
Alien Plant Species in Eastern Wisconsin Natural Areas: An Update

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Abstract

An expanded study of non-native plant species in eastern Wisconsin Natural Areas resulted in a total of 64 exotics being found. The most abundant were *Rhamnus cathartica*, *Taraxacum officinale*, and *Berberis thunbergii*. Sites suffering the greatest degrees of invasion were the oak openings, while the more mesic areas appeared relatively resistant.

Introduction

Recently, as one of the results of the Wisconsin Department of Natural Resources' program to acquire baseline data on state Natural Areas, I reported on the occurrences of non-native vascular plant species in eight of those sites (Leitner 1988). These areas represented predominantly wooded tracts, ranging in habitat from one lowland forest to mesic and dry-mesic upland stands. The most widespread and abundant exotic species was the European buckthorn (*Rhamnus cathartica*), followed by barberry (*Berberis thunbergii*) and highbush cranberry (*Viburnum opulus*). The most heavily invaded sites were the dry-mesic forests.

However, the inventory dates of that study covered only the summer and fall seasons. To remedy this, I re-sampled the sites the following spring to account for the early-season flora. In addition, I surveyed five other Natural Areas in southeastern Wisconsin (Table 1), using the same sampling procedures as before (see Leitner 1988). One of the new sites (Kurtz Woods) is dry-mesic. However, three areas (Eagle, Blue Springs, and Genesee) are oak openings with associated dry-mesic prairie flora, thus representing the xeric end of the continuum of upland, southern Wisconsin plant communities (Curtis 1959). As before, voucher specimens were deposited in the herbaria of the University of Wisconsin-Madison and the Milwaukee Public Museum; data compiled are on file with the DNR, Bureau of Endangered Resources in Madison.

Results

Thirty-six additional alien species were encountered, bringing the total to 64 (Table 2). Maintaining its position as the most frequent and abundant species was *Rhamnus cathartica*, now found in 12 of the 13 sites, followed by *Taraxacum officinale* (10 sites) and *Berberis thunbergii* (9 sites). Of 178 species-site occurrences, only two (*Rhamnus cathartica* in Bluff Creek Woods and *Polygonum persicaria* in wet areas at Muskego) were classified as "abundant," while 53 were "common," 94 were "occasional," and 29 were "rare" (Table 3).

Table 1. Locations and descriptions of the five additional State Natural Areas. CI refers to the Continuum Index of Curtis (1959).

Natural Area Number	Site Description
66	<p>Eagle Oak Opening Waukesha Co. T5N R17E S30. 22 ha. Abrupt morainal/kettle hole topography; contains small patches of remnant dry prairie, ephemeral ponds, closed canopy oak woods, and formerly open bur oak savanna, now with a heavy understory of saplings and shrubs. Dominant trees are <i>Quercus macrocarpa</i>, <i>Juniperus virginiana</i>, and <i>Ulmus americana</i>. CI = 854.</p>
153	<p>Genesee Oak Opening Waukesha Co. T6N R18E W1/2 SW1/4 NE1/4 S28. 6 ha. Bur oak opening and dry—mesic prairie on a hill surrounded by more closed xeric oak forest. Remains of a house and planted exotic species. Dominant trees are <i>Quercus macrocarpa</i>, <i>Q. velutina</i>, <i>Q. alba</i>, and <i>Prunus serotina</i>. CI = 676.</p>
169	<p>Kurtz Woods Ozaukee Co. T10N R21E SW1/4 NW1/4 S1. 13 ha. Somewhat rolling topography containing old-growth remnant of relatively undisturbed southern mesic forest. The canopy is dominated by <i>Acer saccharum</i>, <i>Fraxinus americana</i>, and <i>Fagus grandifolia</i>. CI = 2505.</p>
229	<p>Blue Springs Oak Opening Jefferson Co. T5N R16E SE1/4 SE1/4 S27. 7 ha. Oak opening of open grown bur and black oaks over good dry-mesic prairie flora on a west-facing slope with thin, rocky soil. Horse trail along east edge. CI = 668.</p>
proposed	<p>Bluff Creek Oak Woods Walworth Co. T4N R16E W1/2 NW1/4 S19. approx. 20 ha. Relatively undisturbed red oak woods on kettle moraine topography, bisected by the Ice Age Trail; surrounded by a buffer of younger woods in various stages of regrowth. Dominant trees are <i>Quercus rubra</i> and <i>Q. alba</i>. CI = 1475.</p>

Table 2. Occurrence of non-native plant species in 13 state natural areas surveyed during 1988 and 1989. A=abundant; C=common; O=occasional; R=rare. Sites: Sa, Sanders; Mu, Muskego; RP, Renak-Polak; Ri, Riveredge; Ke, Kewaskum; Ma, Mayville; HN, Haskell Noyes; Wa, Waupun; Ku, Kurtz; BC, Bluff Creek; BS, Blue Springs; Ge, Genesee; Ea, Eagle.

Species	Sa	Mu	RP	Ri	Ke	Ma	HN	Wa	Ku	BC	BS	Ge	Ea	Total
<i>Achillea millefolium</i>	—	—	—	—	—	—	O	—	—	—	O	C	O	4
<i>Alliaria petiolata</i>	—	—	—	—	—	—	—	—	—	O	O	—	—	2
<i>Arctium minus</i>	R	C	R	—	—	—	O	O	R	—	O	—	C	8
<i>Arenaria serpyllifolia</i>	—	—	—	—	—	—	—	—	—	—	—	—	O	1
<i>Asparagus officinalis</i>	—	—	—	—	—	—	—	—	—	—	O	C	O	3
<i>Barbarea vulgaris</i>	R	—	—	—	—	—	—	—	—	O	—	O	—	3
<i>Berberis thunbergii</i>	O	O	O	—	O	—	O	O	R	R	—	—	O	9
<i>Berteroa incana</i>	—	—	—	—	—	—	—	—	—	—	O	C	C	3
<i>Bromus inermis</i>	—	—	—	—	—	—	—	—	—	—	C	C	C	3
<i>Bromus tectorum</i>	—	—	—	—	—	—	—	—	—	—	O	—	—	1
<i>Centaurea maculosa</i>	—	—	—	—	—	—	—	—	—	—	C	C	C	3
<i>Cichorium intybus</i>	—	—	—	—	—	—	—	—	—	—	R	—	—	1
<i>Cirsium vulgare</i>	R	—	—	—	—	—	—	—	—	O	C	O	C	5
<i>Convallaria majalis</i>	O	—	—	—	—	—	—	—	—	—	—	O	—	2
<i>Dactylis glomerata</i>	—	—	—	—	—	—	—	—	—	—	—	C	O	2
<i>Daucus carota</i>	—	—	—	—	—	—	—	—	—	—	O	—	O	2
<i>Echinochloa crus-galli</i>	O	C	—	—	—	O	—	—	—	—	—	—	—	3
<i>Epipactis helleborine</i>	R	—	R	—	—	—	R	—	—	—	—	—	—	3
<i>Glechoma hederacea</i>	—	—	—	—	—	—	—	—	—	O	—	—	—	1
<i>Hemerocallis fulva</i>	R	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Hesperis matronalis</i>	O	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Hypericum perforatum</i>	—	—	—	—	—	—	—	—	—	—	—	—	O	1
<i>Leonurus cardiaca</i>	—	—	—	—	—	O	O	—	—	—	O	—	—	3
<i>Linaria vulgaris</i>	—	—	—	—	—	—	—	—	—	—	O	—	—	1
<i>Lonicera morrowii</i>	—	—	—	—	R	—	—	—	O	O	O	—	—	4
<i>Lonicera tatarica</i>	O	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Lonicera x bella</i>	C	O	—	—	O	—	—	O	—	—	—	O	C	6
<i>Lychnis alba</i>	—	—	—	—	—	—	—	—	—	—	C	C	C	3
<i>Lythrum salicaria</i>	—	C	—	—	—	—	—	—	—	—	—	—	—	1

Species	Sa	Mu	RP	Ri	Ke	Ma	HN	Wa	Ku	BC	BS	Ge	Ea	Total
<i>Medicago lupulina</i>	—	—	—	—	—	—	—	—	—	—	O	C	O	3
<i>Melilotus alba</i>	—	—	—	—	—	—	—	—	—	—	R	O	C	3
<i>Melilotus officinalis</i>	—	—	—	—	—	—	—	—	—	—	—	—	C	1
<i>Morus alba</i>	—	—	—	—	—	—	—	—	—	—	O	—	—	1
<i>Nepeta cataria</i>	—	—	—	—	—	—	—	—	R	—	C	O	—	3
<i>Phleum pratense</i>	—	—	—	—	—	—	—	—	—	—	—	O	C	2
<i>Plantago major</i>	—	C	—	—	—	—	O	—	—	O	—	—	C	4
<i>Poa trivialis</i>	C	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Polygonum hydropiper</i>	—	—	—	—	—	O	—	—	—	—	—	—	—	1
<i>Polygonum persicaria</i>	C	A	—	—	C	C	—	—	—	—	—	—	—	4
<i>Potentilla recta</i>	—	—	—	—	—	—	—	—	—	—	—	O	O	2
<i>Prunella vulgaris</i>	—	O	—	O	—	—	O	—	—	—	—	O	O	5
<i>Pyrus communis</i>	—	—	—	—	—	—	—	—	—	—	—	R	—	1
<i>Pyrus malus</i>	R	—	—	—	—	R	—	—	—	—	—	R	R	4
<i>Rhamnus cathartica</i>	C	O	O	O	O	—	O	C	R	A	O	C	O	12
<i>Rhamnus frangula</i>	—	—	—	—	R	—	—	—	—	—	—	—	—	1
<i>Rosa multiflora</i>	—	—	—	—	—	—	—	—	—	R	O	—	O	3
<i>Rubus idaeus</i>	—	—	—	O	—	—	—	O	—	—	—	—	—	2
<i>Rumex acetosella</i>	—	—	—	—	—	—	—	—	—	—	C	—	C	2
<i>Rumex crispus</i>	—	C	O	—	C	O	—	—	—	—	—	—	—	4
<i>Saponaria officinalis</i>	—	—	—	—	—	—	—	—	—	—	O	—	C	2
<i>Sedum telephium</i>	O	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Setaria viridis</i>	—	—	—	—	—	—	—	—	—	—	—	C	—	1
<i>Solanum dulcamara</i>	—	C	—	C	—	C	—	C	—	—	O	—	O	6
<i>Sonchus uliginosus</i>	—	—	—	—	—	—	—	—	—	—	—	—	O	1
<i>Taraxacum officinale</i>	O	O	—	R	—	—	O	O	O	C	O	O	C	10
<i>Tragopogon dubius</i>	—	—	—	—	—	—	—	—	—	—	C	C	C	3
<i>Trifolium pratense</i>	—	—	—	—	—	—	—	—	—	—	O	—	—	1
<i>Trifolium repens</i>	—	—	—	—	—	—	—	—	—	—	—	O	C	2
<i>Ulmus pumila</i>	—	—	—	—	—	—	—	—	—	—	—	R	—	1
<i>Veronicax pratense</i>	R	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Veronica officinalis</i>	R	—	—	—	—	—	—	—	—	—	—	—	—	1
<i>Viburnum lantana</i>	—	—	—	—	—	R	—	—	—	—	—	—	—	1
<i>Viburnum opulus</i>	—	O	O	O	—	C	—	O	—	—	—	R	—	6
<i>Vinca minor</i>	O	—	—	—	—	—	—	—	—	—	—	—	—	1
Totals 64 spp.	20	13	6	6	7	9	9	8	6	10	27	26	31	178

Table 3. Number of non-native species for each site by abundance category. A = abundant; C = common; O = occasional; R = rare. "Community Type" refers to the predominant plant community in each Natural Area; OO = Oak opening; DMF = Dry-mesic forest; MF = Mesic forest; SWF = Swamp forest.

Site	Community Type	A	C	O	R	Total
Eagle	OO	0	16	14	1	31
Blue Springs	OO	0	7	18	2	27
Genesee	OO	0	11	11	4	26
Sanders	DMF	0	4	8	8	20
Muskego	DMF	1	6	6	0	13
Bluff Creek	DMF	1	1	6	2	10
Haskell Noyes	MF	0	0	8	1	9
Mayville	MF	0	3	4	2	9
Waupun	MF	0	2	6	0	8
Kewaskum	MF	0	2	3	2	7
Kurtz	MF	0	0	2	4	6
Renak-Polak	MF	0	0	4	2	6
Riveredge	SWF	0	1	4	1	6
Totals		2	53	94	29	178

Table 4. Number of non-native species by site as a percentage of total number of species encountered. A = abundant; C = common; O = occasional; R = rare.

Site	Community Type	Total No. of Species	% of Non-native Species				Total %
			A	C	O	R	
Eagle	OO	153	0.0	10.4	9.2	0.6	20.3
Blue Springs	OO	134	0.0	5.2	13.4	1.5	20.1
Genesee	OO	133	0.0	8.3	8.3	3.0	19.5
Sanders	DMF	151	0.0	2.6	5.3	5.3	13.2
Muskego	DMF	135	0.7	4.4	4.4	0.0	9.6
Bluff Creek	DMF	105	1.0	1.0	5.7	1.9	9.5
Waupun	MF	97	0.0	2.1	6.2	0.0	8.2
Mayville	MF	133	0.0	2.3	3.0	1.5	6.8
Kurtz	MF	98	0.0	0.0	2.0	4.1	6.1
Haskell Noyes	MF	153	0.0	0.0	5.2	0.6	5.9
Kewaskum	MF	136	0.0	1.5	2.2	1.5	5.1
Riveredge	SWF	145	0.0	0.7	2.8	0.7	4.1
Renak-Polak	MF	161	0.0	0.0	2.5	1.2	3.7

Of the eight original areas, three (Mayville, Muskego, and Renak-Polak) had no additions to their exotic flora, although there were some changes in abundance categories. New species in the old sites include *Achillea millefolium* found occasionally along paths in Haskell-Noyes; *Lonicera morrowii* rarely found in Kewaskum; and *Taraxacum officinale* occasionally found in Waupun. Several changes were made in Sanders. *Hesperis matronalis* was occasionally found near the west border, while *Lonicera tatarica* was occasional throughout the entire woods. Additionally, in Sanders the status of *Sedum telephium* was raised from "rare" to "occasional" after I found several more patches along trails.

By comparing the number of alien species to the total number of species found by sites, it is evident that the three oak openings also have suffered the greatest invasion (Table 4). In each of these sites, about 20% of all species are non-native. Most of these are either in the "common" or "occasional" categories; none was considered to be "abundant". The three dry-mesic woods had intermediate levels of invasion (between 9.6 and 13.2%). The areas with the lowest percentages of exotic species were the mesic and swamp forests. Despite its disturbed, second-growth nature, only 4.1% of the species in the Riveredge swamp forest were non-native.

The following is an annotated list of newly-encountered exotic species, arranged by families:

- 1) Apiaceae – *Daucus carota* (Queen Anne's lace) — occasionally found in open areas of Blue Springs and Eagle.
- 2) Asteraceae
 - a) *Achillea millefolium* (yarrow)—found especially along worn trails in four sites; particularly common in Genesee (rel. freq. of 1.7%) and Eagle (rel. freq. of 4.8%).
 - b) *Arctium minus* (burdock)—especially frequent in Blue Springs and Eagle.
 - c) *Centaurea maculosa* (spotted knapweed)—common in the three oak openings, especially along the disturbed sides of trails.
 - d) *Cichorium intybus* (chicory)—rare along a trail in one site (Blue Springs).
 - e) *Cirsium vulgare* (bull thistle)—common in Blue Springs (rel. freq. of 3.6%) and Eagle (rel. freq. of 2.9%), and occasional in Bluff Creek and Genesee.
 - f) *Sonchus uliginosus* (sow thistle)—not common; occasional in wet kettle holes at one site (Eagle), with a rel. freq. of 1.0%.
 - g) *Taraxacum officinale* (dandelion)—rather frequent in the new sites; common in Bluff Creek (rel. freq. = 0.7%) and Eagle, where it was the most frequent herbaceous species (rel. freq. = 11.5%); occasional in Kurtz (rel. freq. = 1.5%), Blue Springs (rel. freq. = 4.3%), and Genesee (rel. freq. = 2.3%).
 - h) *Tragopogon dubius* (goatsbeard)—common in Blue Springs, Eagle, and Genesee, with relative frequencies of 4.3%, 2.9%, and 0.6%, respectively.
- 3) Berberidaceae – *Berberis thunbergii* (barberry)—in three additional sites, mostly ("occasional") in Eagle, where it achieved a mean cover of 0.1%.

4) Brassicaceae

a) *Alliaria petiolata* (= *A. officinalis*) (garlic mustard)—in restricted, but dense, patches along entrance trails at Bluff Creek and Blue Springs; should be controlled to prevent spreading.

b) *Barbarea vulgaris* (yellow rocket)—occasionally found along trails at Bluff Creek and Genesee.

c) *Berteroa incana* (hoary allyssum)—in the three oak openings, particularly common in Genesee and Eagle.

5) Caprifoliaceae

a) *Lonicera morrowii* (honeysuckle)—found in low densities at four sites: Kurtz (mean cover of 0.2%); Blue Springs (1.0% mean cover); Kewaskum; and Bluff Creek, where it reached an importance in the shrub stratum of 5.0%, with a density of 4 stems per hectare.

b) *Lonicera tatarica* (honeysuckle)—low density in one site (Sanders).

c) *Lonicera x bella* (honeysuckle)—relatively frequent in two additional sites: Eagle (shrub importance = 2.4%, density = 2 stems per ha., and mean cover = 0.7%) and Genesee (mean cover = 0.9%).

d) *Viburnum opulus* (highbush cranberry)—rare in one additional site (Genesee).

6) Caryophyllaceae

a) *Arenaria serpyllifolia* (sandwort)—occasionally found in Eagle.

b) *Lychnis alba* (white campion)—relatively common in three oak openings: Blue Springs (rel. freq. = 1.4%), Genesee, and Eagle.

c) *Saponaria officinalis* (bouncing-bet)—found scattered at moderate densities along roads and trails in Eagle and Blue Springs.

7) Fabaceae

a) *Melilotus alba* (white sweet-clover)—at the three oak openings, particularly in open, disturbed sites: Genesee (rel. freq. = 3.4%), Blue Springs (rel. freq. = 0.7%), and especially common in Eagle.

b) *Melilotus officinalis* (yellow sweet-clover)—less widespread than the previous species; found only in Eagle (3.4% rel. freq.).

c) *Medicago lupulina* (black medick)—relatively common in the three oak openings (rel. freq. in Genesee = 0.6%).

d) *Trifolium pratense* (red clover)—occasional at only one site (Blue Springs).

e) *Trifolium repens* (white clover)—more common than the previous species, being common along open roads in Eagle.

8) Hypericaceae—*Hypericum perforatum* (St. John's-wort)—at low densities in one site—Eagle (rel. freq. = 1.0%).

9) Lamiaceae

- a) *Glechoma hederacea* (creeping Charlie)—occasional in Bluff Creek, where there are several extensive patches scattered throughout the woods.
- b) *Leonurus cardiaca* (motherwort)—scattered in one new area (Blue Springs).
- c) *Nepeta cataria* (catnip)—relatively common in Genesee and Blue Springs, where the relative frequency was 0.7%; in Kurtz, found only around old entrance road at northwest corner.
- d) *Prunella vulgaris* (self-heal)—occasionally found in two oak openings.

10) Liliaceae

- a) *Asparagus officinalis* (asparagus)—fairly common in the three oak openings; in Genesee, rel. freq. = 1.1%.
- b) *Convallaria majalis* (lily-of-the-valley)—one large clone near remnant of dwelling in Genesee; needs to be controlled.

- 11) Moraceae – *Morus alba* (white mulberry)—occasionally found in Blue Springs; importance in three stratum = 2.2%, and density = 4 stems/ha; importance in shrub stratum = 5.4%, and density = 75 stems/ha.

- 12) Plantaginaceae – *Plantago major* (plantain)—common along roads in Eagle and Bluff Creek.

13) Poaceae

- a) *Bromus inermis* (smooth brome)—common throughout the three oak openings; in Blue Springs, rel. freq. = 0.7%.
- b) *Bromus tectorum* (cheatgrass)—much less common than the preceding species; only at one site (along the trail at Blue Springs).
- c) *Dactylis glomerata* (orchard grass)—relatively common in two oak openings.
- d) *Phleum pratense* (timothy)—relatively common along trails in two oak openings.
- e) *Poa trivialis* (rough stalk bluegrass)—common along footpaths in Sanders.
- f) *Setaria viridis* (green foxtail)—common in Genesee.

- 14) Polygonaceae – *Rumex acetosella* (sheep sorrel)—common in two oak openings; in Blue Springs, rel. freq. = 0.7%.

- 15) Rhamnaceae – *Rhamnus cathartica* (European buckthorn)—found in all five additional sites; especially prevalent in the three oak openings and in the dry-mesic oak woods of Bluff Creek, where it was classified as "abundant;" there, it was the most important shrub species (IV = 42.4%; density = 86 stems/ha); it was also the most important shrub in Eagle (IV = 30.8%; density = 52 stems/ha); in Genesee, mean cover = 8.2%.

16) Rosaceae

- a) *Potentilla recta* (rough-fruited cinquefoil)—occasional in two sites.
- b) *Pyrus communis* (pear)—rare in Genesee; possible relict of habitation.
- c) *Pyrus malus* (apple)—rare in two additional sites: in the tree stratum in Eagle, importance = 1.1% and density = 2/ha.; in the sapling stratum in Eagle, importance = 0.8%, and density = 2/ha.
- d) *Rosa multiflora* (multiflora rose)—found in three sites, most abundantly in Blue Springs and Eagle (mean cover = 0.2%).

18) Scrophulariaceae—*Linaria vulgaris* (butter-and-eggs)—occasional in Blue Springs.

19) Solanaceae – *Solanum dulcamara* (nightshade)—occasional in two additional sites (Blue Springs and Eagle).

20) Ulmaceae – *Ulmus pumila* (Siberian elm)—a few (probably planted) individuals in Genesee; in tree stratum, importance = 3.7% and density = 4/ha.

Discussion

Two aspects of the results are apparent. First, there were relatively few exotics added to the total list of species from the spring sampling of the eight original sites. The great preponderance of the early season flora included native spring ephemerals normally found in southern Wisconsin woods. The greatest changes were in Sanders, where an additional 18 species were found, three of which were non-natives. This increased the percentage of exotics from 12.8% to 13.2%. I found only one additional exotic species in each of three other areas (Waupun, Haskell Noyes, and Kewaskum).

Secondly, it is evident from the data that the more mesic sites, with their closed sugar maple-dominated canopies, are relatively safe from invasion by exotics. Those occasional aliens that do become established could be easily controlled on an individual basis. More at risk are the open woods and savannas. These xeric sites have suffered the greatest degree of encroachment by non-native species. This continues the trend that was noted in the original areas (Leitner 1988), where the dry-mesic woods (Sanders and Muskego), with their relatively open canopies, contained both the highest absolute number of exotics and the greatest percentage of exotics. The three oak openings carry this environment to an extreme; i.e., the broken canopies of the scattered oaks allow for sunny, open conditions beneath. In addition, disturbances in the form of trails, roads, and dwellings have encouraged exotic species establishment. Fire, a natural force which in the past would have mostly prevented such species from surviving, has been applied artificially, but only sporadically, by state forest personnel to the oak openings.

There are a few species that have become pernicious weeds elsewhere which demand immediate attention. These include garlic mustard (*Alliaria petiolata*) in Blue Springs and Bluff Creek and spotted knapweed (*Centaurea maculosa*) in the three oak openings. *Alliaria* is a noxious weed that has dominated the herb layer in many northern Illinois open woodlands. It is still scattered in Wisconsin, though apparently becoming more frequent. I have noticed it mainly along pathways in disturbed oak

woods, such as in Downer Woods on the UWM campus and in Milwaukee's Lake Park. Where it occurs in relatively low densities (as in Blue Springs and Bluff Creek), it can probably be controlled by hand removal. *Centaurea* dominates many of the roadsides and old-fields in the Southern Kettle Moraine and the counties of central Wisconsin. Also, the clonal lily-of-the-valley (*Convallaria majalis*) in Genesee and Sanders should be eliminated.

The problem with European buckthorn (*Rhamnus cathartica*) is both more widespread and of greater magnitude. Although cutting of stems and subsequent application of the herbicide Roundup to the stumps has proven effective in eliminating individual buckthorn plants (Kline 1981), practical methods for control of large populations on a regional scale are wanting. The small numbers of individual buckthorn plants found in mesic sites could be, and should be, eliminated by hand whenever found. But, overall, buckthorn should probably be considered a permanent part of the southern Wisconsin (and, indeed, Midwestern) flora. The permanence of some exotics emphasizes the importance of protecting state Natural Areas as examples of Wisconsin's presettlement vegetation. Future changes in vegetation can then be compared with those in protected natural areas.

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