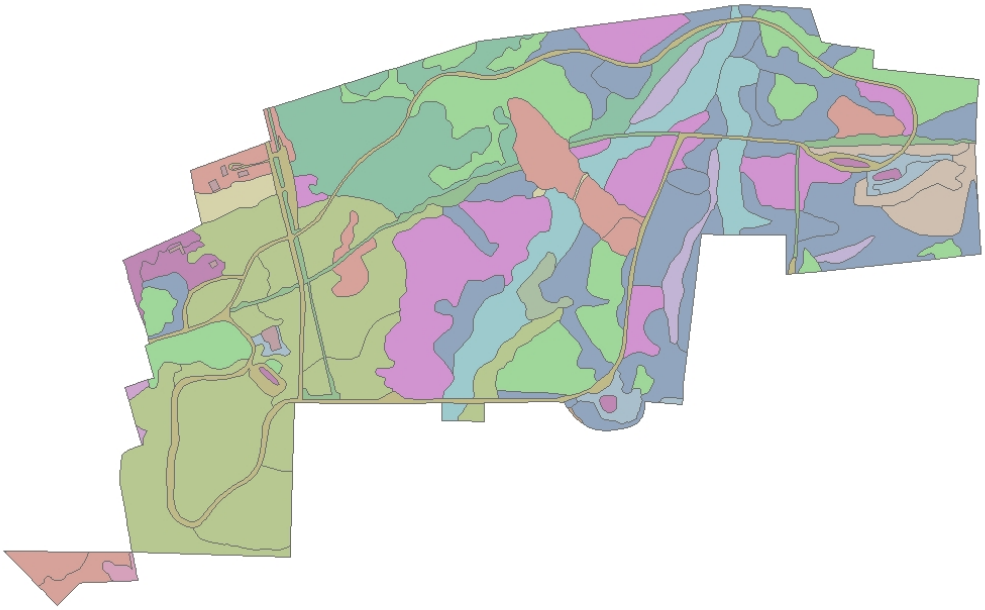
Accuracy Assessment:
Guilford Courthouse National Military Park



Prepared for the National Park Service by NatureServe
Durham, NC
May 2007

NatureServe is a non-profit organization providing the scientific knowledge that forms the basis for effective conservation action.

A NatureServe Technical Report
Prepared for the National Park Service under Cooperative Agreement H 5028 01 0435

Citation: Lyons, Regan. 2007. *Accuracy Assessment: Guilford Courthouse National Military Park*. NatureServe: Durham, North Carolina.

© 2007 NatureServe

NatureServe
6114 Fayetteville Road, Suite 109
Durham, NC 27713
919-484-7857

International Headquarters
1101 Wilson Boulevard, 15th Floor
Arlington, VA 22209
www.natureserve.org

National Park Service
Southeast Regional Office
Atlanta Federal Center
1924 Building
100 Alabama St., S.W.
Atlanta, GA 30303
404-562-3163

The view and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions of policies of the U.S. Government. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Government.

Electronic files have been provided to the National Park Service in addition to hard copies. Current information on all vegetation communities mentioned in this report can be found on NatureServe Explorer at www.natureserve.org/explorer.

Acknowledgements

This report was prepared in cooperation with the Inventory and Monitoring Division of the Cumberland/Piedmont Network, National Park Service, Department of the Interior. Network coordinator Teresa Leibfreid quickly responded and provided support whenever issues arose that needed to be addressed. Shepard McAninch, ecologist and data manager for the Cumberland Piedmont Network, assisted with both protocol development and field work.

Marguerite Madden, Director of the Center for Remote Sensing and Mapping Science (CRMS) at the University of Georgia (UGA), Tommy Jordan, the Associate Director of CRMS, and Phyllis Jackson a photointerpreter/ecologist at CRMS, were actively involved in the vegetation map's creation. We're grateful for their help in providing data and answering the questions that arose in the process of conducting the accuracy assessment.

Numerous individuals assisted with field data collection and analysis as part of an accuracy assessment workshop conducted as Guildford Courthouse. We thank botanist Tom Govus, Shepard McAninch (NPS Cumberland Piedmont Nework), Nora Murdock (NPS Appalachian Highlands Network), Robert Emmott (NPS Appalachian Highlands Network) for their contributions over the course of this workshop.

Introduction

In an effort to catalog and map the biodiversity of the United States, in 1994 the National Park Service (NPS) and the U.S. Geological Survey (USGS) embarked on a collaborative Vegetative Mapping project with the goal of mapping 230+ national park units (ESRI et al. 1994). As part of this national mapping initiative, a digital vegetation map of the Guilford Courthouse National Military Park (GUCO) was created in 2004 by the University of Georgia Center for Remote Sensing and Mapping Science in consultation with NatureServe.

GUCO is located within the city of Greensboro in Guilford County, North Carolina. The 89 hectares (220 acres) on this property all lie within the upper Cape Fear River drainage. The park contains 220 acres (approximately 89 hectares) of land including forest, fields, and riparian areas. Vegetation at GUCO was mapped and classified to the association level using the United States National Vegetation Classification (Grossman et al. 1998), following NPS guidelines. The minimum mapping unit (MMU) was 0.5 hectare. This document contains the results of an accuracy assessment performed on that map.

The accuracy assessment assigns a measure of validity to the map product and allows users to understand the reliability with which the mapped vegetation classes capture conditions on the ground. Knowing the accuracy of the map will enable potential users to determine the suitability of the map for any particular application (ESRI et al. 1994).

It is very important to understand that the accuracy assessment process is not meant to judge the performance of the mapper or the ecologists on the project. Even the best mappers cannot tell the difference remotely between certain species of oaks or pines. It is also important to realize the sources of error include not just “remote sensing error” but also “ecologist error” caused by poor interpretation of the vegetation community concept and “field worker error” caused by mistakes made by fieldworkers while collecting the data (including misreading of the key). However, it is impossible to tease apart which of these errors is causing accuracy issues without more research. The accuracy assessment, therefore, should be used more as a tool to discern usability of map classes rather than a way to judge the performance of the mapmakers.

Methods

The thematic accuracy of the map was assessed by comparing the vegetation type shown on the map to the vegetation type identified on the ground for a representative sample of evaluation points. When vegetation types are mapped and labeled with the correct community types, then the map has high thematic accuracy.

For each map class, both producer’s and user’s accuracy are evaluated. User’s accuracy indicates the probability that a sample point mapped as a given vegetation type will be shown to be of that type on the ground. Producer’s accuracy indicates the probability that a sample point classified as a given vegetation type on the ground will have been assigned to that association on the map. In addition to the user’s and producer’s accuracy, measures of the overall map accuracy are calculated, and contingency tables showing the frequency of confusion (i.e. misclassification) between associations are presented.

Fifty-four points at Guilford Courthouse, representing 12 vegetation types, were evaluated in the the accuracy assessment. A full description of the assessment process, including point selection, field data collection, and data analysis methods, is available in previously publish accuracy assessment reports for the Cumberland Piedmont Network (Lyons and O'Donoghue 2007).

Results

The overall accuracy of the GUCO map at its finest scale is 83%, with a kappa statistic of 0.81 (81%). This number meets the 80% accuracy standard of the NPS. A stricter interpretation of map classes at GUCO, which considers only the dominant mapped vegetation, gives an overall accuracy of 76% with a kappa statistic of 0.72 (72%).

User's and producer's accuracies for both scenarios are provided on Table 1. Overall accuracy of 83% is obtained when an assessment point is considered a match if either the dominant or secondary mapped vegetation type is the same as the vegetation type observed in the field. A contingency table showing misclassification rates by vegetation type for this scenario is presented as Table 2. The contingency table for the stricter scenario, which considers only the dominant mapped vegetation, is provided as Table 3. Confidence intervals for user's and producer's accuracy were not calculated for GUCO because the small number of assessment points per map class inflates the size of the confidence interval and thus limits its usefulness for meaningful interpretation.

Discussion

The vegetation map for Guilford Courthouse provides an accurate representation of vegetation types within the park and meets the NPS 80% accuracy standard.

Those associations with low producer's and user's accuracy, namely blackberry-greenbrier successional shrubland thickets (CEGL004732), sweetgum forests (CEGL007216), and wisteria vine shrublands (CEGL008568) represent a very small area of the park and, for a variety or reasons out of the control of the map makers, present difficulties in the accuracy assessment. The two assessment points within CEGL004732 were identified in the field as belonging to other later successional types, which is likely an artifact of heterogeneity within map polygons for this type and the time that passed between the mapping and accuracy assessment. Sweetgum forest (CEGL007216) is not included in the vegetation key for GUCO and thus was not considered a classification option by the field crew; however, the single assessment point located within the mapped polygon of this type was identified as belonging to a similar successional hardwood forest type. Finally, the wisteria vine shrublands (CEGL008568) were subject to invasive species control measures between the mapping and assessment efforts, and thus vegetation in this area differs from that present at the time of mapping.

References

Environmental Systems Research Institute (ESRI), National Center for Geographic Information and Analysis, and The Nature Conservancy. 1994. NBS/NPS Vegetation Mapping Program: Accuracy Assessment Procedures. Prepared for the United States Department of Interior, National Biological Survey and National Park Service. Washington, D.C.

Grossman, D.H., D. Faber-Langendoen, A.S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: Terrestrial vegetation of the United States. Volume I. The national vegetation classification system: Development, status, and applications. The Nature Conservancy, Arlington, VA.

Lyons, Regan and Brigitte O'Donoghue. 2007. *Accuracy Assessment: Ninety Six National Historic Site*. NatureServe: Durham, North Carolina.

NatureServe. 2004. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of March 29, 2005.

TABLES

Guilford Courthouse National Military Site
Accuracy Assessment

Table 1
Summery of User's and Producer's Accuracy
Guilford Courthouse National Military Park

CEGL	Association Name	Number of Assessment Points	Matching Vegetation (a)		Dominant Vegetation Only	
			User's Accuracy	Producer's Accuracy	User's Accuracy	Producer's Accuracy
2591	Virginia Pine Successional Forest	6	100%	90%	100%	60%
4048	Cultivated Meadow	5	100%	100%	100%	100%
4418	Piedmont Small Stream Sweetgum Forest	5	80%	80%	80%	80%
4732	Blackberry-Greenbrier Successional Shrubland Thicket	2	0%	NA	0%	NA
6327	Shortleaf Pine Early Successional Forest	6	60%	100%	33%	67%
7216	Sweetgum Forest	1	0%	NA	0%	NA
7221	Successional Tuliptree - Hardwood Forest	9	88%	64%	78%	64%
7244	Southern Red Oak - White Oak Forest	5	60%	100%	60%	100%
8462	Successional Loblolly Pine - Sweetgum Forest	2	100%	100%	100%	100%
8465	Acidic Piedmont Mesic Mixed Hardwood Forest	2	100%	100%	100%	100%
8475	Piedmont Dry-Mesic Oak - Hickory Forest	10	100%	77%	100%	77%
8568	Wisteria Vine Shrubland	1	0%	NA	0%	NA

(a) The matching vegetation column considers a point a match if either the mapped dominant or secondary vegetation attribute matches the vegetation type observed in the field.

Table 2
Confusion Matrix Using Mapped Dominant, Secondary, or Tertiary Vegetation (Best Match)
Guilford Courthouse National Military Park

		Observed as:												Grand Total	User's Accuracy
		2591	4048	4418	4732	6327	7216	7221	7244	8462	8465	8475	8568		
Mapped as:	2591	9	0	0	0	0	0	0	0	0	0	0	0	9	100%
	4048	0	5	0	0	0	0	0	0	0	0	0	0	5	100%
	4418	0	0	4	0	0	0	0	0	0	0	1	0	5	80%
	4732	0	0	0	0	0	0	1	0	0	0	0	0	1	0%
	6327	1	0	0	0	3	0	0	0	0	0	1	0	5	60%
	7216	0	0	0	0	0	0	1	0	0	0	0	0	1	0%
	7221	0	0	0	0	0	0	7	0	0	0	1	0	8	88%
	7244	0	0	0	0	0	0	2	3	0	0	0	0	5	60%
	8462	0	0	0	0	0	0	0	0	2	0	0	0	2	100%
	8465	0	0	0	0	0	0	0	0	0	2	0	0	2	100%
	8475	0	0	0	0	0	0	0	0	0	0	10	0	10	100%
	8568	0	0	1	0	0	0	0	0	0	0	0	0	1	0%
Grand Total		10	5	5	0	3	0	11	3	2	2	13	0	54	
Producer's Accuracy:		90%	100%	80%	NA	100%	NA	64%	100%	100%	100%	77%	NA		

Overall Accuracy:	83.3%
Kappa Statistic	80.7%

Table 3
Confusion Matrix Using Mapped Dominant Vegetation Only
Guilford Courthouse National Military Park

		observed as												Grand Total	User's Accuracy:
		2591	4048	4418	4732	6327	7216	7221	7244	8462	8465	8475	8568		
mapped as	2591	6	0	0	0	0	0	0	0	0	0	0	0	6	100%
	4048	0	5	0	0	0	0	0	0	0	0	0	0	5	100%
	4418	0	0	4	0	0	0	0	0	0	0	1	0	5	80%
	4732	1	0	0	0	0	0	1	0	0	0	0	0	2	0%
	6327	3	0	0	0	2	0	0	0	0	0	1	0	6	33%
	7216	0	0	0	0	0	0	1	0	0	0	0	0	1	0%
	7221	0	0	0	0	1	0	7	0	0	0	1	0	9	78%
	7244	0	0	0	0	0	0	2	3	0	0	0	0	5	60%
	8462	0	0	0	0	0	0	0	0	2	0	0	0	2	100%
	8465	0	0	0	0	0	0	0	0	0	2	0	0	2	100%
	8475	0	0	0	0	0	0	0	0	0	0	10	0	10	100%
	8568	0	0	1	0	0	0	0	0	0	0	0	0	1	0%
	Grand Total	10	5	5	0	3	0	11	3	2	2	13	0	54	
Producer's Accuracy:		60%	100%	80%	NA	67%	NA	64%	100%	100%	100%	77%	NA		

Overall Accuracy: 75.9%
Kappa Statistic: 72.3%