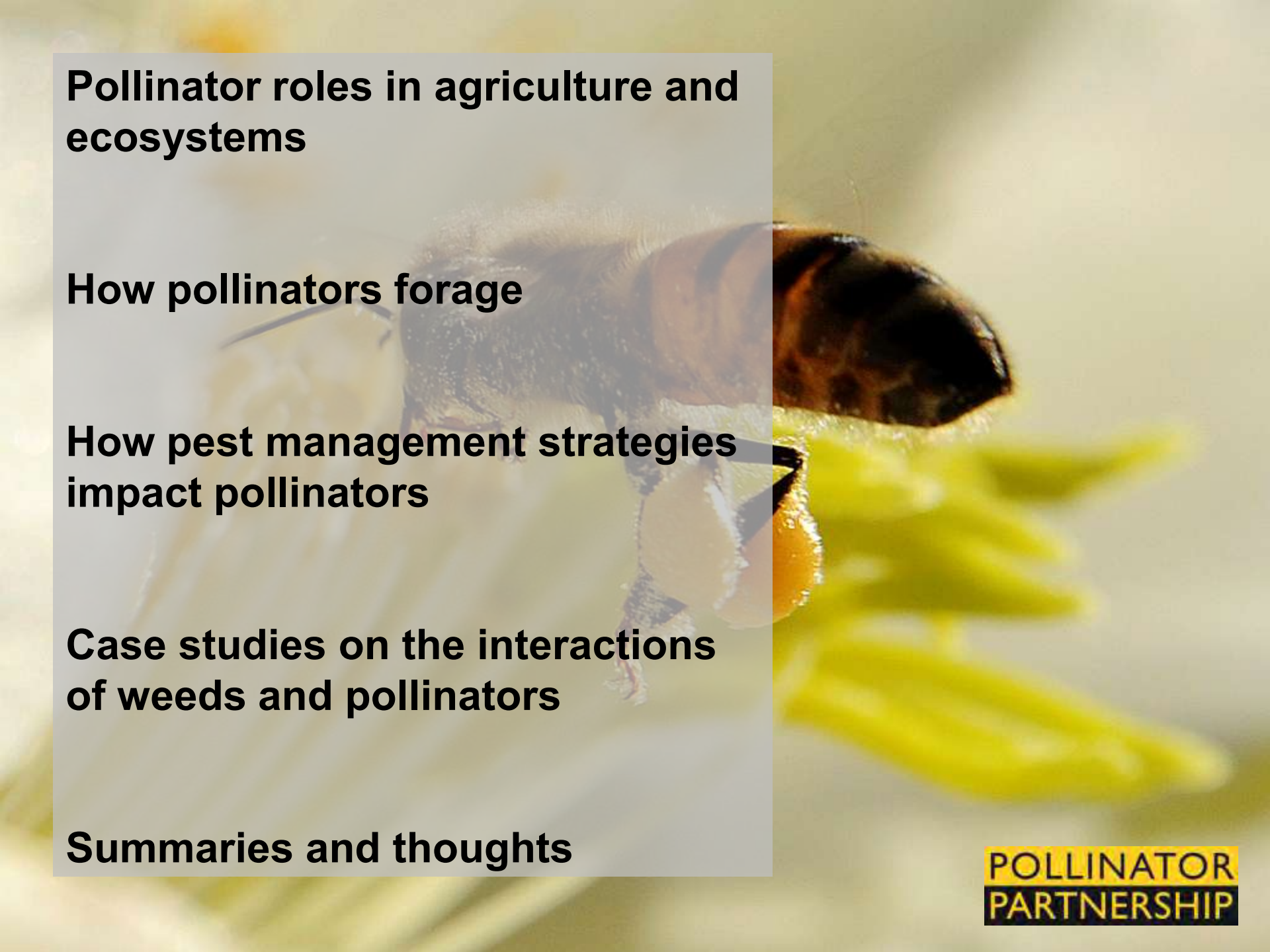


A photograph of a field of tall green grasses with scattered purple flowers. The background shows a line of trees under a clear blue sky. The text is overlaid on the center of the image.

Pollinators and invasive plants: Implications for agriculture and restoration

Victoria Wojcik
Pollinator Partnership



Pollinator roles in agriculture and ecosystems

How pollinators forage

How pest management strategies impact pollinators

Case studies on the interactions of weeds and pollinators

Summaries and thoughts

A close-up photograph of a flower with vibrant pink and orange petals. The center of the flower is dark, filled with numerous yellow stamens. The lighting is warm, highlighting the texture of the petals.

75% of ALL flowering plants depend on animal pollinators for reproduction – we rely on pollinators to sustain many ecosystem services.

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Ecosystem services provided by pollinators



Pollination

Raw Materials

Food Production

Recreation

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Ecosystem services provided by pollinators



Pollination

Food Production

Raw Materials

Recreation

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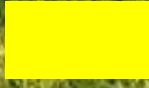
Vulnerability of Agricultural Exports to Loss of Pollinators



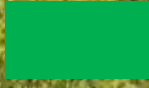
>50 % Pollinator Dependent



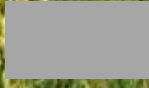
25-50 % Pollinator Dependent



10-24 % Pollinator Dependent



>10 % Pollinator Dependent



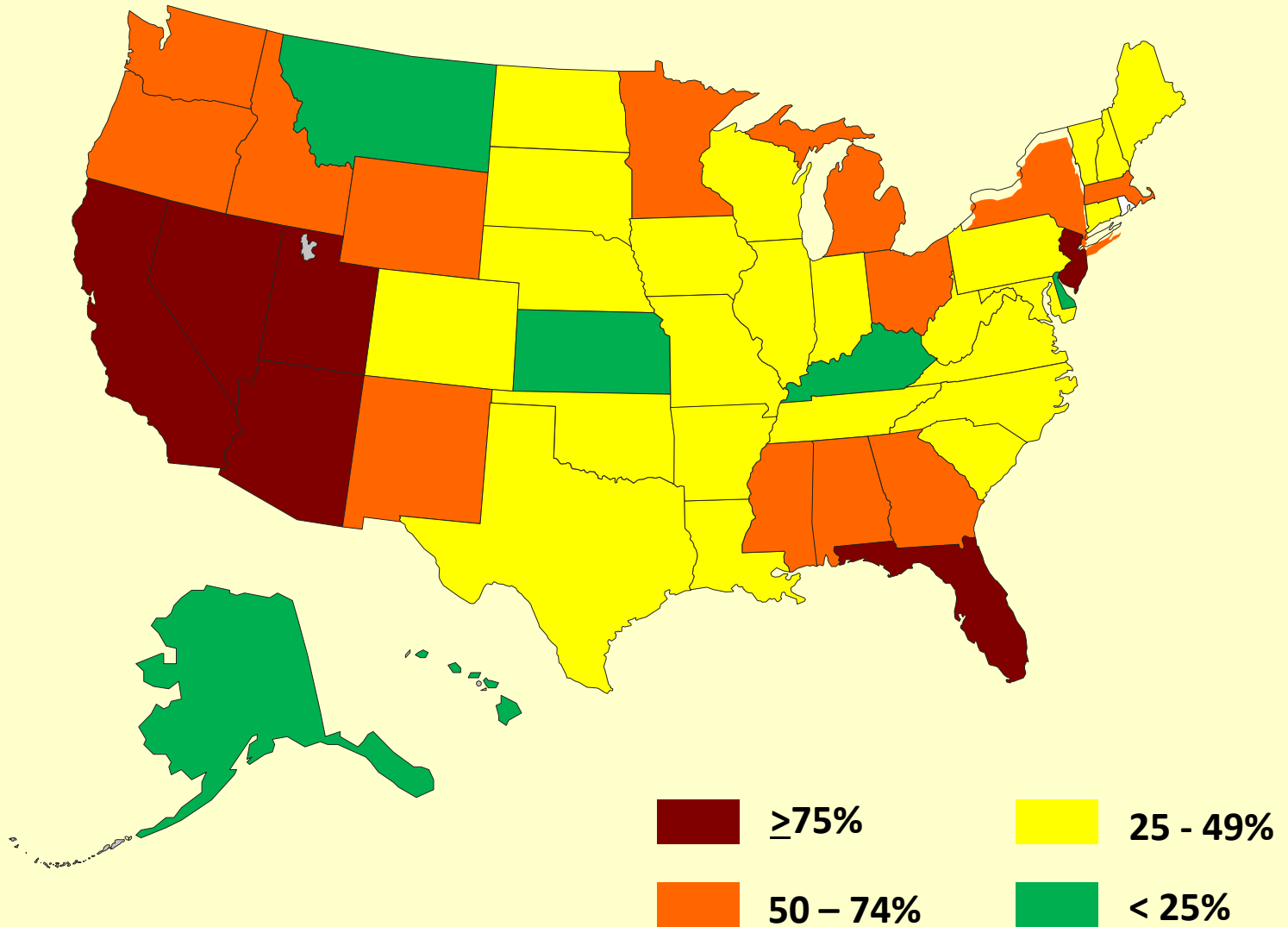
Not an OAS State

Total Agricultural Exports (2005) = \$172 Billion



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IMPORTANCE OF POLLINATORS TO U.S. AGRICULTURAL CROPS: VALUE OF AGRICULTURAL PRODUCTION (2007)



Ecosystem services provided by pollinators

A yellow forklift is shown in a lumber yard, carrying a large log and stacks of lumber. The scene is set in a well-lit industrial environment with various wooden products and equipment visible in the background.

Pollination

Raw Materials

Food Production

Recreation

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Ecosystem services provided by pollinators

Pollination
Raw Materials

Food Production
Recreation

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Ecosystem services supported by pollinators

Climate Regulation
Nutrient Cycling

Erosion Control
..and others

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Ecosystem services supported by pollinators



Climate Regulation
Nutrient Cycling

Erosion Control
..and others

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Ecosystem services supported by pollinators

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The Biology of Bees

More than 1500 species in California

About 70% nest in the ground

Most native bees are solitary nesters

Native bees have seasonal emergence patterns

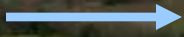
How Bees Forage

- Optimal foraging strategies
- Flight is expensive
- Floral density is important

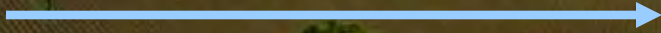
How Bees Forage

- Size limits foraging range

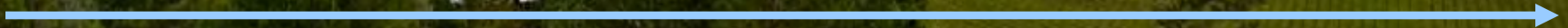
Small bees – 200 m



Medium bees – 500 m



Large bees – 1 km Honey bees – 2 km +



The Biology of Butterflies

Require larval host plants to lay eggs

Nectar plants required for adults

Need sunlit basking areas

Migratory species need habitat throughout the landscape at the right time.

What do weeds do to pollinators?

- Weediness has been correlated with lower **beneficial** insect diversity in many studies (Way 1977; Ries et al. 2000; Vitonen et al. 2006)



Removing exotics increases abundance and diversity of butterflies

- Mulching and felling of Chinese privet tested for impact on butterflies
 - Removal increased populations (diversity and abundance)
- (Hanula and Horn 2011)

Butterflies prefer native plants



- Butterflies prefer woody plants (likely due to structure)
- Native plants have more butterflies (diversity and abundance)

(Tallamy and Shropshire 2009)

- Host plant presence as a significant factor in determining species occurrence (multiple sources)

Bees do not prefer non-natives, but will use them

(Williams et al. 2011)

- Dominance in landscape makes a plant more used.
- Non-natives can be important food sources in the absence of natives



Honey bees are known to promote YST

A significant correlation between honey bee visitation and seed number for yellow star-thistle (***Centaurea solstitialis***).

(Barthell et al. 2001)

Non-native species support each other

Work from New Zealand

(Handley and Goulson 2003)

- **The flowers of introduced plants are visited by introduced bees.**
- **Increased seed set when introduced plants are visited by non-native bee species.**

Weed eradications will have an impact on the local pollinator community

- Remove a food source (food desert)
- Change foraging dynamics
- Improve nutrition/habitat
- Reinststate natural phenologies
- Reduce/Increase competition from other species

Pesticide Toxicity



Insecticides: potentially the most toxic because most pollinators are insects.

Fungicides and herbicides: do not normally kill pollinators directly. Pollinators may be indirectly harmed when herbicides destroy flowers.

Nematicides and miticides: toxic to pollinators

Rodenticides: may be toxic to bat and bird pollinators

How might other methods of weed control impact pollinators?

- Mechanical Control
- Cultural Control
- Burning

Ground nesting bees can be impacted by tilling, machinery, mulches, and burning.



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Extensive mowing can remove a food source – timing is everything.

- mowing increased bee and butterfly occurrence (Noordijk et al. 2009), but initial decreases occurred due to food plant availability
- limited and timed mowing were the most successful in increasing beneficial species occurrence (Ries et al. 2000; Wynhott et al. 2011)

Landscape Management that promoted butterflies

- Host plant presence is paramount
- Increased edges (scalloped edges), favored trees, and increased bare ground provided better butterfly habitat (Carter and Anderson, 1987).
- Sunlight important in occurrence patterns-basking behaviors (Smallidge et al. 1996).

Landscape Management that promoted butterflies

- Native plant seeding increased native bee presence (Hopwood et al. 2009)
- Bumble bees were positively influenced by roadside mowing (Noordijk et al. 2009)

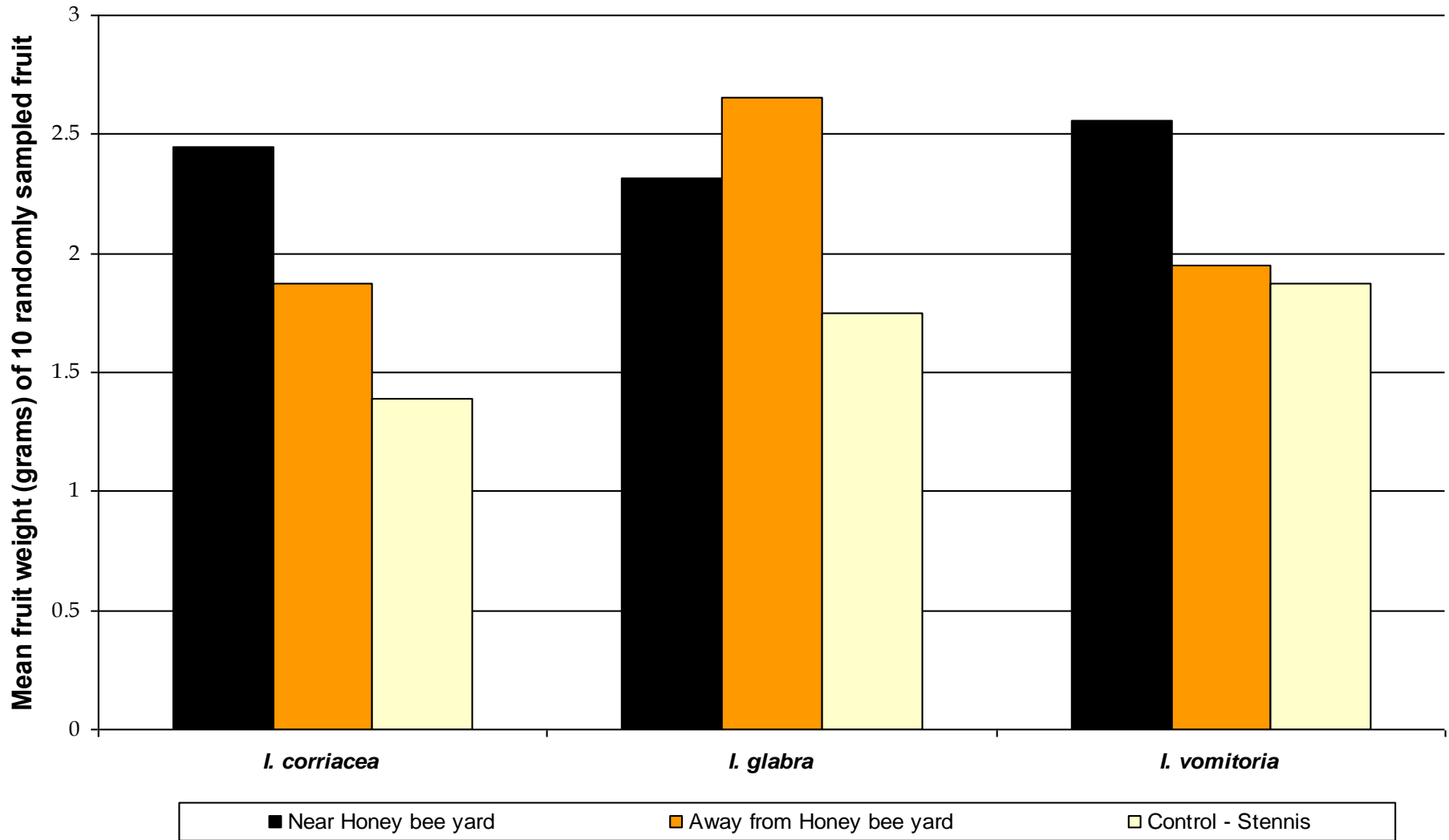
Changing Herbicide Usage Patterns To Promote Pollinators in Timberlands

A case study from Mississippi



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Effect of Honey Bees and Landscape Management on Fruit Quality (weight) in Southern Mississippi forest landscapes.



References – Also on hand-out

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Thank You - Questions

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