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
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 ??

1995 GYPSY MOTH TRAP SURVEY DATA
NAPIS DOWNLOAD 2/23/96

- More than 1 moth, at least 1 multiple moth trap
- More than 1 moth, only 1 moth/trap
- One moth trapped in county
- No moth trapped in county
- Gypsy moth Regulated Areas
- No survey reported
“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 (Babbit 1998)
- Invasive weeds cover 4500 new acres of public lands/ waters each day (Aq Pl 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
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 climes, unlike other species." The Guardian, 7/9/2015
Insects are being found at higher elevations
Plant Insect Synchrony

Insects, birds, foilivores, 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
‘Small 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
- Cherry bark tortrix
- Lily leaf beetle
- Cherry ermine moth
- Viburnum leaf beetle
- 2 species of click beetle
- Lilac root weevil
- Nut leaf weevil
- Brown punctate weevil
- Dark-eyed weevil
- Hairy spider weevil
- Elm seed bug
- Azalea lace bug
- 3 seed bugs
- Mountain ash sawfly
- Dogwood sawfly
- Pine sawfly
- Rhododendron lace bug
- Black vine weevil
- Strawberry root weevil
- Rough strawberry root weevil
- Clay-colored weevil
- Poplar-and-willow borer
- European pine shoot moth
- Apple ermine moth
- Oystershell scale
For a full list of introduced insect species
http://agr.wa.gov/PlantsInsects/insectpests/Exotics/SpeciesOfConcern.aspx

<table>
<thead>
<tr>
<th>Common Name &amp; Scientific Name</th>
<th>Common Name &amp; Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exotic Plant Pests New to Washington State Since 1985</strong></td>
<td></td>
</tr>
<tr>
<td><strong>2008</strong></td>
<td></td>
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<tr>
<td>Eurasian noctuid moth</td>
<td><em>Hecatera dysodea</em> (D. &amp; Schiff.)</td>
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<tr>
<td>European hardwood ambrosia beetle</td>
<td><em>Trypodendron domesticum</em> L.</td>
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<tr>
<td>European pine sawfly</td>
<td><em>Neodiprion sertifer</em></td>
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<td><strong>2007</strong></td>
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<tr>
<td>Daylily midge</td>
<td><em>Contarinia quinquenotata</em> (Loew)</td>
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<tr>
<td>Dogwood sawfly</td>
<td><em>Macremphytus tarsatus</em></td>
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<td><strong>2006</strong></td>
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<tr>
<td>Apple clearwing moth</td>
<td><em>Synanthedon myopaeformis</em> Haliday</td>
</tr>
<tr>
<td>Wrinkled dune snail</td>
<td><em>Candidula intersecta</em> (Poiret)</td>
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<tr>
<td><strong>2005</strong></td>
<td></td>
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<tr>
<td>Longneck field slug</td>
<td><em>Deroceras panormitanum</em> (L. &amp; P.)</td>
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<tr>
<td>Vineyard snail</td>
<td><em>Cernuella virgata</em> (Da Costa)</td>
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<tr>
<td>Conifer bark tortrix</td>
<td><em>Cydia coniferana</em> (Saxesen)</td>
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<td><strong>2004</strong></td>
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<tr>
<td>Large yellow underwing</td>
<td><em>Noctua pronuba</em> (Linnaeus, 1758)</td>
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<tr>
<td>Viburnum leaf beetle</td>
<td><em>Pyrrhalta viburni</em> (Paykull)</td>
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<tr>
<td>Heather thrips</td>
<td><em>Ceratothrips ericae</em> Haliday</td>
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<tr>
<td>Apple fruit moth</td>
<td><em>Argyresthia conjugella</em> (Zeller)</td>
</tr>
<tr>
<td>Year</td>
<td>Insect Type</td>
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<tr>
<td>2003</td>
<td>Bordered plant bug</td>
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<td>2002</td>
<td>European fruit tree tortrix</td>
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<tr>
<td>2000</td>
<td>Cereal leaf beetle</td>
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<td></td>
<td>Dusky wireworm</td>
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<td></td>
<td>European poplar shoot borer</td>
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<td></td>
<td>Lined click beetle</td>
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<tr>
<td>1999</td>
<td>Large European crane fly</td>
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<tr>
<td>1998</td>
<td>Straw-colored tortrix</td>
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<tr>
<td>1997</td>
<td>European rose bud borer</td>
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<td></td>
<td>European oak skeletonizer</td>
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<tr>
<td></td>
<td>Carnation tortrix</td>
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<td>1996</td>
<td>Exotic click beetle</td>
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<td></td>
<td>Exotic bark beetle</td>
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<td>Bark beetle</td>
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<tr>
<td>1995</td>
<td>Green budworm</td>
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<td>European emerald moth</td>
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<td>Apple tortrix</td>
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<tr>
<td>1994</td>
<td>Apple leafcurling midge</td>
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<td></td>
<td>Lesser budmoth</td>
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<td></td>
<td>Green pug moth</td>
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<tr>
<td></td>
<td>'Golden' leaf roller</td>
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<tr>
<td></td>
<td>Dark fruit tree tortrix</td>
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<tr>
<td></td>
<td>Barred fruit tree tortrix</td>
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<tr>
<td></td>
<td>Apple skeletonizer</td>
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<tr>
<td>1993</td>
<td>Cherry ermine moth</td>
</tr>
<tr>
<td>1991</td>
<td>European rose shoot borer</td>
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<tr>
<td></td>
<td>Cherry bark tortrix</td>
</tr>
<tr>
<td>1990</td>
<td>Pear leaf midge</td>
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<tr>
<td>1988</td>
<td>Grape phylloxera</td>
</tr>
<tr>
<td>1985</td>
<td>Apple ermine moth</td>
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</table>
### Exotic Nuisance Pests Established in Washington State Since 1985

<table>
<thead>
<tr>
<th>Year</th>
<th>Pest Name</th>
<th>Scientific Name</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>Metapoplax seed bug</td>
<td><em>Metapoplax ditomoides</em> (Costa)</td>
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<tr>
<td>2002</td>
<td>Raglius seed bug</td>
<td><em>Raglius alboacuminatus</em> (Goeze)</td>
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<tr>
<td>2000</td>
<td>Rhyparochromis seed bug</td>
<td><em>Rhyparochromis vulgaris</em> (Schilling)</td>
<td></td>
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<tr>
<td>1999</td>
<td>European paper wasp</td>
<td><em>Polistes dominulus</em> (Christ)</td>
<td></td>
</tr>
</tbody>
</table>

### Exotic Plant Pests Introduced and Eradicated in Washington State Since 1985

- Gypsy moth (European): *Lymantria dispar* L.
- Gypsy moth (Asian): *Lymantria dispar* L.
- Japanese beetle: *Popilia japonica* Newman
- Citrus longhorned beetle: *Anoplophra chinensis* (Forster)

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Pest Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>Brown marmorated stink bug</td>
<td><em>Halyomorpha halys</em> (StÃ¶hnl)</td>
</tr>
<tr>
<td></td>
<td>European Chafer</td>
<td><em>Rhizotrogus majalis</em></td>
</tr>
</tbody>
</table>
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
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
Suppression Costs from 1980 to 2013

$268,616,819
(Northeastern area only)

Photos USDA - Extension
Invasives that became pests

- Black vine weevil 1832
- Clay-colored weevil 1891
- Dark-eyed weevil
- Brown punctate weevil
- Nut leaf weevil
- Clay-colored weevil 1891
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)

(Apple ermine moth)
(Cherry bark tortrix, *Enarmonia formosana*)
(Apple skeletonizer, *Swammerdamia pellicaria*)
(Bared fruit tree tortrix, *Pandemis cerasaria*)
(Dark fruit tree tortrix, *Pandemis heparana*)
(Golden leafroller, *Croesia holmiana*)
(Green pug moth, *Chloroclystus rectangulana*)
(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*)
(Shar-colored tortrix, *Clepsis spectrana*)
(European poplar tip borer, *Gypsonoma aceriana*)
New leaf rollers

Photos WSDA - Eric LaGasa
Japanese beetle


Lynette Schimming;
http://bugguide.net/node/view/12589/bgimage
JAPANESE BEETLE LIFE CYCLE
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)
“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 “shoulders”
Whiteflies

- Ash whitefly
- Bemesia whitefly
- Greenhouse whitefly
- Adult ash whitefly
Spotted Lanternfly
*Lycorma delicatula*

Image by Greg Hoover

Holly Raguza,
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.

Comparissoon of Spotted Lanternfly and Gypsy Moth Egg Masses

Spotted Lanternfly Eggs

Gypsy Moth Eggs

Image by Greg Hoover
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.