

The Landscape Professional's Challenge: New Pests in a New Climate



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WSU Snohomish County Extension
Green Gardening Workshop
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Definition

- ▶ AKA exotic, alien, non-native, introduced, non-indigenous, or foreign sp.
- ▶ National Invasive Species Council definition:
 - (1) "a non-native (alien) to the ecosystem"
 - (2) "a species likely to cause economic or harm to human health or environment"
 - ✓ Not all invasive species are foreign origin (*Spartina*, bullfrog)
 - ✓ Not all foreign species are invasive (*Most US ag species are not native*)
 - ✓ Definition increasingly includes exotic diseases (*West Nile virus, anthrax etc.*)
 - ✓ Can include genetically modified/ engineered and transgenic organisms

Executive Order 13112 (1999)

- ▶ Directed Federal agencies to make IS a priority, and:
 - ▶ *“Identify any actions which could affect the status of invasive species;*
 - ▶ *use their respective programs & authorities to prevent introductions;*
 - ▶ *detect & respond rapidly to invasions;*
 - ▶ *monitor populations*
 - ▶ *restore native species & habitats in invaded ecosystems*
 - ▶ *conduct research; and*
 - ▶ *promote public education.”*
 - ▶ *Not authorize, fund, or carry out actions that cause/promote IS intro/spread*

quietly Invading

Political, Social, Habitat,
Ecological, Environmental,
Economic, Health, Trade &
Commerce, & Climate Change
Considerations

Historical Perspective

- ▶ Native Americans -
- ▶ Early explorers - Plant explorers in Europe
- ▶ Pioneers moving across the US
 - ▶ Food -
 - ▶ Plants -
 - ▶ Stored products -
 - ▶ Crops - renegade seed
- ▶ Animals -
 - ▶ Insects - ants, slugs
- ▶ Travelers - gardeners exchanging plants with friends

Invasive Species...

...can also be moved by

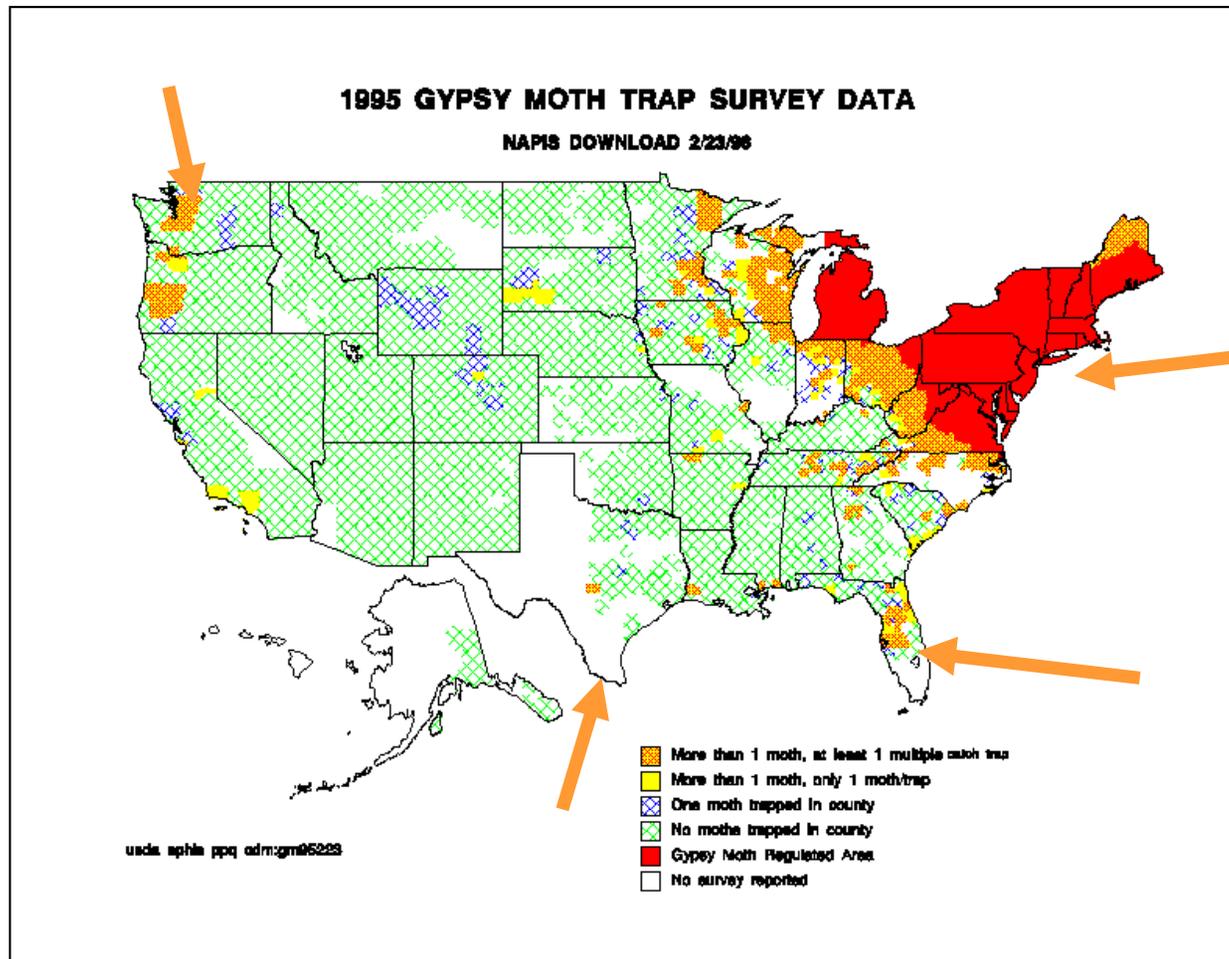
- Household goods
- Vehicles
- Packing and dunnage
- Pallets of non-plant goods
- Travelers with smuggled plants
 - *Aspirinus deceptus* (willow)
- Pet trade, aquatic plants
- Ships dumping ballast water
- Global winds and air and water currents
- Firewood and landscape compost
- Plants, pots, soil

Routes of Entry

- ▶ Nursery stock
- ▶ Plant sales (groups, clubs)
- ▶ Gardeners (plant sharing)
- ▶ Pet trade (walking sticks, snakes, birds, others)
- ▶ Shipping (dunnage, ballast water, zebra mussel)
- ▶ Soil
- ▶ Travellers (campers, autos, gear, trash,)
- ▶ Moving (lawn furniture, goods)



?? Invading from Where ??



Urgency

- ▶ “Invasive species are second only to habitat loss as the greatest threat to decreasing global biodiversity” (*UN 2002*).
- ▶ Both aquatic & terrestrial ecosystems endangered
- ▶ Invasive weeds invade 1.7 million new acres of U.S. wildlife habitat/yr (*Babbitt 1998*)
- ▶ Invasive weeds cover 4500 new acres of public lands/ waters each day (*Aq PI Mgmt Soc.*)
- ▶ Currently aquatic invasives infest over 100 million acres (twice the size of CA)

Factors Accelerating Spread

- ▶ Globalization of trade & tourism/
reduction of trade barriers
 - ▶ *Ballast H₂O water a major transport mechanism; coast areas most vulnerable*
 - ▶ *100 years of weed legislation, but aquatic invasions relatively new, so few laws*
 - ▶ *Global movement of nursery and landscape products (compost, landscape wood, pots, plants)*
 - ▶ *Gardeners*
- ▶ Global warming
- ▶ Genetic engineering
- ▶ The internet
- ▶ Bio-terrorism

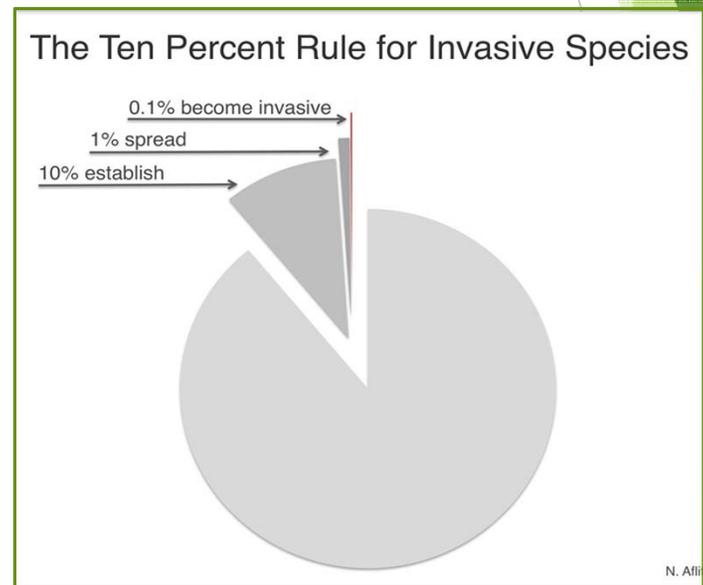
Numbers

- ▶ 4,000 plant & 2,300 animal species already established in US
- ▶ Assumed 10% existing known species have invasive potential, = 26,000 potential problems
- ▶ San Francisco Bay: 230 established;
- ▶ Preliminary Puget Sound survey = 52 species

Ten Percent Rule

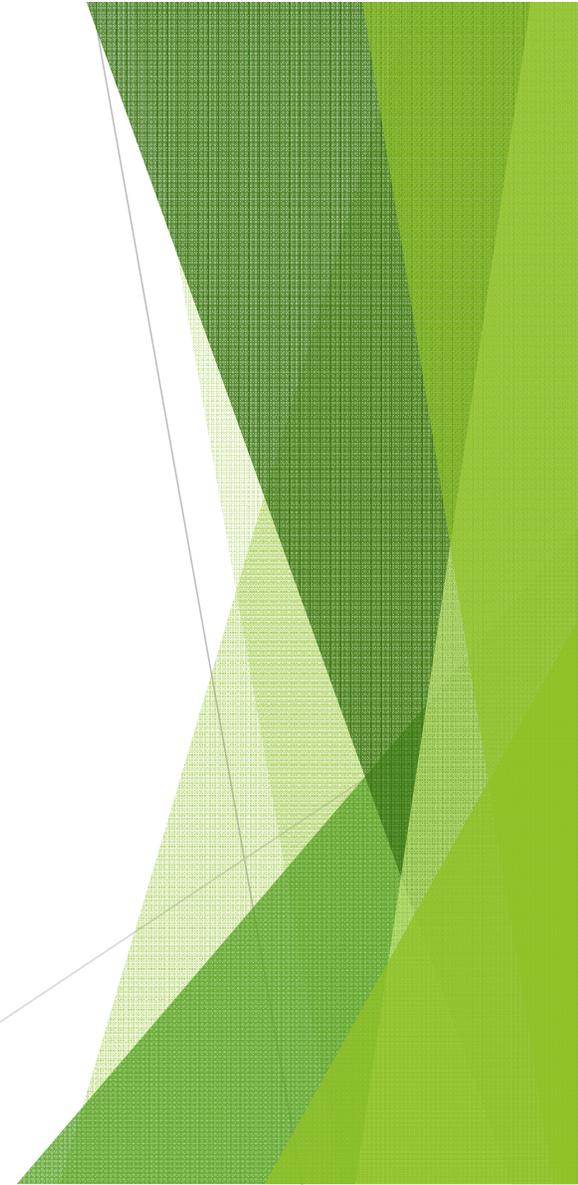
Not all introduced species will become invasive

- The 10% Rule is a generalized concept
- 10% of introduced species become established
- 10% of those will spread
- 10% of those will become invasive



Environmental Impacts

- ▶ Native Species Displacement
 - ▶ no predators to keep new species in check
 - ▶ out-compete natives for light, water & nutrients
 - ▶ convert local floral biodiversity into monotypic stands (bad for native bees)
 - ▶ disrupt food chains: as flora simplifies, so does fauna



(Continued)

Environmental Impacts

- ▶ **Endangered Species**
 - ▶ 400 of the 958 listed ESA species are at risk primarily due to Invasives
- ▶ **Archaeologic/Historic Site Destruction**
 - ▶ Coat and/or destroy structures (zebra mussels)
- ▶ Challenge to biodiversity and all that depend on the various species.

Economic Impacts

- ▶ “Environmental degradation, increase frequency & severity of natural disasters, damaged goods and equipment, unemployment, power failures, food and water shortages, disease epidemics, even lost lives” (*NISC, 2001*).
- ▶ Wide variety of industries affected: agriculture, forestry, water supply, tourism, fisheries etc. (*Ag most impacted: est. \$71 B/yr*)
- ▶ US: \$137 billion annually (*Pimentel, 2000*)
- ▶ UK, Australia, India, Brazil, & South Africa: U.S. \$177 billion annually (*Pimentel, 2001*)

Invasive Pests May...

- ▶ Damage and kill plants, trees, forests
- ▶ Be very costly to control, then costly to manage
- ▶ Threaten natural ecosystems
- ▶ Reduce habitat for birds, fish, insects, small mammals, other plants
- ▶ Threaten exports, reduce supplies
- ▶ Result in lost markets, shipping ports
- ▶ Result in quarantines
- ▶ Cause social upheaval and stress (resistance to spray and control programs)
- ▶ Create political issues
- ▶ Create by-products such as frass, honeydew, bore into siding, invade homes
- ▶ Contamination of crop or products (egg masses, insect parts)

Example:

A shipment of plants from Oregon was turned away in Kansas due to the presence of the brown punctate weevil.

New state record for WA in E. Wenatchee

Now found in 5 WA counties



Contamination and destruction



Climate Change = Warming Trend



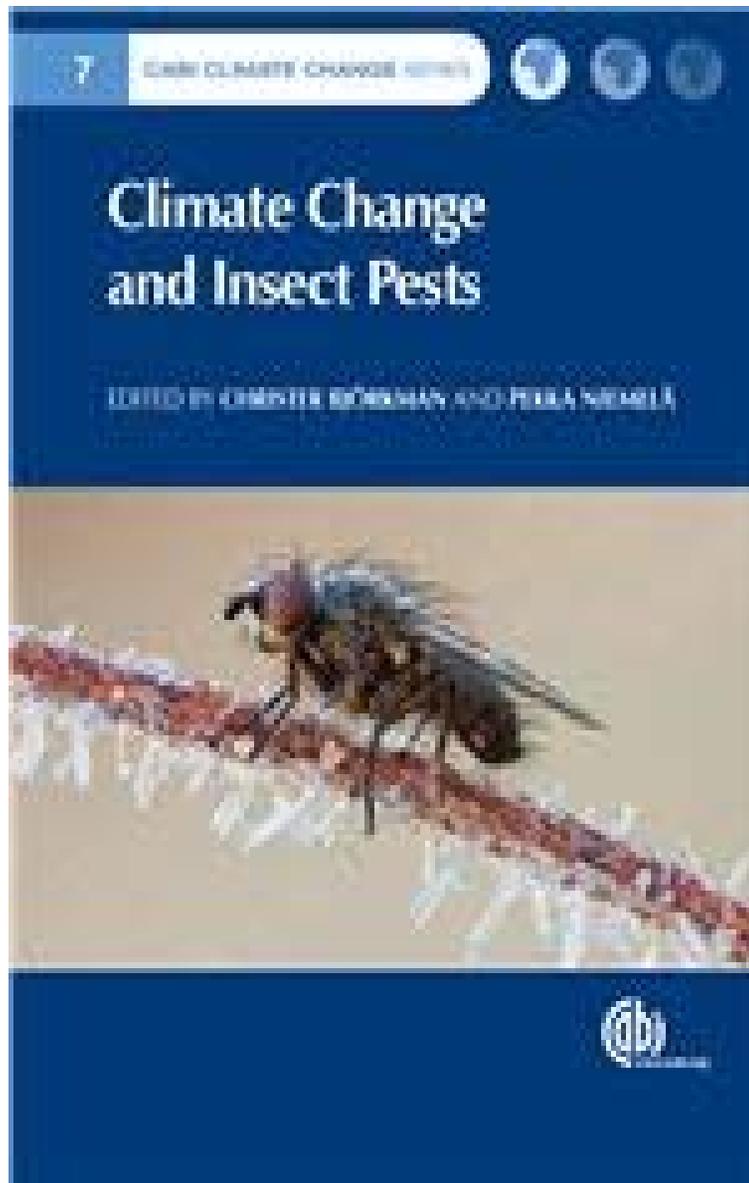
- ▶ Insect development is temperature driven
- ▶ Yellow jacket population outbreaks
- ▶ Akre found a positive correlation between early spring high temperatures and high populations of yellowjackets.

Early spring → yellowjacket queen begins nest earlier. Successful feeding and nest building → earlier emergence of first workers → queen starts laying more eggs earlier → young develop faster and emerge earlier → more workers to feed and tend more broods in a summer → higher numbers of yellowjackets by fall.

Mountain ash sawfly

- ▶ Some insects have 2 - 3 generations per year.
- ▶ Higher temperatures = faster development
- ▶ Potential to squeeze in an extra generation
- ▶ Resulting in greater plant damage and
- ▶ More adults wintering over to lay eggs the next season





Some insects need winter chilling to break diapause

If no winter chilling, insect can't complete its development so

Numbers of insects could be reduced.

Climate Change Impacts Insects

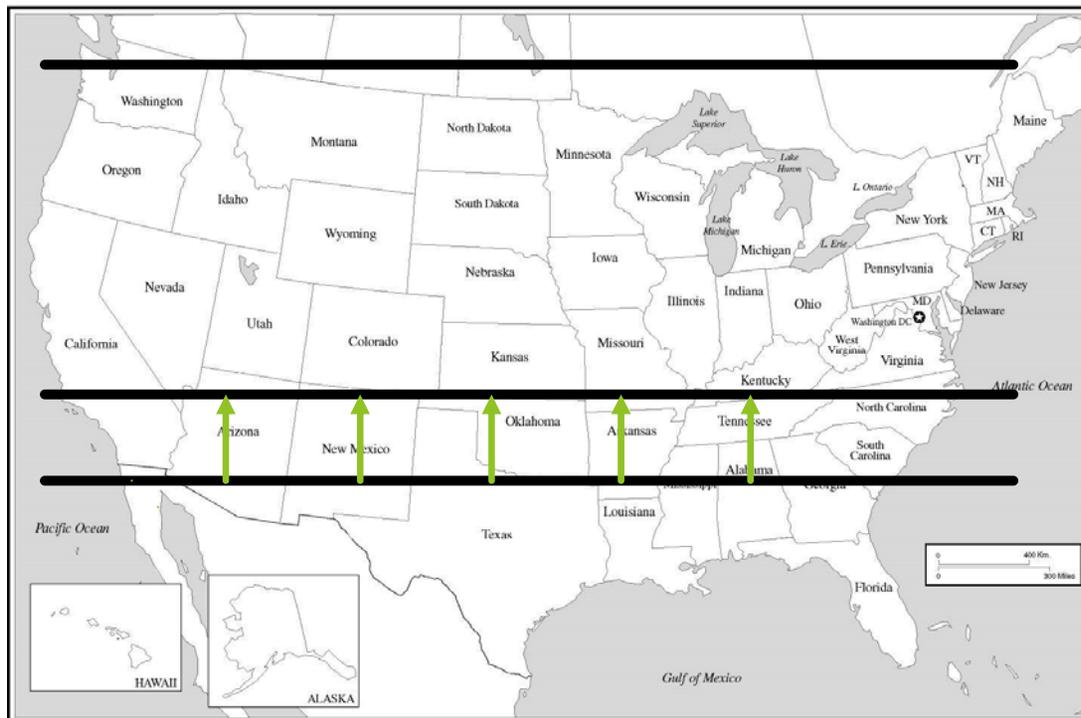
- ▶ Invade previously uninhabitable areas (too cold)
- ▶ Widened invasion niche - where temps are now adequate for survival
- ▶ Milder winters = increased survival of many frost-sensitive insects.
- ▶ Increasing temperatures = higher rates of growth and reproduction.
- ▶ Studies on aphids and moths have shown that increasing temperatures can allow insects to reach their minimum flight temperature sooner, aiding in increased dispersal capabilities.
- ▶ Multiple studies have shown the northward expansion or shift of insect ranges, such as the mountain pine beetle, to be correlated with increasing temperatures.
- ▶ Faster insect growth and development (possibly an extra generation in a year).



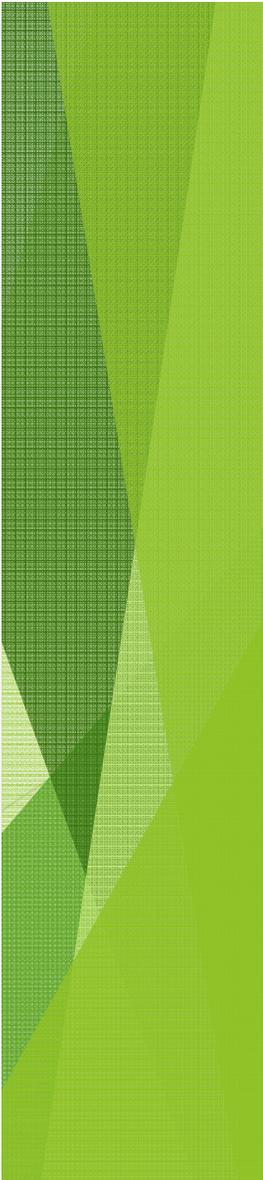
Trees killed by
mountain pine beetle

“As temperatures have risen ...the bees are being killed off by increased heat in their southern habitats. But ...they are failing to move north to cooler climates, unlike other species.” The Guardian, 7/9/2015

The United States

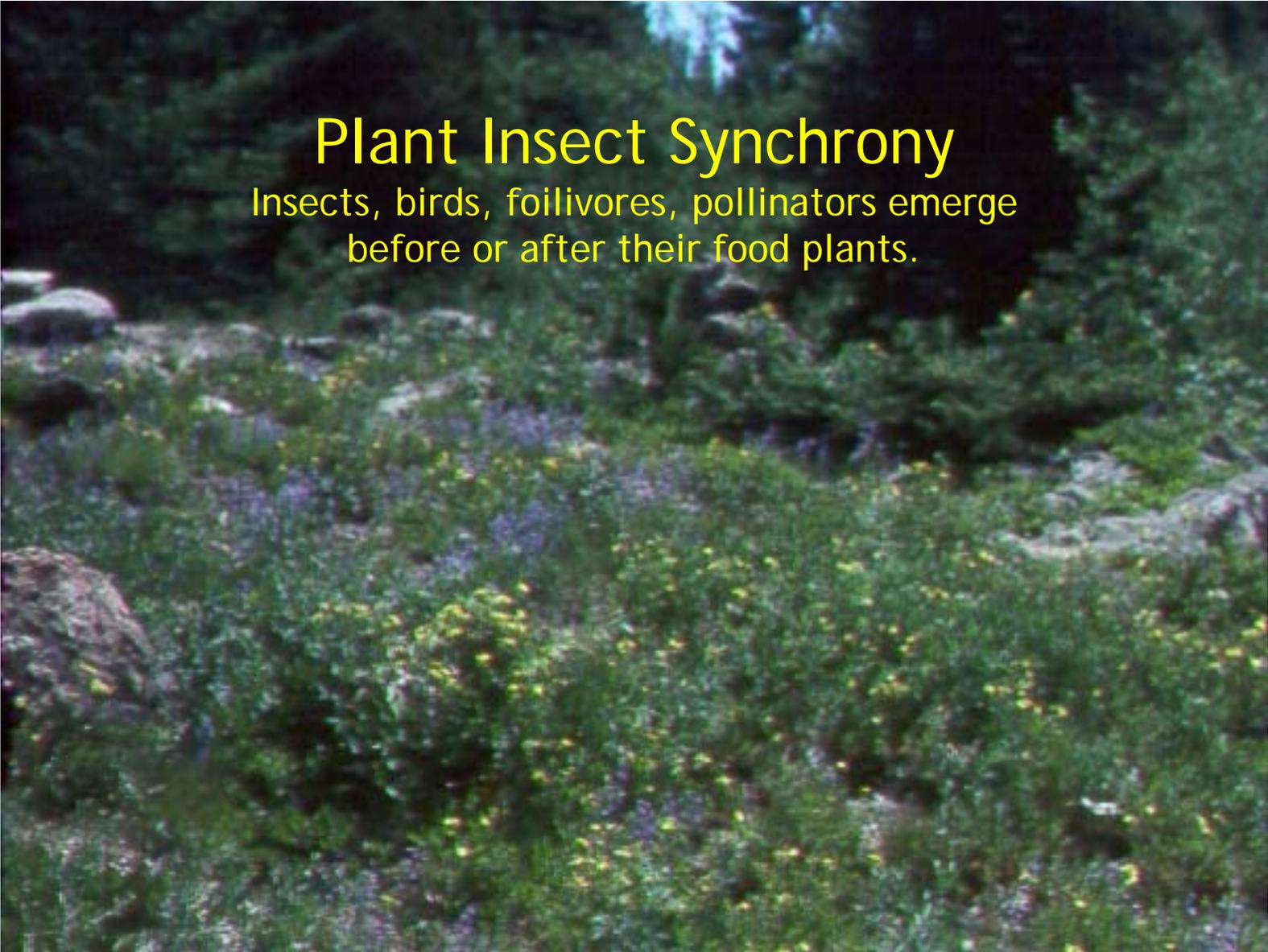


Insects are being found
at higher elevations



Plant Insect Synchrony

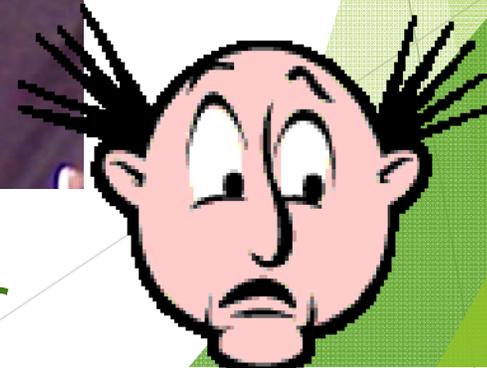
Insects, birds, folivores, pollinators emerge before or after their food plants.



You are the eyes in the field.



You may be a first detector



Tent caterpillars



Photos: SJCollman



An estimated
2000 - 4500 insect species
are recorded.

“Of these about 20
exotic species have become
serious pests in North
American Forests”

Faith Campbell, American Lands Alliance, 2003

New Pests of Concern

'Apopka weevil'

Pink hibiscus mealybug

Lewis mite

Coconut palm mite

Tortoise beetle

Glassy-winged sharpshooter

A bamboo mealybug

Cherry bark tortrix

Citrus longhorned beetle

Bamboo longhorned beetle

Ash moth

Juniper leafminer

Red-haired bark beetle

Brown marmorated stinkbug

Common pine shoot beetle

Papaya mealybug

Lily leaf beetle

Hemlock woolly adelgid

Oriental beetle

Madeira mealybug

> a dozen snails and slugs

Citrus longhorned beetle

Spotted gum lerp

Redgum lerp psyllid

Eucalyptus longhorned borer

Japanese beetle

Bougainvillea rust mite

Lobate lac scale

Greenidea ficiola (Aphid)

Asian longhorned beetle

Brown spruce longhorned beetle

Emerald ash borer

Camphor shoot beetle

Asian woolly hackberry aphid

'Mexican bromeliad weevil'

A European slug (*Arion lusitanicus*)

'Blossom midge'

Cycad aulacaspis scale

'Smaller Japanese cedar longhorned beetle'

Viburnum leaf beetle

Asian ambrosia beetle

Poplar and willow borer

European chafer

European crane fly

New Pests of Concern

Lurking in US or nearby states or isolated detections

Japanese beetle

Glassy-winged sharpshooter

Emerald ash borer

European chafer

Gypsy moth

Spotted lanternfly

Citrus longhorned beetle

Asian longhorned beetle

Several snails and slugs

Citrus longhorned beetle

Asian gypsy moth

Recently arrived and spreading or now established

Washington Department of Agriculture - Exotic Pests of Concern for Full List

Brown marmorated stinkbug

Lily leaf beetle

Viburnum leaf beetle

Lilac root weevil

Brown punctate weevil

Hairy spider weevil

Azalea lace bug

Mountain ash sawfly

Pine sawfly

Black vine weevil

Rough strawberry root weevil

Poplar-and-willow borer

Apple ermine moth

Cherry bark tortrix

Cherry ermine moth

2 species of click beetle

Nut leaf weevil

Dark-eyed weevil

Elm seed bug

3 seed bugs

Dogwood sawfly

Rhododendron lace bug

Strawberry root weevil

Clay-colored weevil

European pine shoot moth

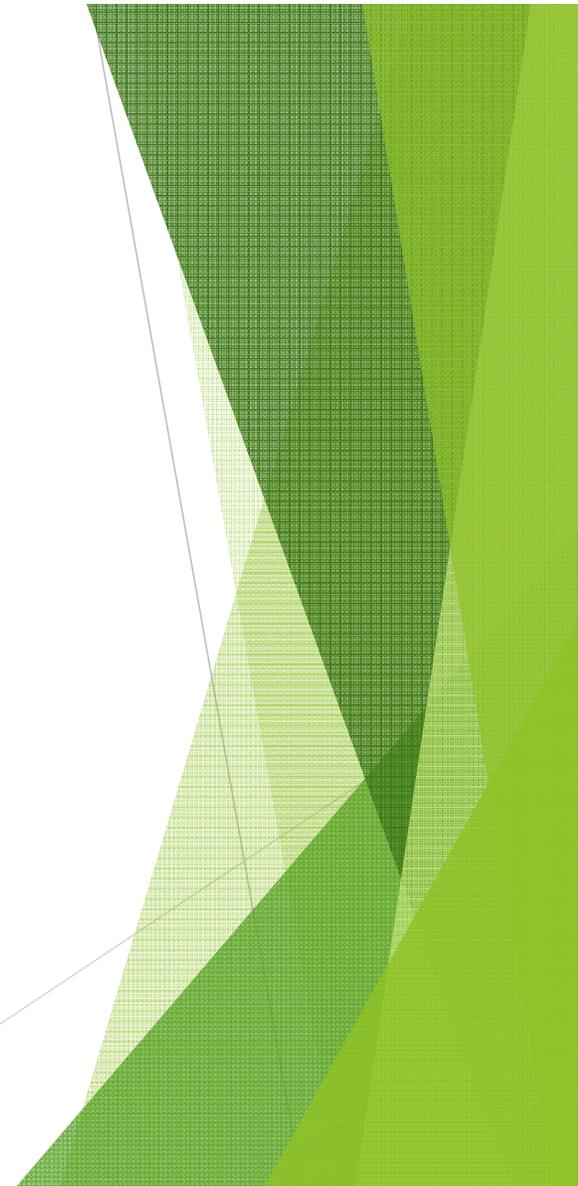
Oystershell scale

For a full list of introduced insect species

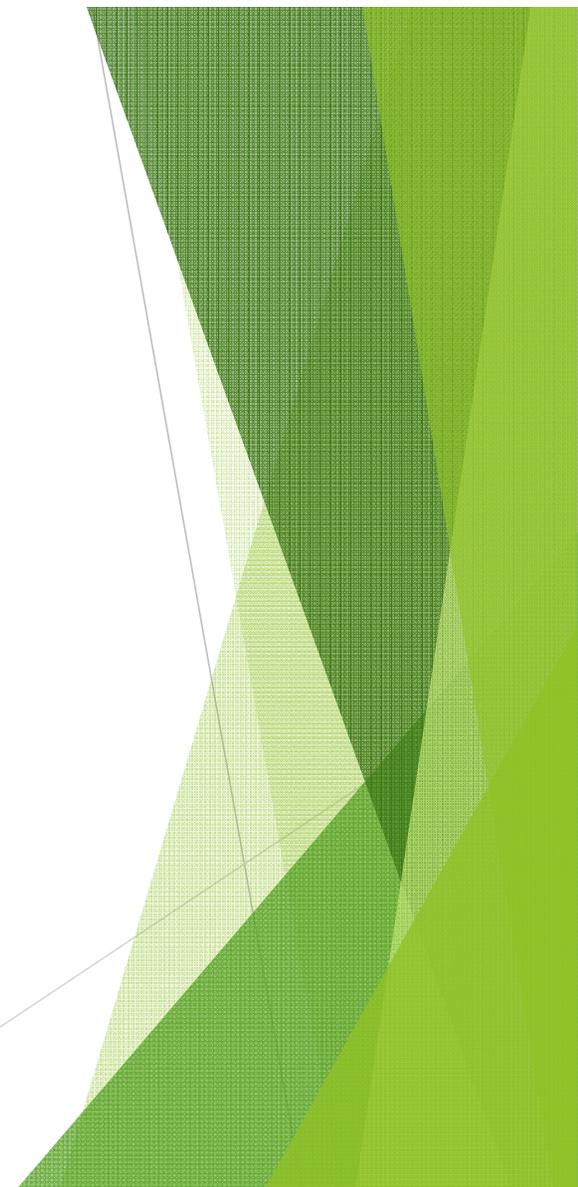
<http://agr.wa.gov/PlantsInsects/insectpests/Exotics/SpeciesOfConcern.aspx>

Common Name &	Scientific Name
Exotic Plant Pests New to Washington State Since 1985	
2008	
Eurasian noctuid moth	<i>Hecatera dysodea</i> (D. & Schiff.)
European hardwood ambrosia beetle	<i>Trypodendron domesticum</i> L.
European pine sawfly	<i>Neodiprion sertifer</i>
2007	
Daylily midge	<i>Contarinia quinquenotata</i> (Loew)
Dogwood sawfly	<i>Macremphytus tarsatus</i>
2006	
Apple clearwing moth	<i>Synanthedon myopaeformis</i> Haliday
Wrinkled dune snail	<i>Candidula intersepta</i> (Poiret)
2005	
Longneck field slug	<i>Deroceras panormitanum</i> (L. & P.)
Vineyard snail	<i>Cernuella virgata</i> (Da Costa)
Conifer bark tortrix	<i>Cydia coniferana</i> (Saxesen)
2004	
Large yellow underwing	<i>Noctua pronuba</i> (Linnaeus, 1758)
Viburnum leaf beetle	<i>Pyrrhalta viburni</i> (Paykull)
Heather thrips	<i>Ceratothrips ericae</i> Haliday
Apple fruit moth	<i>Argyresthia conjugella</i> (Zeller)

2003	
Bordered plant bug	<i>Largus cinctus</i> (Schf.)
2002	
European fruit tree tortrix	<i>Archips podana</i> (Scopoli)
2000	
Cereal leaf beetle	<i>Oulema melanoplus</i> L.
Dusky wireworm	<i>Agriotes obscurus</i> L.
European poplar shoot borer	<i>Gypsonoma aceriana</i> (Duponchel)
Lined click beetle	<i>Agriotes lineatus</i> L.
1999	
Large European crane fly	<i>Tipula oleracea</i> L.
1998	
Straw-colored tortrix	<i>Clepsis spectrana</i> (Treitschke)
1997	
European rose bud borer	<i>Notocelia cynosbatella</i> (L.)
European oak skeletonizer	<i>Carcina quercana</i> (Fabricius)
Carnation tortrix	<i>Cacoecimorpha pronubana</i> (Häfbner)
1996	
Exotic click beetle	<i>Melanotus cete</i> Candeze
Exotic bark beetle	<i>Xyleborinus alni</i> (Niisima)
Bark beetle	<i>Xyloterinus politus</i> (Say)



1995	
Green budworm	<i>Hedya nubiferana</i> (Haworth)
European emerald moth	<i>Hemithea aestivaria</i> (Häfbner)
Apple tortrix	<i>Archips fuscocupreanus</i> Walsm.
1994	
Apple leafcurling midge	<i>Dasineura mali</i> (Kieffer)
Lesser budmoth	<i>Recurvaria nanella</i> (Häfbner)
Green pug moth	<i>Chloroclystis rectangulata</i> (L.)
'Golden' leaf roller	<i>Acleris holmiana</i> (L.)
Dark fruit tree tortrix	<i>Pandemis heparana</i> (D & Schif)
Barred fruit tree tortrix	<i>Pandemis cerasana</i> (Hubner)
Apple skeletonizer	<i>Swammerdamia pellicaria</i> (Retz.)
1993	
Cherry ermine moth	<i>Yponomeuta padellus</i> L.
1991	
European rose shoot borer	<i>Notocelia rosacolana</i> Doubleday
Cherry bark tortrix	<i>Enarmonia formosana</i> Scopoli
1990	
Pear leaf midge	<i>Dasineura pyri</i> (Bouche)
1988	
Grape phylloxera	<i>Daktulosphaira vitifoliae</i> (Fitch)
1985	
Apple ermine moth	<i>Yponomeuta malinellus</i> Zeller



Exotic Nuisance Pests Established in Washington State Since 1985

2004	
Metapoplax seed bug	<i>Metapoplax ditomoides</i> (Costa)
2002	
Raglius seed bug	<i>Raglius alboacuminatus</i> (Goeze)
2000	
Rhyparochromis seed bug	<i>Rhyparochromis vulgaris</i> (Schilling)
1999	
European paper wasp	<i>Polistes dominulus</i> (Christ)

Exotic Plant Pests Introduced and Eradicated in Washington State Since 1985

Gypsy moth (European)	<i>Lymantria dispar</i> L.
Gypsy moth (Asian)	<i>Lymantria dispar</i> L.
Japanese beetle	<i>Popilia japonica</i> Newman
Citrus longhorned beetle	<i>Anoplophra chinensis</i> (Forster)

Exotic Plant Pests Newly Established in the Region (B.C. and Oregon) Threatening Washington State

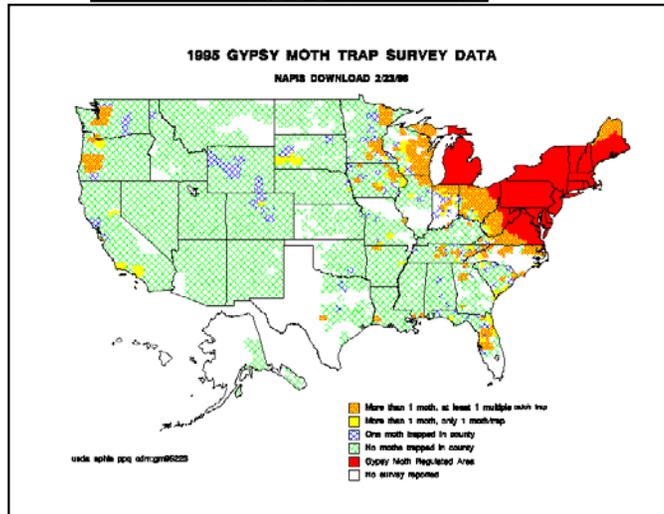
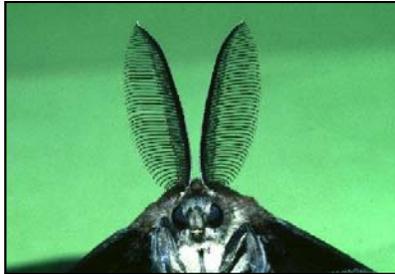
2004	
Brown marmorated stink bug	<i>Halyomorpha halys</i> (Stål)
European Chafer	<i>Rhizotrogus majalis</i>

Invasive Insects That Are Already Here

- ▶ Elm leaf beetle
- ▶ Black vine, strawberry root and other pest weevils
- ▶ Slugs and snails (*Arion ater*, *Helix aspersa*)
- ▶ Oystershell scale
- ▶ White pine blister rust
- ▶ Many small moths
- ▶ West Nile virus
- ▶ Slugs
- ▶ Cherry bark tortrix
- ▶ Large yellow underwing
- ▶ Indian meal moth
- ▶ Beneficial ground beetle



The Gypsy Moth Threat



Photos USDA - Extension



...and others from the US Service of Marine Corps, Cumberland, says the 2,200 birds' droppings have just about taken over her home.

Desperate home-owners and the state fight the horde of hairy invaders

By PETER C. GOSWELD
Investigative Staff Writer

Thousands of House Martins were packed in brown-green balls with swarms of greyish-brown mosquitoes yesterday in the worst day yet of what was officials' estimate of the heaviest infestation of the bugs in 50 years.

An eagle-eyed homeowner spotted the trouble in a wooded area near the Seaside Executive Apartments in the city last night, looking up at the sky with a gasp. He called the police, and they sent a team of men to investigate. The police reported a swarm of birds flying from the trees, and the man who spotted them called them "hairy invaders".

But then a few nights ago, Gosweld said, the bugs got the upper hand. "I was wearing shorts and T-shirt and they were crawling out of the grass on their little legs and getting on me," he said. "It was a real pain."

By yesterday morning, they were out of hand altogether.

Gosweld said they had returned to his car, and considered a special delivery by the apartment manager. He said they couldn't do that, so he called the police. And they reported the bugs.

In some places, the mosquitoes turned the house's walls into a black "It looked all sticky with them," Gosweld said. In several areas, the mosquitoes



- Nest sites
- Cover
- Foliage
- Food
- Exposure
- Camp sites
- Water runoff
- Soil loss

Photos USDA Extension



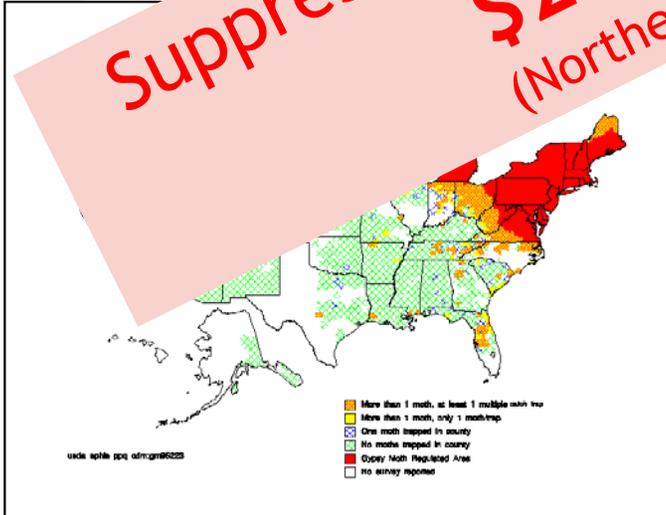
Gypsy Moth

RASH & Asthma
pupae,
moths &
egg masses



Photos USDA - Extension

The Gypsy Moth Threat



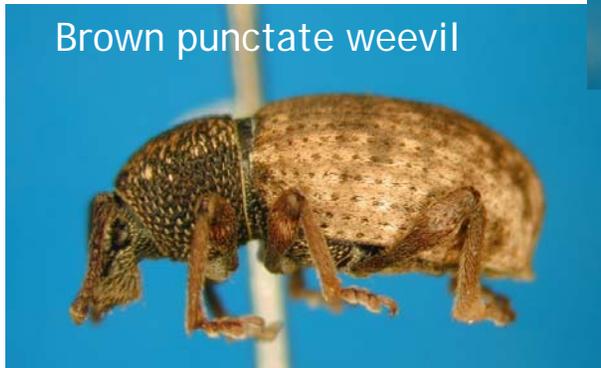
Suppression Costs from 1980 to 2013
\$268,616,819
(Northeastern area only)



Photos USDA - Extension



Invasives that became pests



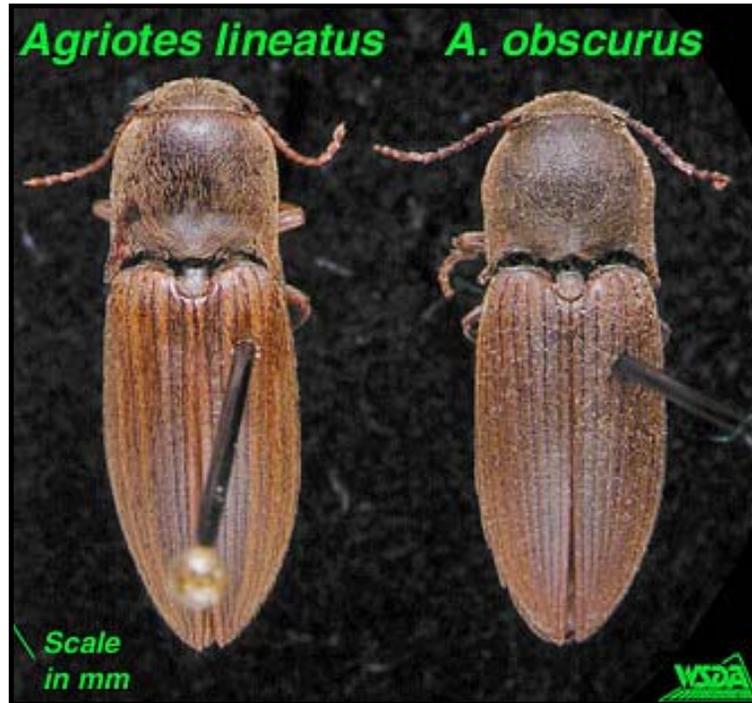
New paper wasp

Polistes dominulus



- Destroys local insects
- Competes for bird nest sites
- Numerous nests in an area
- May change how we manage paper wasps

Wireworms





New crop pest, more pesticides



Viburnum Leaf Beetle



Viburnum leaf beetle



Wrinkled dune snail



Long-neck field slug



Vineyard snail

New Exotic Defoliator Species in Western Washington State

(Year Detected)

(New to North America)

(New to U.S.)

(New to West Coast / U.S.)



Apple ermine moth

Cherry bark tortrix, *Enarmonia formosana*

Apple skeletonizer, *Swammerdamia pellicaria*

Bared fruit tree tortrix, *Pandemis cerasana*

Dark fruit tree tortrix, *Pandemis heparana*

Golden leafroller, *Croesia holmiana*

Green pug moth, *Chloroclystus rectangularana*

Green Budworm, *Hedya nubiferana*

Lesser bud-worm, *Recurvaria nanella*

Apple tortrix, *Archips fuscocupreanus*

Rose stem borer, *Notocelia rosacolana*

Oak skeletonizer, *Carcina quercana*

European rose bud borer, *Notocelia cynosbatella*

Straw-colored tortrix, *Clepsis spectrana*

European poplar tip borer, *Gypsonoma aceriana*

New leaf rollers



Photos WSDA - Eric LaGasa



Lynette Schimming;
<http://bugguide.net/node/view/12589/bgimage>

Japanese beetle



University of
Illinois

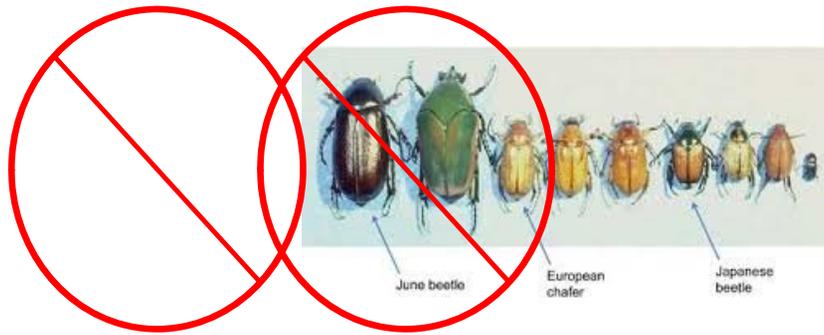


<http://www.stpaul.gov/index.aspx?NID=2827>



JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
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European chafer
Adults feed on tree leaves
Found in British Columbia Canada
Larvae feed on turf



European Chafer



Asian longhorned beetle

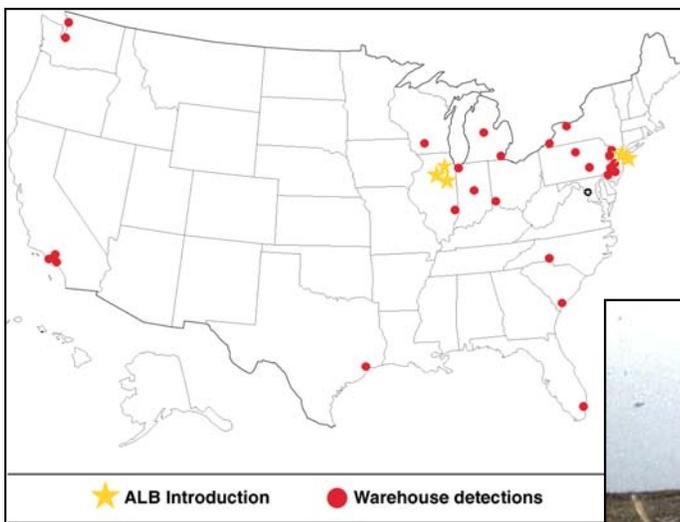




Cost of replacing just city trees killed by ALB estimated at \$669 billion over a 30 year period.

(Nowak, et al. 2001)

Asian longhorn borer



“Since 1996 over 80 million dollars has been spent on Asian longhorned beetle detection and eradication measures.”



As of 2008, \$373 million for the United States

Emerald Ash Borer



Adult next to exit hole.

Damage under the bark

Red Lily Beetle

<http://cru.cahe.wsu.edu/CEPublications/FS084E/FS084E.pdf>

- ▶ First detection in Bellevue in 2012
- ▶ Second detection nearby
- ▶ Now spread to other nearby areas



Red lily beetle host plants

- > Asiatic lily hybrids, some Oriental varieties are resistant.
- > *Polygonatum* (Solomon's seal),
- > *Solanum* (such as bittersweet nightshade and potatoes),
- > *Smilax*, and
- > *Nicotiana*.

Daylilies (Hemerocallis spp.) are not impacted by this pest



Brown marmorated stink bug - (BMSB)

Wanted Dead or Alive Poster: BMSB

<http://ext100.wsu.edu/yakima/invasive-pests/>

Pest Watch: BMSB

<http://cru.cahe.wsu.edu/CEPublications/FS079E/FS079E.pdf>



P. Schearer, OSU



njaes.rutgers.edu

Other Stink Bugs





Brown Marmorated Stinkbug
Smooth "shoulders"



Native Stinkbug
Toothed "s



Whiteflies

▶ Ash whitefly



Ash whitefly



Adult ash whitefly



Bemesia whitefly



Greenhouse whitefly



Greenhouse whitefly



Spotted Lanternfly *Lycorma delicatula*



Lawrence
Pennsylvania Department of Agriculture



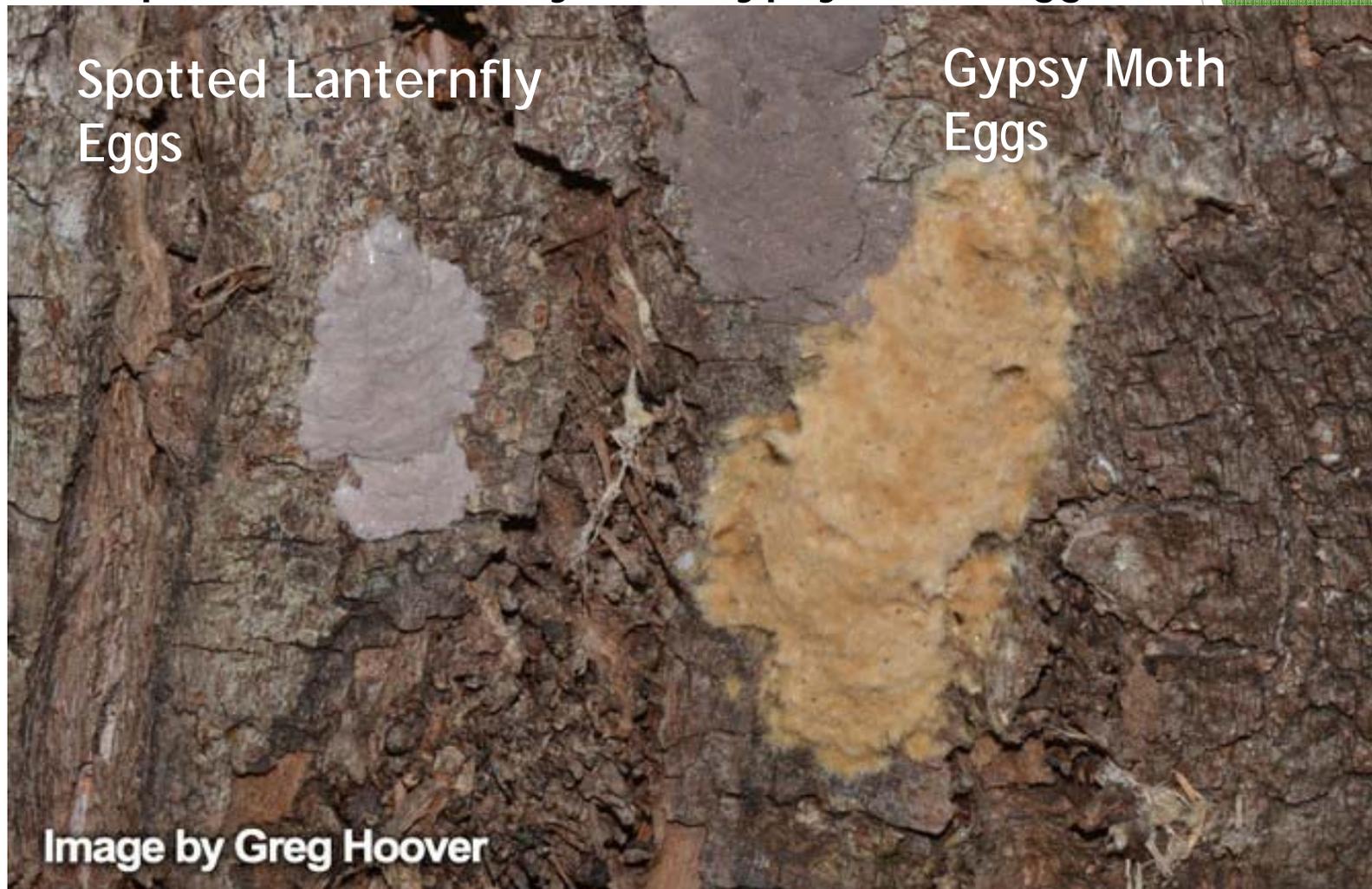


Spotted Lanternfly

- ▶ poses a threat to many economically important species of trees and woody ornamentals in Pennsylvania.
- ▶ attacks a variety of plants, including grape, apple, pine, stone fruit, tree of heaven and many others - 65 plant species in Korea
- ▶ willow, maple, aspen and tulip poplar in PA
- ▶ \$20 million, \$134 million and \$24 million, respectively. Also at risk are \$12 billion in pine and hardwood lumber sales.

Read more at: <http://phys.org/news/2014-11-entomologists-vigilance-newly-lanternfly.html#jCp>

Comparisson of Spotted Lanternfly and Gypsy Moth Egg Masses



You ARE the EYES IN THE Field

What can you do?

- ▶ Alert pest managers
- ▶ Send photos or samples for ID to WSDA or to me

collmans@wsu.edu

- ▶ Send a note to the PestSightings listserv with

Pest, host plant or site, date, location,
any notes or observations



To subscribe to pestsightings listserv; type URL below and fill out the two lines (name and email) and subscribe

http://lyris.cahe.wsu.edu/read/all_forums/subscribe?name=pestsightings-hg&page=all_forums

To post notes and information once you have subscribed, type in the URL pestsightings-hg@lyris.cahnrs.wsu.edu

You will also get the sightings from others so you can be prepared.