoring approaches**
  - Enables more detailed, spatial and temporal tracking of bloom extent, duration, and intensity

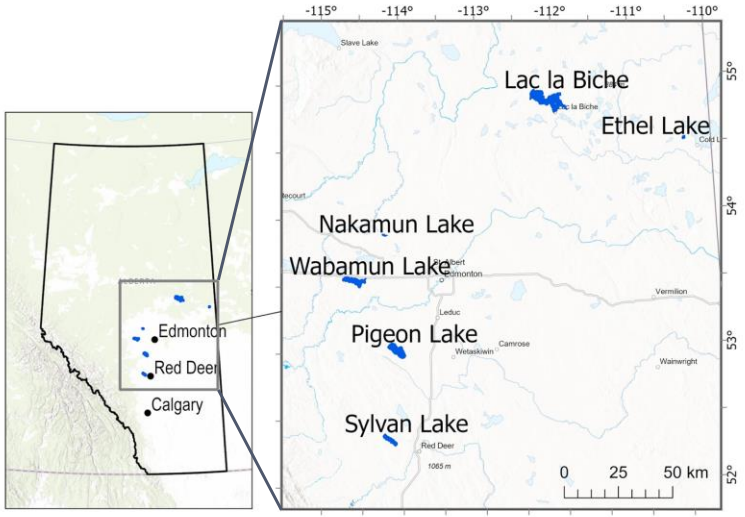


Photos: ALMS

3-Year Project

1. Can we calibrate satellite-based chl-*a* retrieval models for harmful algal blooms in Alberta?
2. Can we make this a publicly available tool to better understand and track harmful algal blooms?

We can… with support from our partners!



Six focus lakes:

- Lac La Biche (236.5 km^2)
- Ethel Lake (4.9 km)
- Nakamun Lake (3.3 km^2)
- Wabamun Lake (80.3 km^2)
- Pigeon Lake (97.3 km^2)
- Sylvan Lake (42.2 km^2)

3-Year Project

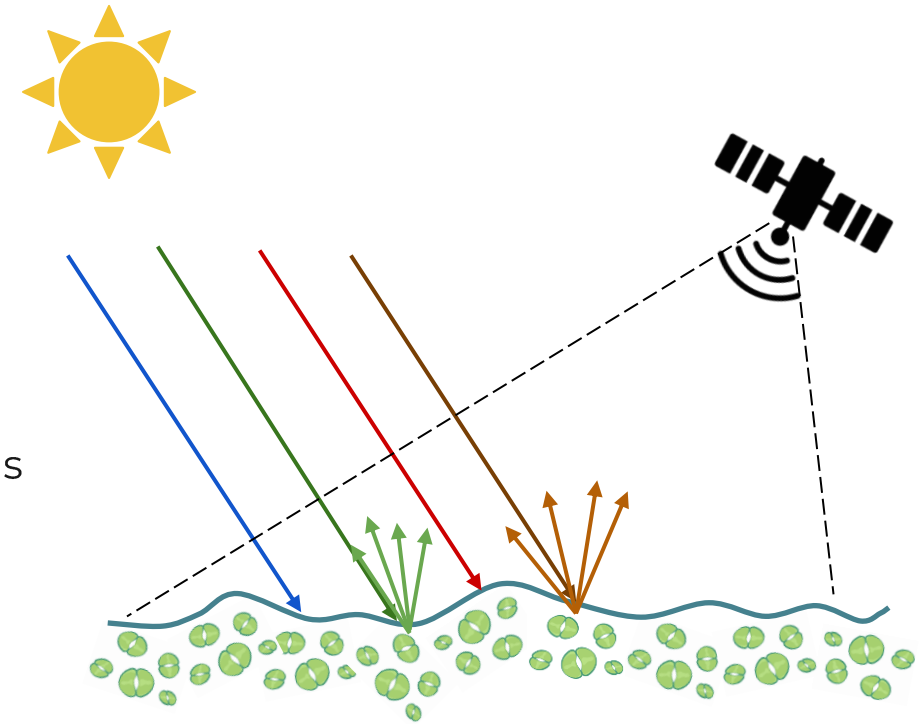
Field sampling

- Coordination of field sampling with overpass of Sentinel-2 satellites
  - Generally within a couple hours of the satellite overpass
  - Cloud-free (& smoke free) at 1 p.m.
- 20-30 sample sites per lake/basin
- Water chemistry, chl-*a*, and phytoplankton collected using Kemmerer at each sample location
- 1071 samples matching with Sentinel-2 satellite overpasses!

Photos: ALMS

Remote sensing of harmful algal blooms

Cyanobacterial cells and their pigments (e.g. chl-*a*) interact with differently with different wavelengths of sunlight.



Satellites detect these interactions.

A *spectral index* combines wavelengths in a single number that captures these varying responses

Satellite modeling of chl-*a*

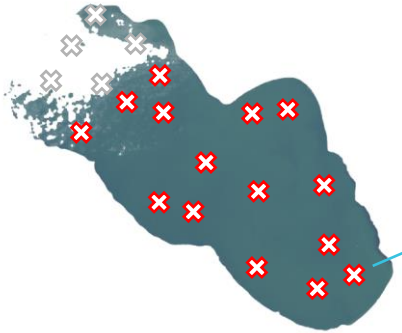
Index used:
Maximum Peak Height (MPH)
Combines near-infrared, red, and red-edge bands

Original imagery, with multiple spectral bands (i.e., wavelengths)

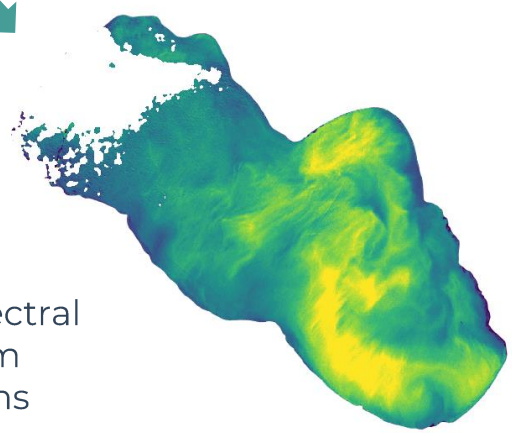
Linear regression analysis of spectral index vs sampled chl-*a* levels

Spatial model of chl-*a* concentrations, as a proxy for cyanobacteria

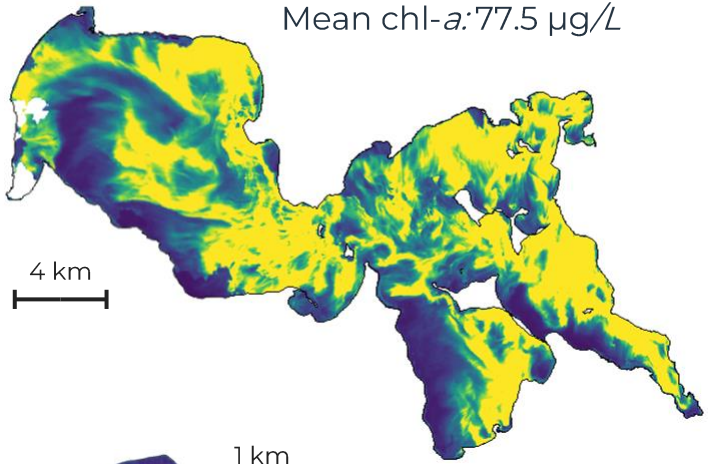
Pre-processing (e.g., clipping, cloud masking, spectral index calculation)



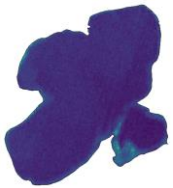
Extraction of spectral index values from sampled locations



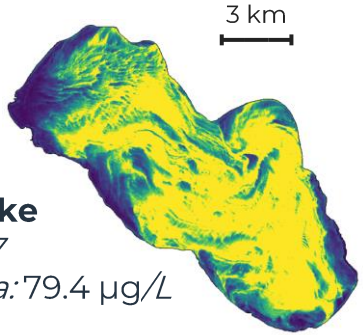
Results: Peak blooms 2017 - 2025



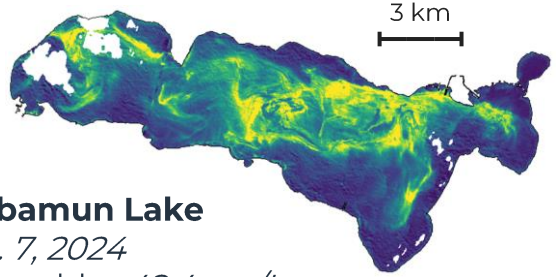
Lac La Biche
Aug. 23, 2025
Mean chl-*a:* 77.5 µg/L



Ethel Lake
Sep. 18, 2020
Mean chl-*a:* 13.3 µg/L

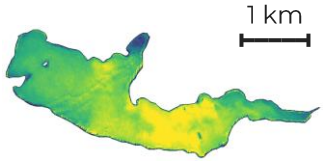


Pigeon Lake
Oct 4, 2017
Mean chl-*a:* 79.4 µg/L



Wabamun Lake
Oct. 7, 2024
Mean chl-*a:* 42.4 µg/L

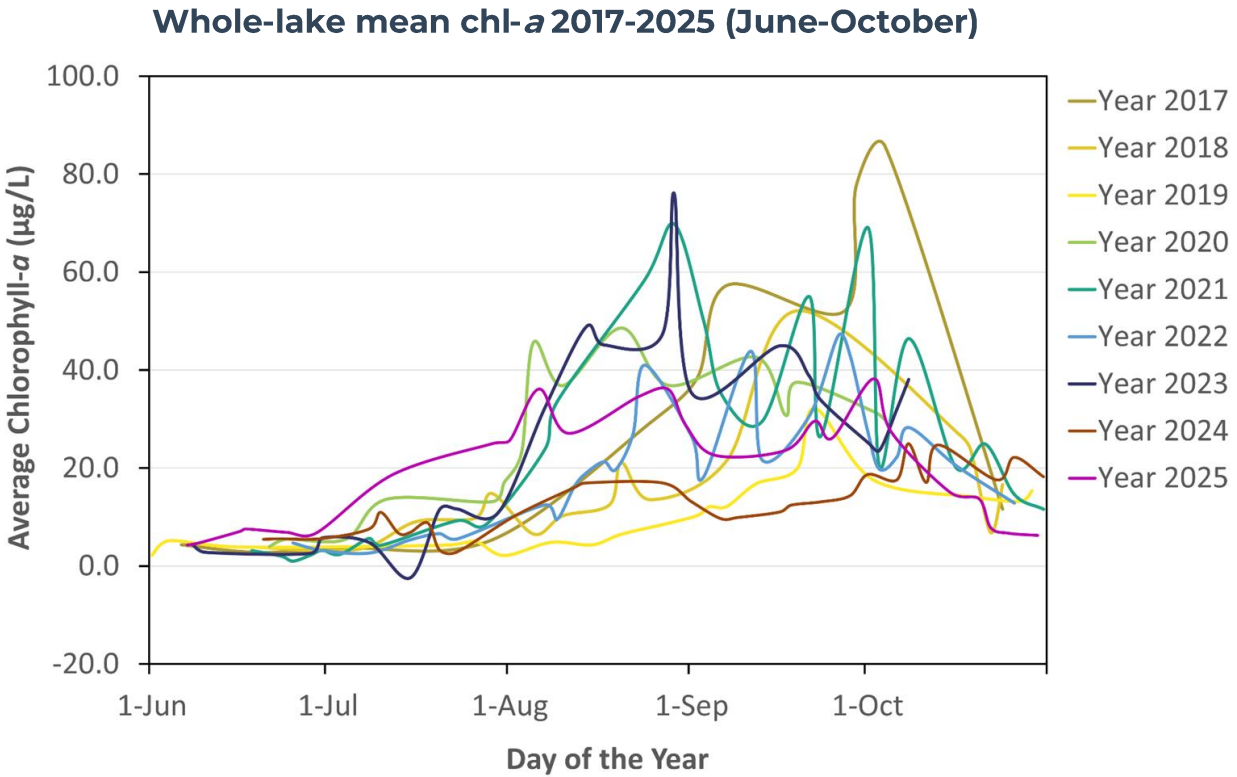
Sylvan Lake
Oct. 12, 2024
Mean chl-*a:* 7.4 µg/L



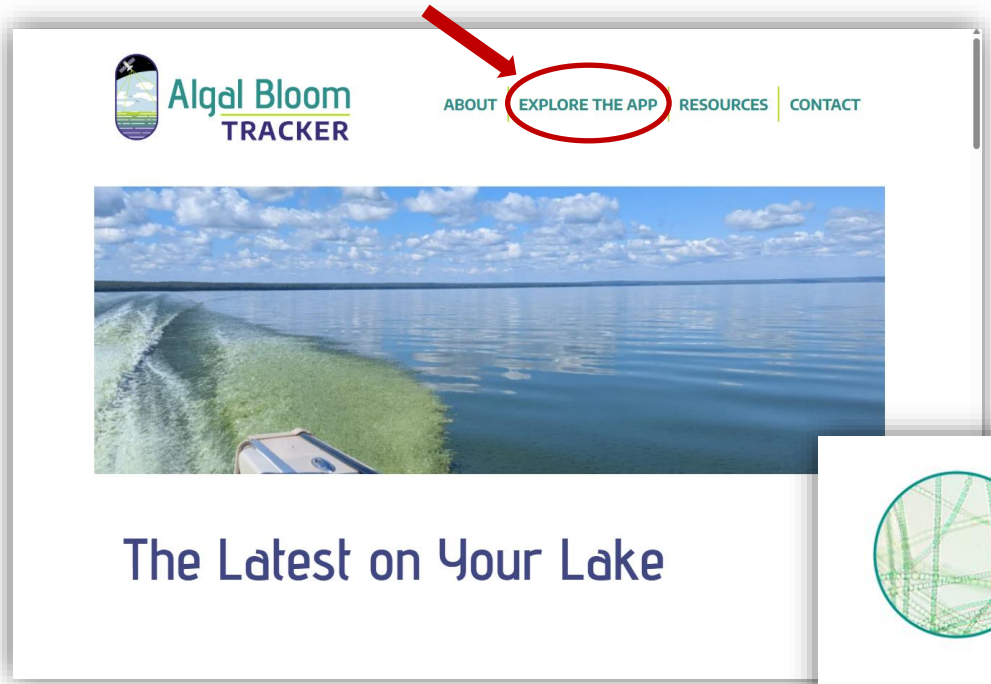
Nakamun Lake
Aug. 6, 2025
Mean chl-*a:* 70.8 µg/L

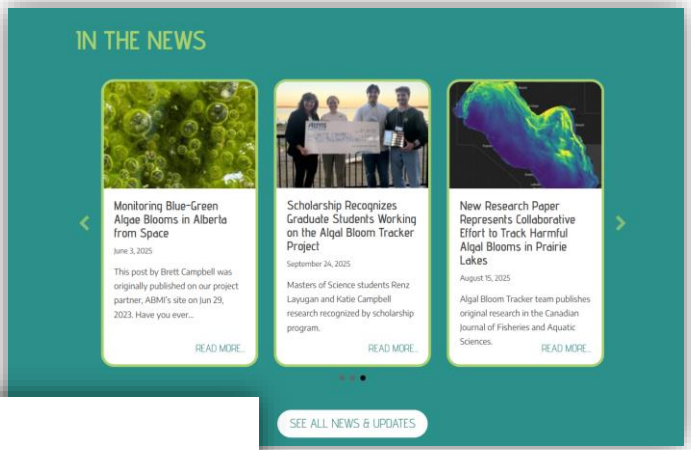
Chl *a* concentration: 0 — 100 µg/L

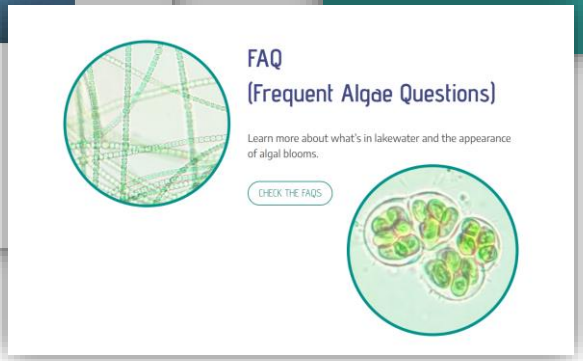
Results: A look at Pigeon Lake

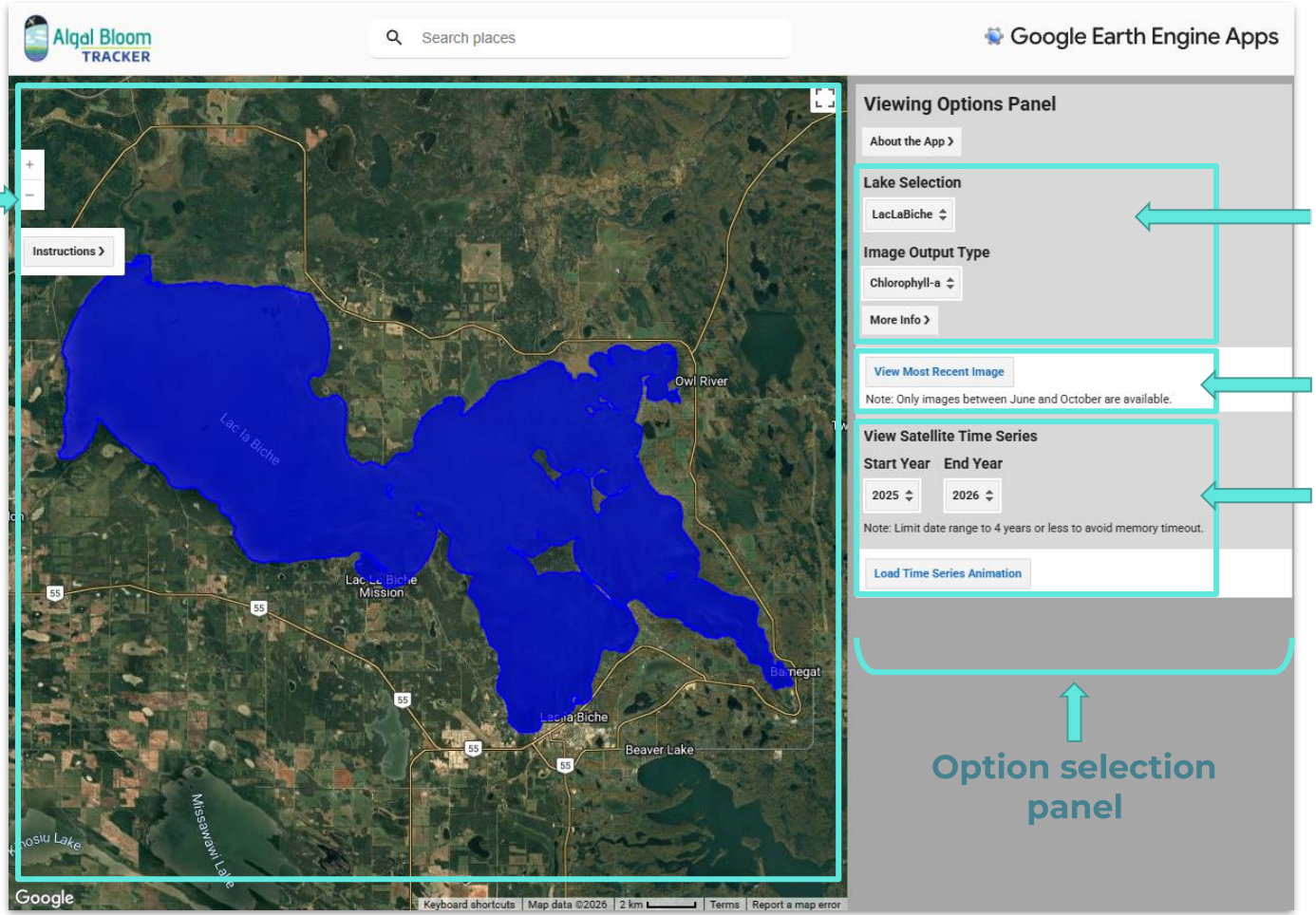


Algalbloomtracker.ca









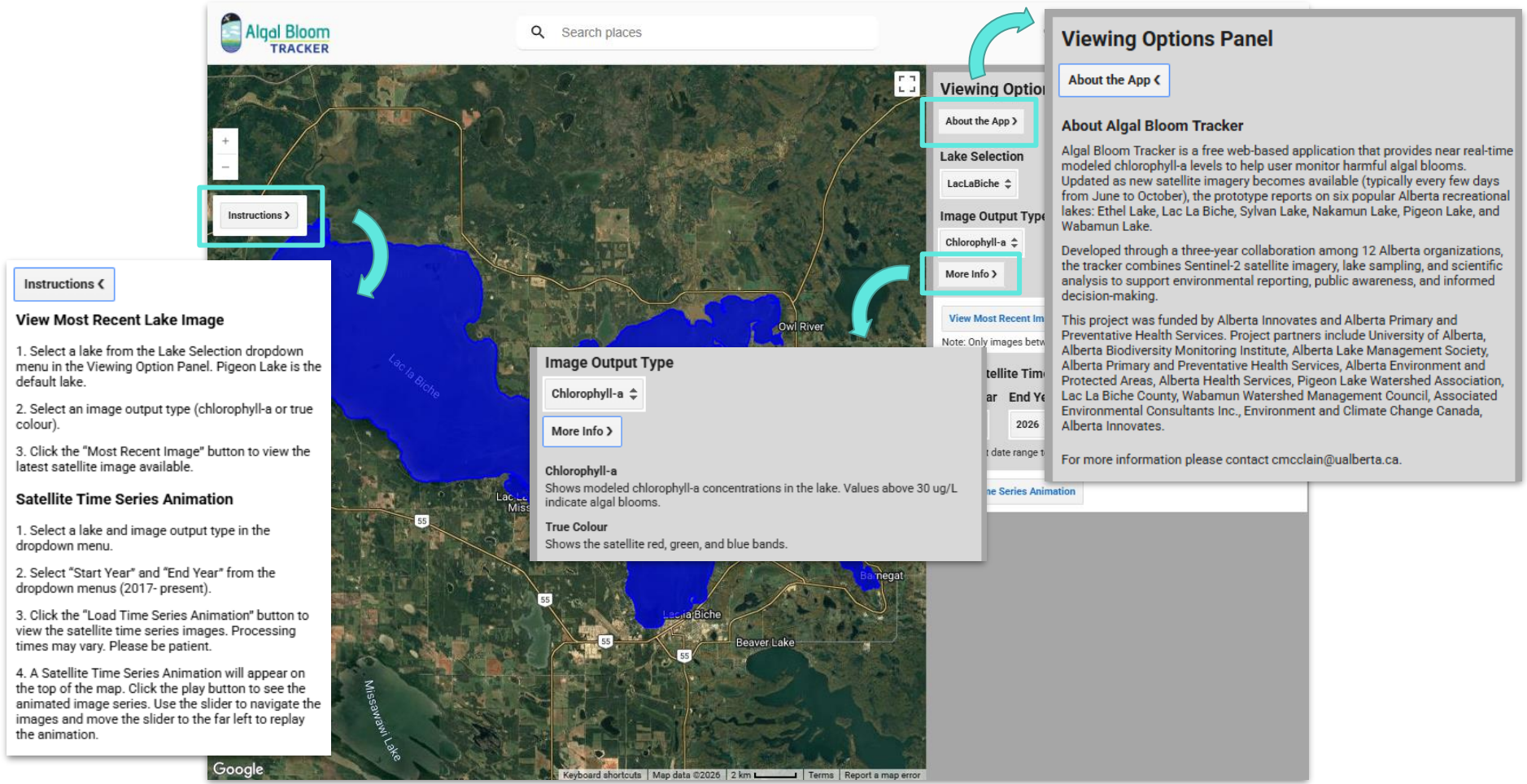
Map panel

Chose lake and visualization (modeled chl a or a true colour image)

View most recent image

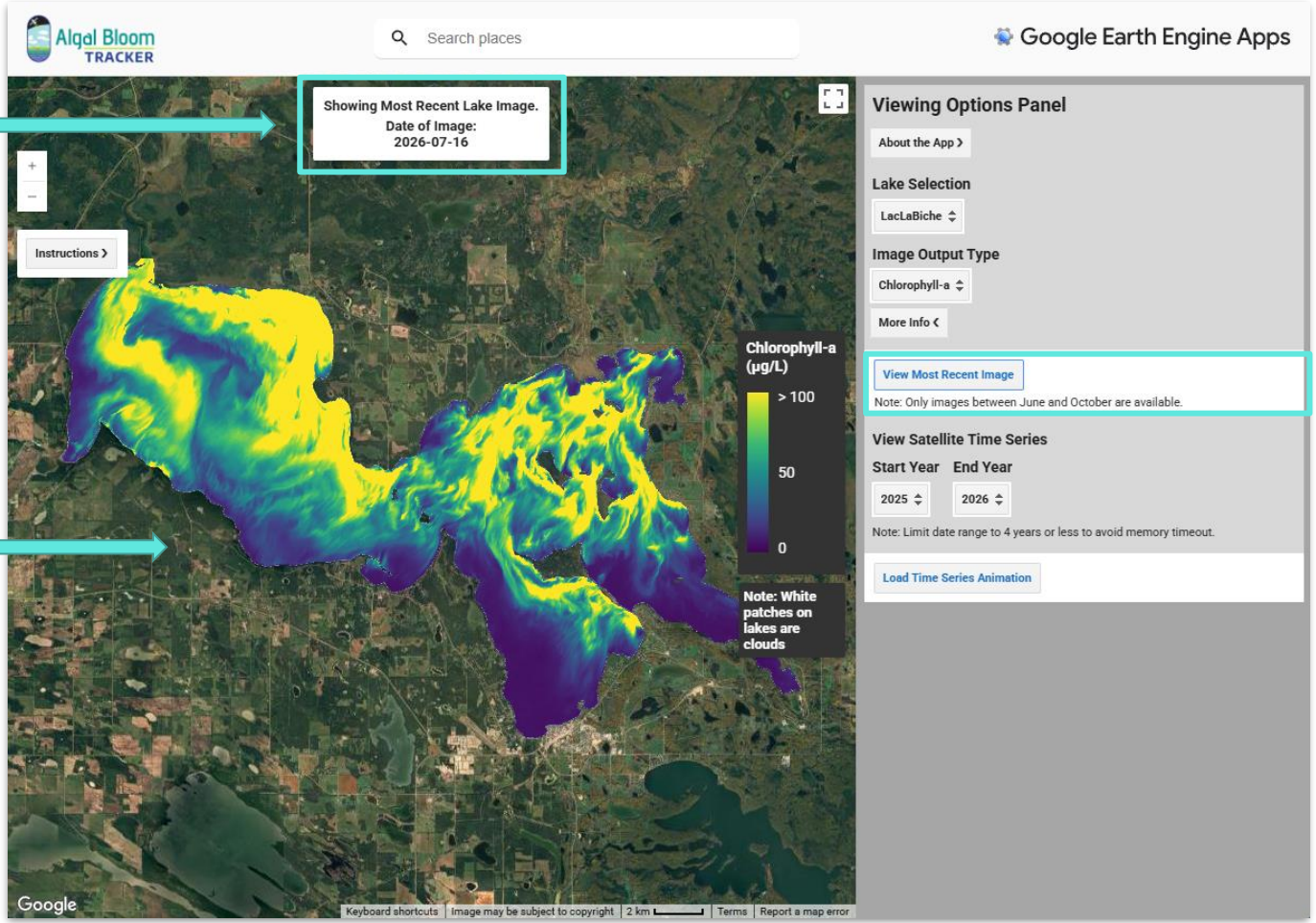
Load satellite time series animation

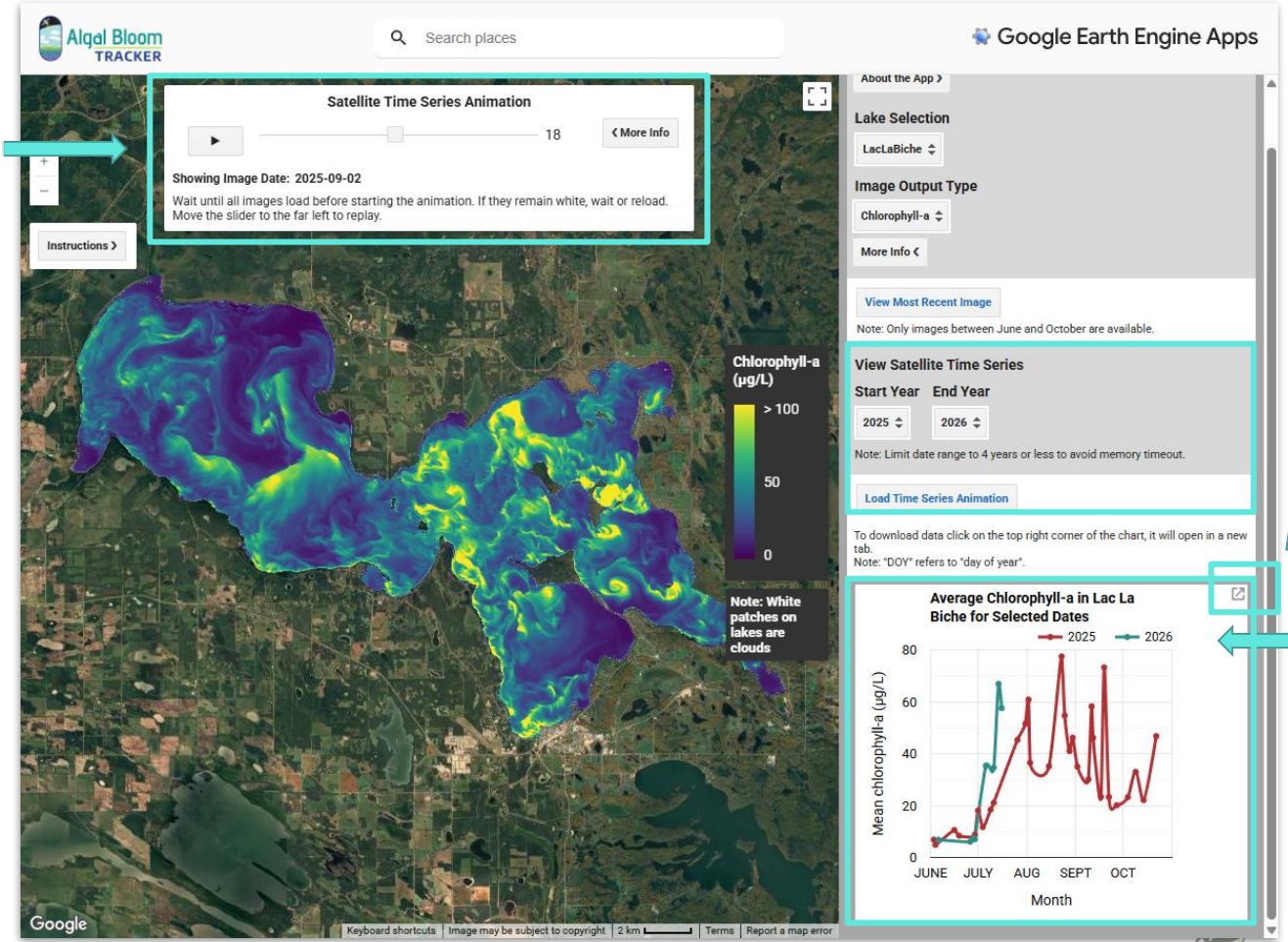
Option selection panel


Algal Bloom TRACKER
Search places
Instructions
Viewing Options Panel
About the App
About Algal Bloom Tracker
Algal Bloom Tracker is a free web-based application that provides near real-time modeled chlorophyll-a levels to help user monitor harmful algal blooms. Updated as new satellite imagery becomes available (typically every few days from June to October), the prototype reports on six popular Alberta recreational lakes: Ethel Lake, Lac La Biche, Sylvan Lake, Nakamun Lake, Pigeon Lake, and Wabamun Lake.
Developed through a three-year collaboration among 12 Alberta organizations, the tracker combines Sentinel-2 satellite imagery, lake sampling, and scientific analysis to support environmental reporting, public awareness, and informed decision-making.
This project was funded by Alberta Innovates and Alberta Primary and Preventative Health Services. Project partners include University of Alberta, Alberta Biodiversity Monitoring Institute, Alberta Lake Management Society, Alberta Primary and Preventative Health Services, Alberta Environment and Protected Areas, Alberta Health Services, Pigeon Lake Watershed Association, Lac La Biche County, Wabamun Watershed Management Council, Associated Environmental Consultants Inc., Environment and Climate Change Canada, Alberta Innovates.
For more information please contact cmcclain@ualberta.ca.
Instructions
View Most Recent Lake Image
1. Select a lake from the Lake Selection dropdown menu in the Viewing Option Panel. Pigeon Lake is the default lake.
2. Select an image output type (chlorophyll-a or true colour).
3. Click the "Most Recent Image" button to view the latest satellite image available.
Satellite Time Series Animation
1. Select a lake and image output type in the dropdown menu.
2. Select "Start Year" and "End Year" from the dropdown menus (2017- present).
3. Click the "Load Time Series Animation" button to view the satellite time series images. Processing times may vary. Please be patient.
4. A Satellite Time Series Animation will appear on the top of the map. Click the play button to see the animated image series. Use the slider to navigate the images and move the slider to the far left to replay the animation.
Lake Selection
LacLaBiche
Image Output Type
Chlorophyll-a
More Info
Chlorophyll-a
Shows modeled chlorophyll-a concentrations in the lake. Values above 30 ug/L indicate algal blooms.
True Colour
Shows the satellite red, green, and blue bands.
View Most Recent Im
Note: Only images betw
End Ye
2026
Series Animation
Owl River
Lac la Biche
Lac La Biche
Beaver Lake
Barnegat
Missawawi Lake
Google
Keyboard shortcuts
Map data ©2026
2 km
Terms
Report a map error

Date of most recent image

Most recent image





Animation slider bar

Button for downloading graph data

Graph of mean lake chl-*a* over the selected years

Expanding the Algal Bloom Tracker

- Project team pursuing additional funding to:
  - Expand Algal Bloom Tracker to hundreds of additional Alberta lakes
  - Answer new research questions:
    - Role of unique algal pigments
    - Impact of tea-coloured lakes
    - Reconstructing historical water quality
    - Forecasting future water quality & blooms
- Develop novel infrastructure to expand functionality:
  - Bloom extent, intensity, and severity
  - Condition of the Environment reporting

Photos: ALMS

Acknowledgements

Current and former staff, participants, and supporters

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Summer Staff

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Pigeon Lake Watershed Association
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Don Davidson
Amanda Koot

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ALBERTA INNOVATES

Alberta Primary and Preventative Health Services

Alberta Health Services

Alberta Environment and Parks

PIGEON LAKE WATERSHED ASSOCIATION

Associated Environmental

Lac La Biche County
welcoming by nature.

WABAMUN WATERSHED MANAGEMENT COUNCIL

Environment and Climate Change Canada | Environnement et Changement climatique Canada

Check out the tool for yourself at Algalbloomtracker.ca!

Thank You!

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