

Growth and response of four *Vallisneria* taxa to aquatic herbicides

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USDA-ARS

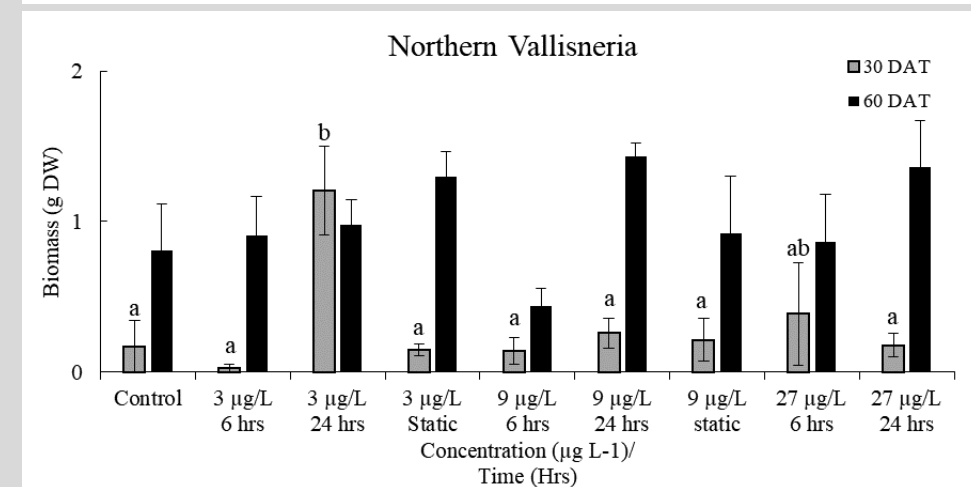
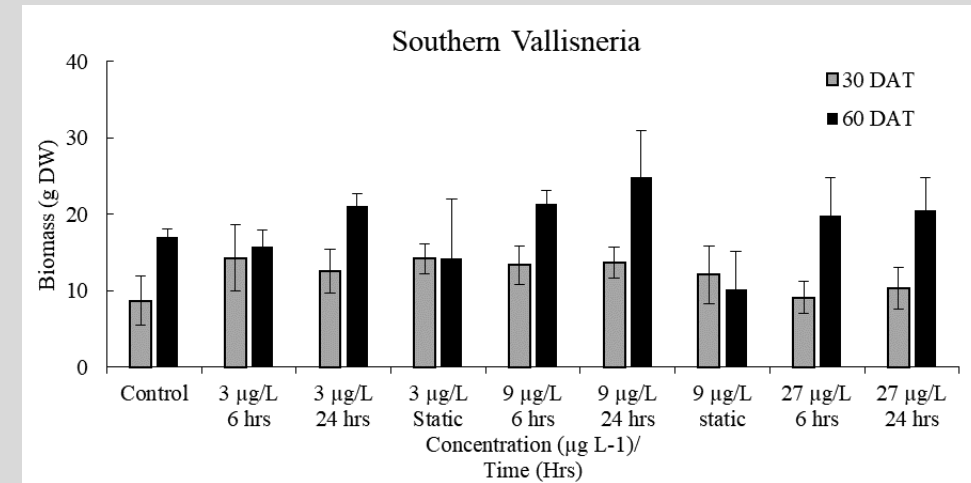
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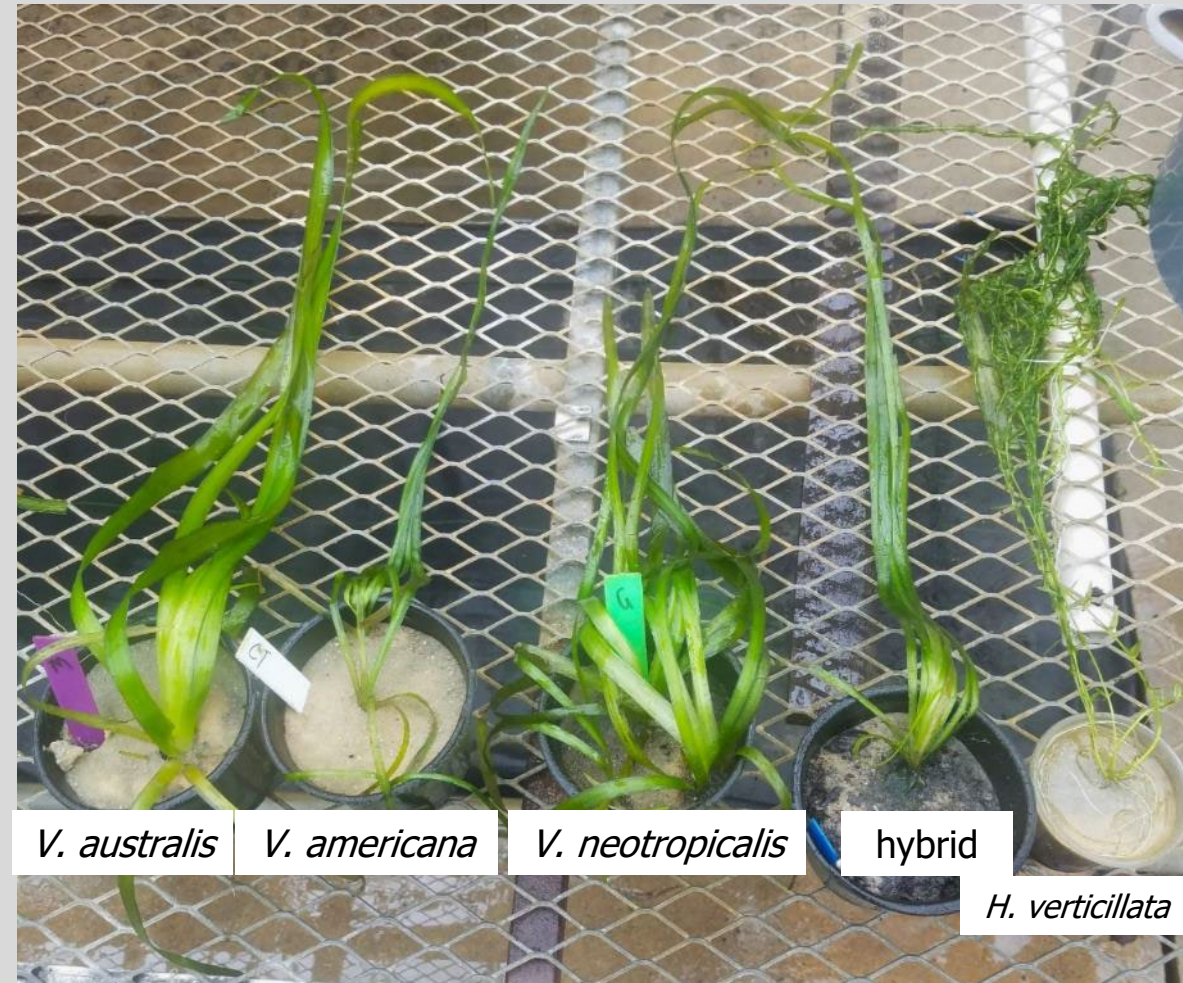
Vallisneria americana

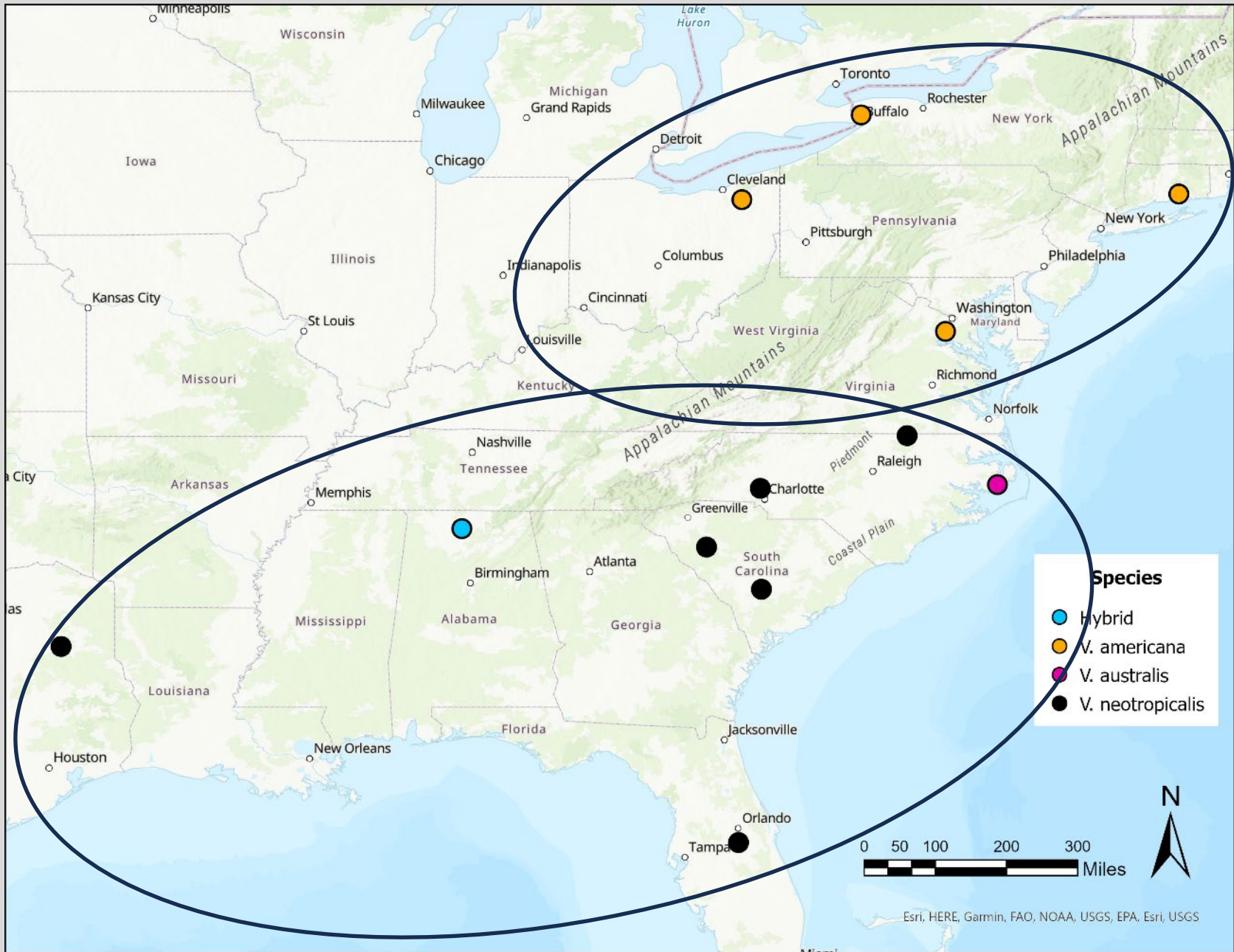
- Desirable for restoration
 - Habitat
 - Food source
 - Soil & water stabilization
- “Narrow-leaf” vs “broad leaf” (Mudge 2013)
- Genetic analysis by Thum lab at MSU
- Resurrecting *Vallisneria neotropicalis* (Martin & Mort 2023)

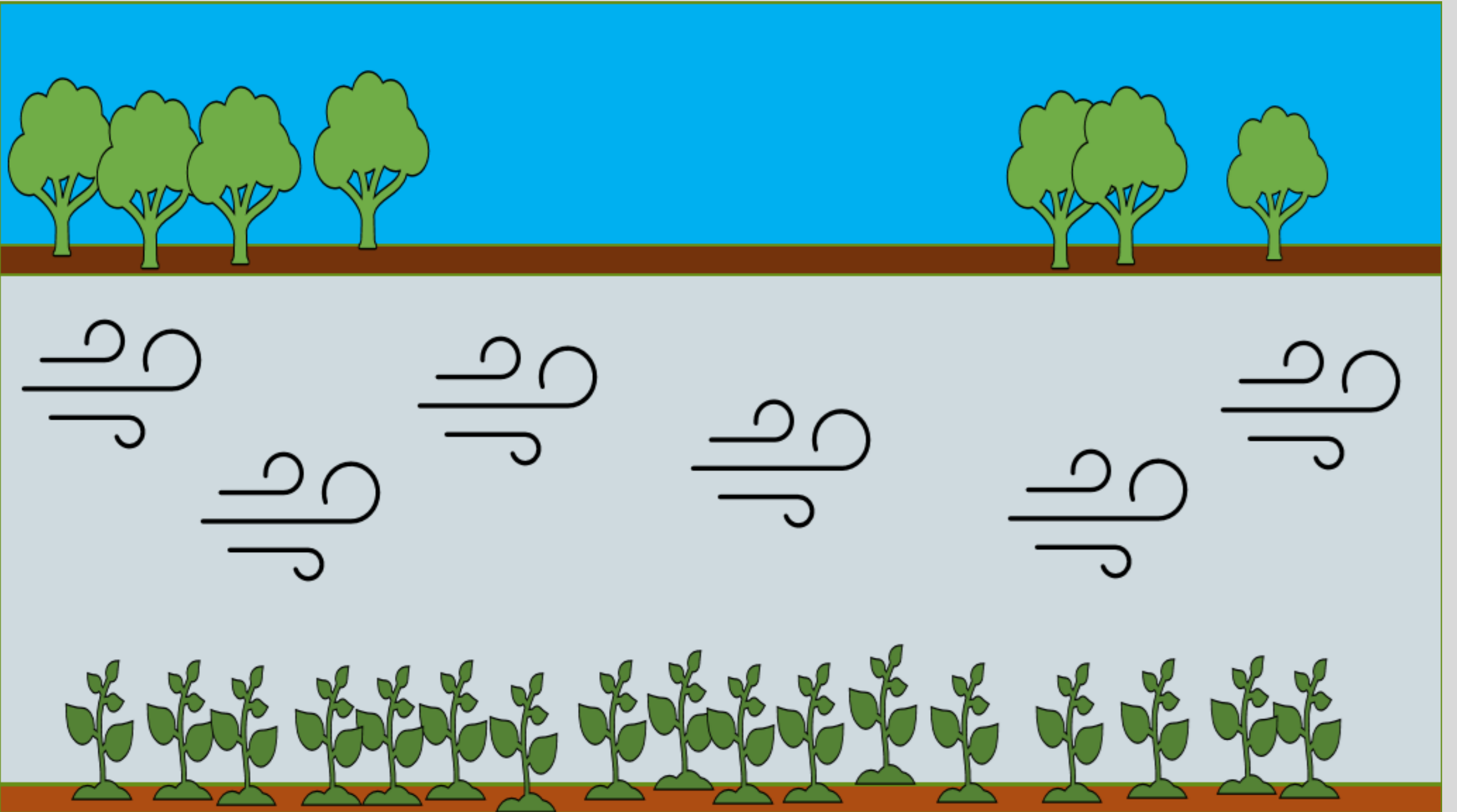


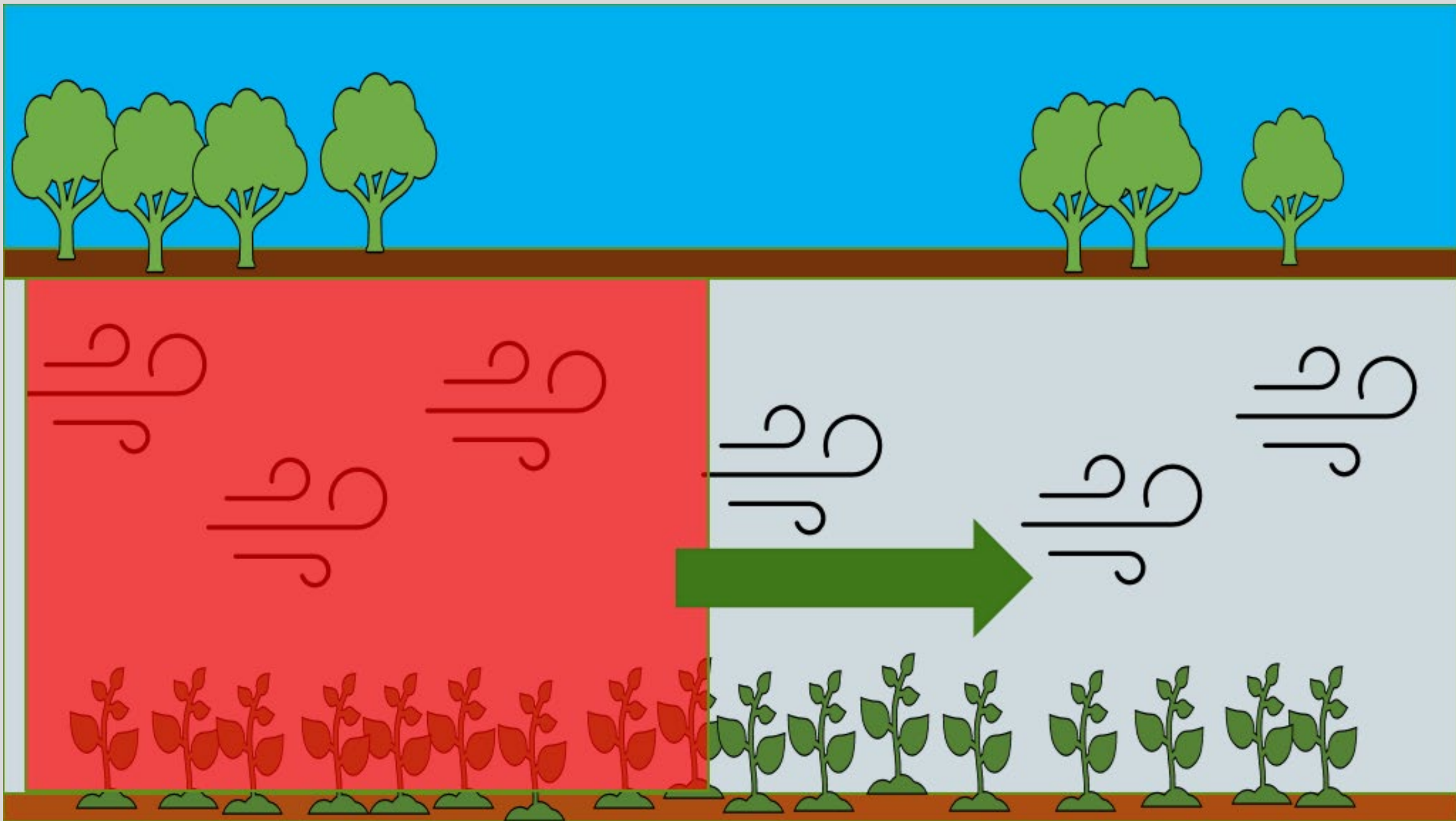
Cryptic *Vallisneria* Taxa

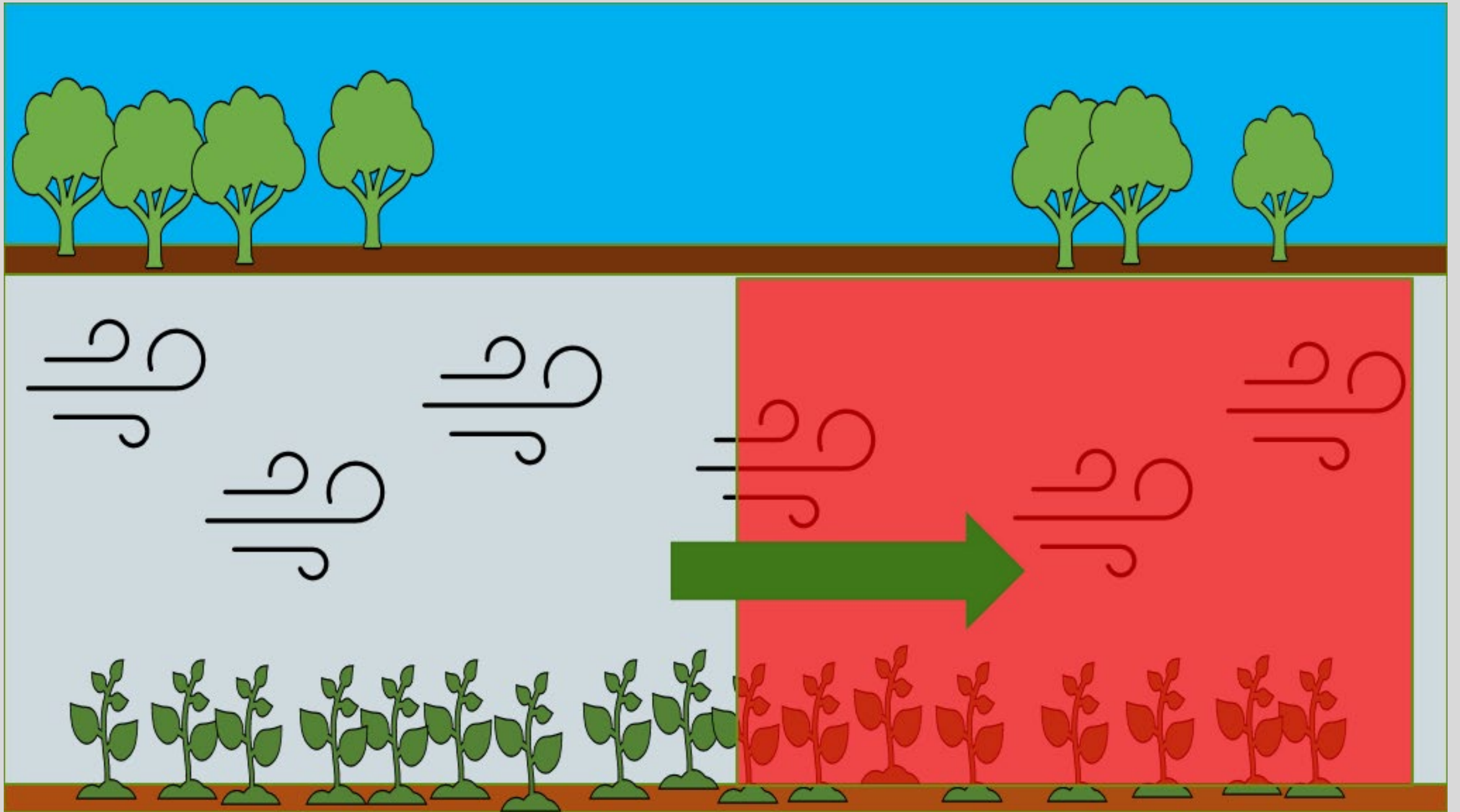
- New cryptic taxa (Gorham et al. 2021, Martin & Mort 2023)
 - *V. americana*
 - Northern distribution
 - *V. neotropicalis*
 - Southern distribution
 - *V. australis* (Invasive)
 - CA, NC, FL
 - *V. spiralis* × *V. denseserrulata* (Invasive)
 - SE US
- Hydrilla (Invasive)





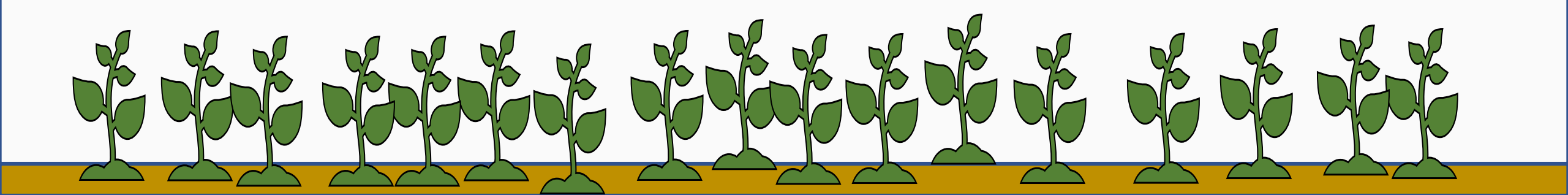
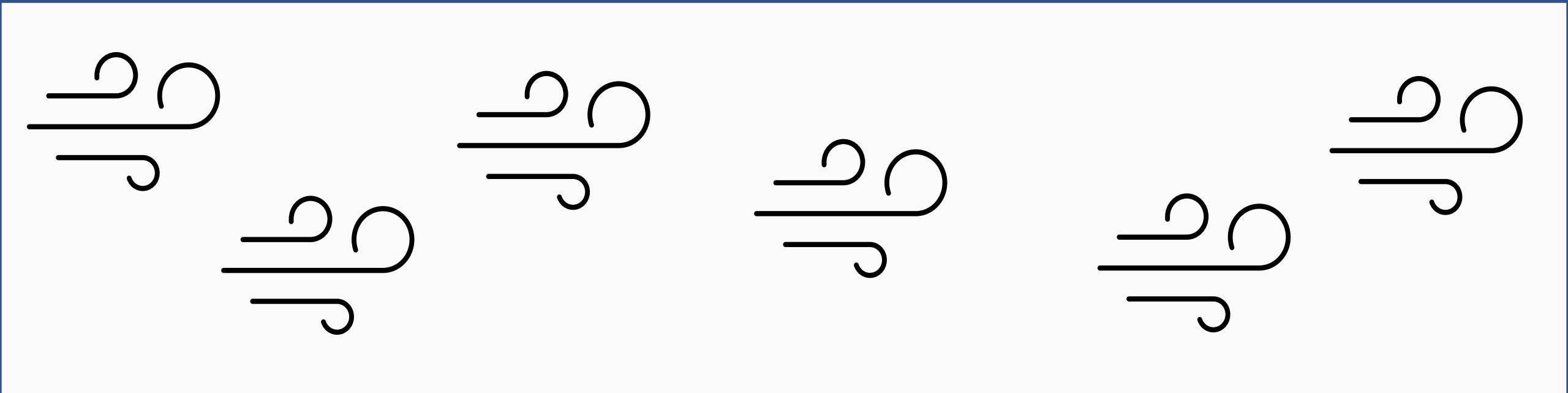
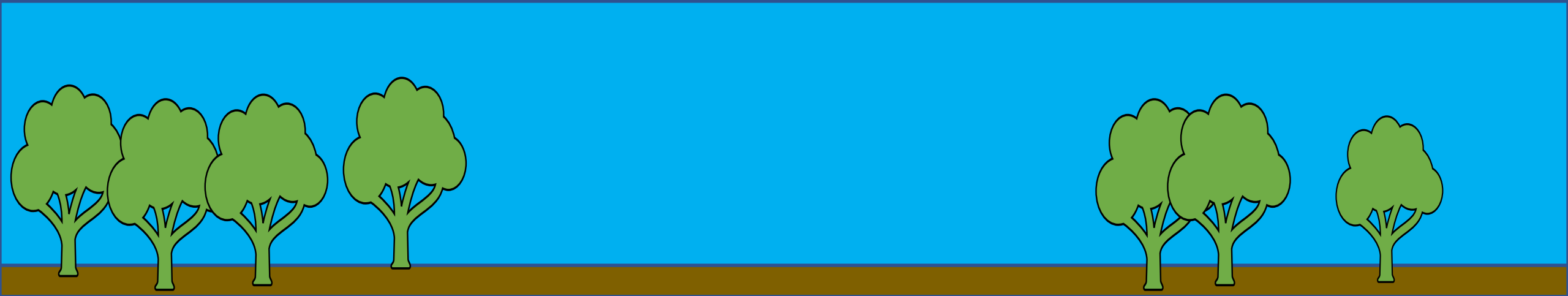


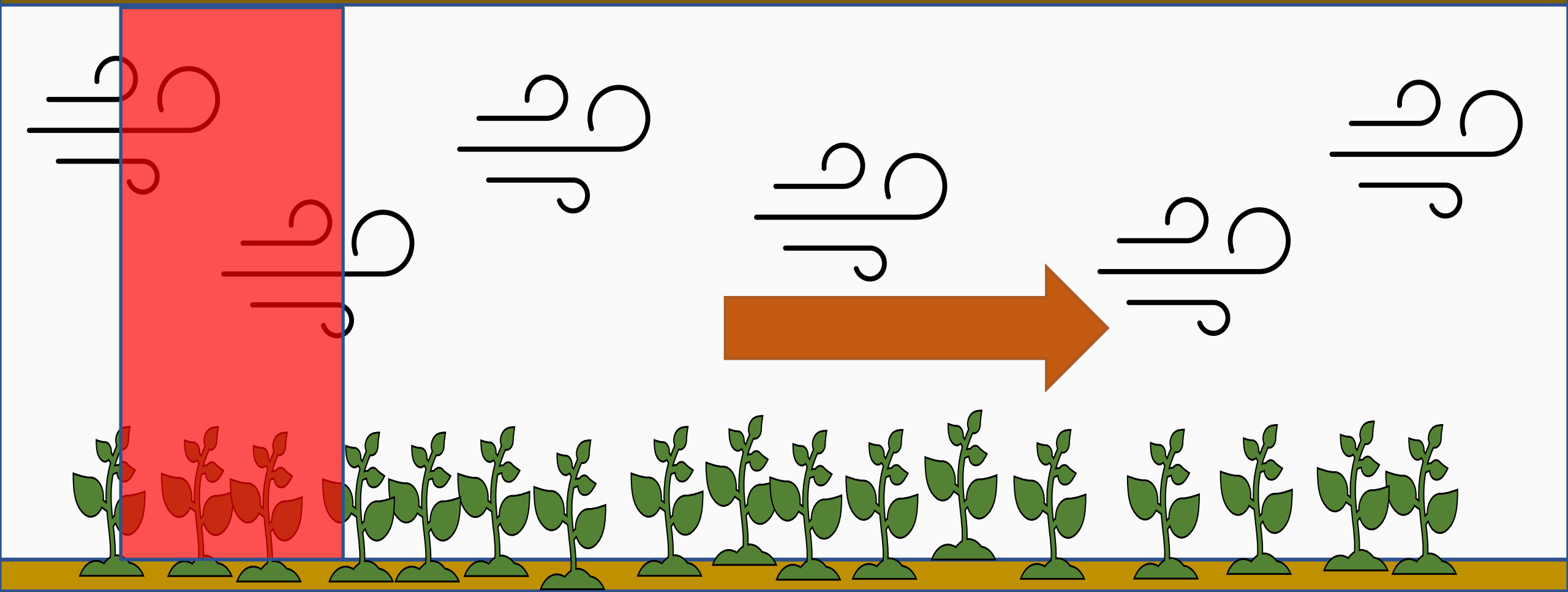


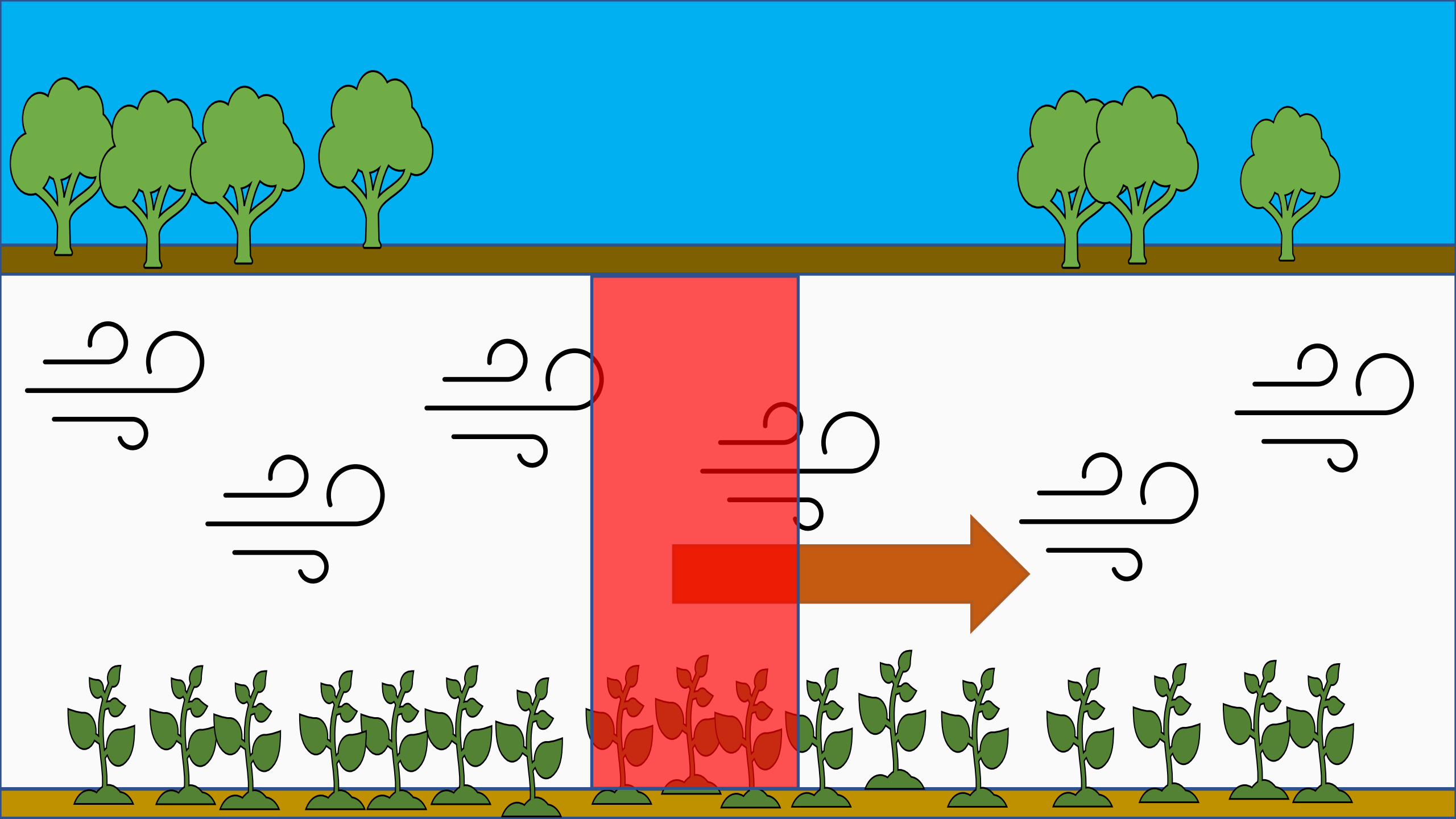


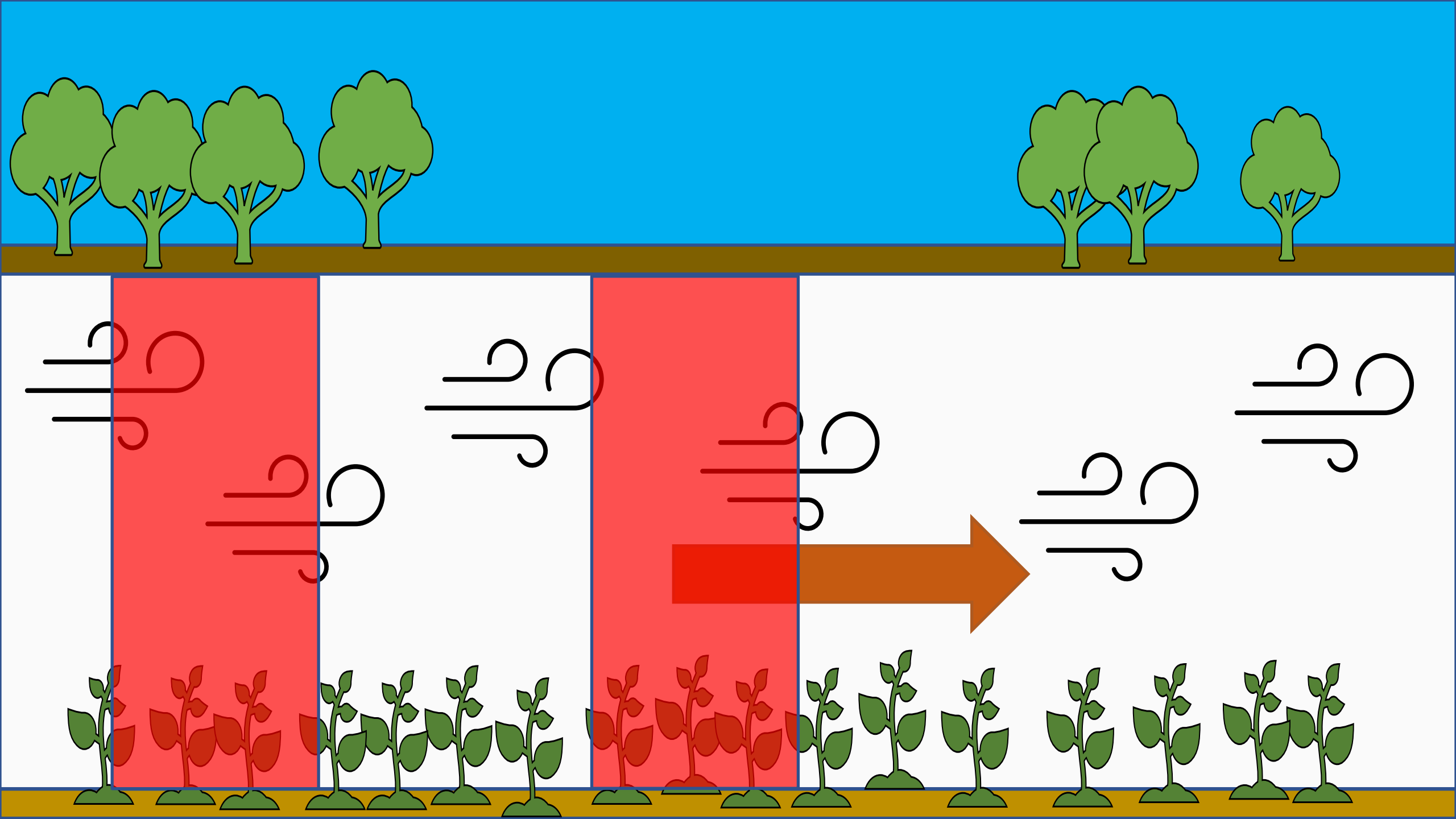
Intermittent Exposures/Applications

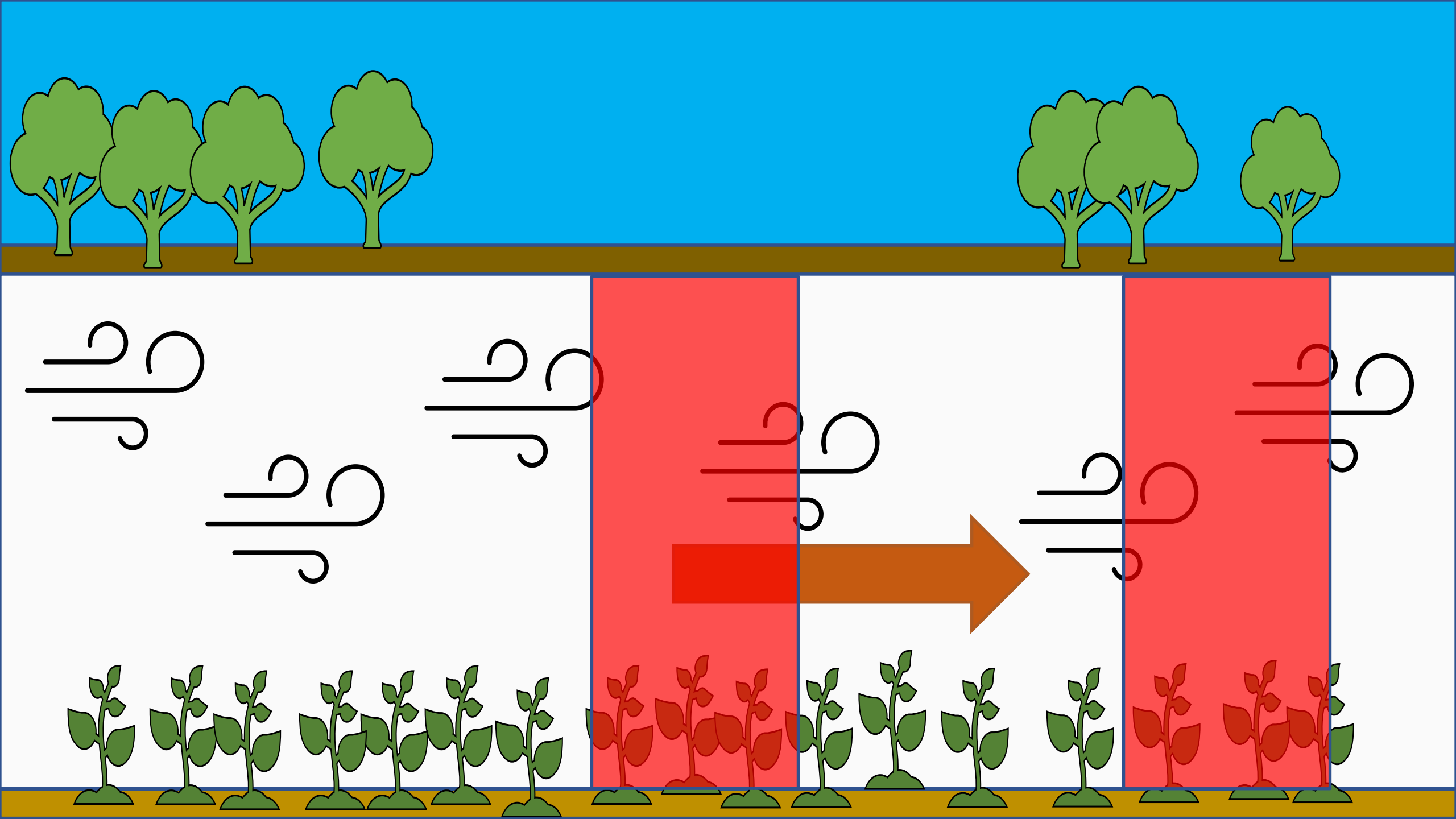
- What happens if we can't maintain longer exposure times
 - Dynamic or tidal systems
- Intermittent fluridone exposures resulted in similar hydrilla response compared to continuous exposure (Netherland 2015)
- Can we use this to improve SAV control?

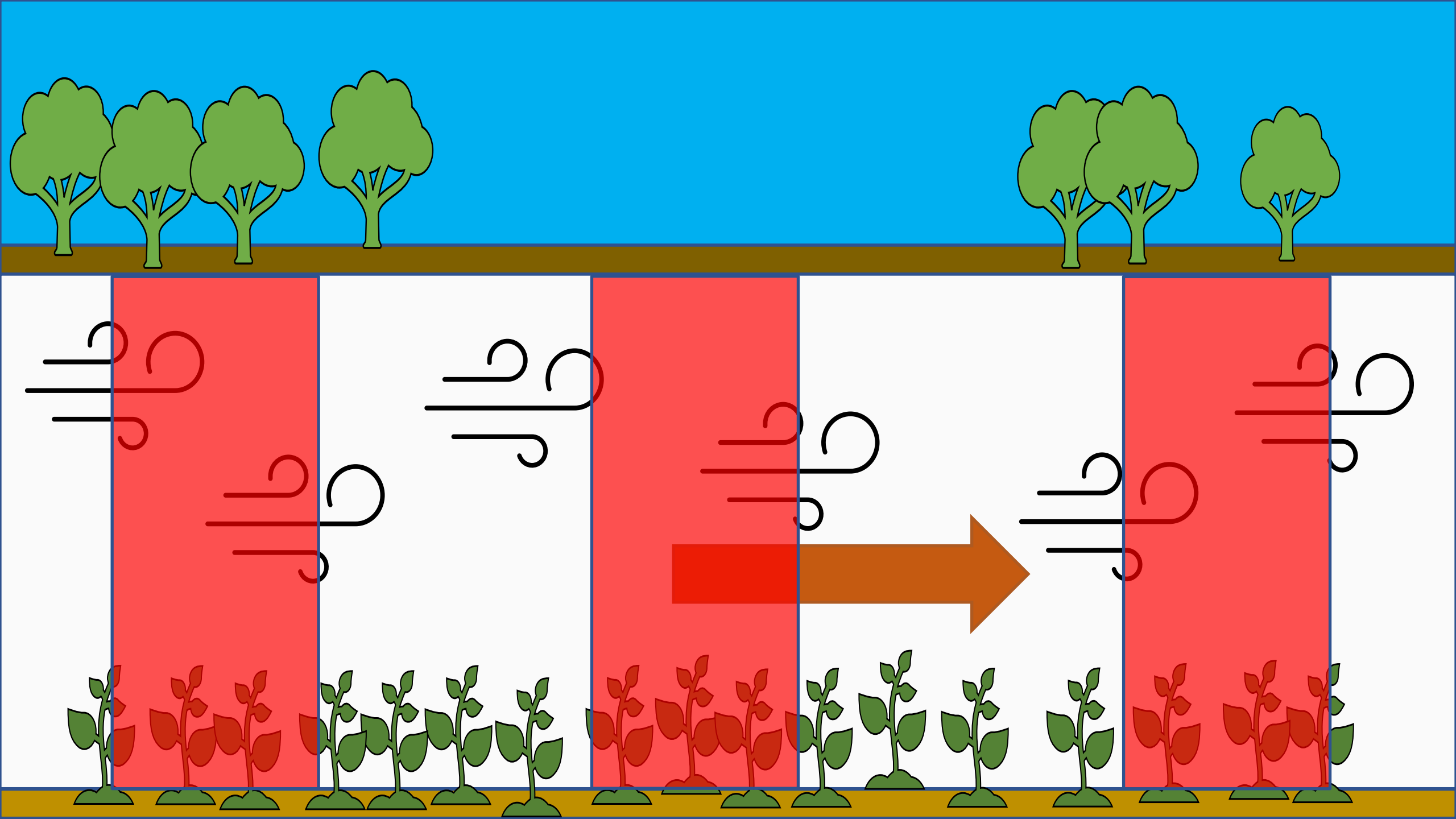












Research Questions

Cryptic *Vallisneria*

Do invasive *Vallisneria* taxa respond similar to native species to herbicides?

Are there growth differences between these taxa?

Can hydrilla management intended for lotic systems be selective?



Methods

- 16-L mesocosms
- Each mesocosm contained
 - *V. americana*
 - *V. neotropicalis*
 - *V. spiralis* × *V. denseserrulata* hybrid
 - *V. australis*
 - Hydrilla
- Select treatments from NCSU & UF hydrilla experiments
- In water application
- Placed in new mesocosm to end exposure
- Harvest 6 weeks after treatment



| Herbicide | Rate | Exposure |
|--------------------------------------|-------------------|-----------------------------|
| Diquat | 0.37 ppm | 12 hours |
| Endothall | 2 ppm | 12 hours |
| Endothall | 3 ppm | 24 hours |
| Endothall | 3 ppm | 8 hours / 40-hour rest (3X) |
| Endothall Diquat | 2 ppm 0.37 ppm | 12 hours |
| Florpyrauxifen-benzyl | 30 ppb | 72 hours |
| Florpyrauxifen-benzyl | 30 ppb | 24 hours / 6-day rest (3X) |
| Endothall Florpyrauxifen-benzyl | 2 ppm 30 ppb | 48 hours |
| Florpyrauxifen-benzyl Flumioxazin | 30 ppb 300 ppb | 48 hours |
| Fluridone | 10 ppb | 45 days |
| Fluridone | 10 ppb | 15 days / 6-day rest (3X) |

Results

Vallisneria americana



Vallisneria neotropicalis



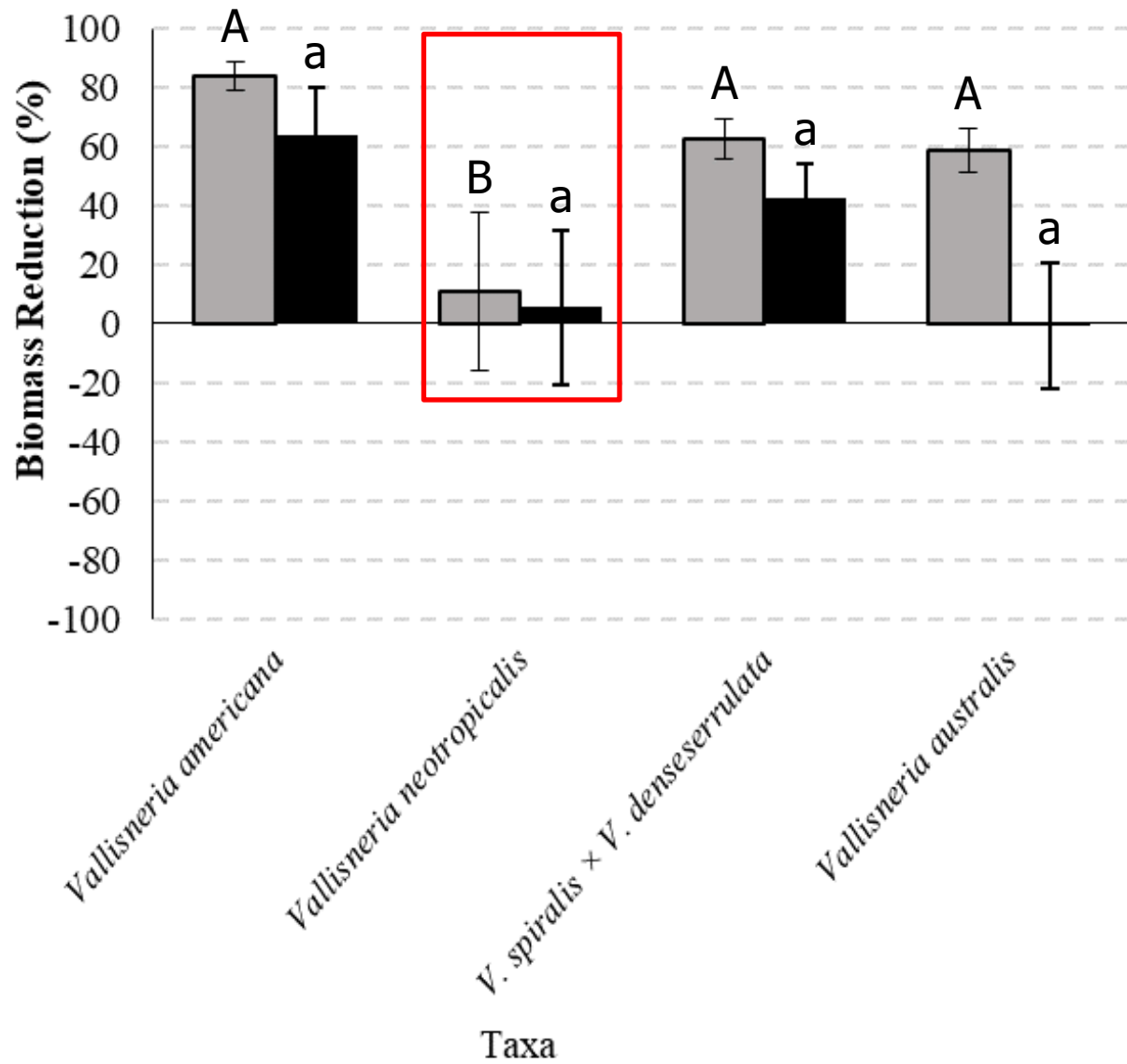
V. spiralis ×
V. denseserrulata



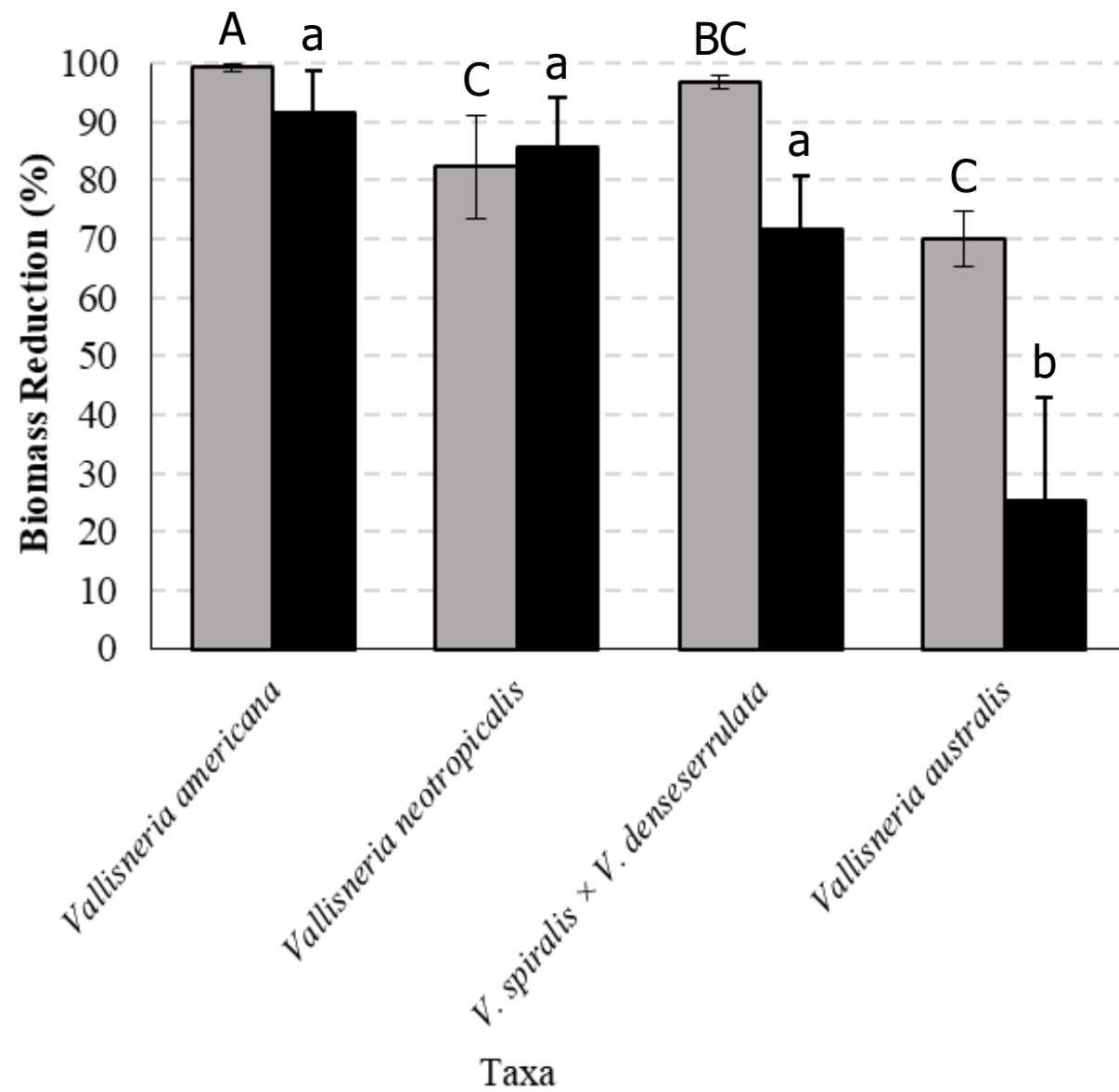
Vallisneria australis



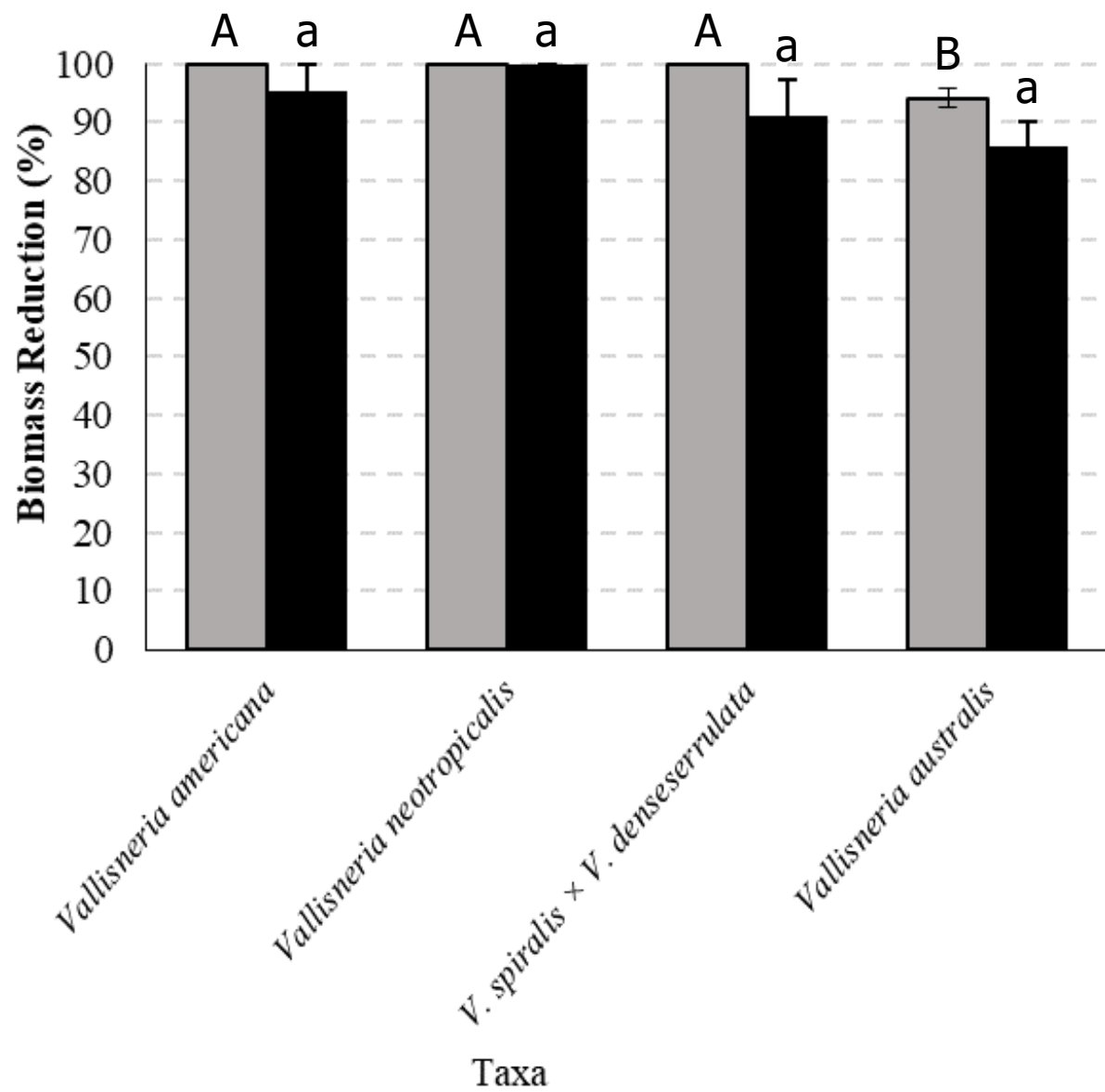
Diquat 0.37 ppm (12-hr)



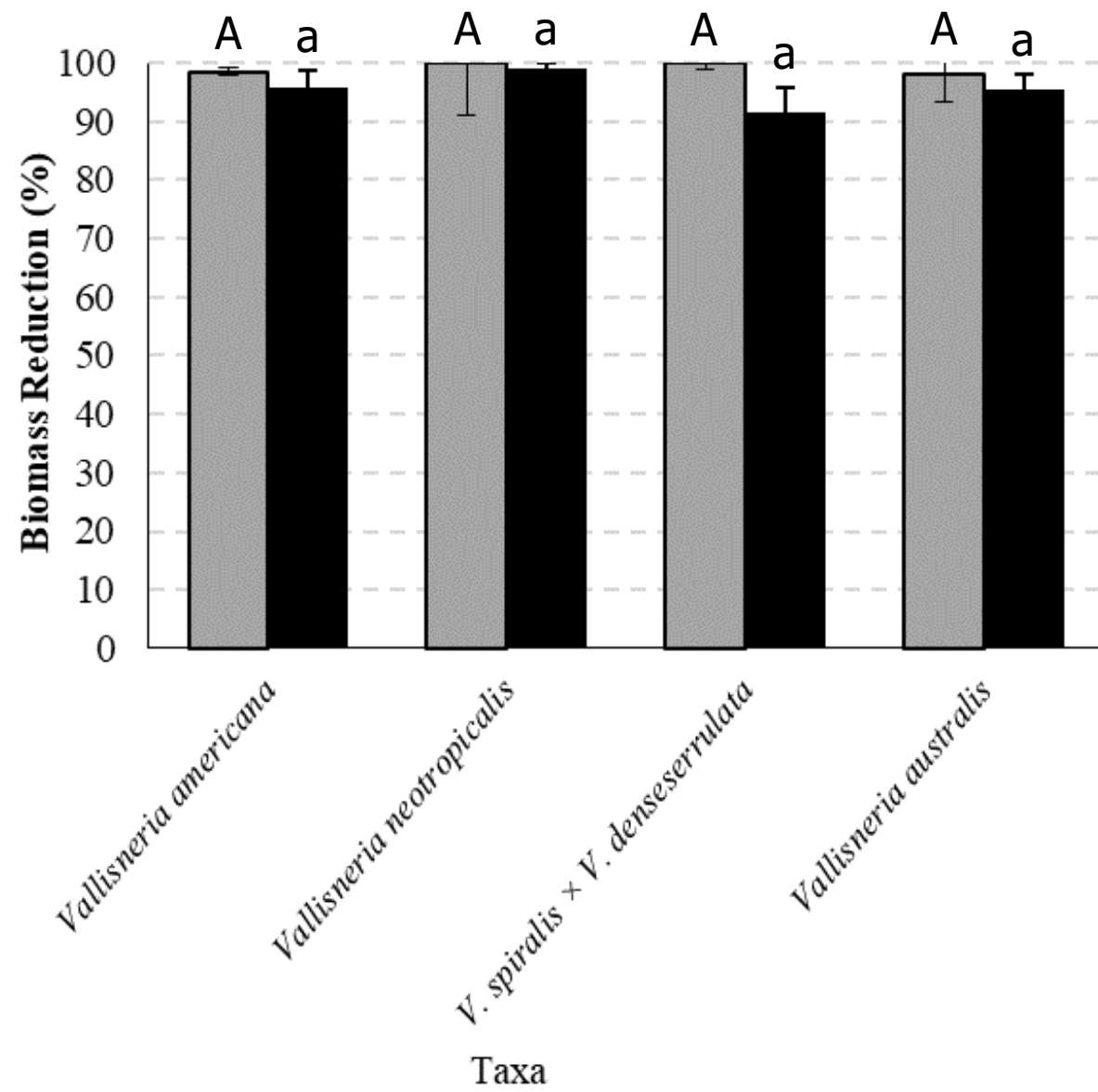
Endothall 2 ppm (12-hr)



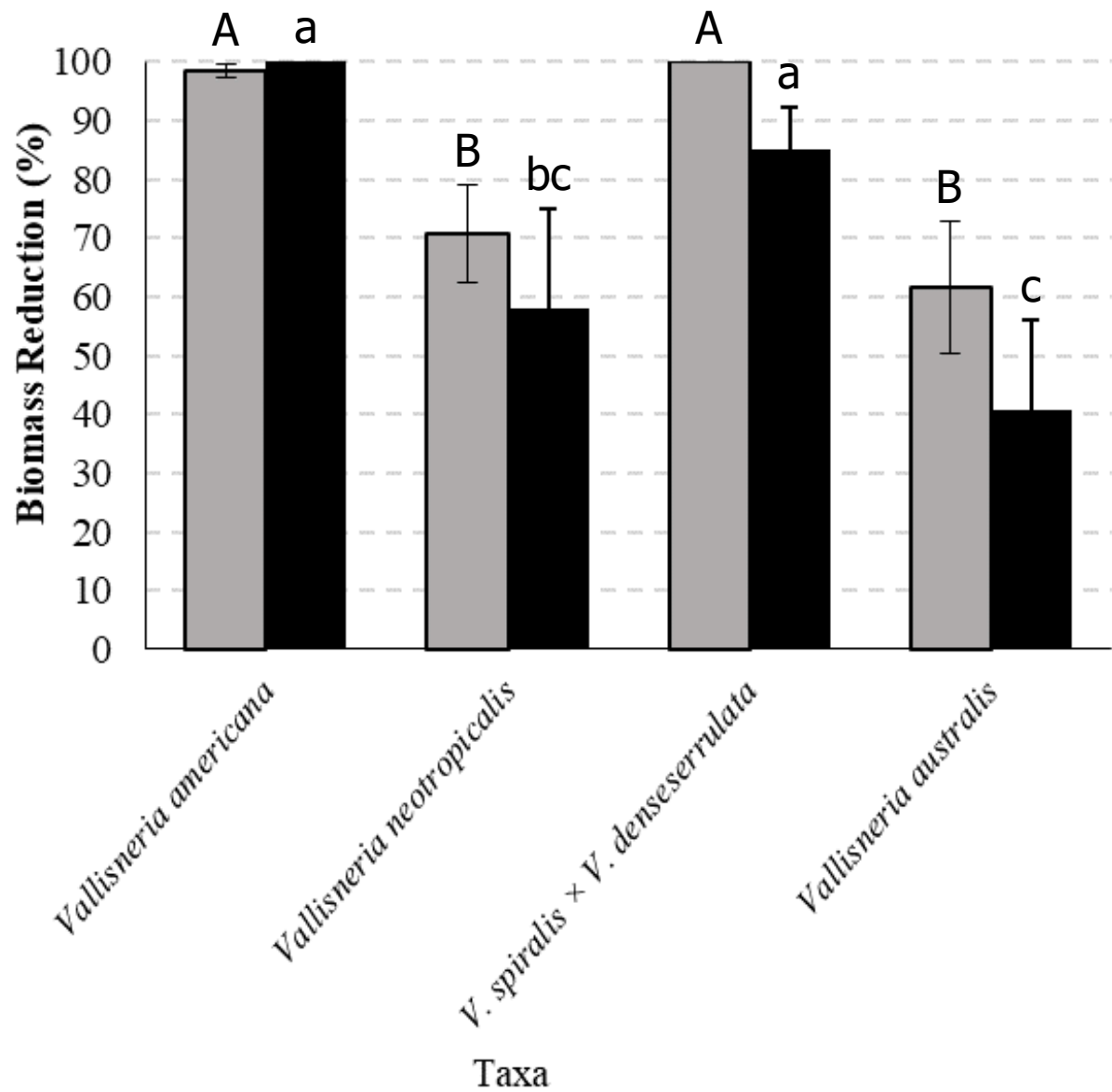
Endothall 3 ppm (24-hr)



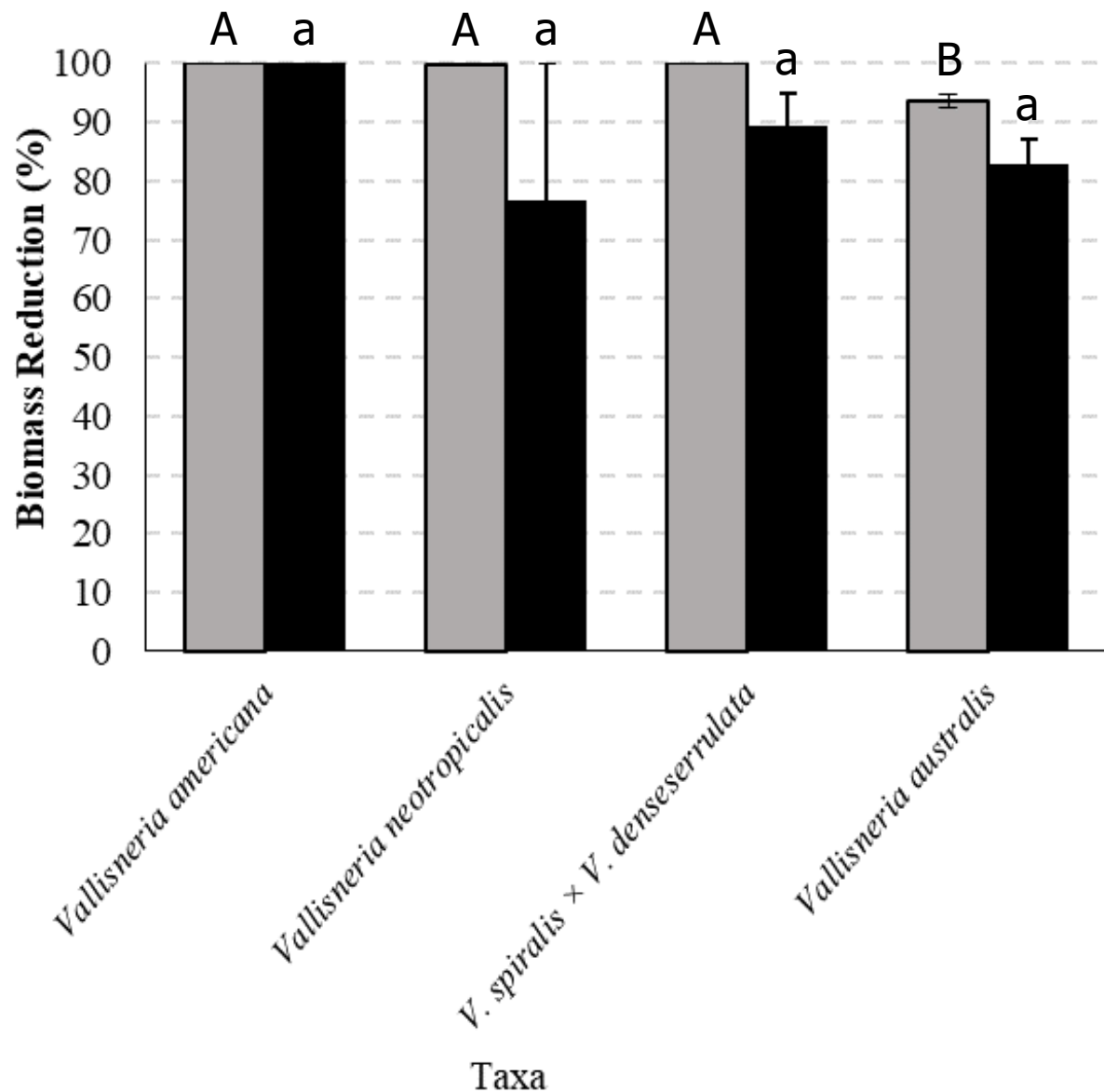
Endothall 3 ppm (8-hr + 40-hr rest) [3x]



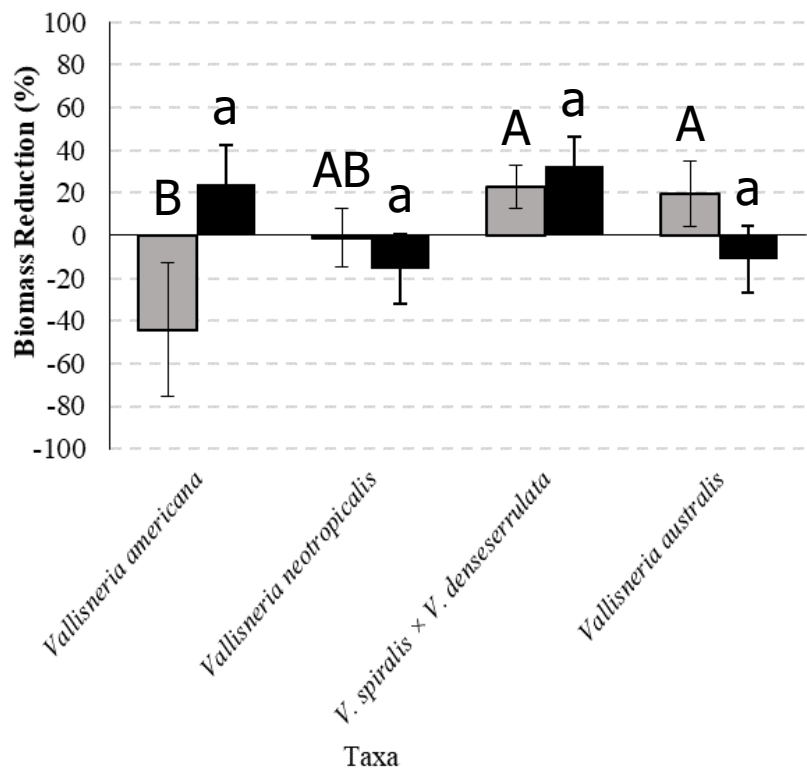
Endothall 2 ppm + Diquat 0.37 ppm (12-hr)



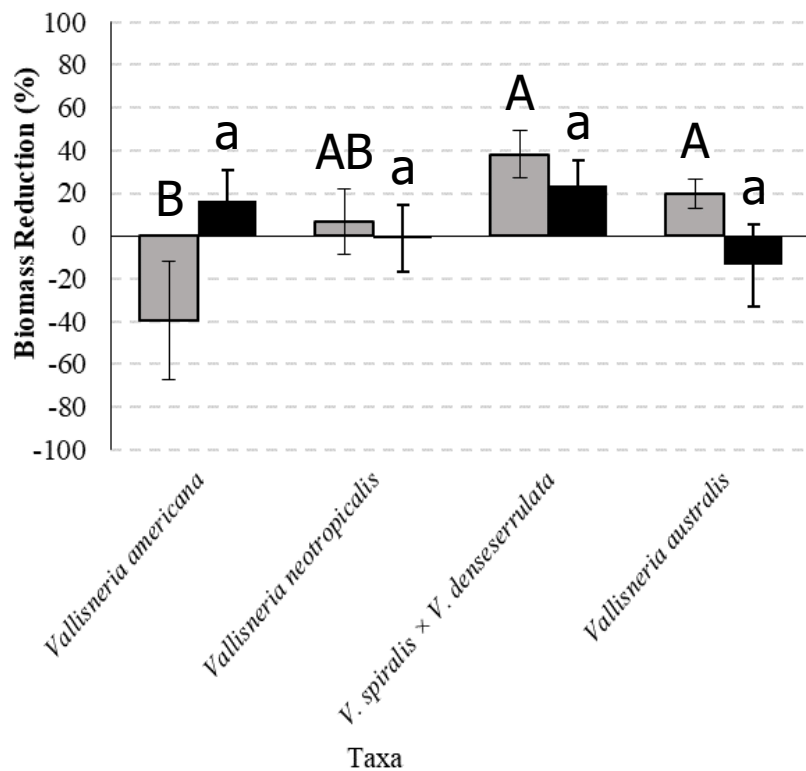
Endothall 2 ppm + FB 30 ppb (48-hours)



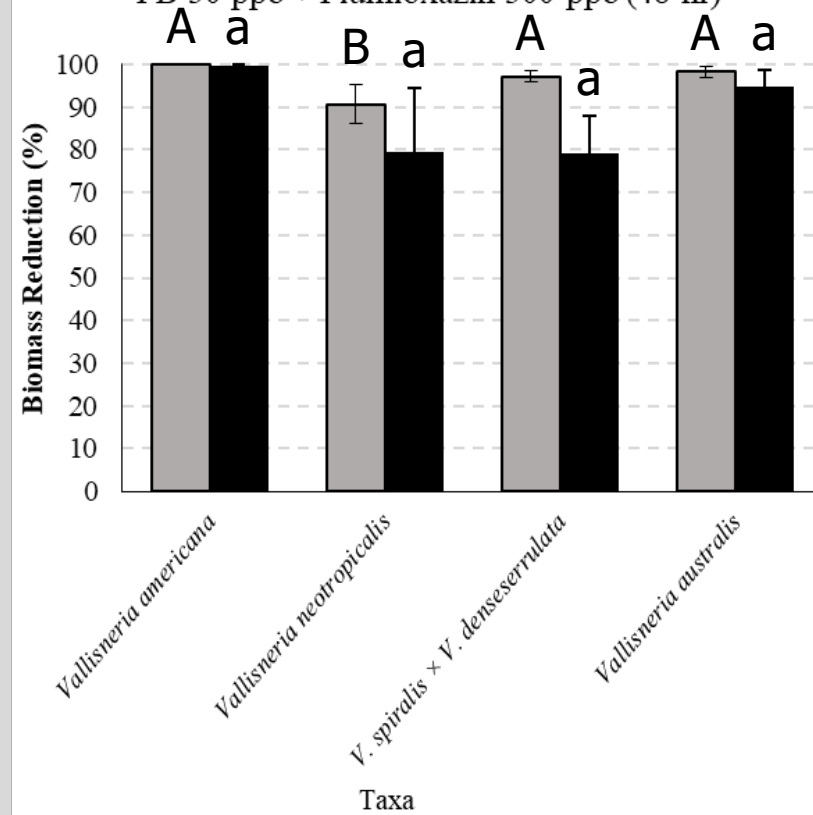
FB 30 ppb (72-hr)

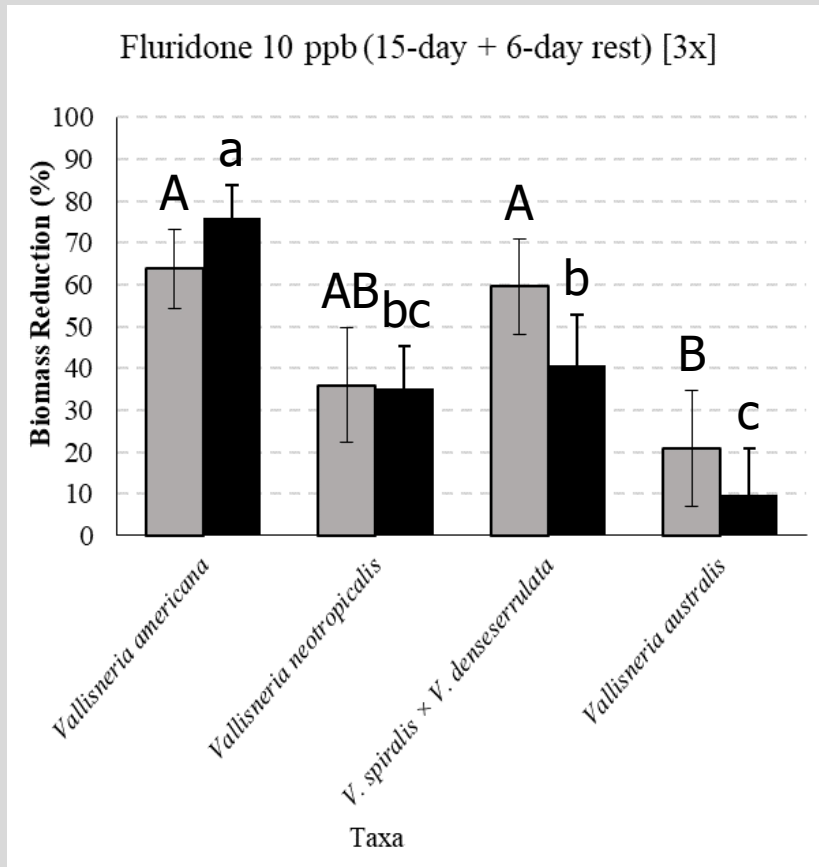
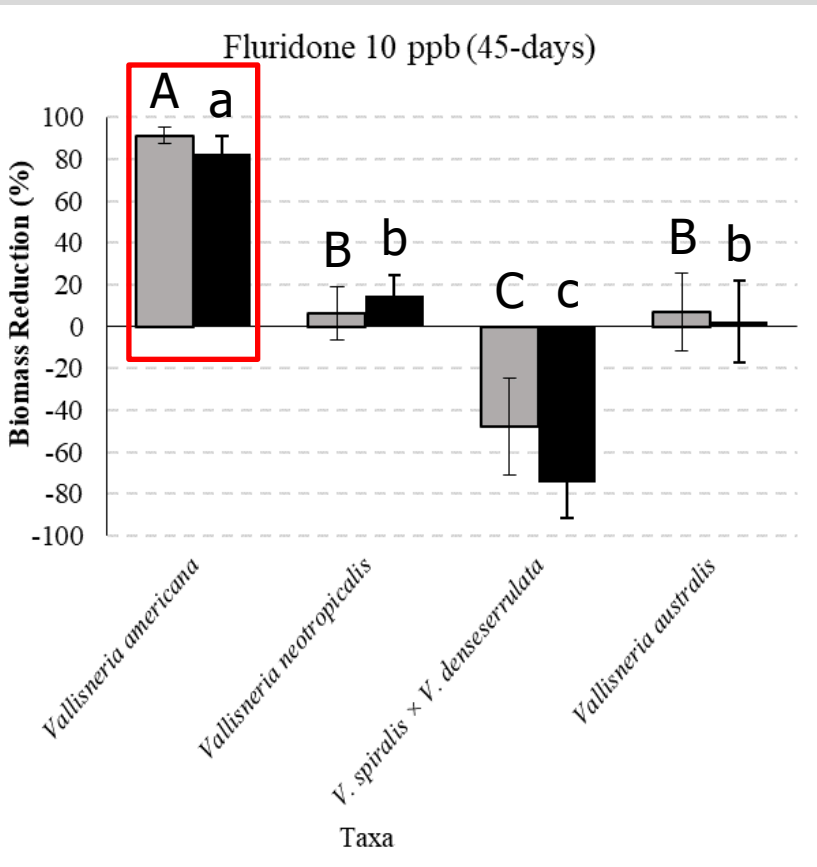


FB 30 ppb (24-hr + 6-day rest) [3x]

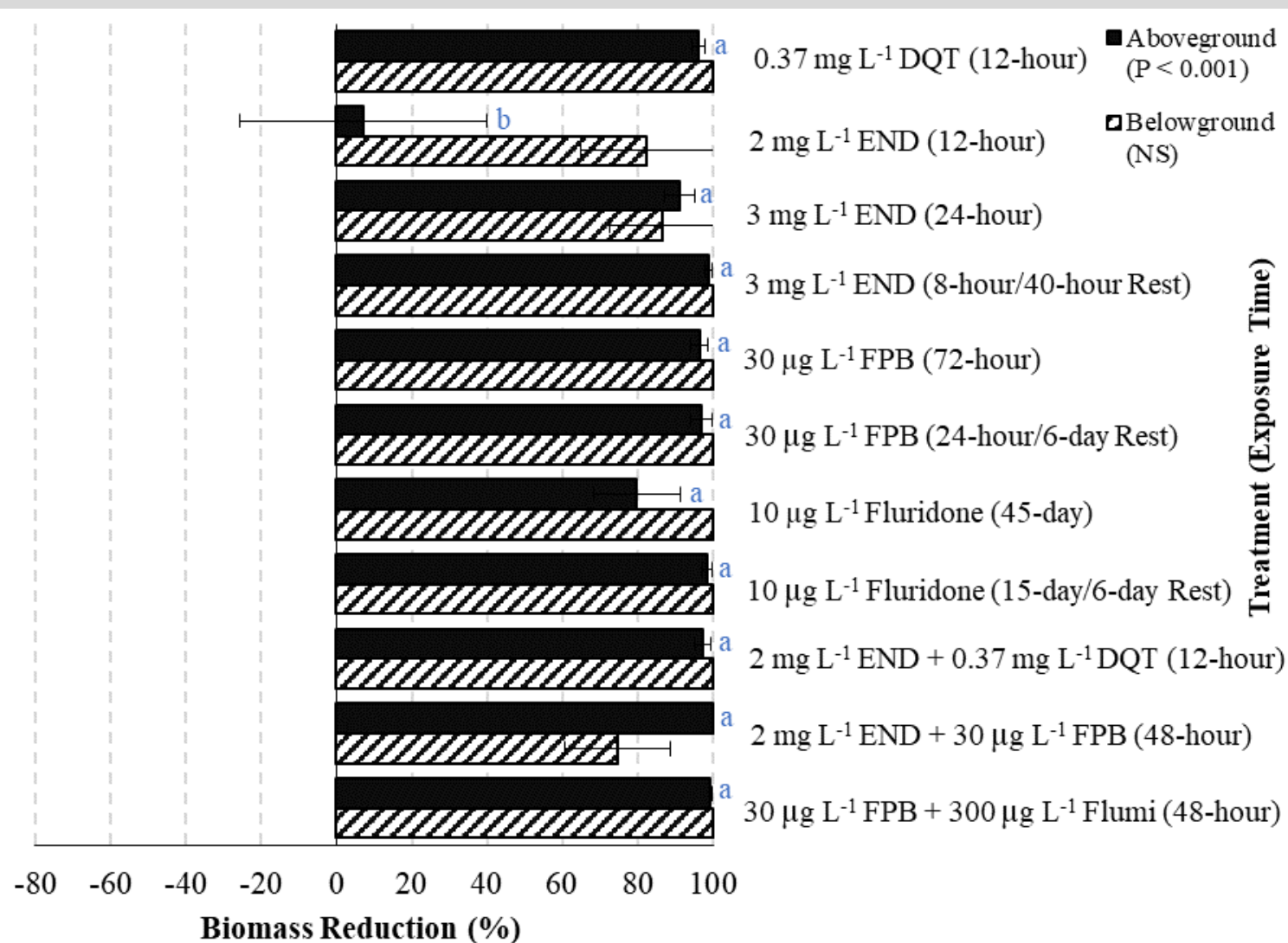


FB 30 ppb + Flumioxazin 300 ppb (48-hr)



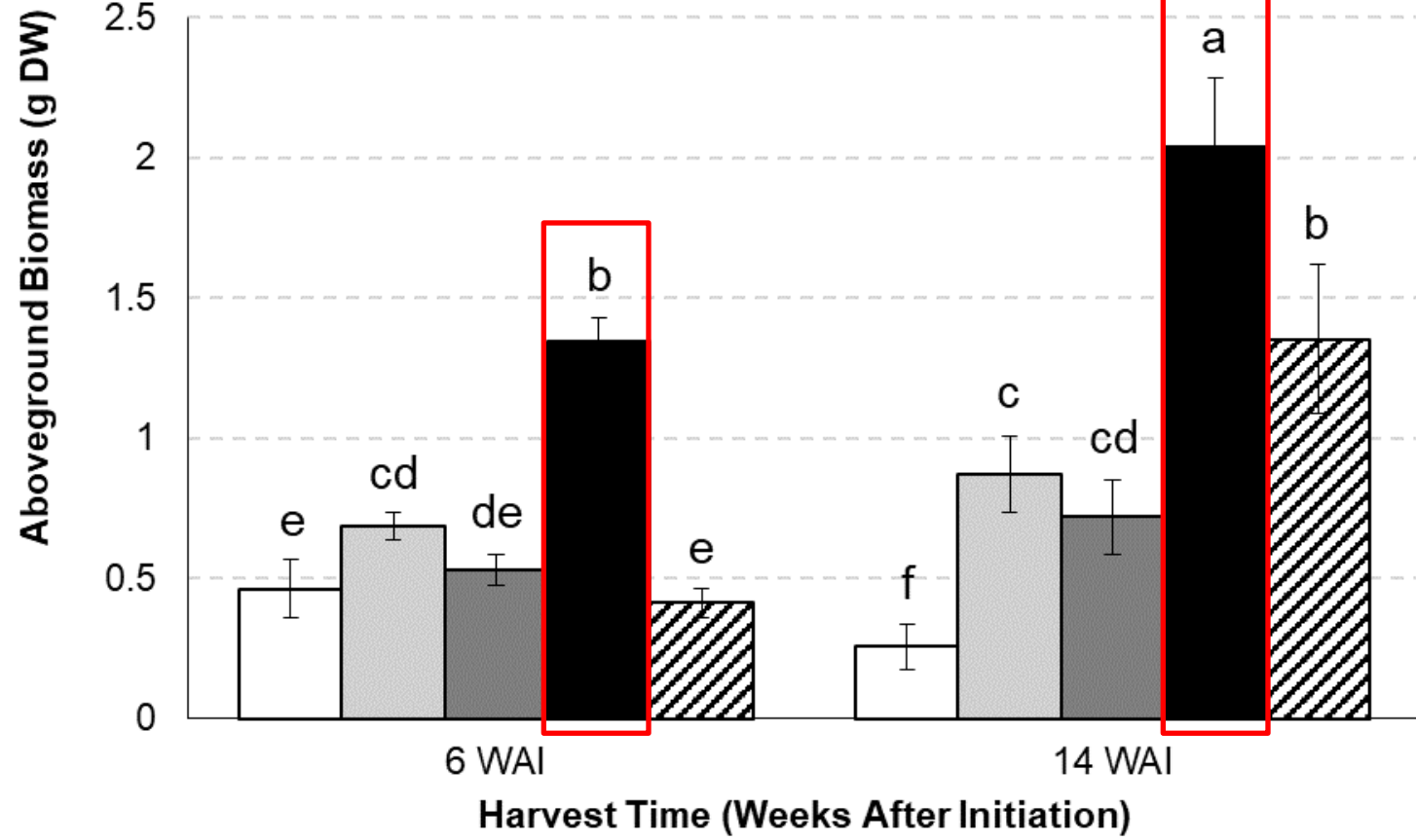


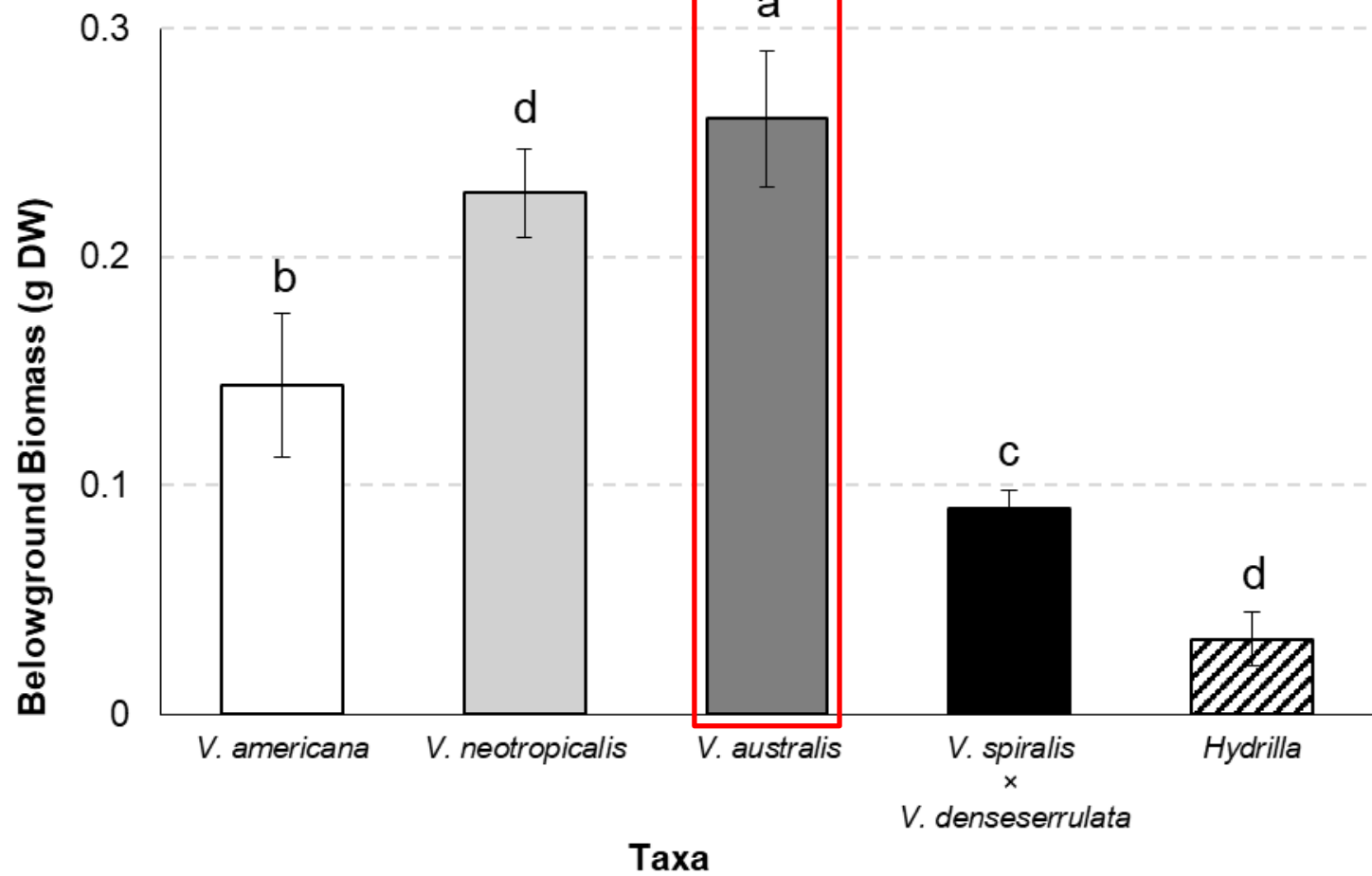
Hydrilla



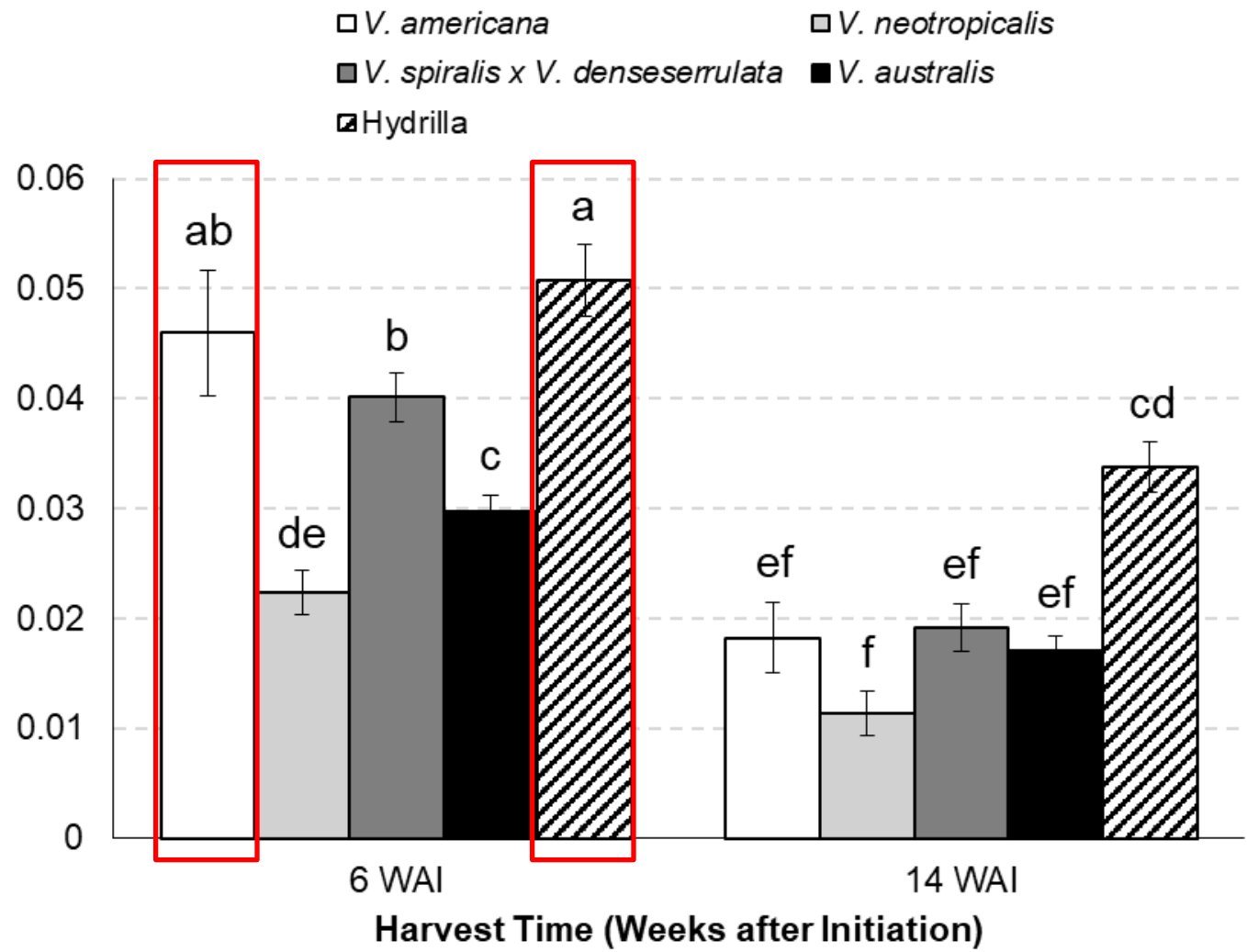
A

□ *V. americana* □ *V. neotropialis* $p < 0.001$
■ *V. spiralis* x *V. denseserrulata* ■ *V. australis*
▨ Hydrilla



B

C

Relative Growth Rate ($\text{g g}^{-1} \text{ day}^{-1}$)

Importance of Genetic Testing

- Rapid identification of cryptic species and hybrids
- Map spread of problematic species
- Understand genetic diversity in aquatic weeds
- Improve understanding of herbicide resistance and weed fitness

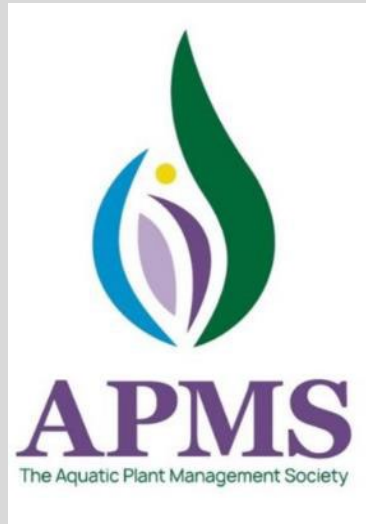


Conclusions

- Low selectivity between native and invasive *Vallisneria*
 - Fluridone and florypyrauxifen-benzyl applications least likely to impact native populations
 - Intermittent applications of fluridone improve efficacy on *Vallisneria*
- Native *V. americana* most sensitive to treatments
- *V. australis* more robust than other taxa
- Efficacious hydrilla management usibg!

Acknowledgments

- Funding:



- Dr. Ryan Thum
- Kara Foley
- Dr. Andrew Howell
- Technical:
 - Logan Wilson, Delaney Davenport, Michael Punt
- Stephen Turner
- Greg Bugbee

References

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An aerial photograph of a wetland area. The foreground shows a body of water with a dense, tangled mass of green vegetation, likely a submerged aquatic plant. The water is a dark green color. In the background, there is a line of taller, more upright green vegetation, possibly a forest or a thicket of trees. The overall scene is a natural, undisturbed wetland environment.

Questions?

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