



NEON Site-Level Plot Summary Great Smoky Mountains National Park (GRSM)

Document Information

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Author

Tiffany Smith, MLRA 130B Soil Survey Project Leader, 6-WAY

Site Background

The Great Smoky Mountain National Park (GRSM) site is located within MLRA 130B (Southern Blue Ridge) in northeast Tennessee and consists of 509,338 acres. The area included in the park is one of the most biodiverse areas in North America. It is also one of the largest protected areas east of the Rocky Mountains. The GRSM NEON Site encompasses approximately 8,087 acres.

Site Information

Due to the size of the park, the site information has been narrowed to encompass only the information on which the sampled plots are located.

Elevation ranges from approximately 500 to 1790 meters (1640 – 5872 feet) above sea level.

Parent materials consist of residuum, colluvium, and local alluvium weathered or derived from Precambrian-, Late Proterozoic-, and Paleozoic-age crystalline (igneous and metasedimentary) and sedimentary rocks. Rock types include gneiss, diorite, gabbro, greywacke, slate, siltstone and sandstone.

Land use of the plots sampled was 100% forestland.

Plant communities and landforms mainly consisted of the following:

Soco-Stecoah (Mesic Residuum on Backslopes and Summits): The dominant vegetative cover is oak, hickory, and yellow pine. Oak, hickory, and yellow pine generally refer to such trees as black oak, scarlet oak, chestnut oak, bitternut hickory, mockernut hickory, pignut hickory, shortleaf pine, Virginia pine, and pitch pine. Some map units may also have tree species such as northern red oak, white oak, shagbark hickory, white ash, and/or white pine.

Northcove-Maymead-Nowhere (Mesic Coves): The dominant vegetative cover is mixed cool and hot micro-climate tree species. Some of the cool micro-climate trees are yellow-poplar,

basswood, black birch, black cherry, eastern hemlock, northern red oak, white pine, and yellow buckeye. Some of the hot micro-climate trees are shortleaf pine, Virginia pine, black oak, scarlet oak, chestnut oak, bitternut hickory, mockernut hickory, and pignut hickory. Rhododendron and/or laurel may dominate the understory vegetation and may form thickets in some areas.

Spivey-Santeetlah-Nowhere (Mesic Coves): The dominant vegetative cover is yellow-poplar mixed with a variety of other tree species such as basswood, black birch, black cherry, eastern hemlock, northern red oak, sugar maple, white pine, and/or yellow buckeye. The yellow-poplar cover type gives way to northern hardwoods above 1,150 meters in elevation. Northern hardwoods refer to such trees as northern red oak, black cherry, yellow birch, sugar maple, beech, and serviceberry. Rhododendron commonly is dominant in the understory vegetation and may form thickets in some areas.

Junaluska-Brasstown (Mesic Residuum on Backslopes and Summits): The dominant vegetative cover is oak, hickory, and yellow pine. Oak, hickory, and yellow pine generally refer to such trees as black oak, scarlet oak, chestnut oak, bitternut hickory, mockernut hickory, pignut hickory, shortleaf pine, Virginia pine, and pitch pine. Some map units may also have tree species such as yellow-poplar, northern red oak, white oak, shagbark hickory, white ash, and/or white pine.

Junaluska-Tsali (Mesic Residuum on Backslopes and Summits): The dominant vegetative cover is oak, hickory, and yellow pine. Oak, hickory, and yellow pine refer to such trees as black oak, scarlet oak, chestnut oak, bitternut hickory, mockernut hickory, pignut hickory, shortleaf pine, Virginia pine, and pitch pine. The understory vegetation is often sparse, except where laurel forms small thickets. This map unit has a high number of downed trees due to the shallow soils.

Oconaluftee-Guyot-Cataloochee (Frigid Residuum on Backslopes, Summits, and Shoulders): The dominant vegetative cover is spruce/fir, northern hardwoods, or a mix of the two. Spruce/fir refers to red spruce and Fraser fir. Northern hardwoods refer to such trees as northern red oak, black cherry, yellow birch, sugar maple, beech, and serviceberry. The spruce/fir cover type is dominant above 1,645 meters in elevation. Northern hardwoods are dominant below 1,465 meters in elevation. Mixing of the two cover types occurs between these elevations. The tree growth is stunted in this map unit by the high winds and ice damage. The poor tree growth is a function of climate. The understory vegetation is often sparse, except where laurel forms small thickets. Low-growing shrubs, such as blueberries, huckleberries, and high bush raspberries, are not stunted by the high winds and ice. The diversity of the cover types ranges from very limited for spruce/fir to very good for northern hardwoods. This map unit has a high amount of downed tree tops because of the ice and wind damage.

Breakneck-Pullback (Frigid Residuum on Backslopes, Summits, and Shoulders): The dominant vegetative cover is spruce/fir, northern hardwoods, or a mix of the two. Spruce/fir refers to red spruce and Fraser fir. Northern hardwoods refer to such trees as northern red oak, black cherry, yellow birch, sugar maple, beech, and serviceberry. The spruce/fir cover type is dominant above 1,645 meters in elevation. Northern hardwoods are dominant below 1,465 meters in elevation. Mixing of the two cover types occurs between these elevations.

Dellwood-Smokemont (Floodplain): The dominant vegetative cover is yellow-poplar mixed with a variety of other species, such as basswood, black birch, black cherry, eastern hemlock, northern red oak, sugar maple, white pine, and/or yellow buckeye. Rhododendron commonly is

dominant in the understory vegetation and may form thickets in some areas. Some map units, in the Cataloochee and Cades Cove areas, have a dominant vegetative cover of introduced and maintained grasslands. In many of these map units, a thick fescue sod has developed for the most part. The fescue sod, over time, chokes out other grasses and forbs. In the wetter secondary channels, rushes and sedges are common.

Analysis of Plots for Sampling

The GRSM NEON Site encompasses approximately 8,080 acres. Of the 34 plots where soil sampling may occur, 28 were available for soil characterization. A summary of soil types and the distribution of NEON plots is provided in Table 1. It should be noted that the NEON plots at the NEON GRSM site were not spread geographically across GRSM, and therefore they do not represent the soil properties or map units for the entire site.

Map Unit Symbol	Map Unit Name	# Acres	% Acres	Calculated Min. # Plots	# NEON Plots
Bm	Biltmore sand, 0 to 3 percent slopes, frequently flooded	3	0.04%	1	0
BpD	Breakneck-Pullback complex, 15 to 30 percent slopes, very rocky	152	1.88%	2	1
BpF	Breakneck-Pullback complex, 30 to 95 percent slopes, very rocky	261	3.23%	2	1
CaB	Cades silt loam, 2 to 8 percent slopes	28	0.34%	1	0
CcF	Cataska-Sylco complex, 30 to 95 percent slopes, very rocky	23	0.28%	1	0
ChF	Cheoah channery loam, 30 to 95 percent slopes, stony	105	1.30%	2	0
CmD	Chiltooskie-Heintooga complex, 15 to 30 percent slopes, stony	2	0.03%	1	0
Dg	Dellwood-Smokemont complex, 0 to 5 percent slopes, frequently flooded	308	3.82%	2	1
DhB	Dellwood-Wesser complex, 0 to 5 percent slopes, frequently flooded	28	0.35%	1	0
DtD	Ditney-Unicoi complex, 15 to 30 percent slopes, very rocky	12	0.14%	1	0
DtF	Ditney-Unicoi complex, 30 to 95 percent slopes, very rocky	324	4.02%	2	0
JbD	Junaluska-Brasstown complex, 15 to 30 percent slopes, stony	689	8.53%	2	4
JbE	Junaluska-Brasstown complex, 30 to 50 percent slopes, stony	93	1.16%	2	0
JtD	Junaluska-Tsali complex, 15 to 30 percent slopes	213	2.64%	2	1
JtF	Junaluska-Tsali complex, 30 to 95 percent slopes	112	1.39%	2	0
JtC	Junaluska-Tsali complex, 8 to 15 percent slopes	49	0.60%	1	0

Map Unit Symbol	Map Unit Name	# Acres	% Acres	Calculated Min. # Plots	# NEON Plots
LoD	Lonon silty clay loam, 15 to 30 percent slopes	37	0.45%	1	0
LoC	Lonon silty clay loam, 8 to 15 percent slopes	8	0.10%	1	0
LrF	Luftee-Anakeesta complex, 30 to 95 percent slopes, very rocky	116	1.43%	2	0
NtC	Northcove-Maymead-Nowhere complex, 8 to 15 percent slopes, very stony	10	0.13%	1	1
OwD	Oconaluftee-Guyot-Cataloochee complex, 15 to 30 percent slopes, stony, windswept	56	0.70%	1	4
OwE	Oconaluftee-Guyot-Cataloochee complex, 30 to 50 percent slopes, stony, windswept	3	0.04%	1	0
OwF	Oconaluftee-Guyot-Cataloochie complex, 50 to 95 percent slopes, stony, windswept	34	0.42%	1	0
OcF	Oconaluftee-Heintooga-Rubble land complex, 30 to 95 percent slopes, stony	4	0.05%	1	0
RuF	Rock outcrop-Unicoi complex, 30 to 95 percent slopes	0.5	0.01%	1	0
Rv	Rosman-Reddies complex, 0 to 5 percent slopes, frequently flooded	9	0.11%	1	0
RZ	Rubble land, 30 to 95 percent slopes	9	0.12%	1	0
RxF	Rubble land-Spivey complex, 50 to 95 percent slopes, extremely bouldery	14	0.18%	1	0
SnF	Snowbird loam, 30 to 95 percent slopes, stony	56	0.69%	1	0
SoD	Soco-Stecoah complex, 15 to 30 percent slopes, stony	520	6.44%	2	1
SoF	Soco-Stecoah complex, 30 to 95 percent slopes, stony	1451	17.96%	3	3
SpF	Soco-Stecoah complex, 30 to 95 percent slopes, stony, windswept	84	1.03%	2	0
SsD	Spivey-Santeetlah complex, 15 to 30 percent slopes, very stony	985	12.19%	3	4
SsE	Spivey-Santeetlah complex, 30 to 50 percent slopes, very stony	331	4.09%	2	1
SsB	Spivey-Santeetlah-Nowhere complex, 2 to 8 percent slopes, very stony	205	2.54%	2	2
SsC	Spivey-Santeetlah-Nowhere complex, 8 to 15 percent slopes, very stony	1741	21.55%	3	4
Totals		8075.5	100	56	28

Table 1. Documented soil map units at the GRSM site. Areal values based on the GRSM site boundary. The minimum number of plots was calculated using a weighted average approach.

Plot evaluation was conducted utilizing available soils, geology, landform, and vegetative community information. These four features were identified for each plot. Each unique

combination of these four features was labeled as a ‘setting’. Plots that represented a unique setting were identified and chosen for sampling, unless there were other mitigating factors (access problems, undesirable or non-representative landscape feature, etc.). Where multiple plots occurred in the same setting, plot access (a logistically-based factor) was considered to choose a plot.

The analysis resulted in 16 plots being selected for sampling, 4 plots selected as back-ups, and 8 plots rejected. Three other plots (GRSM_047, GRSM_050, and GRSM_051) were included in the initial sampling plan that were approved for boring samples only.

Plot ID	Vegetation	Rock Type 1	Rock Type 2	Map Unit Symbol	Landform	Selected for Sampling
GRSM_001	Deciduous Forest	siltstone	sandstone	NtC	cove	Y
GRSM_002	Deciduous Forest	graywacke	arkose	SoF	backslope	Y
GRSM_003	Deciduous Forest	siltstone	sandstone	SoD	summit	Y
GRSM_006	Deciduous Forest	siltstone	sandstone	Dg	floodplain	Y
GRSM_007	Deciduous Forest	siltstone	sandstone	JbD	summit	Y
GRSM_008	Deciduous Forest	siltstone	sandstone	SsC	cove	N
GRSM_009	Deciduous Forest	siltstone	sandstone	SsD	cove	Y
GRSM_011	Deciduous Forest	graywacke	arkose	SsD	cove	Backup to GRSM_022
GRSM_012	Deciduous Forest	siltstone	sandstone	SsE	cove	Y
GRSM_013	Deciduous Forest	siltstone	sandstone	SsB	cove	Backup to GRSM_017
GRSM_014	Deciduous Forest	siltstone	sandstone	SsC	cove	Backup to GRSM_020
GRSM_016	Evergreen Forest	graywacke	arkose	OwD	shoulder	N
GRSM_017	Deciduous Forest	siltstone	sandstone	SsC	cove	Y
GRSM_018	Deciduous Forest	graywacke	arkose	SsD	cove	N
GRSM_019	Deciduous Forest	siltstone	sandstone	SsB	cove	Y
GRSM_020	Deciduous Forest	graywacke	arkose	SsC	cove	Y
GRSM_021	Deciduous Forest	siltstone	sandstone	SoF	backslope	Y
GRSM_022	Deciduous Forest	graywacke	arkose	SsD	cove	Y
GRSM_024	Deciduous Forest	siltstone	sandstone	JbD	summit	N
GRSM_025	Evergreen Forest	graywacke	arkose	BpF	backslope	Y

Plot ID	Vegetation	Rock Type 1	Rock Type 2	Map Unit Symbol	Landform	Selected for Sampling
GRSM_026	Evergreen Forest	siltstone	sandstone	JtD	summit	Y
GRSM_027	Evergreen Forest	metasedimentary rock	slate	BpD	summit	Y
GRSM_028	Evergreen Forest	graywacke	arkose	OwD	shoulder	N
GRSM_029	Evergreen Forest	graywacke	arkose	OwD	shoulder	Y
GRSM_030	Evergreen Forest	graywacke	arkose	OwD	shoulder	Backup to GRSM_029
GRSM_047	Deciduous Forest	siltstone	sandstone	JbD	summit	Y – Boring Only
GRSM_050	Deciduous Forest	siltstone	sandstone	SoF	backslope	Y – Boring Only
GRSM_051	Deciduous Forest	siltstone	sandstone	JbD	summit	Y – Boring Only

Table 2. Characteristics of the GRSM plots available for characterization during this project, and selections for sampling. Y: plot selected for sampling’ N: plot not selected; Backup: in the event that the selected plot cannot be sampled, this plot is sampled; Boring Only: Sampling performed via auger boring rather than typical 1m x 1m x 1m pit.

Plot Findings

Of the original 16 plots chosen for sampling, 13 were able to be sampled (Table 3). One plot had a very steep slope that was deemed to dangerous to sample. Three additional plots were unable to be sampled due to the large quantity of coarse fragments.

Plot ID	Map Unit Symbol	Map Unit Name	Sampled	Reason
GRSM_021	SoD	Soco-Stecoah complex, 30 to 95 percent slopes, stony	N	Safety concerns in sampling on 95% slope
GRSM_027	BdP	Breakneck-Pullback complex, 15 to 30 percent slopes, very rocky	N	Plot conditions unacceptable at time of sampling
GRSM_029	OwD	Oconaluftee-Guyot-Cataloochee complex, 15 to 30 percent slopes, stony, windswept	N	Plot conditions unacceptable at time of sampling
GRSM_030	OwD	Oconaluftee-Guyot-Cataloochee complex, 15 to 30 percent slopes, stony, windswept	N	Plot conditions unacceptable at time of sampling

Plot ID	Map Unit Symbol	Map Unit Name	Sampled	Reason
GRSM_047	JbD	Junaluska-Brasstown complex, 15 to 30 percent slopes, stony	N	Can't obtain proper samples because of fragments.
GRSM_050	SoF	Soco-Stecoah complex, 30 to 95 percent slopes, stony	N	Can't obtain proper samples because of fragments.
GRSM_051	JbD	Junaluska-Brasstown complex, 15 to 30 percent slopes, stony	N	Can't obtain proper samples because of fragments.
GRSM_001	NtC	Northcove-Maymead-Nowhere complex, 8 to 15 percent slopes, very stony	Y	
GRSM_002	SoF	Soco-Stecoah complex, 30 to 95 percent slopes, stony	Y	
GRSM_003	SoD	Soco-Stecoah complex, 15 to 30 percent slopes, stony	Y	
GRSM_006	Dg	Dellwood-Smokemont complex, 0 to 5 percent slopes, frequently flooded	Y	
GRSM_007	JbD	Junaluska-Brasstown complex, 15 to 30 percent slopes, stony	Y	
GRSM_009	SsD	Spivey-Santeetlah complex, 15 to 30 percent slopes, very stony	Y	
GRSM_012	SsE	Spivey-Santeetlah complex, 30 to 50 percent slopes, very stony	Y	
GRSM_017	SsC	Spivey-Santeetlah-Nowhere complex, 8 to 15 percent slopes, very stony	Y	
GRSM_019	SsB	Spivey-Santeetlah-Nowhere complex, 2 to 8 percent slopes, very stony	Y	
GRSM_020	SsC	Spivey-Santeetlah-Nowhere complex, 8 to 15 percent slopes, very stony	Y	
GRSM_022	SsD	Spivey-Santeetlah complex, 15 to 30 percent slopes, very stony	Y	
GRSM_025	BpF	Breakneck-Pullback complex, 30 to 95 percent slopes, very rocky	Y	
GRSM_026	JtD	Junaluska-Tsali complex, 15 to 30 percent slopes	Y	

Table 3. Outcome of field sampling efforts at pre-selected NEON plots at the GRSM site.

Landforms/Parent Material - NEON Plots GRSM_003, GRSM_007, GRSM_026, GRSM_002, GRSM_025 consist of soil formed in residuum. Plots GRSM_001, GRSM_009, GRSM_012, GRSM_017, GRSM_019, GRSM_020, and GRSM_022 formed in colluvium. Plot GRSM_006 formed in alluvium over colluvium. Sampled plots were 38% residuum, 54% colluvium, and 8% alluvium.

Summary of Soils

Of the 13 plots that were sampled, only 3 plots were sampled as the actual soil series to which they were mapped (Table 4):

GRSM_003 – This plot was mapped Soco-Stecoah and sampled as Soco. It was noted during sampling that the soil was marginally coarse loamy and on the border of being considered fine-loamy.

GRSM_007 – This plot was mapped Junaluska-Brasstown and sampled as Junaluska. The plot was sampled with all horizon depths, textures, structure, matrix colors, and consistence falling within the range of characteristics for the Junaluska series.

GRSM_026 – This plot was mapped Junaluska-Tsali and sampled as Tsali. The plot was sampled with all horizon depths, textures, structure, matrix colors, and consistence falling within the range of characteristics for the Tsali series.

In addition, two plots were mapped as a different soil series entirely:

GRSM_019 – This plot was mapped Spivey-Santeetlah-Nowhere but sampled as Tsali. Spivey-Santeetlah-Nowhere is mapped in coves, however, the plot was sampled as residuum on a summit. The plot was sampled with all horizon depths, textures, structure, matrix colors, and consistence falling within the range of characteristics for the Tsali series.

GRSM_020 - This plot was mapped Spivey-Santeetlah-Nowhere but was sampled as Northcove. Although these soils are found in coves and formed in colluvium, Northcove tends to be on slopes that do not get as much shade during the day. The plot was sampled with all horizon depths, textures, structure, matrix colors, and consistence falling within the range of characteristics for the Northcove series.

Of the 13 plots that were sampled, 8 were identified as taxadjuncts to the series sampled. These plots fell within most of the range in characteristics (RIC) for the named series while also having some features that were outside the RIC. This means that the soils sampled at the plots classified differently, but the soils behave similarly enough to be identified as that series. An explanation of how each taxadjunct differed from the soil series that was sampled is provided in Table 4.

Plot ID	Map Unit Symbol	Map Unit Name	Observed Soil Series	Observed Landform	Taxadjunct Details
GRSM_001	NtC	Northcove-Maymead-Nowhere complex, 8 to 15 percent slopes, very stony	Spivey Taxadjunct	Mountainbase - Footslope	Surface too thin to be Spivey. Consider that the described Bt's may be a clay bulge in a Bw instead. Otherwise the soil matches ranges and depths.
GRSM_002	SoF	Soco-Stecoah complex, 30 to 95 percent slopes, stony	Soco Taxadjunct	Mountainflank LT - Backslope	Too shallow as described to be Soco. Described as being 15" to a Cr Horizon. Soco should be moderately deep.
GRSM_003	SoD	Soco-Stecoah complex, 15 to 30 percent slopes, stony	Soco	Mountainslope - Backslope	
GRSM_006	Dg	Dellwood-Smokemont complex, 0 to 5 percent slopes, frequently flooded	Spivey Taxadjunct	Mountainbase - Footslope	Supposed to be mapped in a floodplain. Too steep for Reddies due to the 15% slope. Possibly colluvial over residual.
GRSM_007	JbD	Junaluska-Brasstown complex, 15 to 30 percent slopes, stony	Junaluska	Mountainflank - Shoulder	
GRSM_009	SsD	Spivey-Santeetlah complex, 15 to 30 percent slopes, very stony	Spivey Taxadjunct	Mountainbase - Footslope	Matches Spivey range in characteristics except for Bx fragipan.
GRSM_012	SsE	Spivey-Santeetlah complex, 30 to 50 percent slopes, very stony	Spivey Taxadjunct	Mountainslope - Footslope	Spivey-like because it has a thin umbric epipedon and low percent of flagstones.
GRSM_017	SsC	Spivey-Santeetlah-Nowhere complex, 8 to 15 percent slopes, very stony	Reddies Taxadjunct	Terrace - Footslope	Reddies-like because there is no umbric epipedon, the Bw1 Horizon color is off by 1 chroma, and the C Horizon is a sandy-loam which is out of the textural range. Slope is 3% and in a cove.
GRSM_019	SsB	Spivey-Santeetlah-Nowhere complex, 2 to 8 percent slopes, very stony	Tsali	Ridge - Summit	
GRSM_020	SsC	Spivey-Santeetlah-Nowhere complex, 8 to 15 percent slopes, very stony	Northcove	Cove - Footslope	
GRSM_022	SsD	Spivey-Santeetlah complex, 15 to 30 percent slopes, very stony	Junaluska Taxadjunct	Cove - Backslope	Has a thicker A Horizon. Out of range of characteristics of Spivey. Junaluska is not colluvial but sampled soil was colluvial material.
GRSM_025	BpF	Breakneck-Pullback complex, 30 to 95 percent slopes, very rocky	Oconoluftee Taxadjunct	Mountainslope - Backslope	Chroma is out of range of characteristics in the Bw1 Horizon.
GRSM_026	JtD	Junaluska-Tsali complex, 15 to 30 percent slopes	Tsali	Mountainslope - Backslope	

Table 4. Observed soil series and landforms for the sampled locations. The rationale for identifying particular soils as taxadjuncts is provided in the 'Taxadjunct Details'.

Organic "O" Horizons:

The "O" Horizon thickness ranged from 2-7 cm, with GRSM_001, GRSM_006, and GRSM_009 having no "O" horizons described. It is notable, however, that many fine, medium, and coarse roots were found in the surface horizons.

Soil Moisture Status:

On each of the plots that were sampled, the dry nature of the soil throughout the soil profile was observed. The lack of soil moisture made excavating the pits very difficult. Due to a lack of precipitation in the region, drought-like conditions caused the soil to resemble hydrophobic soil characteristics, with little to no moisture in the soil bulk density sample containers.