

Keep Calm and Drone On: Two *Three* Years of Invasive Species Management with Drones

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KCI Technologies, Inc

Integrated Vegetation Management Association
of British Columbia- Biennial Forum

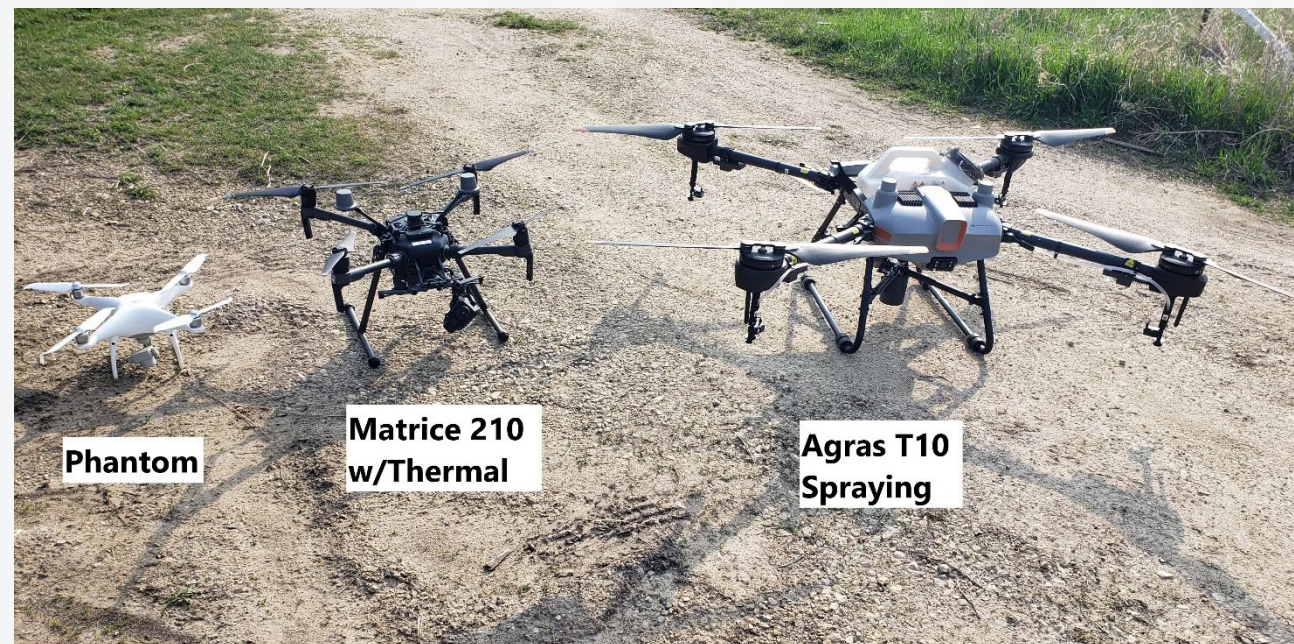
November 5, 2025





Flight Crew

- Samantha Loutzenhiser- Project Manager
 - ▶ Chief Supervisor in UAS agricultural systems operations
 - ▶ KCI Responsible Person for internal drone program
 - 45 pilots, 35 drones
- Herbie the Sprayer Drone
 - ▶ DJI Agras T10
- Hotshot the Thermal Drone
 - ▶ DJI Matrice 210 with thermal camera
- Phantom the Imagery Drone
 - ▶ DJI Phantom 4 Pro v2
- *NEW* Hylio AG230 spray drone





DJI Phantom 4 Pro

DJI Matrice 210
Thermal

DJI T10 "Herbie"
2.5 gallons
Under 55lbs

DJI Mini 4k
Under 0.55 lb

Hylío AG230
8 gallons
Over 55lbs



Drones for Invasive Species Management

- Imagery drones to search
- Sprayer drones to kill
- Seeding drones to restore
- Multispectral, Thermal, LiDAR, and more
- Can be operated manually or with programmed flights
- Limitations



Laws, Rules, and Other Regulations

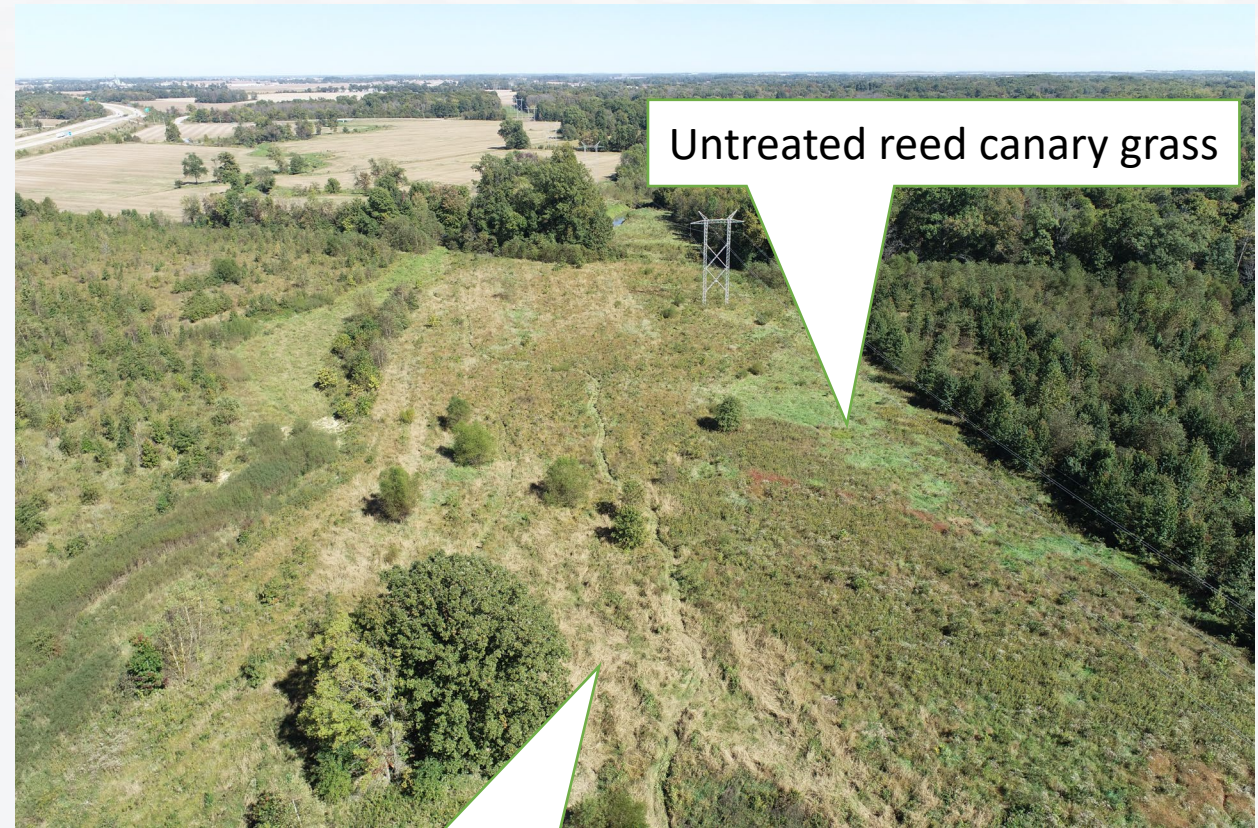
- Part 107 Remote Pilot Certificate
- Air space
 - ▶ Federal, State, City
- Visual Line of Sight (VLOS)
 - ▶ Beyond Visual Line of Sight (BVLOS)
 - ▶ Changed in Canada Nov 4th
- 400 feet (122m) or lower
- **THIS LIST IS NOT EXHAUSTIVE OF THE LAWS ASSOCIATED DRONE OPERATIONS**
- Drone vocabulary: Visual Observer (VO)- someone other than the pilot who helps watch the drone and for any hazards



Gemini

Hunting for Invasive Species with Drones

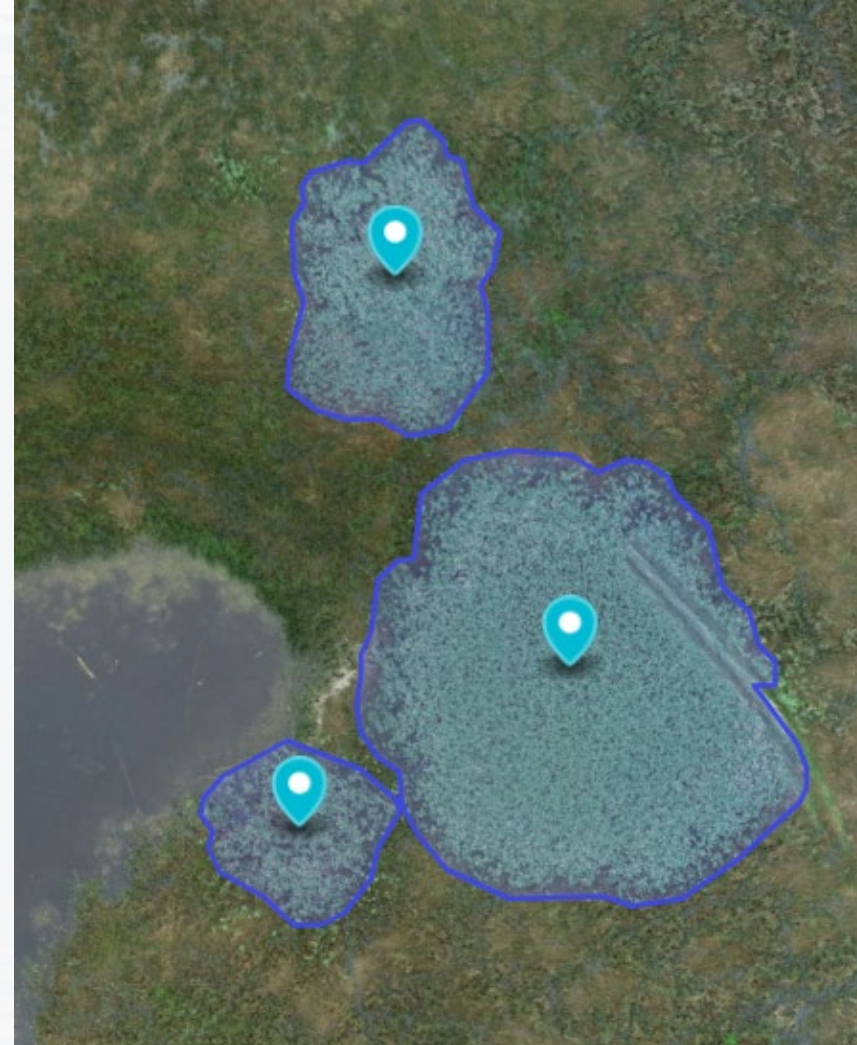
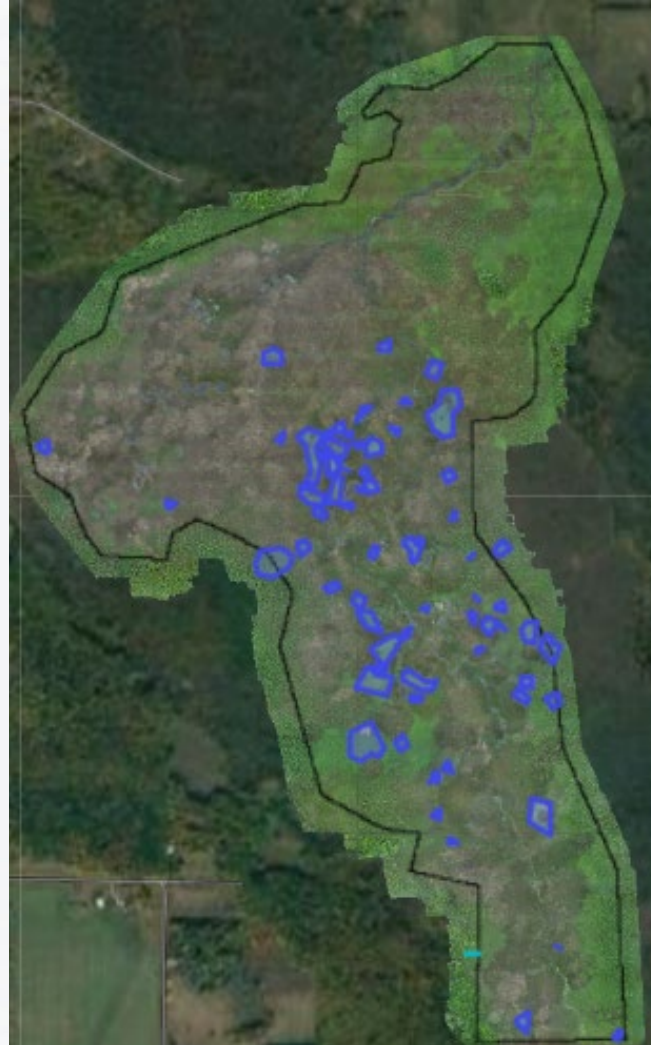
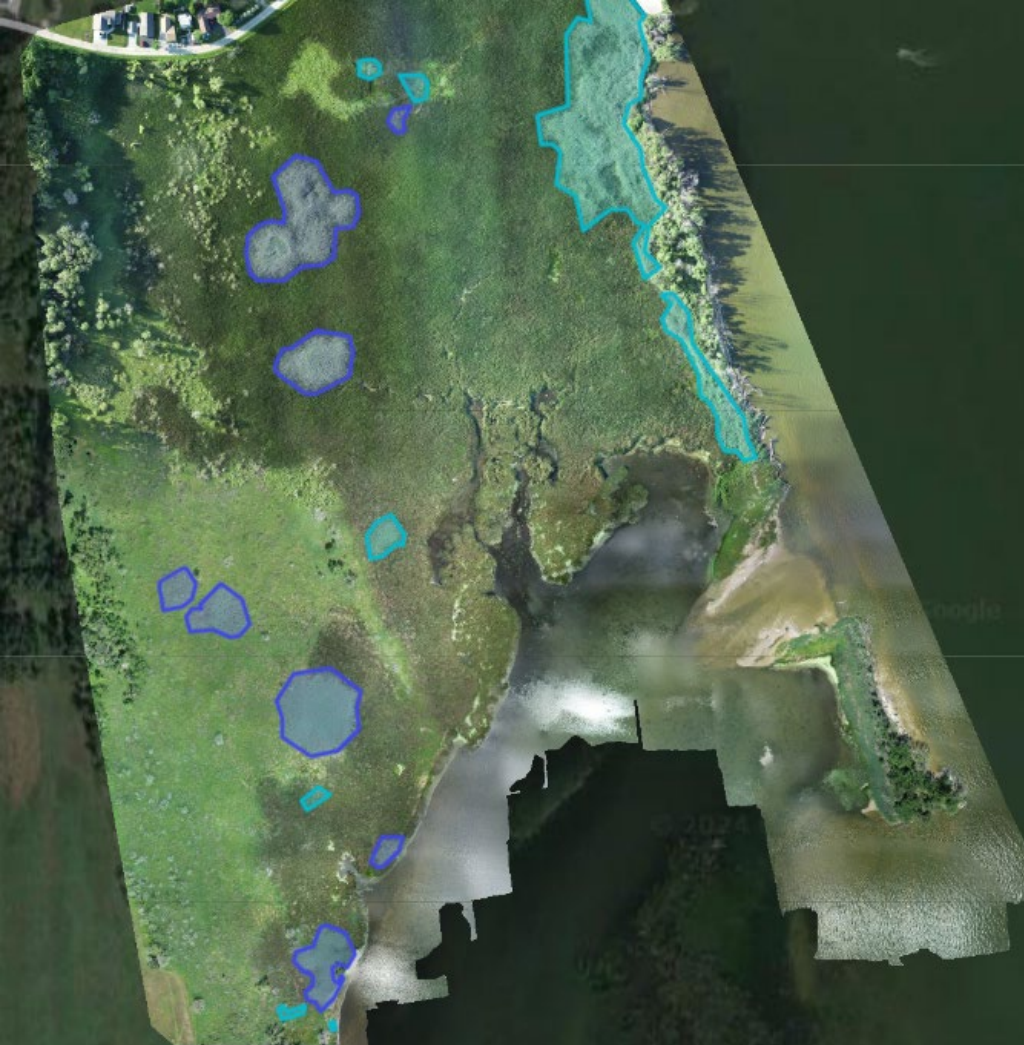
- Use a "regular" drone to capture imagery
 - ▶ Obliques
 - ▶ Orthomosaics
- Multi-spectral imagery
- Ground truthing
- Manually or auto-generate polygons around target species
- Load polygons into spraying drone



Treated reed canary grass

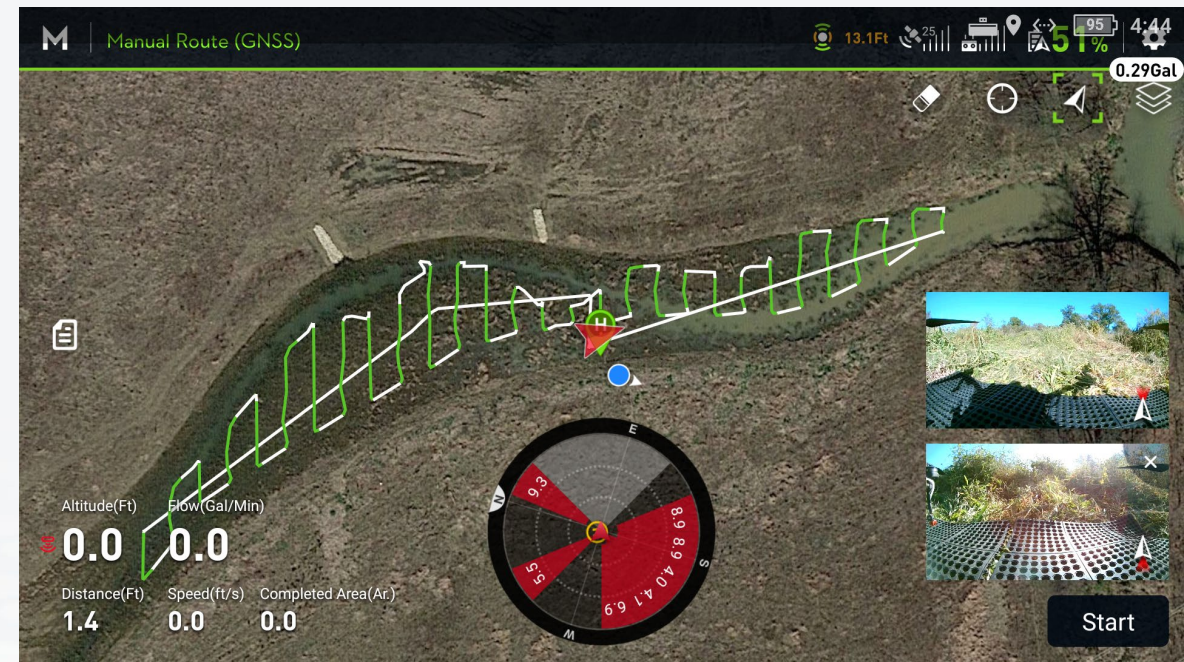
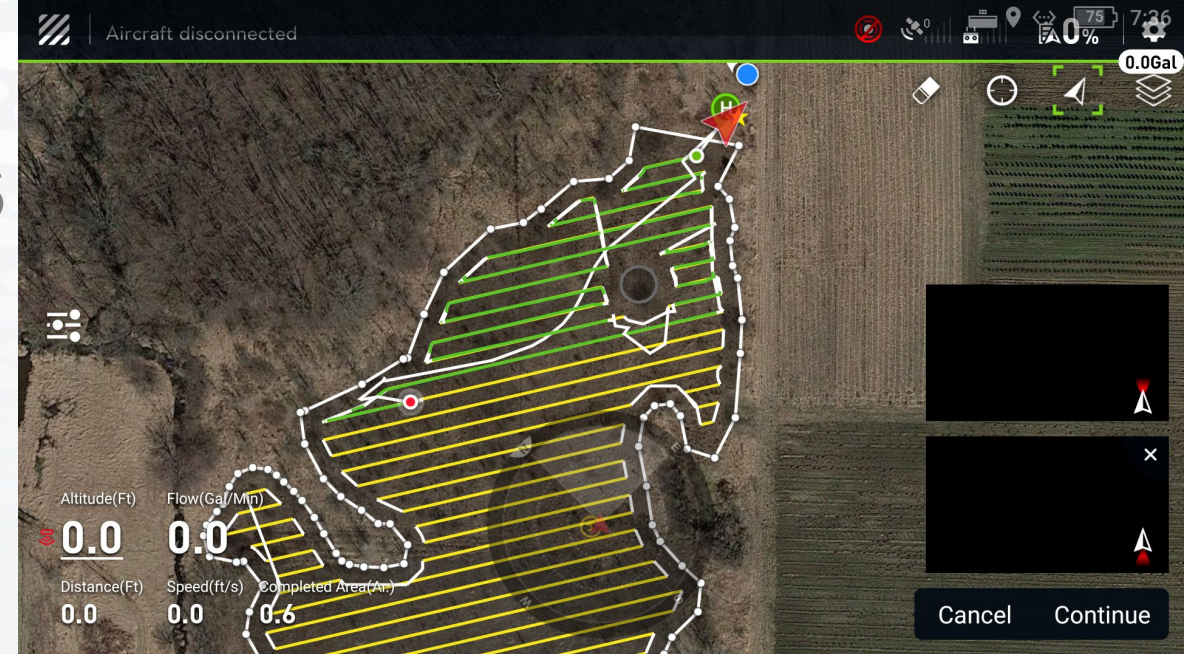


Hunting for Invasive Species with Drones



Attacking Invasive Species

- Drone is pre-programmed to fly a grid
- Choose your chemical and application rate
 - ▶ Read the label
- Best used on dense and monoculture species- phragmites, reed canary grass, cattails, etc.
- Not applicable for extremely sensitive areas without buffer



Laws, Rules, and Other Regulations- Spraying



- **MUST** have a Part 137 certificate and 44807 exemption
- Over 55lb drones require additional paperwork and restrictions
- All operators must have a Part 107 (for all drones)
- State licensing: Aerial applicator and community type (ie wetlands/aquatic) Category numbers vary by state, so check with you pesticide board
- Process can take several months
 - ▶ From purchase to legally able to fly- our Hyllo took 7 months. Still waiting on Part 137 due to government shut down

*“Need I remind you 007, you have a license to kill,
not to break traffic laws” ~Q*

GoldenEye (1995)





Time vs Concentration



Amount of Chemical



Amount of Water

Note: Manufacture spec sheets indicate more acres per hour achieved than is realistic for many pesticides. Many herbicides require 5 gal/ac with some as much as 10 gal/ac.

Challenges

- Trees, Powerlines, and Other objects
- Line-of-sight
- Distance from launch point
- Battery power vs work time
- Application rates
- Wind
 - ▶ Most labels require less than 10mph
- Height above vegetation
 - ▶ Most labels require that you fly no more than 10 feet above the top of the *target* vegetation



Microsoft Designer Image Creator. May 27, 2024



Solutions

- Assess the area
- Communication
- Maintain line of sight
- Know your drone
- Take a power source
- Be creative
- Plan ahead
- Expect weather to not cooperate





Success



Ken Evers Nature Area. Green Bay, WI. Treated: October 17, 2023. Photo: July 19, 2024.



Success



Photo credit: Eric Kilburg, Wisconsin DNR, Horicon Marsh

Success



<https://uwaterloo.ca/news/drone-herbicide-applications-prove-effective-common-reed>

Link for treatment done in Canada with drones for phragmites control

Invasive Plant Science and Management

www.cambridge.org/inp

Research Article

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Suppression efficacy of remotely piloted aircraft systems-based herbicide application on invasive *Phragmites australis* in wetlands

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Abstract

Invasive common reed [*Phragmites australis* (Cav.) Trin. ex Steud. ssp. *australis*] has established and dominated Ontario wetlands for decades. The detrimental effects of *P. australis* invasions on wetland habitats have demanded intervention through aggressive suppression efforts. However, constraints in available control methods to suppress *P. australis* have led to persistent invasions. To improve *P. australis* management in wetlands, we investigated remotely piloted aircraft systems (RPASs) as a precision tool for herbicide application. We applied an imazapyr-based herbicide (240 g ai L⁻¹) with a spray-equipped RPAS at selected test sites, marking the first-ever application of its kind in Canada. We then (1) evaluated the efficacy of RPAS-based herbicide application to *P. australis* and (2) examined the plant community changes 1 yr after the initial herbicide application. We found a >99% reduction in live *P. australis* stems, along with reductions in species richness (33%), Shannon-Weiner diversity (73%), Simpson's reciprocal diversity (50%), and Pielou's evenness (73%) in the year following herbicide application. Plant community changes varied by field site; one wetland underwent a secondary invasion by European frog-bit (*Hydrocharis morsus-ranae* L.) while the other was dominated by the native spotted jewelweed (*Impatiens capensis* Meerb.), highlighting the complexities of plant community succession following herbicide application in biodiverse wetlands.



Success



European Frog-Bit Annihilation Team



Flying to Success

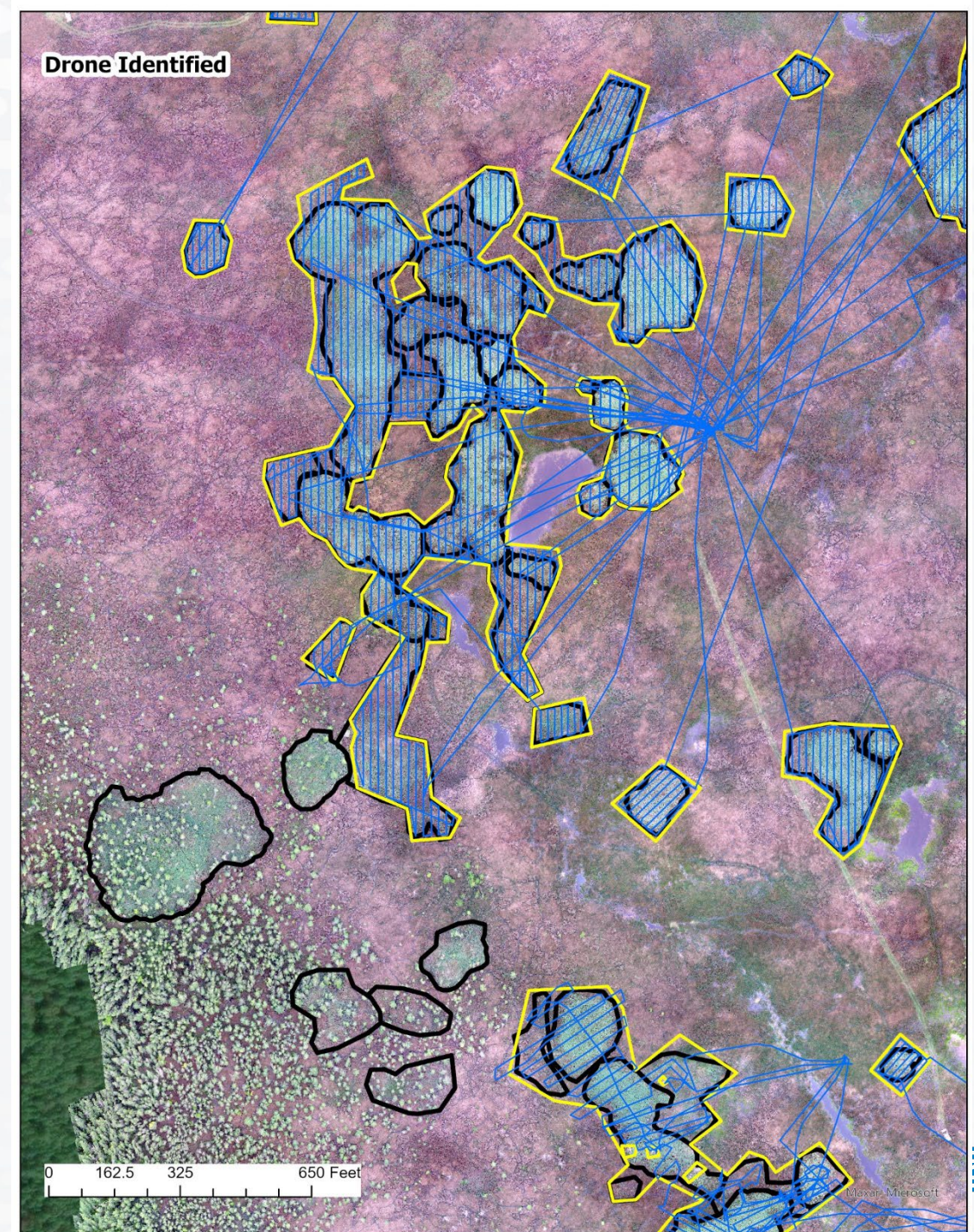
- Polygons
- Application rate
- Access
- Buffer area
- Access to fresh water for mixing
- Understanding that the weather is rarely in our favor
- Funding induced drone restrictions



Photo Credit: Karl Janczak- KCI

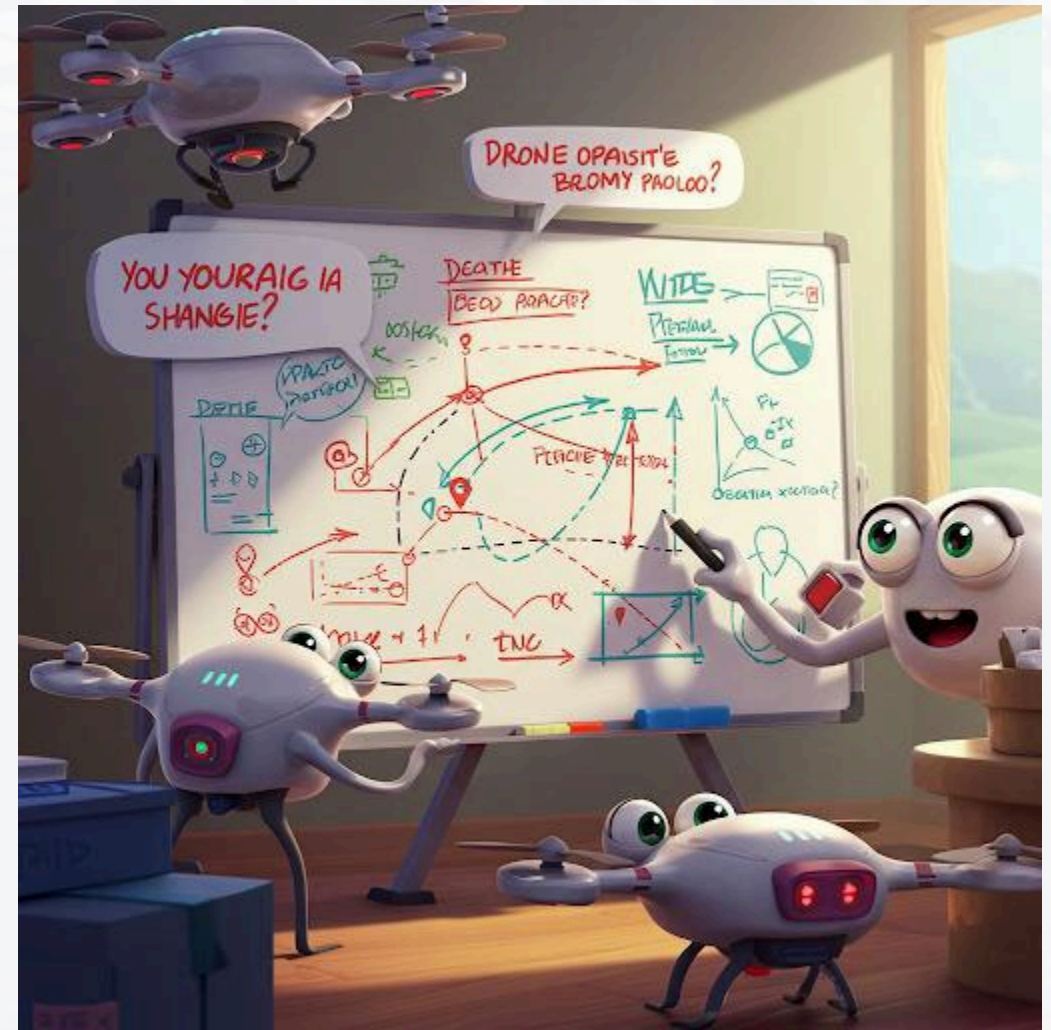
Flying to Success

- Consider polygon efficiency
- Clear guidance on target species
 - ▶ “If he dies, he dies” theory. What to absolutely not kill and what is ok



Putting it all together

- There is no straight answer
- The more complicated, the more expensive
- If its worth the complexity to you, we will try
- Everything scales
- Mobilization, pre-planning, paperwork, and programming account for a lot of the time
- Sun up to sun down- take advantage of the weather



Gemini: "Cartoon of Drones Making a Plan"



What should you look for in a pilot?

- Part 107- need to renew every two years (for any drone)
- Part 137 and up-to-date 44807 (expires every 2 years)
- Herbicide license- Aerial plus associated categories
- Understanding of the laws
- Any additional waivers are discussed and their “conditions and limitations”
- Invasive knowledge



Conclusion

- Safe
- Quick
- Effective
- See the forest through the trees
- Minimize disturbance
- Access area otherwise inaccessible





Thank you for listening!
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