TEACHERS AND RESEARCHERS EXPLORING AND COLLABORATING

POLAR TREC

Welcome to *PolarConnect*



Carbon in the Arctic

With PolarTREC Teacher David Walker

& Team Researcher Rose Cory

June 26, 2019

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

Questions

During the Presentation:

- Type your question into the text chat box and we will insert your question when the right opportunity arises.
- Don’t worry! If we haven’t been able to ask your question during the presentation, we will save it for the end.
- At the end of the presentation, we often open the webinar up to family and friends who want to say ”Hello” or have any last minute questions for the presenters.

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

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**

Carbon in the Arctic

June 4-29, 2019

Toolik Field Station

Introductions

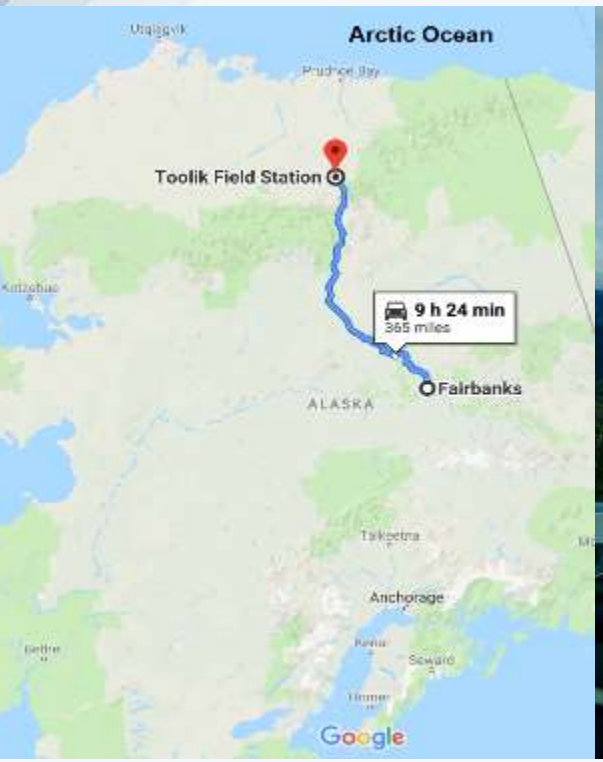
David Walker

PolarTREC Teacher

Rose Cory

Principal Investigator

Toolik Field Station



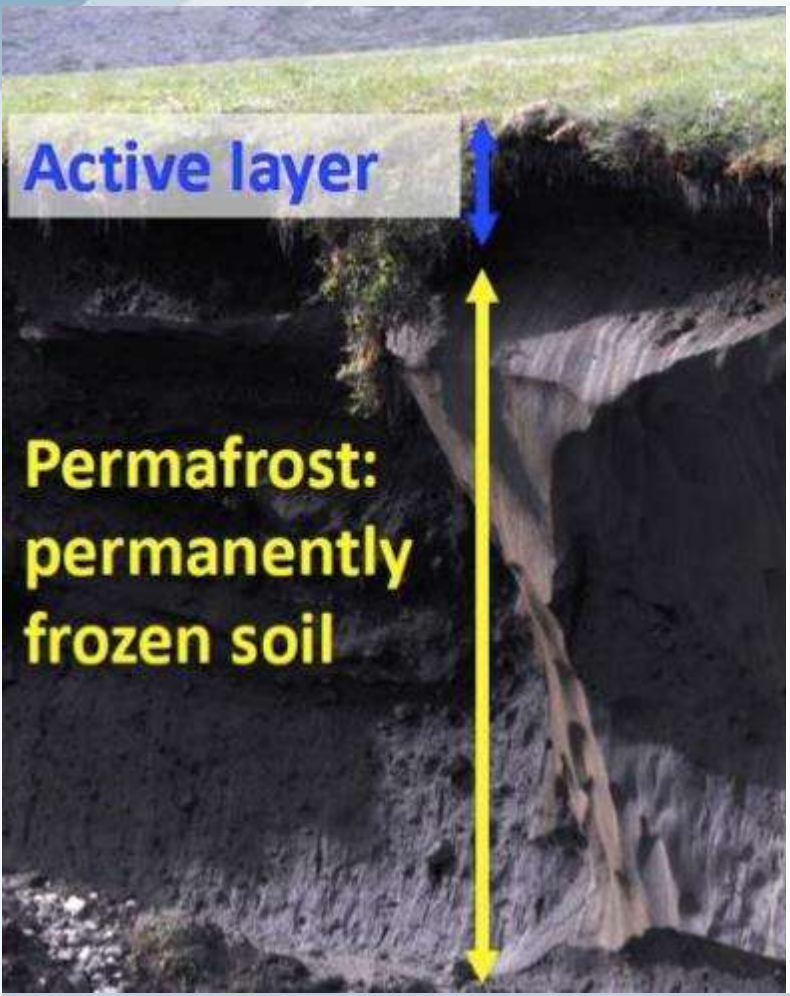
Map of Drive

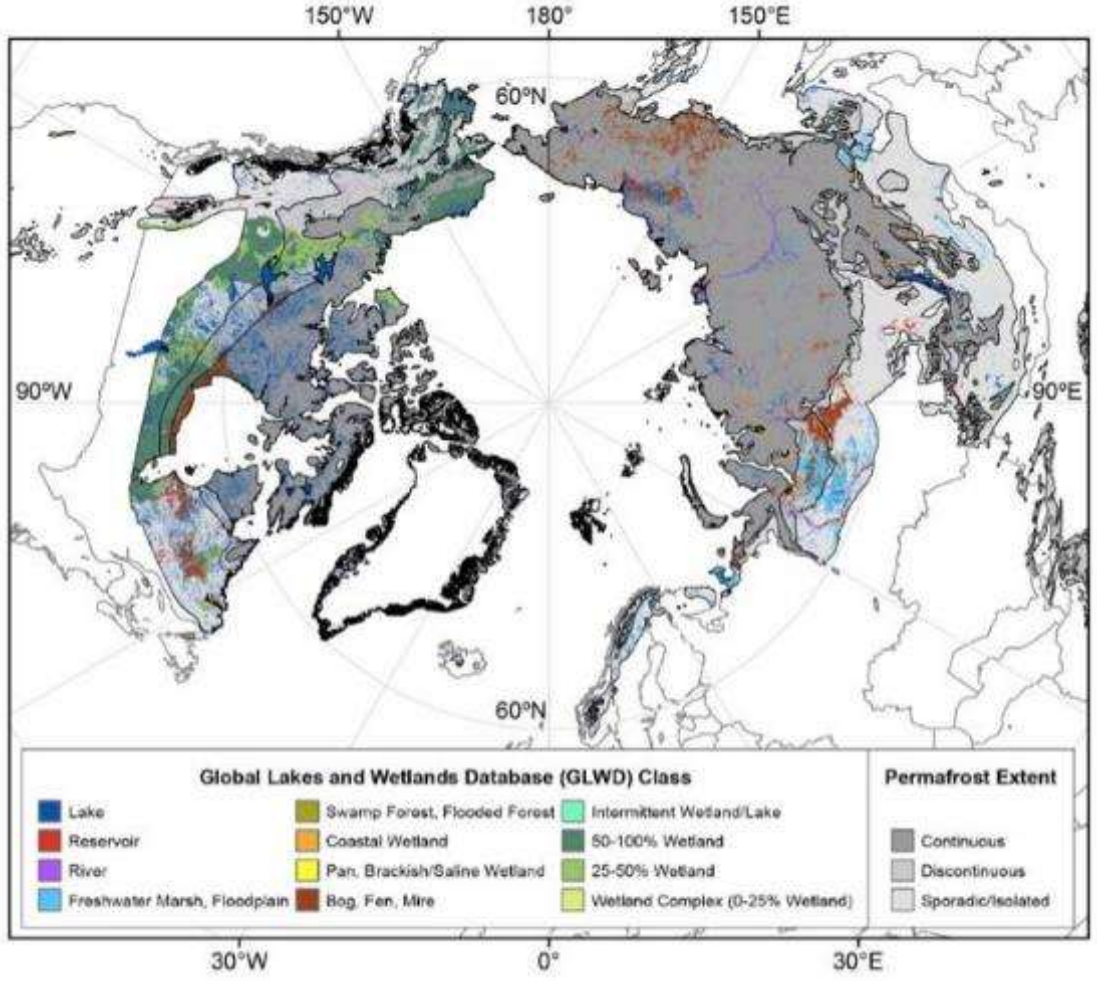
Dalton Highway

Entrance to Toolik Field Station

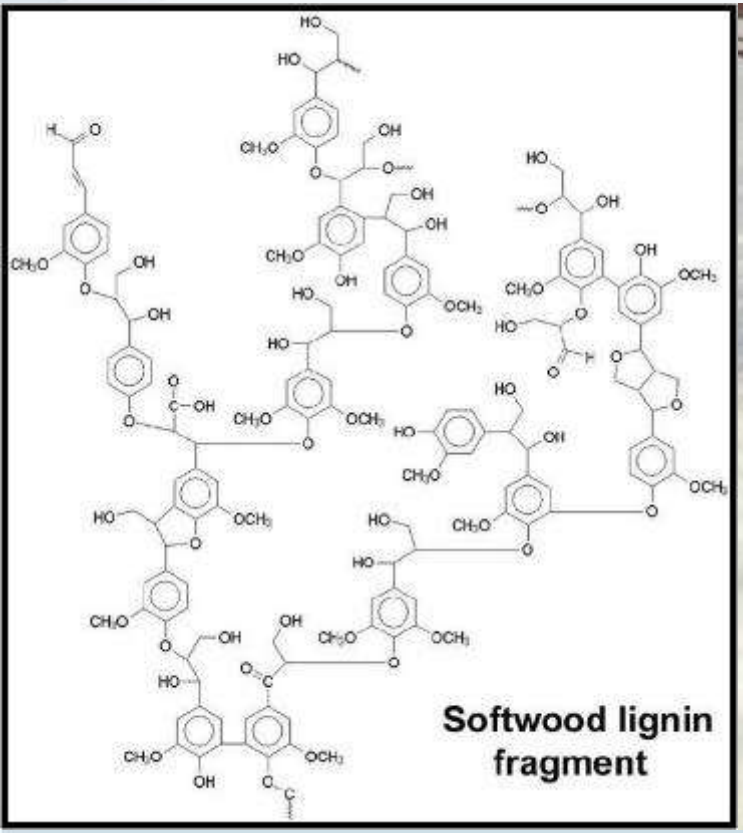
Background

What is Permafrost?

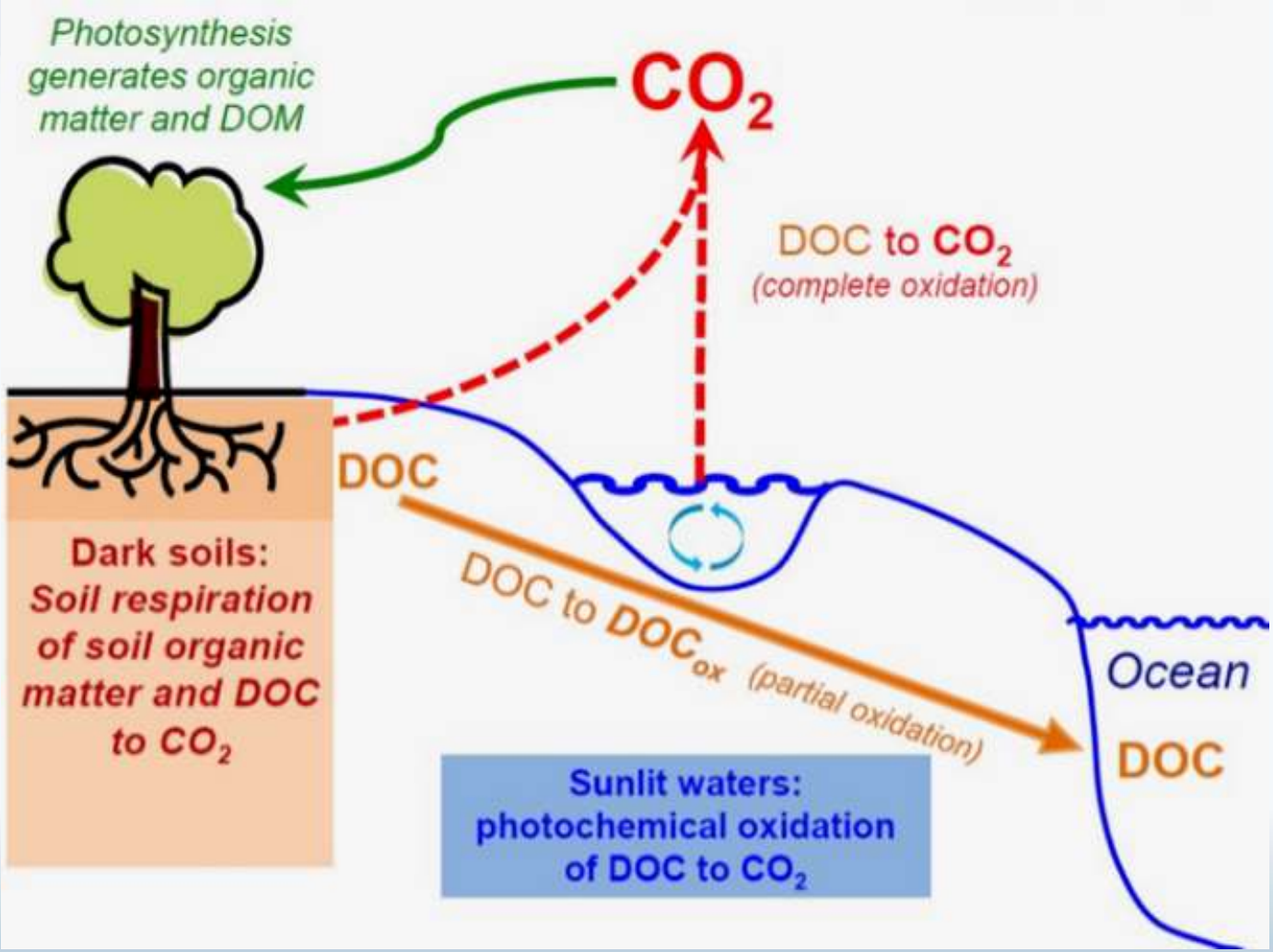




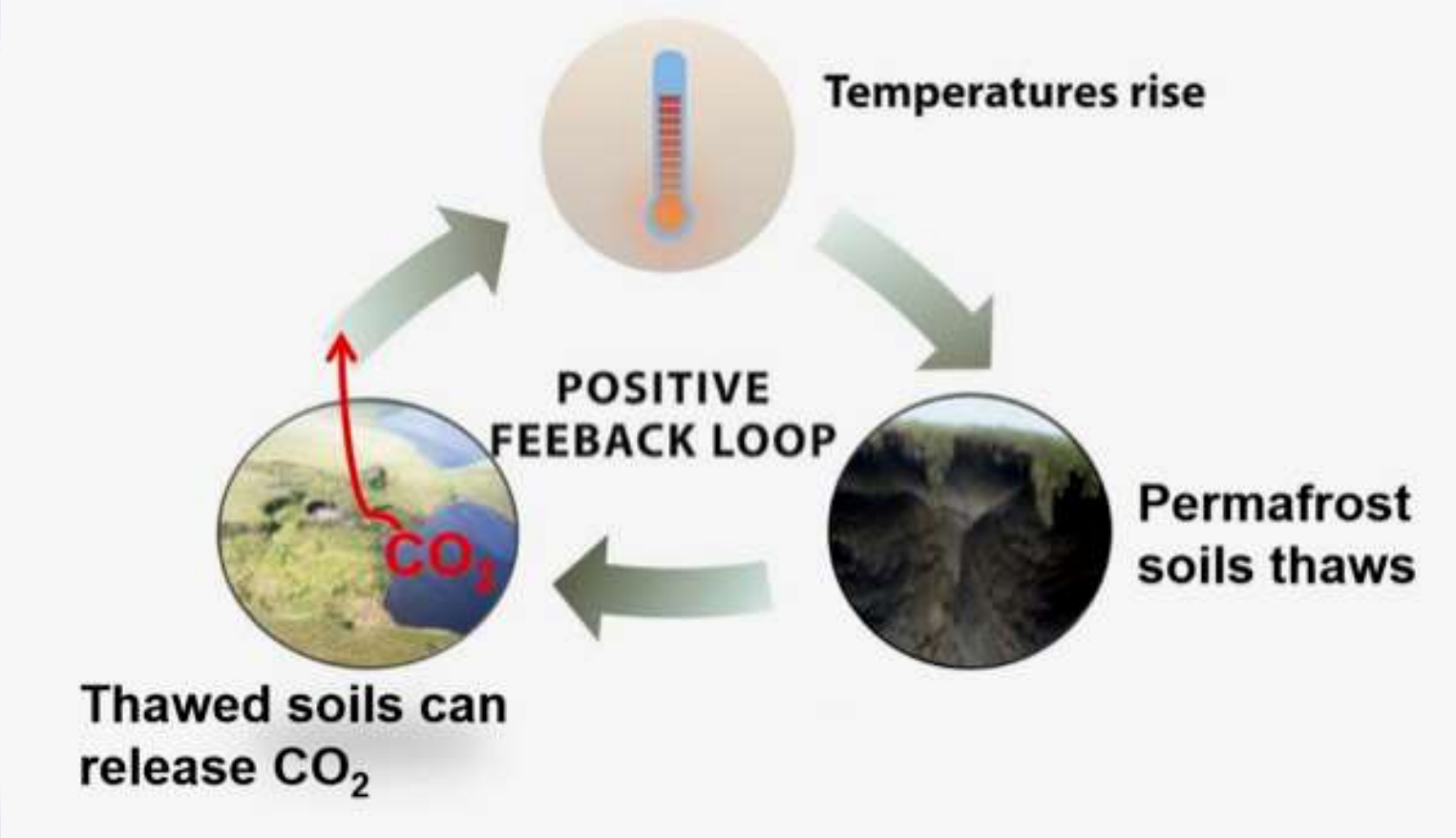
Dissolved Organic Carbon (DOC)



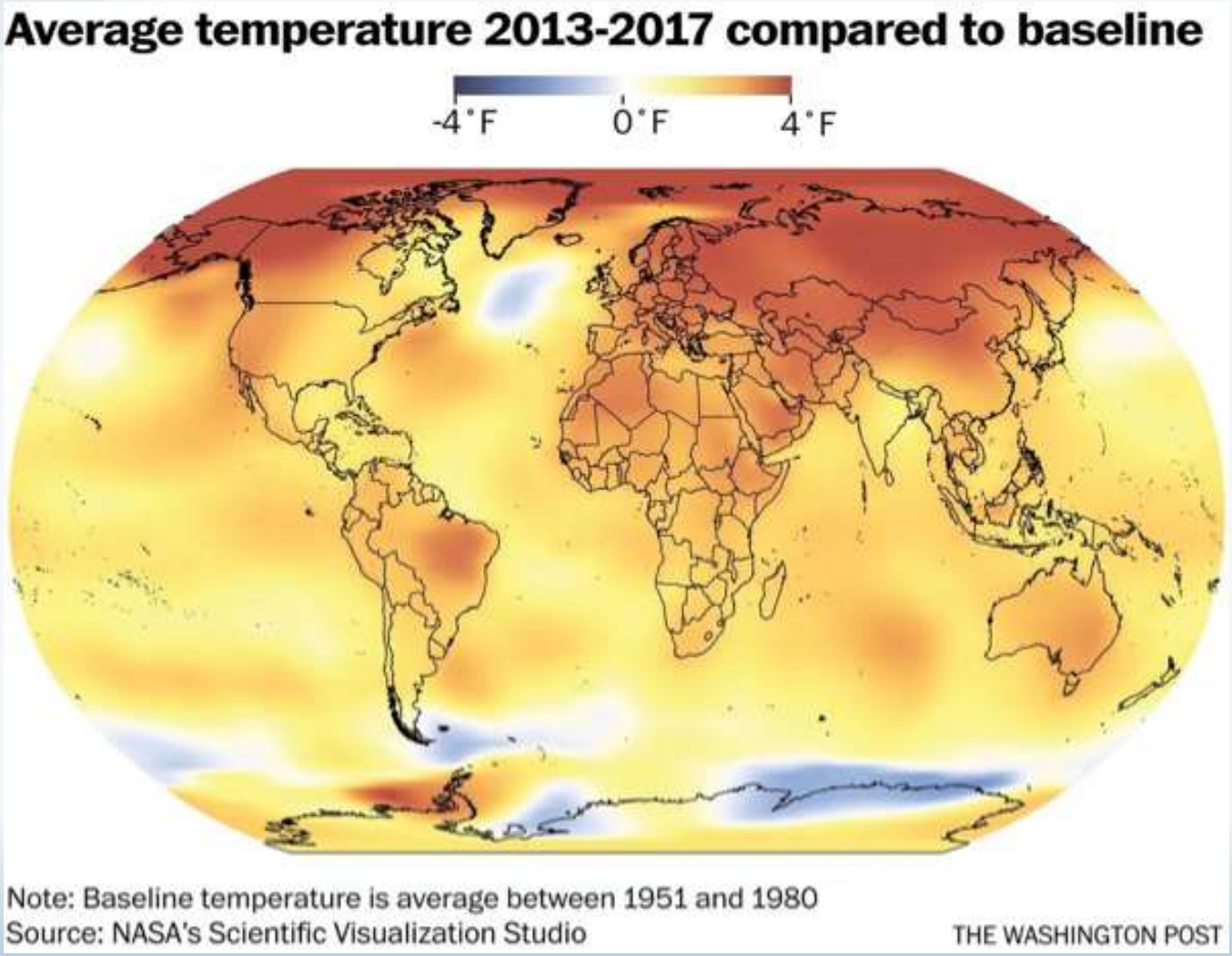
The Fate of Arctic DOC



Positive Feedback



Arctic Amplification



Summer Photo-Bio Project

Byron Crump
Principal Investigator
Oregon State University

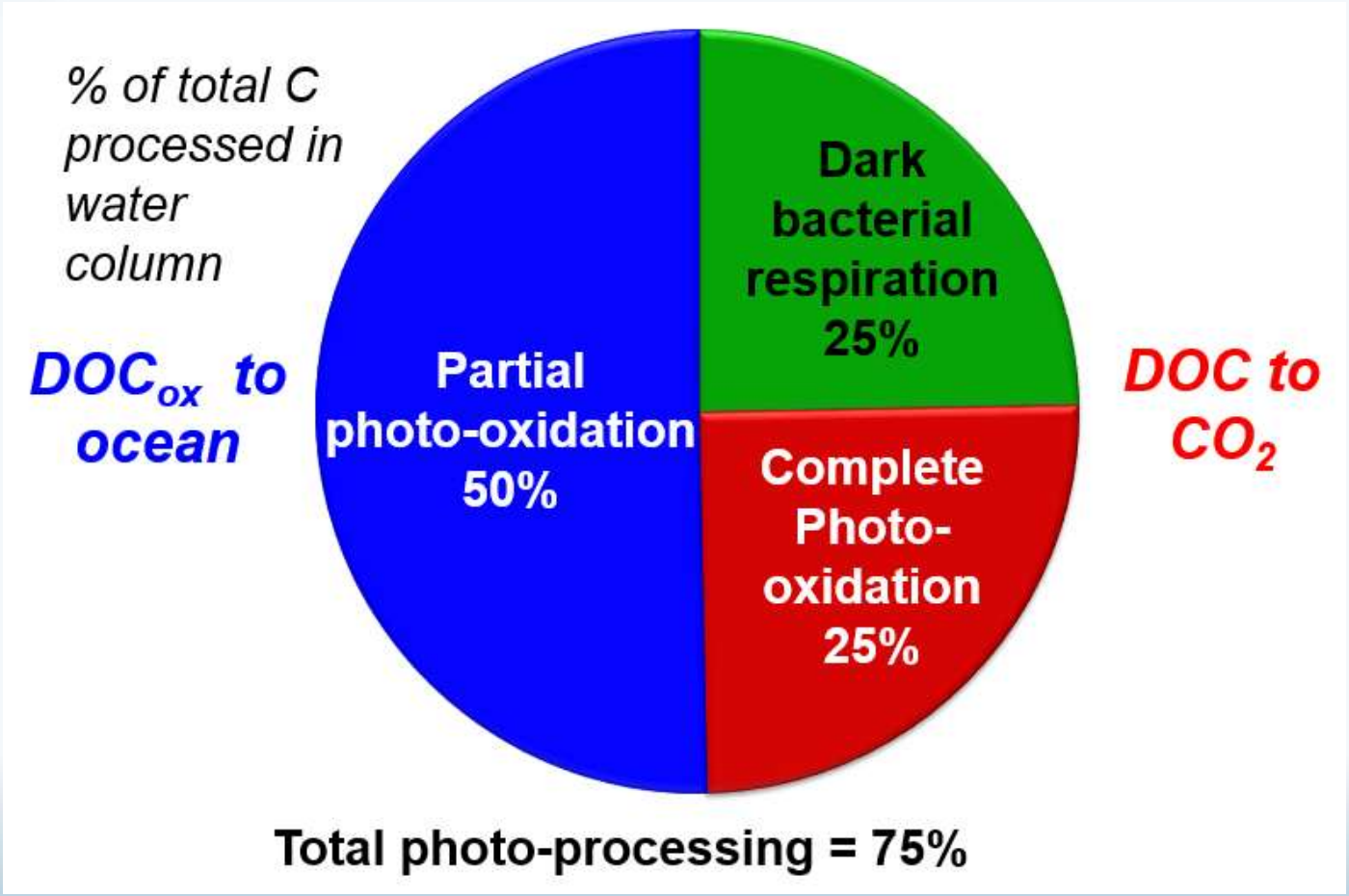
Rose Cory
Principal Investigator
University of Michigan

George Kling
Principal Investigator
University of Michigan

Natasha Christman
Graduate Student
Oregon State University

The Importance of Sunlight

Cory, et al., 2014



Overview

Purpose: Better understand the specifics of how DOC is being broken down to CO_2 in Arctic watersheds

Applicability: Update climate models to better account for permafrost positive feedback loop in predicting future CO_2 levels

Critical Question 1: How does DOC chemistry affect the metabolic process of microbes?

Critical Question 2: How do soil depth (surface mat vs. permafrost) and DOC exposure to sunlight factor into this equation?

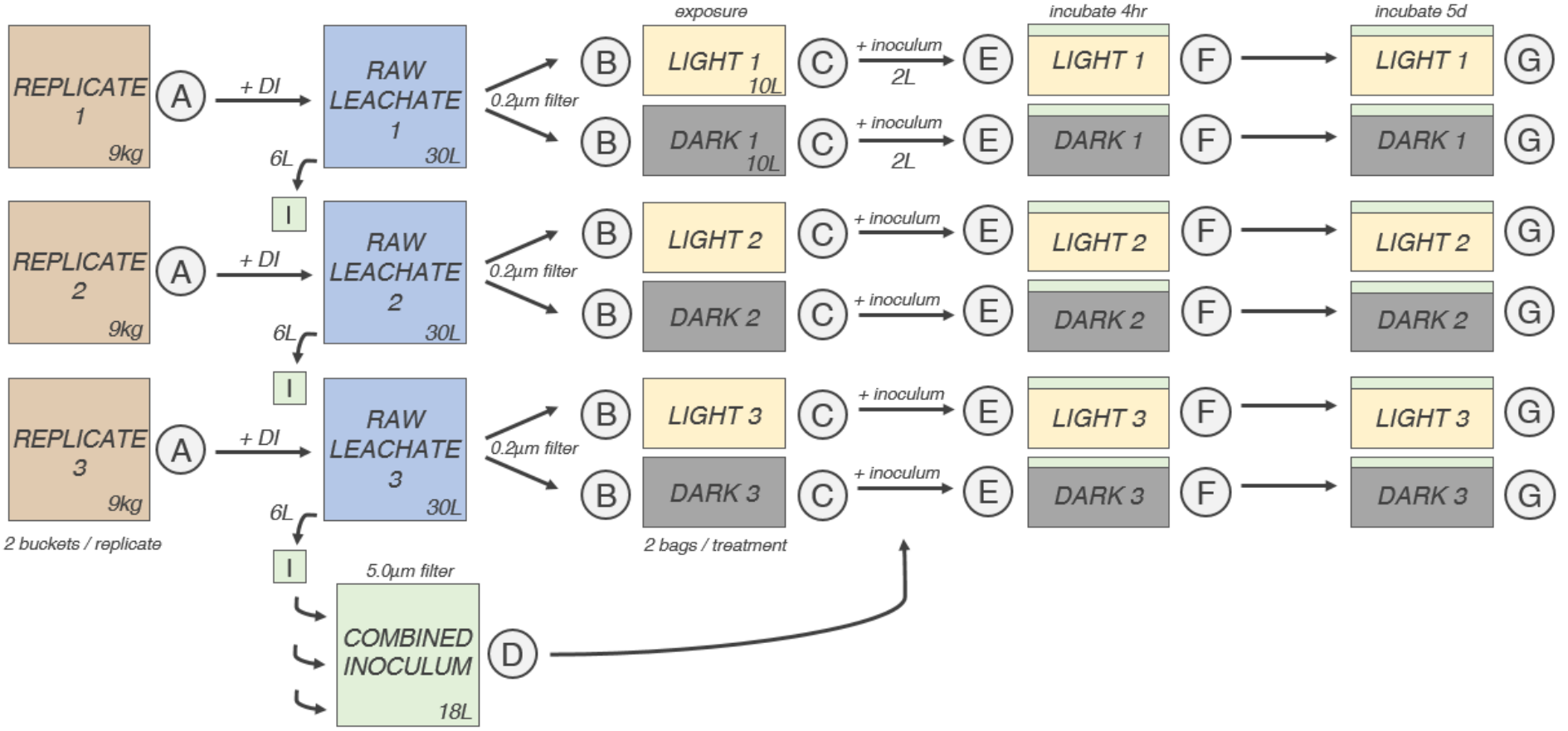
Critical Question 3: How does long-term microbial community adaptation affect the rate of DOC breakdown?

Study Site

**Imnavait Creek
North Slope, AK**

**Study site on wet
sedge tundra**

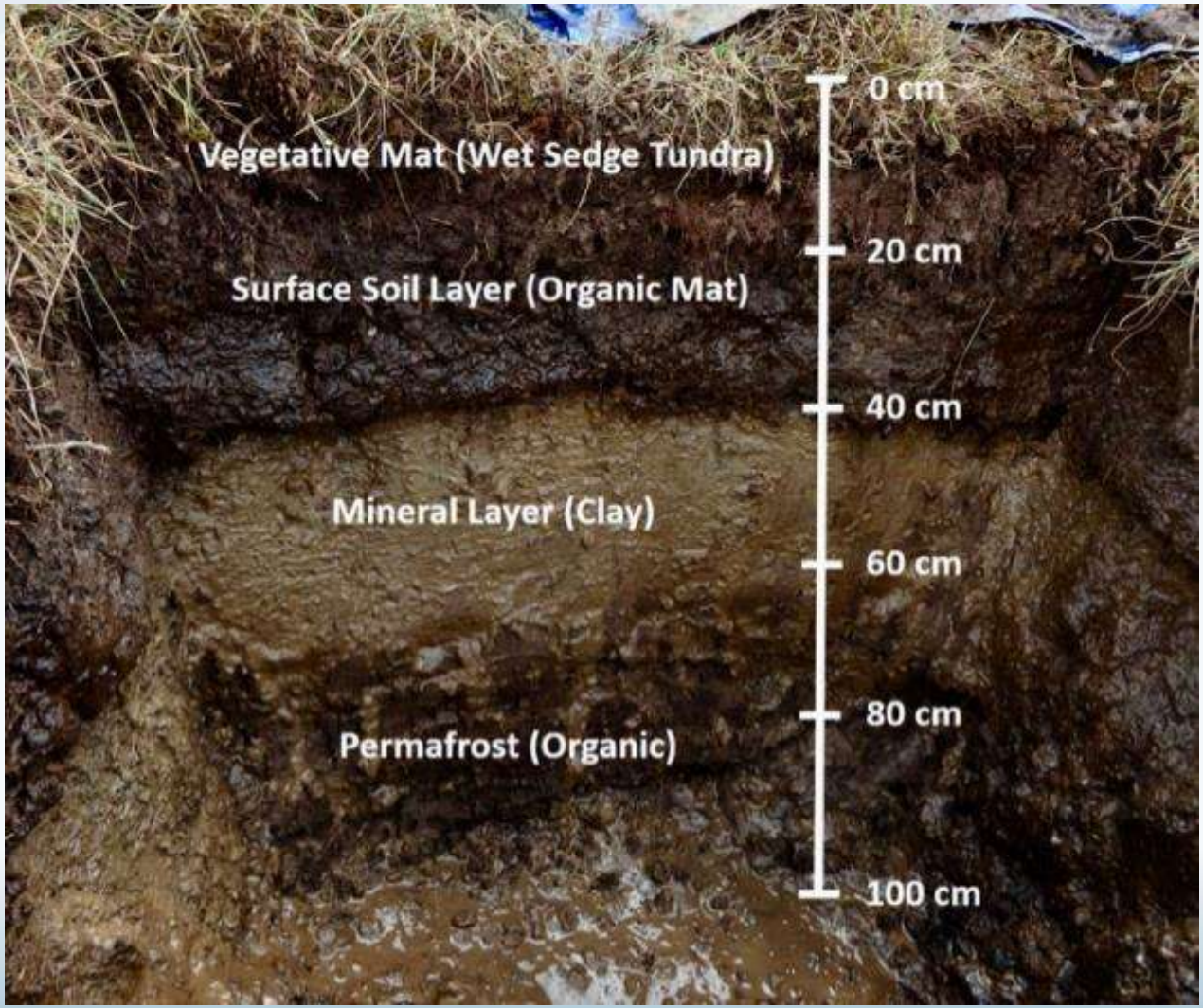
Procedural Flow Chart



Complete for both surface mat and permafrost

Part 1: Permafrost Pits

Part 1: Permafrost Pits



Part 2: Sampling

Surface Mat Layer

Permafrost Layer

Part 3: Extraction

Soil Sample

H_2O

72 hrs

Crude Leachate

Part 4: Filtration

Crude Leachate

0.2 µm Filter

Filtered Leachate

Part 5: Photoexposure

Transferring filtered leachate to Whirl-Pak® bags

24 hr photoexposure (dark controls in cooler)

Part 6: Inoculation

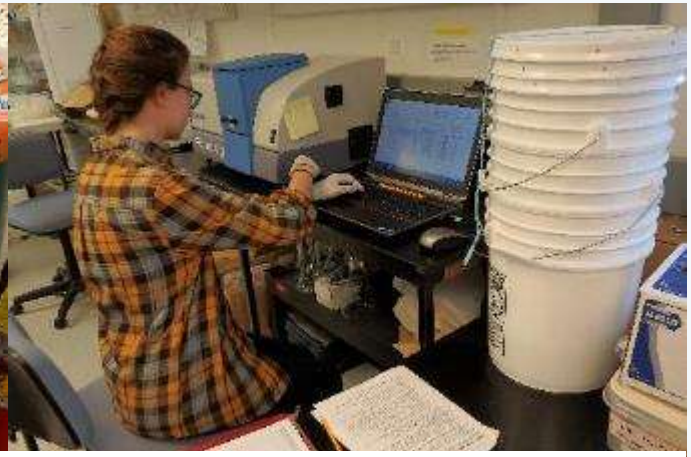
Preparing inoculum from crude leachate

Part 7: Incubation

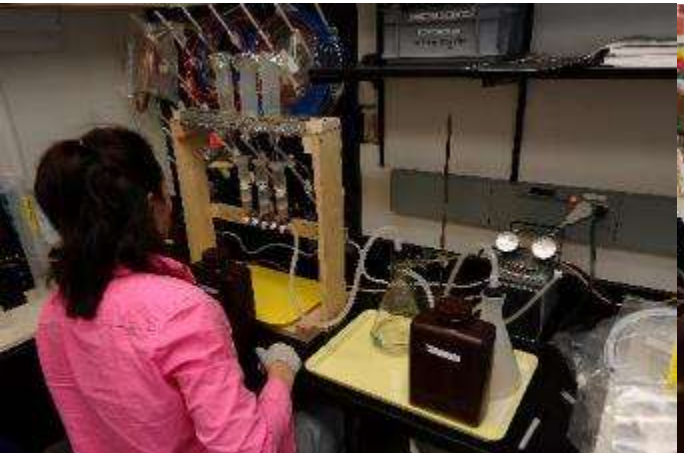
Incubating filtered leachate with inoculum

Part 8: Data Collection

Analyzing dissolved CO_2



Measuring absorbance and fluorescence



Concentrating DOC via Extraction

Preparing samples for cell counts

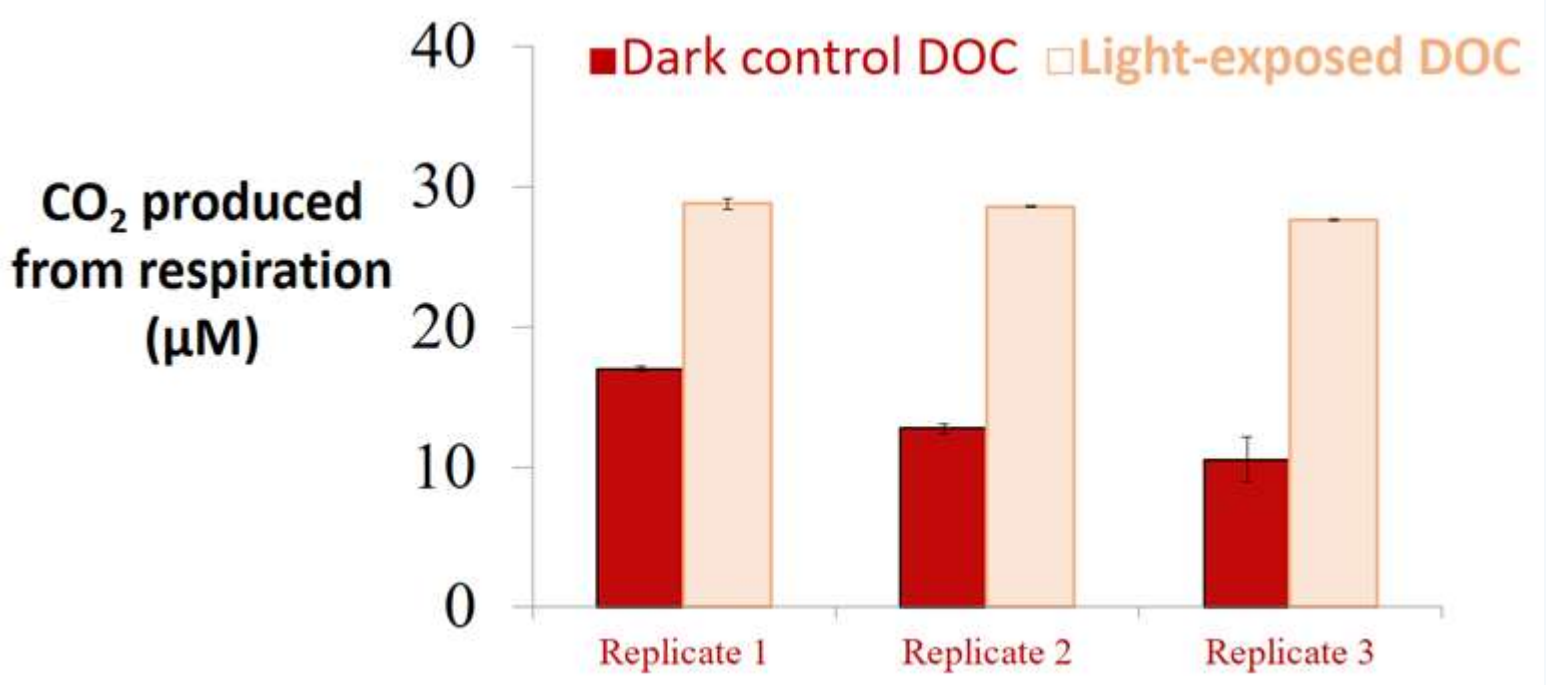
Battery of Analyses

- Cell counts
- Bacterial production
- Volatile organic carbons
- Full water chemistry
- Metagenomics
- Metatranscriptomics
- Mass Spectrometry
- Spectroscopy
- Consumed O_2
- Produced CO_2

Preliminary Results

Study on Tussock Tundra

Ward, et al., 2017

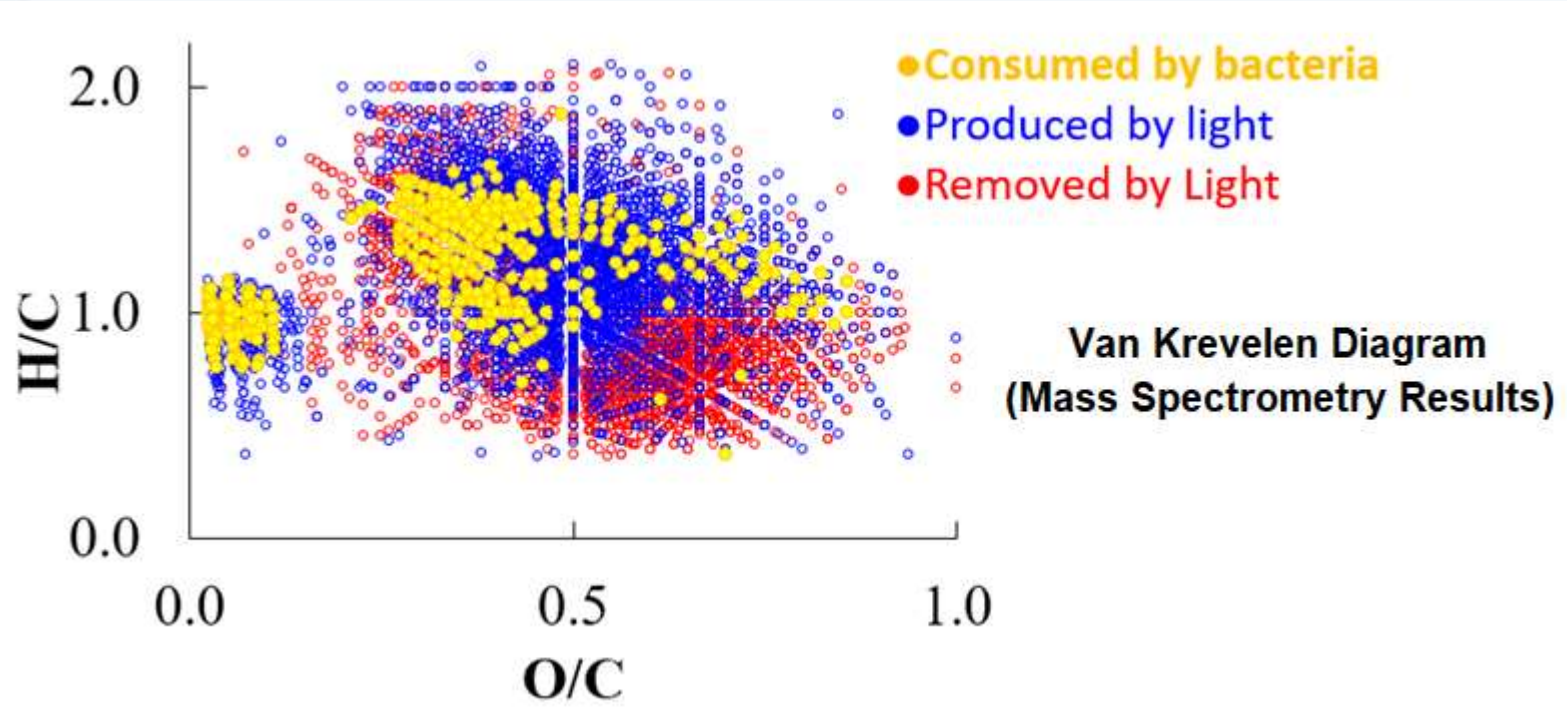


Microbes *prefer* to respire *sun-brewed* permafrost DOC to CO_2 (as compared to same DOC kept in dark)

Preliminary Results

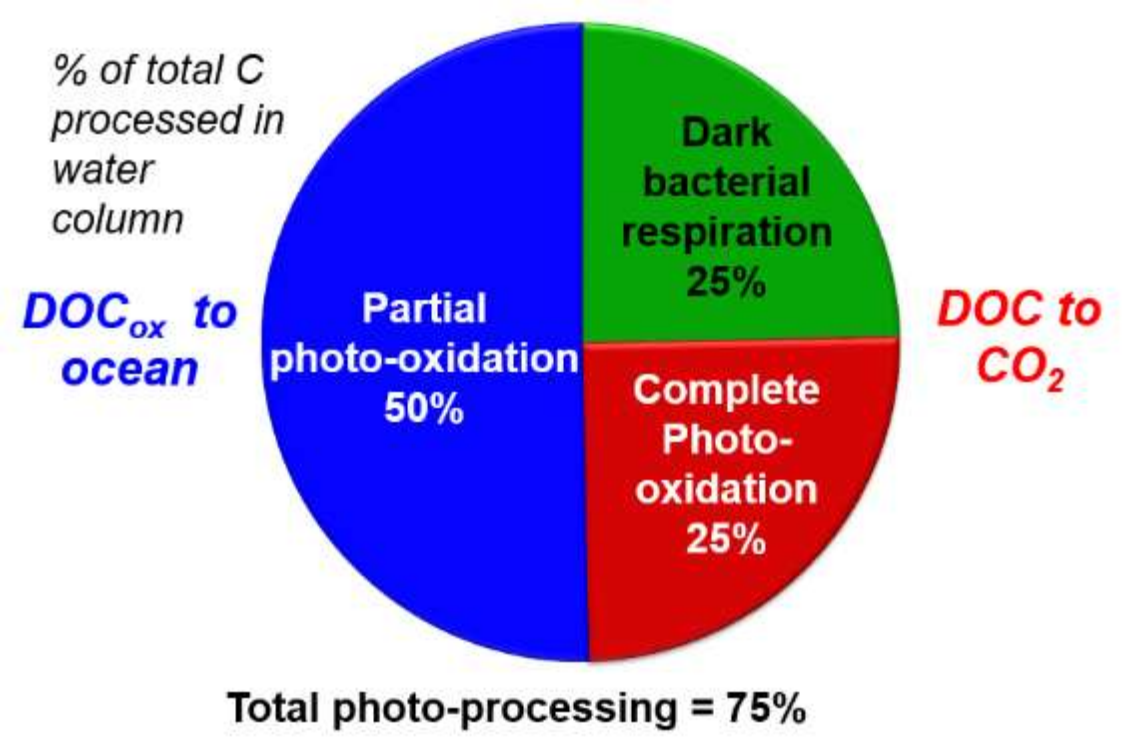
Study on Tussock Tundra

Ward, et al., 2017



Photodegradation of permafrost DOC produces same compounds bacteria are *already degrading*

What Does This Mean?



Microbes prefer to respire sun-brewed DOC

Even more CO_2 will be released from thawing permafrost as Arctic warms

Questions?

Thank You!

An archive of the event will be available shortly.

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

NSF

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