Heterogeneous Patterns in Leaf Phenology Across a Climate Gradient in Maritime Canada Observed through Phenocams

BG11: Remote sensing for forest applications

EGU General Assembly 2021: EGU21-83

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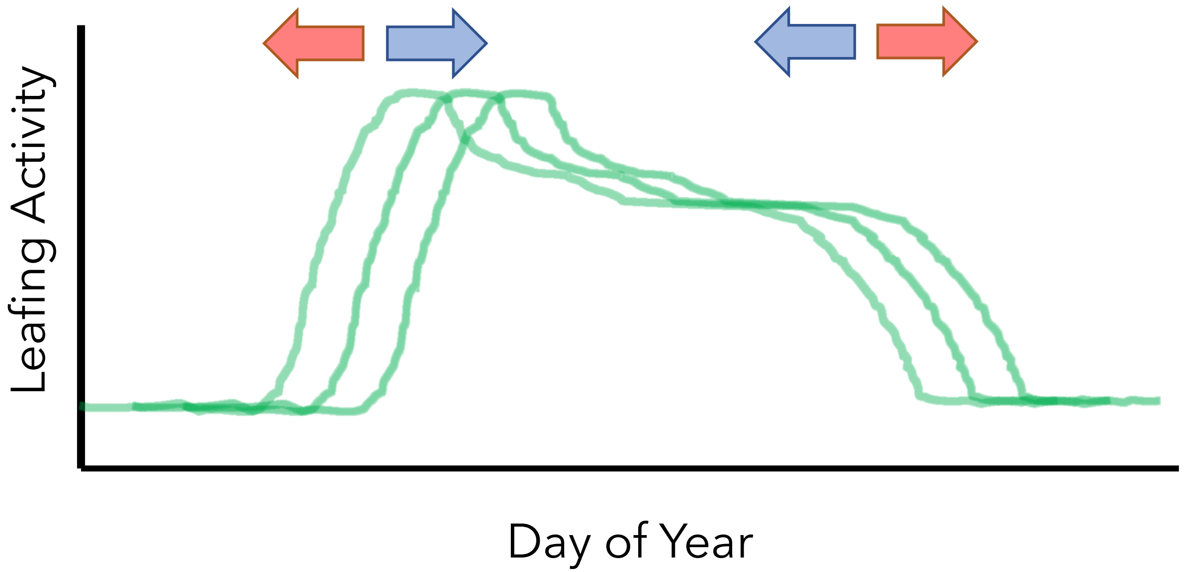
Uncertain Long Term Temperate & Boreal Leaf Phenology Forecast



- Earlier spring events due to warming or later due to delayed meeting of chilling requirements?
- Later fall events due to warming or earlier due to drought/heat stress?
- Non-linear response due to influence of photoperiod and extreme events?

Chen et al., 2019; Piao et al., 2019; Xie et al., 2018

Objectives

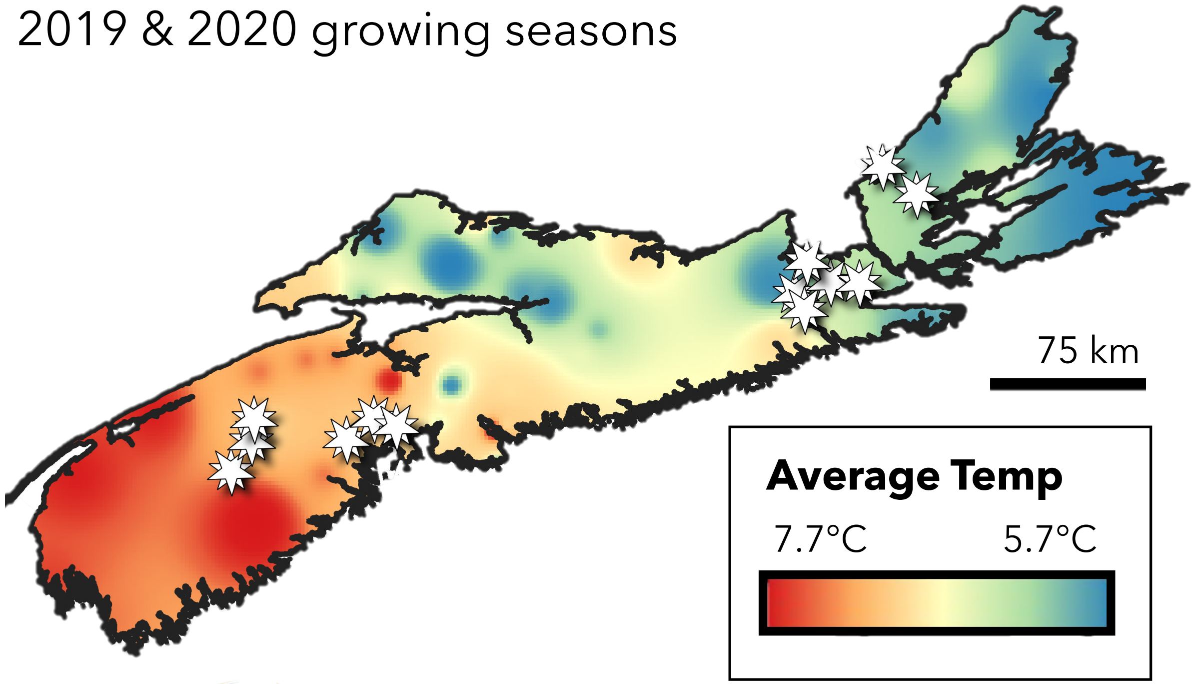
1. Design an environmentally robust means of remotely observing leaf phenology. Establish a network of canopy-level leaf phenology monitoring stations across a climate gradient in Maritime Canada in comparative contexts.

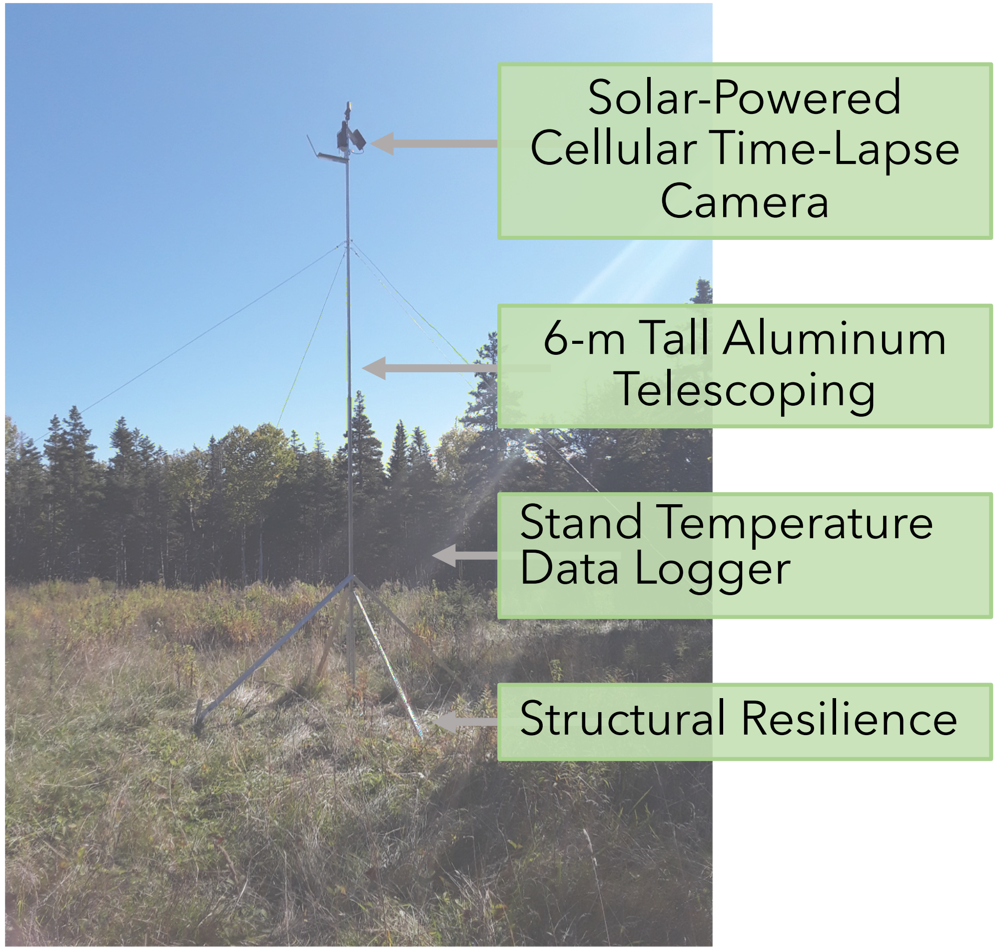
2. Estimate the timing of spring leaf green-up (SOS) and fall leaf green-down (EOS) using phenocams.

3. Examine how the timing of these events are influenced by microclimate and region.

Network and Phenocam Station Design

- intermediate soil nutrient & drainage profiles
- > 12 common species including red maple (*Acer rubrum*) & balsam fir (*Abies balsamea*)
- 2019 & 2020 growing seasons





Environment Canada, 2020

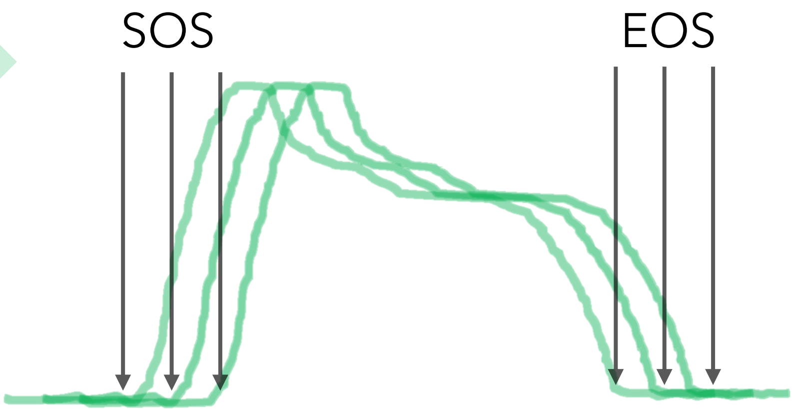
Analysis

- Image timeseries - 6 images daily

- Leaf phenology extraction from green chromatic coordinate (Gcc) of individual regions of interest using spline method

$$Gcc = \frac{G}{(G + R + B)}$$

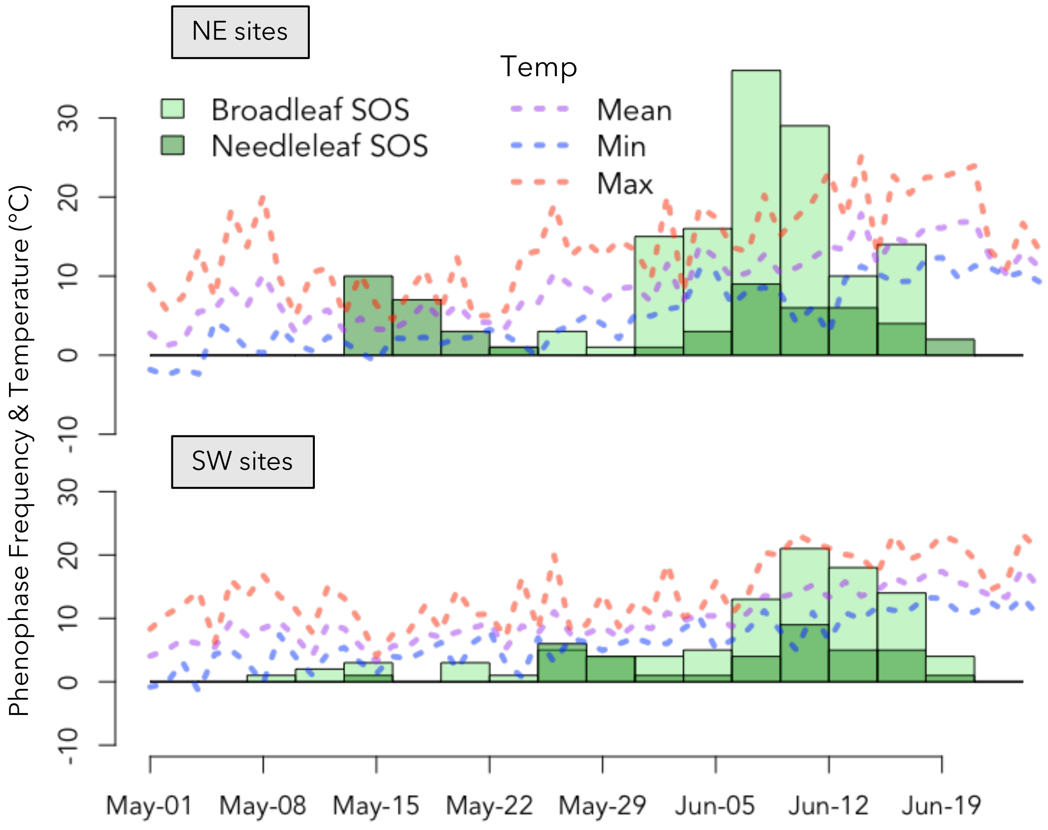
G, R, B: green, red, and blue colour channel brightness

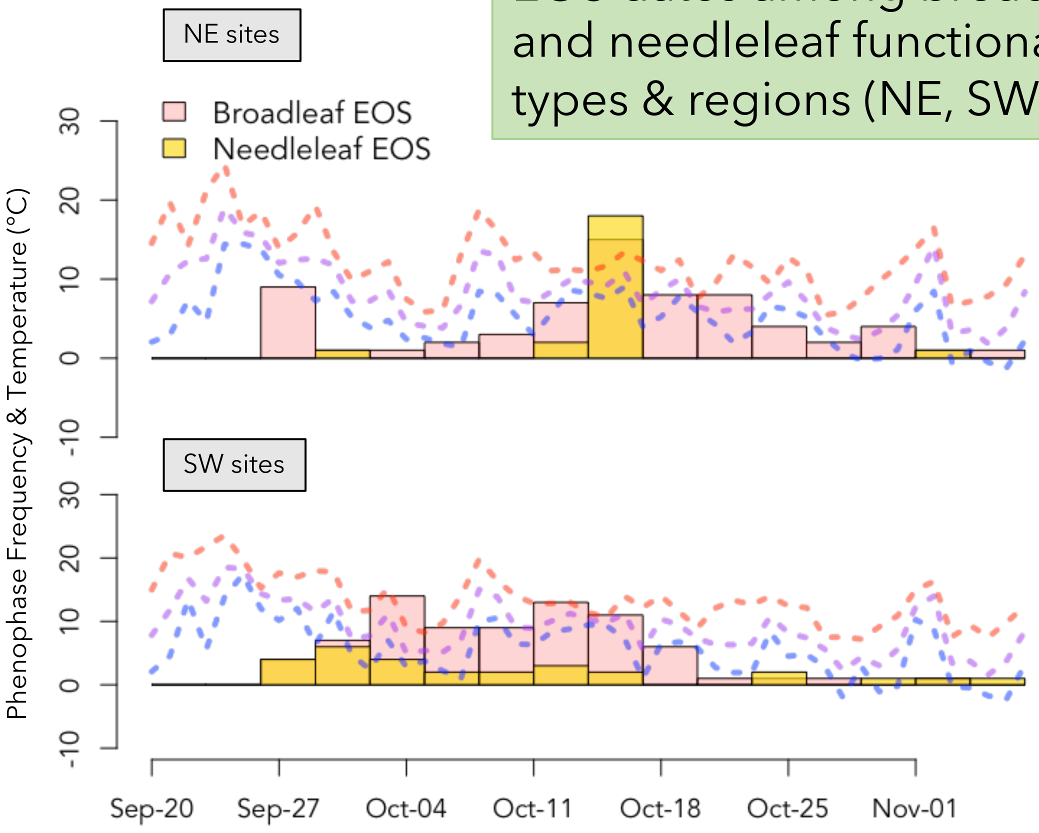


Cremonese & Fillippa, 2019; Fillippa et al., 2016; Migliavacca et al., 2011

Results: 2019 SOS[1] & EOS[2]

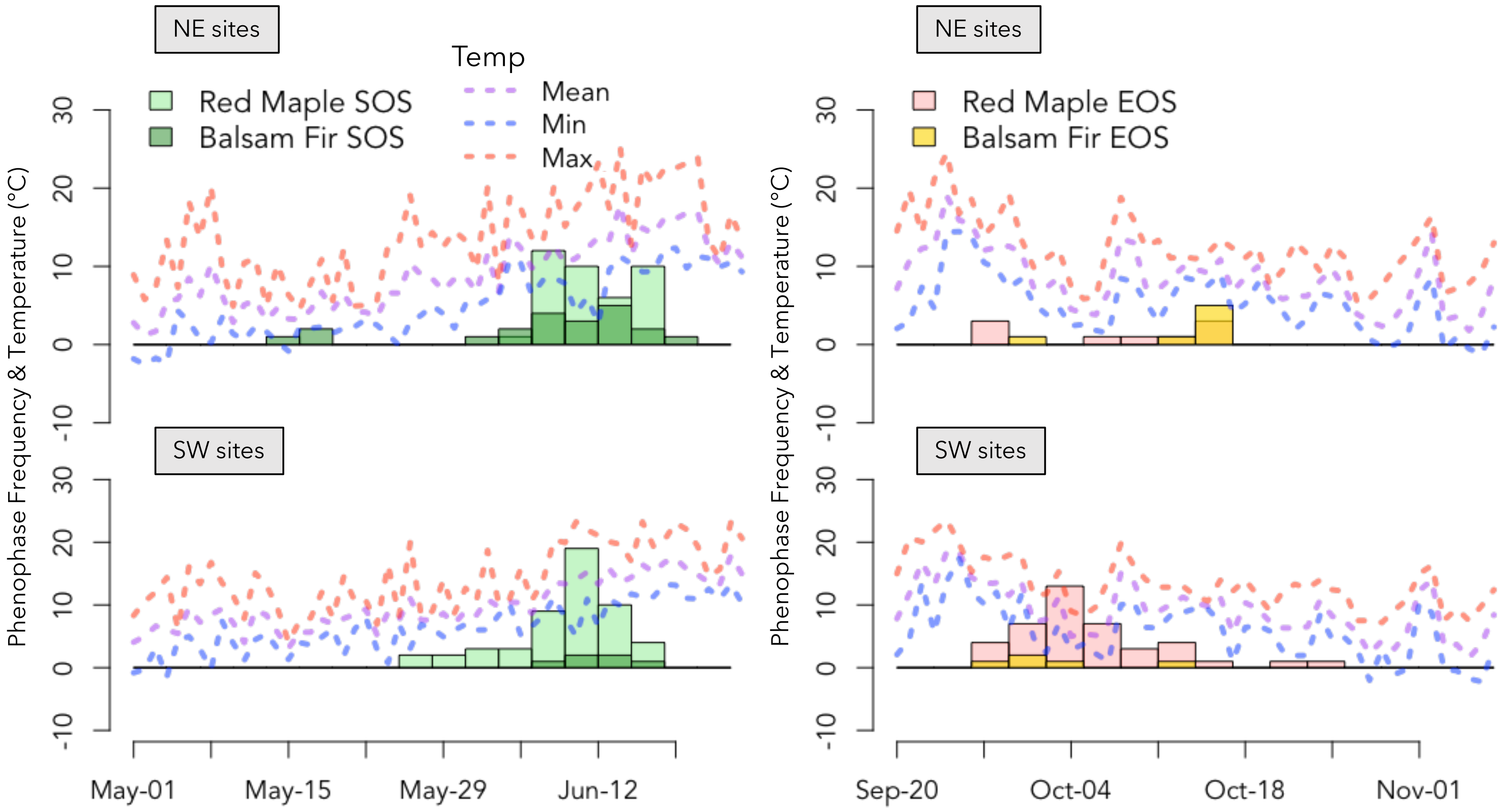
>1 month spread in SOS & EOS dates among broadleaf and needleleaf functional types & regions (NE, SW)





[1]start of season; [2]end of season

Results: 2019 SOS & EOS – by species



Reduced variability at the species level for red maple and balsam fir, through SOS still spans > 20 day range for red maple

Next Steps

1. Monitor the upcoming 2021 growing season.

2. Develop species specific process based models of leaf phenology including temperature, moisture, and photoperiod.

3. Test the wider application of our techniques to observational records from other regions (collaboration with Parks Canada to include other provinces such as New Brunswick, Prince Edward Island, and Newfoundland).

References

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