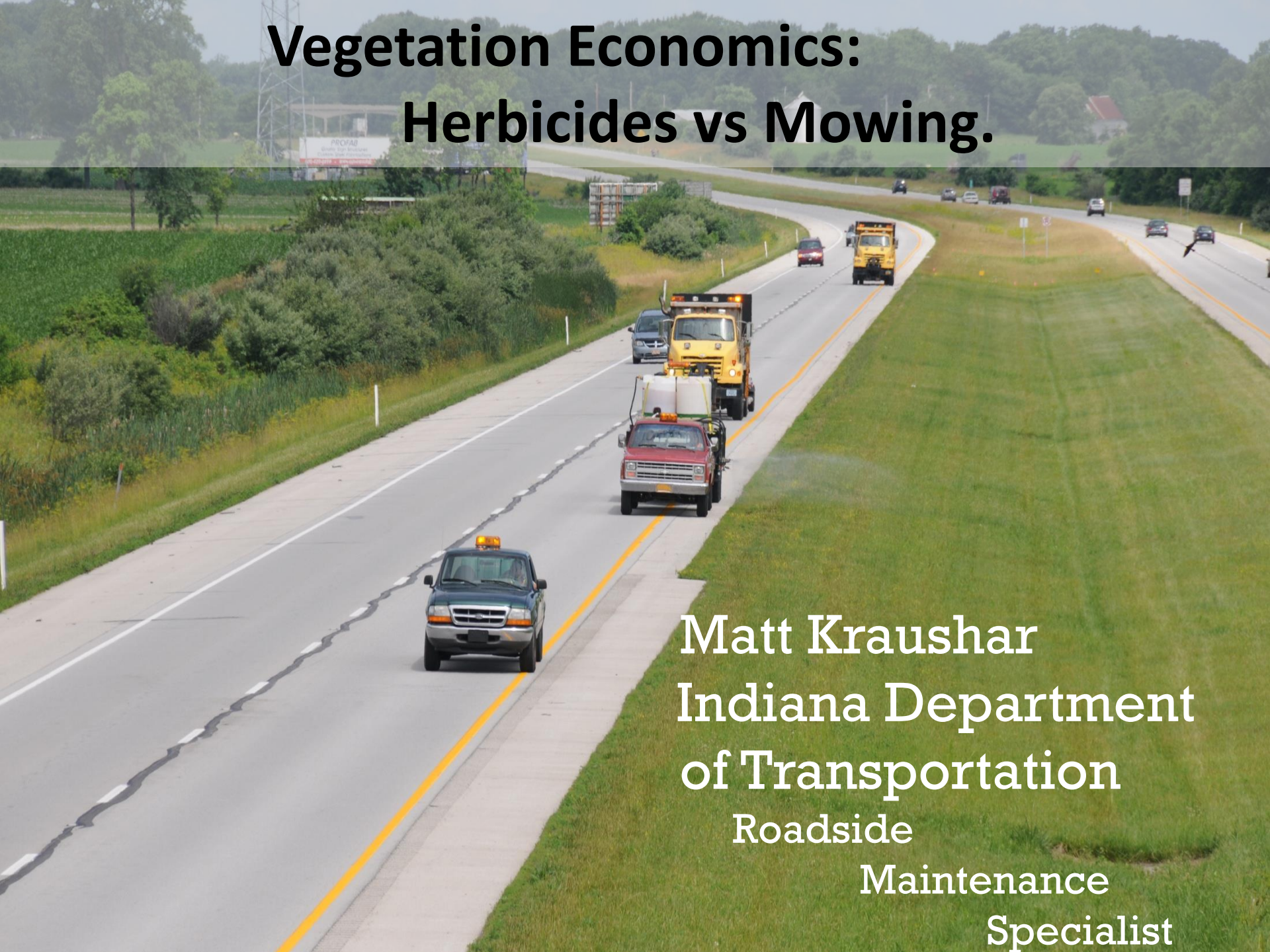
# Vegetation Economics: Herbicides vs Mowing.



Matt Kraushar
Indiana Department of Transportation
Roadside Maintenance Specialist


Speeding
Max $1000
Reckless Driv
Max 8 Yrs


Wants……


Needs….


Wants….

# Anything wrong here?

http://www.flickr.com/photos/adaenn/624467511/

# Vegetation Management Options

- Chemical - use of any herbicide/pesticide
- Mechanical - physical attack on the plant
- Natural - competition*, drought, fire, etc.
- Biological - purposeful release of a predatory organism
- IVM- combinations of the above

# Is grass *REALLY* the problem?

# Yeah, this was on East side of the Mississippi… And North of the Mason-Dixon…

**Common roadside grass**

- Fescue
- Kentucky bluegrass
- Brome species
- Purpletop
- Orchard grass
- Timothy
- Broomsedge and other NWSG
- Reed canarygrass
- Annual bluegrass (weed)
- Johnsongrass (weed)
- Foxtail (weed- several species)

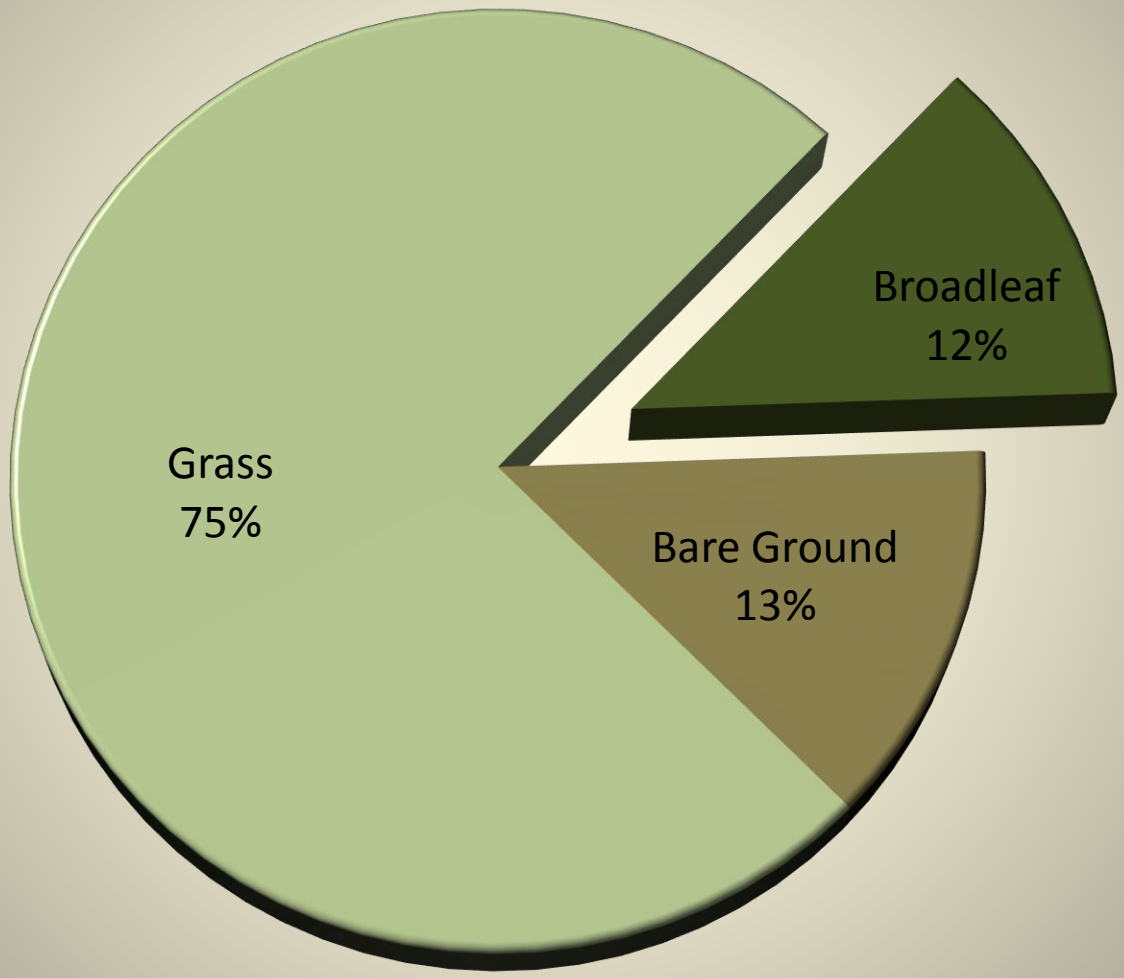
**Common roadside weeds**

- Chicory
- Wild carrot
- Milkweed species
- Dogbane
- Canada thistle
- Goldenrod
- Ragweed (giant and common)
- Plantain species
- Parsnip
- Clover (red, white & sweets)
- Crown vetch
- Dock species
- Several Aster species
- Ironweed
- Yarrow
- Kochia, knapweed, knotweed

# Roadside Vegetation Research

- 6 vegetation management sites
  - 13 miles by 18 feet
  - 9 treatments in half mile replicates
  - 6 sites scattered across three regions (south, central and north) on both state highways and interstates
- Objectives
  - Develop a Best Management Practice for INDOT which includes plant growth regulation and selective broadleaf control
  - Show a cost savings of 10%, or more, over the status quo of 2-3 cycle mowing.
- NWSG Plantings….

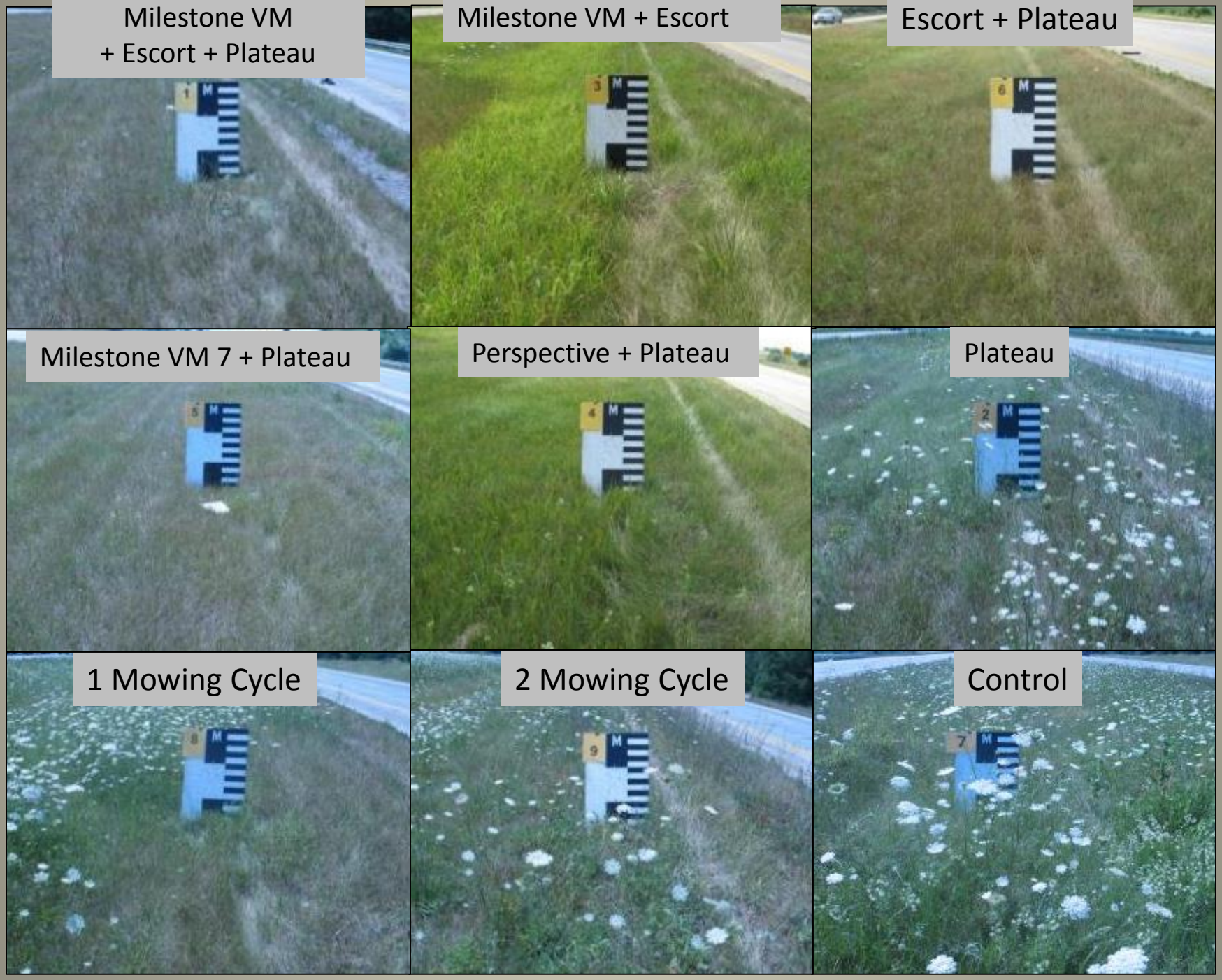
# Average Composition at Time of Herbicide Application



# Why mow… let the neighbors do it!

# 2010 Vegetation Management

| Treatment | Initial Mowing | Broadleaf Control | Plant Growth Regulation | Second Mowing |
|---|---|---|---|---|
| Plateau 3 oz/A<br>Milestone VM 7 oz/A<br>Escort 0.5 oz/A | X | X | X | |
| Milestone VM 7 oz/A<br>Escort 0.5 oz/A | X | X | | |
| Plateau 3 oz/A<br>Escort 0.5 oz/A | X | X | X | |
| Plateau 3 oz/A<br>Milestone VM 7 oz/A | X | X | X | |
| Perspective 4.76 oz/A<br>Plateau 3 oz/A | X | X | X | |
| Plateau 3 oz/A | X | | X | |
| 1 Mowing Cycle | X | | | |
| 2 Mowing Cycle | X | | | X |
| Control | | | | |


Milestone VM
+ Escort + Plateau
Milestone VM + Escort
Escort + Plateau
Milestone VM 7 + Plateau
Perspective + Plateau
Plateau
1 Mowing Cycle
2 Mowing Cycle
Control

# Perspective 4.76 O/A -30 DAT

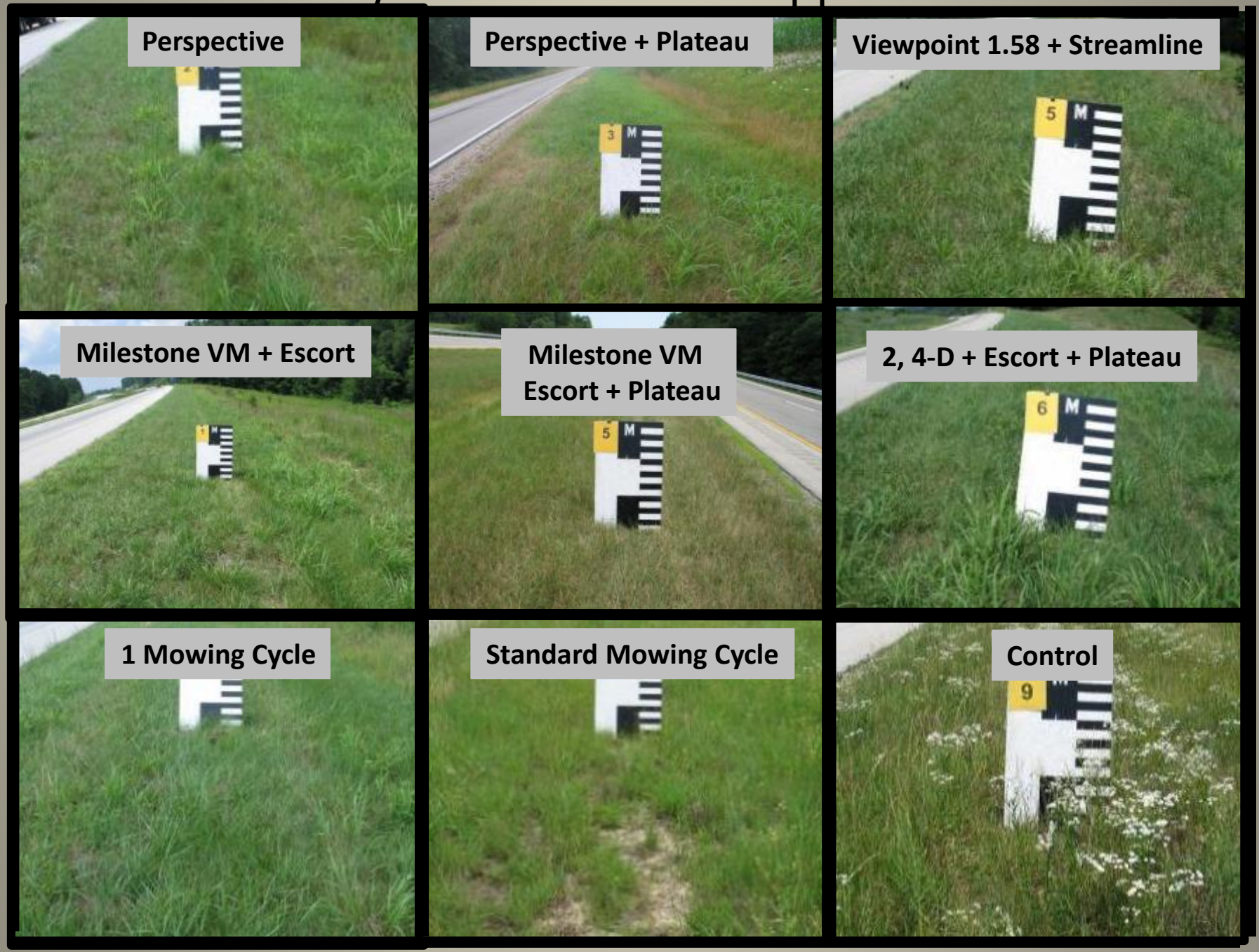
# Perspective 4.76 O/A + Plateau 3 O/A -30 DAT



# 2011 Vegetation Management

| Treatment | Initial Mowing | Broadleaf Control | Plant Growth Regulation | Second Mowing |
|---|---|---|---|---|
| Milestone VM 7 oz/A + Escort 0.5 oz/A | X | X | X | |
| Milestone VM 7 oz/A + Escort 0.5 oz/A + Plateau 3 oz/A | X | X | X | |
| Perspective 3.5 oz/A | X | X | X | |
| Perspective 3.5 oz/A + Plateau 3 oz/A | X | X | X | |
| Viewpoint 1.58 oz/A + Streamline 1.46 oz/A | X | X | X | |
| 1 Mowing | X | | | |
| 2 Mowing Cycle | X | | | X |
| Control | | | | |

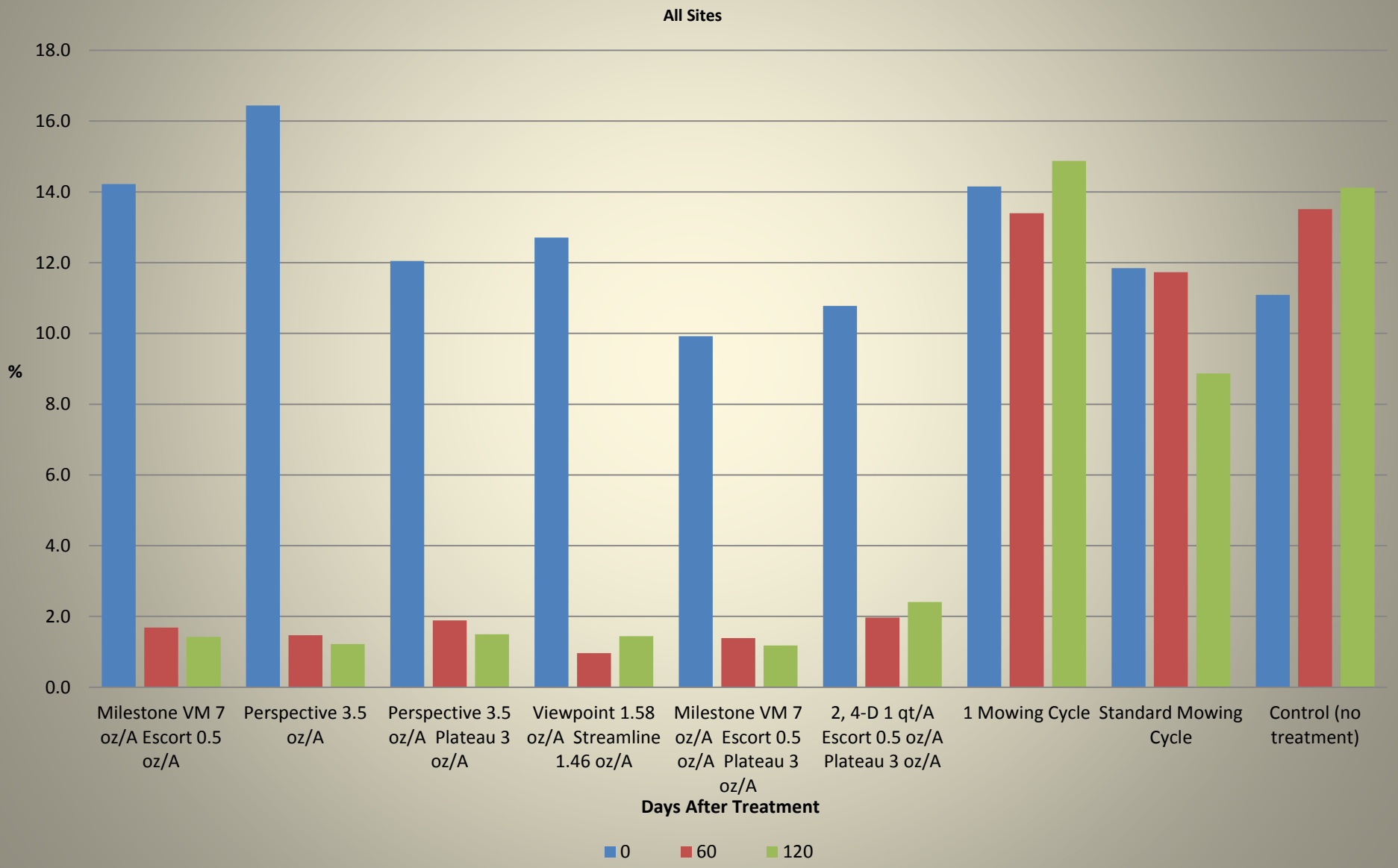
# 60 Days After Herbicide Application



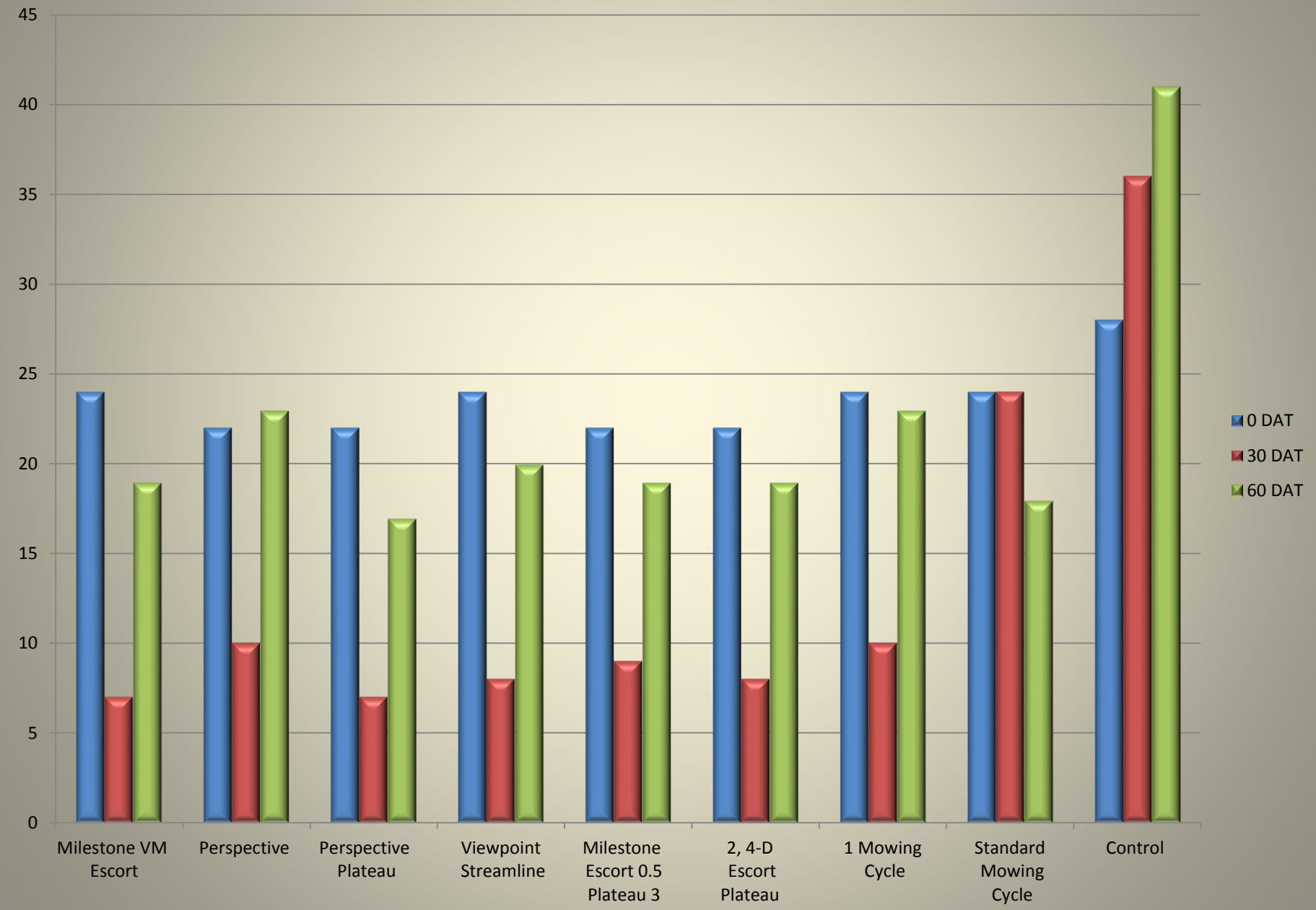
No treatment 30DAT 3.76 oz/Acre Perspective

# Results

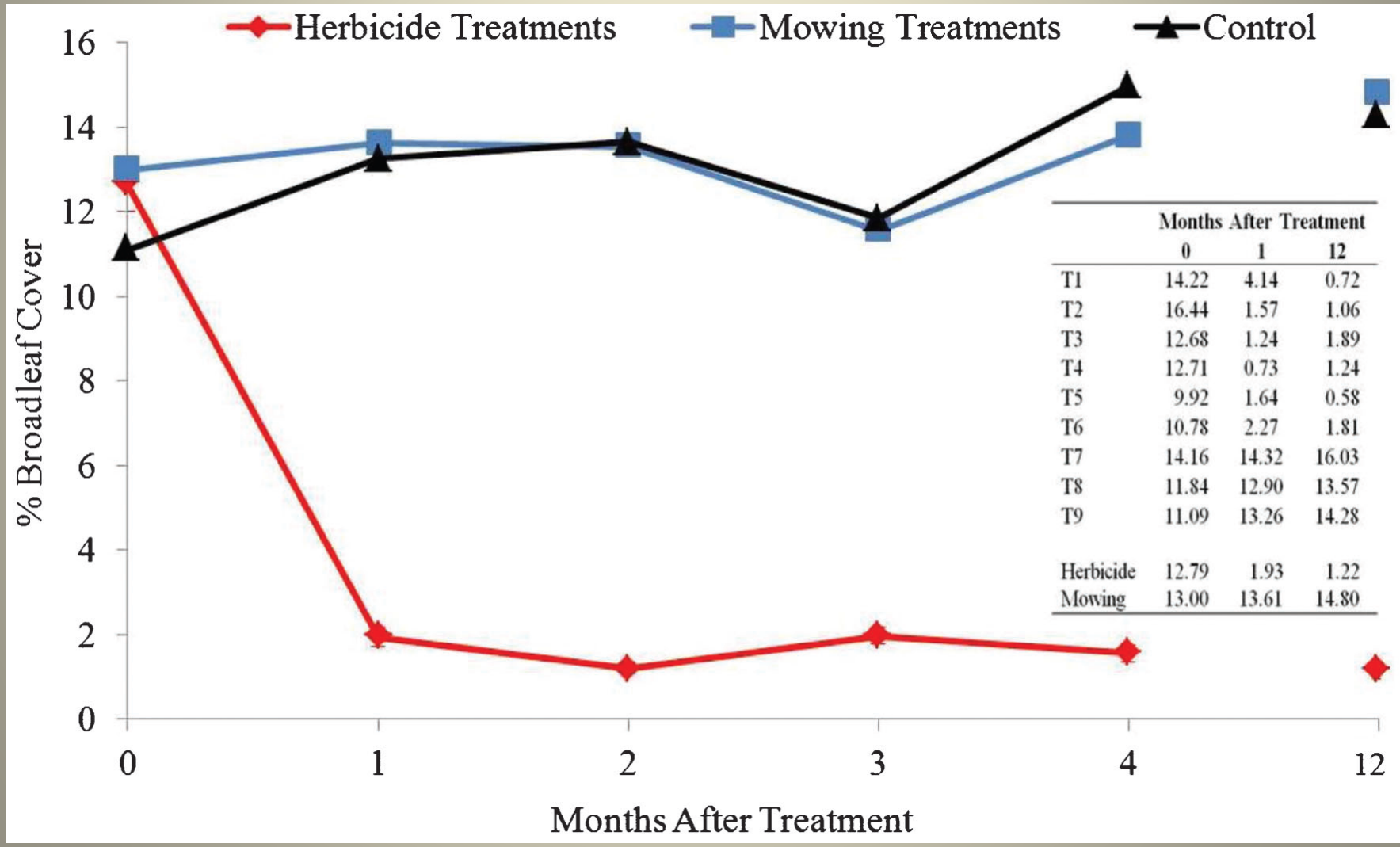

# Results


Broadleaf Cover Over Time
All Sites
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
%
Milestone VM 7 oz/A Escort 0.5 oz/A
Perspective 3.5 oz/A
Perspective 3.5 oz/A Plateau 3 oz/A
Viewpoint 1.58 oz/A Streamline 1.46 oz/A
Milestone VM 7 oz/A Escort 0.5 oz/A Plateau 3 oz/A
2, 4-D 1 qt/A Escort 0.5 oz/A Plateau 3 oz/A
1 Mowing Cycle
Standard Mowing Cycle
Control (no treatment)
Days After Treatment
0
60
120

# Grass Height

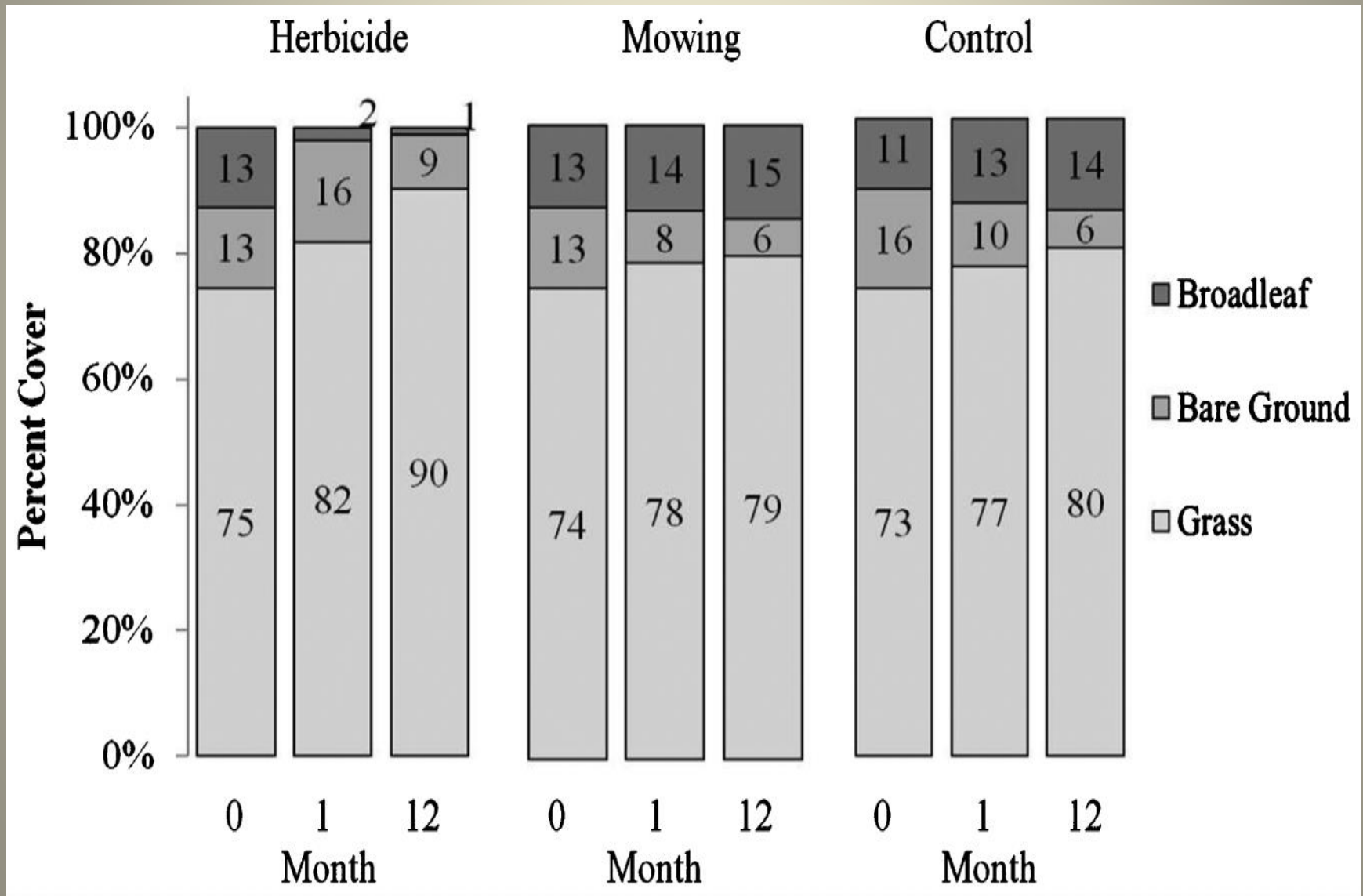


# Broadleaf Control




| | Months After Treatment | | |
|---|---|---|---|
| | 0 | 1 | 12 |
| T1 | 14.22 | 4.14 | 0.72 |
| T2 | 16.44 | 1.57 | 1.06 |
| T3 | 12.68 | 1.24 | 1.89 |
| T4 | 12.71 | 0.73 | 1.24 |
| T5 | 9.92 | 1.64 | 0.58 |
| T6 | 10.78 | 2.27 | 1.81 |
| T7 | 14.16 | 14.32 | 16.03 |
| T8 | 11.84 | 12.90 | 13.57 |
| T9 | 11.09 | 13.26 | 14.28 |
| Herbicide | 12.79 | 1.93 | 1.22 |
| Mowing | 13.00 | 13.61 | 14.80 |

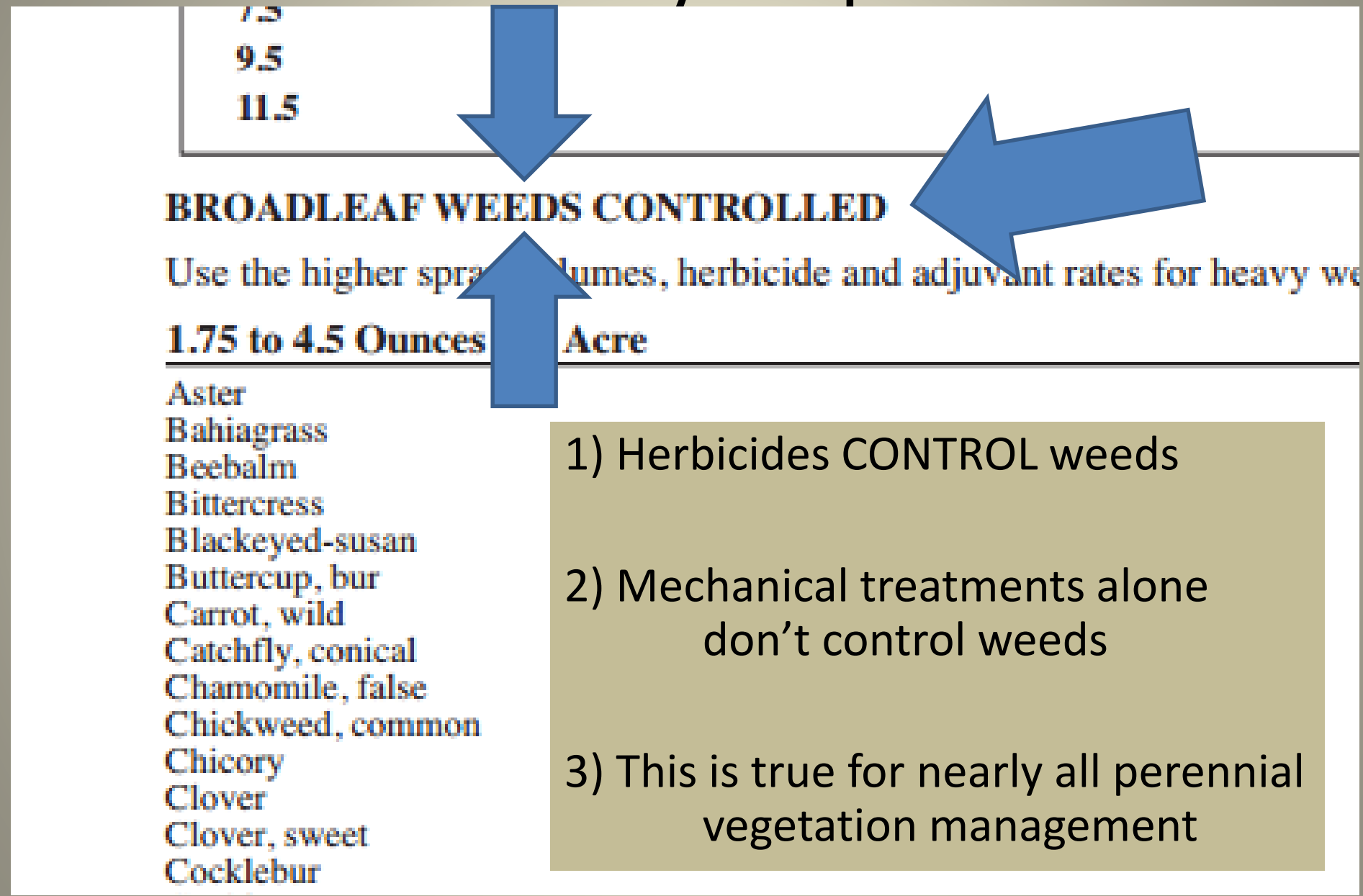
# Percent Cover Over Time




Mowing Treatment – Month 24

# Herbicide Treatment – Month 24

# So what's your point?!



7.5
9.5
11.5

**BROADLEAF WEEDS CONTROLLED**

Use the higher spra[illegible]lumes, herbicide and adjuvant rates for heavy we

**1.75 to 4.5 Ounces [illegible] Acre**

Aster
Bahiagrass
Beebalm
Bittercress
Blackeyed-susan
Buttercup, bur
Carrot, wild
Catchfly, conical
Chamomile, false
Chickweed, common
Chicory
Clover
Clover, sweet
Cocklebur

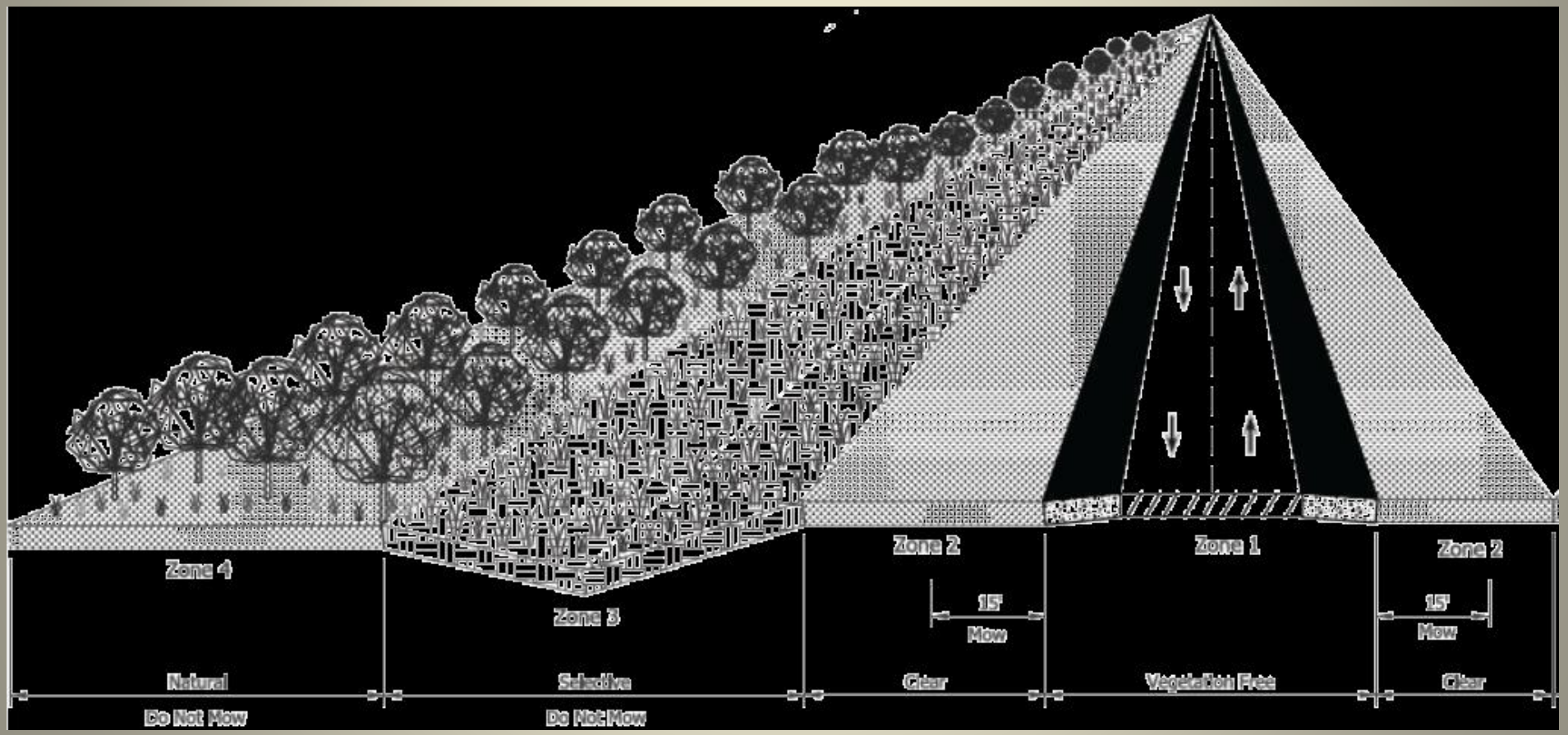
1) Herbicides CONTROL weeds

2) Mechanical treatments alone don't control weeds

3) This is true for nearly all perennial vegetation management


WARNING
TO AVOID INJURY
DON'T TELL ME HOW
TO DO MY JOB

# Zoned approach…



# FHWA Encourages States to Take Action in Achieving Pollinator Health

Pollinator species such as bees, birds, bats, and butterflies assist the reproduction of over 80 percent of the world's flowering plants. Honey bee pollination, in particular, adds more than $15 billion in value to U.S. agricultural crops each year. In recent years, the recorded populations of these species have reached historic lows, posing threats to the Nation's environmental and economic health.

In response to the rapid decline of pollinator species, President Obama released *Presidential Memorandum—Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators* on June 20, 2014. The memorandum discusses the importance of pollinators and establishes the Pollinator Health Task Force (Task Force), which comprises representatives from executive departments and agencies including the U.S. Department of Transportation (U.S. DOT). The Task Force is responsible for increasing and improving pollinator habitat. The U.S. DOT will work with State Departments of Transportation (DOTs) to promote pollinator-friendly practices and corridors.

## State DOTs Share New and Existing Best Practices for Pollinator Habitat Management

Following guidance from the Task Force, the Federal Highway Administration (FHWA) produced a case study series that highlights how several State DOTs are encouraging pollinator health using various vegetation management practices such as reducing herbicide use and decreasing mowing frequency. The purpose of the series is to provide agencies with tools that can help roadside managers encourage native vegetation—all plant species that occur naturally in a particular habitat—that benefits pollinators. The case studies describe practices in Indiana, Texas, and Washington.

**Indiana Expands Vegetation Management Practices**

The Indiana Department of Transportation (INDOT) has incorporated native plant and wildflower species into Indiana's roadside landscapes since the 1990s when the agency created the Hoosier Roadside Heritage Program. The program was initially established to reduce erosion, improve soil quality, and enhance plant pollination. After decades of successful pollinator practices, INDOT plans to expand the roadside management program to increase ecological and economic benefits.


INDOT has reduced roadside mowing since it converted anti-icing trucks to spray herbicides. The roadside in this image was mowed in early June 2015 and maintains pollinator habitat throughout the year. The pollinator habitat has not been mowed for three years. (Courtesy of INDOT)

Control of invasive species is an important component in encouraging native plant growth. To detect and manage new and existing invasive species, the Indiana State legislature established the Indiana Invasive Species Council (IISC), which includes INDOT. The IISC used the Early Detection and Distribution Mapping System (EDDMapS), a web-based mapping system for documenting invasive species distribution in order to control and

# Mowing and Spraying last 4 years

| | machine mowing | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CY | Swath miles | cost/swath | acres | cost/acre | hours | labor cost/ swath mile | benefits | Total cost | total/ acre |
| 2013 | 111199 | $22.41 | 53909 | $46.23 | 79469 | $11.10 | $529,263.54 | $3,021,233.13 | $56.04 |
| 2014 | 77581 | $19.89 | 37611 | $41.03 | 48255 | $9.67 | $279,975.51 | $1,823,061.60 | $48.47 |
| 2015 | 115676 | $18.95 | 56080 | $39.09 | 70265 | $9.55 | $402,618.45 | $2,594,678.65 | $46.27 |
| 2016 | 104854 | $18.98 | 50833 | $39.15 | 63095 | $9.46 | $595,151.30 | $2,585,280.22 | $50.86 |
| Average | 102327.5 | $20.06 | 49608 | $41.37 | 65271 | $9.95 | $451,752.20 | $2,506,063.40 | $50.41 |

| CY | square feet | cost/sq. ft | acres | Cost/acre | hours | labor cost/ square foot | benefits | Total Cost | Total/acre |
|---|---|---|---|---|---|---|---|---|---|
| 2013 | 6395003 | $0.03 | 147 | $1,306.80 | 9025 | 0.02 | $76,740.04 | $268,590.13 | $1,829.52 |
| 2014 | 11777366 | $0.02 | 270 | $871.20 | 10708 | $0.01 | $70,664.20 | $306,211.52 | $1,132.56 |
| 2015 | 18737467 | $0.02 | 430 | $871.20 | 14909 | $0.01 | $112,424.80 | $487,174.14 | $1,132.56 |
| 2016 | 20895527 | $0.02 | 480 | $871.20 | 17076 | $0.01 | $125,373.16 | $543,283.70 | $1,132.56 |
| Average | 14451341 | $0.02 | 332 | $980.10 | 12930 | $0.01 | $96,300.55 | $401,314.87 | $1,306.80 |

# Mowing and Spraying last 4 years

| CY | acres | cost/acre | hours | labor cost/acre | benefits | Total cost | Total/Acre |
|---|---|---|---|---|---|---|---|
| 2013 | 9920 | $39.24 | 4541 | $7.60 | $45,235.20 | $434,496.00 | $43.80 |
| 2014 | 9879 | $33.33 | 9879 | $6.51 | $38,587.37 | $367,854.44 | $37.24 |
| 2015 | 24324 | $34.87 | 9926 | $6.68 | $97,490.59 | $945,668.47 | $38.88 |
| 2016 | 25962 | $31.70 | 8179 | $5.25 | $81,780.30 | $904,775.70 | $34.85 |

| Spot treatment | | | | | | |
|---|---|---|---|---|---|---|
| acres | Cost/acre | hours | labor cost/acre | benefits | Total Cost | Total/Acre |
| 4572 | $70.32 | 7288 | 25.71 | $70,527.67 | $392,030.71 | $85.75 |
| 5530 | $81.52 | 9619 | $28.71 | $95,259.78 | $546,065.38 | $98.75 |
| 7461 | $74.63 | 11416 | $25.31 | $113,302.75 | $670,117.18 | $89.82 |
| 9805 | $79.10 | 13582 | $23.25 | $136,779.75 | $912,355.25 | $93.05 |

# Costs of Roadside Maintenance

- Mowing costs (4 year average)
  - In-house- $58.22/acre (49,940 acres)
    - Machine mowing- $50.41/acre (49,608 acres)
    - Mowing and Trimming- $1,307/acre (332 acres)
  - Contract- $1,190/mile (3,656 miles)
    - Estimated at 64’ per mile= $155/acre
    - Estimated at 128’ per mile= $77.34/acre
- Manual Brush Cutting Costs (3 year average)
  - $4646/acre
- Herbicide costs (4 year average)
  - Broadcast- $37.70/acre (average of 15,500 acres/year)
  - Spot Treatment- $101.63/acre (average of 5,700 acres/year)

# Example:
# INDOT “in house” Cost Comparison
# Broadcast vs. Mowing (FY2013 actual per acre)

## Roadside Selective

- 3 people
- 2 trucks
- 1 sprayer, 1 arrow board
- 76 acres/day (7hrs)
- $28.57/acre

Per 1000 acres

- 13 days
- 93 man hours

## Mowing (1 cycle)

- 4 people
- 1 truck
- 3 mowers
- 20 acres/day
- $46.95/acre

Per 1000 acres

- 50 days
- 347 man hours

# Other Costs of Roadside Maintenance

- In the last 3 years:
  - Vegetation related litigation claims- $5,450,000
    - Trees- $700,000+
    - Foliage- $3,250,000+
    - Drainage- $1,500,000+
- In the past 5 years
  - 12 official investigations of herbicide negligence
  - Currently a claim of $1,415,000
- Complaints- what do these cost?


JOHN DEERE
2012 4 11


6364
2012 4 11


LIQUID
DE-ICER
LIQUID SALT SPRAY
STAY BACK 300 FT.
2012 3 15

# Actual numbers from an INDOT Unit

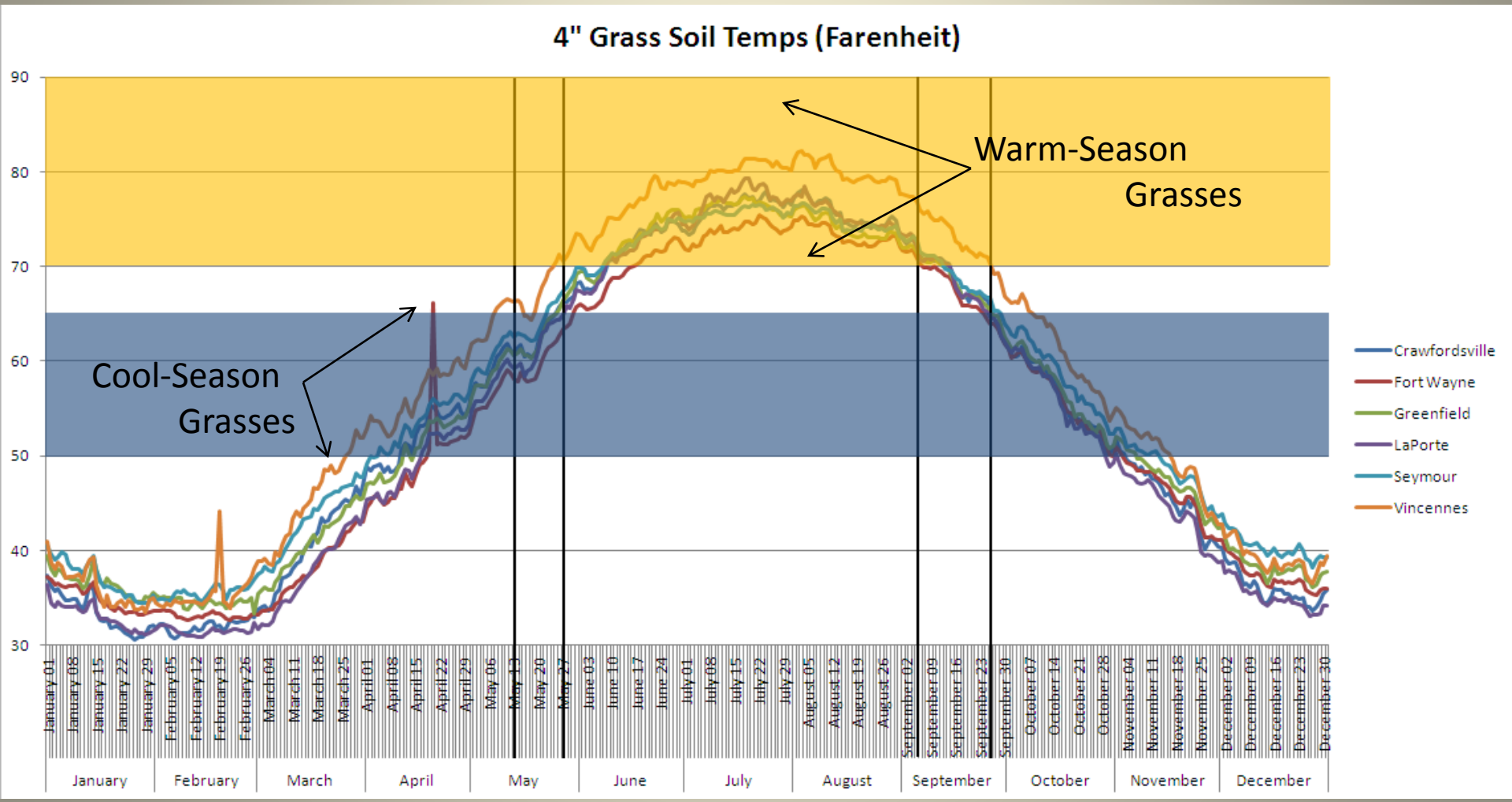
- Treated roads with PGR and selective weeding treatment
- Two people were responsible to decide WHEN to mow for EACH road.

**The result?**

- Mowed 10,000 less swath miles!
- Equating to $240,000 in savings
- There was an increase in herbicide cost-$99,000 BUT….
- “They received a few complaints but they receive a few regardless of how many times they mow.”

# Timing your targets

## Soil Temps @ 4” in Grass cover



# So what's your point!?

- Vegetation Management is a SCIENCE!!!
- Herbicide treatments
  - Are CHEAPER
  - Are FASTER
  - Last LONGER
- Roadsides are used as a model system
  - These same principles apply to:

✓Railroads
✓Roadsides
✓Pipeline
✓Transmission
✓Forestry
✓Agriculture
✓Aquatic
✓Turf and Ornamental

# Challenges

- Budget….
  - Staffing
    - Me and what army?!
    - Turnover….
  - Equipment
  - The Balancing Act
- Wants vs. Needs
  - The old way….
  - The public….
- Ownership….

# Last thoughts

- Currently working on:
  - Revising Specs for mowing and herbicide contracts
  - Decision trees for woody vegetation management
  - Scheduling for a hazard tree assessment training course
  - Revisions of WPS for all roadside maintenance
  - Herbicide recommendation guide is forthcoming.
- Suggested changes to broadcast program
- Signs/sight restrictions, Ditches, Bridge cones

# Thank YOU!

- Purdue University- Dept. Forestry and Natural Resources
- Bill Fielding- INDOT
- DuPont Land Management- Randy Denhart
- Dow AgroSciences- David Jay
- Red River – Greg Ressler and Andy Pierce
- Herold, J. M., Z. E. Lowe, and J. S. Dukes. *Integrated Vegetation Management (IVM) for INDOT Roadsides. Publication FHWA/IN/JTRP-2013/08. Joint Transportation Research Program,* Indiana Department of Transportation and Purdue University, West Lafayette, Indiana, 2013. DOI:10.5703/1288284315210.


Questions?


Roadside
Guardrails


SR 43
Delberts Dr
35

Importance of vegetation management:

What is growing here?

What will be growing here?

Importance of vegetation management:

What is growing here?

What will be growing here?

Importance of vegetation management:

What is growing here?

What will be growing here?