BLOOMWATCH

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THE PROBLEM

Harmful Algal Blooms (HABs) are rapidly degrading marine ecosystems in Canada.

These toxic blooms:

- Reduce biodiversity

- Devastate fisheries

- Threaten human and animal health.

If left uncontrolled, their spread is projected to cost Canada over **$5.3 billion** in tourism losses, property devaluation, water treatment costs, and damage to commercial fisheries over the next 30 years.

WHAT CAUSES HAB'S?

Nutrient Runoff: Excess nitrogen and phosphorus from agriculture and urban areas

Warmer Water Temperatures: Higher temperatures accelerate algal reproduction.

Agricultural Land Use: Fertilizers and livestock operations increase nutrient inputs into nearby waterways.

Increased Precipitation / Storm Events: Heavy rains wash more nutrients and sediments into lakes and rivers.
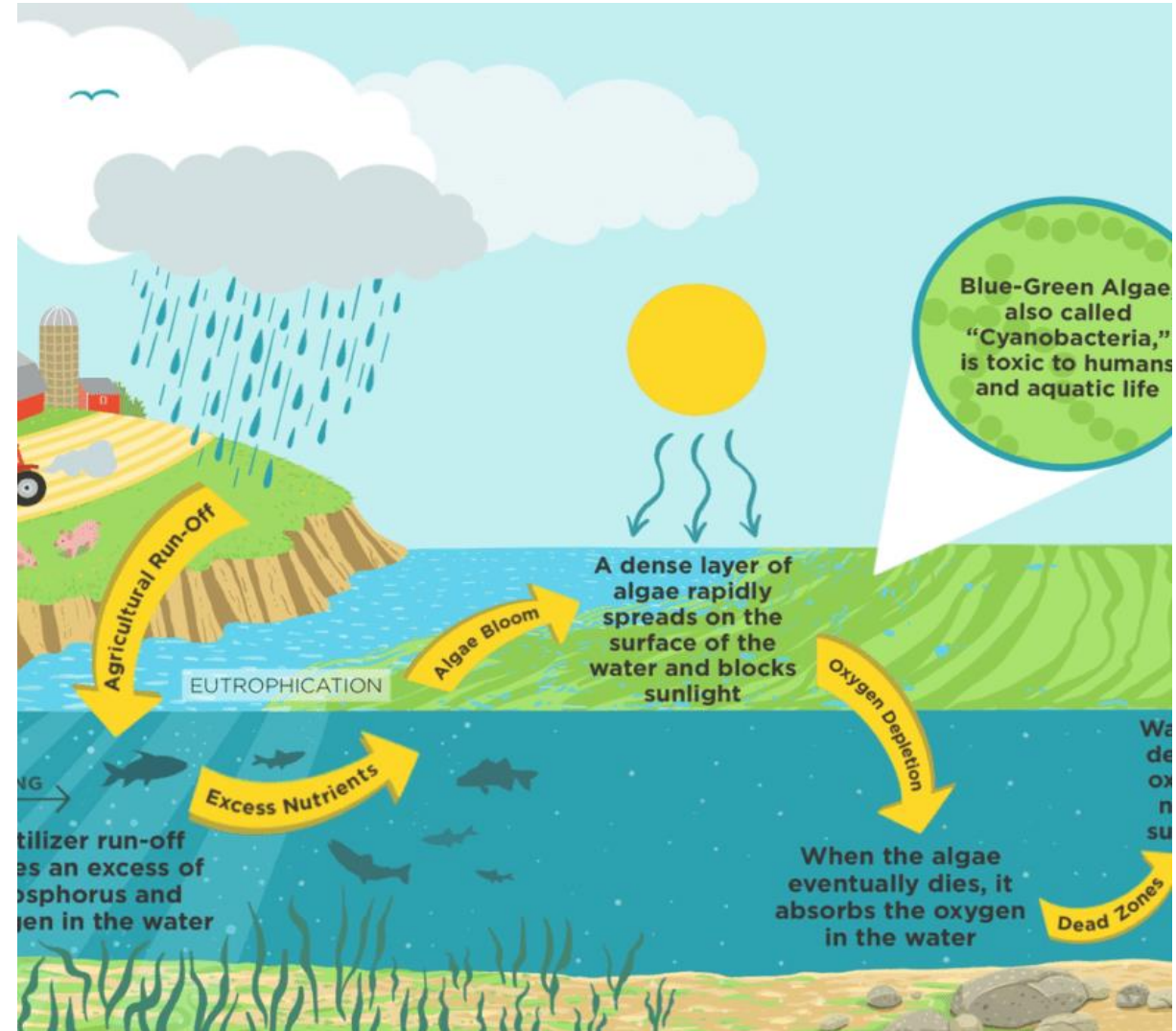
HOW DO WE COMBAT THEM?

Vegetative Buffer Strips: Planting permanently vegetated areas of trees, shrubs, and grasses between fields and water bodies that slow runoff, trap sediment, and absorb excess nutrients.

Cover Crops: Seasonal crops that reduce soil erosion, improve nutrient retention, and limit runoff from fields.

**Controlled Drainage / Retention Ponds:** Capture and slow runoff before it reaches lakes or rivers.

Prevention Over Treatment: Taken preventative measures is more impactful than treatment after the fact. Algaecides are not recommended after blooms appear, as they can release more toxins.

OUR SOLUTION

Bloomwatch is a satellite-powered analysis platform that detects algal blooms and the nearby contributing factors such as:

- High elevation areas -> carries nutrients into water bodies.

- Agricultural land - excess nitrogen and phosphorus from fertilizers and livestock.

- Precipitation - heavy rains increase surface runoff, washing nutrients and sediment into lakes.

- Water temperature - warmer waters accelerate algal growth

Demo Video

https://www.youtube.com/watch?v=klrSO1sKj7Y&feature=youtu.be
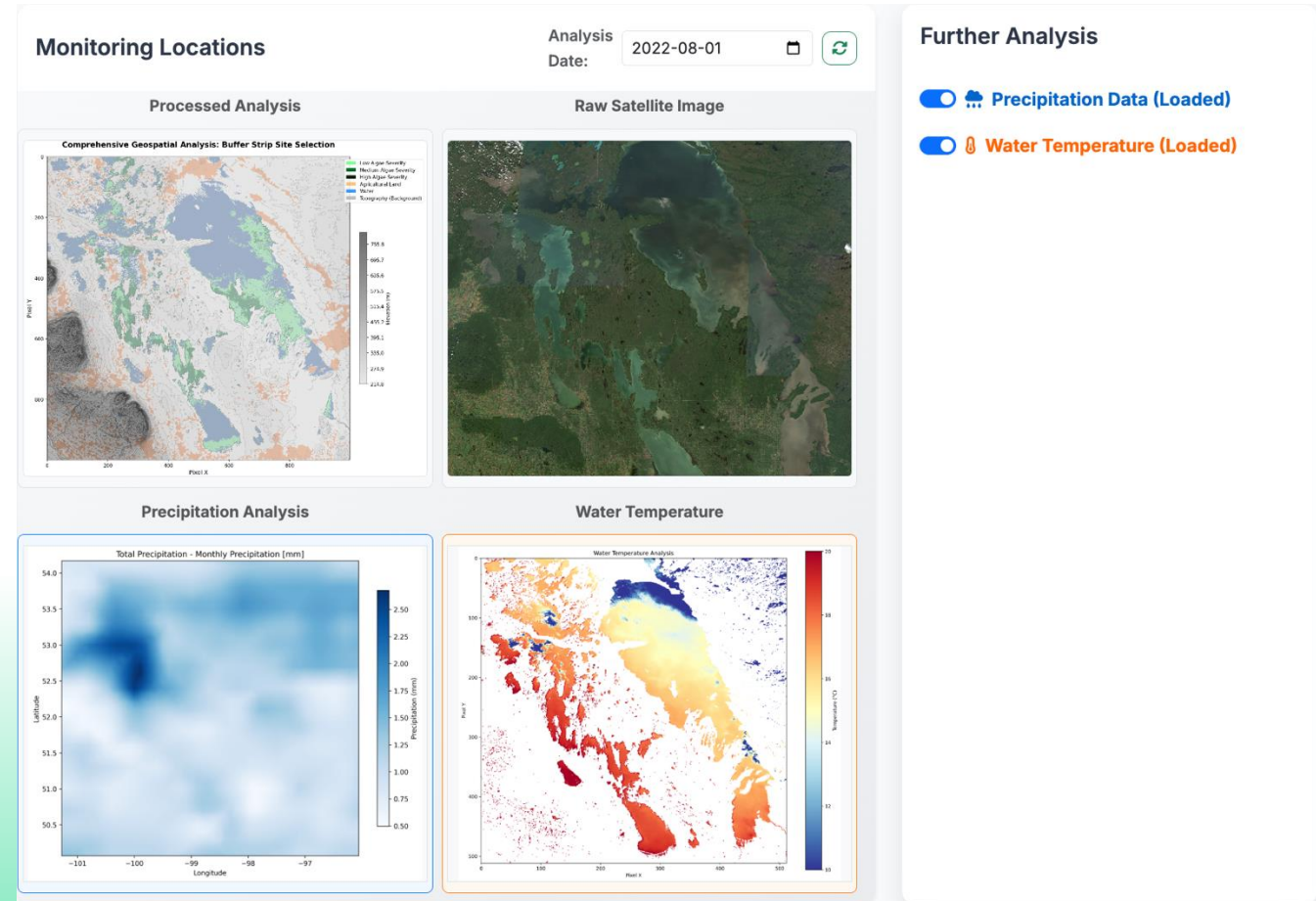
WHAT DOES THIS SOLVE?

We provide **environmental authorities** with instant insights on where to implement preventative measures.

This gives them results in minutes instead of **waiting hours** for sampling teams or even years for nutrient policies to take effect.

Our platform can also provide a source of **historical data to train machine learning models on** correlations between algal blooms and contributing factors.
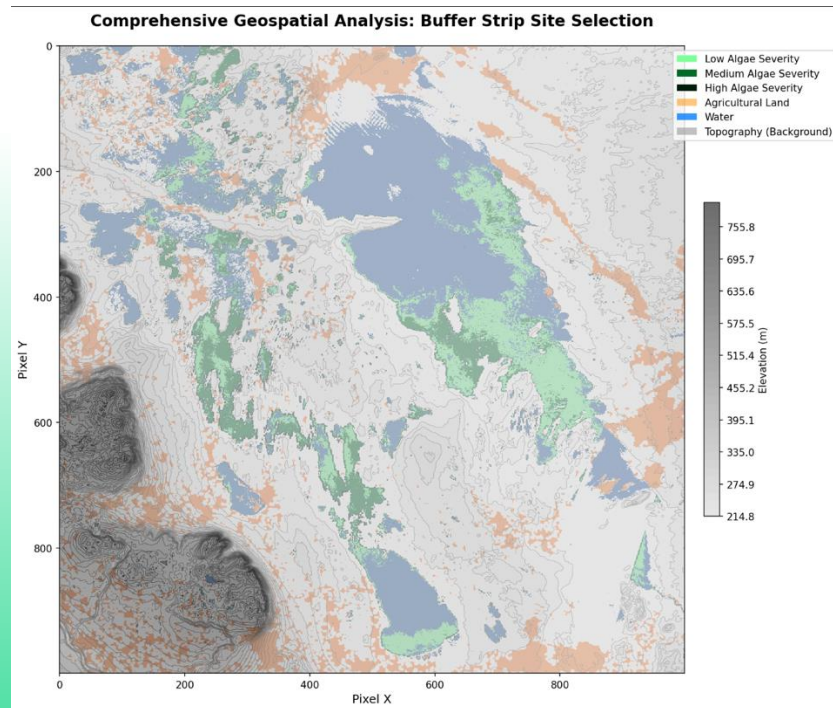
HOW THE ALGAE DETECTION WORKS

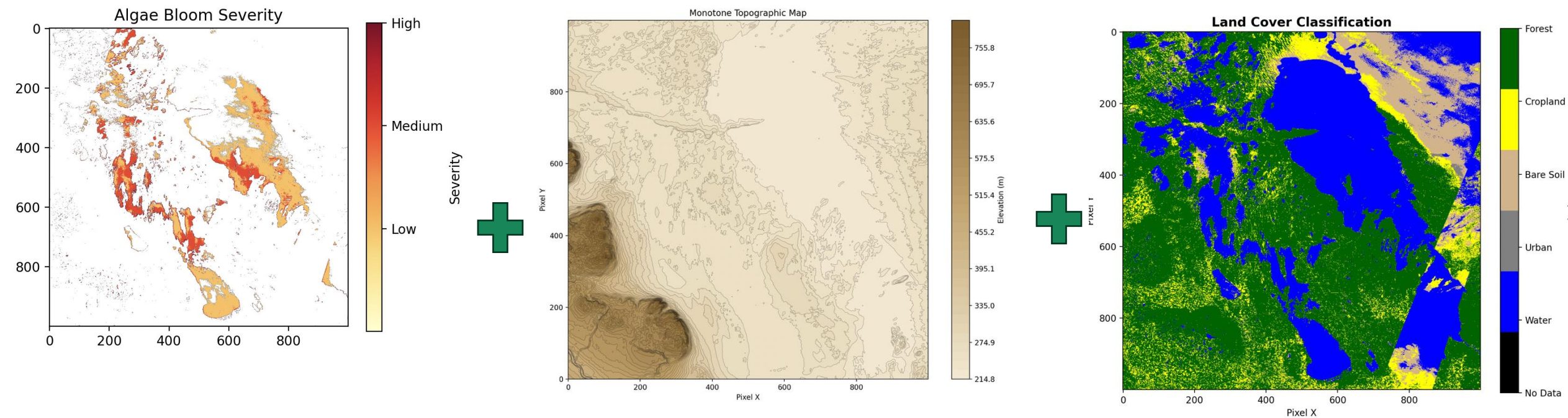**Algae Detection:**

- NDWI (Normalized Difference Water Index). Range from [-1, 1], closer to 1 the more likely its water.

- Calculate NDVI (Normalized Difference Vegetation Index) [-1, 1], closer to 1, the more likely its vegetation.

- We do this with Sentinel-2's satellite bands (Blue, Green, Red, Near-Infrared)

$$NDWI = \frac{(NIR - SWIR)}{(NIR + SWIR)}$$

$$NDVI = \frac{NIR - Red}{NIR + Red}$$

Algae Bloom Severity

Severity: High / Medium / Low

Monotone Topographic Map

Elevation (m): 755.8 / 695.7 / 635.6 / 575.5 / 515.4 / 455.2 / 395.1 / 335.0 / 274.9 / 214.8

Land Cover Classification

Forest / Cropland / Bare Soil / Urban / Water / No Data

Comprehensive Geospatial Analysis: Buffer Strip Site Selection

Low Algae Severity
Medium Algae Severity
High Algae Severity
Agricultural Land
Water
Topography (Background)

Elevation (m): 755.8 / 695.7 / 635.6 / 575.5 / 515.4 / 455.2 / 395.1 / 335.0 / 274.9 / 214.8

FUTURE ADDITIONS

A machine learning model to analyze the historical data and provide location suggestions for vegetation strips.

A notification system for alerting environmental authorities of the status of algal blooms