

# Monitoring: Useful at Every Step

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Tracking Changes, with Purpose



# Monitoring Basics

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- What is monitoring?
  - Repeated **observations** or **measurements** to identify and track changes
- Why monitor riverbanks?
  - Tells us **where, when** and **how quickly** erosion or slope creep is occurring
    - Are conditions improving or getting worse?
  - **Trends** allow us to predict how long until impact
  - Managing risks by providing an ‘**early warning**’
    - Evacuations or other measures
  - **Input** to studies by technical specialists



# Monitoring with Purpose!

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- No point in monitoring if you don't know how to respond to the results!
- Establish decision points that 'trigger' specific actions
  - Separation distance? Amount of undercut? Settlement depth?
- Actions?
  - **Do nothing** (continue to monitor)
  - **Expand monitoring**
  - **Request support** (NWTAC or technical specialist)
  - **Emergency measures** to manage risk – evacuation, road/trail closure, temporary protections, etc.



# Monitoring Methods

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- **Remote sensing**

- Air photos, satellite imagery, UAV (drone) surveys



- **Elevation surveys**

- Topography, bathymetry



Credit: nhc (2024)

- **Soil movement detection**

- Inclinometers, extensometers, ErosionAlert?



Credit: J. Coates

- **Visual assessment**

- Fixed stakes, strings, photos, game cameras

# Ground Temperature Monitoring



# Timelapse Clips with Satellite Imagery



**Fort Smith**  
**(Sentinel: 2014 – 2025)**

**Mackenzie River and  
tributaries near Axel Island**  
**(Landsat: 1984 – 2022)**

<https://earthengine.google.com/timelapse#v=65.6591,-128.80541,9.433,latLng&t=2.54&ps=50&bt=19840101&et=20221231>

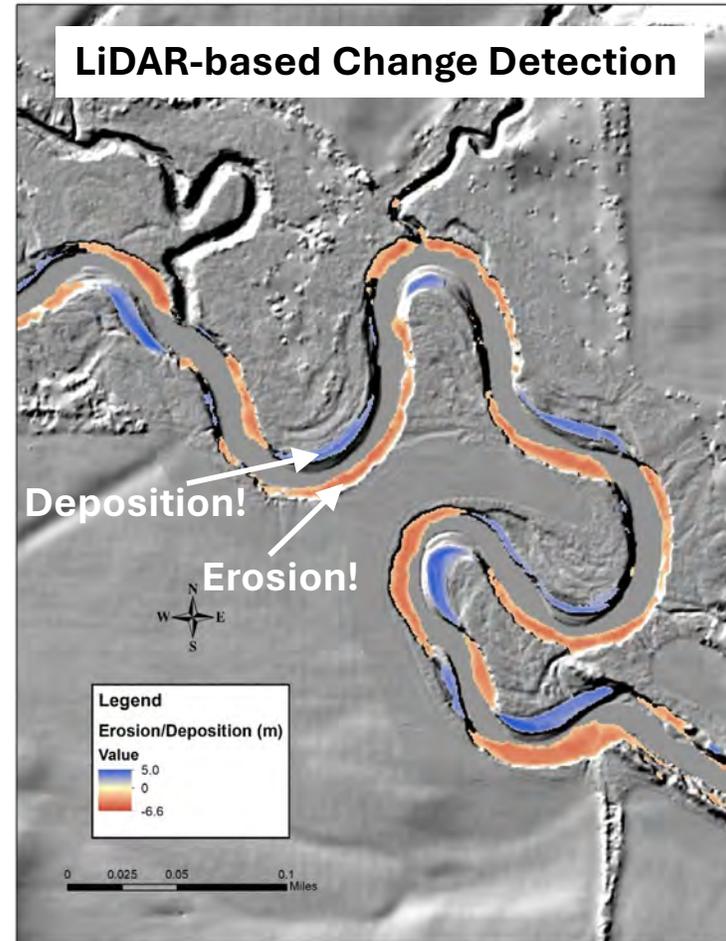
**Root River near Wrigley**  
**(Landsat: 1984 – 2022)**

<https://earthengine.google.com/timelapse#v=62.86483,-124.01407,10.062,latLng&t=3.72&ps=50&bt=19840101&et=20221231>

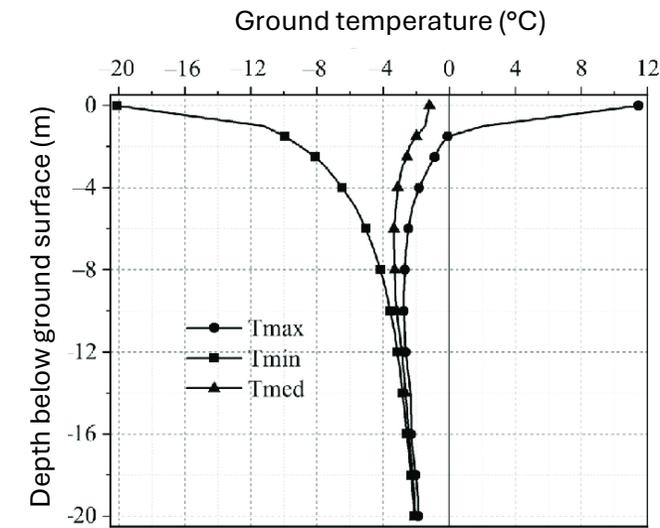
**Very dynamic river in Peru**  
**(Landsat: 1985 – 2020)**

<https://youtu.be/IINZNRyLLAw>

# How to Read Results of Monitoring



Wolter et al. (2025)



Yu et al. (2022)

