

Three-slide introduction

"Alien" Species versus Invasive Table II. Native vs. Introduced Taxa

	1999 number of taxa	1999 percent of total flora	2011 number of total taxa	2011 percent of total flora	2011 Number of established taxa	2011 percent of established flora
Native Taxa	1,770	57%	1,814	55%	1,814	67%
Introduced, established	1,349*	43%*	898	27%	898	33%
Introduced, Waifs			581	18%		
Total	3,119	1	3,293	· · · · · · · · · · · · · · · · · · ·	2,712	

*Waifs were not distinguished from established introductions in 1999 Checklist

In plain English: one third of the plants currently found in the State did not occur here prior to European settlement.

"Established" = reproducing on their own. "Waifs" = seen once or occasionally but not establishing

Source: The Vascular Plants of Massachusetts: A County Checklist

According to "The Vascular Plants of Massachusetts: A County Checklist" by Bryan Connolly (at the time the MA State Botanist), as of 2011 when the last survey was updated, there were 2712 species of vascular plants in the Commonwealth. Of these, an impressive 898 species were not native, as in not present at the time of arrival to North America of the first people of European origin. In more simpler terms, one third of the plants in the state are relatively recent arrivals. We don't care as much about 99% of these non-natives because they generally behave themselves. It is important in our communications about invasive plants to make this distinction between non-native and invasive. The list of aggressive non-natives is really quite small.

Just a small handful of invasive plants, out of 898 alien:

Garlic Mustard Japanese Knotweed Oriental Bittersweet

Glossy buckthorn Black Swallow-wort Shrub Honeysuckles (several non-native invasives)

Winged Euonymus = Burning Bush Climbing Euonymus Bishops Weed = Ground Elder = Aegopodium podagraria Japanese Wisteria

....and a few others.

So please, pushing back against these invasives does not make you antiimmigrant!

Managing Invasives At Home and Around Town

Eric Olson Brandeis University

Olson - background Lifelong interest in butterflies and moths



Suburban/Urban boy who always wished he could live in a place like this.



Spicebush Swallowtail Butterfly Caterpillar

I grew up with raising and collecting insects.



Regal Moth "Hickory Horned Devil"

Olson - education

- BA, Geology.
- MSF = Masters of Forest Science
- PhD tropical insect ecology Costa Rica. Began by testing a moth caterpillar species against ~ 80 "non-host" plants. It grew well on only one. Specific insects need specific plants.
- Post-doc, I studied the community ecology of plant-eating insects in a tropical forest for six years.

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The Power of Volunteer Teams – a lot of work gets done.



"Frass Rain" Traps



One lesson learned: insects eat a lot of forest leaves. How much?

Combining studies to estimate:

Mass of fallen	Plus kg	= Total	Percent of	
leaves collected	leaves	leaves	total	
per ha per year	consumed	produced	consumed	
(in Palo Verde NP, Gessel et al. 1980)	by insects (my study)	per ha/yr	by insects	
~ 5800 kg	~ 800 kg	~ 6600 kg	12.1%	
Plants are "taxed" by insects. Its normal.				

Of course its normal

- We learn in ~ 3rd grade: sun goes to plant, plant to insect, insect to shrew or bird, shrew to owl. This is a food chain.
- Ecologists refer to these layers as "trophic levels".



What we know:

- From ~ 3rd grade: sun goes to plant, insect eats plant.
- "Insect eats plant" means leaf damage happens Leaf damage is a sign of a <u>healthy</u> food web.
- Consistent with my results, in forests worldwide around 5% to 15% of every tree's leaf area is eaten by insects each year. Call it a "tax" paid by trees as part of their participation in a thriving ecosystem.

LEAF DAMAGE IS NORMAL

Prof. Hoseob Yoon Graphic Artist Seoul, Korea

Only the herbivore trophic level can convert low-value plant tissue into high-value animal protein and fat.





Proportion of insects in each group that are herbivorous This has been a reminder of how nature works...



Garlic mustard

Leaf damage? Evidence of insect feeding? Not on garlic mustard.

Learn to look for leaf damage, and realize its *normal*.

You can come to see plants as either participants (like most native species) or nonparticipants (most invasives) in forest food webs.



Garlic mustard



See any evidence of insect feeding here?



Japanese Knotweed

How about here?



Asiatic Bittersweet

What we aim to avoid: a plant trophic level dominated by inedible species, here Oriental Bittersweet.



To native insects these plants may as well be plastic.

OK but wait just a second! Who knows the saying about nature and unused space or resources?

"Nature abhors a vacuum" – Aristotle (384-322 BC)

In the context of tons (yes **tons**, no kidding) of non-native leaf tissue in our area, we should certainly ask, "won't native insects colonize these potential host plants quickly, and bring them under control?" See classic book Insects on Plants: Community Patterns and Mechanisms" (1984). Harvard University Press

By Donald Strong, John H. Lawton, Sir Richard Southwood

Chapter 4: Community patterns through time: the dynamics of colonization and speciation.

Focused on the time frame of 10 years to 10,000 years after a new plant arrives to an island or continent.

For 5000+ years humans have moved plants around, unintentionally conducting these exact kind of ecological experiments. COMMUNITY PATTERNS THROUGH TIME

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But look at these key caveats:

- "Many of the insects that colonize a newly introduced plant are polyphagous, that is they already feed on a wide range of plants."
- "Not all species of introduced plants recruit insects from the local fauna, despite being exposed to attack for many years." The prickly pear cactus introduced to Africa had not been colonized by a single African insect after 250 years.
- *Main finding: Colonizations, if they do occur, are usually rapid.* "The high rate of insect acquisition is rapid at first....subsequently slowing to a trickle."

HOSTING CAPACITY OF ALIEN PLANTS INTRODUCED TO NORTH AMERICA					
Plant Species	Herbivores Supported in Homeland	Herbivores Supported in North America	Years Since Introduction to North America	Reference	
Clematis vitalba	40 species	1 species	100	Macfarlane & van den Ende 1995	
Eucalyptus stellulata	48 species	1 species	100	Morrow & La Marche 1978	
Melaleuca quinquen- ervia	409 species	8 species	120	Costello et al. 1995	
Opuntia ficus-indica	16 species	0 species	250	Annecke & Moran 1978	
Phragmites australis	170 species	5 species	300+	Tewksbury et al. 2002	

Chart from Doug Tallamy book "Bringing Nature Home"

Any evidence that invasive plants harm food chains?

 Tallamy and students – looked not just at <u>diversity</u> of insect species on introduced plants but, from the bird view point, <u>number</u> of potential food items

 Blossey and friends – did a brilliant experiment with frogs



Source: Prof. Doug Tallamy, Chair, Dept. of Entomology and Wildlife Ecology, Univ. Deleware



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Impact of Native Plants on Bird and Butterfly Biodiversity in Suburban Landscapes

KARIN T. BURGHARDT, DOUGLAS W. TALLAMY,* AND W. GREGORY SHRIVER Department of Entomology and Wildlife Ecology, University of Delaware, Newark, DE 19716-2103, U.S.A

- Conservation Biology (2008)

"Native properties supported significantly more caterpillars and caterpillar species and significantly greater bird abundance, diversity, species richness, biomass, and breeding pairs of native species. Of particular importance is that bird species of regional conservation concern were 8 times more abundant and significantly more diverse on native properties."

Birds birds birds, all eating bugs









Even seed-eating birds switch to hunting insects when raising nestlings.



Caterpillars are especially preferred.











Science

New Research Further Proves Native Plants Offer More Bugs for Birds

The study found that oaks and other native trees deliver a major chunk of the Carolina Chickadee's insect-intensive diet.



By Michelle Donahue July 27, 2017

Birds in This Story



Popular Stories

Pumpkin Bird Feeder Makes a Happy Harvest For Birds



Carolina Chickadees sure love their caterpillars and insects: Invertebrates comprise up to 90 percent of some individuals' diets. Photo: Papilio/Alamy

Carolina Chickadee Study

- Known before study: mom and dad chickadees must find about 7000 caterpillars to raise five baby birds.
- In suburban Washington DC, researchers looked for caterpillars on plants, on 97 properties.
- Per five minutes of search on each plant type, found zero to one caterpillar on non-native plants, but up to 20 or more on oaks.
- Oaks are in the lead (557 species of caterpillar!!) but other good host trees are black cherry and maples.
- See Nature's Best Hope, Tallamy's new book

Birds help prevent too much damage to trees



Our Friends the Wasps



Scientist #2, Bernd Blossey and friends. He asked: "Can frogs find insects to eat in a knotweed patch?"



Figure 1. Photos of (a) an uncovered foraging bucket with a Green frog, *Rana clamitans*, inside; (b) a covered foraging bucket among dense, diverse vegetation in the non-invaded portion of site 2; and (c) a covered foraging bucket in the Japanese knotweed-invaded portion of site 2. Note the dramatic difference in vegetation composition and structure between photos b and c of plots that were only 10 m apart.

Source: Maerz and Blossey et al. 2005. Biological Diversity and Conservation

Blossey's frog results

- <u>Most frogs in native wetland vegetation</u> <u>gained weight during 36 hours of trial.</u>
- <u>No</u> frogs in the knotweed-invaded areas gained weight, and many lost weight.
- Most frogs from native plant plots but only two from invaded plots <u>defecated</u> shortly after removal from foraging buckets (poop = verification of recent feeding).

What else do we know?

Some invasive plants are allelopathic.

That means they use chemical warfare – not just shade and root competition – against their nearby competitors.

Uncontrolled, over time these chemicals can alter forest structure and tree diversity in New England.



The upshot: Garlic Mustard releases chemicals into the soil that effectively sterilize it. These chemicals inhibit the growth of the friendly fungi (mycorrhizae) that are critical for normal growth of most native plants.



Friendly Fungi.

These are the unsung belowground partners of our native trees.

Invasive Plant Control Measures



Garlic Mustard

Garlic Mustard – Biennial, pull it up, shake dirt off roots, bag and dispose of in trash.

Work in spring from time of first flowers to mid June, best before plant has set seed. Figure on 2 to 3 years minimum of work in the same site, <u>don't miss a year</u>.



Japanese Knotweed

Perennial, very difficult. I am digging, cutting, pulling, using <u>six year root fatigue method</u>. In small areas this is workingmeanwhile there are UK biocontrol trials underway.





Asiatic Bittersweet

Celastrus orbiculatus

Cut spring to midsummer to stop seed production.

Cut low and cut high, so new shoot has no easy "ladder" back up.

Return and keep at it, watch for resprouting. (Tallamy says, will need to use stem herbicide applications.)



Black Swallow-Wort on a Cambridge Chain Link Fence



Black Swallow-wort

Text, National Park Service: Remove pod-bearing plants from the site and destroy them. Eradication on a small scale must be **very thorough and requires dedication**. The complete root crown must be dug out before the seeds ripen. Plants bearing seeds should be burned or bagged and disposed of in a landfill. Infested land might be brought under control by plowing and planting an annual crop until the seed soil bank is depleted, possibly as long **as five years**.

Common buckthorn (Rhamnus cathartica)

Appearance: Tall understory shrub or small tree up to 25' high with a spreading loosely branched crown, often multiple stems at the base. Female and male plants.







Wood: Brown bark with elongate silvery corky projections (caution: native plums or cherries have a similar bark). Cut branch exposes yellow sapwood and orange heartwood.



Common Buckthorn



Removing small buckthorn with hand tools.

Herbicides to Control Buckthorn

Trade Name	Chemical Name	Concentration	Use
Ortho Brush-B- Gon	Triclopyr amine	Premixed at 8%	Cut stump
Ferti-Lome Brush Killer and Stump Killer	Triclopyr amine	Premixed at 8.8%	Cut stump
Garlon 3A	Triclopyr amine	25-50% solution with water	Cut stump
Garlon 4	Triclopyr ester	I part Garlon 4 and 3 parts bark oil/dilutent	Cut stump or basal bark
Pathfinder II	Triclopyr ester	Pre-mixed at 13.6%, pre-mixed with oil/dilutent	Cut stump or basal bark
Roundup, Rodeo, Accord, Etc.	Glyphosate	25-50% solution with water. Look for 10-25% active ingredient glyphosate for cut-stump treatments. Lower concentrations work for foliar spray of seedlings.	Cut stump

Small plants, small infestations – pull up by roots. Large plants, large infestations – saw at base and apply herbicide to cut stems for larger plants (need license).

CONTROL OPTIONS

(NATIONAL PARK SERVICE)

GENERAL GUIDANCE FOR MOST SHRUBS

http://www.nps.gov/plants/alien/pubs/midatlantic/control-shrubsandsubshrubs.htm

Herbicides applicators need licenses and insurance in the Commonwealth.

"The amine form of triclopyr carries a Danger signal word due to its corrosive properties which, in concentrated form, can cause irreversible eye damage. For this reason, it should only be used by trained and certified applicators who are familiar with this hazard and know the precautions that need to be taken when using it."



BUCKTHORN BAGGIE

Patent Pending

Instructions

Step one:

Cut any buckthorn (or plant) with loppers or saw leaving a 6 inch flat topped stump.

Step two:

Place proprietary plastic bag over flat topped buckthorn stump.

Step three:

Zip tie bag at middle of flat topped buckthorn stump. (up 3" from the ground)

Step four:

Make sure Buckthorn baggie is touching ground and fanned out at bottom to catch any new buckthorn shoots, Leave attached for one year.

Reusable





Summer showing winged stem

Fall, a brilliant red

Winged Euonymus "Burning Bush"



For small plants use the weed wrench.

Same slide again, same basic rules.

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Exotic honeysuckles (Lonicera tartarica, L. morrowii, L. x bella)



QUOTE – Be careful not to mistake exotic bush honeysuckles for native honeysuckles such as northern bush honeysuckle (*Diervilla lonicera*) or American fly honeysuckle (*Lonicera canadensis*).

KEY: Native types have solid rather than hollow stems and typically do not form extensive invasions.

Exotic honeysuckles (Lonicera tartarica, L. morrowii, L. x bella)



Mechanical: pull seedlings, persistently cut larger plants (small areas).

"Physical removal by hand-pulling smaller plants or grubbing out large plants should not be used in sensitive habitats."

Most websites recommend herbicide to cut stem or foliar spray...you've seen that slide.

English Ivy

https://www.nytimes.com/2017/01/20/nyregion/english-ivy-spread-by-admiringhumans-and-hungry-birds.html



English ivy is extravagantly green even during winter's worst, and is an excellent climber of trees and fences. Dave Taft

IN SUM:

We have created conservation areas for a purpose, or for many purposes really, and just keeping them green (covered in whatever plant grows there) satisfies some, but not all, of these purposes.

Although we will never eradicate invasive plants completely, we can at least invest time in the control and management of these plants in those areas that we have specifically set aside at significant expense, to showcase native plant species.

IN SUM:

By doing so, we also favor the many-millionyear-in-evolving relationships between plants the insects that feed on them, and therefore help the hundreds of species of bird and frog and others that feed on these insects.

Finally, by doing so with volunteers we increase awareness of how nature works, and foster a sense of ownership and stewardship over public conservation areas. This translates to private properties.

Last slide April 2020 WLT



Not the future we want.

The End

Thank you

Questions?