

# Field Freezing Experiment

**ORIGINAL DESIGN (without a real false spring):** I will design a field experiment to evaluate the differences in damage sustained across life stage to assess forest recruitment and sustainability. I will monitor the phenology of sapling and adult individuals across 8-9 species for 16 adults and 24 saplings per species and expose half of the individuals to simulated false spring events (Table 1). I will quantify the traits important for frost tolerance (i.e. leaf serrations and number of trichomes) and monitor those traits across life stage. To simulate a false spring, I will construct multiple in-field growth chambers and place them over individuals between budburst and leafout for an hour just after sunrise, which is the coldest time of day. I will then monitor their growth and phenology from budburst to leaf drop to determine the effects of false springs across life stage.

## QUESTIONS:

1. Do different life stages utilize different avoidance and/or tolerance strategies?
2. Does false spring damage vary across life stage?

## PLANS FOR ANALYSIS:

*Question 1:* I want to first evaluate the variation in strategies across life stage. For this question, I will have either Duration of Vegetative Risk, number of trichomes or number of leaf serrations as the response variable (Equation 1).

$$y_i = \alpha_{sp(i)} + \beta_{lifestage_{sp(i)}} + \sigma_{sp(i)} \quad (1)$$

*Question 2:* I will look at how the duration of vegetative risk shifts under the treatment and I will also have leaf chlorophyll content and SLA as response variables (Equation 2).

$$y_i = \alpha_{(i)} + \beta_{tx_{sp(i)}} + \beta_{serrations_{sp(i)}} + \beta_{trichomes_{sp(i)}} + \sigma_{sp(i)} \quad (2)$$

**POTENTIAL SHIFT IN DESIGN (if a real false spring is expected):** Could I place hobo loggers on individuals that are between budburst and leafout and if the temperature drops below -2.2°C then it is considered a false spring treatment? The temperatures would vary but at least I would be monitoring that temperature...? Still thinking! Temperatures have been in the 50s and 60s over the last couple of weeks. We are supposed to get into the high 60s a couple times this week and then it's suppose to drop again... and then go back up to the 50s. I few of my smaller individuals are already showing signs of bud swelling. From my experiment last spring, I saw that – depending on the species – the buds

could look like that for quite a while before bursting so it may be okay, but it is still so early in the year. My concern is that I will start the experiment and then a false spring will hit halfway through and I will greatly reduce my sample size and number of species. Right now, I will continue to monitor the buds and if I think an individual is very close to budburst, I will look at the 10 day forecast and try to determine the best course of action from there. I also have a lot of individuals tagged at the Grant (Table 2), which I will go check on those individuals in the next couple of weeks. Maybe one site will have a false spring and the other won't — at least one can hope!

Table 1: Number of individuals already tagged in Harvard Forest for the spring field season.

Species	Stage	# of Individuals
<i>Acer pensylvanicum</i>	Sapling	24
<i>A. saccharum</i>	Sapling	24
<i>Betula lenta</i>	Sapling	24
<i>Carya ovata</i>	Sapling	24
<i>Corylus cornuta</i>	Sapling	24
<i>Fagus grandifolia</i>	Sapling	16
<i>Hamamelis virginiana</i>	Sapling	24
<i>Ilex verticillata</i>	Sapling	24
<i>Viburnum acerfolium</i>	Sapling	24
<i>A. pensylvanicum</i>	Tree	16
<i>A. saccharum</i>	Tree	16
<i>B. lenta</i>	Tree	16
<i>C. ovata</i>	Tree	16
<i>C. cornuta</i>	Tree	16
<i>F. grandifolia</i>	Tree	16
<i>H. virginiana</i>	Tree	16
<i>I. verticillata</i>	Tree	16
<i>V. acerfolium</i>	Tree	16

Table 2: Field Freezing (Grant) - number of saplings marked per species.

<b>Species</b>	<b>No. of Individis</b>
VIBLAN	16
ILEMUC	16
BETALL	16
FAGGRA	16
ALNINC	16
PRUPEN	16
ACERUB	16
ACESAC	16
ACEPEN	16