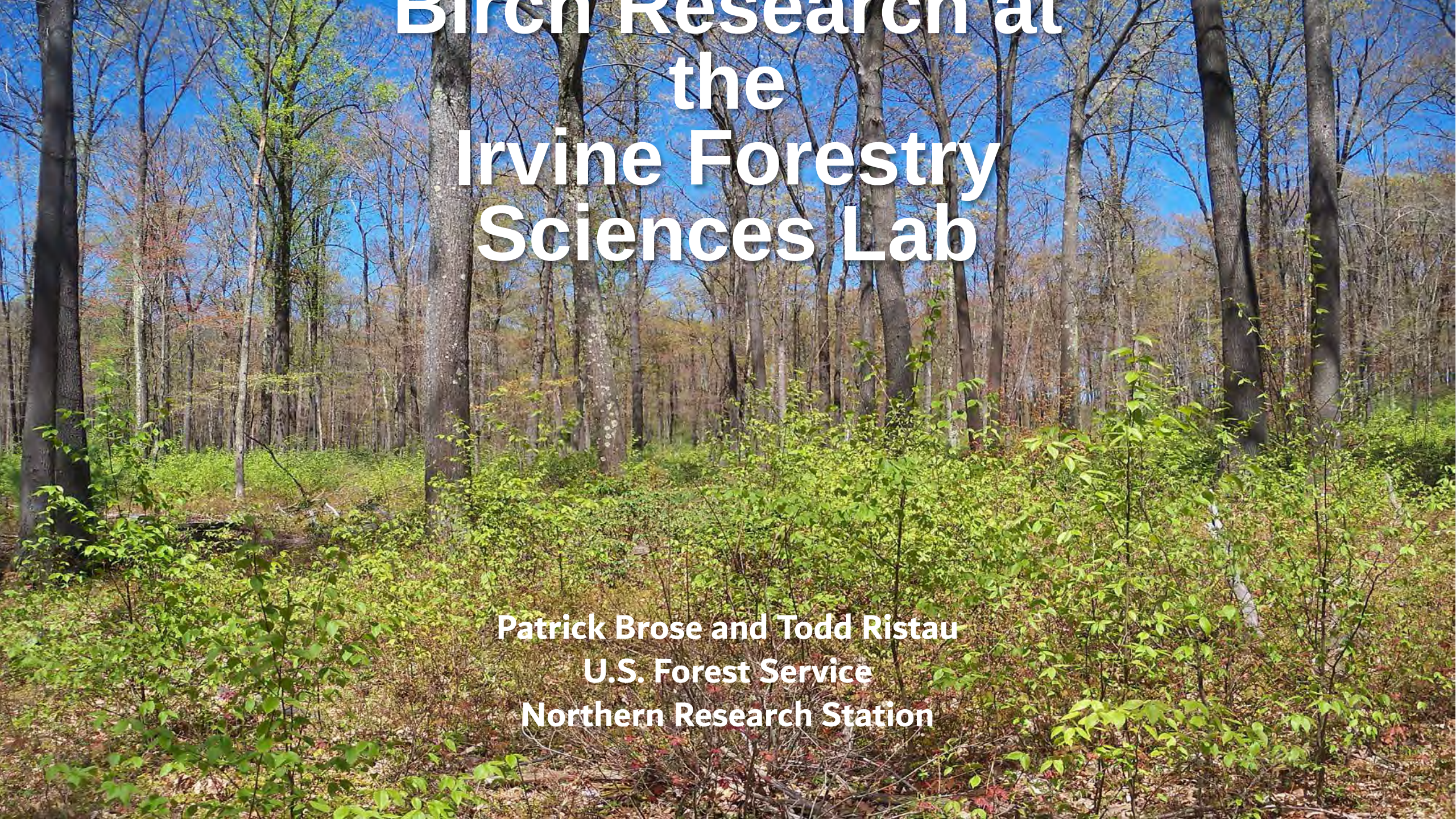

# Birch Research at the Irvine Forestry Sciences Lab

Patrick Brose and Todd Ristau
U.S. Forest Service
Northern Research Station

# Today's Objectives

**Present the most recent findings from three separate, yet related, studies on the presence of birch in young Allegheny hardwood and mixed oak stands.**

**The Allegheny Hardwood Dominance Probability Project**

**Historic Development of Mid-Rotation Allegheny Hardwood Stands with a Sizeable Birch Component**

**Comparison of Treatments for Controlling Birch in Young Allegheny Hardwood and Mixed Oak Stands.**

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# Allegheny Hardwood Dominance Probability Project

**Started in 2012 to better understand the developmental dynamics among the reproduction of the principal species commonly found in Allegheny Hardwood forests.**

**In a typical seedling sampling plot, it is common to have multiple species of varying heights. In the race to canopy closure, who is going to win the growing space?**

**In 9 unfenced shelterwood stands (6 Allegheny hardwood, 3 mixed oak), we established 380 seedling sampling plots.**

**Stands were on Allegheny NF, Bradford Water District, Collins Pine, and Forestry Investment Associates lands.**

# Allegheny Hardwood Dominance Probability Project

**Seedling plots inventoried pre-harvest as per lab procedures. All plots contained BC and RM, 46% had BIR, and CUC, NRO, PC, or YP occurred on 25 to 33% of plots.**

**Seedlings ranged from 0.2 to 6+ feet in height.**

**In each plot, we tagged 4 to 6 seedlings.**

**Total tagged seedlings = 749 BC, 292 BIR, 63 CUC, 113 NRO, 97 PC, 583 RM, and 66 YP seedlings. Total = 1963.**

**Also tagged 167 BC and 106 RM overstory trees marked for cutting to include stump sprouts in the project.**

# Allegheny Hardwood Dominance Probability Project

**All stands harvested in 2012 and 2013.**

**Plots relocated in Post-Harvest Year 1. Partial re-inventory (10 tallest stems) in Post-Harvest Years 2, 3, 5, and 8.**

**Tagged seedlings relocated in Post-Harvest Year 1 and survival determined. Followed for survival and growth ever since with remeasurements done in Post-Harvest Years 2, 3, 5, and 8.**

**Tagged stumps also relocated in Post-Harvest Year 1 to determine sprouting. Not rechecked until Year 8.**

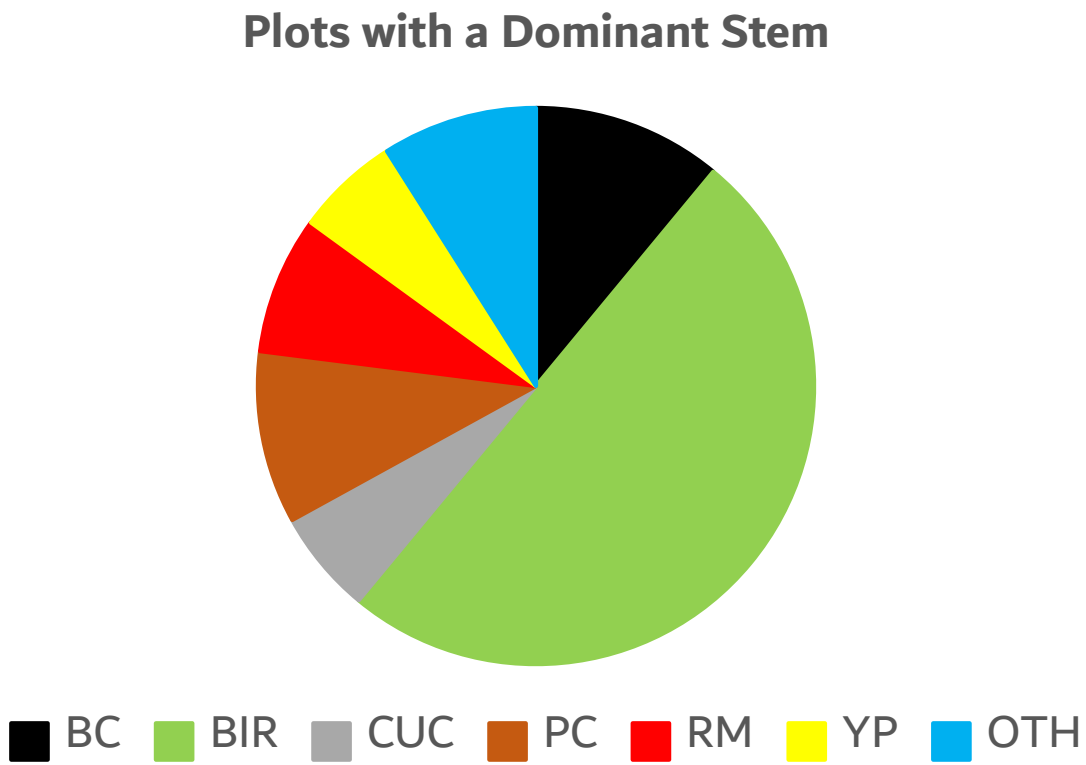
# AH Dom. Prob. Project: Some Early Results

**Logging killed between 10 and 15% of the tagged seedlings with PC experiencing more mortality than the other species. Almost all mortality was due to a skid trail obliterating a plot.**

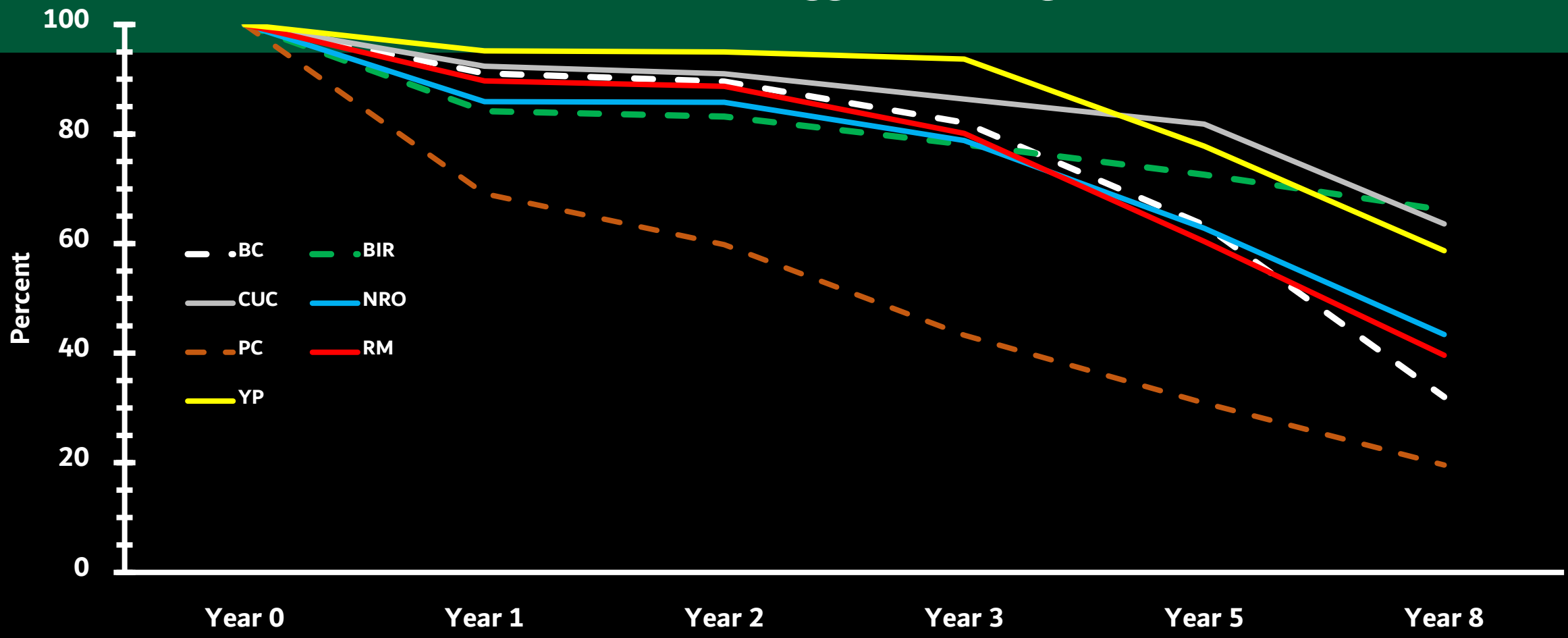
**Post-harvest invasion of BIR increased its occurrence on plots from 46 to 74%.**

**By Year 8, 300 plots have a clearly dominant species. BIR is that dominant on 50% of those plots followed by BC (11%), PC (10%), RM (8%), CUC (6%), YP (6%), and Other (8%).**

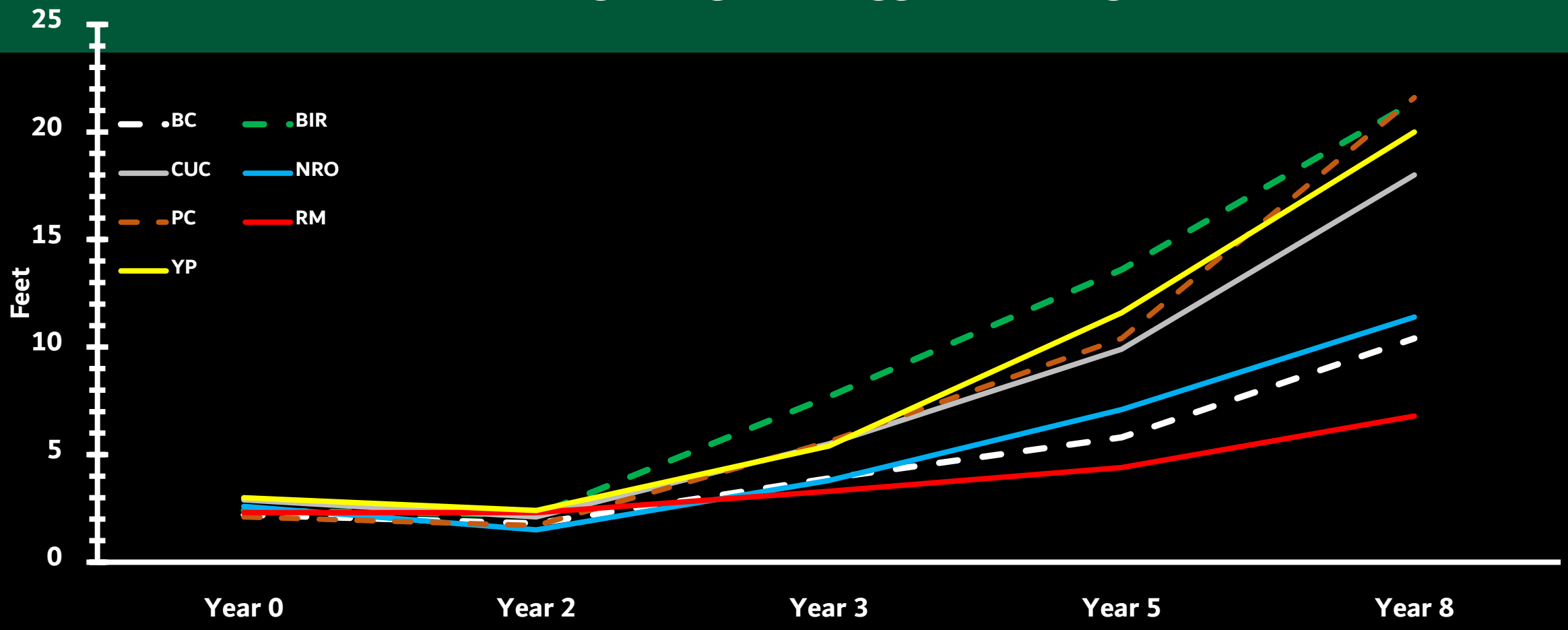
**On the plots without a clear dominant stem, BIR co-dominates with another species on half of them.**



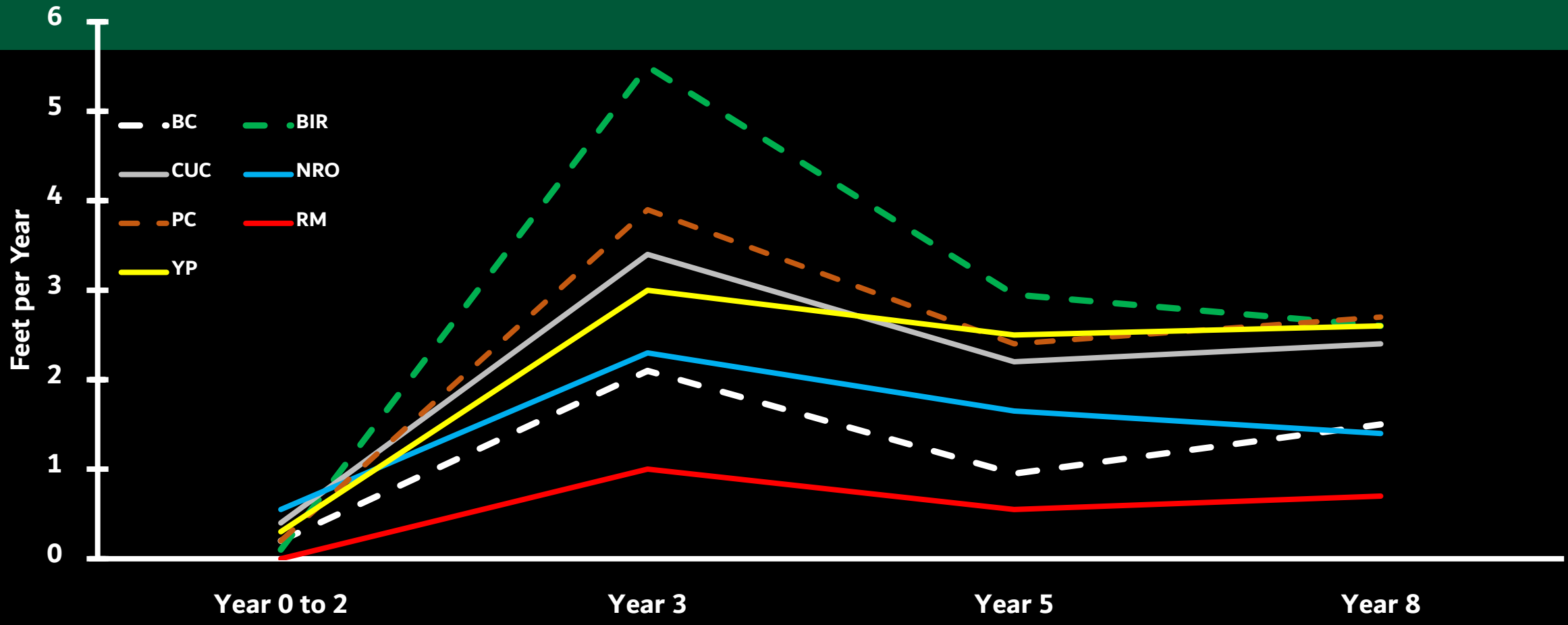
# Survival of Tagged Seedlings



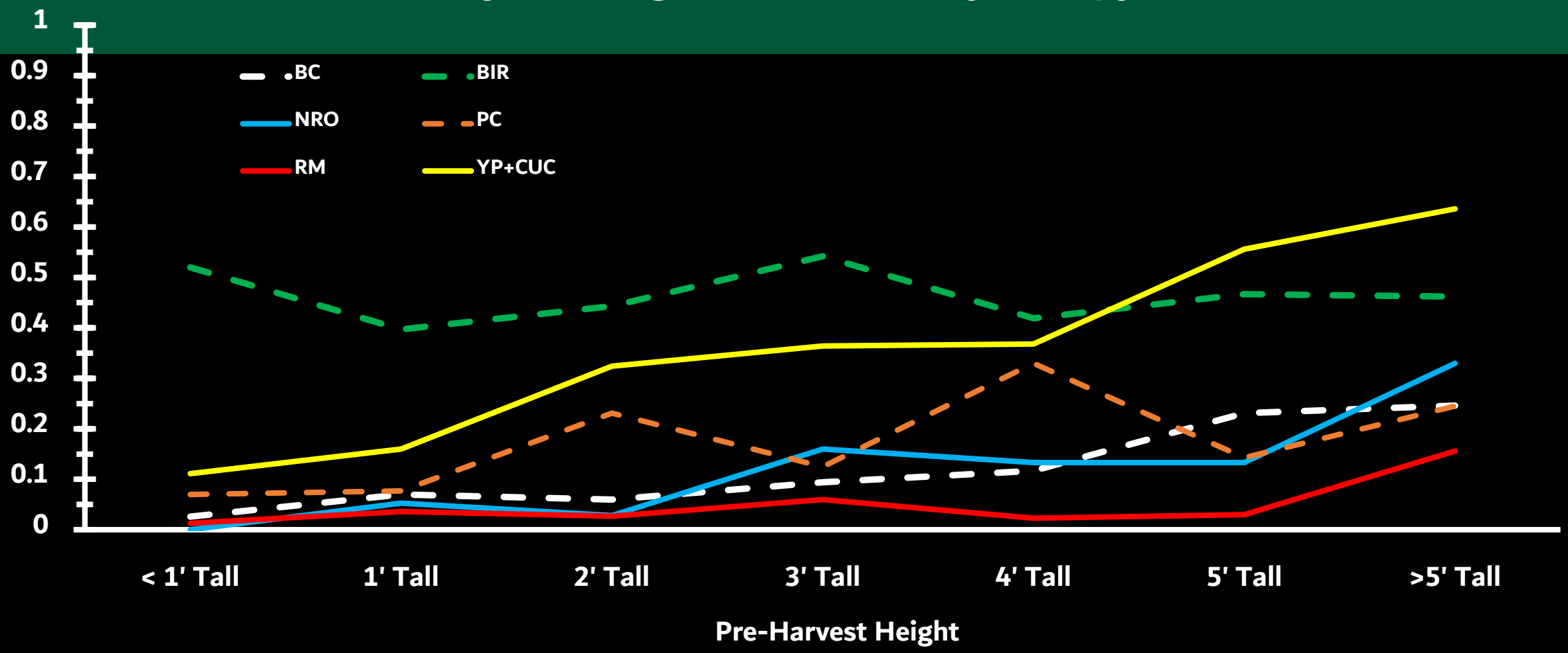
# Average Height of Tagged Seedlings



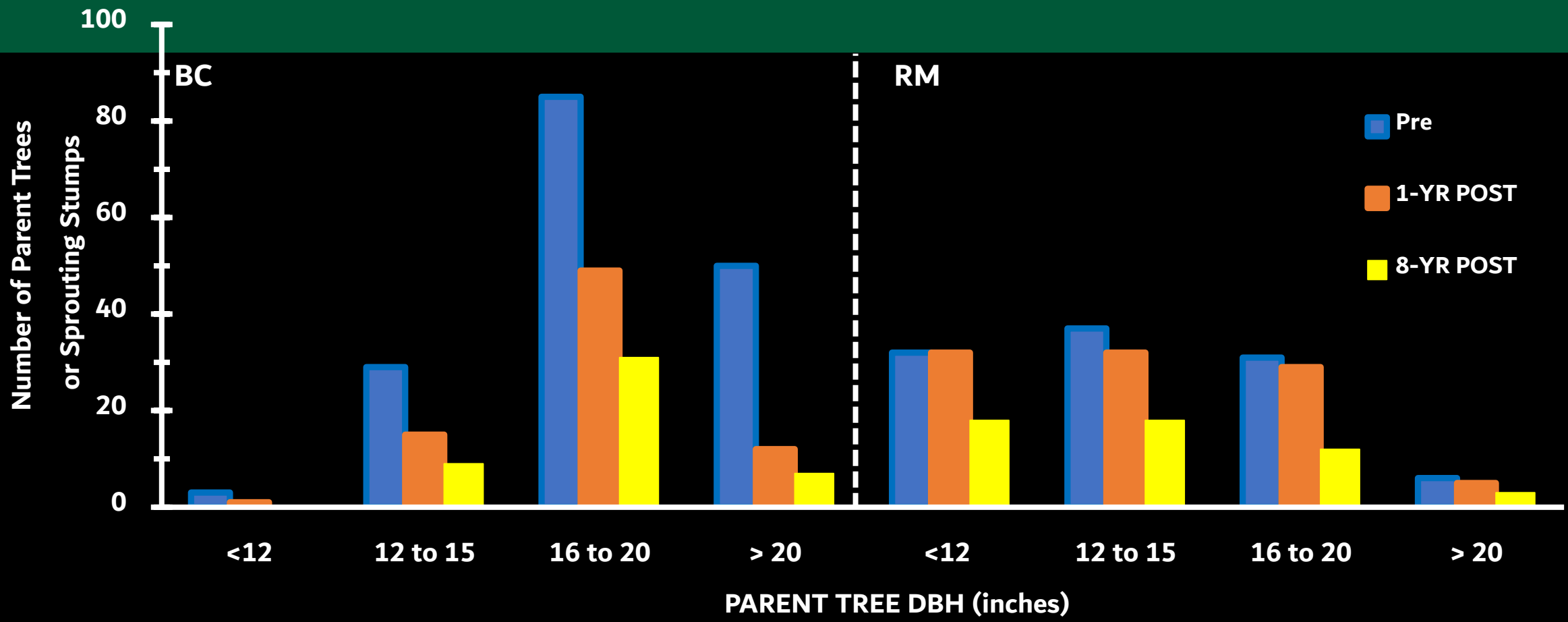
# Height Growth Rate of Tagged Seedlings



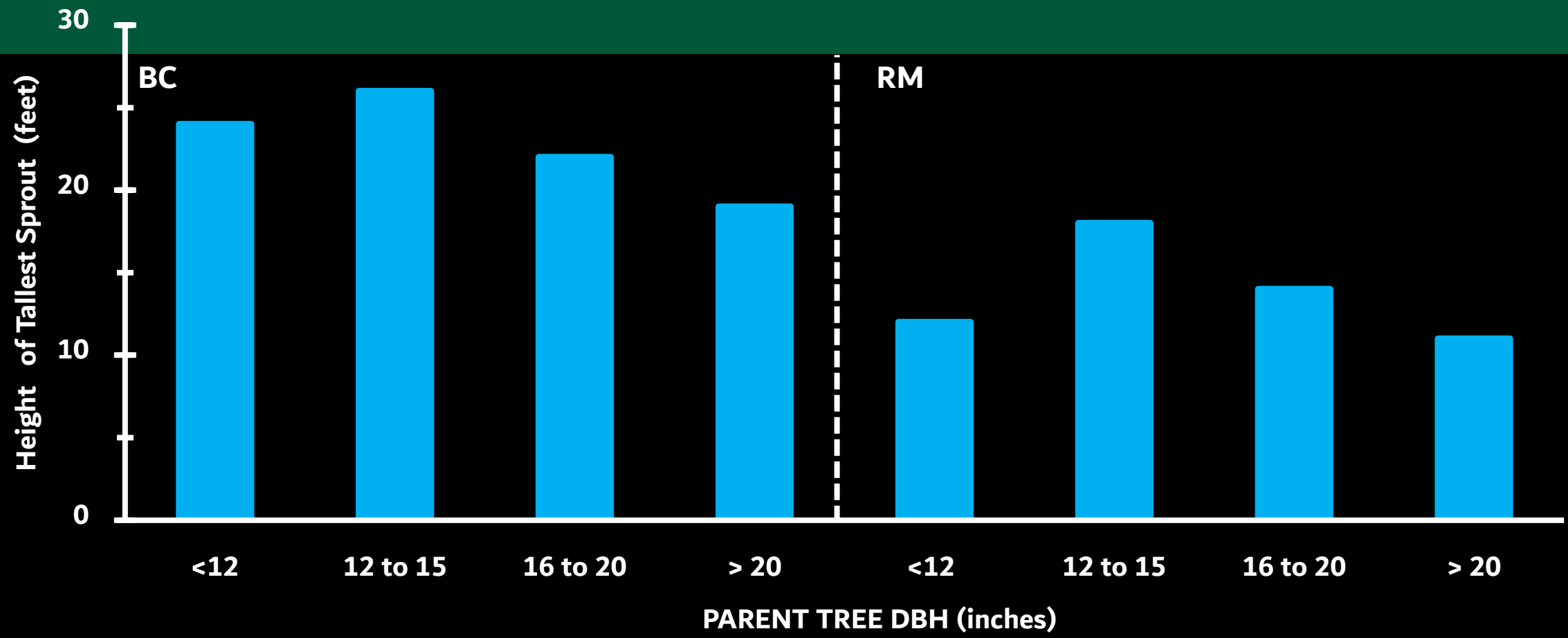
# Probability of Being Co-Dominant by Canopy Closure



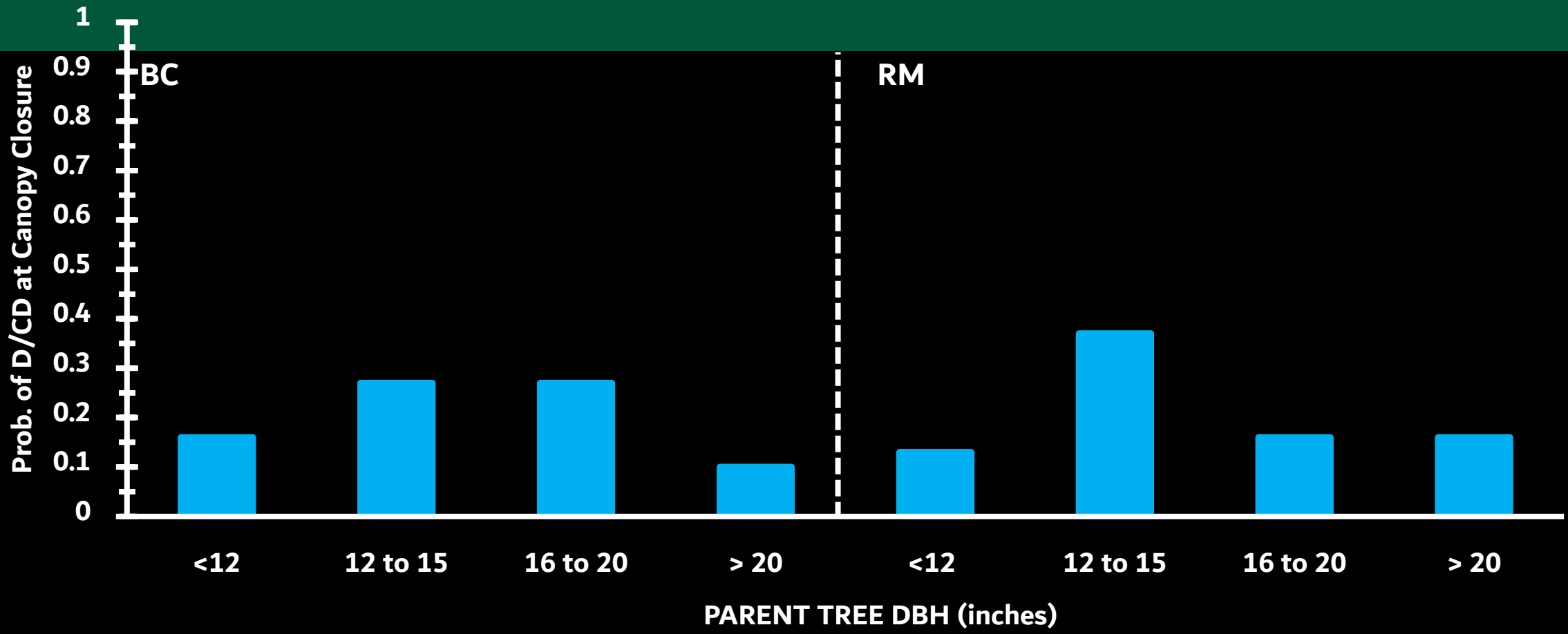
# AH DOM. PROB. PROJECT – STUMP SPROUT SURVIVAL



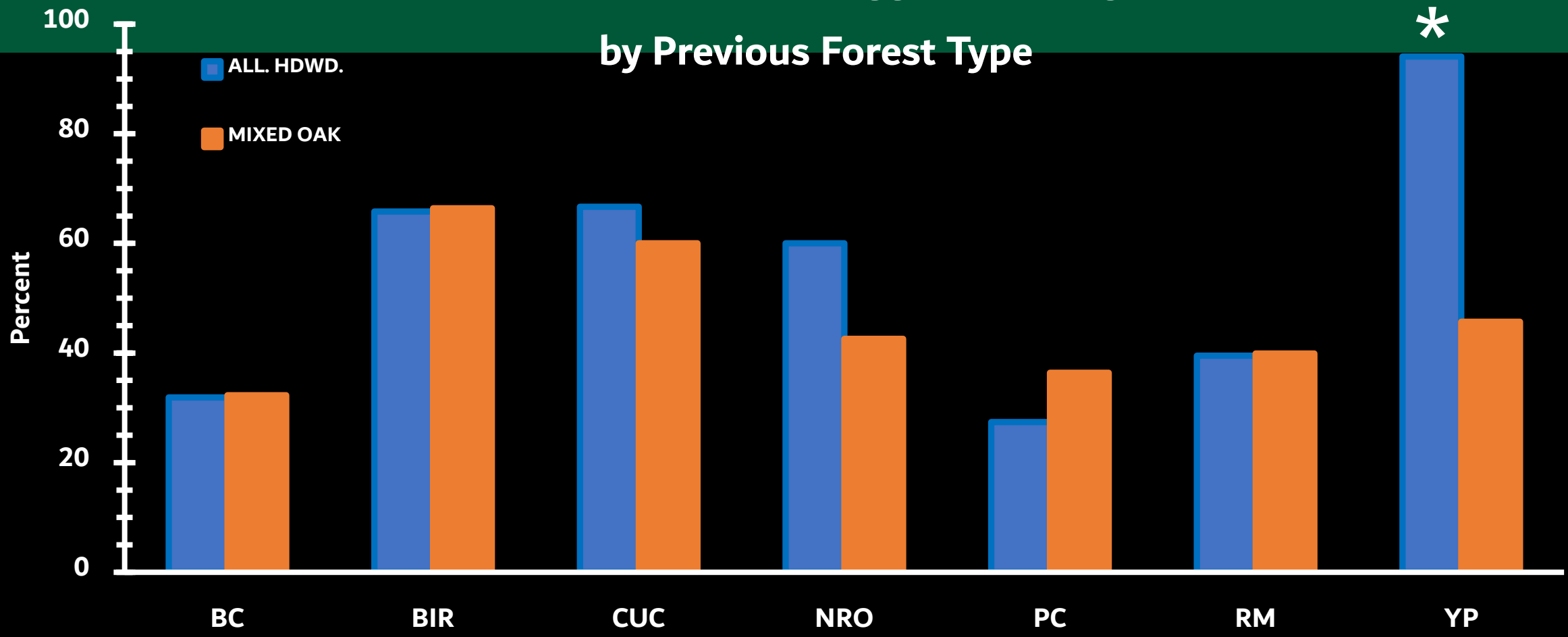
# AH DOM. PROB. PROJECT – STUMP SPROUT GROWTH



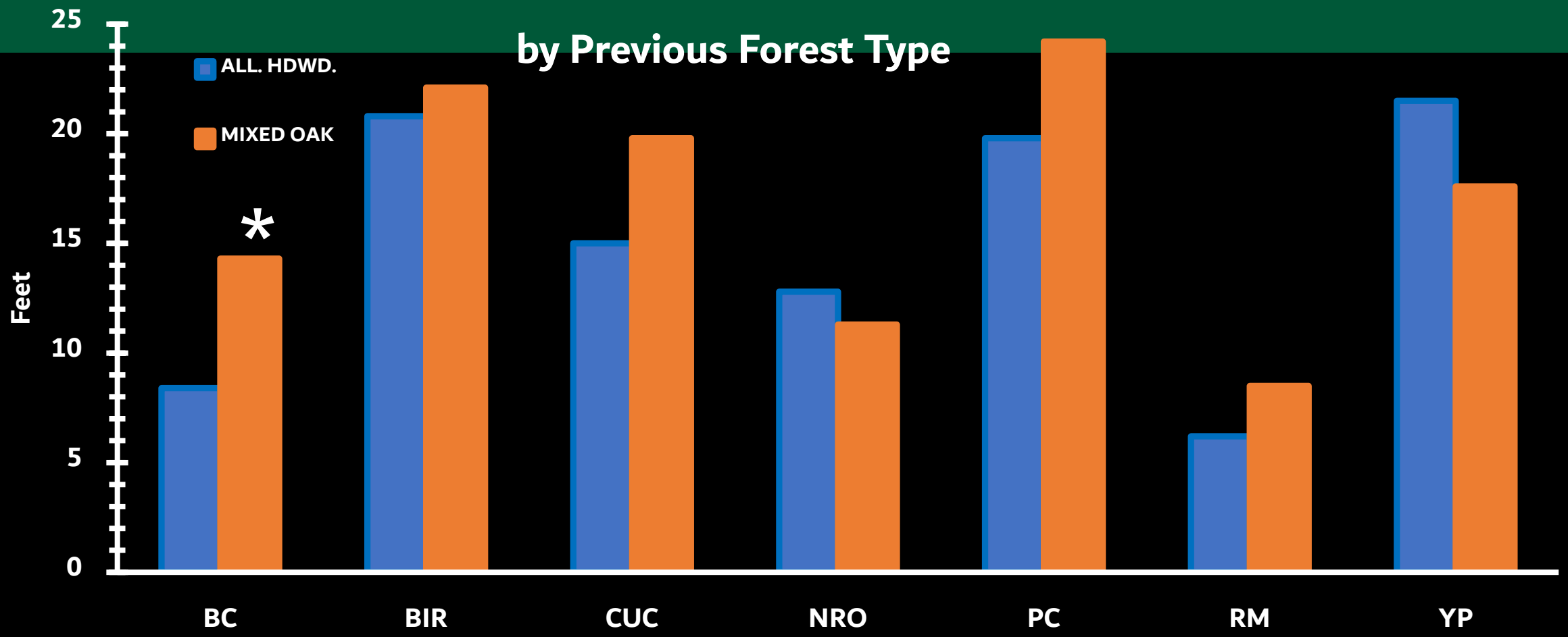
# AH DOM. PROB. PROJECT – STUMP SPROUT DPs



# Year 8 Survival of Tagged Seedlings by Previous Forest Type



# Year 8 Heights of Tagged Seedlings by Previous Forest Type



# AH Dom. Prob. Project: More Early Results

**BIR began having tremendous height growth in the 3rd growing seasons after the harvests (5.5 feet average/year) but CUC and YP are catching up to it by Year 8. Surviving BC, NRO, & RM seedlings holding steady.**

**RM is a prolific stump sprouter but the sprouts do not persist and their height growth is mediocre by Year 8. BC is not as prolific stump sprouter as RM but its sprouts survive better and exhibit much faster height growth.**

**Within the constraints of this study, the forest type of the parent stand only influences YP survival (better in former AH stands) and BC height growth (better in former oak stands).**

# AH Dom. Prob. Project: The Future

**Stems that are dominant or co-dominant at canopy closure are considered successful and then used to calculate dominance probability coefficients.**

**Coefficients already incorporated in SILVAH-8.**

**Plan is to follow all tagged seedlings and sprouts until Year 11 or 14 and maybe beyond depending on staffing levels and resources.**

**Will any species catch birch or is its lead in height insurmountable? Cucumber magnolia and yellow-poplar show potential. Will black cherry rally? What will be the fate of the intermediate and suppressed black cherry stems? Will birch persist?**

# Developmental History of Mid-Rotation Allegheny Hardwood Stands

**In the 1950s and 1960s, numerous AH stands were clearcut and then had portions of the harvested areas fenced to exclude deer or left unfenced (Study 48). These stands were periodically inventoried until 2002.**

**Four of these stands (3 on Allegheny NF, 1 on LandVest) had a sizeable birch component from the start so we have gone back to them to see how the birch was doing and to reconstruct the developmental dynamics between black cherry and birch via stem dissection.**

**In this approach, two neighboring co-dominant black cherry and birch are felled then cross sections cut from their boles in 2-foot increments from the ground to the trees' tops.**

# Developmental History of Mid-Rotation Allegheny Hardwood Stands

**The cross sections are labeled by site, species, and height above the ground (0 = forest floor, 10 = 10 feet up the bole.**

**Cross–sections brought to our hi-tech passive solar oven (the greenhouse) where they are dried and then sanded with increasingly finer sandpaper (50-grit to 400-grit) to expose the annual rings.**

**Annual rings then counted under a dissecting microscope to determine the age of the tree at that particular height.**

**Because each BC-BIR pair are the same size and come from the same microsite, the analysis reveals if the pair grew at the same rate through time or if one accelerated or slowed through the years.**

# Developmental History of Mid-Rotation Allegheny Hardwood Stands

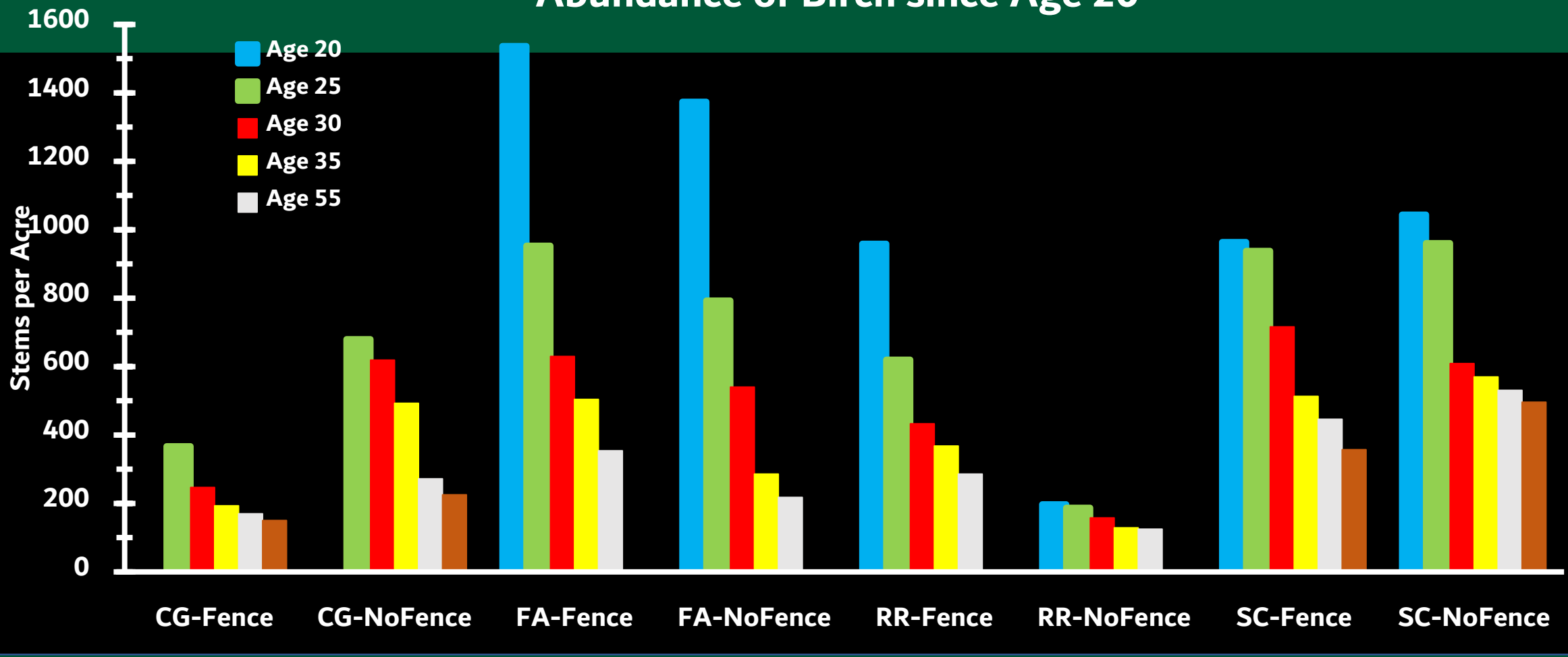
**Because the sampling plots ranged from 0.15- to 0.30-acres and they received a 100% inventory each time, we have a solid record of how species composition, basal area, and stem density changed over the past 50 to 60 years.**

**Also have detailed records on bole quality for each tree.**

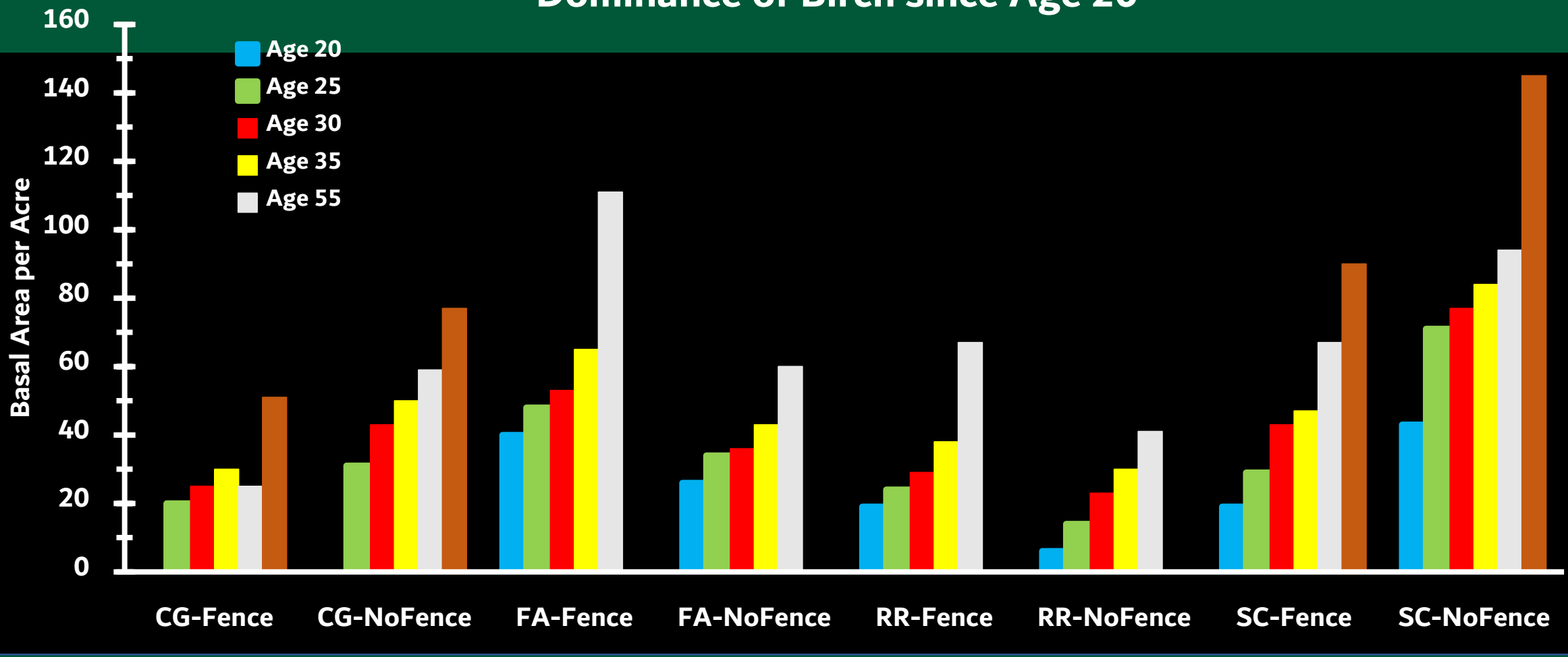
**From these records and the stem dissection analysis, we can reconstruct how these stands have developed over the past 60 years.**

**Is birch proliferation an ephemeral part of AH stand development or is the birch here for the entire rotation?**

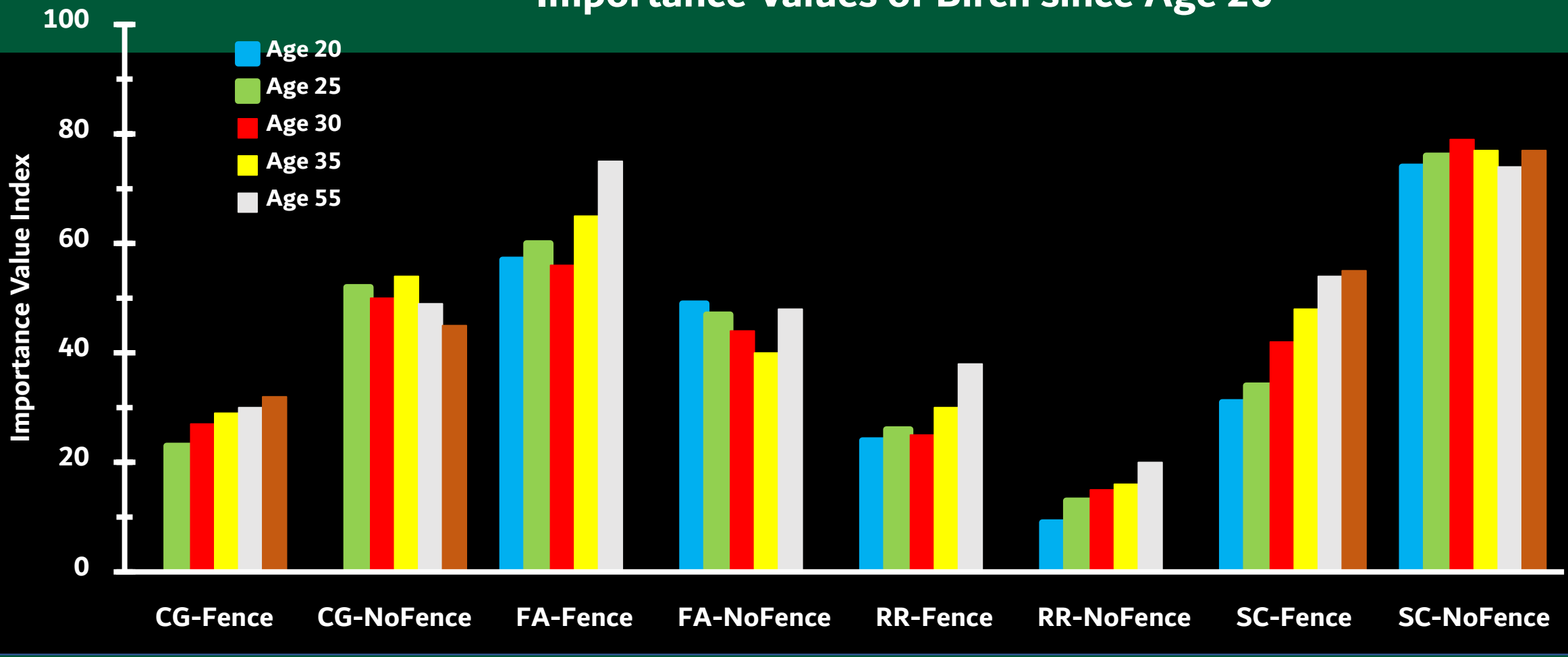
# Abundance of Birch since Age 20



# Dominance of Birch since Age 20



# Importance Values of Birch since Age 20



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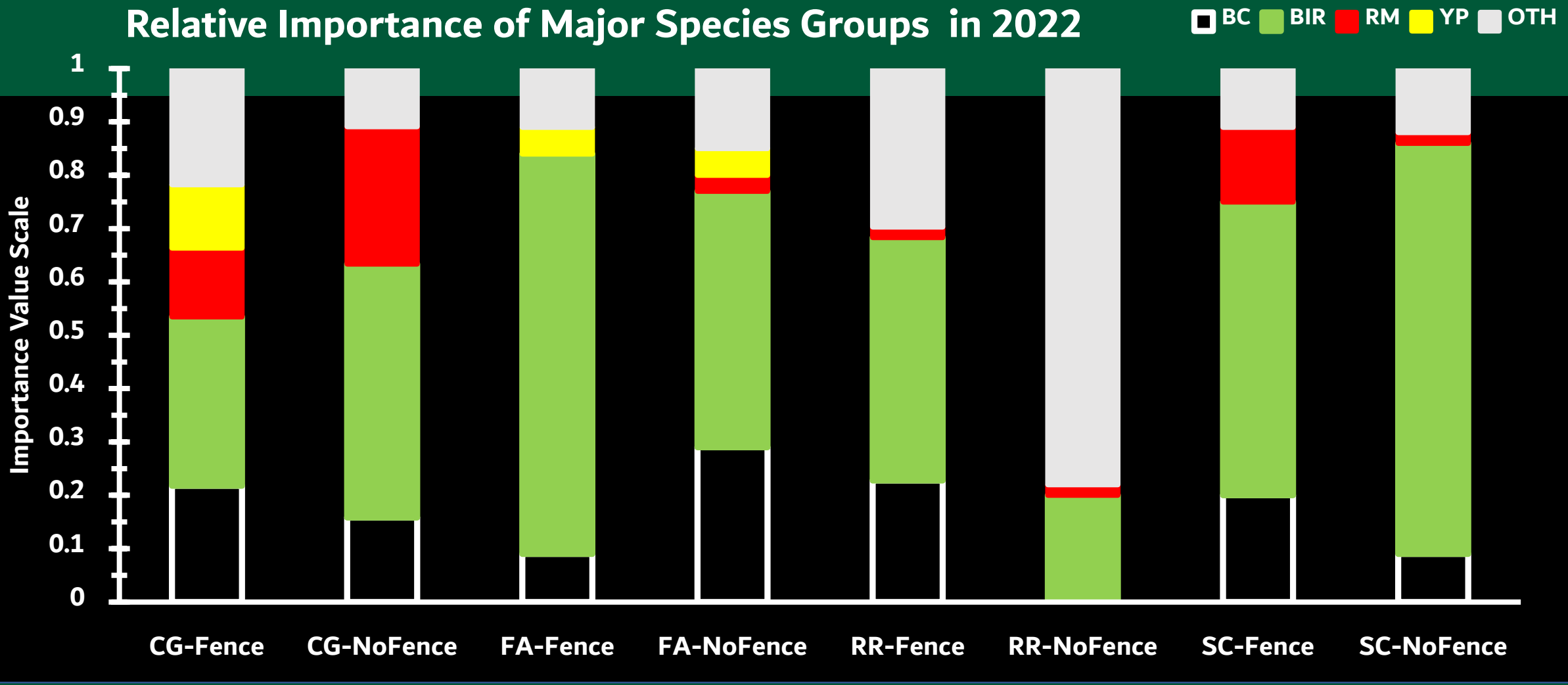
# Relative Importance of Major Species Groups in 2022



# Developmental Dynamics of Mid-Rotation Allegheny Hardwood Stands

**These stands originated approximately 60 years ago with a substantial birch component and that component has persisted until today.**

**The birch is healthy and appears able to persist through the rest of the rotation.**

**However, bole quality is questionable as many birch are leaning or have considerable sweep.**

**No results to report yet on the BC / BIR height growth dynamics. Still a lot of work to be done on this aspect of the project.**

**Will continue with this as staffing & resources permit.**

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# Comparison of Silvicultural Treatments to Control Birch Proliferation in Young Stands

**What can be done before, during, or after the regeneration process to stop birch from taking over stands and choking out desirable reproduction?**

**This project focuses on "AFTER" the final harvest, specifically the first 5 years following the last removal cut.**

**There are 3 groups of possible treatments: Fire, Herbicide, and Mechanical. There is also the "Do Nothing" alternative.**

**This project examines Herbicide, Mechanical and Do Nothing.**

# Comparison of Silvicultural Treatments to Control Birch Proliferation in Young Stands

**Study started in 2017 with funding from the PA Bureau of Forestry.**

**Study is taking place at 3 locations in northwest Pennsylvania – Clear Creek SF in northern Jefferson County, Collins Pine land in Forest County, and PGC Gameland 143 in western Warren County.**

**All sites had 1 or more 40-acre stands that had just been regenerated via the shelterwood system.**

**All sites had an abundance of desirable reproduction (BC, CUC, NRO, RM, YP) with copious amounts of BIR mixed in. Most stems 2 to 5 feet tall.**

# Comparison of Silvicultural Treatments to Control Birch Proliferation in Young Stands

**All stands divided into 9 treatment blocks and we selectively located 12 to 15 0.01-acre sampling plots in each block. Selection criteria was presence of birch and desirable reproduction of comparable height in each plot.**

**All plots inventoried before applying the treatments.**

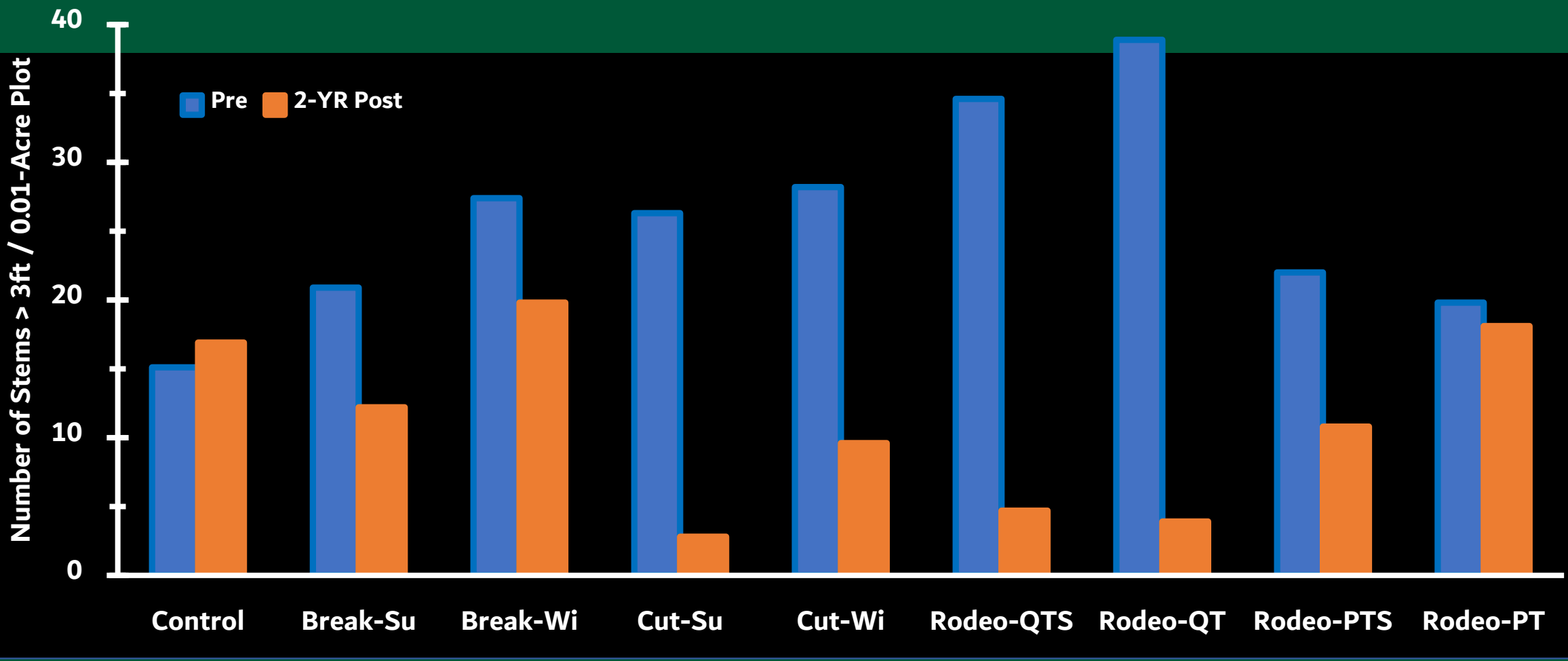
**Treatments were:**
**Cutting birch at ground level in summer and winter.**
**Partial breaking of birch at 4' in summer and winter.**
**1 Quart/acre glyphosate with and without surfactant.**
**1 Pint/acre glyphosate with and without surfactant.**
**Control (do nothing).**

# Comparison of Silvicultural Treatments to Control Birch Proliferation in Young Stands

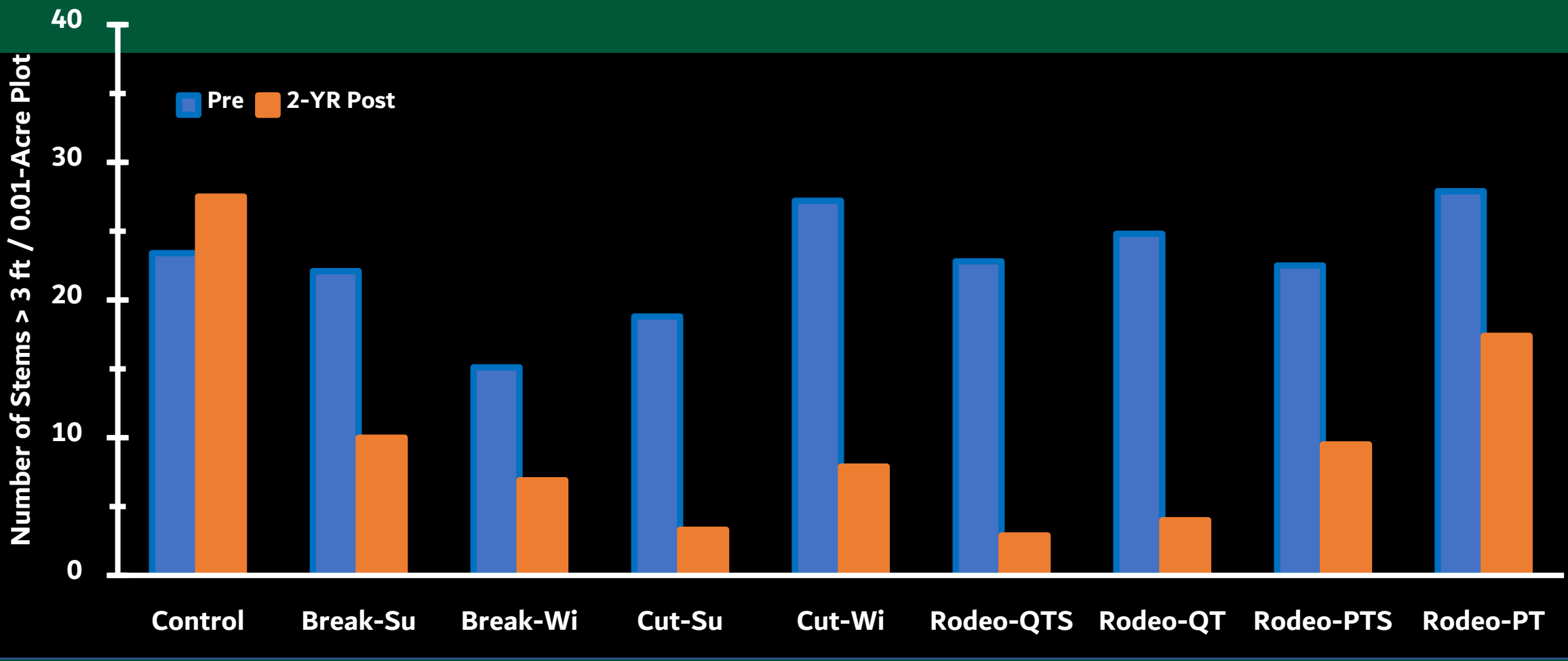
**Treatment implementation spread out from 2019 to 2022 due to a myriad of reasons.**

**Consequently, only partial results from the first round of post-treatment inventories available at this time.**

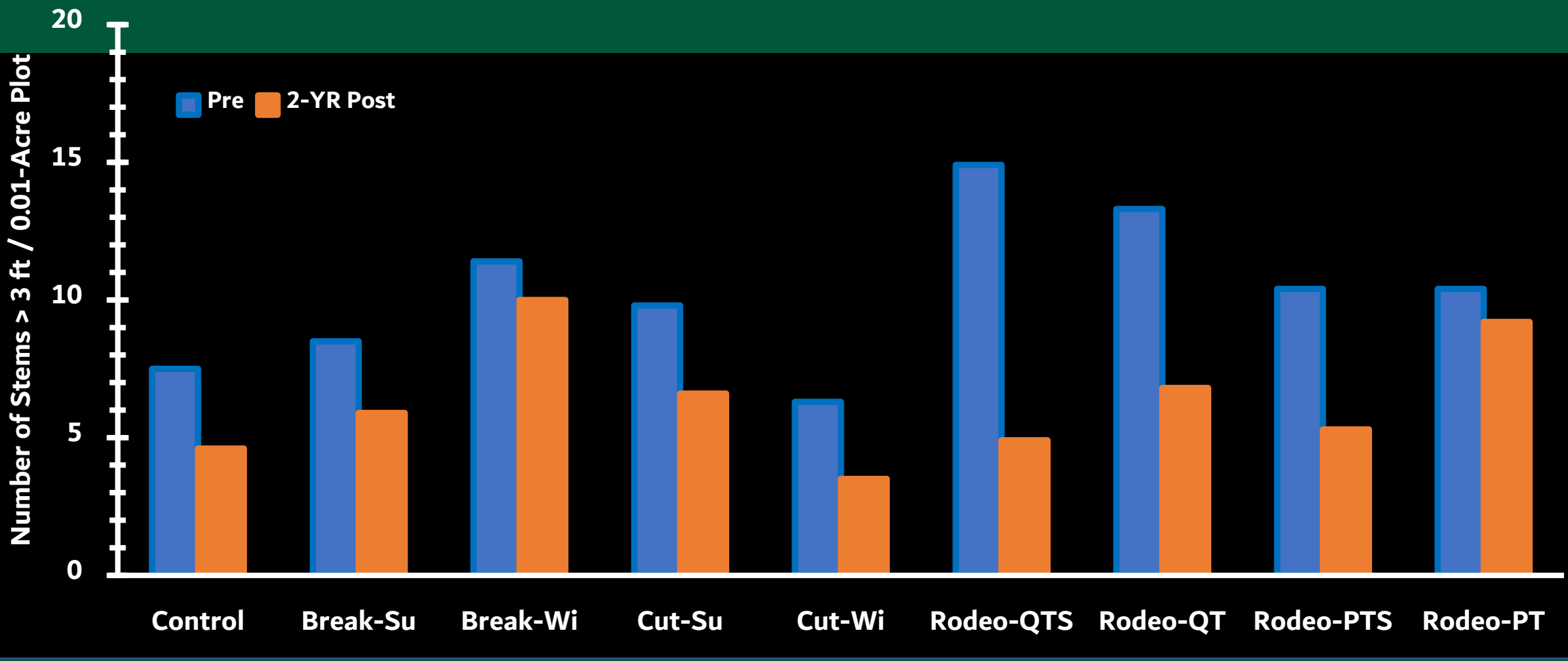
# CLEAR CREEK SF: BIR + PC Density



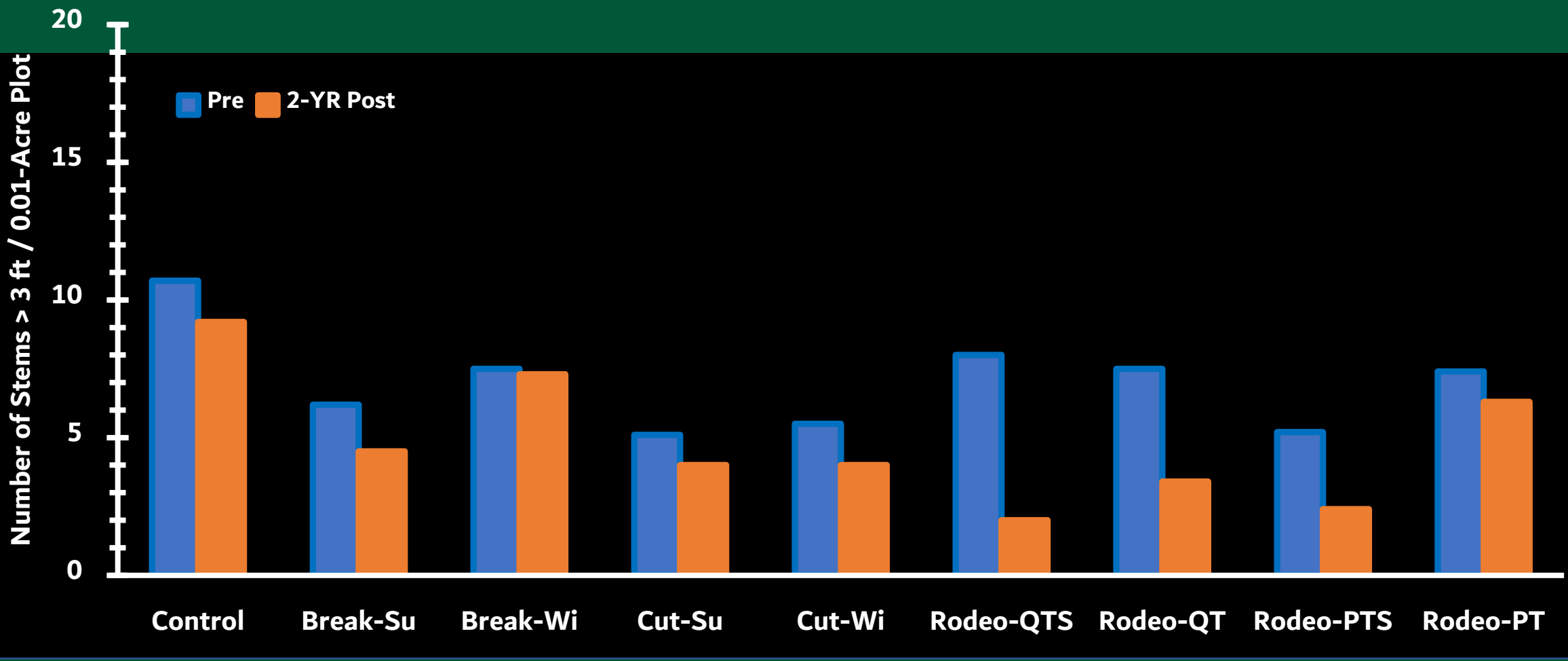
# PGC GAMELANDS 143: BIR + PC Density



# CLEAR CREEK SF: Desirable Species Density



# PGC GAMELANDS 143: Desirable Species Density



# Comparison of Silvicultural Treatments to Control Birch Proliferation in Young Stands

**No treatment looks to be the silver bullet for controlling birch proliferation after the final harvest. Each method has strengths and weaknesses.**

**Doing nothing means that the birch will choke out most or all of the desirable reproduction within a few years.**

**Breaking birch stems is easy to do but there is a maximum diameter limit and the broken birch responds by having a branch below the break become the new leader. Summer breaking has more of a negative impact on the birch than winter breaking but moving through young stands in those months is near impossible.**

# Comparison of Silvicultural Treatments to Control Birch Proliferation in Young Stands

**Cutting the birch at ground level in the summer is quite effective at controlling birch but extremely laborious to do. Winter cutting is easier to do but less effective due to sprouting.**

**All of the mechanical treatments have little impact on the desirable reproduction.**

**The standard glyphosate treatment (quart/acre + surfactant) definitely kills birch but complete crown coverage is a must (partially sprayed birch survive). This treatment also kills many of the desirable stems that are co-dominants or strong intermediates. Over-topped desirables survive but will they become competitive is an unanswered question.**

# Other Possible Approaches to Dealing With Birch in Young Stands

**Fire. Anecedotal evidence suggests mid-spring burns (during or just after birch leaf expansion) can greatly reduce birch density but this needs to be correctly researched to identify seasonality and fire intensity.**

**Fertilizer. Urea or other nitrate-nitrogen fertilizers will accelerate height growth of black cherry so it can stay with or surpass birch. Another treatment ripe with research possibilities.**

**Crop Tree Release. Generally initiated at canopy closure or shortly thereafter. Can it be done sooner? What are the release parameters (2-, 3-, or 4-sided)?**

# Other Possible Approaches to Dealing With Birch in Young Stands

**Prevention. Reduce the eventual birch proliferation by removing all of it from a stand at the beginning of a shelterwood sequence. In simple terms – Don't leave birch as a reserve tree.**

**Use Birch as a Nurse Tree. Birches are ectomycorrhizal so they are maintaining that soil fungal community on site. White pine is also ectomycorrhizal and can tolerate some shading that protects its leader from weevil. Underplant white pine when birch monocultures begin to break up to lay the foundation for the next stand.**

**Utilization. Find or develop markets for small-diameter birch. Birch is a high BTU species and its oils were extracted 75 to 100 years ago in the chemical wood era.**

# Summary

**For reasons not fully yet understood, sweet birch has been proliferating across Pennsylvania since the early 2000s.**

**Indications are that birch will be a dominant species in our forests throughout the next rotation.**

**There are several silvicultural options for addressing birch proliferation so it doesn't choke out more desirable hardwood species but all come with limitations.**

**The challenges of managing our forests with this hyper-aggressive species may rival those of the 1960s and 70s when we were dealing with beech brush, fern, and deer.**

**Research questions certainly rival those of 50 years ago.**

# Acknowledgements

**A *LONG* list of foresters and forestry technicians that have worked at the Irvine Lab through the years.**

**AH Dom. Prob. Study: Eric Baxter, Reid Garrison, Joshua Hanson, Chris Roskosh, Greg Sanford, Julie Smithbauer, Mike Trisket, and Ed Vandever.**

**Study 48: Von Brown, Virgil Flick, Lance Meyen, Judd Piemme, Julie Smithbauer, Harry Steele, and Ernie Wiltsie.**

**Birch Control Study:  Reid Garrison, Chris Roskosh, Julie Smithbauer, and Ed Vandever.**

**PA Bureau of Forestry for funding the Birch Control Study.**

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# SPECIAL ANNOUNCEMENT

**The SILVAH workshops are restarting this year! After nearly a 3-year hiatus, the Irvine Lab is once again offering its week-long SILVAH workshops. Version 8 will be taught.**

**2022 workshops are:**
**June 6 to 10 at Clear Creek SF. Focus on mixed oak forests.**

**August 29 to September 2 at Kane Expt. Forest. Focus on Allegheny hardwood forests.**

**Space is limited.**

**Contact Todd Ristau or me (814-563-1040) for more information, Scott Weikert (sjw128@psu.edu) to register.**