TEACHERS AND RESEARCHERS EXPLORING AND COLLABORATING

POLAR TREC

Welcome to *PolarConnect*

Microbial Changes in Arctic Freshwater 2016

With PolarTREC Teacher DJ Kast & Arctic Researchers

Dr. Byron Crump and Dr. George Kling

7 July 2016

Getting to Know Adobe Connect

Slides will be shown here

Exit presentation

Mute your speakers

Raise your hand

List of all participants

Follow the chat

Find out more about the presentation

Chat here

Participant Introductions

In the Chat box, please introduce yourself by typing in your:

- ✓ Name
- ✓ School or Institution
- ✓ The number of students and adults participating with you in the same location

What is PolarTREC?

- Since 2004, the Arctic Research Consortium of the United States (ARCUS), a non-profit organization, has been administrating the PolarTREC Program.
- PolarTREC is professional development for K-12 teachers. They are paired with researchers for 2-6 week research experiences in the polar regions.
- Over 150 teachers from around the United States have joined scientists in the Arctic and Antarctica to learn about science, the polar regions, and to share what they have learned with their students and communities.

ARCUS
ARCTIC RESEARCH CONSORTIUM OF THE UNITED STATES

25 Years of Connecting Arctic Research
www.arcus.org

Questions

During the Presentation:

- Type your question in the text chat box

At the End of the Presentation:

- Raise your hand with the "hand button".
- PolarTREC staff will call on you and activate your microphone.
- Speak loud and clear, directly into the computer microphone or the phone to ask your question.

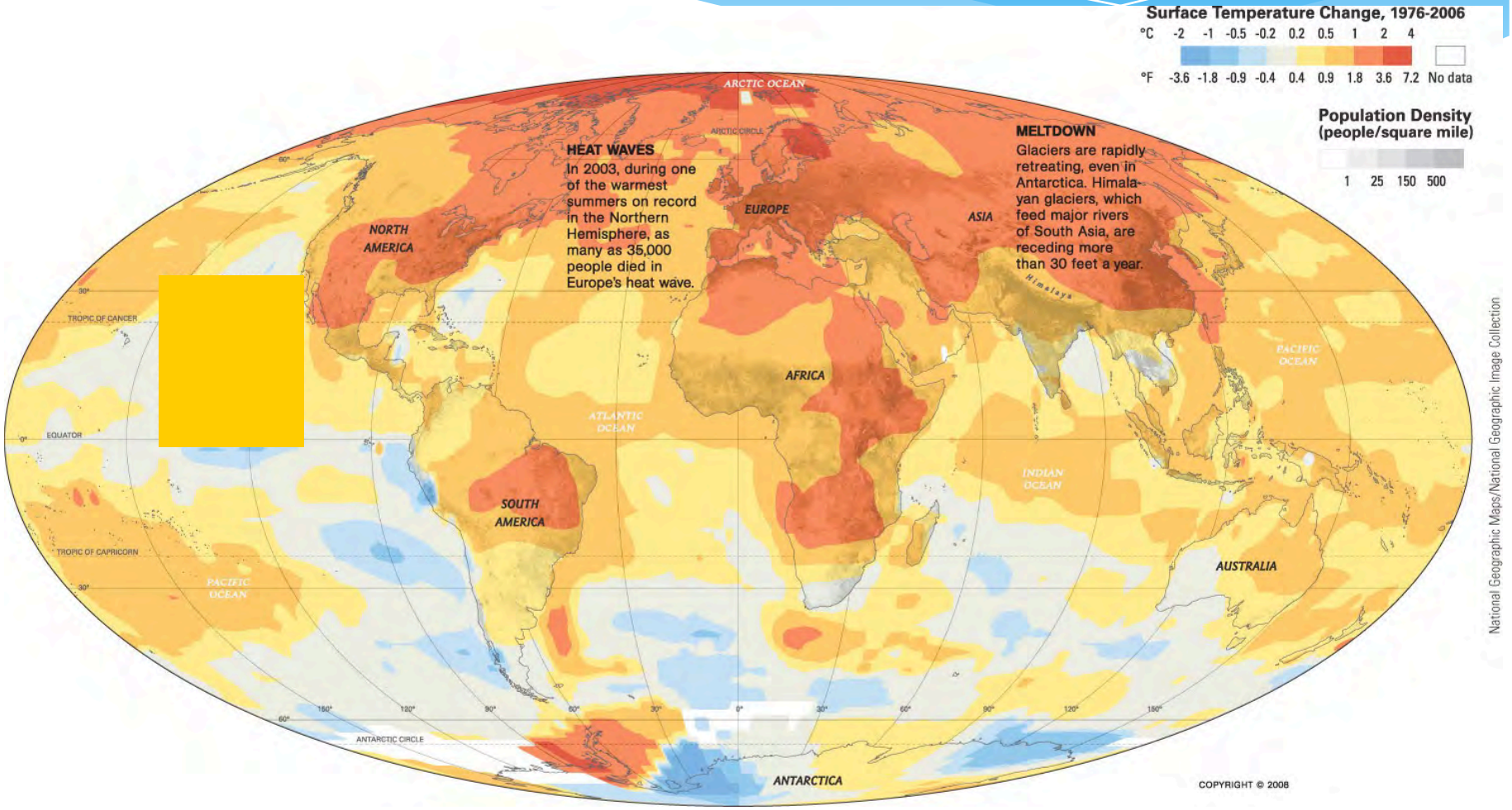
Welcome to our PolarConnect event from Toolik Field Station in the Arctic!

* Educator: DJ Kast
  * USC STEM Programs Manager
* Arctic researchers: Dr. Kling and Dr. Crump

Climate Change and the World

* Our world is changing.
* Carbon dioxide or CO_2 levels are increasing
* This increase in CO_2 has dire consequences for humans all over the world
  * Extreme droughts in places like Los Angeles
  * Sea level rise and floods
  * Warmer global temperatures
  * Extreme weather

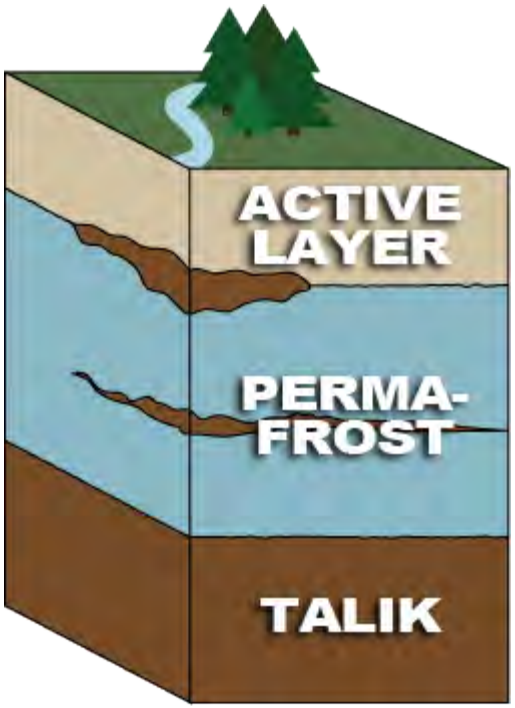
The Arctic is warming faster than the rest of the Earth



- Average global land and ocean temperatures are increasing
- Greenhouse gases and heat are not distributed evenly on Earth

Figure 2-14a p36

Arctic contains permafrost soils



Permafrost is permanently frozen soil, sediment or rock

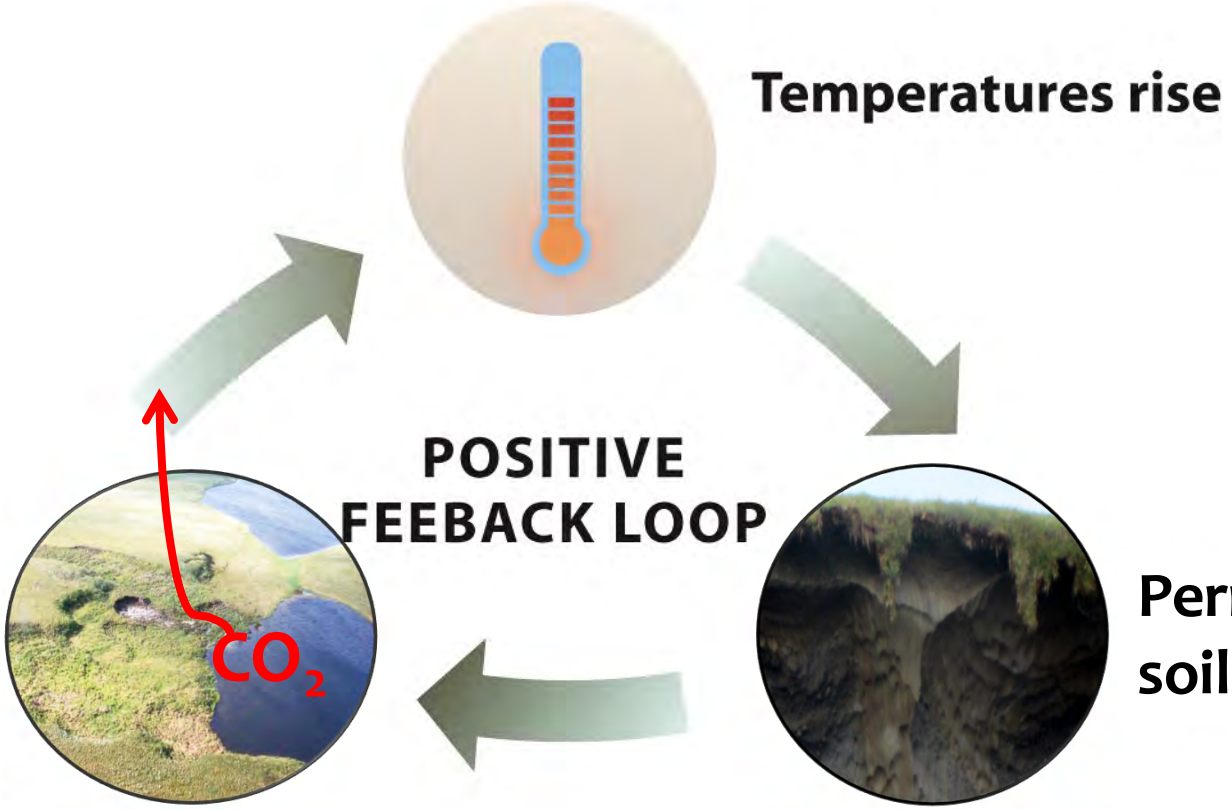
Source: International Permafrost Association, 1998. Circumpolar Active-Layer Permafrost System (CAPS), version 1.0.

Toolik Field Station, Alaska

Permafrost soils contain tons of carbons

Permafrost = permanently frozen soils

Positive Feedback Loop: Thawing permafrost will cause more warming on Earth



Food (organic matter) stored in freezer

Warmer temperatures thaws food

Organisms eat thawed food!

Food in

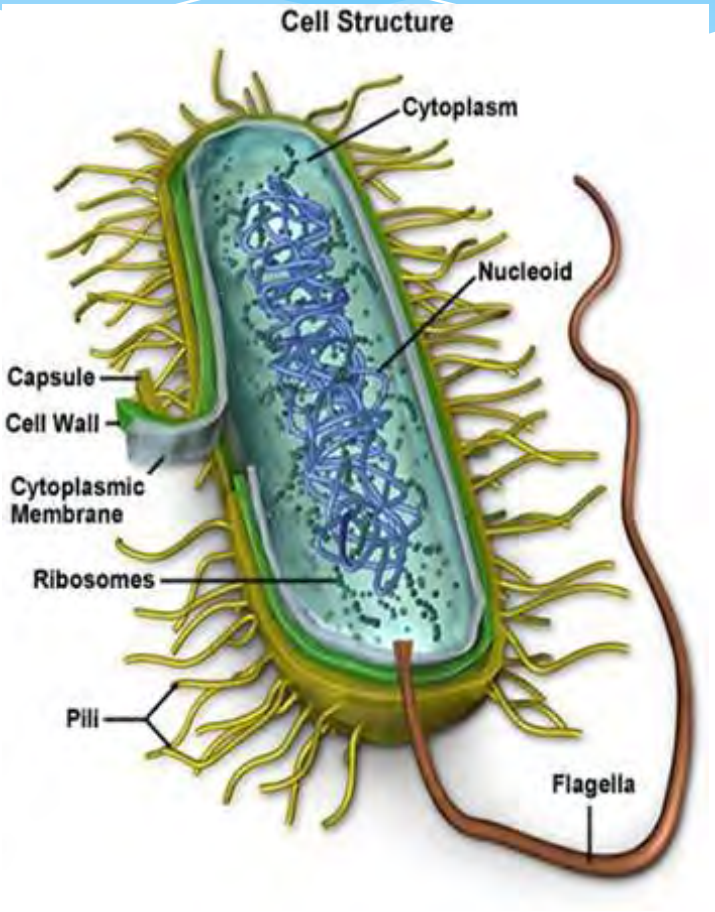
CO_2 out!!

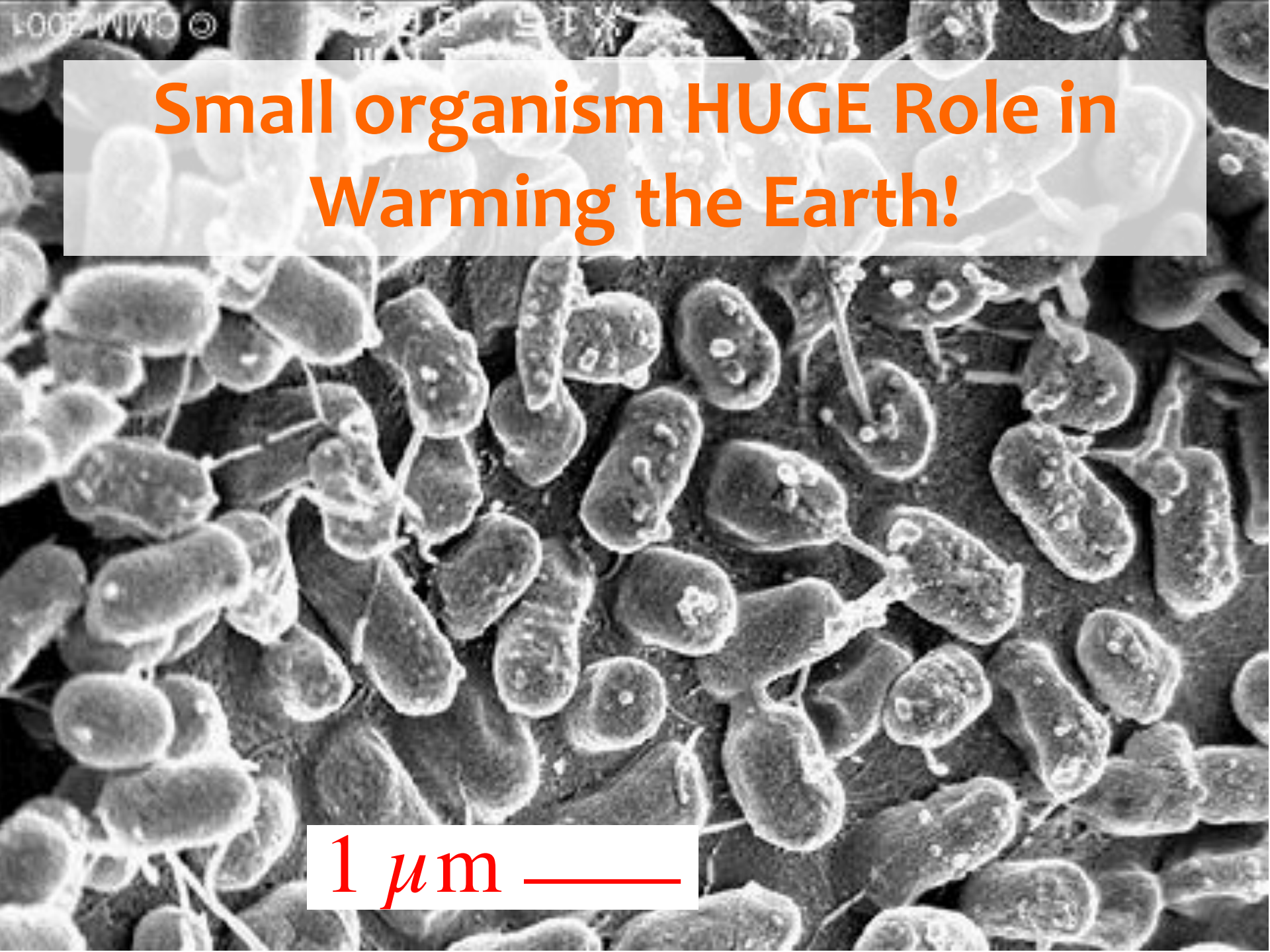
Research Overview

* Microbes are everywhere in the natural world.
* Microbes eat soil carbon and breathe out CO_2
* The rate of this CO_2 production depends on which microbes are there and whether they have the ability to convert soil carbon into CO_2
* Each environment has its own distinct bacteria like in lakes and streams that have different genetic capabilities to convert soil carbon into CO_2

What is a microbe?

* A microbe is a category of organism that is so small to be seen by the naked eye. The category of Microbes include bacteria and viruses.
* Bacteria are microscopic single-celled organisms that thrive in diverse environments.




Small organism HUGE Role in Warming the Earth!
1 μm

Arctic Microbial Crime Scene

Who's there and what are they doing?

DNA →

* Lake Bacteria

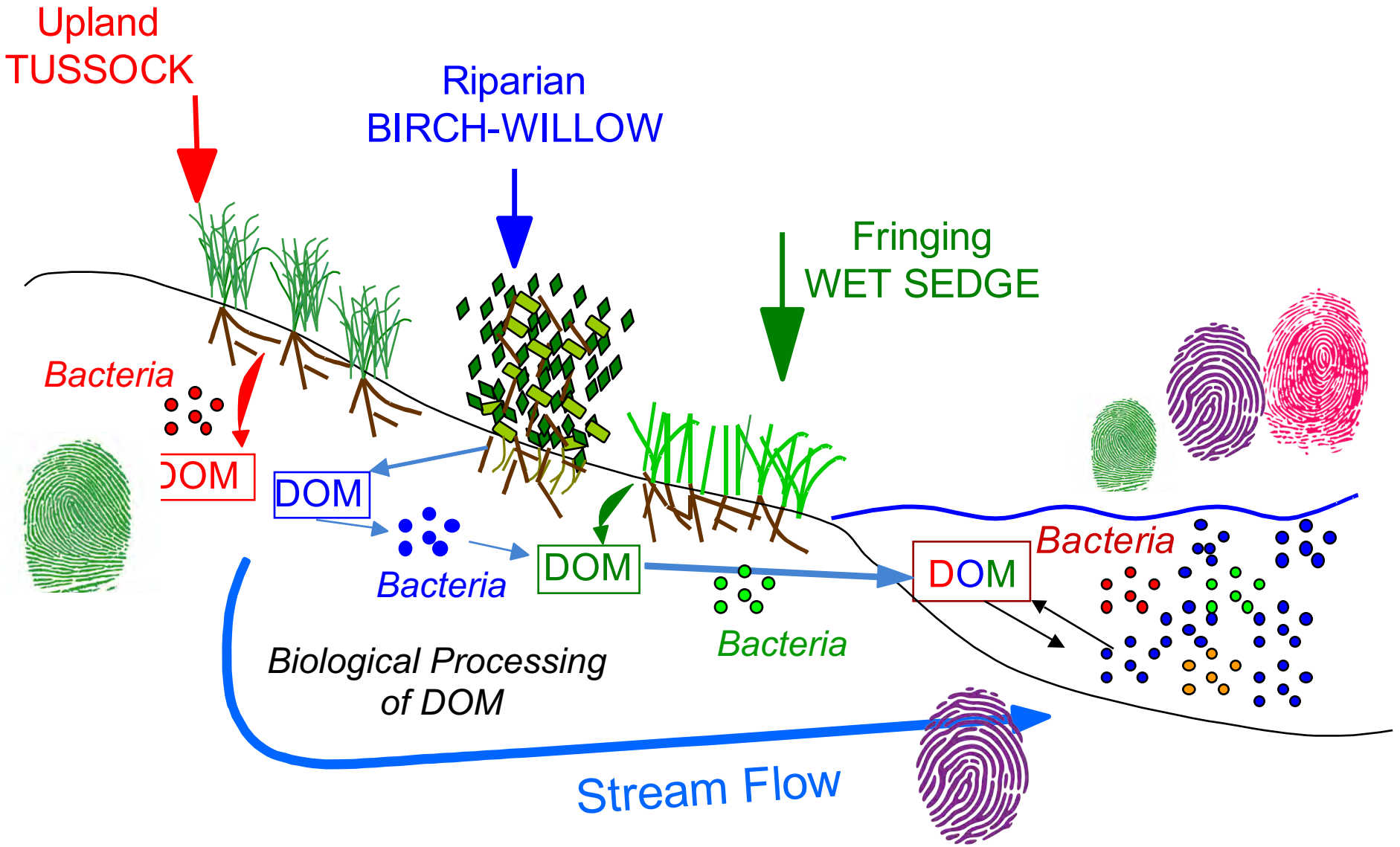
DNA →

* Stream Bacteria

DNA →

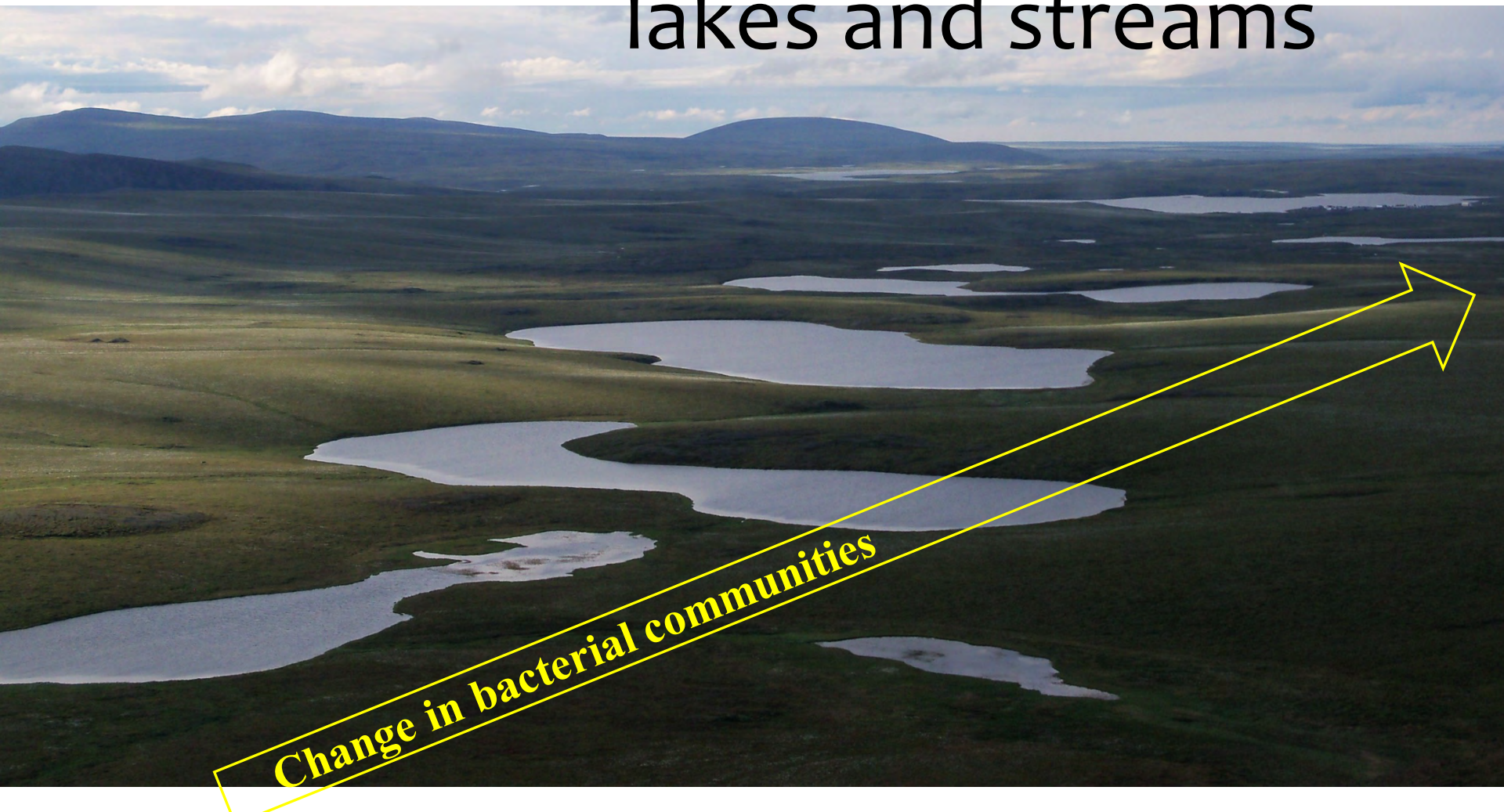
* Soil bacteria

How microbe populations change across the landscape.

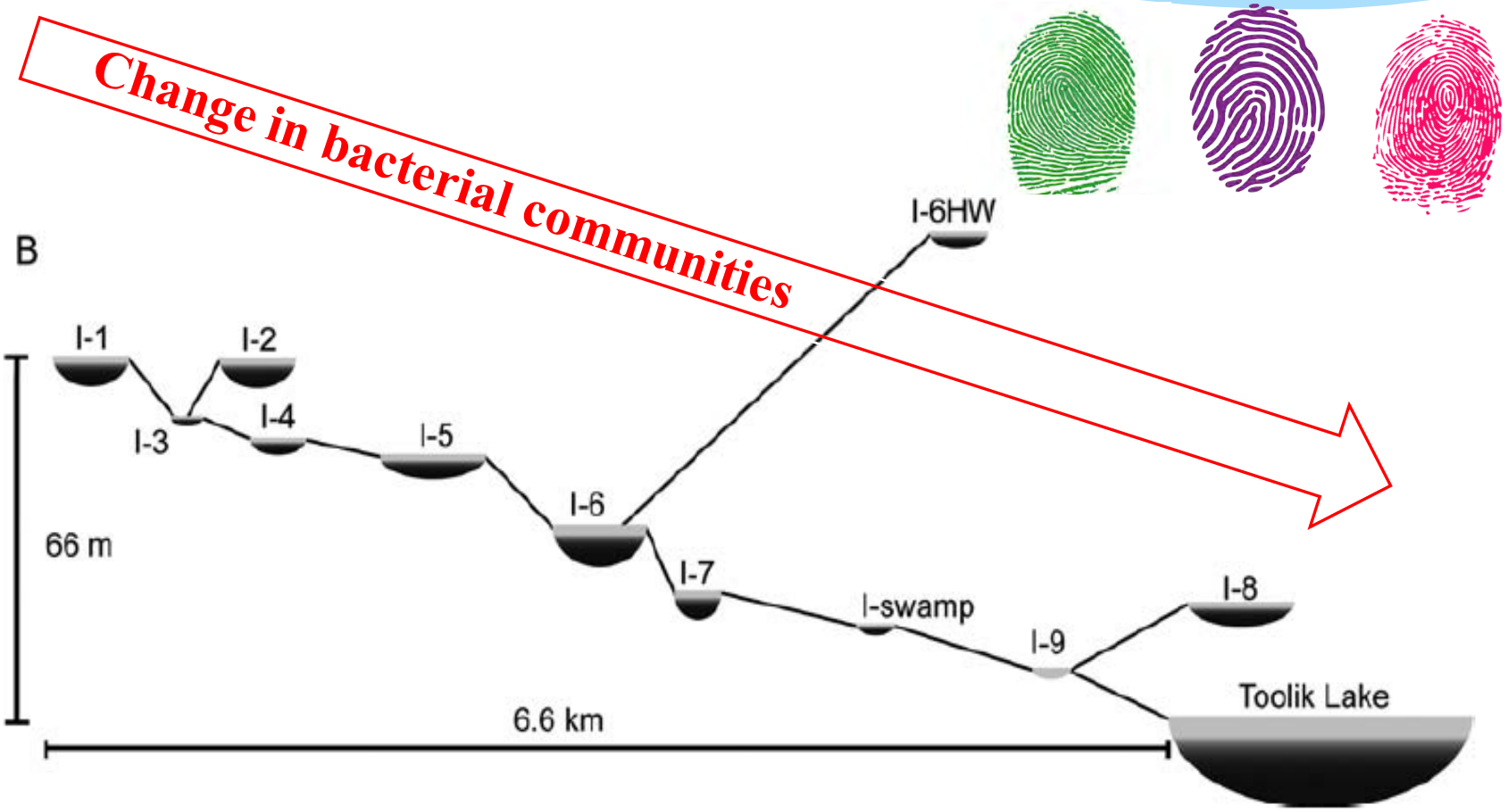


Judd et al. 2006, 2007. Crump et al. 2007, Zak & Kling 2006

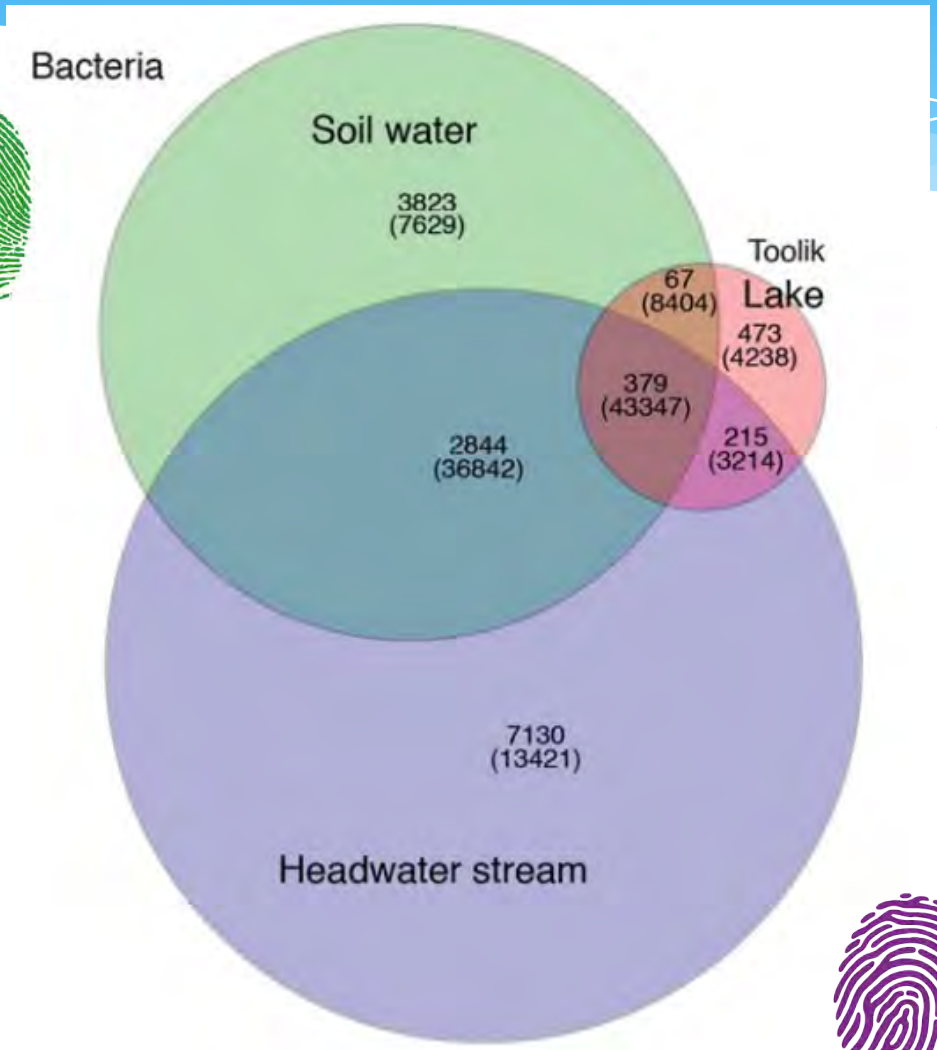
Fingerprinting microbes in a chain of lakes and streams



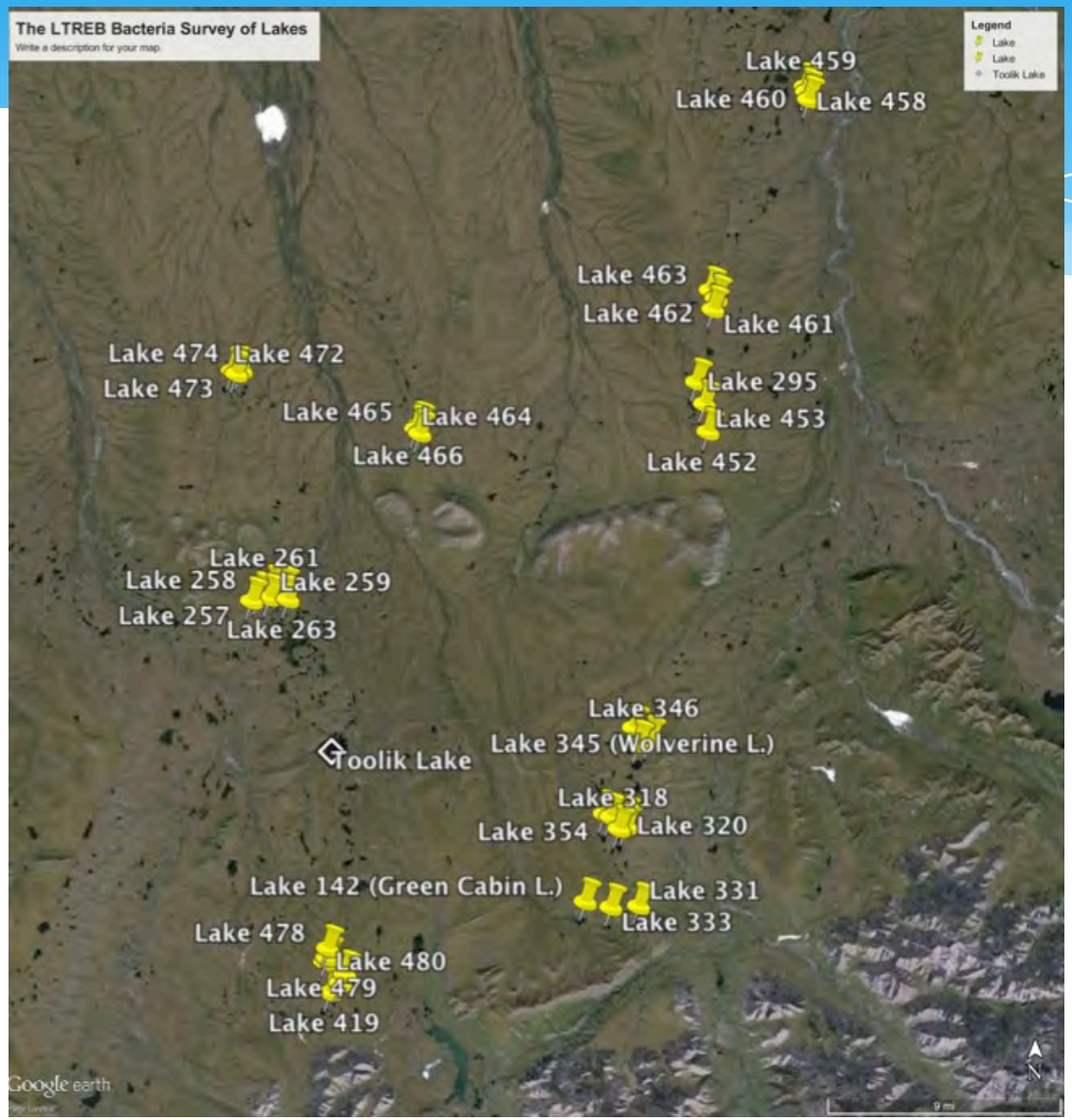
Q1: Are there different bacteria living in streams compared to lakes?



Different bacteria live in soils, streams, and lakes

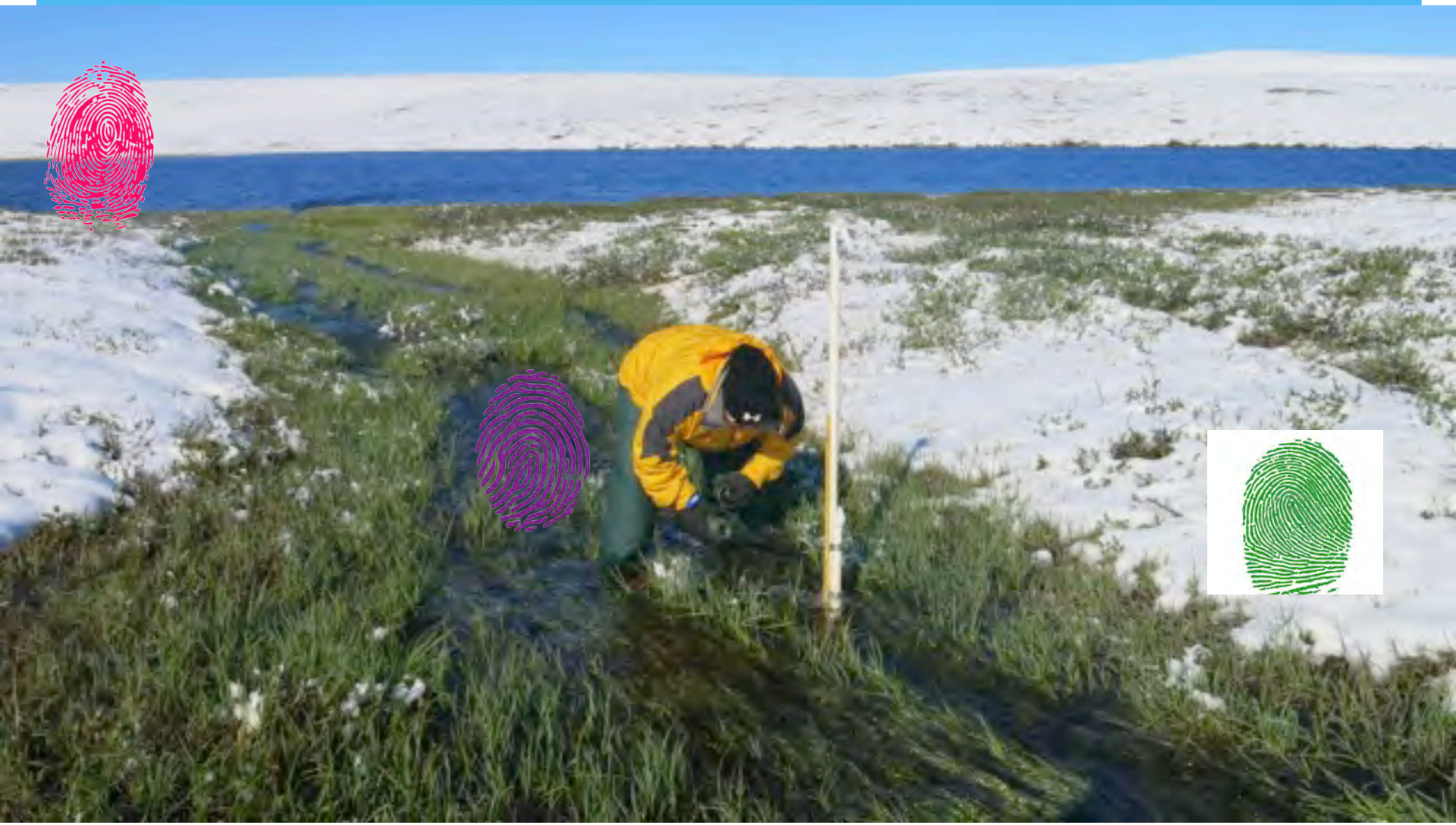


Fingerprinting bacteria on a larger scale



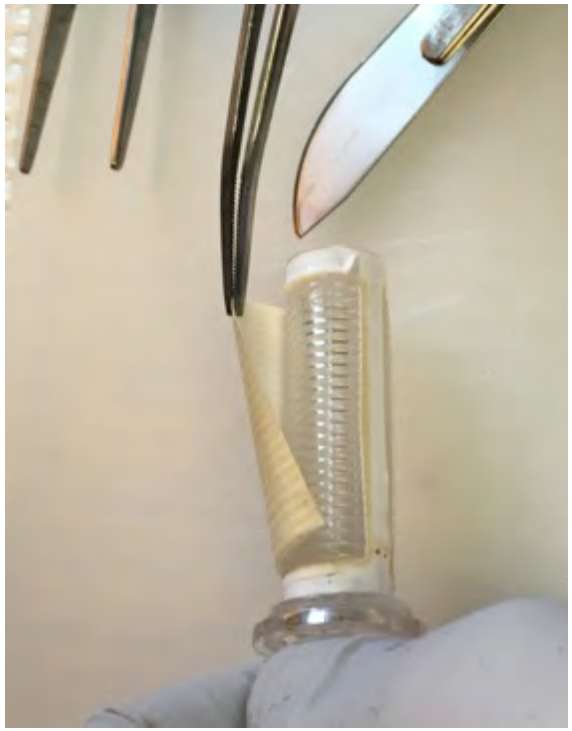
Bacteria Survey Science

Who dun it?



Collecting our microbial criminals

Fingerprinting microbes with their DNA in the Lab



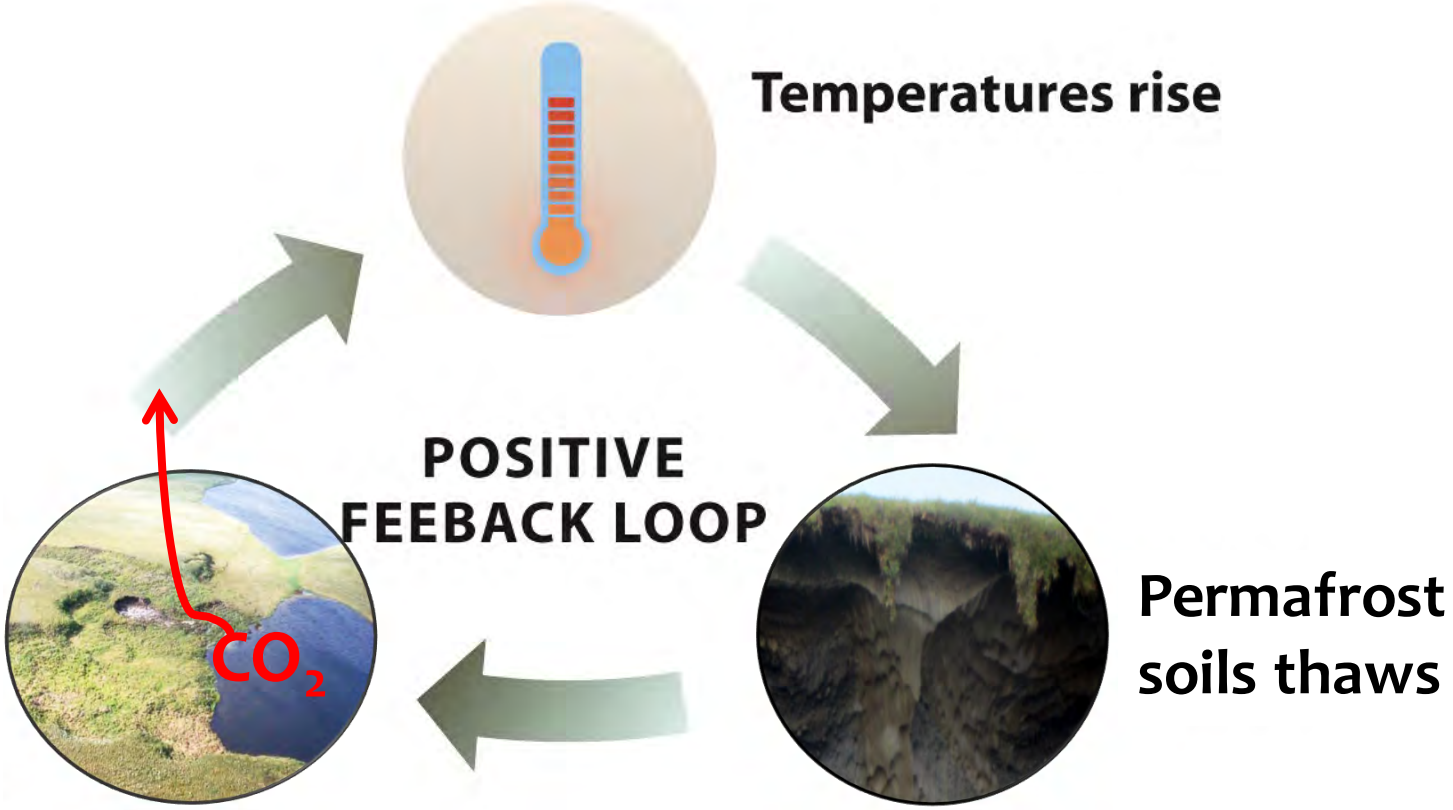
How does DNA help us identify microbes?

* Dust for all the fingerprints in a specific area and we look to identify the sources of the fingerprints
* The microbial fingerprints are barcoded with a unique marker on the DNA that labels them as stream, lake, or soil bacteria.
* The barcodes allow us to both identify bacterial species using DNA databases and sort them into the soil, lake, and stream categories.

What have we learned from the DNA fingerprinting of microbes?

Soil microbes seed lake microbes through streams
Microbes in lakes are equipped with the genetic toolbox to convert soil carbon into CO2.

Microbe fingerprinting discovery adds to positive feedback loop



Outreach

Outreach During & Post-Expedition

Fight on for Science!

Join PolarTREC!

www.polartrec.com/about/join

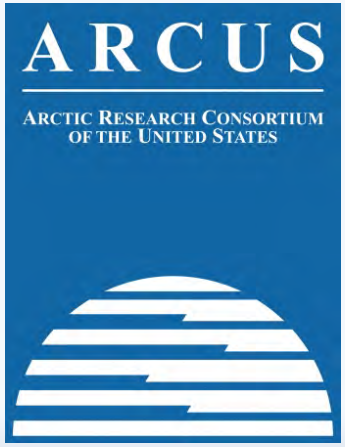
Everyone can participate in different ways:

- **Follow Expeditions**
- **Participate in PolarConnect Events**
- **Join the Polar Education Email List**
- **Check out the great resources**
- **Become a PolarTREC Teacher or Researcher**
- **Become a member of ARCUS**

Thank You!

An archive of the event will be available shortly.

http://www.polartrec.com/polar-connect/archive



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