Non-chemical control of *Viburnum plicatum* (Maryland, USA)

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Abstract

Chemical control of invasive plants is often more effective than non-chemical control. However, many practitioners find themselves in situations where they cannot use herbicides. The study presented here evaluated four methods tested at three times of the year to control the non-native shrub Japanese snowball (*Viburnum plicatum*). All methods (tarping, peeling, cutting low, and cutting high) reduced plant volume in the short term. Tarping cut stumps was the most effective technique and cutting in September was more effective than cutting in March or June.

Introduction

Invasive shrubs alter plant (Powell et al. 2013), bird (Ortega at al. 2014), and arthropod (Fickenscher et al. 2014) communities in forests. Removing invasive plants can restore ecological function (Heleno et al. 2010, Kaiser-Bunbury et al. 2017. Krivek 2017). Japanese snowball (*Viburnum plicatum* Thunb.) is a deciduous shrub in the Adoxaceae native to China and Japan (Dirr 1998). Like many landscape plants, *Viburnum plicatum* is of increasing concern as an invasive species (Loeb 2012). Although it has been planted in the United States since the mid-1800s (Dirr 1998) it is a relatively recent addition to the naturalized flora of the area around Washington DC (Steury 2011). It has been reported escaped at least once in Connecticut, the District of Columbia, Indiana, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, Pennsylvania, Virginia, and West Virginia (EDDMaps 2019).

Although chemical control methods are often the most effective and time efficient methods to control invasive plants, they are not always the method of choice. Some jurisdictions forbid the use of specific herbicides or all herbicides in some settings, managers may not have the tools or training, some staff and volunteers are not allowed to use herbicides, and some people choose not to use herbicides. In my study area (Montgomery County, MD) volunteers for the County Weed Warrior program are not allowed to use herbicide (Montgomery County 2015).

Non-chemical methods include mulching, mastication, pulling, and repeated cutting. Mulching (using organic material mulch, cardboard, or black plastic) is often used in designed landscapes and agricultural settings to target herbaceous species but is less often used to target woody species. However, cardboard or black plastic tarps over the cut stems of woody vines and trees for two years can result in the death of the target plants (personal observation). Masticating (mechanically damaging) cut stems or peeling bark may inhibit growth in some species; peeling the bark back on woody *Cytisus striatus* reduces resprouting (Alvarez 2000). Pulling out woody plant by hand or with the assistance of a lever arm (e.g., Weed Wrench, Pullerbear, Extractigator) or heavy machinery often results in the death of the target plant. Repeated removal of biomass by cutting can eventually lead to plant death (personal observation) and may have positive short-term benefits such as reducing seed set, enhancing the ability of adjacent native plants to compete with the invasive plant, and making access to adjacent plants easier.

All treatment techniques have drawbacks. Mulching is labor intensive, material intensive, and may kill non-target plants. Mastication is labor-intensive and may require specialized tools. Pulling is labor intensive and can produce significant soil disturbance. Repeated cutting is labor intensive and requires specific timed actions. In addition, when plants resprout it is hard to repeat the removal of the plant shoot because there are often many resprouts clustered closely together. Some practitioners cut woody plants well off the ground so that after the plants re-sprout there is original trunk available below the new sprouts that can be cut.

Even though plant phenology can be used to enhance control effectiveness (e.g., Frey et al. 2007), many control trials do not test treatments at multiple times of year (Kettening and Adams 2011).

Methods

Site description

Cabin John Local Park is managed by Montgomery County, Maryland. In the immediate area of the trial the floodplain forest overstory is dominated by tulip poplar (*Liriodendron tulipifera*) and beech (*Fagus grandiflora*) with some box elder (*Acer negundo*), white oak (*Quercus alba*), and sycamore (*Platanus occidentalis*). The midstory is dominated by the *Viburnum plicatum* that was the target of treatment and green ash (*Fraxinus pennsylvanicum*) with scattered *Acer negundo*, American hornbeam (*Carpinus caroliniana*), and spice bush (*Lindera benzoin*). The forest floor is dominated by winter creeper (*Euonymus fortunei*) with some seedling *Fraxinus pennsylvanicum* and scattered poison ivy (*Toxicodendron radicans*).

My study area was the focused of repeated volunteer events targeting removal of *Viburnum plicatum*. When possible, plants were pulled out by hand or with a lever arm. Plants with a basal diameter greater than roughly 7cm were usually too hard to remove. It is these larger plants that are the focus of this paper.

On September 9, 2017, March 10, 2018, and June 16, 2018 four (September) or five (March and June) *Viburnum plicatum* shrubs were assigned to each of four treatments. *Low cut* shrubs were cut to within 7.5cm of the ground, *tarped* plants were cut to within 7.5cm of the ground and then covered with a 60cm x 60cm black plastic tarp made up of two layers of 0.0762mm (3 mil) plastic, *peeled* shrubs were cut to within 7.5cm of the ground and had the bark scraped/peeled back, and *high cut* plants were cut at approximately 60cm above the ground. Tarps were secured with landscape staples as well as logs and rocks but the contact with the ground was not perfect so some light likely entered. On a few occasions some tarps and some flagging tape were removed by flooding and/or park visitors. Whenever possible they were replaced. No control was designated.

Plants were monitored September 7, 2018, March 9, 2019, and June 2, 2019. Monitoring consisted of collecting leaf volume estimates. I recorded the lengths of line segment X (the longest line segment crossing the plant parallel with the ground and including the stem) line segment Y (perpendicular to X and parallel with the ground) and line segment Z (perpendicular to both X and Y and perpendicular to the ground). After monitoring I removed all resprouts from plants that had been treated. On plants *high cut* 12 months earlier I also removed approximately 15cm of trunk. I could not re-locate all plants at all monitoring events. I estimated canopy volume by multiplying X, Y, and Z for each plant.

Results and Discussion

Tarping at any time of the year was the most effective *Viburnum plicatum* treatment (Table 1). Notably, only one plant appeared dead at any point during monitoring; a September cut tarped plant (data not shown). Tarped plants required periodic maintenance to replace damaged or missing tarps. In an area without flooding and without substantial human and dog activity tarp replacement would likely be less needed.

Cutting plants (either high or low) in September was more effective that cutting earlier in the year (Table 1). Overall, cutting plants low was more effective than cutting plants high (Table 1). However, there may still be benefits to the high cutting method. For example, if labor is mobilized to cut in earlier in the year it may be worth cutting the plants high and then returning in September to cut the stumps low.

Overall peeling did not appear to offer greater control than low cutting and took much longer to implement. However, peeling warrants more study. Peeling in June resulted in consistently reduced plant volumes and after one year peeled plants appear to be much reduced.

This trial testing only one species in only one site and had only a small number of replicates. Other species may behave differently.

Table 1 Plant volume estimates (liters and averages) by monitoring date for four treatments (high cut, low cut, peel, tarp) and three treatment dates (March, June, September). March volumes were lower than volume measurements from the previous fall because plants were only just beginning to expand beyond bud stage.

Monitor Date	Treatment Date	Treatment Method				
		High	**Low**	**Peel**	**Tarp**	Avg.
9/7/2018	**Mar**	207.5	133.6	80.5	4.1	106.4
	Jun	119.0	30.8	3.2	0.3	38.3
	Sept	470.4	106.1	262.7	8.5	211.9
	Avg.	265.6	90.2	115.5	4.3	
3/9/2019	**Mar**	179.2	29.1	15.4	0.8	56.1
	Jun	47.3	13.8	5.5	0.4	16.8
	Sept	14.4	6.9	0.4	0.3	5.5
	Avg.	80.3	16.6	7.1	0.5	
6/2/2019	**Mar**	105.5	229.9	360.1	0.0	173.9
	Jun	785.8	266.5	180.2	8.2	310.2
	Sept	69.9	23.7	0.0	0.2	23.4
	Avg.	320.4	173.4	180.1	2.8	
All dates	**Mar**	164.1	130.9	152.0	1.6	112.1
	Jun	317.4	103.7	63.0	3.0	121.8
	Sept	184.9	45.6	87.7	3.0	80.3
	Avg.	222.1	93.4	100.9	2.5	

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