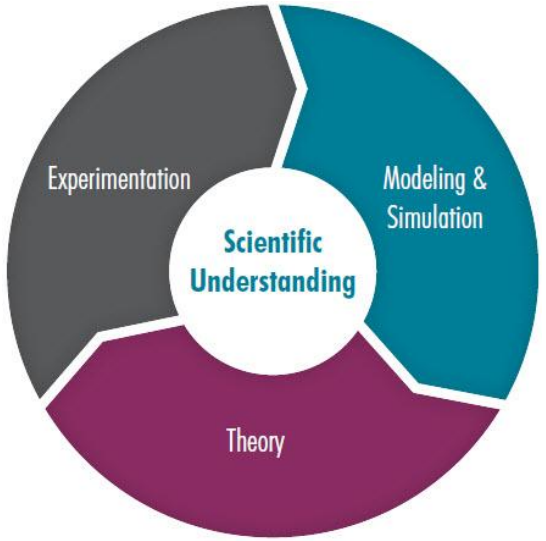
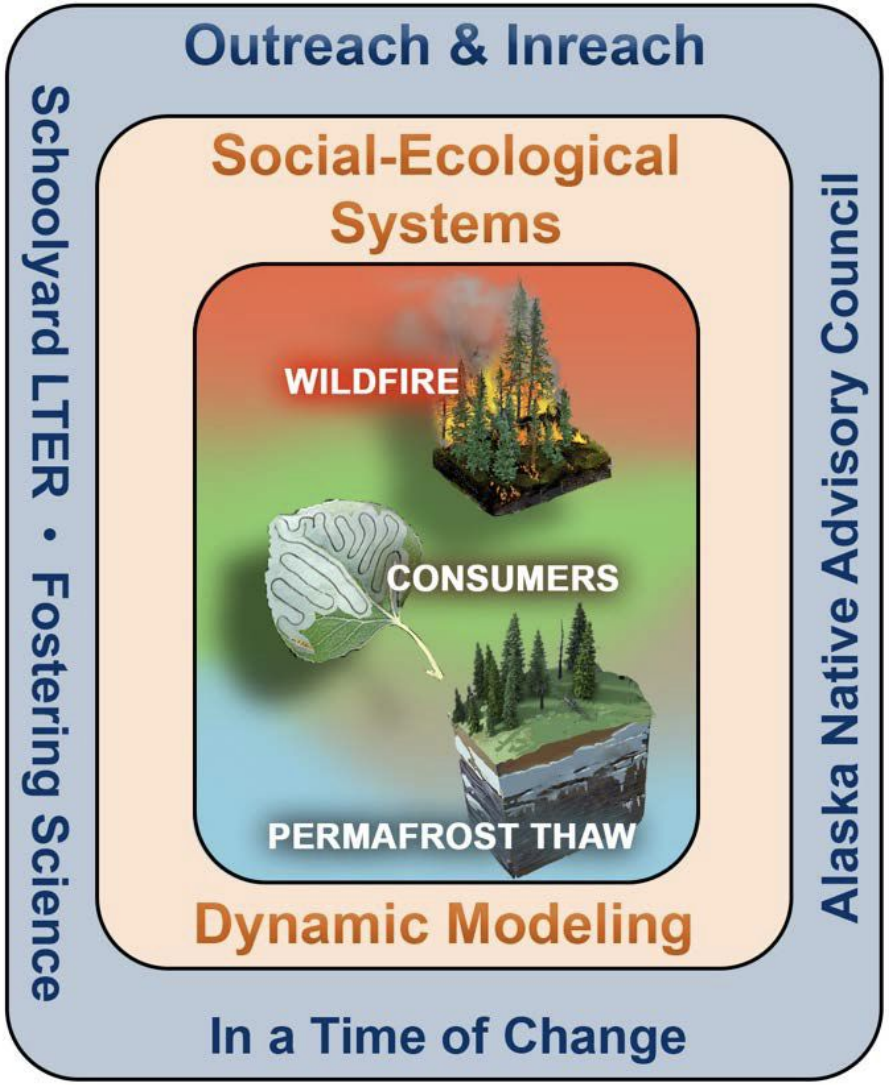
Ecosystem Modeling Working group





Integrating conceptual developments from the disturbance working groups to …

… advance our understanding on the implications of disturbances at multiple spatio-temporal scales, and …

… projecting landscape state changes to support mitigation and adaptation strategies.

DVM-DOS-TEM

H. Genet

E. Euskirchen

B. Maglio

UNIVERSITY OF ALASKA FAIRBANKS

LANDIS

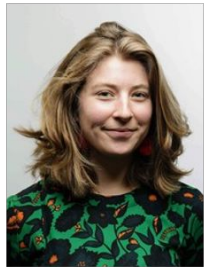
M. Lucash

G. Abreu-Vigil

UNIVERSITY OF OREGON

iLAND

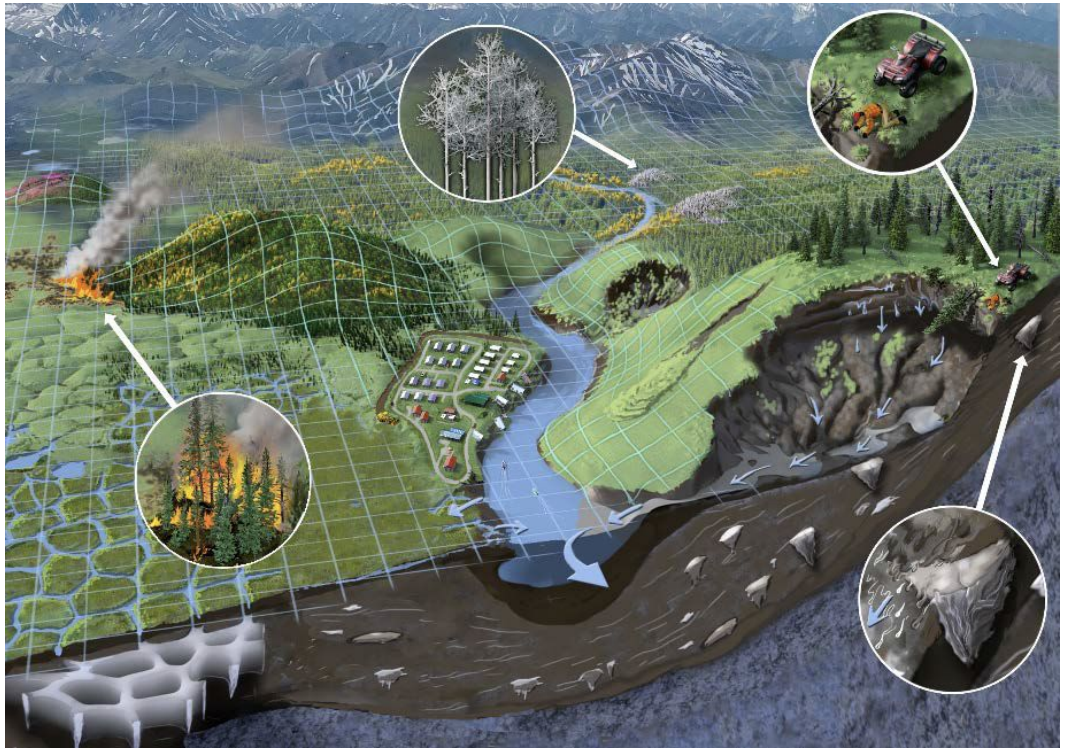
W. Hansen



K. Hayes

Cary Institute of Ecosystem Studies

Model intercomparisons and benchmarking will help identify legacies and ecological processes that underpin boreal forest resilience and future trajectories at local and regional scales, from seasonal to centennial dynamics.



Characteristics	DVM-DOS-TEM	LANDIS-II	ILand
Spatial extent	> 1M km^2	120,000 km^2	600 km^2
Spatial resolution	1 km^2	200 m	2 m
Land cover	Forest, Wetland, Tundra	Forest	Forest
Vegetation representation	Plant functional types	Species / cohort	Individual tree
Soil representation	Multilayer (5 m)	Multilayer (75 m)	
Disturbance	Fire, drought	Fire, drought, insect	Fire, drought, biotic
Primary processes	Carbon, permafrost	Carbon, vegetation dynamic, permafrost	Vegetation dynamic

General questions

1. How will climate change and disturbance from wildfire influence future forest composition and associated feedbacks to fire activity, ecosystem C cycling, and energy balance? **[Y1-Y2]**
2. How will forest consumers interact with climate change and wildfire to affect forest dynamics and consequences for ecosystem C cycle? **[Y3-Y4]**
3. How is permafrost thaw sensitivity to climate modulated by the structure of surface and deep soil layers and what are the implications of thaw for soil moisture, ecosystem C dynamics, and regional C and energy balances? **[Y5-Y6]**

Main focus for Y1-Y2 of the program

Q1: How will climate change and disturbance from wildfire influence future forest composition and associated feedbacks to fire activity, ecosystem C cycling, and energy balance?

H1: The representation of post-fire successional pathways has a substantial effect on the capacity of ecosystem models to simulate changes in carbon cycling and energy balance in response to climate change and wildfire in the boreal region.

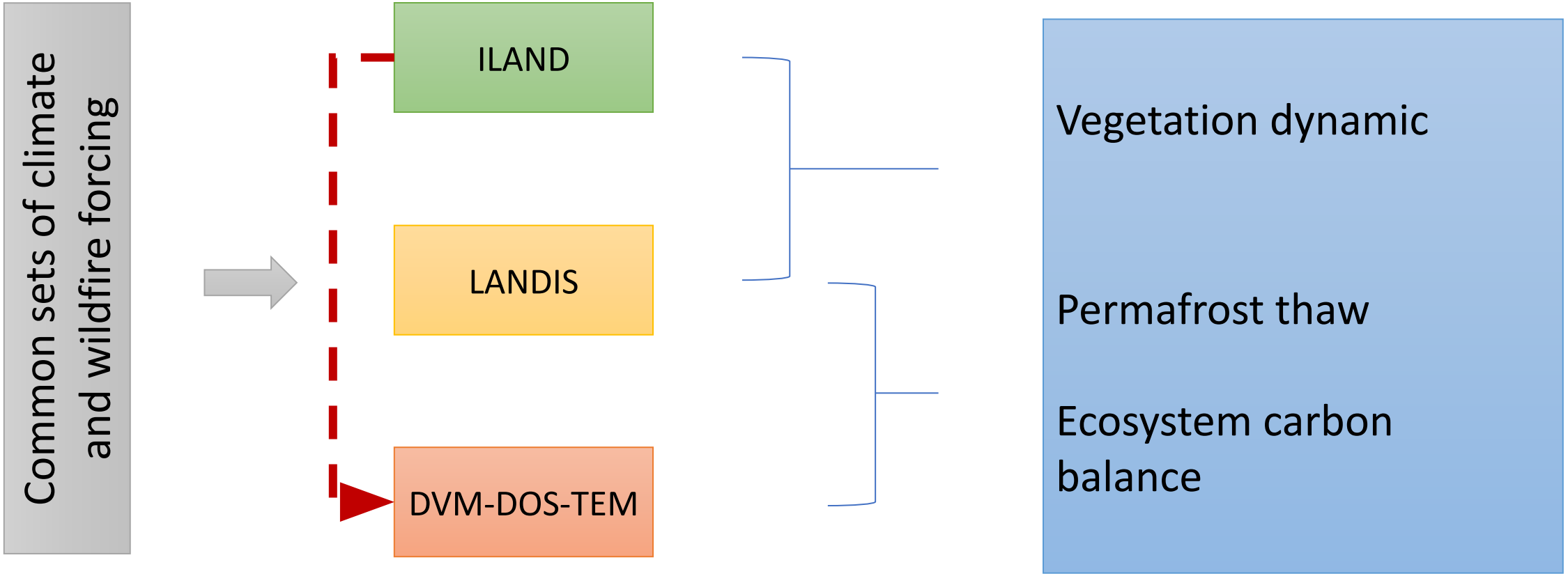
Process representations

- ILand and LANDIS-II will document the relative importance of fire size, fire severity, seedbank, and post-fire climate on **seedling establishment** and its vulnerability to environmental changes.
- DVM-DOSTEM and LANDIS-II will represent the relative effect of post-fire climate and fire-related loss of SOL legacies and successional trajectories on **permafrost and carbon dynamics**.
- To evaluate the **role of fine-scale ecological processes** driving successional trajectory effects on regional C balance, simulation of C dynamics will be conducted where DVM-DOS-TEM will use the post-fire vegetation trajectories generated by ILand.

Workshop 1 – Fall 2023
Simulation protocol

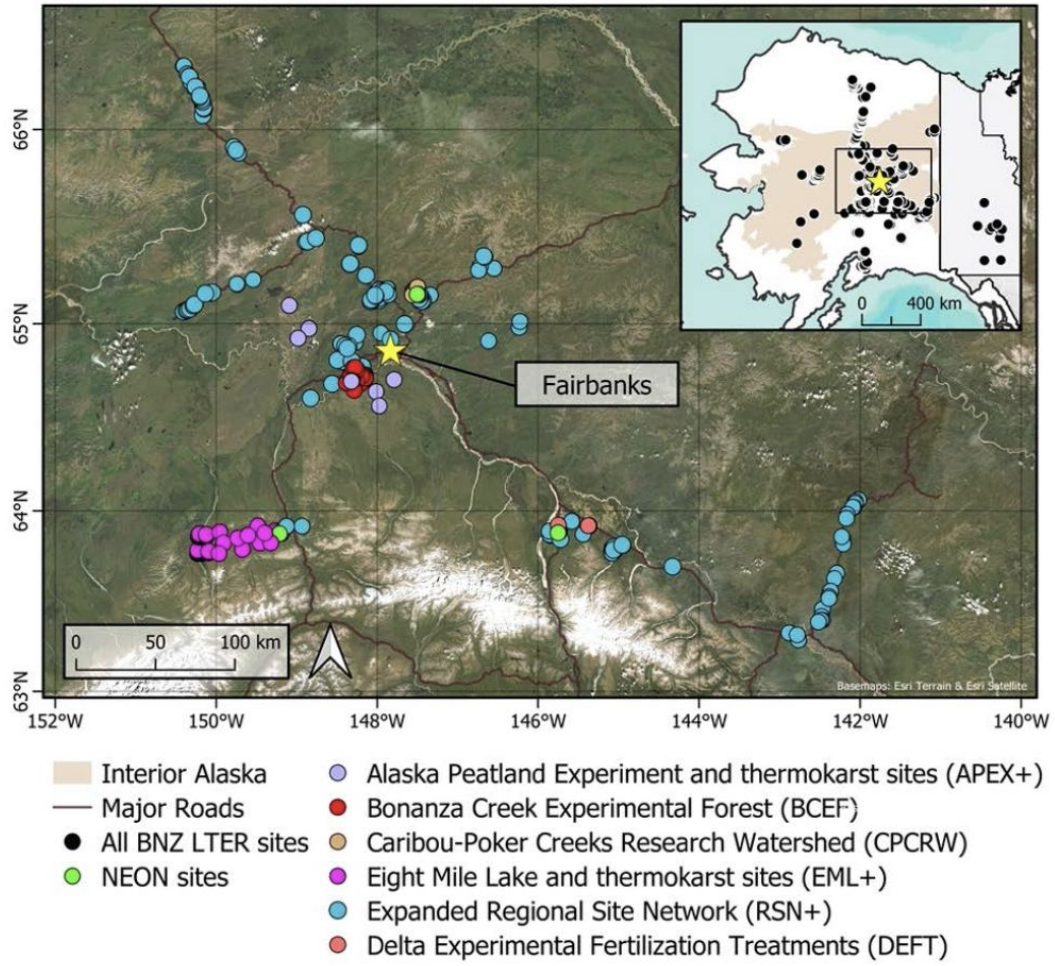
MODELING FRAMEWORK

ECOLOGICAL CONSEQUENCES OF WILDFIRE



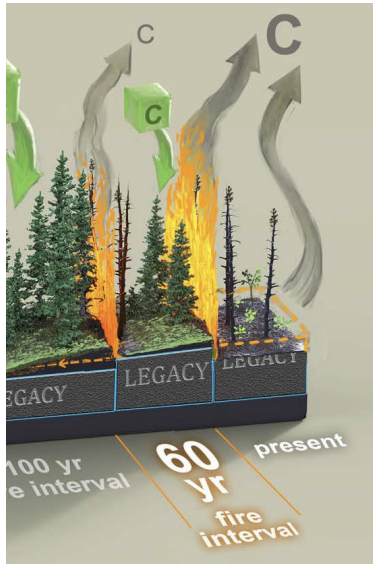
Workshop 2 – Fall 2025
Model output synthesis

Model simulations



- Model simulations across a landscape centered on the BNZ LTER study region
- Using the same climate forcings for historical (1950-2021) and future projections (2022-2100 CMIP6 climate projections).

Model evaluation: representation of the implications of wildfire on ecosystem dynamics



Question W1: How do black spruce ecosystem legacies and post-fire climate conditions impact **successional trajectories**?

Question W3: What are the **ecosystem consequences** of alternative successional trajectories?

Question P4: How does fire severity interact with ground ice to determine rates of **thaw and loss of permafrost C**?

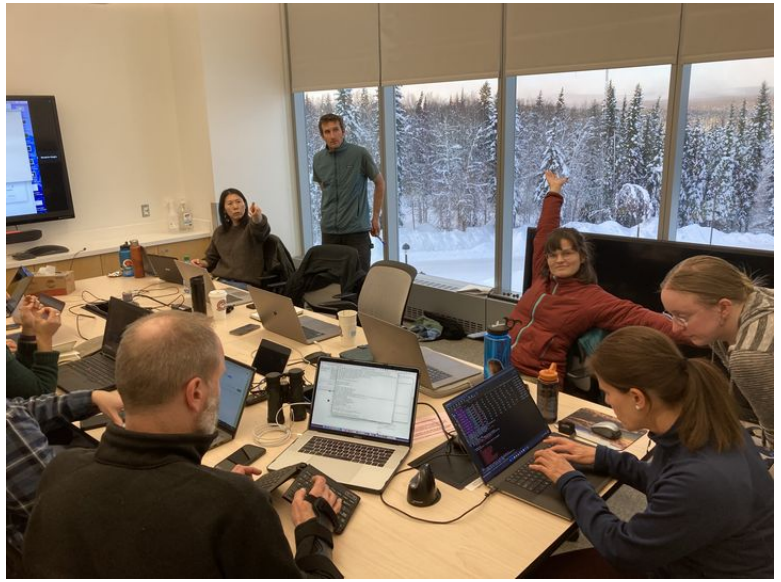
Model simulations as **management tool**

We plan to develop a **close collaboration** with the Alaska Native Advisory Council :

1. to make sure that our modeling activities and data products align with / respond to information needs for designing adaptation strategies, including wildfire management, in the boreal region, and

2. to communicate and collect feedback on the outcomes of our model projections of vegetation, permafrost, and carbon dynamics.

Inreach / outreach activities



- Integration with education

  Annual one-week workshop on ecosystem modeling held at UAF (TEM) and U of Oregon (LANDIS).
  Travelling funds for 4 students / yr to attend TEM and LANDIS workshops.

- Integration with arts and humanities

  One-day introduction to ecosystem modeling designed for non-scientists as part of our annual TEM modeling workshop.

- Integration with Fostering Science

  We are available! and we can even meet you guys in the field!
  to participate in activities Fostering Science to talk about boreal ecology and ecosystem modeling.

Breakout sessions

Can you think of modeling experiments or model/data synthesis that could help us answer the following modeling question?

1. How will climate change and disturbance from wildfire influence future forest composition and associated feedbacks to fire activity, ecosystem C cycling, and energy balance?
2. How will forest consumers interact with climate change and wildfire to affect forest dynamics and consequences for ecosystem C cycle?
3. How is permafrost thaw sensitivity to climate modulated by the structure of surface and deep soil layers and what are the implications of thaw for soil moisture, ecosystem C dynamics, and regional C and energy balances?

What are your needs in model outputs?

https://docs.google.com/spreadsheets/d/1TkeKMfvg4l0xNkVb1b0rskmoinPnbOxTH1McASXW57c/edit?usp=sharing

What is your interest in a workshop on ecosystem modeling?

https://docs.google.com/forms/d/e/1FAIpQLSf0ExrB4GoEZguv3v6lyYl-K8t2o3qpgN7OnCdyquSpVJME0A/viewform?usp=pp_url