

# Roadside Best Management Practices for Pollinators



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# Part 1. Pollinators at the National Level





# Importance of pollinators





# Pollinators and human health

Produce section with bee-pollinated crops





# Pollinators and human health

Produce section without bee-pollinated crops



One third of every bite we eat comes from insect pollinators

Photo: Whole Foods Market



# Pollinators in Decline: Honey Bees

## The European Honey Bee – Our most familiar commercial crop pollinator

- 50% decline in managed hives since 1950
- Average annual colony losses of ~35% (2010-2015)

National Research Council. 2007.  
Bee Informed Partnership 2015.



# Bumble bees in decline

## Bumble bees – critical pollinators of crops and wildflowers

At least 25% of North American species at risk of extinction



*Bombus fraternus*

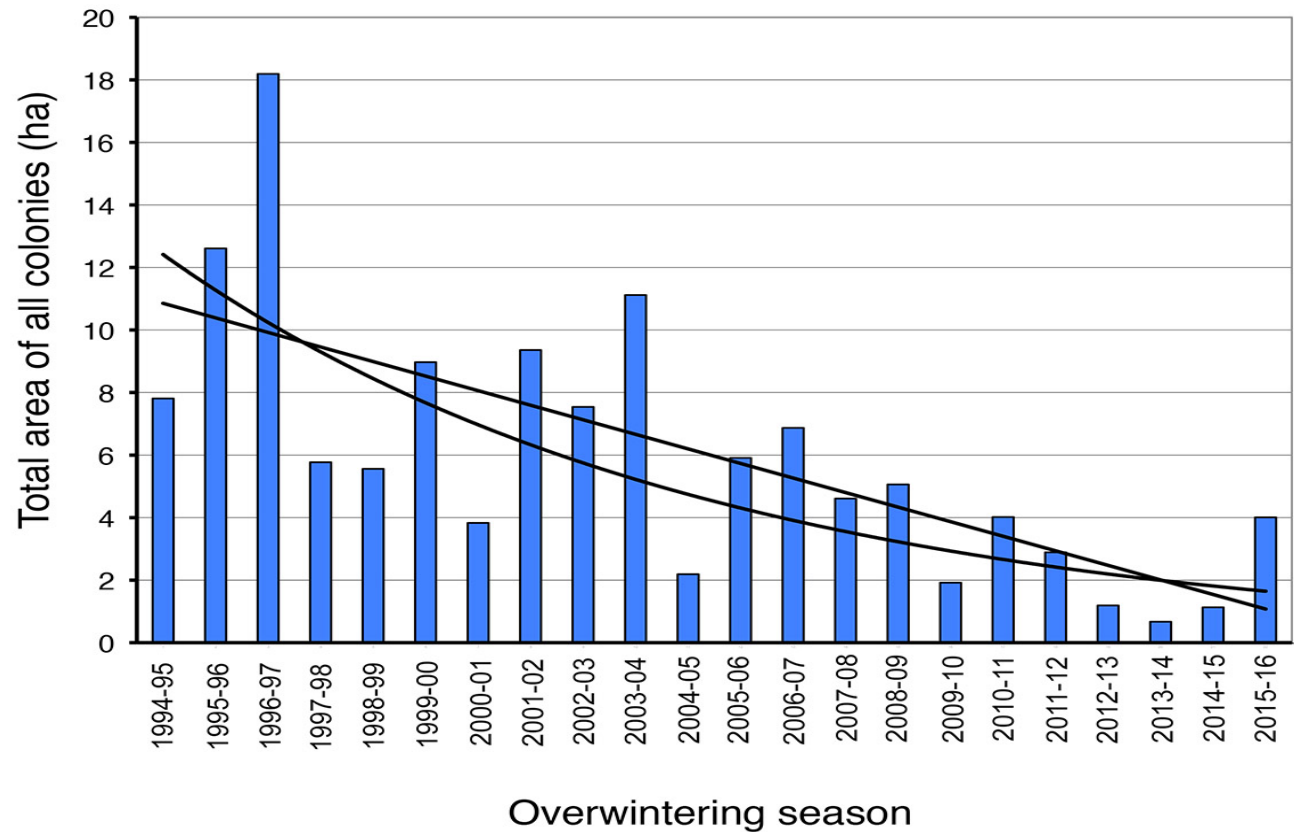
Hatfield et al. 2014 Xerces Society-IUCN status review; Cameron et al. 2011. PNAS



# Butterflies in decline: Monarchs

- More than 17% of North American butterfly species at risk, including habitat specialists and formerly common and widespread species
- In 20 years, **90%** population decline of monarch butterfly in the east

**Large scale  
restoration effort  
needed for  
monarch recovery  
– all hands on  
deck**



Sources: Jepsen and Young 2015 Xerces Society-NatureServe status review, Pleasants and Oberhauser 2012; Wright and Wimberly 2013





# Roadsides as pollinator habitat: Summary of the science

## LITERATURE REVIEW: POLLINATOR HABITAT ENHANCEMENT AND BEST MANAGEMENT PRACTICES IN HIGHWAY RIGHTS-OF-WAY

### PREPARED FOR:

The Federal Highway Administration  
1200 New Jersey Avenue, SE  
Washington, D.C. 20590

### PREPARED BY:

The Xerces Society for Invertebrate Conservation  
in collaboration with  
ICF International  
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Alexandra Charlap, Robert Preston, Kailash Mozumder, Scott Fleury

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## Roadsides provide pollinators with habitat:

### Food

- Plants that provide nectar and pollen
- Host plants for caterpillars

### Shelter

- Nests
- Overwintering sites

### Connectivity to other habitat

- Corridors, stepping stones
- Expanded ranges

Sources: Way 1977; Dirig and Cryan 1991; Munguira and Thomas 1992; Ries et al. 2001; Saarinen et al. 2005; Valtonen and Saarinen 2005; Soderstrom and Hedblom 2007; Skorka et al. 2013; Hopwood et al 2015.





# Roadsides as habitat: Pollinator mortality along roads



- Roads cause pollinator mortality but typically less than 10% of roadside population
- Mortality rates influenced by:
  - Species traits
  - Traffic volume
  - Road width
  - Roadside width
  - Roadside vegetation management
    - Mowing frequency increases butterfly kills
    - Roadside plant diversity reduces butterfly kills

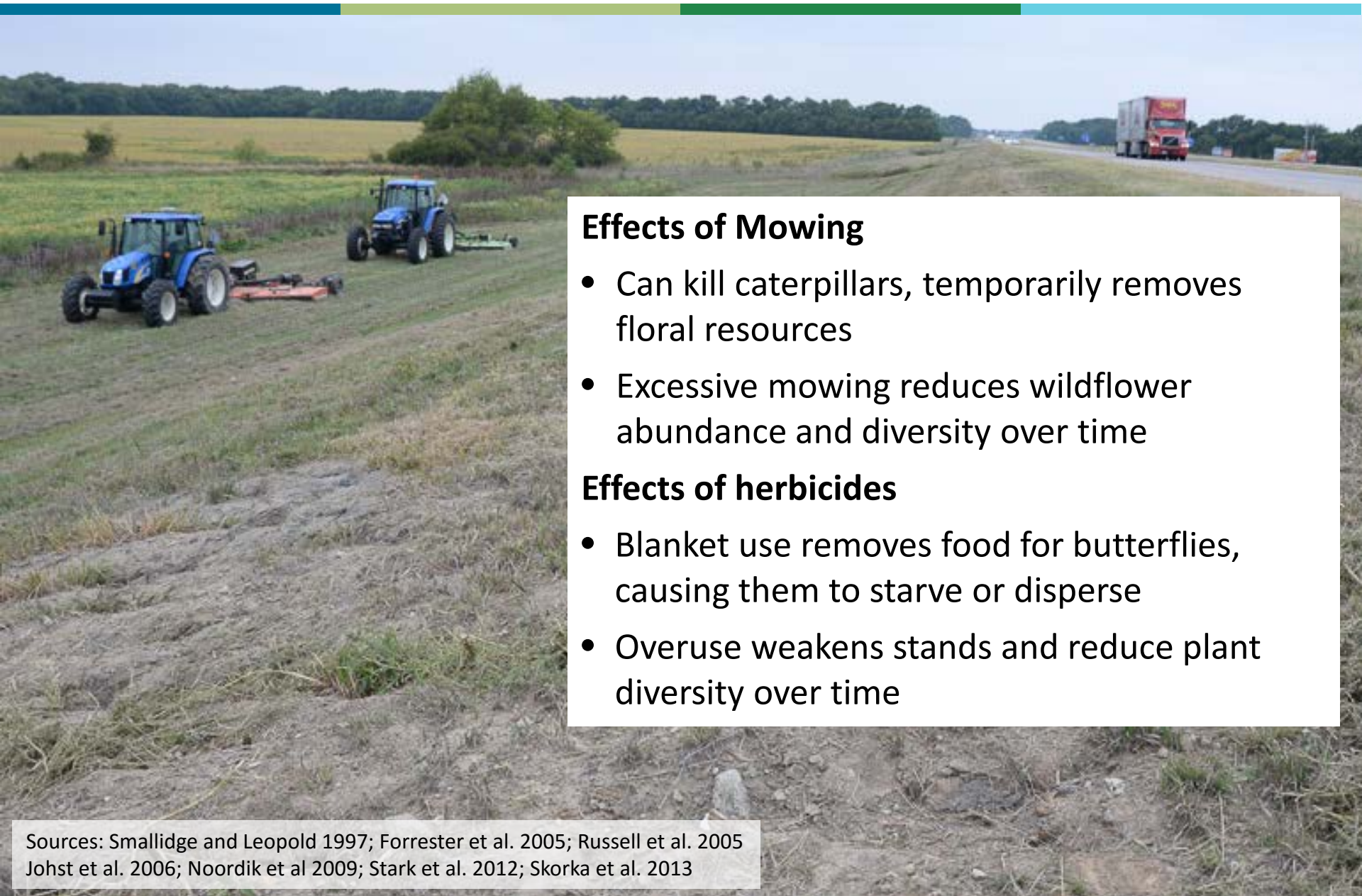
Sources: Munguira and Thomas 1992; McKenna et al. 2001; Ries et al. 2001; Skorka et al. 2013







# Roadsides as habitat: Effects of vegetation management



## Effects of Mowing

- Can kill caterpillars, temporarily removes floral resources
- Excessive mowing reduces wildflower abundance and diversity over time

## Effects of herbicides

- Blanket use removes food for butterflies, causing them to starve or disperse
- Overuse weakens stands and reduce plant diversity over time

Sources: Smallidge and Leopold 1997; Forrester et al. 2005; Russell et al. 2005  
Johst et al. 2006; Noordik et al 2009; Stark et al. 2012; Skorka et al. 2013





# Healthy roadsides can help mitigate the effects of roads

**17+ million acres of roadsides in the U.S.**

- Highway corridors connect all lands
- In many landscapes, roadsides are the only opportunity for habitat that remains

*Florida roadside*



# Federal government: Importance of pollinators

The White House  
Office of the Press Secretary

For Immediate Release

June 20, 2014

## Presidential Memorandum -- Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators

MEMORANDUM FOR HEADS OF EXECUTIVE DEPARTMENTS AND  
AGENCIES

SUBJECT: Creating a Federal Strategy to Promote the Health of



### **2014 Presidential Memorandum directs USDOT/FHWA to:**

1. Evaluate guidance and resource opportunities and update as needed
2. Identify opportunities to increase pollinator habitat along roadways and implement improvements
3. Work with state DOTs to promote pollinator friendly practices



# Federal government: Importance of pollinators

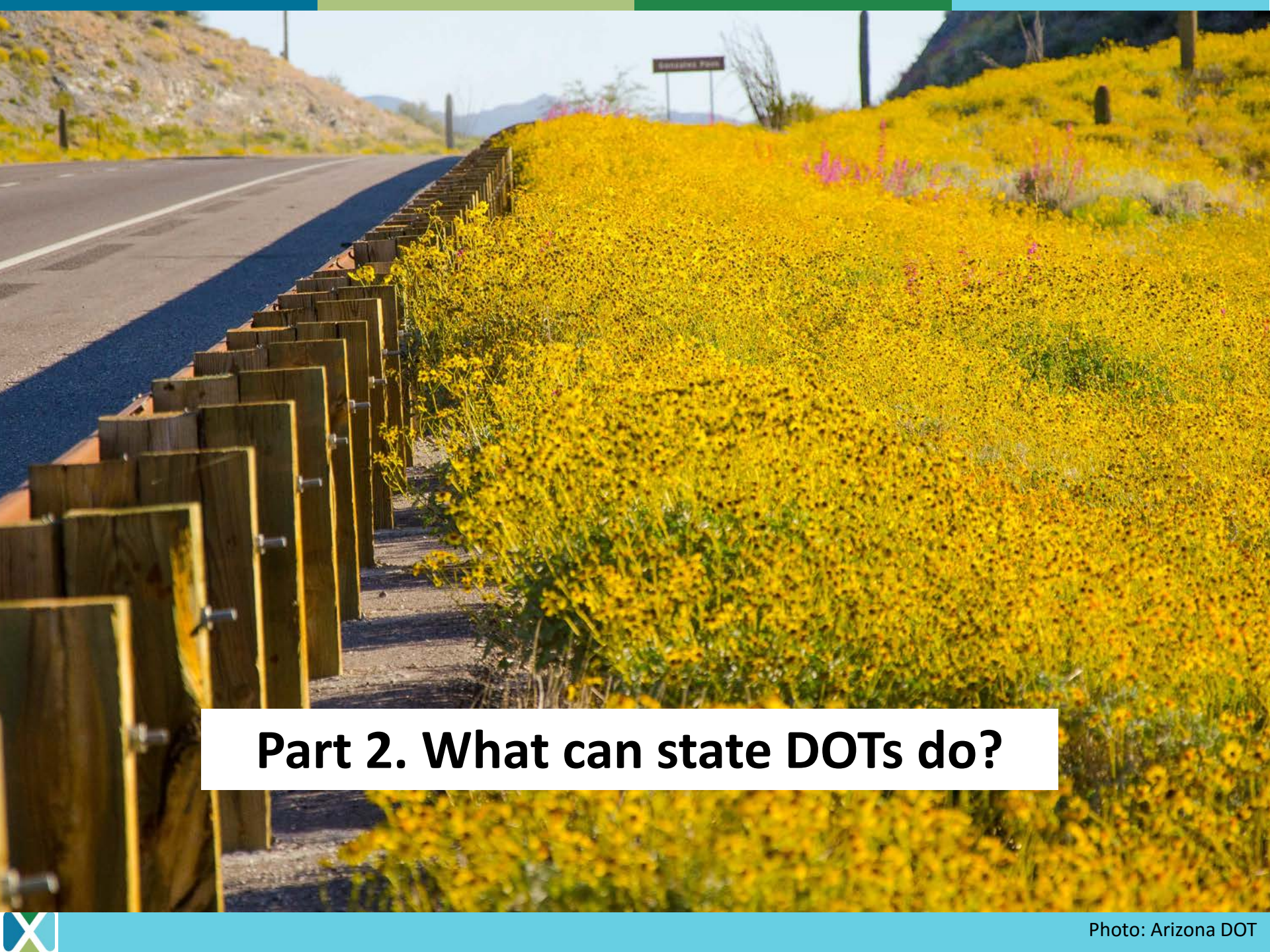


## **2015 Fixing America's Surface Transportation (FAST) Act:**

- Section 1415: Administrative Provisions to Encourage Pollinator Habitat and Forage on Transportation Rights-of-Way
- Encourages IRVM, including reduced mowing
- Encourages the development of pollinator habitat on roadsides through planting native forbs and grasses







## Part 2. What can state DOTs do?





# Increasing the value of roadside habitat for pollinators: BMPs

**These BMPs were informed by the latest science and practitioner experience**

Overview:

- 1) Manage existing habitat to maintain wildflower diversity
- 2) Reduce mowing beyond clear zone/safety strip
- 3) Target herbicide use
- 4) Prioritize native plants in new roadside plantings and include plants beneficial to pollinators
- 5) Education and outreach to gain DOT staff, community, and adjacent landowner acceptance





# BMPs: Remnant habitat

## *Protect existing roadside habitat*

- Inventory and identify existing remnant roadsides
- Maintain wildflower diversity through invasive species removal, carefully timed mowing, and/or prescribed burns
- Consider at-risk pollinator species in timing of management

*Oklahoma remnant roadside with wildflowers*



# BMPs: Reducing the impact of mowing



Reducing mowing is one of the most important steps DOTs can make





# BMPs: Reducing the impact of mowing

## *Roadside mowing practices*

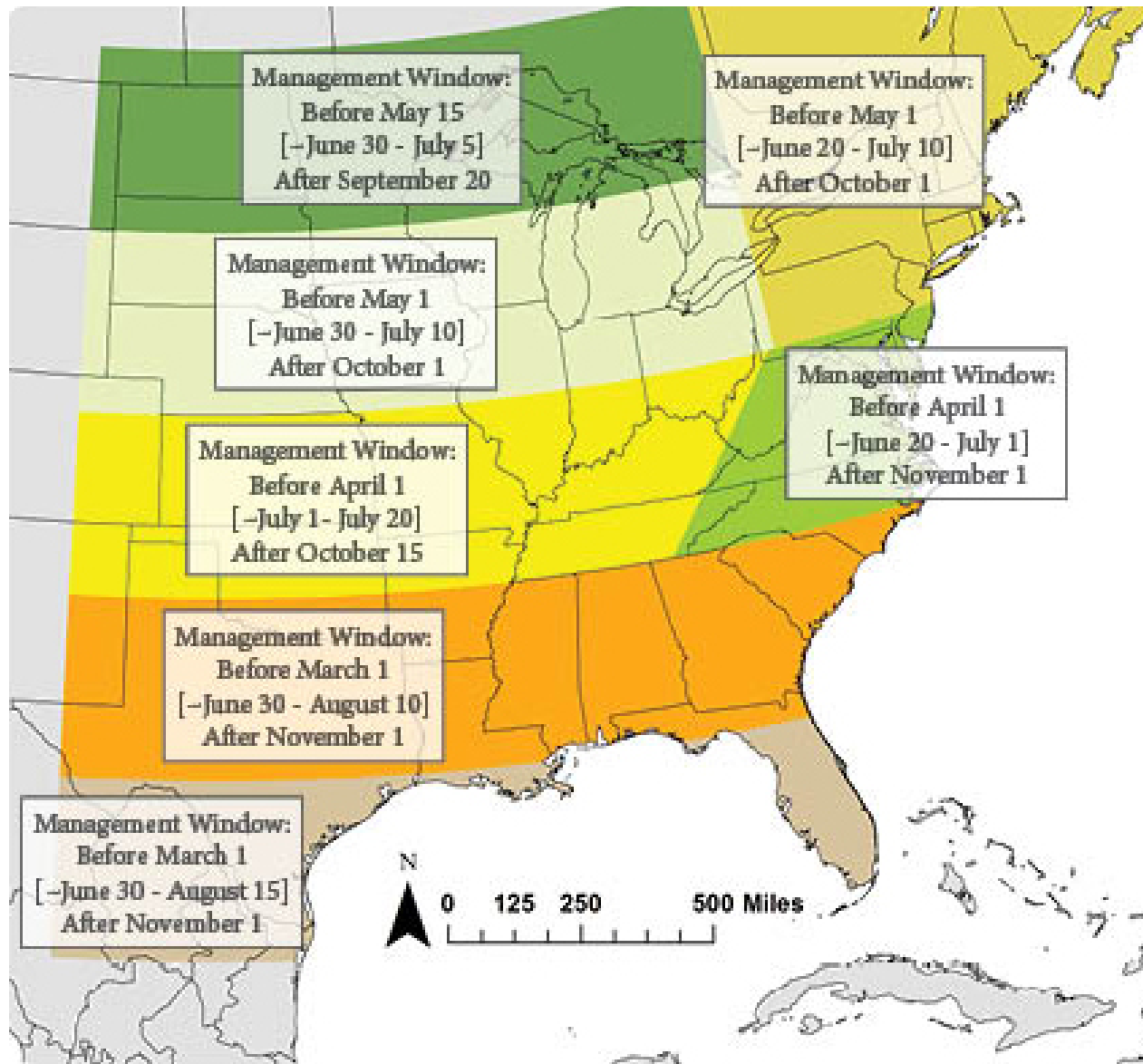
- Limit mowing to no more than twice a growing season
- Delay mowing until after first frost
- Maintain a regularly mown clear/safety zone



Sources: Noordik et al 2009; Forman et al. 2003



# Management windows for mowing to support monarchs



These recommendations are based primarily on monarch breeding and migration activity.

Options listed in [ ] are recommended only if necessary. These summer mowing intervals may still cause some mortality.





# BMPs: Reducing the impact of mowing

*“The wildflowers are already there. We just need to stop mowing them down.”*

— Jeff Caster, Florida DOT

## ***Benefits of reducing mowing***

- Allows wildflowers to grow
- Reduces soil compaction
- Protects nesting grassland birds

Sources: Warner 1992; Norcini 2014; Harrison 2014

Photo: Ron Klataske



# BMPs: Reduced mowing and safety

- Reduced mowing does not increase rates of deer-vehicle crashes.
- Mowing can increase plant palatability.
- Maintain a regularly mown clear zone adjacent to the pavement to help maintain driver visibility.
- Avoid planting known palatable species, especially those that are forage at times when other food sources are scarce (e.g. cool season legumes).

Sources: Mastro et al. 2008; Barnum and Alt 2013; Guyton et al. 2014



# BMPs: Economics of reduced mowing

## Florida:

I-10 reduced mowing pilot study  
Typically mowed 7x/yr, reduced  
mowing to 1x/yr in the fall  
Saved \$1000 per mile, increased  
wildflower abundance and diversity

## Texas:

Texas DOT can save \$25 million per  
year by reducing mowing cycles from  
three to two

## Delaware:

If DelDOT took 500 acres of roadside  
out of routine turfgrass mowing, the  
state could save \$1,305,000 per year

Sources: Norcini 2014; Guyton et al 2014; Lucey and Barton 2010.



Photo: Idaho DOT



# BMPs: Reducing the impact of herbicides

## *Roadside herbicide use*

- Keep applications on target
- Use selective herbicides
- Time applications for vulnerability of weeds
- Recognize native plants (e.g. native thistles)
- Training helps target and reduce herbicide use

*Tall thistle, important to monarch butterflies travelling through Nebraska*



Sources: Brandt et al. 2011; Harper-Lore et al. 2014

Photo: Jennifer Hopwood





# BMPs: Native Plants as Management Tools

## Benefits of native plants on roadsides:

- Stabilize soil, reduce runoff, capture snow drift
- Locally adapted, require fewer inputs
- Robust native plant communities can resist invasive plant encroachment
- Reduced maintenance, long-term cost savings
- Wildflowers are preferred over turf ROW by drivers, can benefit tourism



Sources: Houseal and Smith 2000; Gustafson et al. 2005; Blumenthal et al. 2005; Falk et al. 2013; Guyton et al. 2014







# BMPs: Roadside revegetation to support pollinators

## *Revegetation considerations to support pollinators*

- Prioritize the use of native plants
  - Prioritize locally or regionally sourced plant materials
- Increase the diversity and abundance of wildflowers in roadside plantings whenever possible
- Select flowering plants with sequential overlapping bloom times
- Include milkweeds and other butterfly host plants

Sources: Potts et al. 2003; Norcini et al. 2001; Houseal and Smith 2000; Feber et al. 1996; Croxton et al. 2005

*California roadside planting*

Photo: Jessa Kay Cruz





# BMPs: Are milkweeds weeds?

- Most species do not spread from planting site
- If encroachment is a concern, avoid planting common milkweed (*Asclepias syriaca*)



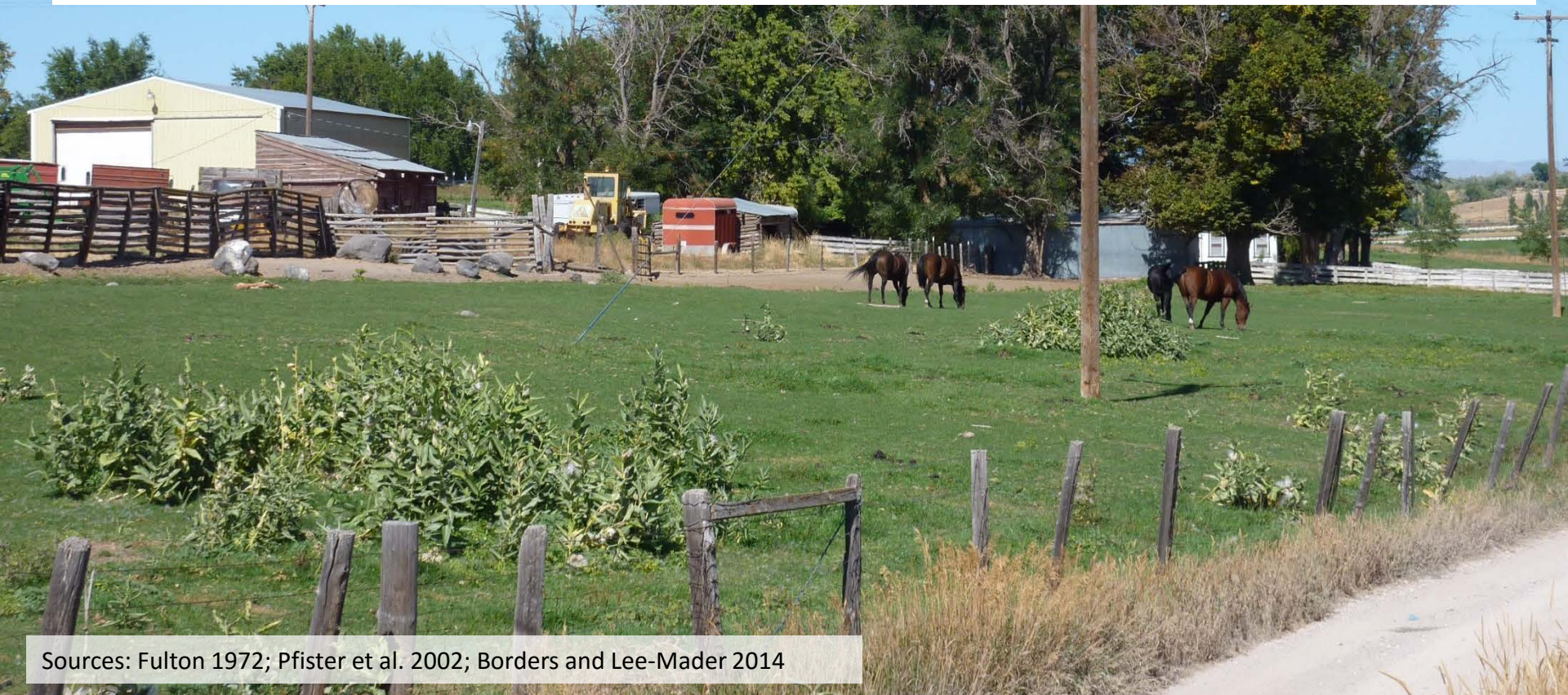
Source: Borders and Lee-Mader 2014

Photo: Jennifer Hopwood



# BMPs: Are milkweeds weeds?

- Milkweed is toxic when consumed in large quantities but is highly unpalatable.
- Most livestock do not consume milkweed on grazing lands at sustainable stocking rates
- Caution: milkweed is more palatable when cured as hay



Sources: Fulton 1972; Pfister et al. 2002; Borders and Lee-Mader 2014

Photo: Brianna Borders



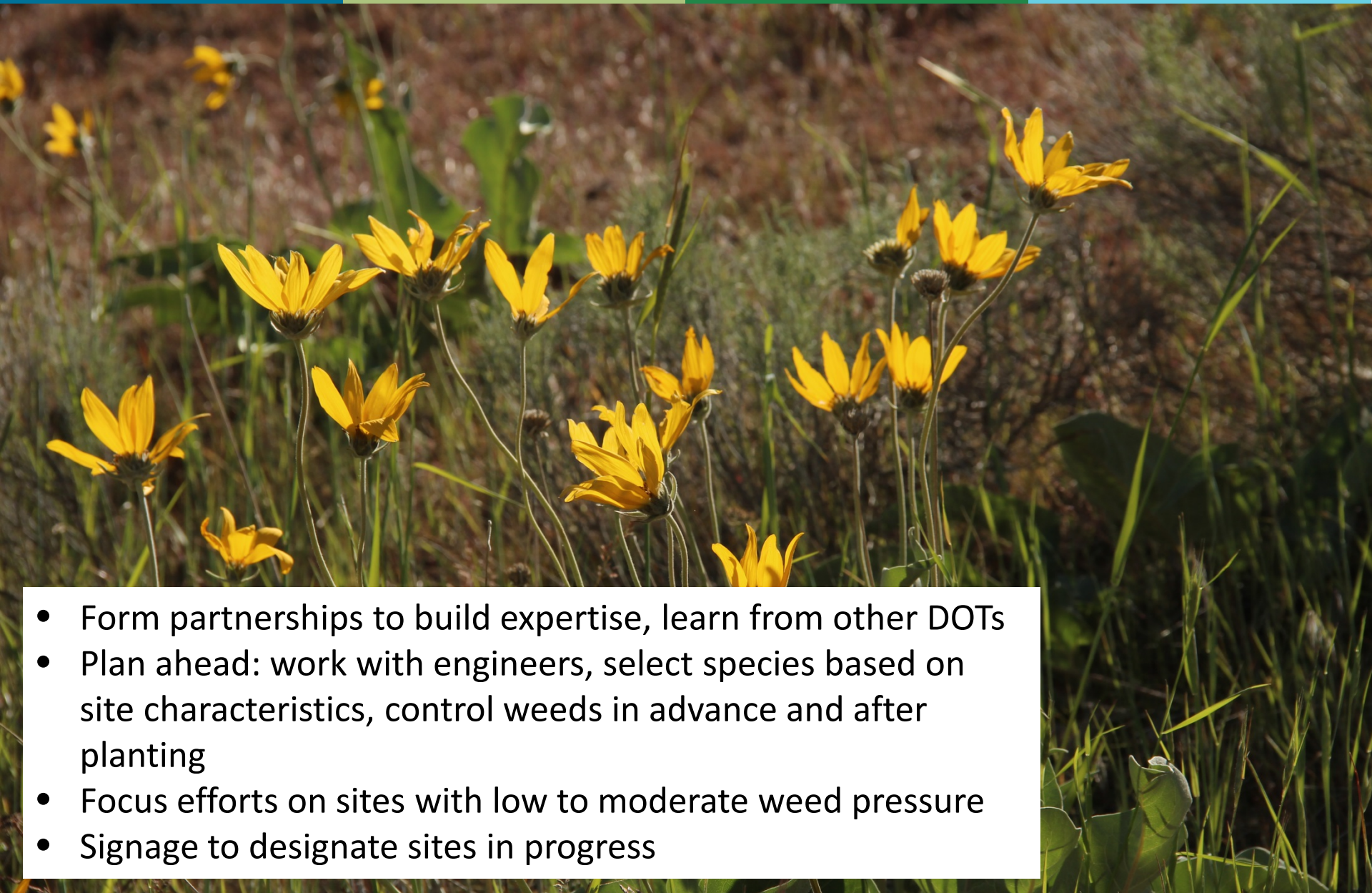
# BMPs: Obtaining plant materials

- Cooperate with agencies and private nurseries to build an industry, in areas of the country where one does not yet exist
- Increase production and availability by consistently committing to use of locally sourced plant material
- Communicate with local vendors to let them know future plans so they can collect and grow out what you need

Sources: Fulton 1972; Pfister et al. 2002; Borders and Lee-Mader 2014



# BMPs: Establishing wildflowers



- Form partnerships to build expertise, learn from other DOTs
- Plan ahead: work with engineers, select species based on site characteristics, control weeds in advance and after planting
- Focus efforts on sites with low to moderate weed pressure
- Signage to designate sites in progress





# BMPs: Prioritizing roadside sites for revegetation



- Prioritize sites that are wide, have low weed pressure
- Working with nearby land managers, prioritize sites that connect existing habitat patches
- Avoid areas subject to excessive pesticide drift or haying
- Start small, build expertise: learn from other DOTs and agencies
- Partner with organizations or agencies to cover costs
- Build community support: showy plantings, educational signage





# BMPs: Training and community outreach

- DOT trainings: technical information and practitioner training, also background knowledge about pollinators for dealing with the public
- Educational signage, news articles, community meetings, license plates





## Part 3. Case Studies





# Case study: Protecting wildflowers in Florida

## Counties focus on protecting existing wildflowers

- Citizens take the lead, work with county commissioners to draft roadside wildflower resolutions
- Attract tourism, support farm ecosystem services, etc.
- 27 of Florida's 67 counties have adopted wildflower resolutions



# Case study: IRVM in Iowa

*Iowa has lost 99.9% of prairie and wetlands*

## **1989 legislation supported Integrated Roadside Vegetation Management:**

- Use of native plants, locally sourced
- Judicious mowing, herbicide use, prescribed burning
- Established funding that supports research, restoration, training, and education

*Iowa roadside planting*





# Case Study: Planning ahead in Arizona



## **Advance planning reduces weeds, aids plant establishment**

- Write weed control into construction specifications
- Use 15-25 species of native plants, usually over 50% forbs
- Plan 3-5 years in advance with plant providers

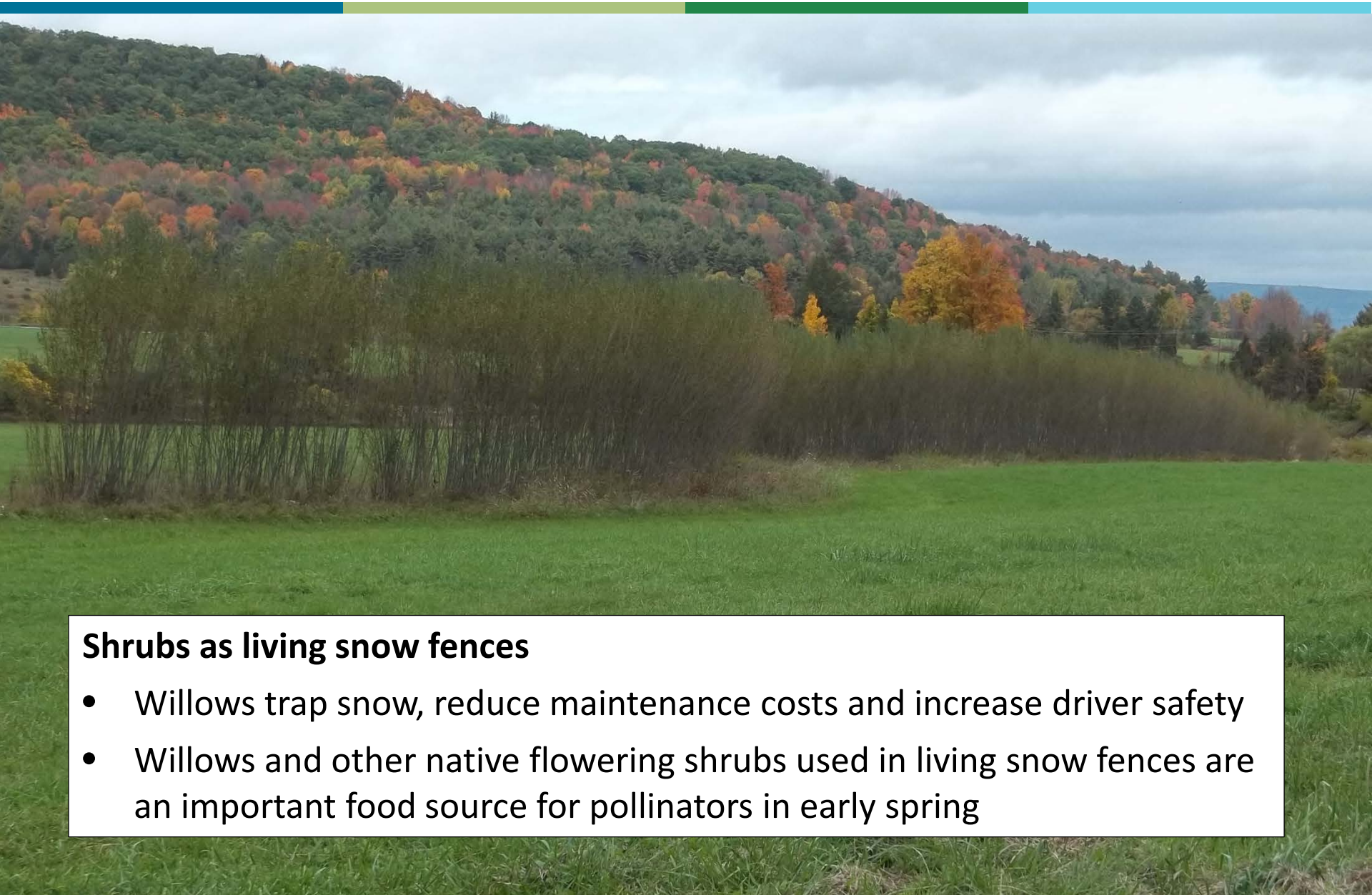
*Arizona roadside planting*



Photo: Arizona DOT



# Case study: Living snow fences in New York



## **Shrubs as living snow fences**

- Willows trap snow, reduce maintenance costs and increase driver safety
- Willows and other native flowering shrubs used in living snow fences are an important food source for pollinators in early spring







# Case study: Establishing wildflowers in Ohio



## District 9 Pollinator Plantings

- Visible location, plenty of floral resources for pollinators, wide ROW, near apiary, outreach to local community, working with partner to gain restoration knowledge





# Final Thoughts: Roadsides and ecosystem health

“I want Texas to look like Texas and Vermont to look like Vermont and every state to look like itself.”

– *Lady Bird Johnson*



**The benefits of native plants on roadsides extend beyond unique regional beauty**





# Companion BMPs documents

## Roadside Best Management Practices that Benefit Pollinators

Supporting Pollinators through Roadside Maintenance and Landscape Design



## Pollinators and Roadsides: Best Management Practices for Managers and Decision Makers



January 2016



U.S. Department of Transportation  
**Federal Highway Administration**





# Thank You!

Thanks to ICF International, Federal Highway Administration, and State DOT representatives and ROW restoration ecologists that contributed their thoughts to the project

Thank you to the many excellent scientists, conservationists, farmers, Xerces Society Members, and our funders



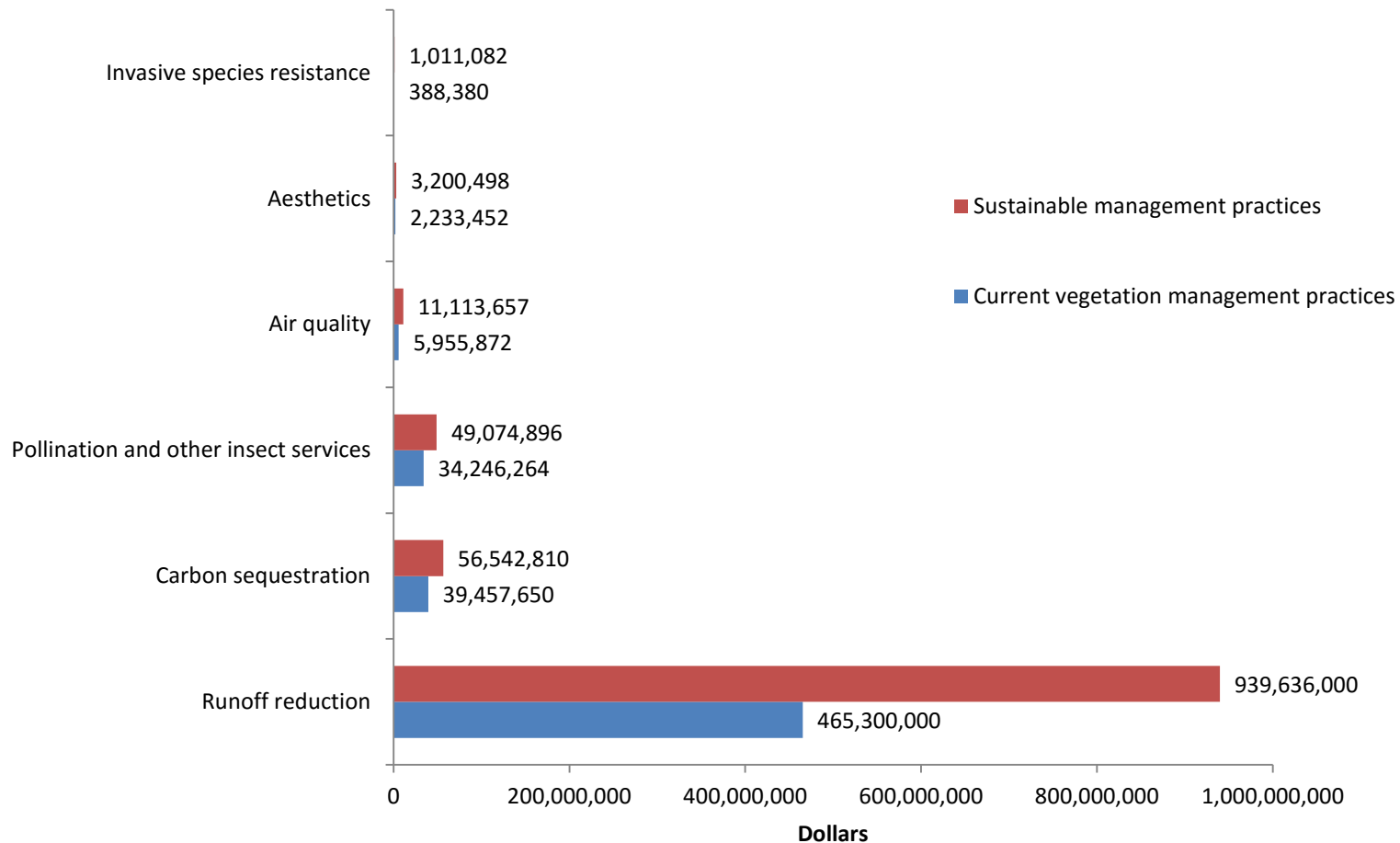
[www.xerces.org](http://www.xerces.org)





# Making the economic case

## Economic benefits of the ecosystem services provided by Florida's State Highway system



*Value could be doubled with designation of wildflower areas and adoption of reduced mowing.*

