Gardening *for* Insects …. or not

How Planting Selection Impacts Insect Populations

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
  - **Search** "BSPM CSU"
- **Within** "Extension and Outreach"
- "Insect Information"
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How Planting Selection Impacts Insect Populations

Whitney Cranshaw

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Bob Hammon photograph

Garden plantings can affect incidence of….

- Butterflies
- Hummingbird moths
- Miller moths
- Honey bees
- Bumble bees
- Natural enemies of insect pests
- Multi-host insect pests
- Nuisance invaders of buildings

Insect Needs

- Food for their young
- Food for the adults
- Shelter (many times)

Larval Food Example:
Painted Lady

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

Adult Food Example:

Many predators of garden pests (biological controls)

Shelter Example:
Leafcutter Bee Boards

In the beginning there was….

Butterfly Gardening

“Parsleyworm”

Susan Ellis photograph

UGA1366082

Eggs on dill

Young larva

Chrysalid (pupal form) of the parsleyworm

The adult form of the parsleyworm is known as…

Black Swallowtail butterfly


Butterfly Gardening

Principles of Butterfly Gardening

- Provide for food needs of adults
- Provide for food needs of larvae (caterpillar)
- Provide some shelter if sites are exposed
- Avoid use of harmful insecticides
- 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
- Sweet pea

Massed plantings are most often visited by butterflies

Some *Perennial Plants* Commonly Used by Butterflies

- Butterfly Bush
- Milkweeds
- Sedums
- Lilac
- Rabbitbrush
- Potentilla
- Thistles
- Monarda

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

‘Mud puddling’ by tiger swallowtail

Bob Hammon photograph

Foods Used by Caterpillars:

Leaves of their host plant

Painted Lady

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

The pygmy blue develops on saltbush, pigweed and some other Chenopodiaceae

The dainty sulfur feeds on sneezeweed, Shepard's needle and various low growing Asteraceae

The common buckeye (left) develops on snapdragons, toadflax, plantain and other plants

The Arizona sister (above) develops on oak

Mourning Cloak

Nymphalis antiopa

Larva (spiny elm caterpillar) feeds on willow, elm, aspen, hackberry

Twotailed Swallowtail

Papilio multicaudata

Twotailed Swallowtail

Eggs are laid on ash, chokecherry, hoptree

Everting the osmeteria (repellent glands)

Butterfly garden spoiler alert!!!

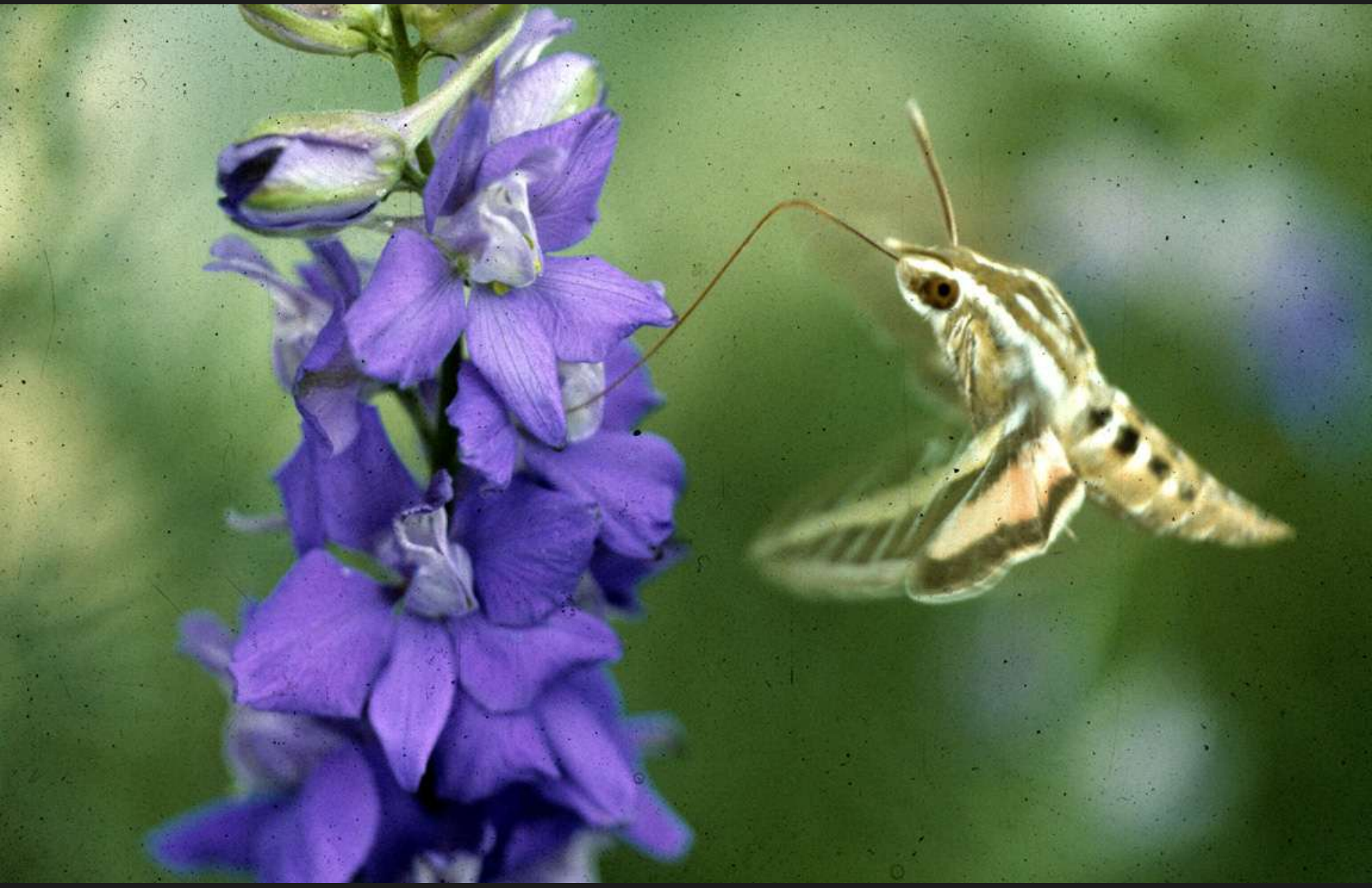
Impacts of the recent colonization by the *European paper wasp*

Paper wasps feed their young chewed insects, mostly caterpillars

Caterpillar populations in yards/gardens have been decimated **over the past decade by the new (ca 2000) arrival of the European paper wasp**

Photograph courtesy of Joseph Berger/BugWood.org

Hummingbird Moths



Photograph courtesy of Bill Ciesla

Hummingbird Moths

A type of sphinx/hawk moth that flies during the day

Colorado has about two dozen kinds of hornworms – Minnesota probably about the same.

Most hornworms are not “pest” insects

Whitelined sphinx

Hyles lineata

The most common hummingbird moth of the western US

Photograph courtesy Bill Ciesla

Plants most visited by hummingbird moths typically have deep sources of nectar that are accessed by their long mouthparts

Some plants most often visited by hummingbird moths include:

Four o’clocks

Evening primrose

Larkspur

Gentian

Honeysuckle……

Landscaping for Biological Control Agents

N

Natural Enemies

- Predators
- Parasitoids
- Pathogens

Some insect natural enemies

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 Beneficial Insects

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Lady beetles

(“Lady bugs”, “Lady birds”….)

Lady beetle larvae

Conserve and enhance existing lady beetles

Flower (Syrphid) Flies

Flower fly larvae

Flower (Syrphid) Flies

Syrphid flies are excellent mimics of bees and wasps

Honey Bees

Photograph courtesy Brian Valentine

Flower (Syrphid) Flies

Syrphid flies are excellent mimics of bees and wasps

Honey Bees

Adult flower flies sustain themselves on nectar and pollen

Green Lacewings

Neuroptera: Chrysopidae

Photograph courtesy of Brian Valentine

Adult green lacewings maintain themselves on nectar and pollen

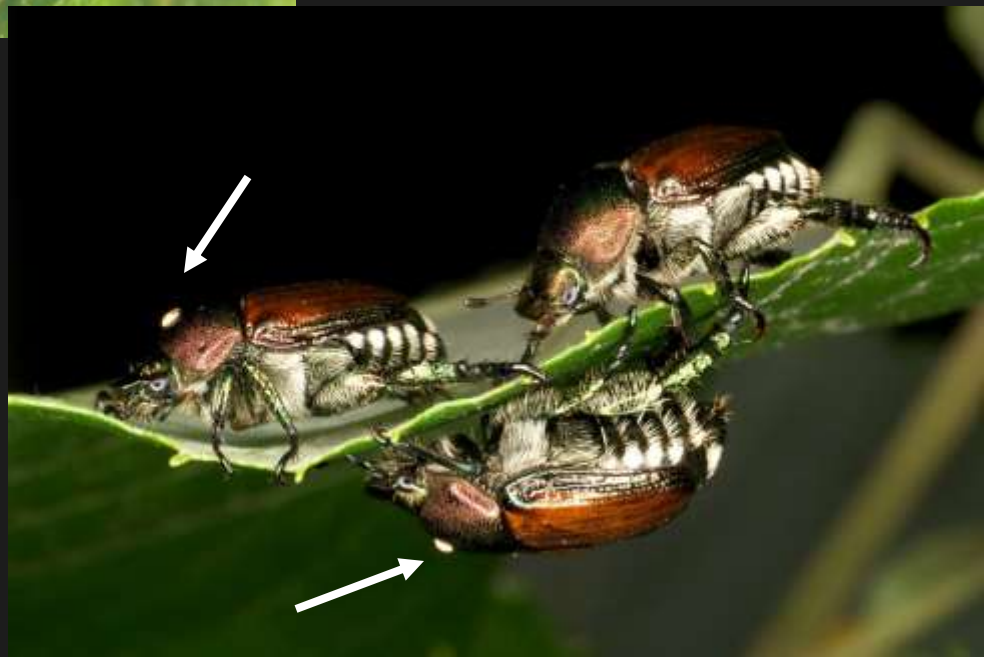
Parasitic wasps

Aphid parasitoids

Parasitic wasps maintain themselves on nectar and pollen

Tachinid Flies

Tachinid fly eggs on caterpillar (above), stink bug (above right) and Japanese beetles (right)



Tachinid fly adults sustain themselves on nectar and pollen

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

Mooncarrot

Seseli gummiferum

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

Spirea aphids on my bridal wreath spirea shrub – A pest??

Principles of Gardening for Beneficial Insects

- Learn to recognize them – and don’t kill them
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- **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

Johnny Dell

Grass Carrying Wasps (I*sodontia* spp.)

Predators of tree crickets

Nest of Isodontia mexicana with cocoons and cells provisioned with tree crickets

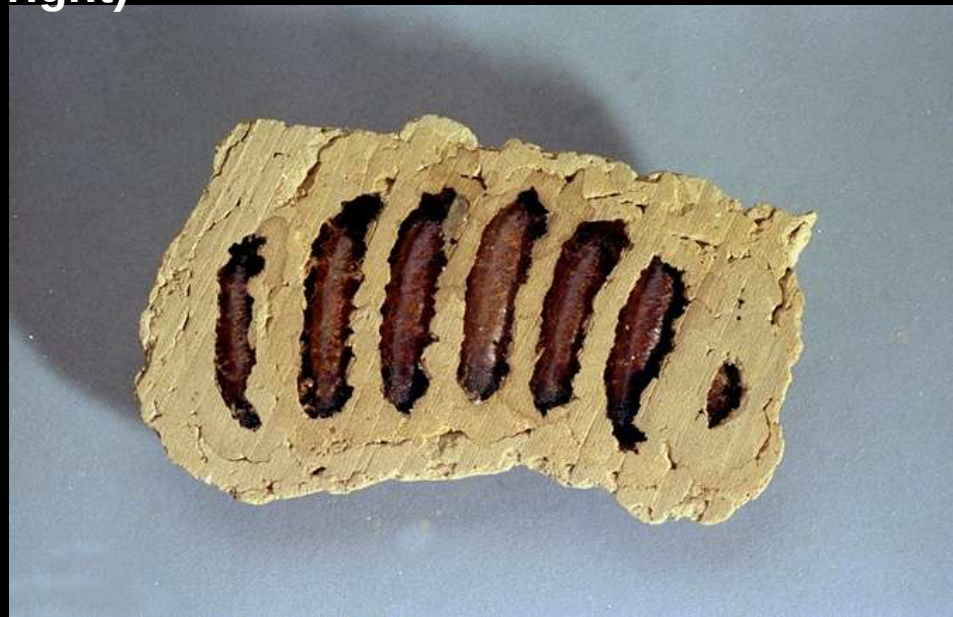
Kevin O,Neill/MSU

Pemphredon **wasps nest in plant stems and hunt aphids**

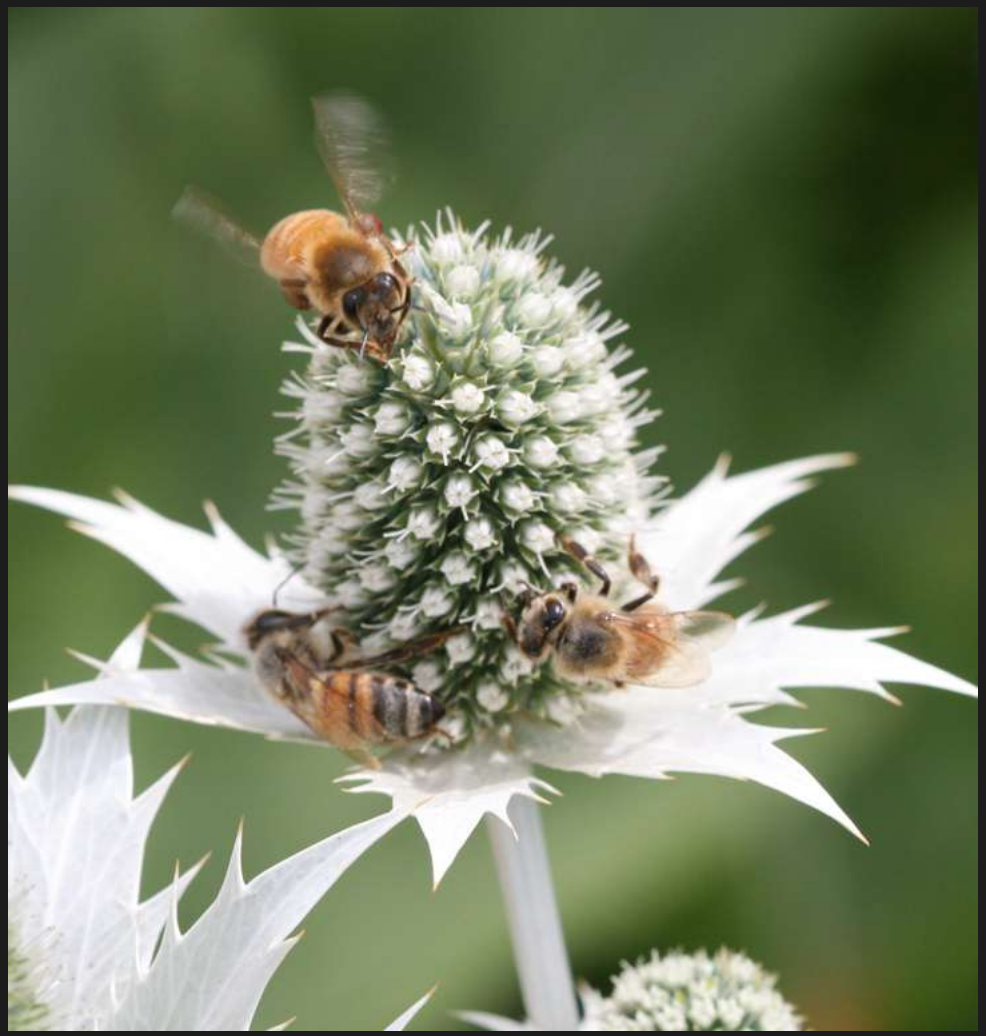
Black and Yellow Mud Dauber

Black and Yellow Mud Dauber (*Scleriphon caementarium*)

Nest (top left), crab spider prey cache (top right), larva feeding on spider prey (below left) and cocoons of pupae (below right)



Landscaping and Pollinators



Gardening for Honey Bees – or Not

Honey Bee *Apis mellifera*

Honey Bee – Flowering Plant Evaluation

- Evaluate the relative use of flowering plants by honey bees (and other bees)
- Identify plants heavily used by honey bees
- Identify plants not visited/used by honey bees

Top Plants Visited by Honey Bees include:

- **Blue mist spirea**
- ***Cleome* (bee plant)**
- ***Agastache foeniculum***
- ***Penstemon eatonii***
- ***Ocimum (basil)***
- ***Nepeta***
- ***Aster novae-angliae***
- ***Sedum spectabile***
- ***Cotoneaster***
- ***Allium tangitucum***

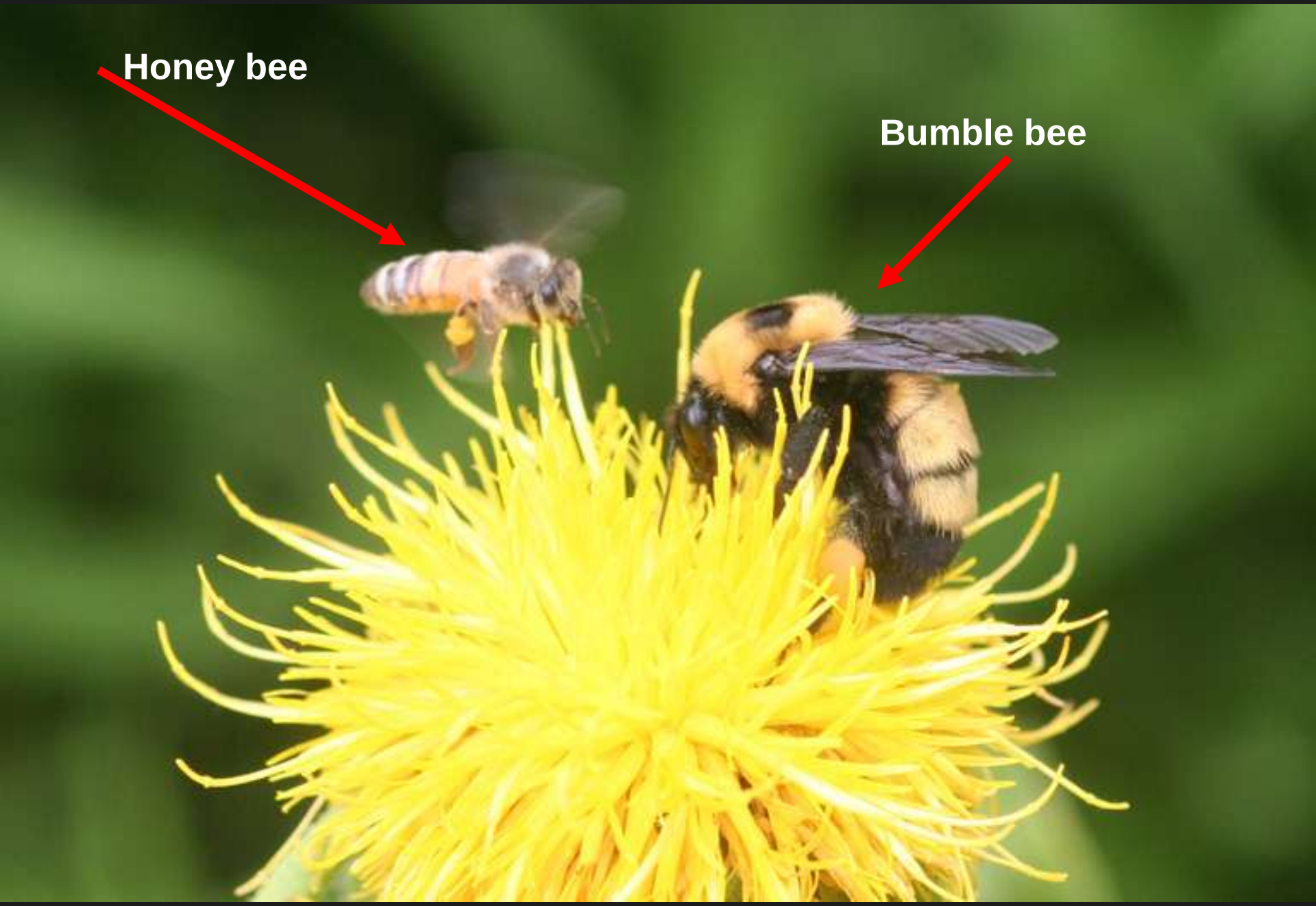
Many willows are good nectar sources – but often bloom during cool weather

Maples, boxelder are good sources of nectar – but often bloom during cold weather

Tilia spp. (basswood, linden) are excellent sources of nectar for honey bees!!!

Plants *not favored* by honey bees include:

- Doubled flower cultivars
- Flowers with long corollas
- Many common bedding plants
  - Marigolds
  - Geraniums
  - Petunias
  - Pansies


Honey bee
Bumble bee

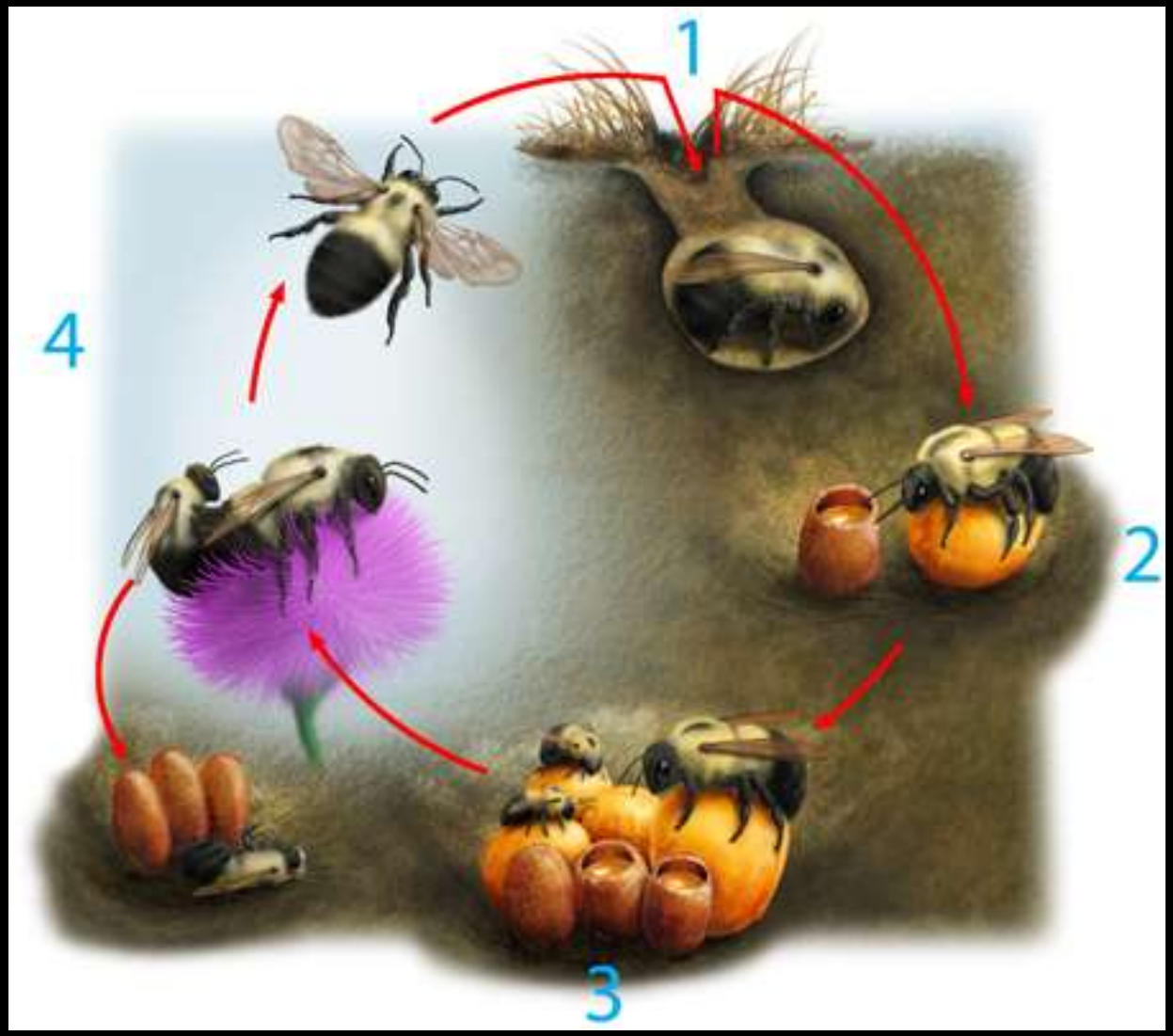
Bumble Bees

Bombus species

FROM:

THE XERCES SOCIETY
FOR INVERTEBRATE CONSERVATION

Bumble Bee Life History



Annual Life Cycle

(New colony produced each year)

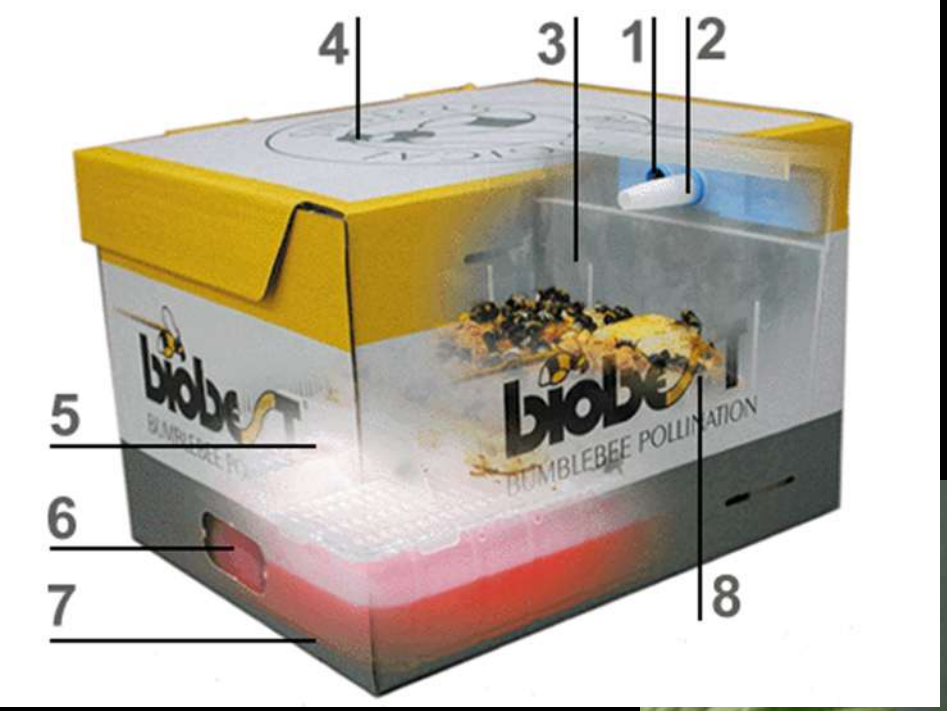
Nest sites – Cavities with some insulating materials is preferred

Bumble bees carry pollen in pollen sacs on the hind legs

Bumble bees are “buzz pollinators”

Some plants are dependent on buzz pollination

Bumble bee brushing pollen from body into pollen baskets



Bumble bees are used for pollination in greenhouse tomato and pepper production.

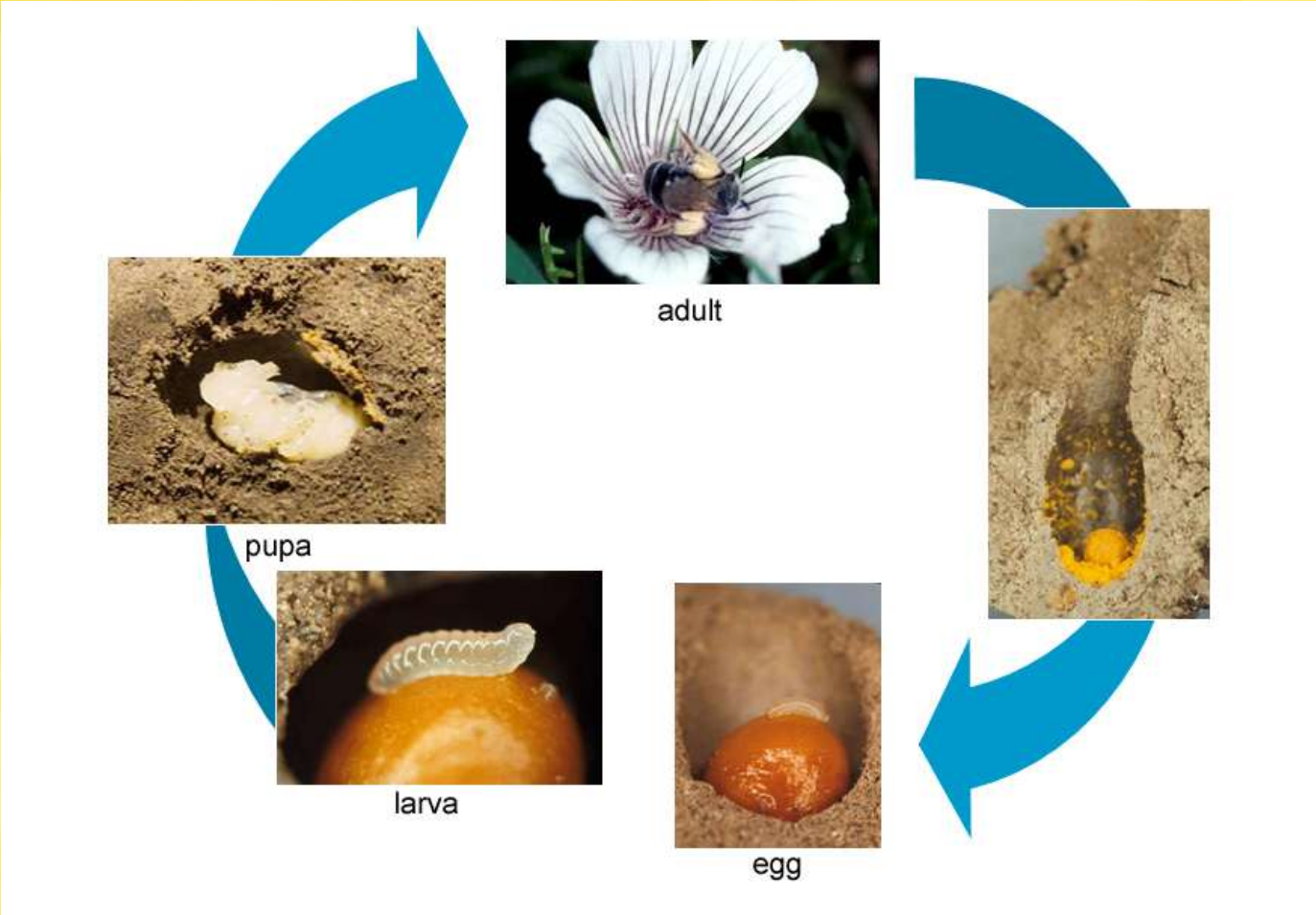
- Most Penstemons
- *Agastache rupestris*

Bumble Bee visited plants include:

- *Echinacea*
- *Echinops*
- Russian sage
- *Hypericum frondosum*

Photograph by Bob Hammon

Native solitary bee life cycle



The life cycle of a solitary bee consists of four stages: egg, larva, pupa and adult. Solitary adult bees provision their young with a pollen-ball, illustrated above.

All photographs in this illustration are by Dennis Briggs except the photograph of the pupa, which is by Robbin Thorp.

Leafcutter Bees

Hymenoptera: Megachilidae

An example where shelter/ nest sites are limiting

Leafcutter bee damage to rose, lilac and Virginia creeper

Leafcutter bee nest sites

Soft, rotting wood is often excavated for nest sites

Leafcutter Bee Excavating Rotten Porch Board

Leafcutter bee excavation in rotten garden timber

Leafcutting Bee damage to rose leaves

Van Waters & Rogers
1983 division of Univar

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

Leafcutter bee carrying leaf fragment

Leafcutter bee returning with leaf fragment

Leafcutter bee cells in hollowed stem of a weed

Leafcutter Bee Boards

Photograph by Sami Waters

Photograph by Sami Waters

Leafcutter Bee Boards

Mason Bees
(*Osmia* species)

Predrilled wood for nesting by the orchard mason bee/ Blue orchard bee

Wool Carder Bee and *Stachys*

Wool Carder Bee

Anthidium manicatum

Nests are made in existing cavities. The nest tunnels are lined with plant hairs.

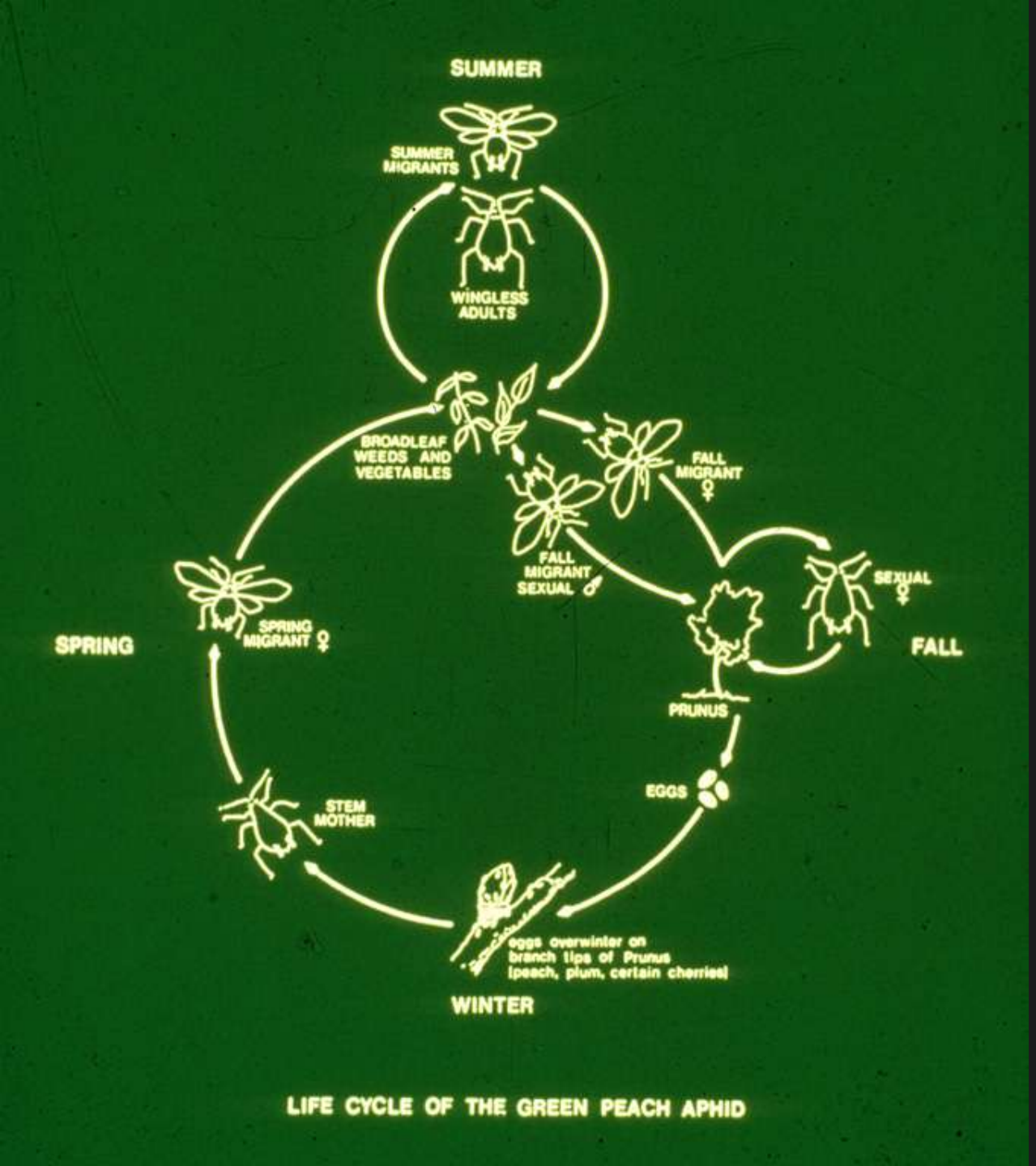
Male wool carder bees patrol and defend territories

“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

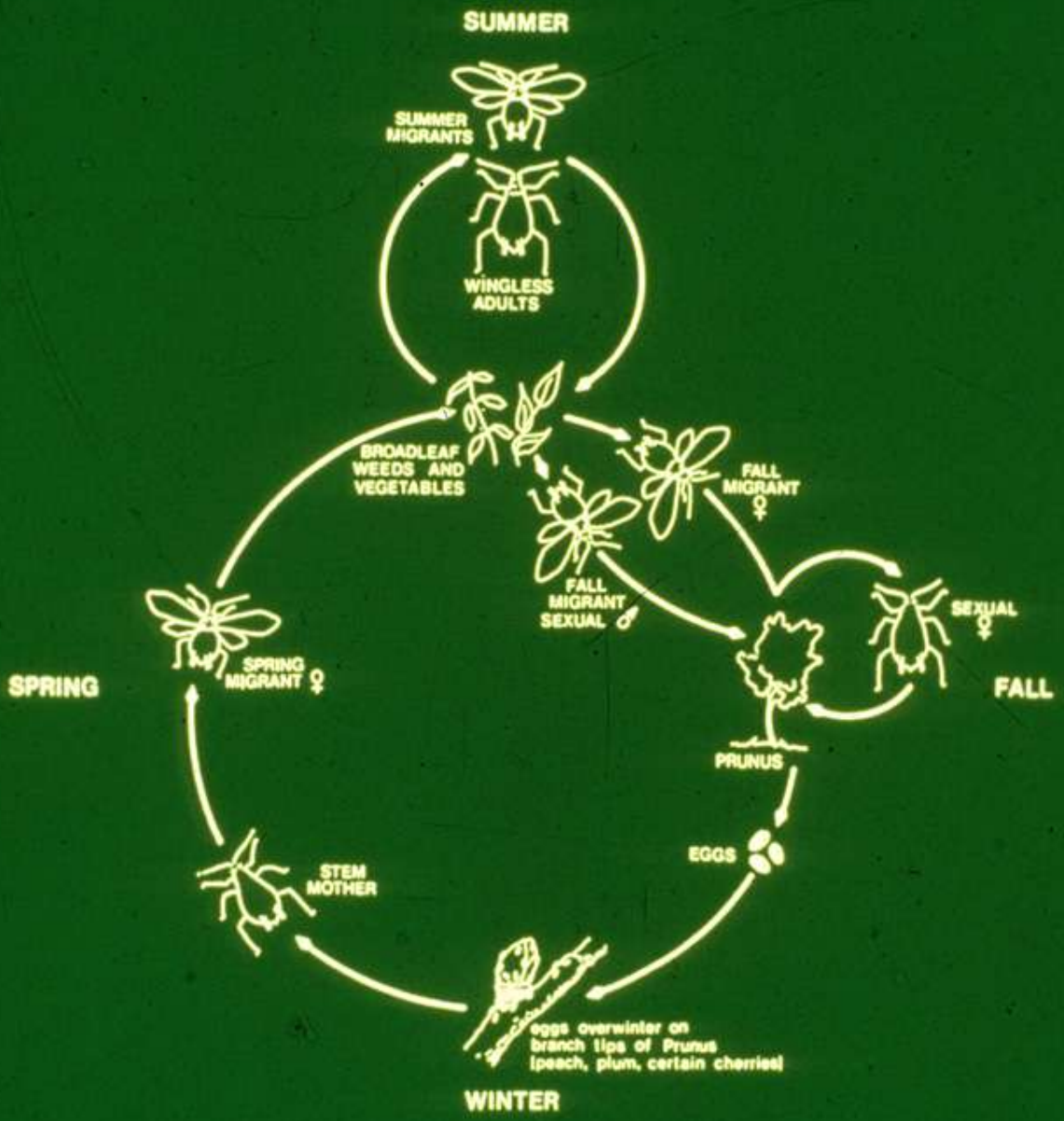
Aphids typically overwinter in the egg stage, laid near buds


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

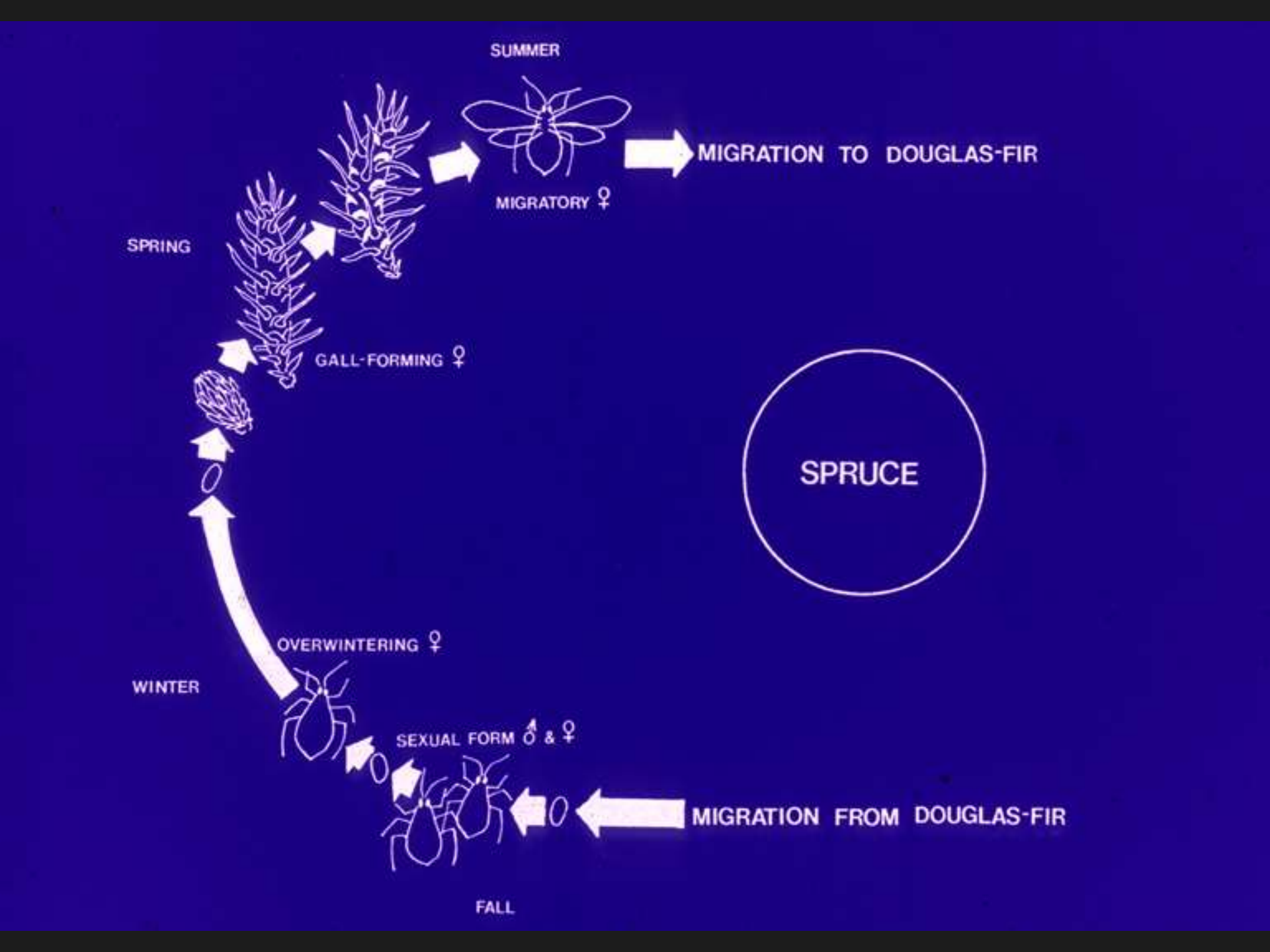
Carrot-Willow Aphid

Cooley Spruce Gall - Produced by the Cooley Spruce Gall Aphid (Adelgid)


UGA1325029

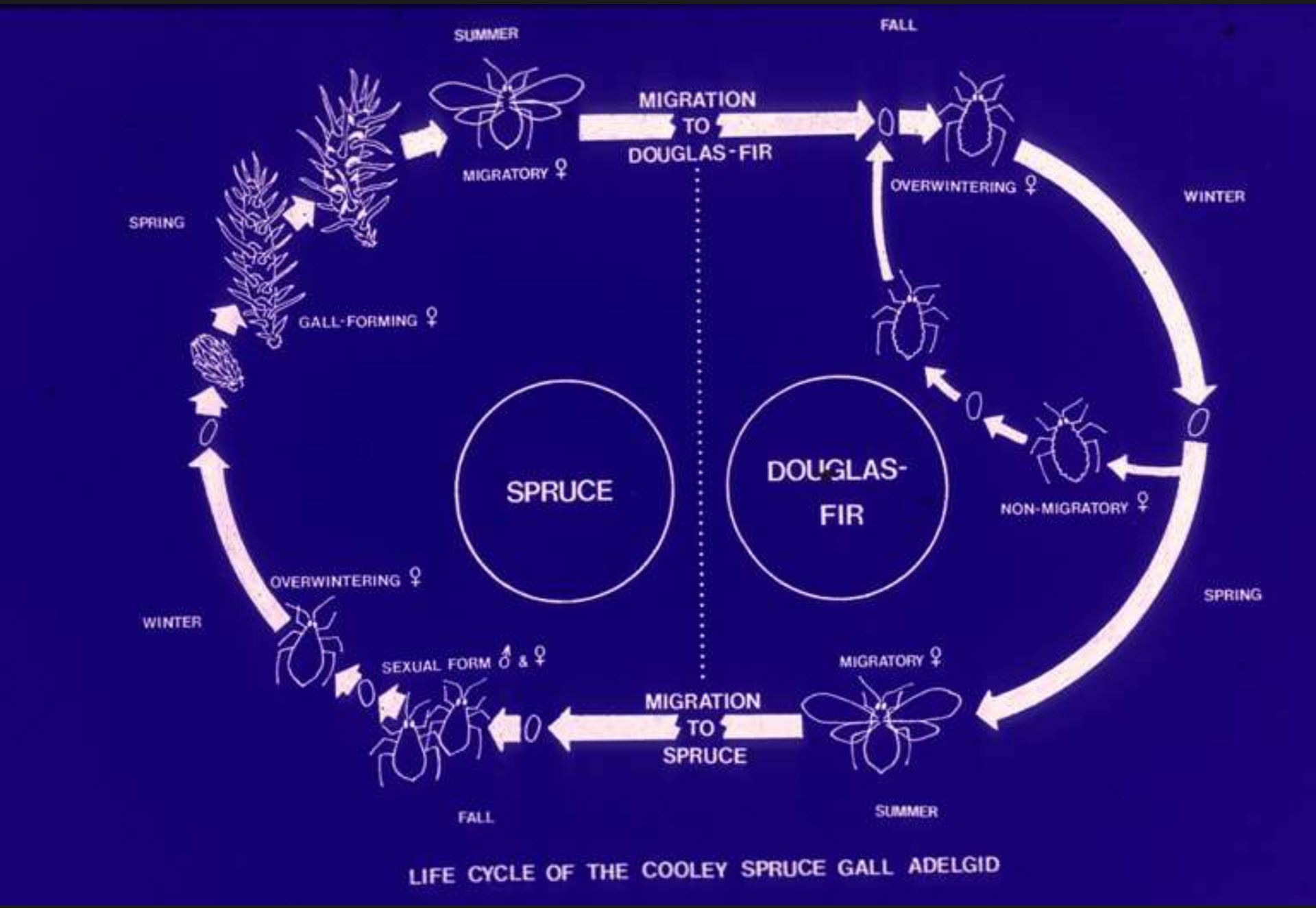

UGA1325028


UGA1325025


SUMMER
MIGRATION TO DOUGLAS-FIR
MIGRATORY ♀
SPRING
GALL-FORMING ♀
SPRUCE
OVERWINTERING ♀
WINTER
SEXUAL FORM ♂ & ♀
MIGRATION FROM DOUGLAS-FIR
FALL

Cooley spruce gall adelgid – Woolly aphid form associated with Douglas-fir


UGA1325031



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

Landscape Effects on Nuisance Invaders

- Host plants of herbivores
- Nectar sources
- Prey sources
- Outdoor lighting
- Mulches, watering

Boxelder Bug

Boxelder bugs are associated with boxelder maple

Goldenrain tree bug (aka “redshouldered bug”)

Associated with soapberry family plants

Western conifer seed bug – associated with pines

Elm leaf beetle

Feeds on Siberian elm. Often enters homes for winter shelter

Host Plants Associated with Nuisance Invaders

- **Birch**
  - Birch catkin bug
- **Boxelder**
  - Boxelder bug
- **Elm**
  - Elm leaf beetle
- **Hackberry**
  - Hackberry blistergall psyllid

- **Tree-of-heaven**
  - Redshoulderd soapberry bug
- **Pines**
  - Western conifer seed bug
- **Yew**
  - Black vine weevil

Mulches and Nuisance Invaders

- European earwig
- Springtails
- Millipedes

- Sowbugs/Pillbugs
- Field crickets
- Odorous house ant
- Some spiders

Mulches and Nuisance Invaders

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- Some spiders

Garden plantings can affect incidence of….

- Butterflies
- Hummingbird moths
- Honey bees
- Bumble bees
- Solitary bees and wasps
- Natural enemies of insect pests
- Multi-host insect pests
- Nuisance invaders of buildings

Gardening *for* Insects …. *or not!* Its your choice!

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Extension Entomology

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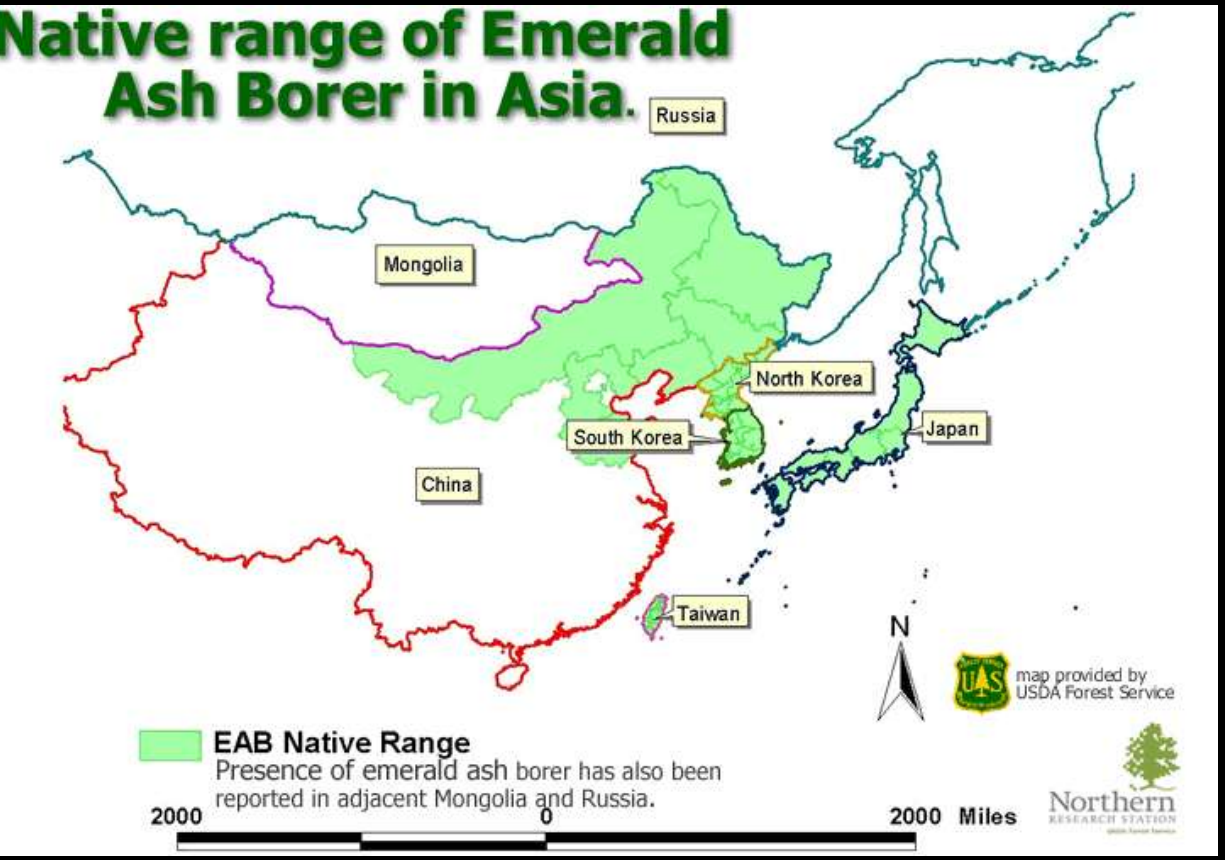
Photograph by Steven Valley

An Introduction to the Emerald Ash Borer

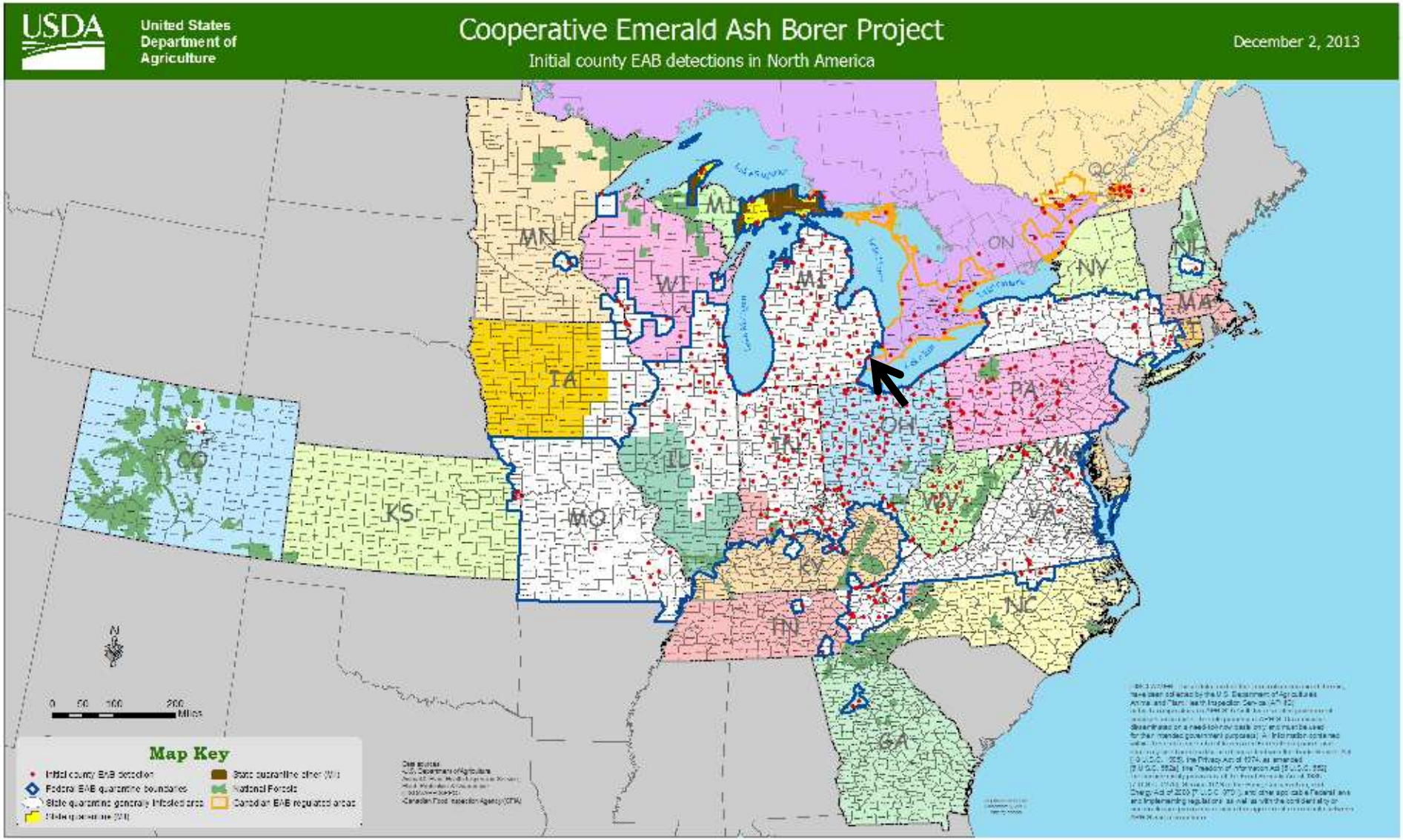
Emerald ash borer (EAB) is a green-colored beetle…….

…that develops in ash trees (*Fraxinus* species)…

……and is Native to Asia



Emerald ash borer was accidentally introduced into and has since spread through North America



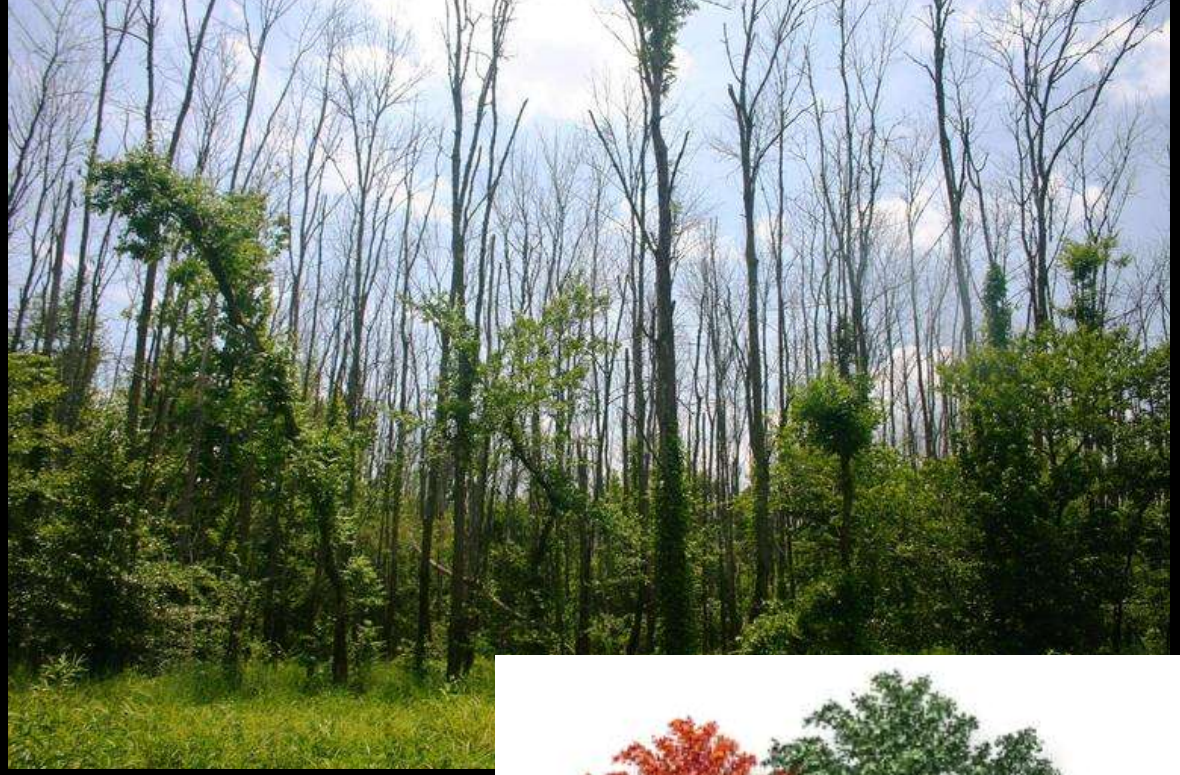
Photograph by Art Wagner

Photograph by David Cappaert

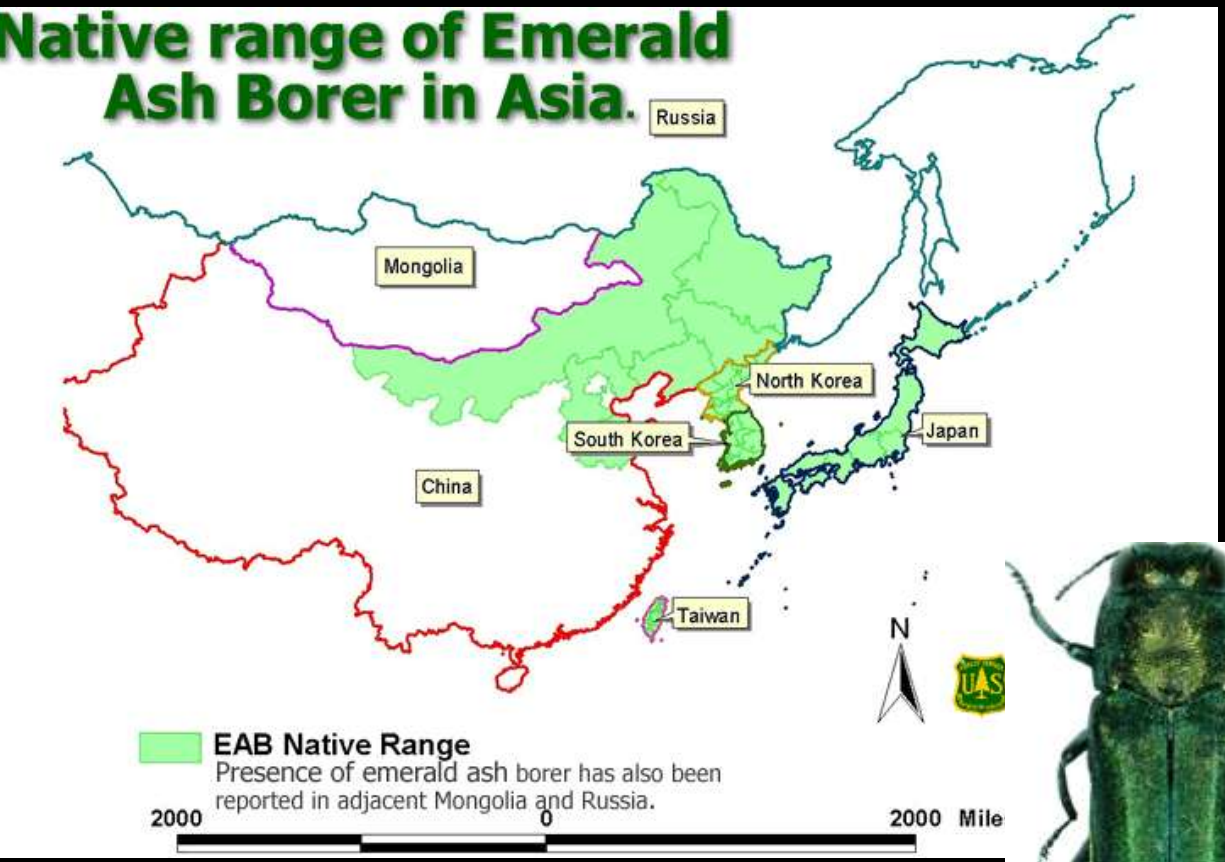
Larvae make meandering tunnels under the bark

Emerald ash borer larvae create meandering tunnels in the phloem and outer sapwood that produce girdling wounds.

Emerald ash borer is devastating to all species of ash that are native to North America



Emerald Ash Borer is an Introduced Species Native to Asia



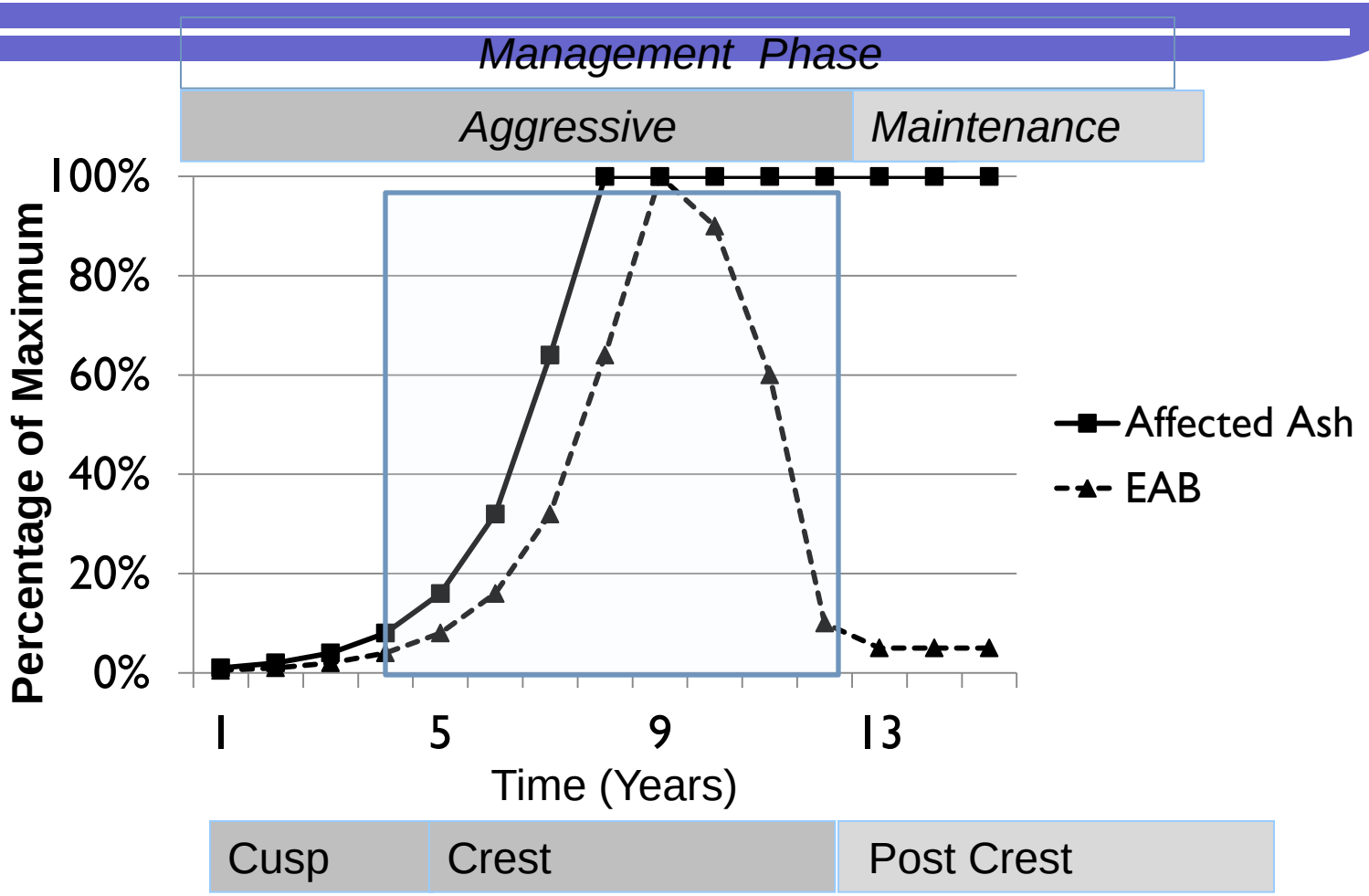
Why is EAB so destructive to ash trees in North America?

NA ash species lack ability to ability to resist EAB

EAB Will Kill All Unprotected Ash

These trees can't be saved. They are already dead.

EAB Invasion Wave and Protection Needs



* Assumes doubling of affected ash and EAB yearly during growth

Chestnut blight – Devastated American chestnut in early 1900s, caused by a fungus

Dutch elm disease – Devastated American elm in mid century. Caused by a fungus, vectored by a bark beetle

Photograph by Debbie Miller

Emerald ash borer

Agrilus plannipennis

Photograph by David Cappaert

Order Coleoptera (beetles)

Family Buprestidae (metallic wood borers, flatheaded borers

Lilac/Ash Borer does not equal Emerald Ash Borer!

Lilac/ash borer, a clearwing borer moth

Emerald ash borer, a metallic wood borer/ flatheaded borer

Damage potential to its host

10 – EAB now defines an aggressive tree killing insect in North America.

Damage potential to its host

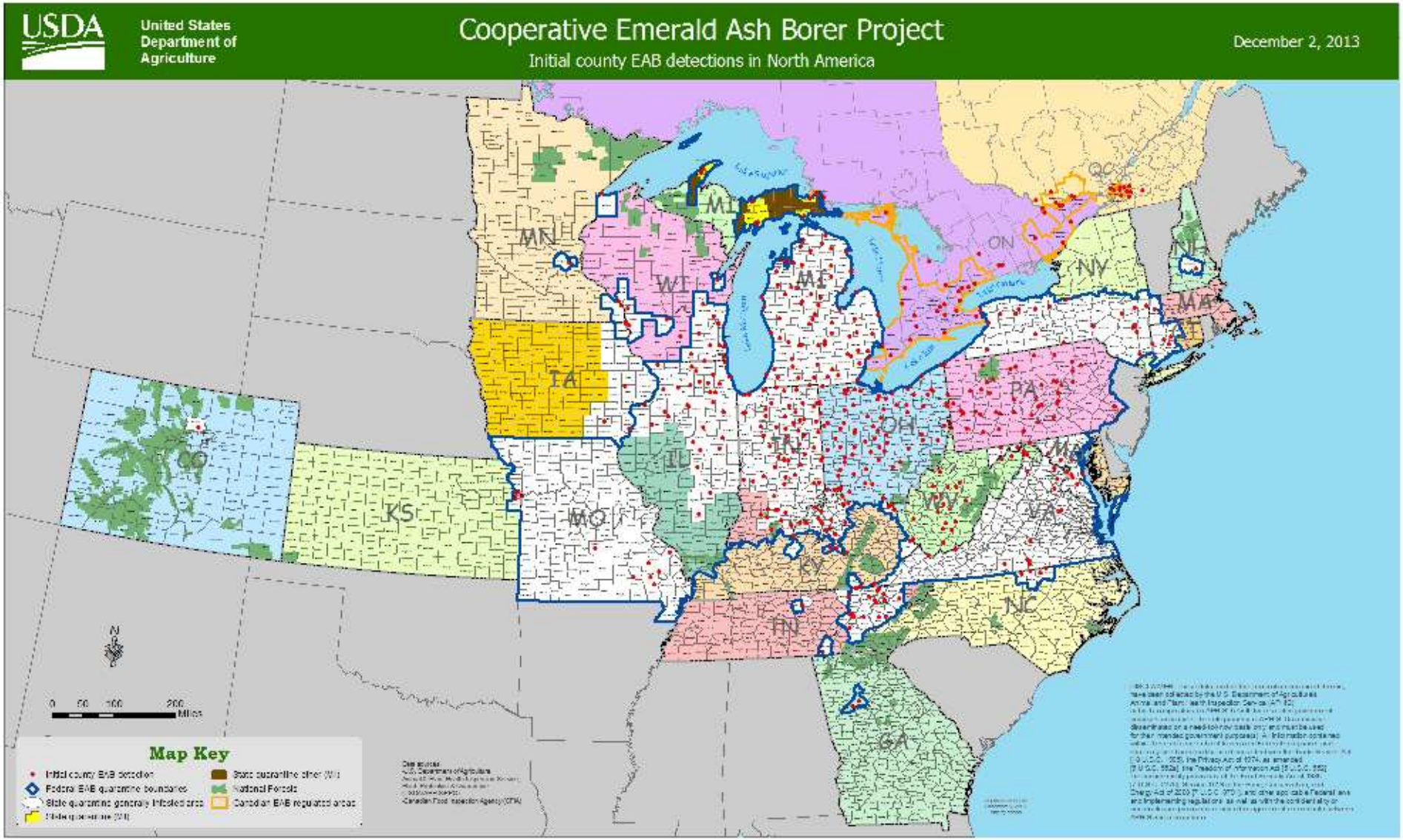
2, maybe 3 – Lilac/ash borer has far lower ability to seriously damage its host

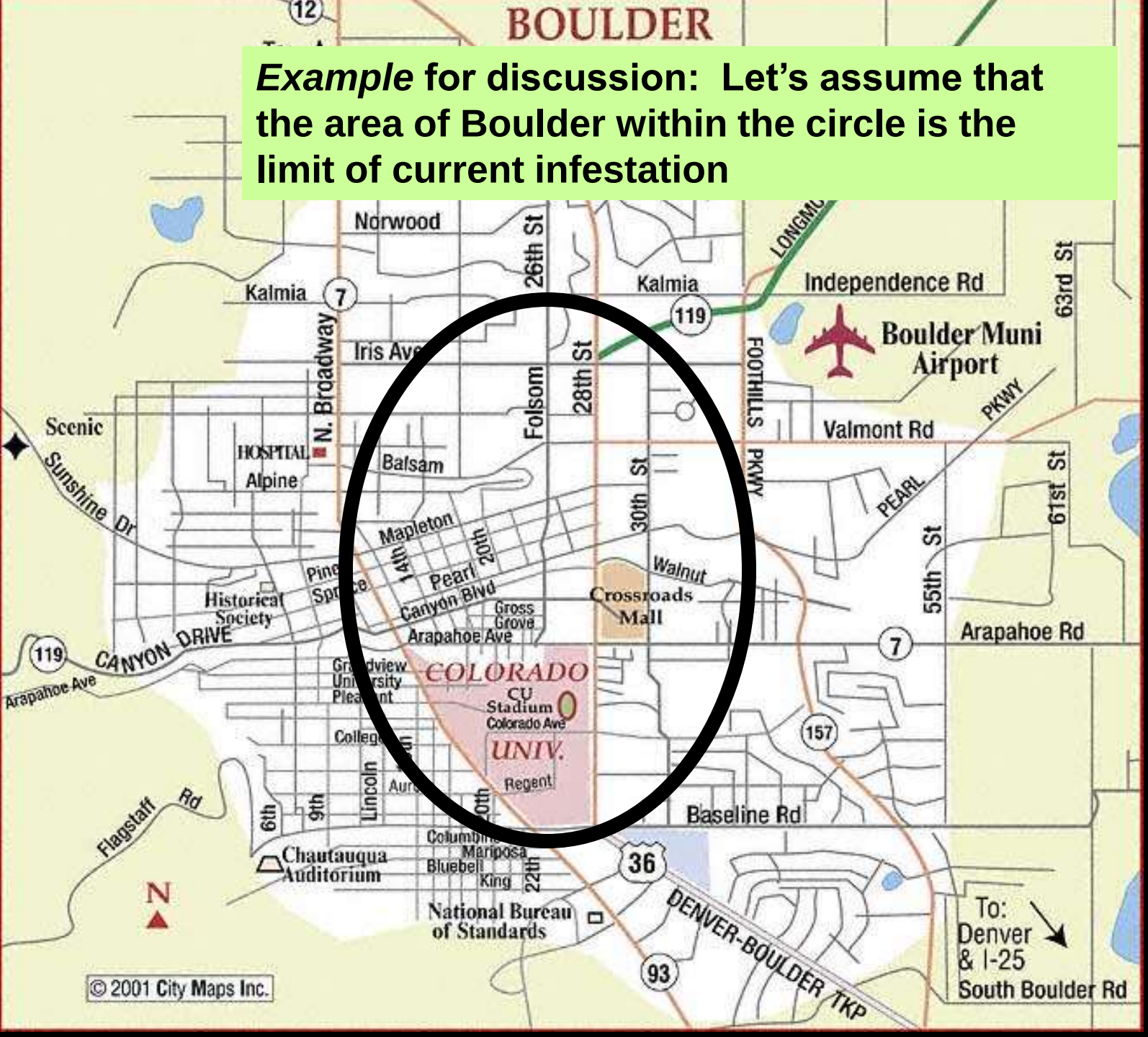
Colorado EAB Tree #1

Located near the intersection of 30th and Valmont, Boulder

Emerald Ash Borer has become established within in the South Platte River Drainage of Colorado – not the entire state of Colorado!

Present distribution of EAB in North America




BOULDER
Example for discussion: Let's assume that the area of Boulder within the circle is the limit of current infestation
Norwood
26th St
Kalmia
7
Kalmia
119
Independence Rd
63rd St
Iris Ave
N. Broadway
Folsom
28th St
FOOTHILLS PKWY
Boulder Muni Airport
Scenic
Sunshine Dr
HOSPITAL
Alpine
Balsam
Valmont Rd
PKWY
30th St
PEARL
61st St
55th St
Mapleton
14th
20th
Pearl
Canyon Blvd
Walnut
Crossroads Mall
Historical Society
Gross Grove
Arapahoe Ave
Arapahoe Rd
119
CANYON DRIVE
Arapahoe Ave
COLORADO
CU
Stadium
Colorado Ave
UNIV.
Regent
157
Lincoln
6th
9th
Flagstaff Rd
Baseline Rd
Chautauqua Auditorium
Mariposa
Bluebell
King
22nd
36
National Bureau of Standards
DENVER-BOULDER TKP
93
To: Denver & I-25
South Boulder Rd
N
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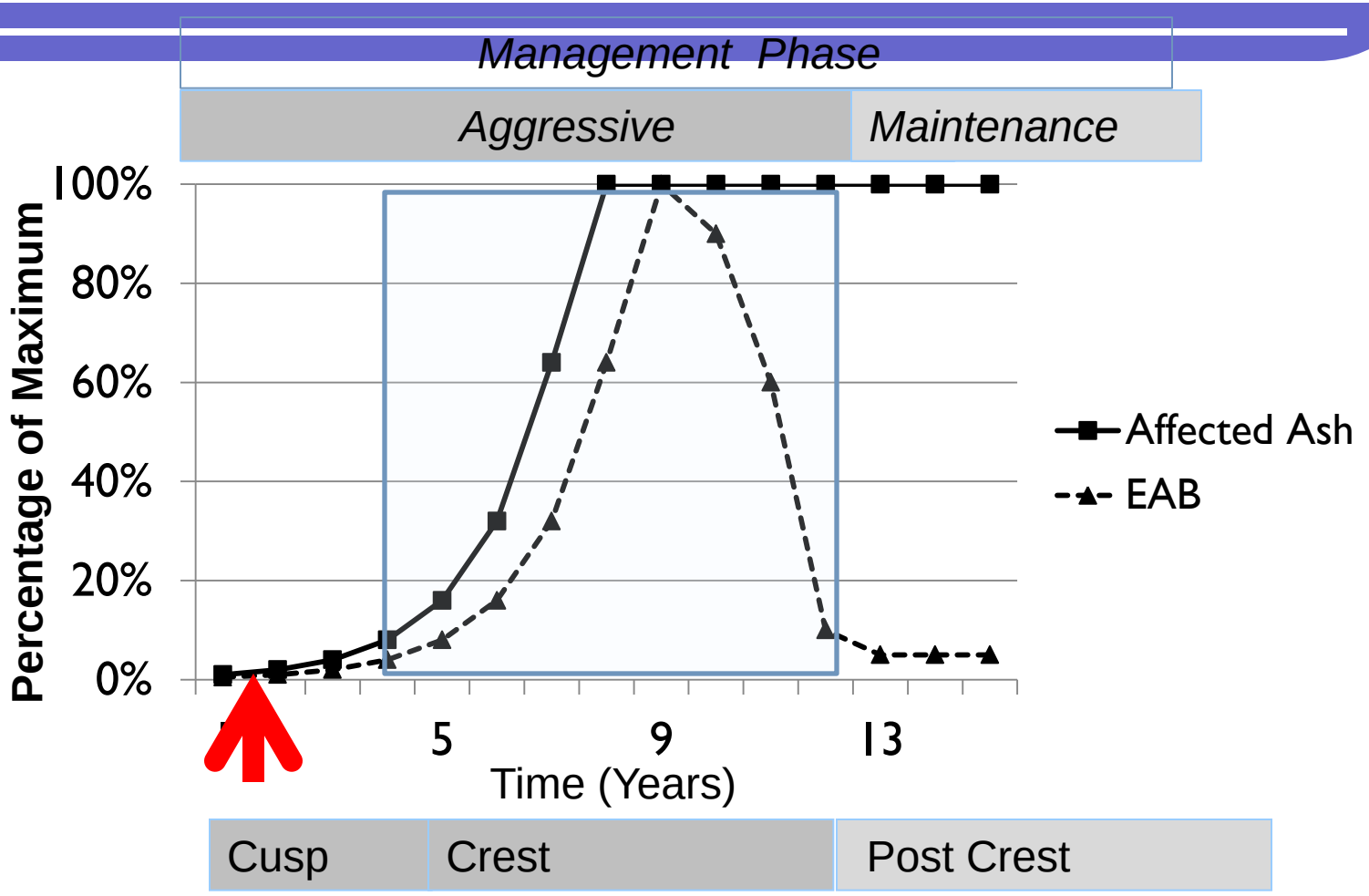
Where are we now with the EAB in Boulder?



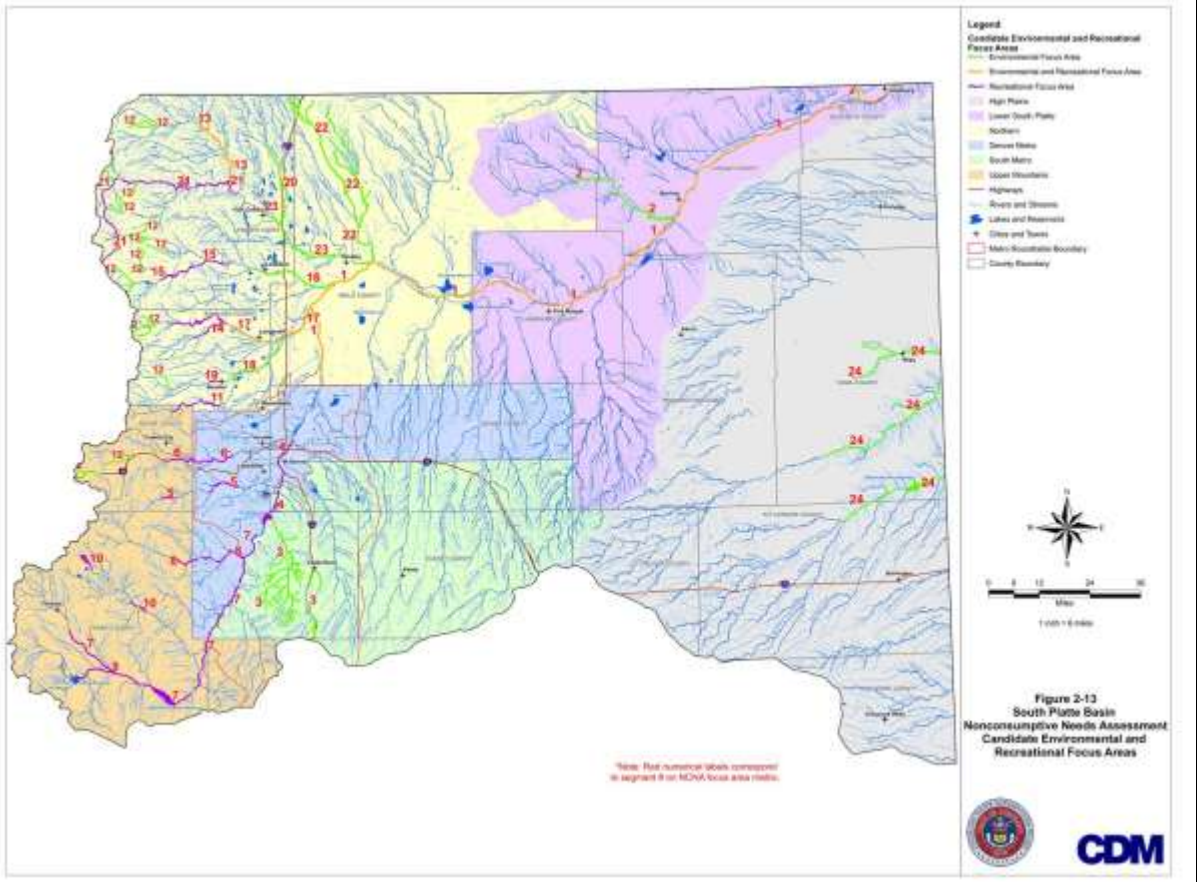
* Assumes doubling of affected ash and EAB yearly during growth

Main Points About Emerald Ash Borer in Colorado

- **Known infestation presently confined to areas within Boulder City limits**
  - In time will spread throughout South Platte drainage
  - Other areas of the state are at no greater risk than before detection
- **Treatments are available that will protect individual trees**
  - Each treatment option involves decisions balancing costs, environmental hazards, effectiveness and ease of application

Unlike states to the east, Colorado is highly compartmentalized due to its geography

The current infestation is an infestation of the South Platte River drainage, not the State of Colorado



Within the next five years, emerald ash borer *will* move out of Boulder into the surrounding counties

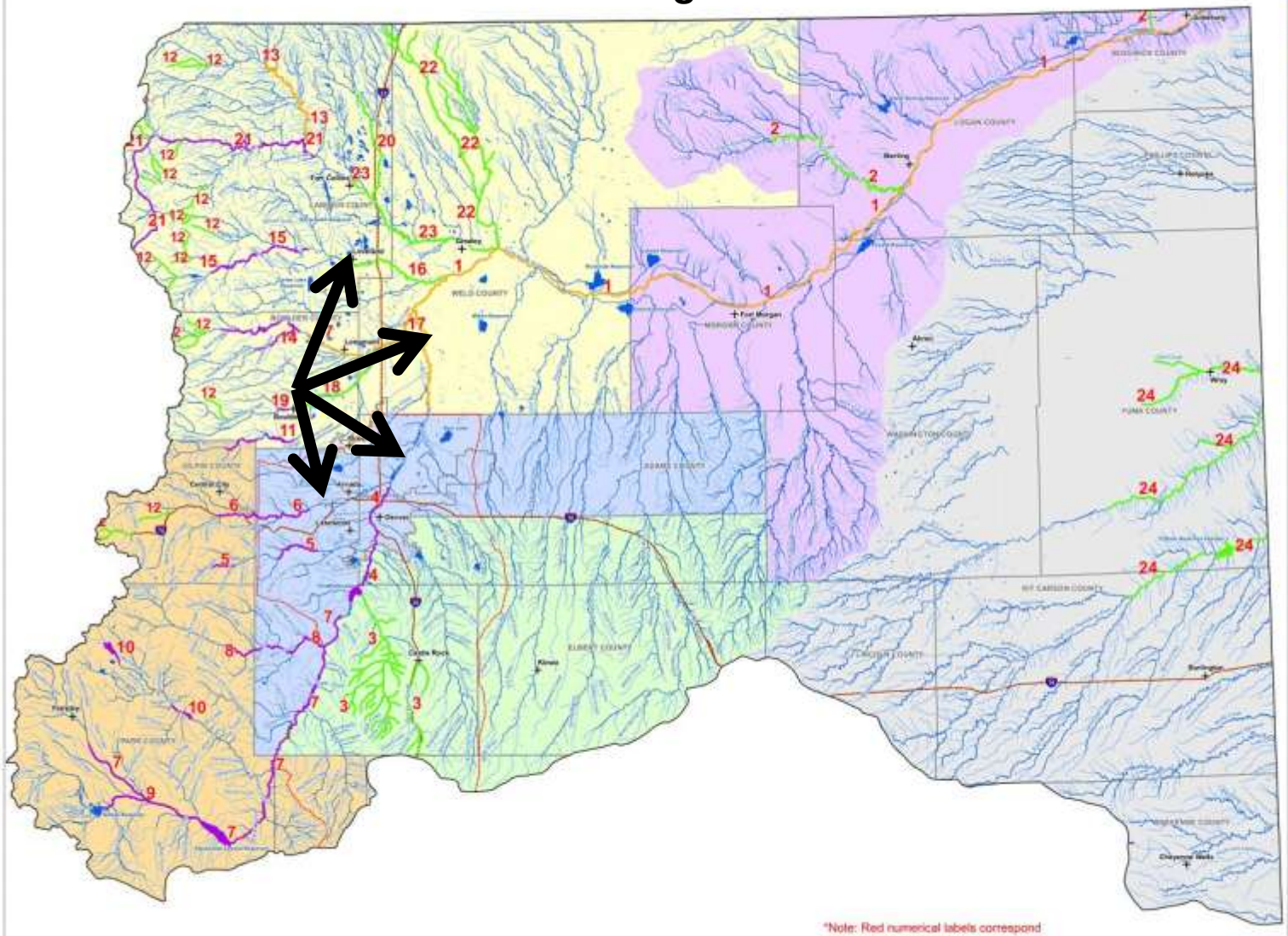
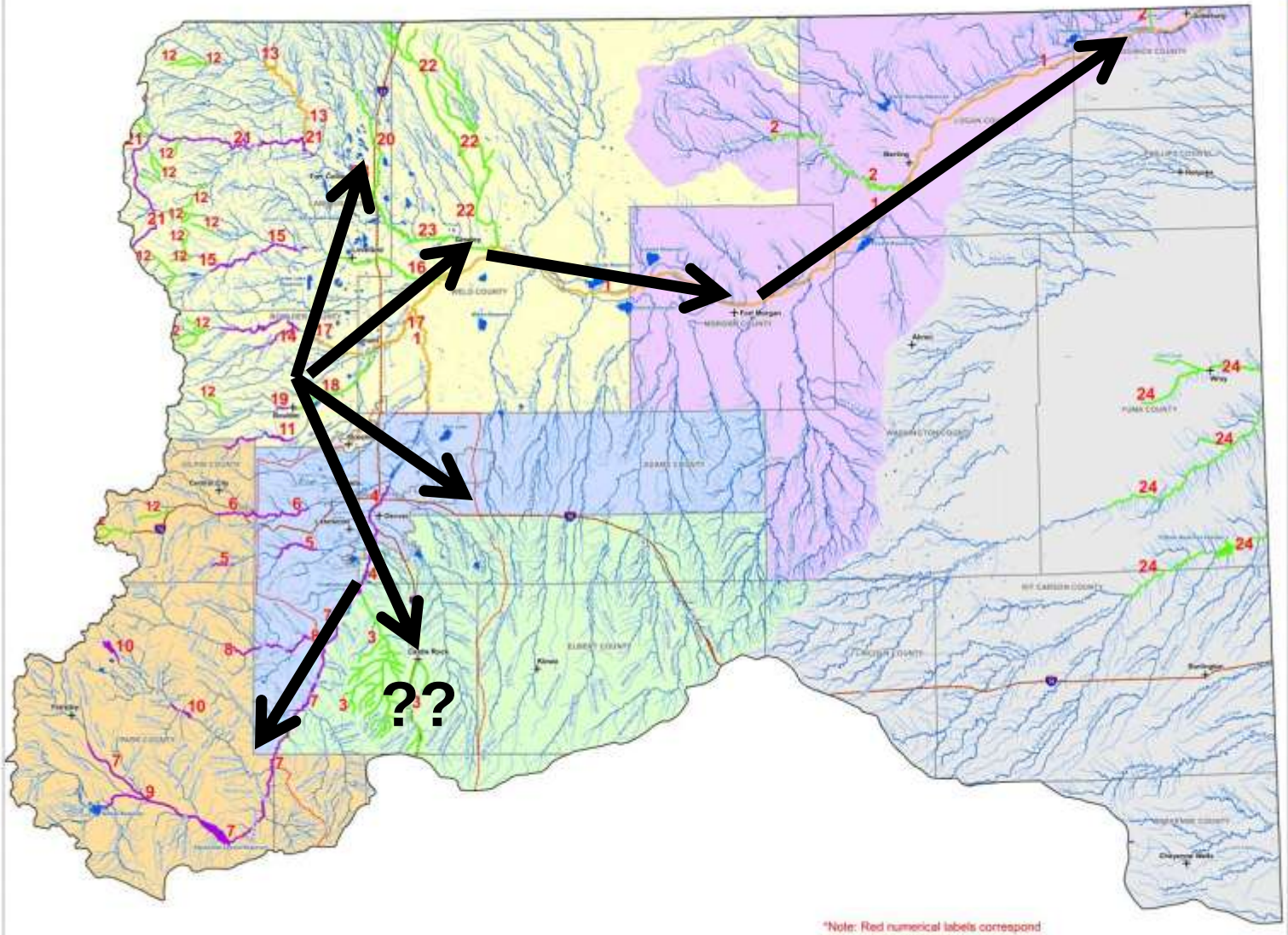


Figure 2-13
South Platte Basin
Nonconsumptive Needs Assessment
Candidate Environmental and Recreational Focus Areas

CDM

Over time the South Platte River Drainage will be colonized by emerald ash borer



*Note: Red numerical labels correspond to segment # on NCNA focus area matrix.

Legend

Candidate Environmental and Recreational Focus Areas

- Environmental Focus Area
- Environmental and Recreational Focus Area
- Recreational Focus Area
- High Plains
- Lower South Platte
- Northern
- Denver Metro
- South Metro
- Upper Mountains
- Highways
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- Metro Roundtable Boundary
- County Boundary

N W E S

0 6 12 24 36

Miles

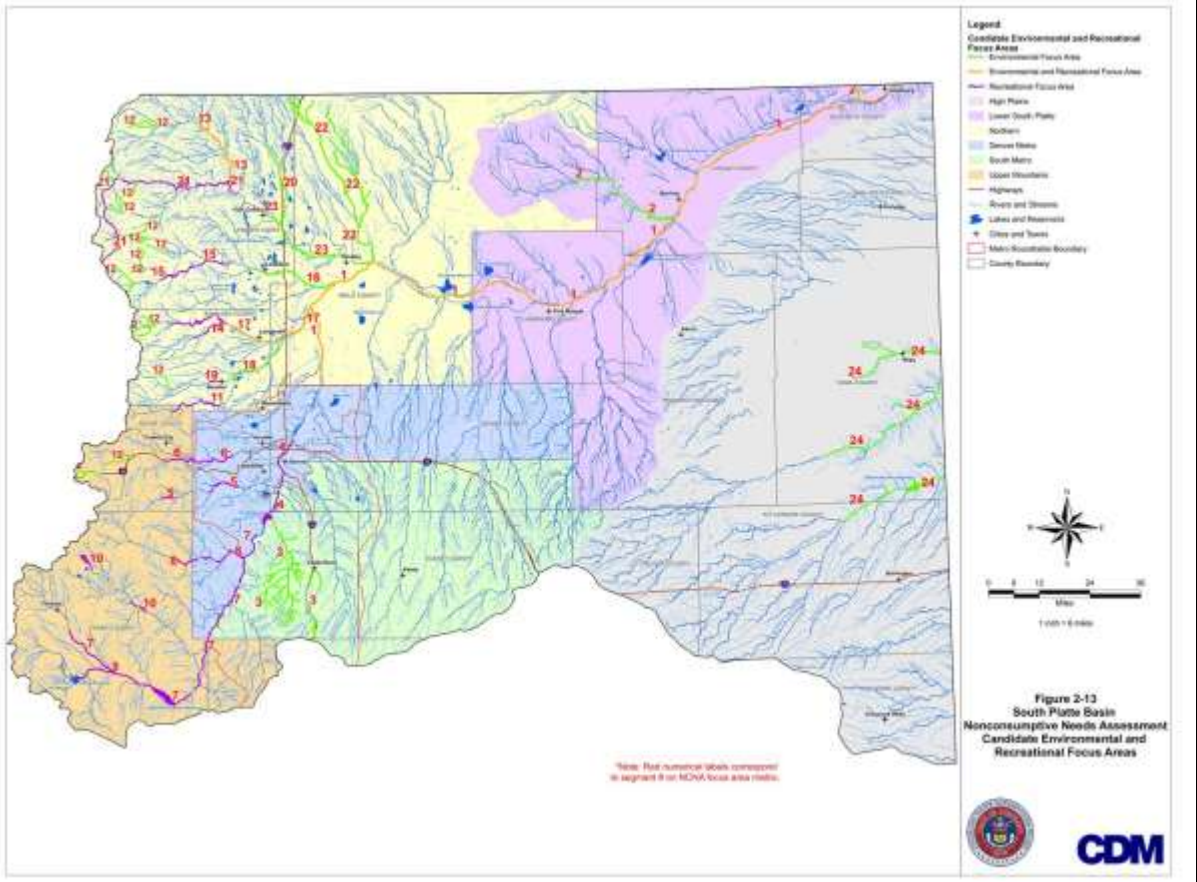
1 inch = 6 miles

Figure 2-13
South Platte Basin
Nonconsumptive Needs Assessment
Candidate Environmental and Recreational Focus Areas

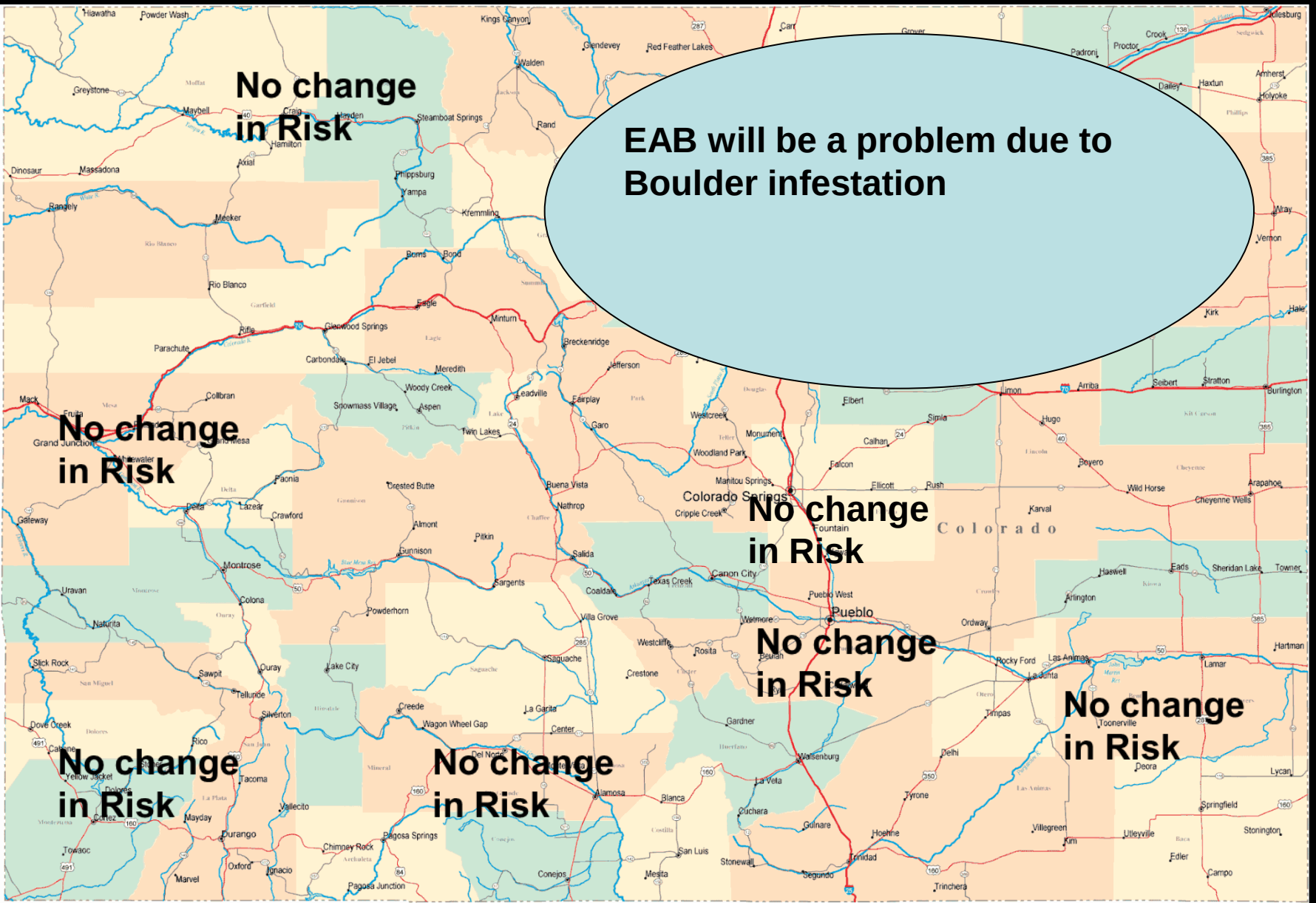
CDM

Unlike states to the east, Colorado is highly compartmentalized due to its geography

The current infestation is an infestation of the South Platte River drainage, ***not the State of Colorado***



Most of Colorado is no more – nor less – at risk of infestation by Emerald Ash Borer



How far away is emerald ash borer from your community?

How far away is emerald ash borer from your community?

One truckload

Control Options for Management of Emerald Ash Borer

Emerald Ash Borer Control Options

- Soil applications with systemic insecticides
  - imidacloprid, dinotefuran
- Non-invasive trunk sprays of systemic insecticides
  - dinotefuran
- Trunk injections of systemic insecticides
  - Emamectin benzoate (Tree-Age), azadirachtin (Treeazin(, imidacloprid

Adults as they feed on foliage

Young larvae that tunnel in the phloem and cambium

Target Life Stages for EAB Treatments

What to Do in 2014?

- **Boulder residents in High Risk areas need to make EAB treatment decisions *now***
- **Everyone in Colorado should renew vigilance in detection of EAB infestations**
- **Communities within the South Platte drainage need to make long-term plans for EAB management *now***
- **Revisit the Colorado situation this time next year (and every year)**

Sources of Information for Emerald Ash Borer in CO

- Colorado Department of Agriculture
  - –http://www.eabcolorado.gov
- Colorado State Forest Service an CSU Extension Offices
- Insect Information Web Site

EAB Information Sites Can Provide:

- Present known distribution of emerald ash borer in Colorado
- Links to resources for identification of EAB and other ash insects
- *Common Questions and Answers about Emerald Ash Borer* (new fact sheet)
- *Control Options for Emerald Ash Borer in Colorado* (new bulletin)

Control Options for Emerald Ash Borer in Colorado

Colorado State University Extension

www.eabcolorado.com

Control Options Document produced this week

This presentation will be saved on the

CSU Insect Information Web Site

Search “BSPM CSU”*

Click on “Extension and Outreach”

Click on “Insect Information”

*** Department of Bioagricultural Sciences and Pest Management**

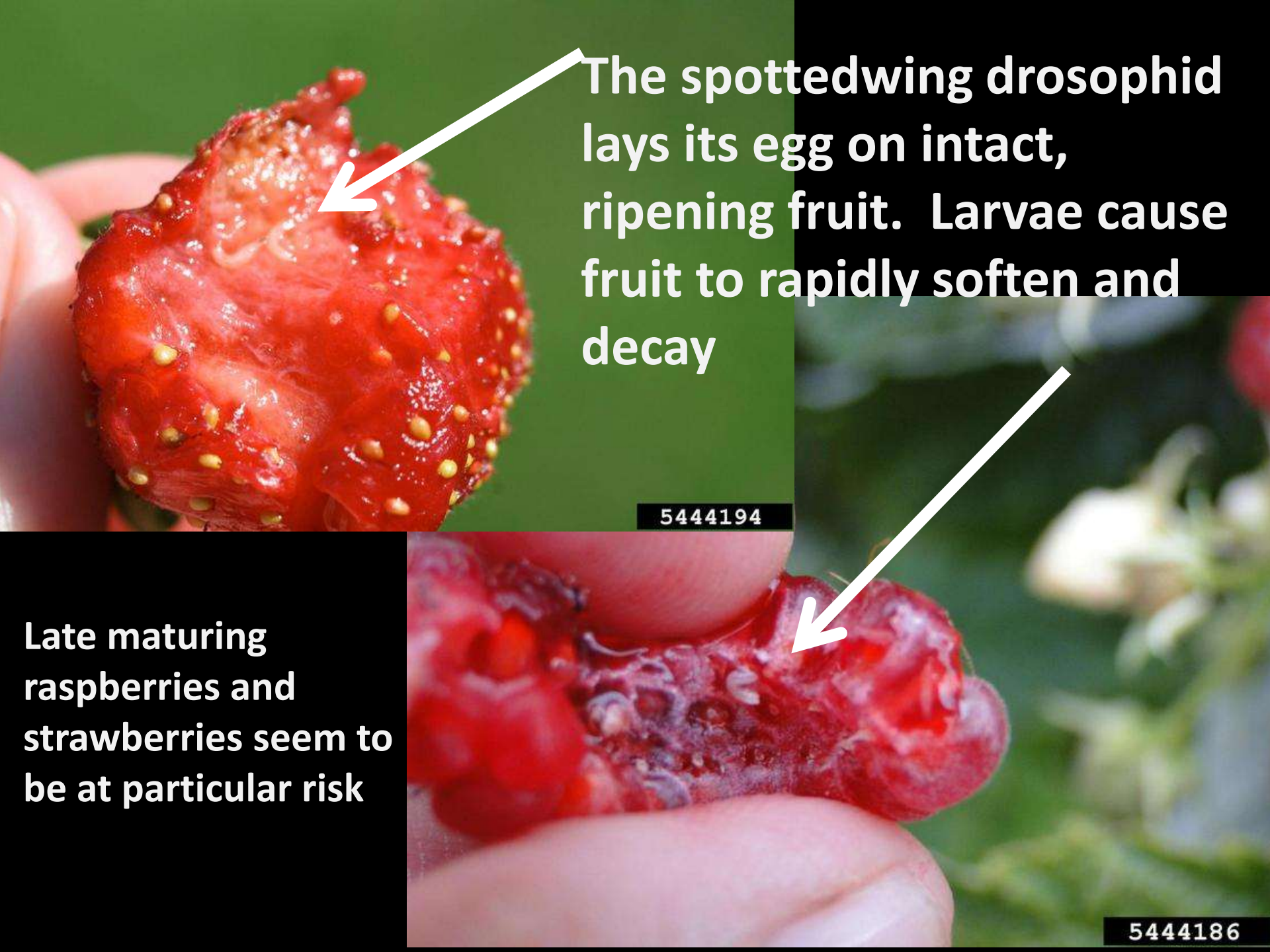
Some Entomology-related Resources

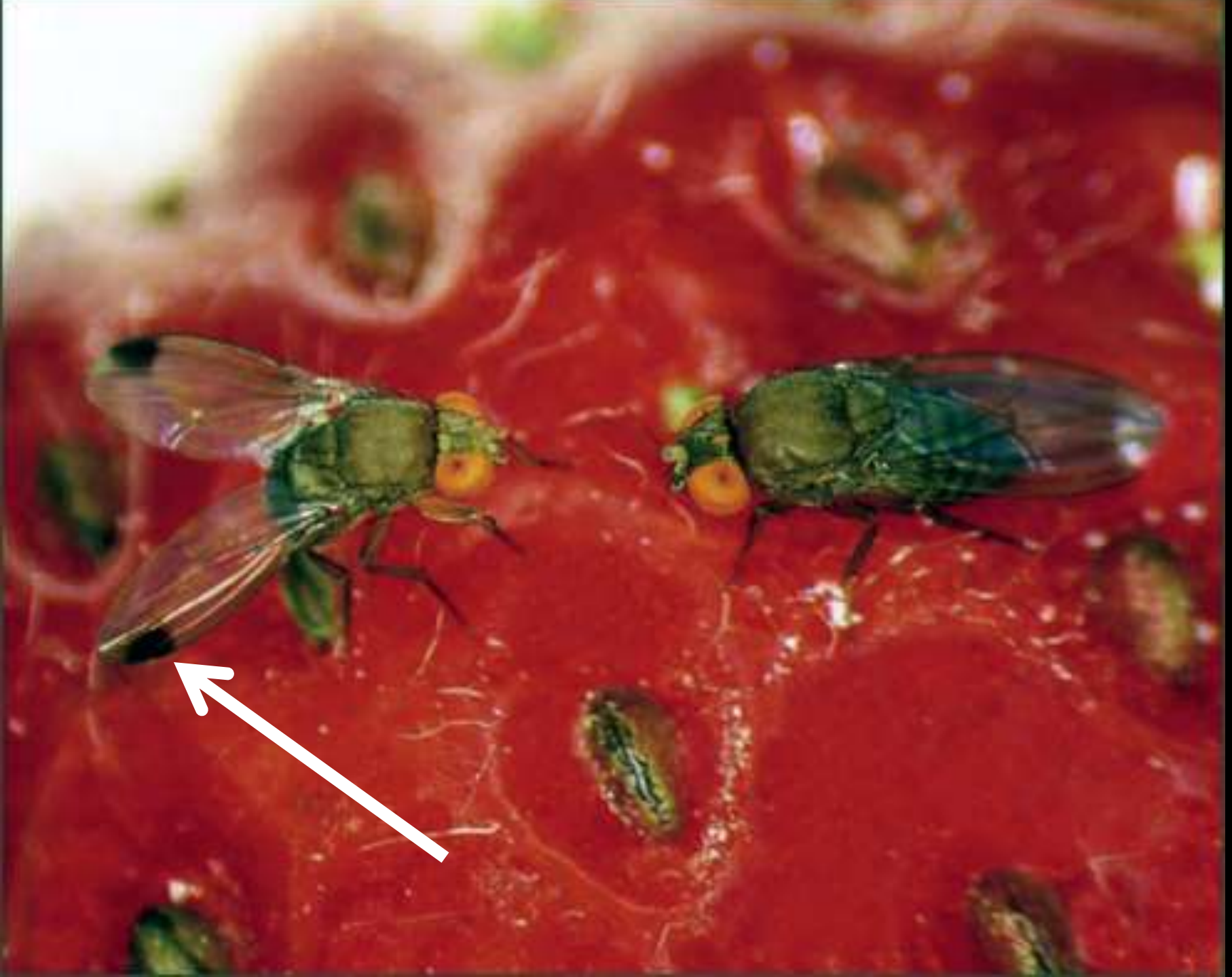
- **Web Sites**
  - **Insect Information Web Site**
  - **Thousand Cankers Web Site**
- **PestTalk (pestserv-l) Listserver Discussion**
- **My contact information:**
  - Whitney.Cranshaw@ColoState.EDU

Spottedwing drosophilid

(*Drosophila suzukii*)

Most *Drosophila* feed on yeasts – the common "fruit flies" of overripe fruit


The spottedwing drosophid lays its egg on intact, ripening fruit. Larvae cause fruit to rapidly soften and decay
5444194
Late maturing raspberries and strawberries seem to be at particular risk
5444186



Adults are readily trapped with lures of apple cider vinegar – or Merlot

Note: The yellow card can increase capture but is not necessary

Spottedwing Drosophild Situation in Colorado

- First detection in Larimer County – September 2012
- Multiple detections across eastern Colorado in 2013
  - Adams, Arapahoe, Boulder, Denver, Jefferson, Larimer, Morgan, El Paso
- Not detect on West Slope

Spottedwing Drosophilid – What To Look For

- Small maggots in ripening (but not overripe) fruit
- Berry crops most likely to be noticed as infected
  - Raspberries, strawberries
- Adult male has a spot on the wings

Spottedwing Drosophila – What To Do?

- Thorough picking of berry crops
  - Cool storage and quick consumption of harvested berries
  - Sanitation to include other fruiting plants in yards?
- Trapping?
- Insecticides?