Control methods and management considerations

of Bell's Honeysuckle (*Lonicera x bella*)

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Abstract

Lonicera x bella, or Bell's Honeysuckle, has been commonly used an ornamental plant in for the last century. *L. bella*, however, is a plant of disturbance that invades natural environments and replaces the desirable vegetation found here. Its resilience and adaptability make it a difficult species to control. This study examines various experimental methods, including use of different herbicides and techniques, to determine what the best solution is for controlling or eradicating *L. bella.* An overview of the issues faced by land managers is also discussed.

Key Words: Non-indigenous species, biological invasions, disturbance, invisibility, exotic species, management considerations.

Introduction

Bell's Honeysuckle (*Lonicera x bella*) is a hybrid of *L. morrowii* and *L. tatarica* which originated in two different regions of Asia. *L. morrowii* is native to Japan and was introduced in North America ca. 1875 (Rehder 1940). *L. tatarica* is native to western and central Russia (Barnes 1974) and was introduced to the United States as early as 1752 (Rehder 1940), has become widely naturalized from Alberta, Canada to the Carolinas and can be found in many states including Wisconsin and Michigan. While *L. x bella* occupies a wide range of sites including lacustrine and riparian habitats, it is most often found on forest edges and in forest interiors (Barnes 1974; Woods 1993).

Lonicera x bella has intermediate characteristics of the *L. morrowii* and *L. tatarica*. Height of *L. x bella* range up to 6 m, leaves are oblong to oval and slightly hairy beneath, flowers are pink to fading yellow on sparsely hairy peduncles 5-15mm long with red or occasionally yellow fruits (Gleason and

Cronquist 1991). Annually, *Lonicera* spp. produce large numbers of viable seeds that are readily dispersed by birds and deer, and germinate in a wide range of conditions (Batcher and Stiles 2000).

Lonicera x bella is a plant of disturbance, which has tremendous amplitude and tolerance for temperature, soil moisture, soil type, and light (Barnes and Cottam 1974). *Lonicera* spp. are widely considered an aggressive, highly successful weedy complex and are extremely adaptable (Barnes 1974, Woods 1993). Forest regeneration following disturbance can be severely impeded by bush honeysuckles, as surveys conducted in Ohio forests have indicated tree seedling density, tree seedling species richness, and herb cover were all inversely related to *Lonicera* spp. and tree regeneration appeared to have been inhibited (Hutchinson 1997). Similarly, in a New England study, *Lonicera* spp. reduced richness and cover of herb communities, reduced establishment of new seedlings, and suppressed annual herbs entirely (Woods 1993).

As *Lonicera* spp. have a high degree of reproductive rigor, a wide range of adaptability, and few pests or predators in North America, controlling *Lonicera* spp. can be difficult and laborious (Batcher and Stiles 2000). Mechanical and chemical methods of control are used with varying degrees of success and there are no known biological controls of *Lonicera* spp.

Mechanical controls include grubbing or pulling seedlings and mature shrubs, as well as repeatedly clipping shrubs. Batcher and Stiles (2002) indicate grubbing or pulling by hand is appropriate for small populations or where herbicides cannot be used, but this method requires a commitment to cut or pull plants at least once a year for a period of three to five years. However, the Tennessee Exotic Pest Plant Council (1997) states that any portions of the root system not removed can resprout.

Batcher and Stiles (2002) conclude that in some conditions treatment with herbicides is necessary to control *Lonicera* spp. Formulations of glyphosate and triclopyr or imazapyr have been used to varying degrees of success, as well as formulations of triclopyr and fluroxypyr, dicamba, or metsulfuron. Herbicides that contain metsulfuron and fosamine have also been used to some degree of success.

This project was designed to determine the relative effectiveness of mechanical controls by manually cutting and pulling *L. x bella* from invaded areas, two over-the-counter, commercially-available herbicides (Roundup Pro and Roundup Poison Ivy & Tough Brush Killer) and a restricted-use herbicide (Rodeo) to determine which glyphosate-based herbicide is most effective in controlling this invasive honeysuckle, *L. x bella*

Hypotheses

Hypothesis 1: Mechanical control methods will be ineffective in the removal or eradication of *L. x bella* if used as the sole means of control due to the rigorous nature of the honeysuckle. Control methods will be useful as a pre- or post-treatment in conjunction with herbicide application.

Hypothesis 2: If used solely as a chemical control method (basal bark or stem-injection application) an over-the-counter, commercially-available herbicide will be the least effective in the control and eradication of *L. x bella* due to its low concentration of glyphosate isopropylamine salt. However, application of the herbicide before development of the fruits will be an effective means of preventing further propagation of the species, as this herbicide will impede fruit development.

Hypothesis 3: Restricted-use chemicals such as Rodeo, which has an active ingredient of 53.8% gylphosate isopropylamine salt, will be the most effective means of control and eradication of honeysuckle, but only when used in conjunction with mechanical controls such as cutting.

Methods

Experimental groups were designed to test different control procedures, including: (1) using a mechanical control method consisting of simply cutting down *L. x bella*; (2) basal application of Roundup Pro (per label directions painting the circumference of basal stems with the product mixed with mineral oil); (3) stem-injection using Roundup Poison Ivy and Tough Brush Killer; (4) stem-injection using Rodeo herbicide (stem-injection involved making downward incision cuts spaced around the tree and squirting herbicide into the "wounds"; it was important to leave part of the cambium in tact so the herbicide was spread throughout the bush quickly); and (5) cut and paint method using Rodeo herbicide (cutting the bush and applying the herbicide to the phloem of the cut stem).

For this experiment, 25 plots were used: five (5) repetitions of each experimental method were conducted. Each plot was assigned an experimental method in a random sequence. To account for variations in soil composition, moisture, light, temperature and other uncontrollable factors, 5 subplots with a radius of 15cm were randomly selected within each, of the 25 larger experimental plots. Five control plots were also used as a reference site maintained to measure relative success of the various control methods.

For the mechanical and cut-paint experimental methods of control, an inventory of live stems or sprouts was determined immediately pre- and post-treatment. Similarly, the percentage of light coming through the bush canopy pre- and post-treatment was also determined using a densitometer. Continual monitoring occurred over a period of 6 weeks to measure recovery and determine the effectiveness of each method.

Results

Of the five experimental methods used, the degree of success of each experimental method vastly differed. It was readily evident that the most effective treatment was the cut and paint method using a restricted-use chemical (Rodeo) that had an active ingredient of 53.8% gylphosate isopropylamine salt. This was followed by: (1) the stem injection treatment with Rodeo; (2) stem injection with Round-Up Poison Ivy and Brush Killer which has an active ingredient of 18.0% gylphosate isopropylamine salt and 2.0% triclopyr triethylamine salt; and (3) basal application using Roundup Pro which has an active ingredient of 41% glyphosate isopropylamine salt. Mechanical control alone was the least effective control method. To verify this information, a comparison was made between the effectiveness of the various experimental methods were made.

To determine differences between each experimental method, an inventory of live stems was recorded upon treatment of the plant, as well as an inventory of stem or sprout re-growth in the weeks to follow. It was noted that no re-growth of stems or sprouts occurred on the shrubs that had been treated with herbicide. However, significant growth was recorded on the shrubs where the mechanical removal had occurred. A Chi-square test was used to establish the effectiveness of each treatment before and after it was used, finding significant differences (see fig. 1).

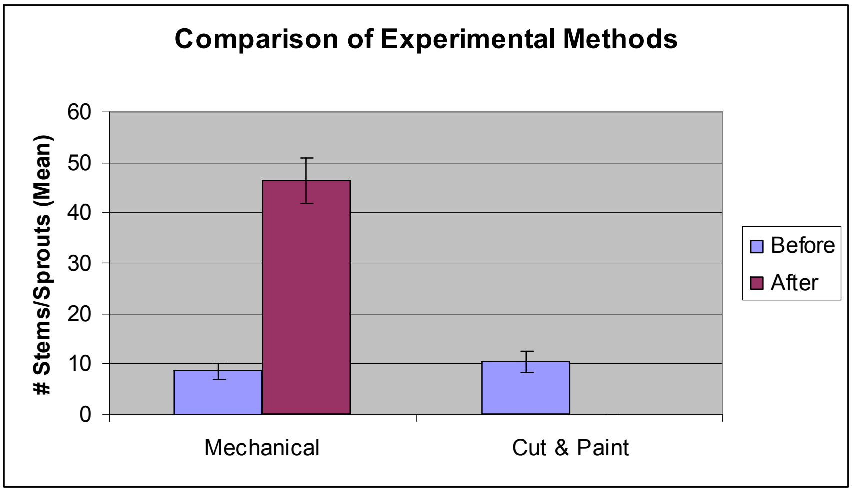

Figure 1. This chart demonstrates the effectiveness of the each experimental method before and after the treatment was applied (Chi squared equals 24.712 with 1 degree of freedom & p<0.0001), which indicates that an extremely statistically significant relationship.

Similarly, observation of the canopy cover (or lack of) in the *L. x bella* was monitored and recorded to determine the relative effectiveness of the chemical treatments (Roundup Pro, Roundup Poison Ivy & Brush Killer, and Rodeo). To determine their effectiveness, each treatment was compared individually against the non-treated, control plots. It was observed that little change in canopy cover occurred in the basal application of the Roundup Pro herbicide (Chi-square, p=0.2475). However, stem injection methods proved to be more effective than simply apply herbicide on the bark of the tree. In addition, it was noted that Rodeo (Chi-square, p<0.0001) was more effective in killing *L. bella* than Roundup Poison Ivy and Brush Killer (Chi-square, p=0.0106). In most cases, Rodeo was 95-100% effective, while Roundup Poison Ivy and Brush Killer was only 33-66% effective (see figure 2).

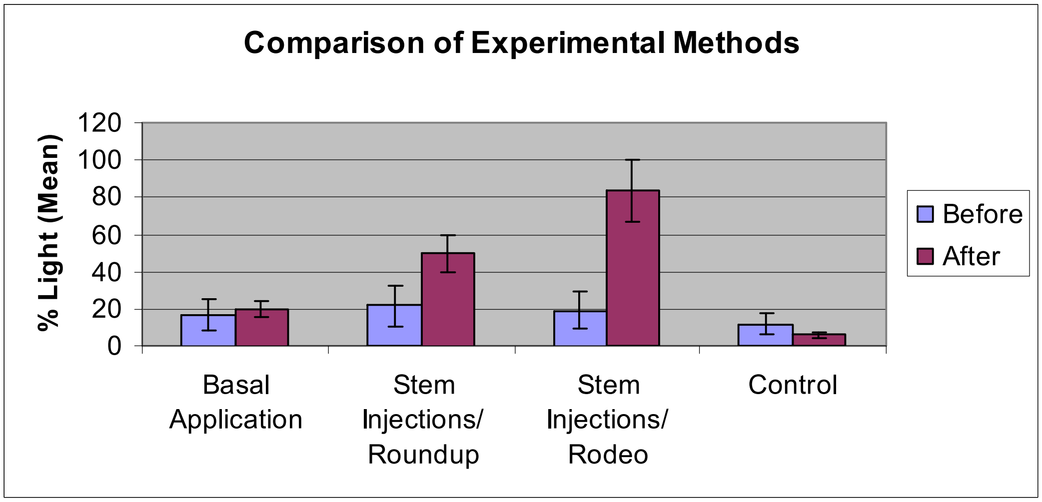

Figure 2. This chart shows the difference and effective between each treatment before and after it was used. A paired t-test was used to differentiate between the beginning and end results. The stem injection with Roundup Poison Ivy & Brush Killer (p=0.007) and the stem injection with Rodeo (p=0.002) were both statistically significant. The basal application was statistically insignificant (P=0.241).

To verify these results, an ANOVA was performed to determine which experimental method was most successful (see results: figure 3).

Discussion

These results verify that: (1) mechanical control methods are ineffective tools in control of the invasive Bell's Honeysuckle, but can be an effective tool for control of invasive Honeysuckle when used in conjunction with an herbicide such as Rodeo; (2) over-the-counter, commercially available herbicides are ineffective in the eradication or control of invasive Honeysuckle, as the much of the plant remains alive even after treatment; and (3) restricted-use herbicides, such as Rodeo, are the most effective means of Honeysuckle eradication and control because of its higher concentration of gylphosate isopropylamine salt.

As indicated by Barnes (1974) and Woods (1993), *Lonicera x bella* is an aggressive, highly successful invasive that is extremely adaptable. These characteristics were readily evident in the sample used in this study; particularly it's resistance to herbicidal application and mechanical control. While mainly found along roadsides, streams, and in open areas, the adaptability of this shrub was obvious as *L. bella* was also found growing in various habitats including riparian, lowland, and terrestrial environments indicating that *L. bella* can adapt to variances in soil, moisture, and even possible temperature gradients. However, Luken and Goessling (1995) found in a study conducted in Northern Kentucky, that *Lonicera* spp. was not as conducive to seedling establishment in forest interiors as it was along roadsides and other open areas or edges, which explains the absence of *L. bella* in forest interiors.

Exotic invasive species, including *Lonicera x bella*, have become increasingly significant management problems in natural areas as they have come to be recognized as one of the most serious ongoing causes of species declines and native habitat degradation (D'Antonio and Meyerson 2002, Vitousek et al. 1997, Wilcove et al. 1998). For natural resource managers, invasives are an ongoing threat to the persistence of native assemblages because they can consume native species, infect them with diseases to which they have no resistance, outcompete them, or alter ecosystem functions, making it difficult to and expensive to return the ecosystem to its prior, often more desirable condition (Vitousek et al. 1997). Thus, it is important to assess the extent of the invasion and to determine the objectives of invasive control.

To determine this, it is important to understand the means of dispersal, the succession or life-cycle cycle of the invasive, and the immediate effects on the environment that the exotic invades. As discussed previously, it is known that *Lonicera* spp. produce large numbers of viable seeds that are readily dispersed by birds and deer, and that these seeds germinate in a wide range of conditions (Batcher and Stiles 2000). Thus, if large populations of deer are present, a land manager must also consider managing the deer population as well. This may present additional problems due to the cost, ethics, and public perception of doing so.

Likewise, it is important to determine the effects of the exotic on the ecosystem which it invades. Whisenant (1990) indicates that some species are short-lived and successional to native species; thus if anticipated, little money needs to be spent on their removal. Conversely, Whisenant suggests that many exotic species, such as *Lonicera* spp., are long-lived plants or persistent annuals that set up feedbacks that perpetuate their own persistence. Their invasion represents a long-term alteration in the succession trajectory of a site. Cronk and

Fuller (1995) imply that many species defy simple life history classification because they are both good colonizers after disturbance and persistent community members. Thus, their control should be a top management priority.

If it is determined that the long-term effects of this invasive will negatively affect the ecosystem it invades, the land manager must consider the most appropriate action. Based on the results presented herein, a probable effective means of control is utilizing the cut and paint method. This, however, would require extensive manpower depending on the extent of the invasion and may be expensive due to the cost of an effective herbicide and labor. Furthermore, the land manager must also consider the vectors of seed dispersal, particularly deer. Considering that often large deer populations exist where L. bella is found, alternatives – such as deer exclosures – may be needed to prevent the propagation of the invasive. This, however, would be a considerable cost if large tracks of land are involved. Lastly, alternative methods of control should be explored including prescribed burns, grubbing followed by a restoration project, direct foliar sprays, or a progressive wildlife management plan.

For the land manager, no simple solution exists for determining the best course of action to take. To make a more informed decision, long-term monitoring and additional research is needed. Ideally, early identification and removal programs are the most effective means to managing the problem of invasives.

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Figures

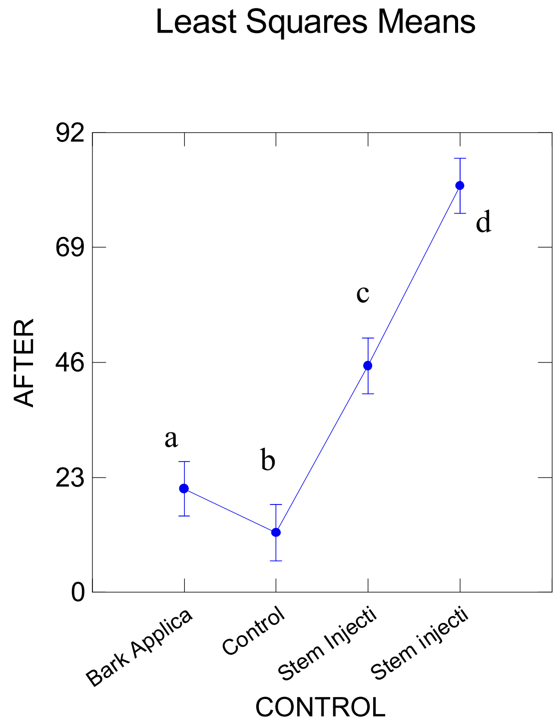

Figure 3: A chart that exhibits the results (as a percentage) after an experimental method has been applied. Note that **a** (Roundup Pro) does not appear to be an effective means of control Whereas, **c** (Roundup Poison Ivy) and **d** (Rodeo) appear to be more effective – particularly experimental method d. P=0.00001

TUKEY TEST

	(1) Roundup Pro	**(2) Roundup Poison Ivy**	**(3) Rodeo**	**(4) Control**
1	No (p=1.0000)			
2	No (p=0.6810)	No (p=1.0000)		
3	Yes (p<0.0030)	Yes (p<0.0434)	No (p=1.0000)	
4	Yes (p<0.0001)	Yes (p<0.0001)	Yes (p<0.0016)	No (p=1.000)

Results: Probabilities between the various control methods showing a significant relationship between: (a) 1 & 3; (b) 1 & 4; (c) 2 & 3; (d) 2 & 4; and (e) 3 & 4.