Sparta Mountain Forest Health Monitoring
Summary of Baseline Monitoring

Prepared for
New Jersey Audubon

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Rattlesnake Plantain is a forest herb found in low abundance at Sparta Mountain.

This brief report provides a summary of Sparta Mountain forest health monitoring data collected in 2011 and 2012. A total of 1,904 acres were sampled using 50 plots across four mapped forest stands (See Table 1, Map 1). Forests at Sparta Mountain are relatively healthy compared to many other forests in New Jersey. Invasive species tend to be concentrated along unpaved access roads, other areas with past, intense land uses (e.g., probable former homesteads, parking areas or forestry operation staging areas), and canopy gaps (personal observations from areas not recorded during the sampling process). However, invasive species (e.g., Japanese Barberry, Asiatic Bittersweet, Winged Burning Bush, Japanese Stiltgrass) also occur sporadically throughout the project area.

Native herbs, grasses and woody seedlings (< 1 foot tall) were common in all forest stands. However, the woody understory (shrubs & tree seedlings from 1 to 4.5 feet tall) is sparse (less than half of threshold values) throughout the majority of the project area. In addition, herbs were generally not observed in flower/fruit and particular species are not producing large, robust individuals. The reason for this pattern is likely due to the interaction of two factors: 1) current deer density and 2) canopy/understory density. Depending upon perspective, it may be concluded that one or the other factor should be addressed (or perhaps both factors should be addressed in succession or simultaneously). Data from individual forest stands are provided below to allow comparisons, but measured values were similar among all stands.

Table 1. Summary of Sparta Mountain Forest Health Monitoring (all stands)

Stem densities reported as number per acre and do not currently have established thresholds

Site: 1A, 1J, 1O, 1R
Date: 9/15/11, 5/29/12, 6/5/12, 6/11/12
Sample Size: 50 plots
Sample Area: 1904 acres

Response Factor Number	Response Factor Name	Measured Values (Mean %)	Target Threshold Values (Mean %)[1]	Mean Statewide Values[2]	Range of Statewide Values[3]
1	Total Woody Cover Within Browse Zone	31	> 70%	40	2 to 86
2	Native Woody Cover Within Browse Zone	31	> 70%	17	0 to 55
3	Non-Native Woody Cover Within Browse Zone	0	< 1%	27	0 to 74
4	Total Canopy Cover	90	> 60%?	92	72 to 99
5a	Relative Proportion of All Trees - Native Species	100	> 99%	N/A	N/A
5b	Relative Proportion of All Trees - Non-Native Species	0	< 1%	N/A	N/A
5c	Stem Density of All Trees - Native Species	644	?	N/A	N/A
5d	Stem Density of All Trees - Non-Native Species	0	?	N/A	N/A
6a	Relative Proportion of All Saplings - Native Species	100	> 99%	N/A	N/A
6b	Relative Proportion of All Saplings - Non-Native Species	0	< 1%	N/A	N/A
6c	Stem Density of All Saplings - Native Species	1284	?	N/A	N/A
6d	Stem Density of All Saplings - Non-Native Species	0	?	N/A	N/A
7	Frequency of Native Grass Species	34	> 10%	N/A	N/A
8	Frequency of Non-Native Grass Species	0	< 1%	N/A	N/A
9	Frequency of Native Herb Species	71	> 30%	N/A	N/A
10	Frequency of Non-Native Herb Species	0	< 1%	N/A	N/A
11	Frequency of Native Woody Seedlings	67	> 30%	N/A	N/A
12	Frequency of Non-Native Woody Seedlings	1	< 1%	N/A	N/A

[1] Color coding for rapid visualization (red means below target threshold value, green meets or exceeds target threshold).

[2] Represents average values across 46 measurements in Central and Northern New Jersey.

[3] Minimum and maximum values across 46 measurements in Central and Northern New Jersey.

Measurements provided in this report represent pre-stewardship baselines. It is recommended that repeated measurements over time (e.g., every 3 to 5 years) be performed to document the rate of ecological health improvements and demonstrate effectiveness of stewardship activities. In general, quantifying ultimate success should be based upon exceeding all stated thresholds. Although reaching this ultimate goal may take many years, repeated monitoring efforts should indicate incremental progress. It should also be noted that stated thresholds are 'placeholders' that may be changed upon review/performance of scientific research or other insights provided through observation of similar habitats in our region. Statistical analyses may be considered, but are not essential.

Additionally, Bowman's Hill Plant Stewardship Index (PSI) methodology was applied to plant species observed at Sparta Mountain to describe the overall quality of the flora. An explanation of PSI is provided at the Bowman's Hill website: "The index is calculated based on averaging numbers assigned to each plant by a group of leading botanists and ecologists in the state. These numbers are referred to as "CC" or coefficients of conservatism. They range from 0 to 10 with zero being those "generalist" plants that can be found in any area (including parking lots, plowed fields and other highly disturbed land sites) to ten being "specialist" plants that the botanists have agreed can be found naturally in very specific habitats. Many (although not all) of our threatened and endangered plants have been assigned a 10 because they are so specialized and their required habitats are disappearing."

CC Ranks were applied to all species observed at Sparta Mountain (Appendix A) and are summarized in Table 2. There are 14 species (ca. 5.5% of all observed species) with the highest CC Ranks (9 and 10), which are only found in a narrow range of pristine habitats. A sample of species with CC ranks of 10 that were documented includes Mitrewort, Bunchflower and Alum-root. An additional 59 species (or 23% of all observed species) had relatively high ranks (7 or 8). None of the observed species have an official state status.

Table 2. Coefficient of Conservatism Summary for Sparta Mountain (all stands)

CC Rank	Number of Species	% of Species	CC Rank Explanation
0	50	19.7	High range of ecological tolerances/found in a variety of plant communities
1	11	4.3	High range of ecological tolerances/found in a variety of plant communities
2	26	10.2	High range of ecological tolerances/found in a variety of plant communities
3	24	9.4	High range of ecological tolerances/found in a variety of plant communities
4	20	7.9	Intermediate range of ecological tolerances/ associated with a specific plant community
5	34	13.4	Intermediate range of ecological tolerances/ associated with a specific plant community
6	16	6.3	Intermediate range of ecological tolerances/ associated with a specific plant community
7	34	13.4	Poor range of ecological tolerances/associated with advanced successional stage
8	25	9.8	Poor range of ecological tolerances/associated with advanced successional stage
9	8	3.1	High degree of fidelity to a narrow range of pristine habitats
10	6	2.4	High degree of fidelity to a narrow range of pristine habitats
Total	**254**	**100**	

The average CC ranks for all observed species is called the Mean C and is calculated separately for all native species (Native Mean C) and all observed species (Total Mean C) – See Table 3. The combined sum of all CC's is used to calculate the overall FQI (Floristic Quality Index) and PSI for a site. Individual forest stand results are provided below and complete species lists are provided as Appendix A. Currently, there are no criteria for ranking overall site quality based upon its PSI score.

Table 3. Plant Stewardship Index Summary for Sparta Mountain (all stands)

Category	Value	Notes
Native Mean C	4.91	= Sum of CC values for all native species divided by the number of native species
Total Mean C	4.14	= Sum of CC values for all species dividied by the number of all species
FQI	71.84	= Native Mean C multiplied by the square root of the number of native species
PSI	65.95	= Total Mean C multiplied by the square root of the number of all species

Stand 1A.

Table 4. Summary of Sparta Mountain Forest Health Monitoring – Stand 1A

Site: 1A
Date: 9/15/11, 6/5/12, 6/11/12
Sample Size: 15 plots
Sample Area: 609 acres

Response Factor Number	Response Factor Name	Measured Values (Mean %)	Target Threshold Values (Mean %)[1]	Mean Statewide Values[2]	Range of Statewide Values[3]
1	Total Woody Cover Within Browse Zone	27	> 70%	40	2 to 86
2	Native Woody Cover Within Browse Zone	27	> 70%	17	0 to 55
3	Non-Native Woody Cover Within Browse Zone	0	< 1%	27	0 to 74
4	Total Canopy Cover	93	> 60%?	92	72 to 99
5a	Relative Proportion of All Trees - Native Species	100	> 99%	N/A	N/A
5b	Relative Proportion of All Trees - Non-Native Species	0	< 1%	N/A	N/A
5c	Stem Density of All Trees - Native Species	581	?	N/A	N/A
5d	Stem Density of All Trees - Non-Native Species	0	?	N/A	N/A
6a	Relative Proportion of All Saplings - Native Species	100	> 99%	N/A	N/A
6b	Relative Proportion of All Saplings - Non-Native Species	0	< 1%	N/A	N/A
6c	Stem Density of All Saplings - Native Species	1186	?	N/A	N/A
6d	Stem Density of All Saplings - Non-Native Species	0	?	N/A	N/A
7	Frequency of Native Grass Species	25	> 10%	N/A	N/A
8	Frequency of Non-Native Grass Species	0	< 1%	N/A	N/A
9	Frequency of Native Herb Species	55	> 30%	N/A	N/A
10	Frequency of Non-Native Herb Species	0	< 1%	N/A	N/A
11	Frequency of Native Woody Seedlings	65	> 30%	N/A	N/A
12	Frequency of Non-Native Woody Seedlings	2	< 1%	N/A	N/A

[1] Color coding for rapid visualization (red means below target threshold value, green meets or exceeds target threshold).

[2] Represents average values across 46 measurements in Central and Northern New Jersey.

[3] Minimum and maximum values across 46 measurements in Central and Northern New Jersey.

Table 5. Plant Stewardship Index Summary – Stand 1A

Category	Value	Notes
Native Mean C	4.68	= Sum of CC values for all native species divided by the number of native species
Total Mean C	3.91	= Sum of CC values for all species dividied by the number of all species
FQI	55.72	= Native Mean C multiplied by the square root of the number of native species
PSI	50.93	= Total Mean C multiplied by the square root of the number of all species

Stand 1J.

Table 6. Summary of Sparta Mountain Forest Health Monitoring – Stand 1J

Site: 1J
Date: 6/11/2012
Sample Size: 15 plots
Sample Area: 921 acres

Response Factor Number	Response Factor Name	Measured Values (Mean %)	Target Threshold Values (Mean %)[1]	Mean Statewide Values[2]	Range of Statewide Values[3]
1	Total Woody Cover Within Browse Zone	32	> 70%	40	2 to 86
2	Native Woody Cover Within Browse Zone	32	> 70%	17	0 to 55
3	Non-Native Woody Cover Within Browse Zone	0	< 1%	27	0 to 74
4	Total Canopy Cover	92	> 60%?	92	72 to 99
5a	Relative Proportion of All Trees - Native Species	100	> 99%	N/A	N/A
5b	Relative Proportion of All Trees - Non-Native Species	0	< 1%	N/A	N/A
5c	Stem Density of All Trees - Native Species	643	?	N/A	N/A
5d	Stem Density of All Trees - Non-Native Species	0	?	N/A	N/A
6a	Relative Proportion of All Saplings - Native Species	100	> 99%	N/A	N/A
6b	Relative Proportion of All Saplings - Non-Native Species	0	< 1%	N/A	N/A
6c	Stem Density of All Saplings - Native Species	1581	?	N/A	N/A
6d	Stem Density of All Saplings - Non-Native Species	0	?	N/A	N/A
7	Frequency of Native Grass Species	42	> 10%	N/A	N/A
8	Frequency of Non-Native Grass Species	0	< 1%	N/A	N/A
9	Frequency of Native Herb Species	63	> 30%	N/A	N/A
10	Frequency of Non-Native Herb Species	0	< 1%	N/A	N/A
11	Frequency of Native Woody Seedlings	68	> 30%	N/A	N/A
12	Frequency of Non-Native Woody Seedlings	0	< 1%	N/A	N/A

[1] Color coding for rapid visualization (red means below target threshold value, green meets or exceeds target threshold).

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[3] Minimum and maximum values across 46 measurements in Central and Northern New Jersey.

Table 7. Plant Stewardship Index Summary – Stand 1J

Category	Value	Notes
Native Mean C	4.84	= Sum of CC values for all native species divided by the number of native species
Total Mean C	3.85	= Sum of CC values for all species dividied by the number of all species
FQI	52.33	= Native Mean C multiplied by the square root of the number of native species
PSI	46.68	= Total Mean C multiplied by the square root of the number of all species

Stand 1O.

Table 8. Summary of Sparta Mountain Forest Health Monitoring – Stand 1O

Site: 1O
Date: 6/5/2012
Sample Size: 10 plots
Sample Area: 93 acres

Response Factor Number	Response Factor Name	Measured Values (Mean %)	Target Threshold Values (Mean %)[1]	Mean Statewide Values[2]	Range of Statewide Values[3]
1	Total Woody Cover Within Browse Zone	26	> 70%	40	2 to 86
2	Native Woody Cover Within Browse Zone	26	> 70%	17	0 to 55
3	Non-Native Woody Cover Within Browse Zone	0	< 1%	27	0 to 74
4	Total Canopy Cover	96	> 60%?	92	72 to 99
5a	Relative Proportion of All Trees - Native Species	100	> 99%	N/A	N/A
5b	Relative Proportion of All Trees - Non-Native Species	0	< 1%	N/A	N/A
5c	Stem Density of All Trees - Native Species	747	?	N/A	N/A
5d	Stem Density of All Trees - Non-Native Species	0	?	N/A	N/A
6a	Relative Proportion of All Saplings - Native Species	100	> 99%	N/A	N/A
6b	Relative Proportion of All Saplings - Non-Native Species	0	< 1%	N/A	N/A
6c	Stem Density of All Saplings - Native Species	1181	?	N/A	N/A
6d	Stem Density of All Saplings - Non-Native Species	0	?	N/A	N/A
7	Frequency of Native Grass Species	28	> 10%	N/A	N/A
8	Frequency of Non-Native Grass Species	0	< 1%	N/A	N/A
9	Frequency of Native Herb Species	83	> 30%	N/A	N/A
10	Frequency of Non-Native Herb Species	0	< 1%	N/A	N/A
11	Frequency of Native Woody Seedlings	60	> 30%	N/A	N/A
12	Frequency of Non-Native Woody Seedlings	3	< 1%	N/A	N/A

[1] Color coding for rapid visualization (red means below target threshold value, green meets or exceeds target threshold).

[2] Represents average values across 46 measurements in Central and Northern New Jersey.

[3] Minimum and maximum values across 46 measurements in Central and Northern New Jersey.

Table 9. Plant Stewardship Index Summary – Stand 1O

Category	Value	Notes
Native Mean C	5.46	= Sum of CC values for all native species divided by the number of native species
Total Mean C	5.03	= Sum of CC values for all species dividied by the number of all species
FQI	52.68	= Native Mean C multiplied by the square root of the number of native species
PSI	50.55	= Total Mean C multiplied by the square root of the number of all species

Stand 1R.

Table 10. Summary of Sparta Mountain Forest Health Monitoring – Stand 1R

Site: 1R
Date: 5/29/2012
Sample Size: 10 plots
Sample Area: 281 acres

Response Factor Number	Response Factor Name	Measured Values (Mean %)	Target Threshold Values (Mean %)[1]	Mean Statewide Values[2]	Range of Statewide Values[3]
1	Total Woody Cover Within Browse Zone	40	> 70%	40	2 to 86
2	Native Woody Cover Within Browse Zone	40	> 70%	17	0 to 55
3	Non-Native Woody Cover Within Browse Zone	0	< 1%	27	0 to 74
4	Total Canopy Cover	78	> 60%?	92	72 to 99
5a	Relative Proportion of All Trees - Native Species	100	> 99%	N/A	N/A
5b	Relative Proportion of All Trees - Non-Native Species	0	< 1%	N/A	N/A
5c	Stem Density of All Trees - Native Species	639	?	N/A	N/A
5d	Stem Density of All Trees - Non-Native Species	0	?	N/A	N/A
6a	Relative Proportion of All Saplings - Native Species	100	> 99%	N/A	N/A
6b	Relative Proportion of All Saplings - Non-Native Species	0	< 1%	N/A	N/A
6c	Stem Density of All Saplings - Native Species	1000	?	N/A	N/A
6d	Stem Density of All Saplings - Non-Native Species	0	?	N/A	N/A
7	Frequency of Native Grass Species	35	> 10%	N/A	N/A
8	Frequency of Non-Native Grass Species	0	< 1%	N/A	N/A
9	Frequency of Native Herb Species	93	> 30%	N/A	N/A
10	Frequency of Non-Native Herb Species	0	< 1%	N/A	N/A
11	Frequency of Native Woody Seedlings	75	> 30%	N/A	N/A
12	Frequency of Non-Native Woody Seedlings	0	< 1%	N/A	N/A

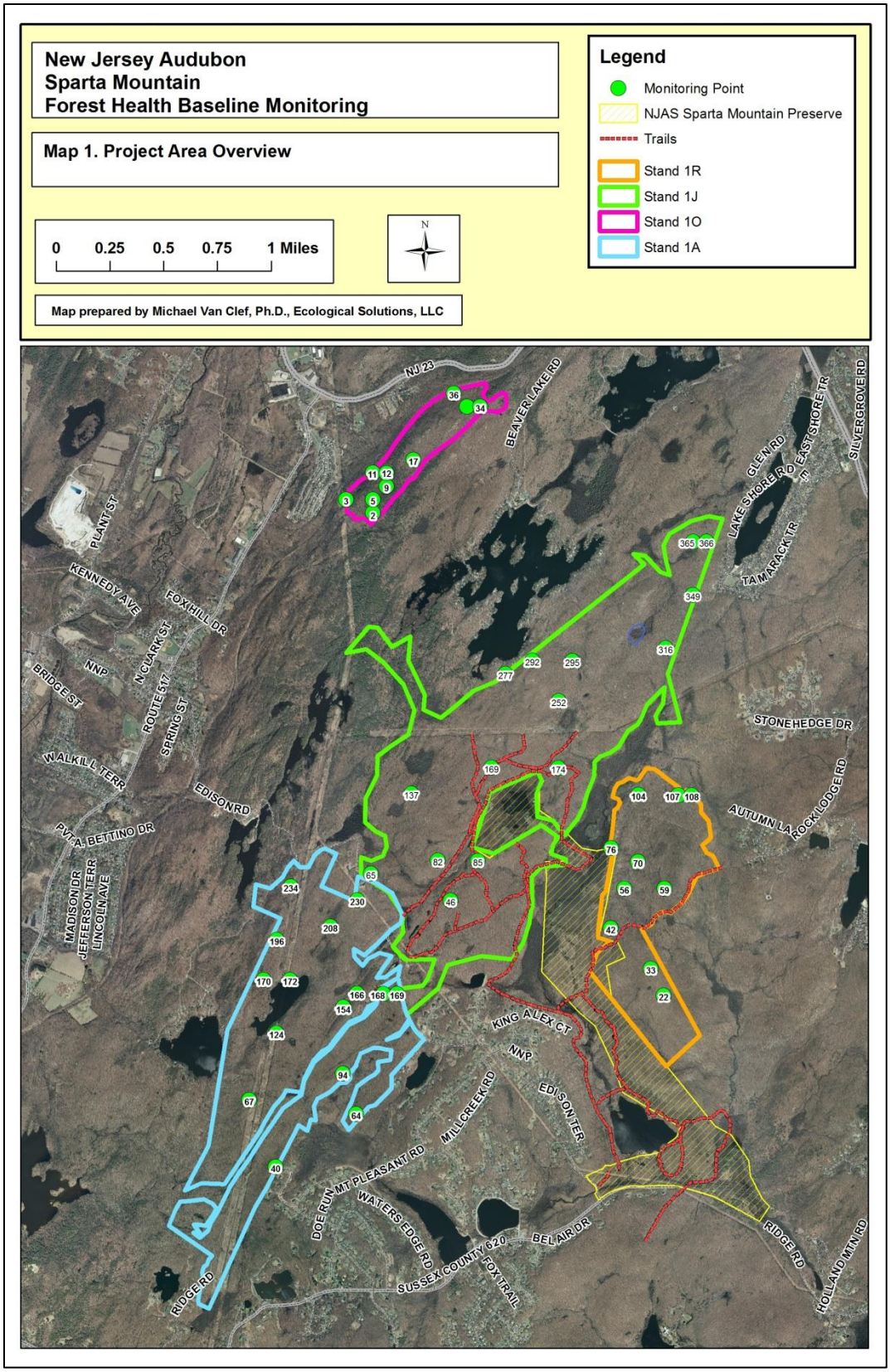
[1] Color coding for rapid visualization (red means below target threshold value, green meets or exceeds target threshold).

[2] Represents average values across 46 measurements in Central and Northern New Jersey.

[3] Minimum and maximum values across 46 measurements in Central and Northern New Jersey.

Table 11. Plant Stewardship Index Summary – Stand 1R

Category	Value	Notes
Native Mean C	5.42	= Sum of CC values for all native species divided by the number of native species
Total Mean C	5.02	= Sum of CC values for all species dividied by the number of all species
FQI	54.20	= Native Mean C multiplied by the square root of the number of native species
PSI	52.15	= Total Mean C multiplied by the square root of the number of all species


New Jersey Audubon
Sparta Mountain
Forest Health Baseline Monitoring
Map 1. Project Area Overview
0 0.25 0.5 0.75 1 Miles
N
Map prepared by Michael Van Clef, Ph.D., Ecological Solutions, LLC
Legend
Monitoring Point
NJAS Sparta Mountain Preserve
Trails
Stand 1R
Stand 1J
Stand 1O
Stand 1A
NJ 23
BEAVER LAKE RD
GLEN RD
LAKE SHORE RD
EAST SHORE TR
SILVERGROVE RD
TAMARACK TR
PLANT ST
KENNEDY AVE
FOXHILL DR
N CLARK ST
NNP
BRIDGE ST
ROUTE 517
SPRING ST
WALKILL TERR
EDISON RD
PVT A BETTINO DR
MADISON DR
JEFFERSON TERR
LINCOLN AVE
STONEHEDGE DR
AUTUMN LA
ROCKLODGE RD
KING ALEX CT
NNP
EDISON TER
MILLCREEK RD
MT PLEASANT RD
DOE RUN
WATERS EDGE RD
SUSSEX COUNTY 620
FOX TRAIL
BEL AIR DR
RIDGE RD
HOLLAND MTN RD