PRESERVING AND PROTECTING HISTORIC FORESTS

FOREST MANAGEMENT PLAN FOR THE CARL SANDBURG HOME NATIONAL HISTORIC SITE



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FOREST MANAGEMENT PLAN FOR THE CARL SANDBURG HOME NATIONAL HISTORIC SITE FLAT ROCK, NORTH CAROLINA

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Background

The Carl Sandburg Home National Historic Site (CSHNHS) occupies about 267 acres in the lower Blue Ridge Mountains in Henderson County, North Carolina, near the small town of Flat Rock (Hart 1993). The estate dates back to 1838, when the property was first acquired by Christopher G. Memminger, a statesman, lawyer, and Secretary of the Confederate Treasury. Memminger, from Charleston, South Carolina, acquired the property for a summer home, which he used until after the Civil War, deeding the property to James Jones Gregg in 1865 (Hart 1993). The Memminger family occupied the property until 1888, when it came under the control of the Gregg family. There are no records of the Gregg family occupying the house, and the estate fell into disrepair until it was acquired by a wealthy Greenville, South Carolina businessman, Ellison Adger Smyth, in 1900. Smyth used the property as a summer home until he retired there in 1925. Originally called Rock Hill by Christopher Memminger, Ellison Smyth renamed the estate "Connemara," for its resemblance to his native Ireland. Smyth maintained the estate as an active farm and was responsible for many development projects. He added Side Lake, improved the main access drive, planted many trees and shrubs, and constructed the hiking trail to the top of Big Glassy Mountain.



In 1945, Carl Sandburg and his wife Lilian purchased Connemara, and moved there with their children. Sandburg, renowned poet, historian, biographer, and musician, spent the last 22 years of his life working, studying, and drawing inspiration from the natural setting of the estate. His wife was an active goat farmer, and raised prized goats for milk and show. Following Sandburg's death in 1967, the estate was acquired by the U.S. Department of the Interior National Park Service in 1972, and opened to the public in 1974. Today the National Park Service manages the historic site, including main home, farm buildings, ponds, pastures and woodlands, for about 56,000 visitors per year. The CSHNHS is primarily intended as a cultural resource park, commemorating the life and works of Carl Sandburg. However, the estate also represents a unique natural setting, with important natural features, some with ecological significance. The estate contains over 500 species of vascular plants, and recently 14 ecological communities have been identified (White, 2003).

Many visitors use the park for its natural features, hiking to the top of Big Glassy Mountain, birdwatching, or merely observing nature along the many trails, streams, and ponds.



CSHNHS has natural resource-based recreational value.

Land Use History

The focus of this management plan is the 232 acres classified as "forest" or "woodland." The bulk of this area is located on the mountain and ridges south of the main house, though small forest patches are found in and around the fields to the north of the house as well. This area of Henderson County has had a long history of human occupation and use. Prior to European settlement in the early 1800's, the area had been a popular hunting and trading ground for the native Cherokee Indians. The flat, granitic rock outcrops common in the area were used for this purpose, and hence the name of the village, Flat Rock. European settlement brought clearing of the forest and more agricultural production, and soon the area became popular as a summer resort area. Wealthy city dwellers from Charleston and other eastern lowland cities came to the Flat Rock area to escape summer heat during the 1800's and early 1900's.

The forests of the CSHNHS may have been partially harvested prior to acquisition, but no records exist. The Sandburgs had a strong no-management bias with their forest land, so certainly no timber harvesting or other forest management activities have occurred on the property since 1945. Additionally, wildfire has been excluded from the park, and hunting restrictions have allowed populations of native animals, particularly whitetail deer, to increase.

Natural processes in the forest are progressing, including plant succession, invasion of exotic plant species in many areas, soil building and covering of the rock outcrops, and gap formation as overmature trees succumb to blowdown, insects, and disease. As the National Park Service has adopted the Sandburgs' philosophy of letting nature take its course, these changes in the forest are both predictable and acceptable.

Natural Resources

Geology and Soils

The CSHNHS lies within the lower Blue Ridge Mountain physiographic province, with elevations ranging from 2,160 feet along the lower stream on the northern boundary to 2,783 feet on the top of Big Glassy Mountain. The CSHNHS lies within the French Broad River Watershed. Geology of this area is controlled by igneous and metamorphic rocks, principally the Henderson Gneiss Formation. Visible granitic outcrops occur in many areas. Rock outcrops are common in the northern reaches of the park, and comprise a globally rare ecological association, the Appalachian Highlands Granitic Domes (White 2003).

Four primary soil series are found within the park, including the Ashe stony sandy loam, Codorus loam, Edneyville fine sandy loam, and Tate fine sandy loam (King 1980). The Ashe stony sandy loam is the primary forest soil in the park, and occurs predominantly in the southern portion of the park. The Ashe soil has a thin layer of sandy loam soil overlying igneous and metamorphic bedrock. The Edneyville soil is found in the northeastern third of the park, and

consists of a deep sandy loam with bedrock 40 inches or more below the surface. The Tate and Codorus soils are deeper and more productive, and underlie the developed and agricultural areas of the park. The surface soil is deeper with the Tate and Codorus soils, and bedrock is 60 inches or deeper below the surface.

Ecological Associations

A recent survey by the Southern Region of NatureServe (White 2003) revealed that the CSHNHS contains 14 distinct ecological associations (Table 1), representing a surprising amount of biodiversity for a small park. Of these associations, only the Appalachian Highlands Rock Outcrops is considered a globally rare ecosystem, labeled as a G2 ecosystem.

Most of the forested areas of the park occur in more common Appalachian oak and pine systems, which are abundant throughout the Appalachian region. Only the Appalachian Highlands Pitch and Table Mountain Pine Woodland is of ecological significance, since this ecosystem is in general decline due to the reduction in wildfire. Both pitch and Table Mountain pine depend to some degree on wildfire to create the necessary conditions for natural regeneration to occur, and in the absence of fire these stands decline and are replaced by more tolerant, drought-resistant hardwood species like chestnut oak, scarlet oak, blackgum, and red maple.

Throughout these ecological associations, over 500 species of vascular plants have been recorded, which is estimated to be 90% of the species occurring in the park (White 2003). Additional surveys of both plant and animal life are on-going in the park. Primary threats to these ecosystems include invasive exotic plants and natural succession in the absence of disturbances like fire, which tend to favor some species over others. In the Flat Rock area continued human development will result in even more pressure on the CSHNHS, bringing in more propagules of invasive exotic species, more visitors, and more impacts on the land.

Table 1. Ecological associations of the Carl Sandburg Home National Historic Site (White 2003).

System (Ecogroup)	Ecological Associations	
	Scientific name	Common name
Appalachian Highlands Hemlock-Hardwood Forests	*Tsuga canadensis – Liriodendron tulipifera – Betula lenta/Rhododendron maximum* forest	Eastern hemlock – tuliptree – sweet birch/great rhododendron forest
Appalachian Highlands Dry-Mesic Oak Forests and Woodlands or Appalachian Shortleaf Pine-Mesic Oak Forest	*Pinus echinata – Quercus alba/ Vaccinium pallidum/Hexastylis arifolia – Chimaphila maculata* forest	Shortleaf pine – white oak/ hillside blueberry/arrowleaf heartleaf – striped wintergreen forest
Appalachian Highlands Xeric Oak Forests	*Quercus* (*prinus*, *coccinea*)/*Kalmia latifolia*/(*Galax urceolata, Gaultheria procumbens*) forest	(Rock chestnut oak, scarlet oak)/ mountain laurel/(galax, wintergreen) forest
Appalachian Montane Oak-Hickory Forests	*Quercus alba – Q.* (*rubra, prinus*)/ *Rhododendron cal – Kalmia latifolia* (*Gaylussacia ursina*) forest	White oak – (northern red oak, rock chestnut oak)/flame azalea – mountain laurel – (bear huckleberry) forest
Appalachian Montane Oak-Hickory Forests	*Quercus prinus – Q. rubra/ Rhododendron maximum/Galax urceolata* forest	Rock chestnut oak – northern red oak/great rhododendron/galax forest
Appalachian Montane Oak-Hickory Forests	*Quercus rubra – Acer rubrum/ Calycanthus floridus – Pyrularia pubera/Thelypteris noveboracensis* forest	Northern red oak – red maple/ sweet-shrub – buffalo-nut – New York fern forest
Appalachian Montane Oak-Hickory Forests	*Quercus prinus* – (*Q. rubra*) – *Carya* spp./*Oxydendrum arboreum – Cornus florida* forest	Rock chestnut oak – (northern red oak) – hickory spp./sourwood – flowering dogwood forest
Eastern Open Marshes and Ponds	*Nuphar lutea* spp. *advena – Nymphaea odorata* herbaceous vegetation	Broadleaf pondlily – white waterlily herbaceous vegetation
Eastern Emergent Marshes	*Juncus effusus* seasonally flooded herbaceous vegetation	Soft rush seasonally flooded herbaceous vegetation
Exotic Species-Dominated Herbaceous Upland Vegetation	*Lolium* (*arundinaceum*, *pratense*) herbaceous vegetation	(Tall fescue, meadow fescue) herbaceous vegetation
Appalachian Highlands Rock Outcrops	*Selaginella rupestris – Schizachyrium scoparium – Hypericum gentianoides – Bulbostylis cappilaris* herbaceous vegetation	Rock spikemoss – little bluestem – pineweed – common hairsedge herbaceous vegetation
Appalachian Highlands Pitch and Table Mountain Pine Woodlands	*Pinus pungens – P. rigida – (Quercus prinus)/Kalmia latifolia – Vaccinium pallidum* woodland	Table mountain pine – pitch one – (rock chestnut oak)/mountain laurel – hillside blueberry woodland
Appalachian Highlands Upland Pine Forests	*Pinus strobus – Quercus (coccinea, prinus)/Gaylussacia ursina – Vaccinium stamineum*) forest	Eastern white pine – (scarlet oak, rock chestnut oak)/(bear huckleberry, deerberry) forest
Semi-natural Wooded Uplands	*Pinus strobus* successional forest	Eastern white pine successional forest

Management Objectives and Constraints

Since the CSHNHS is primarily a cultural resource park, the primary emphasis is toward historic scene restoration, cultural integrity of the main home and farm buildings, and interpretation of the estate as it existed and was used during the historic period, defined as 1960-1967 (Hart 1993). The primary driving force behind management of the forests is to allow nature to take its course, a philosophy adopted and practiced by the Sandburgs. As such, heavy management practices such as timber harvesting and prescribed burning are not envisioned for the park. Even though lack of management will cause natural succession to create a forest much different from the one that the Sandburgs knew, this direction is considered acceptable by park administration. For example, continued fire suppression and lack of a prescribed burning program is allowing a heavy understory of fire-intolerant species, like red maple, white pine, and the birches, to develop and take hold.

The primary objectives, as determined by CSHNHS administration, are as follows:

- Allow nature to take its course, with the exception of wildfire
- Suppress wildfires
- Reduce wildfire hazard
- Maintain safety of trails, e.g., remove hazardous trees
- Reduce environmental impacts of visitor use, e.g., erosion along trails
- Maintain or enhance biodiversity
- Maintain forest health
- Protect globally rare granitic domes
- Reduce the effects of invasive exotic species
- Maintain health and vigor of historic trees

Methods

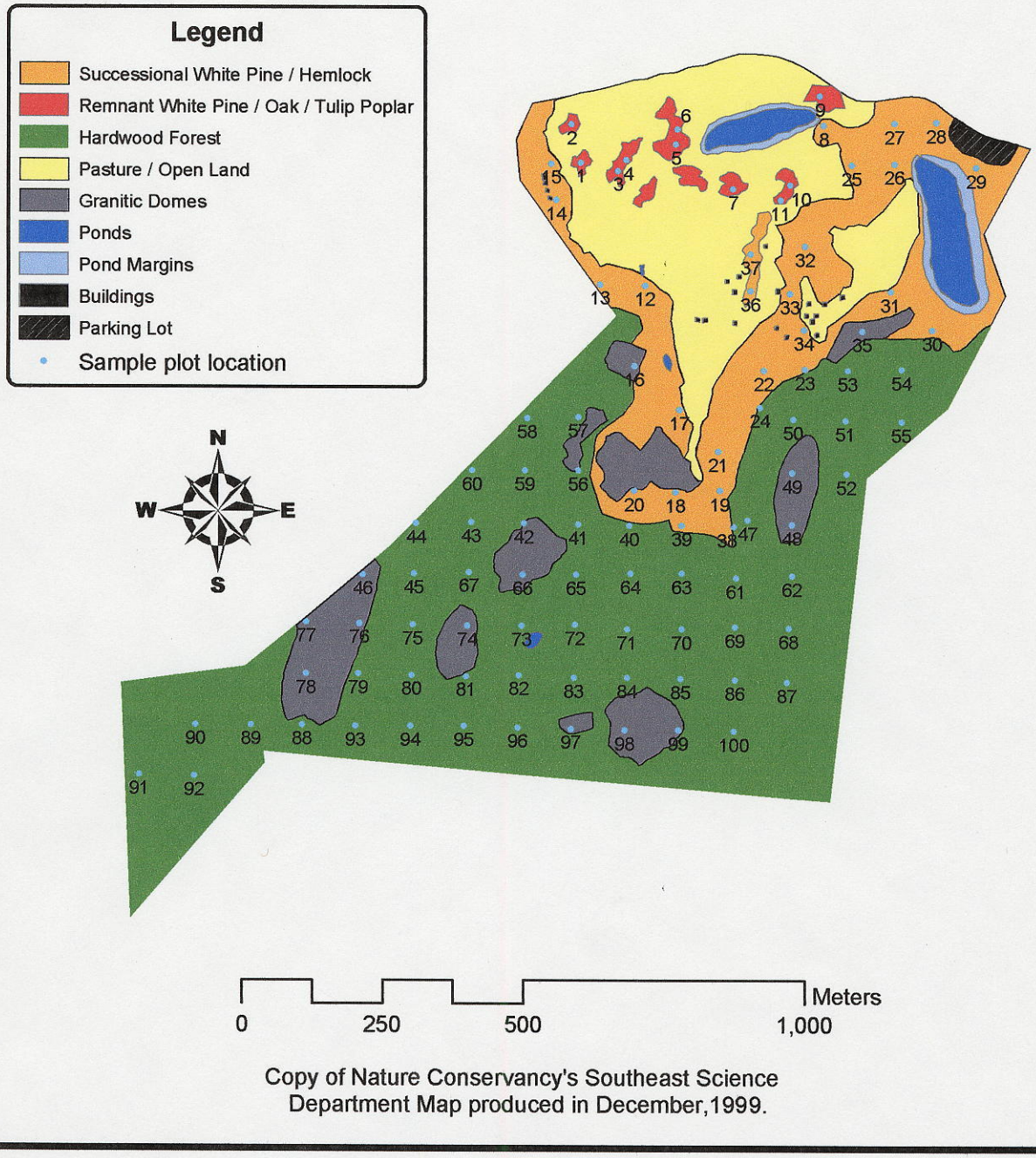
Data collection procedures focused on a field inventory of the forested areas of the CSHNHS. Circular 0.1-acre fixed area plots were located and established in the three primary plant communities identified by The Nature Conservancy (Figure 1):

Plant Community	Number of Plots
Hardwood forest	65
Remnant white pine/oak/yellow-poplar	10
Successional white pine/hemlock	25

Plots were located systematically to insure adequate coverage of the entire area, and were located using a Garmin global positioning system. On each main plot, all trees greater than 5 inches in dbh were recorded by species and diameter. Each overstory tree was also tallied as to its crown health status and crown class. Crown health and crown class categories were as follows:

Code	Crown Health	Crown Class
1	90-100% live	dominant
2	50-89% live	codominant
3	1-40% live	intermediate
4	recently dead	suppressed
5	dead with top gone	---

Sample plot location within the plant communities of the Carl Sandburg Home National Historic Site



Copy of Nature Conservancy's Southeast Science Department Map produced in December,1999.

Using the same plot center, a 0.05-acre subplot was established to measure all understory trees between 1 inch and 5 inches in dbh. Understory trees were also recorded by species and dbh. Additionally, a stem count of all shrubs occurring on this subplot was recorded. Within each main plot, four mil-acre sub-subplots were established to count all woody stems (both trees and shrubs) less than one inch in diameter. These counts and measurements allowed for a full accounting of all woody vegetation on all plots by size category: overstory trees, understory trees and shrubs, and tree and shrub regeneration. For the overstory and understory trees, average and relative basal area per acre, density per acre, and frequency were calculated. The relative values were averaged to determine an importance value for each species. All calculations were done separately for the plots in each plant community. The density and frequency for woody plant regeneration and ground vegetation were also calculated.

Importance value (IV) is an ecological term that captures the relative importance of a species in a plant community. For overstory trees, for example, IV is calculated as the mean of relative dominance (expressed as basal area per unit area), relative density (expressed as the number of stems per unit area), and relative frequency. Thus, IV gives equal weight to all three variables: dominance, density, and frequency. Since it is calculated on a relative percent basis, the sum of the IV's for all species in the plant community is 100.

On each main plot, a visual assessment of fuel load by category was recorded. Fuel loads were determined to be either high, moderate, or low for each of three fuel categories: fine surface, heavy surface, and aerial. The frequency of plots in each fuel load/fuel type category was determined for each plant community. Also, the appropriate fuel model for the National Fire Danger Rating System (Anderson 1982) was also recorded for each plot, and the frequency of plots for each fuel model within each plant community determined.

Additional information recorded on each plot included overall forest health conditions, such as evidence of pine beetle damage, defoliation, disease, oak or pine decline, ice or wind damage, and mortality; management needs to meet park objectives; and age and height for selected trees in each plant community.

An historic tree assessment was conducted on 17 representative trees identified by park staff. The assessment included confirmation of species, dbh, overall tree health and condition, recommended actions to improve condition and health.

All field inventory plots were measured during July and August of 2002 and May of 2003. The historic tree assessment was conducted during October 2002.

Description of Forest Types

Remnant WhitePine/Oak/Yellow-Poplar (WP/O/YP)



Remnant White Pine/Oak/Yellow-poplar forest patch.

The Remnant WP/O/YP forest cover type occupies 3.5 acres in nine small patches in the northern portion of the park. These patches are surrounded by open fields, and thus have a large amount of edge effect. The overstory consists of 12 tree species, although three species dominate. Collectively, white pine, white oak, and yellow-poplar comprise nearly 68% of the importance values (Table 2). The white pines average 100 years of age, white oak 105,

and yellow-poplar 108 years (Table 3). The tallest trees in this cover type are the yellow-poplars, averaging 105 feet tall. Probably the most interesting species in the cover type are three osage-orange trees, averaging 11.4 inches in dbh, which are not currently listed on any vascular plant list for the park. For the most part, the overstory trees in this forest cover type are healthy, as 94% of the trees were classified as class 1 or 2, greater than 50% live crown. Only 6% of the standing trees were dead. There were basically none to low levels of damaging agents in the overstory trees (Tables 4-5).

Table 2. Forest overstory characteristics for the White Pine/Oak/Yellow-Poplar forest cover type at the Carl Sandburg Home National Historic Site.

Species	Avg. dbh (in.)	Avg. BA/ac (sq.ft.)	Relative BA/ac (%)	Avg. No. Trees/ac	Relative No. Trees/ac (%)	Relative Frequency (%)	Importance Value (%)
American sycamore	42.30	9.76	5.90	1.00	1.47	4.35	3.91
Blackgum	20.25	4.53	2.74	2.00	2.94	4.35	3.34
Black oak	28.20	4.34	2.62	1.00	1.47	4.35	2.81
Black walnut	16.10	1.41	0.86	1.00	1.47	4.35	2.22
Osage orange	11.40	2.13	1.29	3.00	4.41	4.35	3.35
Red maple	19.86	17.78	10.75	7.00	10.29	8.70	9.91
Southern red oak	25.70	3.60	2.18	1.00	1.47	4.35	2.67
Sourwood	14.50	1.15	0.69	1.00	1.47	4.35	2.17
White ash	12.40	0.84	0.51	1.00	1.47	4.35	2.11
White oak	25.67	48.53	29.36	11.00	16.18	21.74	22.42
White pine	13.03	48.76	29.50	34.00	50.00	17.39	32.30
Yellow-poplar	27.68	22.49	13.60	5.00	7.35	17.39	12.78
Total	**21.42**	**165.31**	**100.00**	**68.00**	**100.00**	**100.00**	**100.00**

Table 3. Average age and height for dominant tree species in the overstory at the Carl Sandburg Home National Historic Site.

Forest Cover Type	Species	Average Age (yr)	Average Height (ft)
White Pine/Oak/ Yellow-Poplar	white pine	100	106
	blackgum	102	61
	white oak	105	87
	yellow-poplar	108	105
	black walnut	50	67
White Pine/Hemlock	white oak	140	91
	white pine	101	95
	eastern hemlock	50	73
	yellow-poplar	110	111
Mixed Hardwood	chestnut oak	113	56
	white pine	75	78

Table 4. Dominant overstory tree condition for three forest cover types at the Carl Sandburg Home National Historic Site.

Forest Cover Type	Crown Health Class				
	1	2	3	4	5
	%				
White Pine/Oak/Yellow-Poplar	39	55	0	2	4
White Pine/Hemlock	24	66	5	3	2
Mixed Hardwood	13	61	20	3	3

Table 5. Forest health conditions for the White Pine/ Oak/Yellow-Poplar forest cover type at the Carl Sandburg Home National Historic Site.

Condition	Level		
	High	Moderate	None to Low
	%		
Pine beetle	0	0	100
Defoliation	0	0	100
Disease	0	10	90
Oak decline	0	0	100
Ice damage	0	0	100
Wind damage	0	0	100

The understory in the Remnant WP/O/YP forest cover type consists of only eight species, all of them native (Table 6). Clearly, white pine is the dominant understory species, with 46% of the importance values. The second most important species is black cherry, with only 11% of the importance values. Since white pine is moderately tolerant of shade, it is able to persist for longer in the understory, and is likely to form the next forest overstory if the current overstory succumbs to damage, e.g., wind or ice. Three shrub species occur in the understory of the WP/O/YP forest cover type: Alleghany blackberry, common privet, and multiflora rose. Multiflora rose, an invasive exotic species with nearly 66% of the importance values (Table 7), clearly dominates.

The ground layer woody vegetation, less than one inch in dbh, consists of both shrubs and tree regeneration (Table 8). In the WP/O/YP cover type, tree regeneration consisted of only six species, none of which were white pine. Blackgum dominated the regeneration spectrum, with over 46% of the importance values. Black cherry and white oak were the second and third most dominant tree regeneration species, respectively. The dominant shrub in the ground layer vegetation spectrum was multiflora rose, which accounted for almost 40% of the importance values. In all, the WP/O/YP forest cover type had 75 tree seedlings per acre and 963 shrubs per acre in the ground layer.

Table 6. Forest understory characteristics for the White Pine/Oak/Yellow-Poplar forest cover type at the Carl Sandburg Home National Historic Site.

Species	Avg. DBH (in.)	Avg. BA/ac (sq. ft.)	Relative BA/ac (%)	Avg. No. Trees/ac	Relative No. Trees/ac (%)	Relative Frequency (%)	Importance Value (%)
American hornbeam	1.40	0.04	1.21	4.00	5.41	8.33	4.98
Black cherry	2.73	0.29	8.06	6.00	8.11	16.67	10.94
Black locust	3.50	0.13	3.70	2.00	2.70	8.33	4.91
Black walnut	4.50	0.22	6.12	2.00	2.70	8.33	5.72
Flowering dogwood	2.17	0.32	8.94	12.00	16.22	25.00	16.72
Mulberry	1.30	0.02	0.51	2.00	2.70	8.33	3.85
Red maple	2.90	0.23	6.45	4.00	5.41	8.33	6.73
White pine	3.07	2.35	65.01	42.00	56.76	16.67	46.15
Total	**2.70**	**3.61**	**100.00**	**74.00**	**100.00**	**100.00**	**100.00**

Table 7. Forest shrub characteristics in the understory of the White Pine/Oak/Yellow-Poplar forest cover type at the Carl Sandburg Home National Historic Site.

Species	Average No. Stems/ac	Relative Density (%)	Frequency (%)	Relative Frequency (%)	Importance Value (%)
Alleghany blackberry	54	12.56	30	30.00	21.28
Common privet	4	0.93	10	10.00	5.47
Multiflora rose	372	86.51	60	60.00	73.26
Total	**430**	**100.00**	**120**	**100.00**	**100.00**

Table 8a. Forest tree regeneration characteristics for the White Pine/Oak/Yellow-Poplar forest cover type at the Carl Sandburg Home National Historic Site.

Species	Average No. Trees/ac	Relative Density (%)	Frequency (%)	Relative Frequency (%)	Importance Value (%)
Autumn olive	38	4.96	20	12.50	8.73
Black cherry	106	14.05	30	18.75	16.40
Blackgum	513	67.77	40	25.00	46.38
Red maple	50	6.61	20	12.50	9.56
White oak	31	4.13	40	25.00	14.57
Yellow- poplar	19	2.48	10	6.25	4.36
Total	**756**	**100.00**	**160**	**100.00**	**100.00**

Table 8b. Forest shrub regeneration characteristics for the White Pine/Oak/Yellow-Poplar forest cover type at the Carl Sandburg Home National Historic Site.

Species	Average No. Stems/ac	Relative Density (%)	Frequency (%)	Relative Frequency (%)	Importance Value (%)
Alleghany blackberry	38	3.90	30	23.08	13.49
American holly	6	0.65	10	7.69	4.17
Blackhaw	6	0.65	10	7.69	4.17
Common privet	6	0.65	10	7.69	4.17
Multiflora rose	325	33.77	60	46.15	39.96
Silky dogwood	581	60.39	10	7.69	34.04
Total	**963**	**100.00**	**130**	**100.00**	**100.00**

Successional White Pine/Hemlock Forest Cover Type (WP/H)



White Pine/Hemlock forest.

The Successional White Pine/Hemlock forest cover type occupies 40 acres in a thin band bordering the fields and pastures to the north and the mixed hardwood forest to the south. Although termed a "successional"forest, it should be pointed out that in the absence of serious insect or disease infestations, eastern hemlock is considered a climax forest species, and can achieve great longevity – perhaps 500 years or more. Hemlock grows more slowly than most of its associates, but can achieve greater ages. The oldest trees in this forest cover type are the white oaks, at 140 years, followed by the yellow-poplars, at 110 years. The yellow-poplars are also the tallest, averaging 111 feet (Table 3). The white pines average 101 years of age, and the smaller hemlocks only 50 years. The hemlocks are also shorter, averaging 73 feet tall.

The overstory trees in the WP/H forest cover type are generally healthy, with 90% of the trees classified in crown health class 1 or 2, greater than 50% live crown (Table 4). Only 5% of the overstory trees in this cover type are standing dead, and 5% are unhealthy, with less than 50% live crown. However, all 20 plots have some level of pine mortality and pine decline (Table 9), which is typical of a successional forest.

The overstory of the WP/H forest cover type has 22 species, a remarkable degree of diversity (Table 10). However, white pine comprises nearly 34% of the importance values for the cover type, and the next three most dominant species, white oak, yellow-poplar, and eastern hemlock, account for another 30%. This is a fully stocked forest, with nearly 159 square feet of basal area per acre and 144 overstory trees per acre.

Table 9. Forest health conditions for the White Pine/Hemlock forest cover type at the Carl Sandburg Home National Historic Site.

Condition	Level		
	High	Moderate	None to Low
	---------- % ----------		
Pine beetle	0	0	100
Defoliation	0	0	100
Disease	0	0	100
Oak decline	0	0	100
Ice damage	0	0	100
Wind damage	0	0	100
Pine decline	0	100	0
Pine mortality	0	100	0

Table 10. Forest overstory characteristics for the White Pine/Hemlock forest cover type at the Carl Sandburg Home National Historic Site.

Species	Avg. DBH (in.)	Avg. BA/ac (sq. ft.)	Relative BA/ac (%)	Avg. No. Trees/ac	Relative No. Trees/ac (%)	Relative Frequency (%)	Importance Value (%)
Black birch	7.15	0.22	0.14	0.80	0.56	0.79	0.50
Black cherry	5.20	0.06	0.04	0.40	0.28	0.79	0.37
Blackgum	5.52	0.41	0.26	2.40	1.67	3.17	1.70
Black locust	9.18	0.86	0.54	1.60	1.11	1.59	1.08
Black oak	15.04	3.99	2.51	2.80	1.94	4.76	3.07
Black walnut	9.30	0.44	0.28	0.80	0.56	0.79	0.54
Chestnut oak	15.60	9.07	5.71	6.00	4.17	7.14	5.67
Domestic pear	7.20	0.24	0.15	0.80	0.56	0.79	0.50
Eastern hemlock	11.15	8.08	5.08	10.00	6.94	7.14	6.39
Flowering dogwood	6.00	0.32	0.20	1.60	1.11	2.38	1.23
Mockernut hickory	8.50	0.81	0.51	2.00	1.39	2.38	1.43
Northern red oak	11.57	2.41	1.51	2.80	1.94	3.97	2.48
Pignut hickory	11.23	0.87	0.55	1.20	0.83	1.59	0.99
River birch	10.47	2.86	1.80	3.60	2.50	1.59	1.96
Red maple	7.32	2.68	1.68	8.40	5.83	7.94	5.15
Scarlet oak	15.82	6.61	4.16	4.00	2.78	5.56	4.16
Sourwood	8.14	2.27	1.43	5.60	3.89	6.35	3.89
Southern red oak	12.80	0.36	0.23	0.40	0.28	0.79	0.43
Virginia pine	14.95	1.08	0.68	0.80	0.56	0.79	0.68
White oak	16.30	29.51	18.58	17.20	11.94	11.90	14.14
White pine	12.53	68.65	43.22	56.40	39.17	19.05	33.81
Yellow-poplar	13.14	17.06	10.74	14.40	10.00	8.73	9.82
Total	**10.64**	**158.85**	**100.00**	**144.00**	**100.00**	**100.00**	**100.00**

Similar to the overstory, the understory of the WP/H forest cover type has 23 tree species, which is typical for a forest that has not seen a wildfire or prescribed fire for many years. Thin-barked species such as white pine, hemlock, black cherry, red maple, birches, and yellow-poplar, readily killed or injured by fire, are able to persist in the absence of fire. Particularly interesting is the advent of red maple as the second most dominant species in the understory, second only to white pine (Table 11). Collectively, white pine and red maple comprise nearly 50% of the importance values for the understory. Red maple is a common understory species that is increasing in great abundance throughout the eastern U.S. in areas where wildfire is suppressed. Red maple is a relatively fast-growing species that produces abundant crops of wind-dispersed seed early in the spring. It occurs on a wide range of sites from hydric to xeric, is moderately tolerant of shade, allowing it to persist in the understory, and is relatively tolerant of insect and disease problems. The richer soils of these lower elevation sites also favor a greater diversity of tree species.

Table 11. Forest understory characteristics for the White Pine/Hemlock forest cover type at the Carl Sandburg Home National Historic Site.

Species	Avg. DBH (in.)	Avg. BA/ac (sq.ft.)	Relative BA/ac (%)	Avg. No. Trees/ac	Relative No. Trees/ac (%)	Relative Frequency (%)	Importance Value (%)
American hornbeam	2.78	0.78	6.35	17.60	5.42	0.85	4.21
Black cherry	2.11	0.17	1.39	6.40	1.97	4.27	2.54
Blackgum	2.73	0.47	3.80	9.60	2.96	5.98	4.24
Black locust	4.40	0.08	0.69	0.80	0.25	0.85	0.60
Black oak	2.63	0.11	0.89	2.40	0.74	2.56	1.40
Black walnut	1.60	0.01	0.09	0.80	0.25	0.85	0.40
Chestnut oak	1.87	0.05	0.39	2.40	0.74	2.56	1.23
Domestic pear	2.87	0.26	2.14	5.60	1.72	0.85	1.57
Eastern hemlock	2.78	0.49	4.03	9.60	2.96	6.84	4.61
Flowering dogwood	2.55	0.41	3.37	10.40	3.20	5.98	4.18
American holly	2.10	0.04	0.32	1.60	0.49	1.71	0.84
Mockernut hickory	2.41	0.24	1.99	2.40	0.74	2.56	1.76
Northern red oak	1.99	0.14	1.17	5.60	1.72	4.27	2.39
Pignut hickory	2.25	0.05	0.41	1.60	0.49	1.71	0.87
River birch	2.40	0.18	1.45	4.80	1.48	0.85	1.26
Red maple	1.99	1.83	14.95	70.40	21.67	17.09	17.91
Sweet cherry	2.72	0.41	3.33	8.80	2.71	3.42	3.15
Scarlet oak	2.15	0.04	0.33	1.60	0.49	1.71	0.84
Sourwood	2.42	0.67	5.45	18.40	5.67	8.55	6.55
Southern red oak	2.23	0.17	1.37	5.60	1.72	2.56	1.89
White oak	1.72	0.14	1.13	8.00	2.46	5.98	3.19
White pine	2.61	5.20	42.46	123.20	37.93	13.68	31.36
Yellow-poplar	2.59	0.31	2.49	7.20	2.22	4.27	2.99
Total	**2.43**	**12.25**	**100.00**	**324.80**	**100.00**	**100.00**	**100.00**

Fifteen shrub species occurred in the understory of the WP/H forest cover type (Table 12), with deerberry the most dominant. This species comprises nearly 20% of the importance values for the cover type, and averages 372 stems per acre. Other common species include shrub yellow root, great rhododendron, both high-bush and low-bush blueberry, and multiflora rose.

Table 12. Forest shrub characteristics in the understory of the White Pine/Hemlock cover type at the Carl Sandburg Home National Historic Site.

Species	Average No. Stems/Ac	Relative Density (%)	Frequency (%)	Relative Frequency (%)	Importance Value (%)
Alleghany blackberry	50	3.76	24	8.45	6.10
Azalea	51	3.88	16	5.63	4.76
Black raspberry	81	6.12	32	11.27	8.69
Common privet	20	1.52	8	2.82	2.17
Carolina rose	6	0.48	4	1.41	0.95
Deerberry	372	28.18	36	12.68	20.43
Doghobble	24	1.82	8	2.82	2.32
High-bush blueberry	128	9.70	24	8.45	9.07
Low-bush blueberry	108	8.18	28	9.86	9.02
Multiflora rose	126	9.52	24	8.45	8.98
Mountain laurel	52	3.94	28	9.86	6.90
Rhododendron	58	4.36	40	14.08	9.22
Strawberry bush	4	0.30	4	1.41	0.86
St. John's wort	1	0.06	4	1.41	0.73
Shrub yellow root	240	18.18	4	1.41	9.80
Total	**1320**	**100.00**	**284**	**100.00**	**100.00**

Unlike the WP/O/YP forest cover type, the WP/H cover type was far more diverse in ground layer woody vegetation, with 26 tree species and 21 shrub species represented (Table 13). Interestingly, red maple was the most important tree seedling, with over 19% of the importance values, followed closely by white oak with 18%. White pine was the third most important tree species in the regeneration spectrum. Again, the absence of fire is clearly favoring the advent of red maple. Red maple is the sixth most important species in the overstory of the WP/H cover type, the second most important species in the understory, and the most important species in the ground layer. Of the 21 shrub species, three clearly dominate: deerberry, multiflora rose, and doghobble. Collectively, these species represent nearly 40% of the importance values of the shrub spectrum. In all, the WP/H forest cover type has 2,640 tree seedlings per acre and an additional 1,585 shrub stems per acre in the ground layer woody vegetation.

Table 13a. Forest tree regeneration characteristics for the White Pine/Hemlock forest cover type at the Carl Sandburg Home National Historic Site.

Species	Average No. Trees/ac	Relative Density (%)	Frequency (%)	Relative Frequency (%)	Importance Value (%)
American chestnut	10	0.38	16	2.38	1.38
American holly	13	0.47	16	2.38	1.43
Apple tree	18	0.66	4	0.60	0.63
Black cherry	183	6.91	68	10.12	8.52
Boxelder	8	0.28	4	0.60	0.44
Blackgum	30	1.14	20	2.98	2.06
Black locust	10	0.38	4	0.60	0.49
Bitternut hickory	3	0.09	4	0.60	0.34
Black oak	63	2.37	40	5.95	4.16
Black walnut	10	0.38	8	1.19	0.78
Chestnut oak	160	6.06	36	5.36	5.71
Downy serviceberry	130	4.92	24	3.57	4.25
Eastern hemlock	25	0.95	20	2.98	1.96
Eastern hophornbeam	15	0.57	4	0.60	0.58
Flowering dogwood	5	0.19	8	1.19	0.69
Mockernut hickory	13	0.47	16	2.38	1.43
Northern red oak	75	2.84	44	6.55	4.69
Pignut hickory	58	2.18	40	5.95	4.07
Red maple	738	27.94	76	11.31	19.62
Sassafras	28	1.04	20	2.98	2.01
Sugar maple	3	0.09	4	0.60	0.34
Southern red oak	130	4.92	4	4.17	4.55
Sourwood	8	0.28	8	1.19	0.74
White oak	688	26.04	72	10.71	18.38
White pine	210	7.95	76	11.31	9.63
Yellow-poplar	13	0.47	12	1.79	1.13
Total	**2640**	**100.00**	**672**	**100.00**	**100.00**

Table 13b. Forest shrub regeneration characteristics for the White Pine/Hemlock forest cover type at the Carl Sandburg Home National Historic Site.

Species	Average No. Stems/Ac	Relative Density (%)	Frequency (%)	Relative Frequency (%)	Importance Value (%)
Alleghany blackberry	25	1.58	20	8.47	5.03
Azalea	70	4.42	16	6.78	5.60
Black raspberry	58	3.63	24	10.17	6.90
Common privet	50	3.15	8	3.39	3.27
Carolina rose	5	0.32	4	1.69	1.01
Deerberry	343	21.61	36	15.25	18.43
Deciduous holly	28	1.74	4	5.08	3.41
Doghobble	278	17.51	12	1.69	9.60
Elderberry	3	0.16	4	1.69	0.93
Fetterbush	40	2.52	4	1.69	2.11
Fringetree	3	0.16	4	1.69	0.93
Hazel alder	128	8.04	4	1.69	4.87
High-bush blueberry	165	10.41	12	5.08	7.75
Low-bush blueberry	45	2.84	16	6.78	4.81
Multiflora rose	185	11.67	24	10.17	10.92
Mountain laurel	15	0.95	4	1.69	1.32
Rhododendron	23	1.42	16	6.78	4.10
Smooth allspice	100	6.31	12	5.08	5.70
Sweet cherry	18	1.10	4	1.69	1.40
St. John's wort	3	0.16	4	1.69	0.93
Spice bush	5	0.32	4	1.69	1.01
Total	**1585**	**100.00**	**236**	**100.00**	**100.00**



Mixed Hardwood forest.

Mixed Hardwood Forest Cover Type (MH)

The Mixed Hardwood forest cover type occupies 147 acres in the central and southern portions of the park. Most of the granitic domes are also found interspersed in this cover type. This cover type is somewhat of a catch-all type, in that it includes a variety of ecogroups and ecological associations such as the Appalachian Highlands Xeric Oak Forest, the Appalachian Highlands Pitch and Table Mountain Pine Woodland, and the Appalachian Montane Oak-Hickory Forest. Included within this cover type are a variety of site conditions, including coves, xeric and mesic slopes, and ridges. The yellow pine forests are found along the xeric, thin soil margins of the granitic domes.

Twenty-two species of overstory trees are found in the MH forest cover type (Table 14). The two dominant tree species are chestnut oak and white pine. Collectively, these two species comprise nearly 47% of the importance values for the cover type. Of lesser importance, but nonetheless present and likely increasing, are the hickories (bitternut, mockernut, pignut, and shagbark). Collectively, these species comprise 8% of the importance values of the cover type.

Table 14. Forest overstory characteristics for the Mixed Hardwood forest cover type at the Carl Sandburg Home National Historic Site.

Species	Avg. DBH (in.)	Avg. BA/ac (sq.ft.)	Relative BA/ac (%)	Avg. No. Trees/ac	Relative No. Trees/ac (%)	Relative Frequency (%)	Importance Value (%)
Blackgum	8.94	2.39	2.50	4.62	3.86	6.53	4.30
Bitternut hickory	11.60	0.48	0.50	0.62	0.51	1.03	0.68
Bigleaf magnolia	5.55	0.05	0.05	0.31	0.26	0.69	0.33
Black oak	15.05	3.43	3.58	6.80	5.69	3.44	4.24
Chestnut oak	12.80	38.63	40.37	35.38	29.59	18.56	29.51
Eastern hemlock	12.00	0.12	0.13	0.15	0.13	0.34	0.20
Eastern red cedar	9.30	0.07	0.08	0.15	0.13	0.34	0.18
Flowering dogwood	5.10	0.02	0.02	0.15	0.13	0.34	0.17
Mockernut hickory	10.56	3.44	3.60	5.23	4.37	5.15	4.38
Northern red oak	14.72	7.73	8.07	5.69	4.76	8.25	7.03
Pignut hickory	10.03	1.88	1.96	3.08	2.57	3.78	2.77
Pitch pine	12.58	0.63	0.66	0.62	0.51	1.37	0.85
Red maple	9.31	3.50	3.65	6.62	5.53	7.90	5.70
Shagbark hickory	5.70	0.03	0.03	0.15	0.13	0.34	0.17
Scarlet oak	12.64	1.60	1.67	1.69	1.42	3.09	2.06
Sourwood	7.70	3.60	3.77	10.15	8.49	10.31	7.52
Southern red oak	16.30	0.22	0.23	0.15	0.13	0.34	0.24
Table Mountain pine	13.21	1.53	1.60	1.38	1.16	2.41	1.72
Virginia pine	10.60	0.19	0.20	0.31	0.26	0.69	0.38
White oak	13.93	8.90	9.30	7.08	5.92	6.87	7.36
White pine	9.47	14.93	15.60	26.00	21.74	14.78	17.37
Yellow-poplar	10.41	2.33	2.43	3.23	2.70	3.44	2.86
Total	**10.80**	**95.71**	**100.00**	**119.57**	**100.00**	**100.00**	**100.00**

The overstory of the MH forest cover type is relatively healthy, with 74% of the trees classified with greater than 50% live crown. However, 20% of the overstory trees were classified as unhealthy, the highest of the three forest cover types at the CSHNHS. Six percent of the trees in the overstory were dead. None of the 70 plots in this forest cover type exhibited high problems for forest health (Table 15); however, 14% of the plots showed moderate ice damage and 19% showed moderate wind damage. An additional 6% showed moderate evidence of oak decline.

Table 15. Forest health conditions for the Mixed Hardwood forest cover type at the Carl Sandburg Home National Historic Site.

Condition	Level		
	High	Moderate	None to Low
	---------- % ----------		
Pine beetle	0	0	100
Defoliation	0	0	100
Disease	0	2	98
Oak decline	0	6	94
Ice damage	0	14	86
Wind damage	0	19	81

The understory of the MH forest cover type contained 28 tree species (Table 16). Most prevalent were white pine and red maple, which collectively comprise over 48% of the importance values. Again, the prevalence of these two species in the understory is a direct result of the absence of fire, since both species are quite susceptible to serious injury or death with a surface or crown fire. If fire was a part of the ecosystem, the oaks would be more prevalent. As is, the oak species (chestnut oak, northern red oak, scarlet oak, and white oak) comprise slightly over 11% of the importance values. The oak species comprise over 50% of the importance values of the overstory in this cover type. Two species, black oak and southern red oak, occur in the overstory but not the understory.

Sixteen species of shrubs occurred in the understory of the MH forest cover type (Table 17). Most prevalent were deerberry, low-bush blueberry, and mountain laurel. Collectively, these species comprised nearly 70% of the importance values in the cover type. These ericaceous shrubs are most common on xeric sites, and are noteworthy both for their high numbers (over 4,000 stems per acre) and their frequency (38% of the plots for deerberry, 57% for low-bush blueberry, and 50% for mountain laurel).

In the MH forest cover type there were 25 tree species represented in the regeneration spectrum, and an additional 21 shrub species (Table 18). Chestnut oak, red maple, and northern red oak, in that order, dominated. Collectively, these species accounted for 51% of the importance values of the tree regeneration. The woody shrubs were dominated by low-bush blueberry, with nearly 44 percent of the importance values. In the MH forest cover type, there were 2,049 tree seedlings per acre, and an additional 3,225 woody shrubs per acre.

Table 16. Forest understory characteristics for the Mixed Hardwood forest cover type at the Carl Sandburg Home National Historic Site.

Species	Avg. DBH (in.)	Avg. BA/ac (sq.ft.)	Relative BA/ac (%)	Avg. No. Trees/ac	Relative No. Trees/ac (%)	Relative Frequency (%)	Importance Value (%)
American hornbeam	2.50	0.01	0.15	0.31	0.17	0.48	0.27
Black birch	1.90	0.01	0.09	0.31	0.17	0.48	0.25
Black cherry	1.55	0.04	0.51	2.46	1.37	1.91	1.27
Bitternut hickory	2.79	0.88	12.62	17.54	9.76	0.48	7.62
Bigleaf magnolia	3.50	0.02	0.30	0.31	0.17	1.91	0.79
Blackgum	1.92	0.04	0.62	1.85	1.03	11.48	4.38
Chestnut oak	2.85	0.39	5.58	7.38	4.11	6.22	5.30
Downy serviceberry	1.40	0.01	0.10	0.62	0.34	0.48	0.31
Eastern hemlock	4.30	0.03	0.45	0.31	0.17	0.48	0.37
Eastern hophornbeam	1.10	0.00	0.03	0.31	0.17	0.48	0.23
Eastern red cedar	2.17	0.03	0.36	0.92	0.51	0.48	0.23
Flowering dogwood	2.40	0.41	5.87	12.00	6.68	0.96	0.61
Fraser magnolia	1.50	0.00	0.05	0.31	0.17	7.66	6.74
Fringetree	1.10	0.00	0.03	0.31	0.17	0.48	0.23
American holly	1.70	0.00	0.07	0.31	0.17	0.48	0.24
Mockernut hickory	2.15	0.14	1.98	4.62	2.57	3.35	2.63
Northern red oak	1.89	0.22	3.10	9.54	5.31	5.74	4.72
Pignut hickory	2.53	0.05	0.71	1.23	0.68	1.44	0.94
Pitch pine	2.55	0.02	0.32	0.62	0.34	0.96	0.54
Red maple	2.28	1.30	18.64	38.46	21.40	18.18	19.41
Sweet cherry	1.10	0.00	0.06	0.62	0.34	0.48	0.29
Sassafras	2.30	0.01	0.13	0.31	0.17	0.48	0.26
Scarlet oak	2.50	0.02	0.31	0.62	0.34	0.48	0.38
Sourwood	3.07	0.88	12.63	14.77	8.22	9.09	9.98
Table Mountain pine	2.80	0.01	0.19	0.31	0.17	0.48	0.28
White oak	3.07	0.05	0.69	0.92	0.51	1.44	0.88
White pine	2.44	2.26	32.45	58.46	32.53	21.05	28.68
Yellow-poplar	2.25	0.15	2.20	4.62	2.57	2.39	2.39
Total	**2.28**	**6.97**	**100.00**	**179.69**	**100.00**	**100.00**	**100.00**

Table 17. Forest shrub characteristics in the understory of the Mixed Hardwood forest cover type at the Carl Sandburg Home National Historic Site.

Species	Average No. Stems/Ac	Relative Density (%)	Frequency (%)	Relative Frequency (%)	Importance Value (%)
Alleghany blackberry	3	0.07	1.67	0.74	0.40
Azalea	26	0.52	8.33	3.68	2.10
Black raspberry	226	4.52	13.33	5.88	5.20
Common privet	6	0.12	1.67	0.74	0.43
Carolina rose	132	2.64	3.33	1.47	2.05
Deerberry	1552	31.07	38.33	16.91	23.99
Doghobble	60	1.20	3.33	1.47	1.33
High-bush blueberry	234	4.68	15.00	6.62	5.65
Low-bush blueberry	2282	45.69	56.67	25.00	35.35
Mountain laurel	229	4.58	50.00	22.06	13.32
Mapleleaf viburnum	5	0.09	1.67	0.74	0.41
Pink locust	173	3.47	26.67	11.76	7.62
Rhododendron	4	0.07	1.67	0.74	0.40
Shrub yellow root	62	1.23	1.67	0.74	0.98
Vaccinium spp.	2	0.04	1.67	0.74	0.39
Witch hazel	1	0.01	1.67	0.74	0.37
Total	**4995**	**100.00**	**226.67**	**100.00**	**100.00**

Table 18a. Forest tree regeneration characteristics for the Mixed Hardwood forest cover type at the Carl Sandburg Home National Historic Site.

Species	Average No. Trees/ac	Relative Density (%)	Frequency (%)	Relative Frequency (%)	Importance Value (%)
American chestnut	11	0.52	7.69	1.44	0.98
American holly	2	0.09	1.54	0.29	0.19
Autumn olive	2	0.09	1.54	0.29	0.19
Black cherry	19	0.94	18.46	3.45	2.19
Blackgum	63	3.10	33.85	6.32	4.71
Bigleaf magnolia	12	0.56	6.15	1.15	0.86
Bitternut hickory	8	0.38	7.69	1.44	0.91
Black oak	85	4.13	41.54	7.76	5.94
Chestnut oak	616	30.08	60.00	11.21	20.64
Downy serviceberry	154	7.51	44.62	8.33	7.92
Eastern hophornbeam	10	0.47	1.54	0.29	0.38
Flowering dogwood	22	1.08	3.08	0.57	0.83
Mockernut hickory	57	2.77	18.46	3.45	3.11
Northern red oak	167	8.17	66.15	12.36	10.26
Pignut hickory	42	2.06	26.15	4.89	3.47
Persimmon	1	0.05	1.54	0.29	0.17
Red maple	536	26.14	75.38	14.08	20.11
Sassafras	14	0.70	12.31	2.30	1.50
Scarlet oak	29	1.41	12.31	2.30	1.85
Southern red oak	4	0.14	1.54	0.29	0.21
Sourwood	12	0.56	6.15	1.15	0.86
Tree of heaven	1	0.05	1.54	0.29	0.17
White oak	108	5.26	36.92	6.90	6.08
White pine	70	3.43	40.00	7.47	5.45
Yellow-poplar	6	0.28	7.69	1.44	0.86
Total	**2049**	**100.00**	**535.38**	**100.00**	**100.00**

Table 18b. Forest shrub regeneration characteristics for the Mixed Hardwood forest cover type at the Carl Sandburg Home National Historic Site.

Species	Average No. Stems/ac	Relative Density (%)	Frequency (%)	Relative Frequency (%)	Importance Value (%)
Alleghany blackberry	1	0.03	1.54	0.70	0.36
Azalea	16	0.51	4.62	2.10	1.30
Black raspberry	167	5.19	18.46	8.39	6.79
Common privet	36	1.10	7.69	3.50	2.30
Carolina rose	34	1.04	6.15	2.80	1.92
Deerberry	546	16.94	32.31	14.69	15.81
Doghobble	208	6.44	7.69	3.50	4.97
Deciduous holly	2	0.06	1.54	0.70	0.38
Fringetree	8	0.24	3.08	1.40	0.82
High-bush blueberry	86	2.65	7.69	3.50	3.08
Hercules club	5	0.15	1.54	0.70	0.42
Low-bush blueberry	1936	60.02	60.00	27.27	43.65
Multiflora rose	6	0.18	1.54	0.70	0.44
Mountain laurel	107	3.31	32.31	14.69	9.00
Mapleleaf viburnum	3	0.09	1.54	0.70	0.39
New Jersey tea	2	0.06	1.54	0.70	0.38
Pink locust	31	0.09	3.08	1.40	0.74
Rhododendron	3	0.95	13.85	6.29	3.62
Sweet cherry	13	0.42	10.77	4.90	2.66
Summersweet clethra	4	0.12	1.54	0.70	0.41
Shrub yellow root	13	0.42	1.54	0.70	0.56
Total	**3225**	**100.00**	**220.00**	**100.00**	**100.00**

Forest Fuel Conditions

An important consideration in the management of forests in recreation and historic parks is the forest fuel load and arrangement (Helm and Johnson 1995). Both surface and aerial fuels carry wildfire, and fire behavior can be significantly modified through the management of forest fuels. Indeed, the most common means of controlling fires is through the creation of a fire line, a process of depriving the fire of fuel. Fuel assessments were conducted in the three forest cover types in the park (Tables 19-21). In the WP/O/YP forest cover type, 80-90% of the plots had low quantities of fine and heavy surface fuels and aerial fuels. None of the plots had high fuel loads for any fuel category. The WP/H forest cover type had higher fuel loads than the WP/O/YP type. Eight to 12% of the plots had high fuel loads across the categories of fine and heavy surface fuels and aerial fuels, while 32-56% of the plots had moderate fuel loads (Table 20). These loads are likely associated with the successional nature of this softwood forest. The MH forest cover type also had somewhat elevated fuel loads. For example, 68% of the plots had

moderate to high fine surface fuels, 54% had moderate to high heavy surface fuels, and 63% had moderate to high aerial fuel loads (Table 21).

Table 19. Forest fuel assessment for the White Pine/Oak/Yellow-Poplar forest cover type at the Carl Sandburg Home National Historic Site.

Fuel Type	Fuel Level Distribution		
	High	Moderate	Low
	---------- % ----------		
Fine surface	0	20	80
Heavy surface	0	10	90
Aerial	0	20	80

Table 20. Forest fuel assessment for the White Pine/Hemlock forest cover type at the Carl Sandburg Home National Historic Site.

Fuel Type	Fuel Level Distribution		
	High	Moderate	Low
	---------- % ----------		
Fine surface	8	56	36
Heavy surface	12	32	56
Aerial	12	52	36

Table 21. Forest fuel assessment for the Mixed Hardwood forest cover type at the Carl Sandburg Home National Historic Site.

Fuel Type	Fuel Level Distribution		
	High	Moderate	Low
	---------- % ----------		
Fine surface	8	60	32
Heavy surface	17	37	46
Aerial	15	48	37

The National Fire Danger Rating System is keyed to a series of typical fuel models, which have similar loads and characteristics which influence fire behavior. In the CSHNHS, three fuel models were identified (Table 22). All of the plots in the WP/O/YP forest cover type were classified in Fuel Model 1, all of the plots in the WP/H forest cover type were classified in Fuel Model 5, and 98% of the plots in the MH forest cover type were classified in Fuel Model 9 (the remaining 2% of plots in the MH forest cover type were in Fuel Model 5). Fuel Model 1 is known as the Grass Group, and the dominant fuel type carrying fire is fine, very porous, and

continuous herbaceous fuel. Since the WP/O/YP forest cover type consists of small patches surrounded by fields, fire behavior will be more controlled by the grass vegetation surrounding the forest patches. Fuel Model 5 occurs in the Shrub Group, in which fire is carried more by fuels contributed by low to moderate height shrubs than by overstory trees. Low-intensity surface fires are more common in this fuel group. Fuel Model 9 occurs in the Timber Group, and includes loose hardwood litter under stands of oak, hickory, maple, and other hardwood species throughout the eastern U.S. Surface fires are most common in this fuel group. More details for all three fuel models are found in Appendix 1.

Table 22. Fuel model distribution for three forest cover types at the Carl Sandburg Home National Historic Site.

Forest Cover Type	Fuel Model		
	1	5	9
	--------- % ---------		
White Pine/Oak/Yellow-Poplar	100	0	0
White Pine/Hemlock	0	100	0
Mixed Hardwood	0	2	98

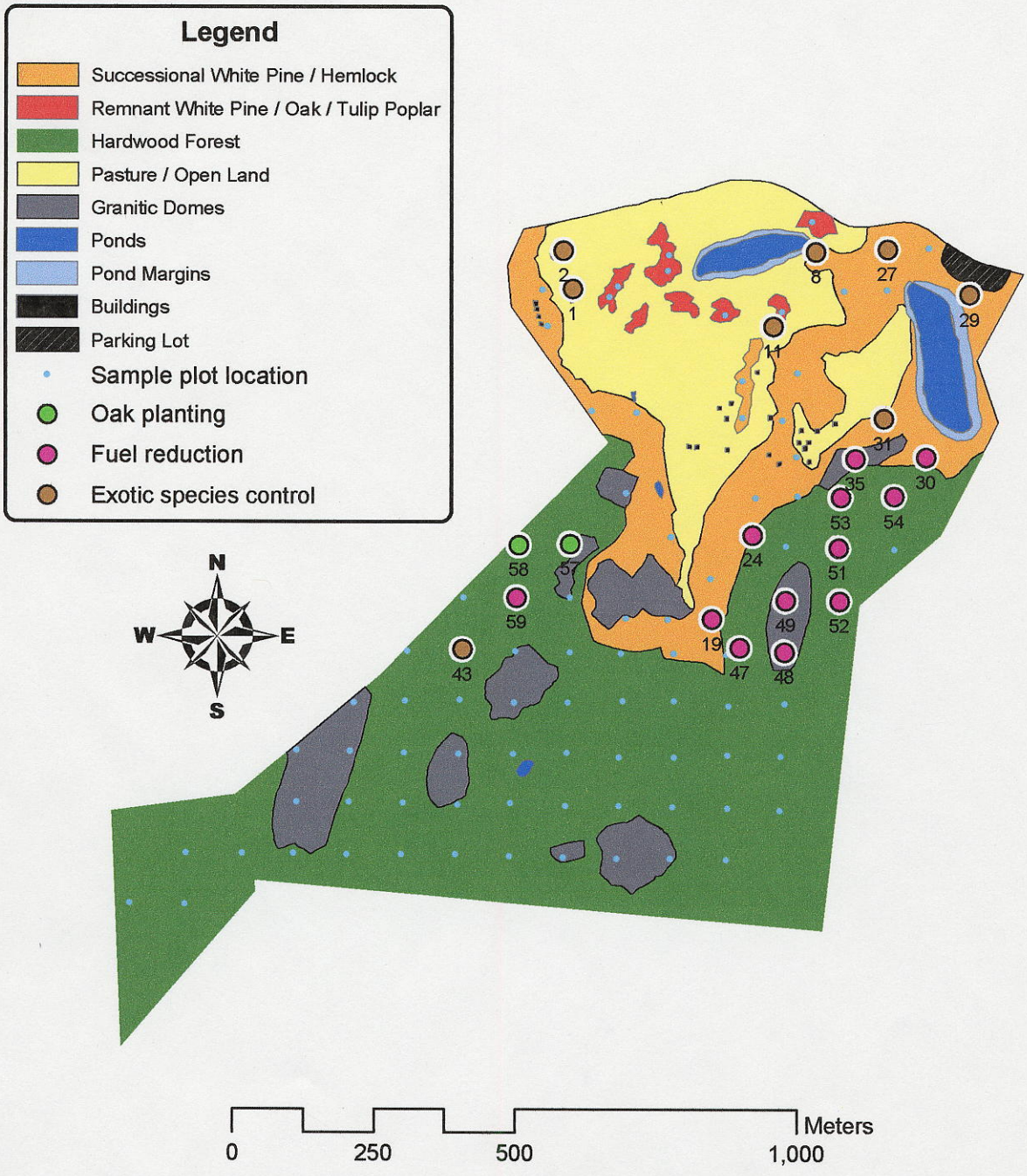
Forest Management Needs

Forest management needs to meet park objectives were determined for each of the 100 forest inventory plots. Management practices proposed were based on field observation – it is presumed that the greater the frequency of plots with a given need, the more widespread the concern (Figure 2). For example, in the WP/O/YP forest cover type, the only management need identified was exotic species control (Table 23). This practice was recommended for three of the 10 plots in the cover type. Common privet and multiflora rose occurred in the shrub layer in the understory, while autumn olive and common privet also occurred in the regeneration stratum. It is clear that the biggest exotic species problem in this cover type is multiflora rose, since it accounted for nearly 66% of the importance values in the understory shrub layer. Control by approved mechanical or chemical methods (Miller 2003) is necessary to slow the spread of this exotic pest.

Table 23. Management needs for the White Pine/Oak/ Yellow-Poplar forest cover type at the Carl Sandburg Home National Historic Site.

Management Needs	No. of Plots	% of Plots
Exotic species control	3	30
Total	**3**	**30**

Recommended management treatments within the plant communities of the Carl Sandburg Home National Historic Site



Copy of Nature Conservancy's Southeast Science Department Map produced in December,1999.

In the WP/H forest cover type, five management needs were recognized, including exotic species control on 16 percent of the plots and fuel reduction on 12 percent (Table 24). Exotic shrubs in the understory of the WP/H cover type include common privet and multiflora rose, comprising over 3,600 stems per acre. These stems could be attacked using approved mechanical and chemical means. Fuel reduction to reduce levels of fine and heavy surface fuels, and aerial fuels is needed on three of the plots in the cover type. Woody debris removal, generally by cutting and hauling, is an intensive treatment, and generally only needed in small areas where there is a high fire risk. This was needed on two plots. There are a variety of means to reduce fuel loads: prescribed burning, cutting and lopping/scattering, cutting and chipping, and removal. In some cases, ladder fuels can be reduced by pruning and cutting of understory trees and shrubs. Declining trees often add to fuel loads, invite pests such as the southern pine beetle, and reduce overall stand health. Improvement cuttings to remove declining trees, while providing more growing space for surrounding healthier trees may alleviate this problem. This treatment was recommended for one plot in the WP/H forest cover type.

Table 24. Management needs for the White Pine/ Hemlock forest cover type at the Carl Sandburg Home National Historic Site.

Management Needs	No. of Plots	% of Plots
Exotic species control	4	16
Harvest declining pine trees	1	4
Hazardous tree removal	1	4
Fuel reduction	3	12
Woody debris removal	2	8
Total	**11**	**44**

Four management needs were identified in the MH forest cover type: exotic species control, grape vine removal, woody debris removal, and oak enrichment planting (Table 25). None of the management needs was extensive. Grapevines may be both a boon and a hindrance to forests. Wild grape is a native species, and provides important food for wildlife. It may also climb into the highest crowns of trees and create a tree health problem by smothering the live crown and increasing possible wind and ice damage. Foresters often encourage grapevine growth on arbors lower to the ground, and cut or kill those stems that reach into the high crown of valuable trees. For example, important historic or wildlife trees (mast/fruit production or den/nest trees) may be endangered by grapevines. This problem was noted with only one plot in the MH forest cover type. Two plots in the MH forest cover type indicated a possible need for oak enrichment planting. Foresters may supplement natural regeneration by planting high-quality hardwood seedlings of a desired species. This is commonly done in areas where desired regeneration of favored species is low due to injury or death of seed trees, or perhaps extraordinary pressure on the seed source due to high levels of seed feeding or predation. This is common in areas of high deer abundance, for example. A noticeable lack of natural oak regeneration was noted with two plots in the MH forest cover type. Oak enrichment planting is a possible treatment to consider.

Table 25. Management needs for the Mixed Hardwood forest cover type at the Carl Sandburg Home National Historic Site.

Management Needs	No. of Plots	% of Plots
Exotic species control	1	2
Grapevine removal	1	2
Woody debris removal	8	12
Oak enrichment planting	2	3
Total	**12**	**18**

Historic Tree Assessment

(Report Prepared by Brian C. P. Kane)

Historic Trees

The National Park Service (NPS) selected 17 historic trees on the property for consideration in this report. Irene Van Hoff of the NPS directed researchers from Virginia Tech to each tree and identified the trees on a map for future reference. Tree numbers in this report correspond to numbers the NPS assigned to each tree.



Historic white oak.

Assessments

Researchers from Virginia Tech examined each historic tree for health, structural condition, and suggested management actions. Researchers did not complete a hazard tree assessment using the NPS protocol; the historic trees were only assessed as to their structural condition (i.e., probability of failure). Systematic tree risk assessment must consider other factors like size of defective tree part and target value. The NPS is responsible for prioritizing tree hazards according to its protocol and in consideration of the historic value of the trees examined in this report.

Definitions

All recommended actions in this report correspond to the American National Standards Institute (ANSI) A300 Standard for Tree Care Operations (Parts 1-3), published by ANSI, 11 W. 42nd St., NY, NY 10036. This is the accepted standard of the tree care industry. This reference should be consulted for details, the following definitions are offered as a summary:

Crown clean refers to removing dead, dying, diseased, and structurally weak branches

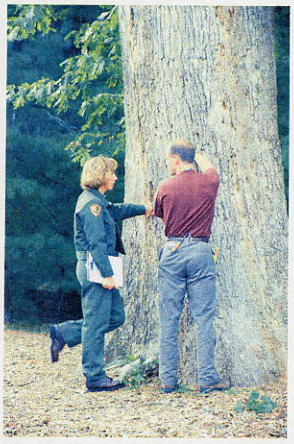
Crown thin refers to selectively removing excess live growth in the tree canopy (primarily in the form of water sprouts—some people call them suckers)

Crown reduce refers to trimming the ends of branches to reduce the sail area of the canopy and its wind resistance

Direct cabling system consists of a single cable between two tree parts

Triangular cabling system consists of connecting tree parts in threes (the preferred method for multiple stems or branches to be cabled)

For this report, pruning recommendations refer to the entire crown, and the NPS will decide the range of branch diameters to be included for a specific tree and pruning type. As an example, if the recommended pruning is "crown clean," the NPS will specify a minimum branch diameter of branches to be removed by the pruning. The range of branch sizes removed during a pruning operation may be influenced by cost, tree health, and aesthetics.



Brian Kane (Virginia Tech) and Irene Van Hoff (NPS) inspect historic white oak.

Several historic trees contain structural weak spots like weak crotches or decayed trunks; these are noted in Table 26. Installing support cables and/or brace rods does not guarantee that weak crotches will not fail under severe wind and other loads, but it offers a safety factor beyond the current situation for the trees that have weak crotches and codominant stems. Trees suggested for removal present a high risk of failure, in combination with a potential target that would be damaged. The NPS will decide ultimately on the actions taken; alternatives to tree removal include moving potential targets. The NPS assumes all risk associated with historic trees examined in this report.

To complete the recommended work, the NPS is strongly encouraged to contract with an International Society of Arboriculture Certified Arborist who is familiar with the ANSI A300 Standard. The NPS is also encouraged to request proof of both liability and worker's compensation insurance from the contractor. The following website will help locate certified arborists who work near Flat Rock, NC: http://www.isa-arbor.com/arborists/arbsearch.html.

Regarding tree health, those historic trees not growing in natural forest conditions, e.g., those by roads or with turfgrass growing around them, should be mulched. A ring of mulch 2-4" deep and as wide as possible under the tree provides many more benefits to the tree than roads or turfgrass. Mulch should be fertilized with 2 lbs. of slow-release nitrogen/1000 sq. ft. to avoid creating nitrogen deficits in the soil below the mulch. Trees should also be drip-irrigated during the growing season if drought conditions persist. This is especially true of trees showing signs of stress (Table 26).

Further recommendations include soil and foliar analyses to determine nutrient deficiencies, although no trees showed obvious signs of nutrient deficiencies. The NPS should fertilize to address soil analysis(es) that determine the extent of specific nutrient deficiencies. Fertilizer application should be made within the confines of the ANSI A300 Standard. The NPS must determine the extent to which it will cater to the historic trees' health, trees on the attached table described as showing signs of physiological stress should receive higher priority than other trees.

The recommendations provided in this report may change over time, and are only truly applicable within a reasonable time after inspection of the historic trees, which occurred on October 14, 2002.

Table 26. Identified historic trees, condition, and recommended action at the Carl Sandburg Home National Historic Site.

Tree #	Species	DBH (in)	Condition	Recommended Action*	Comments
1	*Quercus alba*	54	Fair	Crown clean; remove ivy from trunk	Tree shows signs of physiological stress (top dieback) but is structurally sound and does not present a hazard. There is evidence of prior branch failure, but no main branches appear unsound.
2	*Tsuga canadensis*	52	Good	Install triangular cabling system to reduce risk of storm damage; continue to treat elongated hemlock scale	The scale infestation is severe; it must be treated more effectively or the tree will suffer physiological stress, predisposing it to hemlock woolly adelgid (HWA) and other stressors. No signs of HWA at present.
3	*Ginkgo biloba*	40	Good	Protect root system; remove ivy from trunk	Signs of lawn mower damage to root flare; mulch root system to prevent further damage
4a	*Ulmus americana*	30	Good	Crown reduce to shorten co-dominant stem	
4b	*U. americana*	28	Good	Install direct cabling system and three brace rods to reduce risk of storm damage	Decay in buttress roots?
4c	*U. americana*	34	Fair	Remove	Tree has been struck by lightning and has significant decay and internal cracks
4d	*U. americana*	51	Good	Crown clean; remove ivy	Substantial English ivy on trunk makes inspection difficult; possible defects are not visible
5	*Aesculus hippocas*	25	Good	Crown clean; reduce branches over driveway by 6-10 feet	
6	*Fraxinus americana*	20	Poor	Remove	Tree is in decline; deadwood hangs over path, creating hazard
7	*Pyrus ussuriensis*	42	Good	Install triangular cabling system to reduce risk of storm damage	Tree has decay in main branch heading in direction of house; keep targets away
8	*Q. alba*	43	Good	Crown clean branches >2" diameter	
9	*T. canadensis*	34	Good	Install direct cabling system to reduce risk of storm damage in codominant stems; treat for elongate hemlock scale	
10	*Q. alba*	51	Fair	Crown clean	Tree shows signs of physiological stress (top dieback, bleeding trunk, wood borers) resulting from trenching; evidence of prior branch failure in large branches; tree should be irrigated, mulched, fertilized to help invigorate; do not prune live foliage unless safety risk is present

Table 26 (cont.)

Tree #	Species	DBH (in)	Condition	Recommended Action*	Comments
11	*Q. alba*	46	Good	Crown clean; maintain vigor	
12	*Q. alba*	52	Fair	Crown clean; maintain vigor	Tree is not in same degree of decline as #10, but has lost roots due to trenching and should be cared for as in #10 to maintain vigor
13	*Q. prinus*	58	Good	Crown clean >2" diameter; remove ivy from trunk	
14	*Q. alba*	48	Good	Remove ivy from trunk	Mulch root system; remove grass from under dripline

*Actions refer to ANSI A300 Standards for Pruning Trees terms.

Conclusion

The 267-acre Carl Sandburg Home National Historic Site (CSHNHS) represents a jewel in the National Park Service system. A park of unusual cultural and natural resource value, the CSHNHS is prized for its historical significance and the natural resource-based recreational opportunities it provides. This report details the current status of the forest woody vegetation at all levels: overstory, understory, and ground layer. The park has a large amount of plant diversity, with over 500 species of vascular plants, both woody and herbaceous, located in 14 ecological associations. This report details the density, dominance, frequency, and importance of the woody vegetation of the park. Also included are field observations of overstory tree health, forest health, fuel conditions, and management needs to meet park objectives.

It is important to address the apparent disparity between the management objective that directs the park staff to "let nature take its course" and other more action-oriented objectives that require some management to be done. Clearly, if "nature takes its course," some other objectives may not be met. For example, invasive exotics are a problem, and if nature "takes its course," the exotics will continue to advance into the park ecosystems and perhaps extirpate some native plants. Already the exotics have a strong foothold along fence rows and in disturbed areas, and they are also invading the more resistant forest areas now.

The current direction of forest succession will lead more red maple and other thin-barked, fire susceptible species to dominate. This is particularly true if fire is suppressed. This direction for the forest is not necessarily bad; however, it is also not "natural," since fire suppression is in itself a form of management that has direct consequences on the nature of the forest. Similarly, hunting restrictions mean that some species, such as whitetailed deer, have no natural predators, and their numbers may increase to unnaturally high, pest-like levels. This is also not a "natural" condition. Like it or not, the park will need some form of management to maintain native biodiversity and achieve some objectives.

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APPENDIX 1

Fuel Model Descriptions for the Carl Sandburg Home National Historic Site

FUEL MODEL 1

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area. Grasslands and savanna are represented, along with stubble, grass-tundra, and grass-shrub combinations that meet the above area constraint. Annual and perennial grasses are included in this fuel model.

Fuel Model Values for Estimating Fire Behavior

Total fuel load, < 3-inch dead and live, tons/acre	0.74
Dead fuel load, ¼-inch, tons/acre	0.74
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	1.0

FUEL MODEL 5

Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. The firest are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Young, green stands with no dead wood would qualify: laurel, vine maple, alder, or even chaparral, manzanita, or chamise. Young green stands may be up to 6 feet (2 m) high, but have poor burning properties because of live vegetation.

Fuel Model Values for Estimating Fire Behavior

Total fuel load, < 3-inch dead and live, tons/acre	3.5
Dead fuel load, ¼-inch, tons/acre	1.0
Live fuel load, foliage, tons/acre	2.0
Fuel bed depth, feet	2.0

FUEL MODEL 9

Fires run through the surface litter faster than Model 8 and have longer flame height. Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Fall fires in hardwoods are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling and blowing leaves. Closed stands of long-needled pine like ponderosa, Jeffrey, and red, or southern pine plantations, are grouped in this model. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning.

Fuel Model Values for Estimating Fire Behavior

Total fuel load, < 3-inch dead and live, tons/acre	3.5
Dead fuel load, ¼-inch, tons/acre	2.9
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	0.2

APPENDIX 2

Species Lists for Trees and Shrubs in the Forest Overstory, Understory, and Ground Layer at the Carl Sandburg Home National Historic Site

Appendix Table 2-1. Commonly occurring species and species codes for overstory trees at the Carl Sandburg Home National Historic Site.

Code	Common Name	Scientific Name
AS	American sycamore	*Plantanus occidentalis* L.
BB	Black birch	*Betula lenta* L.
BC	Black cherry	*Prunus serotina* Ehrh.
BG	Blackgum	*Nyssa sylvatica* Marsh.
BH	Bitternut hickory	*Carya cordiformis* (Wangenh.) K. Koch
BL	Black locust	*Robinia pseudoacacia* L.
BLM	Bigleaf magnolia	*Magnolia macrophylla* Michx.
BO	Black oak	*Quercus velutina* Lam.
BW	Black walnut	*Juglans nigra* L.
CO	Chestnut oak	*Quercus prinus* L.
DP	Domestic pear	*Pyrus communis* L.
EH	Eastern hemlock	*Tsuga canadensis* (L.) Carr.
ERC	Eastern red cedar	*Juniperus virginiana* L.
FD	Flowering dogwood	*Cornus florida* L.
MH	Mockernut hickory	*Carya tomentosa* Poir. Nutt.
NRO	Northern red oak	*Quercus rubra* L.
OO	Osage orange	*Maclura pomifera* (Raf.) C.K. Schneid
PH	Pignut hickory	*Carya glabra* (Mill.)
PP	Pitch pine	*Pinus rigida* Mill.
RB	River birch	*Betula nigra* L.
RM	Red maple	*Acer rubrum* L.
SH	Shagbark hickory	*Carya ovata* (Mill.) K. Koch
SO	Scarlet oak	*Quercus coccinea* Muenchh.
SRO	Southern red oak	*Quercus falcata* Michx.
SW	Sourwood	*Oxydendrum arboreum* (L.) DC.
TM	Table Mountain pine	*Pinus pungens* Lamb.
VP	Virginia pine	*Pinus virginiana* Mill.
WA	White ash	*Fraxinus americana* L.
WO	White oak	*Quercus alba* L.
WP	White pine	*Pinus strobus* L.
YP	Yellow-poplar	*Liriodendron tulipifera* L.

Appendix Table 2-2. Commonly occurring species and species codes for understory trees at the Carl Sandburg Home National Historic Site.

Code	Tree Species	Scientific Name
AH	American hornbeam	*Carpinus caroliniana* Walt.
BB	Black birch	*Betula lenta* L.
BC	Black cherry	*Prunus serotina* Ehrh.
BG	Blackgum	*Nyssa sylvatica* Marsh.
BH	Bitternut hickory	*Carya cordiformis* (Wangenh.) K. Koch
BL	Black locust	*Robinia pseudoacacia* L.
BLM	Bigleaf magnolia	*Magnolia macrophylla* Michx.
BO	Black oak	*Quercus velutina* Lam.
BW	Black walnut	*Juglans nigra* L.
CO	Chestnut oak	*Quercus prinus* L.
DP	Domestic pear	*Pyrus communis* L.
DS	Downy serviceberry	*Amelanchier arborea* (Michx. f.)
EH	Eastern hemlock	*Tsuga canadensis* (L.) Carr.
EHB	Eastern hophornbeam	*Ostrya virginiana* (Mill.) K. Koch
ERC	Eastern red cedar	*Juniperus virginiana* L.
FD	Flowering dogwood	*Cornus florida* L.
FM	Fraser magnolia	*Magnolia fraseri* Walt.
FT	Fringetree	*Chionanthus virginicus* L.
HL	American holly	*Ilex opaca* Ait.
MB	Mulberry	*Morus rubra* L.
MH	Mockernut hickory	*Carya tomentosa* Poir. Nutt.
NRO	Northern red oak	*Quercus rubra* L.
PH	Pignut hickory	*Carya glabra* (Mill.)
PP	Pitch pine	*Pinus rigida* Mill.
RB	River birch	*Betula nigra* L.
RM	Red maple	*Acer rubrum* L.
SC	Sweet cherry	*Prunus armeniaca* L.
SF	Sassafras	*Sassafras albidum* (Nutt.)
SO	Scarlet oak	*Quercus coccinea* Muenchh.
SW	Sourwood	*Oxydendrum* DC.
TM	Table Mountain pine	*Pinus pungens* Lamb.
WO	White oak	*Quercus alba* L.
WP	White pine	*Pinus strobus* L.
YP	Yellow-poplar	*Liriodendron tulipifera* L.

Appendix Table 2-3. Commonly occurring species and species codes for understory shrubs at the Carl Sandburg Home National Historic Site.

Code	Common Name	Scientific Name
AB	Alleghany blackberry	*Rubus allegheniensis* Porter
AZ	Azalea	*Rhododendron* L.
BR	Black raspberry	*Rubus occidentalis* L.
CP	Common privet	*Ligustrum vulgare* L.
CR	Carolina rose	*Rosa carolina* L.
DB	Deerberry	*Vaccinium stamineum* L.
DGH	Doghobble	*Leucothoe catesbaei* (Steud.) Sleumer
HBB	High-bush blueberry	*Vaccinium atrococcum* (Gray)
LBB	Low-bush blueberry	*Vaccinium vacillans* (Torr.)
MFR	Multiflora rose	*Rosa multiflora* Thunb.
ML	Mountain laurel	*Kalmia latifolia* L.
MV	Mapleleaf viburnum	*Viburnum acerifolium* L.
PL	Pink locust	*Robina hispida* L.
RD	Rhododendron	*Rhododendron maximum* L.
SB	Strawberry bush	*Euonymus americana* L.
SF	Sassafras	*Sassafras albidum* (Nutt.)
SJW	St. John's wort	*Hypericum prolificum* L.
SYR	Shrub yellow root	*Xanthorhiza simplicissima* Marsh.
VC	Vaccinium spp.	*Vaccinium* L.
WH	Witch hazel	*Hamamelis virginiana* L.

Appendix Table 2-4. Commonly occurring species and species codes for regeneration trees at the Carl Sandburg Home National Historic Site.

Code	Tree Species	Scientific Name
AC	American chestnut	*Castanea dentata* (Marsh.) Borkh.
AT	Apple	*Malus sylvestris* (L.) Mill.
AO	Autumn olive	*Elaeagnus umbellata*
BC	Black cherry	*Prunus serotina* Ehrh.
BE	Box elder	*Acer negundo* L.
BG	Blackgum	*Nyssa sylvatica* Marsh.
BL	Black locust	*Robinia pseudoacacia* L.
BLM	Bigleaf magnolia	*Magnolia macrophylla* Michx.
BNH	Bitternut hickory	*Carya cordiformis* (Wangenh.) K. Koch
BO	Black oak	*Quercus velutina* Lam.
BW	Black walnut	*Juglans nigra* L.
CO	Chestnut oak	*Quercus prinus* L.
DS	Downy serviceberry	*Amelanchier arborea* (Michx. f.)
EH	Eastern hemlock	*Tsuga canadensis* (L.) Carr.
EHB	Eastern hophornbeam	*Ostrya virginiana* (Mill.) K. Koch
FD	Flowering dogwood	*Cornus florida* L.
HL	American holly	*Ilex opaca* Ait.
MH	Mockernut hickory	*Carya tomentosa* Poir. Nutt.
NRO	Northern red oak	*Quercus rubra* L.
PH	Pignut hickory	*Carya glabra* (Mill.)
PM	Persimmon	*Diospyros virginiana* L.
PN	Pecan	*Carya illinoensis* (Wangenh.) K. Koch
RM	Red maple	*Acer rubrum* L.
SF	Sassafras	*Sassafras albidum* (Nutt.)
SM	Sugar maple	*Acer saccharum* Marsh.
SO	Scarlet oak	*Quercus coccinea* Muenchh.
SRO	Southern red oak	*Quercus falcata* Michx.
SW	Sourwood	*Oxydendrum* DC.
TH	Tree of heaven	*Ailanthus altissima* (Mill.) Swingle
WO	White oak	*Quercus alba* L.
WP	White pine	*Pinus strobus* L.
YP	Yellow-poplar	*Liriodendron tulipifera* L.

Appendix Table 2-5. Commonly occurring species and species codes for regeneration shrubs at the Carl Sandburg Home National Historic Site.

Code	Common Name	Scientific Name
AB	Alleghany blackberry	*Rubus allegheniensis* Porter
AZ	Azalea	*Rhododendron* L.
BH	Black haw	*Viburnum prunifolium* L.
BR	Black raspberry	*Rubus occidentalis* L.
CP	Common privet	*Ligustrum vulgare* L.
CR	Carolina rose	*Rosa carolina* L.
DB	Deerberry	*Vaccinium stamineum* L.
DGH	Doghobble	*Leucothoe catesbaei* (Steud.) Sleumer
DH	Deciduous holly	*Ilex montana* Ait.
EB	Elderberry	*Sambucus canadensis* L.
FB	Fetterbush	*Leucothoe racemosa* (L.) Gray
FT	Fringetree	*Chionanthus virginicus* L.
HA	Hazel alder	*Alnus serrulata* Mill.
HBB	High-bush blueberry	*Vaccinium atrococcum* (Gray)
HC	Hercules' club	*Aralia spinosa* L.
HL	American holly	*Ilex opaca* Ait.
LBB	Low-bush blueberry	*Vaccinium vacillans* (Torr.)
MFR	Multiflora rose	*Rosa multiflora* Thunb.
ML	Mountain laurel	*Kalmia latifolia* L.
MV	Mapleleaf viburnum	*Viburnum acerifolium* L.
NJT	New Jersey tea	*Ceanothus americanus* L.
PL	Pink locust	*Robina hispida* L.
RD	Rhododendron	*Rhododendron maximum* L.
SA	Smooth allspice	*Calycanthus floridus* L.
SC	Sweet cherry	*Prunus avium* (L.) L.
SD	Silky dogwood	*Cornus amomum* Mill.
SJW	St. John's wort	*Hypericum prolificum* L.
SPB	Spice bush	*Lindera benzoin* (L.) Blume
SSC	Summersweet clethra	*Clethra alnifolia* L.
SYR	Shrub yellow root	*Xanthorhiza simplicissima* Marsh.