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.
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.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>DVM-DOS-TEM</th>
<th>LANDIS-II</th>
<th>ILand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial extent</td>
<td>&gt; 1M km²</td>
<td>120,000 km²</td>
<td>600 km²</td>
</tr>
<tr>
<td>Spatial resolution</td>
<td>1 km²</td>
<td>200 m</td>
<td>2 m</td>
</tr>
<tr>
<td>Land cover</td>
<td>Forest, Wetland, Tundra</td>
<td>Forest</td>
<td>Forest</td>
</tr>
<tr>
<td>Vegetation representation</td>
<td>Plant functional types</td>
<td>Species / cohort</td>
<td>Individual tree</td>
</tr>
<tr>
<td>Soil representation</td>
<td>Multilayer (5 m)</td>
<td>Multilayer (75 m)</td>
<td></td>
</tr>
<tr>
<td>Disturbance</td>
<td>Fire, drought</td>
<td>Fire, drought, insect</td>
<td>Fire, drought, biotic</td>
</tr>
<tr>
<td>Primary processes</td>
<td>Carbon, permafrost</td>
<td>Carbon, vegetation dynamic, permafrost</td>
<td>Vegetation dynamic</td>
</tr>
</tbody>
</table>
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.
Common sets of climate and wildfire forcing

MODELING FRAMEWORK

- ILAND
- LANDIS
- DVM-DOS-TEM

ECOLOGICAL CONSEQUENCES OF WILDFIRE

- Vegetation dynamic
- Permafrost thaw
- Ecosystem carbon balance

Workshop 1 – Fall 2023
Simulation protocol

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).
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?
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