

2016
New Hampshire Department of Agriculture's
Statewide Invasive Species Control Project

A cooperative effort involving NH Dept. of Agriculture, Markets & Food and
NH Dept. of Transportation

Re: Watershed Special Permit #SP-206

Introduction

This report details the fifth year of herbicide applications conducted by the NH Dept of Agriculture, Markets & Food (DAMF), Division of Plant Industry for the 2016 growing season. This work was done in accordance with the approved Watershed Special Permit (SP-206). Funding for the purchase of herbicide products, and project support provided by the NH Department of Transportation.

The 2016 treatment season revealed several Japanese knotweed (*Reynoutria japonica*, formerly known as *Falopia japonica*), henceforth called knotweed, sites exhibiting regeneration from dormant underground rhizome stock. These sites had been treated 2-3 years prior and appeared extirpated during that period of time. The regrowth was stunted / mutated. Although this type of regrowth has occurred in the past, it has always been found the year subsequent to treatment, not 2-3 years later.



Japanese knotweed regeneration

With regard to this type of delayed regeneration, it's possible that the extensive underground rhizomes shutdown before the herbicide has the ability to affect it entirely and thus the rhizome remains viable. It's common for rhizomes to extend up to 26', if not more, and achieve a 2-3" diameter range up to several feet from the crown. The photo to the right shows a knotweed crown with a 2" diameter rhizome, which originally extended over 20' in length.



For experimental purposes, the rate of Roundup Pro Concentrate was increased from 5% to 7% for this year's applications. The rate will drop back to 5% for the 2017 treatment season

The table below, Table 1, details the treatment areas for the 2016 growing season:

2016 Invasive plant treatment sites

Location	Town Beginning	Town End	Length	Square Feet of treatment	Land Use
Route 1A	Hampton	Rye	13 Miles	-15,000	ROW
Route 3	Ashland	Meredith	11 Miles	-2,000	ROW
Route 25	Wentworth	Rumney	7 Miles	-26,000	ROW
Route 25	Ashland		3 miles	-3,500	ROW
Route 25	Meredith	Sandwich	14 Miles	-1,500	ROW
Route 106	Loudon	Meredith	31 Miles	-6,000	ROW
Route 109	Moultonborough		5 Miles	-3,500	ROW
Route 113	Sandwich		4.5 Miles	-3,500	ROW
I-93	New Hampton	Plymouth	11.5 Miles	-2,300	ROW
DOT Shed	New Hampton			500	State
Giant knotweed	Rye			-13,800	Residential
Boscawen Town Forest	Boscawen	Boscawen		-60,500	ROW
F&G Chapmans Landing	Stratham			-38,000	State
F&G Merrimack River Boat Launch	Boscawen			3,140	State
Laconia Stump Dump	Laconia			500	Municipal
Meredith Neck Rd	Meredith	Meredith	6 Miles	-13,000	State Maintained
Moultonboro Neck Rd	Moultonborough		5.5 Miles	-35,000	State Maintained
Odiorne State Park	Rye			-171,000	State Park
Rye Harbor State Park	Rye			-9,500	State Park
UNH Dairy Farm	Lee			-3,000	Agriculture
Total			83 Miles	411,240	

Table 1

Herbicide applications began on August 30, 2016 and continued through October 26, 2016. The herbicide mixes that were used are described in Tables 2 through 4.

Table 2 Herbicide Mix #1 (7% Glyphosate Formulation)

Active Ingredient	Herbicide/Product	EPA Reg #	Application Method	Amount / Liter of Tank Mix	% AI in Formulation	Diluent	% herbicide in Tank Mix
Glyphosate	Roundup Pro Concentrate	524-529	Foliar	70ml	50.2	H ₂ O	7
Aminopyralid	Milestone	62719-519	Foliar	0.5ml	40.6	H ₂ O	0.05
Ethylene glycol	N/S3 Non-Ionic Surfactant	N/A	Foliar	2.5ml	100	H ₂ O	0.25

Table 3 Herbicide Mix #2 (5% Triclopyr Formulation)

Active Ingredient	Herbicide/Product	EPA Reg #	Application Method	Amount / Liter of Tank Mix	% AI in Formulation	Diluent	% herbicide in Tank Mix
Triclopyr	Garlon 4 Ultra	62719-527	Foliar	50ml	60.45	H ₂ O	5
Aminopyralid	Milestone	62719-519	Foliar	0.5ml	40.6	H ₂ O	0.05
Metsulfuron methyl	Escort XP	352-439	Foliar	0.25g	60	H ₂ O	N/A
Ethylene glycol	N/S3 Non-Ionic Surfactant	N/A	Foliar	2.5ml	100	H ₂ O	0.25

Table 4 Herbicide Mix #3 (5% Triclopyr Formulation)

Active Ingredient	Herbicide/Product	EPA Reg #	Application Method	Amount / Liter of Tank Mix	% AI in Formulation	Diluent	% herbicide in Tank Mix
Triclopyr	Garlon 4 Ultra	62719-527	Foliar	50ml	60.45	H ₂ O	5
Aminopyralid	Milestone	62719-519	Foliar	1ml	40.6	H ₂ O	0.10
Metsulfuron methyl	Escort XP	352-439	Foliar	0.15g	60	H ₂ O	N/A
Ethylene glycol	N/S3 Non-Ionic Surfactant	N/A	Foliar	2.5ml	100	H ₂ O	0.25

Label Restrictions

Roundup Pro Concentrate: Except as otherwise specified, the combined total of all treatments must not exceed 8.5 quarts of this product per acre per year. (8,044ml/acre/year).

Year	Total Product Used	Sq. Feet	Coverage	Application Rate	Volume/Acre
2016	1,142.75ml	236,240	-5.4 Acres	7%	<u>211ml/Acre/Year</u>
Total	1,142.75ml	236,240	-5.4 Acres		

Milestone: The total amount of Milestone applied broadcast, as a re-treatment, and/or spot treatment cannot exceed 7 fl. oz. per acre per year. (207ml/acre/year)

Year	Total Product Used	Sq. Feet	Coverage	Application Rate	Volume/Acre
2016	146.6ml	389,740	-8.9 Acres	.05%	<u>16.4ml/Acre/Year</u>
2016	20ml	21,500	-.5 Acres	.1%	<u>40.5ml/Acre/Year</u>
Total	166.6ml	411,240	-9 Acres		

Escort XP: The total amount of Milestone applied broadcast, as a re-treatment, and/or spot treatment cannot exceed 3.5 oz. per acre per year. (99g/acre/year)

Year	Total Product Used	Sq. Feet	Coverage	Application Rate	Volume/Acre
2016	25g	153,500	- 3.5Acres	2.5g/10L	<u>7.14g/Acre/Year</u>
2016	3g	21,500	-.5 Acres	1.5g/10L	<u>1.5g/Acre/Year</u>
Total	28g	175,000	- 4 Acres		

Garlon 4 Ultra: The total amount of Garlon 4 Ultra applied as a high volume foliage treatment cannot exceed 2 gallons per acre per year. (7,570.82ml/acre/year)

Year	Total Product Used	Sq. Feet	Coverage	Application Rate	Volume/Acre
2016	7,500ml	175,000	- 4 Acres	500ml/10L	<u>1,875ml/Acre/Year</u>
Total	7,500ml	175,000	- 4 Acres		

The application method used was a Foliar Spray (FS) treatment. The total amount of diluted tank mix used was 82.75 gallons (313.25 liters). Table 6 lists the total number of woody invasive plants and acreage of knotweed treated since 2012.

Table 5 - Invasive species treated and application method used

Common name	Scientific name	Plant type	Application method
Autumn olive	<i>Elaeagnus umbellata</i>	Woody	Foliar Spray
Black swallow-wort	<i>Cynanchum louiseae</i>	Herbaceous Vine	Foliar Spray
Burning bush	<i>Euonymus alatus</i>	Woody	Foliar Spray
Common buckthorn	<i>Rhamnus cathartica</i>	Woody	Foliar Spray
Glossy buckthorn	<i>Frangula alnus</i>	Woody	Foliar Spray
Honeysuckle	<i>Lonicera spp.</i>	Woody	Foliar Spray
Japanese barberry	<i>Berberis thunbergii</i>	Woody	Foliar Spray
Japanese knotweed	<i>Reynoutria japonica</i>	Herbaceous	Foliar Spray
Multiflora rose	<i>Rosa multiflora</i>	Woody	Foliar Spray
Norway maple	<i>Acer platanoides</i>	Woody	Foliar Spray
Oriental bittersweet	<i>Celastrus orbiculatus</i>	Woody vine	Foliar Spray
Perennial pepperweed	<i>Lepidium latifolium</i>	Herbaceous	Foliar Spray

Table 6 - Invasive species treated

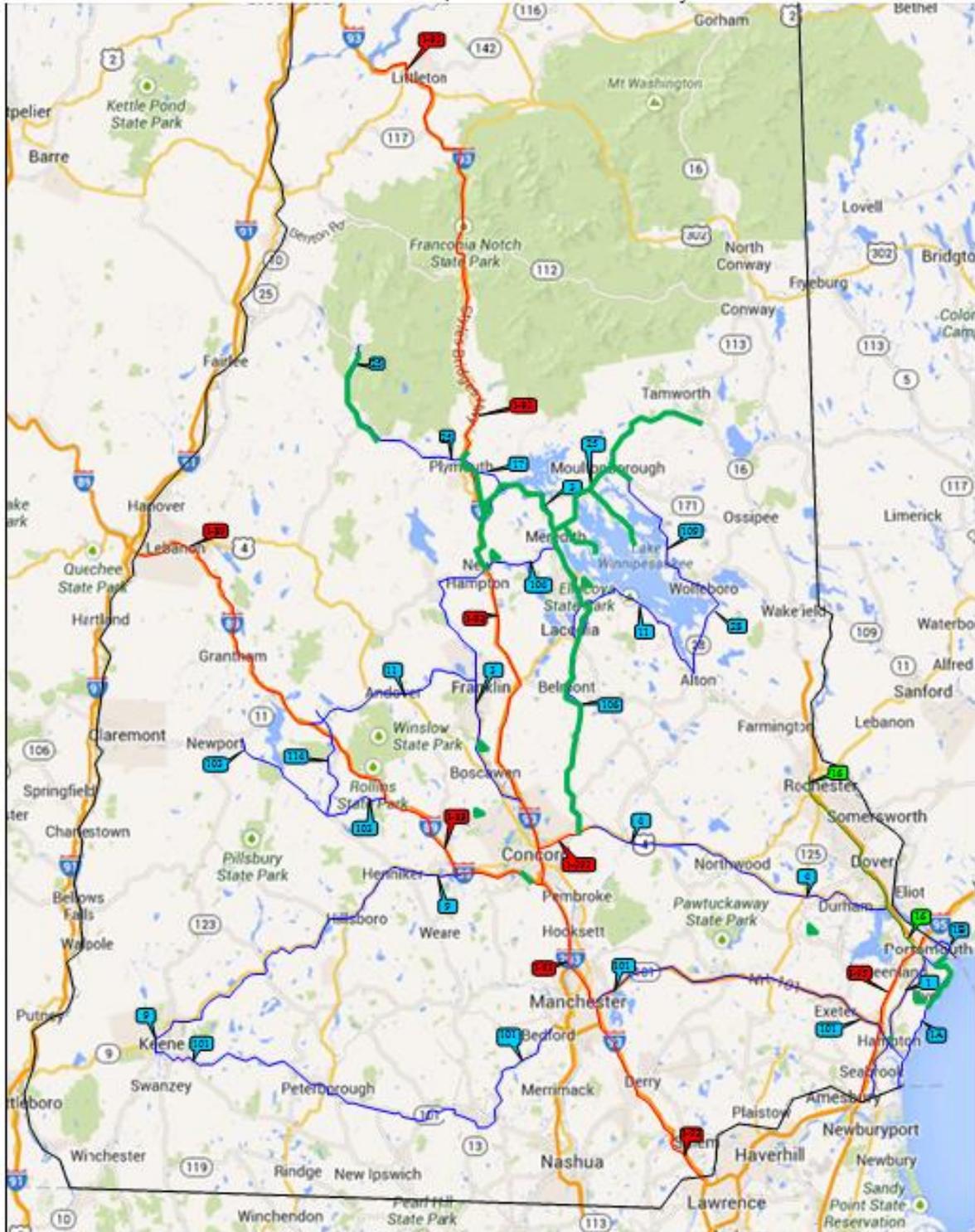
Treatment Year	# of Stems Spot Treated	Acres of Woody Foliar Treatments	Acres of ROW/Knotweed Treated
2012	-2,690	Undetermined	23 Acres
2013	-7,000	Undetermined	43 Acres
2014	-6,589	Undetermined	25 Acres
2015	-1,000	>1	21.5 Acres
2016	-3,300	>4	-5.5 Acres
Total	-17,279	>5	-118 Acres



A plastic tray/lid is used for precautionary measures as a recovery reservoir if drips or a spill were to occur.

Statewide Invasive Species Control Program 2016

New Hampshire Department of Agriculture,
Markets & Food, Division of Plant Industry



Map showing the locations of proposed herbicide treatments to control upland invasive plants

- = State Highway Systems
- = Interstate Highway Systems
- = State Turnpike
- = 2016 Herbicide Treatment Areas

The map above shows the roadways/highways that were permitted for the 2016 treatment period and the areas that received treatment are shown in green.

Japanese knotweed –The applications were done using a backpack pump sprayer just after the knotweed went out of flowering. The treatments included unmanaged populations as well as follow-up applications to a few knotweed stands that didn't die off completely from the previous year's work. In these instances, success rates were estimated at approximately 85-95%. Of the stems that survived, some appeared normal while others were severely stunted and deformed from the previous years' treatment, see photo below.



The red circle shows one of the sites where regeneration occurred after 2-years of no observable living knotweed.

Other Projects

Rye-Giant knotweed

A few years ago, while scouting for invasive species, a population of Giant knotweed was found at a private residential property in Rye. This is just one of only a handful of Giant knotweed sites known to occur in New Hampshire. This would be a case of Early Detection / Rapid Response (EDRR). The property owner was contacted and approvals granted allowing this population to be managed. The knotweed was treated using herbicide mix #1 as a low volume foliar spray. The site will be monitored and follow up applications done as needed.

Boscawen Town Forest

The Town of Boscawen requested assistance with the management of Oriental bittersweet over taking the town forest / Weir Tree Farm. Herbicide mix #2 applied as a low volume foliar spray. On the property is the cellar hole for the house and barn. For safety reasons, the bittersweet growing outside the perimeter of the cellar was treated in late August. The bittersweet growing within the cellar hole was then treated after the perimeter bittersweet had died, which occurred in mid-October. The site will be monitored and retreated as needed.

UNH Dairy Farm

The University of New Hampshire (UNH) operates a dairy farm in the Town of Lee, which was once privately owned and had Japanese knotweed growing around the old farmhouse. The knotweed was cut in early June to help improve the efficacy of the herbicide treatment. The knotweed was allowed to regrow and then in mid-September treated using herbicide mix #1. See photos on next page.



Knotweed at UNH Dairy Farm-Before



Knotweed at UNH Dairy Farm-After

Odiorne State Park, Rye

One of the primary components of this Statewide Invasive Plant Control Project is to actively manage invasive species in areas that offer educational and awareness opportunities to the general public, such as Odiorne State Park. Odiorne SP is a unique coastal habitat system located in the Town of Rye and encompasses 330 acres of recreational land. Over time, Odiorne SP has undergone significant changes to its landscape making it highly vulnerable to invasion by non-native species. Prior to the State of New Hampshire acquiring the property, it was the site of Fort Dearborn, which was built during WWII to protect the Portsmouth Naval Shipyard. To accommodate and construct the large bunker facilities, many former privately owned estate cottages were purchased and razed and the landscape manipulated and excavated to bury the bunkers for cloaking and fortification. This disturbance combined with the areas importance for migratory birds allowed the site to quickly become invaded, see photo below.



Odiorne State Park prior to invasive plant management near boat ramp.

DAMF initiated invasive plant control effort along the paved bicycle path fronting Route 1A in 2015 at which point it became clearly evident that herbiciding alone would not be the most effective or efficient method for managing the enormity of the invasions. The dominant invasives found include Oriental bittersweet, Glossy buckthorn, and Multiflora rose. To a lesser degree, Blunt leaved privet, Japanese barberry, Burning bush, Honeysuckle, Black swallow-wort, and Norway maples occupy the site. Upon meeting with state agencies to discuss the difficulties of management, high powered brush mowing equipment was offered as a solution, see photo on next page.



The skid-steer being used is a Caterpillar 289D with wide tracks to lower the ground pressure. It is equipped with a Diamond hydraulic mower head.

Starting in early June, the Caterpillar 289D skid-steer with a hydraulic brush mower arrived at the site. For safety purposes, due to flying debris, all of the trails surrounding the immediate vicinity of the area being mowed were barricaded and signed. In addition, park radios were used to alert the operator if people wandered into the area or were too close. On four occasions groups of people walked past the barricades, orange cones and lifted the yellow caution flagging to take a closer look. Each of these occurrences necessitated the mowing to cease until the area was cleared.



In all, the first round of mowing lasted 6-days in the first week of June and achieved 5+ acres of clearing. Efforts were taken to flag individual and pockets of native plants to help retain as much of the natural diversity as possible. What was saved included numerous mature trees including Oaks, Birch, Maples and Cherry trees along with small isolated clumps of herbaceous and small woody plants. Although numerous healthy trees were saved, there were also as much if not more trees heavily damaged and weakened by blanketing Oriental bittersweet draping over their canopies.



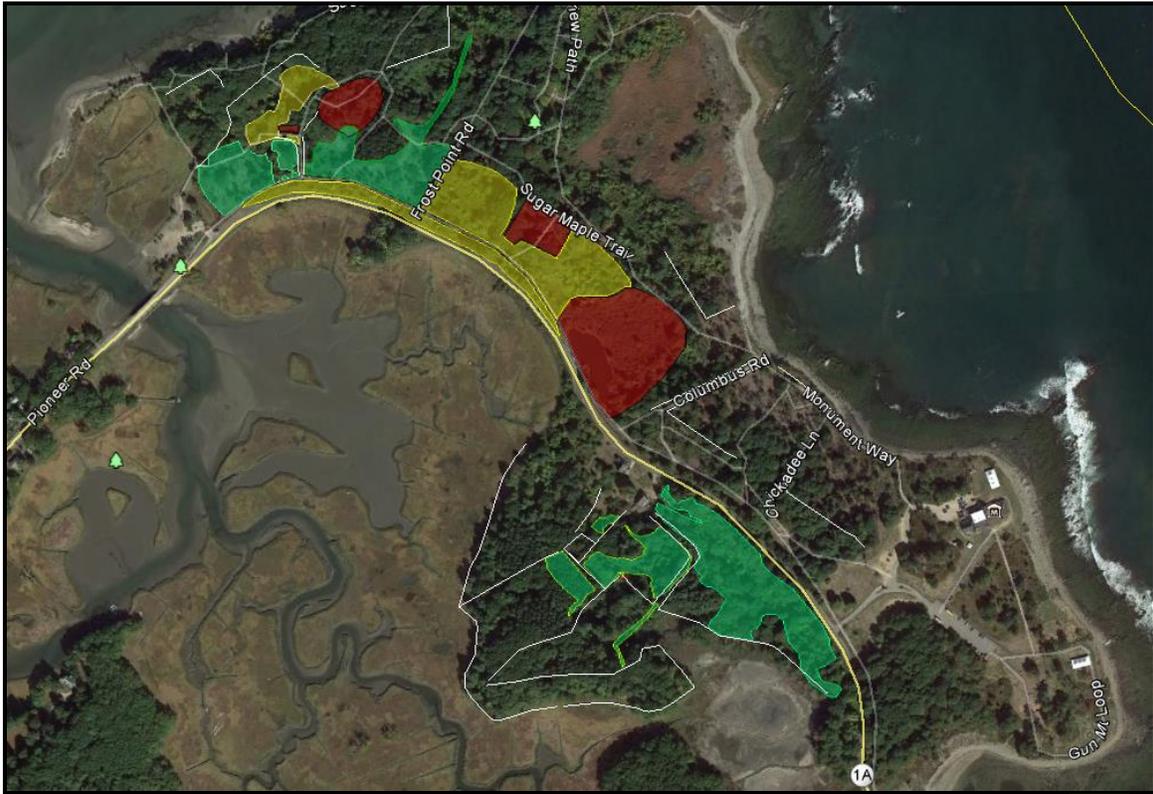
Odiorne-After mowing-June, 2016



Odiorne-Regeneration-August, 2016



Targeted herbicide applications to ensure native species, such as this Oak seedling survive



The image above shows the different management areas associated with this project at Odiorne SP. **Green** indicates invaded areas that have been mowed. **Yellow** highlights areas proposed for management. **Red** shows areas where mowing will not occur.

Additional mowing occurred in November on the opposite side of Route 1A where the maintenance facility is located. This effort achieved 7+ acres of invasive species management. This area was heavily populated with Glossy buckthorn, Oriental bittersweet and Multiflora rose. The image below shows the extent of the invasion.



Another round of mowing occurred in November on the opposite side of Route 1A where the maintenance facility is located. This effort achieved 7+ acres of mowing.

Conclusion

In all, 5.5 acres of Japanese knotweed invaded land, primarily roadway rights-of-Way, was treated. With regard to woody invasive plants, approximately 3,300 were treated on an estimated 4 acres of land.

The species targeted included Japanese knotweed, Oriental bittersweet, Multiflora rose, Glossy buckthorn, Autumn olive, honeysuckle, Japanese barberry, Burning bush, Norway maple, Black swallow-wort, and Poison ivy.

This project is continuing to make great strides in controlling invasive plants throughout the state especially with regards to diminishing populations of Japanese knotweed. Monitoring efforts also revealed that some of the older knotweed sites that were herbicided two years prior were exhibiting regeneration and required follow up treatments. It appears that just using Roundup Pro Concentrate exhibited lower levels (one to ten stems) of isolated regrowth whereas knotweed treated using the mixture of Roundup Pro Concentrate with Milestone exhibited much higher success rates and very limited regeneration. Overall, the estimated percent control of knotweed continues to remain in the 85-100% success range, with the higher rates linked to the inclusion of 0.05% Milestone.

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Pesticide Applicator's License (2016) # S-162200IN; (2017) #S-2127817N

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