3 years of monitoring 15 riparian tree plantings on ANR lands

Mortality and natural regeneration as a function of pre-planting, planting, and post-planting conditions

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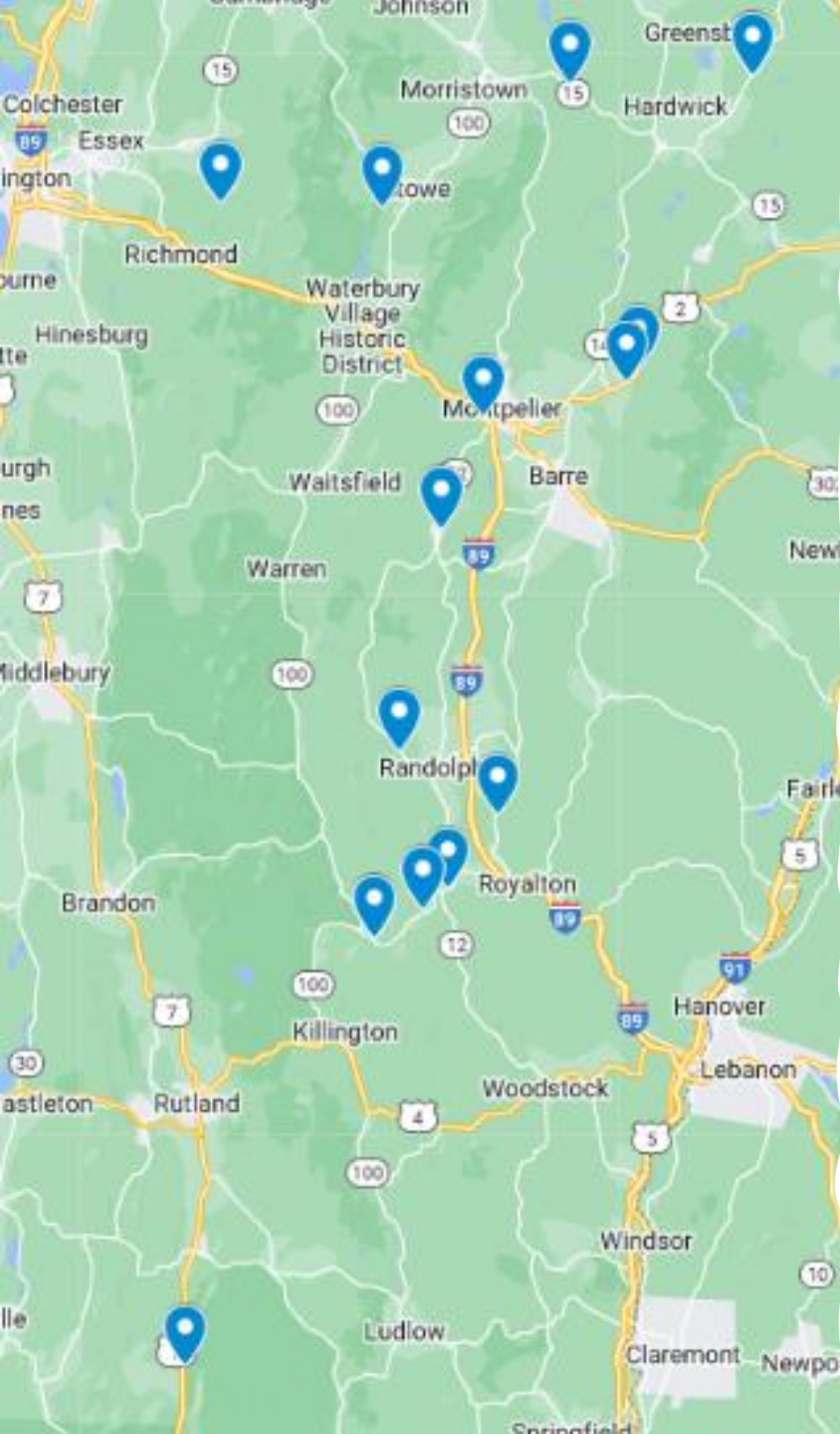Samuel Puddicombe and William Eldridge

Why Monitor?

- Tree Planting
  - Return riverbanks to their natural, forested state
- Monitor
  - Return and monitor for survival and natural regeneration
- Learn
  - What conditions lead to the highest success rates

Planting / Monitoring Sites

- 15 sites across the state
  - 0.1 – 8 acres
  - Re-establish riparian habitat
- Planted from 2018-2021
  - Experimental plots started in 2019
- Monitored in 2021, 2022, 2023
  - 0-5 years since planting
- 81 plots
  - 1 – 20 plot(s) / site
  - 20' x 20' – 200' x 100'
- 0 – 90 planted stems / plot

Data Collected: Tree Level

- ID
- Species
- Height

- Vigor
  - Vigorous
  - Not Vigorous
  - Dead
  - Not Found
- Origin
  - Planted
  - Natural

- Comments
- Photos

Data Collected: Plot Level

- Ground Cover
  - % thatch
  - Thatch depth
- Problematic Species
- Seed trees

Plot Conditions / Variables

PRE-PLANTING   PLANTING   POST-PLANTING

Pre-Planting Conditions

High Disturbance

- Corn
- Scoured Bank
- Grubbed Rip Rap
- Untreated knotweed
- Restored wetland
- Dirt road

Low Disturbance
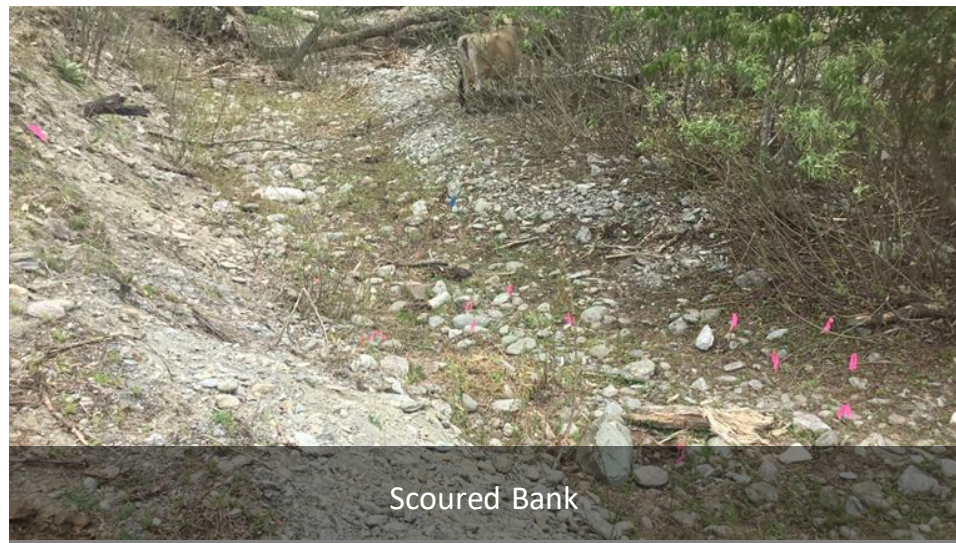
- Athletic field
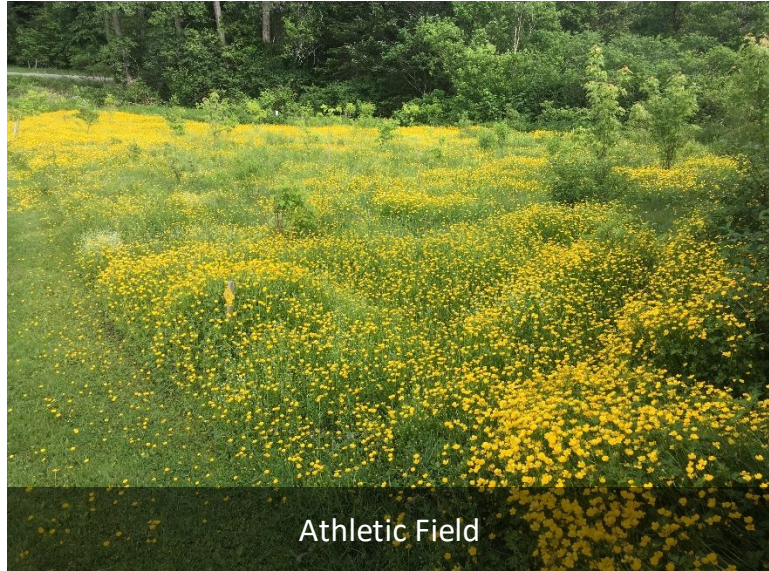- Managed grasslands
- Hay

Berm Cut

Scoured Bank

Corn

Athletic Field

Hay

Managed Grassland

Live stakes

Bareroot

Planting Conditions

- Type planted
  - Bareroot
  - Live stakes
- Spacing
  - Evenly spaced
  - Clustered

- Planting crew
  - Professional
  - Volunteer
- Planting density

Post-Planting Conditions

- Exclusion fencing
  - Yes
  - No
- Competitor Suppression
  - 2yr Herbicide
  - None

Enclosure

Herbicide Treatment
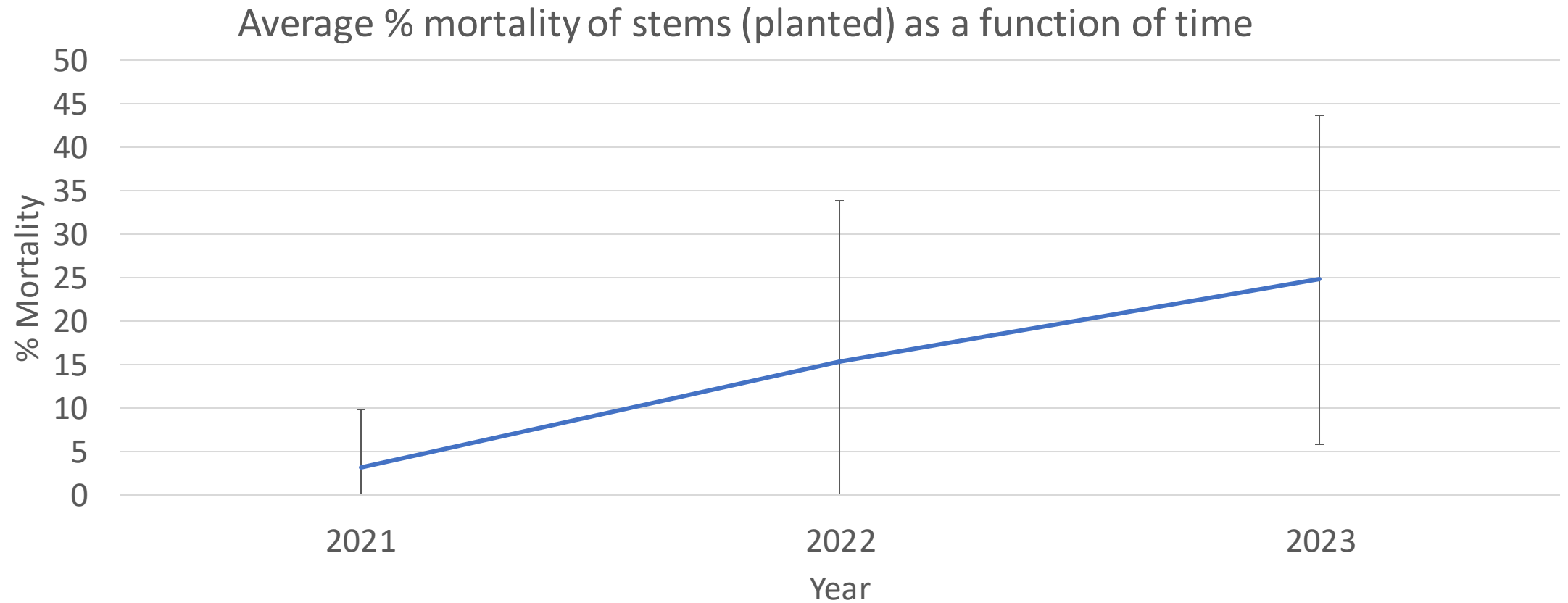
Metrics

DENSITY

SURVIVAL

NATURAL REGENERATION

Mortality

*of planted stems

Mortality
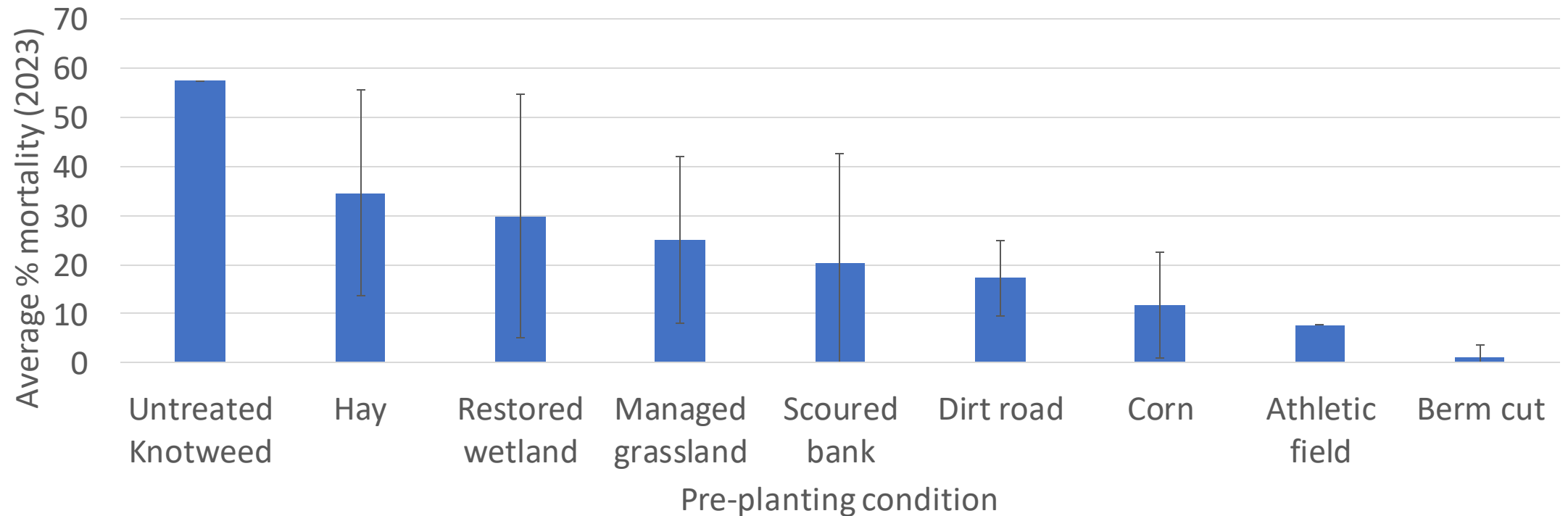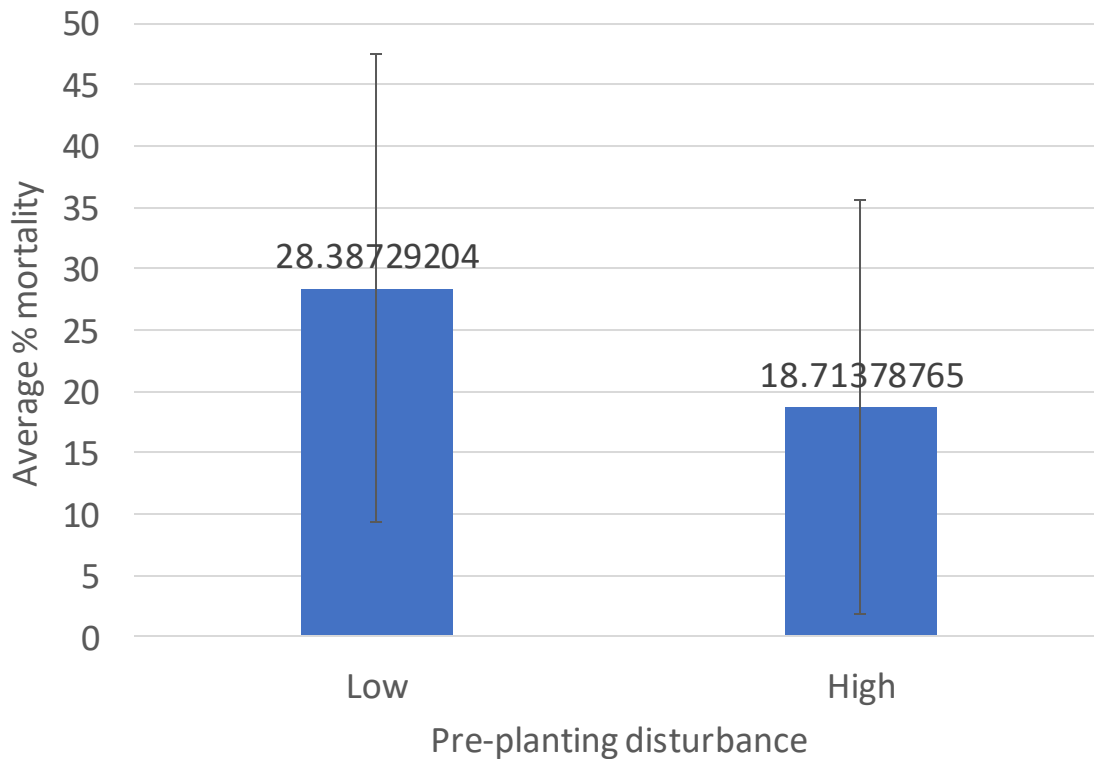
10% increase per year with a ~25% average in 2023

Average % mortality of stems (planted) as a function of time

Mortality: Pre-planting condition

Average % mortality of stems (planted) in 2023 as a function of pre-planting condition

Mortality: Pre-planting condition
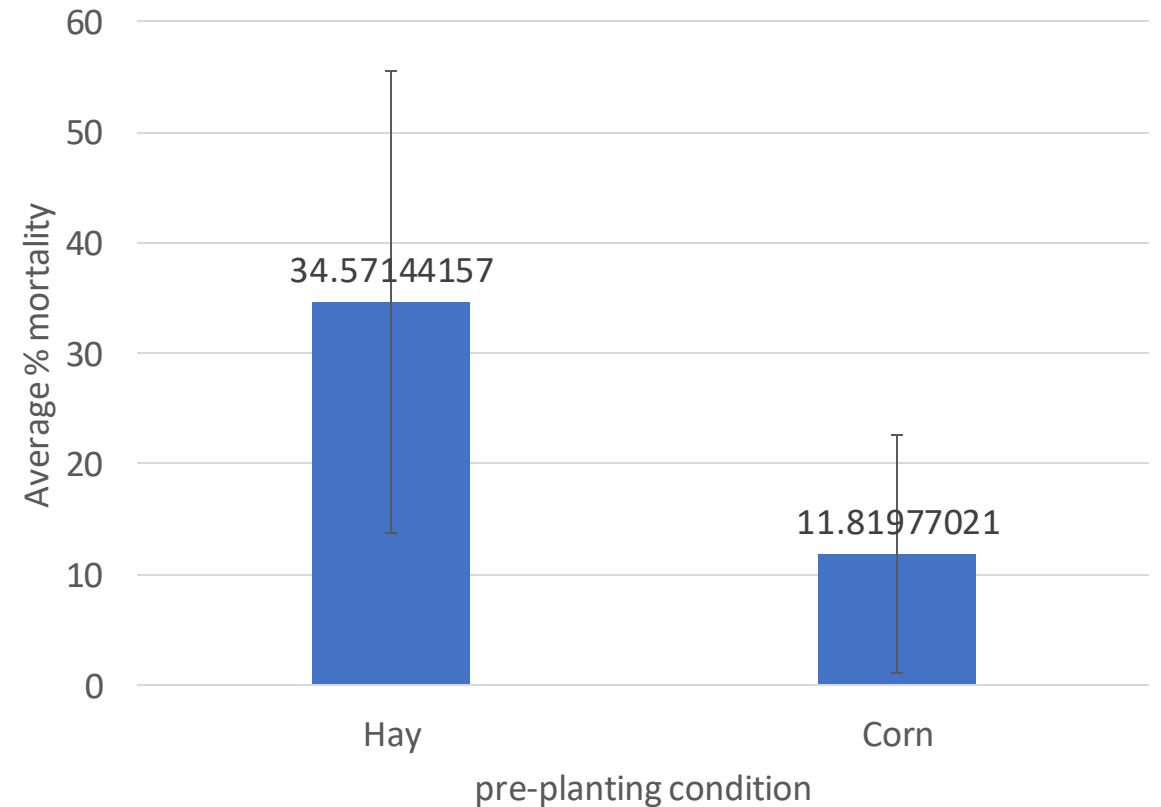

Average % mortality of stems (planted) in 2023 as a function of pre-planting disturbance

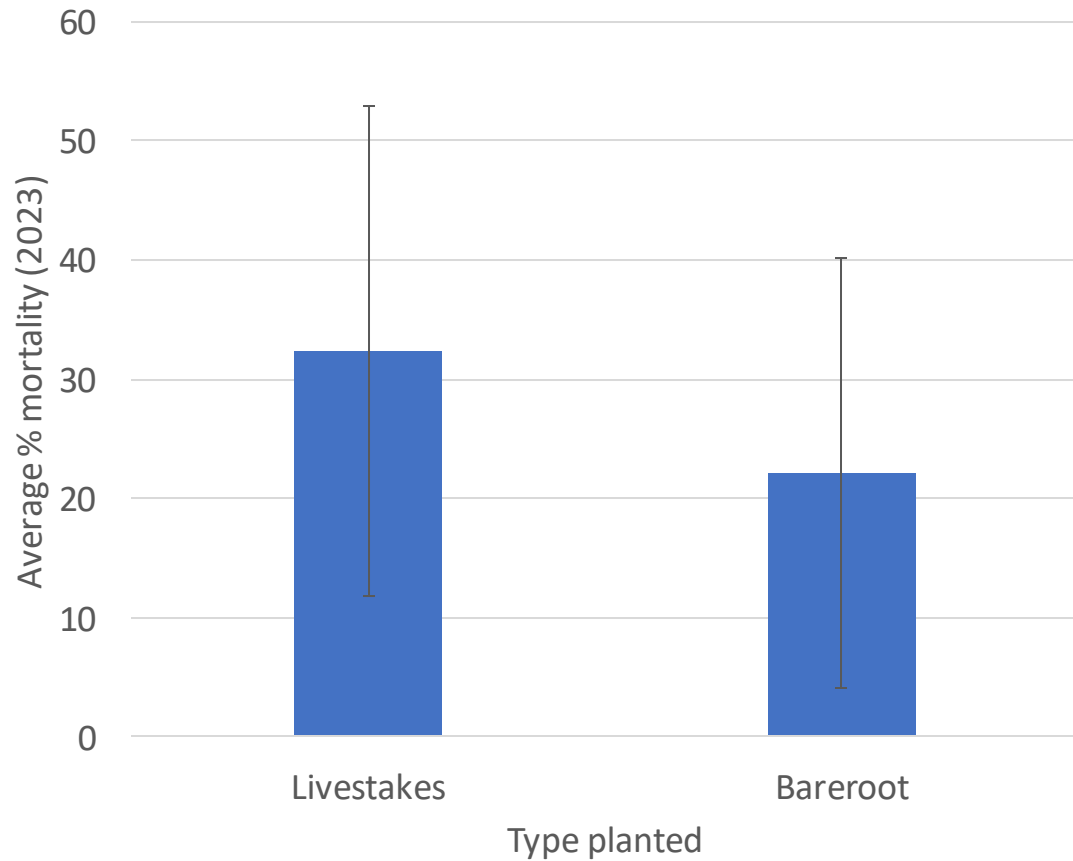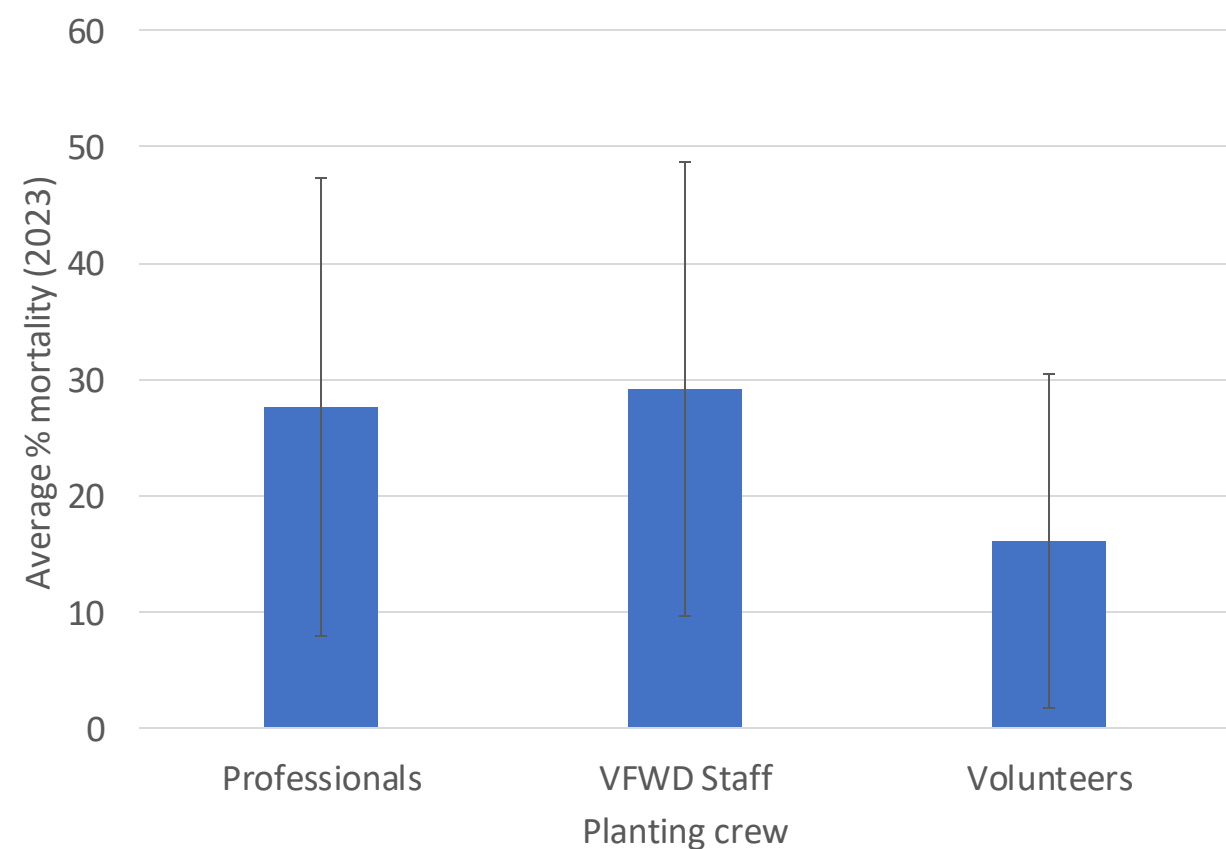Average % mortality of stems (planted) in 2023 as a function of pre-planting condition

Mortality: Planting condition

Average % mortality of stems (planted) in 2023 as a function of type planted
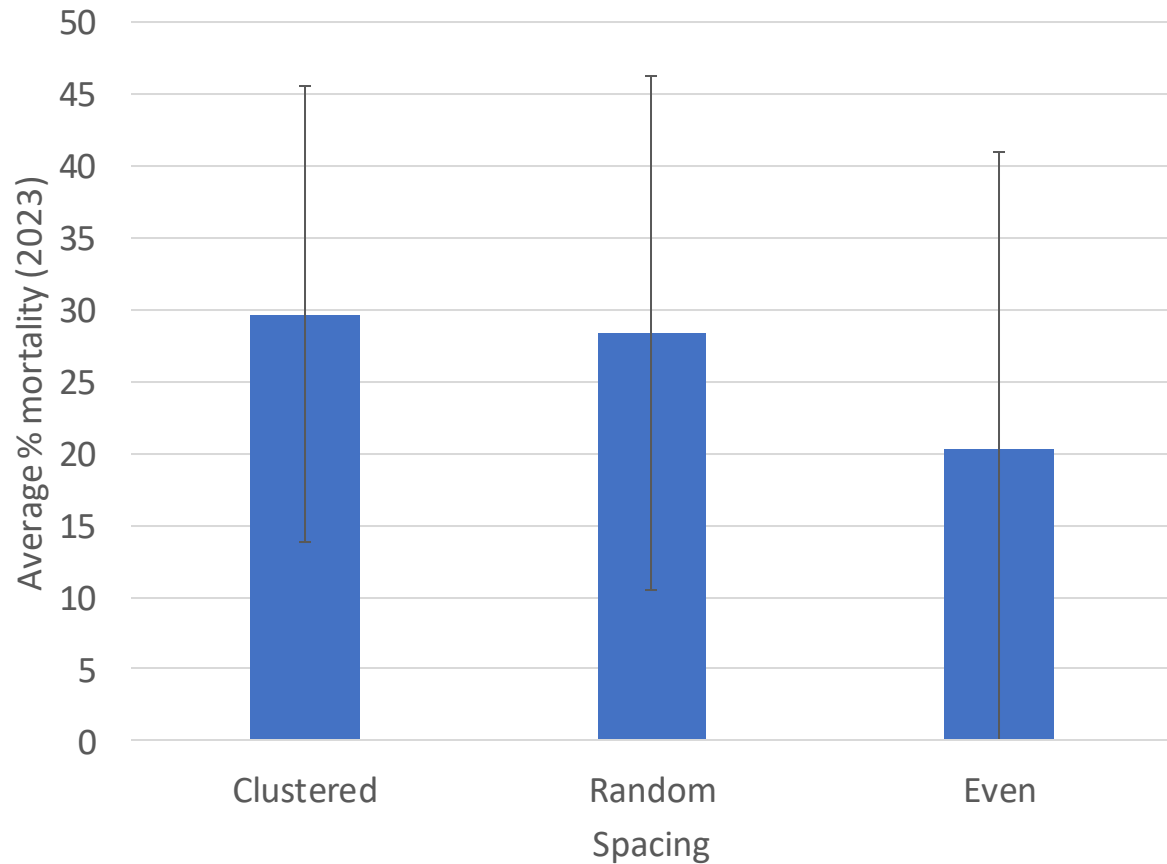
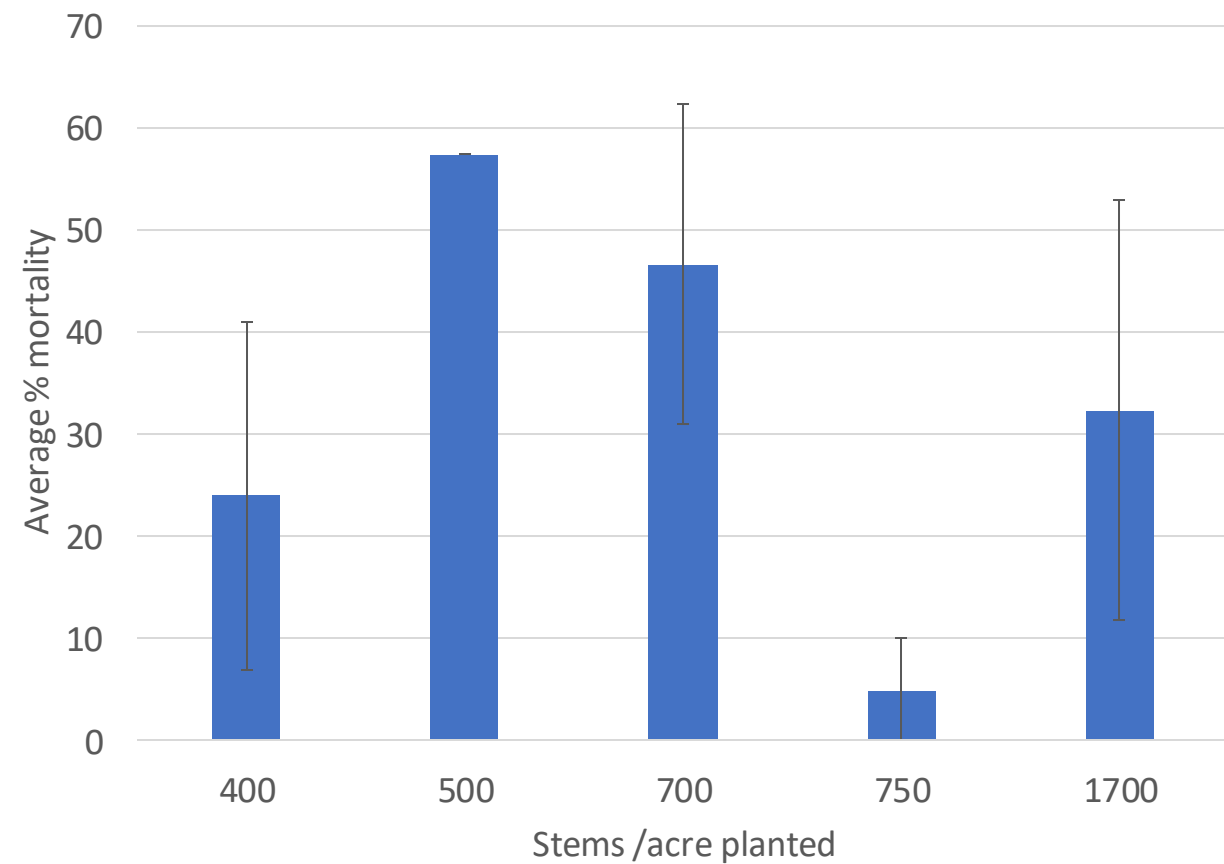Average % mortality of stems (planted) in 2023 as a function of planting crew

Mortality: Planting condition

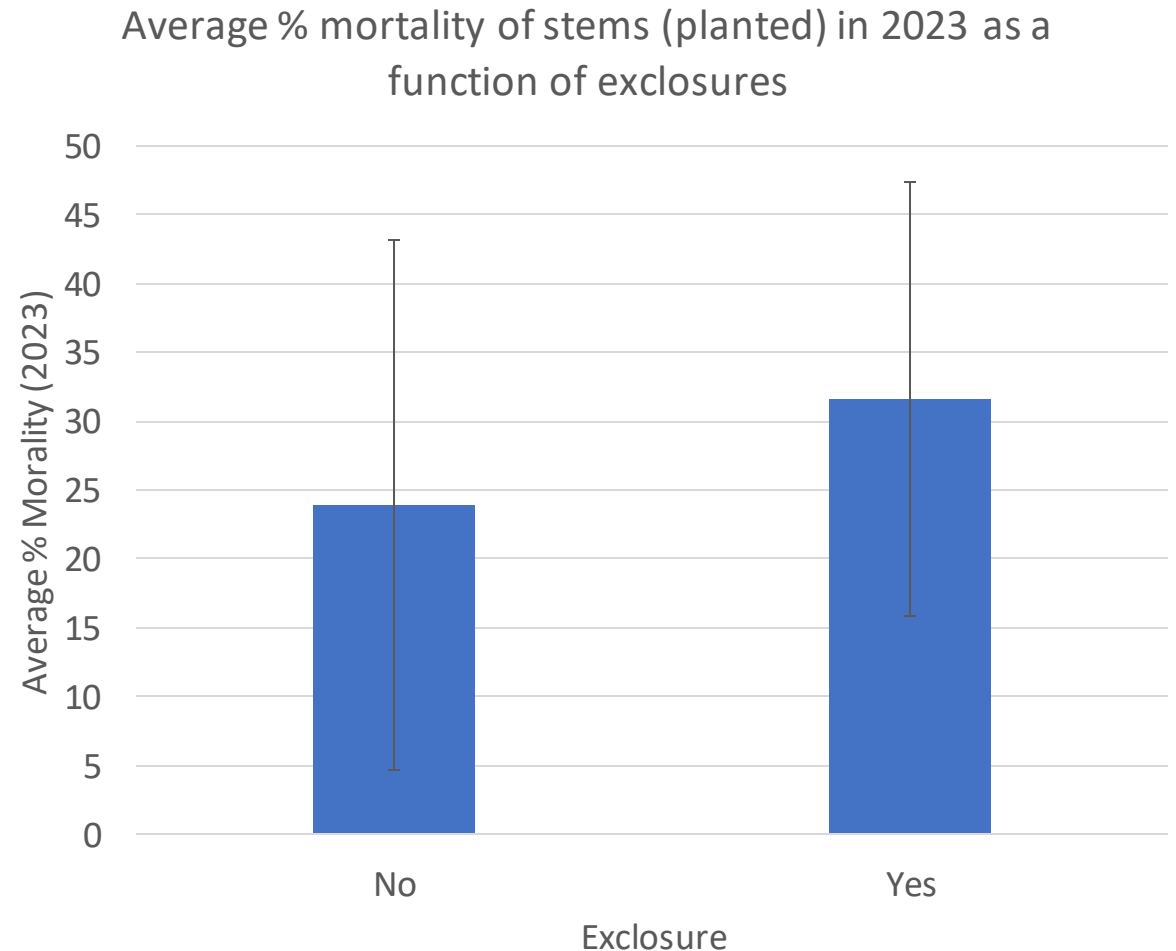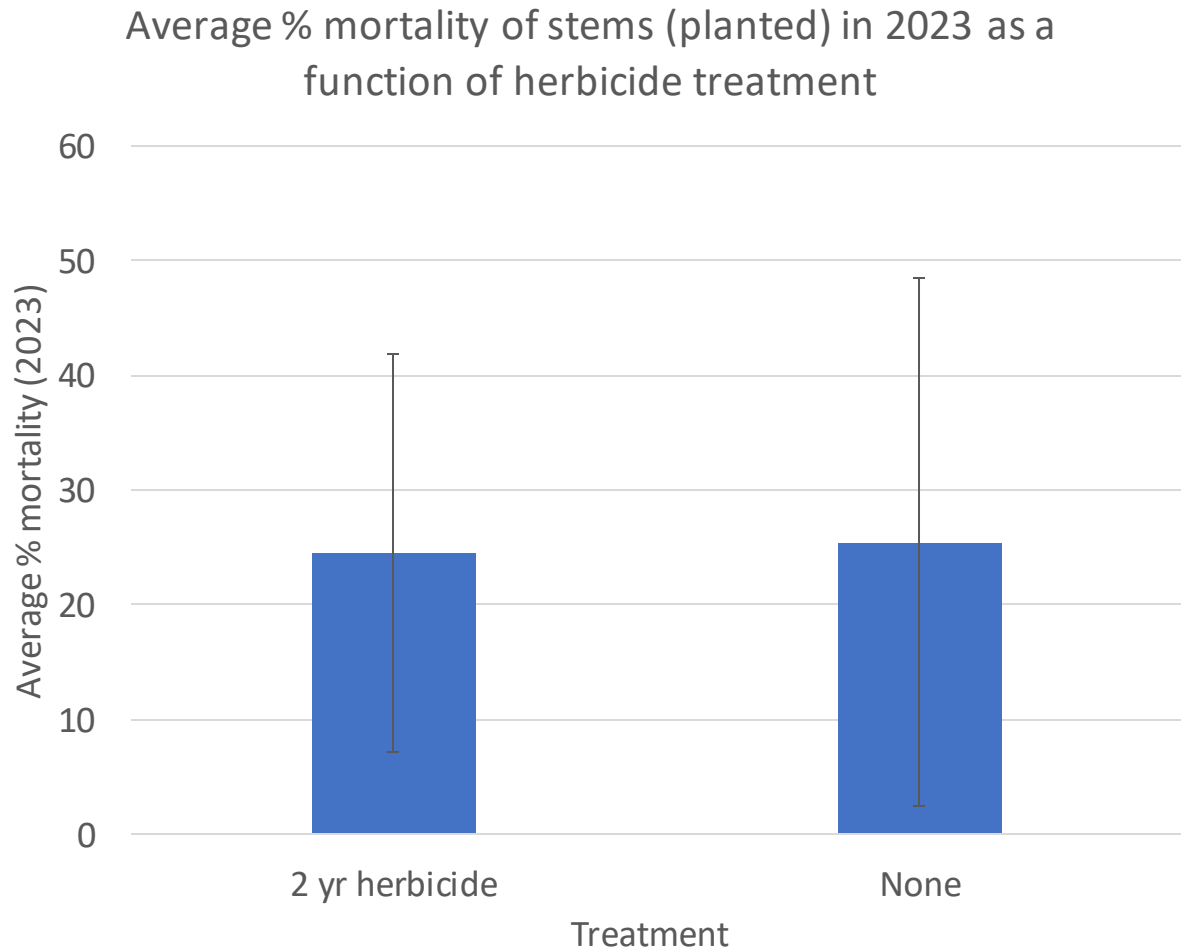Average % mortality of stems (planted) in 2023 as a function of spacing

Average % mortality of stems (planted) in 2023 as a function of planting density

Mortality: Post-planting condition

Average % mortality of stems (planted) in 2023 as a function of herbicide treatment

Average % mortality of stems (planted) in 2023 as a function of exclosures
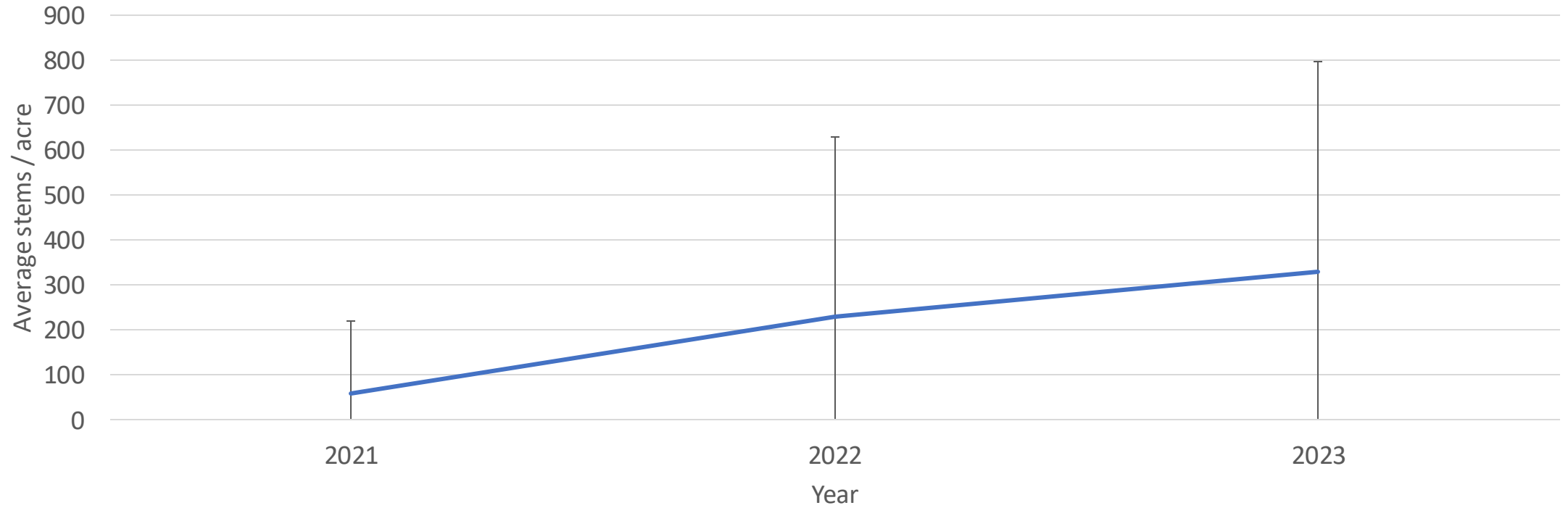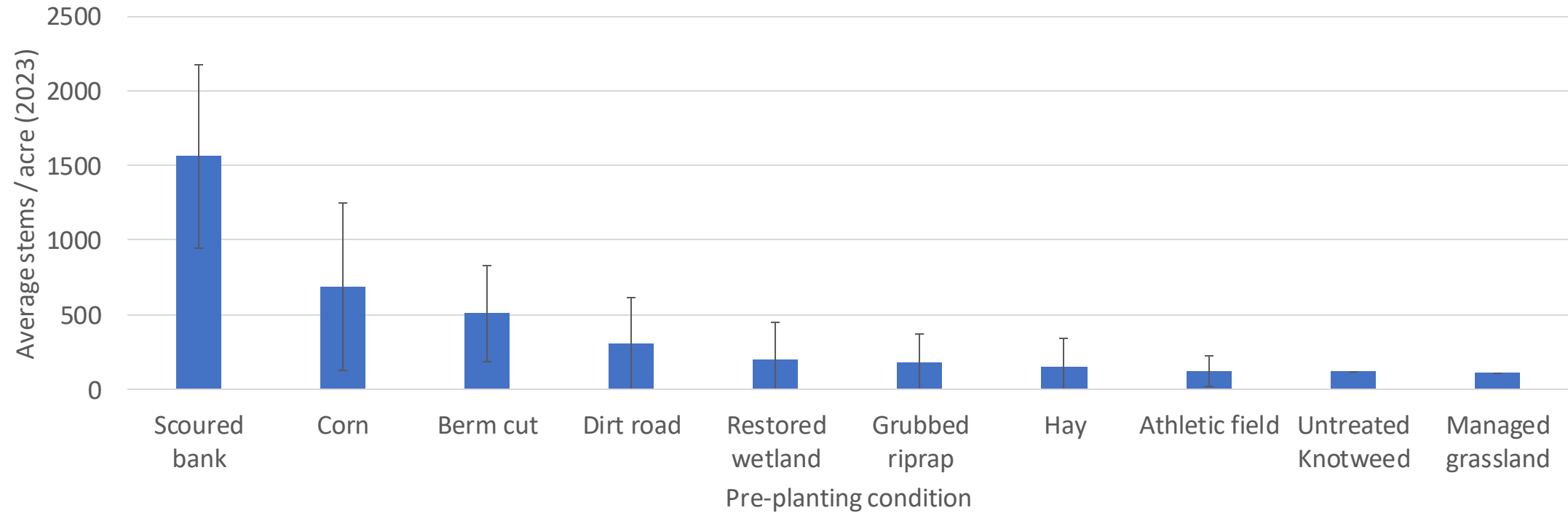
Natural Regeneration

Natural Regeneration

Average stems / acre (natural) as a function of time

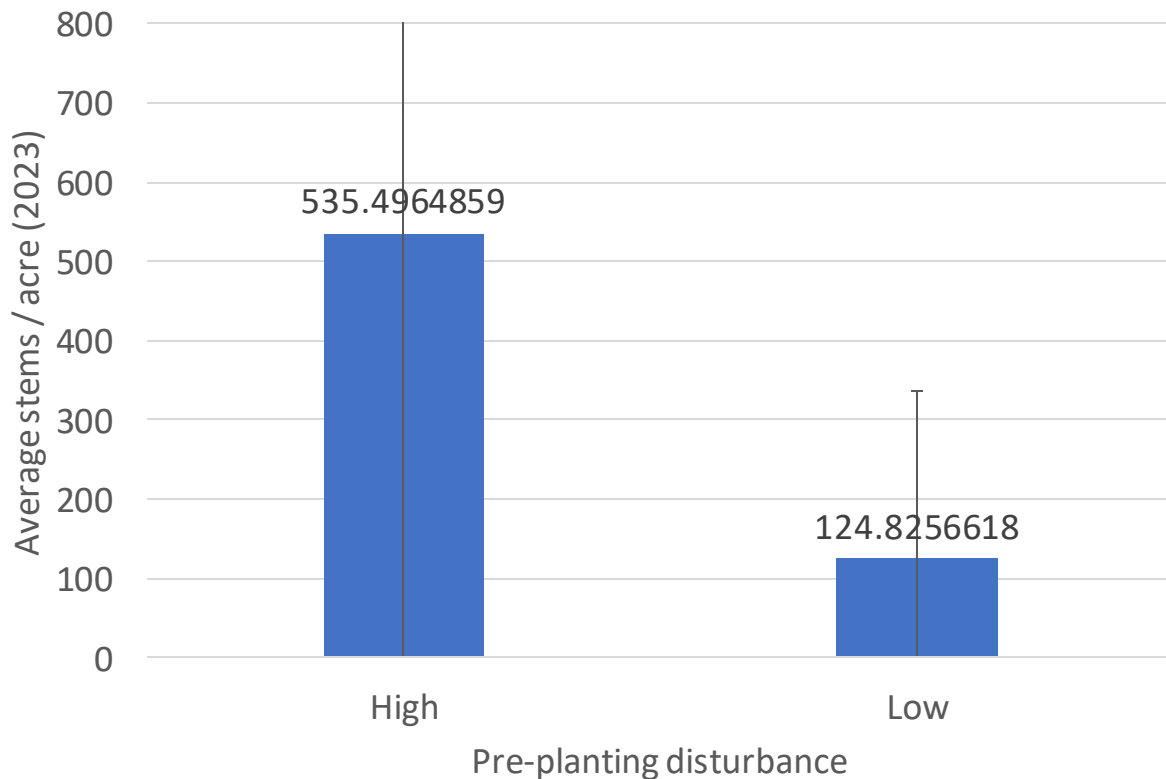# Natural Regeneration: Pre-planting conditions

Average stems / acre (natural) in 2023 as a function of pre-planting condition
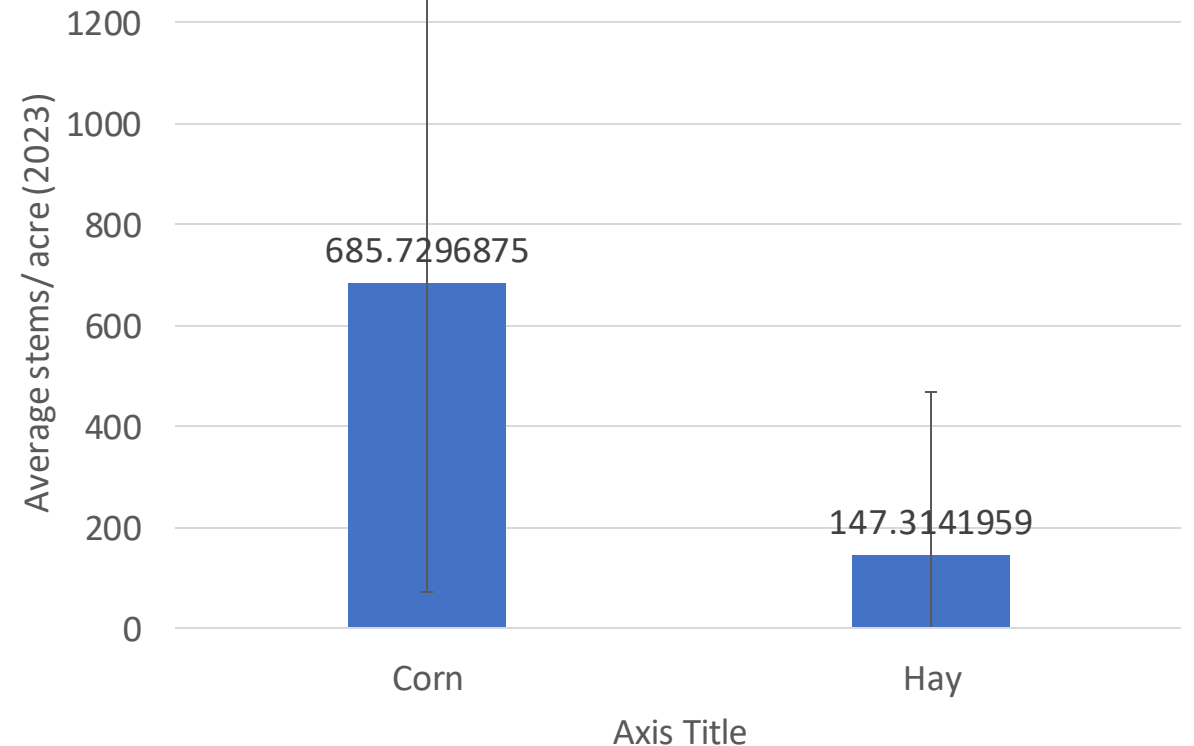
Natural Regeneration: Pre-planting conditions

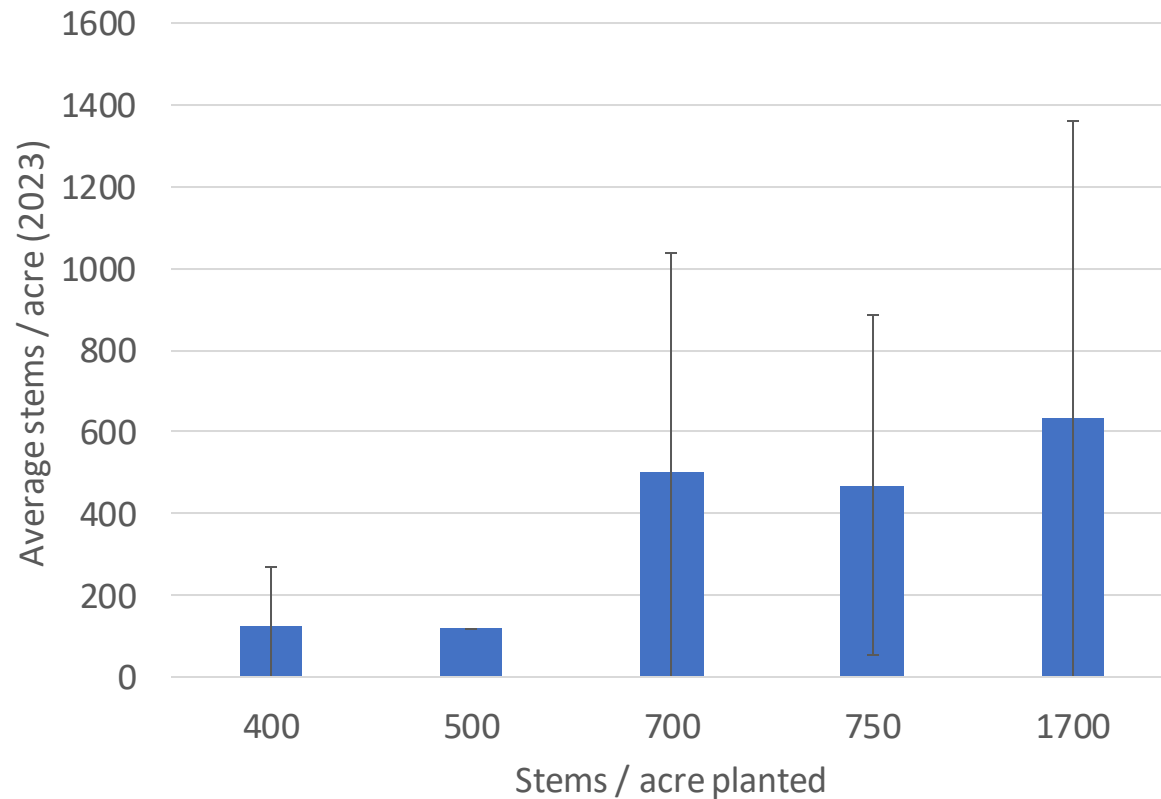Average stems / acre (natural) in 2023 as a function of pre-planting disturbance

535.4964859

124.8256618

Average stems / acre (2023)

High   Low

Pre-planting disturbance

Average stems / acre (natural) in 2023 as a function of pre-planting disturbance

685.7296875

147.3141959

Average stems / acre (2023)
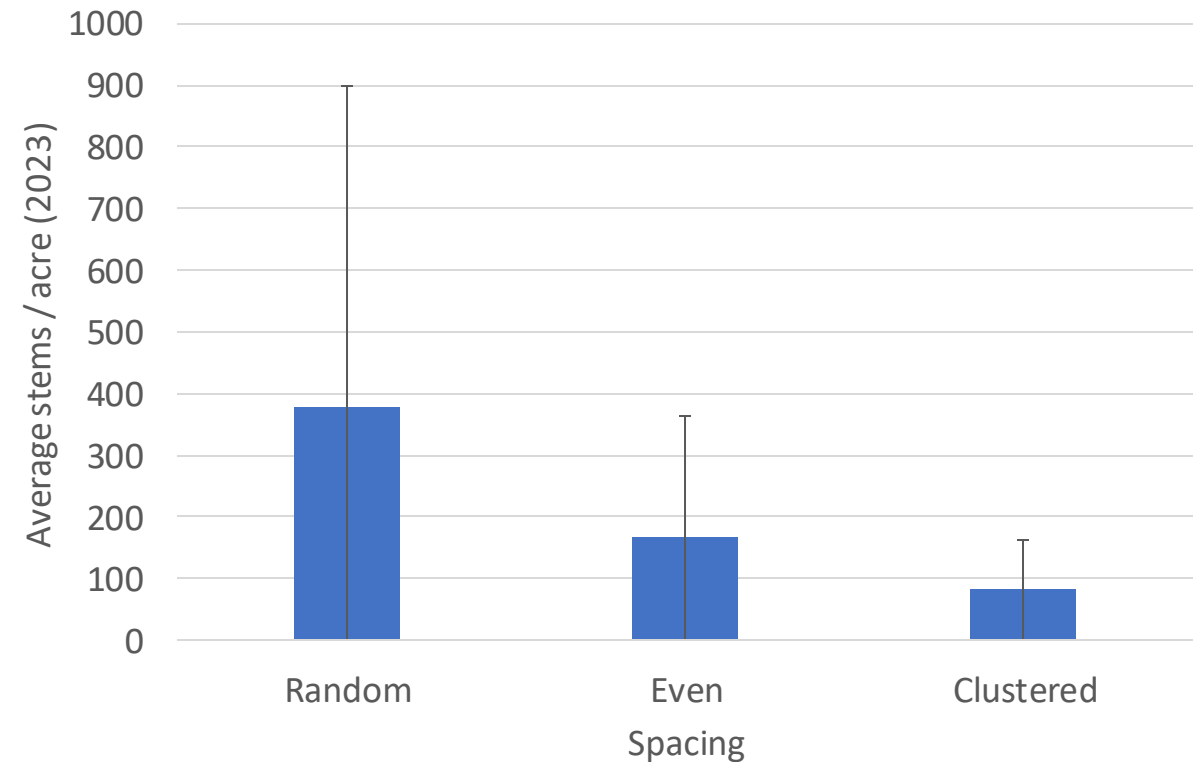
Corn   Hay

Axis Title

Natural Regeneration: Planting conditions

Average stems / acre (natural) in 2023 as a function of planting density

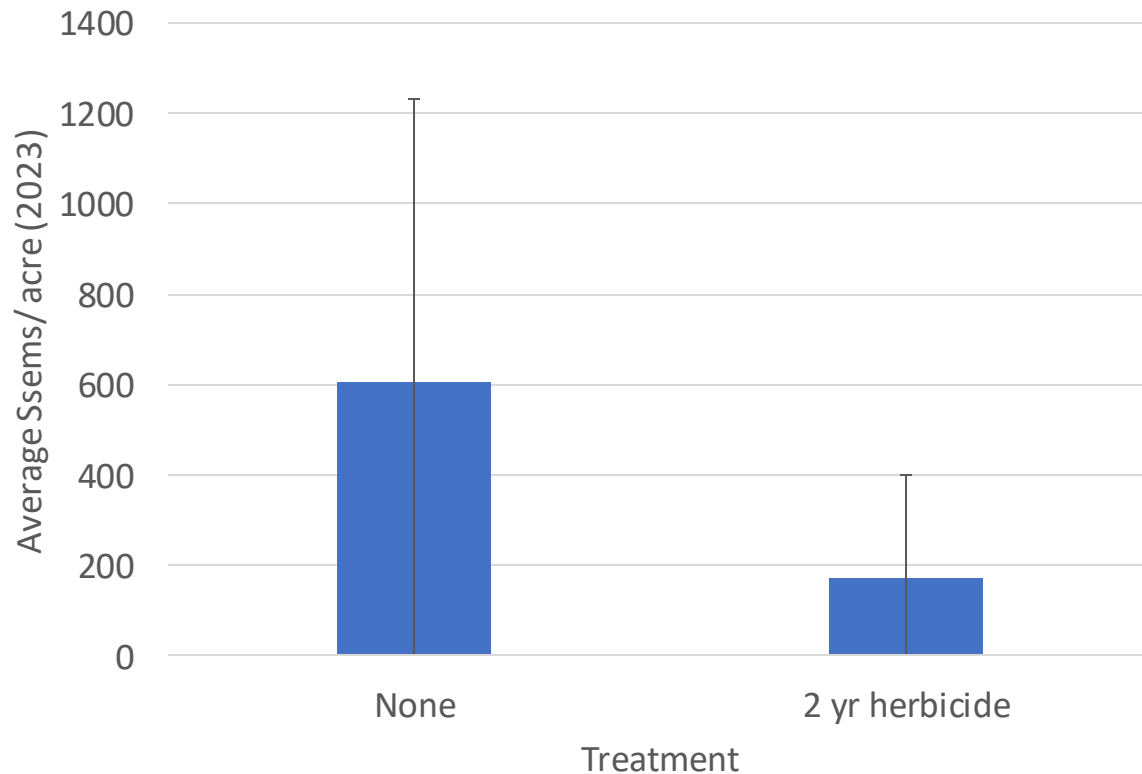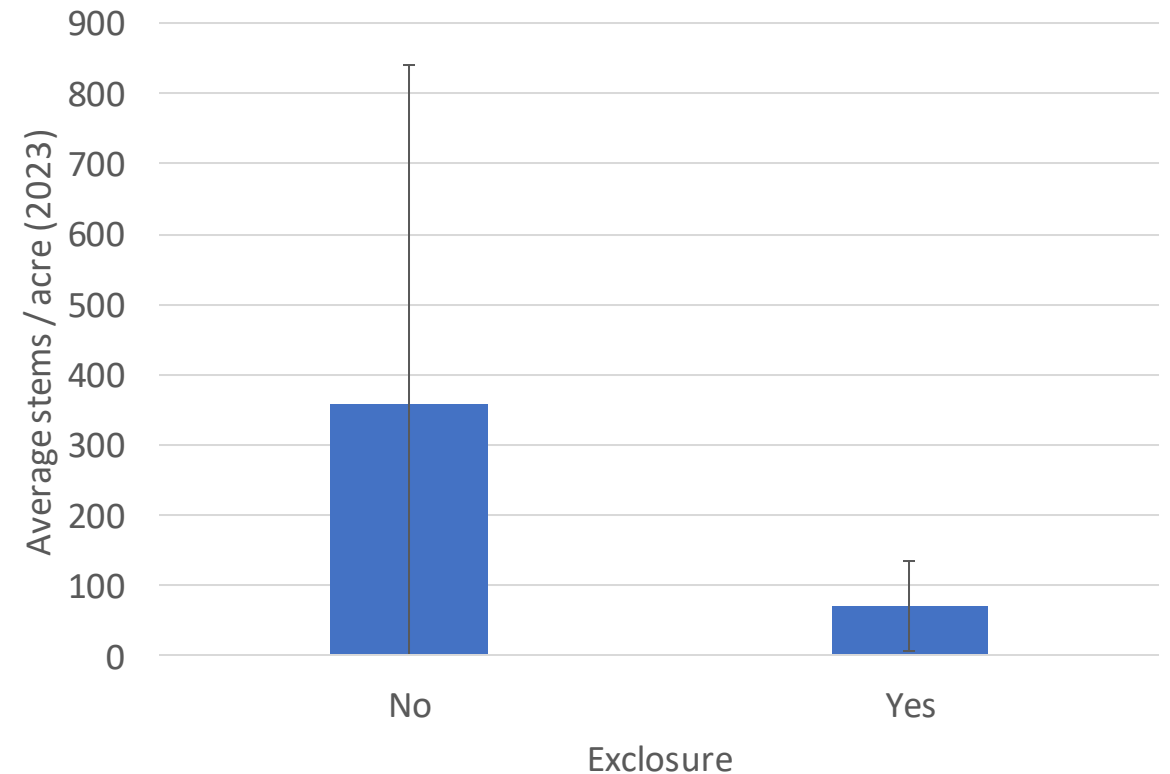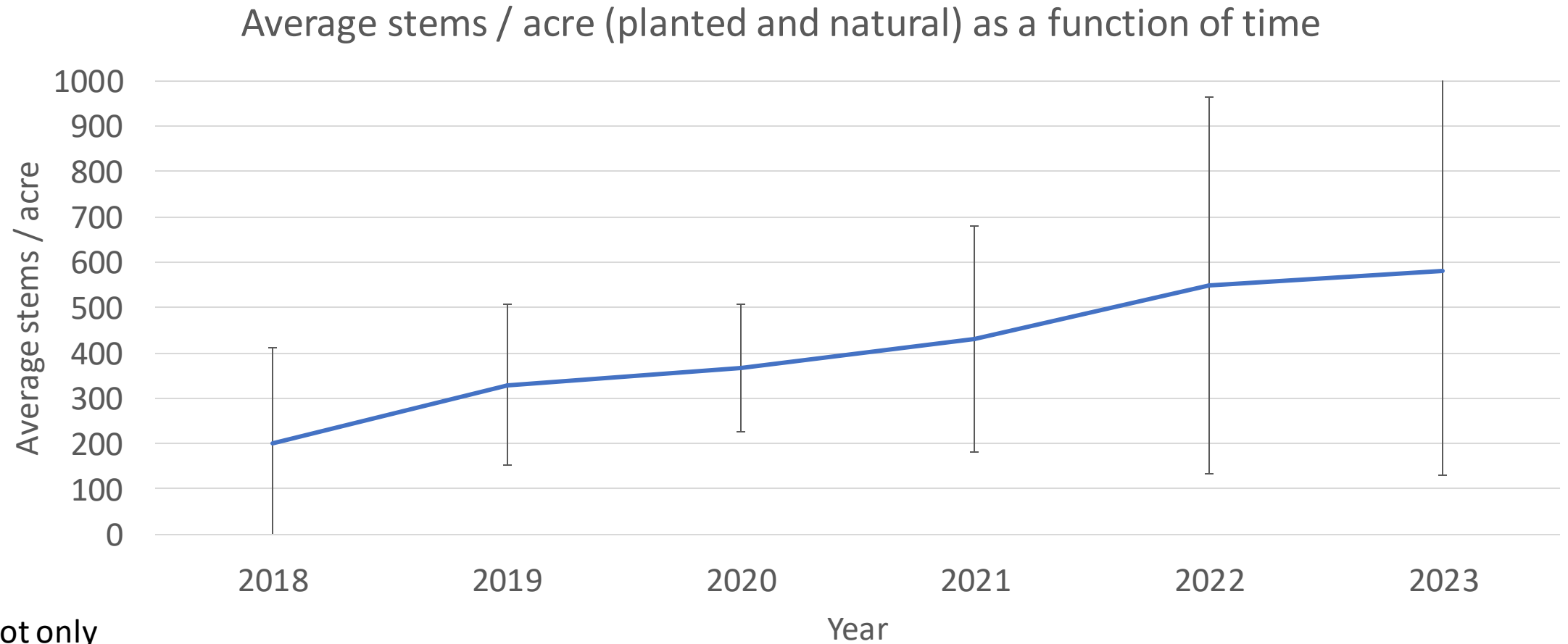Average stem / acre (natural) in 2023 as a function of spacing

Natural Regeneration: Post-planting conditions

Density

Density

Goal : 400 Stems / Acre

Average stems / acre (planted and natural) as a function of time

*bareroot only
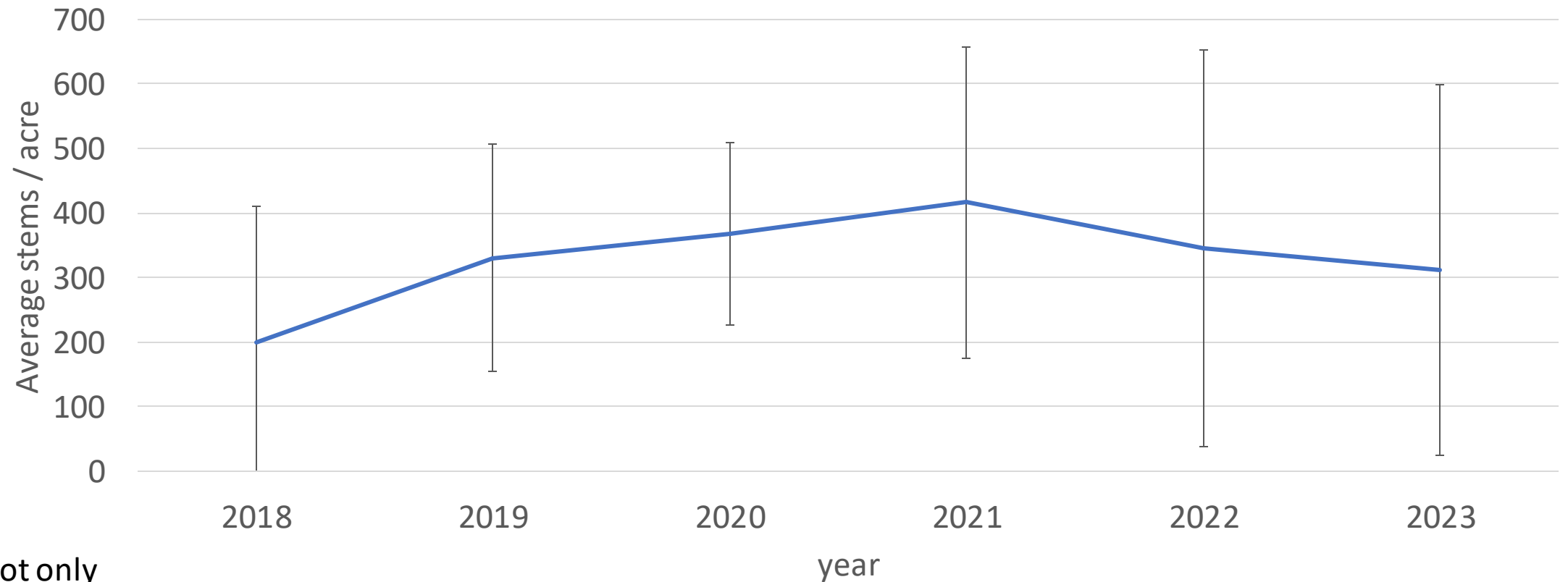
Density: planted

Average stems / acre (planted) as a function of time
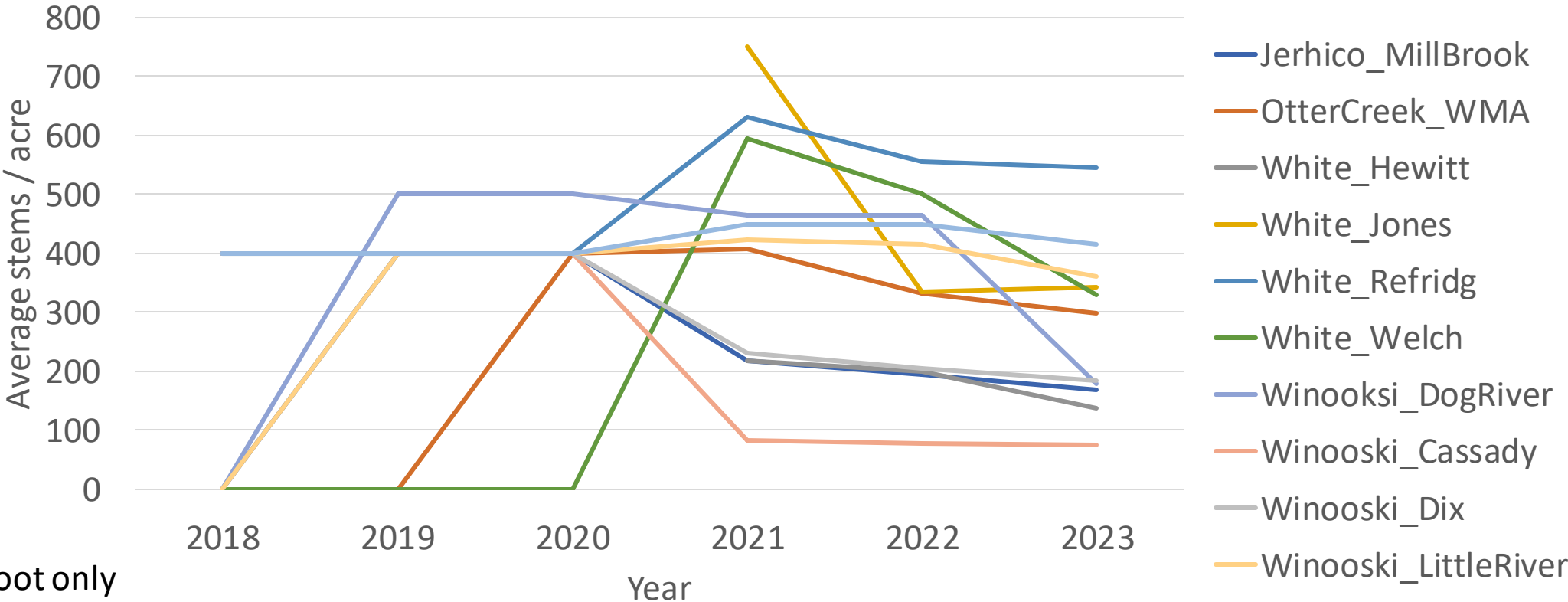

*bareroot only

Density: planted by site

Average stems /acre (planted) by site as a function of time

*bareroot only

Some possible takeaways

- Sights with higher levels of disturbance pre-planting have higher levels of natural regeneration
  - ~ 535 stems / acre vs. ~125 stems / acre

- Natural regeneration along with all other metrics are patchy
  - Huge standard deviation
  - Huge plot by plot variance (and within plot)

- Pre-planting condition also affected mortality of planted stems
  - ~35% mortality hay vs. ~10% mortality in corn

- Effects from planting and post-planting conditions are not as significant
  - Volunteer planting does not increase mortality
  - Live stakes only increase mortality 10% from bareroot
  - Herbicide and enclosures did not prove helpful if not harmful