

# Deer and sedge: bottlenecks to seedling regeneration in

northern hardwood forests: Potential

restoration techniques aimed  
at reversing the effects.



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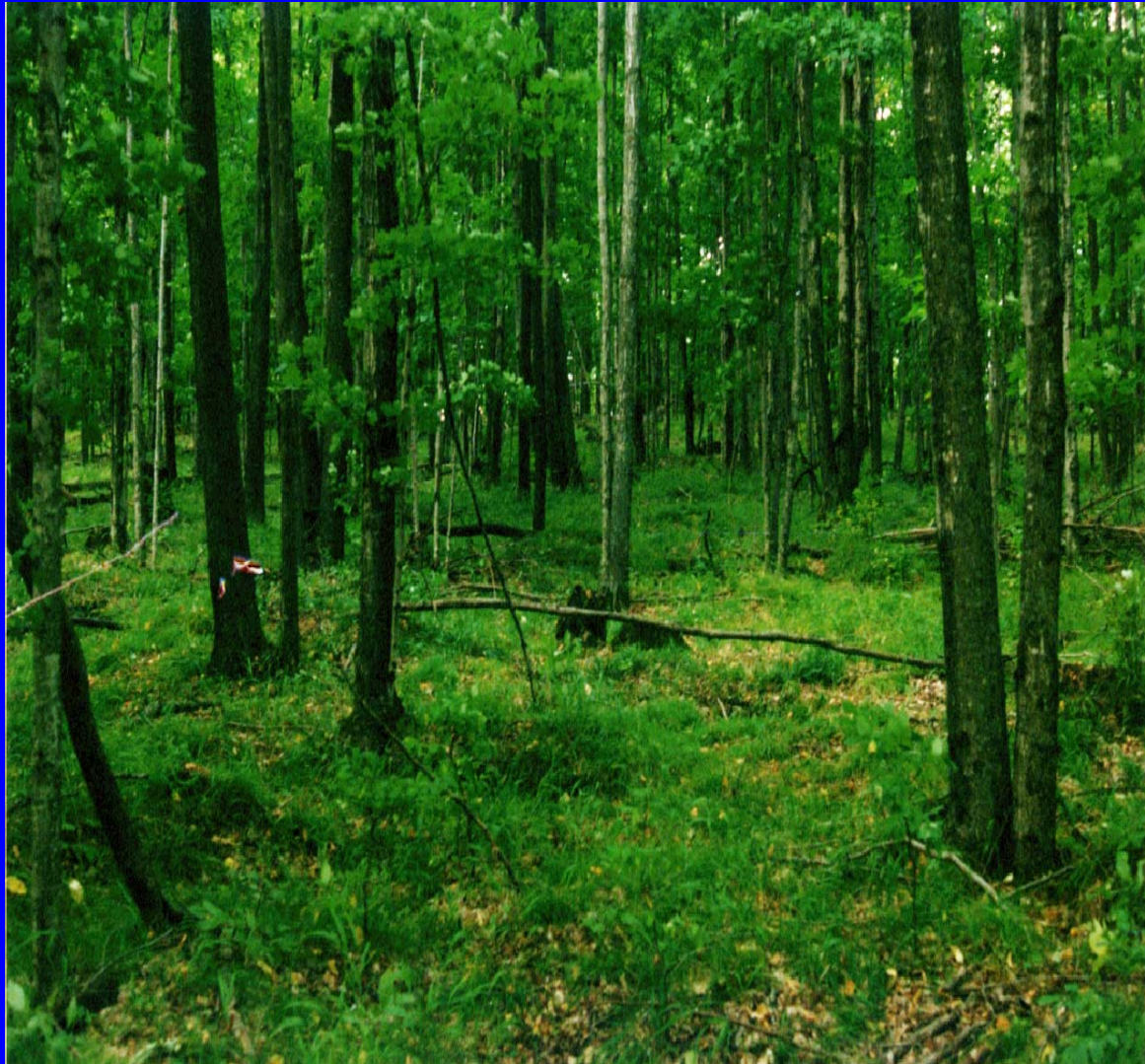
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# Currently

Michigan forests with high deer numbers have:

- limited tree regeneration
- less structural complexity in the remaining forests
- shifts in understory vegetation to less browsed species such as sedge (*Carex pensylvanica*) and *Ostrya virginiana*.

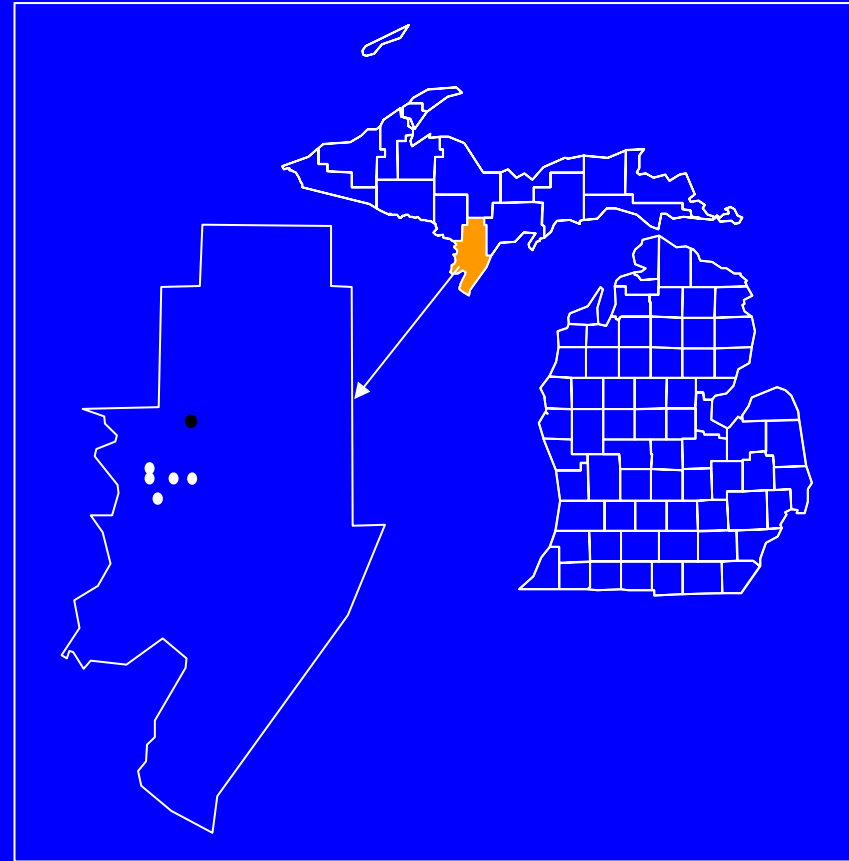


## Research questions:

- 1) What happens to the forest when you have high deer and high sedge densities?
- 2) Does light and sedge have an effect on sugar maple seedling growth and survival?
- 3) Can timed herbicide applications effectively control sedge while reducing the impacts to non-target species such as seedlings and herbs?

## Study area

- International Paper's (IP) lands in Menominee County, Michigan
- Dominated by sugar maple (*Acer saccharum*), with a long history of selection harvesting.
- Nutrient rich drumlins with high deer densities ( $> 30$  deer/mile<sup>2</sup>)
- Little recruitment of seedlings to sapling sized trees for over 25 years
- High sedge densities ( $\geq 80\%$  of herb layer biomass)



Five replicate exclosure / open areas (●) and six timed herbicide treatment areas (●) located in Menominee County, MI.

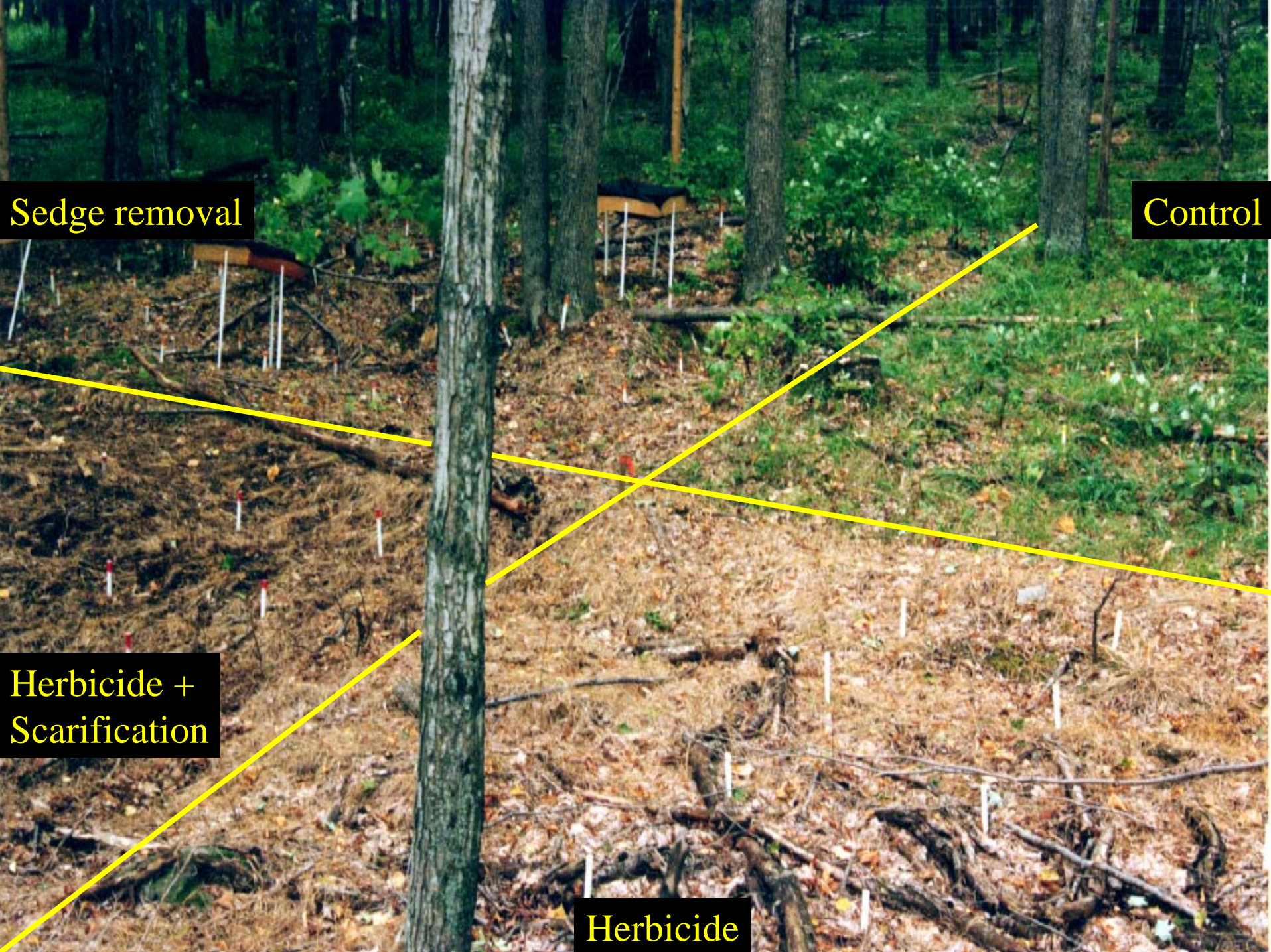


**Sedge removal**

**Control**

**Herbicide +  
Scarification**

**Herbicide**



Are deer densities that different on our sites?

Flowering trillium counts:



## Are deer densities that different on our sites?

Flowering trillium counts:

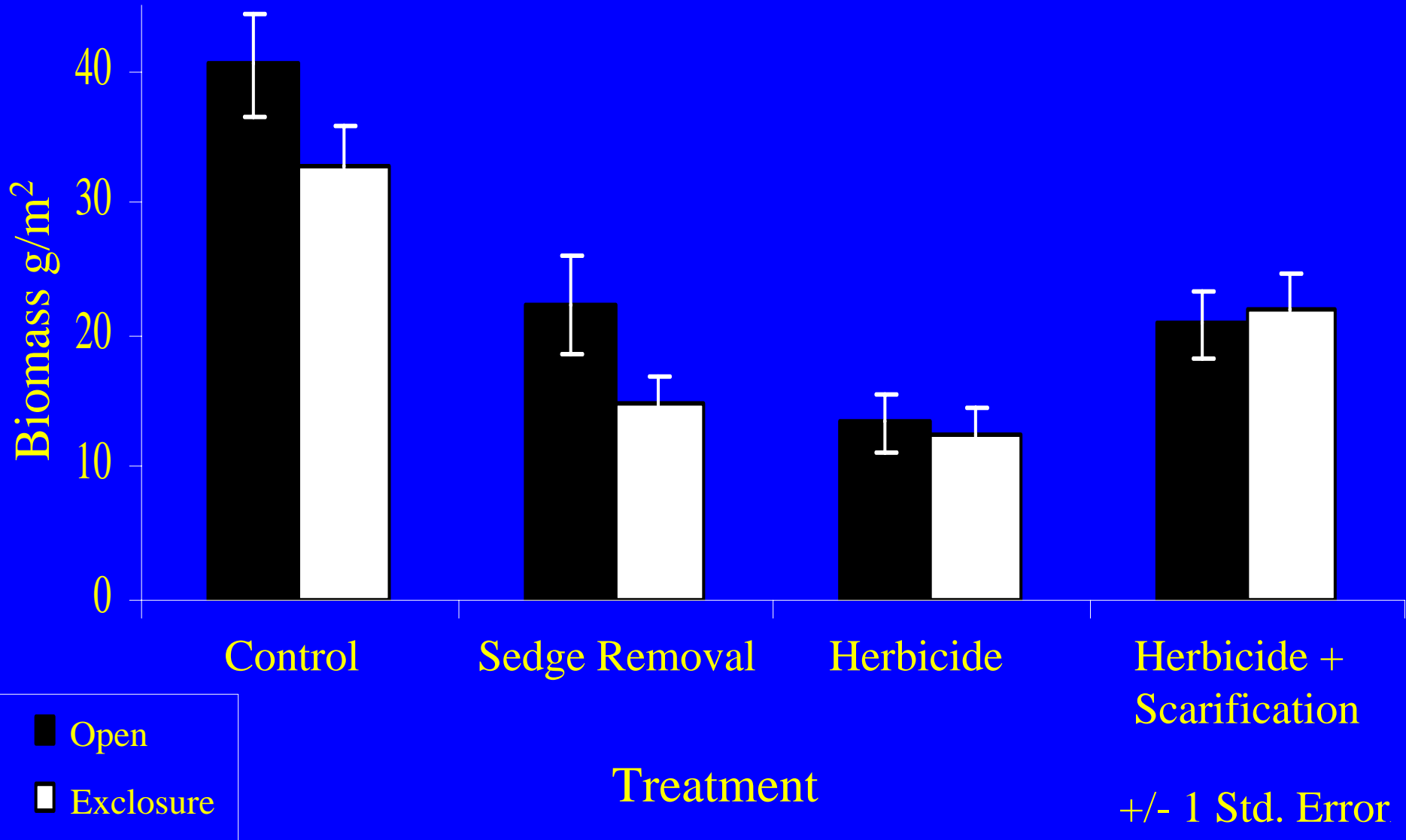
Open to deer = 18 / acre

Deer excluded = 1200 / acre

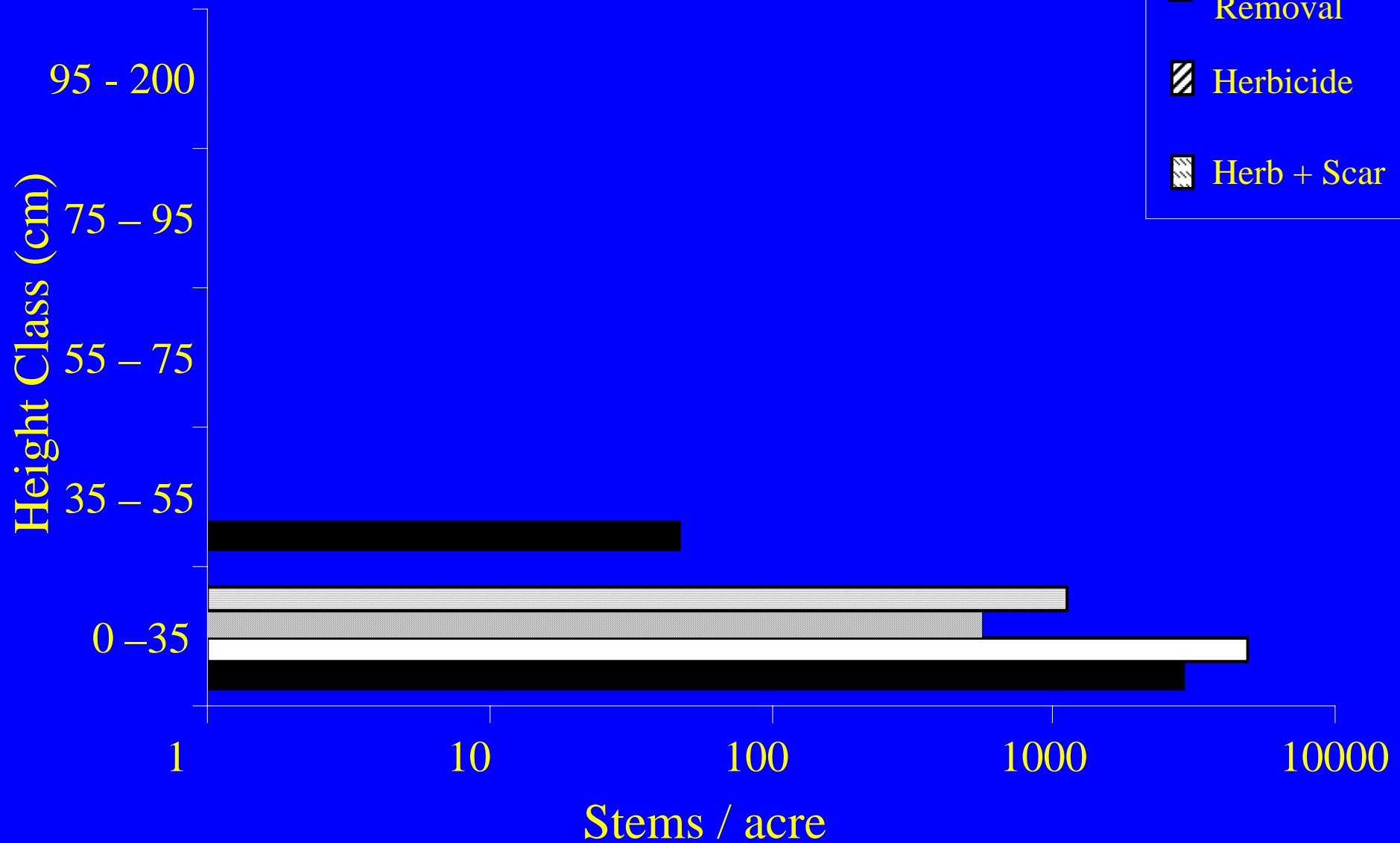




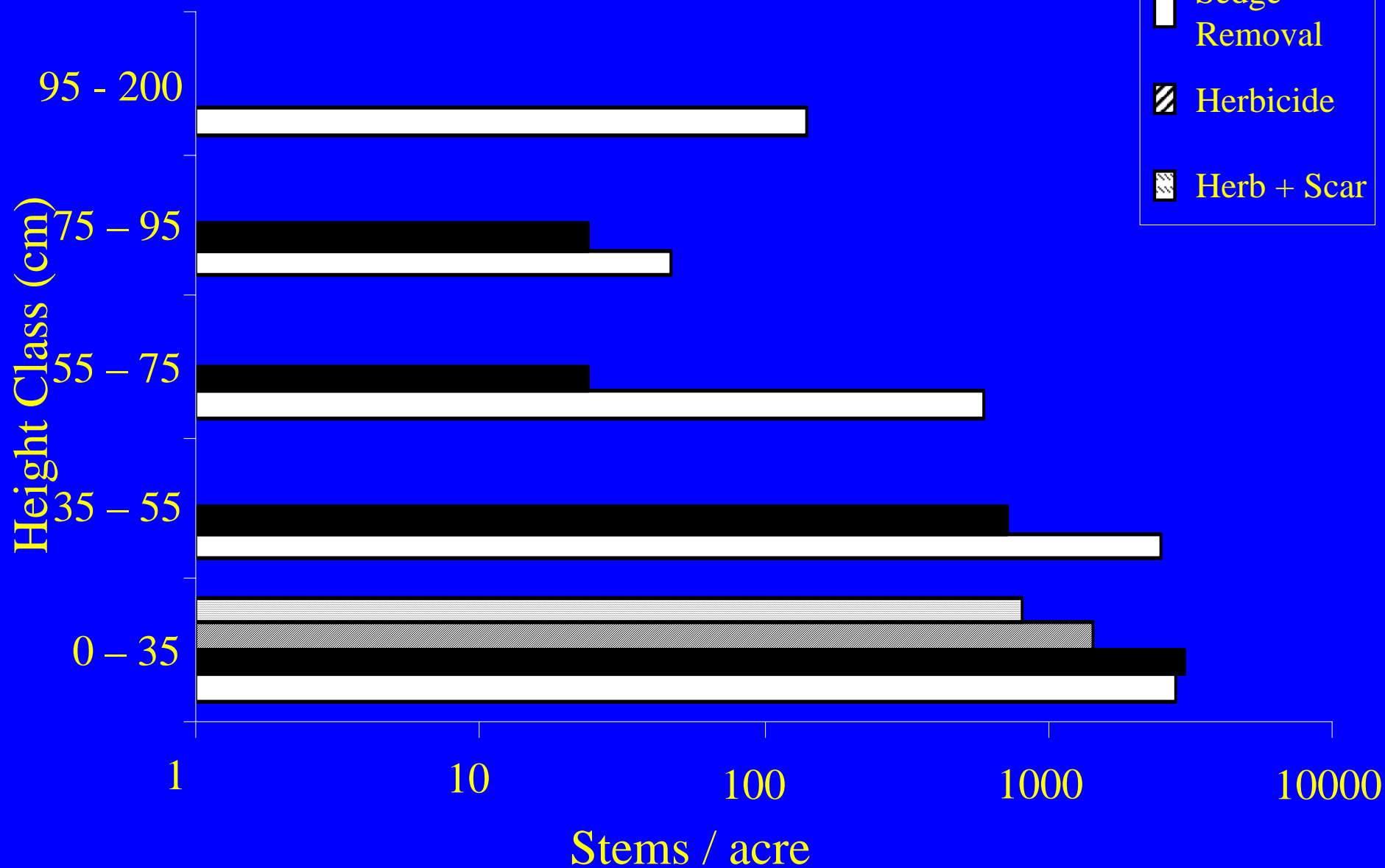
# Sedge biomass (4 years after treatments)



# Height distribution of sugar maple seedlings – Open to deer browsing



# Height distribution of sugar maple seedlings - Deer browsing excluded



# Sugar maple seedling survival

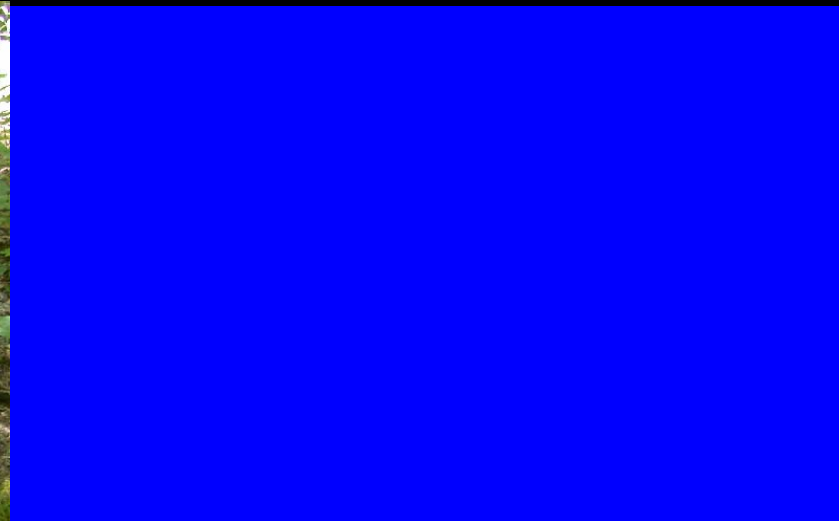
(4 growing seasons)

<u>Treatment</u>	<u>Deer excluded</u>	<u>Open to deer</u>
Control	63	24
Sedge Removal	56.5	22
Herbicide	78.4	25
Herbicide + Scarification	73.6	29

## Control areas – deer excluded



# Sedge Removal – deer excluded



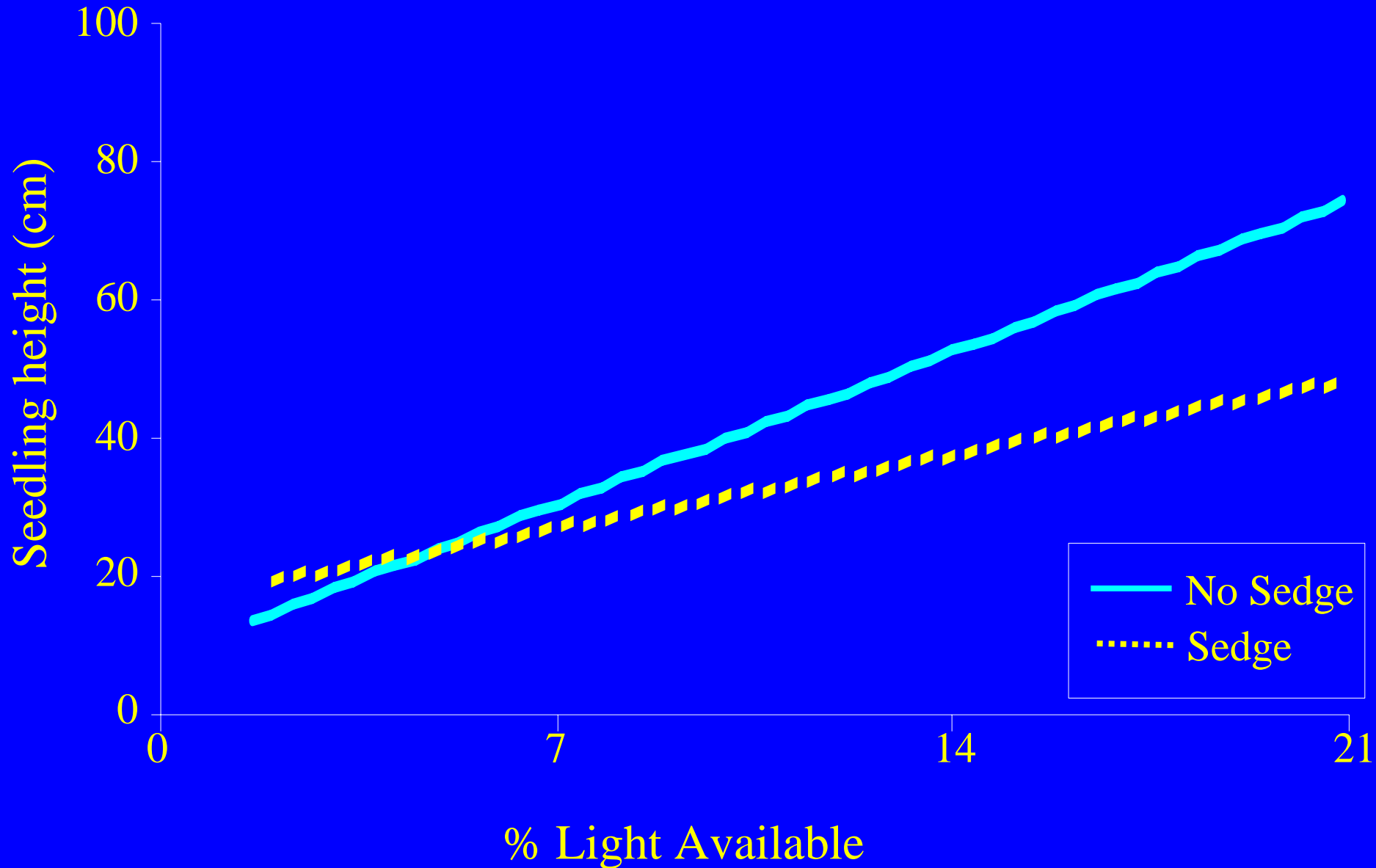


Does light and sedge have an effect on sugar maple seedling growth and survival?





# Sugar maple seedling height (4 years after vegetation removal)



Can timed herbicide applications effectively control sedge while reducing the impacts to non-target species such as seedlings and herbs?



Control areas



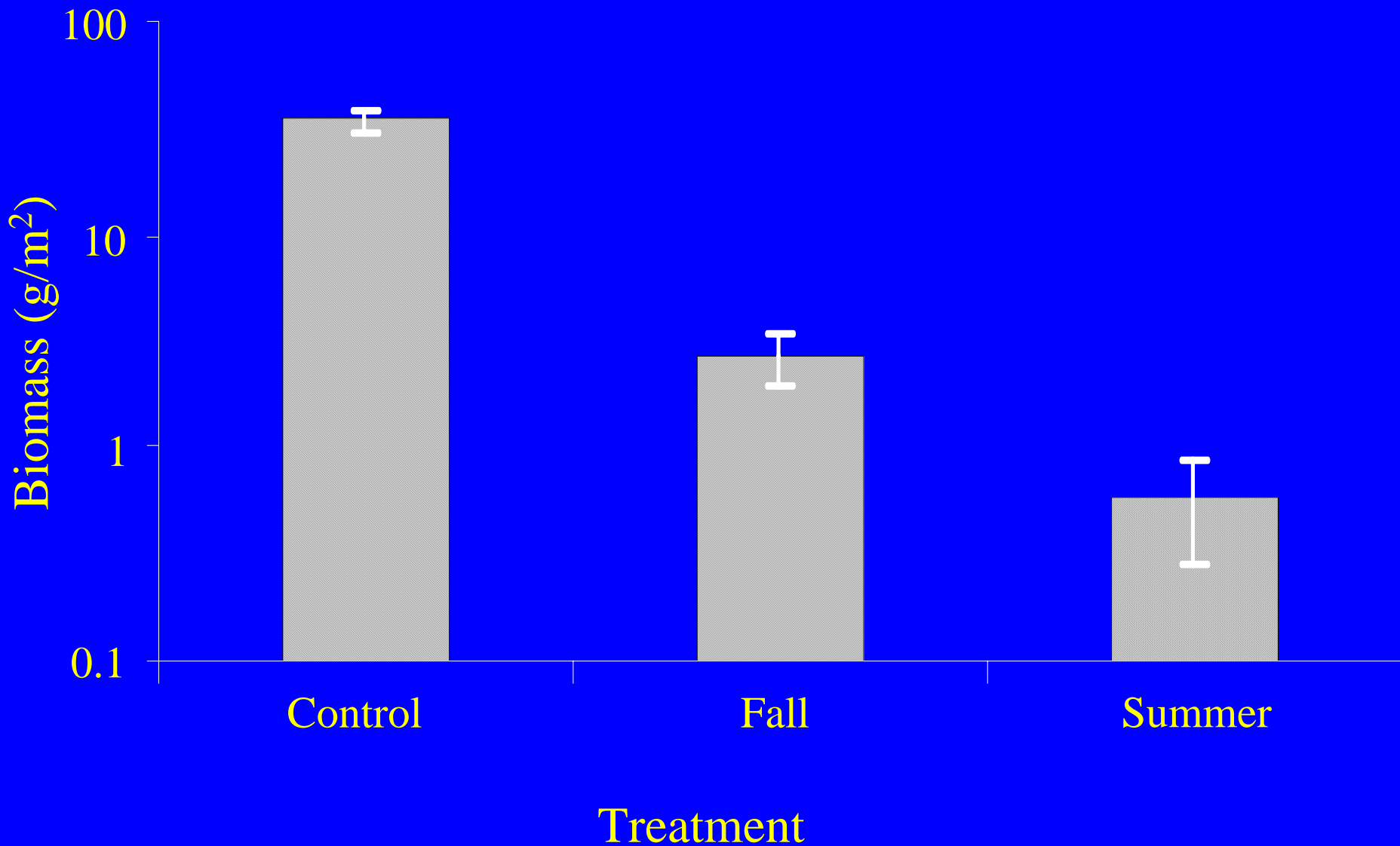
Summer application



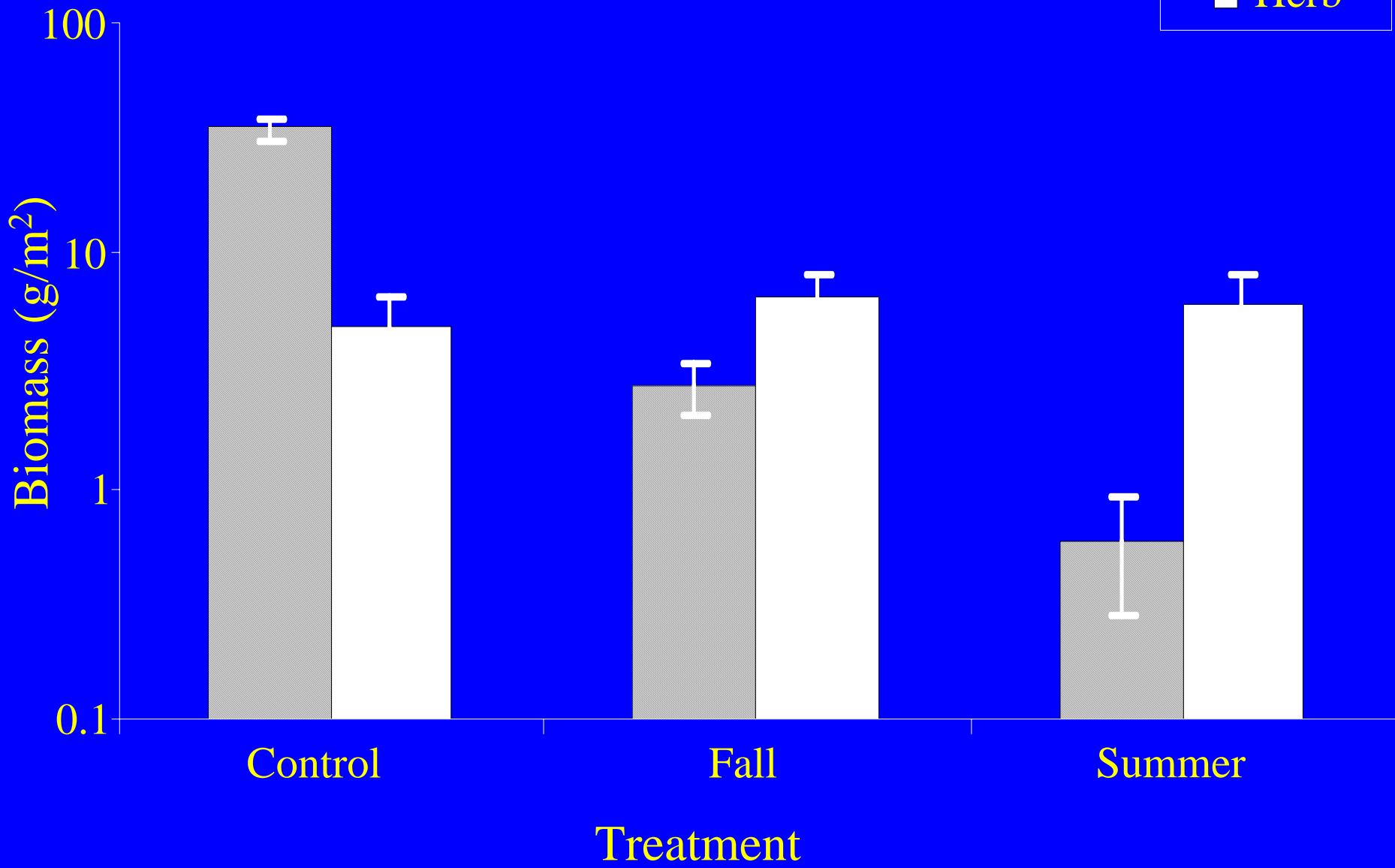
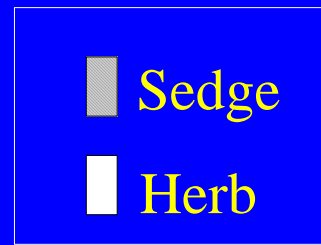
Fall application

# Sedge biomass

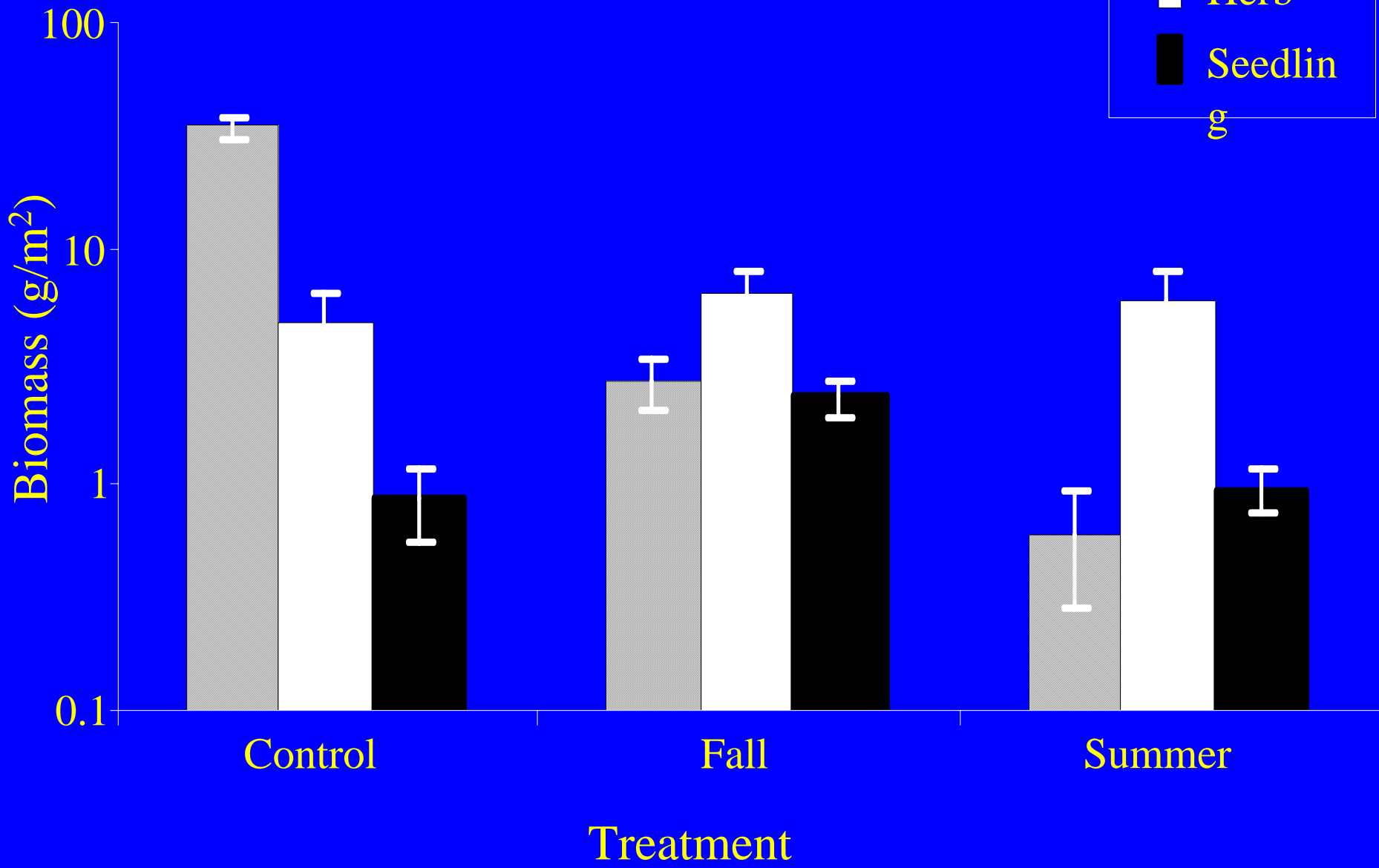
(Harvested 2 years after treatment)



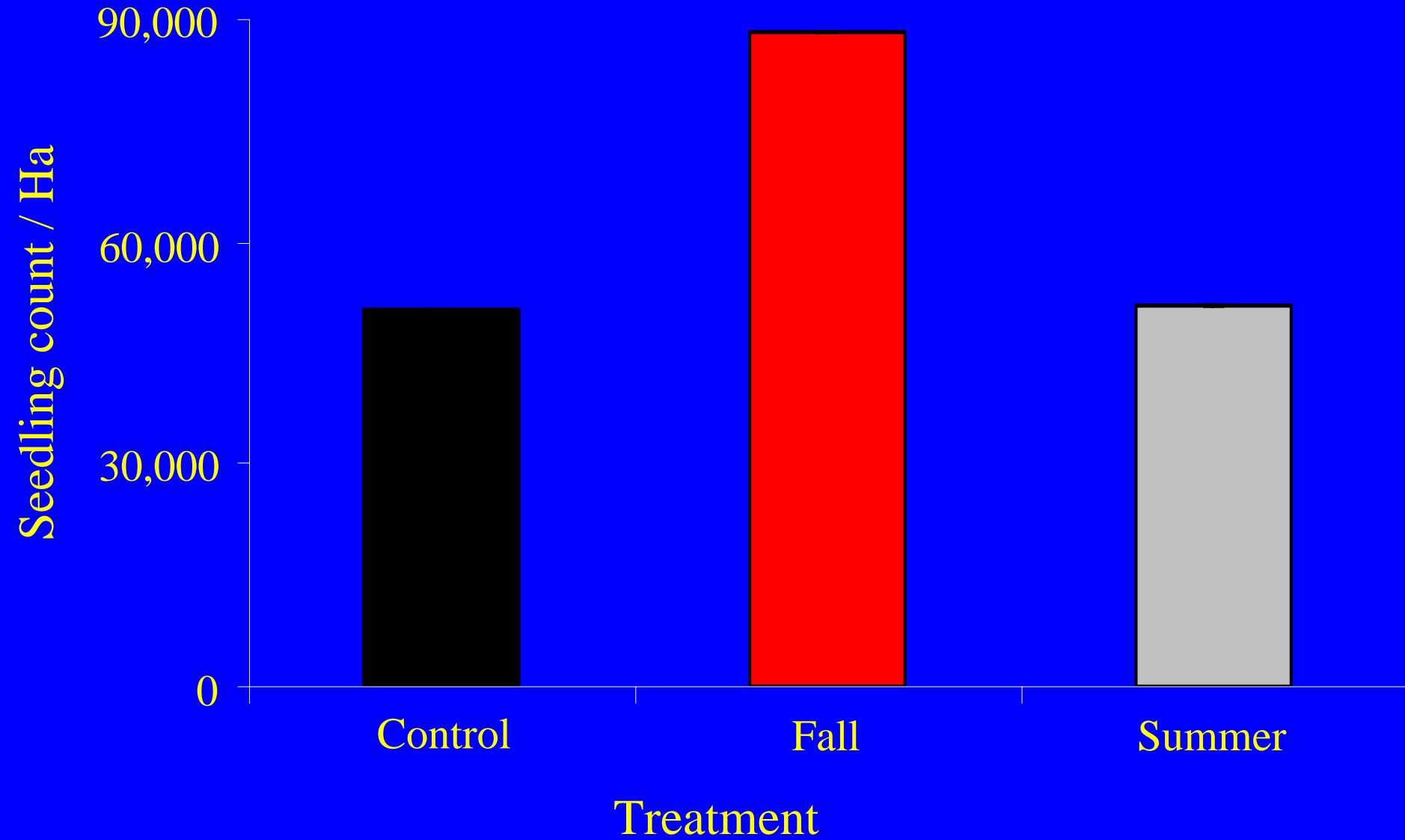
# Vegetation biomass (Harvested 2 years after treatment)



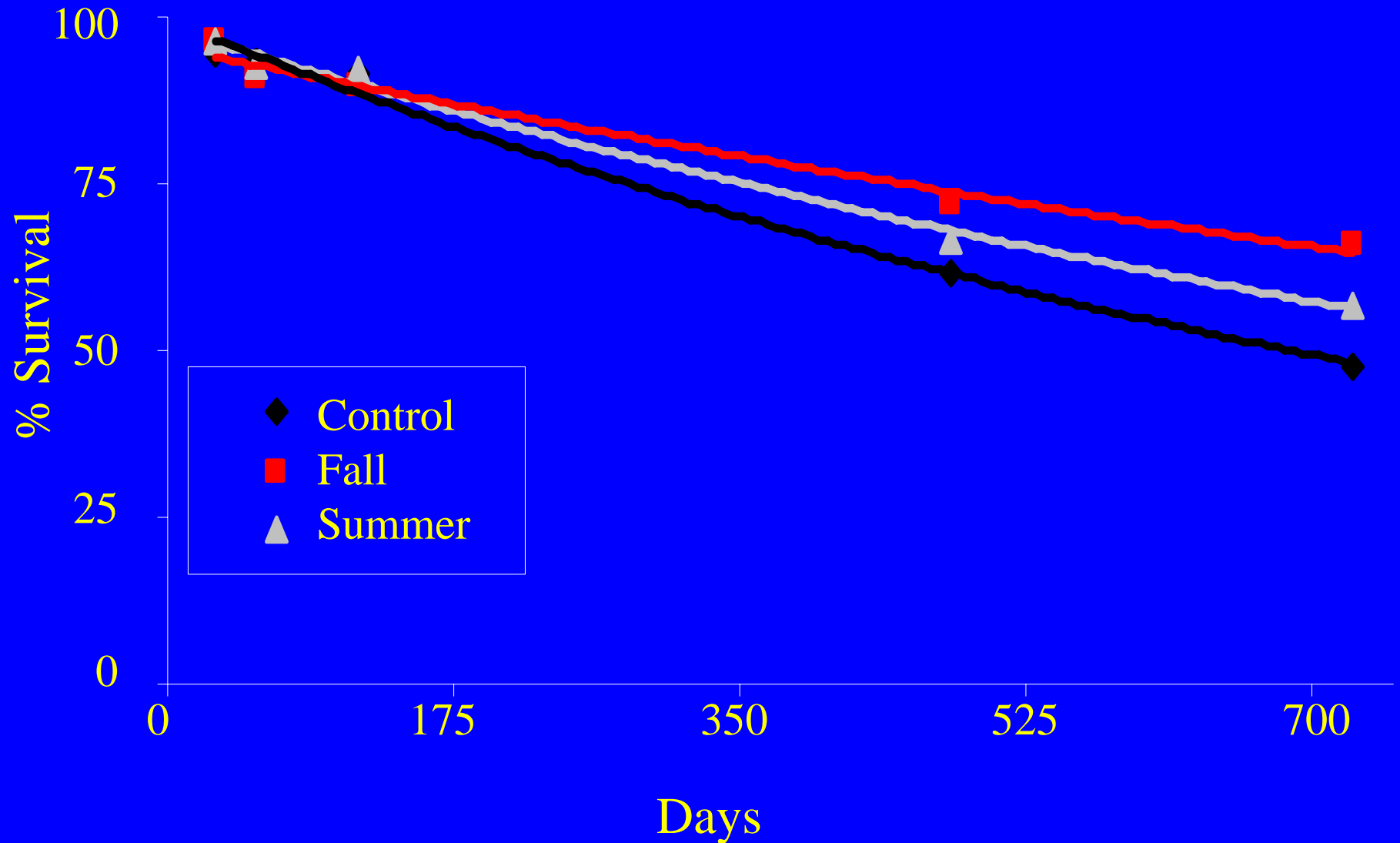
# Vegetation biomass (Harvested 2 years after treatment)



# Sugar Maple Germinants

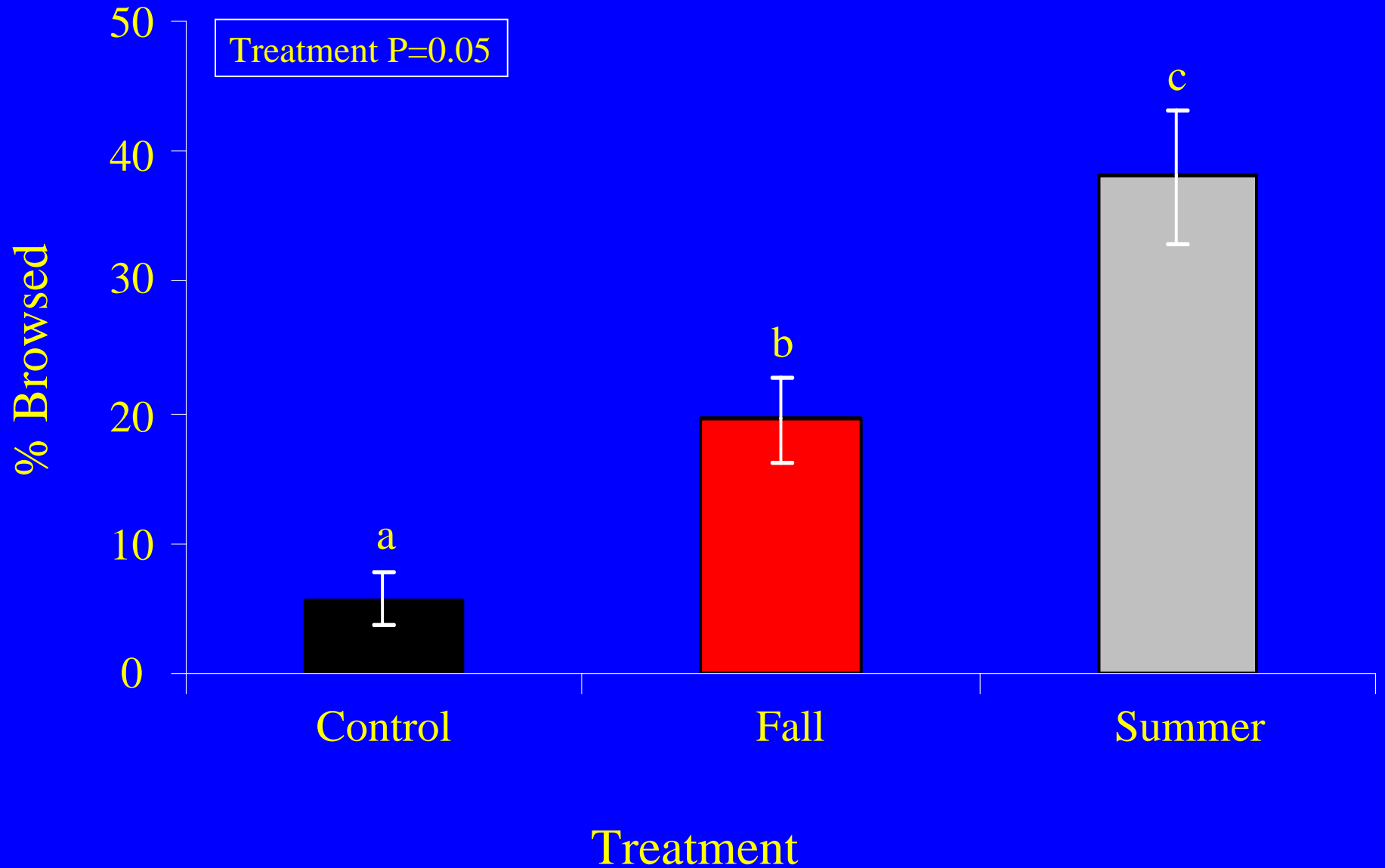


# Timed herbicide application – seedling survival (726 days)





# Sugar maple seedlings browsed



## Management Recommendation

1) If deer densities are reduced the forests will regenerate

### Caution:

- What you have now is what you will have in the future  
e.g. ironwood seedlings = ironwood saplings
- Thus your treatments will depend on what you have or don't have as advanced regeneration

## Management Recommendation

### 2) Apply a broad-spectrum herbicide in mid-late fall

- Fall application effectively controls sedge
- ↑ the number of seedling germinants
- ↑ seedling survival
- ↓ mortality of non-target herb species and advanced seedling regeneration

## Management Recommendation

- 3) If you treat in the fall, opening the canopy up and leaving large seed trees may increase the chance for success
- ↑ seed trees = more germinants
  - ↑ light promotes seedling growth
  - Operationally, removing trees will make aerial and/or ground-based spraying easier





Photo by:  
Don Dickmann

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# 1<sup>st</sup> year seedling germinants

