

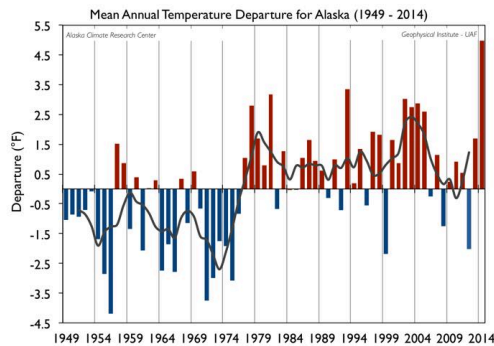
# Modeling landscape vulnerability to thermokarst disturbance and its implications for ecosystem services in the Yukon Flats National Wildlife Refuge

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# Vulnerability of permafrost to climate change

- Permafrost thaw has been largely documented across boreal and arctic Alaska over the past 4 decades and is controlled by a number of environmental factors.



Warming



Fire

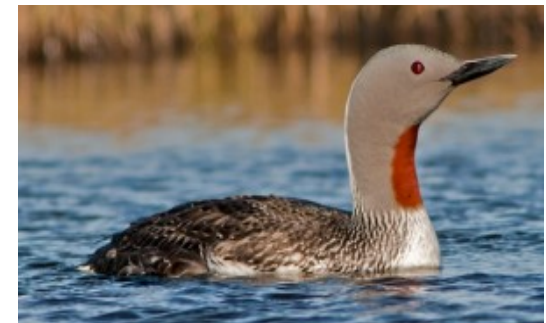
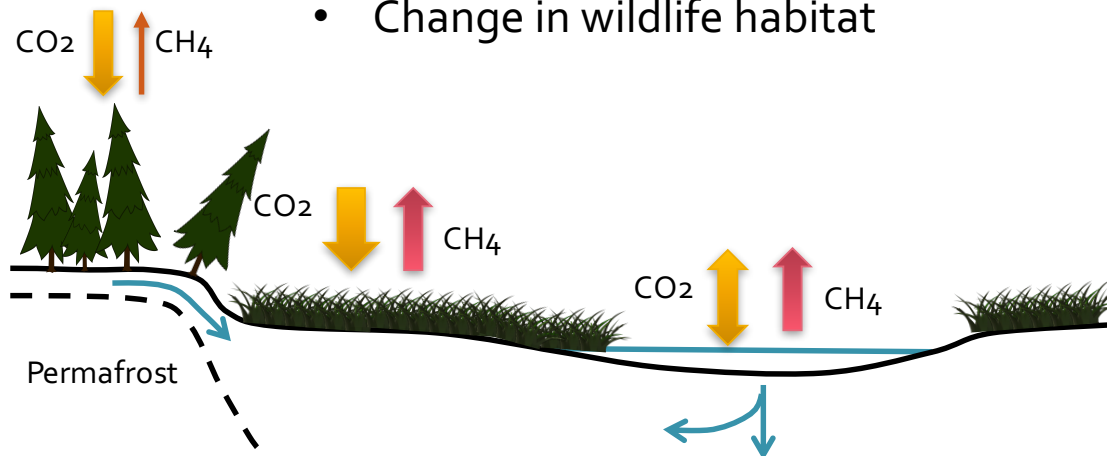


Site conditions

Permafrost Thaw

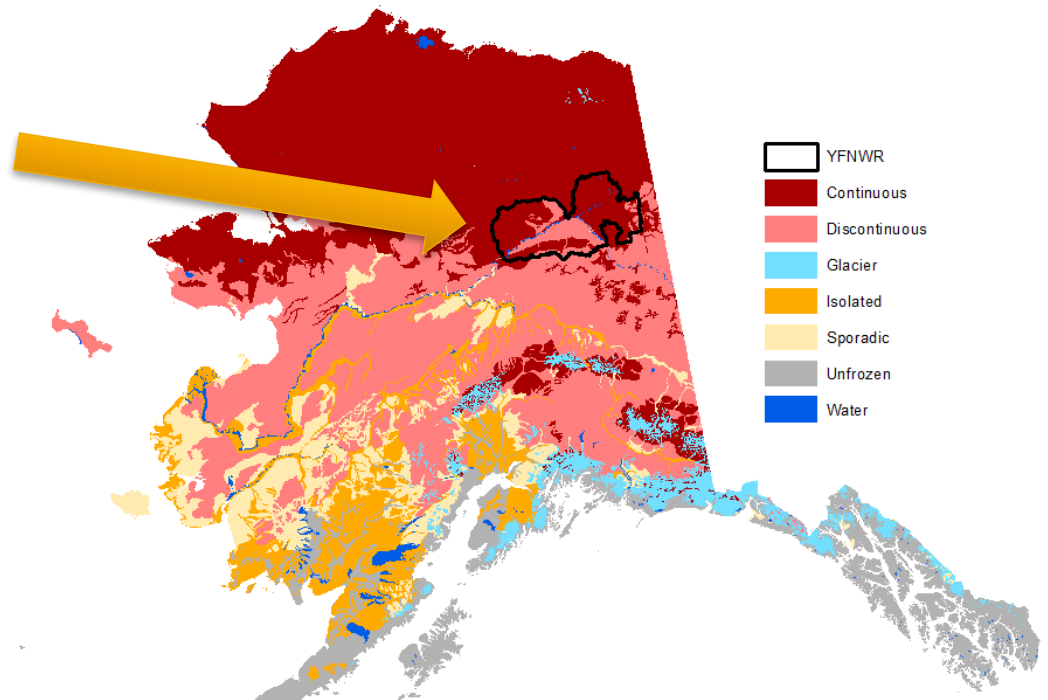
# Permafrost degradation and thermokarst disturbance

- In addition to active layer deepening, lateral thaw of ice-rich permafrost can trigger abrupt subsidence of the ground surface, forming thermokarst.
  - Change in vegetation composition
  - Change in hydrology
  - Change in the local and regional C balance
  - Change in wildlife habitat



The overarching goal of this project is to build on an existing modeling framework to represent the key-processes that will improve understanding of the impacts of permafrost thaw and thermokarst disturbance on ecosystem structure and function in boreal regions.

## The Yukon Flats National Wildlife Refuge

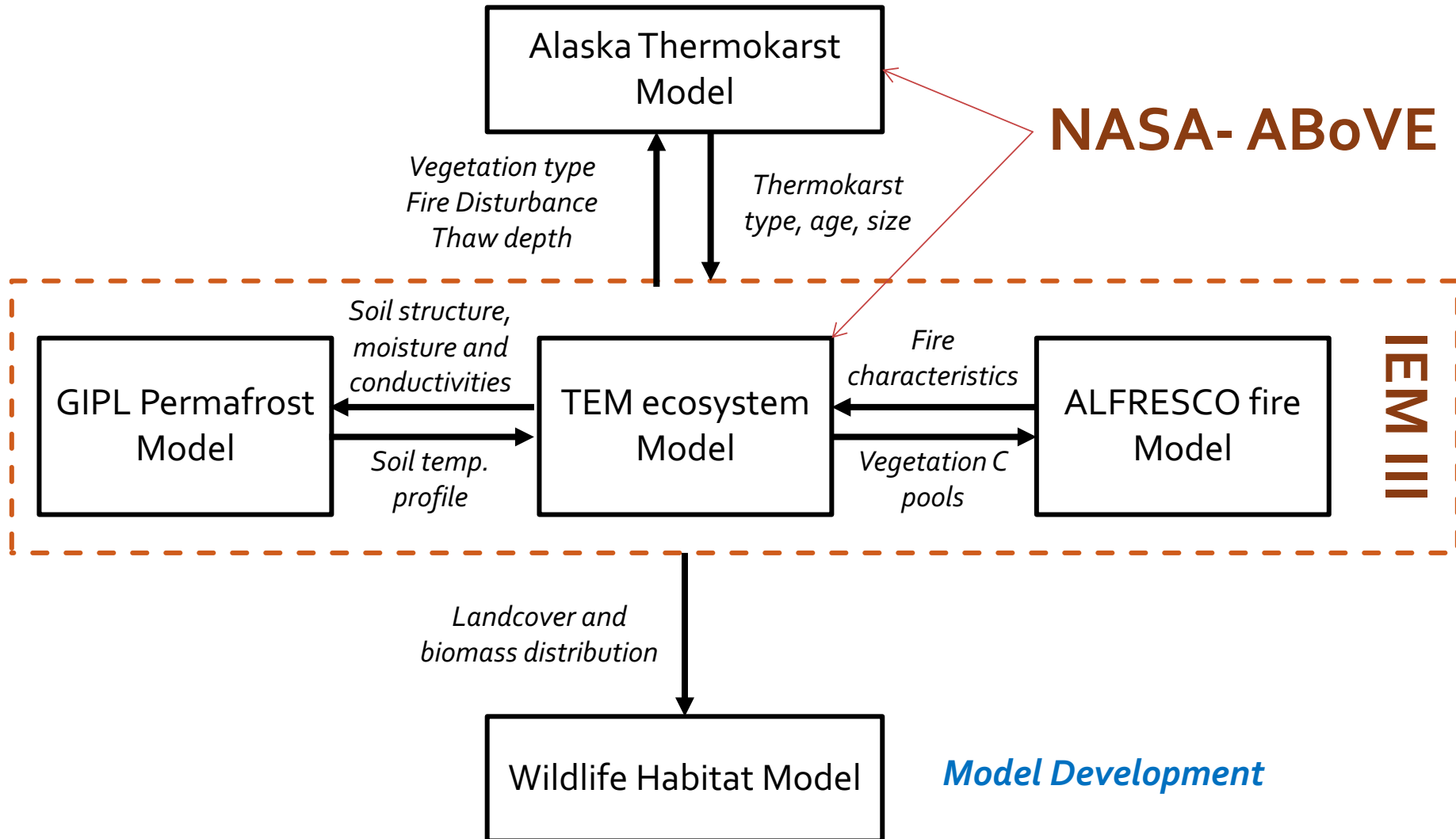


- YFNWR
- Continuous
- Discontinuous
- Glacier
- Isolated
- Sporadic
- Unfrozen
- Water

# Research Question

- What is the vulnerability to thermokarst disturbance across the YFNWR?
- How will the vulnerability to thermokarst evolve with projected climate change?
- How will the changes in hydrology and land cover associated with thermokarst disturbance affect regional carbon balance and wildlife habitat across the YFNWR?

# Modeling Framework: Integrated Ecosystem Model III



# Collaboration with the NASA- ABOVE program

- Striegl-01: Vulnerability of inland waters and the aquatic carbon cycle to changing permafrost and climate across boreal northwestern North America
  - Use lake biogeochemical and environmental observations to develop a new module for incorporation in the terrestrial ecosystem model (TEM) to simulate lake ecology
  - Conduct imagery analysis of the effects of wildfire on thermokarst to better represent the potential effects of change in fire regime on thermokarst disturbances in the Alaska Thermokarst Model (ATM).
  - Utilize results of geophysical surveys of permafrost distribution to better represent the relationship between fire, permafrost thaw and thermokarst disturbance in the Alaska Thermokarst Model (ATM).
  - Validate ATM thermokarst simulations with observations of land cover distributions.

# Timeline of the project

- Phase I [2016-2019] : improve the model framework to represent thermokarst dynamics and their consequences on landcover and carbon dynamics.
- Phase II [2019-2021]: apply the improved model framework across Yukon Flats National Wildlife Refuge to develop and apply a wildlife habitat model for the refuge from 2000 to 2100.