Creating Landscapes for Insects ... or not!

How Planting Selection Impacts Insect Populations – for Good or Bad

Whitney Cranshaw
Colorado State University
This presentation will be posted at the Insect Information web site

- **Housed at** Department of Bioagricultural Sciences and Pest Management
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Creating Landscapes for Insects .... or not!

How Planting Selection Impacts Insect Populations – for Good or Bad

Whitney Cranshaw
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Garden plantings can affect incidence of:

- Butterflies
- Hummingbird moths
- “Miller” moths
- Honey bees
- Bumble bees
- Various solitary bees

- Natural enemies of insect pests
- Nuisance invaders of buildings
- “Double or Nothing” species
Insect Needs

• Food for their young
• Food for the adults
• Shelter (many times)
Insect Needs

Food for the young
Larval Food Example: Painted Lady

Larval host plants are thistles, hollyhock, mallow, occasionally legumes and some other plants.
Insect Needs

Food for the adults
Adult Food Example:
Many predators of garden pests (biological controls)
Insect Needs (for some species)

Shelter
Shelter Example: Nest cavities for leafcutter and mason bees
In the beginning there was....

Butterfly Gardening
Parsleyworm – the gateway bug to butterfly gardening for me
Eggs on dill

Young larva
Parsleyworms are interesting caterpillars to find in the garden
When disturbed the parsleyworm everts a scent gland (osmeterium) from behind the head.
Bill and Sam checking out a parsleyworm
When full grown, the caterpillars retreat to a sheltered area and prepare for the next stage – the pupa (chrysalis or chrysalid).
Chrysalid (pupal form) of the parsleyworm
The adult form of the parsleyworm is known as...
Black Swallowtail Butterfly

Gerald Lenhard photograph
Principles of Butterfly Gardening

- Provide for food needs of adults
- Provide for food needs of larvae (caterpillar)
- Avoid use of harmful insecticides
- Provide mud puddling habitat?
Foods Used by Butterflies:

Nectar, fruit juices, oozing sap....
Some *Annual Plants* Commonly Used by Butterflies

- Zinnia
- Larkspur
- Cosmos
- Verbena
- Sunflowers
- Asters
- Coreopsis
- Some marigolds
Some *Perennial Plants* Commonly Used by Butterflies

- Butterfly Bush
- Milkweeds
- Sedums
- Lilac
- Purple coneflower
- Thistles
- Monarda
- New England aster
- ...........
Massed plantings are most often visited by butterflies.
Foods Used by Butterflies:

*Nectar*, fruit juices, oozing sap....
Brushfooted butterflies (Nymphalidae) will visit a variety of foods, in addition to nectar-bearing flowers.....

Hackberry butterfly on a dead raccoon

Butterfly and honey bee visiting wild hog dropping
Ripe fruit is visited and used for food by many brushfooted butterflies
‘Mud puddling’ by tiger swallowtail
Swallowtail Mud Puddle Club

Bob Hammon photograph
Foods Used by Caterpillars: 

Leaves of their host plant
Black Swallowtail butterfly

Parsleyworm
Twotailed Swallowtail

*Papilio multicaudata*
Twotailed Swallowtail

Eggs are laid on ash, chokecherry, hoptree
Late stage caterpillars have a different appearance.

Twotailed swallowtail caterpillar everting osmeteria (repellent scent glands)
Monarch
*Danaus plexippus*
Asclepias tuberosa

Good milkweed hosts of monarch caterpillars

Asclepias incarnata

Photos courtesy of Monarch Watch
Larval host plants are thistles, hollyhock, mallow, occasionally legumes and some other plants.
The common buckeye develops on snapdragons, toadflax, plantain and other plants.

The spring/summer azure develops on black cherry, *Vaccinium*, and *Spirea*.
Mourning Cloak

Larval host plants are willow, aspen, hackberry and elm
Butterfly Houses – Do they provide benefits to butterflies?
Butterfly Houses – Do they provide benefits to butterflies?

Very dubious value.

Can’t hurt, but probably won’t help
Landscaping for Hummingbird Moths
Hummingbird Moth

A type of sphinx/hawk moth that flies during the day
Colorado has about two dozen kinds of hornworms. Most hornworms are not “pest” insects.
Whitelined sphinx

*Hyles lineata*

The most common hummingbird moth of the western US
Whitelined Sphinx
"hummingbird moth" of the West
Hummingbird clearwing sphinx
Hemaris thysbe

“Bumble Bee” Clearwing Sphinx Moths

Snowberry clearwing
Hemeris diffinis
Some plants most often visited by hummingbird moths include:

- Four o’clocks
- Evening primrose
- Larkspur
- Gentian
- Nasturtium
- Catmint
- Datura
- Winecup
- Honeysuckle
Landscaping for Biological Control Agents
Principles of Gardening for Beneficial Insects

- Learn to recognize them – and don’t kill them
- Provide for food needs of adults
- Provide for food needs of immature stages
- Provide nest sites, if required
Principles of Gardening for Natural Enemies of Insect Pests

• Learn to recognize them – and don’t kill them
  • Provide for food needs of adults
  • Provide for food needs of immature stages
  • Provide nest sites, if required
Lady beetles lay masses of eggs near sources of food for their young.
Lady beetle larvae at egg hatch
Lady beetle larvae
Principles of Gardening for Natural Enemies of Insect Pests

• Learn to recognize them – and don’t kill them

• Provide for food needs of adults

• Provide for food needs of immature stages
• Provide nest sites, if required
Lady beetles

(“Lady bugs”, “Lady birds”....)
Lady beetle adults feed on nectar and pollen
Flower (Syrphid) Flies
Syrphid flies are excellent mimics of bees and wasps.

Honey Bees

Flower (Syrphid) Flies
Flower fly larvae

Ken Gray

Brian Valentine
Adult flower flies sustain themselves on nectar.
Green Lacewings

Neuroptera: Chrysopidae
Adult green lacewings maintain themselves on nectar and pollen.
Parasitic wasps maintain themselves on nectar and pollen
Tachinid fly adults sustain themselves on nectar and pollen.

Larvae develop within and kill other insects.
Adults of many predators use flowers (nectar, pollen) for sustenance
Small, accessible flowers are most commonly used by natural enemies of garden pest insects.
Some plants useful for providing food for adult stages of insect predators and parasites

• Most Apiaceae - (dill, fennel, mooncarrot, etc.)
• Yarrow
• Many sedums
• Spurges
• Alyssum
• Basket-of-gold
• Thyme, several herbs
My favorite plant for insect action

Mooncarrot

Seseli gummiferum
Principles of Gardening for Insect Natural Enemies

- Learn to recognize them – and don’t kill them
- Provide for food needs of adults

- Provide for food needs of immature stages
- Provide nest sites, if required
Spirea aphids on my bridal wreath spirea shrub – A pest??
Perennial plants that consistently provide predator food sources in my garden
Principles of Gardening for Beneficial Insects

• Learn to recognize them – and don’t kill them
• Provide for food needs of adults
• Provide for food needs of immature stages

• Provide nest sites, if required
Hunting Wasps

Families Sphecidae, Pompilidae
Ammophila wasp digging nest (left), carrying caterpillar prey (lower left), at nest entrance with prey (below)
Bembix wasp digging while holding horse fly prey

Howard Ensign Evans
Golden Digger Wasp – Predator of longhorned grasshoppers/katydid
Cicada Killers – Largest hunting wasps
Pemphredon wasps nest in plant stems and hunt small insects
Pemphredon wasps nest in plant stems and hunt small insects.
Condominium Project for Pith Nesting Pempredon Wasps
An excellent new publication by the Xerces Society
Landscaping and Pollinators
Principles of Gardening for Bees

- Provision of high quality sources of nectar
- Provision of high quality sources of pollen
- Provision of nesting sites
Gardening for Honey Bees – or Not
Principles of Gardening for Bees

- Provision of high quality sources of nectar
- Provision of high quality sources of pollen
- Provision of nesting sites
Principles of Gardening for Bees

- Provision of high quality sources of nectar
- Provision of high quality sources of pollen
- Provision of nesting sites
Principles of Gardening for Bees

• Provision of high quality sources of nectar
  – Sources need to be available throughout the growing season!

• Provision of high quality sources of pollen
  – Sources need to be available throughout the growing season!

• Provision of nesting sites
Top Ornamental Plants Visited by Honey Bees in CO include:

- Blue mist spirea
- *Cleome* (bee plant)
- *Agastache foeniculum*
- *Penstemon eatonii*
- *Ocimum* (basil)
- *Nepeta*
- *Aster novae-angliae*
- *Sedum spectabile*
- *Cotoneaster*
- *Allium tangitucum*
Some important pollinator resource plants early in the season

- Winter annual brassicas
- Boxelder, other maples
- Dandelion
- Redbud
Some important pollinator resource plants late in the season

Rubber Rabbitbrush

Thymus spp.

Blue Mist Spirea

Monarda
Some wind pollinated plants (maples, some willows, alder) can be important early season pollen sources for honey bees.
Lawns can be an important resource site from many pollinating insects!
Pollinator assemblages on dandelions and white clover in urban and suburban lawns

Jonathan L. Larson · Adam J. Kesheimer · Daniel A. Potter

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Abstract Flowering weeds, though often deemed undesirable in turfgrass lawns, provide food resources for declining pollinator populations in urbanized landscapes. We sampled bees and other pollinators directly from flowering common dandelion (Taraxacum officinale) and white clover (Trifolium repens) in lawns of similar characteristic percentage of hardscape in surrounding areas. Fostering public awareness of the diversity of bees and other pollinators that visit flowering lawn weeds might help nurture a sociocultural shift toward more pollinator-friendly lawn care practices.
>50 total species collected
Gardeners can help pollinators by promoting plants that are used by pollinators.
Plants *not favored* by honey bees include:

- Doubled flower cultivars
- Flowers with long corollas
- Many common bedding plants
  - Marigolds (pom-pom types)
  - Geraniums
  - Petunias
  - Pansies
Bumble Bees

*Bombus* species
Bumble bees are “buzz pollinators”

Some plants are dependent on buzz pollination
Bumble bee brushing pollen from body into pollen baskets
Bumble Bee visited plants include:

- Most Penstemons
- *Agastache rupestris*
- *Echinacea*
- *Echinops*
- Russian sage
- *Hypericum frondosum*
- *Cleome*
Bumble Bee Life History

1. **Pollination**
   - Bees collect pollen while pollinating flowers.

2. **Dwelling Creation**
   - Bees build or use existing dwellings to store pollen and nectar.

3. **Hibernation**
   - Bees enter a state of winter dormancy, called hibernation, where they conserve energy.

4. **Spring Activation**
   - Bees emerge from hibernation as the weather warms up, ready to start their active season.
Bumble Bee Queen and Worker
Bombus huntii – Overwintered queen on left
Providing nesting sites for bumble bees?
Project Bumble Bee

A Xerces Society Citizen Science project to identify and record bumble bees found throughout North America.

http://www.xerces.org/bumblebees/
The greatest number of kinds of bees are solitary bees
Ground Nesting Solitary Bees
Andrenid bee nest site in Steamboat Springs
Favorable digger bee nesting site in Weld County
Examples where shelter/nest sites can be limiting to solitary bees
Leafcutter Bees

*Megachile* spp.

Solitary Bees
Soft, rotting wood is often excavated for nest sites.
Leafcutter bee excavation in rotten garden timber
Leafcutter bee damage to rose, lilac and Virginia creeper
Leafcutter bees cut fragments from the edges of leaves that are suitable for nest building.
Leafcutter bee carrying leaf fragment
Leafcutter bee returning with leaf fragment
For nest construction:

3-4 rectangular pieces, crimped for the base

Oval pieces along the sides of the cell

Near perfect circles used to cap the cell

All leaf fragments are oriented with the smooth side inwards
For nest construction:

3-4 rectangular pieces, crimped for the base

Oval pieces along the sides of the cell
Leafcutter bees carry their pollen on the underside of the abdomen.
For nest construction:

- 3-4 rectangular pieces, crimped for the base
- Oval pieces along the sides of the cell
- Nearly perfect circles used to cap the cell
Nesting sites for leafcutter bees
Wool Carder Bee and *Stachys*
Wool Carder Bees

*Anthidium spp.*
Nests are made in existing cavities. The nest tunnels are lined with plant hairs.
Male wool carder bees patrol and defend territories.
Mason Bees
(*Osmia* species)
Predrilled wood for nesting by the orchard mason bee/ Blue orchard bee
Nesting habitat may be limiting activity of many native bees (leafcutter bees, mason bees)
A variety of hole sizes can be used to attract a variety of species.
The Bees Needs Project –
University of Colorado, Boulder

Step 2. Hang it up

Photo by Virginia Scott
Built nest site habitats for pollinators and other insects, Dorothy Clive Garden, England
Excellent publication on how to improve habitat for native pollinators

The Xerces Society Guide
Attracting Native Pollinators
Protecting North America’s Bees and Butterflies

Ensure pollination in your garden, orchard, or farm
Identify the flower-visiting insects of your region
Provide host plants and nesting sites for bees and butterflies

Create a landscape that is beautiful, diverse, and pollinator friendly

Foreword by Dr. Maria Spivak

The Xerces Society for Invertebrate Conservation
Landscaping *for* Insects .... or not. Its your choice!

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A pair of publications on how to modify habitat to augment populations of “beneficial” insects (pollinators, natural enemies)
Nuisance Invaders and Landscaping
Landscape Effects on Nuisance Invaders

- Host plants of herbivores
- **Nectar sources**
- Prey sources
- Outdoor lighting
- Landscape watering
- Mulches
Boxelder Bug
Boxelder bugs are associated with boxelder maple.
Western conifer seed bug – associated with pines
Hackberry psyllids are associated with hackberry plantings
Host Plants Associated with Nuisance Invaders

- **Birch**
  - Birch catkin bug

- **Boxelder**
  - Boxelder bug

- **Elm**
  - Elm leaf beetle

- **Hackberry**
  - Hackberry blister gall psyllid

- **Tree-of-heaven**
  - Redshouldered soapberry bug

- **Pines**
  - Western conifer-seed bug

- **Yew**
  - Black vine weevil
Mulches and Nuisance Invaders

- European earwig
- Springtails
- Millipedes

- Sowbugs/Pillbugs
- Field crickets
- Some ants
- Some spiders
Household “Bugs” Most Associated with Thick Mulch around Foundations

Earwigs
Household “Bugs” Most Associated with Thick Mulch around Foundations

Millipedes
Household “Bugs” Most Associated with Thick Mulch around Foundations

Pillbugs/Sowbugs and the “Roly-Poly Hunter”
Household “Bugs” Most Associated with Thick Mulch around Foundations

Springtails
Household “Bugs” Most Associated with Thick Mulch around Foundations

Odorous House Ant
Garden plantings can affect incidence of....

- Butterflies
- Hummingbird moths
- Miller Moths
- Honey bees
- Bumble bees
- Solitary bees
- Natural enemies of insect pests
- Nuisance invaders of buildings
- “Double or Nothing” species
“Double or Nothing Pests”

Organisms that Require Two Host Species
Juniper-Hawthorn Rust (a fungus)
Juniper-Hawthorn Rust (a fungus)
Some insects (particularly aphids) have life cycles that involve host alternation.
Aphids typically overwinter in the egg stage, laid near buds.
Stem mother arises from overwintered eggs
Leaf curling may be associated with the spring generation.

...then they all leave that plant for their summer hosts.
Summer hosts include different plant species, often herbaceous plants.
LIFE CYCLE OF THE GREEN PEACH APHID
Annual problem – leafcurling aphids on dill, parsley
Carrot-Willow Aphid
Cooley Spruce Gall - Produced by the Cooley Spruce Gall Aphid (Adelgid)
SPRING
GALL-FORMING ♀
WINTER
OVERWINTERING ♀
FALL
SEXUAL FORM ♂ & ♀
SUMMER
MIGRATORY ♀
MIGRATION TO DOUGLAS-FIR
MIGRATION FROM DOUGLAS-FIR
SPRUCE
Cooley spruce gall adelgid – Woolly aphid form associated with Douglas-fir
LIFE CYCLE OF THE COOLEY SPRUCE GALL ADELGID
Root Aphids
Pemphigus spp. galls on Populus
Summer hosts of *Pemphigus* spp. are roots of herbaceous plants.
Woolly elm aphid, *Eriosoma americanum*
Amelanchier, alternate host of the woolly elm aphid
Treatment timing – When woolly elm aphids move from leaf curls of elm (June)
Woolly aphid associated with moneywort runners
*Thecabius lysimachiae* – althernate host
*Populus nigra*