Propagule pressure of invasive common reed (*Phragmites australis*) in Suisun Marsh: seedset, germination success, and seedling susceptibility to herbicide

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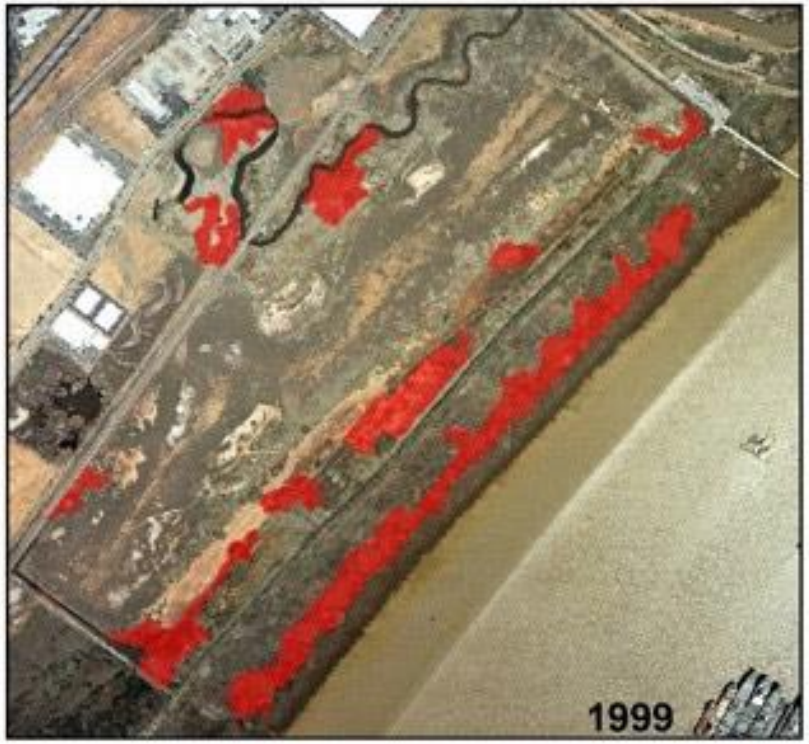
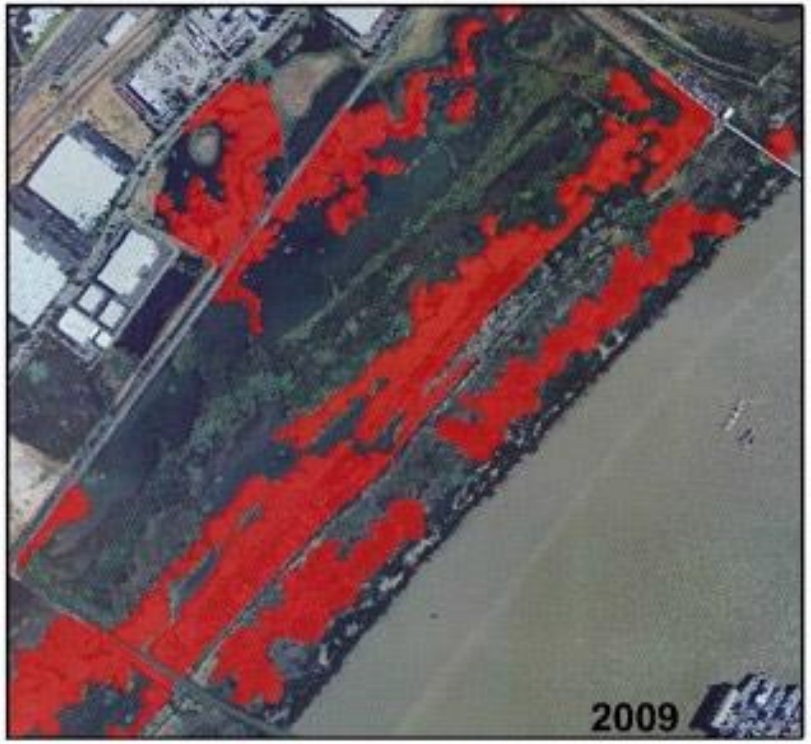
Phragmites australis, “common reed”

Native to Eurasia, now invasive worldwide

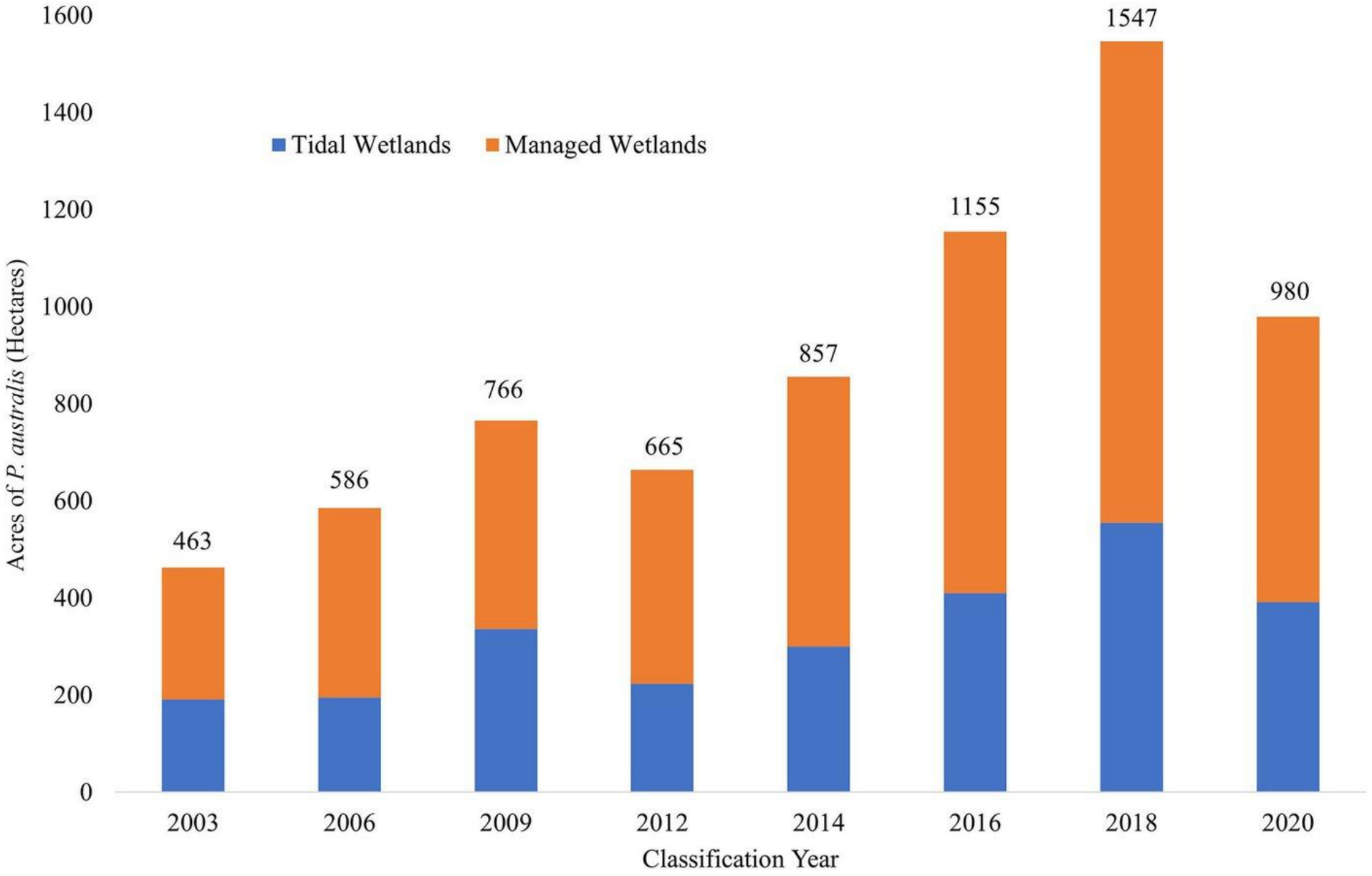
Impedes navigation and recreational access by increasing , crowds out native fish and waterbirds, decreases food availability for wildlife



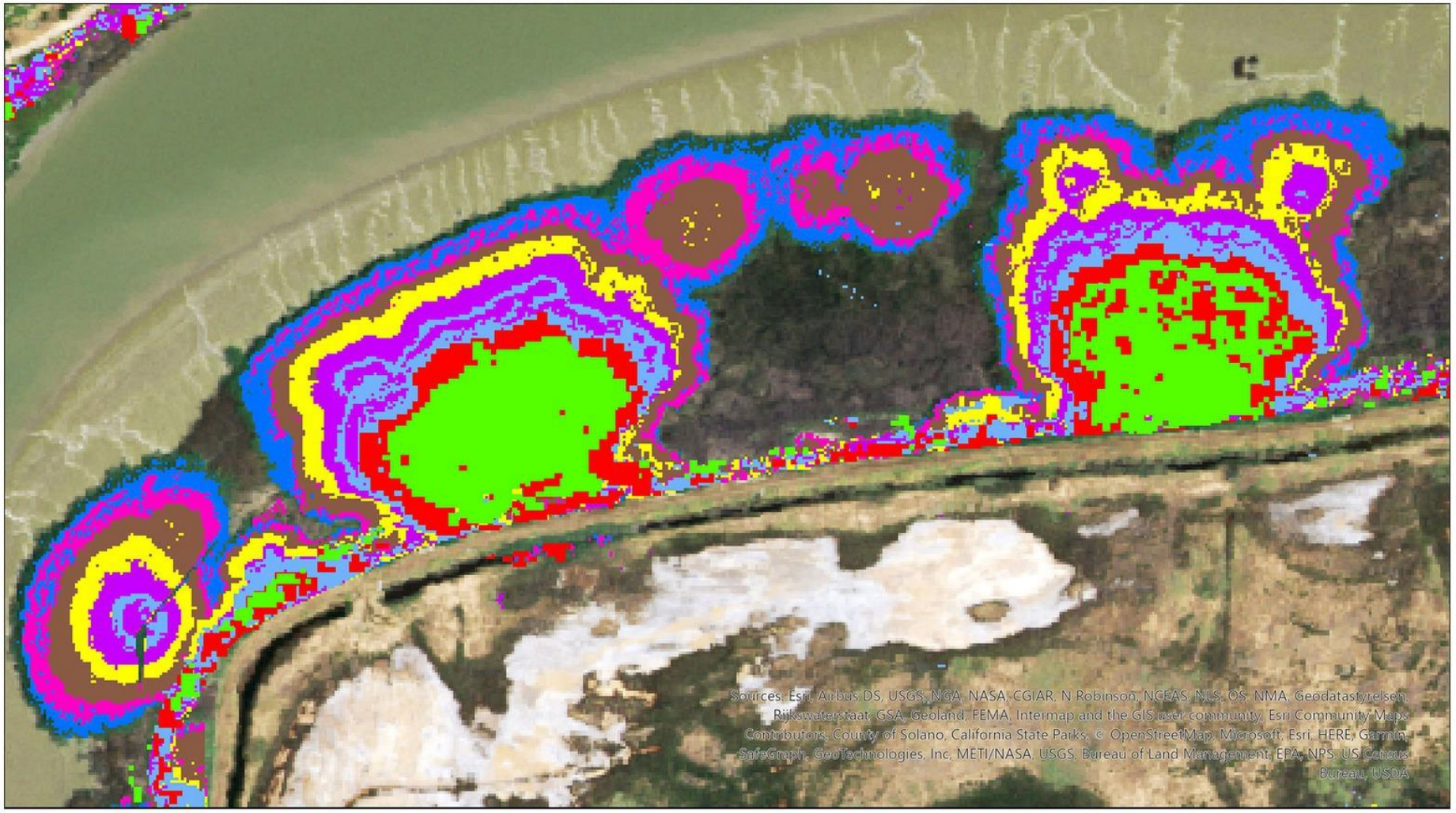


Phragmites spreads fast when untreated

Hagani et al. 2023



Marsh-wide, treatment is not halting the spread of Phragmites



P. australis Classifications

2003 2009 2014 2018

2006 2012 2016 2020

0 0.03 0.07 0.13 Kilometers

N W E S

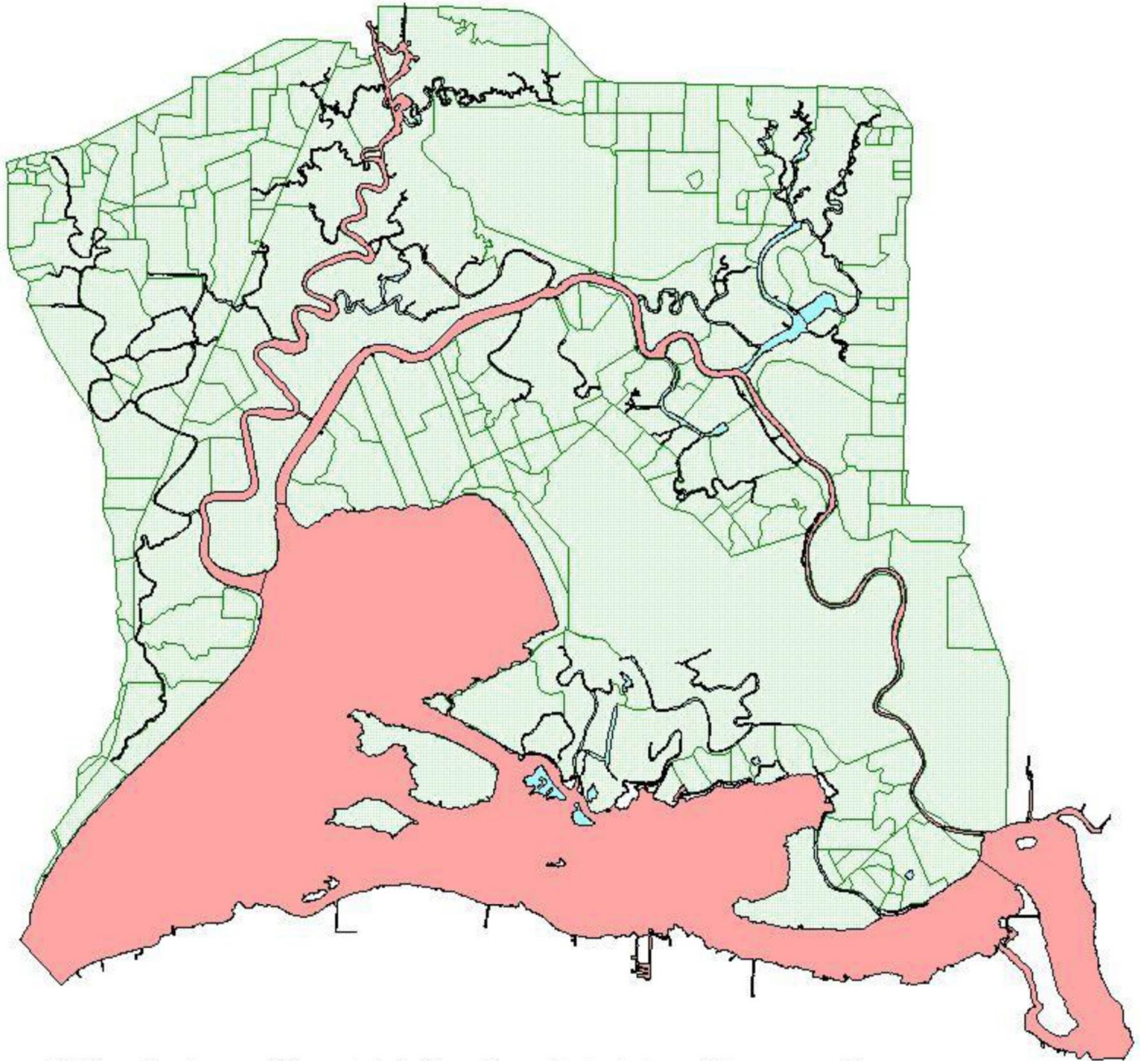
Remote imaging suggests that much of *Phragmites* increase at a site is due to spread from underground rhizomes


Gabe Rodkey
Michael Weatherford

Questions:

1) Does intensive control of *Phragmites* result in lower seed production?

2) Does intensive control of *Phragmites* result in more herbicide-resistant plants?



We used data from Suisun Resource Conservation District to characterize marsh parcels as:

- “high-intensity management”(10+ years of control)
- or “low-intensity management” (0-3 years of control)

We located parcels with at least 5 patches of *Phragmites* from which we could sample seed.

We did this at both “high-intensity” and “low-intensity” managed sites

We collected the inflorescences (seedheads) of *Phragmites* when they were ripe in August 2022.

We measured patch size and the density of inflorescences

Seeds are *very* tiny…
so stripping, weighing, and counting
the spikelets is quite tedious

Seeds per spikelet

Spikelets per inflorescence

Inflorescences per m^2

m^2 of Phragmites in high- and low-intensity areas

Seeds per spikelet

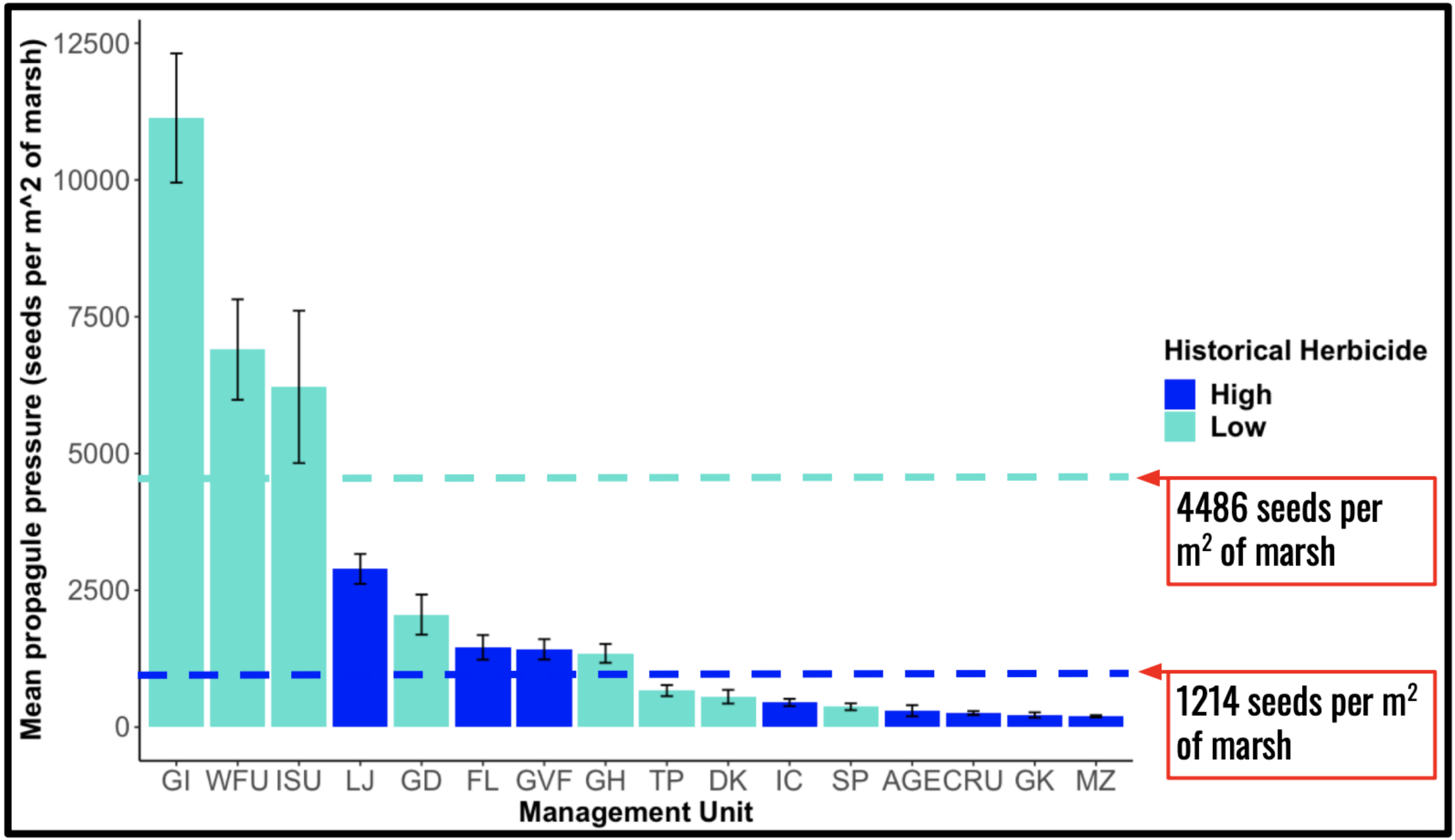
X Spikelets per inflorescence

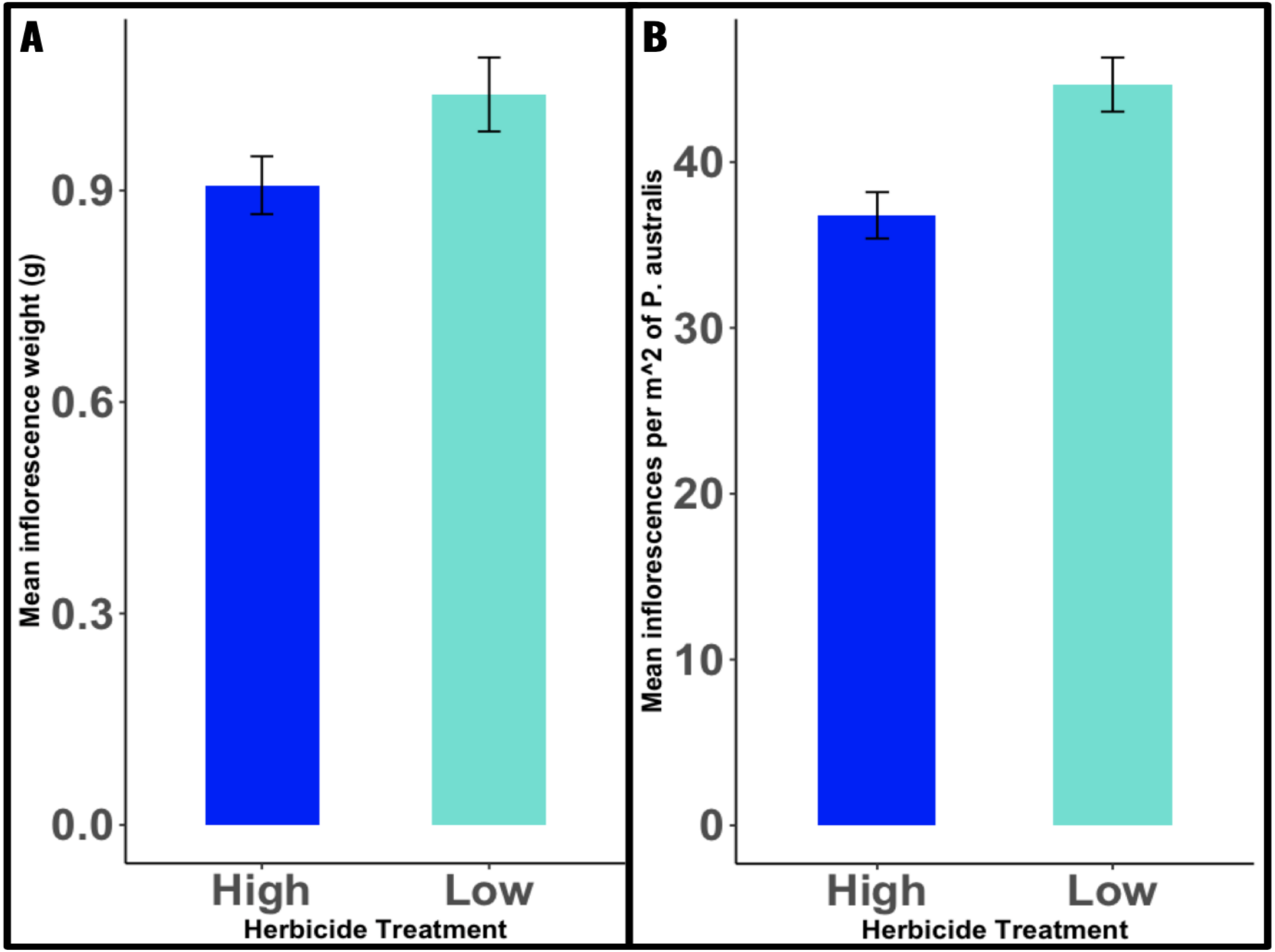
X Inflorescences per m^2

X m^2 of Phragmites in high- and low-intensity areas

="propagule pressure,"

seeds per m^2 of marsh, a measure of threat of invasion spread from seeds


Mean propagule pressure (seeds per m^2 of marsh)
12500
10000
7500
5000
2500
0
GI
WFU
ISU
LJ
GD
FL
GVF
GH
TP
DK
IC
SP
AGE
CRU
GK
MZ
Management Unit
Historical Herbicide
High
Low
4486 seeds per m² of marsh
1214 seeds per m² of marsh



This is partly due to *Phragmites* making less seed and fewer inflorescences in patches where control has been long-term.

But our analysis shows the major driver of the trend is *patch size*.

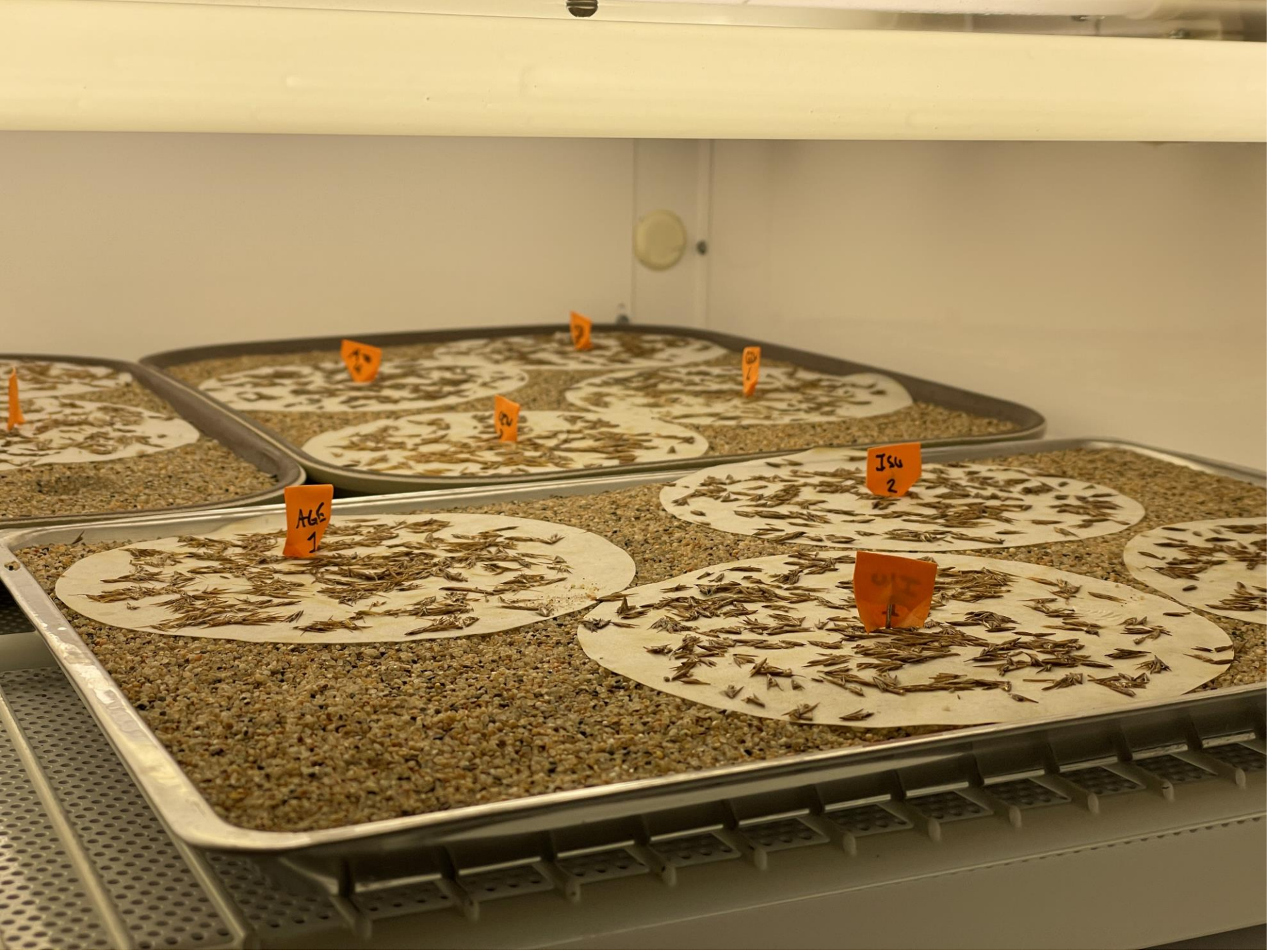
Seeds per spikelet

X Spikelets per inflorescence

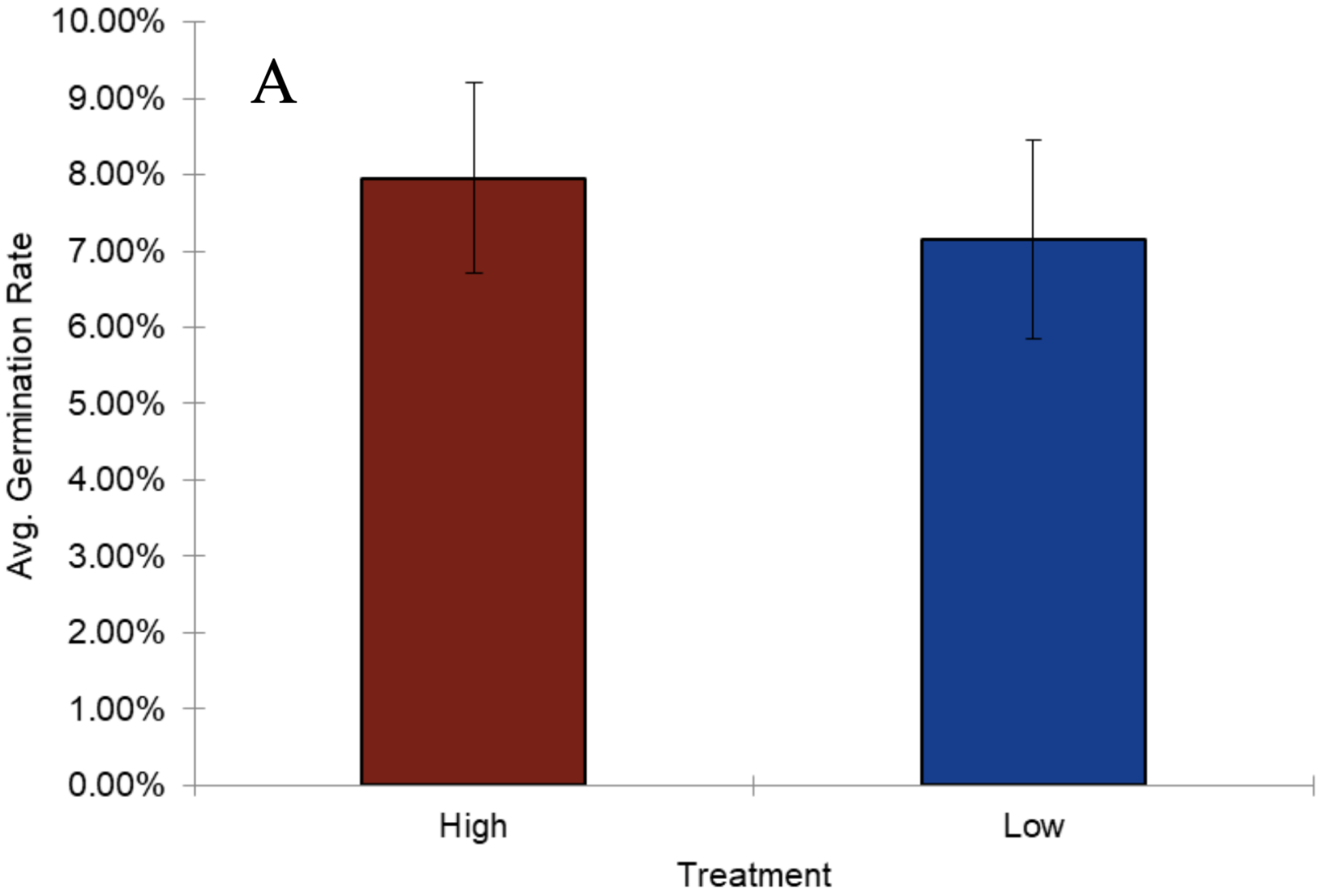
X Inflorescences per m^2

X m^2 of Phragmites in high- and low-intensity areas

But how many of these seeds will actually germinate?



After a period of cold treatment to break seed dormancy, seeds were germinated in SCU growth chambers to test viability



We couldn't detect any statistical difference in germination rate as a result of treatment intensity.

We then took our germinable seeds and outplanted them in the greenhouse, grew them up as baby *Phragmites* plants

…and killed them with herbicide.

Plants were visually assessed on a 0-5 damage scale

0 – no damage

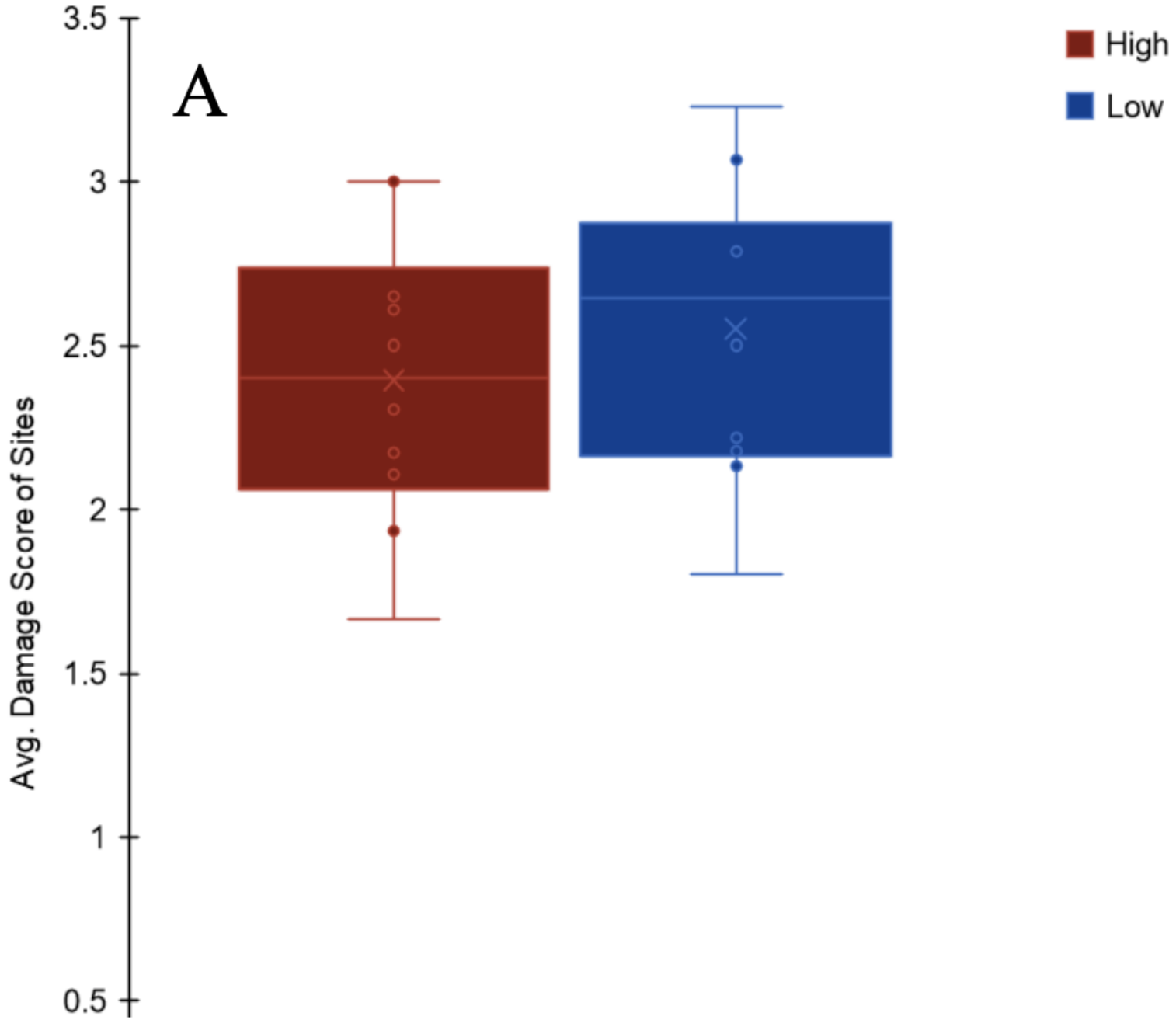
1 – treated leaf has partial damage

2 -- treated leaf completely dead

3 – some stem or leaf damage below treated leaf

4 – mostly dead below treated leaf

5 – completely dead



Good news– we found no statistical evidence of herbicide resistance in *Phragmites* from heavily treated areas

Conclusions:

1) Propagule pressure of *Phragmites* is greatly diminished in heavily treated areas of the marsh, but this has more to do with decreasing patch size and inflorescence number, not seedset

2) A long history of treatment did not have a detectable effect on germinability of *Phragmites* seeds

3) There was no evidence of herbicide resistance developing in long-treated populations of *Phragmites*

Additional thanks to:

SRCD
Jason Hagani
John Takekawa
CDFW

…and all the kind landowners who allowed us access to their properties