The Effects of Site Preparation on the Long Term Growth and Productivity of Interior Douglas-fir and Western White Pine

Jonathan Cherico

MS Student

University of Idaho, College of Natural Resources

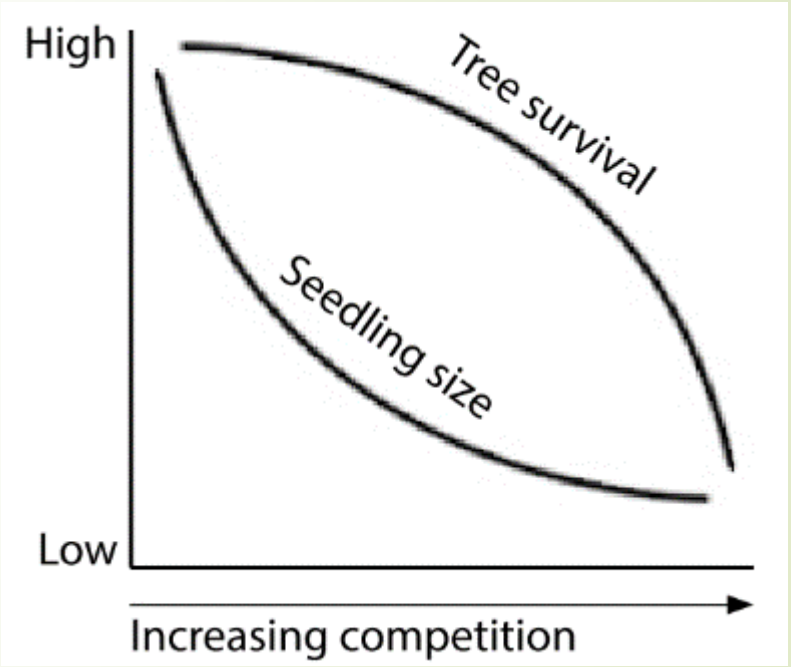
Department of Forest, Rangeland and Fire Sciences

Overview

- Introduction
- Objectives
- Methods
  - Site Description and Study Design
  - Data Collection and Field Procedure
  - Laboratory Procedure and Data Analysis
- Results
  - Height, Diameter, and Volume- age relations
- Discussion and Future Steps

Introduction

- Artificial regeneration is common and essential in the Inland Northwest
  - In Idaho for 2014 alone (Hernández et al. 2015):
    - More than 4.9 million tree seedlings produced
    - 8,958 acres of land planted
- Site preparation is used to improve planted tree survival and establishment
  - Abundant data for stand initiation years
  - What happens after the first 10 years?



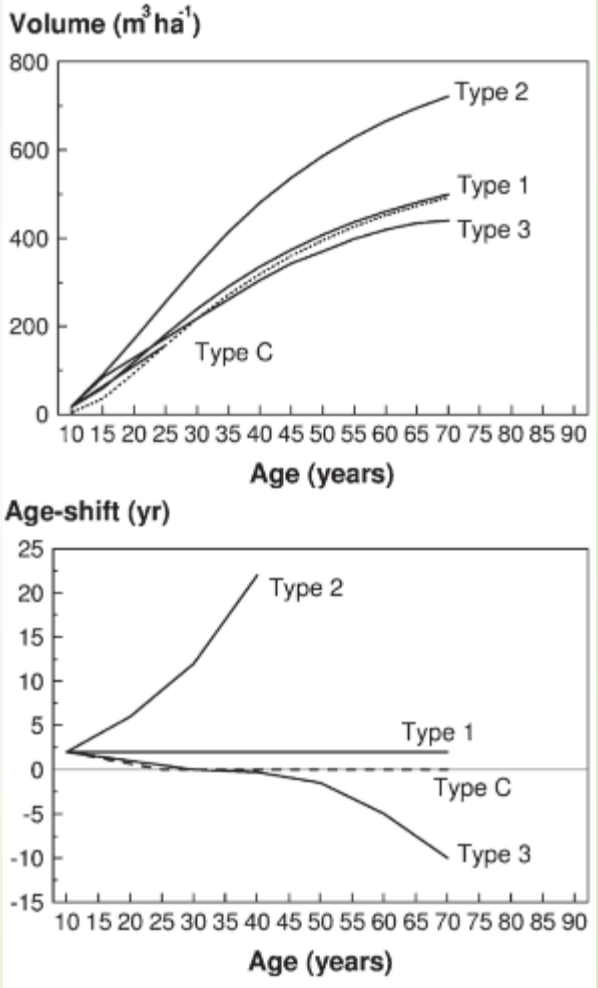
From Oester and Fitzgerald (2016)

Site Preparation

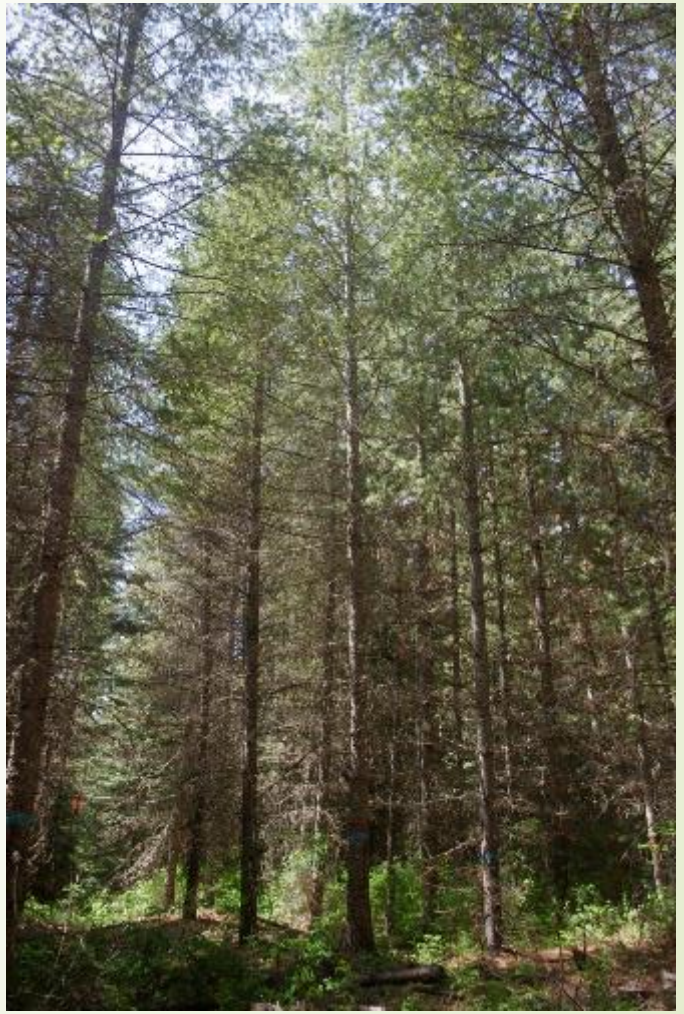
- Improves initial site conditions for desired regeneration
- Reduces resource competition
- Mechanical, chemical, and combined methods are common

- Age-shift: quantifies the year advancements in stand growth due to silvicultural treatments

From South et al. (2006)



Study Species



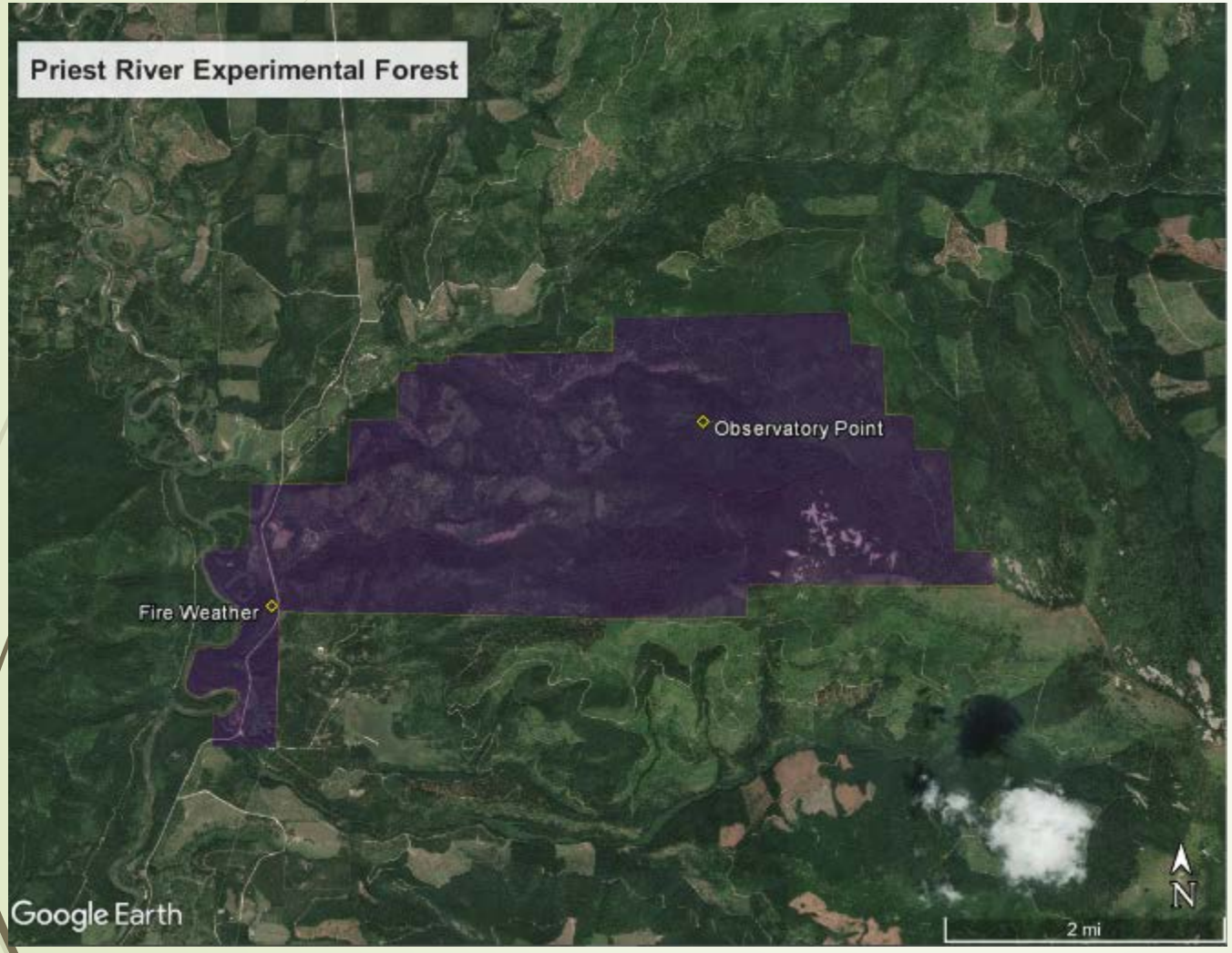
Stem Analysis

- Incremental disk removal along the stem
- More accurate growth reconstruction than nondestructive methods
- Height/diameter/volume – age relationships

Objectives

- Examine if site preparation treatments performed in 1982 influenced trends in stem growth of western white pine and interior Douglas-fir at two different site elevations
  - Observe how height, volume, and DBH- age relationships changed in response to site preparation treatments

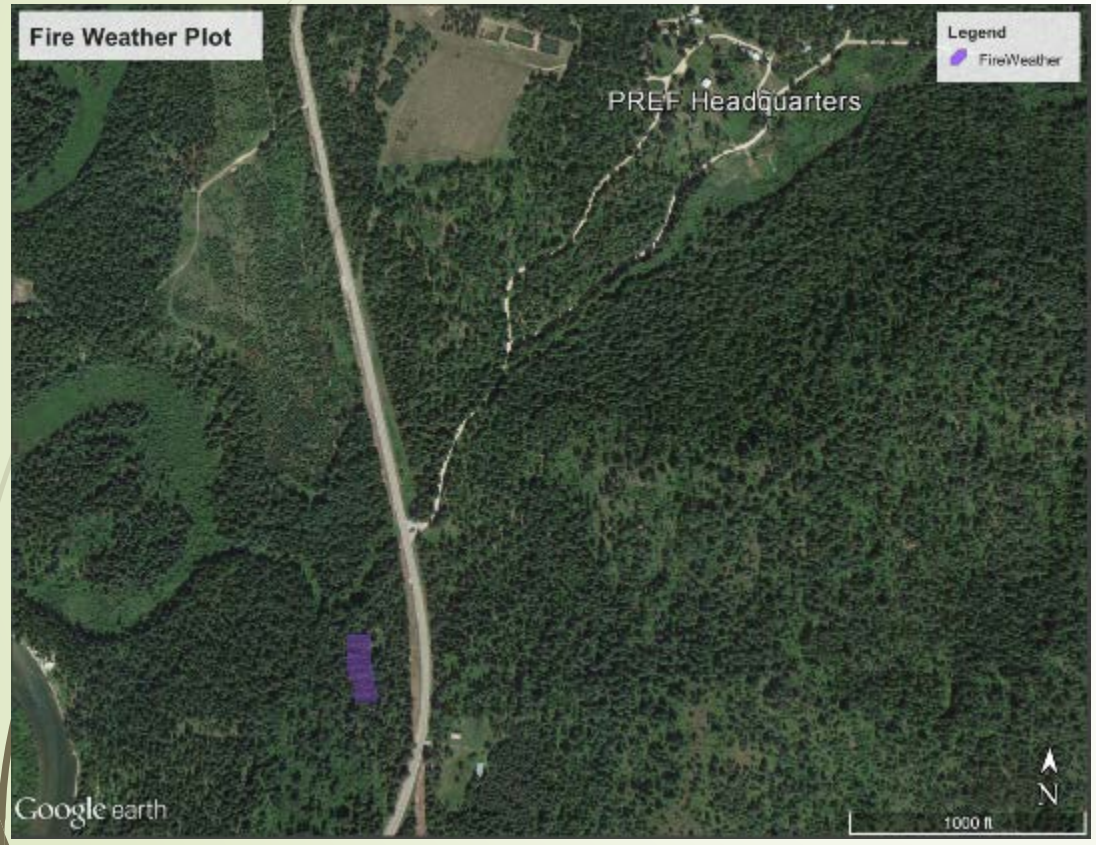
Study and Site Description

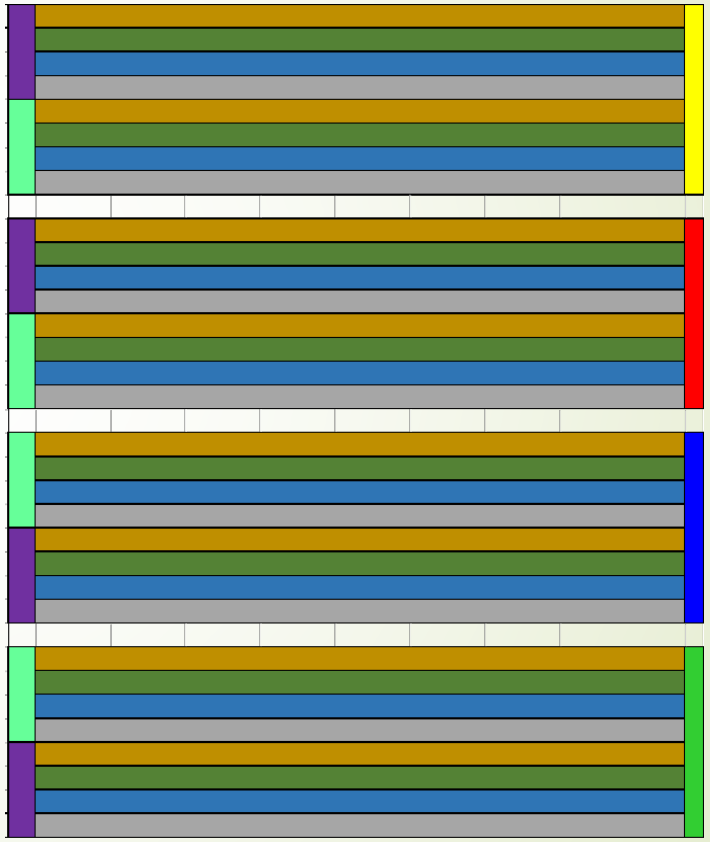


Study Design- Treatments

- Treatments applied in 100 foot rows (1982):
  - Scalping
    - Top 4 inches of surface organic and mineral horizons removed
  - Bedding without competition control
    - 1.5 ft high x 5 ft wide
  - Bedding with competition control (overtopping)
    - Vegetation manually removed in planting year
    - 1.5 lb/ac glyphosate applied in years 2 and 3 of study
  - Untreated control
    - Only harvest slash removed from rows
- 1-0 containerized stock of DF and WP planted in 1982

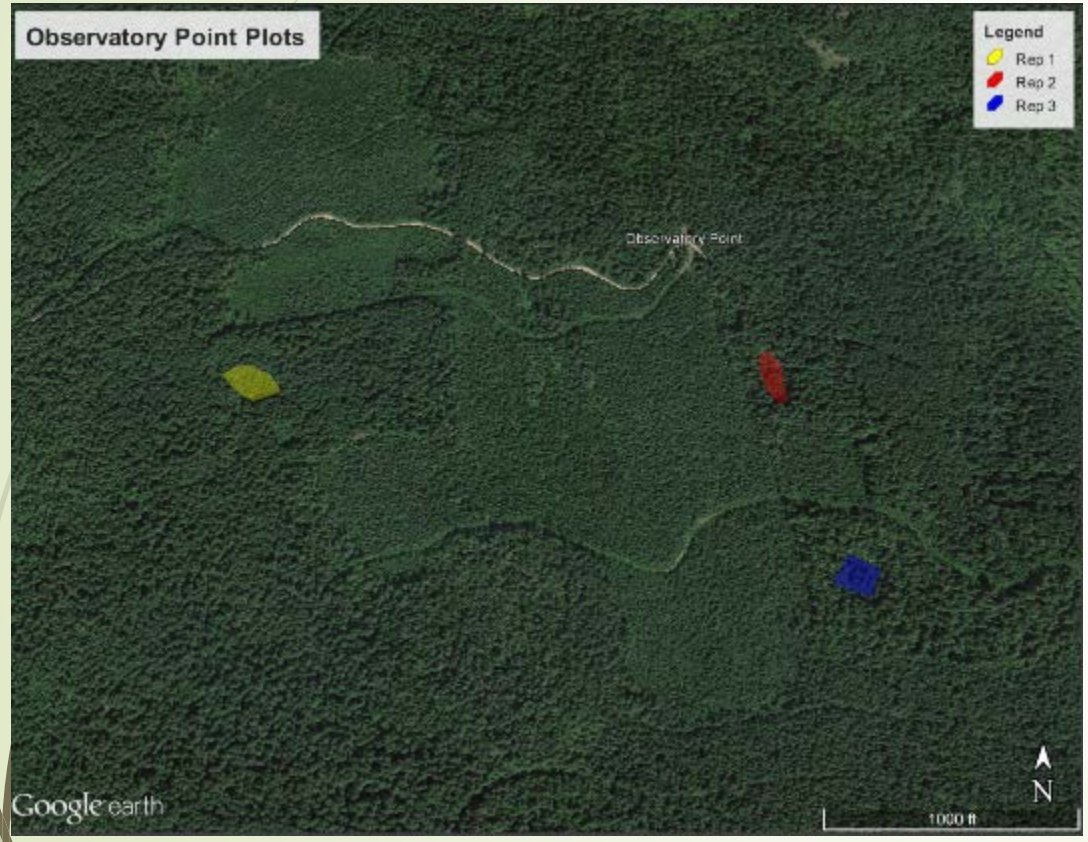
Low Elevation Site- Fire Weather

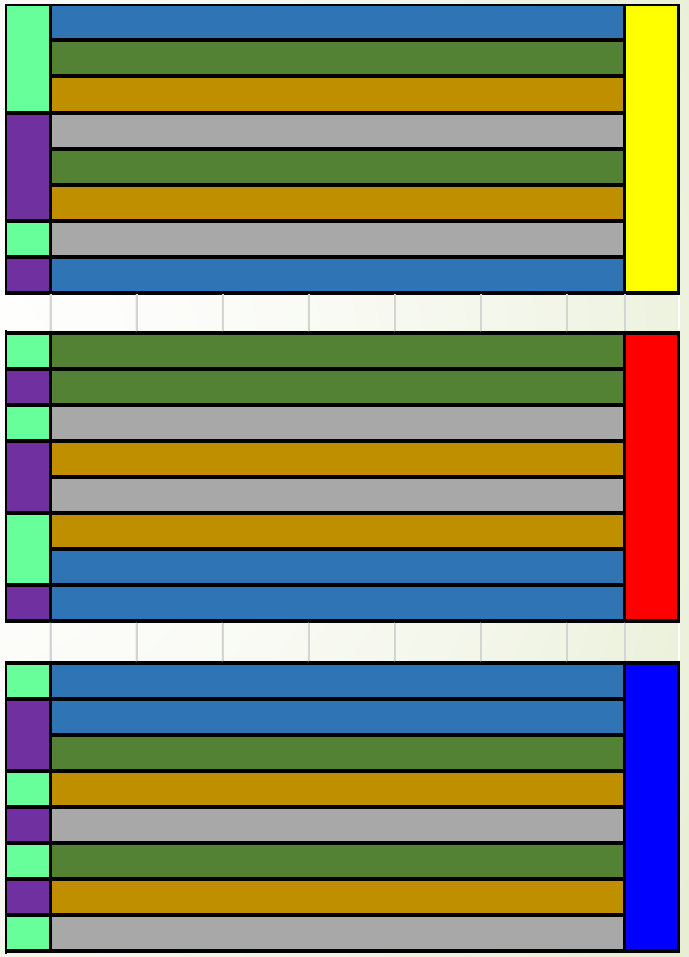




Species	Treatment	Replication
WWP	Bed	R1
DF	Bed + Herb	R2
	Scalp	R3
	Control	R4

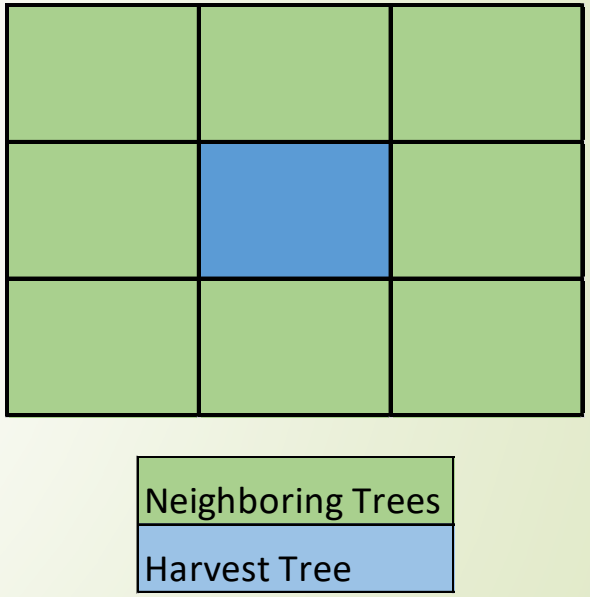
High Elevation Site- Observatory Point





Species	Treatment	Replication
WWP	Bed	R1
DF	Bed + Herb	R2
	Scalp	R3
	Control	

Field Procedure- Neighborhood Sampling

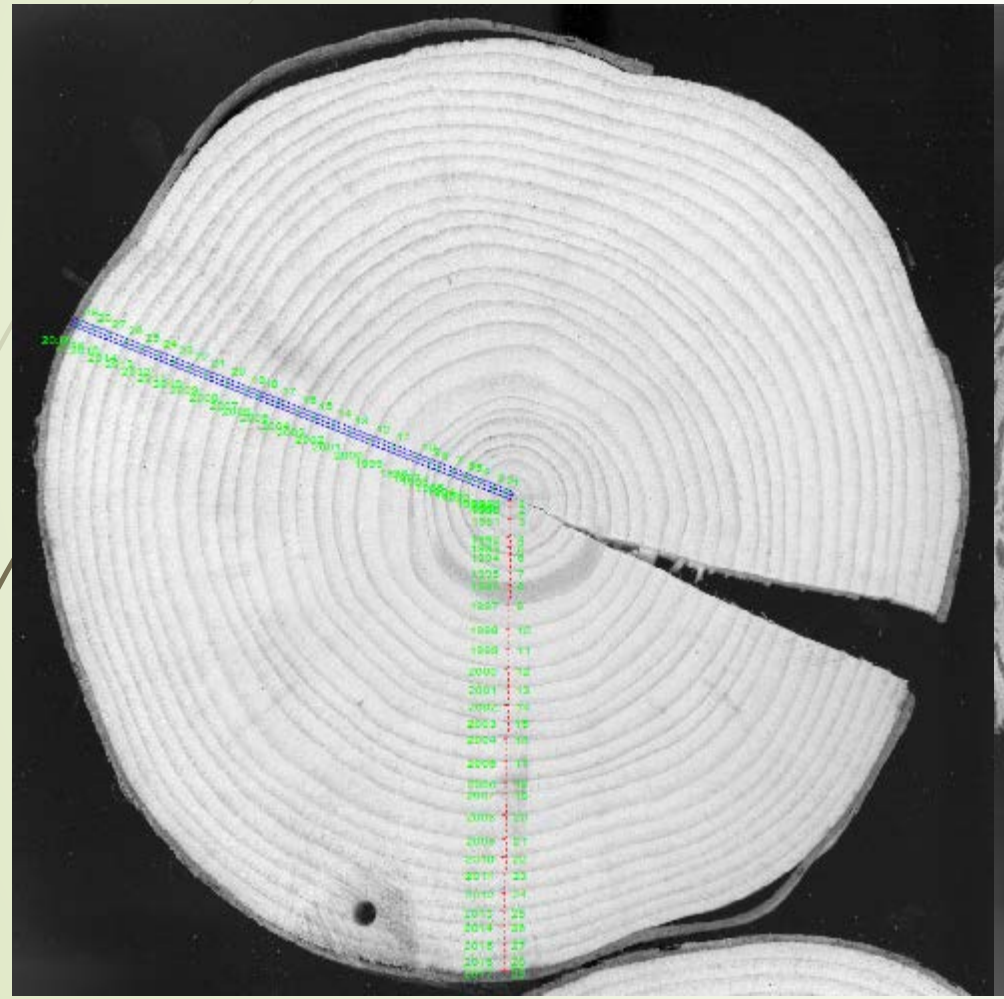


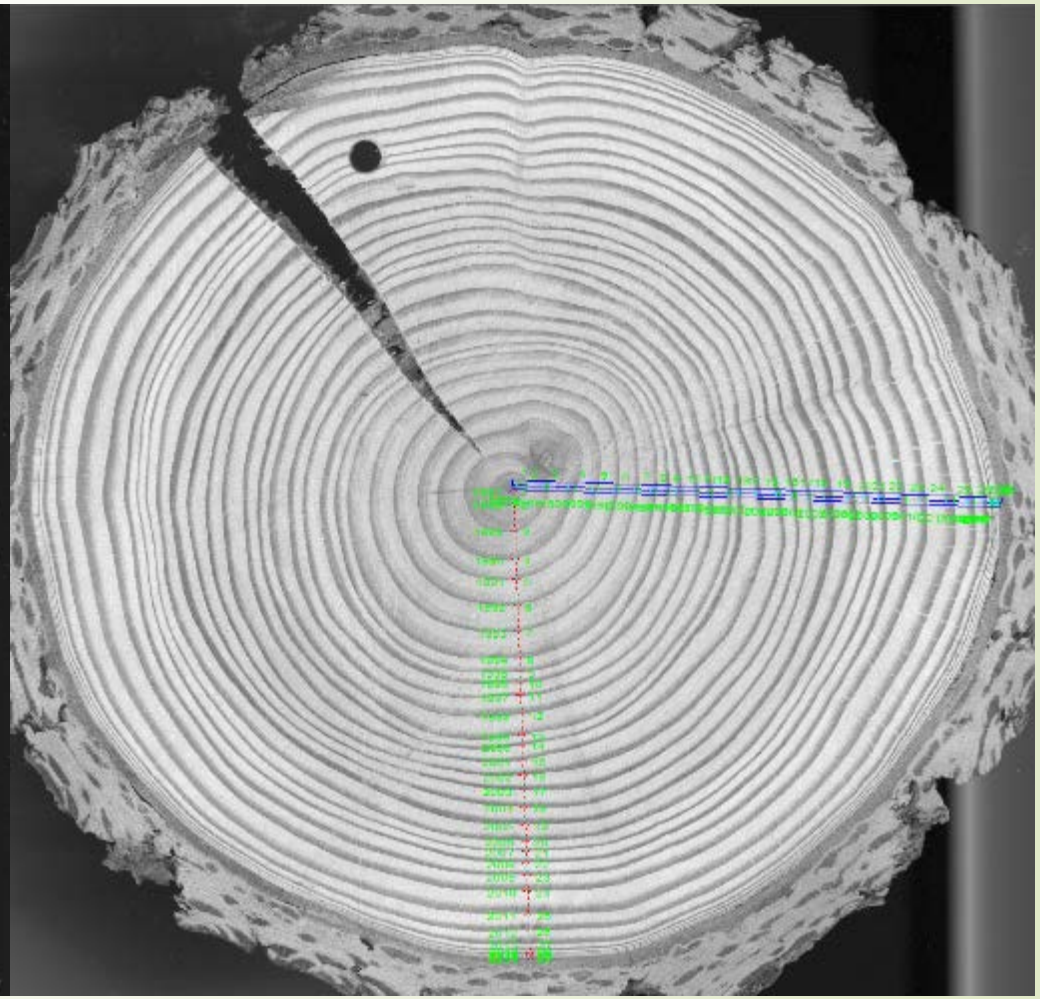
Field Procedure

- 75 trees randomly selected for harvest evenly across diameter classes
  - 39 Douglas-fir, 36 white pine
- Stem measurements recorded:
  - DBH, base diameter, diameter at base of live crown, height, height to live crown
  - Disks taken at 0.5, 2.5, 4.5 ft, then every 3 feet up the stem
    - Disks taken at base, 1/3rd and 2/3rd of live crown length
- Disk measurements recorded (at two 90° intervals):
  - Total radius, bark thickness, sapwood radius, and 5-year radial increment

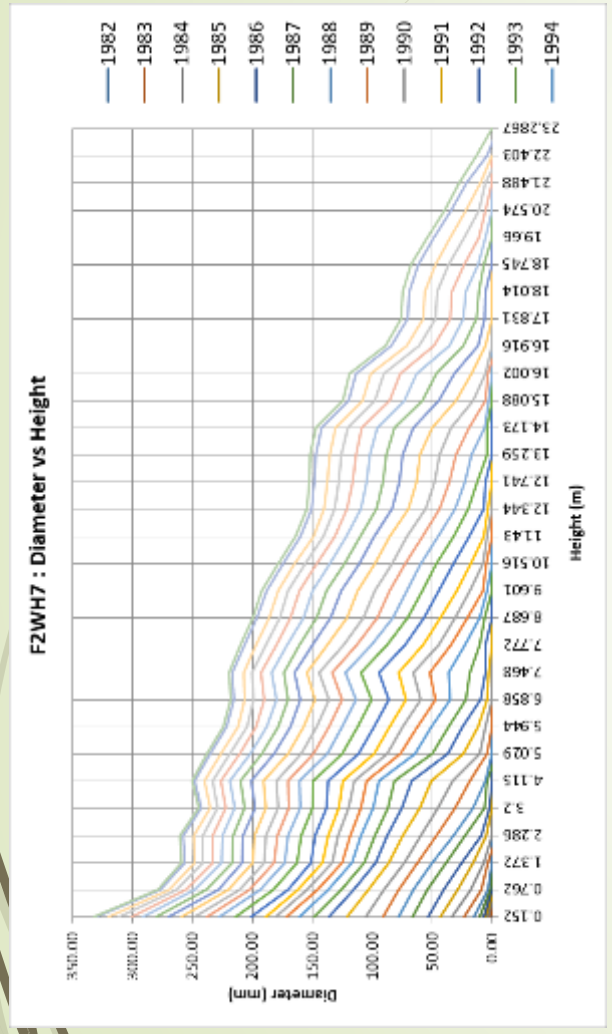
Sample Processing and Lab Analysis

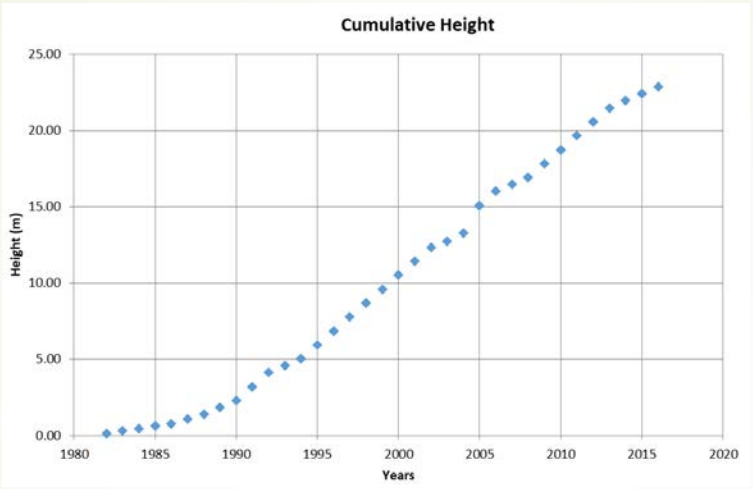
Lab Analysis

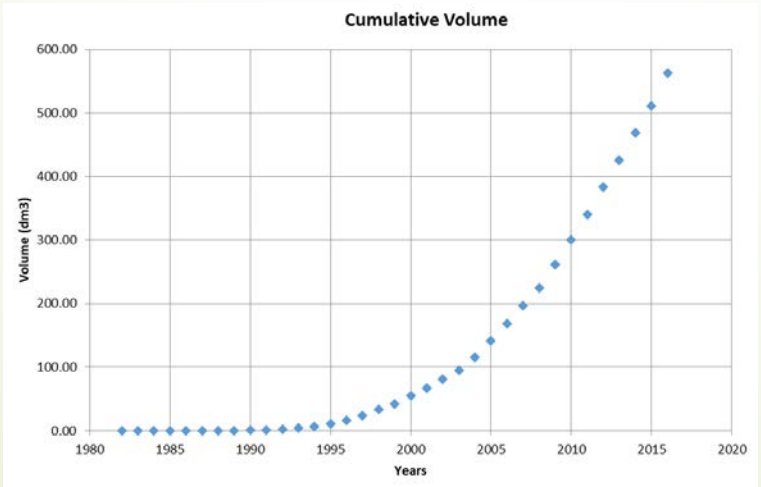


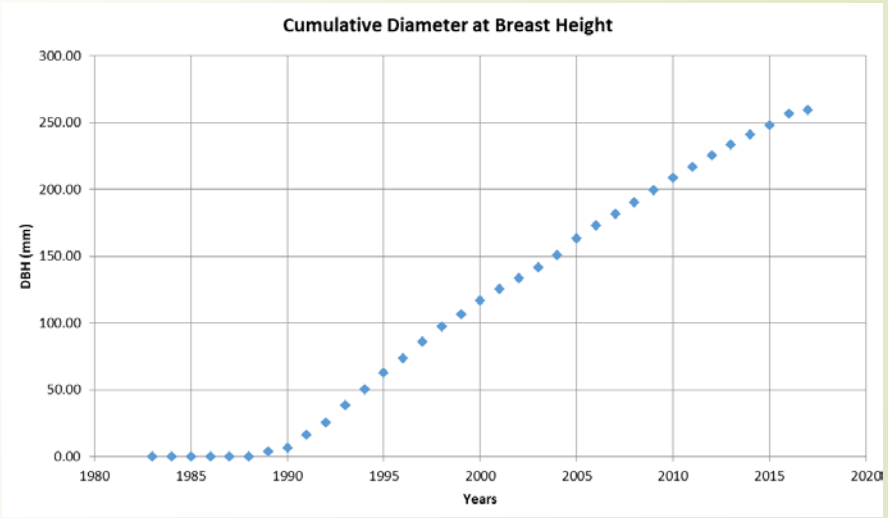


WinDendro Outputs- XLStem

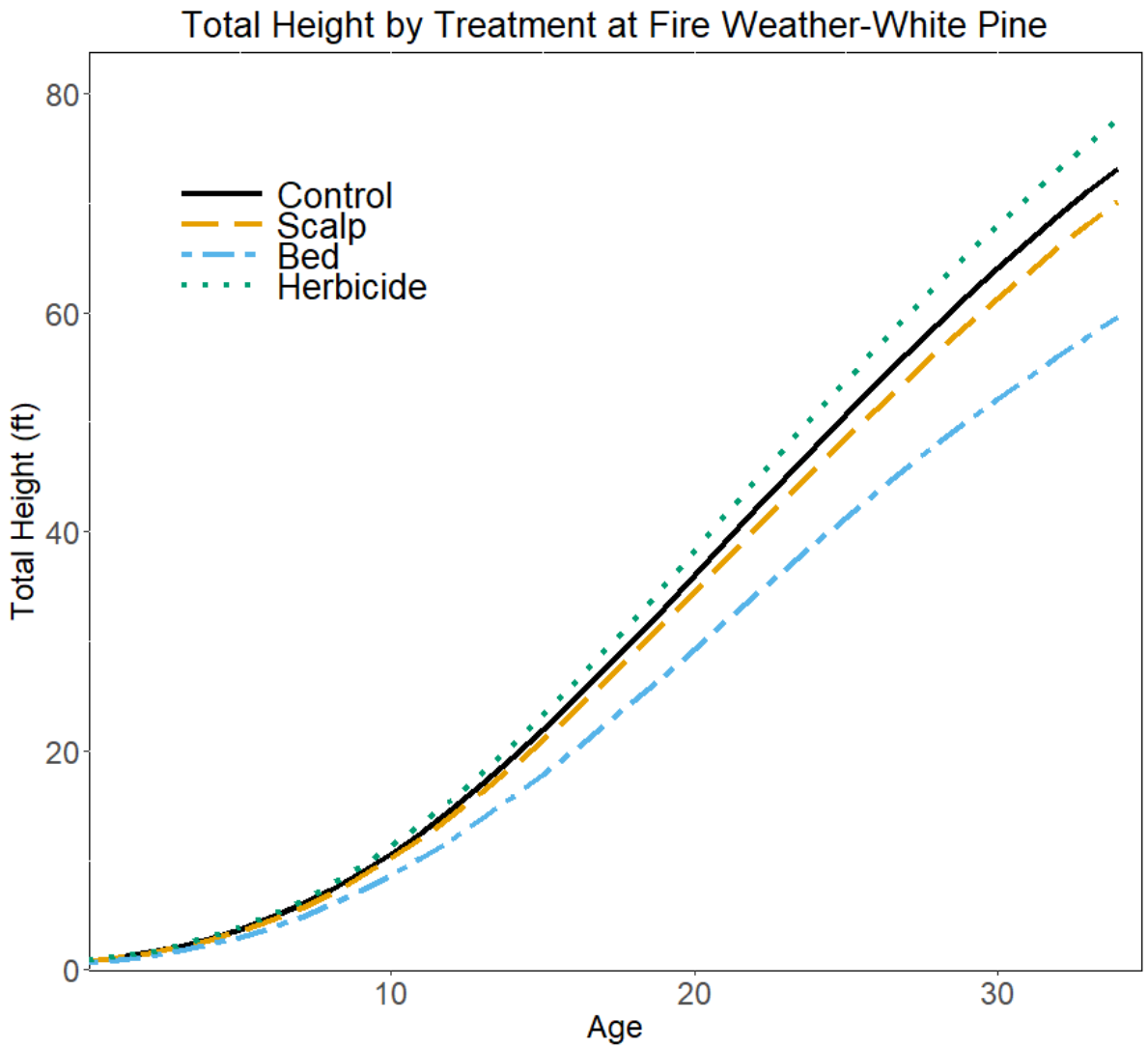


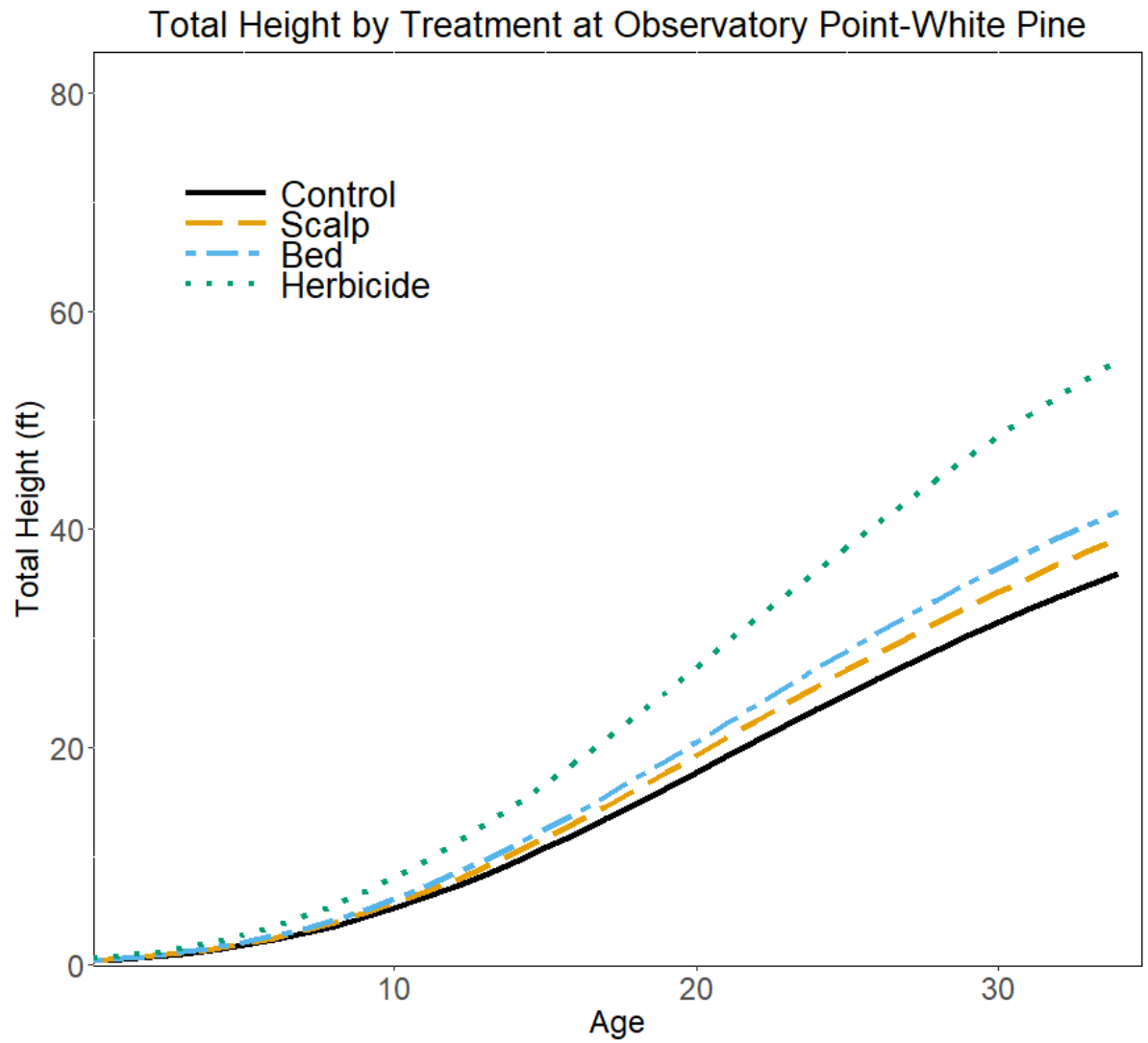




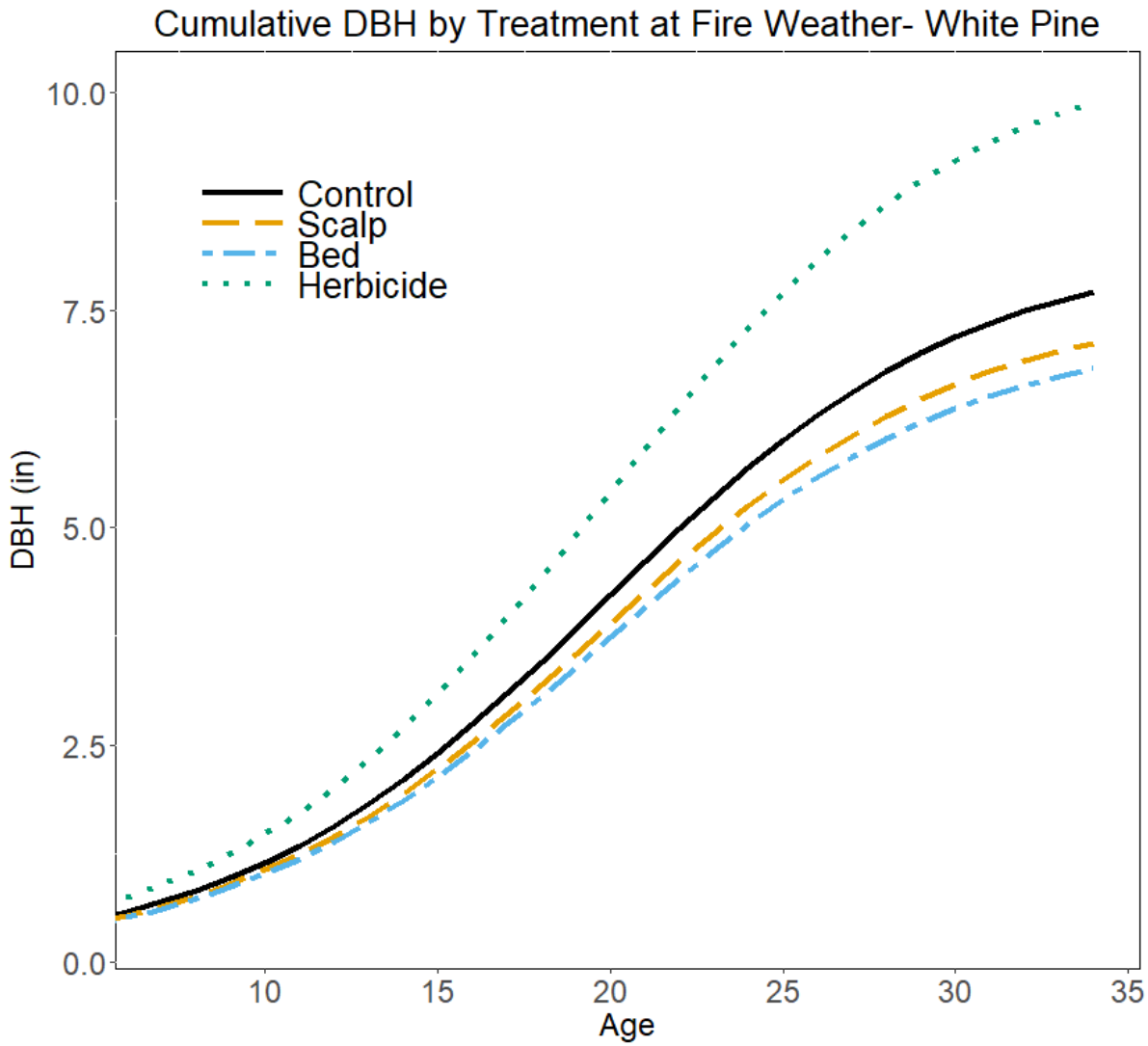


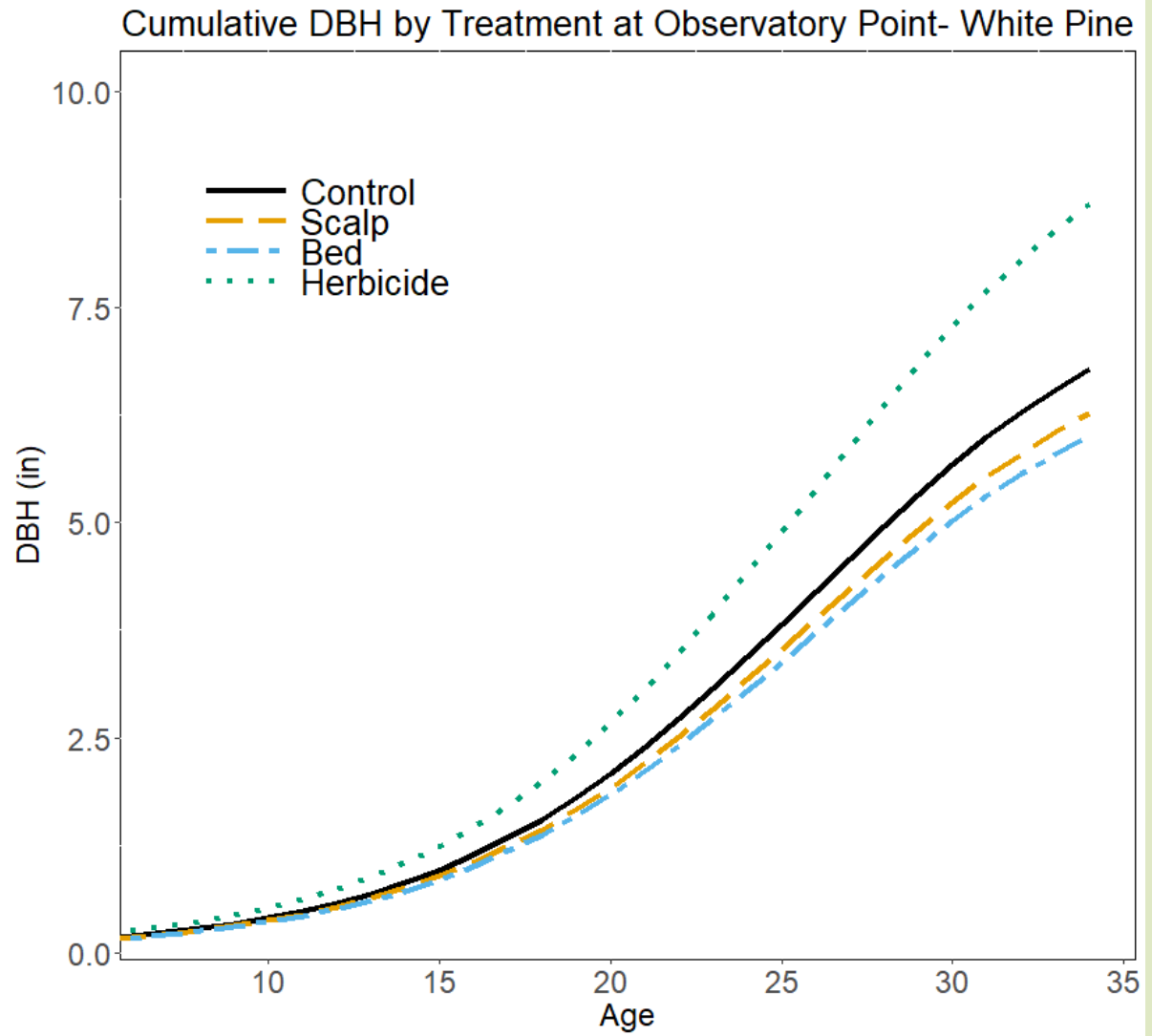
Results- White Pine Height Growth



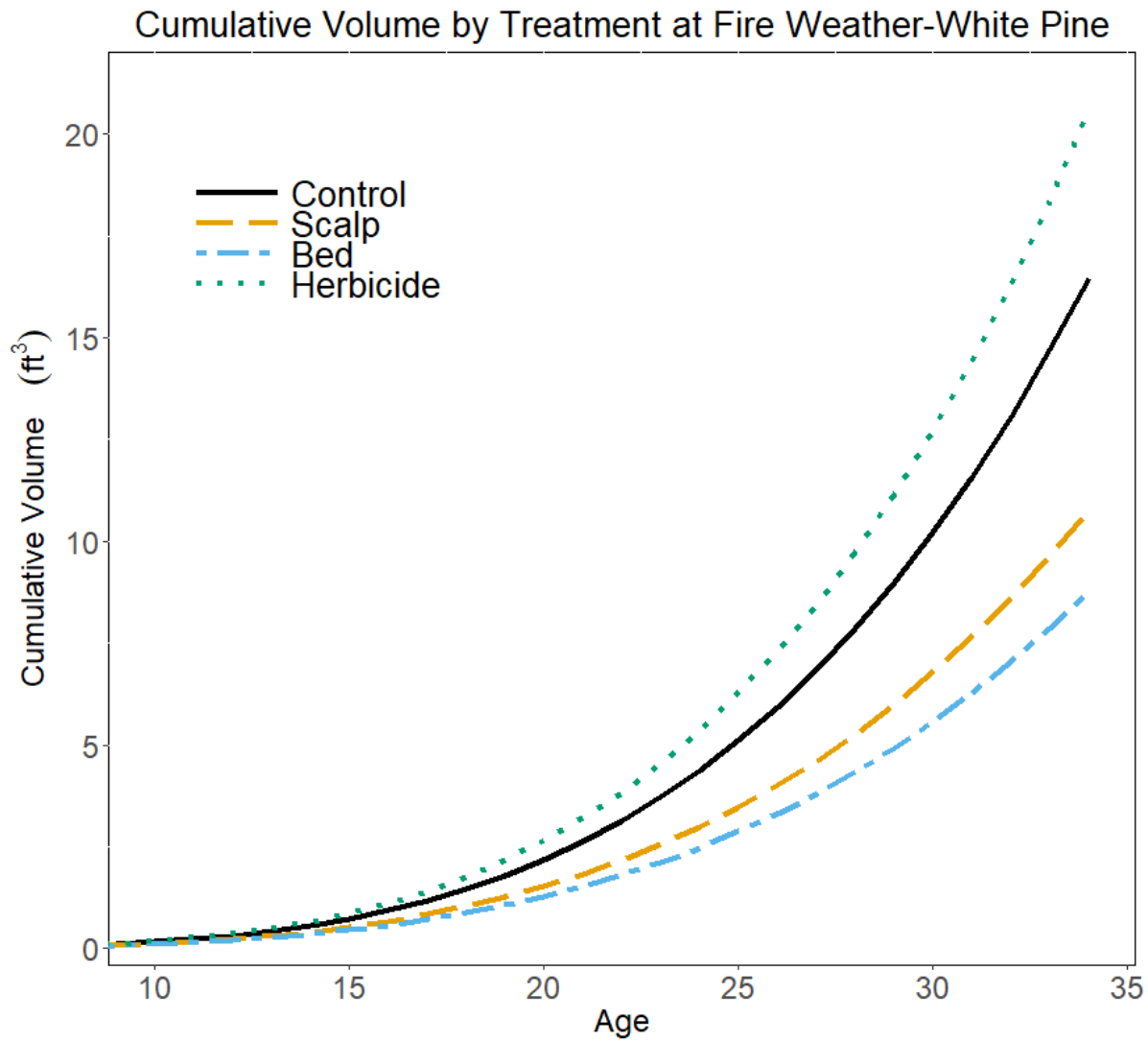


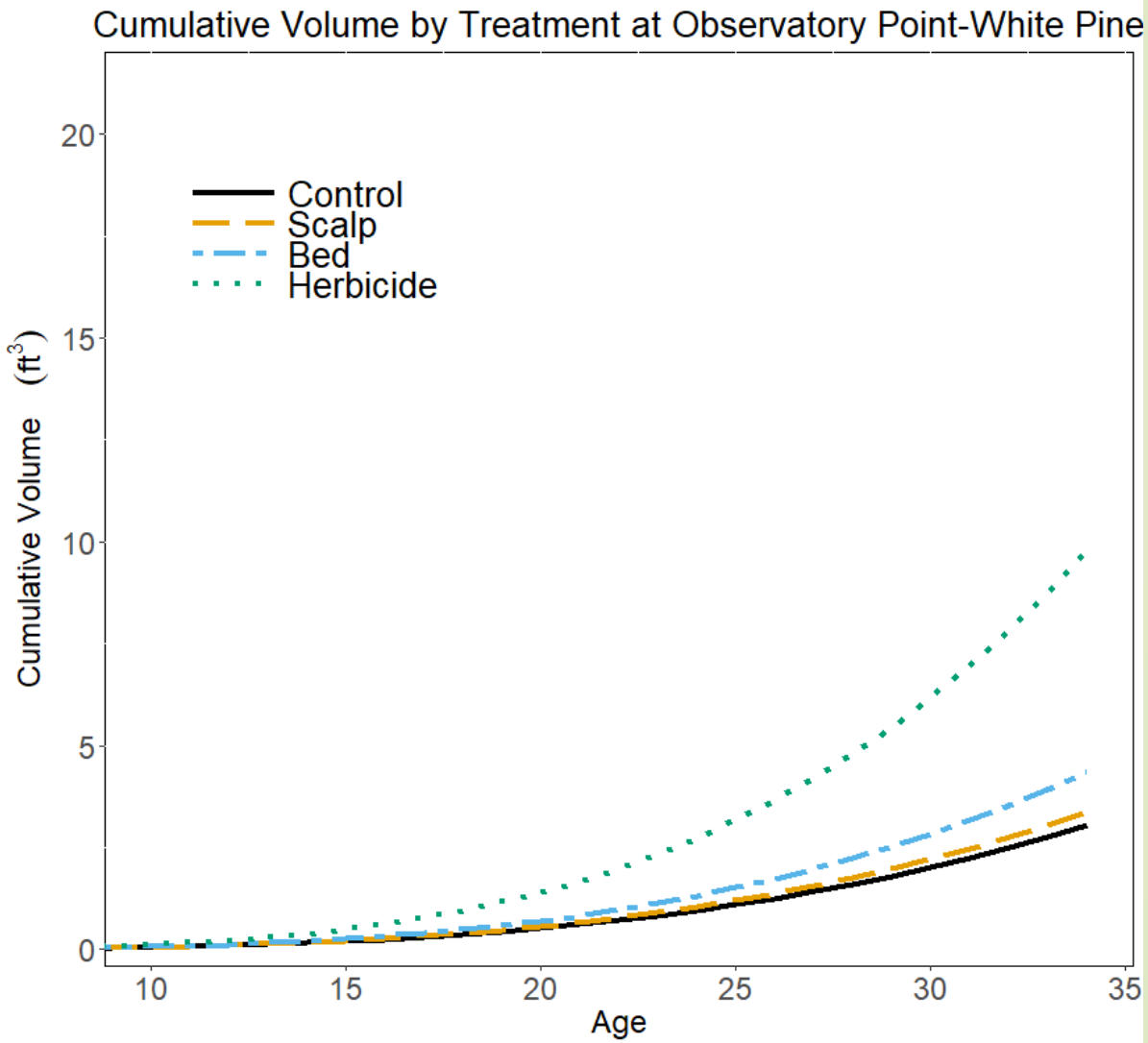
Results- White Pine DBH Growth





Results- White Pine Volume Growth



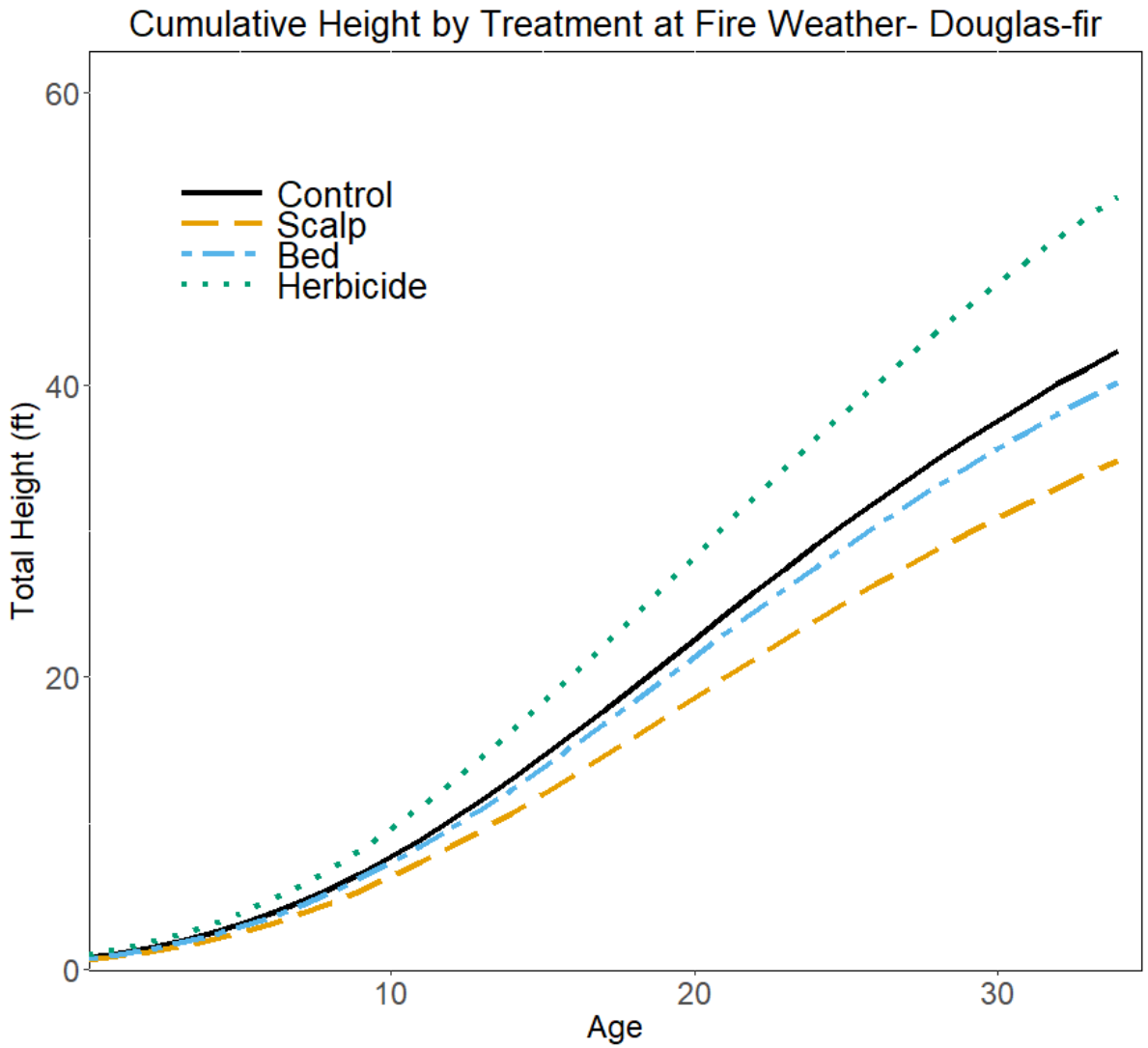


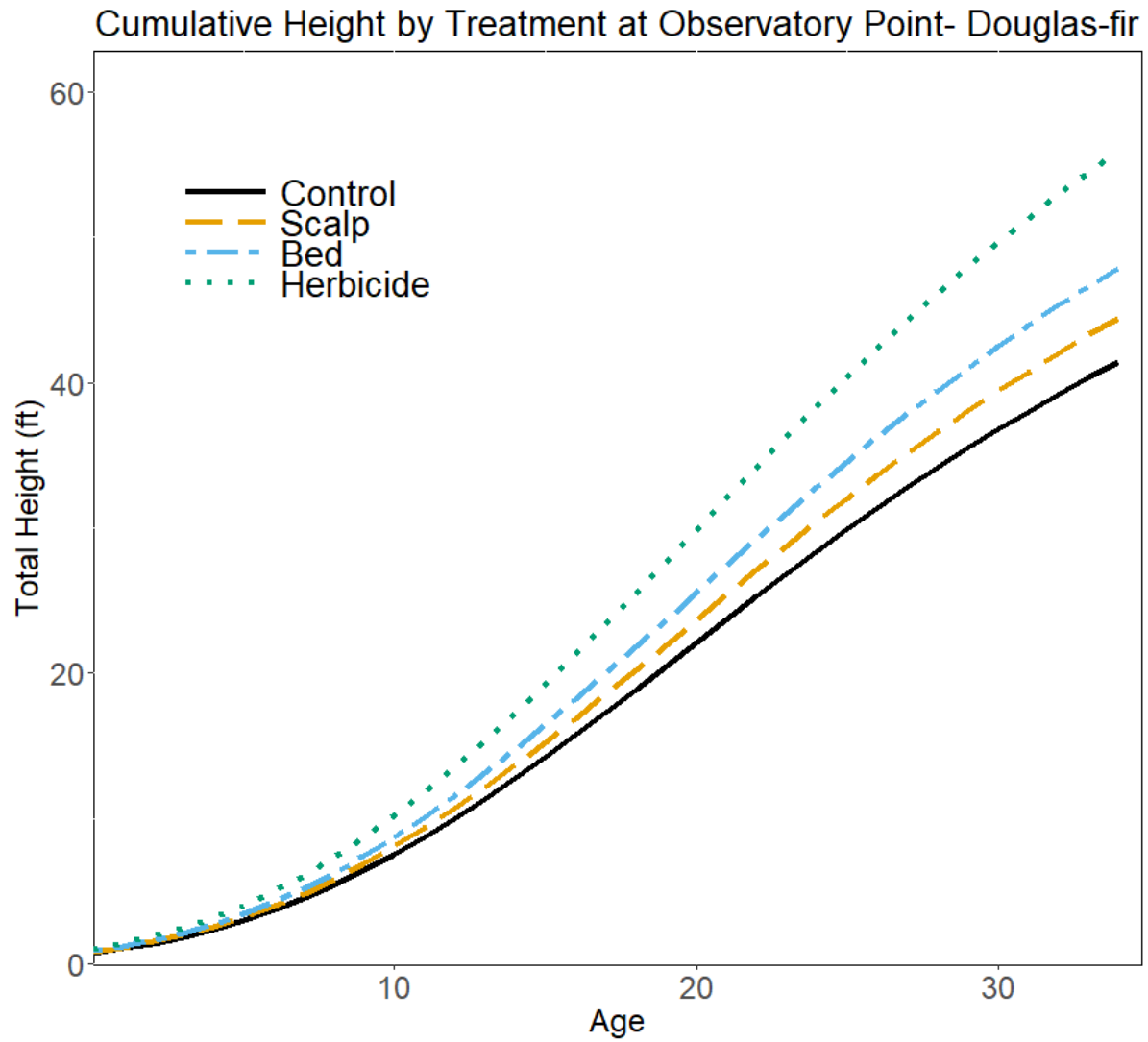
Volume Age-shift vs Control: White Pine

Fire Weather			
	Age-shift		
Age	Herbicide	Scalp	Bed
10	0.4	-0.6	-1
15	0.7	-1.2	-1.8
20	1.1	-1.8	-2.6
25	1.4	-2.4	-3.5
30	1.8	-3.1	-4.4
34	2.1	-3.6	-5.2

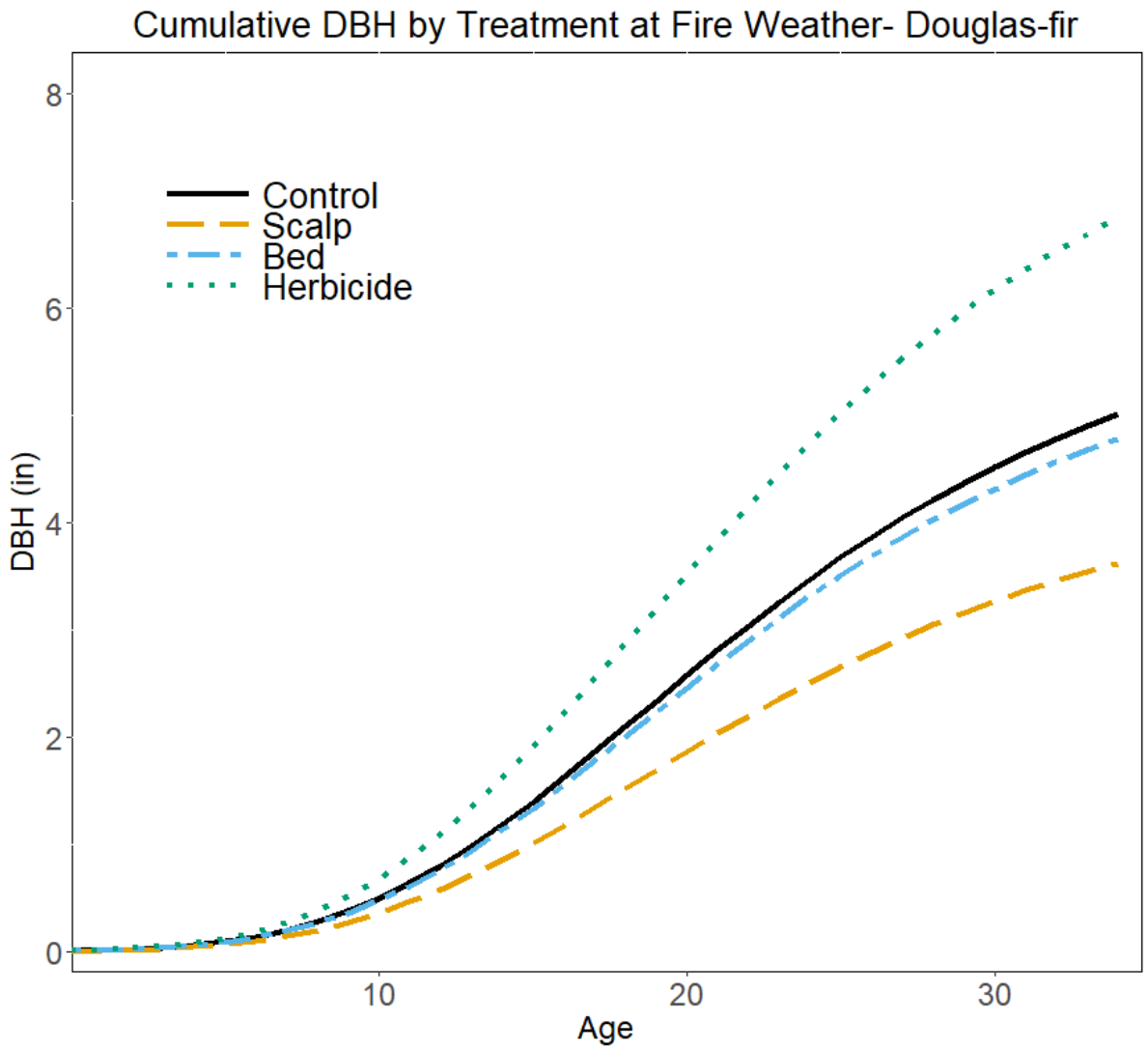
Observatory Point			
	Age Shift		
Age	Herbicide	Scalp	Bed
10	2.6	0.2	1.1
15	4.6	0.5	1.3
20	6.9	0.5	1.8
25	9.4	0.7	2.5
30	12.0	0.9	3.2
34	14.2	1	3.8

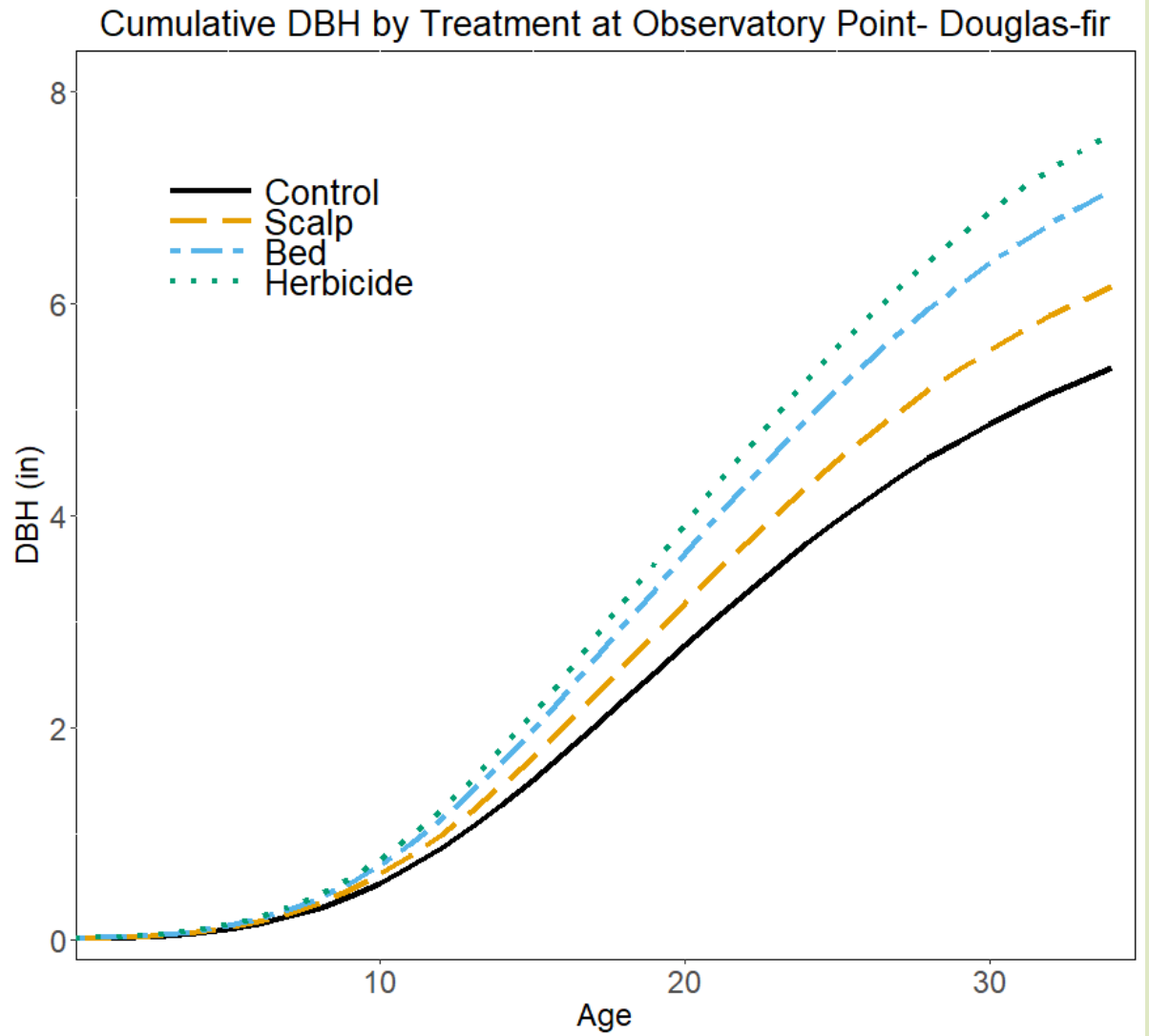
Results- Douglas-fir Height Growth



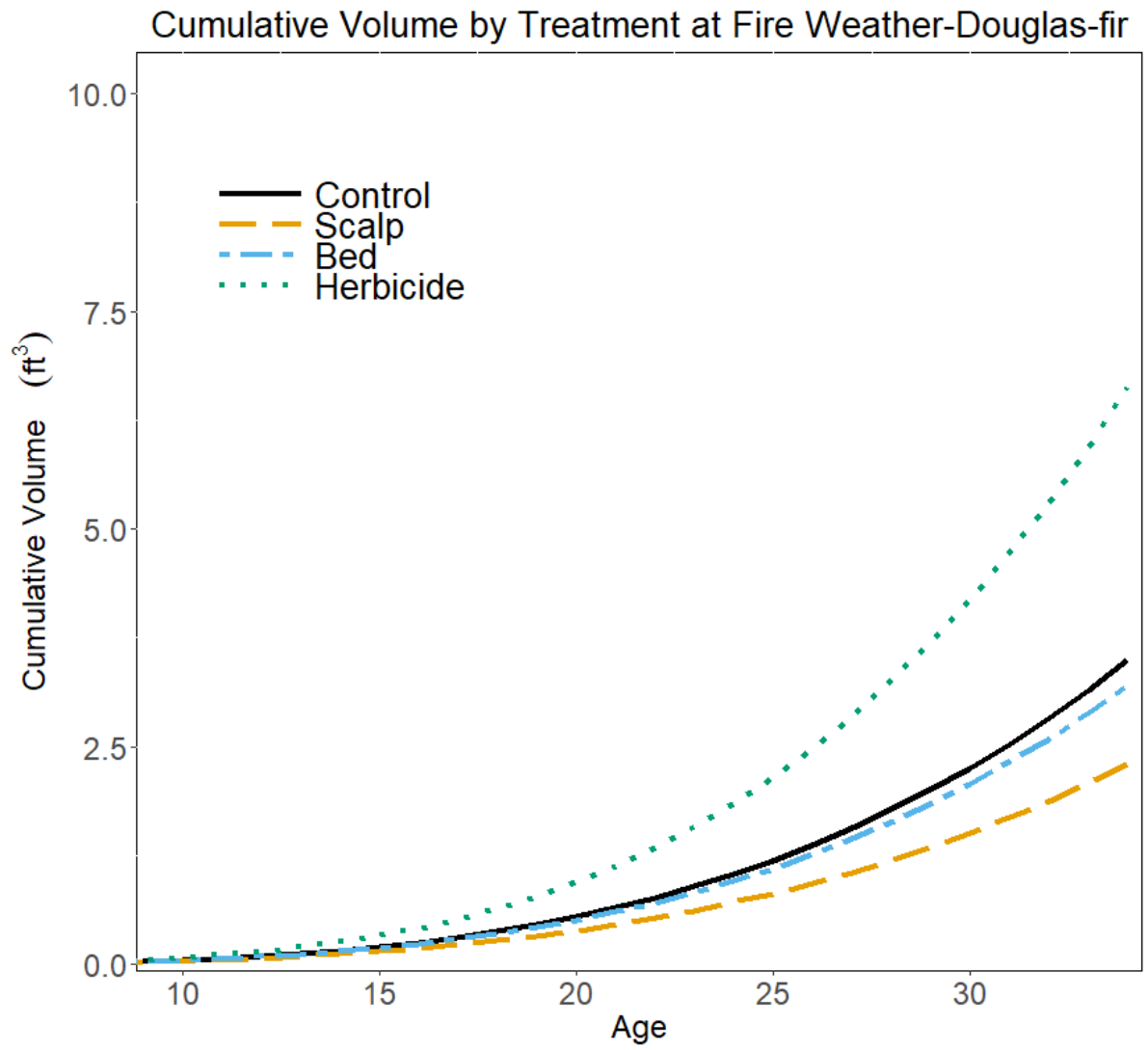


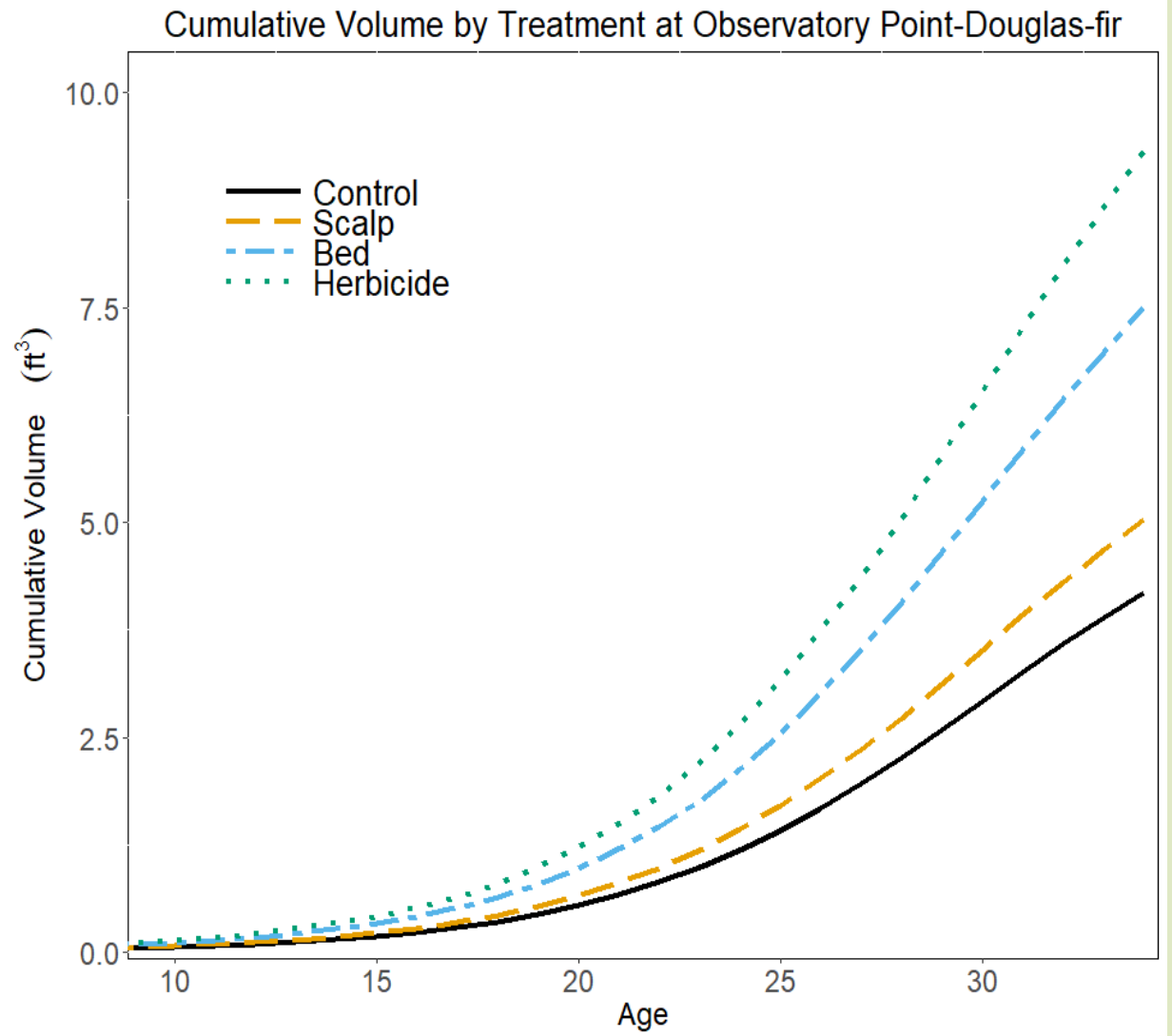
Results- Douglas-fir DBH Growth





Results- Douglas-fir Volume Growth





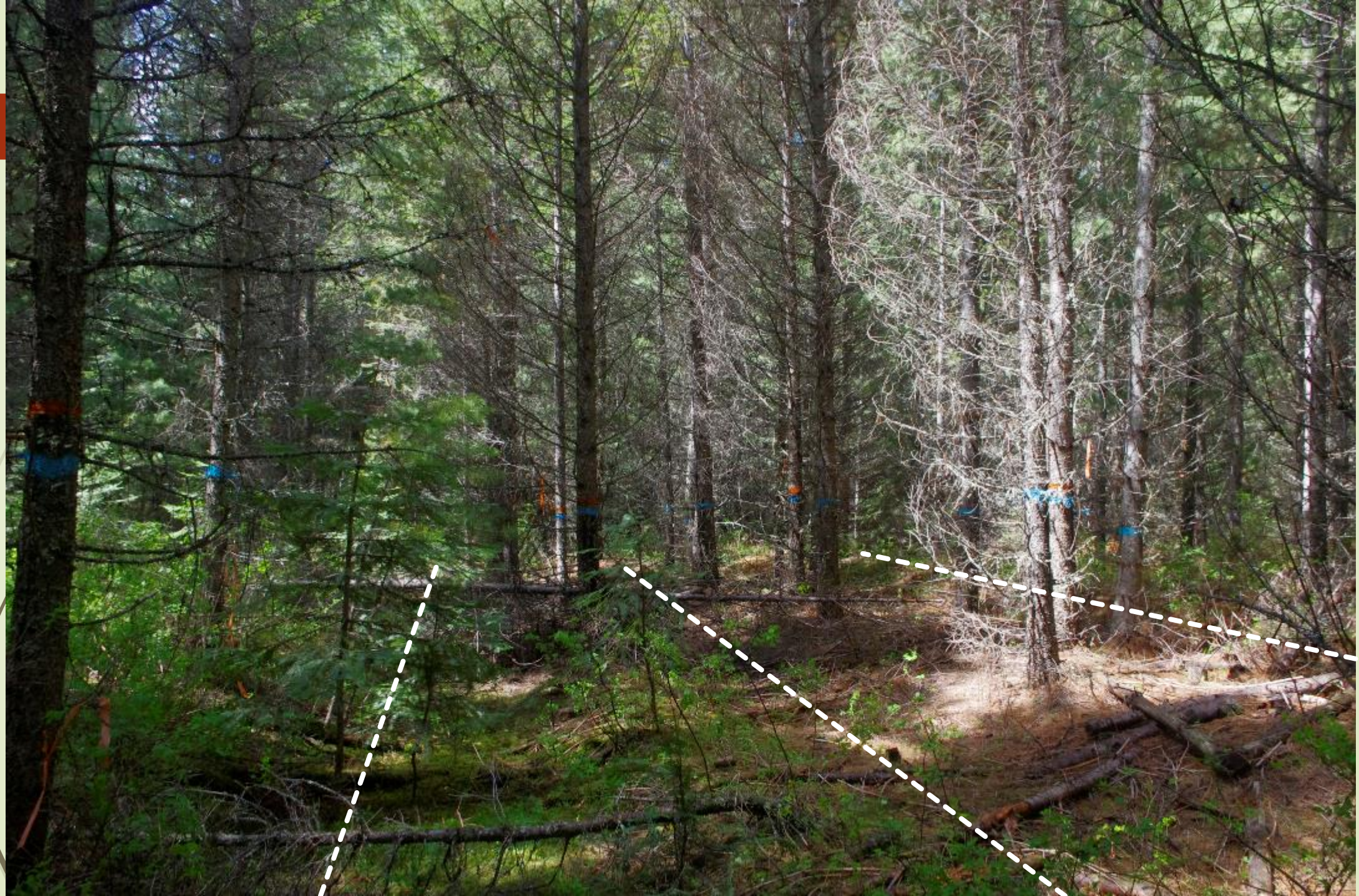
Volume Age-shift vs Control: Douglas-fir

Fire Weather			
	Age-shift		
Age	Herbicide	Scalp	Bed
10	1	-0.3	0
15	2.3	-1.1	-0.2
20	3.4	-2.0	-0.4
25	4.6	-2.6	-0.6
30	5.8	-3.2	-0.7
34	6.9	-3.8	-0.8

Observatory Point			
	Age-shift		
Age	Herbicide	Scalp	Bed
10	1.9	0	0.9
15	2.9	0.7	2.1
20	4.4	0.9	3.1
25	5.9	1.2	4.2
30	7.6	1.6	5.3
34	8.9	1.9	6.3

Results/Discussion

- Bedding + herbicide treatment significantly increased volume, DBH and height growth over time across treatments and species
  - Increased carrying capacity for DF at both sites, as well as WP at Observatory Point
- Bedding treatment alone underperformed at fire weather compared to the control
- Scalping treatment frequently underperformed compared to the control and bedding treatments
- Match your treatment and species to the site!
- Why did bedding + herbicide do so much better than bedding alone?



Future Steps/Considerations

- Plot/stand level site preparation studies
  - Reduce effects of neighboring competition and row interaction
  - Control stand density to more accurately determine treatment effects
- Model temporal trends in height, DBH, and volume increment vs site preparation treatments
  - Incorporate competition index from neighboring tree measurements to evaluate treatment effects

Questions?