Improving forest conditions for pollinators

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Pollinator diversity

- ~4,000 bee species in the U.S.
- 575 butterfly species
- Also many flies, moths, beetles

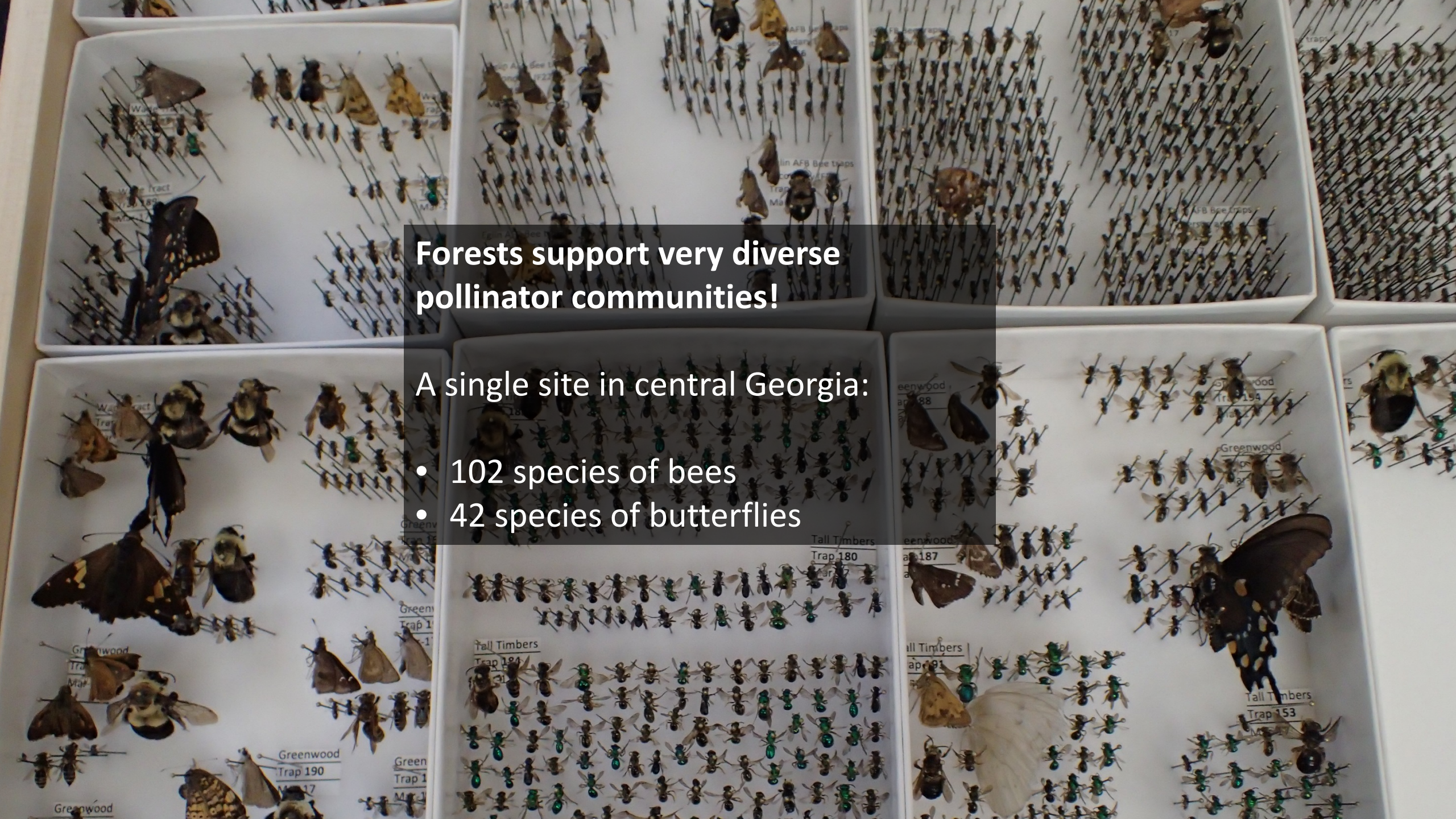
Source: beesinyourbackyard.blogspot.com

M Ulyshen

F. Kohl


M Ulyshen


M Ulyshen



Forests support very diverse pollinator communities!

A single site in central Georgia:

- 102 species of bees
- 42 species of butterflies

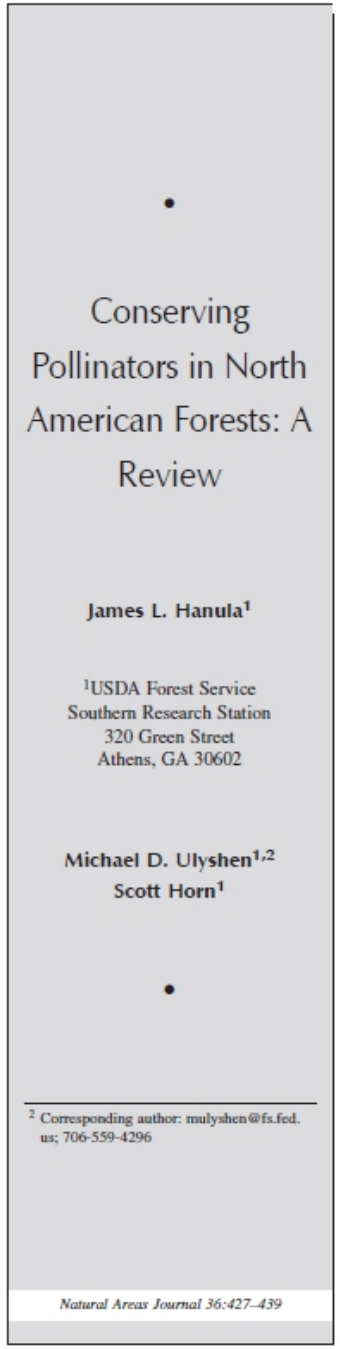
Forest-dependent species

- Wood-nesting bees
- Resin bees

Photos by M Ulyshen

General Recommendations for improving forest conditions for pollinators

- Pollinators are sun-loving and broadly benefit from
  - thinning and gap creation
  - prescribed fire
  - removing non-native shrubs
  - maintaining forest road margins



Conserving Pollinators in North American Forests: A Review

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ABSTRACT: Bees and butterflies generally favor open forest habitats regardless of forest type, geographic region, or methods used to create these habitats. Dense shrub layers of native or nonnative species beneath forest canopies negatively impact herbaceous plant cover and diversity, and pollinators. The presence of nonnative flowers as a source of nectar, pollen, or larval food can have positive or negative effects on pollinators depending on the situation, but in cases where the nonnatives exclude native plants, the results are almost always negative. Roads and roadside corridors offer an opportunity to increase open, pollinator-friendly habitat even in dense forests by thinning the adjacent forest, mowing at appropriate times, and converting to native herbaceous plant communities where nonnative species have been planted or have invaded. Efforts to improve forest conditions for pollinators should consider the needs of specialist species and vulnerable species with small scattered populations. Conservation of bees and butterflies, as well as other pollinating species, in forested areas is important for most forest plant species, and forests may serve as reservoirs of pollinators for recolonization of surrounding habitats.

Index terms: fire, forest management, invasive species, prescribed burning, verges

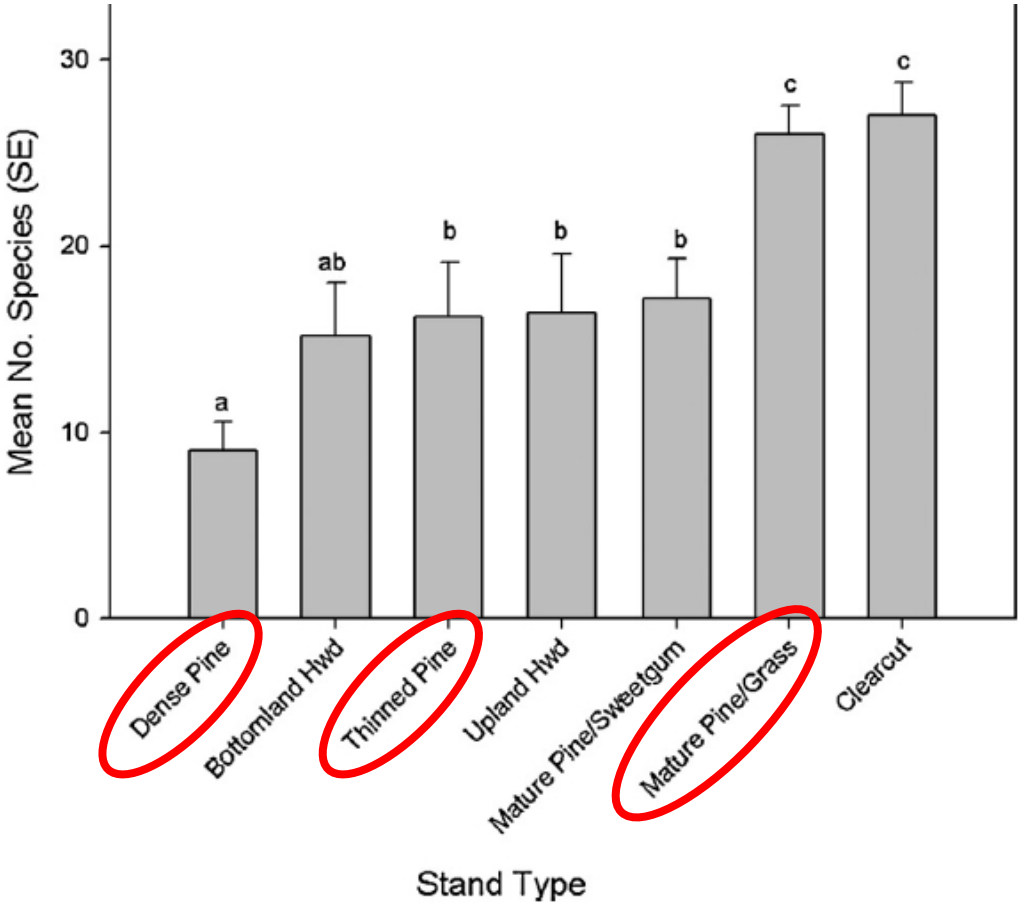
INTRODUCTION

Nearly 90% of the world's flowering plants rely on pollination by animals (Ollerton et al. 2011), and of those, bees are considered to be the primary group responsible (Winfree et al. 2011). Native pollinators provide most of the pollination in forests and grasslands of the United States (Mader et al. 2011), where many wild forb and tree species require their services. Additionally, native pollinators from these natural areas contribute substantially to the pollination of adjacent crops, often without the need for managed honey bees (Garibaldi et al. 2013; Morandin and Kremen 2013). The consensus among experts is that pollinators are in decline, and publication of "The Forgotten Pollinators" (Buchmann and Nabhan 1996) raised awareness of the problem. Bees, flies, and butterflies are considered the best native pollinators, and the United States alone has approximately 4000 species of bees (Moisset and Buchmann 2011) and 575 species of butterflies (NABA 2016). Although evidence is growing that many pollinators and their functions are declining (Potts et al. 2010; Burkle et al. 2013), not enough information is available to assess the conservation status of most species (National Research Council 2007). Nevertheless, the Xerces Society lists 31 species of bees (Xerces Society 2016a) and 58 species of butterflies (Xerces Society 2016b) in North America that are vulnerable, imperiled, critically imperiled, or even possibly extinct. Of the butterflies, 24 are listed as federally endangered. Some evidence indicates that while at least one of the 46 bumble bee species known to occur in North America has gone extinct, half may now be at risk (Grixti et al. 2009; Williams et al. 2014). Other bee genera have received less attention, despite accounting for >95% of known species (Bartomeus et al. 2013) and playing essential roles as pollinators of most native tree and forb species in our forests. A study using historical data sets found a 50% reduction in bee species over a 120-year period, resulting in major changes to the plant-pollinator network (Burkle et al. 2013). This underscores the paucity of information on the status of most native bees in North America (Cane and Tepedino 2001). The many factors implicated in the declines of bee and butterfly populations include habitat fragmentation, nonnative plants, pathogens, nonnative insects, biocontrol agents, overgrazing by white-tailed deer, herbicides and insecticides, fire (too frequent), shrub encroachment due to fire suppression, right-of-way management, harvesting of wild plants, logging of mature forests, and losses of open forests and forest clearings (van Swaay et al. 2006; Miller and Hammond 2007; Cameron et al. 2011; Schweitzer et al. 2011; Szabo et al. 2012; Fartmann et al., 2013).

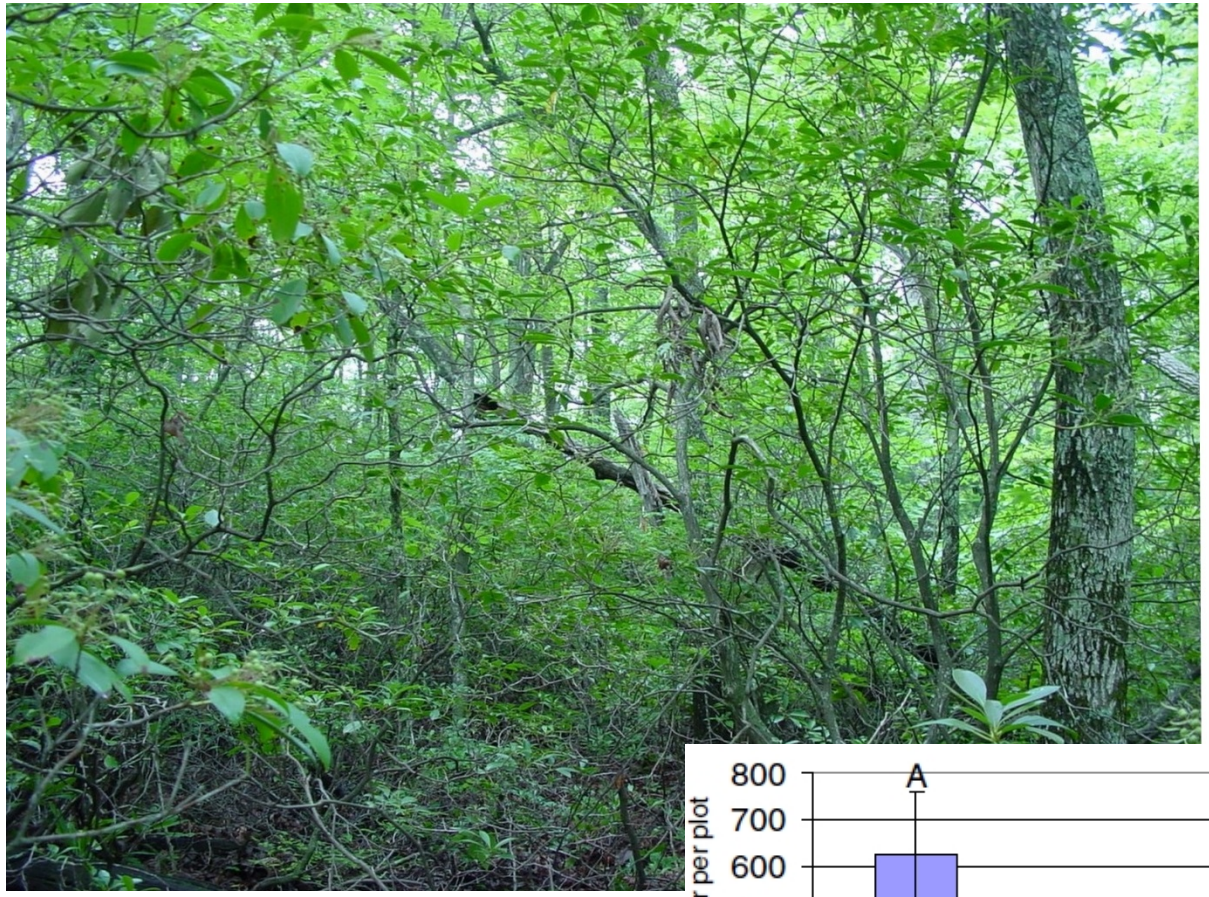
Forests currently cover more than one third of the land area in North America (World Bank 2016) and provide important resources for many pollinators. In addition to supporting forest specialists (Winfree et al. 2007), a large number of generalists are known to move readily between forests, agricultural fields, and other land-use types (Blitzer et al. 2012; Monasterolo et al. 2015). Some forest conditions favor pollinators more than others and there is a growing interest in optimizing management practices for pollinator conservation.

Photos by J Hanula

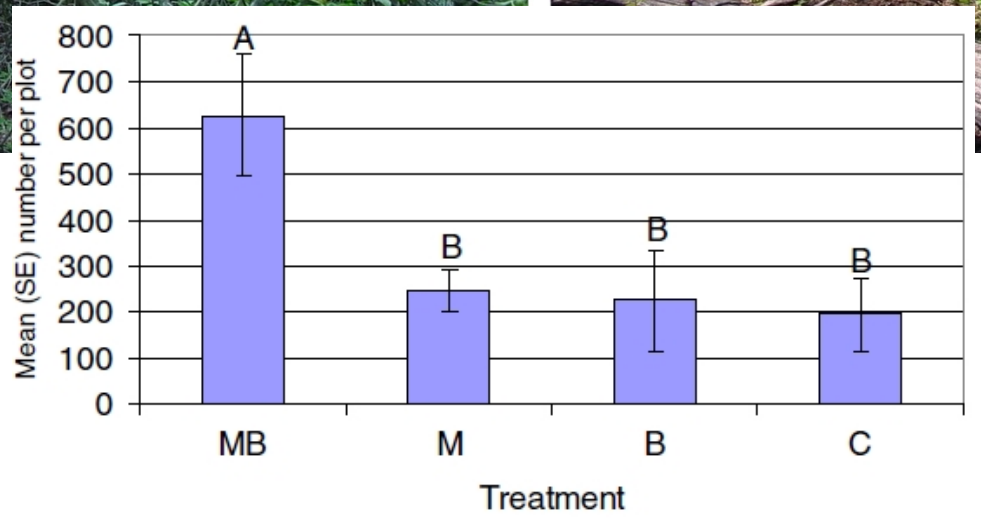
Example 1: Thinning and regular burning increase bee richness in Georgia (Hanula et al. 2015)



Example 2: Shrub-layer removal and burning improved habitat for pollinators in North Carolina (Campbell et al. 2007)

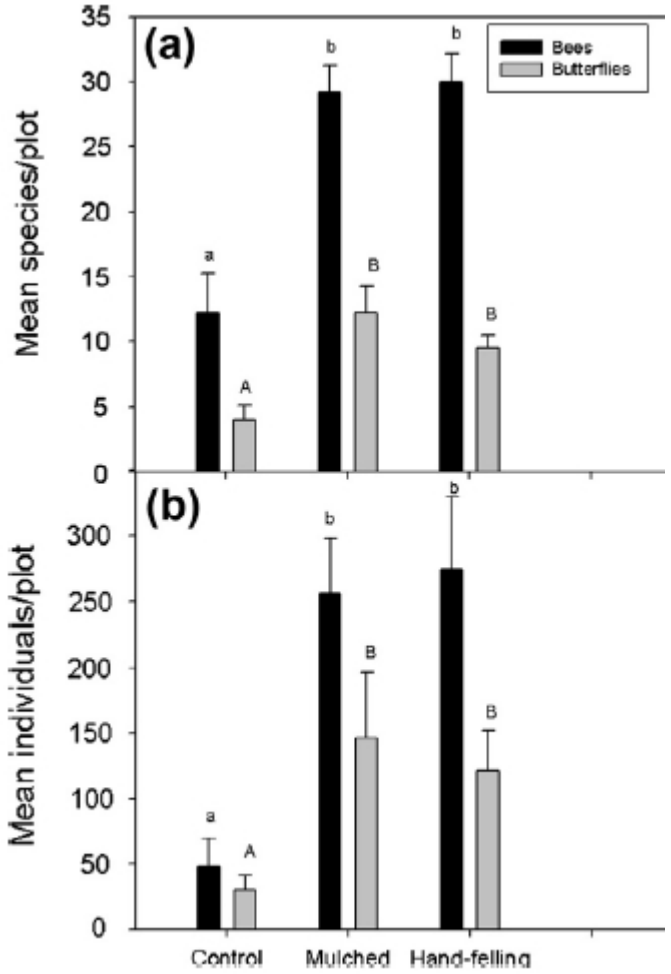


Photos by T Waldrop



Photos by J Hanula

Example 3: Removing Chinese privet benefits bees and butterflies (Hudson et al. 2013)



Creating open road edges can provide floral resources for pollinators (Hanula et al. 2016)

Photos by J Hanula

Legacy of fire suppression…

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Have changing forests conditions contributed to pollinator decline in the southeastern United States?

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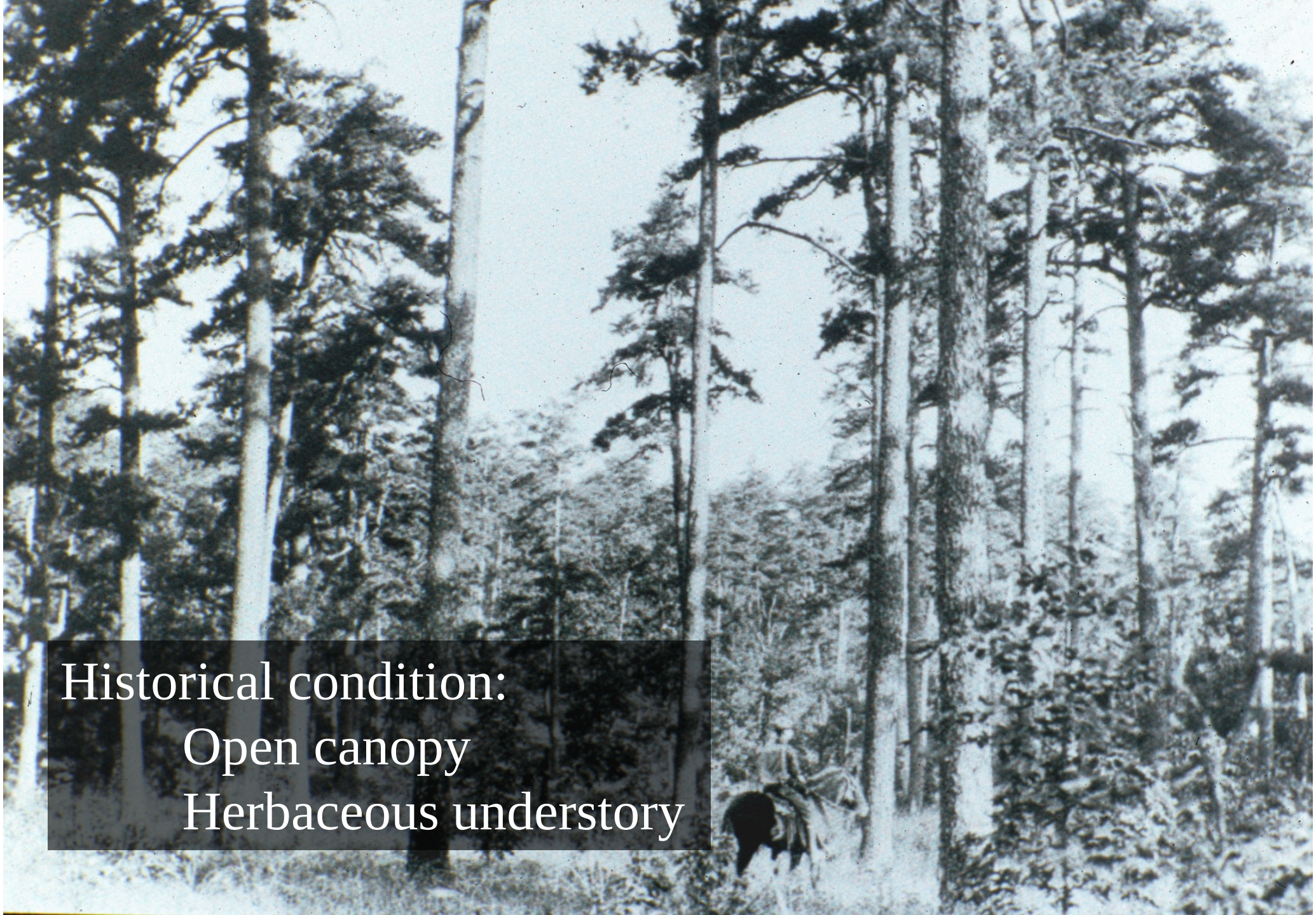
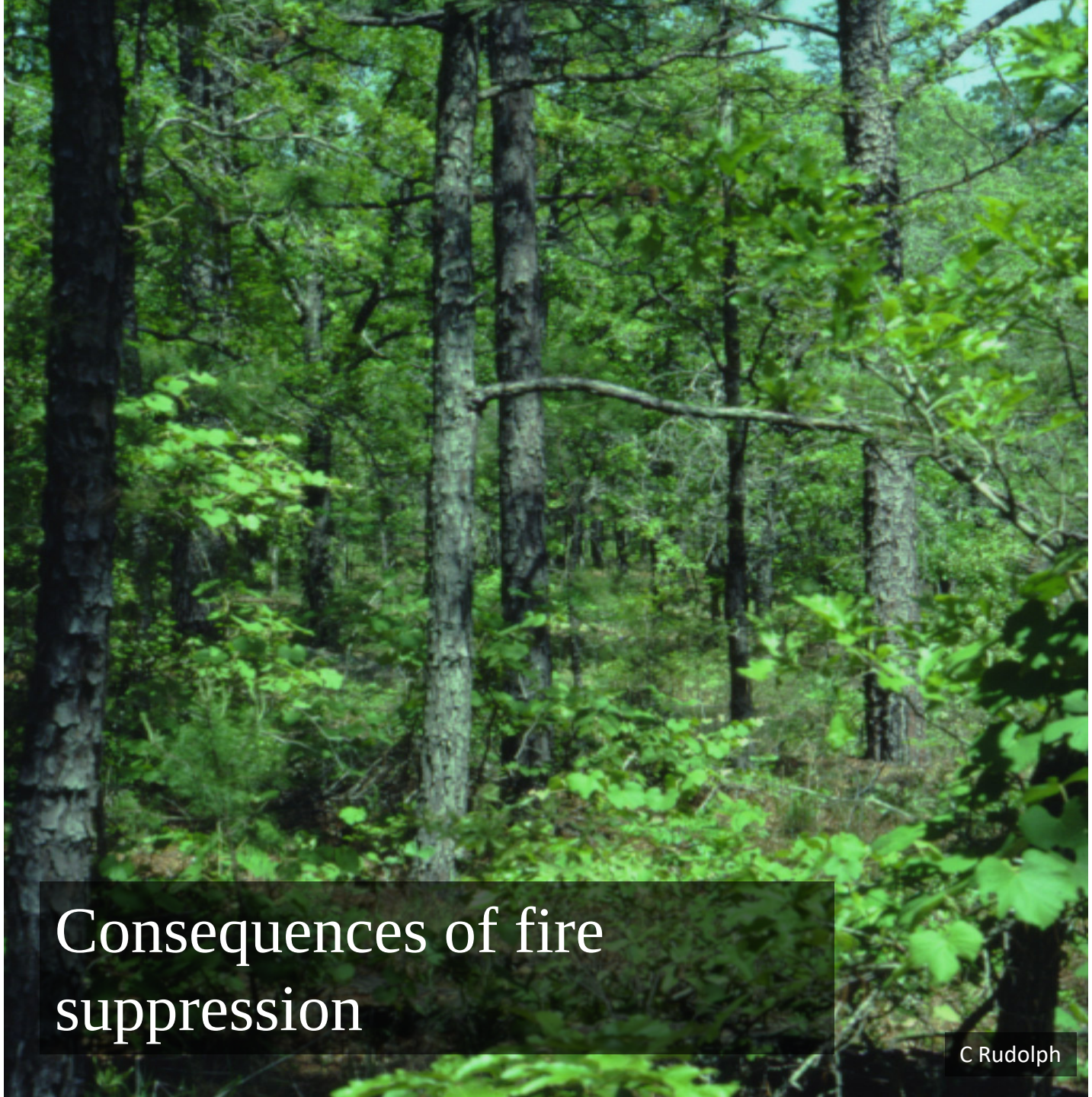

Historical condition:
Open canopy
Herbaceous understory


Consequences of fire suppression
C Rudolph

Insights from lepidopteran surveys – Ouachita National Forest shortleaf pine/bluestem restoration

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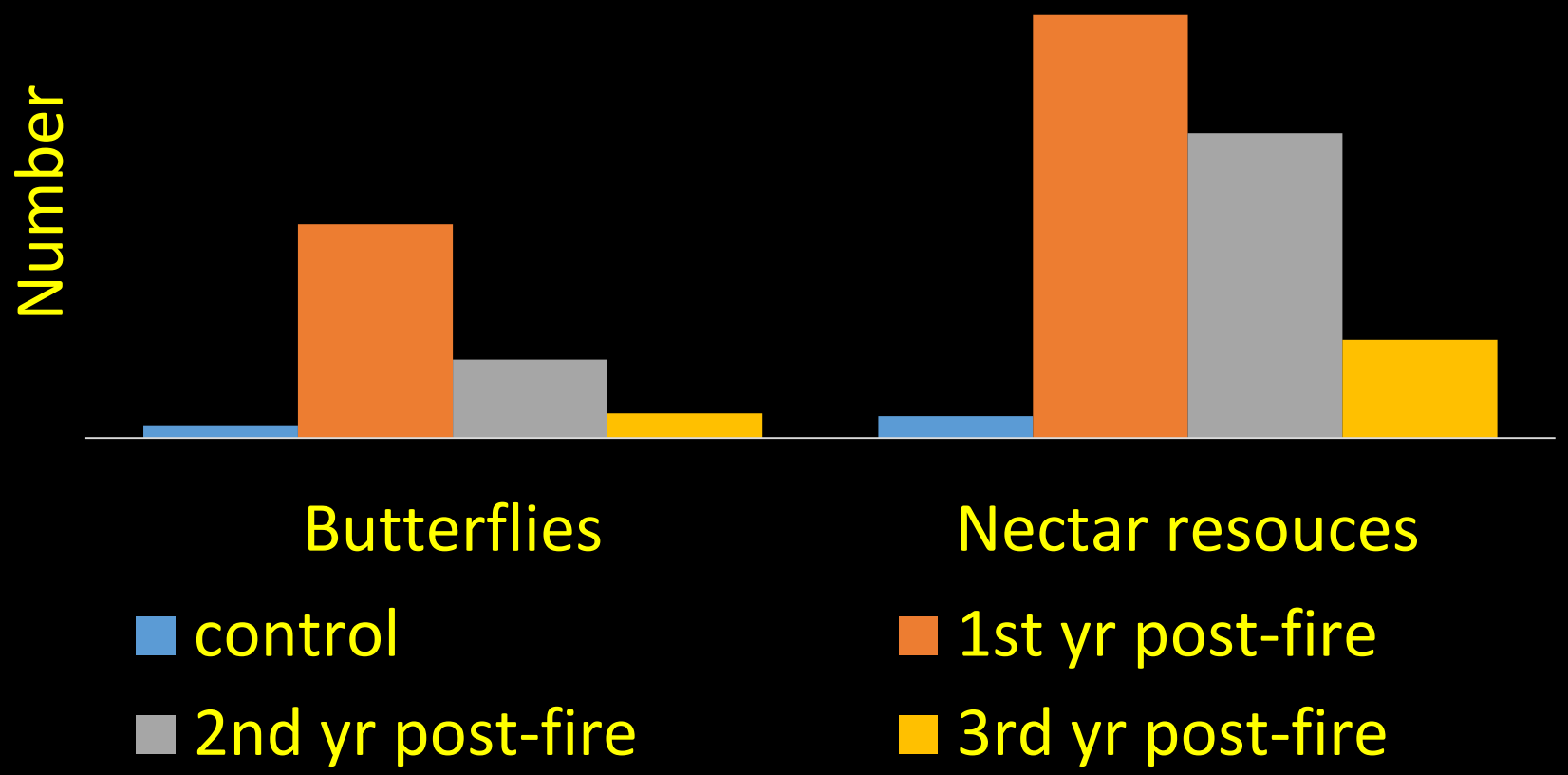
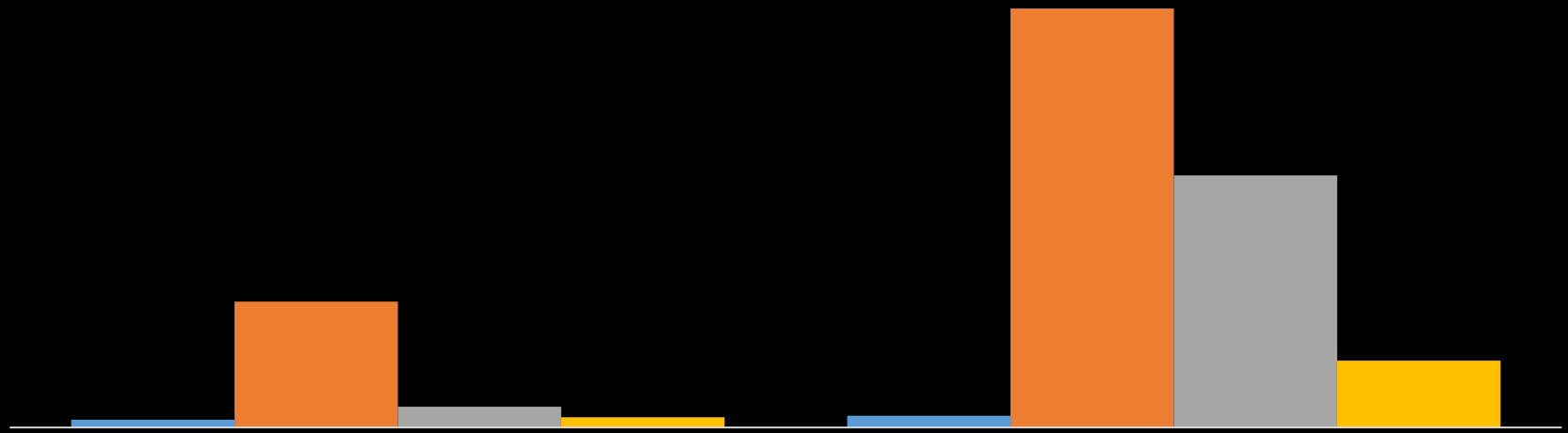
Restored condition
*3 year fire return interval
C Rudolph

Relative Number of Butterflies and Nectar Resources



Relative Number of Fall Monarchs and Nectar Resources



Monarchs

- control
- 2nd yr post-fire

Nectar resouces

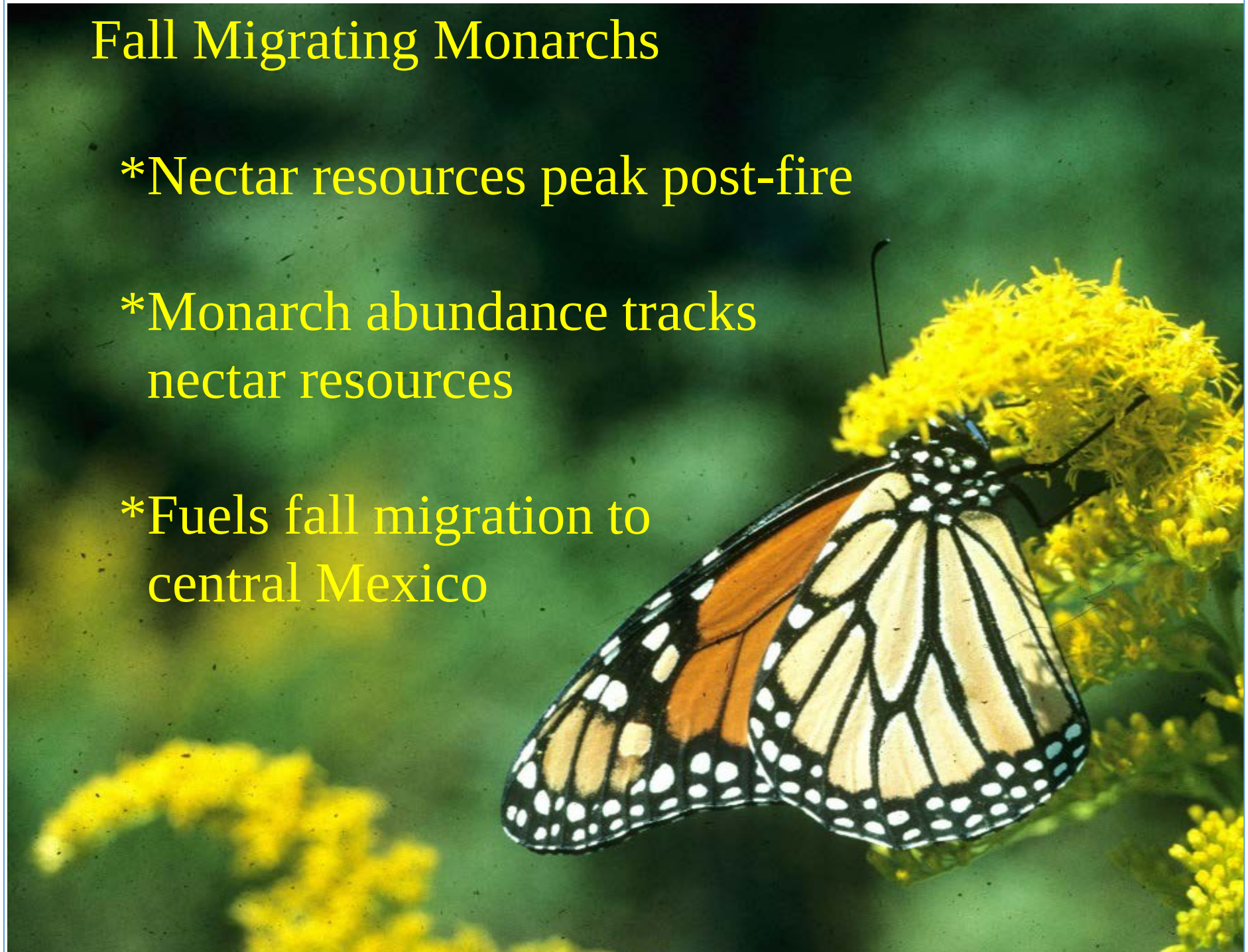
- 1st yr post-fire
- 3rd yr post-fire

Fall Migrating Monarchs

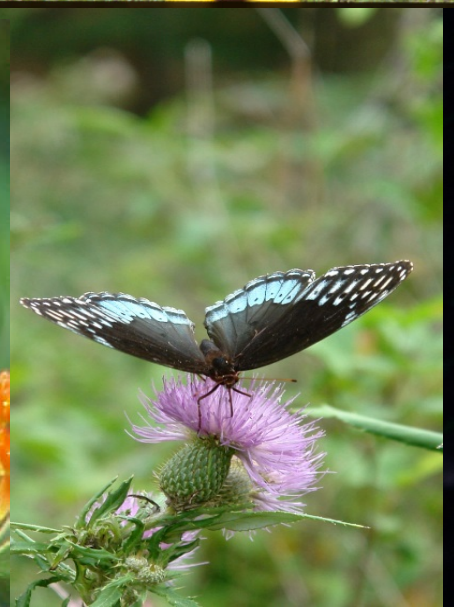
*Nectar resources peak post-fire

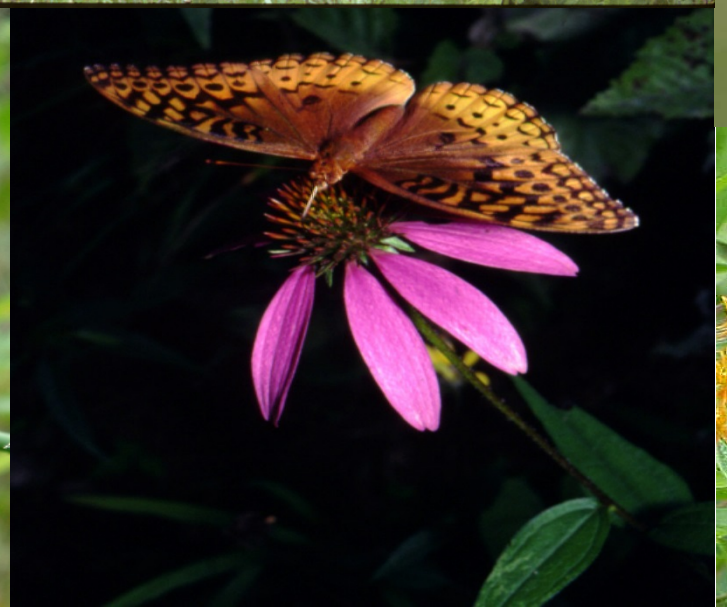
*Monarch abundance tracks nectar resources

*Fuels fall migration to central Mexico



Nectar Resources are Key to Pollinator Abundance





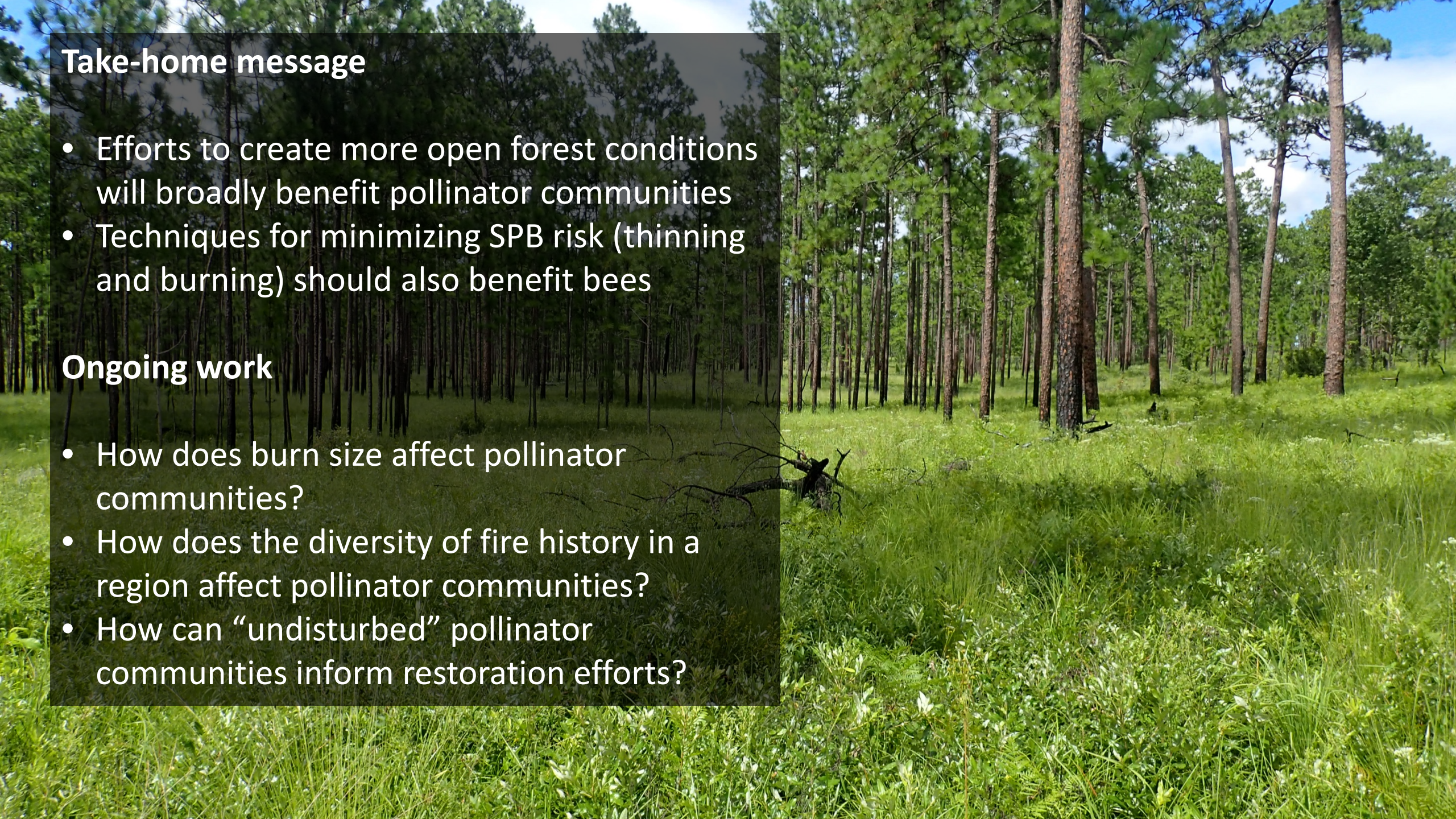
Photos by C Rudolph

*Benefits extend to most species in the local fauna.

*Populations recover, or expand in 1st. Growing season post-fire.

*Major declines by 3rd year post-fire.

* Evidence that conclusions generalize to Bees, moths, beetles, flies.



Take-home message

- Efforts to create more open forest conditions will broadly benefit pollinator communities
- Techniques for minimizing SPB risk (thinning and burning) should also benefit bees

Ongoing work

- How does burn size affect pollinator communities?
- How does the diversity of fire history in a region affect pollinator communities?
- How can “undisturbed” pollinator communities inform restoration efforts?