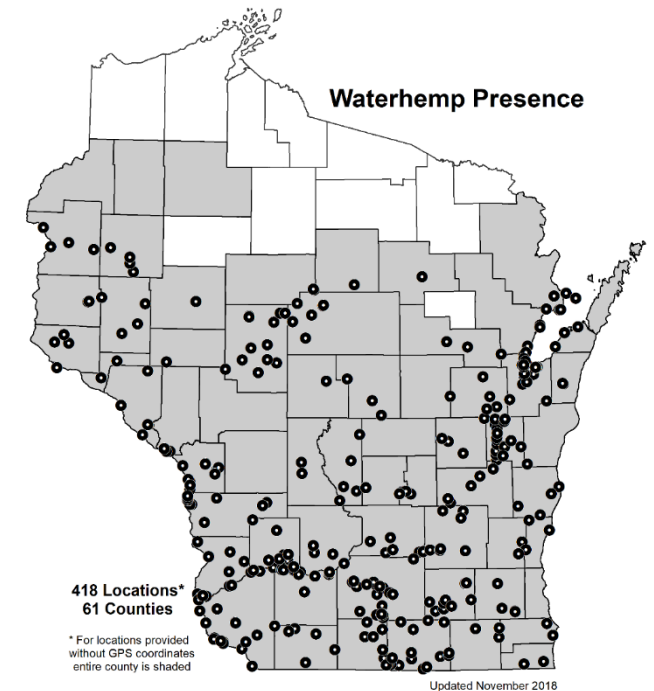


WATERHEMP BIOLOGY IN WISCONSIN



Extension

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Why are we concerned about waterhemp?

1. Rapidly spreading throughout WI
2. Potential to develop herbicide resistance
3. More competitive than common weeds



One of thirteen Pigweed species (*Amaranthus*) found in Wisconsin

6 important to Agriculture

- Red-root pigweed
- Smooth pigweed
- Prostrate pigweed
- Powell's amaranth
- Common/tall waterhemp*
- Palmer Amaranth*



Waterhemp

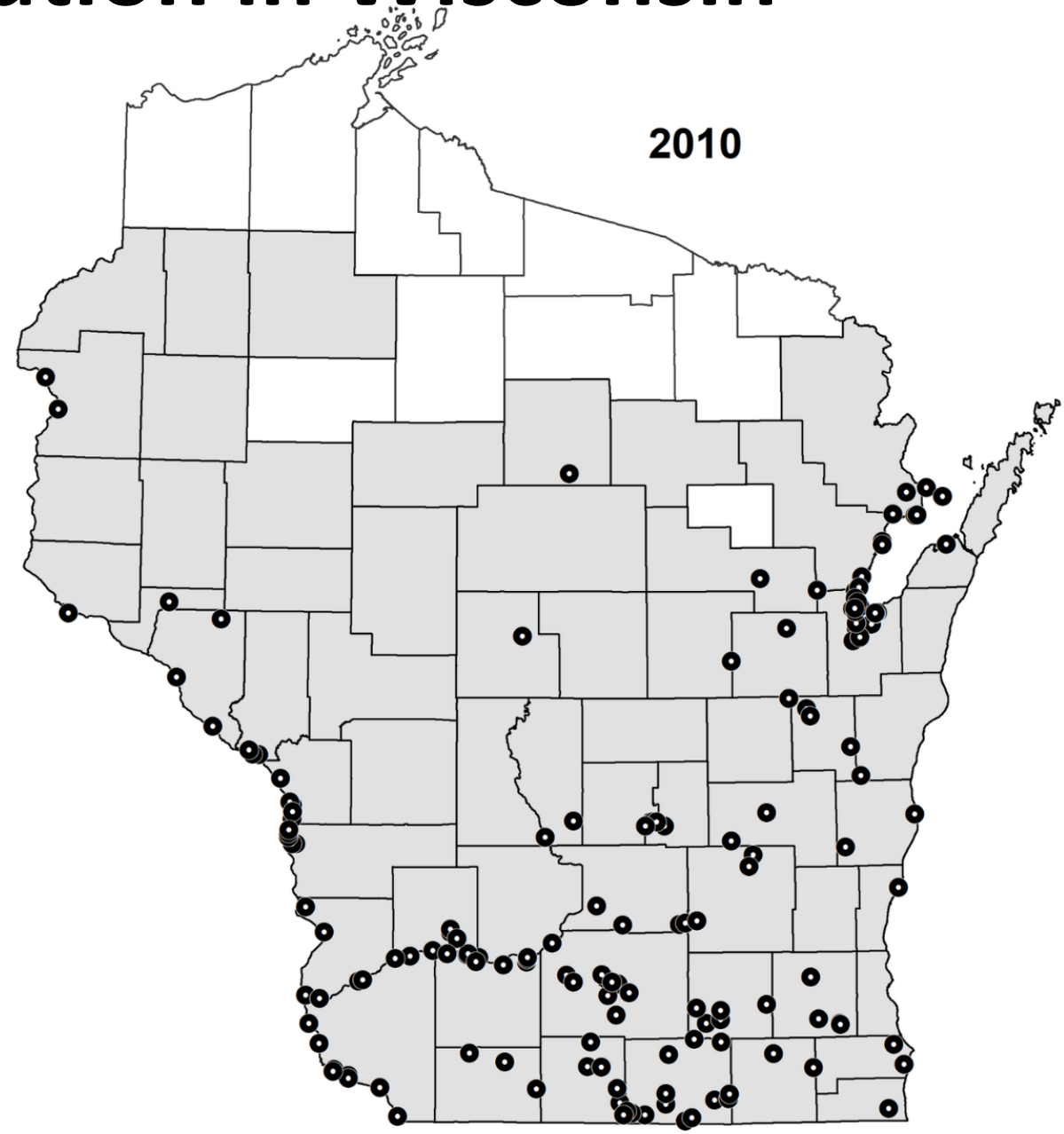
- Native to Wisconsin
- Recent rapid expansion observed
 - Current surveys estimate 2-6% of fields infested with waterhemp



Waterhemp distribution in Wisconsin

Historically

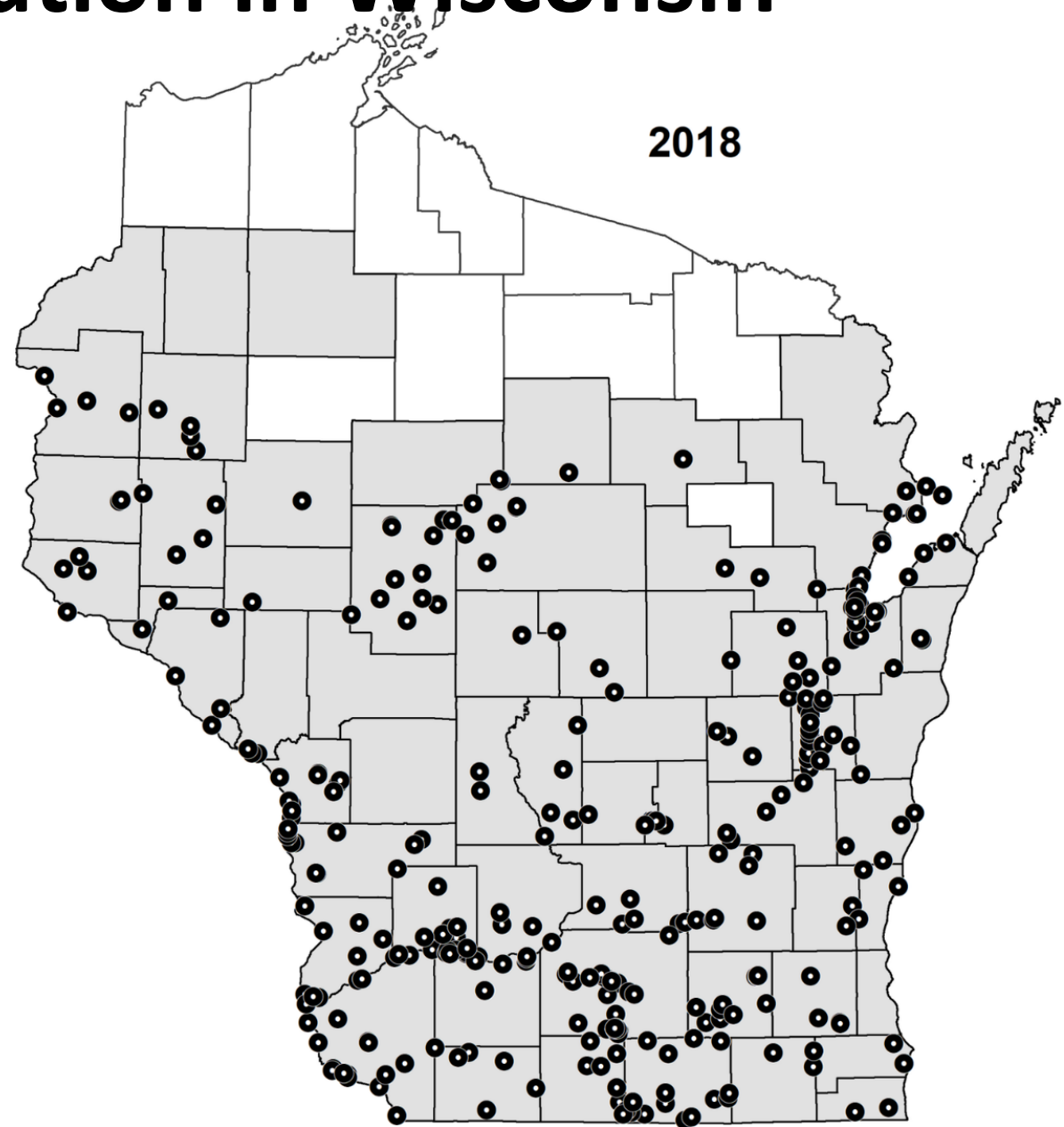
- Mississippi & Wisconsin rivers
- Southern WI
- Green Bay



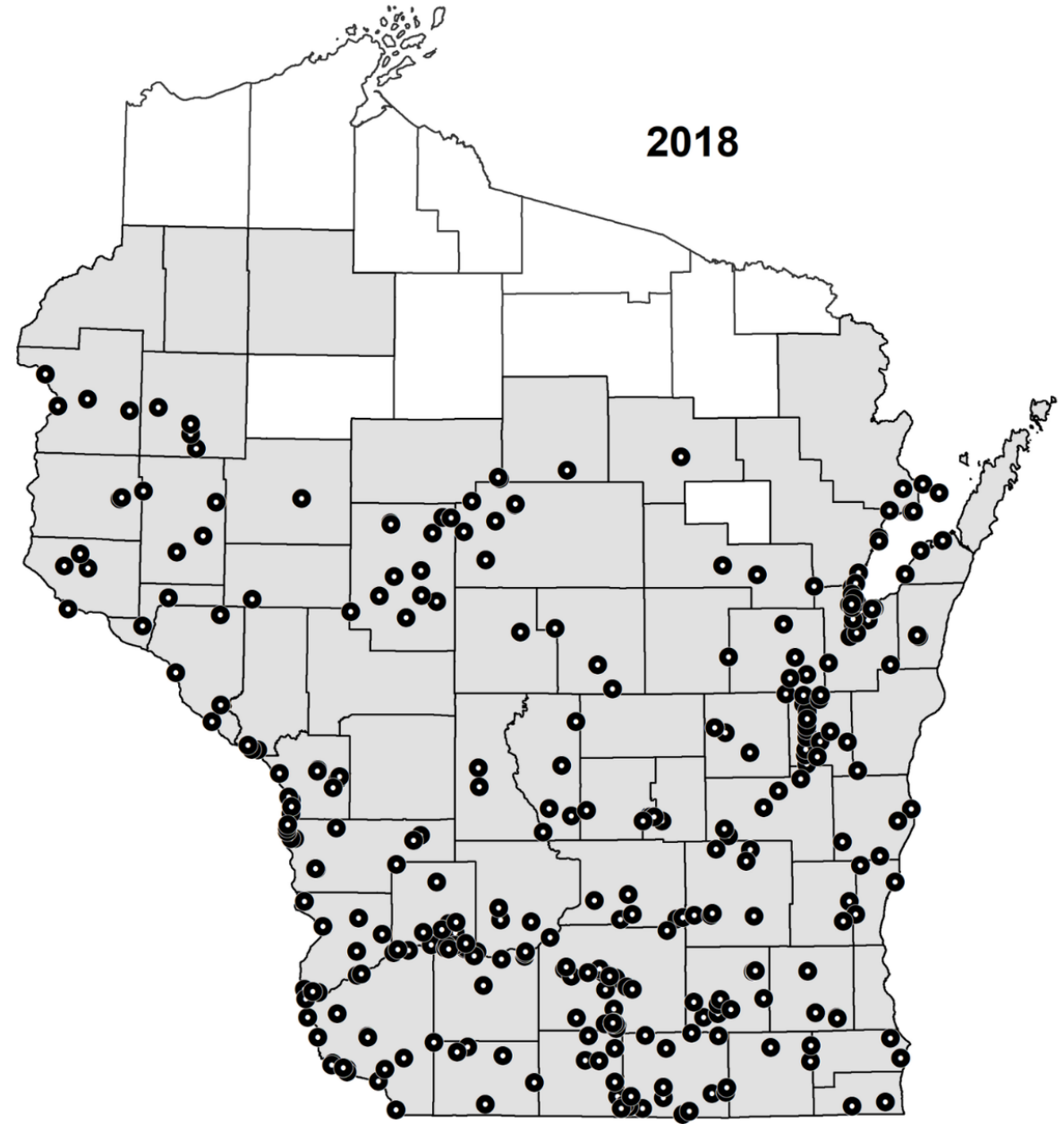
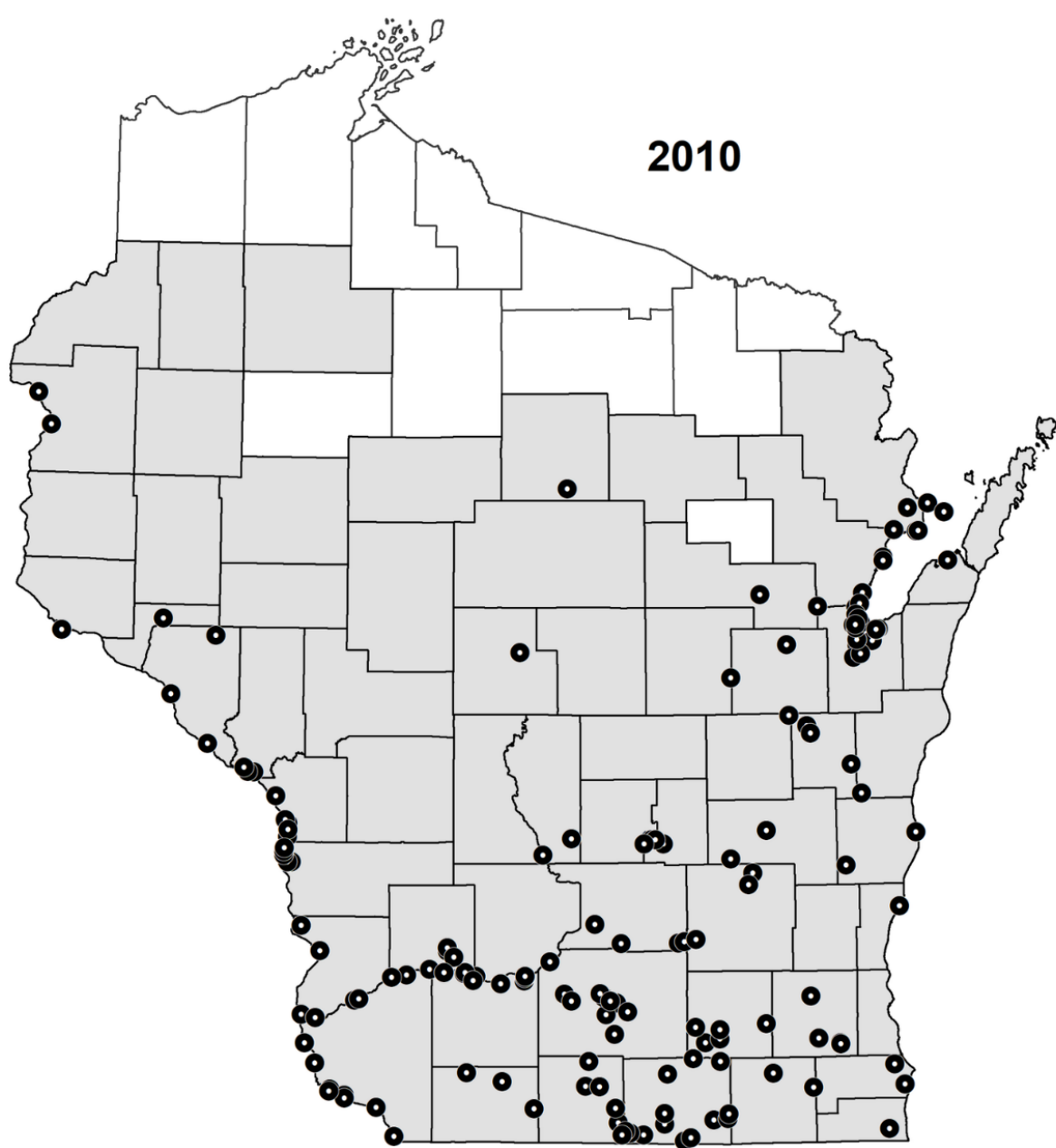
Waterhemp distribution in Wisconsin

Expanding

- Western
- Central
- Eastern



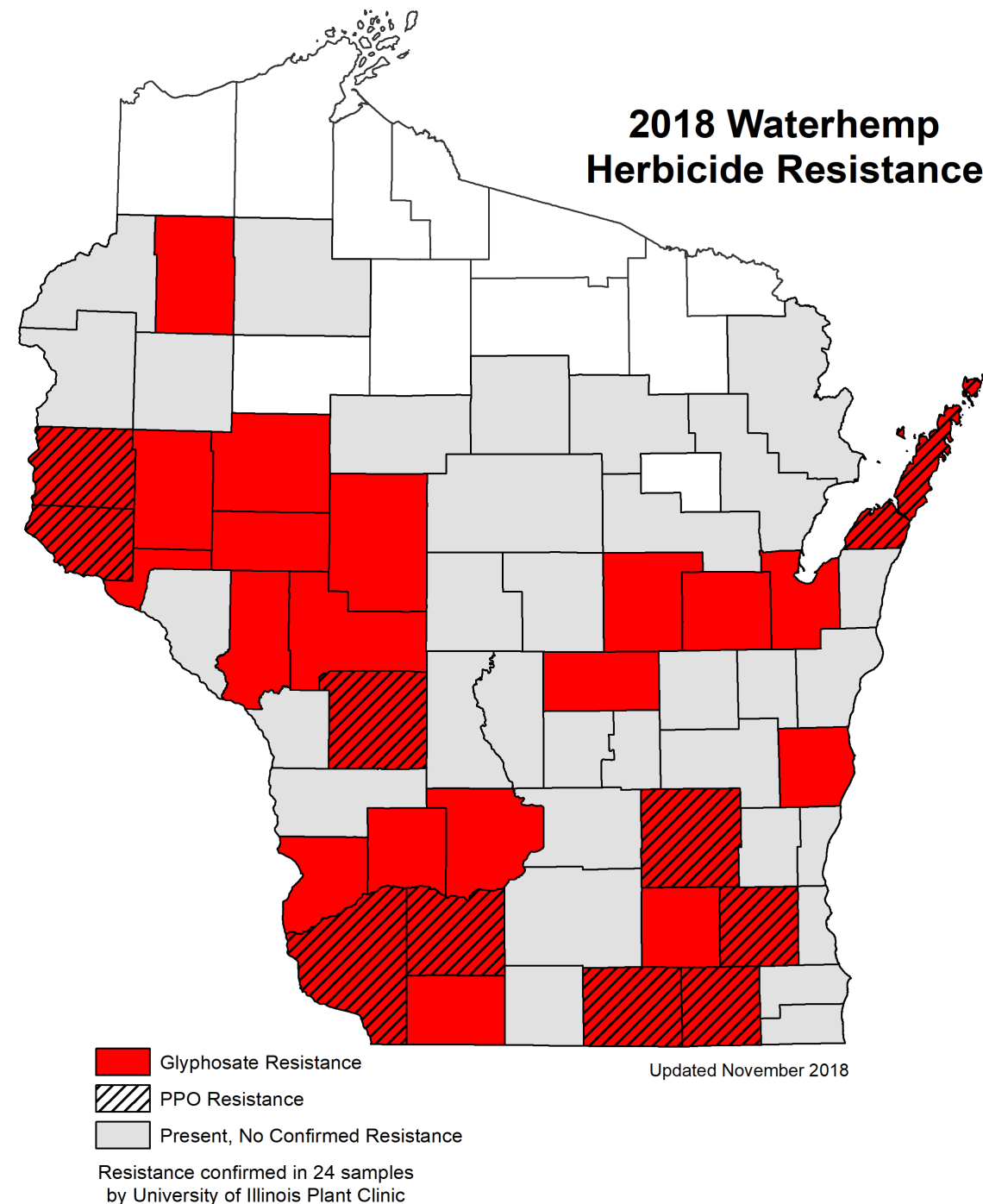
Waterhemp distribution in Wisconsin



Waterhemp resistance to herbicides in Wisconsin

28 counties with glyphosate resistant populations

10 counties with glyphosate + PPO resistant populations





Waterhemp Resistances documented in US (3/8/19)

| Mode of action | States reported in midwest |
|--------------------------|--|
| 5 (Atrazine) | MO, KS, IL ⁵ , IA ⁴ , NE ⁵ = 5 states |
| 2 (ALS inhibitors) | MN*, IA ⁴ , IL ⁵ , MO ³ , OH, WI, KS*, OK, IN, NE ⁴ , MI, TN, MS = 13 states |
| 9 (glyphosate) | MO ³ , IL ⁴ , KS, MN*, OH, IN, IA ⁴ , SD, ND, WI*, NE ⁴ , TX, MS, KY, OK, TN, AR, LA = 18 states |
| 27 (HPPD) | IL ⁵ , IA ⁴ , NE = 3 states |
| 14 (PPO) | KS*, IL ⁵ , MO ³ , IA, MN, IN, NE ⁴ , WI* = 8 states |
| 4 (Auxins) | NE ³ , IL ⁵ = 2 states |
| 6 (fatty acid inhibitor) | IL = 1 state |

Now two locations in the US have waterhemp resistant to 5 modes of action

Illinois

- ALS inhibitors (2)
- Photosystem II inhibitors (5)
- PPO inhibitors (14)
- HPPD inhibitors (27)
- Synthetic Auxins (4)

Missouri

- ALS inhibitors (2)
- Photosystem II inhibitors (5)
- PPO inhibitors (14)
- Synthetic Auxins (4)
- Glyphosate (9)



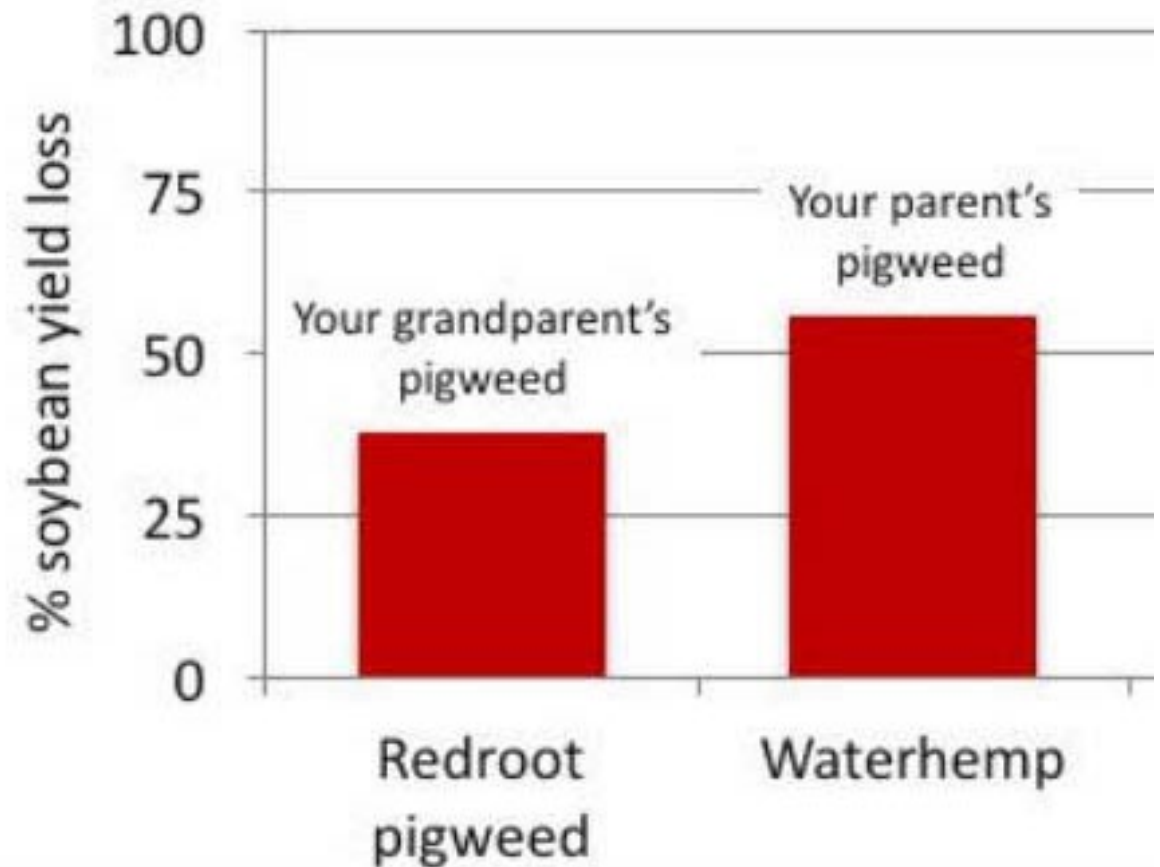
Waterhemp is more competitive than common weeds in WI

- More competitive weed
- Produces more seed
- Emerges later in the season

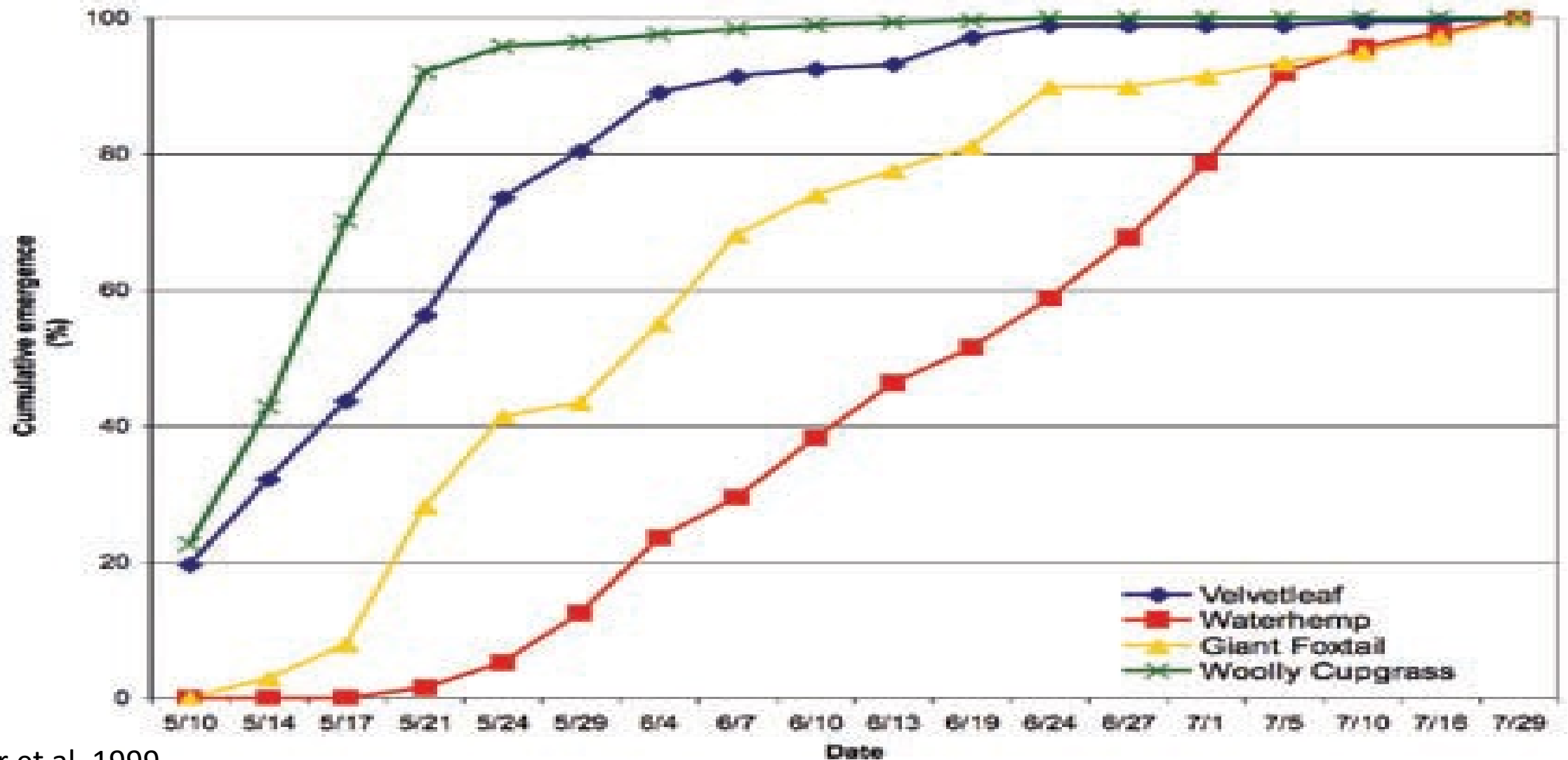


Waterhemp is more competitive than common weeds

- Is more competitive
 - reducing corn and soybean yield by 15 to 44% (North Dakota)
- High seed production
 - > 300,000 seeds per plant
 - 1.5 times more seed
- Seed can remain viable for 2-4 years



Emergence pattern of 4 annual weeds



Estimated waterhemp emergence pattern in WI

from data from annual row crops in 1990s

