D08 FIU Site Characterization
Supporting Data

PREPARED BY	ORGANIZATION	DATE
H Luo/E Ayres/H Loescher	FIU	3/23/2012

APPROVALS (Name)	ORGANIZATION	APPROVAL DATE
Hank Loescher	**FIU**	4/30/2012
Hanne Buur	**CCB DIR SE**	5/10/2012

RELEASED BY (Name)	ORGANIZATION	RELEASE DATE
Anne Balsley	CCB ADMIN/DCS	5/14/2012

See Configuration Management System for approval history.

Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
1.0	06/15/2010	NEON.FIU.000243.CRE	Initiation
A	09/15/2010	NEON.FIU.000256.CRE	Update reports according to feedback from other teams
B	6/23/2011	ECO-00215	Original site was Armistead, but this site was not suitable/available for NEON. Dead Lake was substituted and the site characterization was conducted in Spring 2011.
C	9/23/2011	ECO-00279	Update to new document numbers/template throughout document.
D	5/14/2012	ECO-00400	Replace Choctaw site with Lenoir Landing site.

TABLE OF CONTENTS

1 DESCRIPTION 1
1.1 Purpose 1
1.2 Scope 1
2 RELATED DOCUMENTS AND ACRONYMS 2
2.1 Applicable Documents 2
2.2 Reference Documents 2
2.3 Acronyms 2
2.4 Verb Convention 2
3 TALLADEGA NATIONAL FOREST (ADVANCED TOWER SITE) 3
3.1 Site description 3
3.2 Ecosystem 4
3.3 Soils 8
3.3.1 Soil description 8
3.3.2 Soil semi-variogram description 13
3.3.3 Results and interpretation 15
3.4 Airshed 19
3.4.1 Seasonal windroses 19
3.4.2 Results (graphs for wind roses) 20
3.4.3 Resultant vectors 22
3.4.4 Expected environmental controls on source area 22
3.4.5 Footprint model results (source area graphs) 24
3.5 Site design and tower attributes 30
3.6 Information for ecosystem productivity plots 33
3.7 Issues and attentions 33
4 LENOIR LANDING, RELOCATEABLE TOWER 1 34
4.1 Site description 34
4.2 Ecosystem 34
4.3 Soils 38
4.3.1 Description of soils 38
4.3.2 Soil semi-variogram description 45
4.4 Airshed 47
4.4.1 Seasonal windroses 47

4.4.2 Results (graphs for wind roses) 48
4.4.3 Resultant vectors 50
4.4.4 Expected environmental controls on source area 50
4.4.5 Footprint model results (source area graphs) 52
4.5 Site design and tower attributes 58
4.6 Information for ecosystem productivity plots 61
4.7 Issues and attentions 61
5 DEAD LAKE, RELOCATEABLE TOWER 2 63
5.1 Site description 63
5.2 Ecosystem 64
5.3 Soils 65
5.3.1 Description of soils 66
5.3.2 Soil semi-variogram description 77
5.3.3 Results and interpretation 79
5.4 Airshed 83
5.4.1 Seasonal windroses 83
5.4.2 Results (graphs for wind roses) 84
5.4.3 Resultant vectors 86
5.4.4 Expected environmental controls on source area 86
5.4.5 Footprint model results (source area graphs) 89
5.5 Site design and tower attributes 95
5.6 Information for ecosystem productivity plots 100
5.7 Issues and attentions 100
6 APPENDIX A. CONCEPTUAL DESIGN LAYOUT OF SOIL ARRAY PATTERNS. 101
7 REFERENCES 106

LIST OF TABLES

Table 1. Percent Land cover type at Talladega National Forest 5
Table 2. Percent Land cover by vegetation height type at Talladega National Forest 6
Table 3. Soil Series and percentage of soil series within 1 km^2 centered on the tower. 10
Table 4. Summary of soil array and soil pit information at Talladega. 0° represents true north and accounts for declination. 18
Table 5. The resultant wind vectors for D08 Talladega Forest Advanced site. 22
Table 6. Expected environmental controls to parameterize the source area model, and associated results from Talladega National Forest Advanced tower site. 23
Table 7. Site design and tower attributes for the Talladega Forest Advanced site. 31
Table 8. Land cover information at Lenoir Landing relocatable site 35

Table 9. Percent Land cover by vegetation height at Lenoir Landing relocatable site 36
Table 10. Soil series and percentage of soil series within 2.1 km^2 centered on the tower, Lenoir Landing. 41
Table 11. Summary of soil array and soil pit information at Lenoir Landing. 0° represents true north and accounts for declination. 46
Table 12. The resultant wind vectors from D08 Lenoir Landing Relocatable site. 50
Table 13. Expected environmental controls to parameterize the source area model, and associated results from D08 Lenoir Landing Relocatable tower site. 51
Table 14. Site design and tower attributes for D08 Lenoir Landing Relocatable site 59
Table 15. Percent Land cover information at the Dead Lake relocatable site (from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm) 64
Table 16. Ecosystem and site attributes for the Dead Lake Relocatable site. 65
Table 17. Soil series and percentage of soil series within 6.1 km^2 at Dead Lake. 68
Table 18. Summary of soil array and soil pit information at Dead Lake. 0° represents true north and accounts for declination. 82
Table 19. The resultant wind vectors from D08 Dead Lake Relocatable site 86
Table 20. Expected environmental controls to parameterize the source area model, and associated results from D08 Dead Lake Relocatable tower site. 87
Table 21. Site design and tower attributes for the Dead Lake alternative Relocatable tower site. 95

LIST OF FIGURES

Figure 1. Boundary map of Talladega National Forest and NEON candidate tower location 3
Figure 2. Vegetative cover map of Talladega National Forest and surrounding areas 5
Figure 3. A photo to show the ecosystem structure at Talladega Forest Advance tower site 7
Figure 4. 1 km^2 soil map for Talladega National Forest NEON advanced tower site, center at tower location. 8
Figure 5. Example semivariogram, depicting range, sill, and nugget. 14
Figure 6. Spatially cyclic sampling design for the measurements of soil temperature and soil water content. 14
Figure 7. Left graph: mobile (circles) and stationary (line) soil temperature data. Center graph: temperature data after correcting for changes in temperature in the stationary data (circles) and a linear regression based on time of day (line). Right graph: residual temperature data after correcting for changes temperature in the stationary data and the time of day regression. Data in the right graph were used for the semivariogram analysis. 15
Figure 8. Left graphs: exploratory data analysis plots for residuals of temperature. Center graph: directional semivariograms for residuals of temperature. Right graph: empirical semivariogram (circles) and model (line) fit to residuals of temperature. 16
Figure 9. Left graph: mobile (circles) and stationary (line) soil water content data. Center graph: water content data after correcting for changes in water content in the stationary data (circles) and a linear regression based on time of day (line). Right graph: residual water content data after correcting for changes water content in the stationary data and the time of day regression. Data in the right graph were used for the semivariogram analysis. 17
Figure 10. Left graphs: exploratory data analysis plots for residuals of soil water content. Center graph: directional semivariograms for residuals of water content. Right graph: empirical semivariogram (circles) and model (line) fit to residuals of water content. 17
Figure 11. Site layout at Talladega showing soil array and location of the FIU soil pit. 19

Figure 12. Windroses of January – March for D08 Talladega Forest Advanced Site. 20
Figure 13. Windroses of April – June for D08 Talladega Forest Advanced Site. 20
Figure 14. Windroses of July – September for D08 Talladega Forest Advanced Site. 21
Figure 15. Windroses of October – December for D08 Talladega Forest Advanced Site. 21
Figure 16. D08 Talladega Forest summer daytime (convective) footprint output with max wind speed.. 24
Figure 17. D08 Talladega Forest summer daytime (convective) footprint output with mean wind speed. 25
Figure 18. D08 Talladega Forest summer nighttime (stable) footprint output with mean wind speed. ... 26
Figure 19. D08 Talladega Forest winter daytime (convective) footprint output with max wind speed. ... 27
Figure 20. D08 Talladega Forest winter daytime (convective) footprint output with mean wind speed. . 28
Figure 21. D08 Talladega Forest winter nighttime (stable) footprint output with mean wind speed. 29
Figure 22. Site layout for Talladega National Forest Advanced tower site 32
Figure 23. Boundary map of Lenoir Landing with proposed tower location 34
Figure 24. Vegetative cover map of Lenoir Landing relocatable site and surrounding areas (information is from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm) 35
Figure 25. General view of the ecosystem at Lenoir Landing Relocatable tower location 38
Figure 26. 2.1 km^2 soil map for Lenoir Landing relocatable site, center at tower location, north is top of map. 39
Figure 27. Site layout at Lenoir Landing showing soil array and location of the FIU soil pit. 47
Figure 34. Windroses of January – March for D08 Lenoir Landing Relocatable site. 48
Figure 35. Windroses of April – June for D08 Lenoir Landing Relocatable site. 48
Figure 36. Windroses of July – September for D08 Lenoir Landing Relocatable site. 49
Figure 37. Windroses of October – December for D08 Lenoir Landing Relocatable site. 49
Figure 38. D08 Lenoir Landing summer daytime (convective) footprint output with max wind speed. ... 53
Figure 39. D08 Lenoir Landing summer daytime (convective) footprint output with mean wind speed. . 54
Figure 40. D08 Lenoir Landing summer nighttime (stable) footprint output with mean wind speed. 55
Figure 41. D08 Lenoir Landing winter daytime (convective) footprint output with max wind speed. 56
Figure 42. D08 Lenoir Landing winter daytime (convective) footprint output with mean wind speed. 57
Figure 43. D08 Lenoir Landing winter nighttime (stable) footprint output with mean wind speed. 58
Figure 44. Overview and a close look of site layout at Lenoir Landing Relocatable site 60
Figure 46. Vegetative cover map of the Dead Lake relocatable site and surrounding areas 64
Figure 47. General view of the ecosystem at Dead Lake Relocatable site. Site is periodically and seasonally flooded. 65
Figure 48. 6.1 km^2 soil map for Dead Lake relocatable site. 66
Figure 49. Example semivariogram, depicting range, sill, and nugget. 78
Figure 50. Spatially cyclic sampling design for the measurements of soil temperature and soil water content. 78
Figure 51. Left graph: mobile (circles) and stationary (line) soil temperature data. Center graph: temperature data after correcting for changes in temperature in the stationary data (circles) and a linear regression based on time of day (line). Right graph: residual temperature data after correcting for changes temperature in the stationary data and the time of day regression. Data in the right graph were used for the semivariogram analysis. 79
Figure 52. Left graphs: exploratory data analysis plots for residuals of temperature. Center graph: directional semivariograms for residuals of temperature. Right graph: empirical semivariogram (circles) and model (line) fit to residuals of temperature. 80

Figure 53. Left graph: mobile (circles) and stationary (line) soil water content data. Center graph: water content data after correcting for changes in water content in the stationary data (circles) and a linear regression based on time of day (line). Right graph: residual water content data after correcting for changes water content in the stationary data and the time of day regression. Data in the right graph were used for the semivariogram analysis. 80
Figure 54. Left graphs: exploratory data analysis plots for residuals of soil water content. Center graph: directional semivariograms for residuals of water content. Right graph: empirical semivariogram (circles) and model (line) fit to residuals of water content. 81
Figure 55. Site layout at Dead Lake showing soil array and location of the FIU soil pit. 83
Figure 56. Windroses of January – March for D08 Dead Lake Relocatable site. 84
Figure 57. Windroses of April – June for D08 Dead Lake Relocatable site. 85
Figure 58. Windroses of July – September for D08 Dead Lake Relocatable site. 85
Figure 59. Windroses of October – December for D08 Dead Lake Relocatable site. 86
Figure 6**0**. D08 Dead Lake relocatable site summer daytime (convective) footprint output with max wind speed. 89
Figure 61. D08 Dead Lake relocatable site summer daytime (convective) footprint output with mean wind speed. 90
Figure 62. D08 Dead Lake relocatable site summer nighttime (stable) footprint output with mean wind speed. 91
Figure 63. D08 Dead Lake relocatable site winter daytime (convective) footprint output with max wind speed. 92
Figure 64. D08 Dead Lake relocatable site winter daytime (convective) footprint output with mean wind speed. 93
Figure 65. D08 Dead Lake relocatable site winter nighttime (stable) footprint output with mean wind speed. 94
Figure 66. Site layout for D08 Dead Lake alternative Relocatable site 97
Figure 67. Generic diagram to demonstration the relationship between tower and instrument hut when boom facing south and instrument hut on the north towards the tower. 99
Figure A1. Conceptual diagram of Soil Array Pattern A. 101
Figure A2. Conceptual diagram of Soil Array Pattern B 102
Figure A3. Conceptual diagram of Soil Array Pattern C 102
Figure A4. Generic patterns for the boardwalk configuration 104

1 DESCRIPTION

1.1 Purpose

Data collected, analyzed and described here are used to inform the site design activities for NEON project Teams, EHS (permitting), FCC, ENG and FSU. This report was made based on actual site visit to the 3 NEON sites in Domain 08. This document presents all the supporting data for FIU site characterization.

1.2 Scope

FIU site characterization data and analysis results presented in this document are for the three D08 tower locations: Talladega National Forest site (Advanced), Lenoir Landing site (Relocatable 1), and Dead Lake site (Relocatable 2). Issues and concerns for each site that need attentions are also addressed in this document according to our best knowledge.

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

AD[01]	NEON.DOC.011008 FIU Tower Design Science Requirements
AD[02]	NEON.DOC.011000 FIU Technical and Operation Requirements
AD[03]	
AD[04]	

2.2 Reference Documents

RD[01]	NEON.DOC.000008 NEON Acronym List
RD[02]	NEON.DOC.000243 NEON Glossary of Terms
RD[03]	
RD[04]	

2.3 Acronyms

2.4 Verb Convention

"Shall" is used whenever a specification expresses a provision that is binding. The verbs "should" and "may" express non-mandatory provisions. "Will" is used to express a declaration of purpose on the part of the design activity.

3 TALLADEGA NATIONAL FOREST (ADVANCED TOWER SITE)

3.1 Site description

NEON Advanced tower site at Talladega National Forest is located within Oakmulghee district (Figure 1). Oakmulghee district of the Talladega National Forest located where the upper coastal plain gives rise the Appalachian foothills, the lands of this region are rich mosaic if forest types and habitats (Figure 2). Steep ridges to rolling hills fading to hardwood bottoms make up the diversity of forest conditions found on Oakmulgee. While known for its longleaf forests, over 40% of Oakmulgee is covered with mixture hardwoods and wetlands affording all who venture into the forest an array of opportunities. Over 500 miles of roads provide experience for the horse ride, the mountain bike, as well as the pleasure driver. The 44000 acres wildlife management area is embedded with the Talladega National Forest, and provides hunters and wildlife enthusiasts an array of habitats and special seasons to enjoy their hunting heritage. The area is destination for spring's turkey hunting. Hunting regulations are reviewed annually and are subject to change. (Information source: http://www.nationalforeststore.com/merchant.mvc?Screen=PROD&Store_Code=NFS&Product_Code=AL-2&Category_Code=AL)

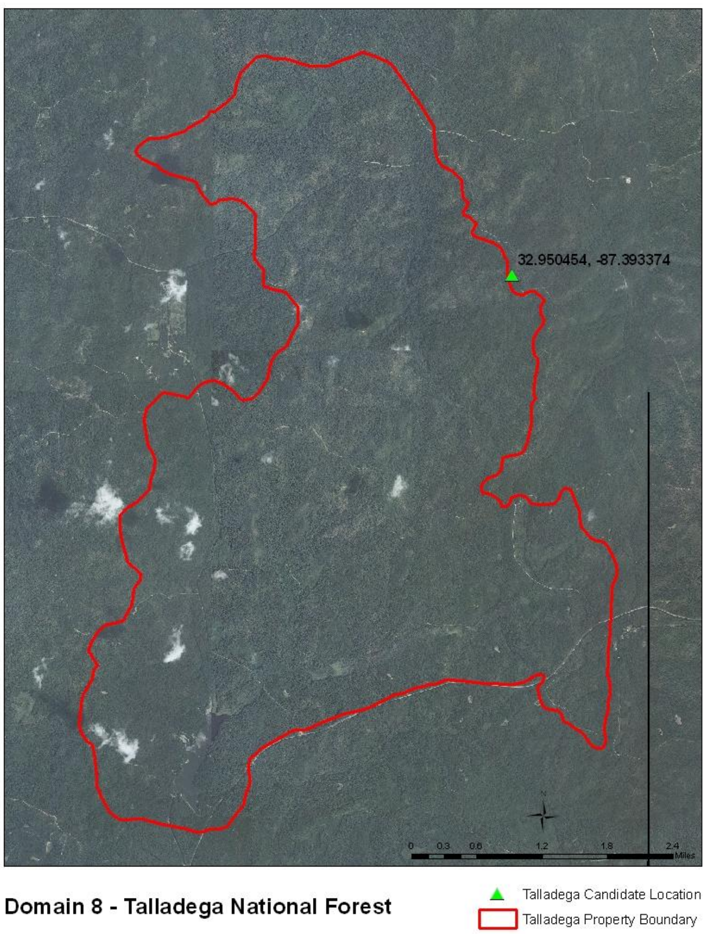


Figure 1. Boundary map of Talladega National Forest and NEON candidate tower location

3.2 Ecosystem

During the mid-1800s the lands that became the Oakmulgee were documented as open longleaf pine ridges. In the years that followed, much of the longleaf pine that once flourished was replaced with loblolly pine trees. This unnatural condition set forth a complex forest health problem often resulting dead and dying trees. Maintaining a firm commitment to restore the native longleaf forest, the Oakmulgee district is removing the non-native and over stocked trees and allowing the native conditions to thrive. These treatments are generally executed through a commercial timber sale, which implements contractual provisions to insure special precautions and ecological protections and mitigations. Active logging operations and traffic on roads can be seen. Restoring native fire regimes is another management activity that is used here. Many plants and animals species common to the longleaf pine ecosystem depend on fire for their existence. To perpetuate this fire dependent ecosystem, managers prescribe fire under specific conditions to simulate natural lightning fires and to maintain native plant and animal diversity. During times of prescribed burning visitors may experience smoky conditions. In addition to the longleaf ecosystem, other popular ecosystems include the mixed hardwoods of hickory, beech, and oak on the north facing slopes and bottomland systems ranging from beaver ponds to cypress and tupelo forests. Birding along these bottomland systems often results in finds such as prothonotary warblers. Home to Alabama's largest population of the Alabama's largest population of Red-cockaded woodpeckers, the Oakmulgee offers multiple opportunities to observe this unique bird. Placed on the endangered species list in the 1970's, today the Red-cockaded woodpecker is one of the key indicator species driving restoration of the longleaf forest. (Information source: http://www.nationalforeststore.com/merchant.mvc?Screen=PROD&Store_Code=NFS&Product_Code=AL-2&Category_Code=AL).

The ecosystem we are interested in is the restored longleaf pine forest. Candidate tower location was lat 32.95045448°, long -87.39337396. After FIU site characterization, we determine the exact **tower location** to be at 32.95046°, -87.39327° to minimize the needs for tree cutting during tower construction. New location is next to the original site, and next to access road (county road 723). The canopy height of the pine forest is about 25 meters. Canopy is closed. Lowest branch is about 8 m above ground level. No obvious strata observed at canopy. Shrub understory is about 1.2 m tall (Figure 3). Species is unclear.

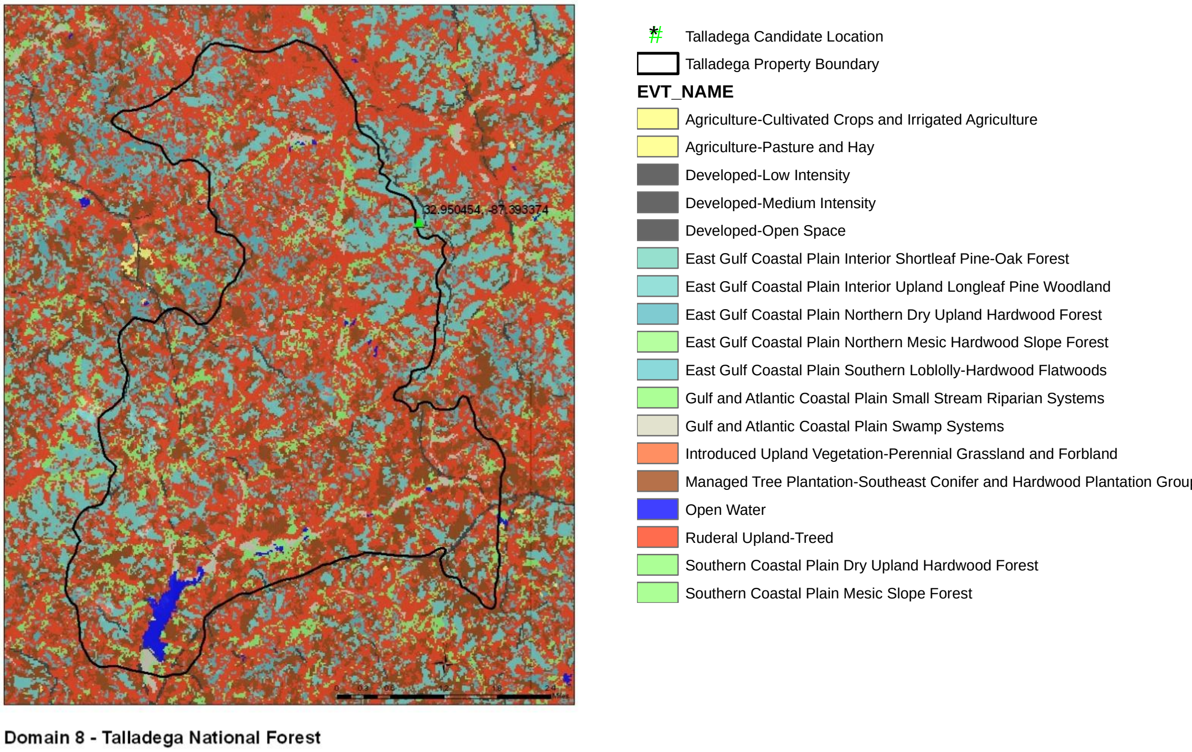


Figure 2. Vegetative cover map of Talladega National Forest and surrounding areas (information is from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm).

Table 1. Percent Land cover type at Talladega National Forest (information is from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm)

Vegetation Type	Area	Percent
Agriculture-Pasture and Hay	0.002784	0.005317
Developed-Open Space	0.648478	1.238532
East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest	0.085633	0.16355
East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland	7.858318	15.00864
East Gulf Coastal Plain Northern Dry Upland Hardwood Forest	3.578093	6.833816
East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest	0.000576	0.001101
East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwoods	0.0009	0.001719
Gulf and Atlantic Coastal Plain Small Stream Riparian Systems	0.598333	1.142758
Gulf and Atlantic Coastal Plain Swamp Systems	1.033232	1.973375
Introduced Upland Vegetation-Perennial Grassland and Forbland	0.001516	0.002896
Managed Tree Plantation-Southeast Conifer and Hardwood Plantation Group	9.370061	17.89592
Open Water	0.604183	1.153932
Ruderal Upland-Treed	24.56132	46.90978
Southern Coastal Plain Dry Upland Hardwood Forest	0.147632	0.281964
Southern Coastal Plain Mesic Slope Forest	3.867576	7.3867

Total Area sq km	52.35864	100

Table 2. Percent Land cover by vegetation height type at Talladega National Forest (information is from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm)

Vegetation Height	Vegetation Type	Area	Percent
Pasture/Hay	Agriculture-Pasture and Hay	0.002784	0.005317
Developed-Open_Space	Developed-Open Space	0.65097	1.243291
Forest_Height_10_to_25_meters	East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest	0.085633	0.16355
Forest_Height_10_to_25_meters	East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland	7.531903	14.38522
Forest_Height_5_to_10_meters	East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland	0.010153	0.019391
Shrub_Height_>3.0_meters	East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland	0.295592	0.564552
Forest_Height_0_to_5_meters	East Gulf Coastal Plain Northern Dry Upland Hardwood Forest	0.0063	0.012032
Forest_Height_10_to_25_meters	East Gulf Coastal Plain Northern Dry Upland Hardwood Forest	3.540433	6.76189
Forest_Height_5_to_10_meters	East Gulf Coastal Plain Northern Dry Upland Hardwood Forest	0.032905	0.062846
Forest_Height_10_to_25_meters	East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest	0.000576	0.001101
Forest_Height_10_to_25_meters	East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwoods	0.0009	0.001719
Forest_Height_10_to_25_meters	Gulf and Atlantic Coastal Plain Small Stream Riparian Systems	0.563406	1.076052
Forest_Height_5_to_10_meters	Gulf and Atlantic Coastal Plain Small Stream Riparian Systems	0.001476	0.00282
Herb_Height_>1.0_meter	Gulf and Atlantic Coastal Plain Small Stream Riparian Systems	0.0009	0.001719
Herb_Height_0.5_to_1.0_meters	Gulf and Atlantic Coastal Plain Small Stream Riparian Systems	0.0009	0.001719
Shrub_Height_>3.0_meters	Gulf and Atlantic Coastal Plain Small Stream Riparian Systems	0.030091	0.057472
Forest_Height_0_to_5_meters	Gulf and Atlantic Coastal Plain Swamp Systems	0.0009	0.001719
Forest_Height_10_to_25_meters	Gulf and Atlantic Coastal Plain Swamp Systems	1.031979	1.970982
Forest_Height_5_to_10_meters	Gulf and Atlantic Coastal Plain Swamp Systems	0.0018	0.003438
Herb_Height_0.5_to_	Introduced Upland Vegetation-Perennial	0.0018	0.003438

1.0_meters	Grassland and Forbland		
Forest_Height_0_to_5_meters	Managed Tree Plantation-Southeast Conifer and Hardwood Plantation Group	0.113936	0.217607
Forest_Height_10_to_25_meters	Managed Tree Plantation-Southeast Conifer and Hardwood Plantation Group	8.946365	17.0867
Forest_Height_5_to_10_meters	Managed Tree Plantation-Southeast Conifer and Hardwood Plantation Group	0.300744	0.574393
Shrub_Height_>3.0_meters	Managed Tree Plantation-Southeast Conifer and Hardwood Plantation Group	0.004856	0.009274
Open_Water	Open Water	0.604183	1.153932
Forest_Height_0_to_5_meters	Ruderal Upland-Treed	0.041657	0.079561
Forest_Height_10_to_25_meters	Ruderal Upland-Treed	24.45196	46.70092
Forest_Height_5_to_10_meters	Ruderal Upland-Treed	0.086906	0.165982
Forest_Height_10_to_25_meters	Southern Coastal Plain Dry Upland Hardwood Forest	0.147632	0.281964
Forest_Height_10_to_25_meters	Southern Coastal Plain Mesic Slope Forest	3.867189	7.385963
Forest_Height_5_to_10_meters	Southern Coastal Plain Mesic Slope Forest	0.0018	0.003438
	Total Area sq km	52.35863	100

Figure 3. A photo to show the ecosystem structure at Talladega Forest Advance tower site

3.3 Soils

3.3.1 Soil description

Soil data and soil maps (Figures 4, Table 3) below for the Talladega National Forest Advanced tower site were collected from 1 km^2 NRCS soil maps(http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm), which centered at the tower location, to determine the dominant soil types in the larger tower foot print. This was done to assure that the soil array is in the dominant (or in the co-dominant) soil type present in the tower footprint.

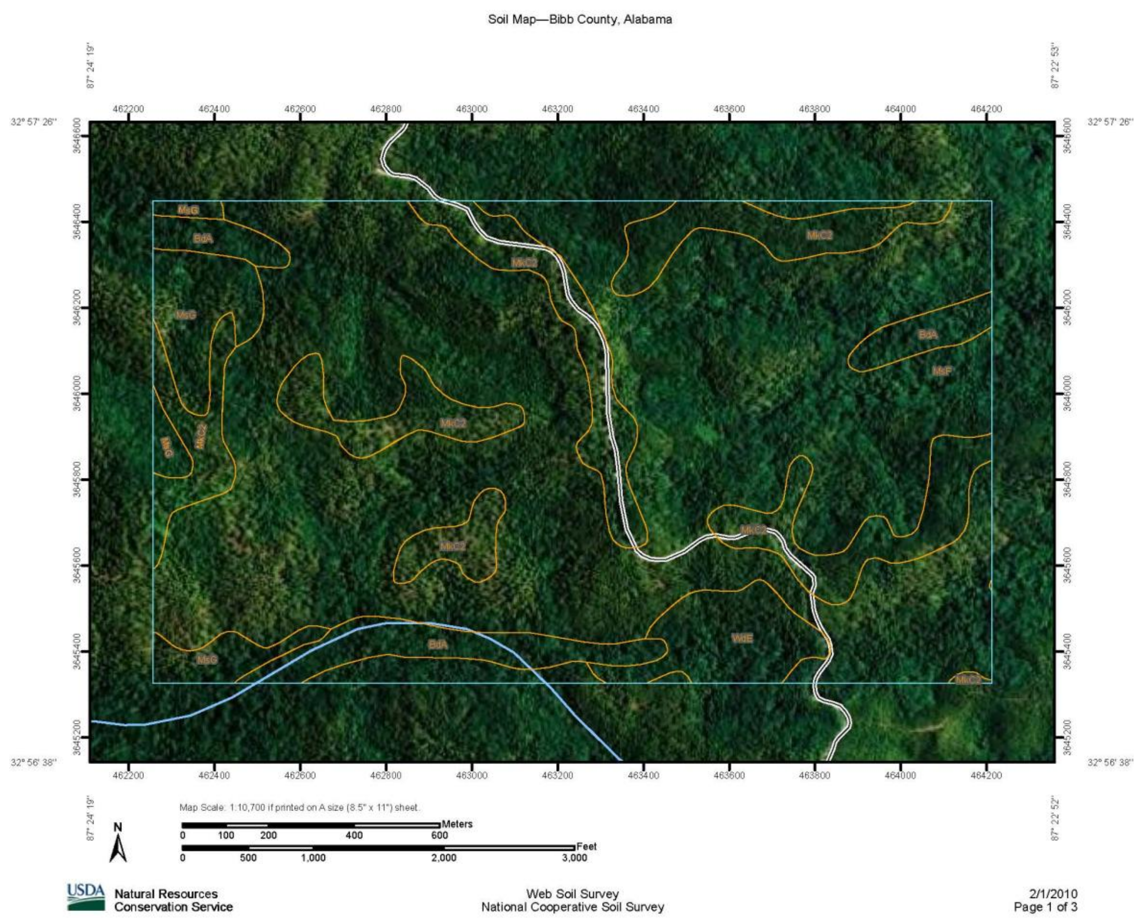


Figure 4. 1 km^2 soil map for Talladega National Forest NEON advanced tower site, center at tower location.

Map Unit Description The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit. A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils. Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called non-contrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soil types or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas. An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a soil series. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into soil phases. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series. Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups. A complex consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example. An association is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example. An undifferentiated group is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example. Some surveys include miscellaneous areas. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Table 3. Soil Series and percentage of soil series within 1 km^2 centered on the tower.
Area Object Interest (AOI) is the mapping unit from NRCS.

Bibb County, Alabama (AL007)			
Map Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BdA	Bibb-Iuka complex, 0 to 1 percent slopes, frequently flooded	30.1	5.50%
MkC2	Maubila flaggy loam, 2 to 8 percent slopes, eroded	89.9	*16.60%
MsF	Maubila-Smithdale complex, 15 to 35 percent slopes	376.8	*69.50%
MsG	Maubila-Smithdale complex, 35 to 45 percent slopes	26.6	4.90%
WdE	Wadley-Smithdale-Boykin complex, 5 to 20 percent slopes	18.8	3.50%
Totals for Area of Interest		542.2	100.00%

Note, asterix indicates dominate soil type in airshed

Bibb County, Alabama: BdA—Bibb-Iuka complex, 0 to 1 percent slopes, frequently flooded. Map Unit Setting *Elevation:* 50 to 450 feet *Mean annual precipitation:* 48 to 67 inches *Mean annual air temperature:* 51 to 68 degrees F *Frost-free period:* 190 to 225 days **Map Unit Composition** *Bibb and similar soils:* 50 percent *Iuka and similar soils:* 35 percent *Minor components:* 5 percent **Description of Bibb Setting** *Landform:* Flood plains *Landform position (three-dimensional):* Base slope *Down-slope shape:* Concave *Across-slope shape:* Concave *Parent material:* Stratified sandy and silty alluvium **Properties and qualities** *Slope:* 0 to 1 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Poorly drained *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* About 6 to 12 inches *Frequency of flooding:* Frequent *Frequency of ponding:* None *Available water capacity:* Moderate (about 9.0 inches) **Interpretive groups** *Land capability (nonirrigated):* 5w **Typical profile** *0 to 8 inches:* Sandy loam *8 to 55 inches:* Sandy loam *55 to 80 inches:* Loamy sand **Description of Iuka Setting** *Landform:* Flood plains *Landform position (three-dimensional):* Base slope *Down-slope shape:* Convex *Across-slope shape:* Linear *Parent material:* Coarse-loamy alluvium **Properties and qualities** *Slope:* 0 to 1 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Moderately well drained *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* About 12 to 36 inches *Frequency of flooding:* Frequent *Frequency of ponding:* None *Available water capacity:* Moderate (about 8.7 inches) **Interpretive groups** *Land capability (nonirrigated):* 5w **Typical profile** *0 to 15 inches:* Fine sandy loam *15 to 46 inches:* Sandy loam *46 to 80 inches:* Loam **Minor Components Fluvaquents** *Percent of map unit:* 3 percent *Landform:* Flood plains *Landform position (three-dimensional):* Base slope *Down-slope shape:* Concave *Across-slope shape:* Concave **Mantachie** *Percent of map unit:* 2 percent *Landform:* Flood plains *Landform position (three-dimensional):* Base slope *Down-slope shape:* Concave *Across-slope shape:* Linear

Bibb County, Alabama: MkC2—Maubila flaggy loam, 2 to 8 percent slopes, eroded. Map Unit Setting *Elevation:* 300 to 500 feet *Mean annual precipitation:* 48 to 67 inches *Mean annual air temperature:* 51 to 68 degrees F *Frost-free period:* 190 to 225 days **Map Unit Composition** *Maubila and similar soils:* 85

percent *Minor components:* 12 percent **Description of Maubila Setting** *Landform:* Ridges, ridges *Landform position (three-dimensional):* Interfluve, side slope *Down-slope shape:* Convex *Across-slope shape:* Convex *Parent material:* Clayey marine deposits derived from sedimentary rock **Properties and qualities** *Slope:* 2 to 8 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Moderately well drained *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr) *Depth to water table:* About 24 to 42 inches *Frequency of flooding:* None *Frequency of ponding:* None *Available water capacity:* Moderate (about 7.2 inches) **Interpretive groups** *Land capability (nonirrigated):* 4e **Typical profile** *0 to 4 inches:* Flaggy loam *4 to 27 inches:* Clay *27 to 32 inches:* Sandy clay loam *32 to 42 inches:* Silty clay *42 to 80 inches:* Clay **Minor Components Smithdale** *Percent of map unit:* 5 percent *Landform:* Hillslopes, ridges *Landform position (three-dimensional):* Side slope, interfluves *Down-slope shape:* Convex *Across-slope shape:* Convex **Luverne** *Percent of map unit:* 3 percent *Landform:* Ridges *Landform position (three-dimensional):* Interfluve *Down-slope shape:* Convex *Across-slope shape:* Convex **Boykin** *Percent of map unit:* 2 percent *Landform:* Hillslopes *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex **Wadley** *Percent of map unit:* 2 percent *Landform:* Hillslopes *Landform position (two-dimensional):* Footslope, backslope *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex

Bibb County, Alabama: MsF—Maubila-Smithdale complex, 15 to 35 percent slopes. Map Unit Setting *Elevation:* 50 to 500 feet *Mean annual precipitation:* 48 to 67 inches *Mean annual air temperature:* 51 to 68 degrees F *Frost-free period:* 190 to 225 days **Map Unit Composition** *Maubila and similar soils:* 60 percent *Smithdale and similar soils:* 30 percent *Minor components:* 9 percent **Description of Maubila Setting** *Landform:* Hillslopes *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex *Parent material:* Clayey marine deposits derived from sedimentary rock **Properties and qualities** *Slope:* 15 to 35 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Moderately well drained *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr) *Depth to water table:* About 24 to 42 inches *Frequency of flooding:* None *Frequency of ponding:* None *Available water capacity:* Moderate (about 7.2 inches) **Interpretive groups** *Land capability (nonirrigated):* 7e **Typical profile** *0 to 4 inches:* Flaggy loam *4 to 27 inches:* Clay *27 to 32 inches:* Sandy clay loam *32 to 42 inches:* Silty clay *42 to 80 inches:* Clay **Description of Smithdale Setting** *Landform:* Hillslopes, hillslopes *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex *Parent material:* Loamy marine deposits derived from sedimentary rock **Properties and qualities** *Slope:* 15 to 35 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Well drained *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* More than 80 inches *Frequency of flooding:* None *Frequency of ponding:* None *Available water capacity:* High (about 9.3 inches) **Interpretive groups** *Land capability (nonirrigated):* 7e **Typical profile** *0 to 12 inches:* Sandy loam *12 to 43 inches:* Sandy clay loam *43 to 80 inches:* Sandy loam **Minor Components Boykin** *Percent of map unit:* 3 percent *Landform:* Hillslopes *Landform position (two-dimensional):* Backslope, footslope *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex **Wadley** *Percent of map unit:* 2 percent *Landform:* Hillslopes *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex **Luverne** *Percent of map unit:* 2 percent *Landform:* Hillslopes *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex **Bibb** *Percent of map unit:* 1 percent *Landform:* Flood plains *Landform position (three- dimensional):* Base slope *Down-slope* *shape:* Concave *Across-slope shape:* Concave **Iuka** *Percent of map unit:* 1 percent *Landform:* Flood plains *Landform position (three-dimensional):* Base slope *Down-slope shape:* Convex *Across-slope shape:* Linear

Bibb County, Alabama: MsG—Maubila-Smithdale complex, 35 to 45 percent slopes. Map Unit Setting *Elevation:* 50 to 500 feet *Mean annual precipitation:* 48 to 67 inches *Mean annual air temperature:* 51 to 68 degrees F *Frost-free period:* 190 to 225 days **Map Unit Composition** *Maubila and similar soils:* 50 percent *Smithdale and similar soils:* 35 percent *Minor components:* 9 percent **Description of Maubila Setting** *Landform:* Hillslopes *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex *Parent material:* Clayey marine deposits derived from sedimentary rock **Properties and qualities** *Slope:* 35 to 45 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Moderately well drained *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr) *Depth to water table:* About 24 to 42 inches *Frequency of flooding:* None *Frequency of ponding:* None *Available water capacity:* Moderate (about 7.2 inches) **Interpretive groups** *Land capability (nonirrigated):* 7e **Typical profile** *0 to 4 inches:* Flaggy loam *4 to 27 inches:* Clay *27 to 32 inches:* Sandy clay loam *32 to 42 inches:* Silty clay *42 to 80 inches:* Clay **Description of Smithdale Setting** *Landform:* Hillslopes *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex *Parent material:* Loamy marine deposits derived from sedimentary rock **Properties and qualities** *Slope:* 35 to 45 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Well drained *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* More than 80 inches *Frequency of flooding:* None *Frequency of ponding:* None *Available water capacity:* High (about 9.3 inches) **Interpretive groups** *Land capability (nonirrigated):* 7e **Typical profile** *0 to 12 inches:* Sandy loam *12 to 43 inches:* Sandy clay loam *43 to 80 inches:* Sandy loam **Minor Components Boykin** *Percent of map unit:* 3 percent *Landform:* Hillslopes *Landform position (two-dimensional):* Footslope, backslope *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex **Wadley** *Percent of map unit:* 2 percent *Landform:* Hillslopes *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex **Luverne** *Percent of map unit:* 2 percent *Landform:* Hillslopes *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex **Bibb** *Percent of map unit:* 1 percent *Landform:* Flood plains *Landform position (three dimensional):* Base slope *Down-slope shape:* Concave *Across-slope shape:* Concave **Iuka** *Percent of map unit:* 1 percent *Landform:* Flood plains *Landform position (three-dimensional):* Base slope *Down-slope shape:* Convex *Across-slope shape:* Linear

Bibb County, Alabama: WdE—Wadley-Smithdale-Boykin complex, 5 to 20 percent slopes. Map Unit Setting *Elevation:* 50 to 500 feet *Mean annual precipitation:* 48 to 67 inches *Mean annual air temperature:* 51 to 68 degrees F *Frost-free period:* 190 to 225 days **Map Unit Composition** *Wadley and similar soils:* 45 percent *Smithdale and similar soils:* 30 percent *Boykin and similar soils:* 15 percent *Minor components:* 10 percent **Description of Wadley Setting** *Landform:* Hillslopes *Landform position (two-dimensional):* Backslope, footslope *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex *Parent material:* Sandy and loamy marine deposits derived from sedimentary rock **Properties and qualities** *Slope:* 5 to 20 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Somewhat excessively drained *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* More than 80 inches *Frequency of flooding:* None *Frequency of ponding:* None *Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm) *Available water capacity:* Moderate (about 6.3 inches) **Interpretive groups** *Land capability (nonirrigated):* 6s **Typical profile** *0 to 10 inches:* Loamy sand *10 to 44 inches:* Loamy sand *44 to 80 inches:*

Sandy loam **Description of Smithdale Setting** *Landform:* Hillslopes *Landform position (two-dimensional):* Backslope *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex *Parent material:* Loamy marine deposits **Properties and qualities** *Slope:* 5 to 20 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Well drained *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* More than 80 inches *Frequency of flooding:* None *Frequency of ponding:* None *Available water capacity:* High (about 9.3 inches) **Interpretive groups** *Land capability (nonirrigated):* 6e **Typical profile** *0 to 12 inches:* Sandy loam *12 to 43 inches:* Sandy clay loam *43 to 80 inches:* Sandy loam **Description of Boykin Setting** *Landform:* Hillslopes *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex *Parent material:* Loamy marine deposits **Properties and qualities** *Slope:* 5 to 20 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Well drained *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* More than 80 inches *Frequency of flooding:* None *Frequency of ponding:* None *Maximum salinity:* Nonsaline (0.0 to 2.0 mmhos/cm) *Available water capacity:* Low (about 5.9 inches) **Interpretive groups** *Land capability (nonirrigated):* 6e **Typical profile** *0 to 4 inches:* Loamy sand *4 to 31 inches:* Loamy sand *31 to 80 inches:* Sandy clay loam **Minor Components Maubila** *Percent of map unit:* 5 percent *Landform:* Hillslopes *Landform position (three-dimensional):* Side slope *Down-slope shape:* Convex *Across-slope shape:* Convex **Bibb** *Percent of map unit:* 3 percent *Landform:* Flood plains *Landform position (three-dimensional):* Base slope *Down-slope shape:* Concave *Across-slope shape:* Concave **Iuka** *Percent of map unit:* 2 percent *Landform:* Flood plains *Landform position (three-dimensional):* Base slope *Down-slope shape:* Convex *Across-slope shape:* Linear

3.3.2 Soil semi-variogram description

The goal of this aspect of the site characterization is to determine the minimum distance between the soil plots in the soil array such that data farther apart can be considered spatially independent. The collected field data will be used to produce semivariograms, which is a geostatistical technique to characterize spatial autocorrelation between mapped samples of a quantitative variable (*e.g.*, soil property data in our case). In an empirical semivariogram, the average of the squared differences of a response variable is computed for all pairs of points within specified distance intervals (lag classes). The output is presented graphically as a plot of the average semi-variance versus distance class (Figure 5). For the theoretical variogram models considered here, the semivariance will converge on the total variance at distances for which values are no longer spatially auto-correlated (this is referred to as the range, Figure 5).

For the theoretical variograms considered here, three parameters estimated from the data are used to fit a semivariogram model to the empirical semivariogram. This model is then assumed to quantitatively represent the correlation as a function of distance (Figure5), the range, the sill (the sill is the asymptotic value of semi-variance at the range), and the nugget (which describes sampling error or variation at distances below those separating the closest pairs of samples). The range, sill and nugget are estimated from theoretical models that are fitted to the empirical variograms using non-linear least squares methods.

The variogram analysis will be used, to determine the spatial scales at which we can consider soil measurements spatially independent. This characterization will directly inform the minimum distance between *i*) soil plots within each soil array, *ii*) the soil profile measurements, *iii*) EP plots, and *iv*) the microbial sampling locations. These data will directly inform NEON construction and site design activities.

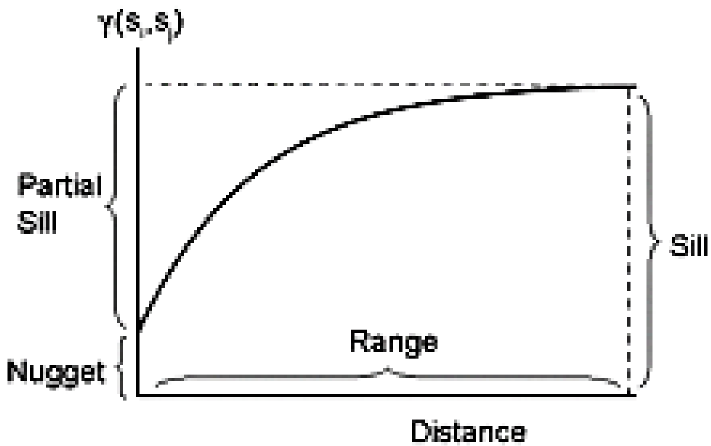


Figure 5. Example semivariogram, depicting range, sill, and nugget.

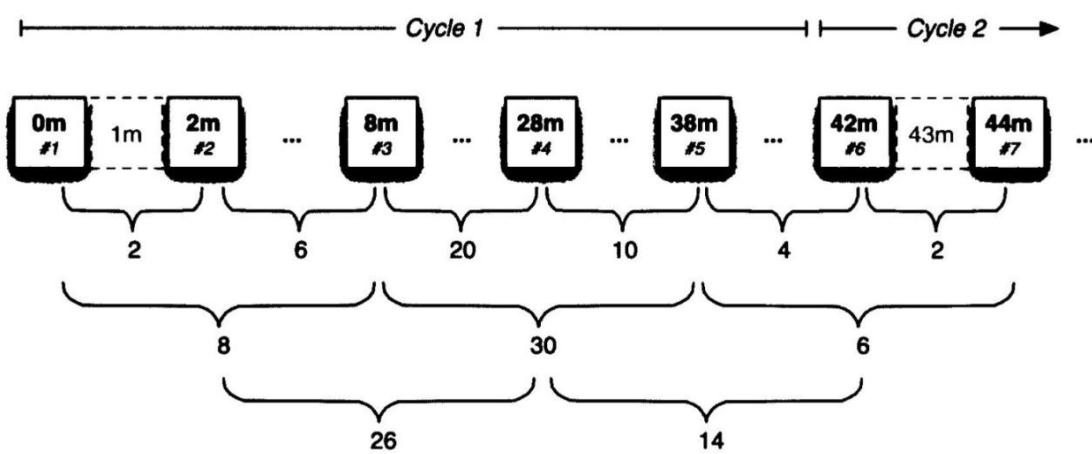


Figure 6. Spatially cyclic sampling design for the measurements of soil temperature and soil water content.

Field measurements of soil temperature (0-12 cm) and moisture (0-15 cm) were taken on 16 April 2010 at the Talladega site. The sampling points followed the spatially cyclic sampling design by Bond-Lamberty et al. (2006) (Figure 6). Soil temperature and moisture measurements were collected along three transects (168 m, 84 m, and 84 m) located in the expected airshed at Talladega (Figure 22). Details of how the airshed was determined are provided below. Soil temperature was measured with platinum resistance temperature sensors (RTD 810, Omega Engineering Inc., Stamford CT) and soil moisture was measured with time domain diaelectric sensors (CS616, Campbell Scientific Inc., Logan UT).

As well as measuring soil temperature and moisture at each sample point in Figure 6, measurements were also taken 30 cm in front and behind the sampling point along the axis of the transect. For example, at the 2 m sampling point, soil temperature and moisture was measured at 1.7 m, 2 m, and 2.3

m; this data is referred to as mobile data, since the measurements were taken at many different locations. In addition, soil temperature and moisture were continuously recorded at a single fixed location (stationary data) throughout the sampling time to correct for changes in temperature and moisture throughout the day.

Data collected were used for geospatial analyses of variograms in the R statistical computing language with the geoR package to test for spatial autocorrelation (Trangmar *et al.* 1986; Webster & Oliver 1989; Goovaerts 1997; Riberiro & Diggle 2001) and estimate the distance necessary for independence among soil plots in the soil array. To correct for changes in temperature and moisture over the sampling period, the stationary data was subtracted from the mobile data. In many instances a time of day trend was still apparent in the data even after subtracting the stationary data from the mobile data. This time of day trend was corrected for by fitting a linear regression and using the residuals for the semivariogram analysis. Soil temperature and moisture data, R code, graphs, and R output can be found at: P:\FIU\FIU_Site_Characterization\DXX\YYYYYYY_Characterization\Soil Measurements\Soil Data Analysis (where XX = domain number and YYYYYYY = site name).

3.3.3 Results and interpretation

3.3.3.1 Soil Temperature

Soil temperature data residuals, after accounting for changes in temperature in the stationary data and any remaining time of day trend, were used for the semivariogram analysis (Figure 7). Exploratory data analysis plots show that there was no distinct patterning of the residuals (Figure 8 left graphs) and directional semivariograms do not show much anisotropy (Figure 8, center graph). An isotropic empirical semivariogram was produced and a spherical model was fitted using Cressie weights (Figure 8, right graph). The model indicates a distance of effective independence of 42 m for soil temperature.

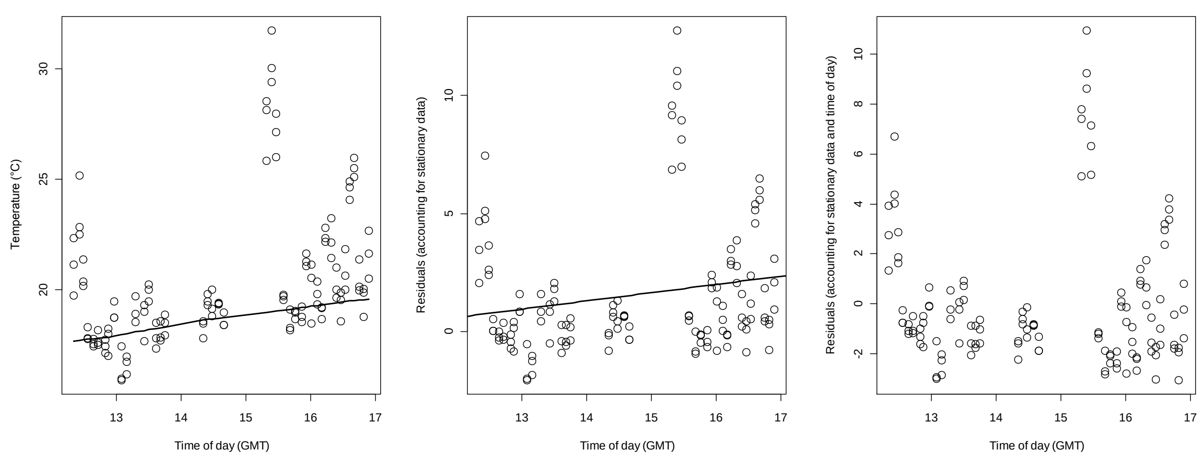


Figure 7. Left graph: mobile (circles) and stationary (line) soil temperature data. Center graph: temperature data after correcting for changes in temperature in the stationary data (circles) and a linear regression based on time of day (line). Right graph: residual temperature data after correcting for

changes temperature in the stationary data and the time of day regression. Data in the right graph were used for the semivariogram analysis.

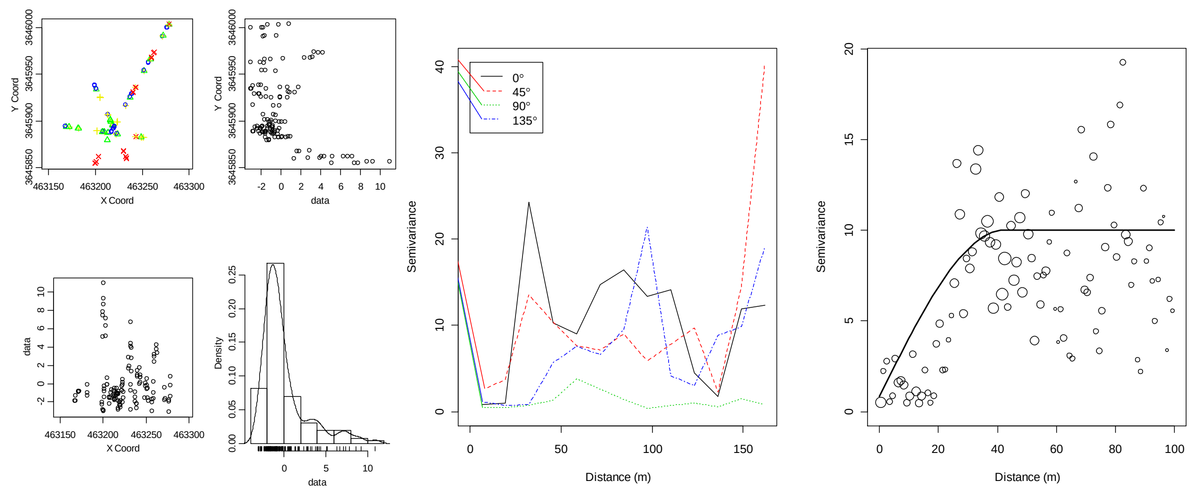


Figure 8. Left graphs: exploratory data analysis plots for residuals of temperature. Center graph: directional semivariograms for residuals of temperature. Right graph: empirical semivariogram (circles) and model (line) fit to residuals of temperature.

3.3.3.2 Soil water content

Soil water content data residuals, after accounting for changes in water content in the stationary data and any remaining time of day trend, were used for the semivariogram analysis (Figure 9). Exploratory data analysis plots show that there was no distinct patterning of the residuals (Figure 10, left graph) and directional semivariograms do not show anisotropy (Figure 10, center graph). An isotropic empirical semivariogram was produced and a spherical model was fitted using Cressie weights (Figure 10, right graph). The model indicates a distance of effective independence of 20 m for soil water content.

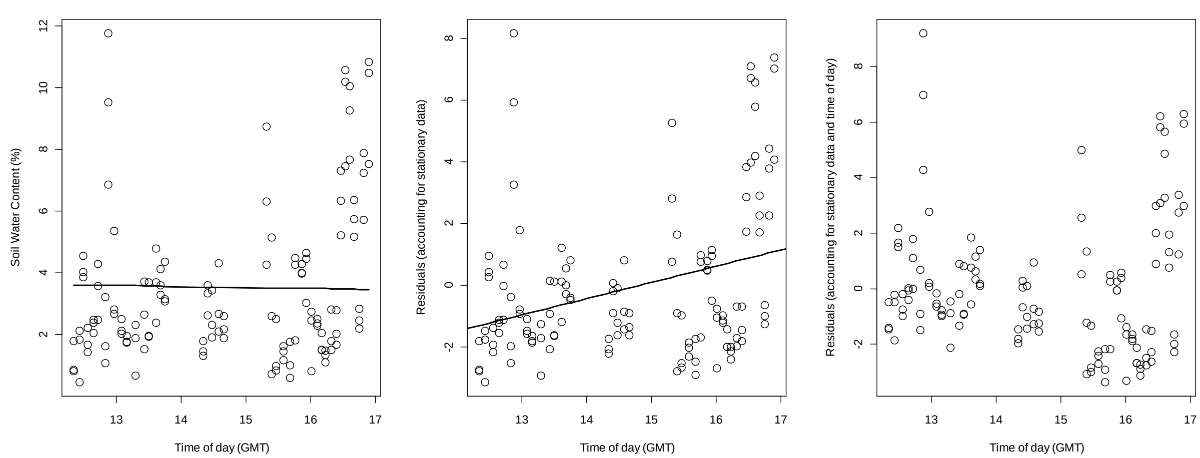


Figure 9. Left graph: mobile (circles) and stationary (line) soil water content data. Center graph: water content data after correcting for changes in water content in the stationary data (circles) and a linear regression based on time of day (line). Right graph: residual water content data after correcting for changes water content in the stationary data and the time of day regression. Data in the right graph were used for the semivariogram analysis.

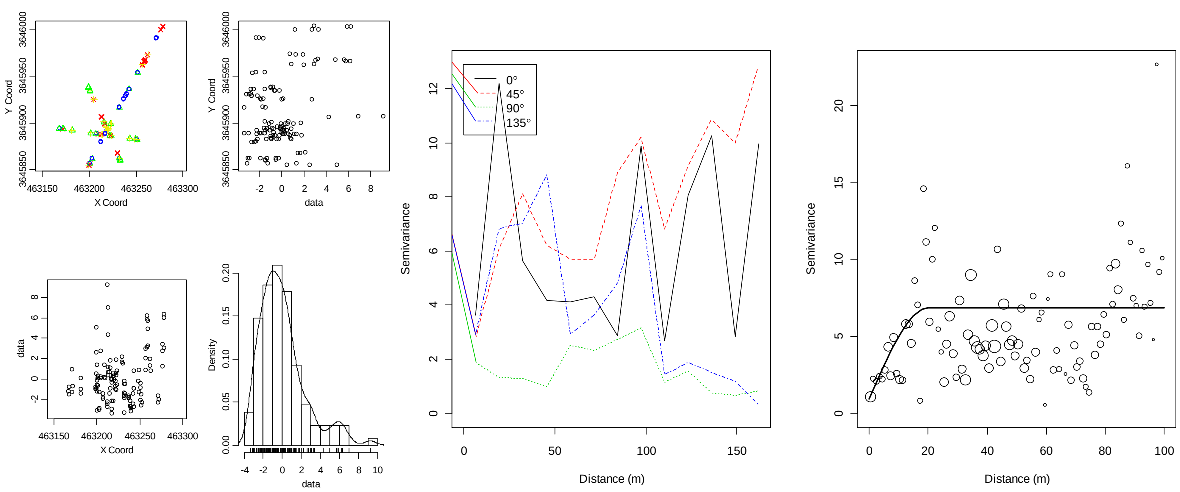


Figure 10. Left graphs: exploratory data analysis plots for residuals of soil water content. Center graph: directional semivariograms for residuals of water content. Right graph: empirical semivariogram (circles) and model (line) fit to residuals of water content.

3.3.3.3 Soil array layout and soil pit location

The minimum distance allowable between soil plots is 25 m to ensure a degree of spatial independence in non-measured soil parameters (i.e., other than temperature and water content) and the maximum distance allowable between soil plots is 40 m due to cost constraints. The estimated distance of effective independence was 42 m for soil temperature and 20 m for soil moisture. Based on these results and the site design guidelines the soil plots at Talladega shall be placed 40 m apart. The soil array shall follow the linear soil array design (Soil Array Pattern B) with the soil plots being 5 m x 5 m. The direction of the soil array shall be 330° from the soil plot nearest the tower (i.e., first soil plot). The location of the first soil plot will be approximately 32.95064°, -87.39329° (approximately 19 m northwest of tower location).The soil array was placed northwest of the tower (i.e. outside the airshed) to avoid crossing a fire road and going down a particularly steep slope. The exact location of each soil plot will be chosen by an FIU team member during site construction to avoid placing a soil plot at an unrepresentative location (e.g., rock outcrop, drainage channel, large tree, etc). The FIU soil pit for characterizing soil horizon depths, collecting soil for site-specific sensor calibration, and collecting soil for the FIU soil archive will be located at 32.95053°, -87.39299°. A summary of the soil information is shown in Table 4 and site layout can be seen in Figure 11.

Dominant soil series at the site: Maubila-Smithdale complex, 15 to 35 percent slopes. The taxonomy of this soil is shown below:
Order: Ultisols

Suborder: Udults
Great group: Hapludults
Subgroup: Aquic Hapludults - Typic Hapludults
Family: Fine, mixed, subactive, thermic Aquic Hapludults - Fine-loamy, siliceous, subactive, thermic Typic Hapludults
Series: Maubila-Smithdale complex, 15 to 35 percent slopes

Table 4. Summary of soil array and soil pit information at Talladega. 0° represents true north and accounts for declination.

Soil plot dimensions	5 m x 5 m
Soil array pattern	B
Distance between soil plots: x	40 m
Distance from tower to closest soil plot: y	~19 m
Latitude and longitude of 1st soil plot OR direction from tower	32.95064°, -87.39329°
Direction of soil array	330°
Latitude and longitude of FIU soil pit	32.95058°, -87.39308°
Dominant soil type	Maubila-Smithdale complex, 15 to 35 percent slopes
Expected soil depth	>2 m
Depth to water table	0.61-1.07 m

Expected depth of soil horizons	Expected measurement depths*
0-0.10 m (flaggy loam)	0.05 m
0.10-0.69 m (clay)	0.40 m
0.69-0.81 m (sandy clay loam)	0.75 m
0.81-1.07 m (silty clay)	0.94 m
1.07-2 m (clay)	1.54 m

*Actual soil measurement depths will be determined based on measured soil horizon depths at the NEON FIU soil pit and may differ substantially from those shown here.

Figure 11. Site layout at Talladega showing soil array and location of the FIU soil pit.

3.4 Airshed

3.4.1 Seasonal windroses

Wind roses analytically determine and graphically represent the frequencies of wind direction and wind speed over a given timeseries, Figures 12-15. The weather data used to generate the following wind roses are from Tuscaloosa Municipal airport, which is ~36 km Northwest of NEON Advanced site at Talladega National Forest. The orientation of the wind rose follows that of a compass (assume declination applied). When we describe the wind directions it should be noted that they are the cardinal direction that wind blows from. Color bands depict the range of wind speeds. The directions of the rose with the longest spoke show wind directions with the largest frequency. These wind roses are subdivided into as 24 cardinal directions.

3.4.2 Results (graphs for wind roses)

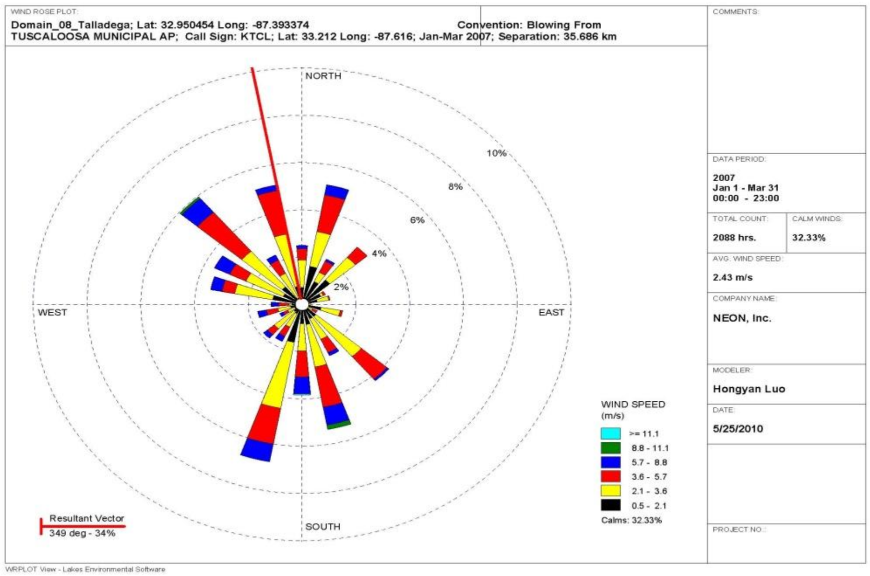


Figure 12. Windroses of January – March for D08 Talladega Forest Advanced Site.

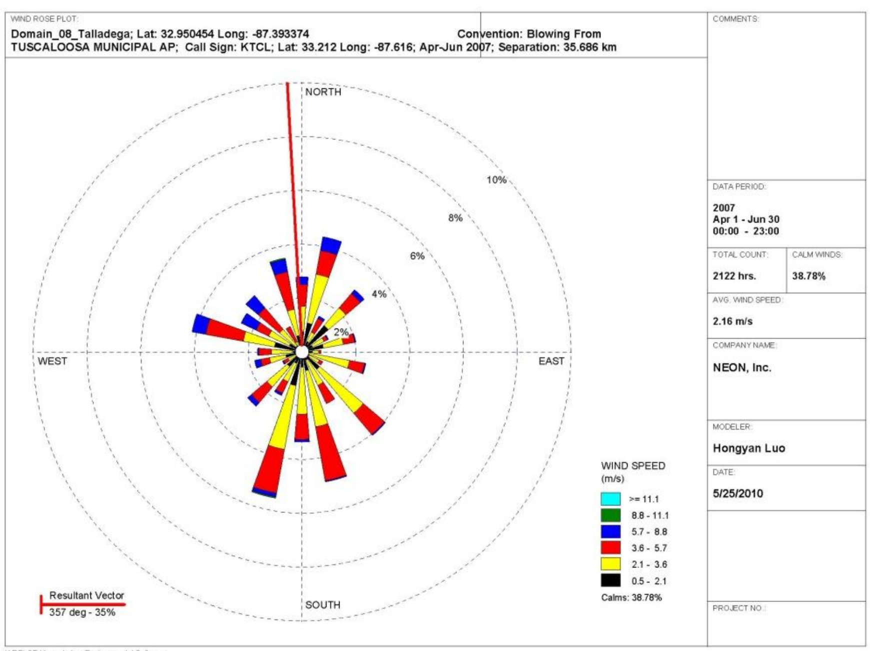


Figure 13. Windroses of April – June for D08 Talladega Forest Advanced Site.

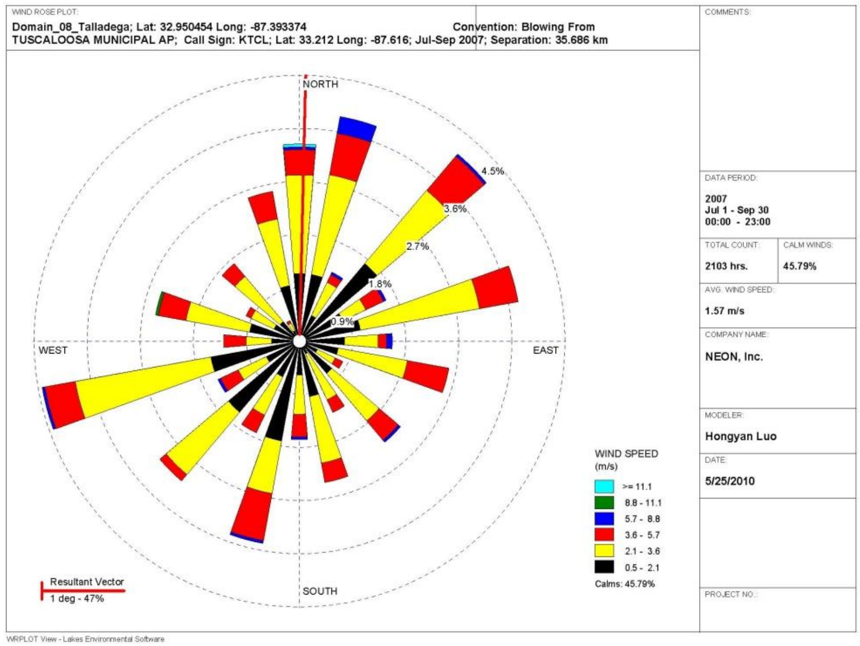


Figure 14. Windroses of July – September for D08 Talladega Forest Advanced Site.

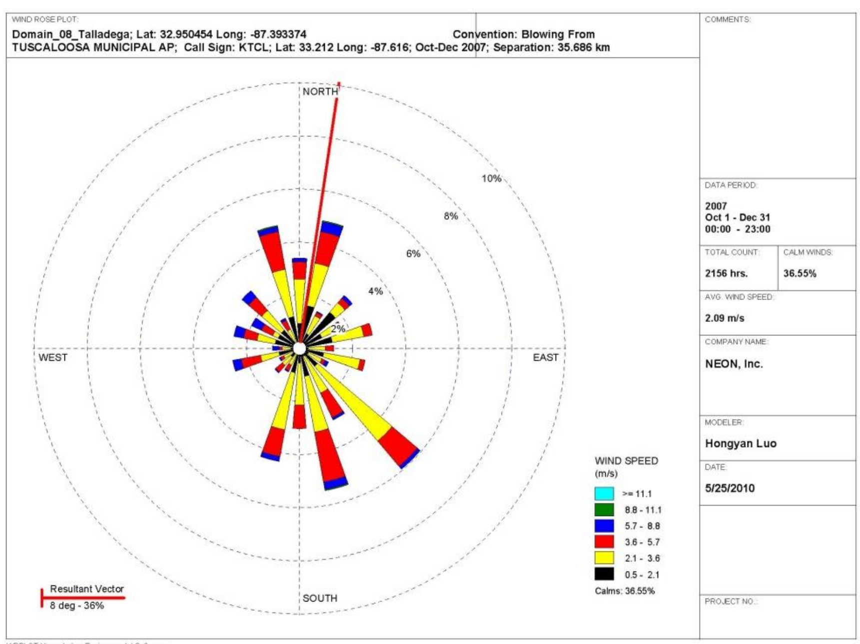


Figure 15. Windroses of October – December for D08 Talladega Forest Advanced Site.

3.4.3 Resultant vectors

Table 5. The resultant wind vectors for D08 Talladega Forest Advanced site.

Quarterly (seasonal) timeperiod	Resultant vector	% duration
January to March	349°	34
April to June	357°	35
July to September	1°	47
October to December	8°	36
Annual mean	358.75°	na.

3.4.4 Expected environmental controls on source area

Two types of models were commonly used to determine the shape and extent of the source area under different and contrasting atmospheric stability classes. An inverted plume dispersion model with modeled cross wind solutions were used for convective conditions (Horst and Weil 1994). For strongly stable conditions, and Lagrangian solution was used (Kormann and Meixner 2001). The source area models where bounded by the expected conditions depict the extreme conditions. Convective conditions typically have strong vertical mixing between the ecosystem and atmosphere (surface layer). Stable conditions typically have long source area and associated waveforms. Convective turbulence is often characterized by short mixing scales (scalar) and moderate daytime wind speeds, *e.g.,* 1-4 m s^{-2}. Higher wind speeds, like those experienced over the Rockies, are often the product of mechanical turbulence with long waveforms. Because thermal stratification is very efficient in suppressing vertical mixing, stable conditions also have typically very long waveforms.

As a general rule, shorter and less structurally complex ecosystems have good vertical mixing during all atmospheric stabilities. Taller and more structurally complex ecosystems have well mixed upper canopies during the daytime, and can be decoupled below the canopy under neutral and stable conditions (e.g., Harvard Forest, Bartlett Experimental Forest, and Burlington Conservation Area). The type of turbulence (mechanical verse convective) and the physical attributes of the ecosystem control the degree of mixing, and the length and size of the source area.

Here, with support from Dr R. Clement, we use a web-based footprint model that made by Micrometeorology Group at University of Edinburgh, UK to determine the footprint area under various conditions (model info: http://www.geos.ed.ac.uk/abs/research/micromet/EdiTools/). Winds used to run the model and generate following model results are extracted from the wind roses. Vegetation information, temperature and energy information were either from the RFI document, previous site visit report, available data files or best estimated from experienced expert. Measurement height was determined from the Tower Height Info document provided by ENG group, then verify according to the real ecosystem structure after FIU site characterization at site. Runs 1-3 and 4-6 represents the expected conditions for summer and winter conditions, respectively, with maximum and mean windspeeds (daytime convective) and nighttime (stable atmospheres) conditions. The wind vector for each run was estimated from wind roses and is placed as a centerline in the site map included in the graphics. The width of the footprint was also estimated using the length between the isopleth of 80% cumulative flux and center line to calculate the angle from centerline. This information, along with distance of the cumulative flux isopleths and wind direction, will define the source area for the flux measurements on the top of the tower.

Table 6. Expected environmental controls to parameterize the source area model, and associated results from Talladega National Forest Advanced tower site.

Parameters	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**	**Run 6**	
Approximate season	summer			winter			Units
	Day (max WS)	Day (mean WS)	Night	Day (max WS)	Day (mean WS)	night	qualitative
Atmospheric stability	Convective	convective	Stable	Convective	convective	Stable	qualitative
Measurement height	40	44	44	44	44	44	m
Canopy Height	32	32	32	32	32	32	m
Canopy area density	3	3	3	2	2	2	m
Boundary layer depth	3029	3029	1318	1508	1508	938	m
Expected sensible heat flux	503	503	129	205	205	60	W m^{-2}
Air Temperature	32	32	27	15	15	10	°C
Max. windspeed	11.2	2.6	2.6	11.2	4.6	3.8	m s^{-1}
Resultant wind vector	195	195	41	161	161	339	degrees
			Results				
(z-d)/L	-0.02	-0.31	-0.2	-0.01	-0.08	-0.05	m
d	25	25	25	24	24	24	m
Sigma v	4.1	2.5	1.4	3.9	2.1	1.50	m^2 s^{-2}
Z0	1.4	1.4	1.4	1.8	1.8	1.8	m
u*	1.8	0.69	0.51	1.9	0.84	0.67	m s^{-1}
Distance source area begins	0	0	0	0	0	0	m
Distance of 90% cumulative flux	950	280	480	1000	720	800	m
Distance of 80% cumulative flux	520	200	280	600	400	450	m
Distance of 70% cumulative flux	350	150	230	400	350	380	m
Peak contribution	75	25	55	75	65	75	m

3.4.5 Footprint model results (source area graphs)

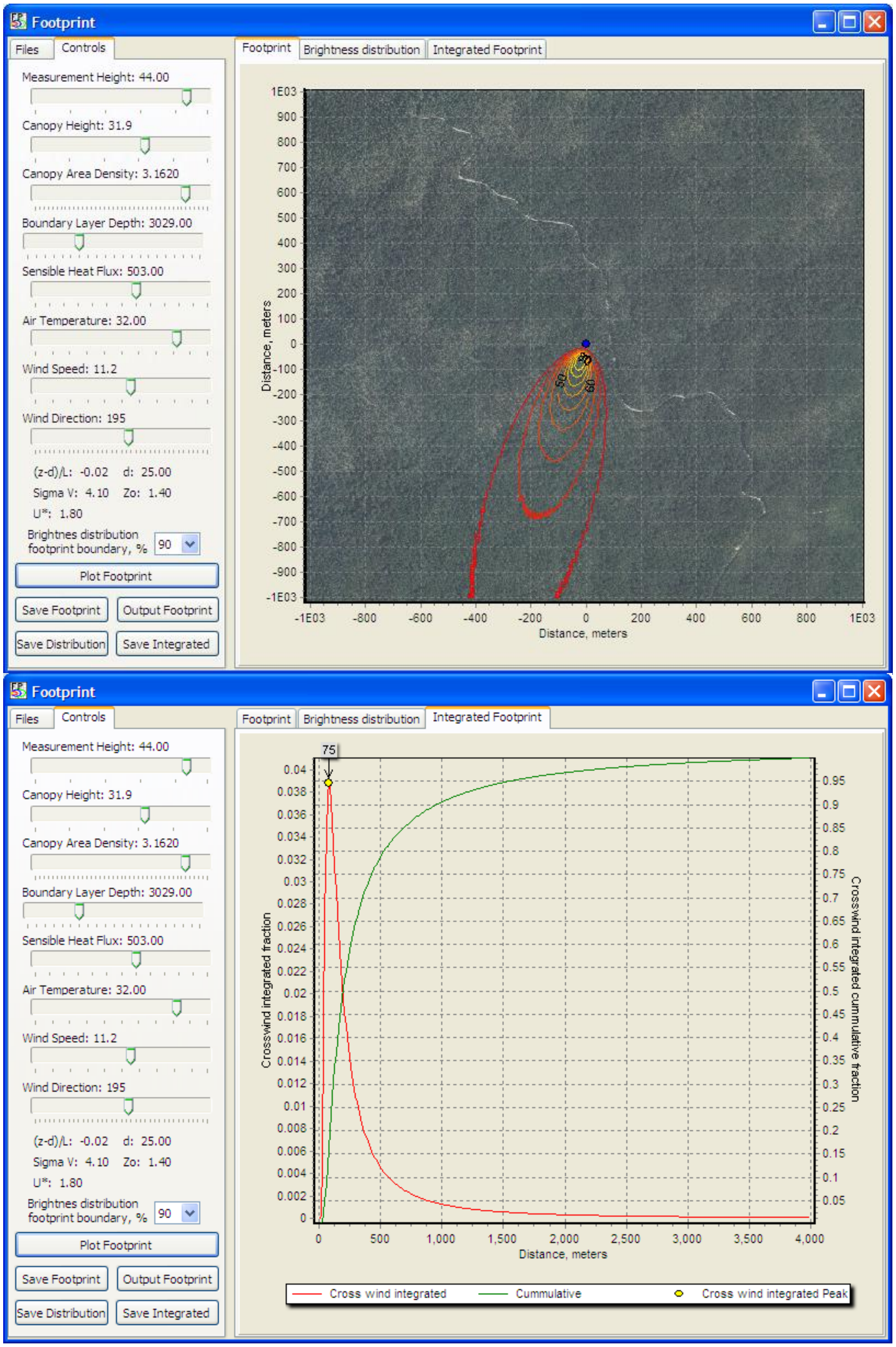


Figure 16. D08 Talladega Forest summer daytime (convective) footprint output with max wind speed.

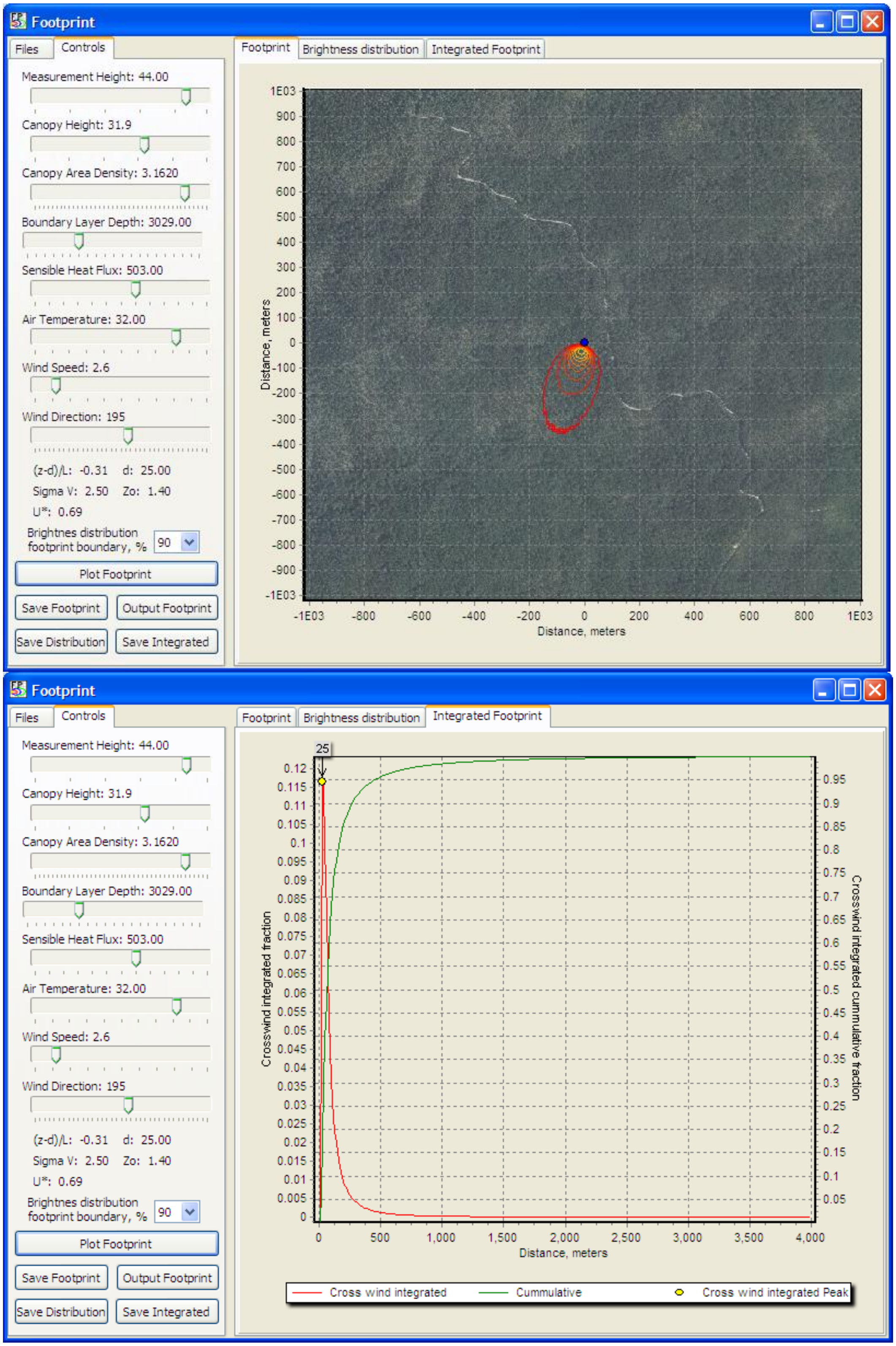


Figure 17. D08 Talladega Forest summer daytime (convective) footprint output with mean wind speed.

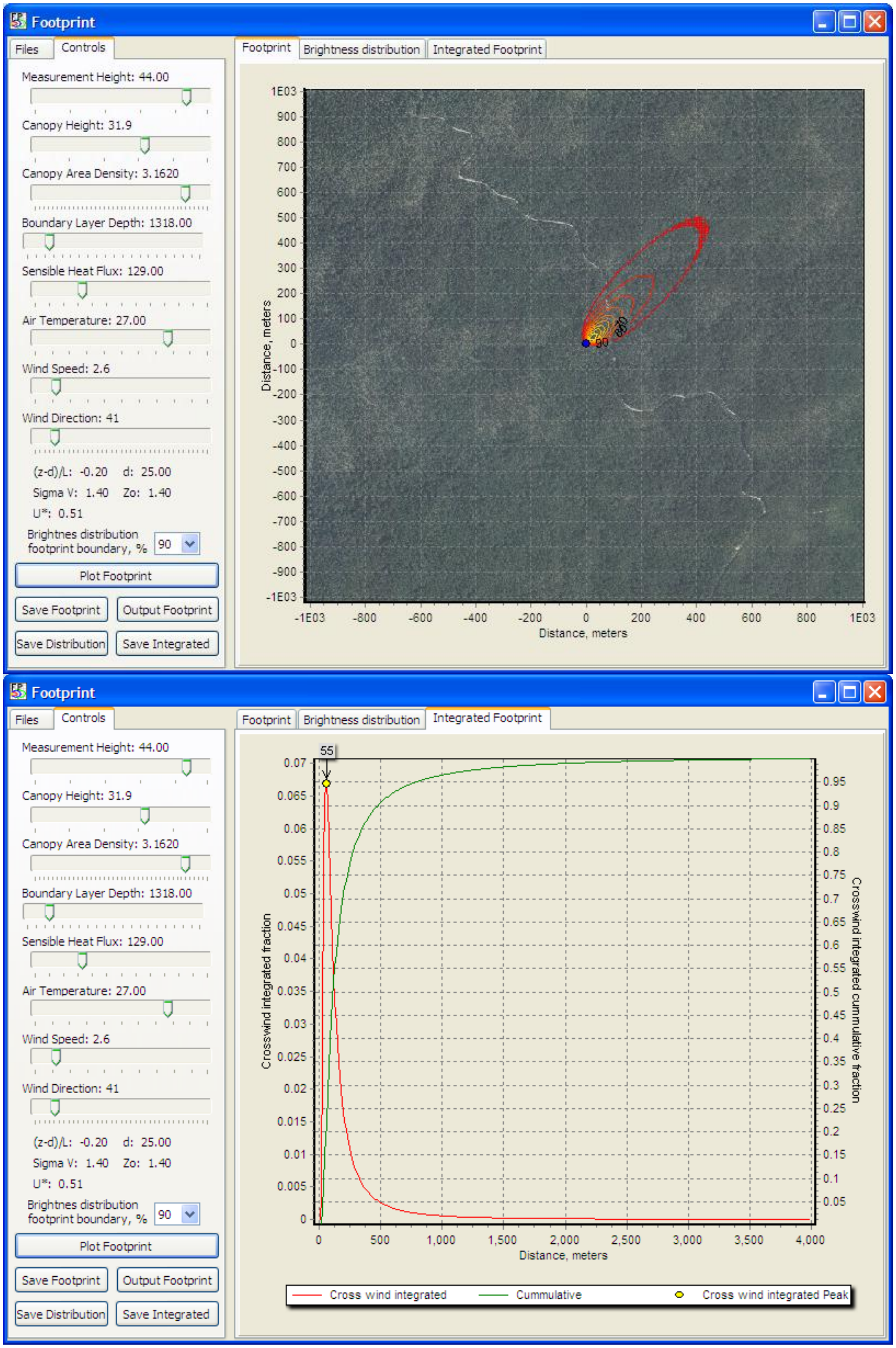


Figure 18. D08 Talladega Forest summer nighttime (stable) footprint output with mean wind speed.

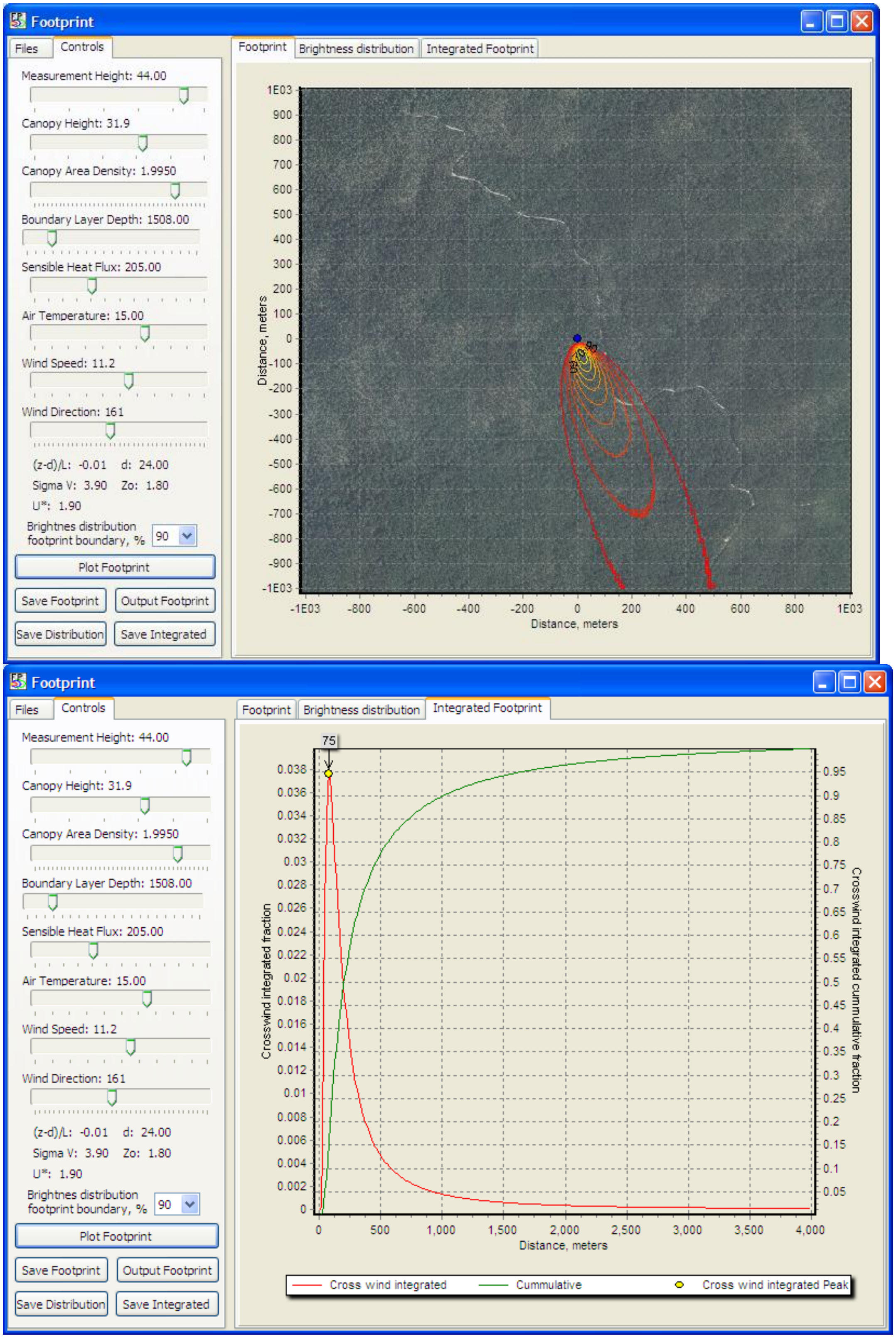


Figure 19. D08 Talladega Forest winter daytime (convective) footprint output with max wind speed.

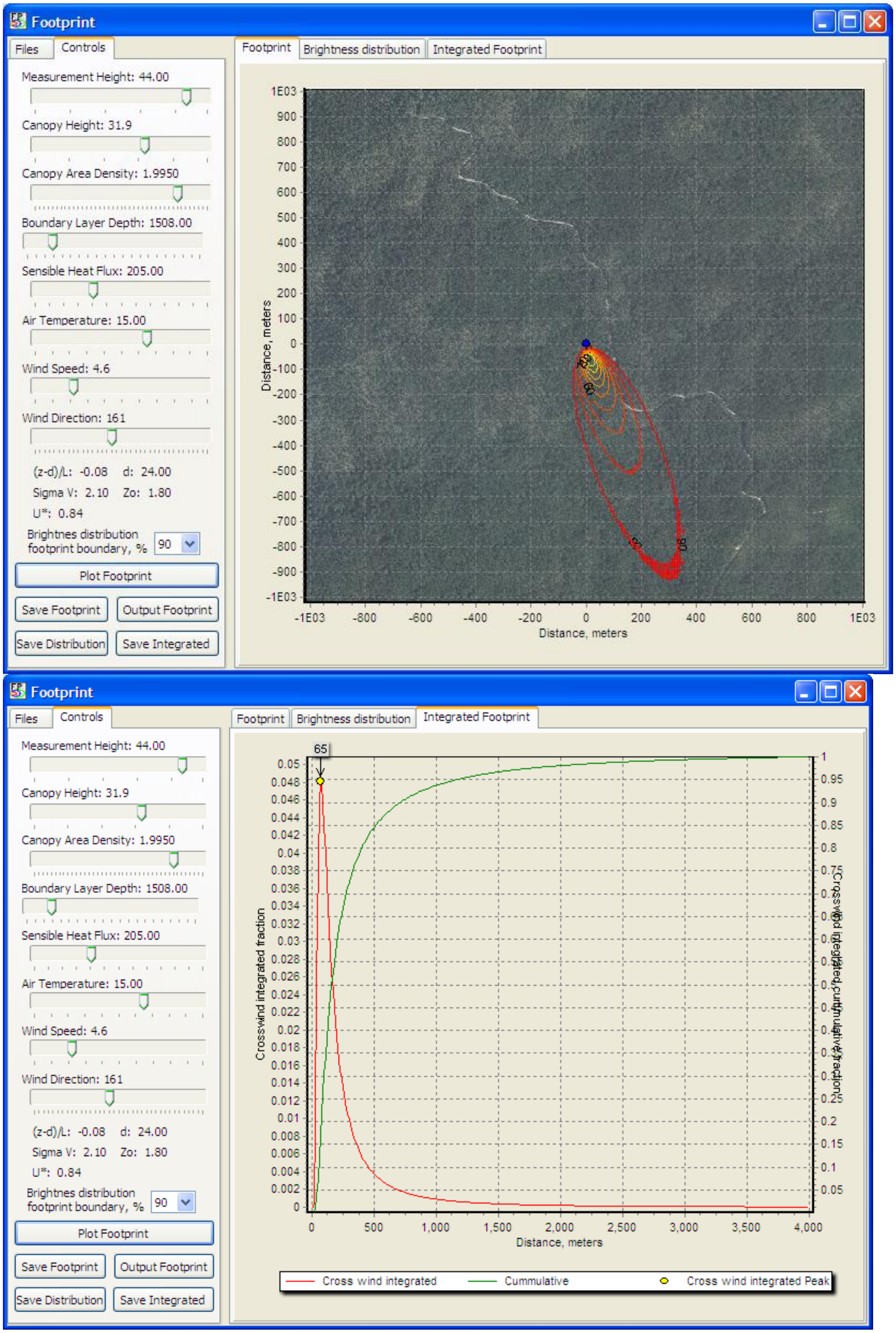


Figure 20. D08 Talladega Forest winter daytime (convective) footprint output with mean wind speed.

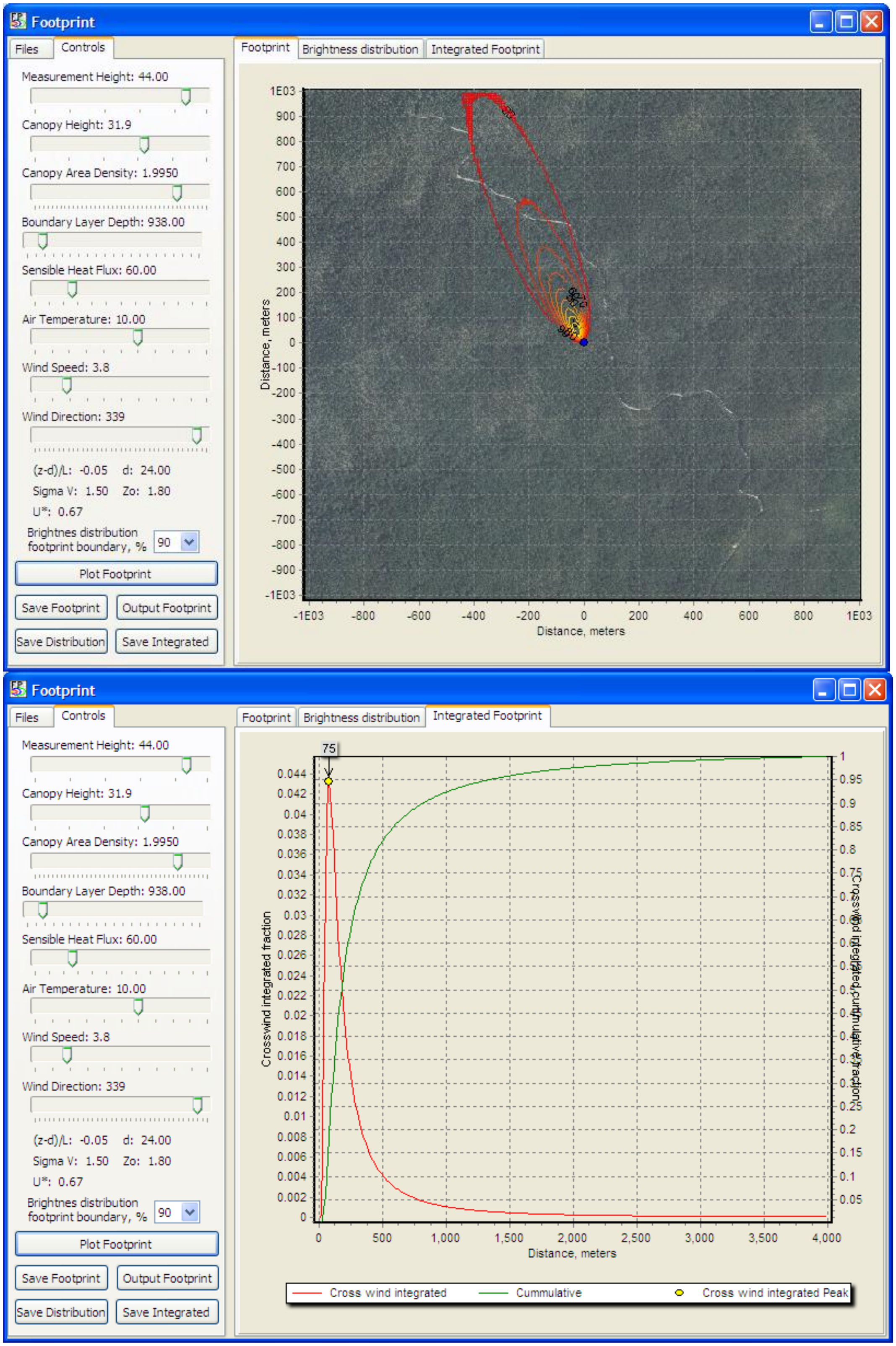


Figure 21. D08 Talladega Forest winter nighttime (stable) footprint output with mean wind speed.

3.5 Site design and tower attributes

According to windroses, the prevailing wind direction blows from north and south throughout the whole year (280° to 80° clockwise from 280°, and 130° to 260° clockwise from 130°). However, Talladega Forest is located in the mountain area and ~36 km away from Tuscaloosa Municipal airport (where we got data for windroses). By communicating with local people, they confirm the prevailing directions are from North along the valley and from west during the day and from southwest along the valley during evening. During winter, less frequent wind blows from Northeast direction. Therefore, based on the local knowledge and topography, for construction purpose, we determine the airshed area would be from 185° to 330° (clockwise from 185°). Tower should be placed to a location to best catch the signals from the airshed of the ecosystem in interest, which is pine forest at this site. The original tower site was lat 32.95045448°, long -87.39337396. After FIU site characterization, we determine the exact **tower location** to be at 32.95046°, -87.39327° to minimize the needs for tree cutting during tower construction. New location is next to the original site, and next to access road (county road 723).

Eddy covariance, sonic wind and air temperature **boom arms** orientation toward the west will be best to capture signals from all major wind directions. **Radiation boom arms** should always be facing south to avoid any shadowing effects from the tower structure. An **instrument hut** should be outside the prevailing wind airshed to avoid disturbance in the measurements of wind and should be positioned to have the longer side parallel to frequent wind direction to minimize the wind effects on instrument huts and to minimize the disturbances of wind regime by instrument hut, and in this case, instrument hut should be positioned on the east side of tower and have the longer side parallel to SW-NE direction.
Therefore, we require the placement of instrument hut at 32.95047°, -87.39312°.

The site is closed pine dominant forest. Canopy height is ~25 m with lowest branch ~8 m above ground. Shrub understory is about 1.2 m tall. We require 5 **measurement layers** on the tower with top measurement height at 35 m, and rest layers are 28 m, 22 m, 2.0 m and 0.3 m, respectively, to best characterize the fluxes on the tower top and environmental conditions in profile.

Because the forest is very dense and spreads widely around tower location, it is very difficult to find a open area to meet class 1 or class 2 criteria for **DFIR** (Double Fenced International Reference) to collect bulk precipitation within 500 m from tower. Two locations are recommended here: first is at 32.97813, -87.41145, which is a clear cut spot that next to NEON aquatic site (<200 m). Power will be available at aquatic site, and can be extended to DFIR site. According to the officer at Talladega Forest (Per communication with C. O. Ragland), they are willing to keep this location as open area as we need for 30 years for accurate precipitation measurements. This site is about 3500 m from tower location. If for any reason this site does not work out, the second suggestion (also agreed by USFS) is at Oakmulgee Wildlife Management Area Check Point (32.95634, -87.45945). This open area is right next to AL-50 highway. AC power is at site. But is about 6200 m away from tower site. **Wet deposition collector** will collocate at the top of the tower. See AD 04 for further information and requirements for bulk precipitation collection and wet deposition collection.

The site layout is summarized in the table below. Assume the projected area of the tower is square. **Anemometer/temperature boom arm direction** is ***from*** the tower ***toward*** the prevailing wind direction or designated orientation. **Instrument hut orientation vector** is parallel to the long side of the instrument hut (short-side of instrument hut is perpendicular to the **Instrument hut orientation vector)**.

Instrument hut distance z is the distance from the center of tower projection to the center of the instrument hut projection on the ground. The numbering of the **measurement levels** is that the lowest is level one, and each subsequent increase in height is numbered sequentially, in this case, level 5 being the upper most level at this tower site.

Table 7. Site design and tower attributes for the Talladega Forest Advanced site.

0° is true north with declination accounted for. Color of Instrument hut exterior shall be tan to best match the surrounding environment.

Attribute	lat	long	degree	meters	notes
Airshed Area			185° to 330°		Clockwise from 185°
Tower location	32.95046°	-87.39327°	--	--	new site
Instrument hut	32.95047°	-87.39312°			
Instrument hut orientation vector	--	--	90° - 270°		Short face parallel to 0° - 180°
Instrument hut distance z	--	--	--	14	
Anemometer/Temperature boom orientation	--	--	270°		
DFIR	32.97813,	-87.41145	--	--	
Height of the measurement levels					
Level 1				0.3	m.a.g.l.
Level 2				2.0	m.a.g.l.
Level 3				22.0	m.a.g.l.
Level 4				28.0	m.a.g.l.
Level 5				35.0	m.a.g.l.
Tower Height				35.0	m.a.g.l.

See AD 03 for technical requirement to determine the boom height for the bottom most measurement level.

Figure 22 below shows the proposed tower location, instrument hut location, airshed area and access road.

Figure 22. Site layout for Talladega National Forest Advanced tower site

i) new tower location is presented (red pin), ii) red lines indicate the airshed boundaries. Vectors 185° and 330° are the southwest most and northwest most vectors (starting clockwise from 185°) that would have quality wind data without causing flow distortions, respectively. iii) Yellow line is the suggested access road to instrument hut.

Boardwalks. Ultimately, the decision to use a boardwalk will be, in part, based on owner's preferences. There are strong science requirements that minimize site disturbance to the surrounding area, which will be difficult to manage over a 30-y period. Traffic control is key to minimizing the site disturbance. Confining foot traffic to boardwalks minimizes site impact; this is particularly true in places where wear caused by foot traffic becomes noticeable and grows. For example, in places with snow part of the year, worn footpaths tend to have low places that collect water, or places where the snow pack becomes uneven causing personnel to walk farther and farther around the sides of the original path, causing the path to grow in width. This is a very common phenomenon. Here FIU assumes that all conduits will be either buried, or placed inside the boardwalk such that it does not extend beyond the 36' wide footprint. While the final design is not yet known, there are some general criteria that can be outlined. We assume that the boardwalk width is 36" (0.914 m). Material is not known, but must be fire proof, and in some locations the site is seasonally flooded and inundated with water. Boardwalks may also provide a scratching structure for grazing animals that in turn, would wear and unduly impact the site. Site by site evaluations must be done.

- There is always a boardwalk from the instrument hut to the tower
- If there is a boardwalk on the south side of the tower, it is never underneath the radiation booms, and it is more than 4 m from the side of the tower

Specific Boardwalks at Talladega Forest Advanced site utilize the orientation outlined in Table 7, and **option 1 in Figure A4**.

- Boardwalk is from the access road (county road 723) to instrument hut, pending landowner decision, and ease to bring supplies to instrument hut)
- Boardwalk from the instrument hut to the tower to intersect on north face of the tower,
- Boardwalk to the soil array
- Boardwalks must be protected from controlled burns
- No boardwalk from the soil array boardwalk to the individual soil plots
- No boardwalk needed at DFIR site

3.6 Information for ecosystem productivity plots

The tower at Talladega Forest Advanced site has been positioned to optimize the collection of the air/wind signals both temporally and spatially over the desired ecosystem (pine-dominated forest). Airshed at this site is from 185^o to 330^o (clockwise from 185^o) in Figure 22, and 90% signals for flux measurements are within a distance of 1000 m from tower, and 80% within 600 m. We suggest FSU Ecosystem Productivity plots be placed within the boundaries of 185^o to 330^o (clockwise from 185^o).

3.7 Issues and attentions

According to our communication with C. O. Ragland, Talladega National Forest Oakmulgee District is wiling to provide continous support to NEON's work, including aquatic site, tower establishment and DFIR site. They are willing to maintain the clear cut area will be used for the DFIR location, and can potentially cut more trees to creat adequate open space if we request and let them schedule ahead. If NEON has other requets for land use or other type forest managements, they could be considered and incoporrated into Talladega Frorest's schedule. But proposals and requests need to be submitted ahead of time (suggest at least 6 months) for discussion and approval. In short, Talladega National Forest Oakmulgee District is very friendly and collaborative.

4 LENOIR LANDING, RELOCATEABLE TOWER 1

4.1 Site description

Lenoir Landing relocatable site was chosen to replace the NEON candidate Relocatable tower site at Choctaw National Wildlife Refuge (CNWR). It is ~0.7 miles northeast of CNWR site. The property owner of Lenoir Landing site is Army Corps of Engineers. The property boundary is showed in Figure 23.

This site is located in southwest Alabama along the Tombigbee River approximately 80 miles north of Mobile AL.

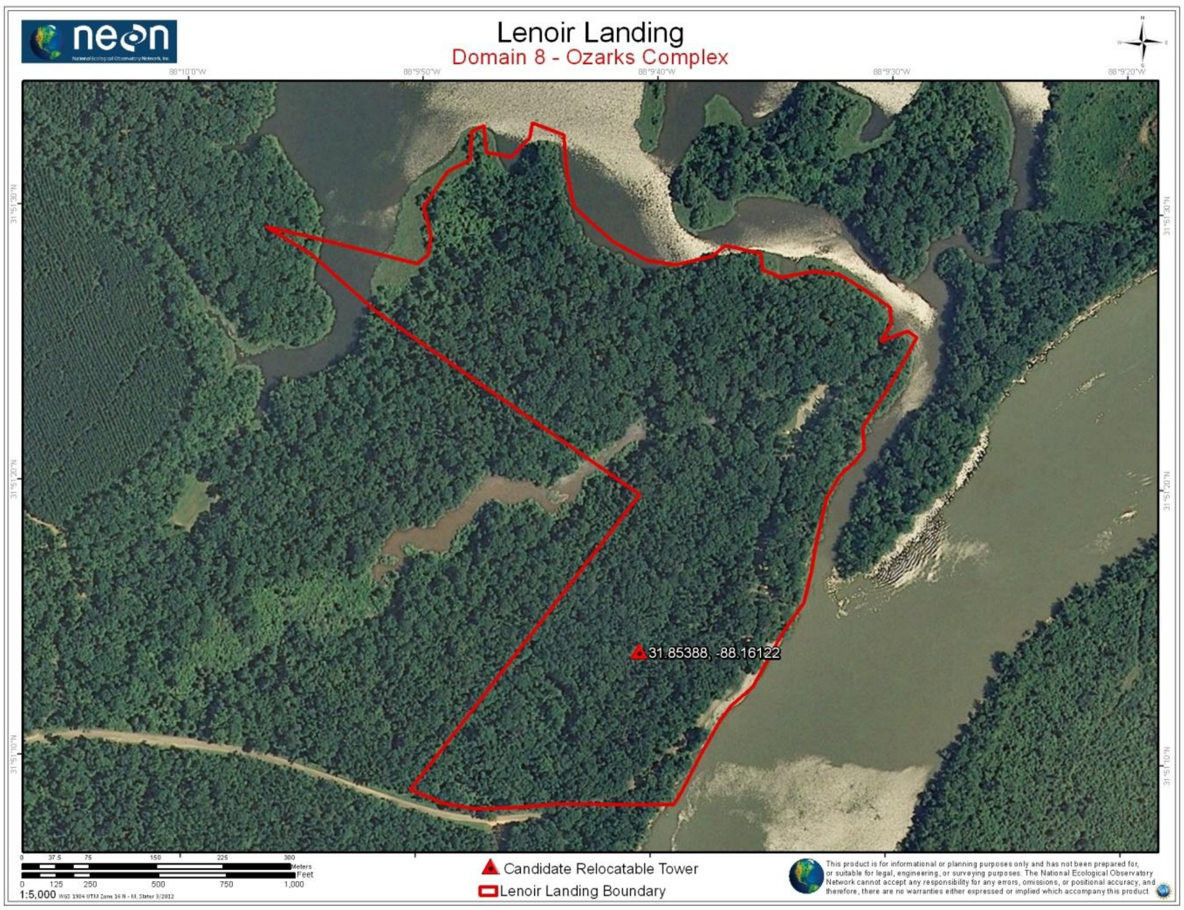


Figure 23. Boundary map of Lenoir Landing with proposed tower location

4.2 Ecosystem

The ecosystem at Lenoir Landing site is dominated by pine-oak mixed forest (~1/4 trees are pine trees), and also includes meadow, wetland, and water bodies (Figure 24, Table 8). This area is periodically flooded and the vegetation type is classified as "Gulf and Atlantic Coastal Plain Floodplain Systems". Oak distributed the whole area, including the lower land with standing water. Pine trees typically found at the relatively less flooded area. The ecosystem is a closed-canopy forest. Tree species is unclear. The mean canopy height around tower is ~35 m with lowest branch at ~8 m above ground. Shrub, seedlings and saplings understory varies from 1 to 20 m in height without obvious strata. Grass and other annuals form understory at ground level with height ~0.5 m. Canopy area density is estimated to be 4 in summer and 2.5 in winter. Figure below shows a general view of the site (Figure 25.)

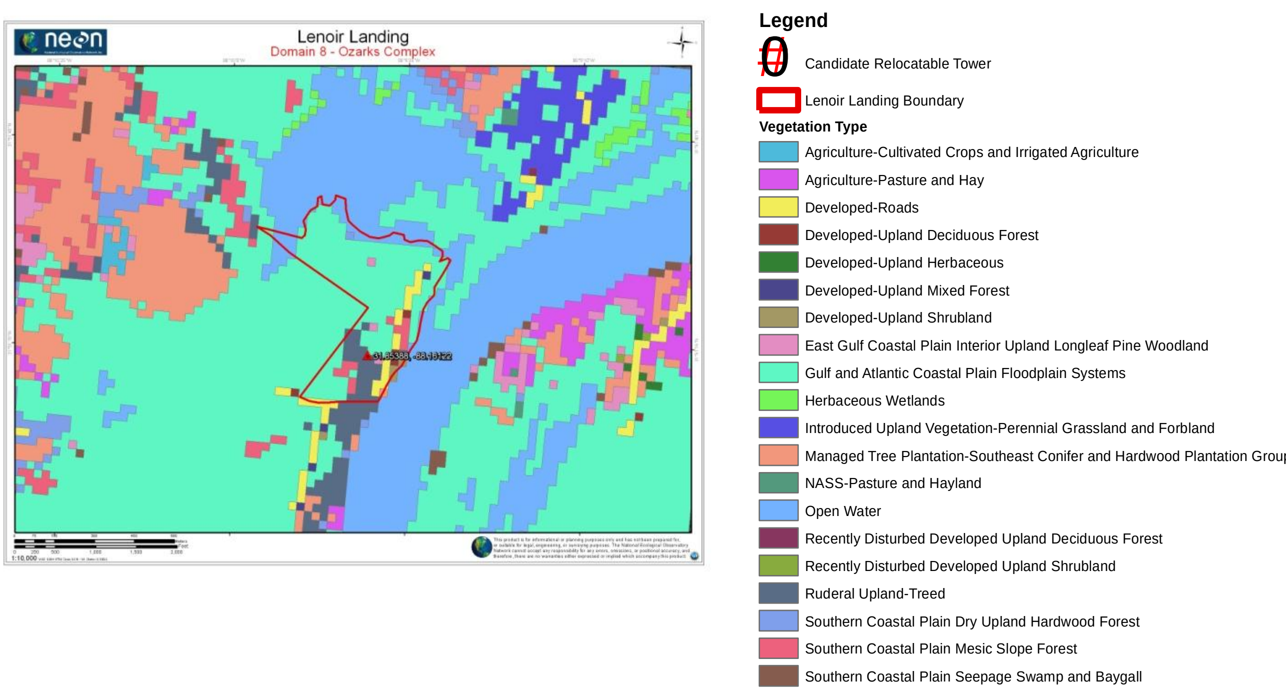


Figure 24. Vegetative cover map of Lenoir Landing relocatable site and surrounding areas (information is from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm)

Table 8. Land cover information at Lenoir Landing relocatable site (information is from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm).

Vegetation Type	Area Km2	Percentage
Developed-Roads	0.0165	7.0248
Developed-Upland Deciduous Forest	0.0027	1.1485
Developed-Upland Mixed Forest	0.0009	0.3830
Developed-Upland Shrubland	0.0016	0.6859
East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland	0.0027	1.1489
Gulf and Atlantic Coastal Plain Floodplain Systems	0.0003	0.1268
Gulf and Atlantic Coastal Plain Floodplain Systems	0.1540	65.5457
Managed Tree Plantation-Southeast Conifer and Hardwood Plantation Group	0.0004	0.1596
Open Water	0.0206	8.7584
Open Water	0.0005	0.2089
Ruderal Upland-Treed	0.0009	0.3736
Ruderal Upland-Treed	0.0222	9.4596
Southern Coastal Plain Dry Upland Hardwood Forest	0.0009	0.3830
Southern Coastal Plain Mesic Slope Forest	0.0108	4.5934
TOTAL	**0.2350**	**100.0000**

Table 9. Percent Land cover by vegetation height at Lenoir Landing relocatable site (information is from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm)

Vegetation Height	Vegetation Type	Area Km2	Percentage
Developed-Open_Space	Developed-Roads	0.0165	7.0248
Developed-Open_Space	Developed-Upland Deciduous Forest	0.0027	1.1485
Developed-Open_Space	Developed-Upland Mixed Forest	0.0009	0.3830
Developed-Open_Space	Developed-Upland Shrubland	0.0016	0.6859
Forest_Height_0_to_5_meters	Gulf and Atlantic Coastal Plain Floodplain Systems	0.0003	0.1268
Forest_Height_0_to_5_meters	Ruderal Upland-Treed	0.0009	0.3736
Forest_Height_10_to_25_meters	East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland	0.0027	1.1489
Forest_Height_10_to_25_meters	Gulf and Atlantic Coastal Plain Floodplain Systems	0.1540	65.5457
Forest_Height_10_to_25_meters	Ruderal Upland-Treed	0.0222	9.4596
Forest_Height_10_to_25_meters	Southern Coastal Plain Mesic Slope Forest	0.0108	4.5934
Open Water	Open Water	0.0206	8.7584

Open_Water	Managed Tree Plantation-Southeast Conifer and Hardwood Plantation Group	0.0004	0.1596
Open_Water	Southern Coastal Plain Dry Upland Hardwood Forest	0.0009	0.3830
Shrub_Height_1.0_to_3.0_meters	Open Water	0.0005	0.2089
	TOTAL	**0.2350**	**100.0000**

Figure 25. General view of the ecosystem at Lenoir Landing Relocatable tower location

4.3 Soils

4.3.1 Description of soils

Soil data and soil maps (Figures 26) below for Lenoir Landing relocatable tower site were collected from 2.1 km^2 NRCS soil maps (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm), which centered at the tower location, to determine the dominant soil types in the larger tower foot print. This was done to assure that the soil array is in the dominant (or in the co-dominant) soil type present in the tower footprint.

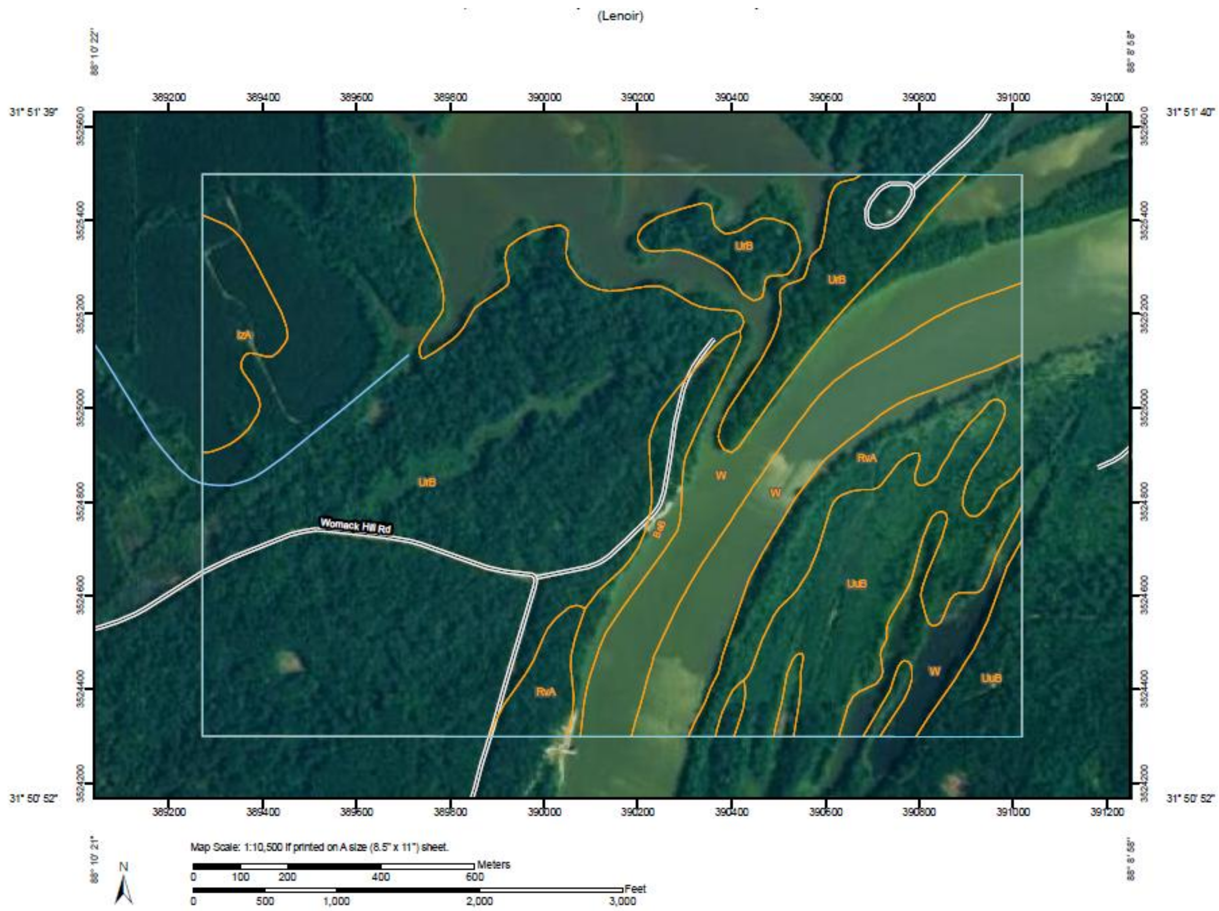


Figure 26. 2.1 km^2 soil map for Lenoir Landing relocatable site, center at tower location, north is top of map.

Soil Map Units Description:
The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit. The map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called non-contrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.
Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.
A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.
An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.
An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.
Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities,

and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Table 10. Soil series and percentage of soil series within 2.1 km^2 centered on the tower, Lenoir Landing.

Choctaw County, Alabama (AL023)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BeB	Bigbee loamy sand, 0 to 5 percent slopes, rarely flooded	13.4	2.6%
IzA	Izagora fine sandy loam, 0 to 2 percent slopes, rarely flooded	14.3	2.8%
RvA	Riverview loam, 0 to 2 percent slopes, occasionally flooded	7.1	1.4%
UrB	Urbo-Mooreville-Una complex, gently undulating, frequently flooded	256.1	49.5%
W	Water	92.0	17.8%
Subtotals for Soil Survey Area		**382.9**	**74.0%**
Totals for Area of Interest		**517.7**	**100.0%**

Clarke County, Alabama (AL025)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
RvA	Riverview fine sandy loam, 0 to 2 percent slopes, occasionally flooded	27.6	5.3%
UuB	Urbo-Mooreville-Una complex, gently undulating, frequently flooded	54.0	10.4%
W	Water	53.2	10.3%
Subtotals for Soil Survey Area		**134.8**	**26.0%**
Totals for Area of Interest		**517.7**	**100.0%**

Choctaw County, Alabama: BeB—Bigbee loamy sand, 0 to 5 percent slopes, rarely flooded. Map Unit Setting *Elevation:* 50 to 800 feet *Mean annual precipitation:* 48 to 56 inches *Mean annual air temperature:* 59 to 64 degrees F *Frost-free period:* 200 to 240 days **Map Unit Composition** *Bigbee and similar soils:* 90 percent *Minor components:* 9 percent **Description of Bigbee Setting** *Landform:* Stream terraces *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Tread *Down-slope shape:* Convex *Across-slope shape:* Convex *Parent material:* Sandy fluviomarine deposits derived from sedimentary rock **Properties and qualities** *Slope:* 0 to 5 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Excessively drained *Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr) *Depth to water table:* About 42 to 72 inches *Frequency of flooding:* Rare *Frequency of ponding:* None *Available water capacity:* Low (about 4.2 inches) **Interpretive groups** *Land capability (nonirrigated):* 3s **Typical profile** *0 to 6 inches:* Loamy sand *6 to 23 inches:* Loamy sand *23 to 70 inches:* Sand **Minor Components Bibb** *Percent of map unit:* 2 percent *Landform:* Flood plains *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Talf *Down-slope shape:* Linear *Across-slope shape:* Concave **Izagora** *Percent of map unit:* 1 percent *Landform:* Terraces *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Riser *Down-slope shape:* Concave *Across-slope shape:* Convex **Cahaba** *Percent of map unit:* 1 percent *Landform:* Stream terraces *Landform position (two-dimensional):* Toeslope *Landform position* *(three-dimensional):* Tread *Down-slope shape:* Linear *Across-slope shape:* Linear **Kinston** *Percent of map unit:* 1 percent *Landform:* Drainageways *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Dip *Down-slope shape:* Linear *Across-slope shape:* Concave **Ochlockonee** *Percent of map unit:* 1 percent *Landform:* Flood plains *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Talf *Down-slope shape:* Linear *Across-slope shape:* Linear **Riverview** *Percent of map unit:* 1 percent *Landform:* Levees *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Rise *Down-slope shape:* Convex *Across-slope shape:* Linear **Urbo** *Percent of map unit:* 1 percent *Landform:* Flood plains *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Dip *Down-slope shape:* Concave *Across-slope shape:* Linear **Latonia** *Percent of map unit:* 1 percent *Landform:* Terraces *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Tread *Down-slope shape:* Linear *Across-slope shape:* Convex

Choctaw County, Alabama IzA—Izagora fine sandy loam, 0 to 2 percent slopes, rarely flooded Map Unit Setting Elevation: 30 to 450 feet Mean annual precipitation: 48 to 56 inches Mean annual air temperature: 59 to 64 degrees F Frost-free period: 200 to 240 days **Map Unit Composition** Izagora and similar soils: 90 percent Minor components: 8 percent **Description of Izagora Setting** Landform: Terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Riser Down-slope shape: Concave Across-slope shape: Convex Parent material: Loamy and clayey fluviomarine deposits **Properties and qualities** Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Moderately well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) Depth to water table: About 24 to 26 inches Frequency of flooding: Rare Frequency of ponding: None Available water capacity: High (about 9.6 inches) **Interpretive groups** Land capability (nonirrigated): 2w **Typical profile** 0 to 7 inches: Fine sandy loam 7 to 65 inches: Loam **Minor Components Bibb** Percent of map unit: 2 percent Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Linear Across-slope shape: Concave **Iuka** Percent of map unit: 1 percent Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Concave **Lenoir** Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Concave Across-slope shape: Linear **Cahaba** Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Linear **Annemaine** Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Concave Across-slope shape: Concave **Mccrory** Percent of map unit: 1 percent Landform: Terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Concave **Deerford** Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Convex

Clarke County, Alabama: RvA—Riverview fine sandy loam, 0 to 2 percent slopes, occasionally flooded. Map Unit Setting *Elevation:* 10 to 120 feet *Mean annual precipitation:* 50 to 69 inches *Mean annual air temperature:* 60 to 67 degrees F *Frost-free period:* 220 to 240 days **Map Unit Composition** *Riverview and similar soils:* 85 percent *Minor components:* 8 percent **Description of Riverview Setting** *Landform:* Flood plains *Down-slope shape:* Linear *Across-slope shape:* Convex *Parent material:* Loamy alluvium derived from sedimentary rock **Properties and qualities** *Slope:* 0 to 2 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Well drained *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* About 36 to 60 inches *Frequency of flooding:* Occasional *Frequency of ponding:* None *Available water capacity:* High (about 9.3 inches) **Interpretive groups** *Land capability (nonirrigated):* 2w **Typical profile** *0 to 12 inches:* Fine sandy loam *12 to 44 inches:* Loam *44 to 80 inches:* Sandy loam **Minor Components Una** *Percent of map unit:* 2 percent *Landform:* Flood plains *Down-slope shape:* Linear *Across-slope shape:* Concave **Mooreville** *Percent of map unit:* 2 percent *Landform:* Flood plains *Down-slope shape:* Linear *Across-slope shape:* Convex **Ochlockonee** *Percent of map unit:* 2 percent *Landform:* Flood plains *Down-slope shape:* Linear *Across-slope shape:* Convex **Urbo** *Percent of map unit:* 2 percent *Landform:* Flood plains *Down-slope shape:* Linear *Across-slope shape:* Convex

Choctaw County, Alabama: RvA—Riverview loam, 0 to 2 percent slopes, occasionally flooded. Map Unit Setting *Elevation:* 100 to 500 feet *Mean annual precipitation:* 48 to 56 inches *Mean annual air temperature:* 59 to 64 degrees F *Frost-free period:* 200 to 240 days **Map Unit Composition** *Riverview and similar soils:* 85 percent *Minor components:* 15 percent **Description of Riverview Setting** *Landform:* Levees *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Rise *Down-slope shape:* Convex *Across-slope shape:* Linear *Parent material:* Loamy alluvium derived from sedimentary rock **Properties and qualities** *Slope:* 0 to 2 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Well drained *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* About 42 to 60 inches *Frequency of flooding:* Occasional *Frequency of ponding:* None *Available water capacity:* Moderate (about 8.5 inches) **Interpretive groups** *Land capability (nonirrigated):* 2w **Typical profile** *0 to 5 inches:* Loam *5 to 33 inches:* Loam *33 to 80 inches:* Fine sandy loam **Minor Components Una** *Percent of map unit:* 5 percent *Landform:* Depressions *Landform position (two-dimensional):* Footslope *Landform position (three-dimensional):* Dip *Down-slope shape:* Linear *Across-slope shape:* Concave **Urbo** *Percent of map unit:* 5 percent *Landform:* Flood plains *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Dip *Down-slope shape:* Concave *Across-slope shape:* Linear **Bigbee** *Percent of map unit:* 5 percent *Landform:* Stream terraces *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Tread *Down-slope shape:* Convex *Across-slope shape:* Convex

Choctaw County, Alabama: UrB—Urbo-Mooreville-Una complex, gently undulating, frequently flooded. Map Unit Setting *Elevation:* 30 to 600 feet *Mean annual precipitation:* 48 to 56 inches *Mean annual air temperature:* 59 to 64 degrees F *Frost-free period:* 200 to 240 days **Map Unit Composition** *Urbo and similar soils:* 40 percent *Mooreville and similar soils:* 35 percent *Una and similar soils:* 15 percent *Minor components:* 9 percent **Description of Urbo Setting** *Landform:* Flood plains *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Dip *Down-slope shape:* Concave *Across-slope shape:* Linear *Parent material:* Clayey alluvium derived from sedimentary rock **Properties and qualities** *Slope:* 0 to 2 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Somewhat poorly drained *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr) *Depth to water table:* About 12 to 24 inches *Frequency of flooding:* Frequent *Frequency of ponding:* None *Available water capacity:* High (about 11.5 inches) **Interpretive groups** *Land capability (nonirrigated):* 5w **Typical profile** *0 to 9 inches:* Silty clay *9 to 80 inches:* Clay loam **Description of Mooreville Setting** *Landform:* Flood plains *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Rise *Down-slope shape:* Convex *Across-slope shape:* Linear *Parent material:* Loamy alluvium derived from sedimentary rock **Properties and qualities** *Slope:* 0 to 2 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) *Depth to water table:* About 18 to 36 inches *Frequency of flooding:* Frequent *Frequency of ponding:* None *Available water capacity:* High (about 9.6 inches) **Interpretive groups** *Land capability (nonirrigated):* 5w **Typical profile** *0 to 3 inches:* Loam *3 to 51 inches:* Clay loam *51 to 80 inches:* Loam **Description of Una Setting** *Landform:* Flood plains *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Dip *Down-slope shape:* Linear *Across-slope shape:* Concave *Parent material:* Clayey alluvium derived from sedimentary rock **Properties and qualities** *Slope:* 0 to 1 percent *Depth to restrictive feature:* More than 80 inches *Drainage class:* Poorly drained *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr) *Depth to water table:* About 0 inches *Frequency of flooding:* Frequent *Frequency of ponding:* Frequent *Available water capacity:* High (about 10.8 inches) **Interpretive groups** *Land capability (nonirrigated):* 5w **Typical profile** *0 to 5 inches:* Silty clay loam *5 to 60 inches:* Silty clay **Minor Components Lenoir** *Percent of map unit:* 2 percent *Landform:* Stream terraces *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Tread *Down-slope shape:* Concave *Across-slope shape:* Linear **Cahaba** *Percent of map unit:* 2 percent *Landform:* Stream terraces *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Tread *Down-slope shape:* Linear *Across-slope shape:* Linear **Latonia** *Percent of map unit:* 2 percent *Landform:* Terraces *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Tread *Down-slope shape:* Linear *Across-slope shape:* Convex **Annemaine** *Percent of map unit:* 2 percent *Landform:* Stream terraces *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Tread *Down-slope shape:* Concave *Across-slope shape:* Concave **Bigbee** *Percent of map unit:* 1 percent *Landform:* Stream terraces *Landform position (two-dimensional):* Toeslope *Landform position (three-dimensional):* Tread *Down-slope shape:* Convex *Across-slope shape:* Convex

Clarke County, Alabama UuB—Urbo-Mooreville-Una complex, gently undulating, frequently flooded **Map Unit Setting** Elevation: 10 to 350 feet Mean annual precipitation: 50 to 69 inches Mean annual air temperature: 60 to 67 degrees F Frost-free period: 220 to 240 days **Map Unit Composition** Urbo and similar soils: 55 percent Mooreville and similar soils: 25 percent Una and similar soils: 15 percent Minor components: 5 percent **Description of Urbo Setting** Landform: Flood plains Down-slope shape: Linear Across-slope shape: Convex Parent material: Clayey alluvium derived from sedimentary rock **Properties and qualities** Slope: 0 to 1 percent Depth to restrictive feature: More than 80 inches Drainage class: Somewhat poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 12 to 24 inches Frequency of flooding: Frequent Frequency of ponding: None Available water capacity: Moderate (about 7.2 inches) **Interpretive groups** Land capability (nonirrigated): 5w **Typical profile** 0 to 4 inches: Silty clay 4 to 13 inches: Silty clay 13 to 68 inches: Silty clay 68 to 80 inches: Sandy clay loam **Description of Mooreville Setting** Landform: Flood plains Down-slope shape: Linear Across-slope shape: Convex Parent material: Loamy alluvium derived from sedimentary rock **Properties and qualities** Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Moderately well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) Depth to water table: About 18 to 36 inches Frequency of flooding: Frequent Frequency of ponding: None Available water capacity: High (about 9.6 inches) **Interpretive groups** Land capability (nonirrigated): 5w **Typical profile** 0 to 5 inches: Clay loam 5 to 69 inches: Clay loam 69 to 80 inches: Sandy loam **Description of Una Setting** Landform: Flood plains Down-slope shape: Linear Across-slope shape: Concave Parent material: Clayey alluvium derived from sedimentary rock **Properties and qualities** Slope: 0 to 1 percent Depth to restrictive feature: More than 80 inches Drainage class: Poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 0 inches Frequency of flooding: Frequent Frequency of ponding: Frequent Available water capacity: Moderate (about 7.5 inches) **Interpretive groups** Land capability (nonirrigated): 7w **Typical profile** 0 to 5 inches: Clay 5 to 42 inches: Clay 42 to 80 inches: Clay **Minor Components Cahaba** Percent of map unit: 1 percent Landform: Stream terraces Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Convex **Chrysler** Percent of map unit: 1 percent Landform: Stream terraces Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Convex **Izagora** Percent of map unit: 1 percent Landform: Stream terraces Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Convex **Lenoir** Percent of map unit: 1 percent Landform: Stream terraces Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Convex **Riverview** Percent of map unit: 1 percent Landform: Flood plains Down-slope shape: Linear Across-slope shape: Convex

Choctaw County, Alabama: W—Water. Map Unit Setting *Mean annual precipitation:* 48 to 56 inches *Mean annual air temperature:* 59 to 64 degrees F *Frost-free period:* 200 to 240 days **Map Unit Composition** *Water:* 95 percent

4.3.2 Soil semi-variogram description

Information received prior to the site characterization visit suggested that large part of this ecosystem flood regularly and would not be suitable for placement of soil plots. Therefore, prior to the site characterization visit, soil plot locations were expected to be selected based on the occurrence of high point within the airshed that would be flooded less frequently. As a result, measurements of spatial variation in soil temperature and soil water content, which are used to inform spacing between soil plots, were not made at this site and semi-variograms were not constructed.

4.3.2.1 Soil array layout and soil pit location

During the site characterization visit the site host representative (Brandon Smith) said that only relatively small low-lying areas of the tower airshed were likely to flood regularly. As a result, we selected a location for the first soil plot (31.85388, -88.16137) and then ran a series of transects from that point and located the other 4 soil plots at ~50 m intervals. The location of the soil plots was constrained by the property boundary located north west of the tower location. As a result, the soil array design does not follow any of the pre-specified patterns. Soil plots shall be 5 x 5 m. The FIU soil pit for characterizing soil horizon depths, collecting soil for site-specific sensor calibration, and collecting soil for the FIU soil archive will be located at 31.85305, -88.16090. A summary of the soil information is shown in Table 11 and site layout can be seen in Figure 27.

Dominant soil series at the site: Urbo-Mooreville-Una complex, gently undulating, frequently flooded. The taxonomy of this soil is shown below:
Order: Inceptisols
Suborder: Aquepts-Udepts
Great group: Epiaquepts-Dystrudepts
Subgroup: Vertic Epiaquepts-Fluvaquentic Dystrudepts-Typic Epiaquepts
Family: Fine, mixed, active, acid, thermic Vertic Epiaquepts-fine-loamy, siliceous, active, thermic Fluvaquentic Dystrudepts-fine, mixed, active, acid, thermic Typic Epiaquepts

Series: Urbo-Mooreville-Una complex, gently undulating, frequently flooded

Table 11. Summary of soil array and soil pit information at Lenoir Landing. 0° represents true north and accounts for declination.

Soil plot dimensions	5 m x 5 m
Soil array pattern	Non-standard pattern
Distance between soil plots: x	Varies (approximately ~45 m)
Distance from tower to closest soil plot: y	14 m
Latitude and longitude of 1st soil plot OR direction from tower	31.85388, -88.16137°
Latitude and longitude of 2nd soil plot	31.85410, -88.16180
Latitude and longitude of 3rd soil plot	31.85452, -88.16177
Latitude and longitude of 4th soil plot	31.85431, -88.16111
Latitude and longitude of 5th soil plot	31.85469, -88.16082
Latitude and longitude of FIU soil pit	31.85305, -88.16090
Dominant soil type	Urbo-Mooreville-Una complex, gently undulating, frequently flooded
Expected soil depth	>2 m
Depth to water table	0-0.91 m

Expected depth of soil horizons	**Expected measurement depths***
0-0.08 m (loam)	0.04 m
0.08-1.30 m (clay loam)	0.69 m
1.30-2 m (loam)	1.65 m

*Actual soil measurement depths will be determined based on measured soil horizon depths at the NEON FIU soil pit and may differ substantially from those shown here.

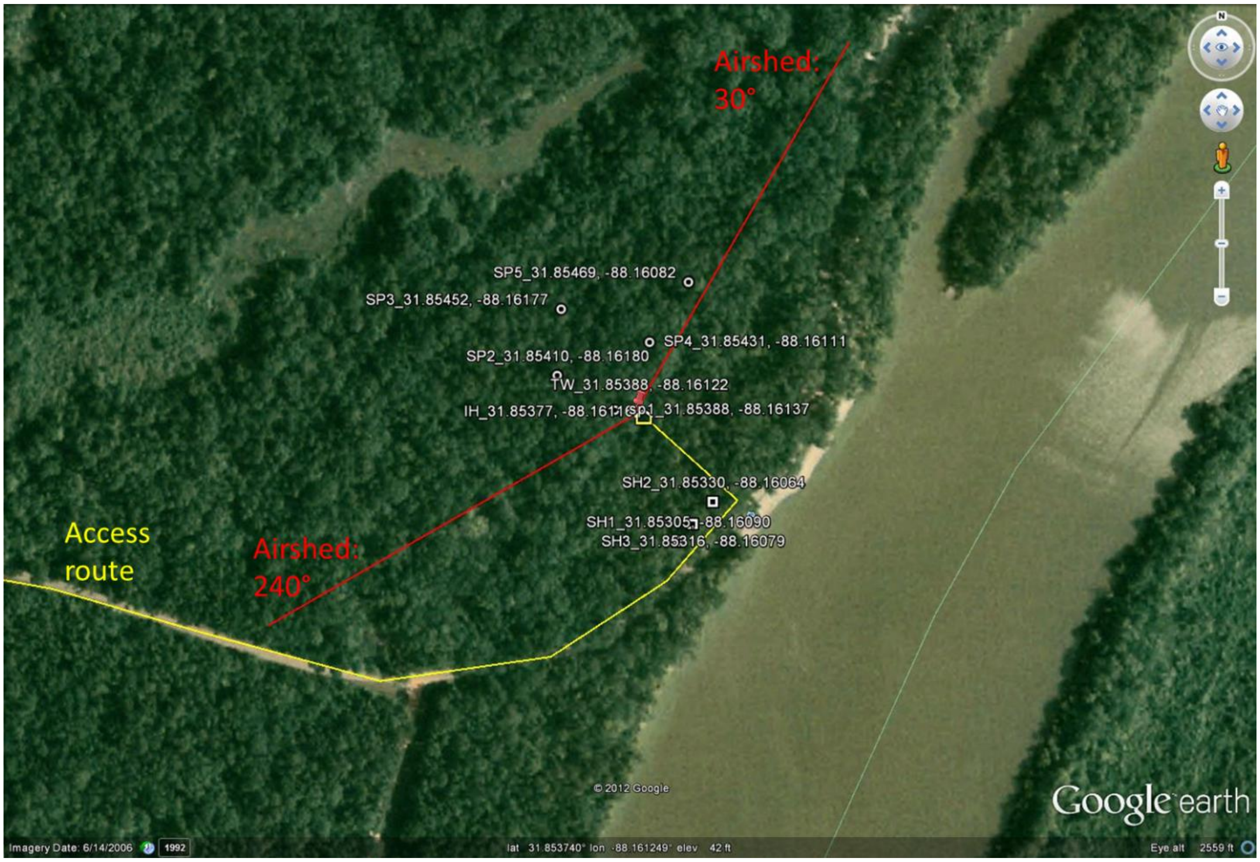


Figure 27. Site layout at Lenoir Landing showing soil array and location of the FIU soil pit.

4.4 Airshed

4.4.1 Seasonal windroses

Wind roses analytically determine and graphically represent the frequencies of wind direction and wind speed over a given timeseries, Figures 34-37. The weather data used to generate the following wind roses are from Meridian Key Field (32.333, -88.751), AL, which is ~77.5 km Northwest of NEON Relocatable site at Lenoir Landing. This set of wind roses below was prepared for Choctaw site. Because Lenoir Landing site is < 1 mile from Choctaw site, we assume this set of wind roses is still applicable for Lenoir Landing site. The orientation of the wind rose follows that of a compass (assume declination applied). When we describe the wind directions it should be noted that they are the cardinal direction that wind blows from. Color bands depict the range of wind speeds. The directions of the rose with the longest spoke show wind directions with the largest frequency. These wind roses are subdivided into as 24 cardinal directions.

4.4.2 Results (graphs for wind roses)

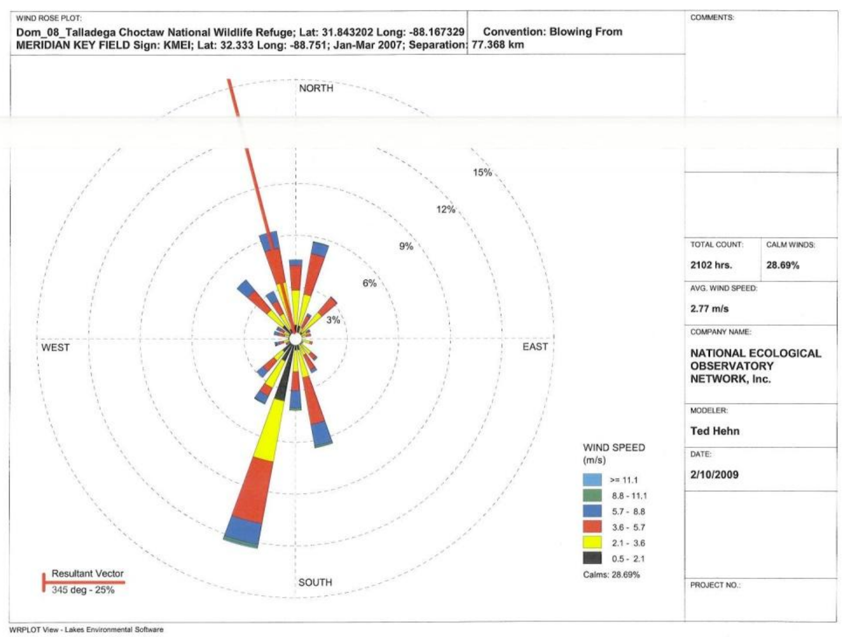


Figure 34. Windroses of January – March for D08 Lenoir Landing Relocatable site.

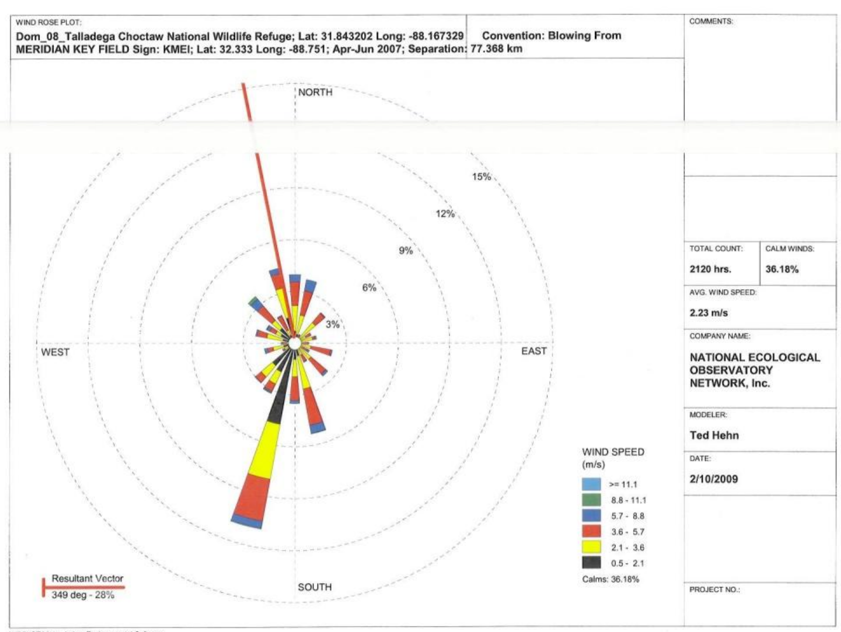


Figure 35. Windroses of April – June for D08 Lenoir Landing Relocatable site.

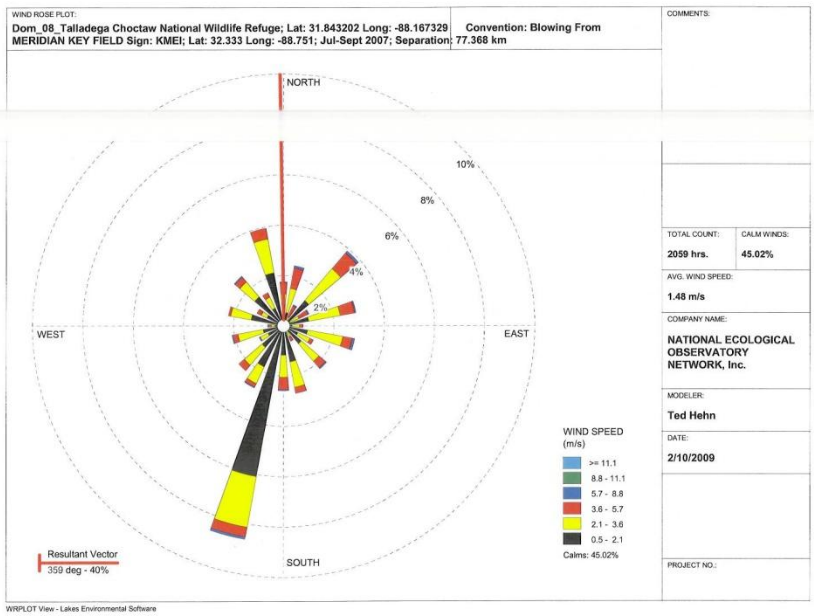


Figure 36. Windroses of July – September for D08 Lenoir Landing Relocatable site.

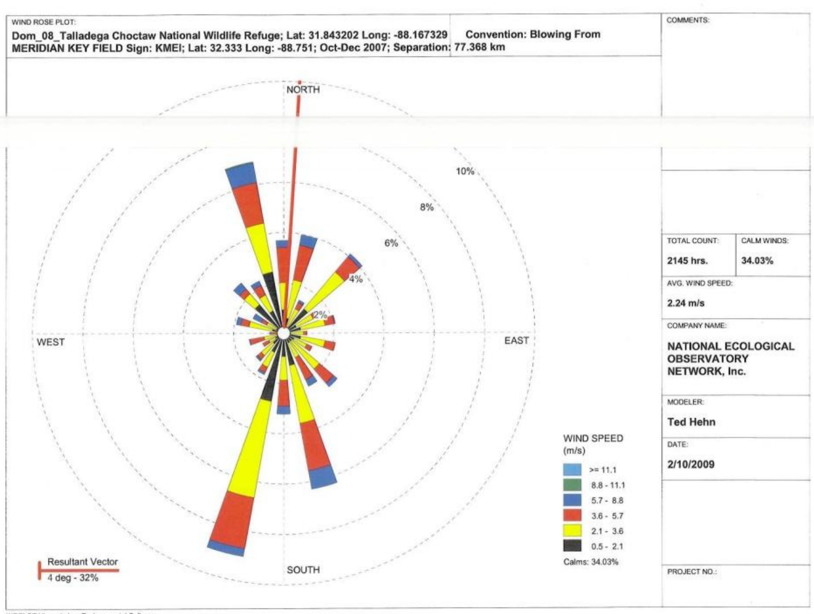


Figure 37. Windroses of October – December for D08 Lenoir Landing Relocatable site.

4.4.3 Resultant vectors

Table 12. The resultant wind vectors from D08 Lenoir Landing Relocatable site.

Quarterly (seasonal) timeperiod	Resultant vector	% duration
January to March	345°	25
April to June	349°	28
July to September	359°	40
October to December	4°	32
Annual mean	354.25°	na.

4.4.4 Expected environmental controls on source area

Two types of models were commonly used to determine the shape and extent of the source area under different and contrasting atmospheric stability classes. An inverted plume dispersion model with modeled cross wind solutions were used for convective conditions (Horst and Weil 1994). For strongly stable conditions, and Lagrangian solution was used (Kormann and Meixner 2001). The source area models where bounded by the expected conditions depict the extreme conditions. Convective conditions typically have strong vertical mixing between the ecosystem and atmosphere (surface layer). Stable conditions typically have long source area and associated waveforms. Convective turbulence is often characterized by short mixing scales (scalar) and moderate daytime wind speeds, *e.g.,* 1-4 m s^{-2}. Higher wind speeds, like those experienced over the Rockies, are often the product of mechanical turbulence with long waveforms. Because thermal stratification is very efficient in suppressing vertical mixing, stable conditions also have typically very long waveforms.

As a general rule, shorter and less structurally complex ecosystems have good vertical mixing during all atmospheric stabilities. Taller and more structurally complex ecosystems have well mixed upper canopies during the daytime, and can be decoupled below the canopy under neutral and stable conditions (e.g., Harvard Forest, Bartlett Experimental Forest, and Burlington Conservation Area). The type of turbulence (mechanical verse convective) and the physical attributes of the ecosystem control the degree of mixing, and the length and size of the source area.

Here, with support from Dr R. Clement, we use a web-based footprint model that made by Micrometeorology Group at University of Edinburgh, UK to determine the footprint area under various conditions (model info: http://www.geos.ed.ac.uk/abs/research/micromet/EdiTools/). Winds used to run the model and generate following model results are extracted from the wind roses. Vegetation information, temperature and energy information were either from the RFI document, previous site visit report, available data files or best estimated from experienced expert. Measurement height was determined from the Tower Height Info document provided by ENG group, then verify according to the real ecosystem structure after FIU site characterization at site. Runs 1-3 and 4-6 represents the expected conditions for summer and winter conditions, respectively, with maximum and mean windspeeds (daytime convective) and nighttime (stable atmospheres) conditions. The wind vector for each run was estimated from wind roses and is placed as a centerline in the site map included in the graphics. The width of the footprint was also estimated using the length between the isopleth of 80% cumulative flux and center line to calculate the angle from centerline. This information, along with distance of the cumulative flux isopleths and wind direction, will define the source area for the flux measurements on the top of the tower.

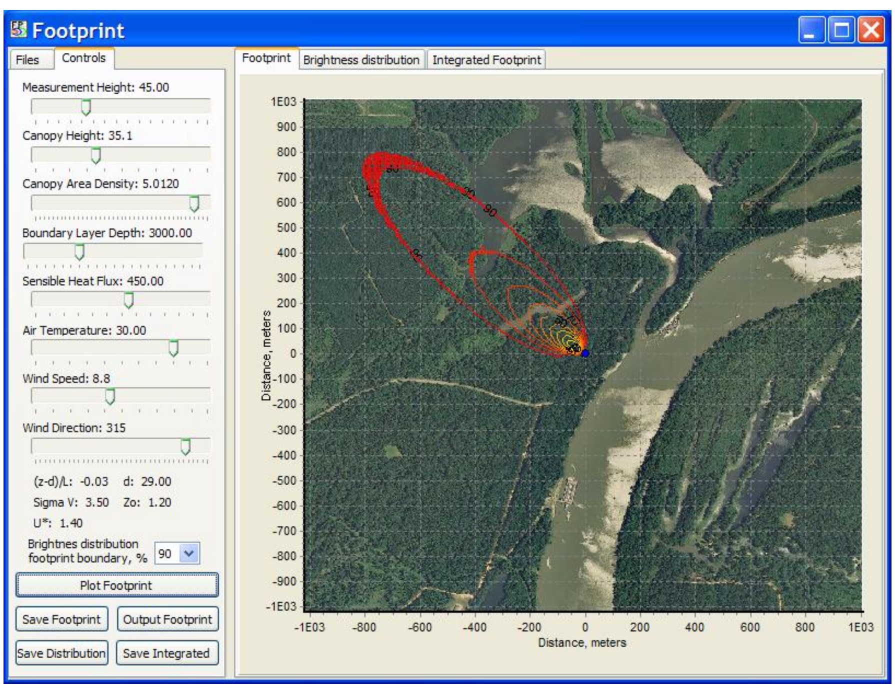
Table 13. Expected environmental controls to parameterize the source area model, and associated results from D08 Lenoir Landing Relocatable tower site.

Parameters	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	
Approximate season	summer			winter			Units
	Day (max WS)	Day (mean WS)	Night	Day (max WS)	Day (mean WS)	night	qualitative
Atmospheric stability	Convective	Convective	Stable	Convective	convective	Stable	qualitative
Measurement height	45	45	45	45	45	45	m
Canopy Height	35	35	35	35	35	35	m
Canopy area density	5	5	5	2.5	2.5	2.5	m
Boundary layer depth	3000	3000	1300	1500	1508	900	m
Expected sensible heat flux	450	450	125	175	175	60	W m^{-2}
Air Temperature	30	30	25	15	15	10	°C
Max. windspeed	8.8	2.6	2	11.2	3.8	2	m s^{-1}
Resultant wind vector	315	315	315	315	315	315	degrees
Results							
(z-d)/L	-0.03	-0.29	-0.26	0.00	-0.09	-0.16	m

d	29	29	29	27	27	27	m
Sigma v	3.5	2.3	1.3	4.0	1.9	1.1	$m^2 s^{-2}$
Z0	1.2	1.2	1.2	1.7	1.7	1.7	m
u*	1.4	0.64	0.44	1.9	0.74	0.43	$m s^{-1}$
Distance source area begins	0	0	0	0	0	0	m
Distance of 90% cumulative flux	750	250	350	850	550	480	m
Distance of 80% cumulative flux	450	150	200	500	300	300	m
Distance of 70% cumulative flux	300	100	150	350	200	200	m
Peak contribution	65	25	35	65	55	45	m

Note: The data for wind roses from Meridian Key Field is located ~77 km away from Lenoir Landing site. By communicating with local people, they confirm the prevailing directions are from North, northwest and west. Therefore, we use 315⁰ to run the footprint model here. Though we fully expect drainage flows (nighttime) to follow the contour of the river basin.

4.4.5 Footprint model results (source area graphs)



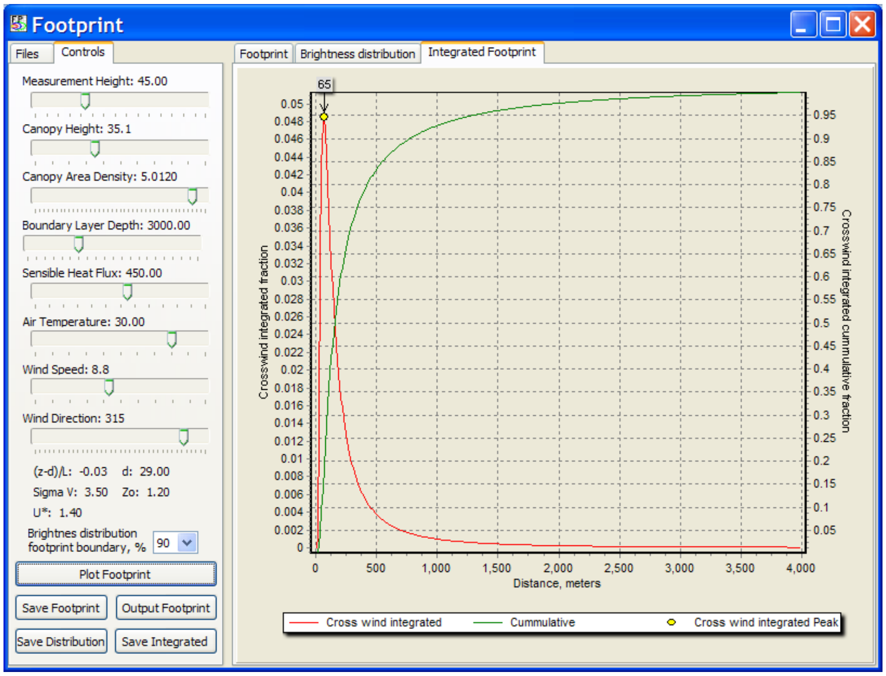
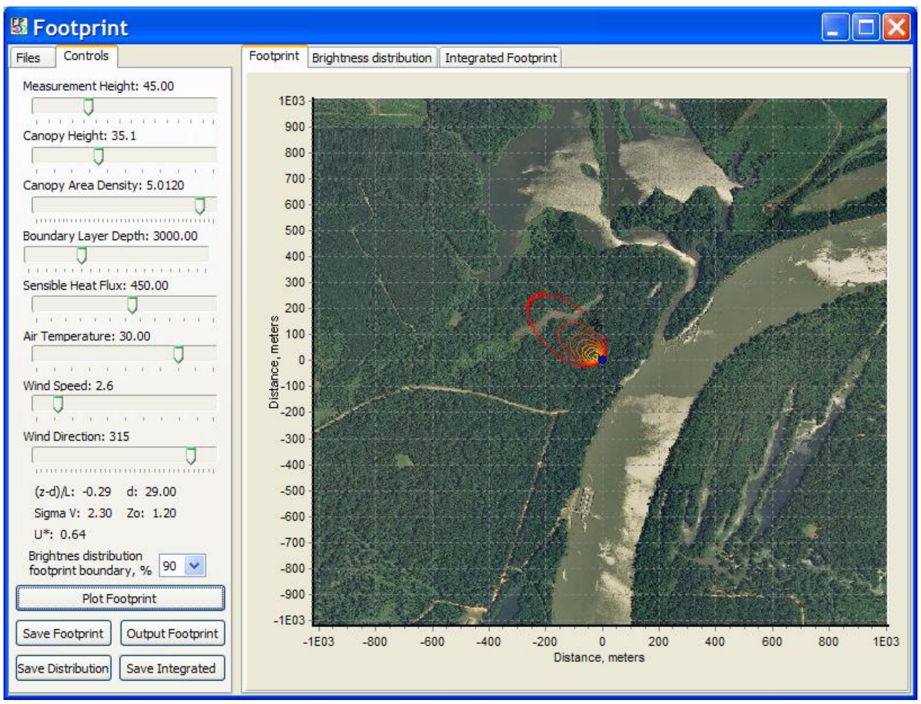


Figure 38. D08 Lenoir Landing summer daytime (convective) footprint output with max wind speed.



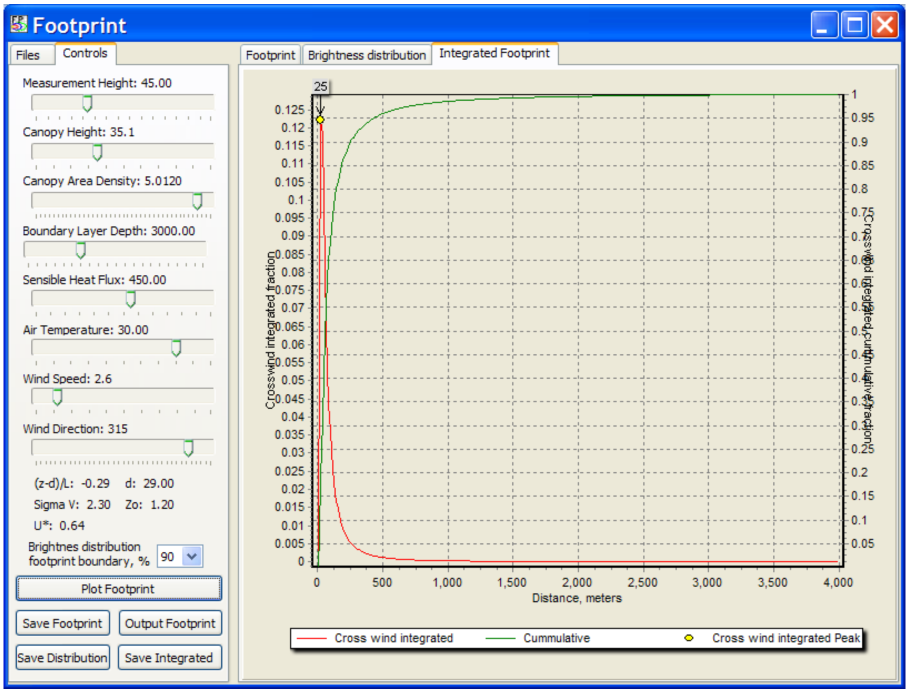
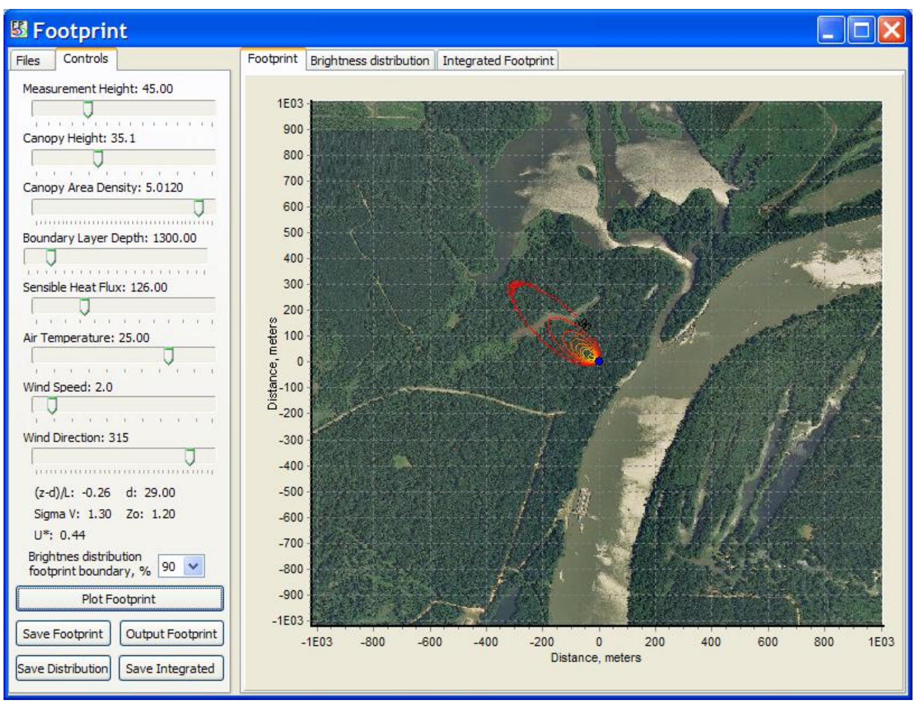


Figure 39. D08 Lenoir Landing summer daytime (convective) footprint output with mean wind speed.



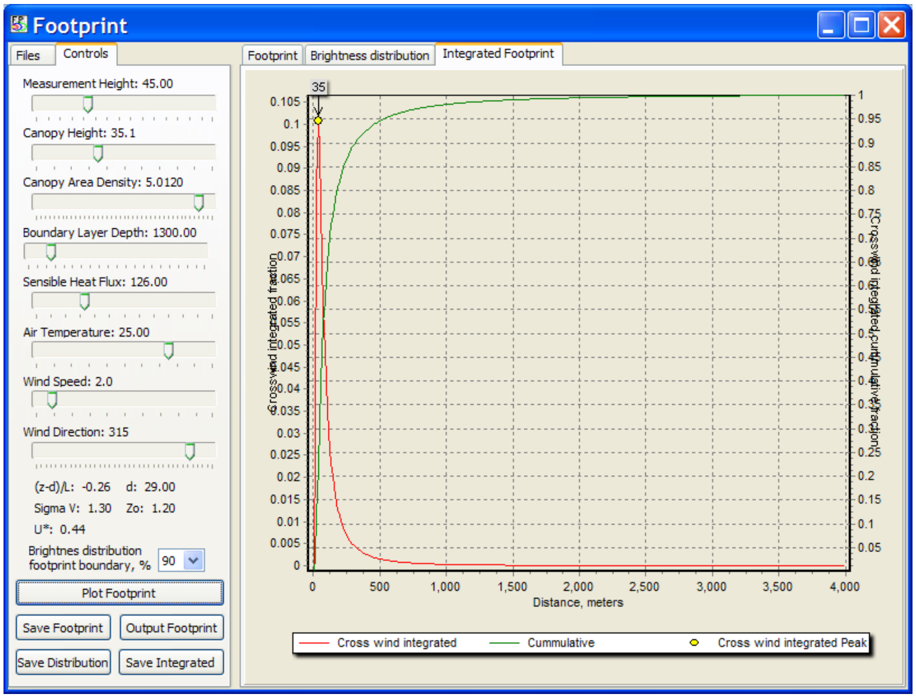
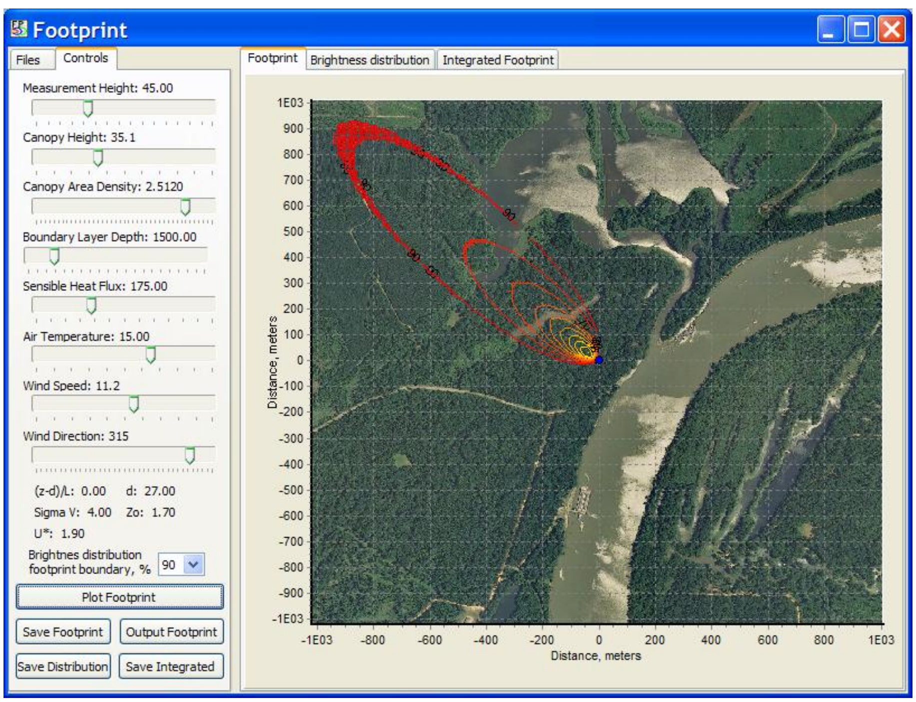


Figure 40. D08 Lenoir Landing summer nighttime (stable) footprint output with mean wind speed.



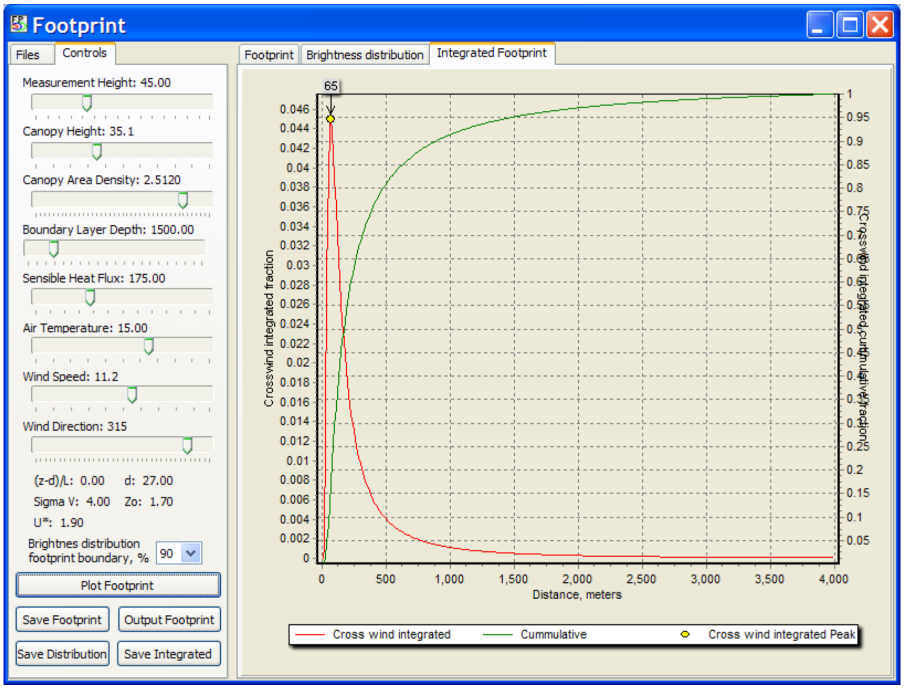
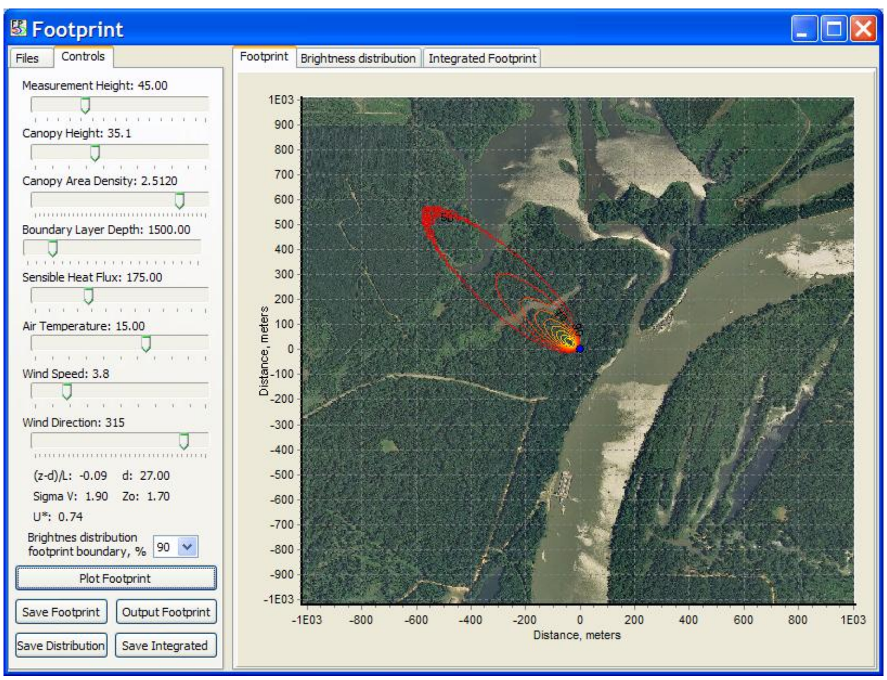


Figure 41. D08 Lenoir Landing winter daytime (convective) footprint output with max wind speed.



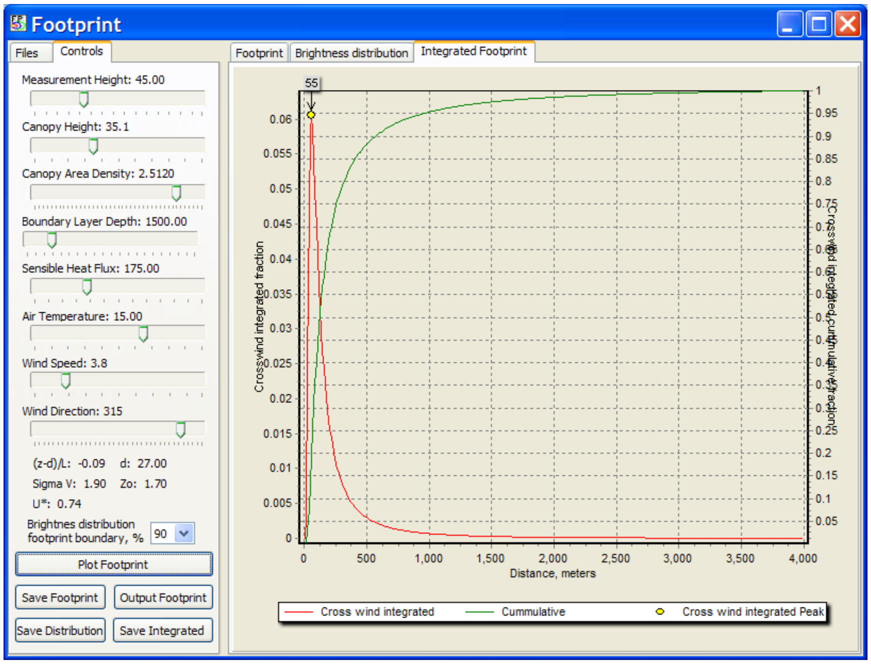
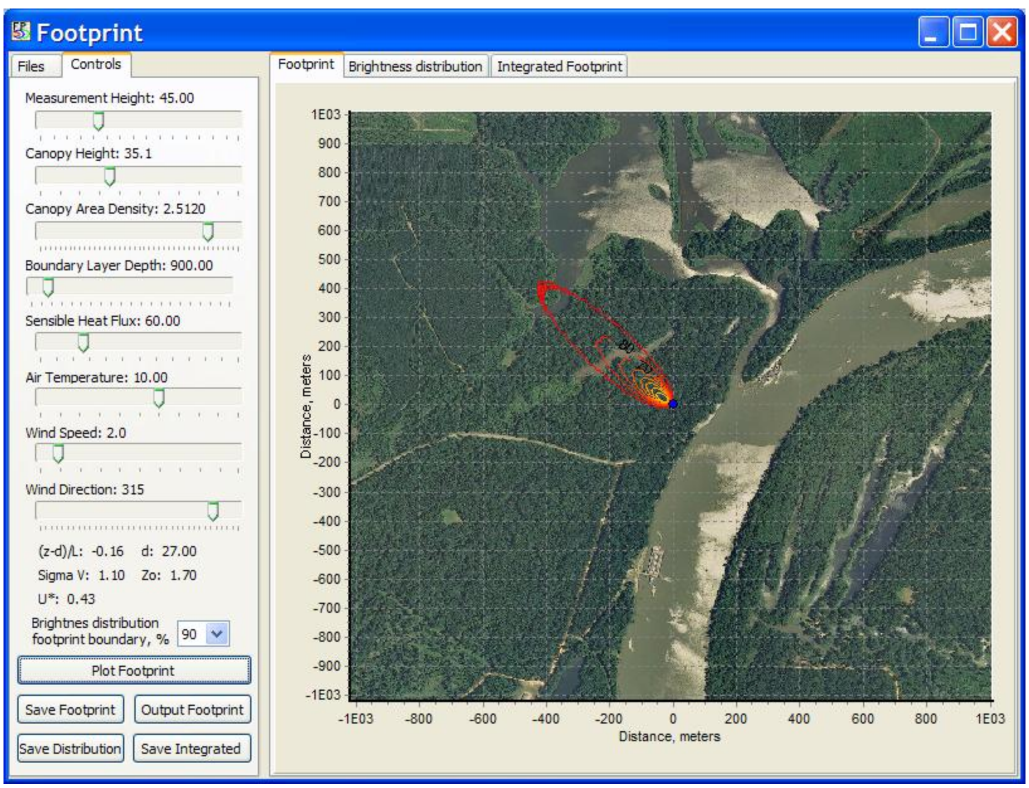


Figure 42. D08 Lenoir Landing winter daytime (convective) footprint output with mean wind speed.



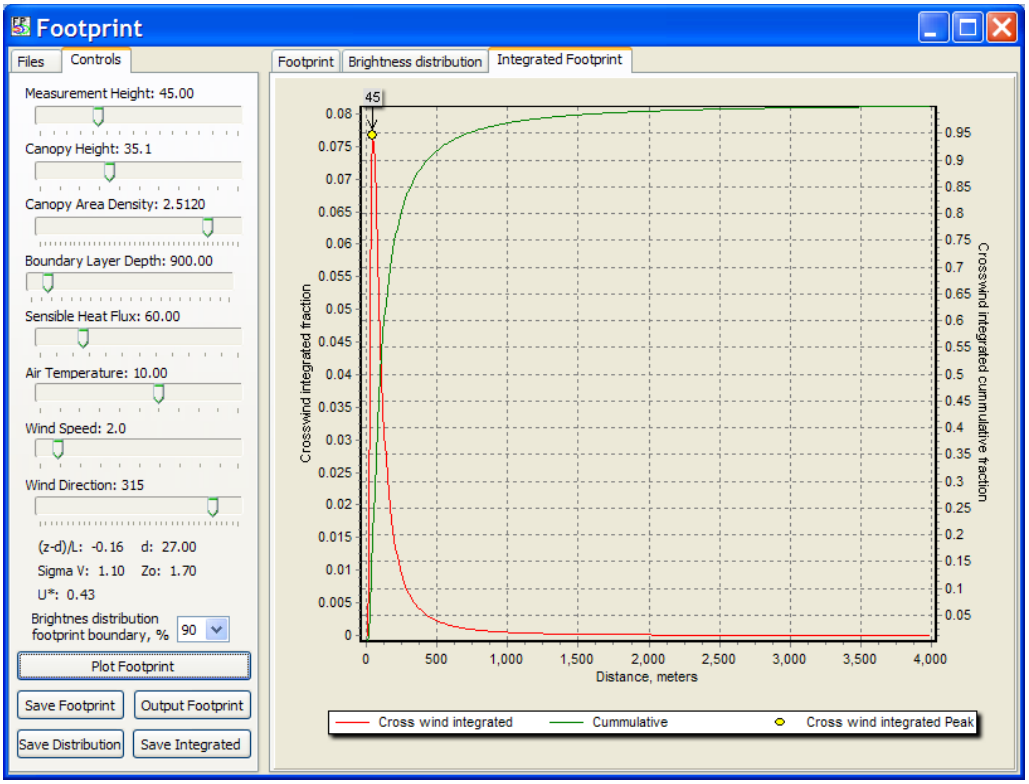


Figure 43. D08 Lenoir Landing winter nighttime (stable) footprint output with mean wind speed.

4.5 Site design and tower attributes

According to windroses, the prevailing wind direction blows from north or south throughout the whole year (310^o to 50^o clockwise from 310^o, and 160^o to 215^o clockwise from 160^o). However, Lenoir Landing site is located ~77 km away from Meridian Key Field (32.333, -88.751, location of the data for windroses). By communicating with local people, they confirm the prevailing directions are from North, northwest and west. During winter, less frequent wind blows from Northeast direction. Though we fully expect drainage flows (nighttime) to follow the contour of the river basin. Therefore, based on the local knowledge and topography, we determine the airshed area would be from 240^o to 30^o (clockwise from 240^o). Tower should be placed to a location to best catch the signals from the airshed of the ecosystem in interest, which is hardwood forest at flooded plain at this site. After FIU site characterization, we determined **tower location** at 31.85388°, -88.16122°.

Eddy covariance, sonic wind and air temperature **boom arms** orientation toward the northwest will be best to capture signals from all major wind directions. **Radiation boom arms** should always be facing south to avoid any shadowing effects from the tower structure. An **instrument hut** should be outside the prevailing wind airshed to avoid disturbance in the measurements of wind and should be positioned to have the longer side parallel to frequent wind direction to minimize the wind effects on instrument huts and to minimize the disturbances of wind regime by instrument hut, and in this case, instrument hut should be positioned on the east side of tower and have the longer side parallel to NW-SE direction. Therefore, we require the placement of instrument hut at 31.85377°,-88.16116°.

The site is a closed hardwood forest. Canopy height is ~35 m with lowest branch ~8 m above ground. Shrub, seedlings and sapling understory varies from 1 m to 20 m in height without obvious strata. Annual plants at ground level are ~0.5 m tall. We require 6 **measurement layers** on the tower with top measurement height at 45 m, and rest layers are 38 m, 32 m, 16 m, 2 m and 0.3 m, respectively, to best characterize the fluxes on the tower top and environmental conditions in profile through forest.

Secondary **precipitation collector** for bulk precipitation collection will be located the top of tower at this site. **Wet deposition collector** will be collocated on the top of tower. See AD 04 for further information and requirements for bulk precipitation collection and wet deposition collection.

The site layout is summarized in the table below. Assume the projected area of the tower is square. **Anemometer/temperature boom arm direction** is ***from*** the tower ***toward*** the prevailing wind direction or designated orientation. **Instrument hut orientation vector** is parallel to the long side of the instrument hut (short-side of instrument hut is perpendicular to the **Instrument hut orientation vector)**. **Instrument hut distance z** is the distance from the center of tower projection to the center of the instrument hut projection on the ground. The numbering of the **measurement levels** is that the lowest is level one, and each subsequent increase in height is numbered sequentially, in this case, level 6 being the upper most level at this tower site.

Table 14. Site design and tower attributes for D08 Lenoir Landing Relocatable site

0° is true north with declination accounted for. Color of Instrument hut exterior shall be tan to best match the surrounding environment.

Attribute	lat	long	degree	meters	notes
Airshed area			240° to 30°		Clockwise from 240°
Tower location	31.85388°,	-88.16122°	--	--	new site
Instrument hut	31.85377°,	-88.16116°			
Instrument hut orientation vector	--	--	135° - 315°		Short face parallel to 45° - 225°
Instrument hut distance z	--	--	--	14*	
Anemometer/Temperature boom orientation	--	--	315°	--	
Height of the measurement levels					
Level 1				0.3	m.a.g.l.
Level 2				2.0	m.a.g.l.
Level 3				16.0	m.a.g.l.
Level 4				32.0	m.a.g.l.
Level 5				38.0	m.a.g.l.
Level 6				45.0	m.a.g.l.
Tower Height				45.0	m.a.g.l.

See AD 03 for technical requirement to determine the boom height for the bottom most measurement level.

*Although the distance calculated from tower and IH instrument hut is 14 m, the actual distance measured at field is 18 m. Wooden stakes were placed on the ground to mark the exact locations FIU identified.

Figure 44 below shows the proposed tower location, instrument hut location, airshed area and access road.

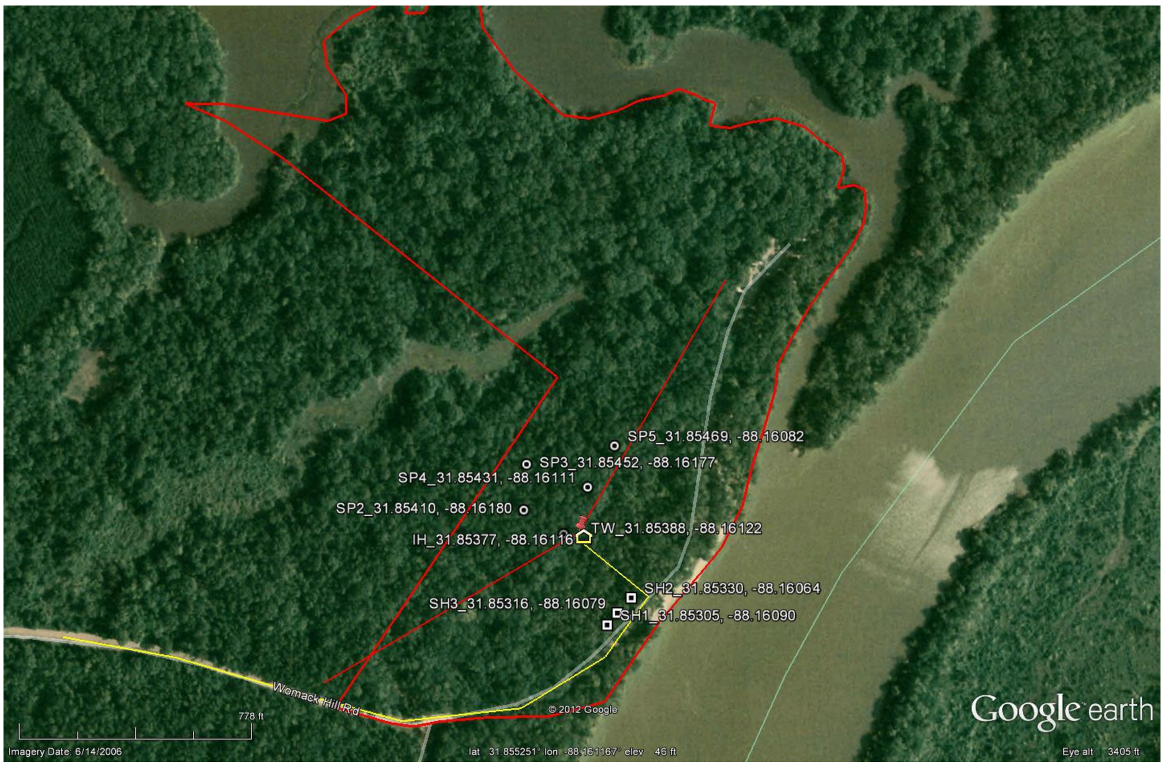


Figure 44. Overview and a close look of site layout at Lenoir Landing Relocatable site

i) new tower location is presented (red pin), ii) red lines indicate the airshed boundaries. Vectors 240° and 30° are the southwest most and northeast most vectors (starting clockwise from 240°) that would have quality wind data without causing flow distortions, respectively. iii) Yellow line is the suggested access road to instrument hut. Iv) Soil plots (SP) and soil horizon (SH) are identified as round dots and square dots, respectively.

Boardwalks. Ultimately, the decision to use a boardwalk will be, in part, based on owner's preferences. There are strong science requirements that minimize site disturbance to the surrounding area, which will be difficult to manage over a 30-y period. Traffic control is key to minimizing the site disturbance. Confining foot traffic to boardwalks minimizes site impact; this is particularly true in places where wear caused by foot traffic becomes noticeable and grows. For example, in places with snow part of the year, worn footpaths tend to have low places that collect water, or places where the snow pack becomes uneven causing personnel to walk farther and farther around the sides of the original path, causing the path to grow in width. This is a very common phenomenon. Here FIU assumes that all conduits will be either buried, or placed inside the boardwalk such that it does not extend beyond the 36' wide footprint. While the final design is not yet known, there are some general criteria that can be outlined. We assume that the boardwalk width is 36" (0.914 m). Material is not known, but must be fire proof, and in some locations the site is seasonally flooded and inundated with water. Boardwalks may also provide a scratching structure for grazing animals that in turn, would wear and unduly impact the site. Site by site evaluations must be done.

- There is always a boardwalk from the instrument hut to the tower
- If there is a boardwalk on the south side of the tower, it is never underneath the radiation booms, and it is more than 4 m from the side of the tower

Specific Boardwalks at Lenoir Landing Relocatable site utilize the orientation outlined in Table 14, and **option 1 in Figure A4**.

- Boardwalk is from the access road to instrument hut, pending landowner decision, and ease to bring supplies to instrument hut)
- Boardwalk from the instrument hut to the tower to intersect on north face of the tower,
- Boardwalk to the soil array
- Boardwalk from the soil array boardwalk to the individual soil plots

4.6 Information for ecosystem productivity plots

The tower at Lenoir Landing Relocatable site has been positioned to optimize the collection of the air/wind signals both temporally and spatially over the desired ecosystem (floodplain hardwood forest). Airshed at this site is from 240^o to 30^o (clockwise from 240^o) in Figure 44, and 90% signals for flux measurements are within a distance of 850 m from tower, and 80% within 500 m. We suggest FSU Ecosystem Productivity plots be placed within the boundaries of 240^o to 30^o (clockwise from 240^o). But considering this property is very small, FSU may eventually need the whole area for the plots and survey.

4.7 Issues and attentions

The fetch area for this tower location could be over several different ecosystems, including floodplain hardwood forest (major), pine plantation, and water body, which will make it challenged to interpret the flux data.

There are several concerns for this site: first is that this site is a flooded site and could be flooded every year. NEON EHS will help communicate with local hosts to find out the frequency of flood and the min and max depth of the flood water. Tower instruments and instrument hut will require elevation at this site. Several wet spots are around tower location. Alligators are possibly present. The second concern is that half of the airshed area is outside Lenoir Landing site boundary and belongs to different owner, possibly a timber company. It is unknown if the land cover will be changed in next 5-10 years. It will also require negotiation with this timber company for permit for FSU sample plots.

Boardwalk (BW) is suggested from access point on Womack Hill road to instrument hut (but started from ~ 50' away from the road according to the request from Arm Corp to make the BW less visible), BW from instrument hut to tower, BW to soil array, and to individual soil plots due to the potential muddy ground surface in the after storm and during flooded season.

Brandon Smith (site host representative) says the tower will likely be shot at.

Precipitation at the site is highest in spring and late fall/early winter. At these times the site becomes very muddy and impacts of construction activities on the site would likely be greater.

Arm Corp doesn't seem to concerned about the BW or tower height we proposed.

Power line is along Womack Hill road and less than 100 m away from instrument hut.

5 DEAD LAKE, RELOCATEABLE TOWER 2

5.1 Site description

NEON original candidate Relocatable tower site (32.72193, -87.777662) was at Armistead, located within a private fish farm. This site was designed to understand the connectivity between terrestrial ecosystem and aquatic ecosystem. After site characterization, the original (Fish Farm) site was not viable for NEON. After several rounds of discussion and site visits, a site called Dead Lake was chosen as the relocatable site. Dead Lake Relocatable site is a periodically flooded deciduous forest site that can meet the science requirements for this relocatable design. The tower location was determined to be 32.54172, -87.80389 (Figure 45). Tower location is < 100 m from the access point on dirt road. Power pole is < 200 m away from tower. This site is managed by Army Corp and open for licensed hunters for Turkey hunting during spring. Gated access ensured the security of facilities at site.

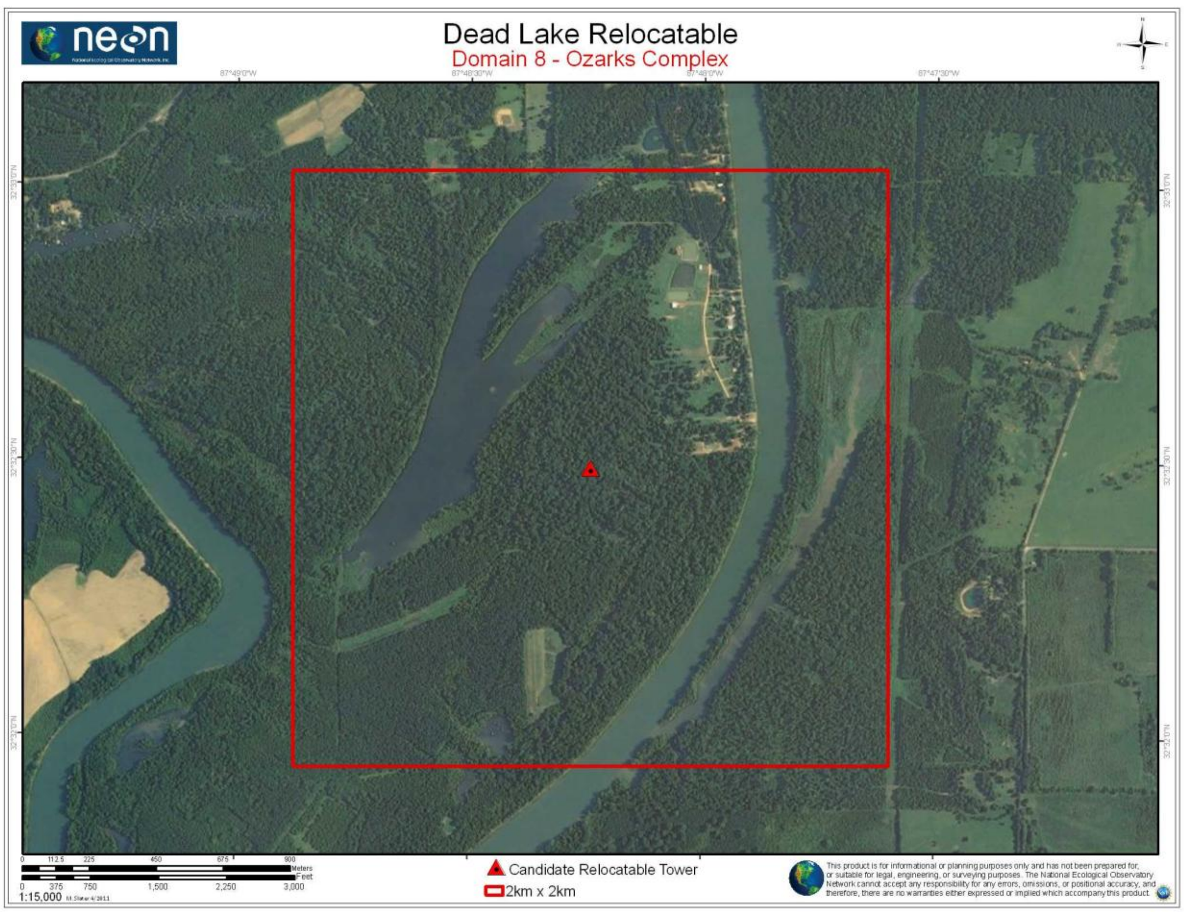


Figure 45. The relocatable site at Dead Lake. Triangle indicates the tower location.

5.2 Ecosystem

Vegetation and land cover around tower site and surrounding area are presented below:

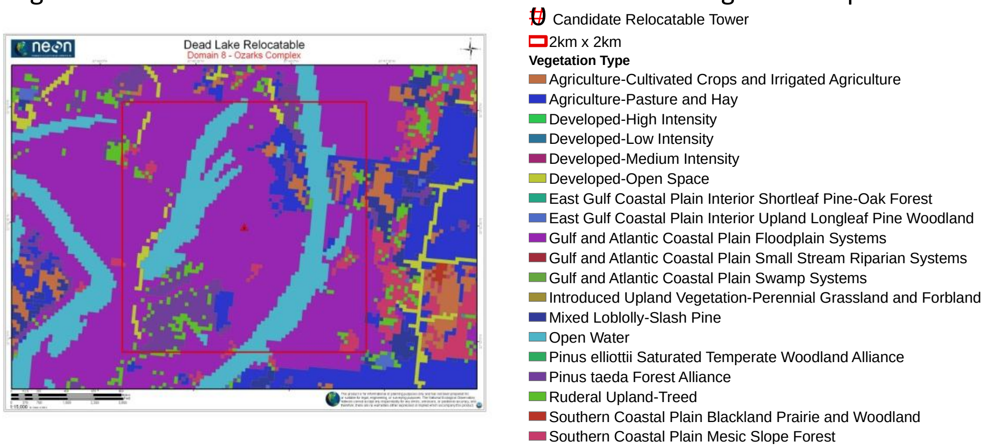


Figure 46. Vegetative cover map of the Dead Lake relocatable site and surrounding areas (from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm)

Table 15. Percent Land cover information at the Dead Lake relocatable site (from USGS, http://landfire.cr.usgs.gov/viewer/viewer.htm)

Vegetation_Type	Area_KM^2	Percentage
Agriculture-Cultivated Crops and Irrigated Agriculture	0.07	1.70
Agriculture-Pasture and Hay	0.21	5.34
Developed-Open Space	0.05	1.30
Gulf and Atlantic Coastal Plain Floodplain Systems	2.39	59.70
Mixed Loblolly-Slash Pine	0.00	0.01
Open Water	0.81	20.17
Pinus elliottii Saturated Temperate Woodland Alliance	0.00	0.00
Pinus taeda Forest Alliance	0.29	7.26
Ruderal Upland-Treed	0.12	2.97
Southern Coastal Plain Mesic Slope Forest	0.06	1.55
TOTAL	**4.00**	**100.00**

This relocatable site is located at a hardwood deciduous forest managed by Army Coop and is open to licensed hunters for turkey hunting during spring season. This site is periodically and seasonally flooded, leaving behind standing water in large depressions in the forest. Standing water was presented in the low depressions on April 18, 2011 during FIU site characterization. When the black warrior river floods, water is backed-up into the Dead Lake site. Water may be deep at times, but no velocity to the flows were apparent, i.e., 1. No removal of soil or road surface, 2. Litter piles that were deposited by water but no scour, 3. No motility or small mortility, 4. No tip ups, and 5. Tall trees, large trees. Site has very small changes in elevation (±1 m).

Canopy is closed and very diverse, and has multiple layers. It appears that many subordinate canopies are at ~ 20 to 24 m, and once liberated, can reach > 30 m in height. Tree density is ~120 stems ha^{-1} for

DBH >10 cm. Overstory is broad mix of cypress, red oak, black gum, shagbark hickory, oaks, green ash. Mid story also includes other gum species and oak species. Ground cover includes bamboo, grass, smilax and sometimes large and complete poison ivy covers. The mean canopy height is 30 m. Top understory is 19-20 m in height, and lower understory is 4-5 m. Understory at forest floor is ~ 0.5 m in height (Figure 47).

Table 16. Ecosystem and site attributes for the Dead Lake Relocatable site.

Ecosystem attributes	Measure and units
Mean canopy height	30.0 m
Surface roughness	2.5 m
Zero place displacement	26.0 m
Structural elements	Floodplain hardwood deciduous forest, multiples canopy layers
Time zone	Eastern
Magnetic declination	1° 59' W changing by 0° 6' W/year

Figure 47. General view of the ecosystem at Dead Lake Relocatable site. Site is periodically and seasonally flooded.

5.3 Soils

5.3.1 Description of soils

Soil data and soil maps below for Dead Lake relocatable tower site were collected from 6.1 km^2 NRCS (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) to determine the dominant soil types in the larger tower foot print. This was done to assure that the soil array is in the dominant (or in the co-dominant) soil type present in the tower footprint.

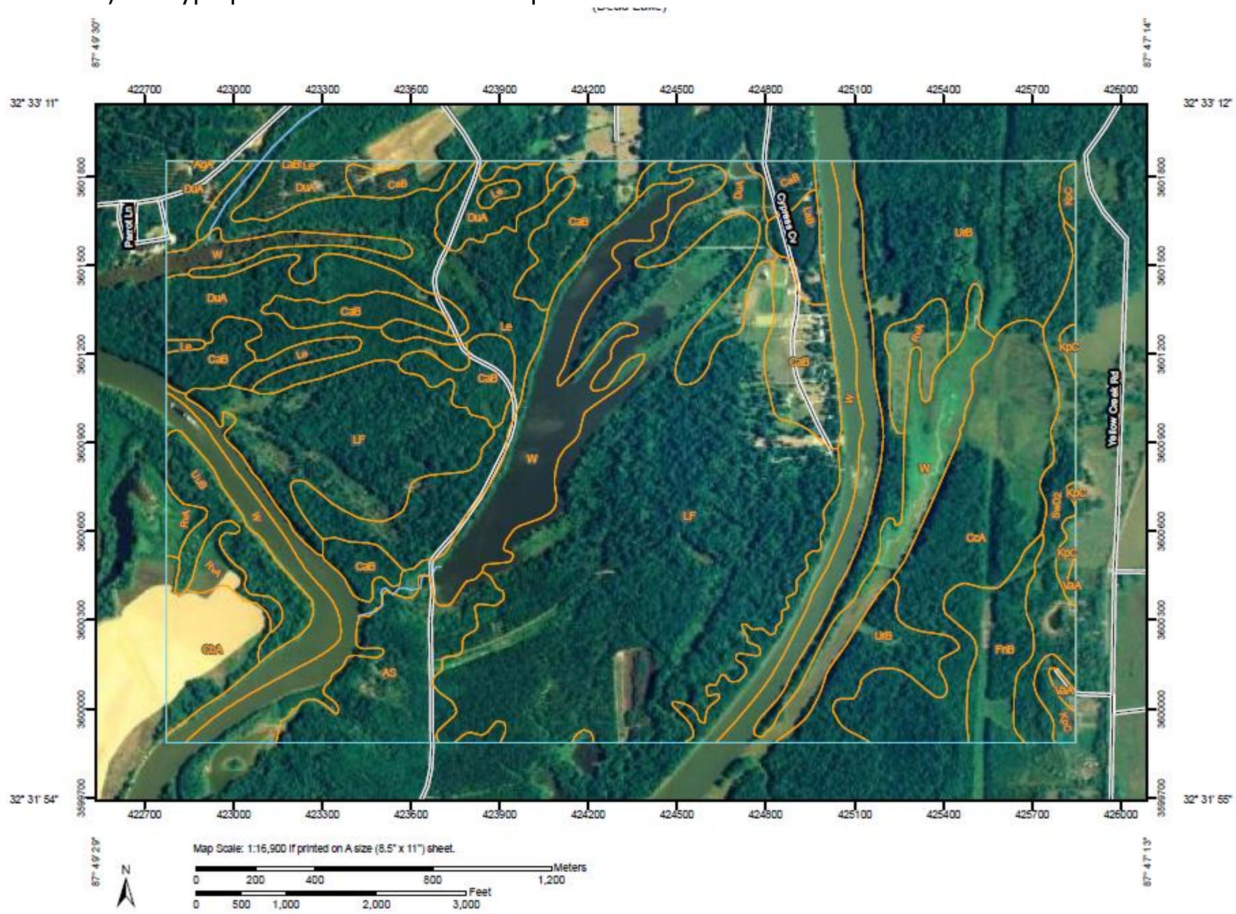


Figure 48. 6.1 km^2 soil map for Dead Lake relocatable site.

Soil Map Units Description:

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit. The map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called non-contrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.
Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example. An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example. An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example. Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Table 17. Soil series and percentage of soil series within 6.1 km^2 at Dead Lake.

Greene County, Alabama (AL063)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AgA	Angie fine sandy loam, terrace, 0 to 2 percent slopes	0.2	0.0%
AS	Angie-Leaf association	54.2	3.6%
CaB	Cahaba fine sandy loam, 0 to 3 percent slopes	115.9	7.7%
DuA	Dulac silt loam, 0 to 2 percent slopes	118.0	7.9%
LaB	Lakeland fine sand, 0 to 5 percent slopes	11.1	0.7%
Le	Leaf silt loam	113.8	7.6%
LF	Leaf-Angie association	422.3	28.2%
W	Water	153.6	10.3%
Subtotals for Soil Survey Area		**989.1**	**66.1%**
Totals for Area of Interest		**1,496.6**	**100.0%**

Hale County, Alabama (AL065)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
CcA	Columbus loam, 0 to 2 percent slopes, occasionally flooded	102.5	6.9%
FnB	Faunsdale clay loam, 1 to 3 percent slopes	28.5	1.9%
KpC	Kipling clay loam, 1 to 5 percent slopes	12.9	0.9%
RvA	Riverview fine sandy loam, 0 to 2 percent slopes, occasionally flooded	12.5	0.8%
SwD2	Sumter-Watsonia complex, 3 to 8 percent slopes, eroded	35.4	2.4%
UrB	Urbo-Mooreville-Una complex, gently undulating, frequently flooded	137.4	9.2%
VaA	Vaiden clay, 0 to 1 percent slopes	2.6	0.2%
W	Water	77.5	5.2%
Subtotals for Soil Survey Area		**409.5**	**27.4%**
Totals for Area of Interest		**1,496.6**	**100.0%**

Marengo County, Alabama (AL091)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
CbA	Cahaba fine sandy loam, 0 to 2 percent slopes, occasionally flooded	30.1	2.0%
RvA	Riverview fine sandy loam, 0 to 2 percent slopes, occasionally flooded	12.6	0.8%
UuB	Urbo-Mooreville-Una complex, gently undulating, frequently flooded	27.6	1.8%
W	Water	27.7	1.9%
Subtotals for Soil Survey Area		**98.0**	**6.5%**
Totals for Area of Interest		**1,496.6**	**100.0%**

Greene County, Alabama AgA—Angie fine sandy loam, terrace, 0 to 2 percent slopes Map Unit Setting Mean annual precipitation: 42 to 56 inches Mean annual air temperature: 59 to 70 degrees F Frost-free period: 200 to 265 days Map Unit Composition Angie, (annemaine), and similar soils: 90 percent Minor components: 1 percent Description of Angie, (annemaine) Setting Landform: Hillslopes Landform position (two-dimensional): Footslope Landform position (three-dimensional): Base slope Down-slope shape: Linear Across-slope shape: Linear Parent material: Loamy and clayey tertiary-aged fluviomarine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Moderately well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr) Depth to water table: About 18 to 30 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: High (about 9.4 inches) Interpretive groups Land capability (nonirrigated): 2w Typical profile 0 to 9 inches: Fine sandy loam 9 to 16 inches: Clay 16 to 37 inches: Clay 37 to 49 inches: Sandy clay loam 49 to 90 inches: Sandy loam Minor Components Leaf Percent of map unit: 1 percent Landform: Drainageways Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Concave Across-slope shape: Linear

Greene County, Alabama AS—Angie-Leaf association Map Unit Setting Mean annual precipitation: 42 to 56 inches Mean annual air temperature: 59 to 70 degrees F Frost-free period: 200 to 265 days Map Unit Composition Angie, (annemaine), and similar soils: 60 percent Leaf and similar soils: 20 percent Description of Angie, (annemaine) Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Linear Parent material: Loamy and clayey tertiary-aged fluviomarine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Moderately well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr) Depth to water table: About 18 to 30 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: High (about 9.4 inches) Interpretive groups Land capability (nonirrigated): 4w Typical profile 0 to 9 inches: Fine sandy loam 9 to 16 inches: Clay 16 to 37 inches: Clay 37 to 49 inches: Sandy clay loam 49 to 90 inches: Sandy loam Description of Leaf Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Concave Across-slope shape: Linear Parent material: Clayey fluviomarine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 1 percent Depth to restrictive feature: More than 80 inches Drainage class: Poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 6 to 18 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: Very high (about 12.1 inches) Interpretive groups Land capability (nonirrigated): 4w Typical profile 0 to 9 inches: Silt loam 9 to 72 inches: Silty clay

Marengo County, Alabama CbA—Cahaba fine sandy loam, 0 to 2 percent slopes, occasionally flooded Map Unit Setting Elevation: 30 to 170 feet Mean annual precipitation: 48 to 56 inches Mean annual air temperature: 61 to 64 degrees F Frost-free period: 220 to 240 days Map Unit Composition Cahaba and similar soils: 90 percent Minor components: 5 percent Description of Cahaba Setting Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Convex Parent material: Loamy fluviomarine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) Depth to water table: More than 80 inches

Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: Moderate (about 7.9 inches) Interpretive groups Land capability (nonirrigated): 2w Typical profile 0 to 7 inches: Fine sandy loam 7 to 43 inches: Sandy clay loam 43 to 65 inches: Sandy loam Minor Components Urbo Percent of map unit: 1 percent Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Convex Bigbee Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Concave Across-slope shape: Convex Chrysler Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Convex Lenoir Percent of map unit: 1 percent Landform: Terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Concave Across-slope shape: Convex Una Percent of map unit: 1 percent Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Convex

Greene County, Alabama CaB—Cahaba fine sandy loam, 0 to 3 percent slopes Map Unit Setting Elevation: 10 to 90 feet Mean annual precipitation: 42 to 56 inches Mean annual air temperature: 59 to 70 degrees F Frost-free period: 200 to 265 days Map Unit Composition Cahaba and similar soils: 90 percent Minor components: 2 percent Description of Cahaba Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Linear Parent material: Loamy fluviomarine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 3 percent Depth to restrictive feature: More than 80 inches Drainage class: Well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) Depth to water table: More than 80 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: Moderate (about 8.7 inches) Interpretive groups Land capability (nonirrigated): 1 Typical profile 0 to 9 inches: Fine sandy loam 9 to 53 inches: Sandy clay loam 53 to 80 inches: Sandy loam Minor Components Chastain Percent of map unit: 1 percent Landform: Depressions Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Concave Across-slope shape: Linear Myatt Percent of map unit: 1 percent Landform: Drainageways Landform position (two-dimensional): Footslope Landform position (three-dimensional): Base slope Down-slope shape: Concave Across-slope shape: Linear

Hale County, Alabama CcA—Columbus loam, 0 to 2 percent slopes, occasionally flooded Map Unit Setting Elevation: 80 to 160 feet Mean annual precipitation: 43 to 63 inches Mean annual air temperature: 60 to 70 degrees F Frost-free period: 211 to 252 days Map Unit Composition Columbus and similar soils: 85 percent Minor components: 1 percent Description of Columbus Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Linear Parent material: Loamy marine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Moderately well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) Depth to water table: About 24 to 36 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: Moderate (about 8.2 inches) Interpretive groups Land capability (nonirrigated): 3w Typical profile 0 to 8 inches: Loam 8 to 48 inches: Clay loam 48 to 80 inches: Fine sandy loam Minor Components Una Percent of map unit: 1 percent Landform: Sloughs Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Concave Across-slope shape: Linear

Greene County, Alabama DuA—Dulac silt loam, 0 to 2 percent slopes Map Unit Setting Elevation: 50 to 450 feet Mean annual precipitation: 40 to 60 inches Mean annual air temperature: 59 to 72 degrees F Frost-free period: 200 to 265 days Map Unit Composition Dulac and similar soils: 90 percent Minor components: 1 percent Description of Dulac Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Linear Parent material: Silty loess over clayey marine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Moderately well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr) Depth to water table: About 18 to 30 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: High (about 9.7 inches) Interpretive groups Land capability (nonirrigated): 2w Typical profile 0 to 9 inches: Silt loam 9 to 16 inches: Clay 16 to 37 inches: Clay 37 to 49 inches: Sandy clay loam 49 to 90 inches: Sandy loam Minor Components Bibb Percent of map unit: 1 percent Landform: Drainageways Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Linear Across-slope shape: Concave

Hale County, Alabama FnB—Faunsdale clay loam, 1 to 3 percent slopes Map Unit Setting Elevation: 150 to 260 feet Mean annual precipitation: 43 to 63 inches Mean annual air temperature: 60 to 70 degrees F Frost-free period: 211 to 252 days Map Unit Composition Faunsdale and similar soils: 90 percent Description of Faunsdale Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Linear Parent material: Clayey marine deposits derived from chalk Properties and qualities Slope: 1 to 3 percent Depth to restrictive feature: 60 to 80 inches to paralithic bedrock Drainage class: Somewhat poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr) Depth to water table: About 12 to 24 inches Frequency of flooding: None Frequency of ponding: None Calcium carbonate, maximum content: 90 percent Available water capacity: High (about 9.7 inches) Interpretive groups Land capability (nonirrigated): 2e Typical profile 0 to 6 inches: Clay loam 6 to 12 inches: Silty clay 12 to 52 inches: Clay 52 to 64 inches: Clay 64 to 80 inches: Weathered bedrock

Hale County, Alabama KpC—Kipling clay loam, 1 to 5 percent slopes Map Unit Setting Elevation: 150 to 260 feet Mean annual precipitation: 43 to 63 inches Mean annual air temperature: 60 to 70 degrees F Frost-free period: 211 to 252 days Map Unit Composition Kipling and similar soils: 90 percent Description of Kipling Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Linear Parent material: Clayey marine deposits derived from chalk Properties and qualities Slope: 1 to 5 percent Depth to restrictive feature: More than 80 inches Drainage class: Somewhat poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 18 to 36 inches Frequency of flooding: None Frequency of ponding: None Calcium carbonate, maximum content: 35 percent Available water capacity: Very high (about 12.6 inches) Interpretive groups Land capability (nonirrigated): 3e Typical profile 0 to 5 inches: Clay loam 5 to 64 inches: Clay 64 to 80 inches: Clay

Greene County, Alabama LaB—Lakeland fine sand, 0 to 5 percent slopes Map Unit Setting Elevation: 50 to 450 feet Mean annual precipitation: 40 to 60 inches Mean annual air temperature: 59 to 72 degrees F Frost-free period: 200 to 265 days Map Unit Composition Lakeland and similar soils: 85 percent Minor components: 1 percent Description of Lakeland Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Linear Parent material: Sandy marine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 5 percent Depth to restrictive feature: More than 80 inches Drainage class: Excessively drained Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr) Depth to water table: About 42 to 72 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: Low (about 4.4 inches) Interpretive groups Land capability (nonirrigated): 4s Typical profile 0 to 17 inches: Fine sand 17 to 80 inches: Sand Minor Components Bibb Percent of map unit: 1 percent Landform: Drainageways Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Linear Across-slope shape: Concave

Greene County, Alabama Le—Leaf silt loam Map Unit Setting Mean annual precipitation: 42 to 56 inches Mean annual air temperature: 59 to 70 degrees F Frost-free period: 200 to 265 days Map Unit Composition Leaf and similar soils: 90 percent Description of Leaf Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Concave Across-slope shape: Linear Parent material: Clayey fluviomarine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 6 to 18 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: Very high (about 12.1 inches) Interpretive groups Land capability (nonirrigated): 4w Typical profile 0 to 9 inches: Silt loam 9 to 72 inches: Silty clay

Greene County, Alabama LF—Leaf-Angie association Map Unit Setting Mean annual precipitation: 42 to 56 inches Mean annual air temperature: 59 to 70 degrees F Frost-free period: 200 to 265 days Map Unit Composition Angie and similar soils: 40 percent Leaf and similar soils: 40 percent Description of Leaf Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Concave Across-slope shape: Linear Parent material: Clayey fluviomarine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 6 to 18 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: Very high (about 12.1 inches) Interpretive groups Land capability (nonirrigated): 4w Typical profile 0 to 9 inches: Silt loam 9 to 72 inches: Silty clay Description of Angie Setting Landform: Hillslopes Landform position (two-dimensional): Footslope Landform position (three-dimensional): Base slope Down-slope shape: Linear Across-slope shape: Linear Parent material: Loamy and clayey tertiary-aged fluviomarine deposits derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Moderately well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr) Depth to water table: About 18 to 30 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: High (about 9.4 inches) Interpretive groups Land capability (nonirrigated): 2w Typical profile 0 to 9 inches: Fine sandy loam 9 to 16 inches: Clay 16 to 37 inches: Clay 37 to 49 inches: Sandy clay loam 49 to 90 inches: Sandy loam

Hale County, Alabama RvA—Riverview fine sandy loam, 0 to 2 percent slopes, occasionally flooded Map Unit Setting Elevation: 80 to 250 feet Mean annual precipitation: 43 to 63 inches Mean annual air temperature: 60 to 70 degrees F Frost-free period: 211 to 252 days Map Unit Composition Riverview and similar soils: 90 percent Minor components: 1 percent Description of Riverview Setting Landform: Terraces Landform position (two-dimensional): Footslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Linear Parent material: Loamy alluvium derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) Depth to water table: About 36 to 60 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: High (about 11.1 inches) Interpretive groups Land capability (nonirrigated): 2w Typical profile 0 to 8 inches: Fine sandy loam 8 to 56 inches: Clay loam 56 to 72 inches: Sandy loam Minor Components Una Percent of map unit: 1 percent Landform: Sloughs Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Concave Across-slope shape: Concave

Marengo County, Alabama RvA—Riverview fine sandy loam, 0 to 2 percent slopes, occasionally flooded Map Unit Setting Elevation: 100 to 500 feet Mean annual precipitation: 48 to 56 inches Mean annual air temperature: 61 to 64 degrees F Frost-free period: 220 to 240 days Map Unit Composition Riverview and similar soils: 90 percent Minor components: 4 percent Description of Riverview Setting Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Convex Parent material: Loamy alluvium derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) Depth to water table: About 42 to 60 inches Frequency of flooding: Occasional Frequency of ponding: None Available water capacity: High (about 10.6 inches) Interpretive groups Land capability (nonirrigated): 2w Typical profile 0 to 10 inches: Fine sandy loam 10 to 56 inches: Clay loam 56 to 65 inches: Loamy fine sand Minor Components Cahaba Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Convex Urbo Percent of map unit: 1 percent Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Convex Bigbee Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Concave Across-slope shape: Convex Una Percent of map unit: 1 percent Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Convex

Hale County, Alabama SwD2—Sumter-Watsonia complex, 3 to 8 percent slopes, eroded Map Unit Setting Elevation: 110 to 280 feet Mean annual precipitation: 43 to 63 inches Mean annual air temperature: 60 to 70 degrees F Frost-free period: 211 to 252 days Map Unit Composition Sumter and similar soils: 50 percent Watsonia and similar soils: 35 percent Description of Sumter Setting Landform: Ridges Landform position (two-dimensional): Backslope Landform position (three-dimensional): Side slope Down-slope shape: Convex Across-slope shape: Convex Parent material: Clayey residuum weathered from chalk Properties and qualities Slope: 3 to 8 percent Depth to restrictive feature: 20 to 40 inches to paralithic bedrock Drainage class: Well drained Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr) Depth to water table: More than 80 inches Frequency of flooding: None Frequency of ponding: None Calcium carbonate, maximum content: 95 percent Available water capacity: Low (about 3.8 inches) Interpretive groups Land capability (nonirrigated): 4e Typical profile 0 to 6 inches: Silty clay loam 6 to 19 inches: Silty clay loam 19 to 26 inches: Silty clay 26 to 80 inches: Weathered bedrock Description of Watsonia Setting Landform: Ridges Landform position (two-dimensional): Backslope Landform position (three-dimensional): Side slope Down-slope shape: Convex Across-slope shape: Convex Parent material: Clayey residuum weathered from chalk Properties and qualities Slope: 3 to 8 percent Depth to restrictive feature: 10 to 20 inches to paralithic bedrock Drainage class: Well drained Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr) Depth to water table: More than 80 inches Frequency of flooding: None Frequency of ponding: None Calcium carbonate, maximum content: 95 percent Available water capacity: Very low (about 2.1 inches) Interpretive groups Land capability (nonirrigated): 4e Typical profile 0 to 2 inches: Clay 2 to 12 inches: Clay 12 to 18 inches: Silty clay 18 to 80 inches: Weathered bedrock

Hale County, Alabama UrB—Urbo-Mooreville-Una complex, gently undulating, frequently flooded Map Unit Setting Elevation: 80 to 150 feet Mean annual precipitation: 43 to 63 inches Mean annual air temperature: 60 to 70 degrees F Frost-free period: 211 to 252 days Map Unit Composition Urbo and similar soils: 40 percent Mooreville and similar soils: 30 percent Una and similar soils: 20 percent Description of Urbo Setting Landform: Backswamps Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Concave Across-slope shape: Concave Parent material: Clayey alluvium derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Somewhat poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 12 to 24 inches Frequency of flooding: Frequent Frequency of ponding: None Available water capacity: High (about 11.4 inches) Interpretive groups Land capability (nonirrigated): 5w Typical profile 0 to 4 inches: Silty clay loam 4 to 14 inches: Silty clay 14 to 80 inches: Silty clay Description of Mooreville Setting Landform: Natural levees Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Rise Down-slope shape: Convex Across-slope shape: Linear Parent material: Loamy alluvium derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Moderately well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) Depth to water table: About 18 to 36 inches Frequency of flooding: Frequent Frequency of ponding: None Available water capacity: High (about 9.7 inches) Interpretive groups Land capability (nonirrigated): 5w Typical profile 0 to 8 inches: Silt loam 8 to 52 inches: Loam 52 to 80 inches: Loam Description of Una Setting Landform: Sloughs Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Concave Across-slope shape: Concave Parent material: Clayey alluvium derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 6 to 12 inches Frequency of flooding: Frequent Frequency of ponding: Frequent Available water capacity: High (about 10.8 inches) Interpretive groups Land capability (nonirrigated): 5w Typical profile 0 to 4 inches: Silty clay loam 4 to 80 inches: Clay

Marengo County, Alabama UuB—Urbo-Mooreville-Una complex, gently undulating, frequently flooded Map Unit Setting Elevation: 50 to 600 feet Mean annual precipitation: 48 to 56 inches Mean annual air temperature: 61 to 64 degrees F Frost-free period: 220 to 240 days Map Unit Composition Urbo and similar soils: 40 percent Mooreville and similar soils: 30 percent Una and similar soils: 20 percent Minor components: 3 percent Description of Urbo Setting Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Convex Parent material: Clayey alluvium derived from sedimentary rock Properties and qualities Slope: 0 to 1 percent Depth to restrictive feature: More than 80 inches Drainage class: Somewhat poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 12 to 13 inches Frequency of flooding: Frequent Frequency of ponding: None Available water capacity: High (about 11.4 inches) Interpretive groups Land capability (nonirrigated): 5w Typical profile 0 to 8 inches: Silty clay loam 8 to 65 inches: Clay Description of Mooreville Setting Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Dip Down-slope shape: Concave Across-slope shape: Concave Parent material: Loamy alluvium derived from sedimentary rock Properties and qualities Slope: 0 to 2 percent Depth to restrictive feature: More than 80 inches Drainage class: Moderately well drained Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr) Depth to water table: About 18 to 36 inches Frequency of flooding: Frequent Frequency of ponding: None Available water capacity: High (about 9.6 inches) Interpretive groups Land capability (nonirrigated): 5w Typical profile 0 to 5 inches: Loam 5 to 48 inches: Clay loam 48 to 60 inches: Loam Description of Una Setting Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Convex Parent material: Clayey alluvium derived from sedimentary rock Properties and qualities Slope: 0 to 1 percent Depth to restrictive feature: More than 80 inches Drainage class: Poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 0 inches Frequency of flooding: Frequent Frequency of ponding: Frequent Available water capacity: High (about 10.8 inches) Interpretive groups Land capability (nonirrigated): 7w Typical profile 0 to 3 inches: Silty clay 3 to 60 inches: Clay Minor Components Cahaba Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Convex Riverview Percent of map unit: 1 percent Landform: Flood plains Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Talf Down-slope shape: Concave Across-slope shape: Convex Chrysler Percent of map unit: 1 percent Landform: Stream terraces Landform position (two-dimensional): Toeslope Landform position (three-dimensional): Tread Down-slope shape: Convex Across-slope shape: Convex

Hale County, Alabama VaA—Vaiden clay, 0 to 1 percent slopes Map Unit Setting Elevation: 110 to 200 feet Mean annual precipitation: 43 to 63 inches Mean annual air temperature: 60 to 70 degrees F Frost-free period: 211 to 252 days Map Unit Composition Vaiden and similar soils: 90 percent Description of Vaiden Setting Landform: Ridges Landform position (two-dimensional): Backslope Landform position (three-dimensional): Crest Down-slope shape: Convex Across-slope shape: Linear Parent material: Clayey sediments over chalk Properties and qualities Slope: 0 to 1 percent Depth to restrictive feature: More than 80 inches Drainage class: Somewhat poorly drained Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr) Depth to water table: About 12 to 24 inches Frequency of flooding: None Frequency of ponding: None Calcium carbonate, maximum content: 35 percent Available water capacity: Moderate (about 7.8 inches) Interpretive groups Land capability (nonirrigated): 3w Typical profile 0 to 4 inches: Clay 4 to 51 inches: Clay 51 to 80 inches: Clay

Greene County, Alabama W—Water Map Unit Setting Mean annual precipitation: 42 to 56 inches Mean annual air temperature: 59 to 70 degrees F Map Unit Composition Water: 100 percent

Hale County, Alabama W—Water Map Unit Setting Mean annual precipitation: 43 to 63 inches Mean annual air temperature: 60 to 70 degrees F Map Unit Composition Water: 100 percent

Marengo County, Alabama W—Water Map Unit Setting Mean annual precipitation: 48 to 56 inches Mean annual air temperature: 61 to 64 degrees F Frost-free period: 220 to 240 days Map Unit Composition Water: 95 percent

5.3.2 Soil semi-variogram description

The goal of this aspect of the site characterization is to determine the minimum distance between the soil plots in the soil array such that data farther apart can be considered spatially independent. The collected field data will be used to produce semivariograms, which is a geostatistical technique to characterize spatial autocorrelation between mapped samples of a quantitative variable (*e.g.*, soil property data in our case). In an empirical semivariogram, the average of the squared differences of a response variable is computed for all pairs of points within specified distance intervals (lag classes). The output is presented graphically as a plot of the average semi-variance versus distance class (Figure 49). For the theoretical variogram models considered here, the semivariance will converge on the total variance at distances for which values are no longer spatially auto-correlated (this is referred to as the range, Figure 49).

For the theoretical variograms considered here, three parameters estimated from the data are used to fit a semivariogram model to the empirical semivariogram. This model is then assumed to quantitatively represent the correlation as a function of distance (Figure 49), the range, the sill (the sill is the asymptotic value of semi-variance at the range), and the nugget (which describes sampling error or variation at distances below those separating the closest pairs of samples). The range, sill and nugget are estimated from theoretical models that are fitted to the empirical variograms using non-linear least squares methods.

The variogram analysis will be used, to determine the spatial scales at which we can consider soil measurements spatially independent. This characterization will directly inform the minimum distance between *i*) soil plots within each soil array, *ii*) the soil profile measurements, *iii*) EP plots, and *iv*) the microbial sampling locations. These data will directly inform NEON construction and site design activities.

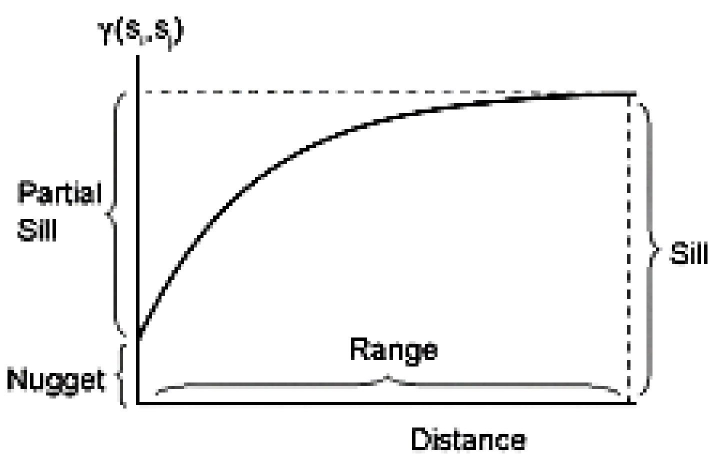


Figure 49. Example semivariogram, depicting range, sill, and nugget.

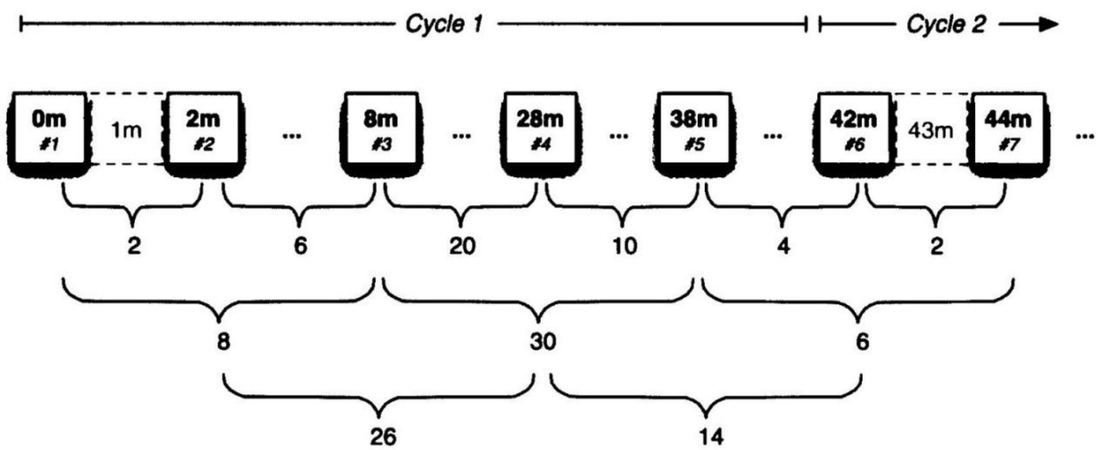


Figure 50. Spatially cyclic sampling design for the measurements of soil temperature and soil water content.

Field measurements of soil temperature (0-12 cm) and moisture (0-15 cm) were taken on 19 April 2011 at the Dead Lake site. The sampling points followed the spatially cyclic sampling design by Bond-Lamberty et al. (2006) (Figure 50). Soil temperature and moisture measurements were collected along four transects (all 84 m) located in the expected airshed at Dead Lake. Details of how the airshed was determined are provided below. Soil temperature was measured with platinum resistance temperature sensors (RTD 810, Omega Engineering Inc., Stamford CT) and soil moisture was measured with time domain diaelectric sensors (CS616, Campbell Scientific Inc., Logan UT).

As well as measuring soil temperature and moisture at each sample point in Figure 50, measurements were also taken 30 cm in front and behind the sampling point along the axis of the transect. For example, at the 2 m sampling point, soil temperature and moisture was measured at 1.7 m, 2 m, and 2.3 m; this data is referred to as mobile data, since the measurements were taken at many different locations. In addition, soil temperature and moisture were continuously recorded at a single fixed location (stationary data) throughout the sampling time to correct for changes in temperature and moisture throughout the day.

Data collected were used for geospatial analyses of variograms in the R statistical computing language with the geoR package to test for spatial autocorrelation (Trangmar *et al.* 1986; Webster & Oliver 1989; Goovaerts 1997; Riberiro & Diggle 2001) and estimate the distance necessary for independence among soil plots in the soil array. To correct for changes in temperature and moisture over the sampling period, the stationary data was subtracted from the mobile data. In many instances a time of day trend was still apparent in the data even after subtracting the stationary data from the mobile data. This time of day trend was corrected for by fitting a linear regression and using the residuals for the semivariogram analysis. Soil temperature and moisture data, R code, graphs, and R output can be found at: P:\FIU\FIU_Site_Characterization\DXX\YYYYYYY_Characterization\Soil Measurements\Soil Data Analysis (where XX = domain number and YYYYYYY = site name).

5.3.3 Results and interpretation

5.3.3.1 Soil Temperature

Soil temperature data residuals, after accounting for changes in temperature in the stationary data and any remaining time of day trend, were used for the semivariogram analysis (Figure 51). Exploratory data analysis plots show that there was no distinct patterning of the residuals (Figure 52, left graph) and directional semivariograms do not show anisotropy (Figure 52, center graph). An isotropic empirical semivariogram was produced and a spherical model was fitted using Cressie weights (Figure 52, right graph). The model indicates a distance of effective independence of >80 m for soil temperature.

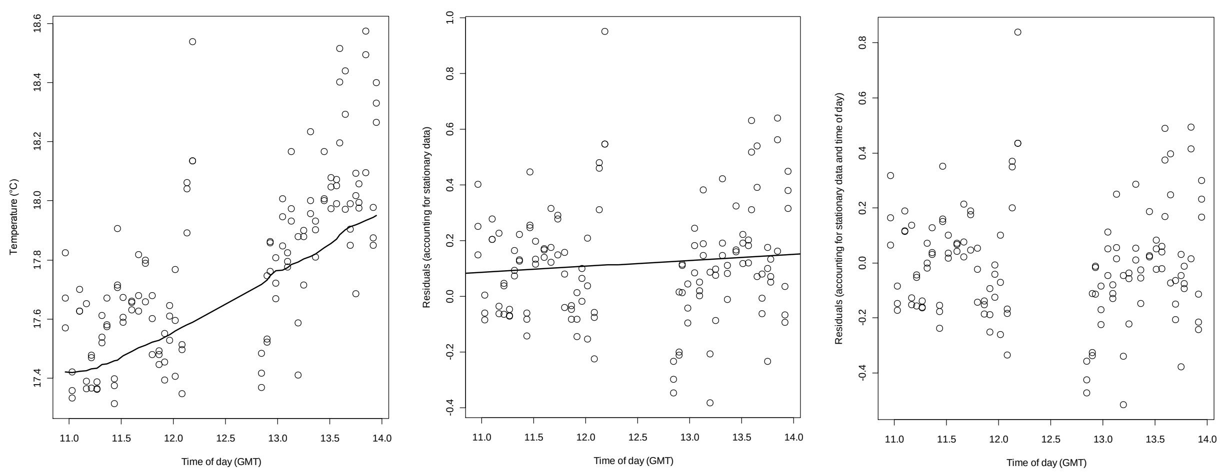


Figure 51. Left graph: mobile (circles) and stationary (line) soil temperature data. Center graph: temperature data after correcting for changes in temperature in the stationary data (circles) and a linear regression based on time of day (line). Right graph: residual temperature data after correcting for changes temperature in the stationary data and the time of day regression. Data in the right graph were used for the semivariogram analysis.

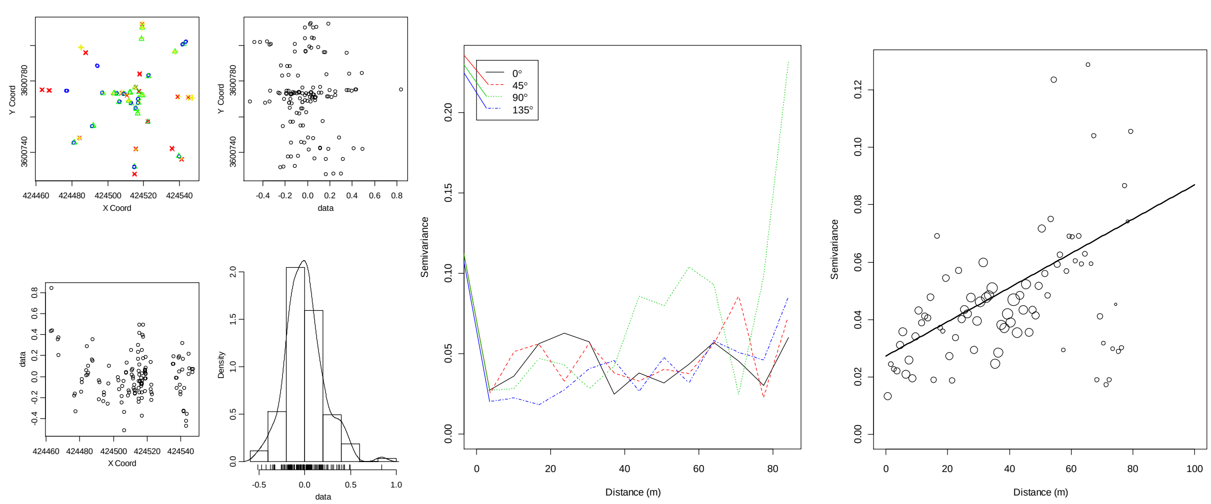


Figure 52. Left graphs: exploratory data analysis plots for residuals of temperature. Center graph: directional semivariograms for residuals of temperature. Right graph: empirical semivariogram (circles) and model (line) fit to residuals of temperature.

5.3.3.2 Soil water content

Soil water content data residuals, after accounting for changes in water content in the stationary data and any remaining time of day trend, were used for the semivariogram analysis (Figure 53). Exploratory data analysis plots show that there was no distinct patterning of the residuals (Figure 54, left graph) and directional semivariograms do not show anisotropy (Figure 54, center graph). An isotropic empirical semivariogram was produced and a spherical model was fitted using Cressie weights (Figure 54, right graph). The model indicates a distance of effective independence of >80 m for soil water content.

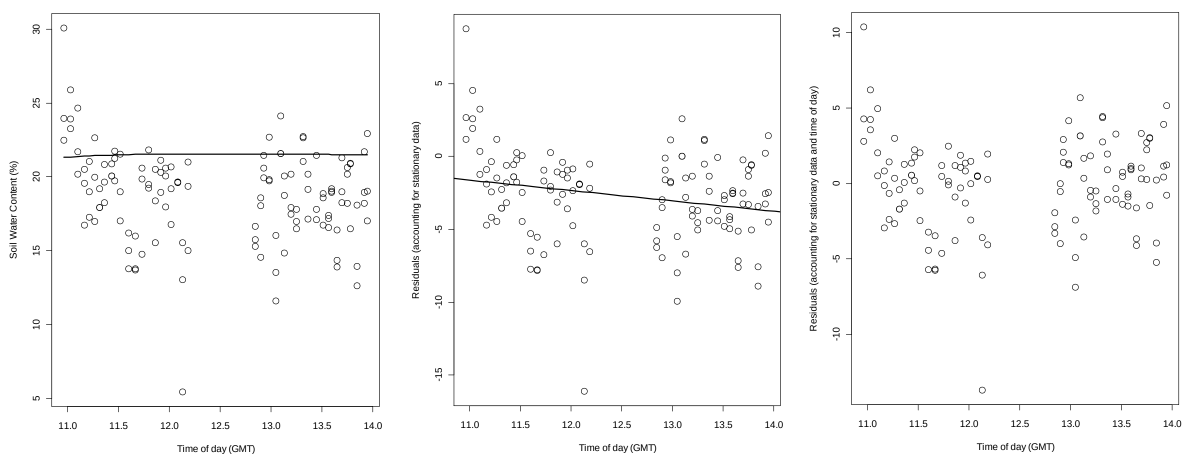


Figure 53. Left graph: mobile (circles) and stationary (line) soil water content data. Center graph: water content data after correcting for changes in water content in the stationary data (circles) and a linear regression based on time of day (line). Right graph: residual water content data after correcting for changes water content in the stationary data and the time of day regression. Data in the right graph were used for the semivariogram analysis.

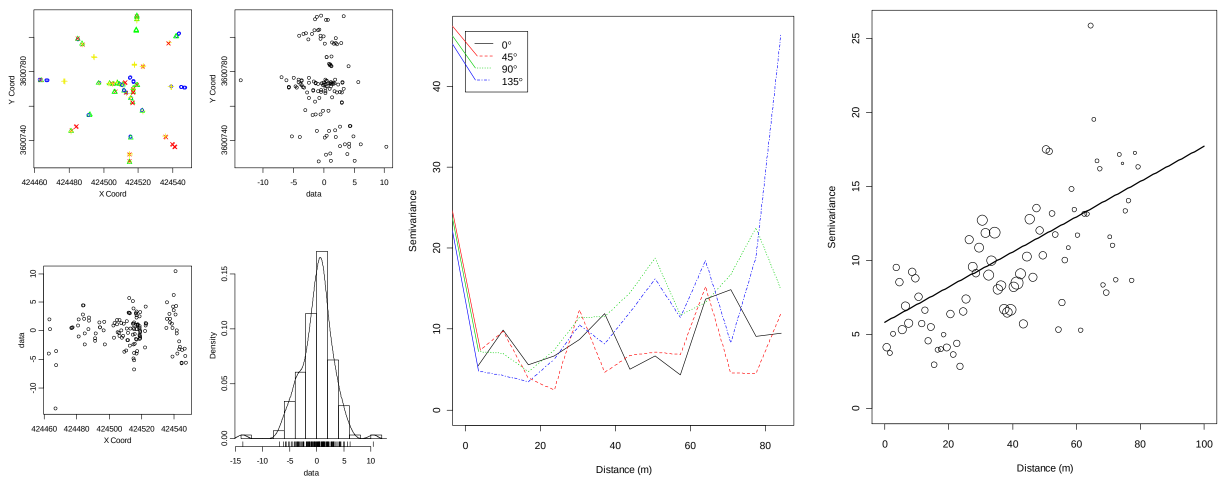


Figure 54. Left graphs: exploratory data analysis plots for residuals of soil water content. Center graph: directional semivariograms for residuals of water content. Right graph: empirical semivariogram (circles) and model (line) fit to residuals of water content.

5.3.3.3 Soil array layout and soil pit location

The minimum distance allowable between soil plots is 25 m to ensure a degree of spatial independence in non-measured soil parameters (i.e., other than temperature and water content) and the maximum distance allowable between soil plots is 40 m due to cost constraints. The estimated distance of effective independence was >80 m for soil temperature and >80 m for soil moisture. Based on these results and the site design guidelines the soil plots at Dead Lake shall be placed 40 m apart. The soil array shall follow the linear soil array design (Soil Array Pattern B) with the soil plots being 5 m x 5 m. The direction of the soil array shall be 240° from the soil plot nearest the tower (i.e., first soil plot). The location of the first soil plot will be approximately 32.541629°, -87.804075°. The exact location of each soil plot may be microsited to avoid placing a soil plot at an unrepresentative location (e.g., rock outcrop, drainage channel, large tree, etc). The FIU soil pit for characterizing soil horizon depths, collecting soil for site-specific sensor calibration, and collecting soil for the FIU soil archive will be located at 32.541010°, -87.803180° (primary location); or 32.54092, -87.80338 (alternate location 1 if primary location is unsuitable); or 32.541118, -87.803801 (alternate location 2 if primary location is unsuitable). A summary of the soil information is shown in Table 18 and site layout can be seen in Figure 55.

Dominant soil series at the site: Leaf-Angie association. The taxonomy of this soil is shown below:
Order: Ultisols
Suborder: Aquults-Udults
Great group: Albaquults-Paleudults
Subgroup: Typic Albaquults-Aquic Paleudults
Family: Fine, mixed, active, thermic Typic Albaquults-Fine, mixed, semiactive, thermic Aquic Paleudults
Series: Leaf-Angie association

Table 18. Summary of soil array and soil pit information at Dead Lake. 0° represents true north and accounts for declination.

Soil plot dimensions	5 m x 5 m
Soil array pattern	B
Distance between soil plots: x	40 m
Distance from tower to closest soil plot: y	20 m
Latitude and longitude of 1st soil plot OR direction from tower	32.541629°, -87.804075°
Direction of soil array	240°
Latitude and longitude of FIU soil pit 1	32.541010°, -87.803180° (primary location)
Latitude and longitude of FIU soil pit 2	32.54092, -87.80338 (alternate 1)
Latitude and longitude of FIU soil pit 3	32.541118, -87.803801 (alternate 2)
Dominant soil type	Leaf-Angie association
Expected soil depth	>2 m
Depth to water table	0.15-0.76 m

Expected depth of soil horizons	**Expected measurement depths***
0-0.23 m (Fine sandy loam)	0.12 m†
0.23-0.41 m (Clay)	0.32 m†
0.41-0.94 m (Clay)	0.68 m†
0.94-1.24 m (Sandy clay loam)	1.09 m
1.24-2.00 m (Sandy loam)	1.62 m
2.00 m	2 m

*Actual soil measurement depths will be determined based on measured soil horizon depths at the NEON FIU soil pit and may differ substantially from those shown here.

†Expected depths for soil CO_2 sensors

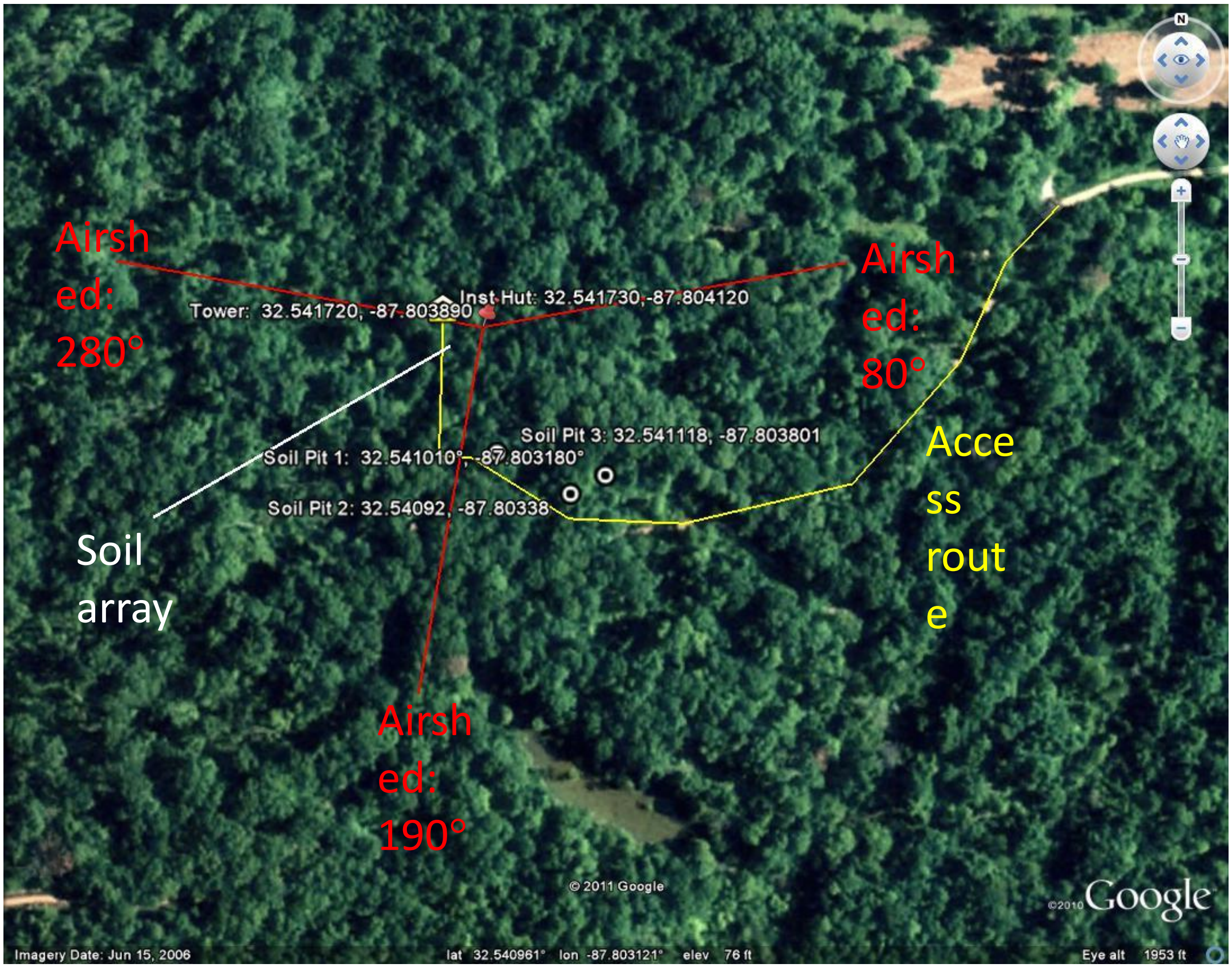


Figure 55. Site layout at Dead Lake showing soil array and location of the FIU soil pit.

5.4 Airshed

5.4.1 Seasonal windroses

Wind roses analytically determine and graphically represent the frequencies of wind direction and wind speed over a given timeseries, Figures 56-59. The weather data used to generate the following wind roses are from MesoWest Station at Demopolis (32.51533, -87.83867), which is ~2.7 miles southwest of NEON Relocatable site at Dead Lake Relocatable site. The orientation of the wind rose follows that of a compass (assume declination applied). When we describe the wind directions it should be noted that they are the cardinal direction that wind blows from. Color bands depict the range of wind speeds. The directions of the rose with the longest spoke show wind directions with the largest frequency. These wind roses are subdivided into as 24 cardinal directions.

5.4.2 Results (graphs for wind roses)

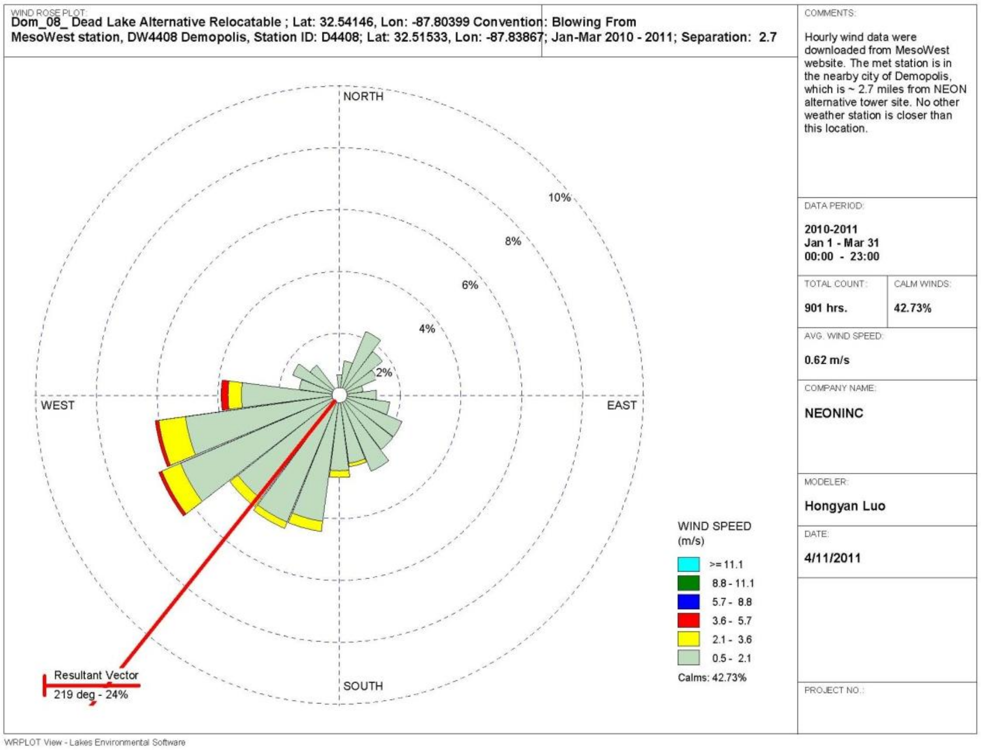


Figure 56. Windroses of January – March for D08 Dead Lake Relocatable site.

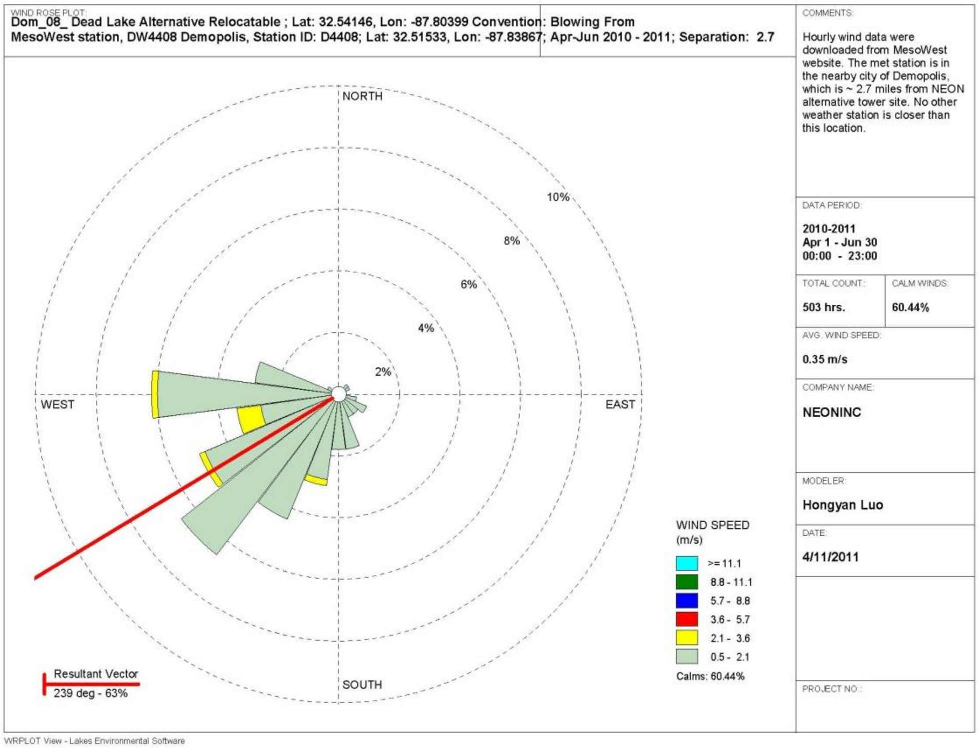


Figure 57. Windroses of April – June for D08 Dead Lake Relocatable site.

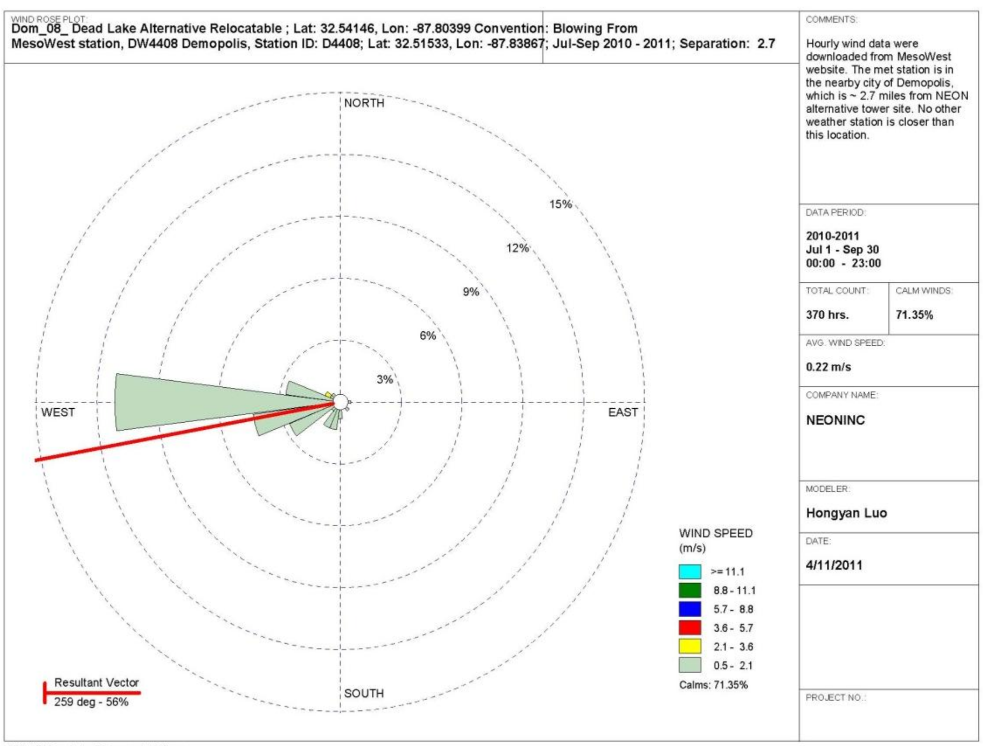


Figure 58. Windroses of July – September for D08 Dead Lake Relocatable site.

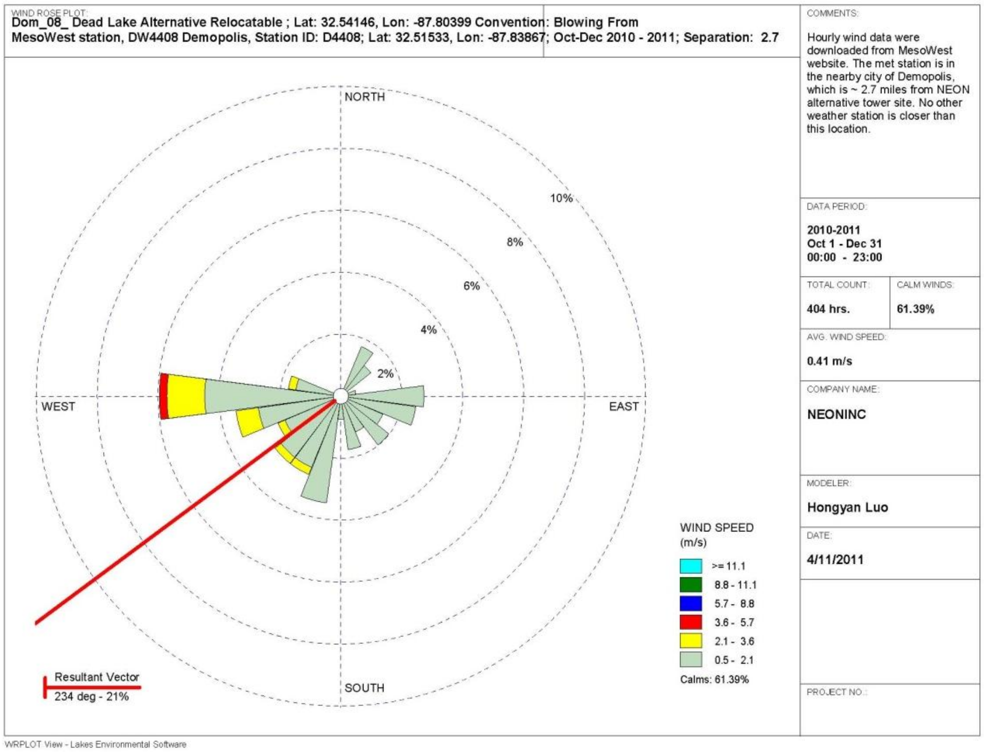


Figure 59. Windroses of October – December for D08 Dead Lake Relocatable site.

5.4.3 Resultant vectors

Table 19. The resultant wind vectors from D08 Dead Lake Relocatable site

Quarterly (seasonal) timeperiod	Resultant vector	% duration
January to March	219°	24
April to June	239°	63
July to September	259°	56
October to December	234°	21
Annual mean	237.75°	na.

5.4.4 Expected environmental controls on source area

Two types of models were commonly used to determine the shape and extent of the source area under different and contrasting atmospheric stability classes. An inverted plume dispersion model with modeled cross wind solutions were used for convective conditions (Horst and Weil 1994). For strongly stable conditions, and Lagrangian solution was used (Kormann and Meixner 2001). The source area models where bounded by the expected conditions depict the extreme conditions. Convective conditions typically have strong vertical mixing between the ecosystem and atmosphere (surface layer). Stable conditions typically have long source area and associated waveforms. Convective turbulence is often characterized by short mixing scales (scalar) and moderate daytime wind speeds, *e.g.,* 1-4 m s^{-2}. Higher wind speeds, like those experienced over the Rockies, are often the product of mechanical turbulence with long waveforms. Because thermal stratification is very efficient in suppressing vertical mixing, stable conditions also have typically very long waveforms.

As a general rule, shorter and less structurally complex ecosystems have good vertical mixing during all atmospheric stabilities. Taller and more structurally complex ecosystems have well mixed upper canopies during the daytime, and can be decoupled below the canopy under neutral and stable conditions (e.g., Harvard Forest, Bartlett Experimental Forest, and Burlington Conservation Area). The type of turbulence (mechanical verse convective) and the physical attributes of the ecosystem control the degree of mixing, and the length and size of the source area.

Here, we use a web-based footprint model to determine the footprint area under various conditions (model info: http://www.geos.ed.ac.uk/abs/research/micromet/EdiTools/). Winds used to run the model and generate following model results are extracted from the wind roses. Vegetation information, temperature and energy information were either from the RFI document, previous site visit report, available data files or best estimated from experienced expert. Measurement height was determined from the Tower Height Info document provided by ENG group, then verify according to the real ecosystem structure after FIU site characterization at site. Runs 1-3 and 4-6 represent the expected conditions for summer and winter conditions, respectively, with maximum and mean windspeeds (daytime convective) and nighttime (stable atmospheres) conditions. The wind vector for each run was estimated from wind roses and is placed as a centerline in the site map included in the graphics. The width of the footprint was also estimated using the length between the isopleth of 80% cumulative flux and center line to calculate the angle from centerline. This information, along with distance of the cumulative flux isopleths and wind direction, will define the source area for the flux measurements on the top of the tower.

Table 20. Expected environmental controls to parameterize the source area model, and associated results from D08 Dead Lake Relocatable tower site.

Parameters	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**	**Run 6**	
Approximate season	summer			winter			Units
	Day (max WS)	Day (mean WS)	Night	Day (max WS)	Day (mean WS)	night	qualitative
Atmospheric stability	Convective	convective	Stable	Convective	convective	Stable	qualitative
Measurement height	42	42	42	42	42	42	m
Canopy Height	30	30	30	30	30	30	m
Canopy area density	4.5	4.5	4.5	2.5	2.5	2.5	m
Boundary layer depth	3000	3000	1300	1500	1500	1300	m
Expected sensible heat flux	450	450	125	175	175	60	$W\ m^{-2}$
Air Temperature	30	30	25	15	15	10	°C
Max. windspeed	2.5	1.0	0.2	5.7	2.0	1.0	$m\ s^{-1}$
Resultant wind vector	270	270	270	220	220	220	degrees
Results							
(z-d)/L	-0.37	-1.4	-3.0	-0.05	-0.36	-0.32	m
d	25	25	25	25	25	25	m

Sigma v	2.3	2.1	0.99	2.1	1.5	1	$m^2 s^{-2}$
Z0	1.1	1.1	1.1	1.1	1.1	1.1	m
u*	0.61	0.39	0.08	0.89	0.45	0.33	$m s^{-1}$
Distance source area begins	0	0	0	0	0	0	m
Distance of 90% cumulative flux	280	200	150	800	280	200	m
Distance of 80% cumulative flux	200	150	100	480	200	150	m
Distance of 70% cumulative flux	150	100	50	300	150	100	m
Peak contribution	35	15	5	75	35	15	m

5.4.5 Footprint model results (source area graphs)

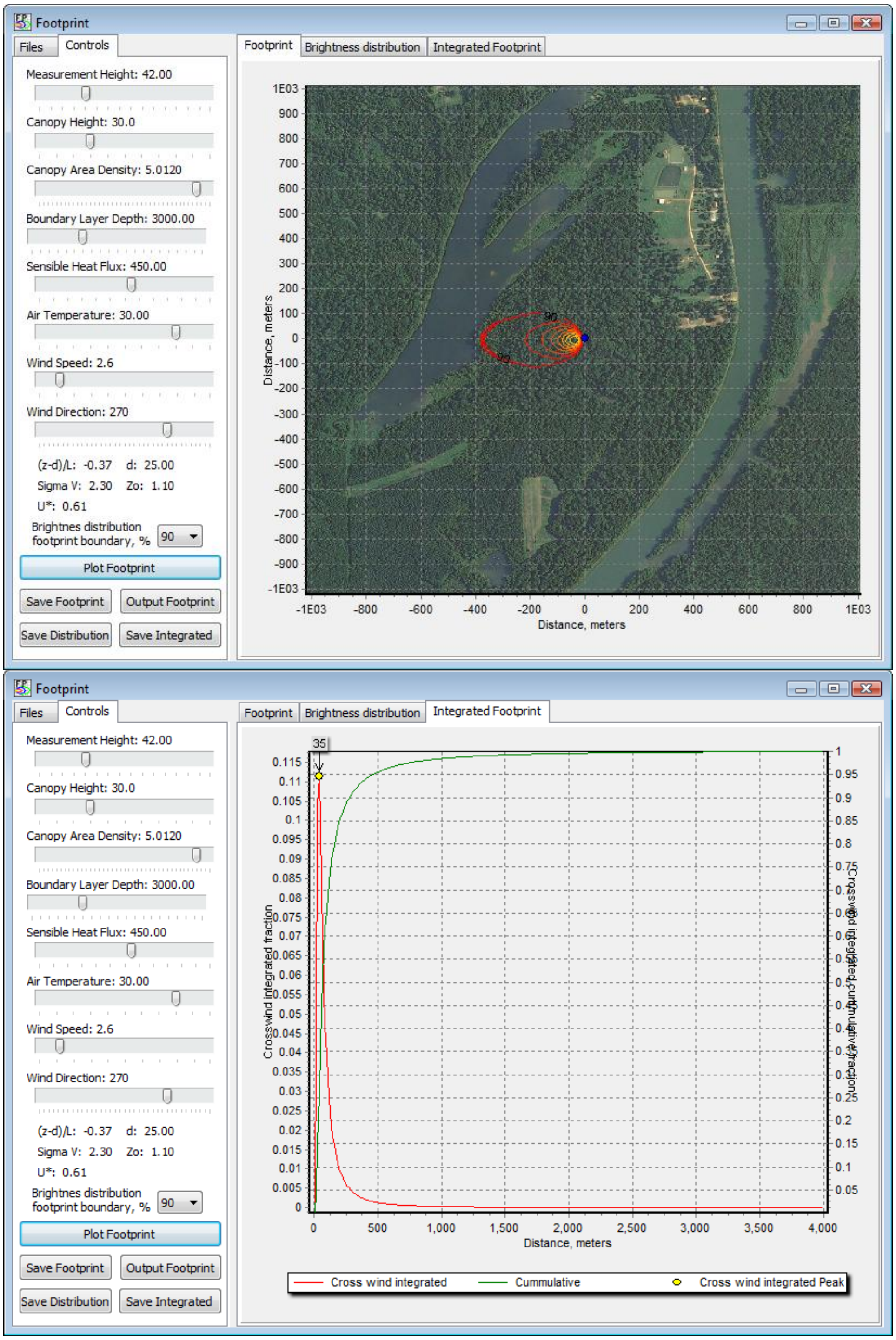


Figure 60. D08 Dead Lake relocatable site summer daytime (convective) footprint output with max wind speed.

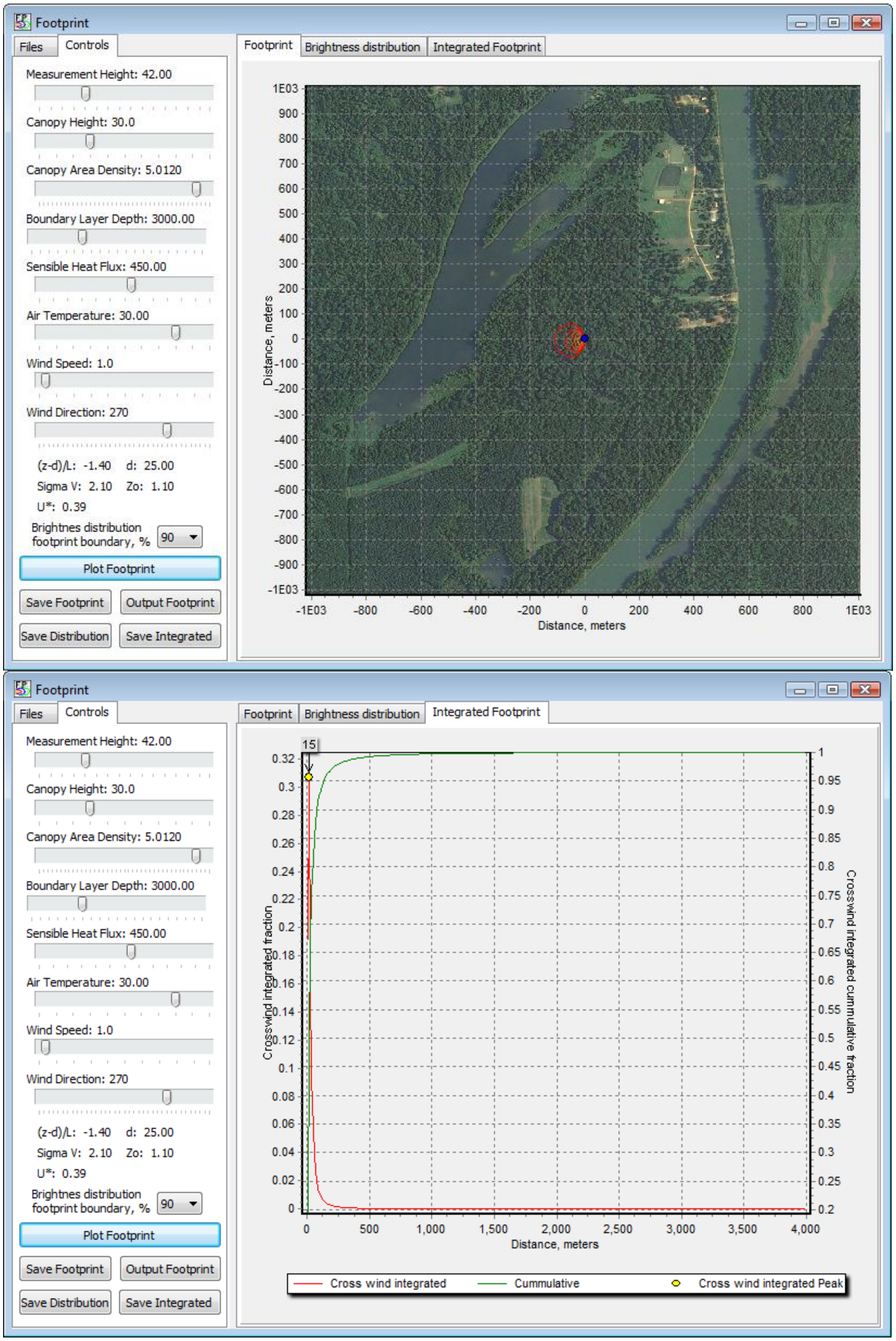


Figure 61. D08 Dead Lake relocatable site summer daytime (convective) footprint output with mean wind speed.

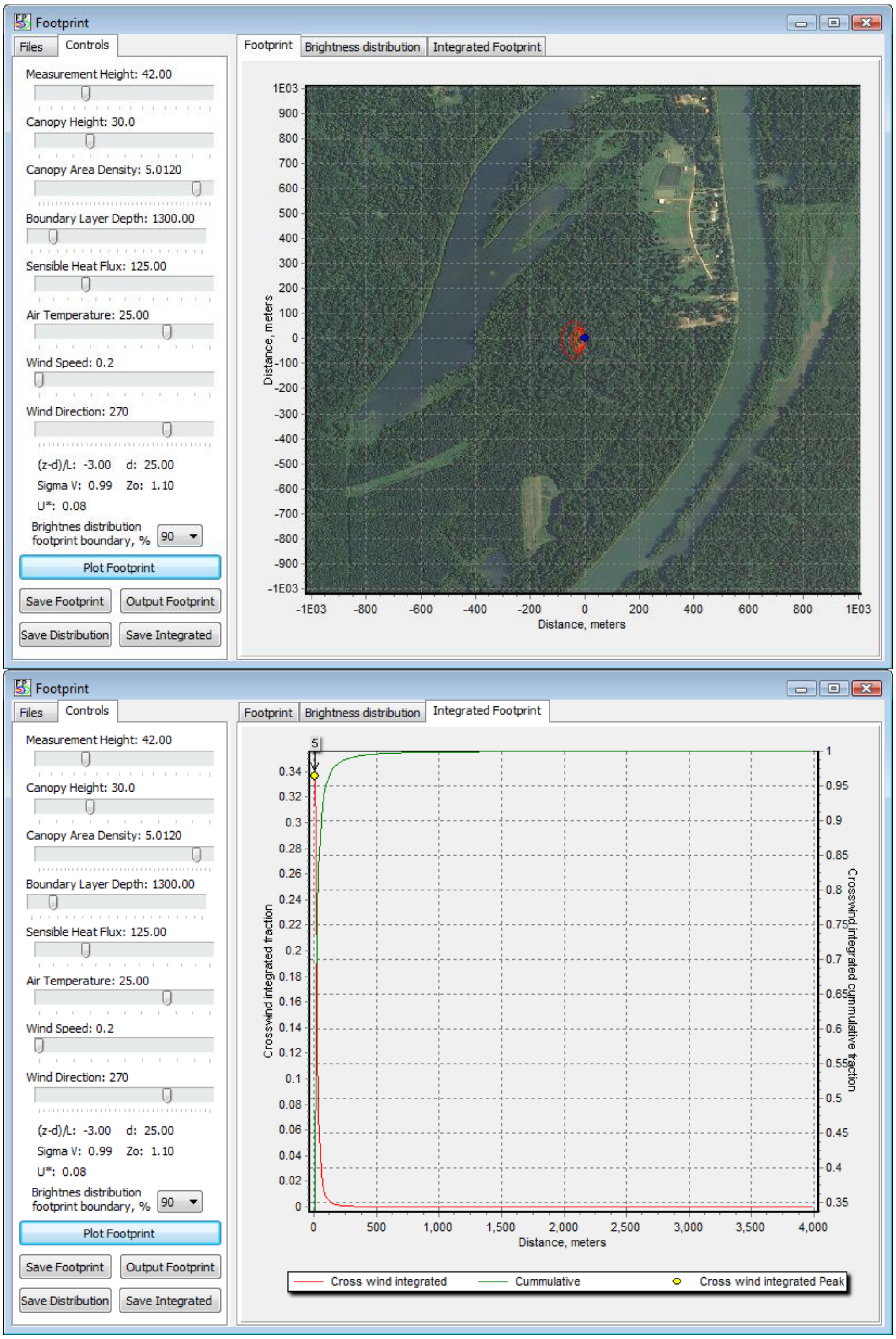


Figure 62. D08 Dead Lake relocatable site summer nighttime (stable) footprint output with mean wind speed.

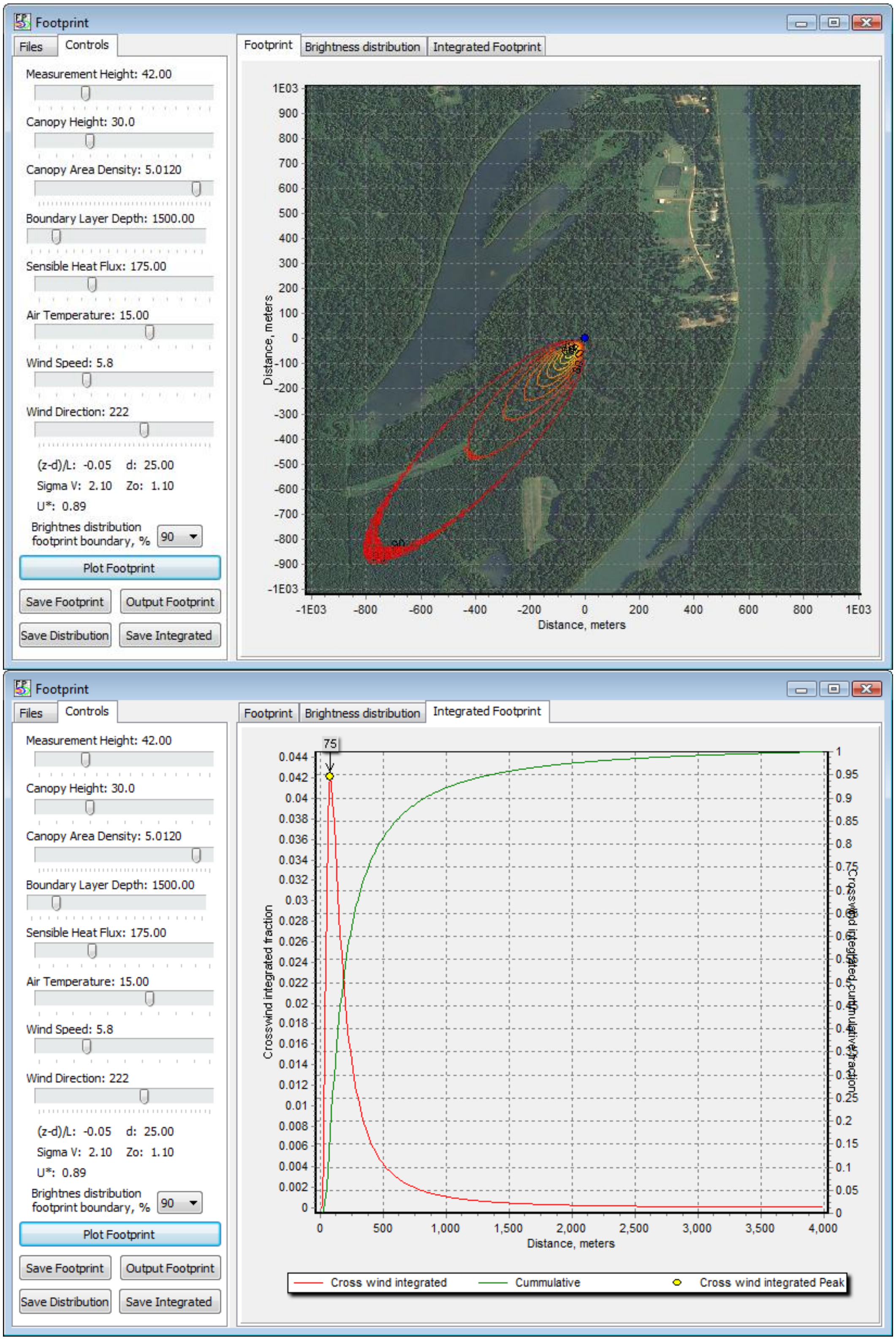


Figure 63. D08 Dead Lake relocatable site winter daytime (convective) footprint output with max wind speed.

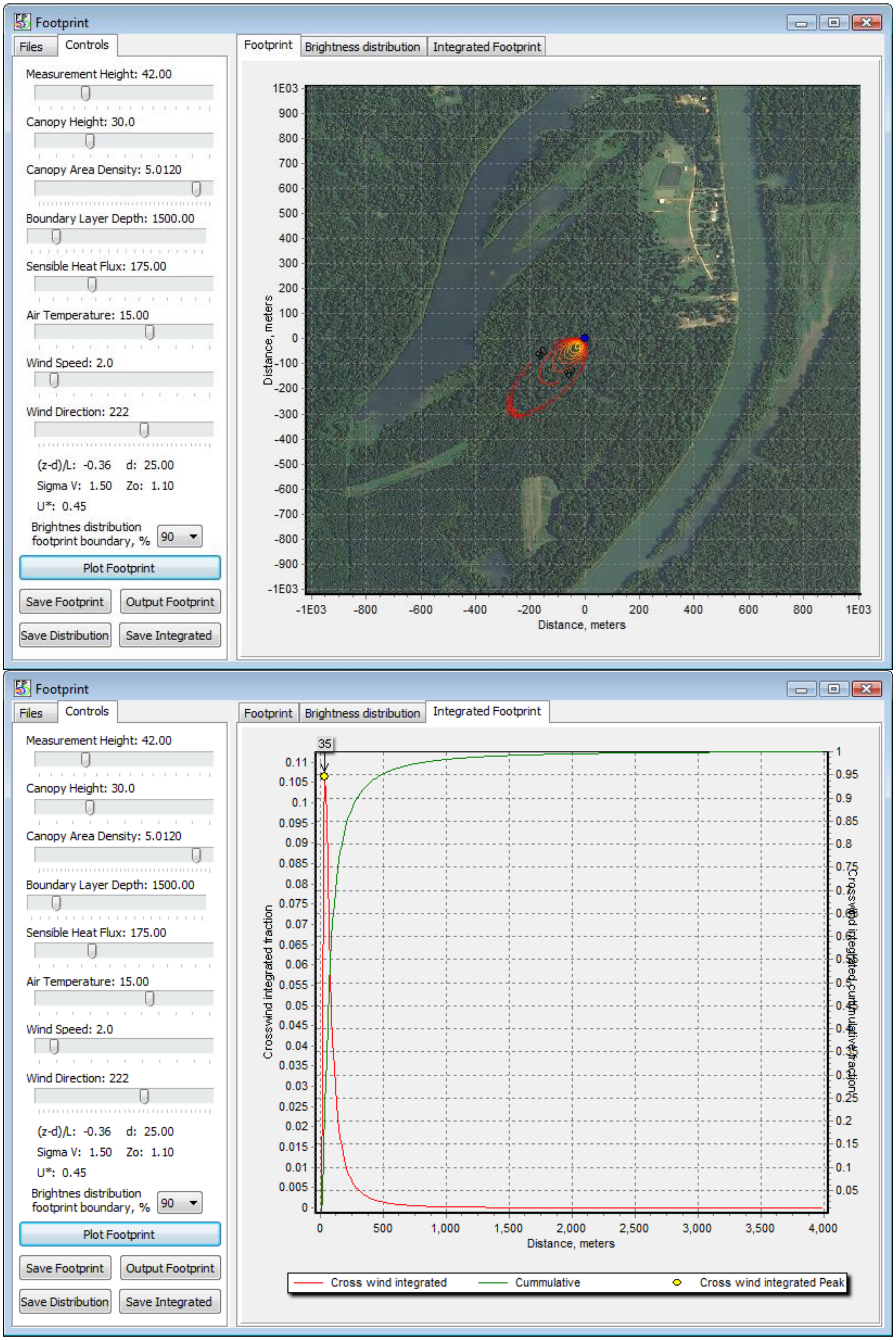


Figure 64. D08 Dead Lake relocatable site winter daytime (convective) footprint output with mean wind speed.

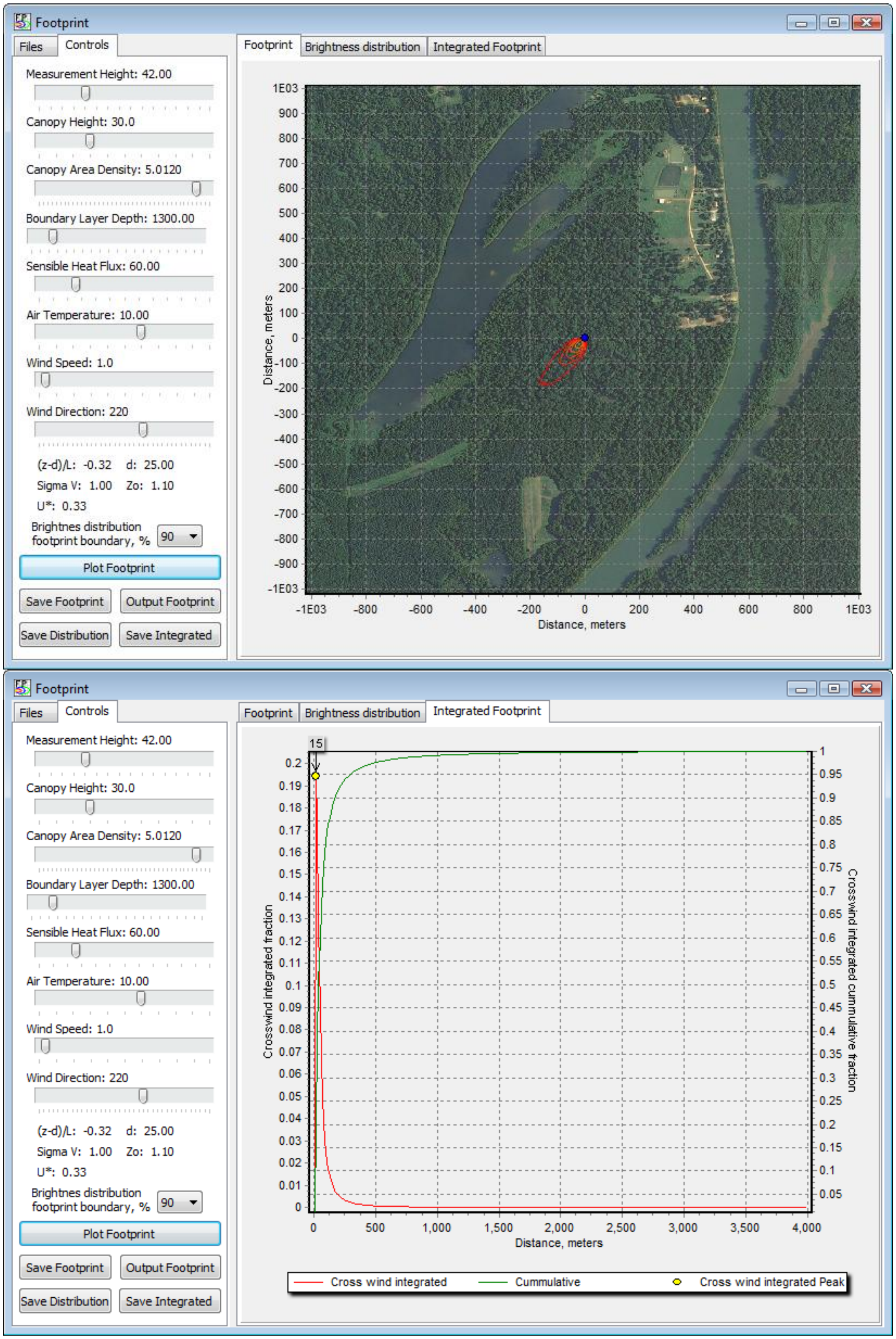


Figure 65. D08 Dead Lake relocatable site winter nighttime (stable) footprint output with mean wind speed.

5.5 Site design and tower attributes

According to windroses, the prevailing wind direction blows from west and southwest throughout the whole year (190° to 280° clockwise from 190° (major airshed), and 80° to 190° clockwise from 80° (secondary airshed)). Tower should be placed to a location to best catch the signals from these airshed of the ecosystem in interest. We determined **tower location** for the alternative site to be at 32.54172, -87.80389.

Eddy covariance, sonic wind and air temperature **boom arms** orientation toward the SSW will be best to capture signals from all major wind directions. **Radiation boom arms** should always be facing south to avoid any shadowing effects from the tower structure. An **instrument hut** should be outside the prevailing wind airshed to avoid disturbance in the measurements of wind and should be positioned to have the longer side parallel to frequent wind direction to minimize the wind effects on instrument huts and to minimize the disturbances of wind regime by instrument hut, and in this case, instrument hut should be positioned on the west side of tower and have the longer side parallel to SW-NE direction. Therefore, we require the placement of instrument hut at 32.541730,-87.804120.

Canopy is closed and very diverse, and has multiple layers. The mean canopy height is 30 m. Top understory is 19-20 m in height, and lower understory is 4-5 m. Understory at forest floor is ~ 0.5 m in height. We require 6 **measurement layers** on the tower with top measurement height at 45 m, and rest layers are 42 m, 33 m, 28 m, 19 m, 5 m and 0.3 m, respectively, to best characterize the fluxes on the tower top and environmental conditions in profile through forest.

Secondary **precipitation collector** for bulk precipitation collection will be located the top of tower at this site. **Wet deposition collector** will be collocated on the top of tower. See AD 04 for further information and requirements for bulk precipitation collection and wet deposition collection.

The site layout is summarized in the table below. Assume the projected area of the tower is square. **Anemometer/temperature boom arm direction** is ***from*** the tower ***toward*** the prevailing wind direction or designated orientation. . The side of the tower with the anemometer boom is perpendicular to the boom direction. **Instrument hut orientation vector** is parallel to the long side of the instrument hut. **Instrument hut distance z** is the distance from the center of tower projection to the center of the instrument hut projection on the ground. The numbering of the **measurement levels** is that the lowest is level one, and each subsequent increase in height is numbered sequentially.

Table 21. Site design and tower attributes for the Dead Lake alternative Relocatable tower site.

0° is true north with declination accounted for. Color of Instrument hut exterior shall be tan to best match the surrounding environment.

Attribute	lat	long	degree	meters	notes
Airshed area			190° to 280° (major), 80° to 190° (secondary)		Clockwise from first angle

Tower location	32.54172,	-87.80389	--	--	new site
Instrument hut	32.541730,	-87.804120			
Instrument hut orientation vector	--	--	235° - 55°		longwise
Instrument hut distance z	--	--	--	22	
Anemometer/Temperature boom orientation	--	--	190°	--	
Height of the measurement levels					
Level 1				0.3	m.a.g.l.
Level 2				5.0	m.a.g.l.
Level 3				19.0	m.a.g.l.
Level 4				28.0	m.a.g.l.
Level 5				33.0	m.a.g.l.
Level 6				42.0	m.a.g.l.
Tower Height				42.0	m.a.g.l.

See AD 03 for technical requirement to determine the boom height for the bottom most measurement level.

Figure 66. below shows the proposed tower location, instrument hut location, airshed area and access road.

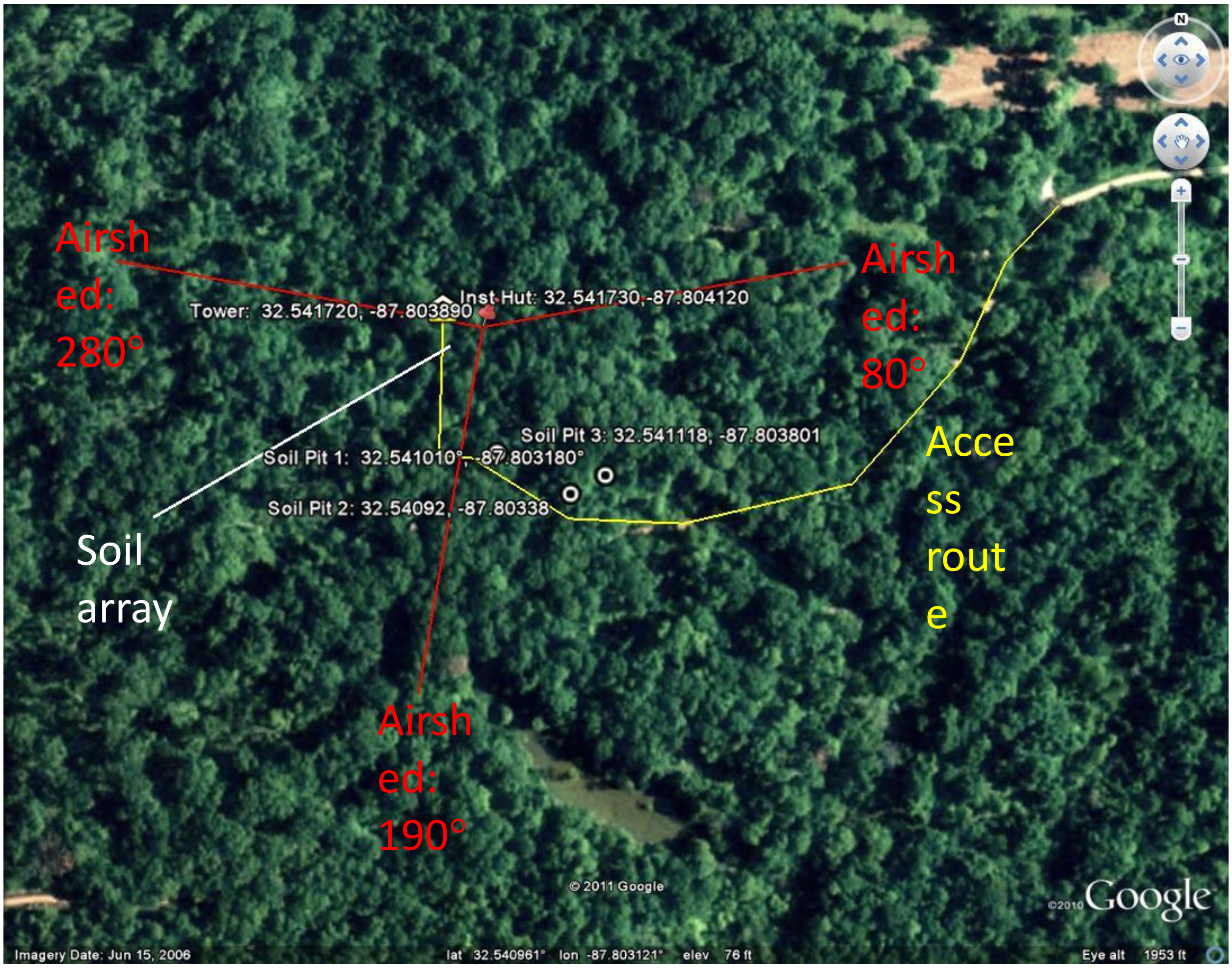


Figure 66. Site layout for D08 Dead Lake alternative Relocatable site

i) new tower location is presented (Red pin), ii) red lines indicate the airshed boundaries. Vectors 190° and 280° (starting clockwise from 190°, major airshed) and vectors 80° and 190° (starting clockwise from 80°, secondary airshed) are the airshed areas that would have quality wind data without causing flow distortions, respectively. iii) Yellow line is the suggested access route to instrument hut.

Boardwalks. Ultimately, the decision to use a boardwalk will be, in part, based on owner's preferences. There are strong science requirements that minimize site disturbance to the surrounding area, which will be difficult to manage over a 30-y period. Traffic control is key to minimizing the site disturbance. Confining foot traffic to boardwalks minimizes site impact; this is particularly true in places where wear caused by foot traffic becomes noticeable and grows. For example, in places with snow part of the year, worn footpaths tend to have low places that collect water, or places where the snow pack becomes uneven causing personnel to walk farther and farther around the sides of the original path, causing the path to grow in width. This is a very common phenomenon. Here FIU assumes that all conduits will be either buried, or placed inside the boardwalk such that it does not extend beyond the 36' wide footprint. While the final design is not yet known, there are some general criteria that can be outlined. We assume that the boardwalk width is 36" (0.914 m). Material is not known, but must be fire proof, and in some locations the site is seasonally flooded and inundated with water. Boardwalks may also provide a scratching structure for grazing animals that in turn, would wear and unduly impact the site. Site by site evaluations must be done.

- There is always a boardwalk from the instrument hut to the tower
- If there is a boardwalk on the south side of the tower, it is never underneath the radiation booms, and it is more than 4 m from the side of the tower
- There is never a boardwalk within 4 m of the tower, except where it perpendicularly intersects the tower for access
- The boardwalk to access the tower is not on any side that has a boom.
- There is never boardwalk within 10 m of a soil plot, except where it perpendicularly intersects a soil plot for access.

Specific Boardwalks at Dead Lake alternative Relocatable site:

- Boardwalk is from the access point to instrument hut, pending landowner decision, and ease to bring supplies to instrument hut)
- Boardwalk from the instrument hut to the tower to intersect on north face of the tower,
- Boardwalk to the soil array from access road
- Boardwalk from the soil array boardwalk to the individual soil plots due to the very muddy conditions and periodic flooding that often occur at this site.

The relative locations between tower, instrument hut and boardwalk can be found in the diagram below:

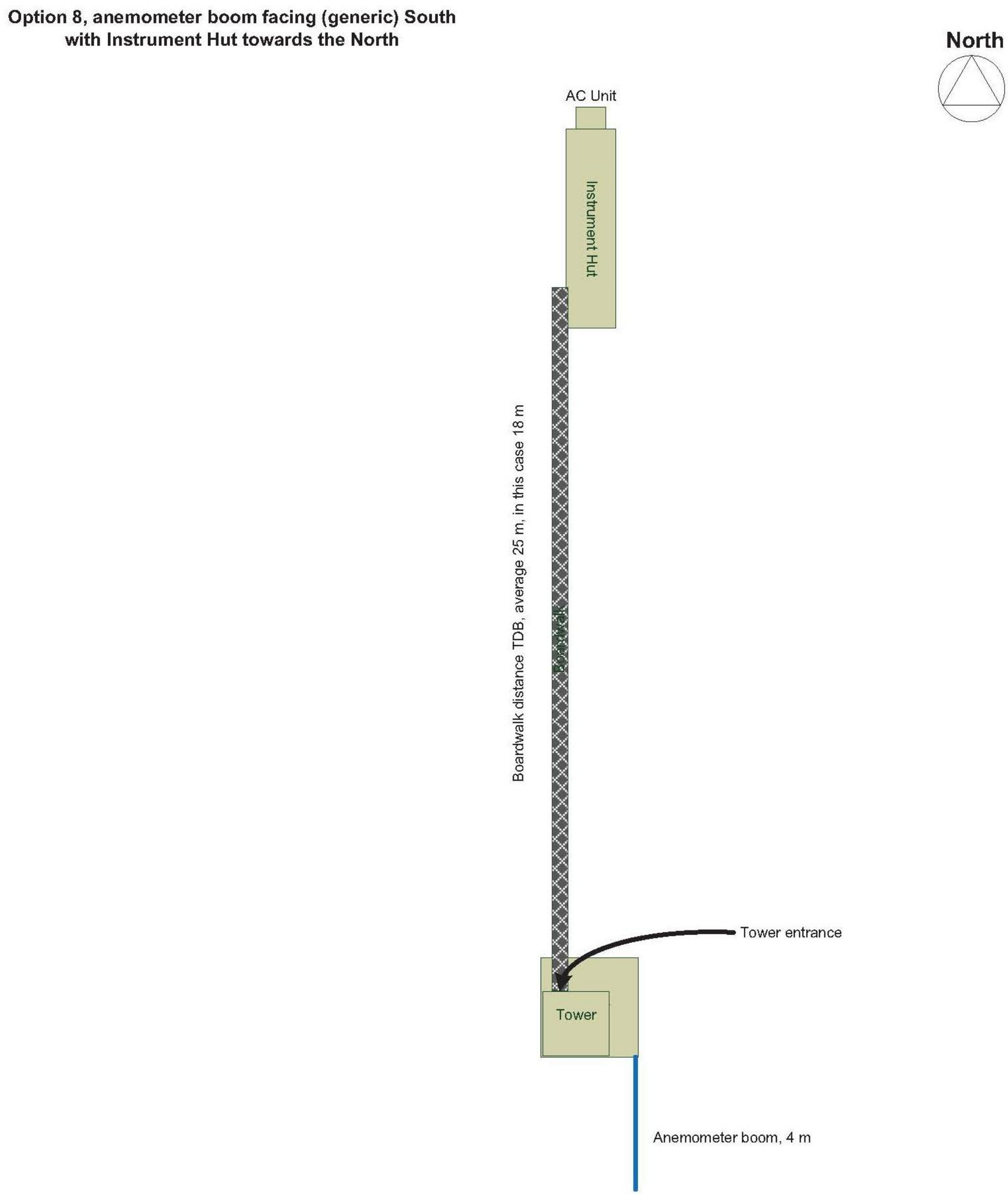


Figure 67. Generic diagram to demonstration the relationship between tower and instrument hut when boom facing south and instrument hut on the north towards the tower.

This is just a generic diagram when boom facing south. The actual design of boardwalk (or path if no boardwalk required) and instrument hut position will be joint responsibility of FCC and FIU. At Dead Lake

Relocatable site, the boom angle will be 190 degrees, instrument hut will be on the west towards the tower, the distance between instrument hut and tower is ~22 m. The instrument hut vector will be SW-NE (235°-55°, longwise).

5.6 Information for ecosystem productivity plots

The tower at Dead Lake alternative relocatable site has been positioned to optimize the collection of the air/wind signals both temporally and spatially over the desired ecosystem (hardwood deciduous forest). Airshed at this site is from 190° to 280° (starting clockwise from 190°, major air shed) and from 80° to 190° (starting clockwise from 80°, secondary airshed), and 90% signals for flux measurements are within a distance of 300 m from tower, and 80% within 200 m, except for the winter under max wind speed, 90% signals are within 800 m from tower and 80% signals are within 480 m. We suggest FSU Ecosystem Productivity plots be placed within the boundaries of 190° to 280° (starting clockwise from 190°) from tower.

5.7 Issues and attentions

This site is periodically and seasonally flooded site. Elevation of instrument hut may be required.

6 APPENDIX A. CONCEPTUAL DESIGN LAYOUT OF SOIL ARRAY PATTERNS.

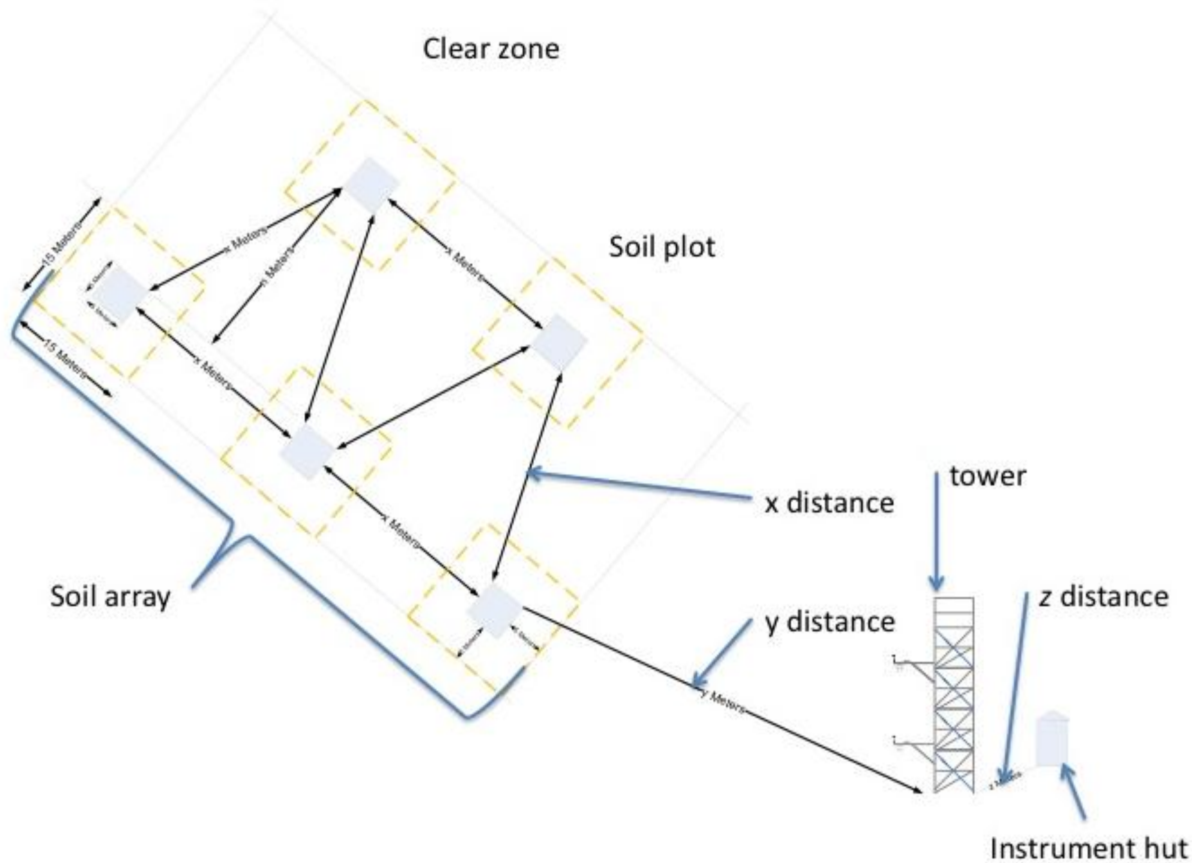


Figure A1. Conceptual diagram of Soil Array Pattern A
Outlines the orientation for the soil array and instrument hut from the center point of the tower. The x, y, z distances are i) the distance between soil plots, ii) distance between the tower centerpoint and the closest edge of soil plot, and iii) the distance between the tower centerpoint and the closest edge of the instrument hut, respectively. The yellow outline around each soil plot is the 5 m perimeter keep out zone.

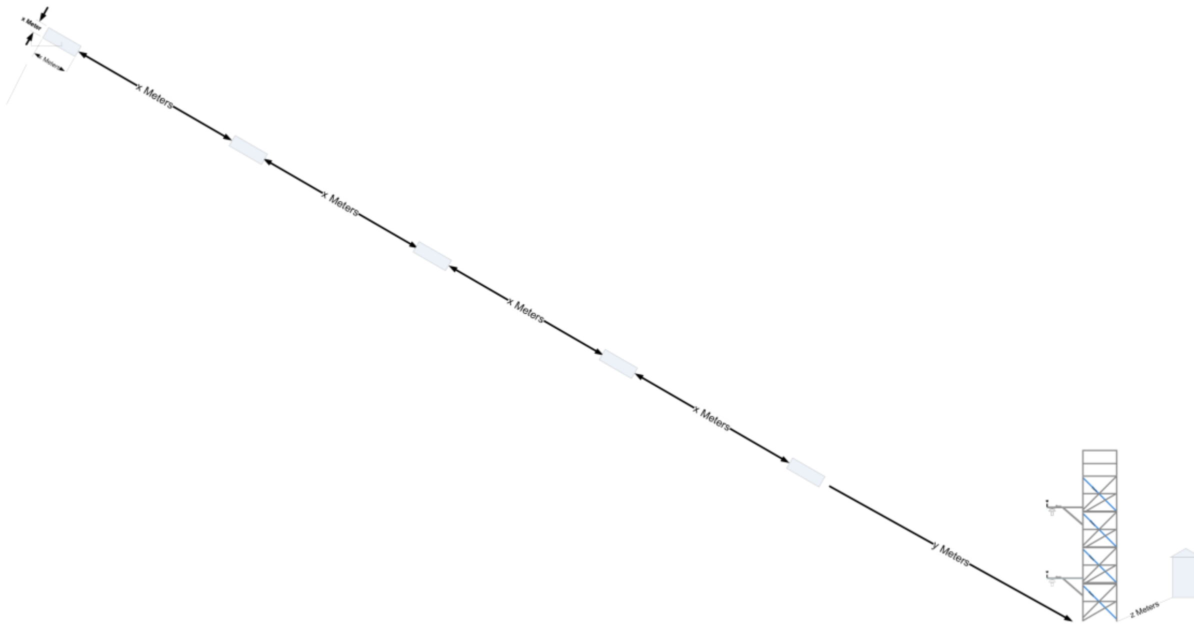


Figure A2. Conceptual diagram of Soil Array Pattern B
Outlines the orientation for the soil array and instrument hut from the center point of the tower. The x, y, z distances are i) the distance between soil plots, ii) distance between the tower centerpoint and the closest edge of soil plot, and iii) the distance between the tower centerpoint and the closest edge of the instrument hut, respectively. The yellow outline around each soil plot is the 5 m perimeter keep out zone.

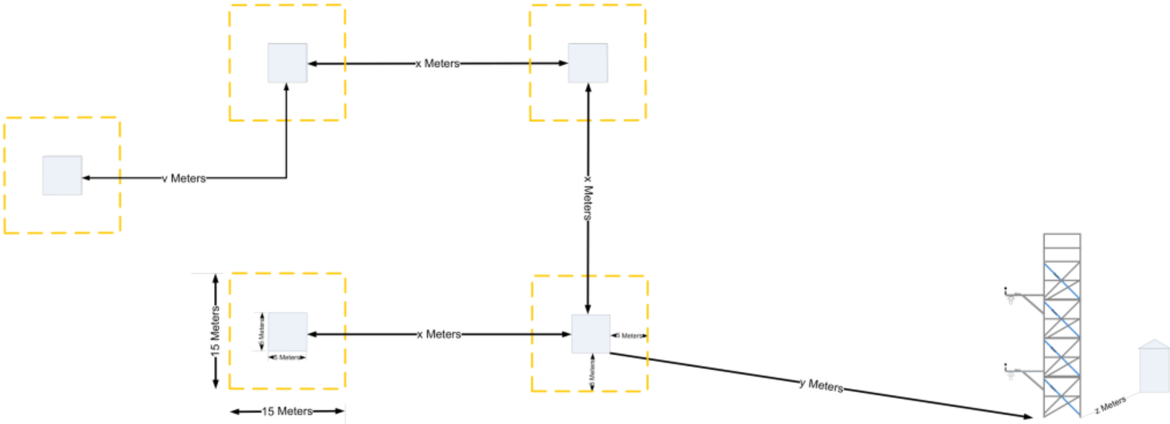
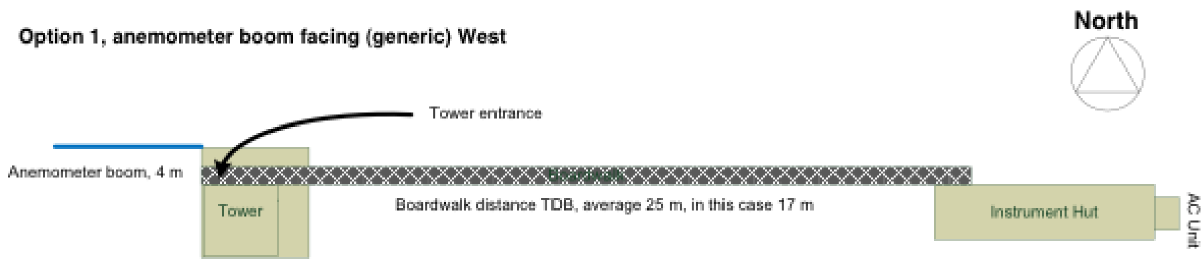
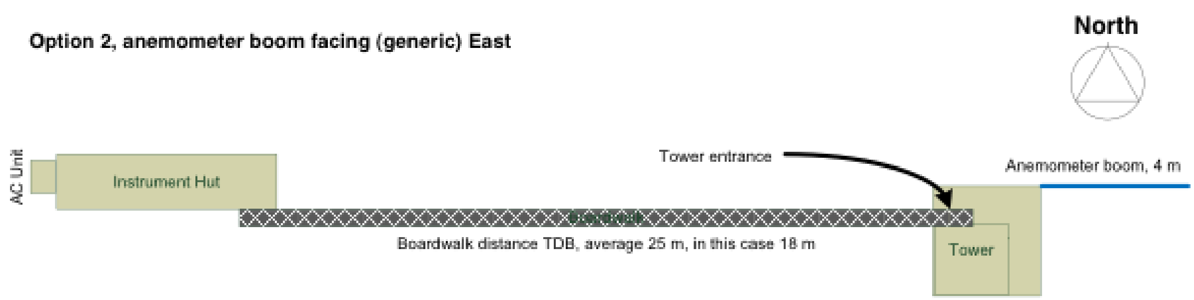


Figure A3. Conceptual diagram of Soil Array Pattern C
Outlines the orientation for the soil array and instrument hut from the center point of the tower. The x, y, z distances are i) the distance between soil plots, ii) distance between the tower centerpoint and the closest edge of soil plot, and iii) the distance between the tower centerpoint and the closest edge of the instrument hut, respectively. The yellow outline around each soil plot is the 5 m perimeter keep out zone.

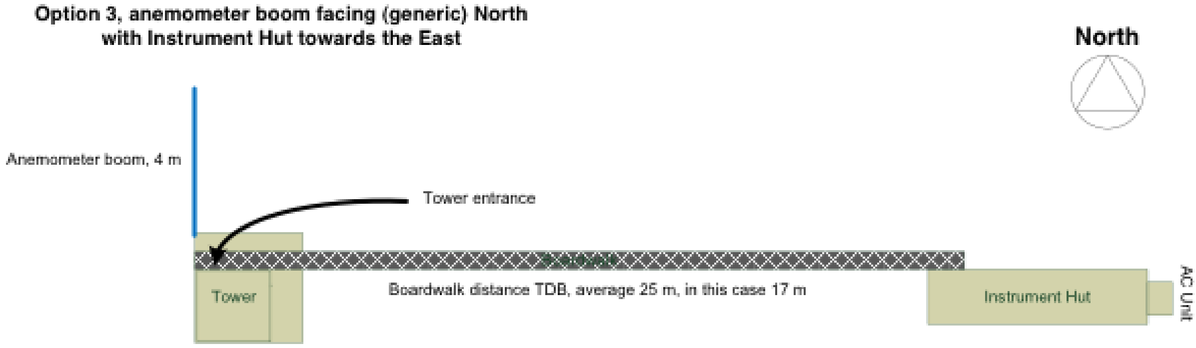
Option 1, anemometer boom facing (generic) West



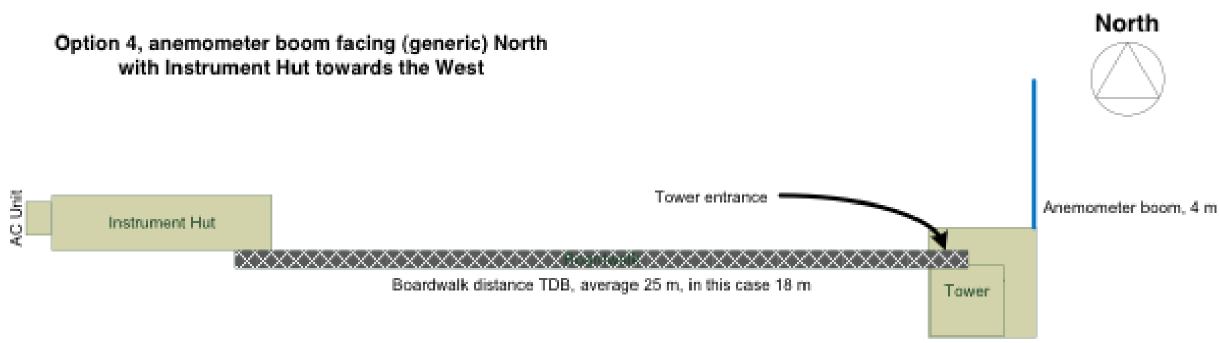
Option 2, anemometer boom facing (generic) East



Option 3, anemometer boom facing (generic) North
with Instrument Hut towards the East



Option 4, anemometer boom facing (generic) North
with Instrument Hut towards the West



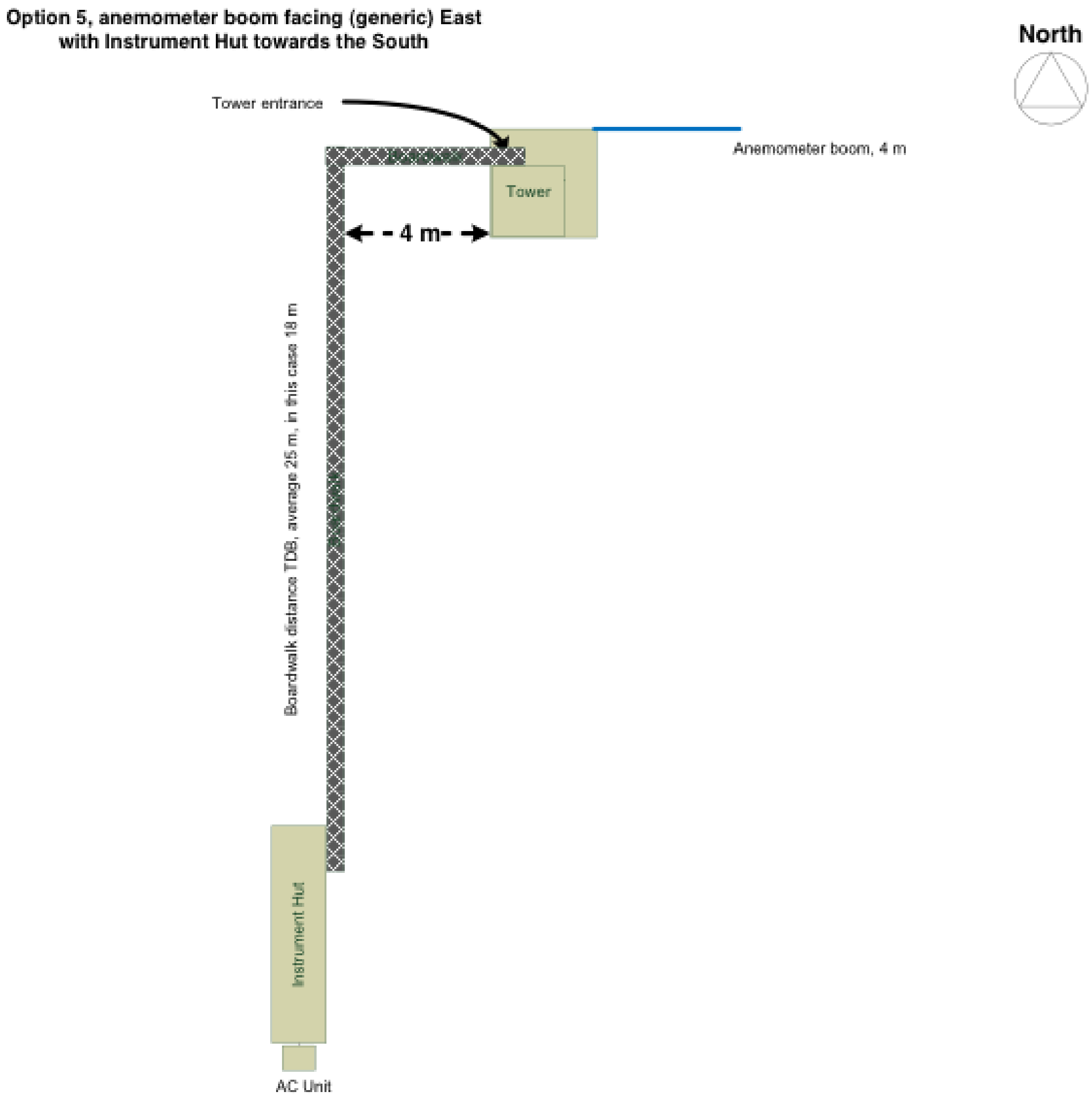


Figure A4. Generic patterns for the boardwalk configuration

These generic configurations are from the instrument hut to the tower based on 5 generic scenarios. The five options are based on anemometer boom orientation and the leeward side of the tower where the instrument hut is located. The tower entrance is always on the North side of the tower. Exact tower and instrument hut location and orientation will be specified at each location and presented in the site characterization document.

7 REFERENCES

Bond-Lamberty B., Brown K.M., Goranson C. & Gower S.T. (2006). Spatial dynamics of soil moisture and temperature in a black spruce boreal chronosequence. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 36, 2794-2802.

Goovaerts P. (1997). Geostatistics for Natural Resource Evaluation. Oxford University Press, Oxford.

Riberiro J.R. & Diggle P.J. (2001). geoR: A package for geostastical analysis. R-NEWS, 1, ISSN 1609-3631.

Trangmar B.B., Yost R.S. & Uehara G. (1986). Application of geostatistics to spatial studies of soil properties. Advances in Agronomy, 45-94.

Webster R. & Oliver M.A. (1989). Optimal interpolation and isarthmic mapping of soil properties: VI Disjuctive kriging and mapping the conditional probability. Journal of Soil Science, 40, 497-512.