EXOTIC WOODY PLANTS OF SHILOH NATIONAL MILITARY PARK, TENNESSEE: A POPULATION SURVEY OF AGGRESSIVE SPECIES

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INTRODUCTION

Invasion by exotic species is one of the most frequent management problems in national parks and other nature preserves (see White and Bratton 1980 and literature reviewed therein). This is true on worldwide, national (National Park Service 1980), and local scales (Bratton et al., in press). In the southeastern, nontropical U.S. National Parks, 17 parks reported problems with kudzu, 14 reported problems with Japanese honeysuckle, eight reported problems with mimosa, three reported problems with princess tree, and two reported problems with tree-of-heaven (Bratton et al., in press).

The purpose of this study was to survey the established woody exotics at Shiloh National Military Park, Hardin County, Tennessee. This survey is part of a recent effort to assess the flora and vegetation at Shiloh. Jones and White (1981) reported and discussed the vascular flora of the park. A list of exotics collected at Shiloh is herein reproduced from that report as Appendix I. They reported 77 exotic species (11.7 percent of Shiloh's vascular flora), including 18 woody and 59 herbaceous plants. The present study sought to document the population status of the most aggressive woody species. Woody species were chosen because they have the potential to be conspicuous, long-lived dominants in the Shiloh region.

Of the exotics reported by Jones and White (1981), 10 species (13 percent of the total) were designated as "invasive"; the other 67 species were noted to occur in field, lawns, and other frequently disturbed habitats, or were merely "persistent after cultivation". The invasive species--capable of invading and persisting in Shiloh's natural communities--are certainly the most important from a managerial standpoint. As shown in Appendix I and discussed by Jones and White (1981), exotic species at Shiloh have come from

a variety of regions, but a large percentage from temperate Europe and East Asia.

Shiloh National Military Park was not primarily established as a preserve of natural diversity; rather, its primary focus is preservation of the historic scene at the time (April 6-7, 1862) of the Civil War battle that took place on this site. Hence, not only must we ask what effect exotic species have on the natural communities of the park but, in addition, what effect do exotic species have on preservation of the historic Shiloh landscape? Indeed, some exotics could have been present at the time of the battle and hence be a legitimate part of the historic scene itself. The critical frame of reference is thus 1862. This report presents the results of a survey of the most important woody exotics and then discusses these management questions. A full description of the landscape, history, flora, and vegetation of Shiloh are contained in other reports in this series (Jones and White 1981; White, in preparation).

METHODS

Data for this report were gathered in August 1980. All trails and roads at Shiloh were surveyed for exotic woody plant populations. Crosscountry reconnaissance was carried out in a few large populations of Lonicera japonica (Japanese honeysuckle). Though all of the park was not directly sampled, the roads which crisscross the area have access to the full range of topographic and habitat types present (Fig. 1); furthermore, exotic species are often most important along roads, in open fields, and in other disturbed, at least partially sunlit environments. Trails gave access to woodland habitats.

Survey methods were adapted from those developed for exotic plant plant studies at Chickamauga-Chattanooga National Military Park and

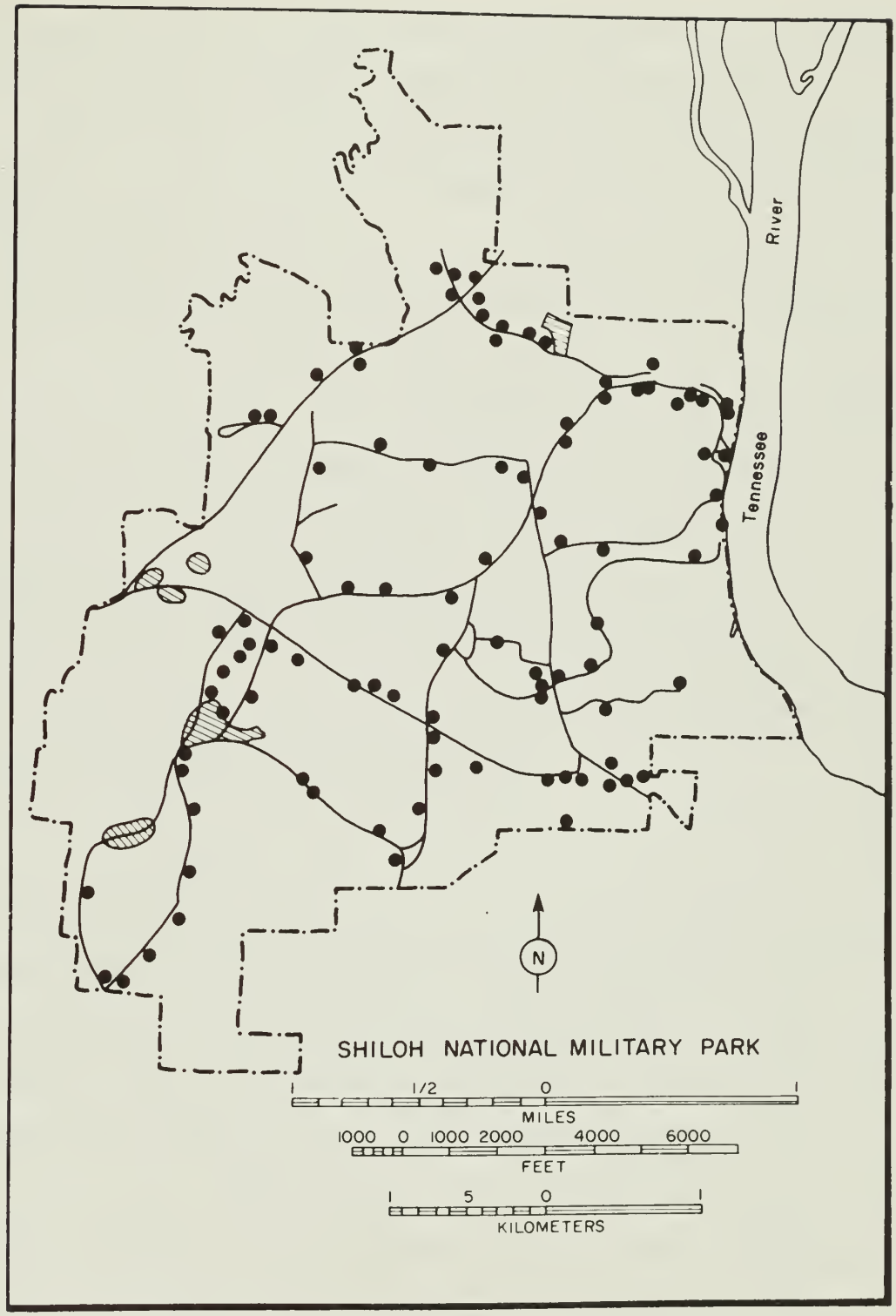

Figure 1. Exotic plant survey routes (dark lines), sampling sites (filled circles), and large Japanese honeysuckle patches (shaded) at Shiloh NMP, Hardin County, Tennessee.

Cumberland Gap National Historical Park (Butler et al. 1981). A "sampling site" was established each time a plant population of an exotic species was encountered. The sites so located were coextensive with the largest continuous exotic population present at the site. Thus, the sampling sites varied greatly in size, as the size of local populations varied. Five characteristics of the plant populations and two characteristics of the habitat were recorded at each sampling site:

A. Characteristics of the exotic populations:

1. Area of cover--two values were recorded: (a) the area of ground surface occupied by each exotic species (m^2), and (b) the total leaf area for each exotic species (ground surface area multiplied times the average percent cover of the exotic species on that ground surface area).
2. Density--the density of each exotic was rated at each site as: 1 (scattered, less than 20 percent cover); 2 (dense, cover 20-90 percent), and 3 (dominant, cover over 90 percent).
3. Stem counts--for exotic trees, the number of stems was counted in each of four size classes: seedlings (individuals less than breast height (1.37 m), saplings (individuals greater than breast height but less than 1 cm diameter at breast height (dbh)), small trees (1-10 cm dbh), and large trees (over 10 cm dbh). The diameter of each stem larger than 1 cm dbh was recorded.
4. Spread--a scalar value for apparent rate of colonization by the exotic in areas surrounding its current distribution. The values ranged from 0 (no spread) to 4 (dispersing from the site and outcompeting neighboring plants).
5. Impact--a scalar value for the impact of exotic species on co-occurring

plants. The values ranged from 0 (no impact) to 5 (complete cover of co-occurring plants). Impact values were recorded separately for each of three strata: the herb layer, shrub layer, and tree canopy.

B. Habitat characteristics:

6. Percent canopy cover--the total percent cover of the forest canopy at a particular sampling site.
7. Successional stage--coded successional stages included: open fields (0); old fields dominated by shrubs (1); old fields dominated by young trees (2); young forest (3); and closed crown, mature forest (4).

Permanent plots were established in several large populations of Japanese honeysuckle. The data for these sites were recorded in the usual format, and these sites will not be distinguished from the others in the presentation and discussion of results below.

RESULTS

Twelve species of woody exotics were encountered and deemed established at Shiloh during this survey (Table 1). (For a list of all exotics, including herbaceous species, see Jones and White (1981) and Appendix I.) Although yucca is also native in dry woods in this part of Tennessee, it has been widely planted at old home sites and escapes to roadsides--hence its inclusion on the list. The sample does not include cultivated areas nor isolated plants at old home sites. Ninety-nine individual sites were sampled along ca 25 km of survey route (Fig. 1). These sites varied greatly in size, from 1 to 4,970 m^2 (hence, the largest exotic plant population observed had the maximum value cited). A total of 86,672 m^2 ground surface area was sampled at these sites.

Table 1. Scientific and common names of exotic woody plants sampled at Shiloh National Military Park.[1] Nomenclature follows Radford et al. (1968). The text and subsequent tables of this report use common names only.

Scientific Name	Common Name	Plant Family
Albizia julibrissin	Mimosa	Fabaceae (Pea family)
Hedera helix	English ivy	Araliaceae (Ginseng family)
Lagerstroemia indica	Crepe-myrtle	Lythraceae (Loosestrife family)
Lespedeza sp.	Lespedeza	Fabaceae (Pea family)
Ligustrum sinense	Chinese privet	Oleaceae (Olive family)
Lonicera japonica	Japanese honey-suckle	Caprifoliaceae (Honeysuckle family)
Paulownia tomentosa	Princess tree	Scrophulariaceae (Figwort family)
Prunus persica	Peach	Rosaceae (Rose family)
Pueraria lobata	Kudzu	Fabaceae (Pea family)
Rosa spp.	Roses	Rosaceae (Rose family)
Vinca minor	Periwinkle	Apocynaceae (Dogbane family)
Yucca flamentosa	Yucca	Liliaceae (Lily family)

[1] Other woody exotics are present and established at Shiloh in addition to the ones directly treated in this survey (see Appendix I). The present evaluation concerns only those species encountered along the survey routes. Zeb McKinney and George Reaves (personal communication) have, in particular, called our attention to populations of Wisteria sinensis, which is of management concern in old fields.

Japanese honeysuckle (the scientific names are given in Table 1; common names will be used in the text and subsequent tables) was the most important exotic species, occupying 83 percent of all exotic sites and contributing 92 percent of total cover by exotic vines and shrubs in this sample (Tables 2 and 3). A total of 49,395 m^2 of Japanese honeysuckle was sampled. Mimosa was the second most frequent species, being found at 24 percent of the sampled sites. Privet was found at 13 percent of the sites and roses at 8 percent. Although English ivy was found at only 2 percent of the sites, it was the second most important species in terms of cover--it occupies a large patch of forest in the vicinity of Pittsburg Landing and contributes 7.4 percent of the total recorded shrub and vine cover (Tables 2 and 3).

In terms of stems tallied as well as frequency, mimosa was by far the most important exotic tree (Table 4). The total stems encountered of this species were 1,026; the combined total for all other exotic trees was only 94 stems. The size class distribution for mimosa is shown graphically in Figure 2. Establishment is ongoing, shown by the large number of individuals in the two smallest size classes. Only 10 percent of mimosa seedlings and 6 percent of mimosa saplings were in areas with no parent trees, however, indicating that establishment away from older trees is slow. Reproduction of crepe-myrtle trees is entirely vegetative--all smaller stems were found in association with larger stems. No princess tree seedlings were observed during this study.

The analysis of density revealed that exotics tend to be found in intense infestations. Over 70 percent of all exotic cover measured was found in populations that were dominant on the sites where they grew. Only honeysuckle showed good representation in the lowest density class (scattered), suggesting that seed dispersal is effectively spreading this

Table 2. Frequency of exotic species at Shiloh at 99 sample sites (frequency is the percent of total sites at which the species was found).

Species	Frequency
Japanese honeysuckle	83
Mimosa	24
Privet	13
Roses	8
Yucca	5
English ivy	2
Crepe-myrtle	2
Princess tree	2
Periwinkle	1
Kudzu	1
Lespedeza	1
Peach	1

Table 3. Cover by vine and shrub infestations (m^2) (the summed surface area of infestations times percent leaf surface area for each species in each sample).

Species	Area (m^2)	Percent of total area sampled
Japanese honeysuckle	49,395	92.13
English ivy	3,948	7.4
Roses	209	.38
Privet	43	.08
Yucca	10	.02
Periwinkle	5	.01
Lespedeza	5	.01
Kudzu*	--	--

*Kudzu was treated just prior to this survey.

Table 4. Stem counts for exotic trees in four size classes.

Species	No. Seedlings	No. DBH less than 1	No. DBH less than 10	No. DBH greater than 10
Mimosa	105	498	420	3
Crepe-myrtle	0	0	90	0
Princess tree	0	0	4	0

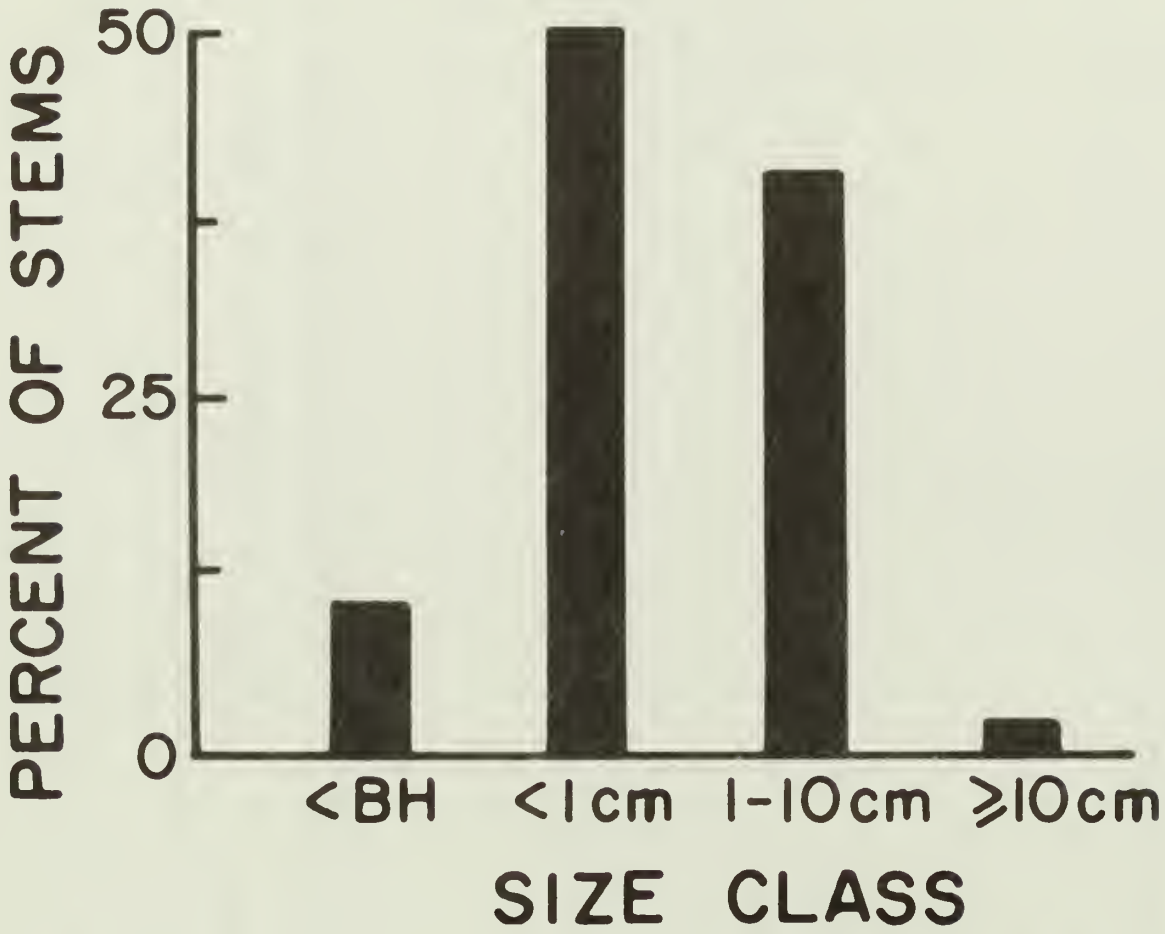

Figure 2. Size class distribution of mimosa stems.

plant. Exotic infestations tended also to be more important on the ground than in trees. Only 7 percent of all honeysuckle cover and 8 percent of all English ivy was observed in tree canopies.

English ivy had the highest rate of spread when the edges of its populations were inspected--both populations of this species were given the highest rating (4, dominant and dispersing). Some Japanese honeysuckle populations also received high spread ratings but had an average spread value of 3 when all samples were pooled. Honeysuckle populations on moist sites with at least partial sun are dominant and spreading rapidly; those on drier, upland sites are apparently less aggressive. Yucca and princess tree had the lowest spread ratings in their current habitats.

English ivy also showed the highest impact rating on native vegetation (Table 5). In areas where ivy was surveyed, it completely covered the forest floor, displacing all native herbs. Japanese honeysuckle was judged to have the second highest average impact on surrounding vegetation. All exotics have relatively more impact on the herb stratum than on higher strata (Table 5). Viney or reclining species had higher impact ratings than shrub or tree species among the exotics. Kudzu, an extremely aggressive exotic, had been clipped and sprayed with herbicide just prior to the survey (Dean Berg, personal communication). Hence, it consistently ranked low in the spread and impact ratings. This reflects, of course, only the recent and intensive management attention that it had received in 1980 and not the potential kudzu has on these sites.

Exotic infestations are most frequent where old fields have been abandoned and have been invaded by young trees (Table 7). Over 80 percent of all exotics were found in such habitats. English ivy and honeysuckle are the only species sampled in forest vegetation--the former is only found in

Table 5. Mean impact of exotic species on co-occurring herbs, shrubs, and trees.

Species	Impact on herbs	Impact on shrubs	Impact on trees
English ivy	5.00	3.50	3.50
Japanese honeysuckle	3.27	2.69	1.91
Roses	2.78	2.38	1.61
Privet	2.38	2.00	0.97
Yucca	2.10	1.60	0.50
Crepe-myrtle	2.00	2.00	0.00
Periwinkle	2.00	1.00	1.00
Mimosa	1.80	1.60	0.65
Princess tree	1.50	1.00	2.00
Lespedeza	1.00	0.00	0.00
Peach	1.00	0.00	0.00
Kudzu	0.00*	0.00*	0.00*

*Kudzu had been clipped and sprayed prior to the survey.

Table 6. Exotic vine and shrub distribution by density class. The total ground surface area affected is given, uncorrected for the actual leaf surface area. (1 = scattered; 2 = dense, 20-90 percent cover; 3 = dominant, over 90 percent cover)

Species	ON GROUND Density Classes 1	2	3	IN TREES Density Classes 1	2	3	TOTAL
Japanese honeysuckle	4,880 (6%)	61,483 (75%)	9,594 (12%)	30 (<1%)	1,885 (2%)	3,924 (5%)	81,796
Ivy	0 (0%)	0 (0%)	4,050 (92%)	0 0%)	210 (5%)	150 (3%)	4,410
Roses	0 (0%)	255 (89%)	33 (11%)	0 (0%)	0 (0%)	0 (0%)	288
Privet	0 (0%)	0 (0%)	43 (100%)	0 (0%)	0 (0%)	0 (0%)	43
Other	90 (67%)	35 (26%)	10 (7%)	0 (0%)	0 (0%)	0 (0%)	135
Total	4,970 (6%)	61,773 (7.1%)	13,730 (16%)	30 (<1%)	2,095 (2%)	4,074 (5%)	86,672

Table 7. Frequency of exotic species with respect to successional state of habitat (percent frequency based on species totals is shown in parentheses).

Species	Open fields	Old fields-shrubby	Old fields-young trees	Young woods	Closed crown mature forest
Japanese honeysuckle	4 (7)	0 (0)	47 (84)	3 (5)	2 (4)
Mimosa	2 (13)	1 (6)	13 (81)	0 (0)	0 (0)
Privet	1 (12)	1 (12)	7 (76)	0 (0)	0 (0)
Roses	0 (0)	0 (0)	5 (100)	0 (0)	0 (0)
English ivy	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)
Other	1 (12)	0 (0)	7 (88)	0 (0)	0 (0)
Total	8 (8)	2 (2)	79 (82)	5 (5)	2 (2)

such sites and so is displaced towards shadier environments compared to other species. It is notable that Japanese honeysuckle is able to invade mature forest, though it is more frequent in younger habitats. The range in canopy cover at exotic plant sites was 0-90 percent, with mean values for the common species all at ca 40 percent. English ivy was found on the shadiest sites (70-90 percent canopy cover). These lines of evidence support the conclusion that woody exotics need some form of disturbance and occur on sites with some form of human history--the Japanese honeysuckle infestations in moist streamside forests being an exception.

DISCUSSION

Shiloh, like other southeastern National Parks (Bratton et al., in press), has been invaded by exotic species. These species were originally introduced by man but have, to varying degrees, become established and are able to persist without ongoing human influence. The total percent of exotic species in the park's flora (11.7 percent - Jones and White (1981)) is not unusual of the eastern temperate United States (Radford et al. 1968). As the data reported above make clear, the exotic species are not all equally important nor are they of equal management concern. The importance of the 12 species is summarized briefly below. Two basic distinctions will be made: (1) between species which are actively spreading by seed and those which are not, and (2) between species which will be outcompeted by native species wherever natural succession is permitted to take place and those which will persist during succession and/or which are able to invade native vegetation. After this summary, the historical importance of the species will be discussed.

Four species are not spreading by seed: English ivy, crepe-myrtle,

periwinkle, and kudzu. English ivy, planted for ornament near the National Cemetery and occupying a large area near Pittsburg Landing (over 4,000 m^2 of ground surface), is the only species which is both actively spreading (albeit vegetatively) and conspicuously dominating its sites. Of the other species, only kudzu is a serious threat. It does not spread aggressively, if at all, by seed (which is of great benefit in its control), but it is extremely aggressive in vegetative spread in the Southeast. It has the potential of becoming a severe exotic problem at Shiloh but was only present in one patch at the time of this study, and that patch had been recently treated (Dean Berg, personal communication, and files). The site where it occurs should be monitored; no additional plants should be introduced at Shiloh.

Eight species are reproducing by seed. In order of importance, they are Japanese honeysuckle, mimosa, privet, princess tree, lespedeza, roses, peach, and yucca. The last two of these are of no management concern. Peach becomes only locally established and never dominates vegetation; in any case, it is an important part of the historic landscape, as will be discussed below. Yucca is both an introduced and a native plant in this region of Tennessee. It persists at old home sites and spreads along roads. Even were it to persist in native vegetation, it would be impossible to discern those populations from truly native populations. Six of the species that spread by seed are of more managerial concern. Their relative importance will be discussed below with reference to their ability to compete with native species during forest succession.

Mimosa and princess tree become established only where there is full sunlight. Although they will be eventually outcompeted during forest succession, they will remain conspicuous members of the vegetation because

of their size and moderately long life spans (measured in the tens of years for mimosa and on the order of a century for princess tree). They will probably also remain conspicuous along roadsides and field edges, where competition is kept down and light levels are high.

Privet, roses, and woody species of lespedeza are similar in that they need light for establishment, spread along roads, and persist in hedgerows and thickets. Privet is able to invade semiopen upland woods. However, all three species will be outcompeted if long term succession is allowed to take place.

Japanese honeysuckle is the most troubling of the species which aggressively spread by seed. It is widespread at Shiloh and is able to invade a variety of habitats, including mature forest, where it may be present in large dominant patches. To honeysuckle should be added two species already discussed under the category of those which spread only vegetatively: English ivy and kudzu. Both of these are able to displace native vegetation and persist during succession. Kudzu is able to retard succession and open up patches of forest.

In summary, then, the top priority species are Japanese honeysuckle, English ivy, and kudzu. Mimosa, princess tree, privet, and roses will likely remain conspicuous elements of the Shiloh landscape, but they are dependent on management in the sense that they benefit from maintenance of open habitat. Even in that regard, however, they do not rapidly invade historic fields which are frequently mowed. The question, then, is to what extent they are desirable in abandoned fields and along field and woodland edges. By contrast, the three top priority species spread and impact surrounding vegetation actively and are not dependent on ongoing creation or maintenance of their habitat.

Because Shiloh has an historical mandate, an important managerial issue concerns the date of introduction of exotic species and whether any exotic species can be shown to be an important element of the historic scene. The date of the battle, 1862, becomes the crucial frame of reference. Dates of first introductions to the United States of the species reported on here are given in Table 8. The species will be discussed below in order of their present importance at Shiloh.

Japanese honeysuckle was first cultivated in this country about 1800, well before the battle of Shiloh. Its presence at Shiloh before 1862 is somewhat difficult to ascertain, however. Black and white photographs on file at Shiloh show the presence of Japanese honeysuckle circa 1900 (Shiloh archives). At the time of the battle, Shiloh had been settled for about 40 years. Peach trees and other useful woody plants were certainly present at the time of the battle. An important skirmish took place in the "Peach Orchard". But was Japanese honeysuckle, a plant grown for ornament, present only after 40 years of settlement history? We have only a few pieces of circumstantial evidence. Augustus Gattinger, who lived in Nashville, catalogued the flora of Tennessee in 1887 and 1901. The first list contains no mention of Japanese honeysuckle growing without cultivation in the state, but the second edition stated that the plant was established along the Cumberland River, north and south of Nashville. Similarly, the first mention of Japanese honeysuckle in standard floristic manuals for the eastern United States occurs in editions published in the late 1800s to early 1900s. These references thus suggest that honeysuckle was becoming established in the late 1800s; however, the evidence is certainly not conclusive. Andrews (1919) directly assessed the state of Japanese honeysuckle in the eastern United States. From his data it appears that

Table 8. Dates of first introduction to the United States of exotic species surveyed at Shiloh (from Rheder 1940).

Species	Date	Country of origin
Japanese honeysuckle	1806	Asia
English ivy	1600s(?)	Europe
Kudzu	1885	Japan
Mimosa	1745	Asia
Princess tree	1834	China
Chinese privet	1852	China
Roses	1600s(?)	Europe
Lespedeza	Late 1800s	Asia
Periwinkle	1600s(?)	Europe
Crepe-myrtle	1747	Asia
Yucca	1675	U.S.
Peach	1600s(?)	China

Japanese honeysuckle was not established in the Shiloh area at the time of the battle.

Another part of this problem is that even if Japanese honeysuckle were present at the time of the battle, it may now dominate much larger areas of Shiloh than in 1862 and, indeed, is still spreading. During the administration of Shiloh by the War Department (ca 1896-1933), fire was repeatedly used to maintain vistas and clear underbrush. This retarding of the native plants, plus release from this management regime in the 1930s when the Park Service took over administration, may have made Shiloh particularly vulnerable to increase in honeysuckle cover.

English ivy was a very early introduction in cultivation; however, its presence is due to recent landscaping efforts (around the National Cemetery), and it too has expanded in recent times and is not, in all likelihood, an historic (i.e., 1862) feature of the Pittsburg Landing scene. Kudzu is a recent (late 1800s to the United States) introduction and not historic.

Mimosa, princess tree, privet, roses, periwinkle, yucca, and crepe-myrtle were all in cultivation in the United States before 1862. Of these, roses, periwinkle, privet, and yucca have always been popular in cultivation. They followed settlement quickly throughout the United States and were therefore likely to be at Shiloh in 1862. Mimosa, princess tree, and crepe-myrtle are probably not historic (i.e., present in 1862) at Shiloh. They would have been luxury items at the time. However, again, we must point out the lack of direct evidence and the tentative nature of these conclusions. Lespedezas are relatively recent introductions in the Shiloh region and are therefore not historic. Peach is clearly historic.

CONCLUSIONS:

1. The most important woody exotics at Shiloh are Japanese honeysuckle, English ivy, and kudzu. The former is widespread, present in native vegetation, and is reproducing by seed. English ivy is present at only two sites but occurs in a large patch. Kudzu was under control when this survey was made.

2. Mimosa, princess tree, privet, roses, and lespedeza are also established but are of less immediate concern because they are less aggressive (at least with reference to mature forest) than the top priority species. They are likely to persist, however, and remain conspicuous elements in the Shiloh landscape. They will be frequent mixed with native species in early successional habitats.

3. Periwinkle, crepe-myrtle, yucca, and peach are unimportant currently. Peach is a clearly documented part of this historic scene and, in any case, is not an aggressive invader of native habitats.

4. Although many of the exotics were present in this country at the time of the battle of Shiloh (1862), it is difficult to prove whether they were actually established near the battlefield. As mentioned, peaches were. It is likely that 40 years of human history were also sufficient for the cultivation of roses, privet hedges, periwinkle, and yucca. Mimosa, English ivy, princess tree, and crepe-myrtle were likely brought in as ornamentals only in the late 1800s and early 1900s, culminating in the landscaping efforts of the National Park Service in the 1930s. Kudzu and lespedezas are more recent and were probably originally used in the area against soil erosion.

5. It is unlikely that Japanese honeysuckle was established at the time of the battle of Shiloh; in any case, it continues to spread and is now established to a greater extent than any time previously.

6. Monitoring of kudzu should continue and additional management should be undertaken when necessary.

7. Containment of English ivy and retarding Japanese honeysuckle are suggested.

8. The work reported here involved a broad scale survey. Additional surveys are needed for the species and habitats not encountered during this project (e.g., Wisteria sinensis, and areas far from roads).

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APPENDIX I. A checklist of exotic species of Shiloh National Military Park. (I = invasive species; P = persistent after cultivation; F = species of fields, lawns, and roadsides) (from Jones and White 1981)

Species	Place of origin
WOODY SPECIES:	
Albizia julibrissin (I)	Asia
Broussonetia papyrifera (P)	Asia
Chaenomeles lagenaria (P)	Japan
Hedera helix (I)	Europe
Hibiscus syriacus (P)	Asia
Lagerstroemia indica (I)	Asia
Ligustrum sinense (I)	China
Lonicera japonica (I)	Asia
Maclura pomifera (P)	South-central U.S.
Magnolia grandiflora (I)	N. American Coastal Plain
Malus pumila (P)	Asia
Paulownia tomentosa (I)	China
Pueraria lobata (I)	Japan
Pyrus communis (P)	Eurasia
Rosa cathayensis (P)	China
Rubus bifrons (P)	Eurasia
Vinca minor (I)	Europe
Wisteria sinensis (P)	Asia
HERBACEOUS SPECIES:	
Aira elegans (F)	Europe
Amaranthus hybridus (F)	Tropical America
Anthoxanthum adoratum (F)	Europe
Arabidopsis thaliana (F)	Eurasia
Arenaria serpyllifolia (F)	Eurasia
Asparagus officinalis (F)	Europe
Belamcanda chinensis (P)	Asia
Bromus commutatus (F)	Europe
Cardamine hirsuta (F)	Old World
Cardiospermum halicacabum (I)	Tropical America
Chenopodium album (F)	Eurasia
Chenopodium ambrosioides (F)	Tropical America
Cynachum laeve (F)	Europe
Cynadon dactylon (F)	Old World
Cyperus iria (F)	Eurasia
Cactylis glomeratus (F)	Europe
Daucus carota (F)	Eurasia
Digitaria sanguinalis (F)	Europe
Dioscorea battatas (F)	China
Draba verna (F)	Eurasia
Duschesnea indica (F)	Asia
Eleusine indica (F)	Old World
Eulalia viminea (I)	Tropical Asia
Festuca elatior (F)	Europe
Heliotropum indicum (F)	Brazil
Hemerocallis fulva (P)	Europe
Holcus lanatus (F)	Europe
Hypericum perforatum (F)	Europe
Hypochoeris radicata (F)	Eurasia
Ipomea hederacea (F)	Tropical America
Limium amplexicaule (F)	Eurasia
Lathyrus latifolius (F)	Europe
Lespedeza cuneata (F)	Asia
Lespedeza stipulacea (F)	Asia
Melilotus alba (F)	Eurasia
Mullogo verticillata (F)	Tropical America
Muscari racemosa (P)	Europe
Ornithogalum umbellatum (P)	Europe
Paspalum dilatatum (F)	South America
Plantago aristata (F)	Southwestern U.S.
Plantago lanceolata (F)	Eurasia
Poa pratensis (F)	Northern U.S. and Europe
Rumex acetosella (F)	Eurasia
Rumex crispus (F)	Europe
Rumex obtusifolius (F)	Europe
Setaria italica (F)	Old World
Setaria viridis (F)	Eurasia
Sherardia arvensis (F)	Europe
Sorghum halepense (F)	Mediterranean
Stellaria media (F)	Old World
Taraxacum officinale (F)	Eurasia
Trifolium pratense (F)	Eurasia
Trifolium procumbens (F)	Eurasia
Trifolium repens (F)	Eurasia
Valerianella locusta (F)	Europe
Verbascum blattaria (F)	Eurasia
Verbascum thaspus (F)	Eurasia
Veronica arvensis (F)	Eurasia
Vicia angustifolia (F)	Europe