Down the rabbit hole

Modeling impacts of moose and hare herbivory on postfire carbon and community trajectories in Alaska

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PDF of poster and more info here:

Herbivores modify postfire successional **timelines***

**** across several decades, at a tree scale, following high-severity fire in boreal forests.***

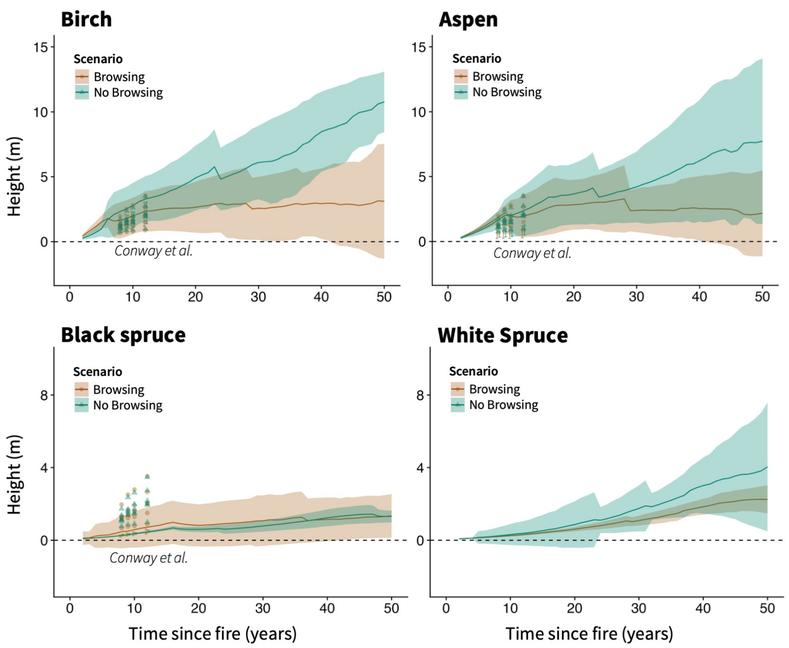
Premise

Increased fire in Alaska shifts boreal forests from conifer to deciduous, leading to questions about future dynamics of carbon storage. Fast-growing deciduous species may leave carbon-rich permafrost vulnerable, but are the preferred forage of herbivores like moose and hare. Can herbivores modify the impact of fire on Alaskan boreal forests at a scale relevant to landscape carbon cycling?

Methods

- We parameterized moose and hare using the biotic disturbance model ***Bite,*** integrating empirical data from exclosure, behavior and forage studies.
- Using the forest landscape model ***iLand***, we simulated fire and herbivory in the Caribou Poker Creek Research Watershed in Interior Alaska.

Modeled relationship of age and growth of individuals regenerating after high-severity fire (complete canopy mortality)



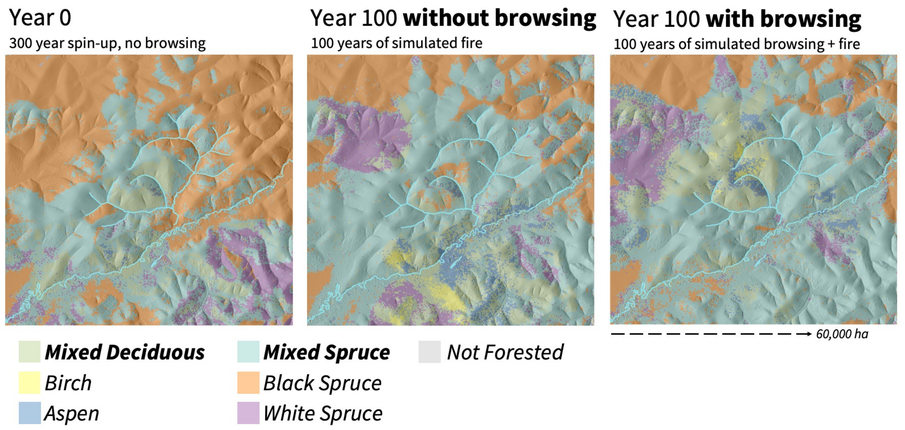
- Bands are standard deviation of average modeled height of individuals.
- Points are site averages from an empirical exclosure study (Conway et al., in prep)

Browsing modifies the time it takes for deciduous forage species to reach maturity, and the effect is persistent across several decades after fire.

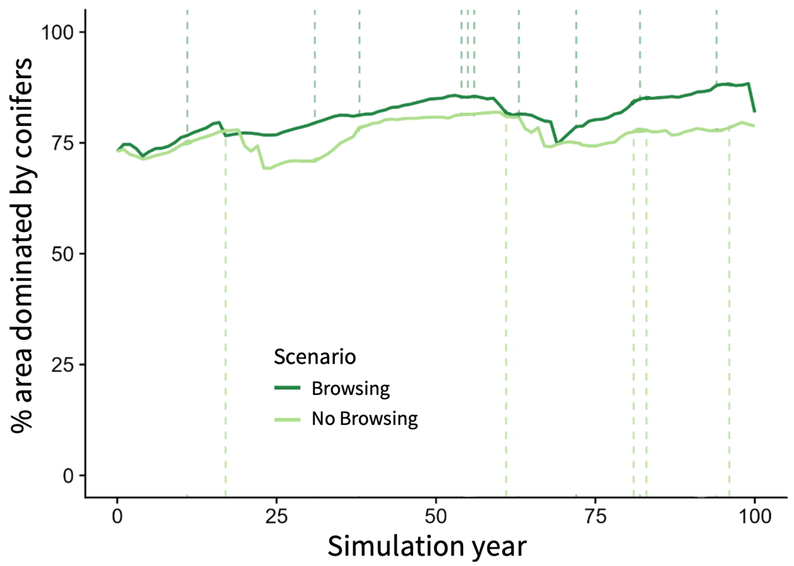
Herbivores do not modify postfire successional **trajectories***

**** at a stand scale across millennial in boreal forests.***

*Species distribution across **iLand** forest landscape before experiment (left), after 100 years (middle) and after 100 years of simulated browsing (right)*



% of landscape area dominated by conifers across the duration of the experiment. Dotted lines represent fires.



- Dominance determined by importance value (IV), calculated as relative proportions of species density and basal area. Dominance set as an IV of 1 or greater.

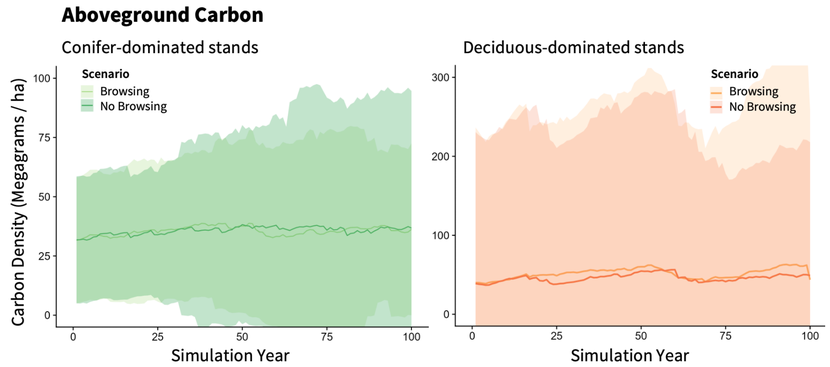
Browsing impacts on height do not appear to manifest in transformational shifts in forest composition from conifer to deciduous across longer time scales.

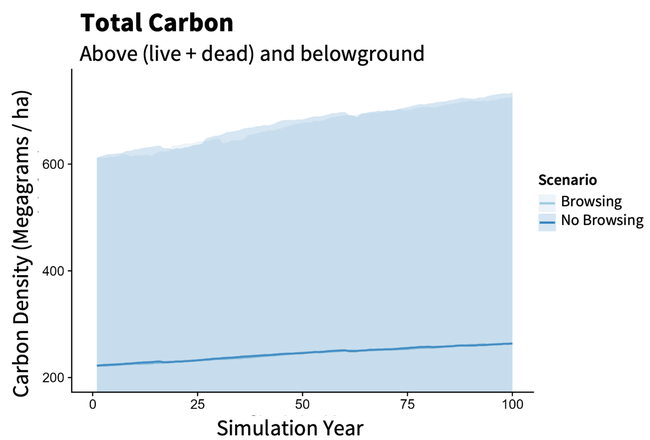
Herbivores do not modify postfire **landscape carbon***

**** through direct and indirect impacts on either above- or belowground carbon in boreal landscapes.***

Methods (cont.)

- We simulated fire-herbivore scenarios under historic climate (1951-2000), recycled with replacement.
- Following the literature, moose targeted birch and aspen, while hare browsed aspen, birch and white spruce.
- We spun up our model for 300 years to develop a mixed-age, mixed composition forest landscape (see Year 0 map).





- Aboveground carbon includes tree carbon (stem, branch, foliage), regeneration and understory carbon, all live.
- Belowground carbon includes soil organic layer carbon, mineral soil carbon, carbon in fine and coarse roots and moss/litter/duff carbon.
- Bands are standard deviation of average modeled carbon density.

Browsing, while impactful at a fine-scale, does not alter landscape-carbon balance.

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