

# Impacts of early springs and winter warming events on spring phenology and cold tolerance among temperate and boreal tree species

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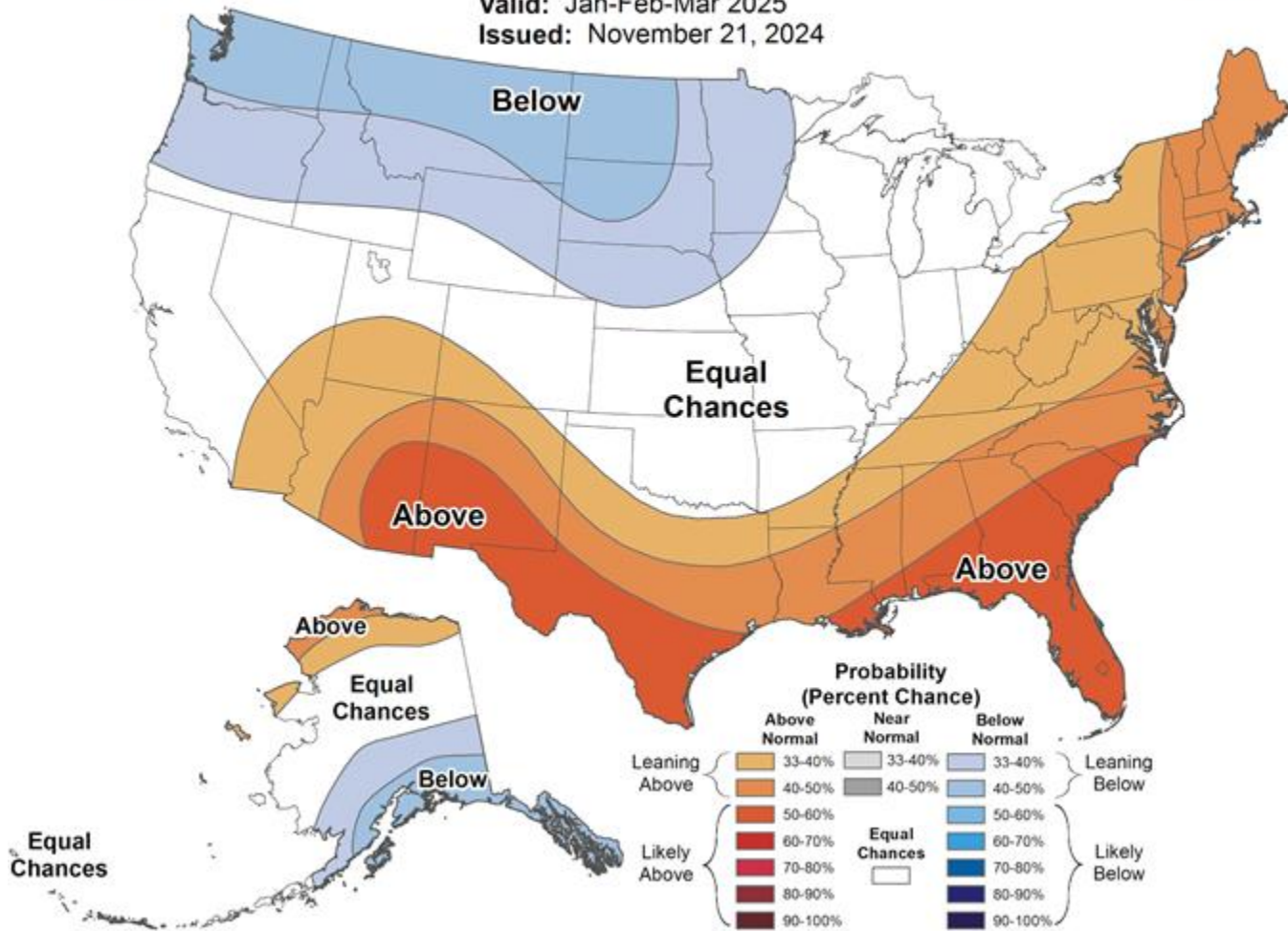




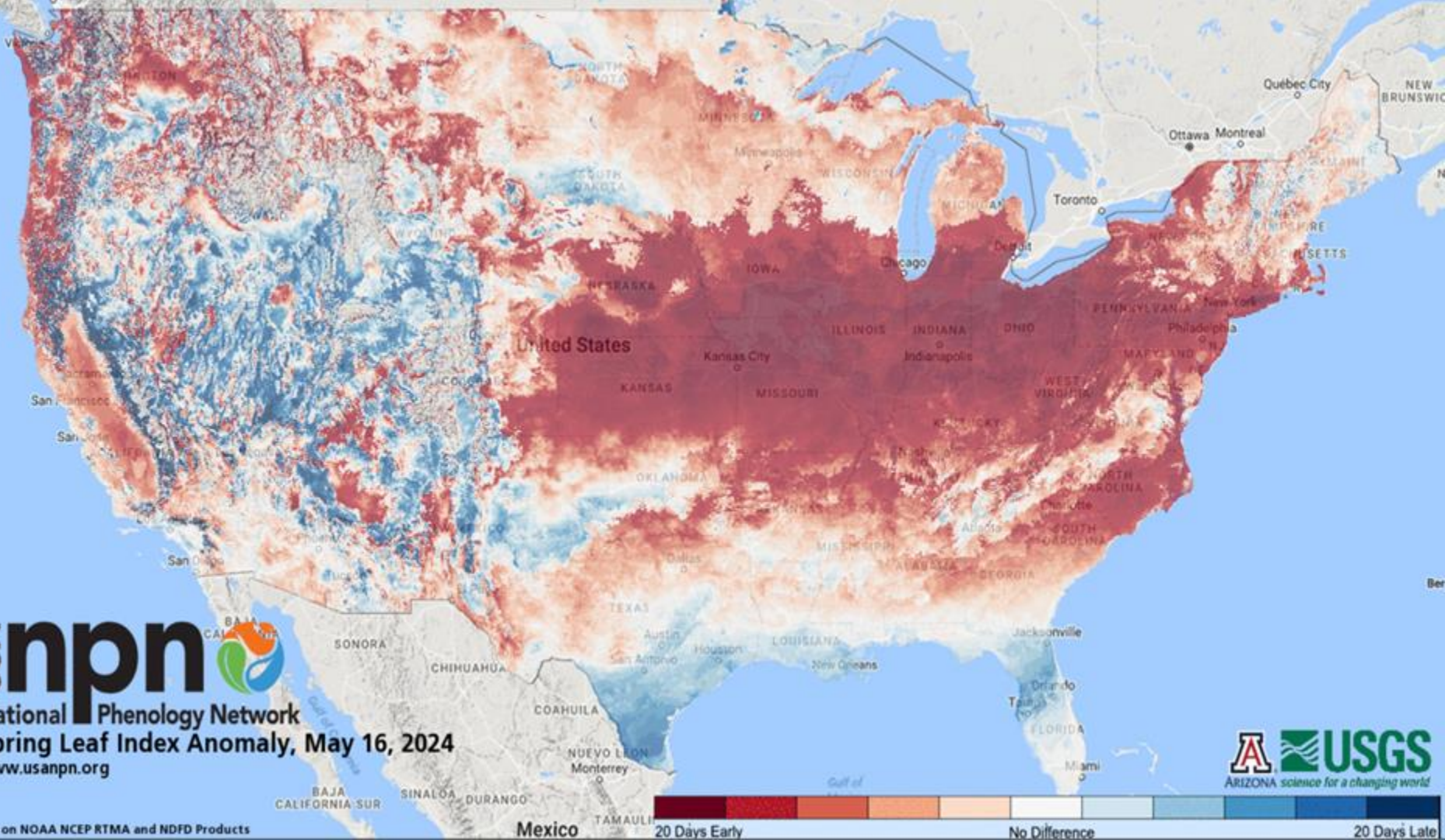
# Seasonal Temperature Outlook



Valid: Jan-Feb-Mar 2025  
Issued: November 21, 2024







National Phenology Network  
 Spring Leaf Index Anomaly, May 16, 2024  
[www.usanpn.org](http://www.usanpn.org)

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Based on NOAA NCEP RTMA and NDFD Products





**Goal:** Determine how tree regeneration in the Northeast will respond to midwinter warming and early spring events in order to provide forest managers needed information to prepare for the future.

**Objective:** Identify the phenological sensitivity and cold tolerance of tree species in response to warming events and the risks associated with subsequent re-freezing.



# Study Area & Species



## **Conifers**

Balsam fir  
Eastern red cedar  
Red pine  
Red spruce  
White pine

## **Deciduous**

American chestnut  
Paper birch  
Red maple  
Red oak  
Sugar maple



# Warming Scenarios

	<b>February</b>	<b>March</b>	<b>April</b>
F14		<b>14 Days</b>	
M7R		<b>7 Days</b>	<b>7 Days</b>
M14		<b>14 Days</b>	
ES			<b>21 Days</b>
C			



F14 = February 14 Days  
M7R = March 7 Days Repeated  
M14 = March 14 Days  
ES = Early Spring  
C = Control

# Deciduous Phenology Guide





# Conifer Phenology Guide



Bud Burst

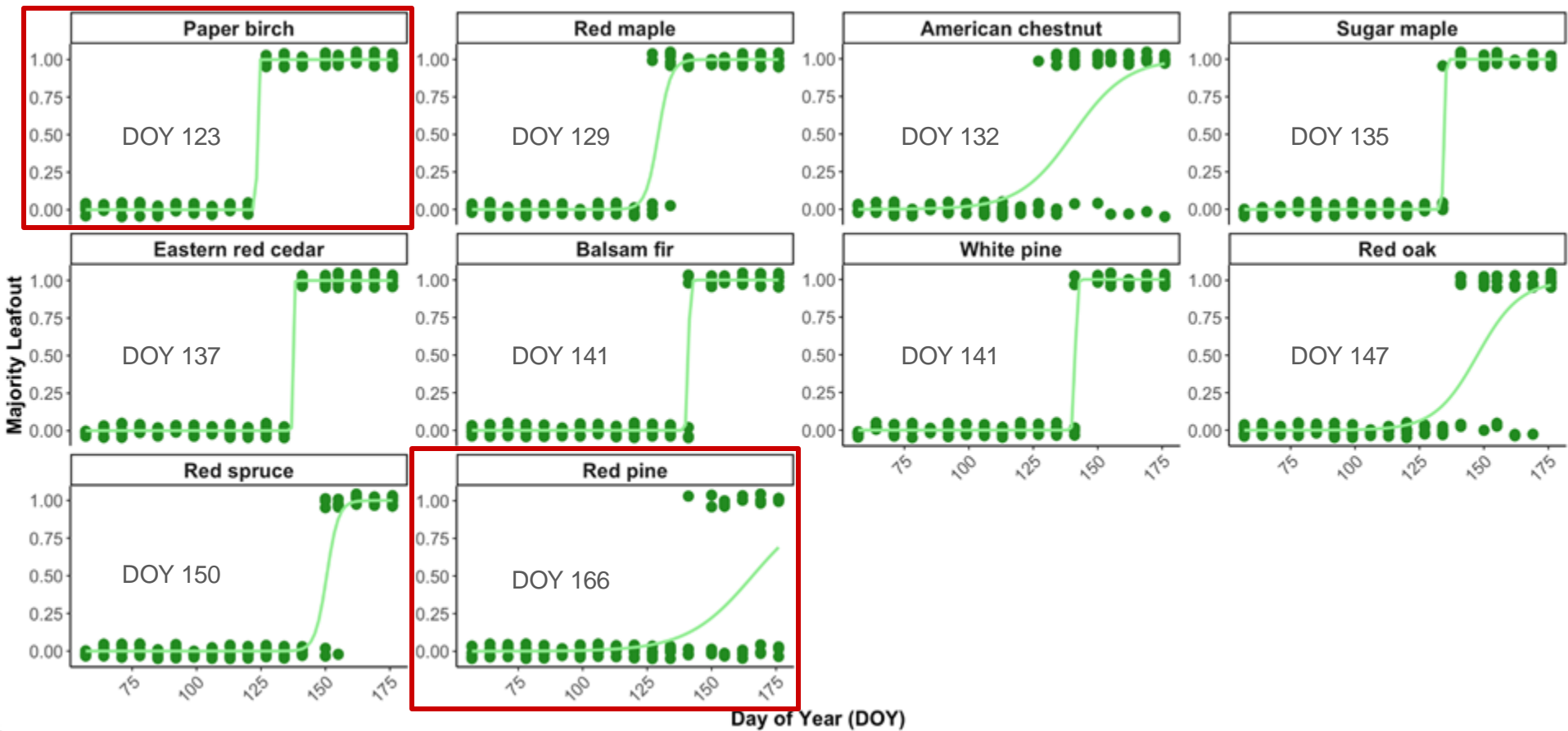


Needle Spread

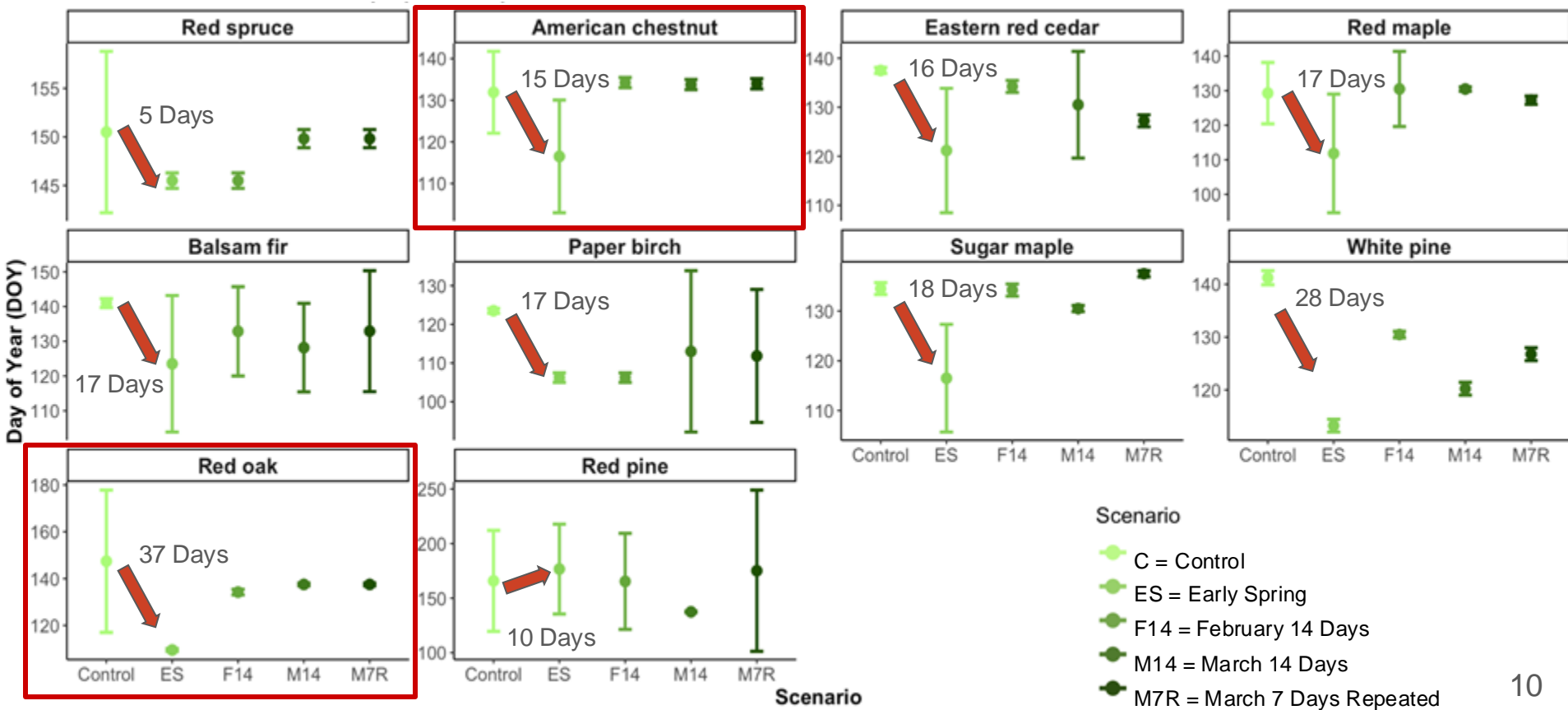




# Species naturally leaf out on different days

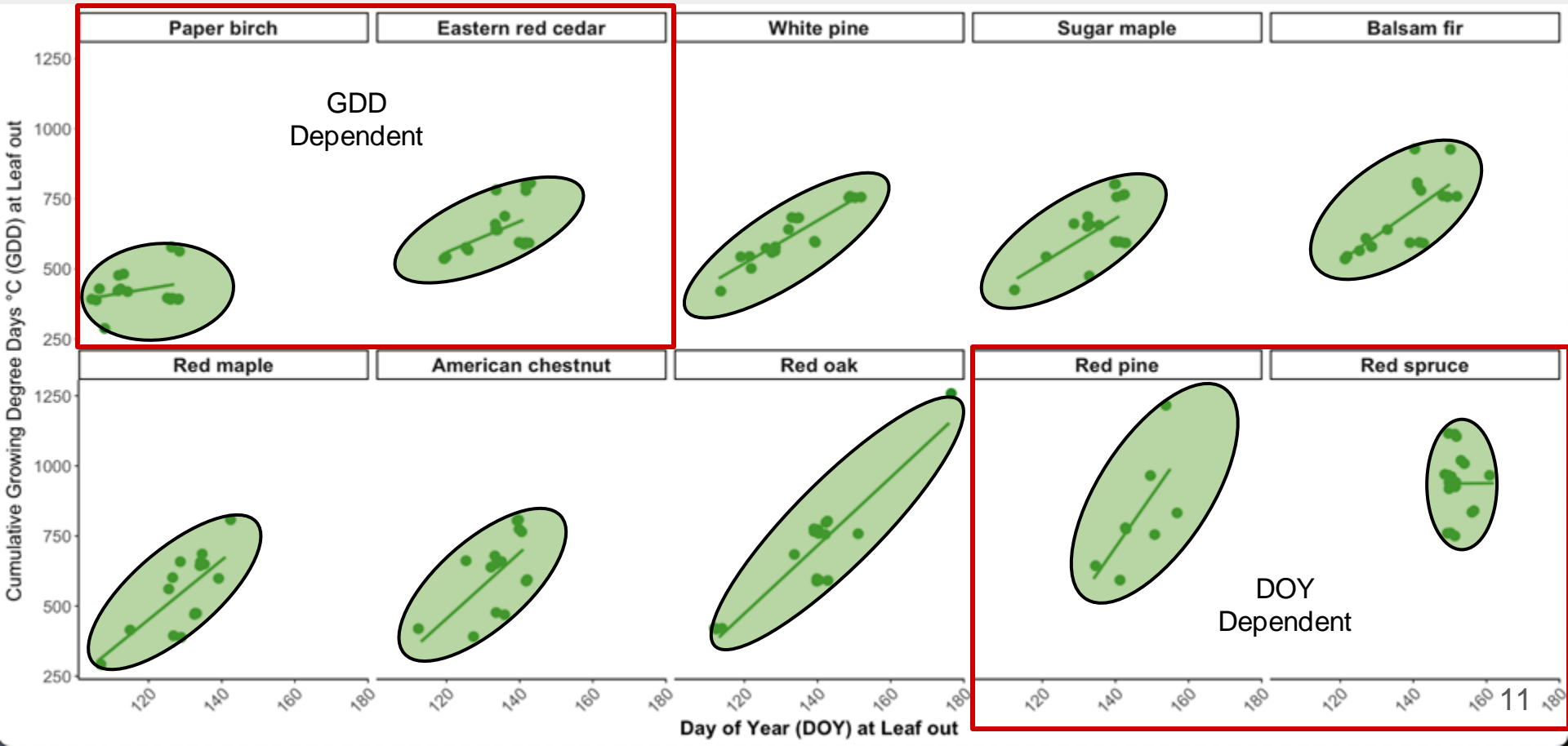


# Early spring forces early leaf out

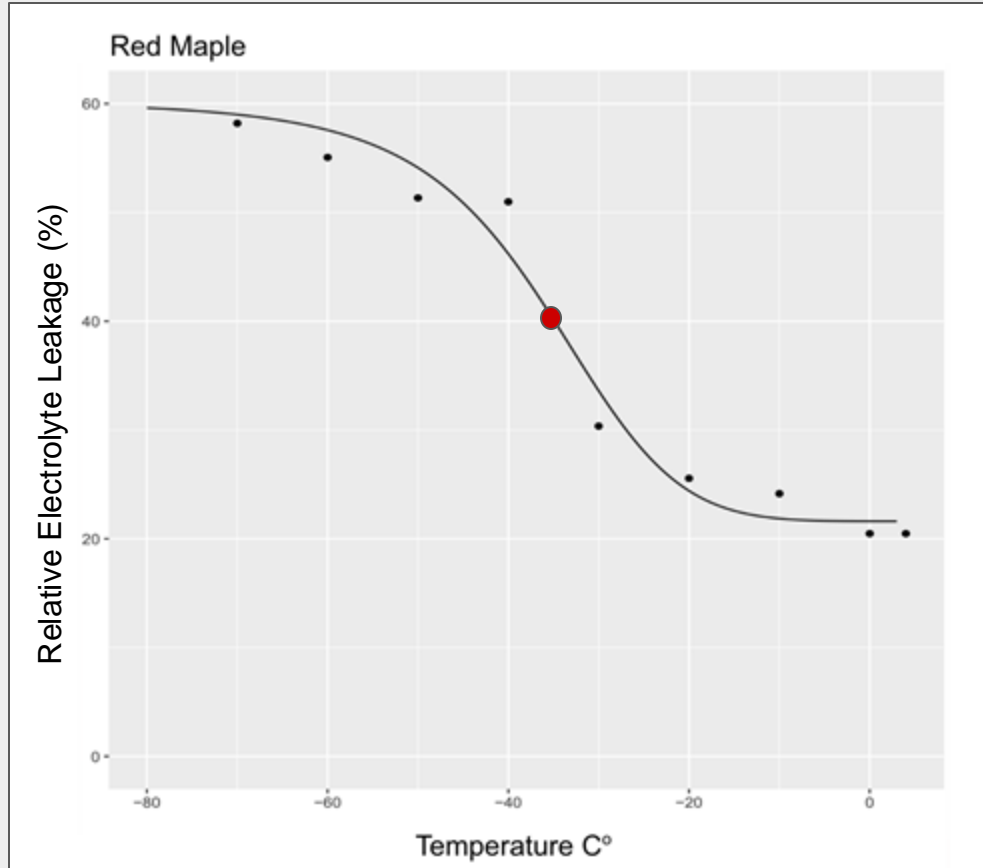




# Leaf out drivers are species specific



# Cold Tolerance



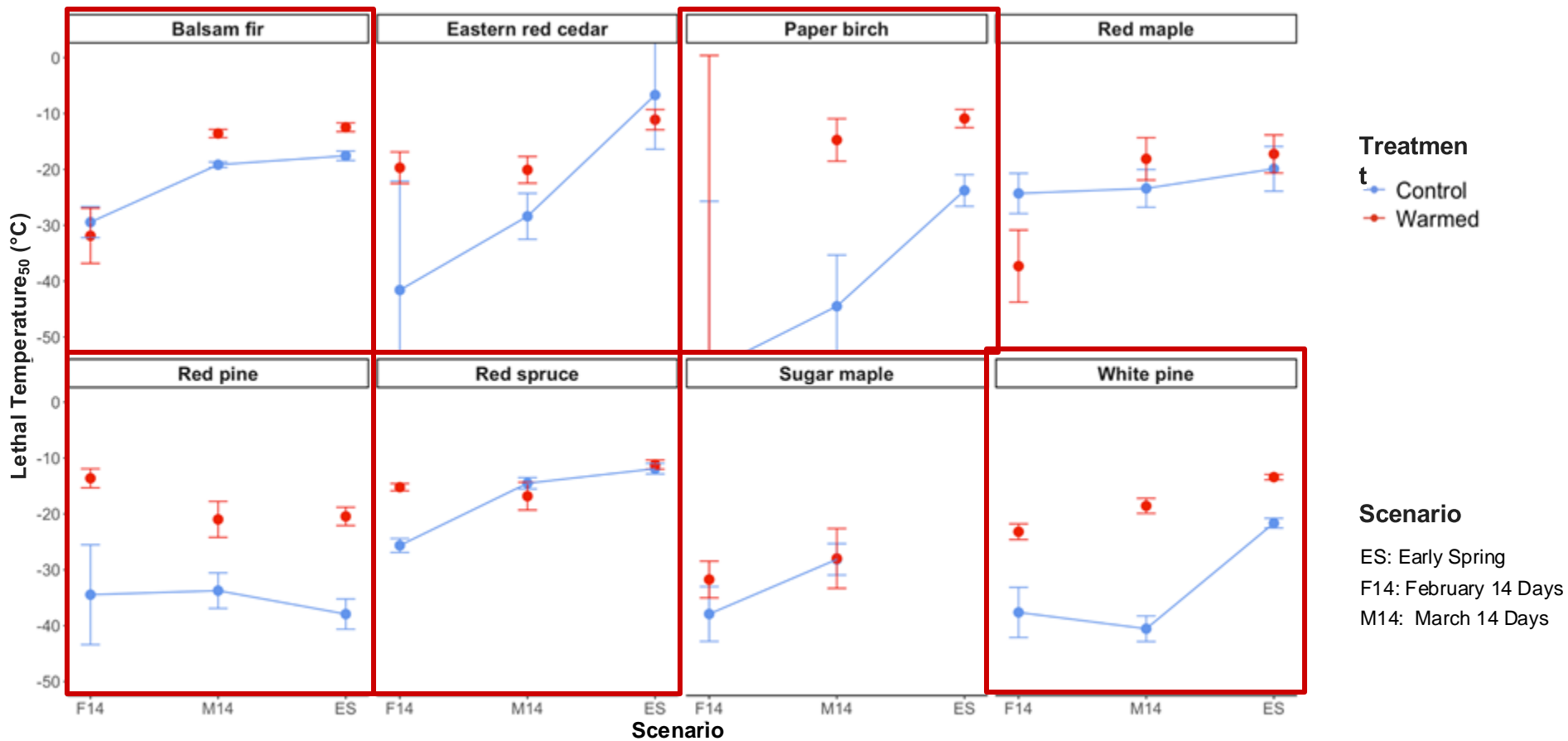
- +4°C to -80°C
- Measured 3x
- Two weeks of warming
- Stem tissue



Photo credit: Dr. John Butnor, USFS



# 2 weeks of warming reduces cold tolerance



# Broader Implications

- **Winter Warming Events**
  - For most species, no major change in leaf out date
  - Dramatic loss in cold tolerance for white pine, red pine, and paper birch
- **Early Spring Events**
  - Leaf out occurred 2 - 4 weeks early for most species (except red pine and red spruce)
  - Major loss in cold tolerance for white pine, red pine, and paper birch
- Assisted migration and flexibility
- Next steps:
  - Budburst, chilling, and forcing





# Thank You!

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