

# Glossy Buckthorn (*Frangula alnus*) Management at Seney National Wildlife Refuge and Adjacent State Lands (2008)

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## Introduction

A species native to Eurasia, glossy buckthorn (*Frangula alnus*, hereafter GLBT) was introduced to North America in the late nineteenth century for horticultural purposes (Voss 1985). GLBT leaves are 0.5 – 2.8 inches long, alternate, simple, ovate and deeply veined. The tops of the leaves are light to dark green, with a slight gloss and a lighter green below; identification of GLBT is easiest in the fall because it retains green foliage longer than native plant species (Heidorn 1990). Flowering occurs from May to June, and the inflorescence consists of perfect five-petal, whitish-yellow flowers. Fruit begins to form in drupes in July and last through September (Barnes 1981). Initially, the berries are yellow-green, but ripen to red, then to black, as the season progresses.

The bark of GLBT ranges from reddish-green in younger plants to a darker grey-green in more mature plants. When cut, it can be differentiated from other shrubs and trees because of its distinctive yellow wood. The sap wood is a rich yellow color and the heartwood a pinkish-orange when first cut, fading with time (WI-DNR 2004). The entire shrub may grow as tall as 22 feet with many stems branching from the base. In older shrubs, base stems can be as large as 10 inches in diameter (Heidorn 1990). GLBT's rapid growth and ability to grow densely were characteristics first thought to make it ideal for use as hedgerows and for other landscaping purposes.

GLBT was first documented in Michigan in Delta County in 1934 (Voss 1985). Based on the age of previously cut stems, the arrival of GLBT at Seney National Wildlife Refuge may have occurred in the 1940's or 1950's, although a review of the historical records at the Refuge does not mention this species. A survey conducted by McNeil et al. (1999) indicated that GLBT was present and widespread in Unit 1 of the Refuge and on adjacent State of Michigan Department of Natural Resources (MDNR) lands (Figure 1 and 2). Further work has identified scattered areas of Unit 2 (especially A-2 and C-2 dikes) with this species as well.

Intensive management of GLBT aimed at reducing its extent and abundance at the Refuge began in the summer of 2001. Initial treatments included cutting GLBT and applying a 20% glyphosate mixture to the cut stumps. In the summer of 2002, Refuge staff began spraying GLBT with a glyphosate solution; during that same year, the scorching of seedlings with a propane torch was also utilized. In 2003, the Refuge and the MDNR began a cooperative effort to manage invasive plants, focusing on GLBT. Through this partnership,

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the State provides a prison crew and guard and the Refuge provides a licensed pesticide applicator, the glyphosate-based herbicide, and the associated equipment. The Refuge began another partnership with Michigan Technological University in 2004 to research the efficacy of different GLBT management treatments (Nagel et. al. 2008, Corace et al. 2008).

During the 2008 season, the focus of GLBT management at the Refuge was to follow-up treatment of areas previously treated on the Refuge and MDNR lands, and continue the search and treat untreated stands of GLBT. We also began a tartarian honeysuckle (*Lonicera tatarica*, hereafter TH) project studying the efficacy of different concentrations of glyphosate (brand name *Rodeo*).

## **Methods**

### **GLBT Management**

A major focus of management in 2008 was to revisit areas treated in previous years and treat GLBT resprouts with a 2.5% solution of *Rodeo*. Per the findings of recent Refuge research (Nagel et. al. 2008, Corace et al. 2008), 20% glyphosate stump treatments were not done in 2008. Instead, management employed the spraying of all stems (including resprouts) <1 inch in diameter with a 2.5% concentration of *Rodeo*. Detailed instructions on the *Rodeo* label were followed regarding preparation and application of the herbicide. Spraying devices included a hand pump and power sprayer attached to an all-terrain vehicle. When spraying occurred in areas with high public use, signs were placed at appropriate increments and left for at least 24 hours to notify the public that herbicide had been applied. Also, a contract was signed by the MDNR-funded prison crew members that allowed them to apply the 2.5% spray in the presence of the commercial pesticide applicator provided by the Refuge. The prison crew also used handsaws and chainsaws to cut any GLBT plants measuring >1 inch in diameter or >7 feet in height.

GLBT treatment areas were located throughout Unit 1 of the Refuge (Figure 1 and 2), with the first treatment area being the M-77 corridor. On MDNR lands in this area, GLBT resprouts from previous cuttings were sprayed for the first time both north and south of Holland Ditch. The second treatment area occurred on the dikes and along the roads of Unit 1. Applications of herbicide occurred around the Visitor Center, Headquarters, and Refuge houses. Herbicide was also applied along the Nature Trail, Wildlife Drive, Fishing Loop, the I-F Pool dike, the H Pool dike, the south D Pool dike, C-2 Pool dike, as well as both A and B Pool dikes. Stands of GLBT that had not been previously treated were also found within this area. The stands mainly occurred on brush humps in the middle of marshy wet areas. The prison crew was ferried by canoe out to these area and cut down these stands with chainsaws. There was, however, one stand of untreated GLBT that was found between the Refuge Entrance and North Entrance Roads in the woodland that runs along Refuge Entrance Road to the north. This stand was cut down as well using the same method. These cut areas were marked by a Global Positioning System (GPS) for follow-up treatment with herbicide next year.

The third treatment area was the Unit 1 Pool islands, which were surveyed in the 2007 field season for the presence of GLBT. The timing of the survey and the treatments were carefully considered to reduce potential impacts on nesting Common Loon (*Gavia immer*) pairs. These treatments were conducted by canoeing to the islands and spraying from both the canoe and the islands themselves. Coordinates were recorded to better show the extent of the treatment areas. The pool islands that were treated were on South Show Pool, F Pool and C-2 Pool. There was also some multiflora rose (*Rosa multiflora*) and TH that was also sprayed.

### **Herbicide Concentration Study**

Invasive species management is a high priority for many government and any non-profit agencies with ecological mandates. On Seney National Wildlife Refuge, GLBT has been intensively managed and researched for the last seven years. However, GLBT management should not preclude management of the other invasive plant species present, including TH, reed canary grass (*Phalaris arundinacea*), and spotted knapweed (*Centurea maculosa*). Consequently, during the 2008 field season we began an efficacy study modeled after the efficacy study of Corace et al. (2008). The focus of the study was to determine at what minimum concentration lethality is observed in TH.

The study area was located around the Office and the Visitor Center, since the majority of the TH was found to be more prevalent in these areas. We randomly selected 20 individual plants in order to have a homogenous plant group for treatment. Each plant was flagged, had coordinates taken (dd, NAD27), and was measured for maximum diameter and height. We measured the effectiveness of four different concentrations of *Rodeo*, 0% (control), 2.5%, 5%, and 10% solution. All solutions were diluted with tap water according to the label and mixed with a blue dye to help highlight sprayed areas. Each solution was applied to five different plants that were systematically selected. The *Rodeo* solution was applied with a low-volume hand-held sprayer to at least 50% of the leaves, but was not sprayed to the point of dripping off. After *Rodeo* application, the plants were monitored for seven times in five weeks. At each visit, each stem of the plant was categorized as having no effect, chlorosis of the leaf, brown and shriveled leaves, or no leaves. Each stem was considered dead when at least 90% of the leaves had fallen off the stem.

## **Results**

### **GLBT Management**

The 2008 GLBT management season began on 2 June 2008 and ended on 25 September 2008. A total of 43 days were spent directly managing GLBT (Table 1); 17 days (or 40% of the total) were spent working with the prison crew, with an average crew size of 6 men. A total of 104,088 ounces (813 gal) of a 2.5% *Rodeo* solution was sprayed on GLBT and other invasive plants, equating to nearly 41 gallons of *Rodeo* (53.8% active

ingredient) being applied. On average, nearly 2,263 ounces (18 gallons) of 2.5% *Rodeo* were sprayed each working day.

The largest and most dense stands of GLBT were encountered on the north and south side of Holland Creek on MDNR property. The GLBT on the Refuge was generally smaller and more sporadic. However, well established stands were encountered between Refuge Entrance Rd. and North Entrance Rd, along the Nature Trail, on shrub humps north of the weather station, and on the backside and islands of most pools in Unit 1. Sporadic stands of established GLBT were also encountered in areas along the Wildlife Drive and the Fishing Loop.

### **Herbicide Concentration Study**

Approximately seven days after the *Rodeo* application, the 2.5%, 5%, and 10% solutions produced on average 53%, 47%, and 53% stem mortality on TH. On the second visitation the results were increasingly better, with an average of 78.9% mortality for the 2.5%, 71.6% for the 5%, and 86% for the 10% solution. The 5% and 10% solutions seemingly killed all the TH plants by the 4<sup>th</sup> visitation, while the 2.5% solution only killed 95% of the plants. These results remained steady until the last visitation (Figure 3). No effects to the treated TH were observed with the control treatment.

### **Discussion**

During the 2009 GLBT management season it is recommended that all of the islands with GLBT in Unit 1 be treated. The majority of these islands can be treated via spraying a 2.5% *Rodeo* solution. However, some of the islands may require cutting. As in previous years, it is also recommended that the 2009 crew follow-up with a spray of 2.5% concentration of glyphosate solution in areas that were previously treated to account for any resprouts. Work with the prison crew should focus on areas not previously treated or in areas where regeneration exceeds the limits of what can be sprayed by one person. Finally, some thought should be put into dividing areas of confirmed GLBT into separate compartments that can be treated on rotation. This would simplify planning of treatment areas and promote regular revisits to areas of GLBT regeneration. Spraying resprouts and other small GLBT plants at the Refuge and on MDNR lands needs to be the priority in 2009.

### **Bulleted List of 2009 Priorities**

- Spray previously treated areas with a 2.5% *Rodeo* solution.
- Revisit 2006-2008 locations on Refuge that had been treated, but do not worry too much about spraying off of roads of the Wildlife Drive and Fishing Loop. Need to get to “backsides” of pools via walking or Marshmaster. Prioritize tough-to-reach areas between Refuge Entrance Rd. and North Entrance Rd, Unit 1 Pool islands, and some pine islands surrounded by marsh in Sec. 8,9,16,21 T45N R13W.
- Start on north end of Refuge along M-77 with Marshmaster and work south along ditch.

- Expand spraying on MDNR land. Revisit areas sprayed in 2008, then start from the north end of M-77 and work south.
- Treat Unit 1 islands that were identified in 2007, work from south to north.
- Treat patches of GLBT along M-77 south of Entrance Rd. under powerline, use Marshmaster.
- Cut large areas of brush with hydromower or similar equipment along M-77.

## Literature Cited

Barnes, B. V. and W. H. Wagner. 1981 Michigan Trees. University of Michigan Press:Ann Arbor, MI.

Corace, R.G. III, K.P. Leister, and E. Brosnan. 2008 Efficacy of different glyphosate concentrations in managing glossy buckthorn (*Frangula alnus*) resprouts at Seney National Wildlife Refuge, Upper Michigan. *Ecological Restoration*. 26(2):111-113.

Heidorn, R. 1990. Vegetation management guideline: exotic buckthorns.

<http://www.inhs.uiuc.edu/chf/outreach/VMG/Buckthorn.html>.

McNeil, R., S. Petrella., and N. Shutt. 1999. A survey of invasive exotic plants in Seney National Wildlife Refuge. Project Report, Seney National Wildlife Refuge.

Nagel, L.M., R.G. Corace, III, and A. Storer. 2008 An experimental approach to testing the efficacy of management treatments for glossy buckthorn (*Frangula alnus*) at Seney National Wildlife Refuge, Upper Michigan. *Ecological Restoration*. 26(2):136-142.

Voss, E.G. 1985. Michigan Flora. (Michigan) Part II. Dicots. Kingsport Press: Bloomfield Hills, MI.

Wisconsin Department of Natural Resources (WI-DNR). 2004.

<http://www.dnr.state.wi.us/org/land/er/invasive/factsheets/buckthorns.htm>.

Table 1. Summary of glyphosate use at Seney National Wildlife Refuge during 2008. Only 2.5% active ingredient glyphosate (*Rodeo*) was used.

Date	Amount (oz.)	NAD83		Legal Location	General Location	Prison Crew Size
		Lat (N)	Long (W)			
6/2/2008	2432			Sec. 5, T45N R13W Sec. 9, T45N R13W Sec.10, T45N R13W	Sprayed from Seney sign south to beginning of N. Show Pool, west of M-77.	0
6/3/2008	1664			Sec. 10, T45N R13W Sec. 16, T45N R13W Sec. 21, T45N R13W	Sprayed from north end of N. Show Pool south to beginning of Refuge Entrance Rd., west of M-77.	0
6/5/2008	768			Sec. 16, T45N R13W Sec. 21, T45N R13W Sec. 28, T45N R13W	Sprayed from Refuge Entrance Rd. to Marshland Drive on west side of M-77. Then from Refuge Entrance to offices.	0
6/16/2008	1152	46°17.19"	85°56.54"		Sprayed around office area.	0
6/18/2008	512			Sec. 16, T45N R13W	Sprayed down Nature Trail from VC east until it turns north or south, both sides.	0
6/19/2008	3072			Sec. 9, T45N R13W	Sprayed from wood bridgewest of M-77 to the second pine ridge north of N. Show Pool, east of ditch approx-60 yards.	5
6/20/2008	1856	46°17.15"	85°56.37"		Sprayed around entire area of pool east of Visitor Center.	0
6/23/2008	896	46°17.15"	85°56.30"		Island in the middle of pool east of VC and around Shop.	0
6/26/2008	768			Sec. 16, T45N R13W Sec. 17, T45N R13W	Sprayed low spot south of Stone Building and the Nature Trail at the Office.	0

Table 1 cont.

Date	Amount (oz.)	NAD83		Legal Location	General Location	Prison Crew Size
		Lat (N)	Long (W)			
6/27/2008	1792	46°17.25"	85°57.00"		Sprayed road by Greg's house until loon sign and Nature Trail	0
6/30/2008	3776			Sec. 16, T45N R13W	Continued spraying from 06/19/08 south to pine stand north of N. Show Pool. Also around Nate's house.	5
7/1/2008	4160	46°17.45"	85°56.12"	Sec. 16, T45N R13W	Sprayed from pine stand north of N. Show Pool south to cut grass on dike. Cut stand of GLBT(coordinates)	6
7/7/2008	128				Sprayed test plots for efficacy of T. Honeysuckle	0
	128					
	64					
7/8/2008	768			Sec. 16, T45N R13W	Islands in S. Show Pool	0
7/9/2008	1664	46°17.09"	85°55.47"		North side of Holland Creek on MDNR land	0
7/14/2008	896	46°17.15"	85°56.45"		Sprayed west side of Wildlife Drive for approx. 100 yards.	0
7/17/2008	576			Sec. 17, T45N R13W	Sprayed from loon sign on I-F Pool dike until beginning of pines.	0
7/23/2008	192			Sec. 27, T45N R14W Sec. 26, T45N R14W Sec. 25, T45N R14W Sec. 30, T45N R13W Sec. 31, T45N R13W Sec. 32, T45N R13W	Sprayed both side of C-2, west D, west B and A Pool dikes.	0

Table 1 cont.

Date	Amount (oz.)	NAD83		Legal Location	General Location	Prison Crew Size
		Lat (N)	Long (W)			
7/24/2008	1472			Sec. 27, T45N R14W Sec. 26, T45N R14W Sec. 25, T45N R14W Sec. 30, T45N R13W Sec. 31, T45N R13W Sec. 32, T45N R13W Sec. 22, T45N R13W	Sprayed C-2 Pool islands, continued on MDNR land north of Holland Ditch, D Pool dike and dikes in lower Unit 1.	0
7/28/2008	11584			Sec. 22, T45N R13W Sec. 17, T45N R13W	Continued spraying on MDNR land on south side of Holland Ditch and down I-F Pool dike.	5
7/29/2008	3584			Sec. 16, T45N R13W Sec. 22, T45N R13W	Sprayed pine islands north of N. Show Pool and continued on MDNR land on north side of Holland Ditch.	6
7/30/2008	1408	46°16.56"	85°55.44"		Sprayed and cut between Refuge Entrance and North Entrance Road (Coordinates given). Also sprayed C-2 Pool islands and wildlife drive.	6
7/31/2008	320	46°16.56"	85°55.44"	Sec. 27, T45N R14W Sec. 26, T45N R14W Sec. 17, T45N R13W	Sprayed C-2 Pool islands, and continued down I-F Pool dike. Also continued cutting between Refuge Entrance and N. Entrance Road.	6
8/1/2008	960	46°17.20"	85°57.12"		Cut GLBT	
		46°17.19"	85°57.03"	Sec. 17, T45N R13W	(coordinates). Also	6
		46°17.20"	85°57.05"	Sec. 20, T45N R13W	sprayed brush islands	
		46°17.13"	85°57.13"		in F Pool.	



Table 1 cont.

Date	Amount (oz.)	NAD83		Legal Location	General Location	Prison Crew Size
		Lat (N)	Long (W)			
8/7/2008	6784	46°17.23"	85°56.51"	Sec. 21, T45N R13W	Sprayed already treated areas and cut stands between N. Entrance and Refuge Entrance Roads.	7
8/11/2008	11008			Sec. 21, T45N R13W Sec. 16, T45N R13W	Sprayed already treated areas between N. Entrance and Refuge Entrance Roads and South Show Pool west dike.	6
8/12/2008	896			Sec. 16, T45N R13W Sec. 17, T45N R13W Sec. 21, T45N R13W Sec. 28, T45N R13W	Sprayed Nature Trail across from Greg's house, I-F Pool until Fishing Loop. Also end of wildlife drive to Grey's Creek Pool.	0
8/14/2008	2496	46°17.10"	85°55.58"	Sec. 16, T45N R13W Sec. 18, T45N R13W Sec. 19, T45N R13W	Sprayed part of S. Show Pool by Wigwam and cut brush hump west of west dike. Also sprayed one side of Fishing Loop.	6
8/15/2008	1920	46°17.11"	85°56.00"	Sec. 16, T45N R13W Sec. 21, T45N R13W	Sprayed west dike of S. Show Pool and cut brush hump west of dike.	7
8/18/08	8960	46°17.30"	85°56.14"		Sprayed west dike if S. Show Pool North to bridge then crossed and went south down brush hump west of dike. Also sprayed other side of Fishing Loop.	7
8/19/08	6912	46°17.39"	85°56.43"		Sprayed nature trail from Do Not Enter sign to end of boardwalk.	6

Table 1 cont.

Date	Amount (oz.)	NAD83		Legal Location	General Location	Prison Crew Size
		Lat (N)	Long (W)			
8/20/08	0	46°16.37"	85°59.06"		Cut area off Fishing Loop and needs to be treated next year.	6
8/25/08	4864	46°17.28", 46°17.70"	58°57.19", 58°69.92"		East end of F Pool, east I Pool dike past Nature Trail.	8
8/25/08	768				From Nature Trail to North Show Pool via old trail. Only ½ done.	0
8/27/08	6400				MDNR land on north side of Holland Ditch.	5
9/3/08	1240				Start Fishing Loop to J Pool.	0
9/4/08	384				M-77 from Entrance Rd. south	0
9/16/08	512				M-77 from Entrance Rd. south	0
9/16/08	640				Wildlife Drive from VC to Fishing Loop (1 side of road)	0
9/17/08	512				Second side of Road of Wildlife Drive to Fishing Loop; Wildlife Drive (both sides of road) to E-C Spillway	0
9/18/08	128				Road to Gray's Creek Pool from Wildlife Drive and Wildlife Drive from this point to Swan Observation Deck	0

Table 1 cont.

Date	Amount (oz.)	NAD83		Legal Location	General Location	Prison Crew Size
		Lat (N)	Long (W)			
9/23/08	512				Finished Wildlife Drive.	0
9/25/08	1,280				Entrance Rd. out to M77, then south past Wildlife Drive.	0

Figure 1. General invasive plant treatment area at Seney National Wildlife Refuge indicated by the red polygon.

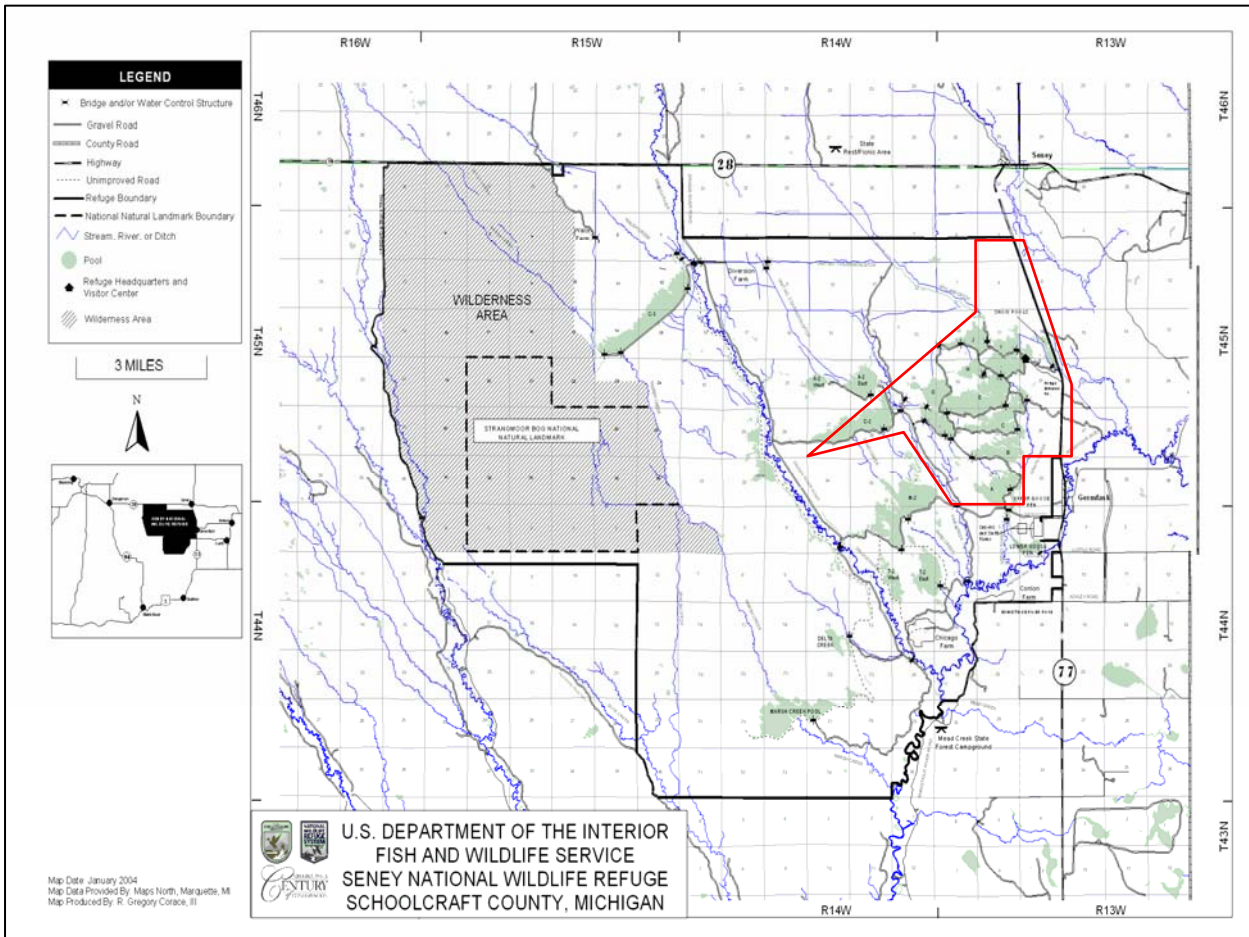


Figure 2. Approximate locations of main glossy buckthorn treatments areas in Unit 1 of Seney National Wildlife Refuge and adjacent Michigan Department of Natural Resources lands (2008). Different colors indicate different treatments: **red** = newly cut material in 2008, **blue** = previously cut material that was sprayed in 2008. All areas should be revisited in 2009, with high-priority areas in **green**.

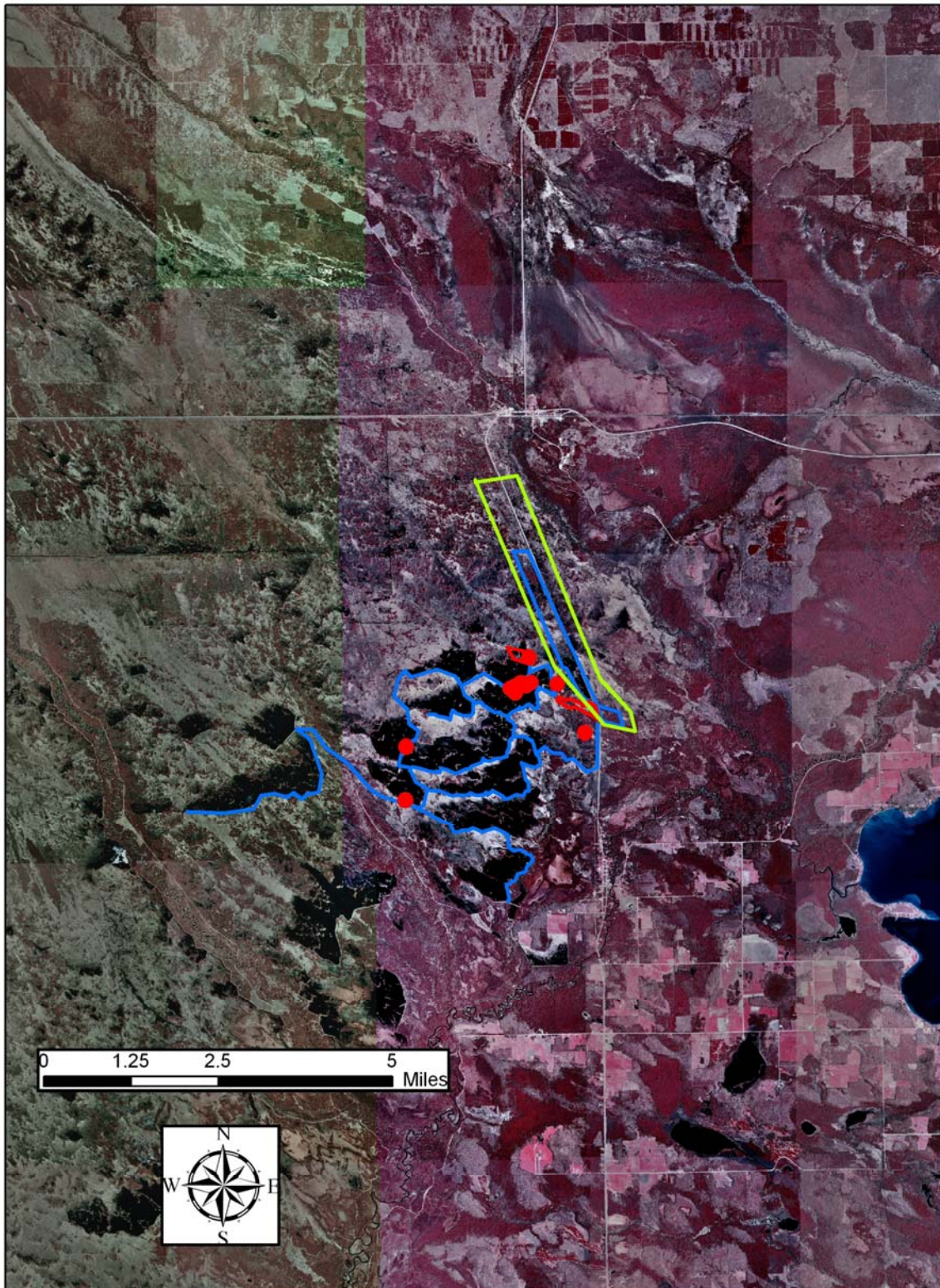


Figure 3. Average percent dead tartarian honeysuckle stems for four concentrations of glyphosate (% active ingredient *Rodeo*) over a five-week monitoring period in 2008. No dead stems were observed in the 0% control plots.

