

**EXOTIC PLANT SURVEY
OF THE LOOKOUT MOUNTAIN UNIT AT
CHICKAMAUGA AND CHATTANOOGA
NATIONAL MILITARY PARK**

REPORT FOR THE SUPERINTENDENT



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Report for the Superintendent

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Abstract

The investigators surveyed the Lookout Mountain Unit of Chicamauga-Chattanooga National Military Park for the locations and population densities of exotic woody plants. A total of 655 exotic populations were recorded. Japanese honeysuckle (Lonicera japonica) was the most common exotic, with 269 populations, and 60% of the total exotic cover of all vine species. Kudzu accounted for 31% of the vine cover, but its individual populations were, on the average, larger than those of honeysuckle. Princess tree (Paulownia tomentosa) was the most common arborescent exotic, followed by tree of heaven (Ailanthus altissima) and mimosa (Albizia julibrissin). Most of the exotic populations were concentrated along roads in the eastern portion of the unit.

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Introduction

In order to better understand the nature and magnitude of the exotic plant invasion on Lookout Mountain at Chickamauga and Chattanooga National Military Park, an exotic plant survey was conducted during the summer of 1980. The objectives of the survey were 1) to identify and locate as many woody exotic populations as possible and 2) to estimate the size of these populations and their impact on native vegetation. Similar surveys were conducted at Cumberland Gap National Historical Park, Cowpens National Battlefield, and Shiloh National Military Park (Butler et al. 1981, Bratton and Butler in press and Jones and White 1981, respectively).

Methods

All roads and trails within the boundaries of Point Park on Lookout Mountain were walked and data recorded each time a woody exotic population was observed. The location of each exotic population was marked on a USGS topographic map. The data recorded at each site included slope, aspect, elevation, topography, forest type, successional stage, understory, and percent canopy cover.

For exotic vines and shrubs, the area occupied by each population was estimated in the following manner. The percent cover provided by the exotic population was divided into three categories: 1) less than 20% cover, 2) 20-90% cover, and 3) greater than 90% cover. The area occupied by the exotic in each of the three categories was paced off and recorded; this was done for both the ground layer and the canopy layer. A total cover estimate was then calculated by summing the amounts of complete cover (100%) in each category. For example, if 100 m² had a 10% cover, 50 m² had a 50% cover, and 50 m² had a 100% cover, the total cover estimate would be $(100 \times 10\%) + (50 \times 50\%) + (50 \times 100\%) = 85 \text{ m}^2$.

In the case of exotic tree species, the number of individuals in the population was counted according to the following size classes: 1) number of seedlings, i.e. stems less than dbh heights, 2) number of stems less than 1 cm dbh, 3) number of stems 1-10 cm dbh, and 4) number of stems greater than 10 cm dbh. Diameter was recorded and basal area calculated for all individuals greater than 1 cm dbh.

The impact of each exotic population on the surrounding native vegetation was rated subjectively using a scale of 0 (almost no impact) to 5 (maximum impact, 100% cover). The impact on the herb, shrub, and canopy layers was rated separately.

Results and Discussion

A total of 655 woody exotic populations were observed along the roads and trails of Point Park. Nine different taxa were represented (see table 1). Japanese honeysuckle (Lonicera japonica) was the most common exotic species with 269 recorded populations, which accounted for 41% of the total. Three tree species, princess tree (Paulownia tomentosa), tree of heaven (Ailanthus altissima), and mimosa tree (Albizia julibrissin) together accounted for 37% of the observed exotic populations. Other species represented were privet (Ligustrum vulgare), kudzu (Pueraria lobata), English ivy (Hedera helix), and periwinkle (Vinca minor).

In terms of total cover, Japanese honeysuckle was again the most important species, with 92,879 m² which represented 60% of the total for all five vine species (see table 2). Kudzu accounted for 31% of the total cover, which made it much more important than its 6% frequency indicated. Kudzu had a mean population cover of 1261 m² compared with 345 m² for Japanese honeysuckle. There were far fewer kudzu populations than

Table 1. Woody exotic taxa found at Point Park by frequency of occurrence.

<u>Species</u>	Frequency	
	<u>(No. of populations)</u>	<u>Percent</u>
<u>Lonicera japonica</u>	269	41
<u>Paulownia tomentosa</u>	105	16
<u>Ailanthus altissima</u>	73	11
<u>Albizia julibrissin</u>	65	10
<u>Ligustrum vulgare</u>	65	10
<u>Pueraria lobata</u>	38	6
<u>Hedera helix</u>	29	4
<u>Vinca minor</u>	6	1
Total		100

honeysuckle populations, but the individual kudzu populations were, on average, more than three times larger in total cover than the individual honeysuckle populations.

Figures 1 and 2 are outline maps of Point Park showing the locations of all observed Japanese honeysuckle and kudzu populations. The maps were prepared using CALFORM (Laboratory for Computer Analysis and Spatial Graphics 1972). Each population is represented by a number which indicates the estimated total cover of that particular population.

As can be seen from table 3, most (88%) of the honeysuckle populations had less than 500 m² of total cover and almost 50% had less than 100 m² of total cover. Kudzu, on the other hand, had a much higher percentage (45%) of populations with more than 500 m² of total cover.

Table 4 shows the number of individuals by size class of each of the three exotic tree species observed, and the total basal area of each. Princess tree had the greatest total basal area with 16.2 m² or 77% of the total for the three species. Little can be inferred about the population structures based on the number of individuals in each size class since there is little correlation between age and diameter (Smith 1974). It does appear that mimosa is a much more prolific seeder than the other two species. However, without survival data it is impossible to tell whether the populations are increasing, decreasing, or stable.

The impact of an exotic population on the surrounding native vegetation was judged by two criteria: to what extent the exotic appeared to be displacing native species, and, for vines, whether the exotic was covering or killing other plants. From table 5 it can be seen that the exotic tree species had very little impact on the herb layer. All of the exotic tree populations were either in impact class 0 (almost no impact),

Table 2. List of exotic vine species observed at Point Park showing total cover estimate and mean total cover per population.

<u>Species</u>	<u>Total cover (m²)</u>	<u>Percent</u>	<u>Mean (m²)</u>
<u>Lonicera japonica</u>	92,879	61	345
<u>Pueraria Lobata</u>	47,909	32	1261
<u>Hedera helix</u>	8,142	5	281
<u>Vinca minor</u>	3,140	2	523
TOTAL	152,070	100	230

Table 3. Japanese honeysuckle and kudzu populations by total cover classes.

<u>Total cover (m²)</u>	<u>Lonicera japonica</u>		<u>Pueraria lobata</u>	
	<u>Frequency</u>	<u>Percent</u>	<u>Frequency</u>	<u>Percent</u>
<100	131	49	8	21
100-500	105	39	13	34
500-2000	21	8	12	32
>2000	12	4	5	13
TOTAL	269	100	38	100

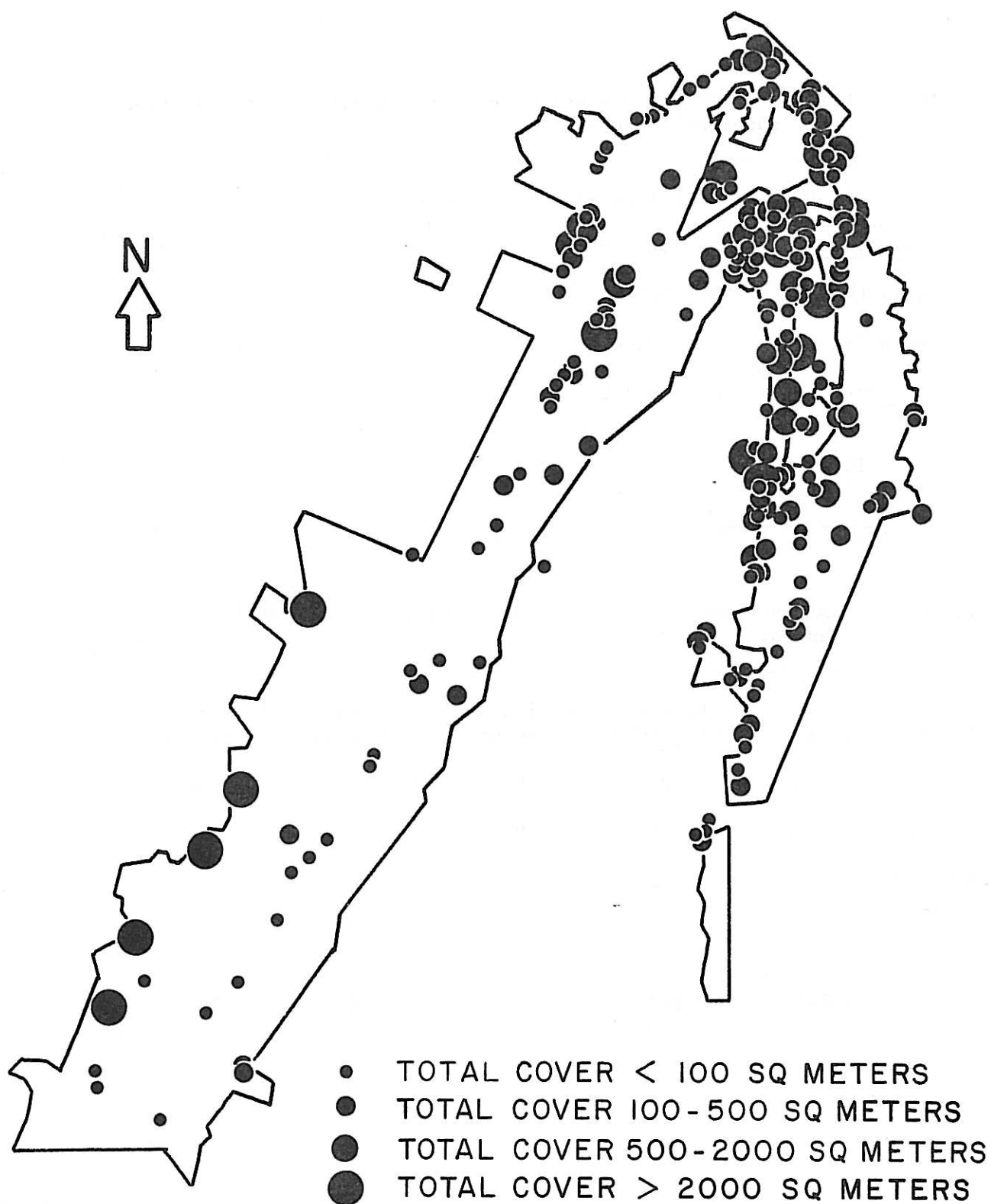


Figure 1. Japanese Honeysuckle populations on Lookout Mountain.

Table 4. Exotic tree species observed at Point Park by size classes and basal area.

<u>Species</u>	<u>Seedlings</u>	<u>1 cm</u>	<u>1-10 cm</u>	<u>10 cm</u>	<u>Basal area (m²)</u>
<u>Paulownia tomentosa</u>	48	48	415	395	16.2
<u>Ailanthus altissima</u>	124	414	598	136	3.9
<u>Albizia julibrissin</u>	2233	435	313	28	0.9

class 1 (displacing a few natives), or class 2 (moderate distribution); the vast majority were in class 0.

The exotic vines were judged to have had a much greater impact on the herb layer than the trees. Forty-seven percent of the Japanese honeysuckle populations were in impact class 3 (dominant species or overcoming woody plants). Thirty-nine percent of the kudzu populations were in class 4 (engulfing site).

The exotic tree populations had a greater impact on the shrub and canopy layers than on the herb layer (see tables 6 and 7). This is reasonable since it is more likely that the small to medium-sized exotic trees would be displacing other trees and shrubs rather than herbs. Of the exotic trees, princess tree had the greatest impact on the canopy layer. This is again reasonable since it had the largest basal area of the three exotic tree species.

Japanese honeysuckle had less impact on the shrub layer than on the herb layer, and even less on the canopy layer. This is not surprising since the heaviest honeysuckle cover was at or near ground level. In many areas Japanese honeysuckle was totally dominant at ground level with minimal impact on the canopy. Ultimately honeysuckle does impact the canopy indirectly by suppressing natural regeneration. Thus it should be recognized that Japanese honeysuckle will eventually cause community changes in all levels of the forest.

Kudzu had a relatively great impact on all three layers. In all three layers, in more than 50% of the kudzu populations, kudzu was either the dominant species or it was engulfing the site. It is clear that kudzu had the greatest impact on native vegetation of all the woody exotic species observed at Point Park.

Table 5. Impact of exotic populations on the herb layer.

<u>Species</u>	<u>Impact classes</u>						<u>Total</u>	
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>		
<u>Alibizia</u>	52	7	6	0	0	0	65	Frequency Percent
<u>julibrissin</u>	80	11	9	0	0	0	100	
<u>Ailanthus</u>	62	7	4	0	0	0	73	
<u>altissima</u>	85	10	5	0	0	0	100	
<u>Paulownia</u>	102	2	1	0	0	0	105	
<u>tomentosa</u>	97	2	1	0	0	0	100	
<u>Hedera</u>	1	1	4	11	11	1	29	
<u>helix</u>	3	3	14	38	38	3	100	
<u>Ligustrum</u>	53	6	5	1	0	0	65	
<u>vulgare</u>	82	9	8	2	0	0	100	
<u>Lonicera</u>	0	6	91	126	46	0	269	
<u>japonica</u>	0	2	34	47	17	0	100	
<u>Pueraria</u>	0	0	10	10	15	3	38	
<u>lobata</u>	0	0	26	26	39	8	100	
<u>Vinca</u>	0	0	1	2	3	0	6	
<u>minor</u>	0	0	17	33	50	0	100	

0 - almost no impact

1 - displacing a few natives or climbing on stems

2 - moderate distribution on ground, in branches, etc.

3 - dominant species or overcoming woody plants

4 - engulfing site, killing shrubs or trees

5 - 100% cover

Kudzu had a relatively great impact on all three layers. In all three layers, in more than 50% of the kudzu populations, kudzu was either the dominant species or it was engulfing the site. It is clear that kudzu had the greatest impact on native vegetation of all the woody exotic species observed at Point Park.

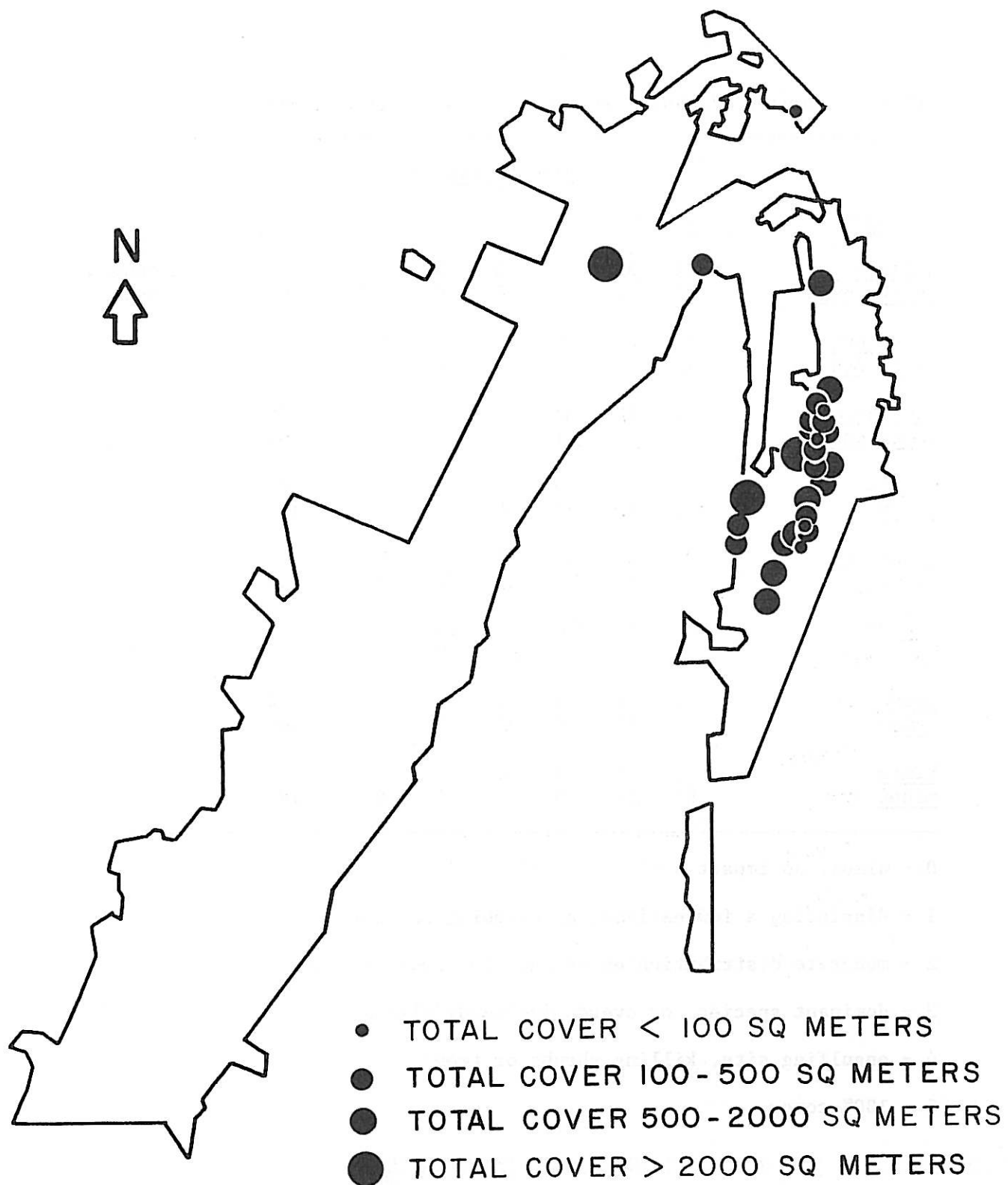


Figure 2. Kudzu populations on Lookout Mountain.

Table 6. Impact of exotic populations on the shrub layer.

<u>Species</u>	<u>Impact classes</u>						<u>Total</u>	Frequency Percent
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>		
<u>Albizia</u>	22	30	13	0	0	0	65	
<u>julibrissin</u>	34	46	20	0	0	0	100	
<u>Ailanthus</u>	11	27	30	5	0	0	73	
<u>altissima</u>	15	37	41	7	0	0	100	
<u>Paulownia</u>	53	40	12	0	0	0	105	
<u>tomentosa</u>	50	38	11	0	0	0	100	
<u>Hedera</u>	25	3	0	0	1	0	29	
<u>helix</u>	86	10	0	0	3	0	100	
<u>Ligustrum</u>	5	24	28	8	0	0	65	
<u>vulgare</u>	8	37	43	12	0	0	100	
<u>Lonicera</u>	65	52	56	73	23	0	269	
<u>japonica</u>	24	19	21	27	9	0	100	
<u>Pueraria</u>	2	4	6	12	14	0	38	
<u>lobata</u>	5	11	16	32	37	0	100	
<u>Vinca</u>	5	1	0	0	0	0	6	
<u>minor</u>	83	17	0	0	0	0	100	

0 - almost no impact

1 - displacing a few natives, or climbing on stems

2 - moderate distribution on ground, in branches, etc.

3 - dominant species, or overcoming woody plants

4 - engulfing site, killing shrubs or trees

5 - 100% cover

Table 7. Impact of exotic populations on the canopy layer.

<u>Species</u>	<u>Impact classes</u>						<u>Total</u>	Frequency Percent
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>		
<u>Albizia</u>	40	23	2	0	0	0	65	
<u>julibrissin</u>	62	35	3	0	0	0	100	
<u>Ailanthus</u>	21	39	10	3	0	0	73	
<u>altissima</u>	29	53	14	4	0	0	100	
<u>Paulownia</u>	23	53	20	9	0	0	105	
<u>tomentosa</u>	22	50	19	9	0	0	100	
<u>Hedera</u>	10	13	6	0	0	0	29	
<u>helix</u>	34	45	21	0	0	0	100	
<u>Ligustrum</u>	60	5	0	0	0	0	65	
<u>vulgare</u>	92	8	0	0	0	0	100	
<u>Lonicera</u>	120	87	41	18	3	0	269	
<u>japonica</u>	45	32	15	7	1	0	100	
<u>Pueraria</u>	1	5	9	11	10	2	38	
<u>lobata</u>	3	13	24	29	26	5	100	
<u>Vinca</u>	6	0	0	0	0	0	6	
<u>minor</u>	100	0	0	0	0	0	100	

0 - almost no impact

1 - displacing a few natives, or climbing on stems

2 - moderate distribution on ground, in branches, etc.

3 - dominant species, or overcoming woody plants

4 - engulfing site, killing shrubs or trees

5 - 100% cover

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