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Pollinator-Friendly Herbicide Practices

October 25, 2018

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Agenda

Section 1. Role of herbicides in habitat management

Section 2. Herbicides and pollinators

Section 3. Herbicide Best Management Practices (BMPs) for pollinators

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Section 1.

Role of herbicides in habitat management

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Herbicides are a type of pesticide used to remove unwanted plants for:

- **Vegetation control**
- **Habitat management**
- **Other (economy, aesthetics, health)**

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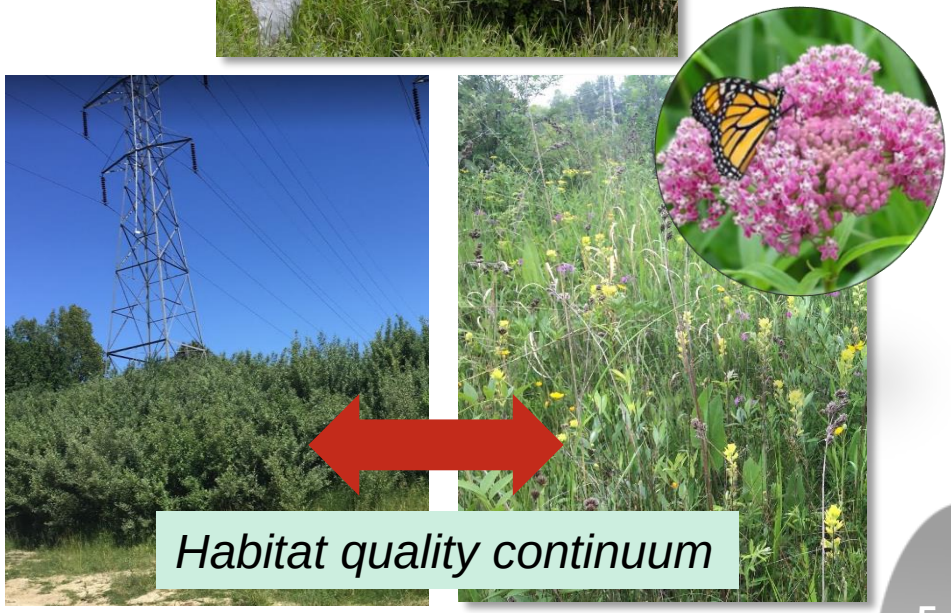
Herbicides are a type of pesticide used to remove unwanted plants for:

- Vegetation control
- Habitat management
- Other (economy, aesthetics, health)

Not all herbicides are created equal. Important distinctions for habitat management:

- **Formulation**
- **Mode of action (e.g. target plants)**
- **Approved legal uses**
- **Ecologically-compatible uses**
- **…**



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Chemical controls

Mechanical controls

Biological controls

Cultural controls

Integrated Control

Herbicides are a critical tool in the vegetation management toolbox

*Like all control methods, herbicides come with **benefits and liabilities***

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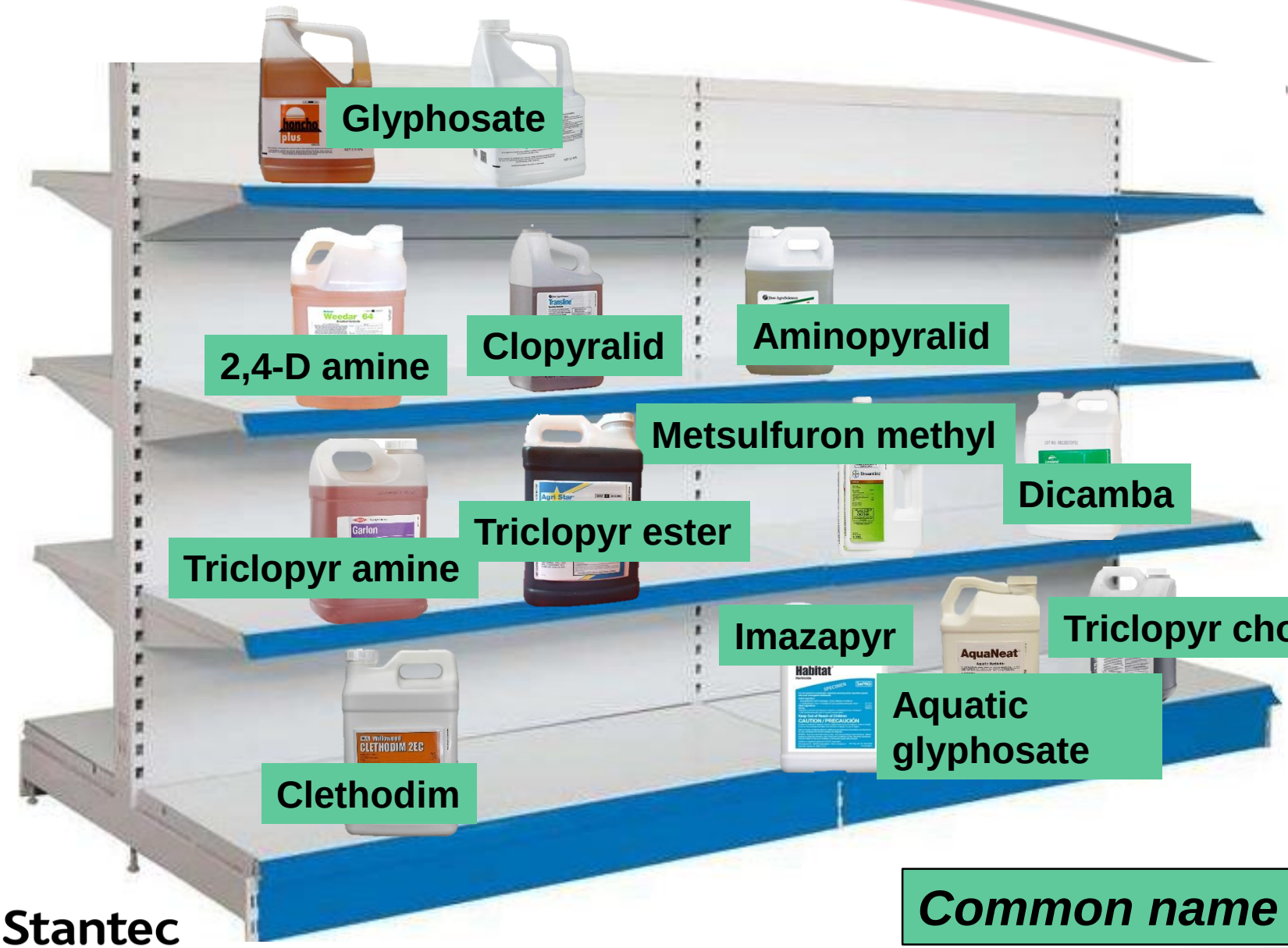

Common name

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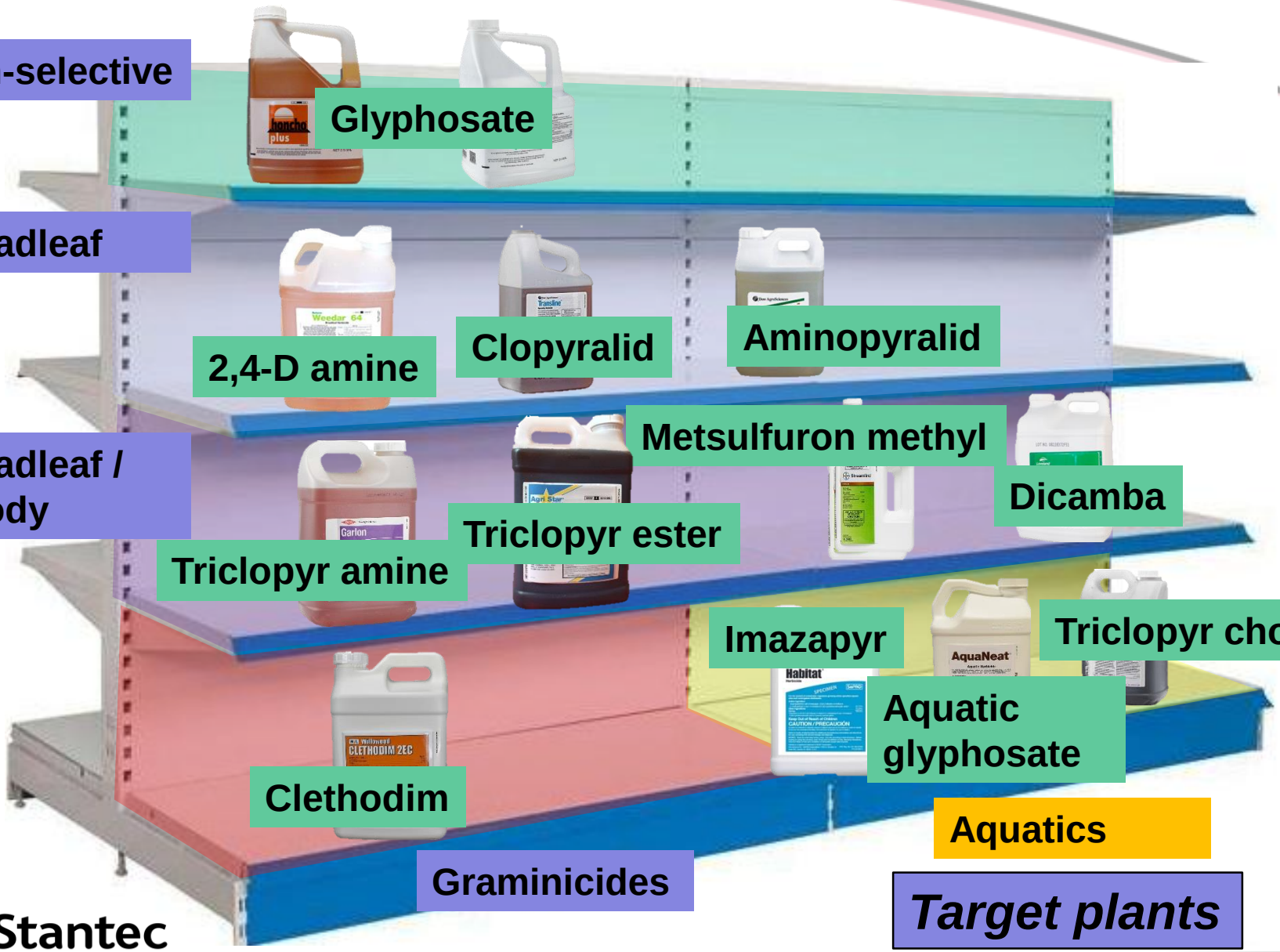

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Habitat conversion: non-sensitive site

Large volume
Non-selective herbicide

Glyphosate

Replace undesirable vegetation with desirable vegetation

Habitat stewardship: sensitive site

Plant invasion

Low volume
Selective herbicide

Aquatic glyphosate

Triclopyr choline

Prevent undesirable vegetation from replacing desirable vegetation

Section 2.

Herbicides and pollinators

Potential indirect effects - pollinators

A results of modification of food supply: removal / reduced vigor of flowering plants from direct spray or drift

Removal of host plants

Degraded pollinator habitat can lead to reduced use by pollinators

** Other control methods can also degrade habitat (e.g. mowing temporarily reduces floral resources)*

Potential direct effects - pollinators

May result from direct exposure of pollinators to **herbicides and adjuvants** when:

1. A pollinator is sprayed ("line-of-fire")

2. A pollinator ingests chemicals during feeding. e.g., for bees:
   - Adults: plants that have been sprayed
   - Larvae: transport of contaminated nectar back to nest

Potential direct effects

Studies on the direct effects of herbicide **active ingredients** are **limited**.

Potential lethal effects
"Higher" concentration or dosage

- Acute toxicity

Potential sub-lethal effects
"Lower" concentration or dosage

- Impaired cognition
- Food sensitivity
- Learning impairments
- Physiological effects

- Not all herbicides show these effects
- Inconsistent results between studies
- Often lack **conclusive** cause-and-effect

Information gaps

- ✓ Not all herbicides and adjuvants have been studied
- ✓ “Inert” herbicide ingredients and adjuvants are proprietary
- ✓ Lab tests often performed only on the active (technical) ingredient
- ✓ U.S. testing requirements are basic (acute oral dose on honey bees)
- ✓ Test concentrations vary and exposure pathways vary
- ✓ When combined multiple active ingredients may have unique effects
- ✓ May be multiple formulations of an active ingredient
- ✓ Formulations change over time; multiple formulations for sale
- ✓ Limited pollinators studied (typically honey bees)

- Difficult to make specific recommendations for / against a specific herbicide

- **How, where, and when** a certain chemical is probably more important

Section 3.

Best Management Practices

The herbicide **label** is the law

BMPs

Training and qualifications

BMPs

Minimize **off-target impacts**:

1. Planning & assessment
2. Site awareness & adaptive management
3. Herbicide selection
4. Application techniques

BMPs

Minimize potential **sub-lethal effects:**

1. Low volumes
2. Low concentrations
3. Timing
4. Herbicide selection??

Integrated control techniques

Pollinator habitat management

Training and qualifications

1. Select the right herbicides and adjuvants for the job
2. Interpret product labels and restrictions on use
3. Identify target **and** non-target plants (e.g. host plants)
4. Familiarity with a range of application techniques to minimize off-target damage
5. Concepts of adaptive management – ability to change approach as conditions require between sites or within a site

Planning and assessment

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Awareness & adaptive management

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Chemical selection

- ✓ **Herbicides:** preference for those that pose the least threat to the environment
  - Mode of action: select **selective** formulations
  - Fate in the environment: select those with low **drift** and **runoff** potential
  - Residual activity: select those with **low** residual activity
  - Toxic effects: select those with **high** LC_{50} and LD_{50}
- ✓ **Adjuvants**: preference for naturally-derived products
  - Crop / seed oil surfactants w/ minimal "other" additives
  - Aquatic-approved (Washington State University Pesticide Information Center)
  - Toxic effects: select those with **high** LC_{50} and LD_{50}

Application techniques

High-volume foliar

Low-volume foliar

Basal bark

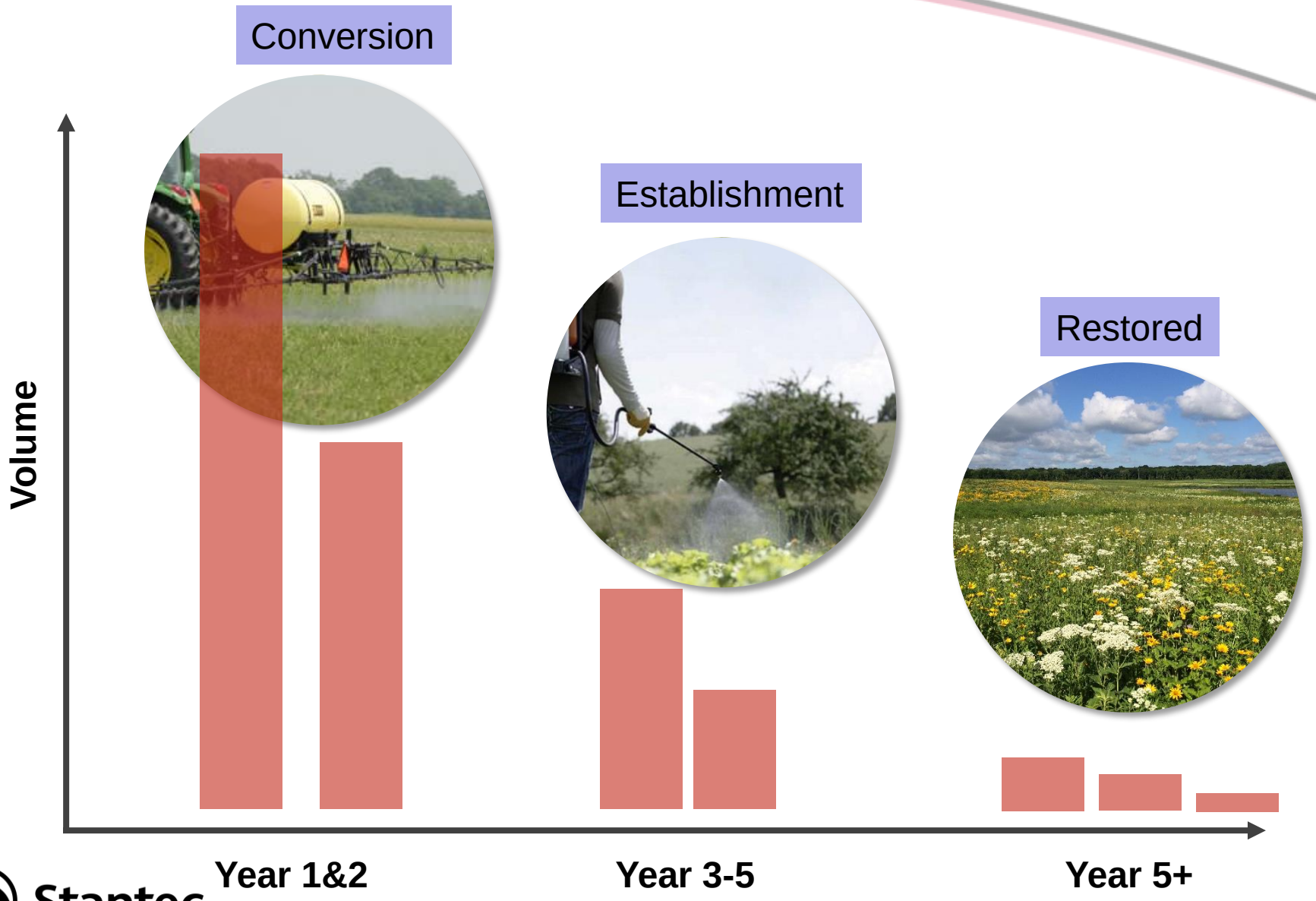
Cut stump

Volume

Concentration

Use lowest combination of **volume & concentration** to achieve the intended outcome

Select appropriate techniques based on application goals and site ecology


Conversion
Establishment
Restored
Volume
Year 1&2
Year 3-5
Year 5+

Application timing

- ✓ Generally difficult to implement on a large scale. May be implemented at the site scale.

- ✓ Considerations:
  1. Environmental conditions – avoid foliar applications in **high wind, dew**, atmospheric inversions
  2. Time of day – morning and evening are best
  3. When beneficial floral resources are low
  4. When pollinator activity is low

Chemical controls

Mechanical controls

Biological controls

Cultural controls

Ecological function

Natural systems with intact ecological processes are more resilient to change

A native plant community is less likely to be invaded by weedy / invasive plants than a disturbed plant community

Reduce reliance on herbicides over the long-term

Use integrated control techniques to improve and manage ecological function

Questions?

Aaron Feggestad
Stantec
Senior Ecologist
Aaron.Feggestad@Stantec.com

Marla Westerhold
ComEd
Senior Program Manager
Vegetation Management Dept.
Marla.Westerhold@ComEd.com