

## Understanding the drivers and magnitudes of CH<sub>4</sub> source-sink transitions in climate sensitive ecosystems

**Dates:** Aug 14 - Aug 16, 2024

**Location:** University of Maine, Orono, and Howland Research Forest, Maine

### Workshop Organizers:

Kathleen Savage & Jennifer Watts, Woodwell Climate Research Center

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**Workshop Co-Organizers:** Hinsby Cadillo-Quiroz (ASU), Debjani Sihi (Emory University), Xiaofeng Xu (SDSU)

### Overarching goals.

**Gather a community of experts:** Bring together scientists working on various aspects of the forest carbon cycle to improve knowledge of the patterns, drivers, processes, and feedbacks regulating CH<sub>4</sub> production and oxidation, and ultimately net CH<sub>4</sub> uptake (or emission, depending on environmental and microbial conditions). Participants will include field scientists, microbial ecologists, and modelers (machine learning and process models). We will also include technology experts to advise on the state-of-science for high frequency greenhouse gas assessments (including EC and chamber-based approaches, and other emerging technologies).

**Identify state-of-knowledge and how to improve data acquisition and models:** The workshop activities will aim to identify the current state of knowledge regarding the community's understanding of CH<sub>4</sub> uptake, including the biogeochemical regulators driving this process as observed through field and lab observations. As part of this effort, we will facilitate knowledge sharing regarding the current state-of-the-science. Through this workshop, we will identify limitations within the current network of observations, and in the ability of models to represent spatiotemporal patterns of CH<sub>4</sub> production vs oxidation. We, as a community, will identify opportunities to reduce these knowledge gaps through integrated approaches that bring together multiple disciplines. We will share our findings with the science community through a Perspectives piece that we will submit to Nature Communications or similar journal.



<b>Date/Time (EST)</b>	<b>Understanding the drivers and magnitudes of CH<sub>4</sub> source-sink transitions in climate sensitive ecosystems</b>	<b>SPEAKERS</b>
<b>Aug 14</b>	<b>Day 1</b>	
8:00 AM	working breakfast at Buchanan in meeting room	
9:00 AM	WELCOME	Adam Daigneault
9:05 AM	INTRODUCTION and MOTIVATION (introduce possible outcome, including a paper)	J Watts
9:20 AM	logistics for meeting	Fraver, Fergusson
9:25 AM	Introduction to Howland Research Forest - from Ameriflux to the NSF-DEB CH <sub>4</sub> project	Savage, Ouimette
<b>THEME: Observations: microsite-to-landscape scale controls on ecosystem CH<sub>4</sub> flux</b>		
<b>9:45 AM</b>	<b>SESSION 1: Field and laboratory analysis- microbial processes and genomic information on CH<sub>4</sub> cycling.</b>	
9:45 - 10:05	Studying the range of spatial and ecophysiological variation of CH <sub>4</sub> -fluxing microbes in the Howland forest	Hinsby Cadillo-Quiroz
10:05 - 10:25	From Archaea to the Atmosphere: linking above and belowground communities to scale emissions	Ruth Varner
10:25 - 10:45		
<b>10:45 AM</b>	<b>BREAK</b>	
11:00 - 11:20	Active microbial community dynamics using DNA-stable isotope probing reveals higher methane production potential from a restored wetland in the Delmarva Bays, USA	Taniya RoyChowdhury
11:20 - 11:40	Viability of Enhancing Methanotrophy in Terrestrial Ecosystems Exposed to Low concentrations of methane	Eric Davidson

11:40-noon	Panel discussion of Session 1 - led by Hinsby and Debjani	
<b>NOON</b>	<b>NETWORKING LUNCH</b>	
<b>1:15 PM</b>	<b>SESSION 2: Field and laboratory measurements to isolate the environmental drivers of source-sink transitions.</b>	
1:15 - 1:35	The role of trees and their microbiomes in forest methane cycling	Jonathan Gewirtzman
1:35 - 1:50	Canals: Gateways or Gatekeepers of Methane Emissions from Drained Tropical Peatlands?	Clarice Perryman
1:50 - 2:10	The control of plant productivity and traits on CH <sub>4</sub> dynamics.	Avni Malhotra
<b>2:10 PM</b>	<b>BREAK</b>	
2:25 - 2:45	Linking microbial dynamics and subsurface biogeochemistry to ecosystem CH <sub>4</sub> fluxes – an example from a brackish wetland	Inke Forbirc
2:45 - 3:10	Trials and Tribulations Measuring Methane Fluxes with Eddy Covariance over Non-Tidal and Tidal Restored Wetlands in the San Francisco Bay-Delta Estuary	Dennis Baldocchi
3:10 - 3:30	Toward an ecosystem-atmosphere CH <sub>4</sub> flux data pipeline for diverse upland NEON sites	Jackie Matthes
3:30 – 4:00	Panel discussion of Session 2 - led by Kathleen and Shawn	
<b>4:00 PM</b>	<b>NETWORKING SESSION</b>	
<b>5:00 PM</b>	<b>END</b>	
<b>6-7 PM</b>	<b>NETWORKING DINNER (Buchanan House)</b>	
<b>Aug 15</b>	<b>Day 2</b>	
<b>8:00 AM</b>	working breakfast at Buchanan in meeting room	
<b>THEME: Integration of field-lab-model approaches to improve model representation.</b>		

<b>9:00 AM</b>	<b>SESSION3: Mechanistic understanding of CH<sub>4</sub> cycling by integrating multiple sources of data with ecosystem models.</b>	
9:00 - 9:20	Integrating multiple observational data with the CLM-Microbe model to understand CH <sub>4</sub> cycling in the Howland Forest	Xiaofeng Xu
9:20 - 9:40	CH <sub>4</sub> uptake data in the most recent Arctic-boreal carbon flux synthesis database	Anna Virkkala
9:40 - 10:00	Challenges and Opportunities in Quantifying Global Biogenic Methane Emissions from Land and Freshwater Ecosystems	Qianlai Zhuang
10:00 - 10:20	MODEX approaches to understanding methane dynamics	Teri O'Meara
<b>10:20 AM</b>	<b>BREAK</b>	
11:00 -11:20	Drivers of methane flux and their scale dependencies	Jianqui Zheng
11:20 - 11:40	Mechanistic predictions of methane fluxes	Debjani Sihi
11:40-noon	Panel discussion of Session 3 - led by Xiaofeng	
<b>NOON</b>	<b>NETWORKING LUNCH</b>	
<b>1:15 PM</b>	<b>SESSION 4: Addressing gaps representation of CH<sub>4</sub> flux at local-to-global scales</b>	
1:15 - 1:35	Estimation of global methane soil sink using multi-source datasets and knowledge-guided machine learning	Youmi Oh
1:35 - 1:55	TBD	Ben Poulter
1:55 - 2:15	Panel discussion of Session 4 - led by Jenny	
<b>2:15 PM</b>	<b>BREAK</b>	
<b>BREAKOUT GROUPS- outlining a perspectives piece addressing uncertainty in current understanding of CH<sub>4</sub>, and best pathways forward</b>		
<b>2:30 PM</b>	Topic 1 : What data currently exists and where are the gaps?	

	Topic 2 : What is the best method/path forward to quantify net uptake in underrepresented ecosystems	
	Topic 3: What opportunities are needed to reduce knowledge gaps	
	Topic 4: Collaborative manuscript and proposal opportunities? How could the community organize efforts	
<b>4:00 PM</b>	<b>DISCUSSING NEXT STEPS (including manuscript development)</b>	
	Report out from breakout groups	
<b>5:00 PM</b>	<b>END</b>	
<b>7:30 PM</b>	<b>NETWORKING DINNER (Woodmans Grill)</b>	
<b>Aug 16</b>	<b>Day 3</b>	
9:00 AM	TRIP TO HOWLAND FOREST- OPTIONAL for in-person attendees	
1:00 PM	END	

List of in person and remote attendees

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