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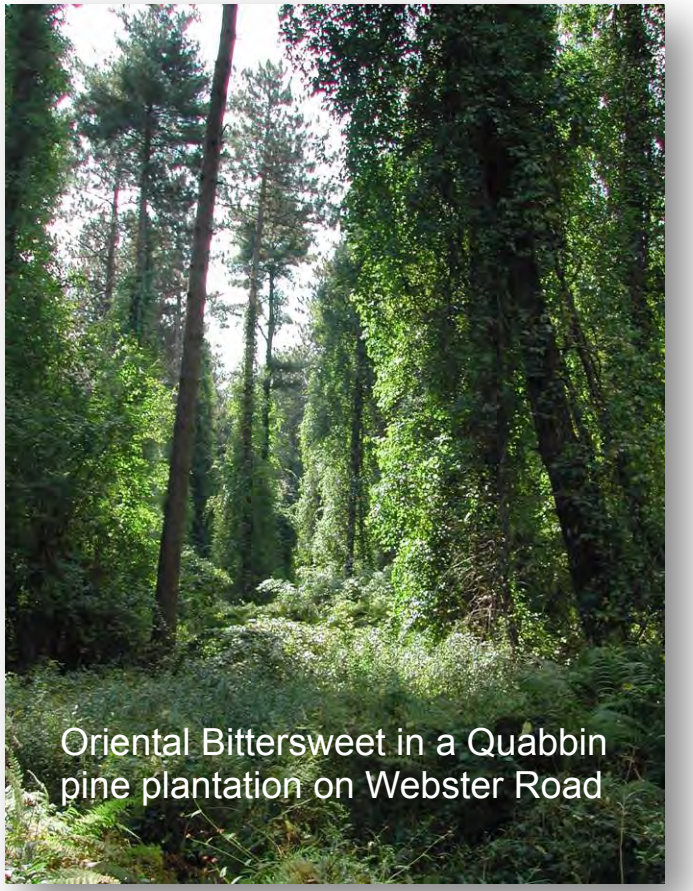
Overview

- Brief review of the terrestrial invasive plant problem and why it is of concern on a forested drinking water supply watershed
- The current status of these plants at Quabbin
- The range of control options and DWSP objectives for control
- Sample cost estimate

What is an *invasive* plant?

- ALL plants work steadily to fill their available habitats, some more aggressively than others
- Lack of competition or natural controls encourages invasiveness
- Non-native, "alien" plants generally have few predators and therefore more success invading



Oriental Bittersweet in a Quabbin pine plantation on Webster Road

Native plants can be invasive…

- Temporarily, when normal competition is disrupted
- E.g., with high deer numbers, native hay-scented fern "*invades*" (monopolizes) the understory
- However, in the same understory, but with reduced deer influence, ALL native plants compete and diversity is restored

...and <u>most</u> *alien* plants are <u>not</u> invasive.

- Plants vary in their ability to compete and proliferate quickly
- Most garden imports only survive in a garden
- Others escape the garden and beat out native plants in the wild

Japanese barberry

Burning bush

How does an alien become an eco**thug?**

- *Vigorous reproduction* **Purple loosestrife** produces a million or more seeds per plant per year
- *Habitat alteration* ***Melaleuca*** or "punk tree" has converted 500,000+ acres of native Florida marsh into swamp forest
- *Rapid growth* **Kudzu** grows a foot a day and has covered over 2 million acres of forest since its deliberate introduction for erosion control in the 1930s

How did/do invasive alien plants get here?

- Colonial ship ballast (home port dirt and seeds to America…)
- Modern shipping and global trade, especially in landscaping or food plants, fruits, seeds, etc.
- Residents of the historical towns in Quabbin unknowingly started the Japanese barberry invasion with house site plantings (early 1900s).
- Conservation and wildlife programs promoted such plantings as autumn olive and multiflora rose, for erosion control and habitat.

How do terrestrial invasive plants (TIPs) influence water supplies?

- TIPs do not categorically, directly *degrade* water
- They may reduce or increase water yield and can alter wetlands
- They may fix nitrogen, or capture nutrients
- They do replace native plants and can limit regeneration of the diverse native forests that protect water supplies

What are the main concerns about invasive plants on DWSP watersheds?

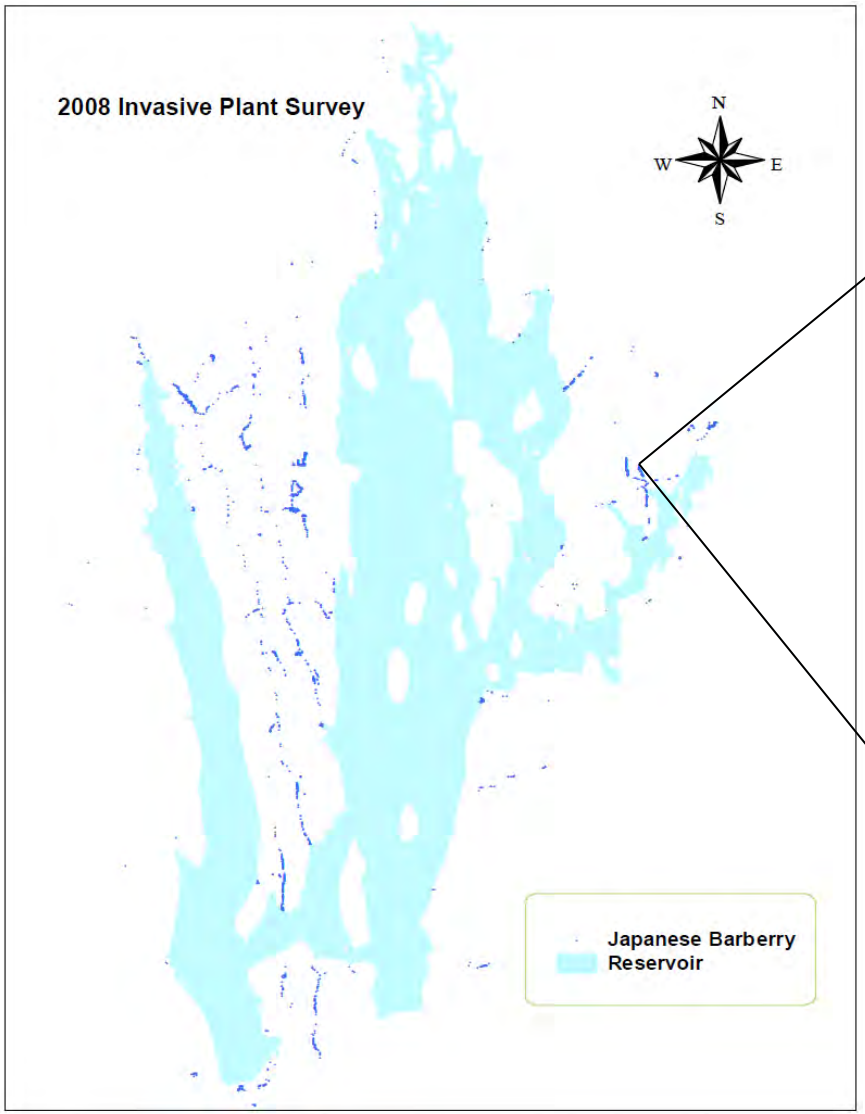
- We rely on species and structural diversity to add resilience to our watershed protection forest.
- We have statutory obligations to protect native plant, animal, and habitat diversity (MESA).
- *Invasive plants challenge both of these objectives.*

Which invasive terrestrial plants are problems for DWSP?

- Top ten offenders:
  - Japanese barberry
  - Oriental bittersweet
  - Japanese knotweed
  - Buckthorns
  - Burning bush
  - Non-native honeysuckles
  - Multiflora rose
  - Autumn olive
  - Common reed
  - Purple loosestrife

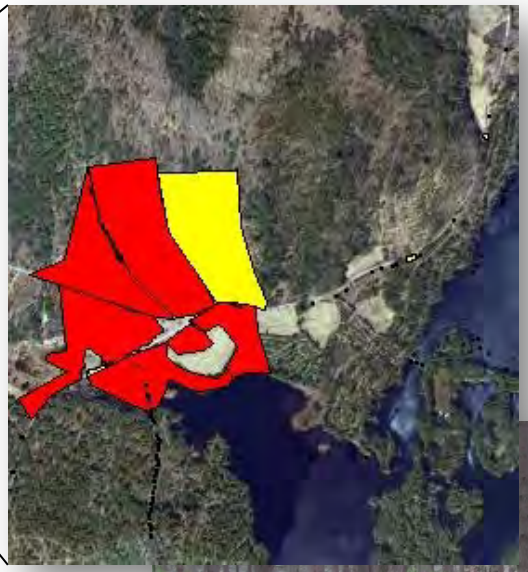
Determining the extent of the problem at Quabbin

- "Windshield" mapping began in 1990s
- Seasonal IP crews in 2007, 2008, 2009
- Crews mapped points and areas along roadways (2008) and within compartments (2009)
- 2010 CFI notes, regeneration surveys, surveys of proposed harvesting lots



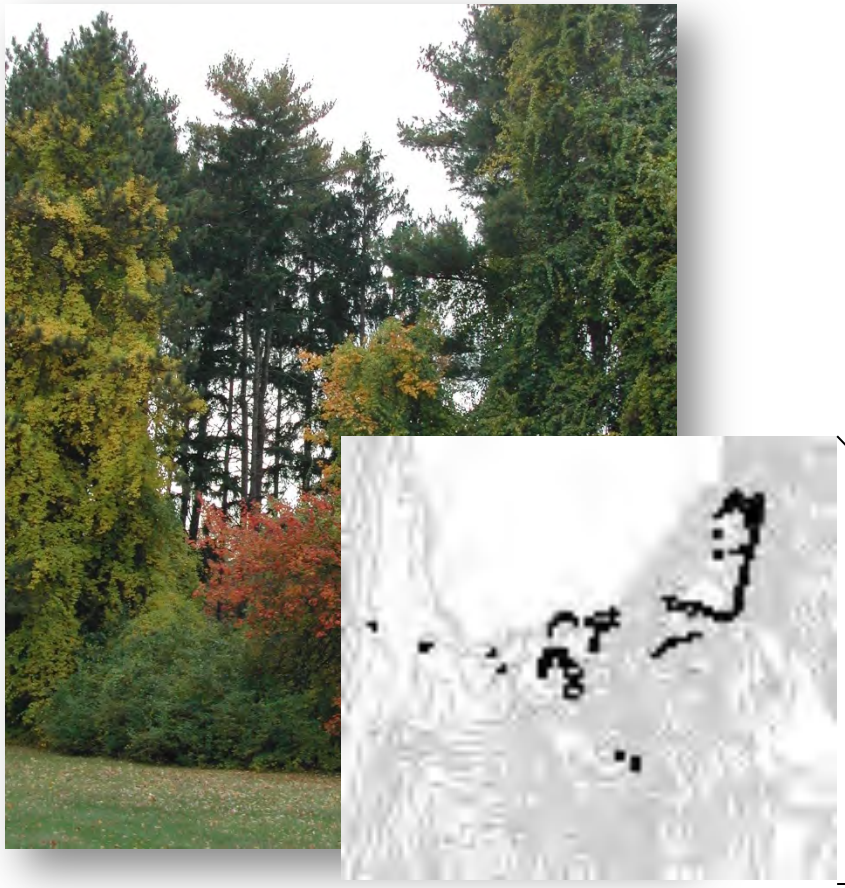
Japanese barberry is by far the most widely distributed terrestrial invasive plant at Quabbin. Dots show location of plants within ~10 of the roads, but not actual population size. At this scale (1:150,000), a dot representing a 20 ft. diameter population would be 16 ten-thousandths of an inch in diameter.

Some mapping examples: Japanese barberry,…

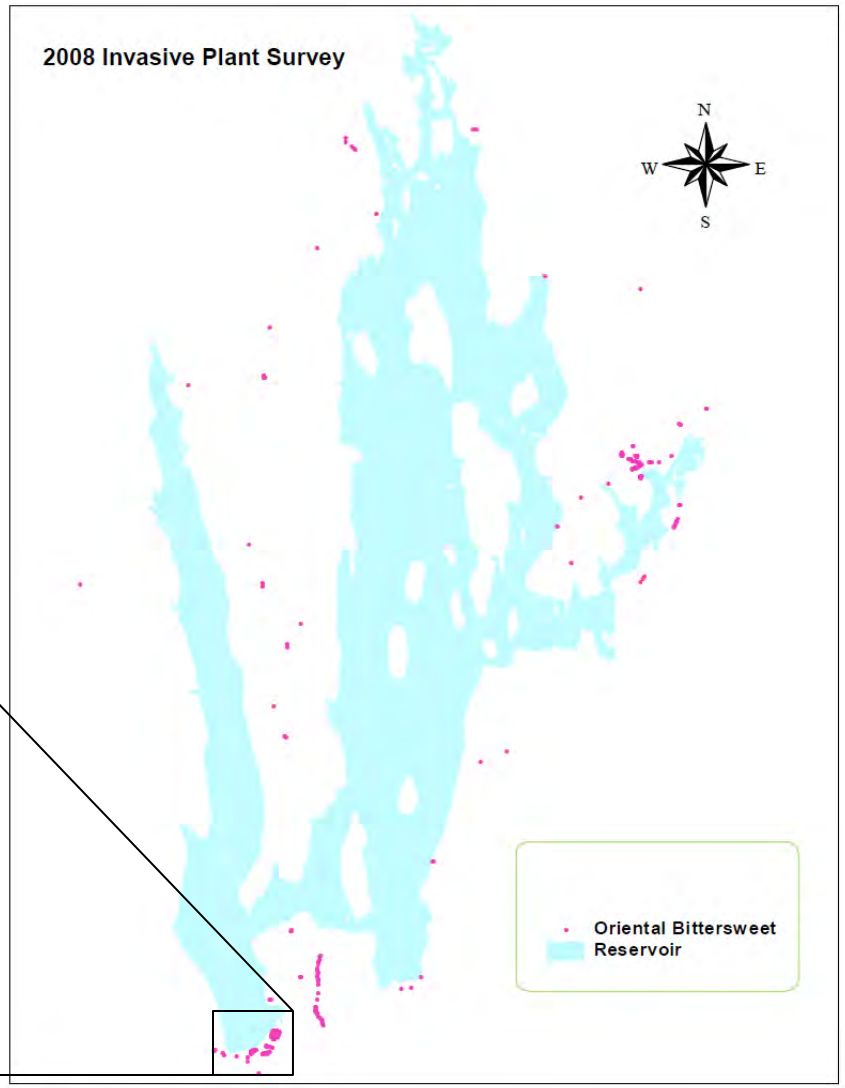


Japanese barberry near Dana Common

Oriental bittersweet, …



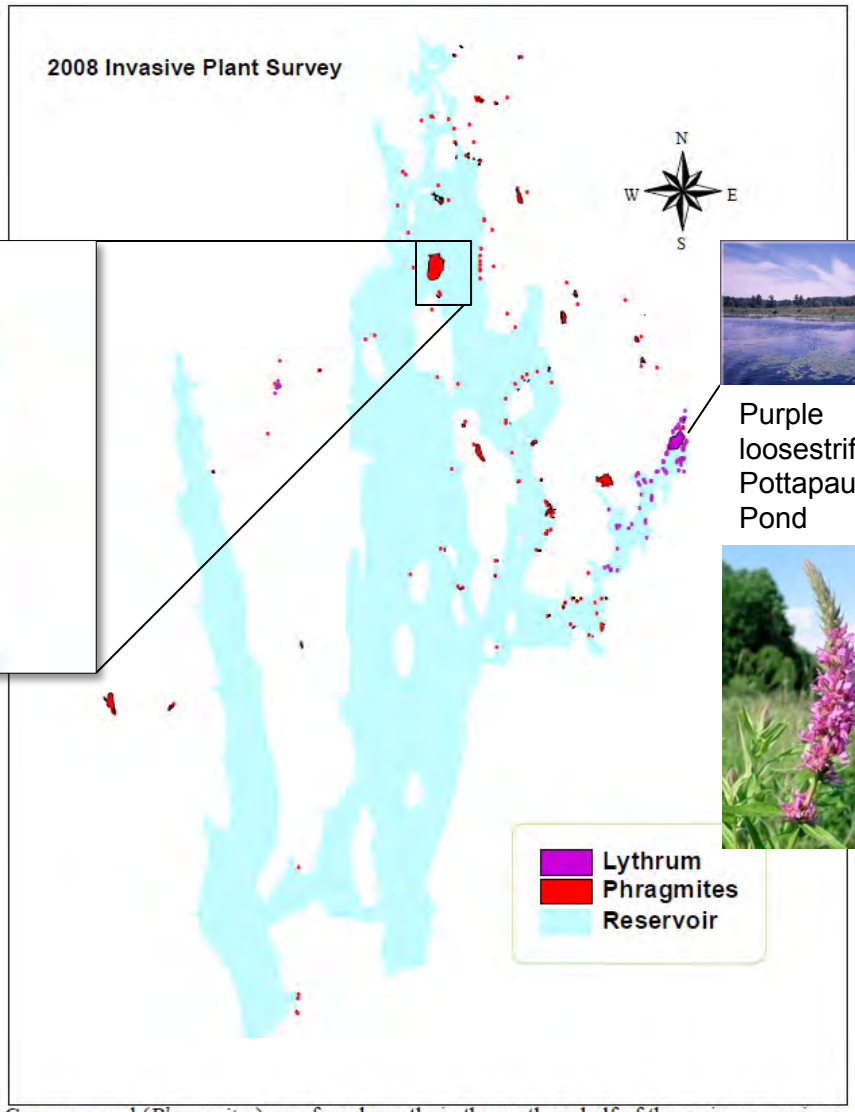
Oriental bittersweet in Quabbin Park



Dots show location of Oriental bittersweet found within ~10 feet of Quabbin roads, but not actual population size. At this scale (1:150,000), a dot representing a 20 ft. diameter population would be 16 ten-thousandths of an inch in diameter.

… and wetland species (purple loosestrife and common reed)

Phragmites on Quabbin islands



Common reed (*Phragmites*) was found mostly in the northern half of the main reservoir on the eastern shore. Purple loosestrife (*Lythrum*) was found principally in Pottapaug Pond.

Purple loosestrife in Pottapaug Pond

Findings from IP summer crews

- Focused first on roads; then interior
- Point location and radius (10-100 ft)
- 3,937 points (~45 acres), plus larger mapped areas (~750 acres)

Species	Polygons	Points
J barberry	290 acres	2,676
Honeysuckle	120	631
Bittersweet	116	507
J knotweed	49	258
P loosestrife	34	134
Phragmites	174	126
Multiflora rose	42	117
Autumn olive	15	44
Buckthorn	49	28

Findings from Continuous Forest Inventory

- 2010-2011 Quabbin CFI
- 82.5% were invasive-free (17.5% of all plots, 16% of unmanaged plots contained at least one invasive plant)
- 4.2% contained invasive plants covering >25% of the plot
- Barberry was the most common
- TIPs are not “everywhere”

Options for control (general)

- Major methods include:
  - Mechanical
    - Mowing
    - Pulling
    - Burning/steaming
    - Smothering
  - Biological
    - Insects (e.g. *Galerucella* beetles on purple loosestrife)
    - Diseases (e.g. rose rosette disease)
  - Chemical
    - Synthetic herbicides
    - Naturally occurring

Control methods DWSP has tested

- Summer crews 2007, 2008, 2009
  - Methods tried included cutting, direct flame, hand pulling, and smothering with plastic or heavy mulches
  - Effective control lasted less than one year for most trial treatments…*follow up is critical.*

One example…mowing, mulching, seeding in an effort to control Oriental bittersweet

Smothered with plastic & mulch…..

Uncovered and seeded to grass…

Allowed to grow…

Bittersweet joins the party again…

Grass beginning to lose…

Bittersweet wins…

Successful control requires follow-up treatments…

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Long-term control methods to be used at Quabbin

- Methods currently used or under consideration include:
  - Mechanical controls such as pulling, mowing, smothering (mulch or plastic)
  - Mowing in combination with propane torch follow-up (Japanese barberry); controlled burns
  - Biological controls with demonstrated ecological safety (e.g., purple loosestrife control via beetle release)

DWSP's plan for controlling these plants on the watersheds

- "Terrestrial Invasive Plant Problem Statement and Management Strategy for DWSP Properties": **completed and available online**.
- Some of the objectives identified in the plan include:
  - Buffer **rare plant** populations
  - Provide **early detection and rapid control** of new TIP populations
  - Ensure vigorous, native **forest regeneration** near intakes
  - Inventory and **control TIPS prior to regeneration harvests**
  - Protect **biological diversity in critical habitats** (e.g. wetlands)

Controlling barberry (and ticks) in Quabbin Park (2011-13)

- (Research in Connecticut by Jeff Ward, CAES)
- First, cut (or burn) mature plants (Apr-June)
- Wait 6-8 weeks for resprouting
- Scorch sprout clumps with propane torches
- Significant concurrent reductions in Japanese barberry (-85%) and ticks (-75%)

Does logging cause TIP problems?

- Conclusion of Harvard study at Quabbin: *Japanese barberry presence/location is unrelated to harvesting* (DeGasperis and Motzkin, 2007)
- Logging does not *create* invasive plants, but all disturbances may encourage invasive plants, and logging is a disturbance
- In addition, logging equipment can transport invasive seeds from off site areas

How will DWSP limit invasives spread during active forest management?

- Expand invasives monitoring during review of proposed harvest areas; design harvests to avoid established invasive populations
- Inspect equipment coming from sites that contained invasives; require cleaning if necessary

Forest regeneration versus TIPs

- The presence of TIPs *before* harvests appears to be strongly correlated to their presence *after* harvests
- Where invasives are not present, regeneration silviculture is still very successful

What might it cost to address TIPs?

Objective	Watershed	Inventory acres	Inventory cost	Treatment acres	Cost to mechanically treat
Buffer rare plant populations	Quabbin	130	$2,400-$4,800	6.5	$1,599-$12,188
	Ware	19.5	$360-$720	1	$246-$1,875
	Wachusett	32.5	$600-$1,200	1.6	$394 - $3,000

Purple milkweed

Musky monkey flower

Purple clematis

Conclusions

- Invasive, non-native plants are not "everywhere" on our watersheds, but they are gaining ground
- Eradication is most likely for brand new invasions only, so ED/RR is critical
- Mechanical control methods require tremendous human and financial commitments, but alternatives remain controversial on water supplies
- Deliberate disturbances without first controlling invasives will be avoided
- More research is needed on the direct and indirect effects of invasives on water supplies

Questions?