

Including fire-vegetation feedbacks for modelling mixed-severity fire regimes at large spatial extents

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Mixed-severity fire (MSF) regimes and their drivers

Wildfires are important disturbances in boreal and montane forests across Canada that affect managed and unmanaged land. Fire regimes are often of mixed-severity (severity = % vegetation mortality) both spatially and temporally¹⁻⁴, due to a combination of drivers acting at different scales. While climate and topography are considered top-down drivers of severity, vegetation is considered a bottom-up driver.

Vegetation mediated responses to fire can act as feedbacks, affecting future fire activity in terms of occurrence, severity and size. Quantifying MSF regimes is essential to ecosystem management⁶.

Objectives:

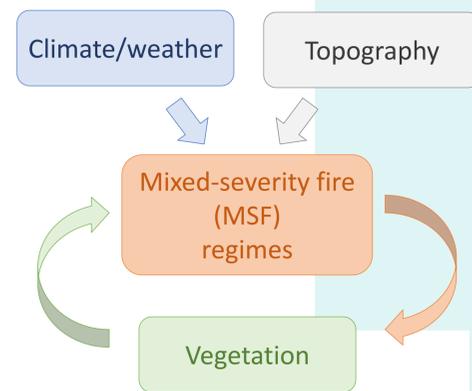
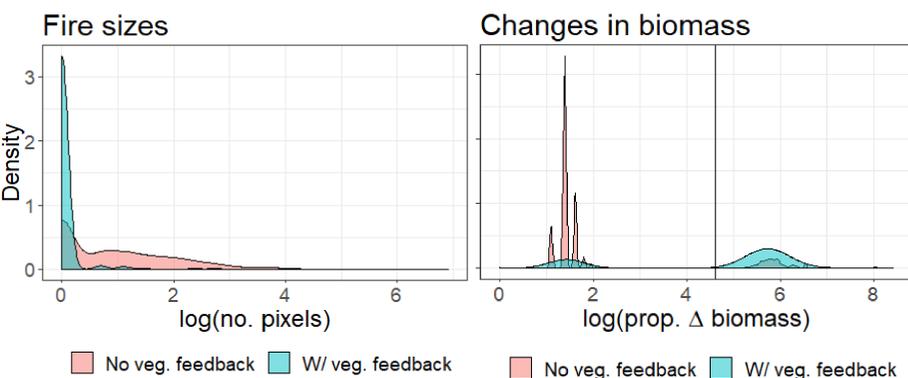
- 1) Develop a landscape, dynamic model that can simulate MSF regimes at large spatio-temporal scales
- 2) Confront model predictions with the reality of southern Alberta Foothills
- 3) Explore drivers and dynamics of MSF regimes in the southern Alberta Foothills

Preliminary results

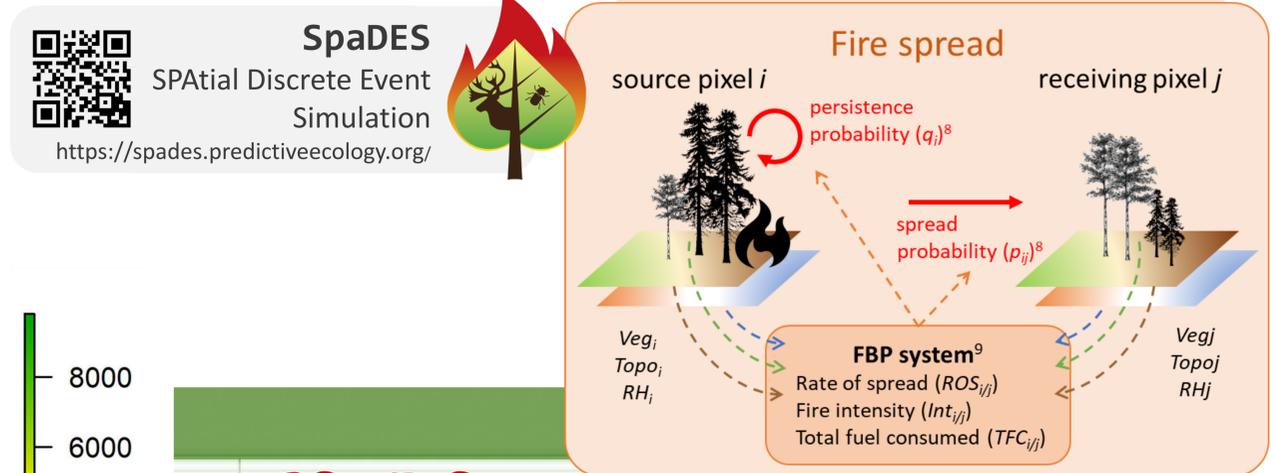
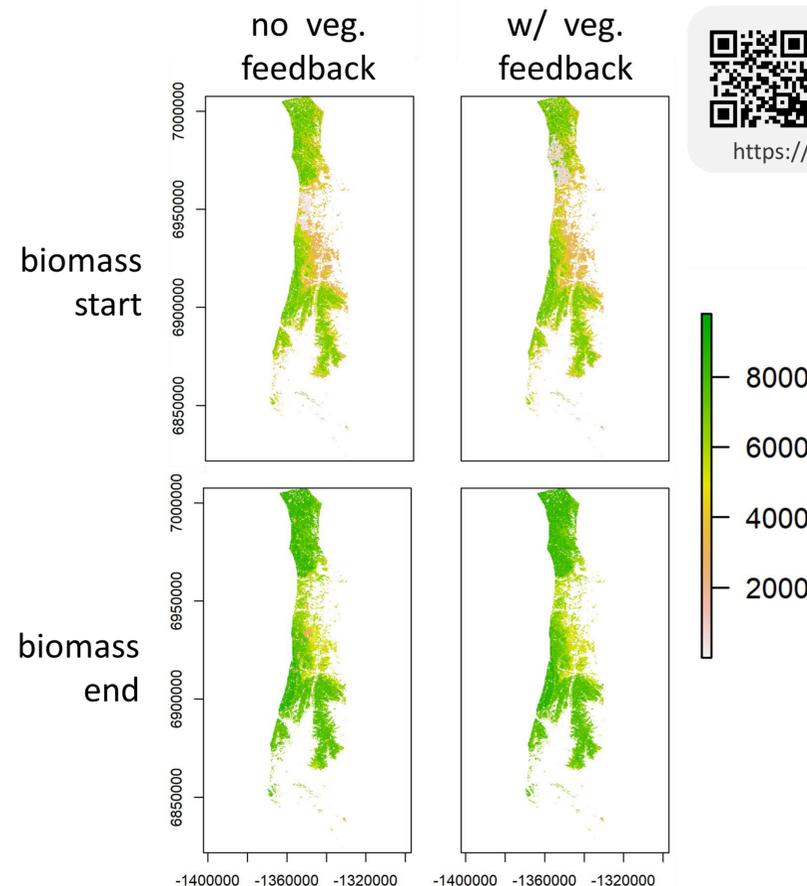
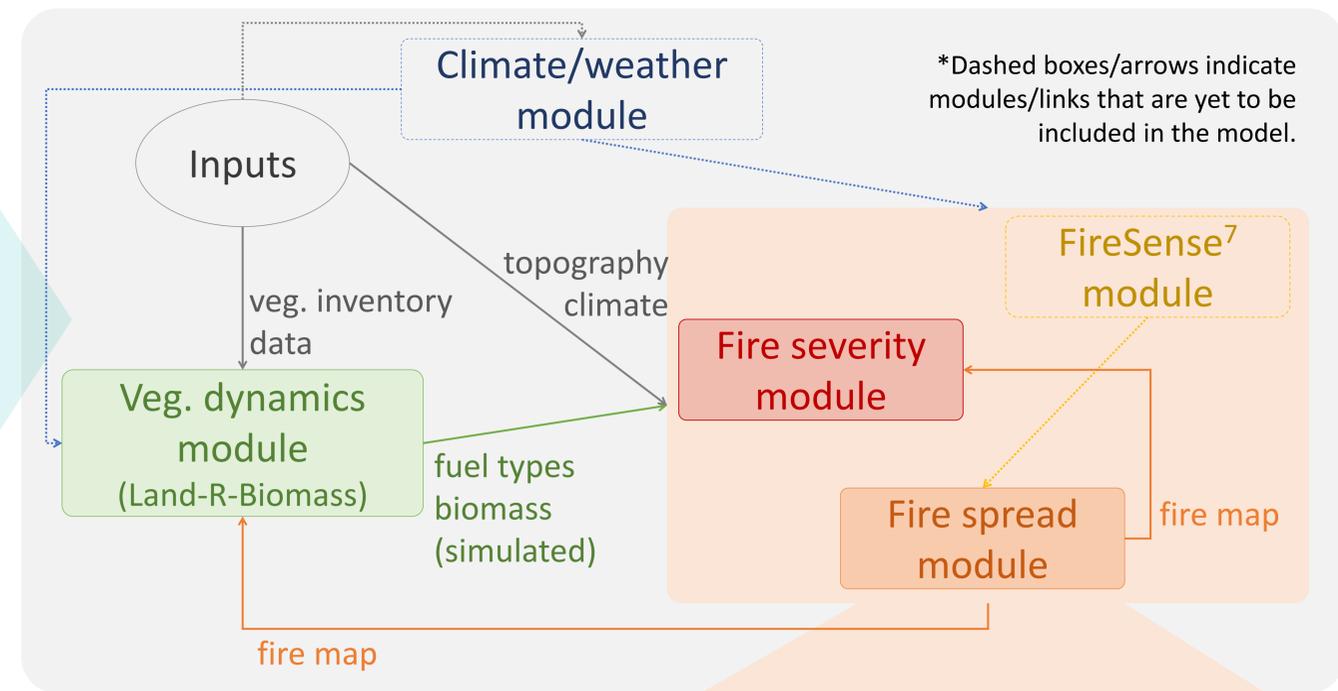
We ran a simple experiment whereby we varied whether fire spread/persistence were updated in function of vegetation conditions ('w/ veg. feedback') or not ('no veg. feedback').



Vegetation effects on fire spread affected final fire sizes but also fire severity (i.e. changes in biomass following fire) highlighting the importance of vegetation as a bottom-up driver



Structure of a spatial dynamic model for mixed-severity fire regimes



TO-DO

- Improve biomass-to-fuel-types conversion;
- Refine relationships between vegetation and spread/persistence probabilities;
- Add vegetation sensitivity to fire attributes (e.g. intensity);
- Include neighbour effects on persistence/spread probabilities;
- Add partial cohort mortality;
- Derive fire frequency from statistical relationships;
- Include climate/weather temporal variability.

References

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