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Vegetation Mapping at Chattahoochee River National Recreation Area

Photointerpretation Key and Draft Vegetation Map

Natural Resource Report NPS/SECN/NRR—2014/859



ON THE COVER
Woodland scene in the Bowman's Island Unit of Chattahoochee River National Recreation Area
Photograph by: Marguerite Madden, June 2014

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Natural Resource Report NPS/SECN/NRR—2014/859

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October 2014

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

Jordan, T. R., M. Madden, N. K. O'Hare, D. L. Cotten, and B. P. Adams. 2014. Vegetation mapping at Chattahoochee River National Recreation Area: Photointerpretation key and draft vegetation map.– final report. Natural Resource Report NPS/SECN/NRR—2014/859. National Park Service, Fort Collins, Colorado.

NPS 636/126788, October 2014

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Executive Summary

Through the use of NatureServe vegetation plots, aerial photos, and data collected in the field, vegetation communities were delineated and assigned attributes. Using dominant vegetation classes and secondary vegetation classes as well as modifiers to describe the diversity of species, detailed draft vegetation maps were created for the Chattahoochee River National Recreation Area (CHAT), both inside CHAT and within a 500 meter buffer. The buffer polygons and attributes were created on a broader scale using a system based on the Anderson Level II classification scheme, which includes anthropogenic and land use/land cover (LULC) classes. Within CHAT, the more detailed community element global (CEGL) codes were used.

The buffer size used for this study covered a much larger area than the region found within CHAT. This illustrates the linear nature of the Recreation Area and how much it, including the river, is susceptible to land use land cover changes outside of the boundary. CHAT covers approximately 3,000 hectares (ha) while the buffer contains approximately 10,700 hectares. The majority of land use within the buffer, 57%, is residential.

The products of this project include draft vegetation maps (Appendix 6), a photointerpretation key (Appendix 4), summary statistics of each vegetation class (Table 6 and Table 7), and a detailed geodatabase with digital maps.

Acknowledgments

We would like to thank the CHAT staff for helping us with this project. Staff at the Island Ford Visitor Center kindly provided us with a complimentary annual park pass. Paula Capeche shared her knowledge of the exotic plant removal program in the Recreation Area. Joseph Jarquin, GIS Intern, provided GIS layers of extensive trail networks, access points, and facilities in CHAT.

Introduction

As part of the National Park Service (NPS) Vegetation Inventory Program (Schmoldt, Peterson, and Silsbee 1994; Fancy, Gross, and Carter 2009), the University of Georgia Center for Geospatial Research (CGR) in the Department of Geography was asked to produce draft vegetation maps of eight park units in the NPS Inventory and Monitoring Program Southeast Coast Network (SECN) using mapping standards defined under the National Vegetation Classification System (NVCS) (Jennings et al. 2009). Under Task Agreement # P13AC01319, CGR agreed to analyze existing leaf-on color infrared (CIR) aerial photography to develop photointerpretion keys, accuracy assessment study plans, final digital maps of vegetation, geodatabases and associated metadata in accordance with NPS vegetation mapping standards, and field verification surveys in accordance with standard mapping practices.

The mapping work is divided into two phases according to location, available funding, and NPS priorities. Study areas (with associated parks and time frames) included in the entire mapping effort are:

Phase 1 – Georgia/Alabama (December 2013 to July 2014):

- Horseshoe Bend National Military Park (HOBE), Alabama
- Chattahoochee River National Recreation Area (CHAT), Georgia
- Ocmulgee National Monument (OCMU), Georgia

Phase 2 – Florida (August 2014 to July 2015):

- Canaveral National Seashore (CANA)
- Timucuan Ecological and Historic Preserve / Fort Caroline National Memorial (TIMU / FOCA)
- Castillo de San Marcos National Monument / Fort Matanzas National Monument (CASA / FOMA)

The contract for Phase 1 parks was signed on November 16, 2013. In compliance with the contract, the following tasks have been completed and delivered to Joe DeVivo, Program Manager for the SECN.

1. Draft overstory maps were delivered on September 5, 2014 and final overstory draft vegetation maps in digital ArcGIS geodatabase format are included with this report. This report also includes PDF files of cartographic products depicting color-coded and labeled overstory vegetation, vegetation legend, Universal Transverse Mercator (UTM) grid, and NPS banner/logo (Appendix 6). The associated spatial data includes vegetation community information according to NVCS standards and Federal Geographic Data Committee (FGDC)–compliant metadata.

2. A photointerpretation key is included as Appendix 3. The key contains a ground image and CIR image chip for each NVCS overstory vegetation class occurring in CHAT and a description of the CIR signature based on color, tone, texture, height, size, shape, location, and association.

3. This report provides written details on the photointerpretation and database/map generation procedures and on the field work. It also includes summary statistics of area coverage and number of polygons for each vegetation class (Table 6). Summary statistics were also developed for the general land use/land cover (LULC) classes within the 500 meter buffer surrounding the Recreation Area (Table 7).

4. Summary statistics of area coverage and number of polygons for each vegetation class within the boundaries of CHAT were generated. This information was then used to develop the study design for the accuracy assessment (Table 9).

Separate reports for OCMU and HOBE were also submitted in September 2014, completing Phase I of the Task Agreement.

Work for Phase II of the project started in July 2014.

Location of Chattahoochee River National Recreation Area

The Chattahoochee River begins in northeast Georgia and travels 867 kilometers downstream to the Apalachicola Bay in Florida. CHAT is located along 77 kilometers of the Chattahoochee River just north of Atlanta, Georgia (Figure 1). The boundary of CHAT is not contiguous. There are over 50 parcels, organized into 16 management units, varying in size from 17 to over 300 hectares (ha). Given its proximity to urban and residential areas, the Recreation Area is constantly adding to and reconfiguring its boundaries.

On August 15, 1978 former President Jimmy Carter signed a congressional bill to establish the Chattahoochee River National Recreation Area. Through this bill the NPS acquired 77 kilometers of the Chattahoochee River, along with land including such areas as the Palisades, Cochran Shoals, and Bowman's Island. The newly acquired property had boundaries of approximately 320 kilometers. However, the boundaries were only described in the bill and were not surveyed on the ground (Senate 1999).

The size and boundaries of CHAT have changed since its establishment. When established in 1978, the initial size was approximately 2,400 hectares; expansion in 1999 increased the size to 4,050 hectares (Getty et al. 2001). There have been other land acquisitions, including some that were associated with land swaps that removed select parcels from CHAT. At least two different boundary layers were provided by CHAT for this project; each had some minor resolution errors related to the river boundary layers. For our purposes, we combined the boundary layers to encompass the greatest possible extent.

CHAT is very popular for recreational activities including fishing, hiking, canoeing, rafting, tubing, and boating. The total annual visitation as of 1999 was estimated to be approximately 3.5 million visitors (Senate 1999). CHAT comprises roughly 75% of the green space found in the greater Atlanta metropolitan area (Kunkle and Vana-Miller 2000). The Recreation Area also contains numerous natural habitats as well as 19th century historic sites and American Indian archaeological sites.

The Chattahoochee River is currently affected by several types of pollution, due to rapid land development. Forsyth County, located immediately adjacent to CHAT, is one of the fastest growing counties in the United States (Senate 1999). This rapid urban sprawl resulted in water treatment plants being outpaced by development, causing wastewater to overflow during heavy rain events. With urban development comes an increase in impervious surfaces. These paved surfaces wash pollutants into the river and cause thermal pollution from the unnatural heating of water runoff (NPS 2014). This study found that over 800 hectares within and around CHAT are at least partially covered by some form of impervious surface, illustrating the need for monitoring of buffer areas surrounding CHAT in addition to monitoring of the area within CHAT boundaries.

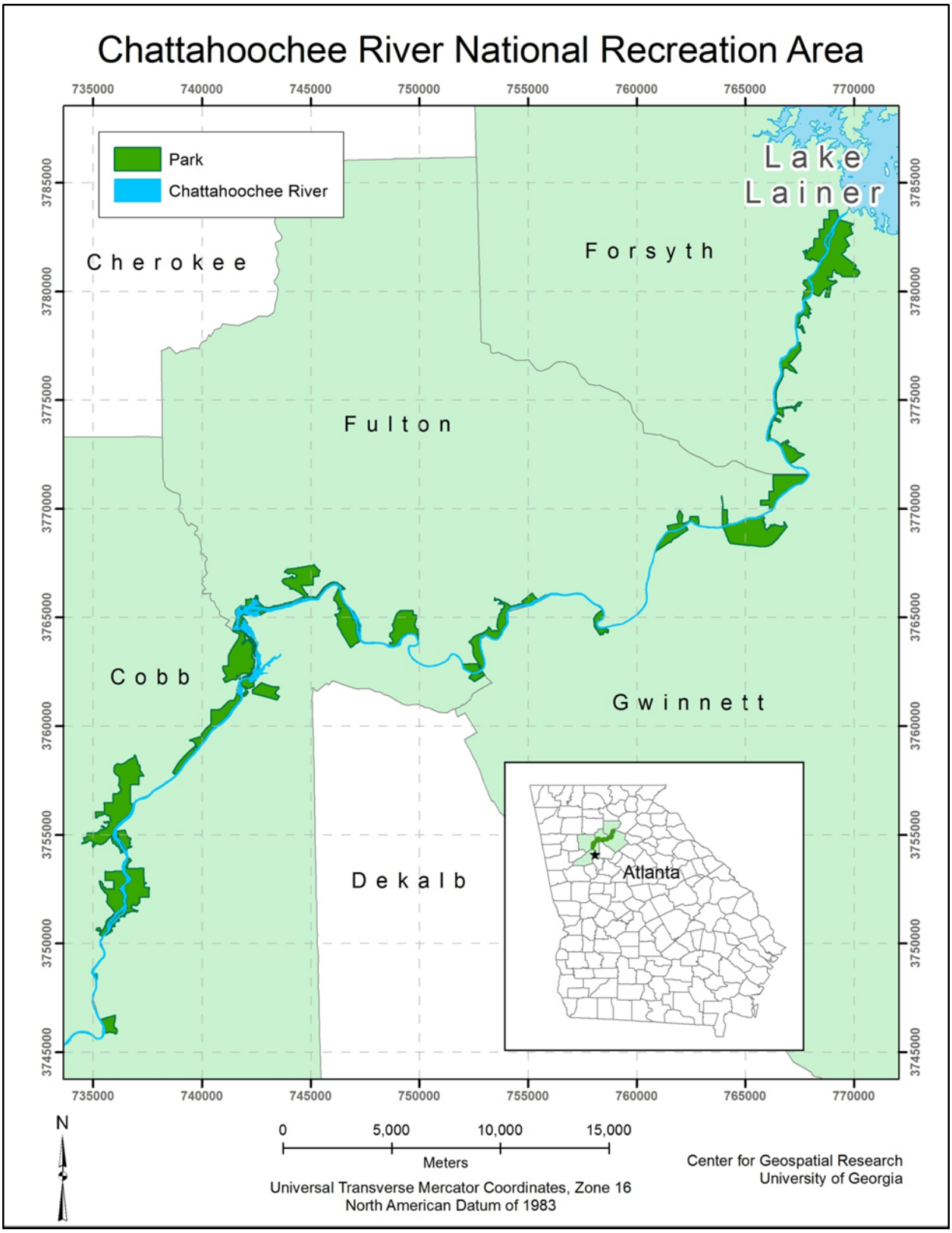


Figure 1: Location of Chattahoochee River National Recreation Area and its position relative to the state of Georgia and the city of Atlanta.

Vegetation Classification System

The task agreement for mapping required that the National Vegetation Classification System (NVCS) be used for areas inside each park. The NVCS was developed by the Nature Conservancy (Grossman et al. 1998; Anderson et al. 1998). It is primarily based upon vegetation rather than climatic or edaphic factors. It emphasizes the existing natural vegetation and recognizes that vegetation communities form a continuum. The system has seven hierarchical levels so that vegetation can be described at multiple scales, depending upon the amount of information available. Higher levels can be broken down to lower levels as more information is available; conversely, lower levels can be aggregated to upper levels. The five upper levels (formation class, formation subclass, formation group, formation subgroup, and formation) describe vegetation physiognomy rather than actual species composition and are a modification of the UNESCO World Physiognomic Classification of Vegetation (UNESCO 1973). The two lowest levels (the alliance and association) are determined by floristic composition. The alliance level is determined by the species composition of the dominant or diagnostic species in the most prevalent stratum. A diagnostic species does not have to be dominant.

The association level is determined by diagnostic species in all strata (tree canopy, subcanopy, tall-shrub, short-shrub, herbaceous, nonvascular, vine/liana, and epiphyte), recognizing that each of these stratums may not occur in every association. The tallest stratum may not be the diagnostic/dominant stratum. The association level is assigned a unique community element global code (CEGL). The CEGL code for the vegetation association is the target vegetation classification specified in the task agreement.

The dominant species in the tallest stratum are always visible in leaf-on aerial photographs. If the tallest stratum is dense, with a closed canopy, then the shorter subcanopy and understory layers are obstructed from the camera's view and are not visible. In vegetation communities where the tallest stratum is open, other strata will be visible in the aerial photograph. In some cases, a CEGL code can be determined solely by identifying its location (e.g., along a ridge or on the south slope) and viewing the uppermost stratum. In other cases, a lower stratum (or strata) not visible in the aerial photography must be used to determine CEGL code. In such cases, it is impossible to use only aerial photographs recorded during leaf-on conditions to accurately determine the NVCS code at the association level. If it was not possible to determine the association-level class due to similar overstory characteristics and lack of information on subcanopy vegetation, a second vegetation was assigned as a supplement to the dominant vegetation code.

Prior to CGR's photointerpretation, NatureServe conducted field surveys in accordance with standard practices (Jennings et al. 2009) to create a list of NVCS CEGL codes for CHAT (NatureServe 2009). Their detailed report includes a dichotomous key for separating the CEGL codes described for the Recreation Area. Many of the couplets in the dichotomous key relied upon differences in the dominant vegetation in the tallest stratum or the presence/absence of diagnostic species. However, some couplets relied upon lower strata which may not be evident in the aerial photographs and/or

edaphic factors[1] (e.g. soil pH) which would not be evident in leaf-on CIR photographs. In the CHAT key, soil pH was frequently used, yet the canopy species did not reflect underlying soil properties. The NatureServe report also includes comprehensive descriptions of diagnostic species for each CEGL, and additional information on both the global and local expressions of the vegetation community type.

In general, the NVCS is best suited to natural or semi-natural vegetation communities that have been relatively undisturbed long enough for vegetation communities to develop in accordance with the environmental and climatic conditions of the site (Grossman et al. 1998; Anderson et al. 1998). Areas that are regularly or extensively disturbed by logging, fire, wind damage, exotic insects, exotic vegetation, and human activities are not easily classified with the NVCS. For this reason, CGR augmented the NVCS classes identified as occurring in the Recreation Area by NatureServe to include additional disturbed, managed, successional, and modified classes, along with alphanumerical modifiers to provide detailed information to users of the vegetation databases and maps. Modifiers to the NVCS classes reflected variations of a particular NVCS class that are characteristic for the local site, but atypical of the global NVCS description.

The task agreement also required mapping a 500 meter buffer around the park. The buffer area around CHAT contained extensive areas subject to human influence; consequently, the NVCS system was not applicable. Buffer areas were therefore mapped using guidelines derived from the Anderson Level II classification system, which includes human influences and water categories (Anderson et al. 1976). Modifiers were also greatly utilized within the buffer to increase the knowledge base about the LULC categories adjacent to the park, though different modifiers were generally used in the buffer compared to within the park.

In summary, the Recreation Area was mapped to the association (CEGL) level of the NVCS while the buffer area was more appropriately mapped using Anderson Level II guidelines. Modifiers to these classification systems were used, as appropriate, to ensure a meaningful classification system for this particular park.

[1] Vegetation tends to reflect edaphic factors. Yet if the indicator vegetation is not visible in the aerial photograph, edaphic factors cannot be inferred.

Vegetation Mapping Workflow

The general workflow for this vegetation mapping project followed a series of steps, including:

1. Define CEGL codes within the study area based upon plot-level ground data (completed by NatureServe)
2. Contact park staff to discuss their needs and concerns as applicable to the final vegetation map, obtain any existing background information on management activities to include in a GIS database (see below), and arrange access
3. Collect base data and construct a GIS foundation geodatabase
    a. Collect and inventory the aerial photographs
    b. If needed, scan and orthorectify the aerial photographs
    c. Obtain available GIS layers on exotic plant removal or prescribed burns that may affect vegetation communities
4. Create an initial photointerpretation key
    a. Overlay NatureServe Vegetation Survey points on photos
    b. Examine photos to understand signatures of vegetation communities as identified by ELCodes or CEGL number
5. Perform initial delineation of vegetation communities on CIR aerial photographs, supplemented by other leaf-off imagery (see Table 1) using photointerpretation from both stereo-pairs and 2D imagery by heads-up GIS methods
    a. Identify spectral signatures dissimilar to the example spectral signatures around the NatureServe ground plots so that vegetation can be evaluated in field visits
6. Field visits
    a. Schedule field trips to the site to visit specific areas where questions exist
    b. Verify vegetation communities present
    c. Reconcile photo signature with NatureServe CEGL code
    d. Refine classification as necessary with reference to field work and ongoing communication with park staff regarding results
7. Refine and extend photointerpretation key and delineation of polygons
    a. As needed, print photos and vegetation polygons for review and refinement

8. Prepare final deliverable products
    a. Prepare final GIS files
        i. Clean up line work and attribute tables
    b. Compute statistics for vegetation polygons
    c. Prepare metadata for vegetation polygon files
    d. Finalize photointerpretation keys

Steps 1, 2, and 3 are self-explanatory; the detailed workflow for the other steps, as pertains to the mapping of CHAT, is described below. Note that steps 4 through 7 reflect an iterative, rather than a linear, process.

Base Data and GIS Geodatabase Construction

Relevant publically available GIS datasets that cover the study area were downloaded and archived on a local server in CGR. Datasets include roads, hydrology, boundary files (political and NPS), digital elevation models (DEMs), and additional aerial photographs. These data are available from sources such as the NPS Datastore, the Georgia GIS Data Clearinghouse, the U.S. Geological Survey National Map, and the National Oceanic and Atmospheric Administration Digital Coast websites. Trail network and exotic plant removal datasets were also obtained. These layers are not publicly available and were obtained through NPS contacts. The datasets used to populate the foundation GIS database were from different sources, compiled for different reasons, and may not be in the same map projection. The task agreement specified that the spatial data be projected to the Universal Transverse Mercator (UTM) Coordinate System, North American Datum of 1983 (NAD83). Finally, a geodatabase in ArcGIS 10.2 format was created as a container to store and organize the data. Details of this database are presented in Figure 2 and Table 1.

Color infrared (CIR) aerial photographs of CHAT at 1:12,000 scale were acquired by Aero-Metric, Inc. on May 11, 2011. These photos were scanned and converted to digital orthophotographs at 0.3 meter (1 ft) resolution before they were delivered to the NPS. Digital orthophotographs and hardcopy photographs in both film transparency and paper print formats were provided to CGR. A total of 142 photos in 14 flight lines were required to cover CHAT. A map guide was created to help with visualization of the park because of its linear layout (Figure 3). Details about the flight lines and photo center locations can be found in Appendices 1 and 2.

The mapping area was split in two sections: park and buffer. The park was defined as the area within the prescribed boundaries of the Recreation Area, while the buffer pertained to the region within 500 meters outside of the Recreation Area boundary. Detailed vegetation mapping using CEGL codes was performed within the park whereas more general mapping using a revised Anderson-type II hierarchical classification scheme was used in the buffer area.

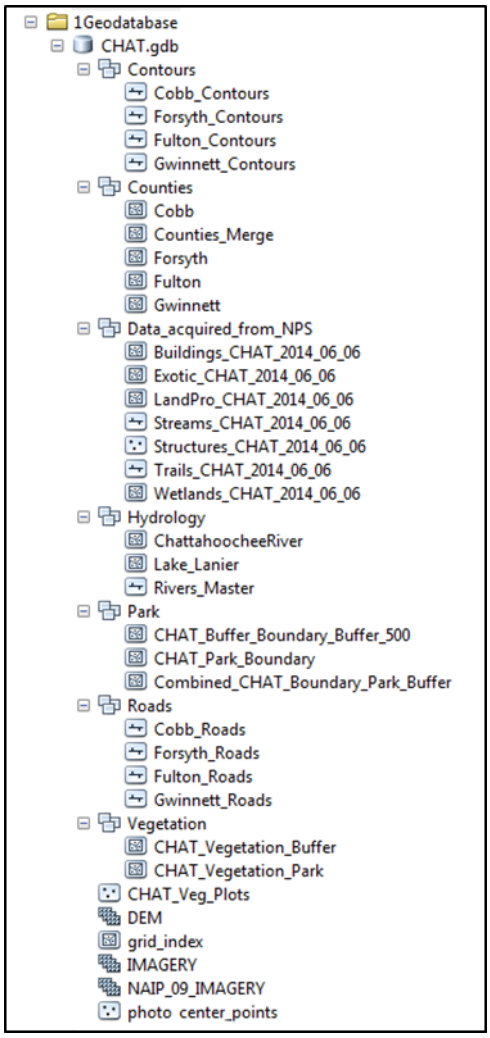


Figure 2. Foundation geodatabase created for Chattahoochee River National Recreation Area**.**

Table 1. Datasets, descriptions, source, date, and scale imported into the geodatabase.

Dataset	Description	Source	Year	Scale/Resolution
Contours	Statewide contours	Georgia GIS Clearinghouse	1996	1:100,000
Counties	County outlines for Bibb and Jones Counties	Georgia GIS Clearinghouse	2008	1:100,000
Park	Park and Buffer outlines	NPS Datastore and buffer analysis	2013	Unknown
Roads	Tiger Line Roads	Georgia GIS Clearinghouse	2006	1:12,000
Hydrology	Lakes and Rivers			
DEM	USGS Digital Elevation Model	USGS National Map Viewer	2010	1/9 arc second
USGS 07 Imagery	Natural color orthoimagery in three bands	U.S. Geological Survey	2011	0.5 meters

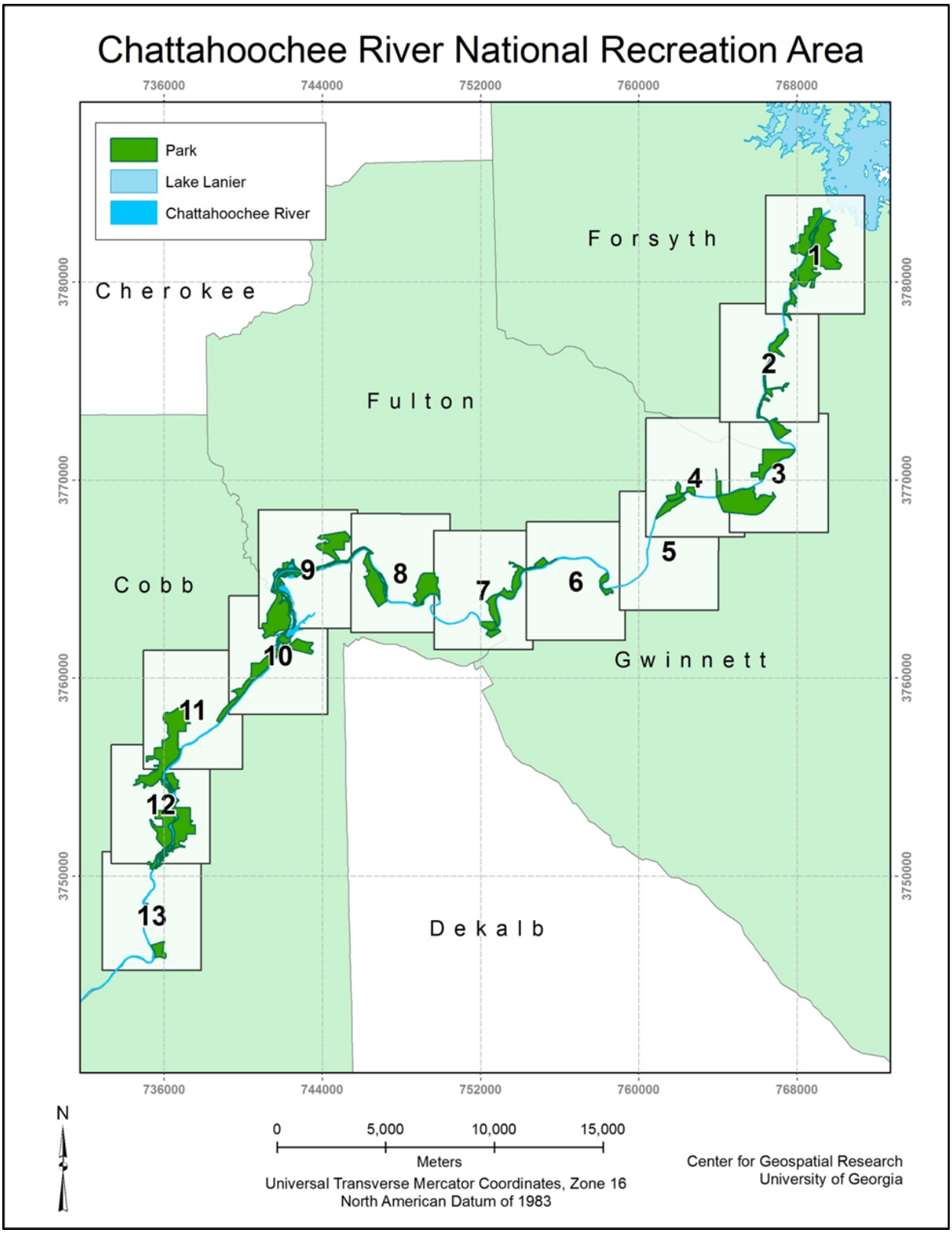


Figure 3. Map guide to aid in displaying the entire area encompassed by Chattahoochee River National Recreation Area. The linear nature of the Recreation Area makes it difficult to display on one page, so the map was divided into 13 sections for this report.

Initial Photointerpretation Key and Vegetation Delineation

Classifying the different vegetation communities within the park was aided by the use of a photointerpretation key. The initial photointerpretation key was based upon the NVCS vegetation classes at the association level. These associates were determined by NatureServe through independent plot level vegetation surveys in accordance with standard NVCS field methods (Jennings et al. 2009). Plot sizes in CHAT ranged in size from 100 square meters (10 m x 10 m) to 1,000 square meters (50 m x 20 m). Plot level species presence/abundance was used to assign a four-digit CEGL number. The results of the survey are reported as a list of point locations and CEGL codes with associated descriptions and field notes (Appendices 2 and 3). The vegetation associations for CHAT were determined by NatureServe from 73 plots. CGR visited 252 points to interpret the CIR signatures of these vegetation associations to delineate vegetation. The future accuracy assessment of CGR's draft vegetation map will include 556 accuracy assessment points.

The NatureServe vegetation plot points were overlaid on the CIR aerial photographs and the photo signature was examined. Most CEGL codes were represented at least once in the park; however some were not sampled at all, such as Southern Buttonbush Pond (2191). Still others were represented by multiple point locations; e.g., Piedmont Dry-mesic Basic Oak Hickory Forest (7232) was sampled eight times. As a result, multiple signatures exist for these codes. The NVCS recognizes that vegetation communities form a continuum both within and between CEGL codes; spectral signatures are also likely to reflect this natural variation.

The photointerpretation key was developed to assist in the extension of the signatures at the plot level to the remainder of the park (Appendix 4). The key noted color, tree crown shapes and sizes, texture, context, and any other characteristics that could help to differentiate one community from the others on the spectral signature of the leaf-on CIR aerial photography. The orthophotographs were examined on-screen in heads-up mode using the ArcGIS software. Where needed, the hardcopy photographs were viewed in stereo/3D using a light table and a mirror stereoscope. This method is excellent for using relative heights of the trees and terrain to assist in determining the vegetation community and to delineate the boundaries of the individual features.

The key for CHAT provided by NatureServe included 26 associations, not including Southern Buttonbush Pond (2191). The strength and intensity of the image were described using color (varying from green to pink to purple), tone (light to dark), and texture (fine to coarse). Other categories were based on canopy structure such as pattern (open to dense canopy) and height (short to tall). The remaining categories were used to express how the different codes are interrelated. These include shape (elongated to broad), size (based on total area, average size, and standard deviations of the polygons in a given class), location (relative to specific areas in the park), association (communities typically found near the specific class), and comments (to express any hints or issues that may arise). Also included are images taken from the field in order to provide a ground-level perspective that can be compared to the sample image chips taken from the airborne CIR images. The NatureServe summary of the vegetation association and its distribution both globally and within CHAT are included for each class following the visual cue description.

The CEGL codes are listed in ascending numerical order in the key. While the NVCS itself is hierarchical, the numbering system for the codes is not hierarchical. Thus, it is impossible to determine physiognomy, species composition, or edaphic factors (e.g. soil saturation or inundation, soil pH, slope) from the CEGL code alone.

Using ArcGIS software, standard GIS methods, and a minimum mapping unit (MMU) of 0.5 hectares, preliminary lines were drawn to delineate areas of uniform signature. Where the vegetation communities were clearly identifiable, polygons were tagged with the appropriate CEGL code. Where confusion existed, the polygons were tagged with an 'unknown' code until field visits could determine the appropriate CEGL.

Field Surveys and Ground Truth

In the course of developing the photointerpretation keys and delineating vegetation communities based upon their CIR signatures, a number of signatures were found that did not easily match the signatures from the NatureServe survey of 70 ground points. These areas required field visits to clarify.

Field work and ground truthing for CHAT took place in June, July, and August 2014. Field visits were aimed at giving specific attention to representative habitats, rare and important communities, areas that have been managed, disturbed, or invaded, and plots previously surveyed by NatureServe to collect data on canopy species composition, diagnostic species for NVCS, and terrain, similar to NatureServe's "Quick Plot" surveys.

Field crews carried paper field maps with the UTM grid coordinates, elevations, roads, rivers, initial vegetation polygons with CEGL codes, and points of interest superimposed on CIR photographs. They also used a Trimble Geo 6000 Xh Global Positioning System (GPS) handheld receiver loaded with similar GIS layers. On some trips, an Apple iPad 4 with a geoPDF (Wuthrich 2006; Pardue 2008) replaced paper field maps. The geoPDF gave the user a higher level of detail of the original CIR compared paper maps and the ability to determine location in real-time using the device's internal GPS relative to the overlay of the line work.

The Trimble GPS was used to record the location of each sampled site. The coordinates were later post-processed by differential correction using Trimble's Pathfinder Office Software and base station data from sites in Atlanta. In some cases, base station data were only partially available, necessitating use of multiple base stations in the Atlanta area for greater coverage. However, even when multiple base stations were used for a particular day, complete time coverage was not guaranteed. Some GPS locations could not be successfully differentially-corrected. Overall, post-processing produced a final accuracy of plus or minus one to five meters. Accuracy was higher in open areas than in closed canopy forested areas.

At each sampling site, researchers recorded GPS position, species data, canopy cover, and topography (e.g. relative slope and aspect) inside an area between 250 and 1,000 square meters, based upon visual uniformity. Researchers also noted: the presence of exotics; evidence of past or present human influence (e.g., agriculture, grazing, logging, mowing, exotic vegetation removal, old

home sites); and damage by insects, wild hogs, blow down, or fire. Before leaving a sampling location, researchers determined the primary association type, i.e. CEGL code (Anderson et al. 1998; Grossman, Goodin, and Reuss 1994; Grossman et al. 1998). Some sites were located in a mixed area indicative of an ecotone or an area of successional recovery. In such cases, secondary associations were determined in addition to dominant associations. Tertiary modifiers were often determined as well. In cases where researchers were unable to determine a clear match to a NVCS CEGL in the field, more detailed notes were taken in order to assign an appropriate CEGL or CGR-created class (e.g., a managed, damaged, human influence, or successional class) after further review of CIR signatures.

GPS points collected in the field were superimposed on CIR images in ArcMap. Field points were used in conjunction with the aerial photographs to refine vegetation delineation and assigned classification attributes (dominant CEGL, secondary CEGL, and modifiers, as appropriate). Additional field visits were conducted during the iterative interpretation process on an as-needed basis in order to refine interpretations, identify communities with unusual signatures, and resolve any questions. Maps were updated between field visits to reflect the ongoing process of photointerpretation of vegetation communities. Any areas visited that were already classified were checked for accuracy throughout the mapping process.

A total of seven field visits/investigations and 252 discrete point locations were collected at CHAT (Table 2 and Appendix 5). The number of sites visited in a single day ranged from 19 to 61 and was often influenced by terrain, weather, and point of interest density. Usually, if more than two people were in the field, two independent field teams worked simultaneously to cover more area.

Table 2. Field visits and points collected for Chattahoochee River National Recreation Area.

Date (2014)	Team Member(s)	Number of Data Points
June 6	N. K. O'Hare, B. P. Adams	19
June 19	D. L. Cotten, B. P. Adams, M. Madden, N. K. O'Hare	24
June 22	D. L. Cotten, B. P. Adams, M. Madden, N. K. O'Hare	44
July 7	M. Madden, N. K. O'Hare	28
July 17	M. Madden, D. L. Cotten, B. P. Adams	46
July 22	D. L. Cotten, B. P. Adams	61
August 4	D. L. Cotten	30
Total		**252**

Photointerpretation and GIS Methods

The industry-standard GIS software, ArcGIS, offers a variety of methods and procedures to perform most common mapping tasks. For the purposes of this project, photointerpretation was performed using heads-up digitizing methods in ArcGIS 10.2 using the CIR digital orthophotographs as the primary source material. Lines were drawn on-screen delineating the boundaries between different classes of vegetation. Where ecotones between features were broad, the line was drawn in the middle

of the transition area. While the MMU for this project was one half of a hectare, features smaller than this threshold that were distinct and could be easily mapped were delineated.

As vegetation areas were delineated with vector lines, points were digitized within each delineated area. These points were assigned attribute information such as the dominate vegetation (a CEGL value if located within the park or an Anderson-type code for the buffer), secondary vegetation, a modifier, the interpreter's initials, the date, the confidence of the classification, and other relevant information.

After the line work was completed and points attributed, the lines were converted to polygons and the attributes assigned to each polygon by joining the tables of the point features and polygons based on spatial location. In this operation, the attributes of the point closest to the polygon were assigned to that polygon. A 'distance' field was also assigned which indicates the distance of the point location from the polygon. If the distance was zero, the point was inside the polygon. Any other value greater than zero meant that the point used to populate the attribute fields was outside of the polygon. Consequently, the 'distance > 0' values were used as flags to select and examine polygons that were not properly attributed. Where necessary, additional points were added to the database to complete the map. The process was repeated until all polygons were properly attributed.

The initial draft maps were plotted at large scale on 'E-size' (34 in x 48 in) paper such that the hollow polygons with their respective CEGL labels were overlaid on the original aerial photographs. Each polygon was individually inspected by a person not directly involved in the original mapping to make sure that that the line work followed the vegetation feature properly, and that the CEGL codes were consistent with spectral signature. Edits were marked on the hardcopy maps and then applied to the database within ArcGIS. This review process was repeated to ensure completeness.

Additional editing and refinement was performed as necessary using information collected during the field surveys.

Draft Vegetation Mapping and Summary Statistics

A total of 31 distinct NVCS CEGL association level vegetation communities were found in CHAT, including water and human influence classes (Table 3). Of the 26 classes found in the original vegetation key for CHAT, all were used except for Southern Button Bush Pond (2191) which did not have a NatureServe vegetation plot location in CHAT. Additionally, four CEGL codes were added from the Kennesaw Mountain National Battlefield Park (KEMO) key (Cultivated Meadow (4048), Southern Piedmont Mafic Shrubland (4243), Piedmont Small Stream Sweetgum - Tuliptree Forest (4418), and Piedmont Dry-Mesic Oak-Hickory Forest (8475)). Also added were two non-CEGL codes, Water (9998) and Human Influence (9999).

In the buffer zone, there were 20 distinct Anderson Level II codes (Table 4). Both the park and buffer area were further classified through the use of modifiers (Table 5).

Table 3. Land cover classes found within the park area of Chattahoochee River National Recreation Area based on the National Vegetation Classification System.

Code	Description
3866	Southern Woolgrass Bulrush Marsh
3901	Black Willow Riverbank Shrubland
4044	Successional Broomsedge Vegetation
4048	Cultivated Meadow
4112	Rush Marsh
4232	Piedmont Loblolly Pine – Oak Forest
4243	Southern Piedmont Mafic Shrubland
4415	Piedmont Chestnut Oak – Heath Bluff
4416	Mafic Xeric Piedmont Oak Forest
4418	Piedmont Small Stream Sweetgum – Tuliptree Forest
4542	Piedmont Rocky Mesic Mafic Forest
4638	Successional Water Oak Forest
4732	Blackberry – Greenbrier Successional Shrubland Thicket
4966	Knotweed Pondshore and Ditchbank Vegetation
6011	Early- to Mid-Successional Loblolly Pine Forest
7178	White Pine Plantation
7220	Successional Tuliptree Forest (Circumneutral Type)
7221	Interior Mid- to Late-Successional Tuliptree – Hardwood Upland Forest (Acid Type)
7232	Piedmont Dry-Mesic Basic White Oak – Hickory Forest
7244	Southern Red Oak – White Oak Mixed Oak Forest
7312	River Birch Levee Forest
7521	Successional Tuliptree – Loblolly Pine Upland Forest
7546	Loblolly Pine – Tuliptree Successional Bottomland Forest
7551	Loblolly Pine – (Willow Oak, Water Oak, Diamondleaf Oak) Temporarily Flooded Forest
7730	Sycamore – Sugarberry – Green Ash / Northern Spicebush – Possumhaw / Reflexed Sedge Forest
8431	Xeric Ridgetop Chestnut Oak Forest
8465	Piedmont Acidic Mesic Mixed Hardwood Forest
8474	Southeastern Smooth Alder Swamp
8475	Piedmont Dry-Mesic Oak – Hickory Forest
9998	Water
9999	Human Influence

Table 4. Land cover/land use classes within the buffer area of Chattahoochee River National Recreation Area.

Code	Description
11	Residential
12	Commercial and Services
13	Industrial
14	Transportation, Communications, and Utilities
15	Industrial and Commercial Complexes
17	Other Urban or Built-up Land
21	Cropland and Pasture
22	Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticulture Areas
24	Other Agricultural Land
31	Herbaceous Rangeland
32	Shrub and Brush Rangeland
41	Deciduous Forest Land
42	Evergreen Forest Land
43	Mixed Forest Land
50	Major River
51	Streams and Canals
53	Reservoirs
61	Forested Wetland
62	Nonforested Wetlands
76	Transitional Areas

Table 5. Modifiers used throughout the park area and buffer of Chattahoochee River National Recreation Area.

Code	Description
BG3	Bare Ground – Greater than 75 percent
Dis	Disturbed
FM1	Mixed Forest – Less than 25 percent
FM2	Mixed Forest – 25 to 75 percent
FM3	Mixed Forest – Greater than 75 percent
GRC	Golf Course/Recreation Field
IS1	Impervious – Less than 25 percent
IS2	Impervious – 25 to 75 percent
IS3	Impervious – Greater than 75 percent
Isl	Small Island
VG3	Vegetation – Greater than 75 percent
XLs	Exotics – Chinese Privet

The most common class found in CHAT was Southern Red Oak - White Oak Mixed Oak Forest (7244), covering approximately 17.5% of the park. This was nearly twice as large as the second most common class, Piedmont Loblolly Pine-Oak Forest (4232), at 10.1%. The smallest class was Southern Woolgrass Bulrush Marsh (3866) and Piedmont Rocky Mesic Mafic Forest (4542), at less than 0.2% each (Table 6 and Figure 4).

Within the buffer region of CHAT, residential areas (11) dominated the land use/land cover classes and comprised 57% of the total buffer area. The next largest class was mixed forest (43), at 10.3 %. The smallest class found within the buffer was nonforested wetlands (62), with only 0.1% of the total area (Table 7 and Figure 5). Of note because of the linear nature of CHAT, the 500 meter buffer area was approximately three times larger than the land area found within the CHAT boundary (approximately 10,700 ha in the buffer compared to approximately 3,000 in CHAT).

Modifiers were utilized throughout the park and buffer regions to further enhance the classification system. The modifier system was based on insect infestation, the presence of exotic plants, or other classification system. This other class can include vegetation, mixed forest, or impervious surface coverage based on a scaling system. The scaling system used is based on percent coverage of the specific modifier, with 1 for less than 25%, 2 for greater than 25% but less than 75%, and 3 for coverage greater than 75% (Table 8). The draft vegetation map can be found in Appendix 6.

Table 6. Community element global code (CEGL) classes, frequency of occurrence, mean area, total area, and percentage of total area within the park boundary of Chattahoochee River National Recreation Area. [ha – hectares].

CEGL	Frequency	Mean Area (ha)	Total Area (ha)	Percentage of Total Area
3866	1	1.4	1.4	0.1
3901	16	1.1	18.0	0.6
4044	20	0.7	14.5	0.5
4048	24	4.4	105.8	3.5
4112	17	1.8	29.9	1.0
4232	70	4.4	308.3	10.1
4243	2	1.9	3.8	0.1
4415	8	2.4	19.3	0.6
4416	4	10.1	40.3	1.3
4418	11	3.4	37.3	1.2
4542	1	7.3	7.3	0.2
4638	91	2.5	230.4	7.6
4732	22	1.4	31.8	1.0
4966	9	1.2	10.6	0.4
6011	21	2.6	54.5	1.8
7178	4	6.6	26.4	0.9
7220	44	3.3	144.6	4.8
7221	18	1.8	33.1	1.1
7232	55	4.4	243.0	8.0
7244	65	8.2	532.9	17.5
7312	14	1.2	16.2	0.5
7521	16	5.0	80.7	2.7
7546	24	4.5	107.5	3.5
7551	26	3.3	85.7	2.8
7730	105	2.1	221.5	7.3
8431	9	1.9	17.3	0.6
8465	14	2.9	39.9	1.3
8474	3	2.3	7.0	0.2
8475	5	1.8	9.1	0.3
9998	23	1.2	27.5	0.9
9999	107	5.0	532.2	17.5
Total	**849**		**3,037.7**	**100**

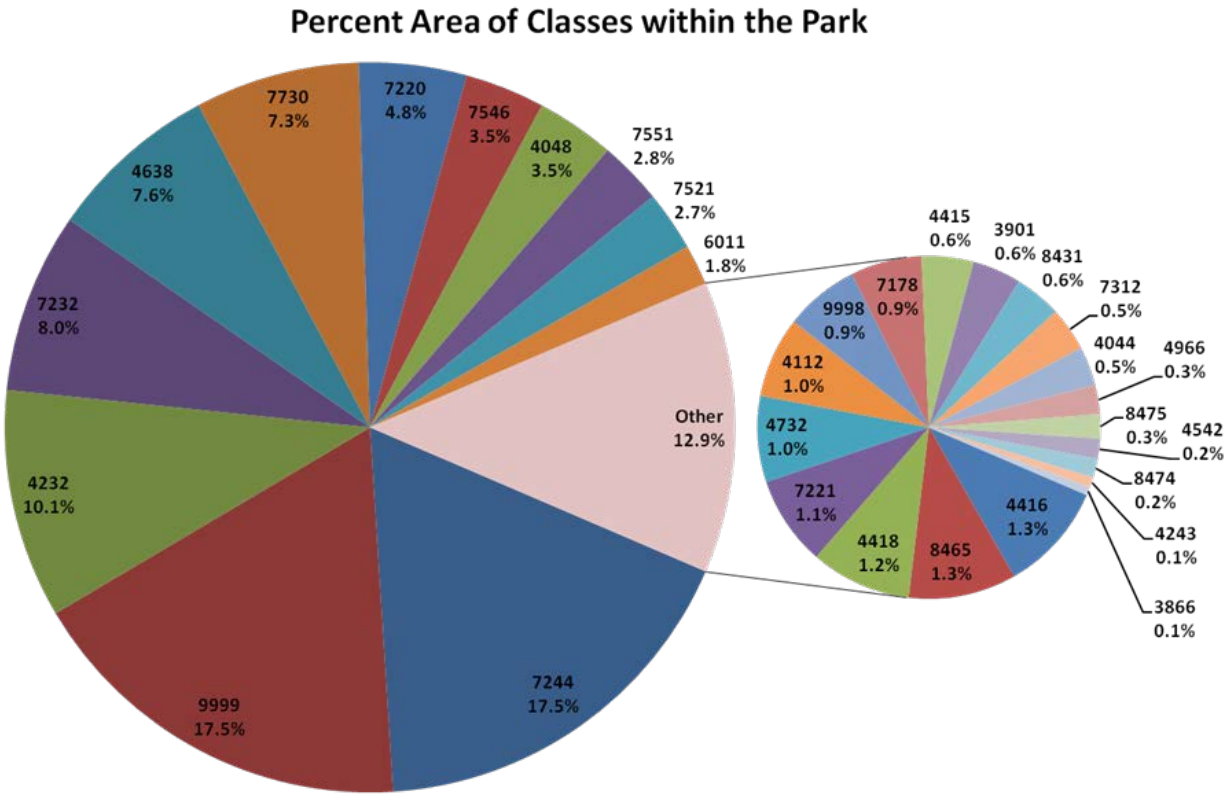


Figure 4. Park vegetation classes in Chattahoochee River National Recreation Area organized by relative size.

Table 7. Land use/land cover class, frequency of occurrence, mean area, total area, and percentage of total area within the buffer area of Chattahoochee River National Recreation Area. [ha – hectares].

Class	Frequency	Mean Area (ha)	Total Area (ha)	Percentage of Total Area
Residential	178	34.2	6,088.1	57.0
Commercial and Services	97	6.1	591.5	5.5
Industrial	4	2.5	9.9	0.1
Transportation, Communications, and Utilities	79	4.1	327.4	3.1
Industrial and Commercial Complexes	7	7.3	51.2	0.5
Other Urban or Built-up Land	65	9.6	623.1	5.8
Cropland and Pasture	3	58.2	174.7	1.6
Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticulture Areas	4	2.5	10.0	0.1
Other Agricultural Land	7	9.2	64.3	0.6
Herbaceous Rangeland	23	4.1	93.2	0.9
Shrub and Brush Rangeland	5	3.1	15.7	0.1
Deciduous Forest Land	82	6.4	523.8	4.9
Evergreen Forest Land	11	2.8	30.8	0.3
Mixed Forest Land	79	13.9	1,101.6	10.3
Major River	21	35.9	754.4	7.1
Streams and Canals	5	2.5	12.4	0.1
Reservoirs	123	1.1	136.3	1.3
Forested Wetland	5	3.2	16.2	0.2
Nonforested Wetlands	4	1.7	6.9	0.1
Transitional Areas	16	2.7	43.1	0.4
Total	**818**		**10,674.8**	**100**

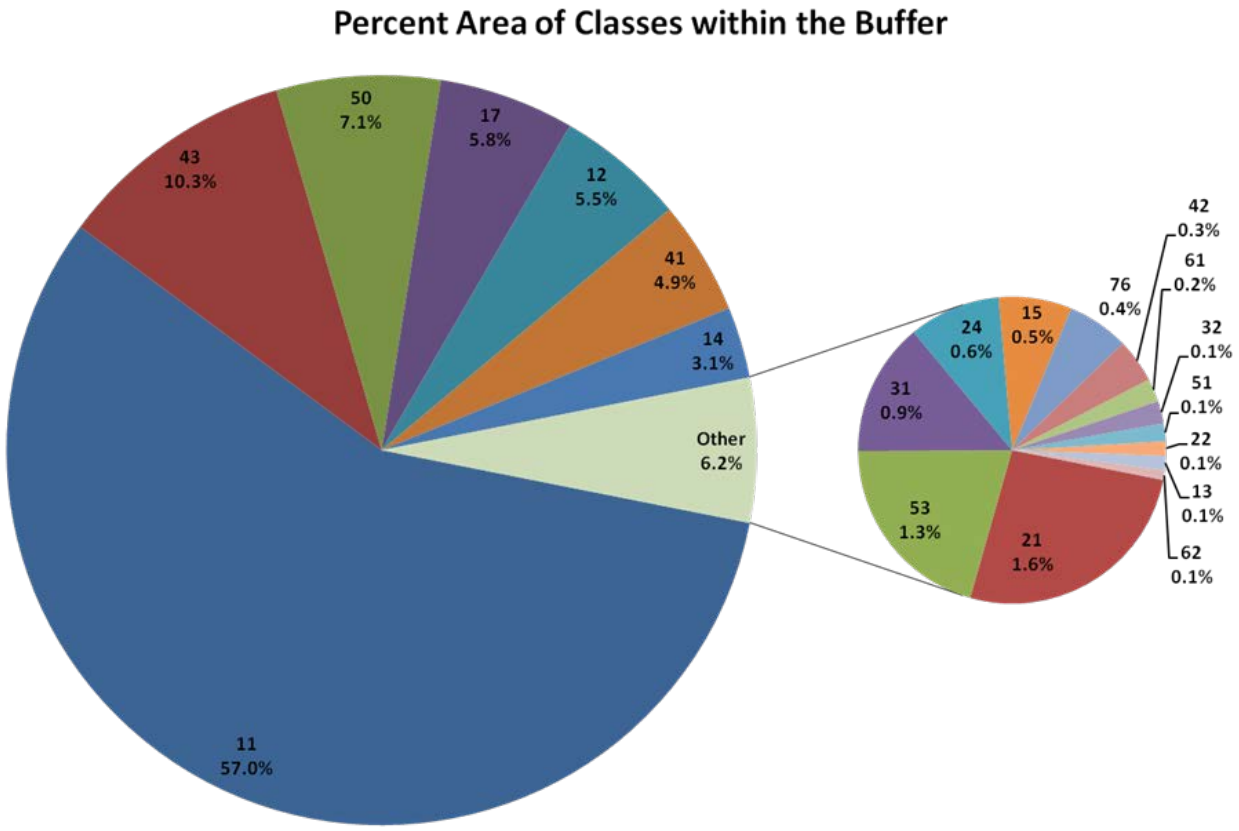


Figure 5. Buffer classes found surrounding Chattahoochee River National Recreation Area, organized by relative size.

Table 8. Modifiers used throughout the park and buffer areas of Chattahoochee River National Recreation Area, including frequency of occurrence, mean area, and total area. [ha – hectares].

Code	Description	Frequency	Mean Area (ha)	Total Area (ha)
BG3	Bare Ground – Greater than 75 percent	12	1.8	22.0
Dis	Disturbed	5	2.0	10.2
FM1	Mixed Forest – Less than 25 percent	76	15.5	1,180.6
FM2	Mixed Forest – 25 to 75 percent	82	29.0	2,374.5
FM3	Mixed Forest – Greater than 75 percent	66	43.9	2,896.9
GRC	Golf Course/Recreation Field	111	6.3	701.3
IS1	Impervious – Less than 25 percent	12	5.7	68.7
IS2	Impervious – 25 to 75 percent	31	6.6	205.8
IS3	Impervious – Greater than 75 percent	137	4.1	563.4
Isl	Small Island	14	0.2	2.4
VG3	Vegetation – Greater than 75 percent	22	3.9	85.5
Total		**568**		**8,111.2**

Mapping Difficulties

Using only aerial photos for classification proved very difficult for some classes within CHAT. For example, Successional Tuliptree Forest (Acidic Type) (7221) and Successional Tuliptree Forest (Circumneutral Type) (7220) are both dominated by Tuliptree but can contain other species within the canopy. During field visits it was easier to distinguish different soil pH associated with each class by using bioindicators such as *Aesculus* sp. (buckeye) in basic soil, and *Vaccinium* sp. (blueberry) in acidic soil. However, these are both understory species not visible on CIR and therefore did not contribute to a leaf-on aerial spectral signature and were not useful for classification.

The use of bioindicators was not as useful when attempting to distinguish between the chestnut oak dominated classes (Piedmont Chestnut Oak/Health Bluff (4415), Xeric Mafic Chestnut Oak Forest (4416), and Xeric Ridgetop Chestnut Oak Forest (8431)). These three classes are all found on or near ridge tops and can have similar canopy components, with slight variations between them. Since all three classes contained chestnut oak as a dominant or codominant species, they were nearly impossible to distinguish from the air photos alone. However field data was helpful because 4415 contains shrub layers that are dominated by *Rhododendron minus* and/or *Kalmia latifolia* while 4416 and 8431 do not. The differences between 4416 and 8431 were based on soil influences on understory vegetation, not canopy tree species. Consequently, the traits defining the two codes were impossible to distinguish from leaf-on aerial photos.

Accuracy Assessment Point Selection

As a part of the total mapping effort, a separate accuracy analysis (AA) of the thematic contents of the draft vegetation maps is required. Only classes with CEGL codes assigned and only polygons that fall within the prescribed park boundary are evaluated. To accomplish this, a set of points is selected to represent the distribution and rarity of the mapped vegetation classes. The number of AA sample points per class depends on the total area (in ha) of the particular vegetation class within the map area, according to the rule set established by the NPS for this purpose:

- Classes with < 8.33 ha — 5 points per class
- Classes with ≥ 8.33 AND < 50 ha — number of points is 0.6 X the area in ha
- Classes with ≥ 50 ha — 30 points per class

The task agreement requires determination of the number of accuracy assessment points. The actual distribution of the sample points will be determined under a separate task agreement, by another contractor. Protocol dictates that the points be randomly distributed and stratified by class. For example, if 30 points are required for a particular class, those 30 points should be randomly distributed within all of the polygons of that particular class. The distribution of classes, the number of polygons, and the areas of each class are given in Table 9.

Table 9. Community element global code (CEGL) classes, number of National Vegetation Classification System (NVCS) vegetation plots (NatureServe plots), total frequency of occurrence (number of polygons), mean area, total area, and number of accuracy assessment points for Chattahoochee River National Recreation Area. [ha – hectares].

CEGL	NatureServe Plots	Number of Polygons	Mean Area (ha)	Total Area (ha)	Accuracy Assessment Points
3866	1	1	1.4	1.4	5
3901	1	16	1.1	18.0	11
4044	1	20	0.7	14.5	9
4048	0	24	4.4	105.8	30
4112	4	17	1.8	29.9	18
4232	6	70	4.4	308.3	30
4243	0	2	1.9	3.8	5
4415	4	8	2.4	19.3	12
4416	0	4	10.1	40.3	24
4418	0	11	3.4	37.3	22
4542	1	1	7.3	7.3	5
4638	6	91	2.5	230.4	30
4732	1	22	1.4	31.8	19
4966	3	9	1.2	10.6	6
6011	2	21	2.6	54.5	30
7178	1	4	6.6	26.4	16
7220	6	44	3.3	144.6	30
7221	1	18	1.8	33.1	20
7232	8	55	4.4	243.0	30
7244	5	65	8.2	532.9	30
7312	4	14	1.2	16.2	10
7521	1	16	5.0	80.7	30
7546	1	24	4.5	107.5	30
7551	1	26	3.3	85.7	30
7730	3	105	2.1	221.5	30
8431	3	9	1.9	17.3	10
8465	4	14	2.9	39.9	24
8474	1	3	2.3	7.0	5
8475	0	5	1.8	9.1	5
Total	**70**	**719**		**2,478.1**	**556**

Conclusion

This product is only one of four steps necessary to produce a final vegetation map based upon aerial photographs. Acquisition of aerial imagery and determination of the CEGL codes occur beforehand; accuracy assessment occurs afterwards. The entire process may take three to seven years to complete. While the NVCS classification system intends to capture stable vegetation categories, either man-made or natural disturbances may change some areas during the three to seven years required to produce a final vegetation map. For example, changes in non-tree dominated areas, which are typically wetlands in this region, may shift annually depending upon local weather, or cover by invasive exotics may change rapidly. More importantly, both of these natural and anthropogenic changes will likely continue in the future. Therefore, the final vegetation map should be evaluated as a snapshot.

As a result of the extensive influence of urban sprawl around the park, applying the NVCS classification scheme to the association (CEGL) level was challenging. The present vegetation of CHAT likely reflects both direct and indirect influences of human habits and land use. The direct influences are related to land use during the past 100 to 200 years, including broad-scale land clearing, agriculture, and selective timbering. Indirect influences include altered hydrology, altered nutrient cycles, and colonization by exotic plant species. The indirect influences may shift the normal vegetative successional patterns (Davis et al. 2005; Thompson et al. 2013; Thompson et al. 2011). As noted above, the NVCS classification system is not readily applicable to disturbed communities. Overall, most regions of CHAT contained intact habitats; thus, applying the NVCS classification was mostly straight forward in these areas.

The buffer size used for this study covered a much larger area than the region found within CHAT. This illustrates the linear nature of the Recreation Area and how much it, including the river, is susceptible to land use/land cover changes outside of the boundary. CHAT covers approximately 3,000 hectares while the buffer contains approximately 10,700 hectares. The majority of land use within the buffer, 57%, is residential. This study found that over 800 hectares within and around CHAT contain some form of impervious surface. This is an extreme lower limit since many impervious surfaces may be obscured from view in an aerial photograph. The results of this study indicate the importance of the areas surrounding CHAT and the ways in which they can influence habitats found within CHAT boundaries.

CGR will assist in the accuracy assessment as needed, and will update the maps provided herein based upon the independent accuracy assessment as part of this task agreement.

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Appendix A – Flight Line and Photo Centers

Chattahoochee River National Recreation Area flight line, photo numbers, and photo center coordinates (UTM Zone 16, NAD83). Photos were acquired by Aero-Metric at 1:12,000 scale on May 1, 2011.

Flight Line	Photo	Easting	Northing
5	1	735123.4	3744887.1
5	2	735118.3	3746002.7
5	3	735119.7	3747101.0
5	4	735121.6	3748193.5
5	5	735111.9	3749283.5
5	6	735115.1	3750341.8
5	7	735114.2	3751413.6
5	8	735119.3	3752484.3
5	9	735123.4	3753546.9
5	10	735116.7	3754618.5
5	11	735114.1	3755689.9
5	12	735122.0	3756756.0
5	13	735118.8	3757847.3
5	14	735114.9	3758924.3
6	1	737059.5	3744829.3
6	2	737060.5	3745939.1
6	3	737064.0	3747030.5
6	4	737059.5	3748118.6
6	5	737053.4	3749190.7
6	6	737044.8	3750280.8
6	7	737056.9	3751370.1
6	8	737074.4	3752445.7
6	9	737071.7	3753521.6
6	10	737072.4	3754611.3
6	11	737069.4	3755641.7
6	12	737064.7	3756736.4
6	13	737057.0	3757824.9
6	14	737071.2	3758865.6
6	15	737065.0	3759954.8
7	1	736807.3	3756470.7
7	2	737637.8	3757149.5
7	3	738482.1	3757848.7
7	4	739317.2	3758545.5
7	5	740161.4	3759232.3
7	6	740980.4	3759926.0

Flight Line	Photo	Easting	Northing
7	7	741828.3	3760627.9
7	8	742657.4	3761307.3
7	9	743494.7	3761988.3
7	10	744315.9	3762674.1
7	11	745159.1	3763367.9
7	12	745973.8	3764044.5
7	13	746803.8	3764722.9
7	14	747661.7	3765434.7
7	15	748481.4	3766103.2
8	1	739008.0	3760770.6
8	2	739831.6	3761464.3
8	3	740671.6	3762144.4
8	4	741503.3	3762831.4
8	5	742360.5	3763536.6
8	6	743183.7	3764217.0
8	7	744038.9	3764914.8
8	8	744866.8	3765593.2
8	9	745699.7	3766279.4
8	10	746541.5	3766962.3
9	1	740277.8	3764297.4
9	2	741123.8	3764990.5
9	3	741966.0	3765698.0
9	4	742804.5	3766375.7
9	5	743626.3	3767066.1
9	6	744472.4	3767766.9
9	7	745286.6	3768444.3
10	1	744874.9	3764023.6
10	2	745938.4	3763834.5
10	3	747019.2	3763643.2
10	4	748052.4	3763462.1
10	5	749083.4	3763269.2
10	6	750136.8	3763083.2
10	7	751202.9	3762902.1
10	8	752270.4	3762715.3
10	9	753353.9	3762523.1
10	10	754455.0	3762327.1
11	1	746350.7	3765697.1
11	2	747420.2	3765516.8
11	3	748487.5	3765330.1
11	4	749551.4	3765138.9
11	5	750605.4	3764951.6

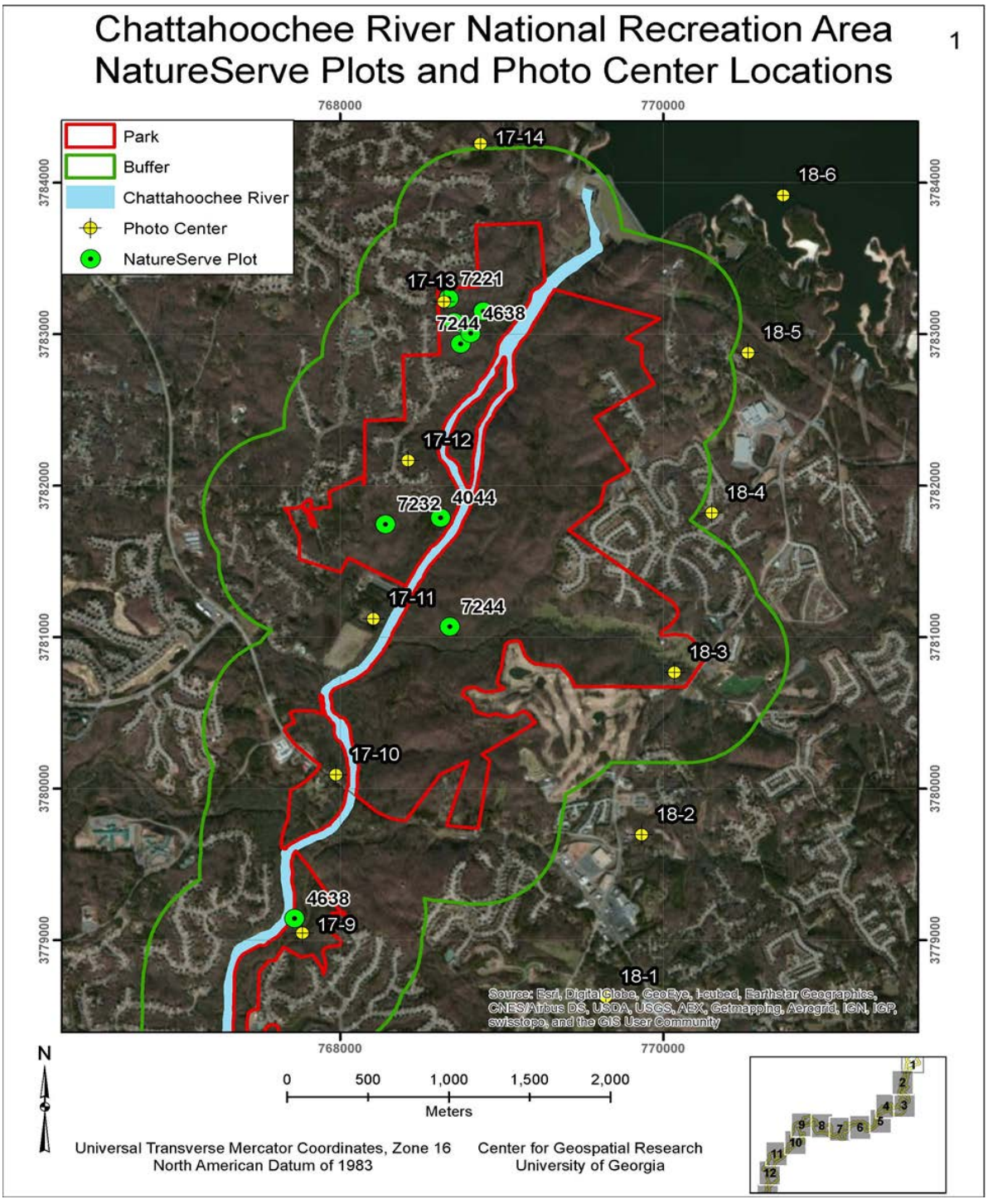
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12	2	750374.8	3762915.7
12	3	751424.0	3763088.0
12	4	752518.3	3763274.4
12	5	753593.0	3763449.2
12	6	754670.7	3763625.4
12	7	755739.6	3763804.2
12	8	756814.8	3763987.6
12	9	757883.3	3764155.4
12	10	758927.8	3764325.7
12	11	760004.8	3764517.0
12	12	761059.4	3764697.1
13	1	750358.9	3764850.5
13	2	751426.8	3765024.7
13	3	752482.4	3765205.6
13	4	753547.2	3765375.4
13	5	754596.0	3765550.9
13	6	755667.6	3765729.4
13	7	756736.0	3765925.2
13	8	757819.8	3766103.8
13	9	758909.3	3766271.2
13	10	759995.4	3766454.1
13	11	761065.4	3766618.9
14	1	760277.2	3766162.5
14	2	760786.7	3767120.2
14	3	761305.2	3768074.0
14	4	761822.6	3769017.7
14	5	762341.9	3769961.1
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15	2	764228.4	3768275.5
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15	4	766207.0	3769196.8
15	5	767169.3	3769621.6
15	6	768167.1	3770093.5
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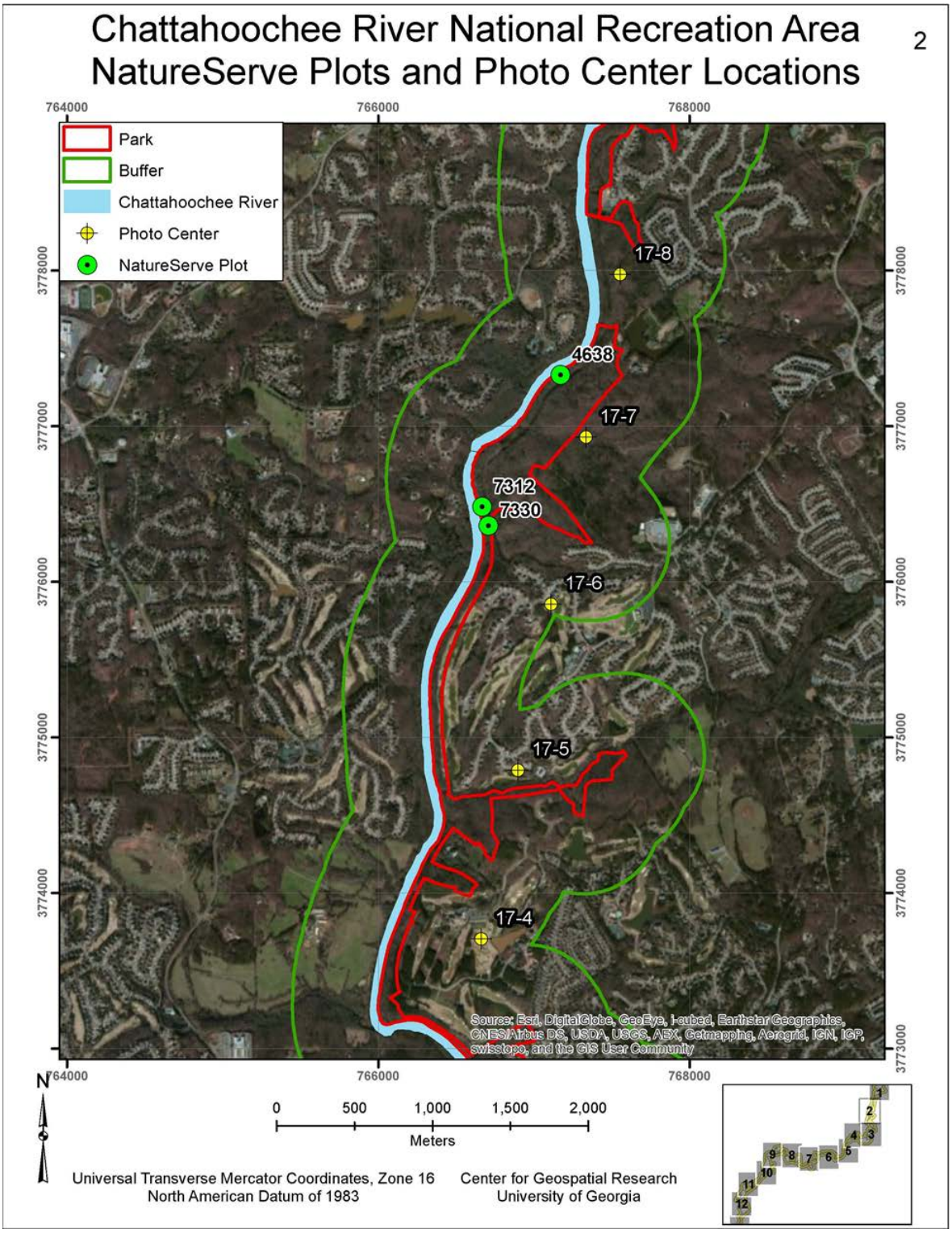
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16	7	767345.5	3771810.0
16	8	768341.9	3772278.1
17	1	765975.3	3770509.5
17	2	766196.1	3771591.0
17	3	766421.1	3772655.2
17	4	766661.3	3773705.4
17	5	766896.7	3774790.3
17	6	767110.2	3775857.2
17	7	767334.4	3776929.5
17	8	767552.9	3777974.7
17	9	767767.0	3779048.3
17	10	767973.6	3780093.2
17	11	768206.5	3781122.1
17	12	768419.9	3782166.5
17	13	768642.5	3783215.1
17	14	768869.6	3784257.7
18	1	769645.6	3778628.1
18	2	769866.1	3779696.8
18	3	770070.3	3780768.3
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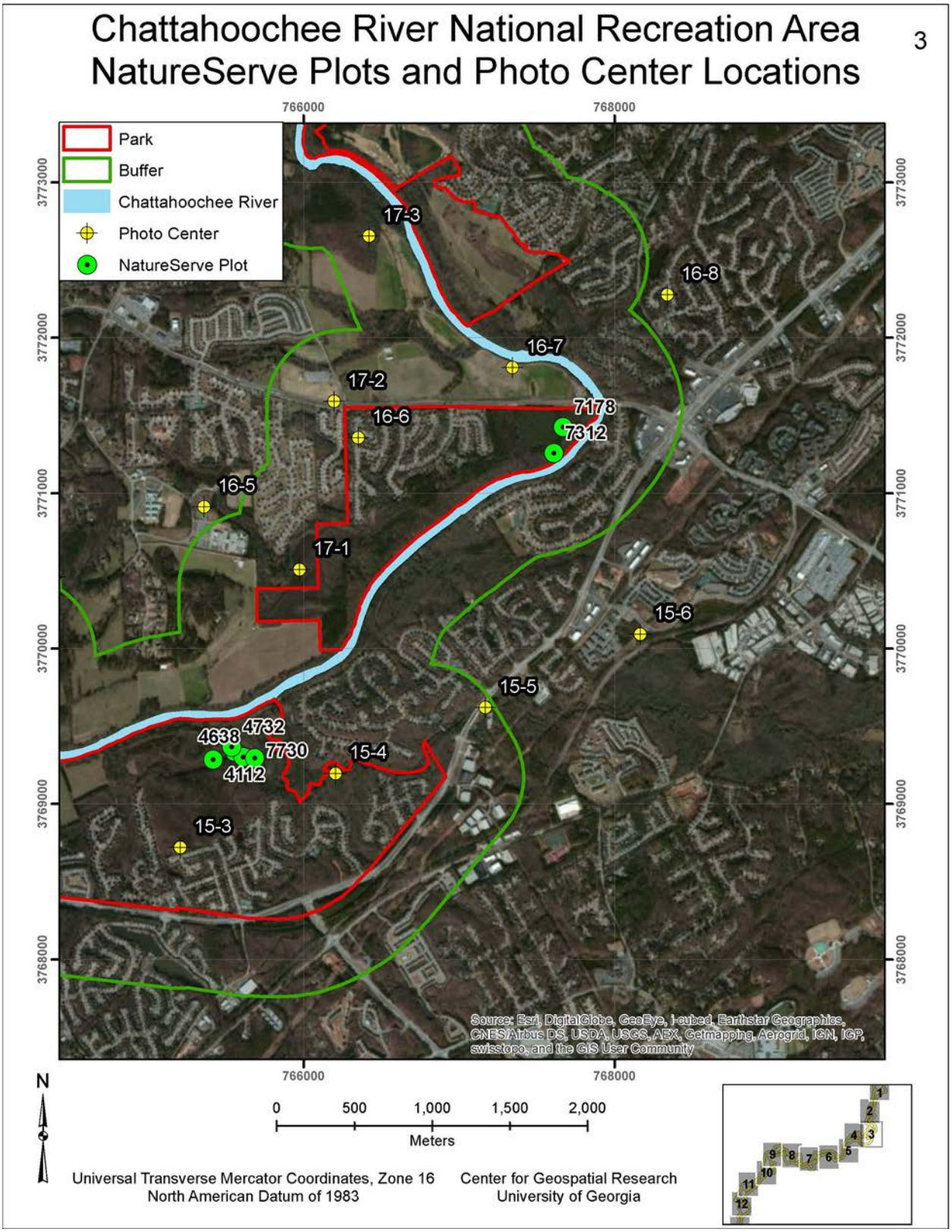
Appendix B – NatureServe Vegetation Plot Locations

NatureServe plot locations and photo center locations overlaid on visible imagery provided by DigitalGlobe. [Recreation Area divided into 13 sections for this report].

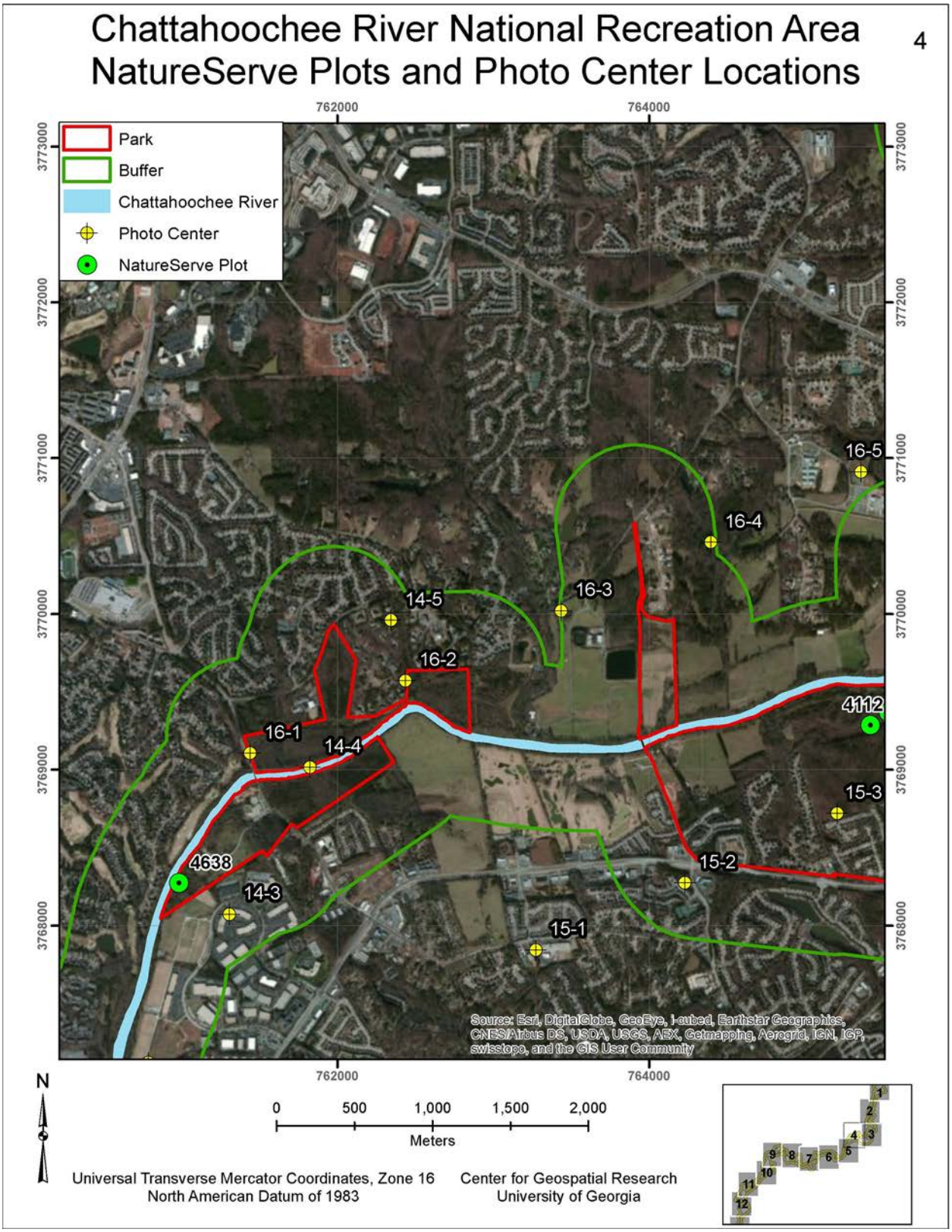
Section 1



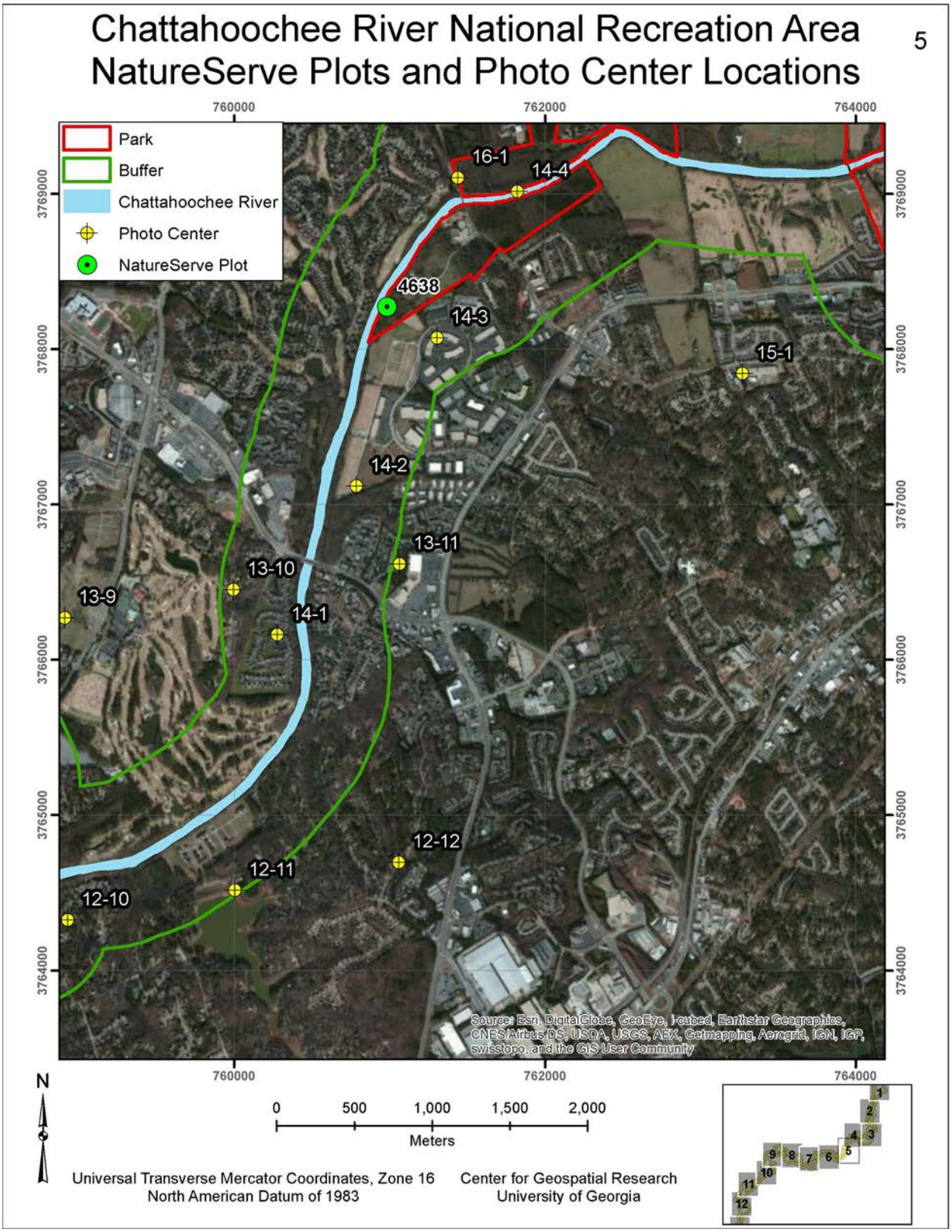

Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
2
Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
17-8
4638
17-7
7312
7330
17-6
17-5
17-4
764000
766000
768000
3778000
3777000
3776000
3775000
3774000
3773000
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Meters
Universal Transverse Mercator Coordinates, Zone 16
North American Datum of 1983
Center for Geospatial Research
University of Georgia


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
3
Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
766000
768000
3773000
3772000
3771000
3770000
3769000
3768000
17-3
16-8
16-7
17-2
16-6
7178
7312
16-5
17-1
15-6
15-5
4638
4732
7730
4112
15-4
15-3
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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North American Datum of 1983
Center for Geospatial Research
University of Georgia

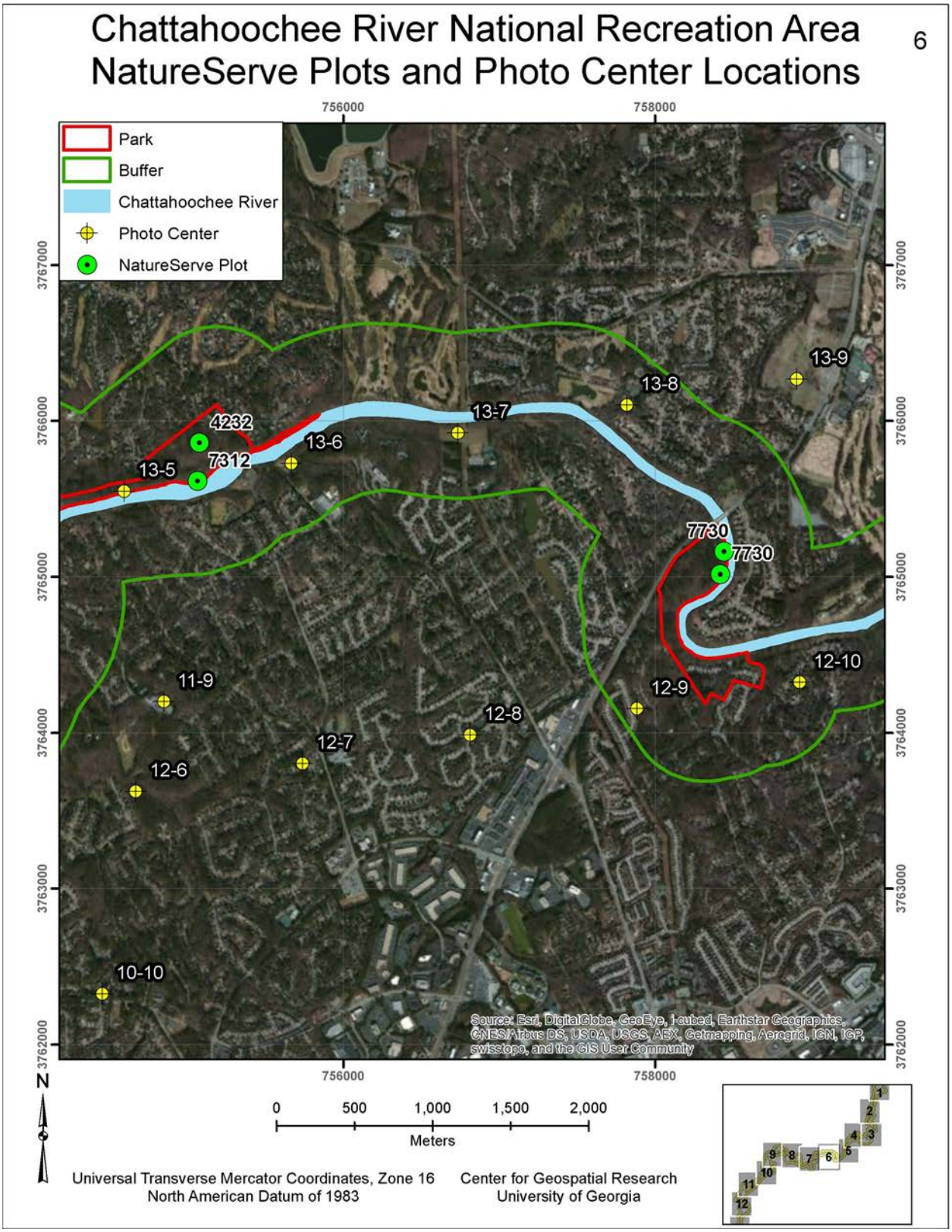
Section 4


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
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Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
762000
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3773000
3772000
3771000
3770000
3769000
3768000
16-5
16-4
16-3
14-5
16-2
4112
16-1
14-4
15-3
4638
14-3
15-2
15-1
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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North American Datum of 1983
Center for Geospatial Research
University of Georgia

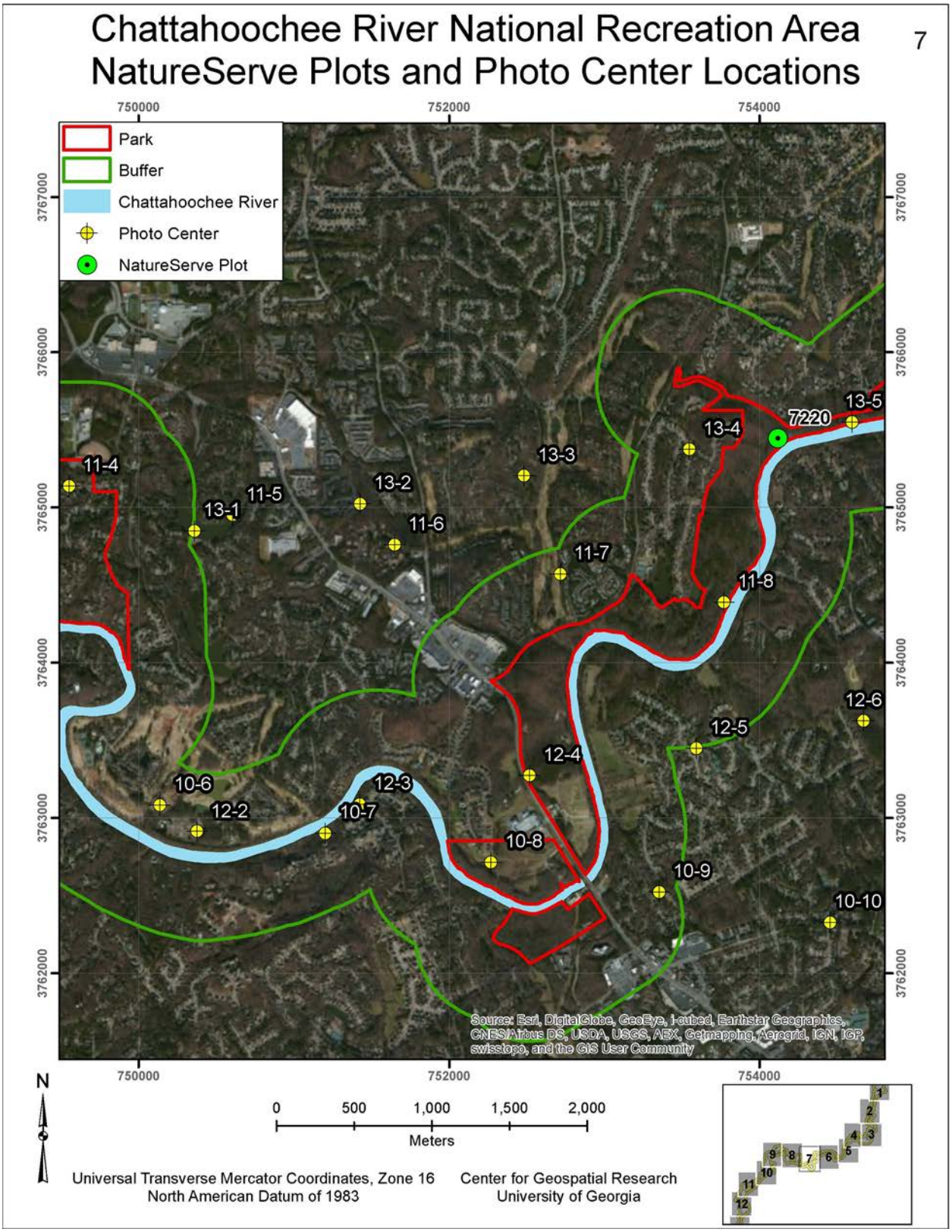
Section 5


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
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Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
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762000
764000
3769000
3768000
3767000
3766000
3765000
3764000
16-1
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4638
14-3
15-1
14-2
13-11
13-10
13-9
14-1
12-12
12-11
12-10
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Universal Transverse Mercator Coordinates, Zone 16
North American Datum of 1983
Center for Geospatial Research
University of Georgia
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12

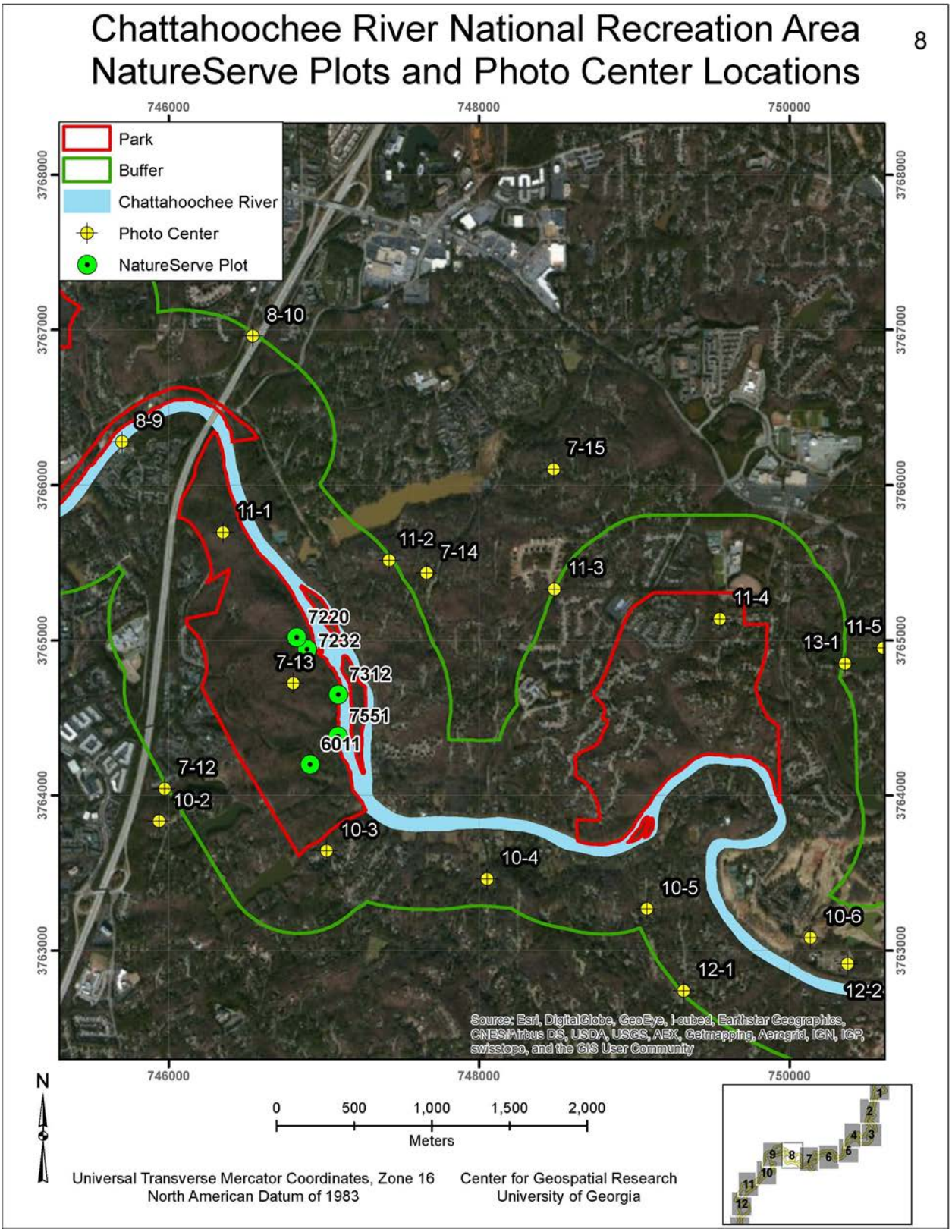
Section 6


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
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Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
756000
758000
3767000
3766000
3765000
3764000
3763000
3762000
4232
7312
13-5
13-6
13-7
13-8
13-9
7730
7730
11-9
12-6
12-7
12-8
12-9
12-10
10-10
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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North American Datum of 1983
Center for Geospatial Research
University of Georgia

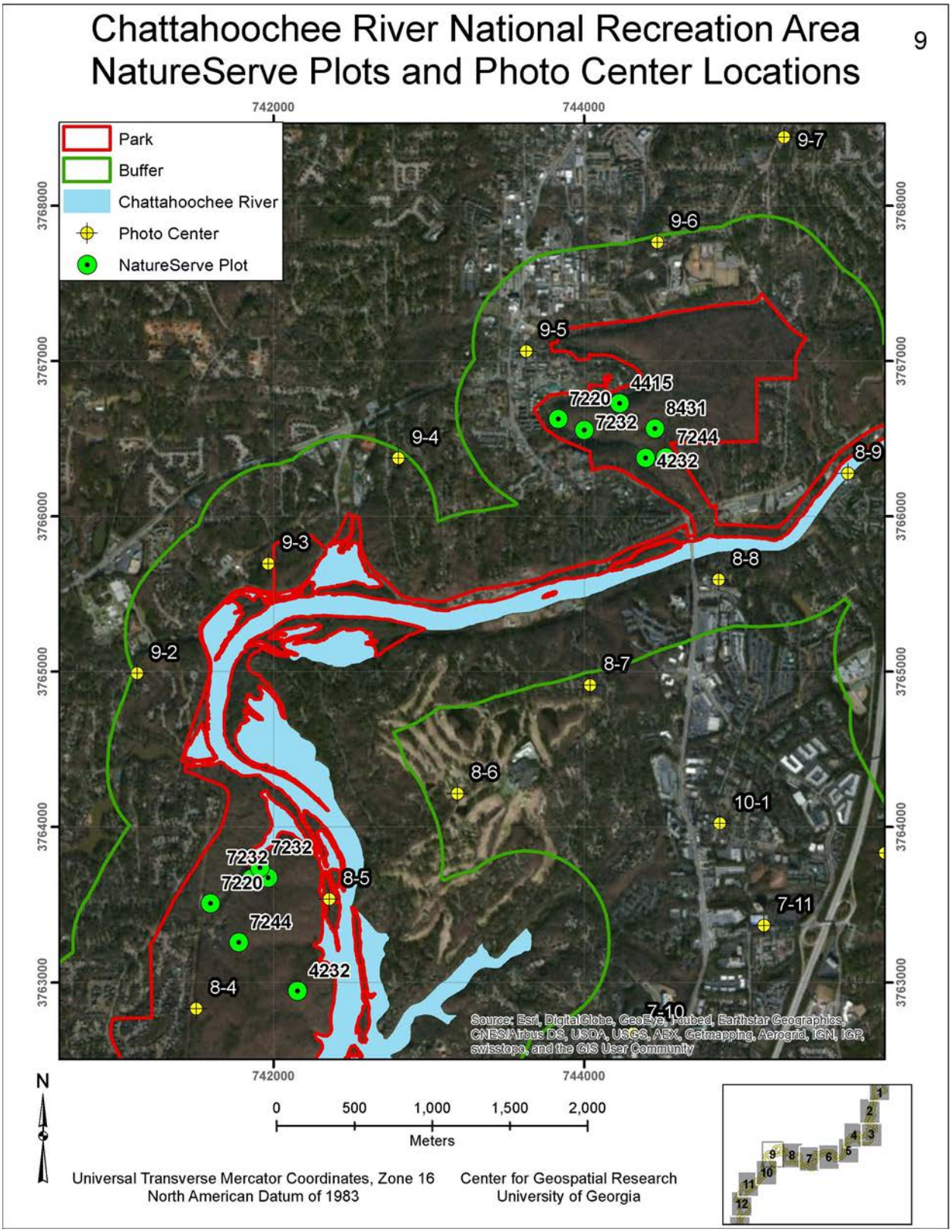
Section 7


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
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Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
750000
752000
754000
3767000
3766000
3765000
3764000
3763000
3762000
11-4
11-5
13-1
13-2
11-6
13-3
11-7
13-4
7220
13-5
11-8
12-6
12-5
12-4
12-3
10-6
12-2
10-7
10-8
10-9
10-10
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Center for Geospatial Research
University of Georgia

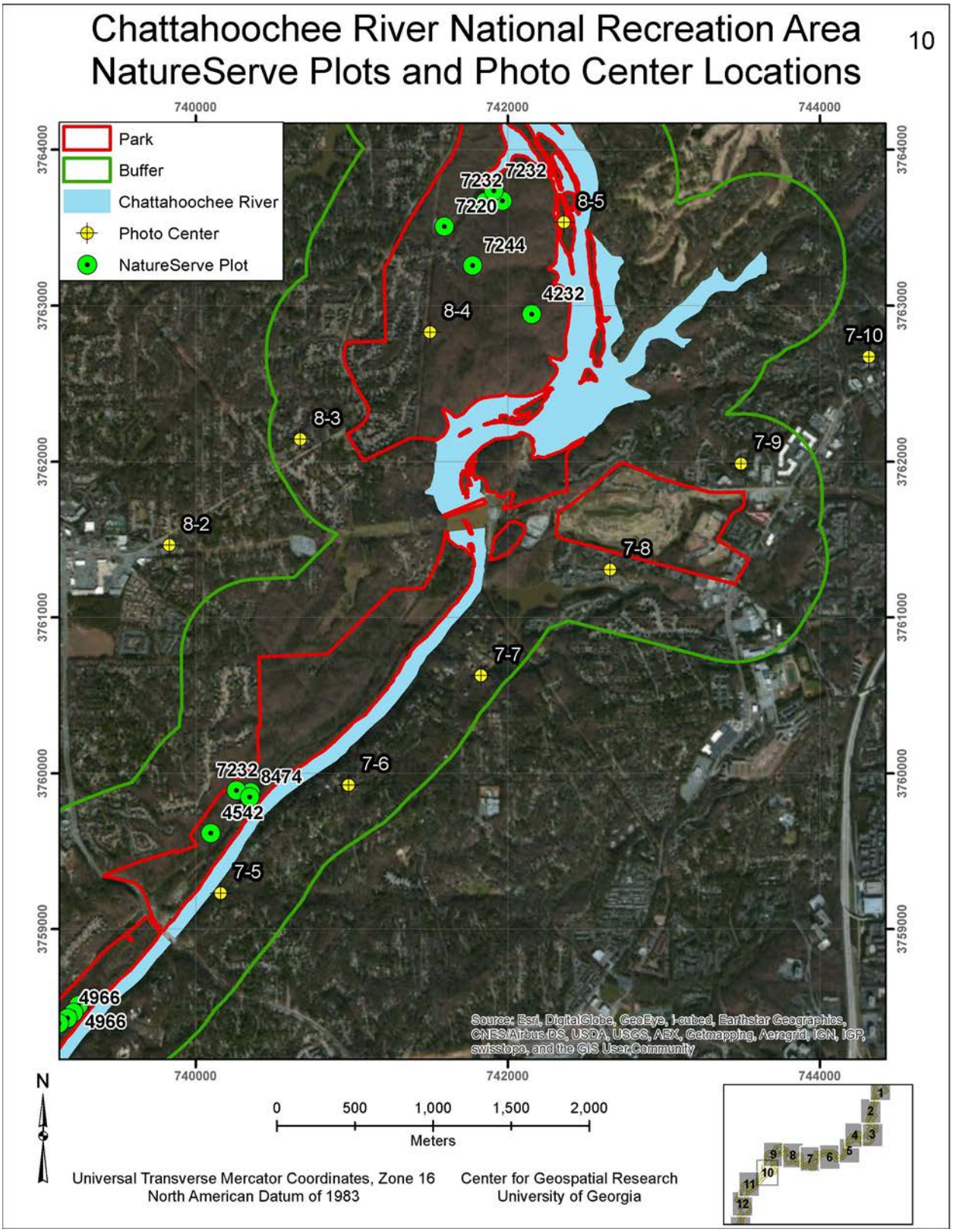
Section 8


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
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Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
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748000
750000
3768000
3767000
3766000
3765000
3764000
3763000
8-10
8-9
7-15
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11-2
7-14
11-3
11-4
11-5
13-1
7220
7232
7-13
7312
7551
6011
7-12
10-2
10-3
10-4
10-5
10-6
12-1
12-2
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Center for Geospatial Research
University of Georgia

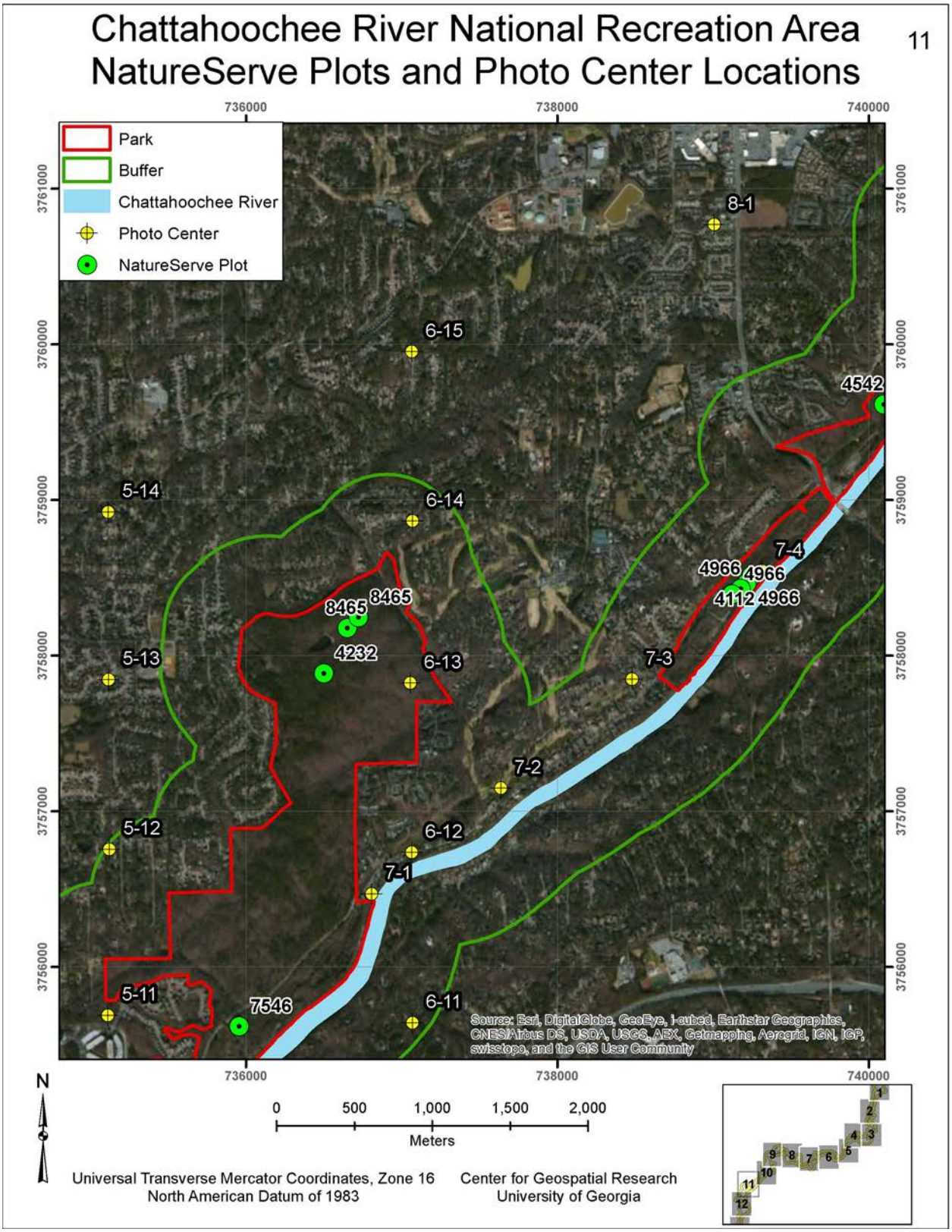
Section 9


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
9
Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
742000
744000
3768000
3767000
3766000
3765000
3764000
3763000
9-7
9-6
9-5
4415
7220
8431
7232
7244
4232
9-4
8-9
9-3
8-8
9-2
8-7
8-6
10-1
7232
7232
7220
8-5
7244
4232
8-4
7-11
7-10
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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North American Datum of 1983
Center for Geospatial Research
University of Georgia

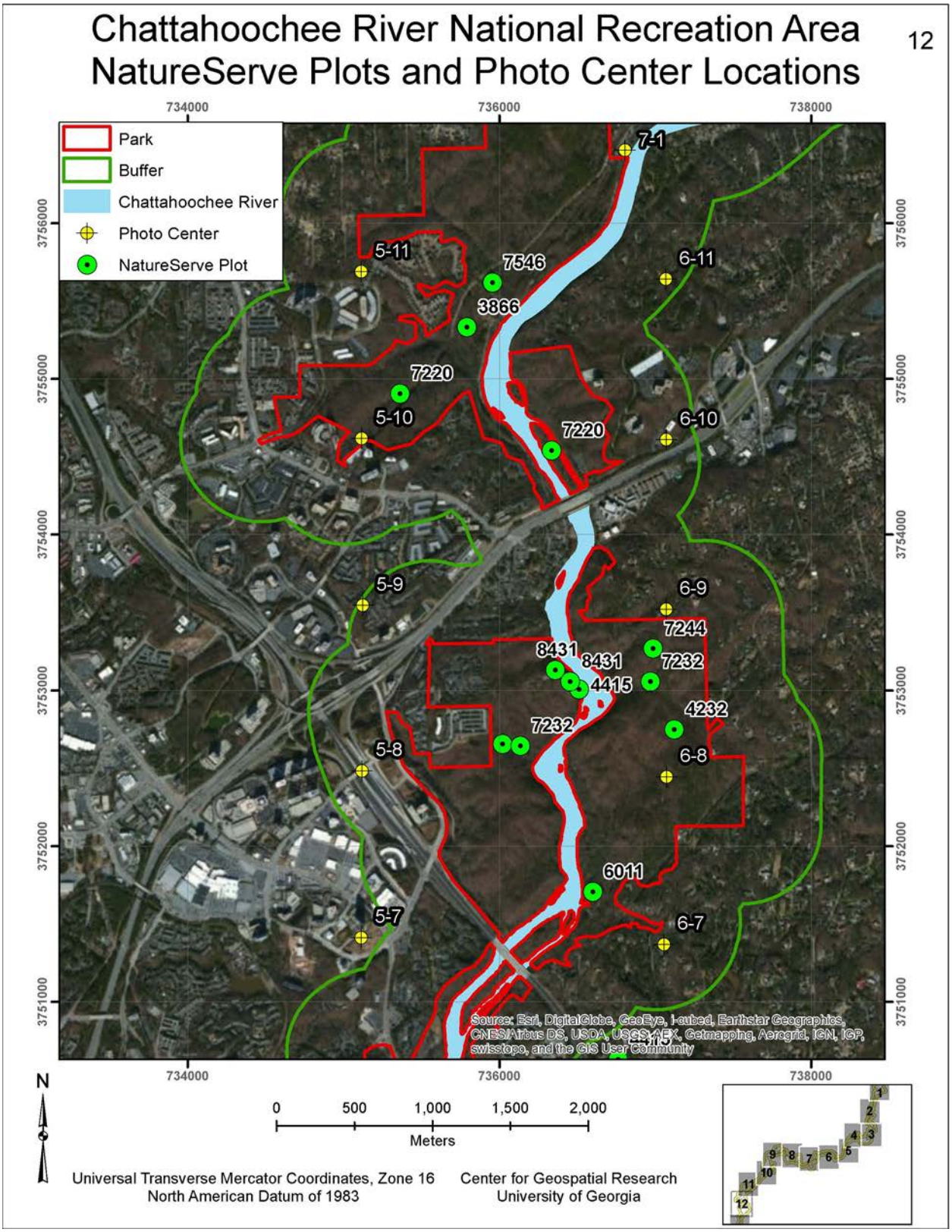
Section 10


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
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Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
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742000
744000
3764000
3763000
3762000
3761000
3760000
3759000
7232
7232
7220
8-5
7244
4232
8-4
7-10
8-3
7-9
8-2
7-8
7-7
7232
8474
7-6
4542
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4966
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Center for Geospatial Research
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12

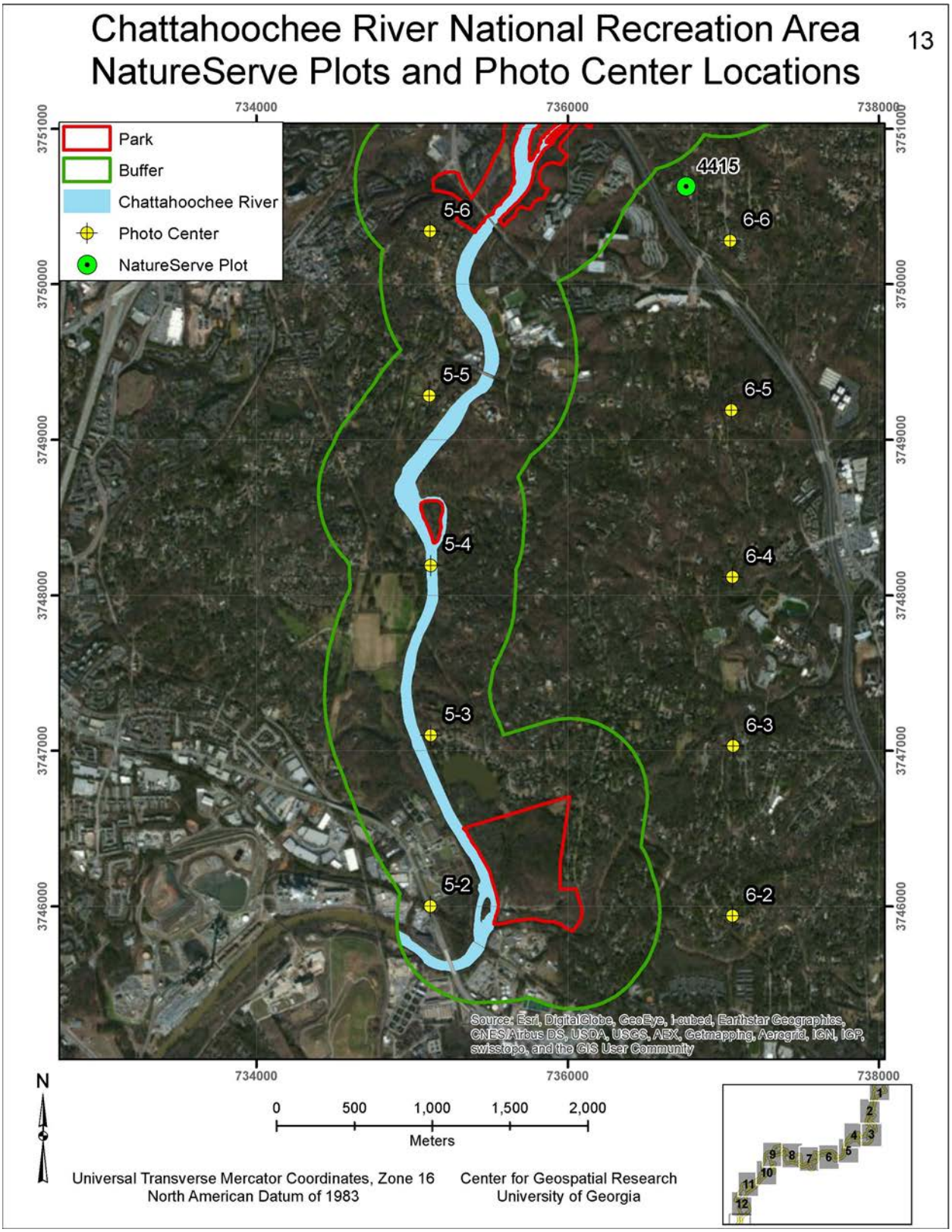
Section 11


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
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Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
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738000
740000
3761000
3760000
3759000
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3756000
8-1
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4542
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6-14
7-4
4966
4966
4112
4966
8465
8465
4232
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6-13
7-3
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6-12
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5-11
7546
6-11
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Meters
Universal Transverse Mercator Coordinates, Zone 16
North American Datum of 1983
Center for Geospatial Research
University of Georgia

Section 12


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
12
Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
734000
736000
738000
3756000
3755000
3754000
3753000
3752000
3751000
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5-11
7546
3866
6-11
7220
5-10
7220
6-10
5-9
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8431
8431
7232
4415
4232
7232
5-8
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N
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Meters
Universal Transverse Mercator Coordinates, Zone 16
North American Datum of 1983
Center for Geospatial Research
University of Georgia

Section 13


Chattahoochee River National Recreation Area
NatureServe Plots and Photo Center Locations
13
Park
Buffer
Chattahoochee River
Photo Center
NatureServe Plot
4415
5-6
6-6
5-5
6-5
5-4
6-4
5-3
6-3
5-2
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N
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Meters
Universal Transverse Mercator Coordinates, Zone 16
North American Datum of 1983
Center for Geospatial Research
University of Georgia

Appendix C – NatureServe Vegetation Plot Data

NatureServe vegetation plot locations and notes. Field data acquired by L. Echols, L. Kruse and G. Burke in May, July, August, September, and October 2007 and August and September 2008.

Plot Code	Field X	Field Y	Provisional	Elcode	Environment	Leaf Type	Leaf Phenology	Physiological Class
CHAT001	33.8913	-84.4375	Rock Chestnut Oak, Mockernut, Big Leaf Magnolia, Small Stream Mesic Slope Forest	7232	Trails, roads, exotic plants	Broad-leaved	Cold-deciduous	Forest
CHAT002	33.8695	-84.4404		4415	Unmarked foot path	Broad-leaved	Cold-deciduous	Forest
CHAT003	33.8932	-84.4373		7244	Numerous canopy gaps, plot falls between two foot trails, potential disturbance from foot traffic; herb layer species richness depauperate	Broad-leaved	Cold-deciduous	Forest
CHAT004	33.8909	-84.4425		4415		Broad-leaved	Cold-deciduous	Forest
CHAT005	33.8879	-84.4479	Mesic stream terrace *Q. alba*			Forest		
CHAT006	33.8878	-84.4467		7232		Broad-leaved	Cold-deciduous	Forest
CHAT007	33.8885	-84.4360		4232	Even-aged pine stand; logging or agriculture in past	Mixed	Mixed evergreen/cold-deciduous	Forest
CHAT008	33.9162	-84.9423	Hibiscus	3901		Broad-leaved	Cold-deciduous	Shrubland
CHAT009	33.9520	-84.3991		4638	Trails/roads	Broad-leaved	Cold-deciduous	Forest
CHAT010	33.9399	-84.4114		4112		Graminoid	Herb-perennial	Herbaceous
CHAT011	33.9395	-84.4118		4966		Broad-leaved	Herb-perennial	Herbaceous
CHAT012	33.9497	-84.4019		4542	Small amount of *Lonicera japonica* and *Ligustrum sinense*	Broad-leaved	Cold-deciduous	Forest
CHAT013	33.9402	-84.0000		4112		Broad-leaved	Herb-perennial	
CHAT014	33.9121	-84.4497		3866		Graminoid	Herb-perennial	Herbaceous
CHAT015	33.9375	-84.4396		8465	Several *Cornus* standing dead with signs of younger sucker shoots, a number of live trees with no immediate signs of disease	Broad-leaved	Cold-deciduous	Forest

Plot Code	Field X	Field Y	Provisional	Elcode	Environment	Leaf Type	Leaf Phenology	Physiological Class
CHAT016	33.9381	-84.4388		8465	Trail upslope outside of plot, minimal human disturbance; *ligustrum sinense* established and could pose threat to area	Broad-leaved	Cold-deciduous	Forest
CHAT017	33.9349	-84.4413		4232		Needle-leaved	Evergreen	Forest
CHAT018	33.9146	-84.4478		7546	Logging, exotic plants, agriculture?	Broad-leaved	Cold-deciduous	Forest
CHAT019	33.9858	-84.3818		8465		Broad-leaved	Cold-deciduous	Forest
CHAT020	33.9858	-84.3806		7232	Small amounts of *Ligustrum sinense*, *Lonicera japonica*, and *Rosa multiflora*	Broad-leaved	Cold-deciduous	Forest
CHAT021	33.9864	-84.3812		7232	Exotic plants	Broad-leaved	Cold-deciduous	Forest
CHAT022	33.9844	-84.3847		7220	Non-official foot trail	Broad-leaved	Cold-deciduous	Forest
CHAT023	33.9821	-84.3828		7244	Small amounts of *Albizzia julibrissin*, slightly more *Ligustrum sinense*	Broad-leaved	Cold-deciduous	Forest
CHAT024	33.9792	-84.3788		4232		Mixed	Mixed evergreen/cold-deciduous	Forest
CHAT025	33.9048	-84.4440		7220	*Lonicera japonica*	Broad-leaved	Cold-deciduous	Forest
CHAT026	34.0096	-84.3536		4232	Exotic plants	Mixed	Mixed evergreen/cold-deciduous	Forest
CHAT027	34.0113	-84.3529		8431	Exotic plants	Broad-leaved	Cold-deciduous	Forest
CHAT028	34.0128	-84.3553		4415		Broad-leaved	Cold-deciduous	Forest
CHAT029	34.0113	-84.3578		7232		Broad-leaved	Cold-deciduous	Forest
CHAT030	33.9083	-84.4544		7220	Exotic plants	Broad-leaved	Cold-deciduous	Forest
CHAT031	34.0096	-84.3522		7244	Exotic plants	Broad-leaved	Cold-deciduous	Forest
CHAT032	33.9910	-84.3250	*Pinus taeda* Temporarily Flooded Forest	7551		Mixed	Mixed evergreen/cold-deciduous	Forest
CHAT033	33.9934	-84.3249	*Betula* / *Carpinus* Floodplain	7312	Exotic plants	Broad-leaved	Cold-deciduous	Forest
CHAT034	33.9961	-84.3270		7232		Broad-leaved	Cold-deciduous	Forest
CHAT035	34.1540	-84.0850	*Fagus* - *Liriodendron tulipifera* - *Pinus taeda* Mesic Slope	8465		Broad-leaved	Cold-deciduous	Forest

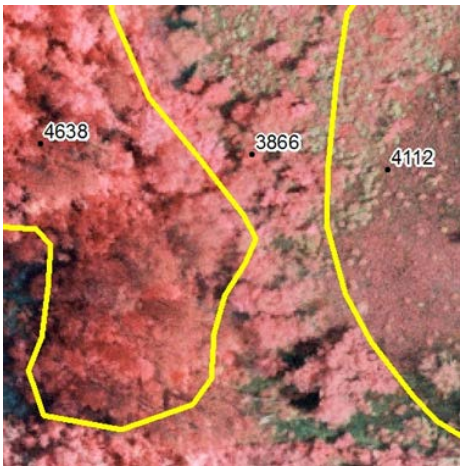
Plot Code	Field X	Field Y	Provisional	Elcode	Environment	Leaf Type	Leaf Phenology	Physiological Class
CHAT036	34.1541	-84.0855		7521	Pine bark beetle	Broad-leaved	Cold-deciduous	Forest
CHAT037	34.1528	-84.0851		7244		Broad-leaved	Cold-deciduous	Forest
CHAT038	34.1547	-84.0835				0	Cold-deciduous	Forest
CHAT039	34.1534	-84.0844			Pine bark beetle	Broad-leaved	Cold-deciduous	Forest
CHAT040	34.1555	-84.0858		7221	Hiker made trail; exotic plants; Dogwood anthracnose	Broad-leaved	Cold-deciduous	Forest
CHAT041	34.1027	-84.1039		4638		Broad-leaved	Cold-deciduous	Forest
CHAT042	34.1422	-84.0905		7232	Exotic plants, dogwood anthracnose	Broad-leaved	Cold-deciduous	Forest
CHAT043	34.1425	-84.0868		4044		Graminoid	Herb-perennial	Herbaceous
CHAT044	34.0941	-84.1092		7330	Exotic plants: *Microstegium* forms a continuous carpet in the herbaceous layer; *Ligustrum sinense* and *Lonicera japonica* are also problematic	Broad-leaved	Cold-deciduous	Forest
CHAT045	34.0952	-84.1096		7312	Exotic plants: *Microstegium vimineum* forms a continuous carpet within plot	Broad-leaved	Cold-deciduous	Forest
CHAT046	34.0311	-84.1238		4112		Graminoid	Herb-annual	Herbaceous
CHAT047	34.0307	-84.1253		4112		Mixed	Herb-annual	Shrubland
CHAT048	34.0308	-84.1232		4638		Broad-leaved	Cold-deciduous	Forest
CHAT049	34.0307	-84.1224		7730	Exotic plants: *Ligustrum sinense* is very established and needs control before native shrubs are excluded	Broad-leaved	Cold-deciduous	Forest
CHAT050	34.0314	-84.1240		4732	Area potentially affected by herbicide spraying - need land use history data	Graminoid	Herb-perennial	Herbaceous
CHAT051	34.0479	-84.1010		7312	*Ligustrum sinense* is well established and problematic	Broad-leaved	Cold-deciduous	Forest
CHAT052	34.0494	-84.1003		7178	Logging	Needle-leaved	Evergreen	Forest
CHAT053	34.1189	-84.0974		4638		Broad-leaved	Cold-deciduous	Forest
CHAT054	34.1360	-84.0864		7244	Dogwood anthracnose	Broad-leaved	Cold-deciduous	Forest
CHAT055	34.1426	-84.0188		4232		Needle-leaved	Evergreen	Forest
CHAT056	34.1426	-84.0188		4415	Water runoff created path to river, only point of soil exposure, likely also used by hikers	Broad-leaved	Cold-deciduous	Forest
CHAT057	34.0120	-84.3596		7220		Broad-leaved	Cold-deciduous	Forest

Plot Code	Field X	Field Y	Provisional	Elcode	Environment	Leaf Type	Leaf Phenology	Physiological Class
CHAT058	33.9968	-84.3277		7220	Exotic plants: *Lonicera japonica* and *Hedera helix* are problematic; *Microstegium* is established	Broad-leaved	Cold-deciduous	Forest
CHAT059	33.9894	-84.3270		6011		Needle-leaved	Evergreen	Forest
CHAT060	33.9521	-84.4001		7232	Exotic plants: *Lonicera japonica* a serious problem in the herbaceous layer	Broad-leaved	Cold-deciduous	Forest
CHAT061	33.9517	-84.3992		8474		Broad-leaved	Cold-deciduous	Shrubland
CHAT062	33.8921	-84.4441		8431		Broad-leaved	Cold-deciduous	Forest
CHAT063	33.8914	-84.4431		8431		Broad-leaved	Cold-deciduous	Forest
CHAT064	34.0227	-84.1736		4638	Exotic plants	Broad-leaved	Cold-deciduous	Forest
CHAT065	33.9953	-84.2020		7730		Broad-leaved	Cold-deciduous	Forest
CHAT066	33.9940	-84.2023		7730		Broad-leaved	Cold-deciduous	Forest
CHAT067	34.0024	-84.2382		4232		Mixed	Mixed evergreen/cold-deciduous	Forest
CHAT068	33.9989	-84.2487		7220		Broad-leaved	Cold-deciduous	Forest
CHAT069	34.0002	-84.2384		7312		Broad-leaved	Cold-deciduous	Forest
CHAT070	33.9392	-84.4122		4966		Graminoid	Herb - perennial	Herbaceous
CHAT071	33.9389	-84.4128		4966		Graminoid	Herb - perennial	Herbaceous
CHAT072	33.8792	-84.4419		6011		Needle-leaved	Evergreen	Forest

Appendix D – Photointerpretation Key

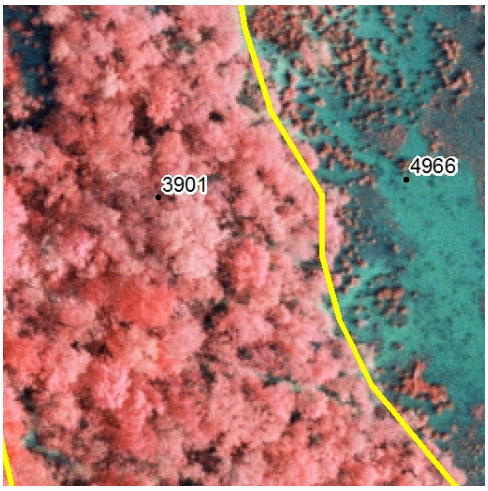
The photointerpretation key describes the attributes of the color infrared (CIR) images used to delineate the vegetation association CEGL codes found within the park. For each CEGL, a CIR image chip from within the park is included. For most CEGL codes, we also included a ground based digital photo of the vegetation, taken within the park. The standard visual cues to interpret and distinguish vegetation are described, including color, tone, texture, and pattern. When applicable, we also include comments on location within the park or topographic position. If there were other vegetation associations within the park that appeared similar on the CIR photographs, traits used to distinguish between similar vegetation associations are described.

The Vegetation Description for the CEGL within the park was copied directly from NatureServe (2009) to provide plot level information on species composition, dominance, characteristic species, and percent estimate of vegetation cover in understory, midstory, and/or canopy. It also includes the Global Description and geographic distribution. A separate literature cited section of the references from NatureServe (2009) text that was directly copied into the photointerpretation key is included at the end of this appendix.

Attribute	Description
CEGL Code	3866
Community Name	Southern Woolgrass Bulrush Marsh
Pictures	 
Color	Pink with gray
Tone	Light
Texture	Coarse
Pattern	Open
Height	Very short
Shape	Oblong
Size	Rare class, occurs only once in park.
Location	Hydric shrubland found in wetlands, especially artificial ones.
Association	4112
Comments	Similar to 4112 but usually wetter with clumps of taller vegetation.

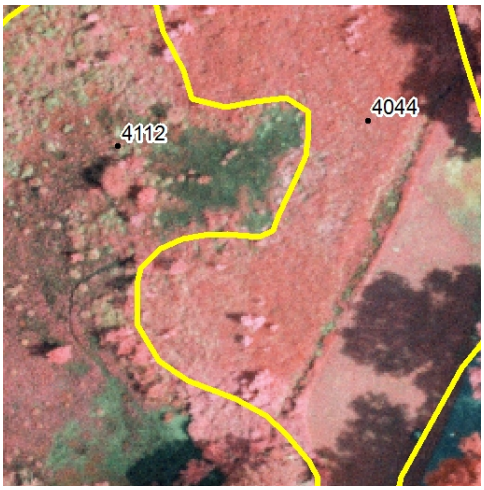
Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: This community is defined by the dominance of *Scirpus cyperinus* (woolgrass) in the herbaceous layer which may be completely closed (90-100% cover). At Chattahoochee River, there is a very sparse (10%) emergent tree layer (5-10 m) of *Fraxinus pennsylvanica* (green ash) and sparse (30%) shrub layer (1-5 m) of *Alnus serrulata* (hazel alder), which is also found at the Kennesaw Mountain site along with a small amount *Salix nigra* (black willow). Additional herbs found in small amounts at one site or the other or both include *Boehmeria cylindrica* (small-spike false nettle), *Eleocharis obtusa* (blunt spikerush), *Juncus biflorus* (bog rush), *Juncus effusus* (common rush), *Lobelia cardinalis* (cardinalflower), *Ludwigia palustris* (marsh seedbox), *Mikania scandens* (climbing hempvine), *Polygonum hydropiper* (marshpepper knotweed) (exotic), *Polygonum punctatum* (dotted smartweed), *Proserpinaca pectinata* (combleaf mermaidweed), *Sparganium americanum* (American bur-reed), and *Triadenum walteri* (greater marsh St. Johnswort).

Global Vegetation: Stands of this association consist of *Scirpus cyperinus* (woolgrass) as an essentially monospecific stand. *Saccharum* (sugarcane) spp., *Carex* (sedge) spp., and *Schoenoplectus* (bulrush) spp. are often found in this community, especially on the margins. Other co-occurring species of this association are not fully understood. In the Interior Low Plateau of Tennessee, *Scirpus cyperinus* (woolgrass) is commonly found with *Typha latifolia* (broadleaf cattail). In addition, *Juncus effusus* (common rush) and an occasional *Alnus serrulata* (hazel alder) are also present.

Attribute	Description
CEGL Code	3901
Community Name	Black Willow Riverbank Shrubland
Pictures	 
Color	Pink to red
Tone	Light
Texture	Coarse
Pattern	Thin with dense thickets
Height	Short
Shape	Patchy, following topography
Size	Uncommon class; very small patches with little variation.
Location	Hydric shrubland found in low, wet regions.
Association	7730, 4966
Comments	Trees in wetland areas; usually small areal extent. Distinguishable from 7312 and 7730 by shorter canopy height.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate (40% cover) tall-shrub layer (2-5 m tall) is dominated by *Salix nigra* (black willow) with lesser amounts of *Acer rubrum* (red maple) and *Liquidambar styraciflua* (sweetgum). The sparse (20%) short-shrub layer (2-5 m) includes *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), and *Rubus argutus* (sawtooth blackberry). The dense (80%) herbaceous layer is codominated by *Erechtites hieraciifolia* (American burnweed) and *Juncus effusus* (common rush) and includes lesser amounts of *Panicum rigidulum* (redtop panicgrass), *Polygonum setaceum* (bog smartweed), and exotic *Polygonum hydropiper* (marshpepper knotweed).

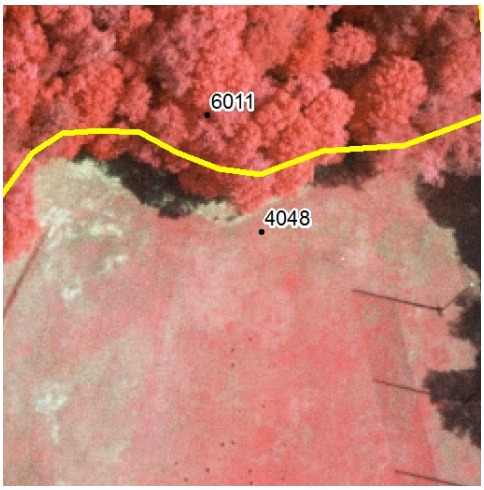
Global Summary: This broadly defined type represents vegetation dominated by scrubby forms of *Salix nigra* (black willow) across the southeastern and northeastern United States, and possibly into Canada. Stature and closure may vary depending on disturbance. Additional types may be developed as more information becomes available.

Attribute	Description
CEGL Code	4044
Community Name	Successional Broomsedge Vegetation
Pictures	 
Color	Pink
Tone	Light
Texture	Fine to medium
Pattern	Homogenous
Height	Very short
Shape	Irregular
Size	Uncommon class with very small average size.
Location	Mesic herbaceous vegetation found in old fields/pastures.
Association	3866
Comments	Drier areas with vegetation other than shrubs or trees. May have variable tone and texture depending upon species diversity.

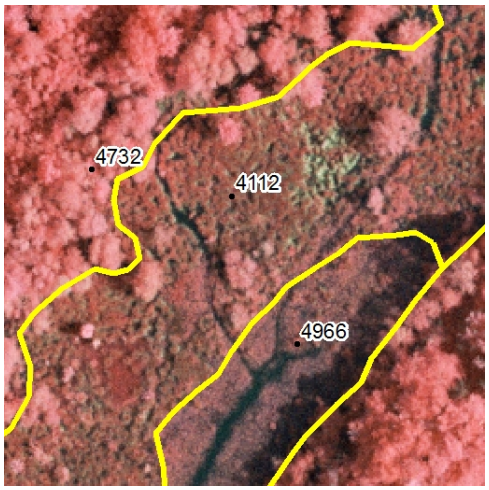
Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The completely closed (100% cover) herbaceous layer (1-2 m tall) is dominated by grasses *Andropogon virginicus* (broomsedge bluestem), *Dichanthelium scoparium* (velvet panicum), and *Tridens flavus* (purpletop tridens) and the forb *Eupatorium capillifolium* (dogfennel). Additional herbs include *Acalypha gracilens* (slender threeseed mercury), *Dichanthelium laxiflorum* (openflower rosette grass), *Eragrostis* (lovegrass) sp., *Lespedeza repens* (creeping lespedeza), *Potentilla canadensis* (dwarf cinquefoil), *Pseudognaphalium obtusifolium*, and exotic *Setaria pumila* (yellow bristlegrass).

Global Vegetation: Stands of this community are dominated by *Andropogon virginicus* var. *virginicus* (broomsedge bluestem), sometimes codominant with *Lolium pratense* (meadow ryegrass). Associated species vary with geography and habitat and include typical pioneer species. Species with high cover values in plot samples attributed to this type include *Tridens flavus* (purpletop tridens), *Setaria parviflora* (marsh bristlegrass), *Eragrostis spectabilis* (purple lovegrass), and *Panicum*

anceps (beaked panicgrass) (NatureServe Ecology, unpubl. data). On the eastern Highland Rim of Tennessee (Arnold Air Force Base), associated species include *Diodia teres* (poorjoe), *Aristida dichotoma* (churchmouse threeawn), *Aristida oligantha* (prairie threeawn), *Packera anonyma* (Small's ragwort), *Paspalum laeve* (field paspalum), *Lespedeza virginica* (slender lespedeza), and *Plantago virginica* (Virginia plantain). *Rubus argutus* (sawtooth blackberry) and *Smilax* (greenbrier) spp. may be locally abundant but are not dominant. In clearcuts, *Schizachyrium scoparium* (little bluestem), *Danthonia spicata* (poverty oatgrass), and *Dichanthelium* (rosette grass) spp. are also common, as are occasional *Quercus* (oak) spp. and *Rubus argutus* (sawtooth blackberry). The plot at Shiloh National Military Park (western Tennessee) was a mowed field of mostly native species, dominated by *Andropogon virginicus* var. *virginicus* (broomsedge bluestem). *Paspalum setaceum* (thin paspalum) and *Tridens flavus* (purpletop tridens) were codominant (with less cover). Other herbaceous plants with high cover values were *Setaria parviflora* (marsh bristlegrass), *Diodia teres* (poorjoe), *Schizachyrium scoparium* (little bluestem), and less common were *Packera anonyma* (Small's ragwort), *Sorghum halepense* (Johnsongrass), and *Cyperus retrorsus* (pine barren flatsedge). At less than 1% cover were *Polypremum procumbens* (juniper leaf), *Oxalis stricta* (common yellow oxalis), *Eragrostis spectabilis* (purple lovegrass), *Salvia lyrata* (lyreleaf sage), *Solanum carolinense* (Carolina horsenettle), *Digitaria sanguinalis* (hairy crabgrass), *Panicum anceps* (beaked panicgrass), *Croton willdenowii* (Willdenow's croton), *Trifolium pratense* (red clover), *Kummerowia striata* (Japanese clover), *Coreopsis pubescens* (star tickseed), *Plantago lanceolata* (narrowleaf plantain), and *Mecardonia acuminata* (axilflower). At only a trace amount of cover were *Conyza canadensis* (Canadian horseweed), *Acalypha virginica* (Virginia threeseed mercury), *Solidago* (goldenrod) sp., *Erigeron annuus* (eastern daisy fleabane), *Sida spinosa* (prickly fanpetals), *Hypericum drummondii* (nits and lice), *Polygala verticillata* (whorled milkwort), *Eupatorium capillifolium* (dogfennel), *Passiflora incarnata* (purple passionflower), and *Asclepias amplexicaulis* (clasping milkweed). In West Virginia, common associates include *Sorghastrum nutans* (Indiangrass), *Dichanthelium clandestinum* (deertongue), *Anthoxanthum odoratum* (sweet vernalgrass), *Phleum pratense* (timothy), *Dactylis glomerata* (orchardgrass), *Daucus carota* (Queen Anne's lace), *Lotus corniculatus* (birdfoot deervetch), *Trifolium pratense* (red clover), *Leucanthemum vulgare* (oxeye daisy), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), and *Solidago nemoralis* (gray goldenrod).

Attribute	Description
CEGL Code	4048
Community Name	Cultivated Meadow
Pictures	
Color	Green/gray with pink
Tone	Light
Texture	Fine to medium
Pattern	Thin
Height	Very short
Shape	Some straight edges following roads and/or boundaries.
Size	Very common class; one of the largest in average size with large variations possible.
Location	Graminoid/Herbaceous (lacking any shrubs or trees) found near park access points and transportation.
Association	4044
Comments	Similar to 4044 but usually shorter, more homogeous canopy and larger in size.

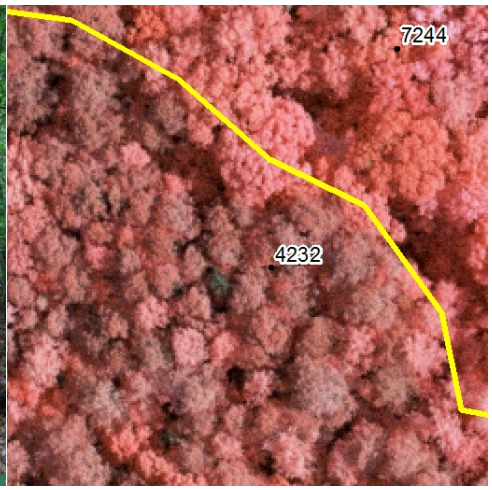
Summary: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. It is currently defined for the Central and Southern Appalachians, Ozarks, Ouachita Mountains, and parts of the Piedmont and Interior Low Plateau, but it is possible throughout much of the eastern United States and southern Canada. The dominant species in this type are the European "tall or meadow fescues" of uncertain and controversial generic placement. Several other exotic grasses (*Agrostis gigantea*, *Dactylis glomerata*, *Holcus lanatus*, *Phleum pratense*, and *Poa pratensis*, for example) are common associates. These communities are sometimes nearly monospecific but can also be very diverse and contain many native as well as exotic species of grasses, sedges, and forbs. Exotic forbs include the legumes *Lespedeza cuneata*, *Trifolium campestre*, *Trifolium hybridum*, *Trifolium pratense*, and *Trifolium repens*, as well as *Achillea millefolium*, *Calystegia sepium*, *Daucus carota*, *Leucanthemum vulgare*, *Oxalis stricta*, and *Plantago lanceolata*. Common native herbs include *Apocynum cannabinum*, *Desmodium canescens*, *Dichanthelium clandestinum*, *Erigeron annuus*, *Fragaria virginiana*, *Potentilla simplex*, *Solanum carolinense*, *Solidago canadensis*, and *Verbesina occidentalis*.

Attribute	Description
CEGL Code	4122
Community Name	Rush Marsh
Pictures	
Color	Pink to purple
Tone	Dark
Texture	Coarse
Pattern	Homogenous
Height	Very short
Shape	Irregular
Size	Common class; small average size with little variation.
Location	Hydric graminoid/herbaceous vegetation found in natural or artificial ponds.
Association	4966
Comments	Difficult to distinguish from 3866 in summer CIR. More even tone and texture relative to 4966.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The general appearance of this community is that of an herbaceous wetland. However, there may also be a moderate (60% cover) emergent tall-shrub layer (5-10 m tall) and a very sparse (10%) short-shrub layer (2-5 m) that may include *Salix nigra* (black willow), *Fraxinus pennsylvanica* (green ash), *Acer negundo* (box-elder), *Acer rubrum* (red maple), and *Liquidambar styraciflua* (sweetgum). The defining stratum (100%) is the herb layer (1-2 m) that is dominated by *Juncus effusus* (common rush); additional herbs include *Erechtites hieraciifolia* (American burnweed), *Hydrolea quadrivalvis* (waterpod), *Impatiens capensis* (jewelweed), *Ludwigia palustris* (marsh seedbox), *Panicum rigidulum* (redtop panicgrass), and *Scirpus cyperinus* (woolgrass). This community also supports state-vulnerable *Polygonum densiflorum* (denseflower knotweed).

Global Vegetation: This type is currently broadly and literally defined, based on dominance by *Juncus effusus* (common rush). In various parts of its broad range as currently defined, associated species may include *Andropogon glomeratus* (bushy bluestem), *Carex* (sedge) spp., *Cyperus*

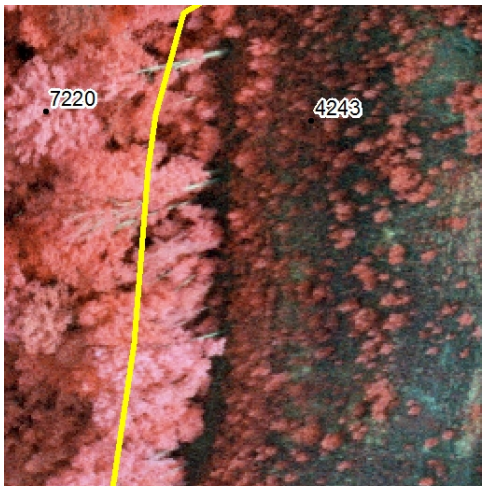
(flatsedge) spp., other *Juncus* (rush) spp., *Typha latifolia* (broadleaf cattail), *Scirpus cyperinus* (woolgrass), *Triadenum walteri* (greater marsh St. Johnswort), *Apios americana* (groundnut), and *Galium aparine* (stickywilly). In Georgia, Wharton (1978) cites *Carex rostrata* (beaked sedge), *Carex stipata* (owlfruit sedge), *Schoenoplectus pungens* (common threesquare), and *Sagittaria latifolia* (broadleaf arrowhead) as associates of beaver pond vegetation containing *Juncus effusus* (common rush).

Attribute	Description
CEGL Code	4232
Community Name	Piedmont Loblolly Pine–Oak Forest
Pictures	 
Color	Pink to purple
Tone	Light to medium
Texture	Fine to medium
Pattern	Dense canopy
Height	Tall
Shape	Expansive
Size	One of the most common in the park, large average size with large variation possible.
Location	Pine dominated forest found in mid to low topographic regions.
Association	6011, 7244, 4638
Comments	Distinguished from 6011 by larger pine crown sizes and a diversity of small to medium hardwood crown sizes, tones, and texture. Distinguished from 7551 by higher topographic position. Distinguished from 7232 by hardwoods with greater crown size (i.e. more developed hardwood).

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (50-80% cover) tree canopy, 20-50 m tall, is dominated by *Pinus taeda* (loblolly pine) and may occur with lesser amounts of *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Pinus echinata* (shortleaf pine), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), *Quercus nigra* (water oak), *Quercus prinus* (chestnut oak), and *Quercus velutina* (black oak). The sparse to moderately dense (30-70%) subcanopy (10-20 m) may include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Prunus serotina* (black cherry), and canopy oaks, particularly *Quercus velutina* (black oak). The sparse to moderate (20-50%) tall-shrub layer (2-10 m) is made up of saplings of the tree species as well as *Fagus grandifolia* (American beech) and *Vaccinium* spp. Common and/or abundant short shrubs in the very sparse (5-30%) short-shrub layer (1-2 m) include *Asimina parviflora* (smallflower pawpaw), *Diospyros virginiana* (common persimmon), *Euonymus americanus* (strawberry bush), *Sassafras*

albidum (sassafras), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium pallidum* (Blue Ridge blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). The very sparse (5-30%) herbaceous layer is made up mostly of seedlings of the tree and shrub species but may also include small amounts of herbs such as *Chimaphila maculata* (striped prince's pine), *Coreopsis major* (greater tickseed), *Dichanthelium* (rosette grass) spp., *Symphyotrichum* (aster) spp., and *Polystichum acrostichoides* (Christmas fern). Vine diversity is high (up to 20% cover) and includes *Bignonia capreolata* (crossvine), *Decumaria barbara* (woodvamp), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax* (greenbrier) spp., *Toxicodendron radicans* (eastern poison-ivy), *Vitis aestivalis* (summer grape), and *Vitis rotundifolia* (muscadine).

Global Vegetation: Stands of this mixed oak-pine upland forest association are dominated by a combination of various oaks and other hardwoods with *Pinus* (pine) spp. *Pinus taeda* (loblolly pine) or *Pinus virginiana* (Virginia pine) are usually present or codominant, being generally less abundant in more mature stands. *Quercus falcata* (southern red oak) is characteristic, but other oaks are also present, including *Quercus alba* (white oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), *Quercus marilandica* (blackjack oak), and *Quercus phellos* (willow oak), along with *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), *Pinus echinata* (shortleaf pine), and *Quercus nigra* (water oak). The subcanopy may include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Prunus serotina* (black cherry), and *Ulmus alata* (winged elm), as well as smaller oaks, particularly *Quercus velutina* (black oak). The shrub layers may include *Fagus grandifolia* (American beech), *Vaccinium arboreum* (farkleberry), and *Vaccinium pallidum* (Blue Ridge blueberry), with *Asimina parviflora* (smallflower pawpaw), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Diospyros virginiana* (common persimmon), *Euonymus americanus* (strawberry bush), *Sassafras albidum* (sassafras), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium pallidum* (Blue Ridge blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). The herbaceous layer may include *Andropogon virginicus* (broomsedge bluestem), *Asplenium platyneuron* (ebony spleenwort), *Chimaphila maculata* (striped prince's pine), *Coreopsis major* (greater tickseed), *Dichanthelium* (rosette grass) spp., *Gaultheria procumbens* (eastern teaberry), *Mitchella repens* (partridgeberry), and *Polystichum acrostichoides* (Christmas fern). Typical vines include *Bignonia capreolata* (crossvine), *Decumaria barbara* (woodvamp), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax* (greenbrier) spp., *Toxicodendron radicans* (eastern poison-ivy), *Vitis aestivalis* (summer grape), and *Vitis rotundifolia* (muscadine). The presence of invasive exotics such as *Lonicera japonica* (Japanese honeysuckle) and *Ligustrum* (privet) *sinense* may be common.

Attribute	Description
CEGL Code	4243
Community Name	Southern Piedmont Mafic Shrubland
Pictures	
Color	Red
Tone	Light
Texture	Coarse
Pattern	Thin with dense thickets
Height	Short
Shape	Elongated
Size	Rare class; small average area.
Location	Mafic shrubland found on steep slopes.
Association	Residential
Comments	Similar to 4112 but found on steeper slopes.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: This community is defined by its moderately dense (40% cover) tall-shrub (2-5 m tall) and short-shrub layers (1-2 m) of *Celtis occidentalis* (common hackberry), *Chionanthus virginicus* (white fringetree), *Philadelphus hirsutus* (streambank mock orange), *Ptelea trifoliata* (common hoptree), and *Vaccinium arboreum* (farkleberry). However, there is also a sparse (20%) emergent tree canopy (5-10 m) that may include *Carya glabra* (pignut hickory), *Carya pallida* (sand hickory), *Juniperus virginiana* (eastern red-cedar), *Quercus rubra* (northern red oak), and/or *Ulmus alata* (winged elm). Additional shrubs include these canopy species as well as *Crataegus* (hawthorn) spp., *Prunus umbellata* (hog plum), and *Rhus copallinum* (flameleaf sumac). The herbaceous layer is sparse (20-40%) but fairly diverse, including *Schizachyrium scoparium* (little bluestem) (dominant), *Andropogon gerardii* (big bluestem), *Arabis laevigata* (smooth rockcress), *Cheilanthes lanosa* (hairy lipfern), *Danthonia spicata* (poverty oatgrass), *Dichanthelium depauperatum* (starved panicgrass), *Dichanthelium sphaerocarpon* (roundseed panicgrass), *Heuchera americana* (American alumroot), *Hypericum gentianoides* (orangegrass), *Lespedeza virginica* (slender lespedeza), *Opuntia humifusa* (devil's-tongue), *Rubus argutus* (sawtooth blackberry), *Talinum teretifolium* (quill fameflower), and

others; over 45 species were recorded from the two sampled plots. *Smilax rotundifolia* (roundleaf greenbrier) is the dominant vine. In addition, this community supports state-imperiled *Pycnanthemum curvipes* (stone mountainmint) and state-vulnerable *Cyperus retrofractus* (rough flatsedge) and *Eupatorium sessilifolium* (upland boneset).

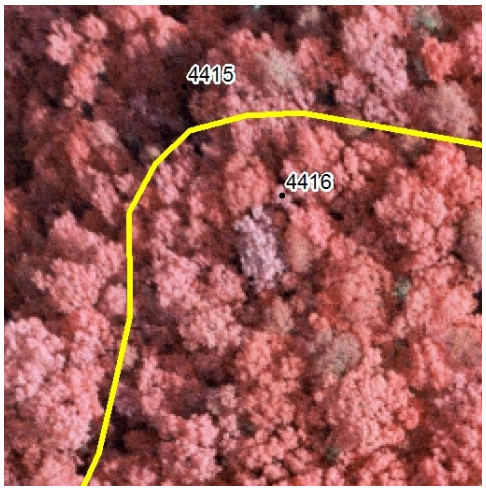
Global Vegetation: This community has dense cover of shrubs and patchy cover of herbaceous vascular plants and also has substantial cover of nonvascular plants. Vascular plants root in the crevices and gaps between rock and boulders. The most abundant shrubs are *Philadelphus hirsutus* (streambank mock orange), *Ptelea trifoliata* var. *mollis* (common hoptree), *Chionanthus virginicus* (white fringetree), and *Crataegus* (hawthorn) spp. Some examples may contain or be codominated by *Vaccinium arboreum* (farkleberry). Other vascular species present include *Yucca filamentosa* (Adam's needle), *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), *Danthonia spicata* (poverty oatgrass), *Pycnanthemum curvipes* (stone mountainmint), *Apocynum cannabinum* (Indianhemp), *Arabis laevigata* (smooth rockcress), *Monarda fistulosa* (wild bergamot), *Tradescantia subaspera* (zigzag spiderwort), *Eupatorium sessilifolium* (upland boneset), *Asplenium platyneuron* (ebony spleenwort), *Euphorbia corollata* (flowering spurge), and *Silene virginica* (fire pink). In addition, *Thuidium delicatulum* (delicate thuidium moss) is a common and conspicuous nonvascular plant. Trees are very limited, at coverages of less than 10%, and may include *Carya glabra* (pignut hickory), *Carya texana* (black hickory), *Celtis occidentalis* (common hackberry), *Ulmus alata* (winged elm), and *Quercus marilandica* (blackjack oak).

Attribute	Description
CEGL Code	4415
Community Name	Piedmont Chestnut Oak/Heath Bluff
Pictures	
Color	Pink
Tone	Light
Texture	Fine to medium
Pattern	Medium to dense
Height	Medium to tall
Shape	Narrow
Size	Common class; medium patch size with some variation.
Location	Hardwood dominated forest found on very steep slopes near streams.
Association	8475
Comments	Difficult to distinguish from 4416 and 8431 because they are all dominated by Chestnut Oak. However usually found on steeper slopes relative to 8431 which is found on ridge tops.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The tree canopies of the sampled plots are quite variable, ranging from relatively sparse (40% cover) and short (15-20 m tall) to extremely dense (80%) and tall (35-50 m). *Quercus prinus* (chestnut oak) is the dominant species and may occur along with significant amounts of *Liriodendron tulipifera* (tuliptree), *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), *Quercus rubra* (northern red oak), and/or *Quercus velutina* (black oak). Dominants in the sparse to very dense (30-90%) subcanopy (10-20 m) may include *Acer rubrum* (red maple), *Magnolia macrophylla* (bigleaf magnolia), (state-vulnerable), *Oxydendrum arboreum* (sourwood), *Quercus prinus* (chestnut oak), and *Quercus velutina* (black oak). The moderate to very dense (50-90%) tall-shrub layer (2-10 m) is codominated by *Kalmia latifolia* (mountain laurel) and *Rhododendron minus* (piedmont rhododendron), as is the sparse to very dense (30-90%) short-shrub layer (0.5-2 m), which may also include small amounts of *Amelanchier arborea* (common serviceberry), *Asimina parviflora*

(smallflower pawpaw), *Sassafras albidum* (sassafras), *Symplocos tinctoria* (common sweetleaf), *Vaccinium pallidum* (Blue Ridge blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). The herbaceous layer is very sparse (<5-30%) due to the dense upper layers. It is mostly comprised of tree and shrub seedlings but may include a few herbs such as *Danthonia spicata* (poverty oatgrass), *Dichanthelium* (rosette grass) spp., *Dryopteris marginalis* (marginal woodfern), *Euphorbia corollata* (flowering spurge), *Eurybia divaricata* (white wood aster), *Galax urceolata* (beetleweed), *Luzula echinata* (hedgehog woodrush), *Polystichum acrostichoides* (Christmas fern), *Pteridium aquilinum* (western brackenfern), and *Uvularia sessilifolia* (sessileleaf bellwort), and vines *Gelsemium sempervirens* (evening trumpetflower), *Smilax* (greenbrier) spp., and *Vitis rotundifolia* (muscadine).

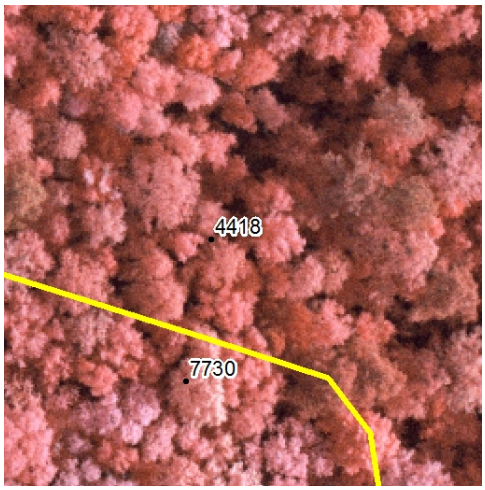
Global Vegetation: The canopy of stands of this association is typically dominated by *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), and *Acer rubrum* var. *rubrum* (red maple). The subcanopy is strongly dominated by *Oxydendrum arboreum* (sourwood). Other canopy and subcanopy trees may include *Quercus coccinea* (scarlet oak), *Quercus stellata* (post oak), *Quercus velutina* (black oak), *Cornus florida* (flowering dogwood), *Pinus echinata* (shortleaf pine), and *Pinus virginiana* (Virginia pine). The shrub stratum is characteristically dense, and is dominated by *Kalmia latifolia* (mountain laurel); other shrubs may include *Symplocos tinctoria* (common sweetleaf), *Gaylussacia frondosa* (blue huckleberry), *Vaccinium stamineum* (deerberry), and *Amorpha schwerinii* (Schwerin's false indigo). The herb stratum is sparse and of low diversity, though typical herbs and subshrubs include *Epigaea repens* (trailing arbutus), *Hexastylis virginica* (Virginia heartleaf), *Chimaphila maculata* (striped prince's pine), *Monotropa hypopithys* (pinesap), *Schizachyrium scoparium* (little bluestem), and *Iris verna* var. *verna* (dwarf violet iris). An Alabama example is dominated by *Quercus prinus* (chestnut oak). *Magnolia macrophylla* (bigleaf magnolia) is a significant canopy and/or subcanopy component in two plots taken from Chattahoochee River National Recreation Area. Other characteristic canopy species include *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Pinus echinata* (shortleaf pine), *Pinus palustris* (longleaf pine), and occasionally *Carya alba* (mockernut hickory), *Quercus stellata* (post oak), and *Oxydendrum arboreum* (sourwood). The shrub layer is represented by a very dense ericaceous component dominated by *Kalmia latifolia* (mountain laurel), *Rhododendron minus* (piedmont rhododendron), and to a lesser degree, *Symplocos tinctoria* (common sweetleaf) and *Vaccinium* (blueberry) spp. Herbs are generally very sparse with *Galax urceolata* (beetleweed), *Tiarella cordifolia* (heartleaf foamflower), *Hexastylis arifolia* (littlebrownjug), and *Polystichum acrostichoides* (Christmas fern) appearing most prominent (Schotz, A. pers. comm.).

Attribute	Description
CEGL Code	4416
Community Name	Xeric Mafic Chestnut Oak Forest
Pictures	
Color	Pink to red
Tone	Light
Texture	Medium to coarse
Pattern	Moderate to dense
Height	Short to medium
Shape	Slightly circular following ridgetop topography
Size	Common class; largest average size with very large variation.
Location	Xeric hardwood forest found on ridge tops.
Association	4415, 8431, 7323
Comments	Difficult to distinguish from 8431 and 4415 using amount of rhododendron or presence of mafic indicator species. Relying upon topographic position on ridge (not slope).

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (50-80% cover) tree canopy, 15-35 m tall, is codominated almost exclusively by *Carya pallida* (sand hickory) and *Quercus prinus* (chestnut oak), as is the very sparse to moderate (5-50%) subcanopy (10-20 m). Additional tree species may include *Carya ovalis* (red hickory), *Pinus echinata* (shortleaf pine), *Quercus rubra* (northern red oak), and *Quercus stellata* (post oak). The very sparse to moderate (5-50%) tall-shrub layer (2-10 m) and sparse (20-40%) short-shrub layer (1-2 m) are dominated by the canopy species; additional shrubs may include *Asimina parviflora* (smallflower pawpaw), *Celtis occidentalis* (common hackberry), *Chionanthus virginicus* (white fringetree), *Diospyros virginiana* (common persimmon), *Philadelphus hirsutus* (streambank mock orange), *Ptelea trifoliata* (common hoptree), *Sassafras albidum* (sassafras), and *Vaccinium arboreum* (farkleberry). The sparse to moderate (10-50%) herbaceous layer may include *Arabis laevigata* (smooth rockcress), *Asplenium platyneuron* (ebony spleenwort), *Chimaphila maculata* (striped prince's pine), *Cocculus carolinus* (Carolina coralbead), *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium commutatum* (variable panicgrass), *Houstonia longifolia*

(longleaf summer bluet), *Passiflora lutea* (yellow passionflower), *Piptochaetium avenaceum* (blackseed speargrass) (often dominant), *Rubus argutus* (sawtooth blackberry), *Schizachyrium scoparium* (little bluestem), and many others. *Parthenocissus quinquefolia* (Virginia creeper), *Smilax bona-nox* (saw greenbrier), and *Vitis rotundifolia* (muscadine) are common and abundant vines. This community supports several state-rare species, including state-critically imperiled *Muhlenbergia sobolifera* (rock muhly), state-imperiled *Pycnanthemum curvipes* (stone mountainmint), and state-vulnerable *Eupatorium sessilifolium* (upland boneset).

Global Vegetation: The canopy of stands typically contains *Quercus prinus* (chestnut oak), *Carya pallida* (sand hickory), *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Carya glabra* (pignut hickory), and *Pinus echinata* (shortleaf pine). The subcanopy may contain *Carya pallida* (sand hickory), *Quercus marilandica* (blackjack oak), *Cercis canadensis* (eastern redbud), and *Cornus florida* (flowering dogwood). Shrubs include *Rhus copallinum* (flameleaf sumac), *Ptelea trifoliata* (common hoptree), *Viburnum rufidulum* (rusty blackhaw), *Asimina parviflora* (smallflower pawpaw), *Styrax grandifolius* (bigleaf snowbell), *Vaccinium arboreum* (farkleberry), and *Vaccinium pallidum* (Blue Ridge blueberry). The rare shrub *Amorpha schwerinii* (Schwerin's false indigo) may be present within its limited range. Some woody vines which may be present include *Cocculus carolinus* (Carolina coralbead) and *Vitis rotundifolia* (muscadine). Some typical herbs (all of which may have low cover values) may include *Schizachyrium scoparium* (little bluestem), *Tragia urticifolia* (nettleleaf noseburn), *Dichanthelium* (rosette grass) sp., *Piptochaetium avenaceum* (blackseed speargrass), *Coreopsis major* (greater tickseed), *Tephrosia virginiana* (Virginia tephrosia), *Pityopsis graminifolia* (narrowleaf silkgrass), and *Solidago odora* var. *odora* (anisescented goldenrod).

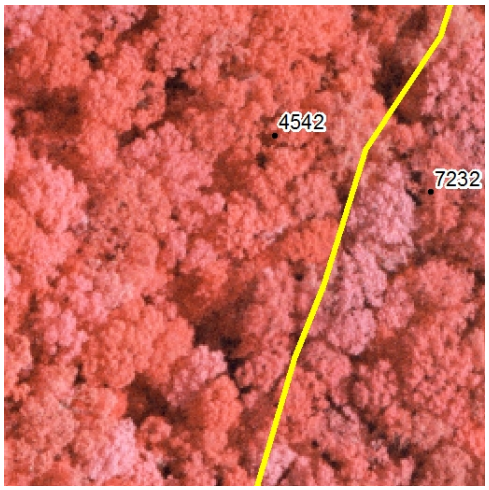
Attribute	Description
CEGL Code	4418
Community Name	Upper Southeast Small Stream Sweetgum – Tuliptree Forest
Pictures	 
Color	Green/gray with pink
Tone	Light
Texture	Fine to medium
Pattern	Thin
Height	Very short
Shape	Some straight edges following roads and/or boundaries.
Size	Very common class; medium average size with large variations possible.
Location	Graminoid/Herbaceous (lacking any shrubs or trees) found near cultural sites and transportation.
Association	4692, 4290
Comments	Similar to 4692 but with less pink. Also similar to 4092 but contains mowing lines.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (60-80% cover) tree canopy, 20-50 m tall, is codominated by *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree); additional species may include *Fraxinus pennsylvanica* (green ash), *Pinus taeda* (loblolly pine), *Platanus occidentalis* (American sycamore), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), and *Quercus rubra* (northern red oak). The moderately sparse (30-40%) subcanopy (10-20 m) is dominated by *Liquidambar styraciflua* (sweetgum) and includes other canopy species, as well as *Fagus grandifolia* (American beech). *Carpinus caroliniana* (American hornbeam) and *Lindera benzoin* (northern spicebush) dominate the sparse to moderate (20-50%) tall-shrub layer (2-10 m) and sparse to moderately dense (10-70%) short-shrub layer (1-2 m); additional shrubs may include *Acer rubrum* (red maple), *Aesculus sylvatica* (painted buckeye), *Carya* (hickory) spp., *Cornus florida* (flowering dogwood), *Corylus americana* (American hazelnut), *Fagus grandifolia* (American beech), *Morus rubra* (red mulberry), *Oxydendrum arboreum* (sourwood), *Prunus serotina* (black cherry), and *Toxicodendron radicans* (eastern poison-ivy). The sparse (10-40%) herbaceous layer is dominated by vines (up to 20%), particularly *Decumaria barbara*

(woodvamp), but may include *Bignonia capreolata* (crossvine), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), and *Vitis rotundifolia* (muscadine). Herbs include *Actaea racemosa* (black bugbane), *Asplenium platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Dioscorea quaternata* (fourleaf yam), *Goodyera pubescens* (downy rattlesnake plantain), *Rubus argutus* (sawtooth blackberry), *Sanicula canadensis* (Canadian blacksnakeroot), *Viola sororia* (common blue violet), and *Viola walteri* (prostrate blue violet). In addition, this community supports state-vulnerable *Collinsonia tuberosa* (deepwoods horsebalm).

Global Vegetation: The canopy, subcanopy, shrub, and herbaceous layers of stands of this association are often well-developed. Dominant canopy species always include *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree), while *Acer barbatum* (southern sugar maple) (in the southern part of the range) and *Acer rubrum* var. *rubrum* (red maple) may also make up significant amounts of the canopy. This community type exists as a continuum between two subtypes, i.e., the tuliptree subtype and the sweetgum subtype. In some examples, only one or the other dominates the canopy. However, in many examples, both are equally dominant. Other common species in the canopy and understory include *Ilex opaca* var. *opaca* (American holly), *Aesculus sylvatica* (painted buckeye), *Carpinus caroliniana* ssp. *caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Juglans nigra* (black walnut), *Morus rubra* var. *rubra* (red mulberry), *Ostrya virginiana* var. *virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), *Prunus serotina* var. *serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra* var. *rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), *Ulmus alata* (winged elm), *Juniperus virginiana* var. *virginiana* (eastern red-cedar), *Nyssa sylvatica* (blackgum), *Fraxinus americana* (white ash), *Halesia tetraptera* var. *tetraptera* (mountain silverbell), *Arundinaria gigantea* ssp. *gigantea* (giant cane), and *Fraxinus pennsylvanica* (green ash). Scattered individuals of *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch) may also occur in some stands. *Euonymus americanus* (strawberry bush), *Lindera benzoin* var. *benzoin* (northern spicebush), and *Corylus americana* (American hazelnut) are common and dominant in the shrub layer. Other shrub species that may be present include *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum nudum* var. *nudum* (possumhaw), *Viburnum prunifolium* (blackhaw), *Viburnum rufidulum* (rusty blackhaw), *Hamamelis virginiana* (American witch-hazel), *Asimina triloba* (pawpaw), and *Ilex decidua* (possumhaw), among others. On the most acidic sites of the Maryland Coastal Plain, *Clethra alnifolia* (coastal sweet-pepperbush), *Vaccinium corymbosum* (highbush blueberry), and *Magnolia virginiana* (sweetbay) may be present. Vines are prominent and include *Vitis rotundifolia* (muscadine), *Apios americana* (groundnut), *Campsis radicans* (trumpet creeper), *Aristolochia macrophylla* (pipevine), *Bignonia capreolata* (crossvine), *Dioscorea quaternata* (fourleaf yam), *Gelsemium sempervirens* (evening trumpetflower), *Parthenocissus quinquefolia* (Virginia creeper), *Campsis radicans* (trumpet creeper), *Passiflora lutea* (yellow passionflower), *Smilax bona-nox* (saw greenbrier), *Smilax glauca* (cat greenbrier), *Smilax hugeri* (Huger's carrionflower), *Smilax rotundifolia* (roundleaf greenbrier), and *Toxicodendron radicans* ssp. *radicans* (eastern poison-ivy). The herbaceous layer is species-rich and often has good sedge development. Common species in this layer include *Thalictrum thalictroides* (rue-anemone), *Trillium cuneatum* (little sweet Betsy), *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* var. *platyneuron* (ebony

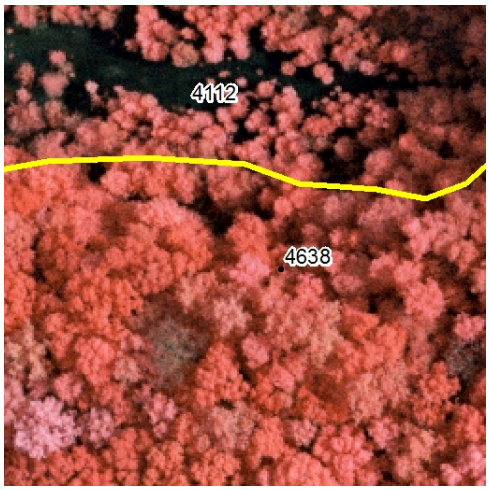
spleenwort), *Botrychium virginianum* (rattlesnake fern), *Carex* (sedge) spp., *Carex impressinervia* (ravine sedge), *Carex striatula* (lined sedge), *Cinna arundinacea* (sweet woodreed), *Elymus virginicus* (Virginia wildrye), *Galium circaezans* (licorice bedstraw), *Geum* (avens) *canadense*, *Medeola virginiana* (Indian cucumber), *Polystichum acrostichoides* (Christmas fern), and *Scutellaria integrifolia* (helmet flower), among many others. *Thelypteris noveboracensis* (New York fern) is a common patch-dominant in the northern part of the range and the Uwharrie Mountains of North Carolina. The exotics *Microstegium vimineum* (Nepalese browntop), *Ligustrum sinense* (Chinese privet), and *Lonicera japonica* (Japanese honeysuckle) are common in this community. Other exotics that colonize quickly in disturbed and fragmented versions of this association include *Wisteria sinensis* (Chinese wisteria), *Rosa multiflora* (multiflora rose), *Clematis terniflora* (sweet autumn virginsbower), *Hedera helix* (English ivy), and *Elaeagnus* (elaeagnus) sp.

Attribute	Description
CEGL Code	4542
Community Name	Piedmont Rocky Mesic Mafic Forest
Pictures	
Color	Red to pink
Tone	Light
Texture	Smooth to medium
Pattern	Medium to dense
Height	Tall
Shape	Patchy
Size	Rare class with small average size.
Location	Mesic hardwood dominated forest found in lower rocky slopes.
Association	7232, 7244
Comments	Difficult to distingush from 7244 but found in regions with greater slope.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70% cover) mature tree canopy, 35-50 m tall, is codominated by *Quercus alba* (white oak) and *Tilia americana* (American basswood) along with a lesser amount of *Carya alba* (mockernut hickory). The moderately sparse (40%) subcanopy (20-35 m) is dominated by *Carya alba* (mockernut hickory) and *Quercus alba* (white oak) and includes *Cornus florida* (flowering dogwood) and *Juglans nigra* (black walnut). The moderate (60%) tall-shrub layer (10-15 m) and moderately sparse (40%) short-shrub layer (1-2 m) are codominated by *Celtis occidentalis* (common hackberry) and *Cercis canadensis* (eastern redbud); additional shrubs found in both layers include sapling canopy species, *Acer leucoderme* (chalk maple), *Aesculus sylvatica* (painted buckeye), *Calycanthus floridus* (eastern sweetshrub), *Fraxinus americana* (white ash), *Sassafras albidum* (sassafras), and *Ulmus rubra* (slippery elm). Less common shrubs include *Asimina parviflora* (smallflower pawpaw), *Cornus alternifolia* (alternateleaf dogwood), and *Viburnum rufidulum* (rusty blackhaw). The herbaceous layer is very sparse (10%) due to the density of the upper layers; herbs present include *Arisaema triphyllum* (Jack in the pulpit), *Aristolochia serpentaria* (Virginia snakeroot), *Arundinaria gigantea* (giant cane), *Asplenium platyneuron* (ebony

spleenwort), *Dichanthelium commutatum* (variable panicgrass), *Galium circaezans* (licorice bedstraw), *Polygonatum biflorum* (smooth Solomon's seal), *Polystichum acrostichoides* (Christmas fern), and *Tradescantia ohiensis* (bluejacket). Vines include *Toxicodendron radicans* (eastern poison-ivy) and *Vitis rotundifolia* (muscadine), which climb well into the tree canopy.

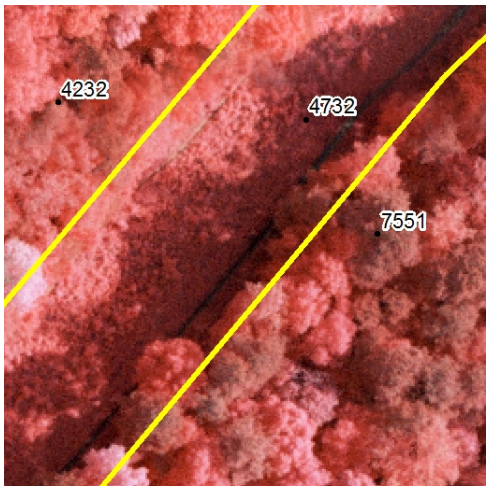
Global Vegetation: The mixed canopy is dominated by *Quercus alba* (white oak), *Carya alba* (mockernut hickory), *Tilia americana* var. *caroliniana* (Carolina basswood), *Quercus rubra* var. *rubra* (northern red oak), *Fraxinus americana* (white ash), *Quercus prinus* (chestnut oak), *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree). The subcanopy is dominated by *Ostrya virginiana* (hophornbeam), *Carpinus caroliniana* (American hornbeam), and *Cornus florida* (flowering dogwood). Other common species in the canopy and subcanopy include *Acer barbatum* (southern sugar maple), *Acer leucoderme* (chalk maple), *Acer rubrum* var. *rubrum* (red maple), *Cercis canadensis* var. *canadensis* (eastern redbud), *Platanus occidentalis* (American sycamore), *Oxydendrum arboreum* (sourwood), *Juglans nigra* (black walnut), *Prunus serotina* var. *serotina* (black cherry), *Aesculus sylvatica* (painted buckeye), *Quercus phellos* (willow oak), *Quercus nigra* (water oak), *Sassafras albidum* (sassafras), and *Ulmus alata* (winged elm). Shrubs of this community include *Viburnum rufidulum* (rusty blackhaw), *Calycanthus floridus* (eastern sweetshrub), *Hydrangea arborescens* (wild hydrangea), and *Euonymus americanus* (strawberry bush). Common herbs and vines are *Actaea racemosa* (black bugbane), *Asplenium platyneuron* var. *platyneuron* (ebony spleenwort), *Galium circaezans* (licorice bedstraw), *Hepatica nobilis* var. *obtusa* (roundlobe hepatica), *Hexastylis arifolia* var. *arifolia* (littlebrownjug), *Parthenocissus quinquefolia* (Virginia creeper), *Polystichum acrostichoides* (Christmas fern), *Prenanthes altissima* (tall rattlesnakeroot), *Toxicodendron radicans* (eastern poison-ivy), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium* (rosette grass) spp., *Maianthemum racemosum ssp. racemosum* (feathery false lily of the valley), *Elymus virginicus* var. *virginicus* (Virginia wildrye), and *Vitis rotundifolia* (muscadine). The exotics *Ailanthus altissima* (tree of heaven), *Albizia julibrissin* (silktree), *Lonicera japonica* (Japanese honeysuckle), and *Lonicera maackii* (Amur honeysuckle) are common in this forest. *Fagus grandifolia* (American beech) is largely lacking from this oak-dominated forest (M. Schafale, pers. comm. 2001).

Attribute	Description
CEGL Code	4638
Community Name	Successional Water Oak Forest
Pictures	 
Color	Pink to red
Tone	Medium
Texture	Fine to medium
Pattern	Dense canopy
Height	Medium to tall
Shape	Elongated
Size	On of the most common classes; medium sized patches with some variation.
Location	Mesic hardwood dominated forest found in past disturbed regions.
Association	7730, 6011, 4232
Comments	Photointerpretation relied upon topographic position and relative evenness of texture. Topographic position relatively low slopes; frequently as a transition between 7730 and other forest types.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (60-80% cover) tree canopy, 20-35 m tall, is dominated by *Quercus nigra* (water oak); additional species may include *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Pinus taeda* (loblolly pine), *Platanus occidentalis* (American sycamore), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), *Quercus pagoda* (cherrybark oak), *Quercus rubra* (northern red oak), and *Quercus velutina* (black oak). The moderately sparse (20-40%) subcanopy (5-20 m) may include *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Carya cordiformis* (bitternut hickory), *Carya pallida* (sand hickory), *Cornus florida* (flowering dogwood), *Halesia carolina* (Carolina silverbell), and *Prunus serotina* (black cherry) but very little of the canopy species except *Liquidambar* (sweetgum), *Liriodendron* (tuliptree), and *Quercus nigra* (water oak). Common species in the moderately sparse (30-50%) tall-shrub layer (2-10 m) and moderately sparse (10-40%) short-shrub layer (1-2 m) include sapling canopy species as well as *Acer barbatum* (southern sugar maple), *Acer*

leucoderme (chalk maple), *Celtis occidentalis* (common hackberry), *Fagus grandifolia* (American beech), *Morus rubra* (red mulberry), *Ostrya virginiana* (hophornbeam), *Vaccinium arboreum* (farkleberry), *Vaccinium elliottii* (Elliott's blueberry), and *Viburnum rufidulum* (rusty blackhaw). The herbaceous species (5-40%) include *Arundinaria gigantea* (giant cane), *Asplenium platyneuron* (ebony spleenwort), *Chimaphila maculata* (striped prince's pine), *Dichanthelium laxiflorum* (openflower rosette grass), *Dioscorea quaternata* (fourleaf yam), *Polystichum acrostichoides* (Christmas fern), *Verbesina occidentalis* (yellow crownbeard), and others. Trailing and climbing vines of *Smilax* (greenbrier) spp., *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine) can make up a significant component of this community. Exotic species can be problematic.

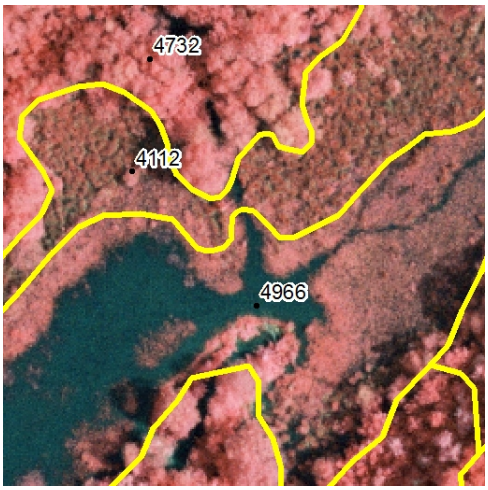
Global Vegetation: The canopy of this association is dominated by *Quercus nigra* (water oak). Other oaks may be intermixed, especially *Quercus phellos* (willow oak), as well as *Quercus falcata* (southern red oak), *Quercus hemisphaerica* (Darlington oak), *Liquidambar styraciflua* (sweetgum), remnant *Pinus palustris* (longleaf pine), weedy *Pinus elliottii* var. *elliottii* (Honduras pine), *Carya* (hickory) spp., or *Pinus taeda* (loblolly pine). In the Upper Gulf Coastal Plain of Georgia, some examples may contain *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), *Carya alba* (mockernut hickory), and *Cornus florida* (flowering dogwood) in the subcanopy.

Attribute	Description
CEGL Code	4732
Community Name	Blackberry–Greenbrier Successional Shrubland Thicket
Pictures	 
Color	Pink
Tone	Light
Texture	Fine to medium
Pattern	Coarse
Height	Very short
Shape	Elongated
Size	Fairly common class; medium with some variation.
Location	Mesic shrubland found in power line right-of-ways.
Association	None
Comments	Used for any overgrown shrub areas, especially along roads/power lines (e.g. areas likely to have been disturbed or maintained). Distinguished form other shrubland based on location, i.e. near trails or power lines.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: This depauperate community is made up almost entirely of 1- to 2-m tall *Rubus argutus* (sawtooth blackberry) with 100% cover. There is also a very sparse (5%) emergent layer (2-5 m) of *Salix nigra* (black willow) and a very sparse herb layer of *Erechtites hieraciifolia* (American burnweed), *Juncus effusus* (common rush), and *Polygonum scandens* (climbing false buckwheat). This constitutes the entire floristic composition of this community.

Global Vegetation: Stands of this association are dominated by greenbrier species (*Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier)) and blackberries/dewberries (*Rubus argutus* (sawtooth blackberry), *Rubus trivialis* (southern dewberry)). They also contain a great variety of tree saplings and other woody species (e.g., *Quercus* (oak) spp., *Liquidambar styraciflua* (sweetgum), *Acer rubrum* (red maple), *Rhus copallinum* (flameleaf sumac)). Some herbs in central Tennessee examples may include *Solidago* (goldenrod) spp., Asteraceae spp., *Helianthus* (sunflower) spp., *Hypericum* (St. Johnswort) spp., *Potentilla simplex* (common cinquefoil); grasses may include

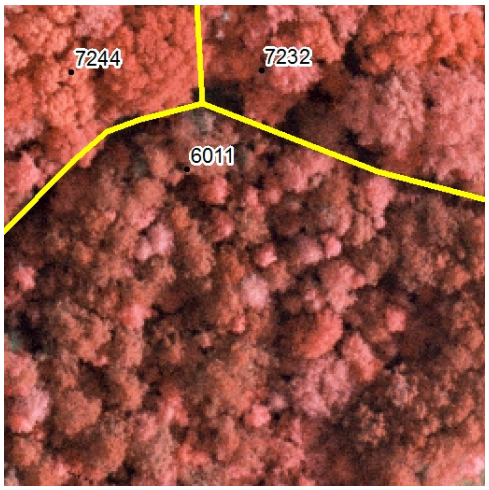
Andropogon (bluestem) spp., *Dichanthelium* (rosette grass) spp., *Panicum* (panicgrass) spp., *Schizachyrium scoparium* (little bluestem), *Lolium* (ryegrass) spp., and *Sorghastrum nutans* (Indiangrass). Communities that are surrounded by relatively intact ecosystems will tend to have more native species. Those surrounded by old fields or fragmented by development tend to have *Lonicera japonica* (Japanese honeysuckle) as a codominant vine overtopping much of the blackberry and greenbrier.

Attribute	Description
CEGL Code	4966
Community Name	Knotweed Pondshore and Ditchbank Vegetation
Pictures	
Color	Pink to red
Tone	Dark
Texture	Medium to coarse
Pattern	Homogenous
Height	Very short
Shape	Irregular
Size	Uncommon class; small average size with little variation.
Location	Hydric graminoid/herbaceous vegetation found ringing natural or artificial ponds.
Association	4112
Comments	Distinguished from 4112 and 3866 by more texture, including some open (wetter) areas.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: This community is strongly dominated by *Polygonum densiflorum* (denseflower knotweed) in the closed (100% cover) herbaceous layer. Species diversity is low but may include substantial amounts of *Hydrolea quadrivalvis* (waterpod), *Juncus effusus* (common rush), *Ludwigia palustris* (marsh seedbox), *Sagittaria latifolia* (broadleaf arrowhead), and *Scirpus cyperinus* (woolgrass). This constitutes nearly the entire floristic composition of this community.

Global Vegetation: Stands of this association are dominated by the perennial *Polygonum densiflorum* (denseflower knotweed). Associated species include *Lemna minor* (common duckweed), *Saccharum giganteum* (sugarcane plumegrass), *Hydrocotyle umbellata* (manyflower marshpennywort), *Saururus cernuus* (lizard's-tail), *Carex lupulina* (hop sedge), *Triadenum walteri* (greater marsh St. Johnswort), *Cephalanthus occidentalis* (common buttonbush), *Leersia* (cutgrass) sp., *Ludwigia peploides* (floating primrose-willow), *Boehmeria cylindrica* (small-spike false nettle), *Juncus effusus* (common rush), *Rhynchospora corniculata* (shortbristle horned beaksedge), *Ludwigia*

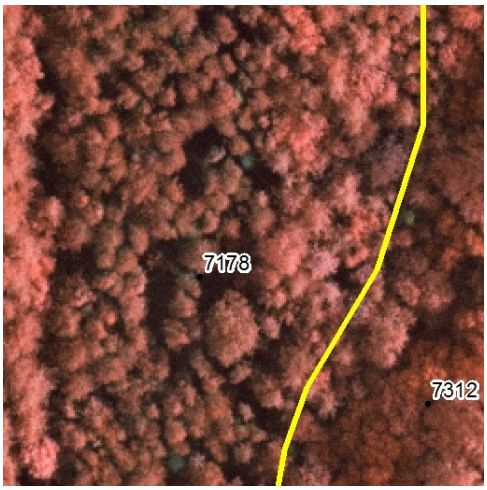
decurrens (wingleaf primrose-willow), *Habenaria repens* (waterspider bog orchid) (within its range), *Mikania scandens* (climbing hempvine), *Scirpus cyperinus* (woolgrass), and others.

Attribute	Description
CEGL Code	6011
Community Name	Early- to Mid-Successional Loblolly Pine Forest
Pictures	 
Color	Purple with some pink
Tone	Medium to dark
Texture	Coarse
Pattern	Medium to dense canopy
Height	Tall
Shape	Patchy
Size	Uncommon class; medium with small variation.
Location	Pine dominated forest found in mid topographic regions.
Association	7730, 4638
Comments	Distinguished from 4232 and 7551 by smaller pine crown size; difficult to distinguish oaks from other hardwoods from summer CIR; NatureServe suggests that may need to be merged with 8462 (not in CHAT).

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (60-70% cover) tree canopy, 20-50 m tall, is dominated almost exclusively by *Pinus taeda* (loblolly pine). The sparse to moderate (10-50%) subcanopy (10-20 m) is dominated by *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), and/or *Ulmus rubra* (slippery elm) and may include lesser amounts of *Acer negundo* (box-elder), *Cornus florida* (flowering dogwood), *Fraxinus americana* (white ash), *Prunus serotina* (black cherry), and *Quercus alba* (white oak). The sparse to dense (10-80%) tall-shrub layer (2-10 m) is made up of canopy and subcanopy species as well as *Cercis canadensis* (eastern redbud), *Fagus grandifolia* (American beech), *Ilex opaca* (American holly), and *Lindera benzoin* (northern spicebush). The sparse to moderate (20-40%) short-shrub layer (1-2 m) is dominated by saplings of species from the upper layers and may also include *Euonymus americanus* (strawberry bush), *Phytolacca americana* (American pokeweed), and *Vaccinium stamineum* (deerberry). The herbaceous layer is sparse (5-30%) but may include *Aristolochia serpentaria*

(Virginia snakeroot), *Chasmanthium sessiliflorum* (longleaf woodoats), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Lespedeza procumbens* (trailing lespedeza), *Mitchella repens* (partridgeberry), *Passiflora lutea* (yellow passionflower), *Polystichum acrostichoides* (Christmas fern), and *Toxicodendron radicans* (eastern poison-ivy). Vines trailing on the ground and climbing into the shrub layers include *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), and *Vitis rotundifolia* (muscadine).

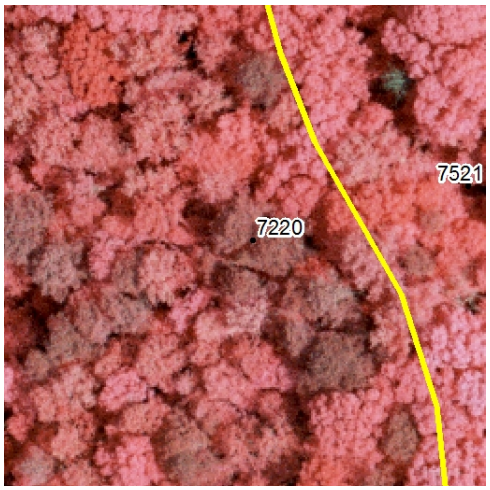
Global Vegetation: The tree canopy of *Pinus taeda* (loblolly pine) is at least 60% but may be considerably more dense, up to and including closed canopies. Tree subcanopy density varies with stand disturbance history but generally is <50%. Shrub and herb layer coverages do not exceed 25% and decrease with increasing age of the stand. Other species of pine, especially *Pinus echinata* (shortleaf pine) and *Pinus virginiana* (Virginia pine) may be sparingly present in the canopy. Other species that may be present in the subcanopy in addition to *Liquidambar styraciflua* (sweetgum) and *Acer rubrum* var. *rubrum* (red maple) include *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Nyssa sylvatica* (blackgum), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), *Diospyros virginiana* (common persimmon), *Prunus serotina* (black cherry), *Cornus florida* (flowering dogwood), *Liriodendron tulipifera* (tuliptree), and *Sassafras albidum* (sassafras) (NatureServe Ecology, unpubl. data). Other species in addition to *Vaccinium stamineum* (deerberry) that may be present in the shrub stratum include *Juniperus virginiana* (eastern red-cedar), *Vaccinium arboreum* (farkleberry), *Rhus copallinum* (flameleaf sumac), *Gaylussacia baccata* (black huckleberry), *Callicarpa americana* (American beautyberry), and probably others. The herbaceous layer usually forms <5% cover and contains such species as *Gelsemium sempervirens* (evening trumpetflower), *Chimaphila maculata* (striped prince's pine), *Polystichum acrostichoides* (Christmas fern), and *Potentilla canadensis* (dwarf cinquefoil). An example from Oconee National Forest has a thinned canopy and grassy herbaceous layer.

Attribute	Description
CEGL Code	7178
Community Name	White Pine Plantation
Pictures	
Color	Purple
Tone	Dark
Texture	Coarse
Pattern	Homogeneous
Height	Medium
Shape	Rectangular patches
Size	Rare with various sizes.
Location	Planted pine dominated forest found near disturbed areas.
Association	Residential and commercial areas
Comments	Trees planted in rows make this class easily distinguishable from other pine dominated forests.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The closed (100% cover) tree canopy, 10-15 m tall, is dominated by *Pinus strobus* (eastern white pine) along with lesser amounts of *Acer negundo* (box-elder), *Juglans nigra* (black walnut), and *Prunus serotina* (black cherry). *Acer negundo* (box-elder) and *Prunus serotina* (black cherry) also form a sparse (20%) subcanopy (5-10 m). The very sparse (<5%) herbaceous layer is made up solely of *Asplenium platyneuron* (ebony spleenwort) and exotic *Ligustrum sinense* (Chinese privet). This, along with *Cocculus carolinus* (Carolina coralbead), constitutes the entire floristic composition of this depauperate community.

Global Vegetation: The tree canopy at maturity is usually dense and contains a monospecific layer of *Pinus strobus* (eastern white pine). *Pinus resinosa* (red pine) or *Pinus virginiana* (Virginia pine) is occasionally present in small amounts. In older stands or gaps, regenerating trees may include *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry); *Robinia pseudoacacia* (black locust) and *Betula lenta* (sweet birch) are

occasionally present. *Acer pensylvanicum* (striped maple) and *Ostrya virginiana* (hophornbeam) are common small trees. The shrub layer is typically sparse and mostly consists of smaller individuals of the tree species. The field layer varies from sparse to absent; it may be locally well-developed in small openings, with variable composition. In some stands, mosses may be abundant.

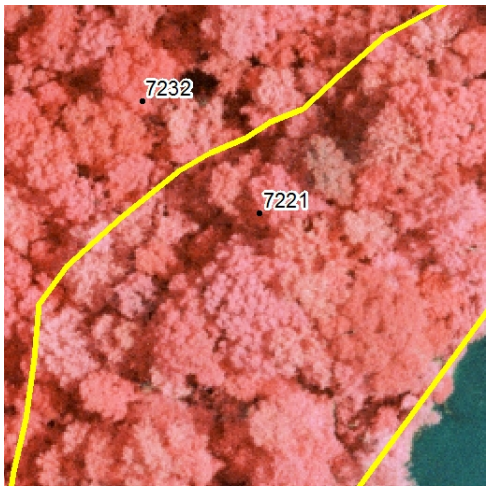
Attribute	Description
CEGL Code	7220
Community Name	Successional Tuliptree Forest (Circumneutral Type)
Pictures	 
Color	Pink to purple
Tone	Medium to dark
Texture	Medium to rough
Pattern	Medium to dense canopy
Height	Medium to tall
Shape	Patchy
Size	Common class; medium individual size with some variation.
Location	Mesic hardwood dominated forest found disturbed areas with rich soils.
Association	7244, 4638
Comments	Nearly impossible to distinguish from 7221 in CIR.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70-80% cover) tree canopy, 20-50 m tall, is dominated by *Liriodendron tulipifera* (tuliptree) and may include lesser amounts of *Carya alba* (mockernut hickory), *Liquidambar styraciflua* (sweetgum), *Pinus taeda* (loblolly pine), and *Quercus* (oak) spp. The sparse (20-40%) subcanopy (10-20 m) typically includes *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree). The sparse to closed (30-100%) tall-shrub layer (2-10 m) may be dominated by *Acer barbatum* (southern sugar maple), *Acer leucoderme* (chalk maple), *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Lindera benzoin* (northern spicebush) (up to 90% cover in one stand), *Magnolia macrophylla* (bigleaf magnolia), *Ostrya virginiana* (hophornbeam), and/or *Ulmus rubra* (slippery elm). The sparse to moderate (10-60%) short-shrub layer (1-2 m) is often dominated by *Lindera benzoin* (northern spicebush) and is made up of other species from the upper layers; it may also include small amounts of *Arundinaria gigantea* (giant cane), *Cercis canadensis* (eastern redbud), *Cornus alternifolia* (alternateleaf dogwood), *Hydrangea arborescens* (wild hydrangea), *Ligustrum sinense* (Chinese privet) (exotic), *Staphylea trifolia* (American

bladdernut), and *Symplocos tinctoria* (common sweetleaf). The moderate (30-60%) herbaceous layer is dominated by tree and shrub seedlings but also includes herbs such as *Actaea racemosa* (black bugbane), *Aristolochia serpentaria* (Virginia snakeroot), *Botrychium virginianum* (rattlesnake fern), *Dioscorea quaternata* (fourleaf yam), *Elephantopus carolinianus* (Carolina elephantsfoot), *Euonymus americanus* (strawberry bush), *Panax quinquefolius* (American ginseng), *Polystichum acrostichoides* (Christmas fern), *Sanicula canadensis* (Canadian blacksnakeroot), *Xanthorhiza simplicissima* (yellowroot), and others. Vines (5-20%) trailing on the ground and/or climbing into upper layers include *Decumaria barbara* (woodvamp), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax* (greenbrier) spp., *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine). Seven species of invasive plants were recorded from five plots. However, this community does support state-vulnerable *Magnolia macrophylla* (bigleaf magnolia), *Panax quinquefolius* (American ginseng), and *Trillium rugelii* (illscented wakerobin). It also supports state-threatened *Schisandra glabra* (bay starvine).

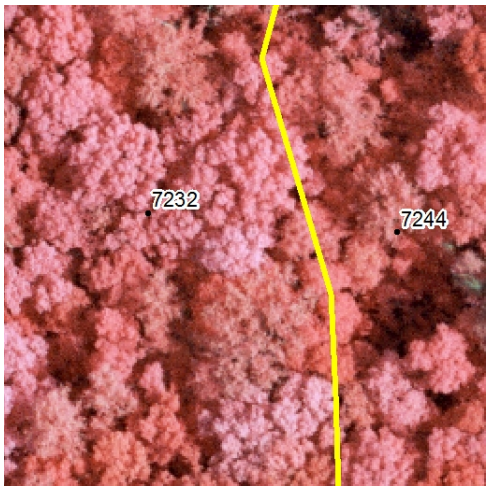
Global Vegetation: Stands are dominated by *Liriodendron tulipifera* (tuliptree) but also include various other species, including ones indicative of nutrient-rich or circumneutral environments. Other species include *Liquidambar styraciflua* (sweetgum), *Acer saccharum* (sugar maple), *Aesculus flava* (yellow buckeye), *Platanus occidentalis* (American sycamore), *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *Robinia pseudoacacia* (black locust), *Juglans nigra* (black walnut), *Halesia tetraptera* (mountain silverbell), *Fraxinus americana* (white ash), *Fagus grandifolia* (American beech), *Magnolia acuminata* (cucumber-tree), *Ulmus rubra* (slippery elm), *Quercus imbricaria* (shingle oak), *Quercus muehlenbergii* (chinkapin oak), and *Carya ovata* (shagbark hickory) (NatureServe Ecology, unpubl. data; Virginia Natural Heritage Program, unpubl. data; West Virginia Natural Heritage Program, unpubl. data). Species often found in the subcanopy include *Acer saccharum* (sugar maple), *Cercis canadensis* (eastern redbud), *Ulmus alata* (winged elm), *Morus rubra* (red mulberry), *Sassafras albidum* (sassafras), and *Cornus florida* (flowering dogwood). *Cercis canadensis* (eastern redbud) is often abundant on soils underlain by carbonate strata. Shrubs include saplings of the subcanopy and canopy species, as well as *Symphoricarpos orbiculatus* (coralberry), *Lindera benzoin* (northern spicebush), *Asimina triloba* (pawpaw), and *Juniperus virginiana* var. *virginiana* (eastern red-cedar). *Lindera benzoin* (northern spicebush) is often abundant in occurrences of this community in the Central Appalachians, Piedmont and inner Coastal Plain regions of Virginia, West Virginia, and Maryland. Exotic shrubs, including *Rosa multiflora* (multiflora rose), *Rubus phoenicolasius* (wine raspberry), and *Lonicera japonica* (Japanese honeysuckle), are present at some sites. Vines, which may be abundant, include *Aristolochia macrophylla* (pipevine), *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax tamnoides* (bristly greenbrier), and *Vitis aestivalis* var. *bicolor* (summer grape). Herbaceous species include the exotics *Microstegium vimineum* (Nepalese browntop), *Alliaria petiolata* (garlic mustard), and *Veronica hederifolia* (ivyleaf speedwell), as well as *Actaea racemosa* (black bugbane), *Ageratina altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Caulophyllum thalictroides* (blue cohosh), *Cryptotaenia canadensis* (Canadian honewort), *Galium triflorum* (fragrant bedstraw), *Laportea canadensis* (Canadian woodnettle), *Impatiens pallida* (pale touch-me-not), *Hydrophyllum canadense* (bluntleaf waterleaf), *Osmorhiza longistylis* (longstyle sweetroot), *Adiantum pedatum* (northern

maidenhair), *Polygonatum pubescens* (hairy Solomon's seal), *Polystichum acrostichoides* (Christmas fern), *Verbesina alternifolia* (wingstem), *Amphicarpaea bracteata* (American hogpeanut), *Solidago caesia* (wreath goldenrod), and *Polystichum acrostichoides* (Christmas fern). (Andreu and Tukman 1995; NatureServe Ecology, unpubl. data; Virginia Natural Heritage Program, unpubl. data; West Virginia Natural Heritage Program, unpubl. data). Examples at Fort Donelson that have been very heavily disturbed may have local dominance by *Celtis laevigata* (sugarberry) and *Juglans nigra* (black walnut).

Attribute	Description
CEGL Code	7221
Community Name	Successional Tuliptree Forest (Acidic Type)
Pictures	 
Color	Pink to moderate
Tone	Light to medium
Texture	Moderate to coarse
Pattern	Medium to dense
Height	Medium to tall
Shape	Irregular
Size	Common class; medium sized individual areas with little variation.
Location	Mesic hardwood dominated forest, with variable environmental setting.
Association	7232, 7244
Comments	Nearly impossible to distinguish from 7220 in summer CIR.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The dense (80% cover) tree canopy, 20-35 m tall, is codominated by *Liriodendron tulipifera* (tuliptree), *Pinus taeda* (loblolly pine), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). The moderate (50%) subcanopy (15-20 m) is dominated by *Carpinus caroliniana* (American hornbeam), as are the moderate (50%) tall-shrub layer (5-10 m) and sparse (30%) short-shrub layer (1-2 m). Additional subcanopy species include *Acer rubrum* (red maple) and *Prunus serotina* (black cherry), and other shrubs are *Aesculus sylvatica* (painted buckeye), *Cornus florida* (flowering dogwood), *Morus rubra* (red mulberry), *Oxydendrum arboreum* (sourwood), *Rhododendron canescens* (mountain azalea), *Toxicodendron radicans* (eastern poison-ivy), and *Vaccinium fuscatum* (black highbush blueberry). The sparse (30%) herbaceous layer includes *Decumaria barbara* (woodvamp), *Elephantopus carolinianus* (Carolina elephantsfoot), *Leersia virginica* (whitegrass), *Polystichum acrostichoides* (Christmas fern), *Vitis rotundifolia* (muscadine), and others.

Global Vegetation: The canopy of this semi-natural upland association is dominated by *Liriodendron tulipifera* (tuliptree). *Quercus* (oak) species (*Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus falcata* (southern red oak), *Quercus nigra* (water oak), *Quercus velutina* (black oak)) are often present; additional associates may include *Acer barbatum* (southern sugar maple), *Acer rubrum* (red maple), *Carya* (hickory) spp., *Fagus grandifolia* (American beech), *Nyssa sylvatica* (blackgum), *Cornus florida* (flowering dogwood), and *Robinia pseudoacacia* (black locust). *Betula lenta* (sweet birch) is a common associate at the northern range limit. Shrub layers may include saplings of the canopy species and *Acer pensylvanicum* (striped maple), *Amelanchier arborea* (common serviceberry), *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush) (in small amounts), and *Vaccinium pallidum* (Blue Ridge blueberry). Herbs vary across the range but may include *Actaea racemosa* (black bugbane), *Dichanthelium clandestinum* (deertongue), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Goodyera pubescens* (downy rattlesnake plantain), *Medeola virginiana* (Indian cucumber), *Potentilla simplex* (common cinquefoil), *Scutellaria serrata* (showy skullcap), *Thelypteris noveboracensis* (New York fern), and *Uvularia perfoliata* (perfoliate bellwort). *Lycopodium digitatum* (fan clubmoss) may be abundant in some stands.

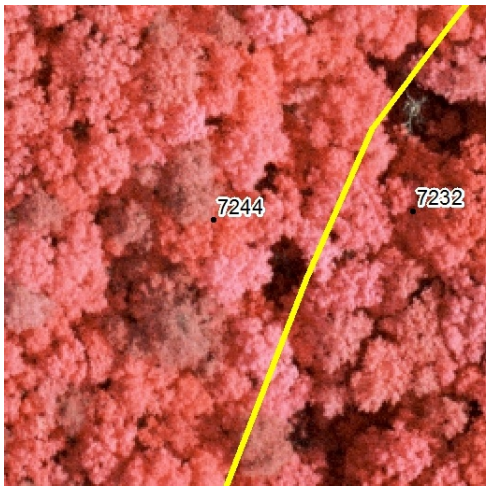
Attribute	Description
CEGL Code	7232
Community Name	Piedmont Dry–Mesic Basic Oak Hickory Forest
Pictures	 
Color	Pink to red
Tone	Light to medium
Texture	Medium to coarse
Pattern	Moderate to dense
Height	Medium to very tall
Shape	Expansive
Size	One of the most common classes; large average size with large variations possible.
Location	Mesic hardwood dominated forest found in mostly midslopes.
Association	7244, 4232
Comments	Distinguished from 7244 by greater texture and tonal variation (i.e. greater species diversity) and topographic position resulting in more mesic conditions (moderate slope, lower down, trough or valley).

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: This oak-hickory forest has a moderate to dense (50-90% cover) mature tree canopy, 20-50+ m tall, is codominated by *Carya alba* (mockernut hickory), *Quercus alba* (white oak) and *Quercus rubra* (northern red oak); additional canopy species may include *Liriodendron tulipifera* (tuliptree), *Pinus taeda* (loblolly pine), *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), and *Quercus stellata* (post oak). The sparse to moderate (20-50%) subcanopy (10-20 m) includes canopy species as well as *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), and *Oxydendrum arboreum* (sourwood). The moderate (30-60%) tall-shrub layer (2-10 m) is dominated by *Acer leucoderme* (chalk maple), *Cornus florida* (flowering dogwood), *Fraxinus americana* (white ash), *Ostrya virginiana* (hophornbeam), and *Oxydendrum arboreum* (sourwood). The short-shrub layer (1-2 m) ranges from very sparse to moderately dense (5-70%) and is dominated by *Acer leucoderme* (chalk maple), *Aesculus sylvatica* (painted buckeye), and *Toxicodendron radicans* (eastern poison-ivy). Common herbs species in the

sparse (10-40%) but often diverse herbaceous layer include *Aristolochia serpentaria* (Virginia snakeroot), *Asplenium platyneuron* (ebony spleenwort), *Aureolaria virginica* (downy yellow false foxglove), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium commutatum* (variable panicgrass), *Elephantopus tomentosus* (devil's grandmother), *Euphorbia corollata* (flowering spurge), *Hexastylis arifolia* (littlebrownjug), *Ligusticum canadense* (Canadian licorice-root), *Maianthemum racemosum* (feathery false lily of the valley), *Oxalis corniculata* (creeping woodsorrel), *Polygonatum biflorum* (smooth Solomon's seal), *Polystichum acrostichoides* (Christmas fern), *Sanguinaria canadensis* (bloodroot), *Sanicula smallii* (Small's blacksnakeroot), *Solidago arguta* (Atlantic goldenrod), and *Uvularia perfoliata* (perfoliate bellwort). *Hybanthus concolor* (eastern greenviolet) is a characteristic herb in one example. Common vines (5-20%) include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax* (greenbrier) spp., *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine). In addition, this community supports state-vulnerable *Agrimonia microcarpa* (smallfruit agrimony), *Magnolia macrophylla* (bigleaf magnolia), *Panax quinquefolius* (American ginseng), and *Zizia trifoliata* (meadow alexanders).

Global Vegetation: Stands of this forest are dominated by *Quercus alba* (white oak) and often *Quercus rubra* (northern red oak), *Carya ovata* (shagbark hickory), and *Carya carolinae-septentrionalis* (southern shagbark hickory) in combination with other species of *Quercus* (oak) and *Carya* (hickory) (i.e., *Quercus velutina* (black oak), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory)). Other overstory and understory species that may occur include *Liquidambar styraciflua* (sweetgum), *Carya ovalis* (red hickory), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Juniperus virginiana* var. *virginiana* (eastern red-cedar), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Viburnum rafinesquianum* (downy arrow-wood), *Viburnum prunifolium* (blackhaw), *Ostrya virginiana* (hophornbeam), *Chionanthus virginicus* (white fringetree), *Ulmus americana* (American elm), *Carpinus caroliniana* (American hornbeam), *Pinus taeda* (loblolly pine), and *Pinus echinata* (shortleaf pine). *Acer leucoderme* (chalk maple) is an important understory component in some Georgia Piedmont stands. Proportions of *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), and *Pinus* (pine) spp. increase following disturbance. Occurrences usually have closed canopies and moderately well-developed subcanopy and shrub layers. Herbaceous cover in this association may vary considerably with site conditions, land-use history, and levels of deer herbivory. Some stands have rather sparse herb layers with <25% total cover and only scattered patches of dry-mesophytic forbs and graminoids such as *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium circaezans* (licorice bedstraw), *Maianthemum racemosum ssp. racemosum* (feathery false lily of the valley), *Polygonatum biflorum* var. *biflorum* (smooth Solomon's seal), *Uvularia perfoliata* (perfoliate bellwort), *Aristolochia serpentaria* (Virginia snakeroot), *Scleria oligantha* (littlehead nutrush), *Botrychium virginianum* (rattlesnake fern), *Agrimonia rostellata* (beaked agrimony), *Bromus pubescens* (hairy woodland brome), *Carex albicans* (whitetinge sedge), *Carex laxiflora* var. *laxiflora* (broad looseflower sedge), *Carex planispicata, Dichanthelium boscii* (Bosc's panicgrass), *Elymus hystrix* var. *hystrix* (eastern bottlebrush grass), *Festuca subverticillata* (nodding fescue), *Scutellaria elliptica* (hairy skullcap), and *Tiarella cordifolia* var. *collina* (heartleaf foamflower). Other stands have high cover of scrambling vines, such *Parthenocissus quinquefolia* (Virginia creeper), *Bignonia*

capreolata (crossvine), and *Vitis rotundifolia* (muscadine), that preclude a diversity of herbaceous species. On the best sites, especially those not subject to heavy deer grazing, stands may have well-developed herb layers with >50% cover and impressive species richness (e.g., >80 taxa per 400 square meters). A number of species with Piedmont distributions restricted to calcium- or magnesium-rich soils have been documented in this association in both Virginia and North Carolina, including *Blephilia ciliata* (downy pagoda-plant), *Clematis ochroleuca* (curlyheads), *Matelea decipiens* (oldfield milkvine), *Matelea obliqua* (climbing milkvine), *Polygala senega* (Seneca snakeroot), *Ruellia purshiana* (Pursh's wild petunia), *Salvia urticifolia* (nettleleaf sage), *Scutellaria nervosa* (veiny skullcap), *Scutellaria ovata* (heartleaf skullcap), *Scutellaria serrata* (showy skullcap), and *Triosteum angustifolium* (yellowfruit horse-gentian).

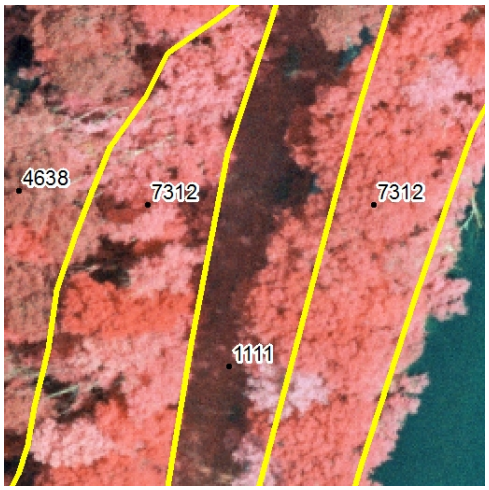
Attribute	Description
CEGL Code	7244
Community Name	Interior Southern Red Oak–White Oak Forest
Pictures	 
Color	Pink to red
Tone	Light to medium
Texture	Fine to medium
Pattern	Moderate to dense canopy
Height	Medium to tall
Shape	Expansive
Size	One of the most common classes; can be largest individual areas but very large variation is possible.
Location	Dry hardwood dominated forest found in most non-lowland regions of the park.
Association	7232, 4638
Comments	Distinguished from 7232 by more even texture and tone and topographic position resulting in drier conditions (higher, steeper slopes, ridge tops).

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (60-80% cover) mature tree canopy, 20-50 m tall, is dominated by *Quercus falcata* (southern red oak); possible codominants include *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Liriodendron tulipifera* (tuliptree), *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), and more commonly *Quercus alba* (white oak), *Quercus stellata* (post oak), and *Quercus velutina* (black oak). The sparse to moderate (30-60%) subcanopy (10-35 m) is made up of canopy species as well as *Cornus florida* (flowering dogwood) and *Oxydendrum arboreum* (sourwood). The sparse (10-30%) tall-shrub layer (2-15 m) and sparse (10-30%) short-shrub layer (1-2 m) are made up mostly of saplings of the canopy species but may also include *Acer leucoderme* (chalk maple), *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Aralia spinosa* (devil's walkingstick), *Asimina parviflora* (smallflower pawpaw), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and *Vaccinium arboreum* (farkleberry), several of

which may dominate. The sparse to moderate (10-40%) herbaceous layer is comprised mainly of tree and shrub seedlings but may also include small amounts of *Asplenium platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium commutatum* (variable panicgrass), *Piptochaetium avenaceum* (blackseed speargrass), and *Polystichum acrostichoides* (Christmas fern). Common vines found trailing on the ground and climbing into the upper layers include *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy), *Vitis aestivalis* (summer grape), and *Vitis rotundifolia* (muscadine). This community also supports state-vulnerable *Castanea dentata* (American chestnut).

Global Vegetation: The vegetation is dominated by *Quercus* (oak) spp. and lesser amounts of *Carya* (hickory) spp. The canopy is continuous, and several species of *Quercus* (oak) may be present (e.g., *Quercus falcata* (southern red oak), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), and *Quercus stellata* (post oak)). The subcanopy closure is variable, ranging from less than 25% to more than 40% cover, and the shrub and herb layers generally are sparse. Subcanopy species include canopy species and *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), *Liquidambar styraciflua* (sweetgum), *Ulmus alata* (winged elm), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), *Juniperus virginiana* var. *virginiana* (eastern red-cedar), and *Vaccinium arboreum* (farkleberry). The tall-shrub stratum may contain *Rhododendron canescens* (mountain azalea) and *Vaccinium arboreum* (farkleberry). The low-shrub stratum is dominated by various ericaceous shrubs such as *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Vaccinium fuscatum* (black highbush blueberry), and *Gaylussacia baccata* (black huckleberry). *Smilax glauca* (cat greenbrier) and *Vitis rotundifolia* (muscadine) are common vines. Herbaceous species that may be present include *Aristolochia serpentaria* (Virginia snakeroot), *Symphyotrichum dumosum* (rice button aster), *Clitoria mariana* (Atlantic pigeonwings), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Euphorbia corollata* (flowering spurge), *Galium circaezans* (licorice bedstraw), *Chimaphila maculata* (striped prince's pine), *Polystichum acrostichoides* (Christmas fern), *Asplenium platyneuron* (ebony spleenwort), *Hexastylis arifolia* (littlebrownjug), *Coreopsis major* (greater tickseed), *Solidago odora* (anisescented goldenrod), *Tephrosia virginiana* (Virginia tephrosia), *Potentilla simplex* (common cinquefoil), *Porteranthus stipulatus* (Indian physic), *Pteridium aquilinum* (western brackenfern), *Lespedeza* (lespedeza) spp., *Dichanthelium* (rosette grass) spp., and *Hieracium venosum* (rattlesnakeweed). At Shiloh (western Tennessee) this association is documented from three plots; the canopy is dominated by *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Quercus stellata* (post oak), *Ulmus alata* (winged elm), and *Carya alba* (mockernut hickory). *Quercus muehlenbergii* (chinkapin oak) is also present as a canopy species in one of the plots. Subcanopy dominants are *Liquidambar styraciflua* (sweetgum), *Ulmus alata* (winged elm), *Nyssa sylvatica* (blackgum), *Fraxinus americana* (white ash), and *Carya glabra* (pignut hickory). Other subcanopy trees are *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Carya alba* (mockernut hickory), *Juniperus virginiana* var. *virginiana* (eastern red-cedar), *Carya ovalis* (red hickory), *Diospyros virginiana* (common persimmon), and *Fagus grandifolia* (American beech). The most abundant tall shrubs are *Carya alba* (mockernut hickory), *Quercus falcata* (southern red oak),

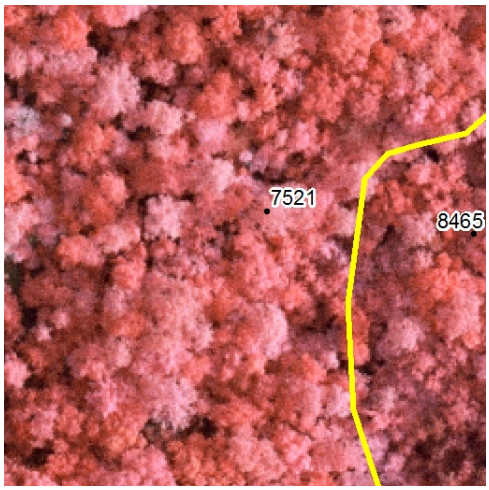
Ulmus alata (winged elm), and *Liquidambar styraciflua* (sweetgum). Other tall shrubs are *Carya ovalis* (red hickory), *Sassafras albidum* (sassafras), *Quercus alba* (white oak), *Nyssa sylvatica* (blackgum), *Vaccinium arboreum* (farkleberry), *Vaccinium stamineum* (deerberry), and less abundant *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Acer rubrum* (red maple), *Smilax rotundifolia* (roundleaf greenbrier), and *Ilex opaca* (American holly). Short shrubs are diverse; *Quercus falcata* (southern red oak), *Vitis rotundifolia* (muscadine), *Vaccinium stamineum* (deerberry), and *Carya alba* (mockernut hickory) are the most abundant. Other short shrubs are *Quercus velutina* (black oak), *Ulmus alata* (winged elm), *Quercus alba* (white oak), *Nyssa sylvatica* (blackgum), *Parthenocissus quinquefolia* (Virginia creeper), *Prunus serotina* (black cherry), and *Sassafras albidum* (sassafras). Short shrubs which are sparse include *Amelanchier arborea* (common serviceberry), *Vaccinium arboreum* (farkleberry), *Juniperus virginiana* var. *virginiana* (eastern red-cedar), *Diospyros virginiana* (common persimmon), *Hypericum hypericoides* (St. Andrew's cross), *Fraxinus americana* (white ash), *Smilax rotundifolia* (roundleaf greenbrier), *Ilex opaca* (American holly), *Acer rubrum* (red maple), *Quercus phellos* (willow oak), *Celtis occidentalis* (common hackberry), *Rubus argutus* (sawtooth blackberry), *Morus rubra* (red mulberry), *Smilax bona-nox* (saw greenbrier), *Ilex decidua* (possumhaw), *Toxicodendron radicans* (eastern poison-ivy), and *Carya ovalis* (red hickory). In one of the plots *Chasmanthium sessiliflorum* (longleaf woodoats) is the dominant herb, in the other plots there is no single dominant and herbs are all sparse. Other herbs include *Dichanthelium boscii* (Bosc's panicgrass), *Carex complanata* (hirsute sedge), *Dichanthelium laxiflorum* (openflower rosette grass), *Danthonia spicata* (poverty oatgrass), *Lespedeza repens* (creeping lespedeza), *Lespedeza procumbens* (trailing lespedeza), *Carex leavenworthii* (Leavenworth's sedge), *Schizachyrium scoparium* (little bluestem) and present a in trace amounts *Carex swanii* (Swan's sedge), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass), *Sericocarpus linifolius* (narrowleaf whitetop aster), *Galium circaezans* (licorice bedstraw), *Panicum anceps* (beaked panicgrass), *Tridens flavus* (purpletop tridens), *Aristolochia serpentaria* (Virginia snakeroot), *Dichanthelium acuminatum* var. *acuminatum* (tapered rosette grass), *Galium pilosum* (hairy bedstraw), *Solidago rugosa* (wrinkleleaf goldenrod), *Erechtites hieraciifolia* (American burnweed), *Sanicula canadensis* (Canadian blacksnakeroot), *Asplenium platyneuron* (ebony spleenwort), *Acalypha rhomboidea* (Virginia threeseed mercury), *Mimosa microphylla* (littleleaf sensitive-briar), *Conyza canadensis* (Canadian horseweed), and *Penstemon calycosus* (longsepal beardtongue).

Attribute	Description
CEGL Code	7312
Community Name	River Birch Levee Forest
Pictures	 
Color	White to pink
Tone	Light
Texture	Medium to rough
Pattern	Sparse to medium
Height	Medium
Shape	Elongated, patchy
Size	Uncommon class; medium sized with little variation.
Location	Hardwood dominated forest found in wetland areas near water.
Association	7730,4048, 4638
Comments	Almost impossible to distinguish from 7730 using summer CIR, but usually appears whiter.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (60-80% cover) tree canopy, 20-50 m tall, is dominated by *Betula nigra* (river birch); additional species may include *Acer leucoderme* (chalk maple), *Celtis laevigata* (sugarberry), *Juglans nigra* (black walnut), *Liriodendron tulipifera* (tuliptree), *Pinus taeda* (loblolly pine), *Platanus occidentalis* (American sycamore), *Prunus serotina* (black cherry), and *Quercus nigra* (water oak). The moderately sparse (40%) subcanopy (15-20 m) is made up of *Acer negundo* (box-elder), *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Celtis laevigata* (sugarberry), *Juglans nigra* (black walnut), and *Quercus nigra* (water oak). The sparse to moderately dense (10-70%) tall-shrub layer (5-10 m) includes many subcanopy species as well as *Acer barbatum* (southern sugar maple), *Cornus florida* (flowering dogwood), *Halesia* (silverbell) spp., *Ilex opaca* (American holly), and others. The sparse to very dense (20-90%) short-shrub layer (1-2 m) shares the same composition as the tall-shrub layer along with *Arundinaria gigantea* (giant cane), *Asimina triloba* (pawpaw), *Lindera benzoin* (northern spicebush), and others. The herbaceous layer is highly variable, ranging from very sparse to complete (5-100%); species may include *Asplenium platyneuron* (ebony spleenwort), *Campsis radicans* (trumpet creeper), *Hypericum* (St.

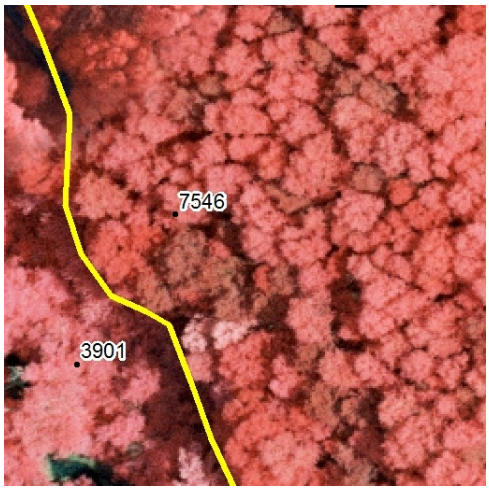
Johnswort) spp., *Parthenocissus quinquefolia* (Virginia creeper), *Polystichum acrostichoides* (Christmas fern), *Verbesina alternifolia* (wingstem), and *Verbesina occidentalis* (yellow crownbeard). At one location, the exotic invasive *Microstegium vimineum* (Nepalese browntop) covers the entire ground surface. In addition, this community supports state-vulnerable *Magnolia macrophylla* (bigleaf magnolia).

Global Vegetation: *Betula nigra* (river birch) contributes at least 50%, and often more, of the tree density of stands of this community. *Platanus occidentalis* (American sycamore) may be codominant, or at least prominent, with large individuals overtopping the *Betula* (birch), which tends to have a greater number of stems, but *Platanus occidentalis* (American sycamore) may be more conspicuous because of its larger size. Other canopy associates include *Liriodendron tulipifera* (tuliptree), *Liquidambar styraciflua* (sweetgum), *Acer rubrum* (red maple), *Acer negundo* (box-elder), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Celtis* (hackberry) spp., and *Quercus* (oak) spp. *Pinus echinata* (shortleaf pine), *Pinus strobus* (eastern white pine), or *Pinus virginiana* (Virginia pine) may be found in some montane or submontane examples. The subcanopy or tall-shrub strata may include *Cornus florida* (flowering dogwood) and *Carpinus caroliniana* (American hornbeam), along with *Acer rubrum* (red maple), *Ilex opaca* (American holly), *Ulmus alata* (winged elm), *Prunus serotina* (black cherry), and *Carya* (hickory) spp. Shrubs and woody vines may include *Alnus serrulata* (hazel alder), *Euonymus americanus* (strawberry bush), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine). Herbs may include *Boehmeria cylindrica* (small-spike false nettle), *Polygonum virginianum* (jumpseed), *Rudbeckia laciniata* (cutleaf coneflower), *Sanicula* (sanicle) sp., *Symphyotrichum lateriflorum* (calico aster), *Thalictrum dioicum* (early meadowrue), *Viola sororia* (common blue violet), *Polystichum acrostichoides* (Christmas fern), *Woodwardia areolata* (netted chainfern), *Botrychium dissectum* (cutleaf grapefern), *Botrychium virginianum* (rattlesnake fern), and *Impatiens capensis* (jewelweed). The exotics *Ligustrum sinense* (Chinese privet), *Lonicera japonica* (Japanese honeysuckle), *Microstegium vimineum* (Nepalese browntop), and *Rosa multiflora* (multiflora rose) may spread into disturbed examples of this community. No effort has been made to subdivide this type into northern and southern, or Coastal Plain and Interior variants, although there are undoubtedly some floristic differences between these extremes, at least in the lower strata.

Attribute	Description
CEGL Code	7521
Community Name	Successional Tuliptree–Loblolly Pine Upland Forest
Pictures	 
Color	Pink to red
Tone	Light to medium
Texture	Rough
Pattern	Sparse to medium canopy
Height	Medium
Shape	Patchy to elongated
Size	Uncommon class; medium individual size with some variation.
Location	Sparse hardwood forest found in areas with large pine bark beetle (PBB) infestations.
Association	4232, 7244
Comments	Downed pine from PBB difficult to determine from summer CIR; similar to 6011 but generally less pines.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The sparse (30% cover) tree canopy, 20-35 m tall, is dominated by *Liriodendron tulipifera* (tuliptree) and includes lesser amounts of *Acer rubrum* (red maple) and *Quercus nigra* (water oak). The moderate (40%) subcanopy (10-15 m) is codominated by *Cornus florida* (flowering dogwood) and *Oxydendrum arboreum* (sourwood) and includes canopy species as well as *Fagus grandifolia* (American beech), *Liquidambar styraciflua* (sweetgum), and *Pinus virginiana* (Virginia pine). The moderate (50%) tall-shrub layer (2-5 m) and sparse (20%) short-shrub layer (1-2 m) are diverse mixes of canopy species, *Carya* (hickory) spp., *Quercus* (oak) spp., *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), *Prunus serotina* (black cherry), and *Vaccinium* (blueberry) spp. The very sparse (10%) herbaceous layer is made up of *Andropogon gerardii* (big bluestem), *Antennaria plantaginifolia* (woman's tobacco), *Chimaphila maculata* (striped prince's pine), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium laxiflorum* (openflower rosette grass), *Hypericum hypericoides* (St. Andrew's cross), and *Polystichum acrostichoides* (Christmas fern). Vines (5%) include *Vitis rotundifolia* (muscadine).

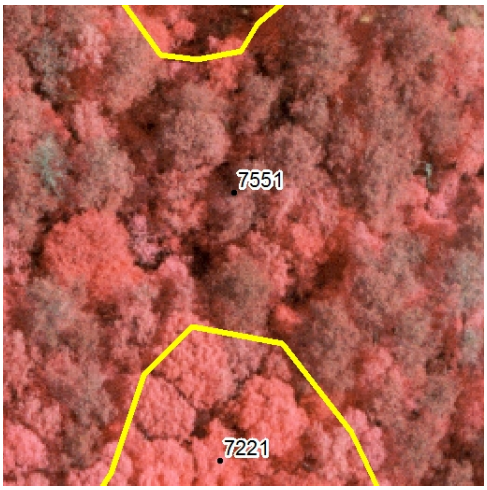
Global Vegetation: Stands of this forest community are strongly dominated by *Liriodendron tulipifera* (tuliptree) and *Pinus taeda* (loblolly pine) which together contribute more than 75% canopy cover. Other canopy species include *Liquidambar styraciflua* (sweetgum) and *Acer rubrum* (red maple). The understory and ground layers are very sparse with much open ground present.

Attribute	Description
CEGL Code	7546
Community Name	Loblolly Pine–Tuliptree Successional Forest
Pictures	 
Color	Red and purple
Tone	Light to dark
Texture	Rough
Pattern	Medium to dense
Height	Medium to tall
Shape	Patchy
Size	Common class; large individual patches with large variations.
Location	Mesic hardwood dominated forest found in old disturbed regions.
Association	7232, 4232, 4638
Comments	Difficult to interpret species diversity from summer CIR. Crown sizes can be quite larger (i.e. not early successional) than 6011.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70% cover) tree canopy, 35-50 m tall, is codominated by *Liriodendron tulipifera* (tuliptree) and *Pinus taeda* (loblolly pine) along with a lesser amount of *Quercus nigra* (water oak). The sparse (30%) subcanopy (15-20 m) is dominated by *Liriodendron tulipifera* (tuliptree). The moderate (60%) tall-shrub layer (2-5 m) and moderate (60%) short-shrub layer (1-2 m) are codominated by *Acer negundo* (box-elder) and the invasive exotic *Ligustrum sinense* (Chinese privet). The sparse (20%) herbaceous layer includes tree and shrub seedlings and *Toxicodendron radicans* (eastern poison-ivy). Vines include *Vitis rotundifolia* (muscadine) and the exotic *Lonicera japonica* (Japanese honeysuckle).

Global Vegetation: This successional vegetation is dominated by *Pinus taeda* (loblolly pine) and *Liriodendron tulipifera* (tuliptree), but many other canopy species are usually present. *Lindera benzoin* (northern spicebush) is a typical shrub, and *Carex crinita* (fringed sedge) is a typical herb. More information is needed on the detailed floristics of this association. Other woody species that

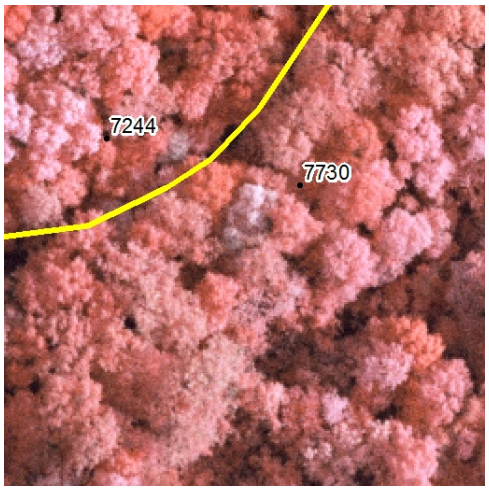
may be present include *Liquidambar styraciflua* (sweetgum), *Platanus occidentalis* (American sycamore), *Cornus florida* (flowering dogwood), *Acer rubrum* (red maple), *Nyssa biflora* (swamp tupelo), *Quercus alba* (white oak), *Fagus grandifolia* (American beech), *Morus rubra* (red mulberry), *Betula nigra* (river birch), *Fraxinus americana* (white ash), *Ilex opaca* (American holly), *Lindera benzoin* (northern spicebush), and *Asimina parviflora* (smallflower pawpaw). Woody species common in the Piedmont portion of the range include *Aesculus sylvatica* (painted buckeye) and *Acer negundo* (box-elder). Herbaceous and woody vine species that may occur include *Carex crinita* (fringed sedge), *Botrychium virginianum* (rattlesnake fern), *Eupatorium purpureum* (sweetscented joepyeweed), *Polystichum acrostichoides* (Christmas fern), *Arundinaria gigantea* (giant cane), *Toxicodendron radicans ssp. radicans* (eastern poison-ivy), *Asplenium platyneuron* (ebony spleenwort), *Woodwardia areolata* (netted chainfern), *Osmunda cinnamomea* (cinnamon fern), *Ophioglossum vulgatum* (southern adderstongue), *Actaea racemosa* (black bugbane), *Dulichium arundinaceum* (threeway sedge), *Carex albolutescens* (greenwhite sedge), *Hypericum nudiflorum* (early St. Johnswort), *Corydalis flavula* (yellow fumewort), and others. The exotics *Ligustrum sinense* (Chinese privet) and *Lonicera japonica* (Japanese honeysuckle) commonly occur in forests of this alliance. The preceding information is from the related alliance description (Weakley et al. 1998), and these floristics were included in a 1995 CCA for the '*Pinus taeda - Liriodendron tulipifera / Lindera benzoin / Carex crinita* Successional Forest' (1C03B020.01F), on which this association is apparently based. It is not clear where these data originated. Some of the taxa mentioned (e.g., *Eupatorium purpureum* (sweetscented joepyeweed)) seem "suspicious" and out of place. Apparently related vegetation from the Savannah River Site cited in Jones et al. (1981b) indicates dominance of some stands by *Pinus taeda* (loblolly pine), *Nyssa biflora* (swamp tupelo), and *Liriodendron tulipifera* (tuliptree) in the canopy, with *Persea palustris* (swamp bay), *Magnolia virginiana* (sweetbay), *Acer rubrum* (red maple), and *Nyssa biflora* (swamp tupelo) in the subcanopy. Other species present include *Vaccinium formosum* (southern blueberry), *Viburnum nudum* (possumhaw), *Arundinaria gigantea* (giant cane), *Toxicodendron radicans ssp. radicans* (eastern poison-ivy), *Mitchella repens* (partridgeberry), *Osmunda cinnamomea* (cinnamon fern), and *Onoclea sensibilis* (sensitive fern).

Attribute	Description
CEGL Code	7551
Community Name	Piedmont Loblolly Pine Mixed Oak Floodplain Forest
Pictures	 
Color	Pink to purple
Tone	Light to medium
Texture	Medium to coarse
Pattern	Dense canopy
Height	Tall
Shape	Patchy
Size	Common class; medium sized with some variation.
Location	Pine dominated forest found in low topographic areas.
Association	7221,6011, 7730, 4232, 7244, 7232
Comments	Distinguished from 6011 by larger, sometimes variable, pine crown sizes. Distinguished from 4232 by lower topographic position and relative lack of slope. Differs from 7551 because pines are not planted in rows.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated by exclusively by *Pinus taeda* (loblolly pine). The moderate (40%) subcanopy (10-15 m) is dominated by *Liriodendron tulipifera* (tuliptree) along with nearly equal amounts of *Acer rubrum* (red maple), *Fraxinus americana* (white ash), *Liquidambar styraciflua* (sweetgum), *Nyssa sylvatica* (blackgum), *Quercus alba* (white oak), *Quercus nigra* (water oak), and *Sassafras albidum* (sassafras). The moderate (50%) tall-shrub layer (5-10 m) and moderate (40%) short-shrub layer (1-2 m) are codominated by *Carpinus caroliniana* (American hornbeam) and *Nyssa sylvatica* (blackgum). Additional shrubs include sapling canopy species and *Acer leucoderme* (chalk maple), *Carya alba* (mockernut hickory), *Halesia carolina* (Carolina silverbell), *Ostrya virginiana* (hophornbeam), *Vaccinium elliottii* (Elliott's blueberry), and *Viburnum* (viburnum) spp. Herbs in the very sparse (10%) herbaceous layer include *Aesculus sylvatica* (painted buckeye), *Chasmanthium latifolium* (Indian woodoats), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium tinctorium* (stiff marsh

bedstraw), *Mitchella repens* (partridgeberry), *Passiflora lutea* (yellow passionflower), and *Polystichum acrostichoides* (Christmas fern). Vines are diverse and include *Bignonia capreolata* (crossvine), *Decumaria barbara* (woodvamp), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax* (greenbrier) spp., *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine).

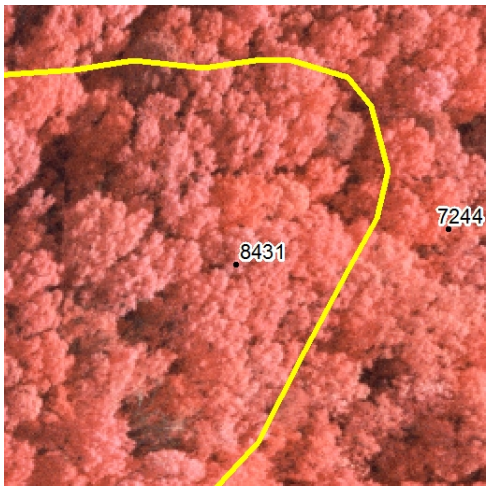
Global Vegetation: Stands are dominated by *Pinus taeda* (loblolly pine) with *Quercus nigra* (water oak) and/or *Quercus phellos* (willow oak), with *Liquidambar styraciflua* (sweetgum) and/or *Liriodendron tulipifera* (tuliptree). *Quercus laurifolia* (laurel oak) is possible in some stands in the Upper East Gulf Coastal Plain. Some other trees that may be present include *Acer rubrum* (red maple), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), *Quercus alba* (white oak), and *Sassafras albidum* (sassafras). Shrubs may include *Acer leucoderme* (chalk maple), *Aesculus sylvatica* (painted buckeye), *Carya alba* (mockernut hickory), *Halesia carolina* (Carolina silverbell), *Ostrya virginiana* (hophornbeam), *Vaccinium elliottii* (Elliott's blueberry), and *Viburnum* (viburnum) spp. Herbs may include *Chasmanthium latifolium* (Indian woodoats), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium tinctorium* (stiff marsh bedstraw), *Mitchella repens* (partridgeberry), *Passiflora lutea* (yellow passionflower), and *Polystichum acrostichoides* (Christmas fern). Vines may include *Bignonia capreolata* (crossvine), *Decumaria barbara* (woodvamp), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax* (greenbrier) spp., *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine) (NatureServe Ecology, unpubl. data).

Attribute	Description
CEGL Code	7730
Community Name	American Sycamore – Sugarberry – Green Ash / Northern Spicebush –Possumhaw /Reflexed Sedge Forest
Pictures	 
Color	Pink to red
Tone	Light to medium
Texture	Medium to coarse
Pattern	Usually dense
Height	Medium to tall
Shape	Elongated
Size	One of the most common classes; small average size with some variation.
Location	Hardwood dominated forest found in lower topographic areas near water.
Association	7734, 7312
Comments	Typically lightest tones on the map, but can be confused with nearly all other groups due to the wide range of species that can be found in this class. Difficult to distingush from 7312 but usually more diverse.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated by various combinations of *Celtis laevigata* (sugarberry), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Liriodendron tulipifera* (tuliptree), and *Platanus occidentalis* (American sycamore); additional canopy species may include *Betula nigra* (river birch), *Carya cordiformis* (bitternut hickory), *Liquidambar styraciflua* (sweetgum), *Pinus taeda* (loblolly pine), *Quercus nigra* (water oak), and *Quercus rubra* (northern red oak). The sparse (30-40%) subcanopy (10-20 m) may include canopy species as well as *Acer barbatum* (southern sugar maple), *Carpinus caroliniana* (American hornbeam), *Fagus grandifolia* (American beech), *Halesia tetraptera* (mountain silverbell), *Morus rubra* (red mulberry), *Ostrya virginiana* (hophornbeam), and *Ulmus rubra* (slippery elm). Dominants in the moderate (40-60%) tall-shrub layer (5-10 m) include *Acer barbatum* (southern sugar maple), *Carpinus caroliniana* (American hornbeam), *Lindera benzoin* (northern spicebush), *Morus rubra* (red mulberry), and the exotic *Ligustrum sinense* (Chinese privet). The

sparse to dense (40-80%) short-shrub layer (1-2 m) may include tall-shrub species along with *Asimina triloba* (pawpaw), *Staphylea trifolia* (American bladdernut), and *Toxicodendron radicans* (eastern poison-ivy). Herbs in the sparse (20-30%) herbaceous layer include *Ageratina altissima* (white snakeroot), *Bignonia capreolata* (crossvine), *Botrychium biternatum* (sparselobe grapefern), *Chasmanthium latifolium* (Indian woodoats), *Chasmanthium laxum* (slender woodoats), *Elephantopus carolinianus* (Carolina elephantsfoot), *Geum canadense* (white avens), *Laportea canadensis* (Canadian woodnettle), *Onoclea sensibilis* (sensitive fern), *Passiflora lutea* (yellow passionflower), *Polystichum acrostichoides* (Christmas fern), and *Verbesina occidentalis* (yellow crownbeard). Vines include *Decumaria barbara* (woodvamp), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine).

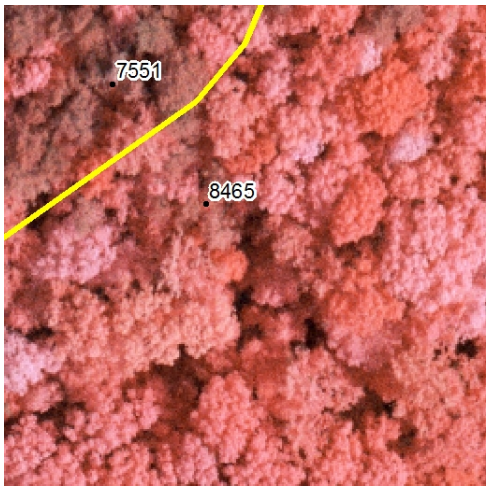
Global Vegetation: The mostly closed canopy of this community is dominated by *Platanus occidentalis* (American sycamore), *Celtis laevigata* (sugarberry), and *Fraxinus pennsylvanica* (green ash). These species, along with *Acer negundo* (box-elder), are important in the well-developed subcanopy also. Other tree species are possible in these strata and include *Crataegus viridis* (green hawthorn), *Juglans nigra* (black walnut), *Acer saccharinum* (silver maple), *Morus rubra* (red mulberry), *Ilex decidua* (possumhaw), *Ulmus americana* (American elm), *Planera aquatica* (planertree), *Quercus laurifolia* (laurel oak), *Liquidambar styraciflua* (sweetgum), *Carya aquatica* (water hickory), and others. The shrub layer generally is sparse and is dominated by *Lindera benzoin* (northern spicebush), *Ilex decidua* (possumhaw), *Asimina triloba* (pawpaw), and likely other species as well. *Acer barbatum* (southern sugar maple) may be an important shrub-layer component at the southern end of this community's range. Some examples of this community also have patches of *Arundinaria gigantea* (giant cane) in spots. The herbaceous layer is typically sparse; constant species are *Boehmeria cylindrica* (small-spike false nettle), *Carex grayi* (Gray's sedge), *Carex retroflexa* (reflexed sedge), and *Viola* (violet) spp. Other typical species include *Botrychium dissectum* (cutleaf grapefern), *Carex lupulina* (hop sedge), *Chasmanthium latifolium* (Indian woodoats), *Onoclea sensibilis* (sensitive fern), *Pilea pumila* (Canadian clearweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum virginianum* (jumpseed), and others. The vine stratum is moderate and many species are possible. Among these are *Bignonia capreolata* (crossvine), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax tamnoides* (bristly greenbrier), *Vitis rotundifolia* (muscadine), and *Toxicodendron radicans* (eastern poison-ivy). Exotic species such as *Ligustrum sinense* (Chinese privet), *Lonicera japonica* (Japanese honeysuckle), and *Microstegium vimineum* (Nepalese browntop) may invade stands of this association and increase following disturbance.

Attribute	Description
CEGL Code	8431
Community Name	Xeric Ridgetop Chestnut Oak Forest
Pictures	 
Color	Pink to red
Tone	Light to medium
Texture	Medium
Pattern	Moderate to dense
Height	Medium to tall
Shape	Circular, found on ridge tops
Size	Uncommon class with small average size.
Location	Xeric hardwood dominated forest found on ridge tops.
Association	7244, 4415
Comments	Difficult to distinguish from 4416 using amount of rhododendron or lack of mafic indicator species. Relying upon topographic position on ridge top and possible presence of pines.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70-80% cover) tree canopy is variable in height, ranging from 15-50 m tall. It is dominated by *Quercus prinus* (chestnut oak); additional species may include *Carya alba* (mockernut hickory), *Carya pallida* (sand hickory), *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Quercus falcata* (southern red oak), and *Quercus stellata* (post oak). The sparse to moderate (20-50%) subcanopy (10-20 m) is also dominated by *Quercus prinus* (chestnut oak). The sparse (20-30%) tall-shrub layer (5-10 m) and sparse (20-30%) short-shrub layer (1-2 m) are made up of saplings of tree species as well as *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), *Rhododendron minus* (piedmont rhododendron), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium* (blueberry) spp., *Viburnum acerifolium* (mapleleaf viburnum), and others. The sparse (5-40%) herbaceous layer is dominated by tree and shrub seedlings along with small amounts of *Chimaphila maculata* (striped prince's pine), *Coreopsis major*, *Dichanthelium acuminatum*, *Dryopteris intermedia* (intermediate woodfern), *Polystichum*

acrostichoides (Christmas fern), and *Solidago arguta* (Atlantic goldenrod). Vines, particularly *Vitis rotundifolia* (muscadine), may cover much of the ground surface and climb into the upper layers.

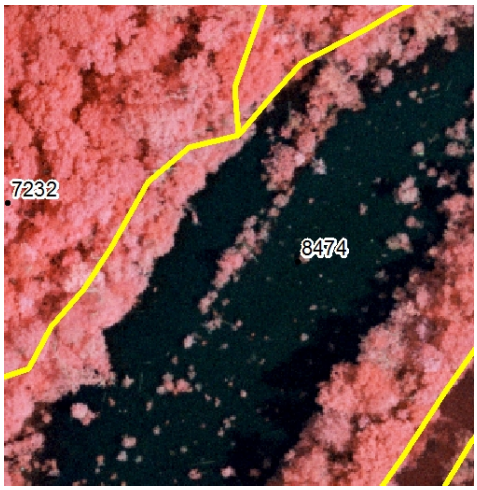
Global Vegetation: This is a closed-canopy, deciduous forest with open to sparse shrub layers and a sparse to absent herb layer. The canopy is dominated by *Quercus prinus* (chestnut oak) sometimes sharing dominance with *Quercus coccinea* (scarlet oak) (and in some Piedmont examples, with *Quercus coccinea* (scarlet oak) as the dominant canopy tree). Other oaks in the canopy can include *Quercus velutina* (black oak), *Quercus stellata* (post oak), and *Quercus alba* (white oak), although these oaks are not dominant. Hickories (e.g., *Carya glabra* (pignut hickory), *Carya pallida* (sand hickory)) may be present in the canopy and/or subcanopy. Some examples may have coverage of pine in the canopy, most commonly *Pinus virginiana* (Virginia pine) and *Pinus echinata* (shortleaf pine). The most common subcanopy trees are *Acer rubrum* (red maple), *Carya pallida* (sand hickory), *Cornus florida* (flowering dogwood), *Nyssa sylvatica* (blackgum), and *Oxydendrum arboreum* (sourwood). Other minor species in the canopy and subcanopy can include *Carya glabra* (pignut hickory), *Castanea dentata* (American chestnut), and *Magnolia macrophylla* (bigleaf magnolia). The most constant shrub species are *Chimaphila maculata* (striped prince's pine), *Vaccinium arboreum* (farkleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Diospyros virginiana* (common persimmon), and *Sassafras albidum* (sassafras). Other shrubs that can occur in examples of this community are *Lyonia ligustrina* (maleberry), *Castanea pumila* (chinkapin), *Viburnum acerifolium* (mapleleaf viburnum), *Rhododendron alabamense* (Alabama azalea), and *Rhododendron canescens* (mountain azalea). Herb coverage is sparse, with little constancy among examples. Some of the more typical herb species are *Euphorbia corollata* (flowering spurge), *Hieracium venosum* (rattlesnakeweed), *Carex nigromarginata* (black edge sedge), and *Solidago odora* (anisescented goldenrod), but many other species may occur. In the lower Piedmont of Georgia, some additional herbs may include *Schizachyrium scoparium* (little bluestem), *Dichanthelium boscii* (Bosc's panicgrass), *Piptochaetium avenaceum* (blackseed speargrass), *Tephrosia virginiana* (Virginia tephrosia), *Verbesina virginica* (white crownbeard), *Hypoxis hirsuta* (common goldstar), *Tragia urticifolia* (nettleleaf noseburn), *Brickellia eupatorioides* (false boneset), *Scutellaria elliptica* (hairy skullcap), *Arnoglossum atriplicifolium* (pale Indian plaintain), *Pityopsis aspera* (pineland silkgrass), and *Coreopsis major* (greater tickseed).

Attribute	Description
CEGL Code	8465
Community Name	Piedmont Acidic Mesic Mixed Hardwood Forest
Pictures	 
Color	Pink to red
Tone	Light
Texture	Fine to medium
Pattern	Dense
Height	Tall
Shape	Patchy following topography
Size	Uncommon class with some large individual regions.
Location	Mesic hardwood dominated forest found in sheltered, north facing slopes near streams.
Association	7551, 7244
Comments	Difficult to distinguish from 7232 and 7244, but usually found on northern facing slopes.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate to dense (50-80% cover) tree canopy, 20-50 m tall, is codominated by *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), and *Quercus alba* (white oak). *Fagus grandifolia* (American beech) and *Oxydendrum arboreum* (sourwood) often dominate the sparse (10-40%) subcanopy (10-20 m). Common and/or dominant species in the very sparse to moderate (5-60%) tall-shrub layer (2-10 m) include *Acer leucoderme* (chalk maple), *Carpinus caroliniana* (American hornbeam), *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), and *Rhododendron canescens* (mountain azalea). The very sparse to sparse (5-40%) short-shrub layer (1-2 m) is made up of tall-shrub species as well as *Aesculus sylvatica* (painted buckeye), *Amelanchier arborea* (common serviceberry), *Asimina parviflora* (smallflower pawpaw), *Calycanthus floridus* (eastern sweetshrub), *Cornus florida* (flowering dogwood), *Lindera benzoin* (northern spicebush), *Toxicodendron radicans* (eastern poison-ivy), *Vaccinium stamineum* (deerberry), *Viburnum acerifolium* (mapleleaf viburnum), and others. The herbaceous layer may have sparse to moderate cover (20-60%); common and/or dominant species include *Actaea racemosa* (black bugbane), *Chimaphila maculata* (striped

prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium commutatum* (variable panicgrass), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Hexastylis arifolia* (littlebrownjug), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonatum biflorum* (smooth Solomon's seal), *Polystichum acrostichoides* (Christmas fern), *Tipularia discolor* (crippled cranefly), *Xanthorhiza simplicissima* (yellowroot), and many others. Vines (5-10%) include *Decumaria barbara* (woodvamp), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax rotundifolia* (roundleaf greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis rotundifolia* (muscadine) and may be found trailing along the ground and/or climbing into upper layers. Several exotic species have invaded this community. However, it also supports state-vulnerable species, including *Agrimonia microcarpa* (smallfruit agrimony), *Castanea dentata* (American chestnut), *Collinsonia tuberosa* (deepwoods horsebalm), and *Dirca palustris* (eastern leatherwood).

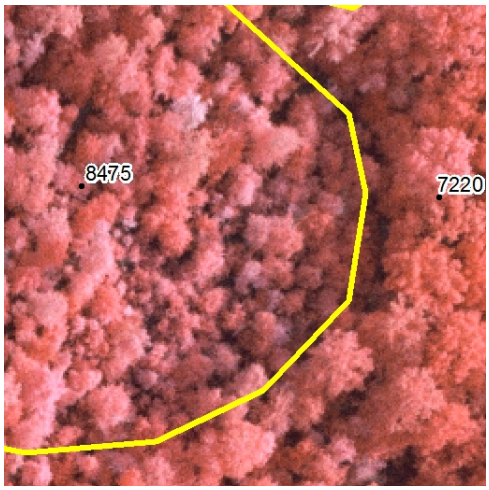
Global Vegetation: The canopy of stands of this association is dominated by mesophytic trees such as *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), and in the western Piedmont, *Tsuga canadensis* (eastern hemlock). Typical understory trees include *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Acer rubrum* (red maple), and *Ilex opaca* (American holly). Shrub species may include *Vaccinium stamineum* (deerberry), *Viburnum rafinesquianum* (downy arrow-wood), *Euonymus americanus* (strawberry bush), and sometimes *Kalmia latifolia* (mountain laurel). The herb layer is often moderately dense and diverse, though it may be sparse under heavy shade. Herb species may include *Polystichum acrostichoides* (Christmas fern), *Viola* (violet) spp., *Dichanthelium* (rosette grass) spp., *Galium circaezans* (licorice bedstraw), *Hexastylis arifolia* (littlebrownjug), *Hexastylis minor* (little heartleaf), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Erythronium umbilicatum ssp. umbilicatum* (dimpled troutlily), *Chamaelirium luteum* (fairywand), *Epifagus virginiana* (beechdrops), *Tiarella cordifolia* var. *collina* (heartleaf foamflower), *Heuchera americana* (American alumroot), *Stellaria pubera* (star chickweed), *Podophyllum peltatum* (mayapple), *Prenanthes serpentaria* (cankerweed), *Thalictrum thalictroides* (rue-anemone), *Chrysogonum virginianum* var. *virginianum* (green and gold), *Hepatica nobilis* var. *obtusa* (roundlobe hepatica), *Thelypteris noveboracensis* (New York fern), and *Botrychium virginianum* (rattlesnake fern) (Schafale and Weakley 1990). Exact composition varies locally with position on slope and nature of soil. Western Piedmont sites often have increasing importance of *Tsuga canadensis* (eastern hemlock), *Rhododendron* (rhododendron) spp., and other species that are more typical of the Southern Blue Ridge.

Attribute	Description
CEGL Code	8474
Community Name	Southeastern Alder Swamp
Pictures	 
Color	Pink
Tone	Light
Texture	Medium to coarse
Pattern	Scattered to dense
Height	Very short
Shape	Elongated
Size	Very rare and very small.
Location	Hydric shrubland found in low, wet areas.
Association	4112, 2191
Comments	Used for shrub cover in wetland areas only. Difficult to distinguish species composition from summer CIR. Distinguished from 2191 because of sparser vegetation.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderate (50% cover) tall-shrub layer (2-5 m) and moderate (40%) short-shrub layer (1-2 m) are codominated by *Alnus serrulata* (hazel alder) and *Cephalanthus occidentalis* (common buttonbush). In addition, there is a very sparse (5%) emergent tree layer (5-10 m) of *Nyssa biflora* (swamp tupelo). The very sparse (5%) herbaceous layer is comprised of *Juncus effusus* (common rush), *Triadenum walteri* (greater marsh St. Johnswort), and *Hypericum mutilum* (dwarf St. Johnswort).

Global Vegetation: Stands of this vegetation are dominated by tall shrubs and are characterized by some combination of *Alnus serrulata* (hazel alder), *Viburnum* (viburnum) spp., *Cornus* (dogwood) spp., and *Salix* (willow) spp. In addition, saplings of *Acer rubrum* (red maple) are typical. Other shrubs present may include *Cephalanthus occidentalis* (common buttonbush), *Decodon verticillatus* (swamp-loosestrife), and *Ilex verticillata* (common winterberry). Herbaceous associates include *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Boehmeria cylindrica*

(small-spike false nettle), *Polygonum sagittatum* (arrowleaf tearthumb), *Commelina virginica* (Virginia dayflower), *Galium* (bedstraw) spp., *Lycopus* (waterhorehound) spp., *Typha latifolia* (broadleaf cattail), *Peltandra virginica* (green arrow-arum), *Mikania scandens* (climbing hempvine), and *Carex* (sedge) spp. (e.g., *Carex crinita* (fringed sedge), *Carex atlantica* (prickly bog sedge)). Tree species such as *Acer rubrum* (red maple) and *Juglans nigra* (black walnut) may exist on the fringes of such an association, occasionally overshadowing parts of it. The exotic *Murdannia keisak* (wartremoving herb) may also be present.

Attribute	Description
CEGL Code	8475
Community Name	Piedmont Dry-mesic Acidic Oak Hickory Forest
Pictures	 
Color	Pink to red
Tone	Light to medium
Texture	Medium
Pattern	Moderate canopy
Height	Medium to tall
Shape	Patchy
Size	Rare class; small average size with very little variation.
Location	Mesic hardwood dominated forest found in upland sites.
Association	8431, 7232
Comments	Difficult to distingush from 7232 in summer CIR but contains more of an oak component.

Chattahoochee River National Recreation Area and Kennesaw Mountain National Battlefield Park Vegetation: The moderately dense (70-80% cover) tree canopy, 20-50 m tall, is dominated by *Carya ovalis* (red hickory); codominants may include *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Quercus stellata* (post oak), and/or *Quercus velutina* (black oak). *Carya pallida* (sand hickory) and *Pinus echinata* (shortleaf pine) are occasional canopy components. The sparse to moderate (10-50%) subcanopy (10-20 m) has basically the same makeup as the canopy. The sparse (20-40%) tall-shrub layer (2-10 m) and sparse (20%) short-shrub layer (1-2 m) are dominated by *Cornus florida* (flowering dogwood) and *Prunus serotina* (black cherry) along with sapling canopy species. The sparse (5-30%) herbaceous layer may include *Carex cherokeensis* (Cherokee sedge), *Dichanthelium boscii* (Bosc's panicgrass), *Dioscorea quaternata* (fourleaf yam), *Mitchella repens* (partridgeberry), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), *Uvularia sessilifolia* (sessileleaf bellwort), and *Viola* (violet) spp. *Vitis rotundifolia* (muscadine) vines can be abundant.

Global Vegetation: Stands of this forest are closed to somewhat open, and are dominated by mixtures of oaks and hickories, with *Quercus alba* (white oak) being most prevalent, along with *Quercus rubra* (northern red oak), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Carya alba* (mockernut hickory), *Carya ovalis* (red hickory), and *Carya glabra* (pignut hickory). *Carya* (hickory) spp. are common in this type but often most abundant in the understory. In Virginia examples, *Quercus prinus* (chestnut oak) and *Quercus falcata* (southern red oak) are inconstant but sometimes important. In addition, *Pinus* (pine) spp., *Liriodendron tulipifera* (tuliptree), *Liquidambar styraciflua* (sweetgum), and *Acer rubrum* (red maple) may be common, especially in disturbed stands. Understory species include *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), *Oxydendrum arboreum* (sourwood), *Ilex opaca* (American holly), and *Nyssa sylvatica* (blackgum). Shrubs include *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum rafinesquianum* (downy arrow-wood), and *Euonymus americanus* (strawberry bush). In Virginia, *Vaccinium pallidum* (Blue Ridge blueberry) and *Vaccinium stamineum* (deerberry) are the principal ericads of patchy low-shrub layers (G. Fleming, pers. comm.). The woody vines *Vitis rotundifolia* (muscadine) and *Toxicodendron radicans* (eastern poison-ivy) often are present. Herbs vary from sparse to moderately dense, with dry-mesophytic species such as *Hexastylis* (heartleaf) spp., *Goodyera pubescens* (downy rattlesnake plantain), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Maianthemum racemosum* (feathery false lily of the valley), *Polygonatum biflorum* (smooth Solomon's seal), *Viola hastata* (halberdleaf yellow violet), *Tipularia discolor* (crippled cranefly), *Carex albicans* (whitetinge sedge), and *Hieracium venosum* (rattlesnakeweed) prevalent (Schafale and Weakley 1990). Although not lush, these forests can be impressively species-rich, with high woody diversity and many low-cover herbaceous species occurring. Species richness of 116 Virginia plots averages 53 taxa per 400 square meters, varying from a low of 17 to a high of 114. Low species richness in this type is most often the result of long-term overgrazing by large deer populations. At least some of the stands with high species richness are located on sites where deer populations are effectively controlled.

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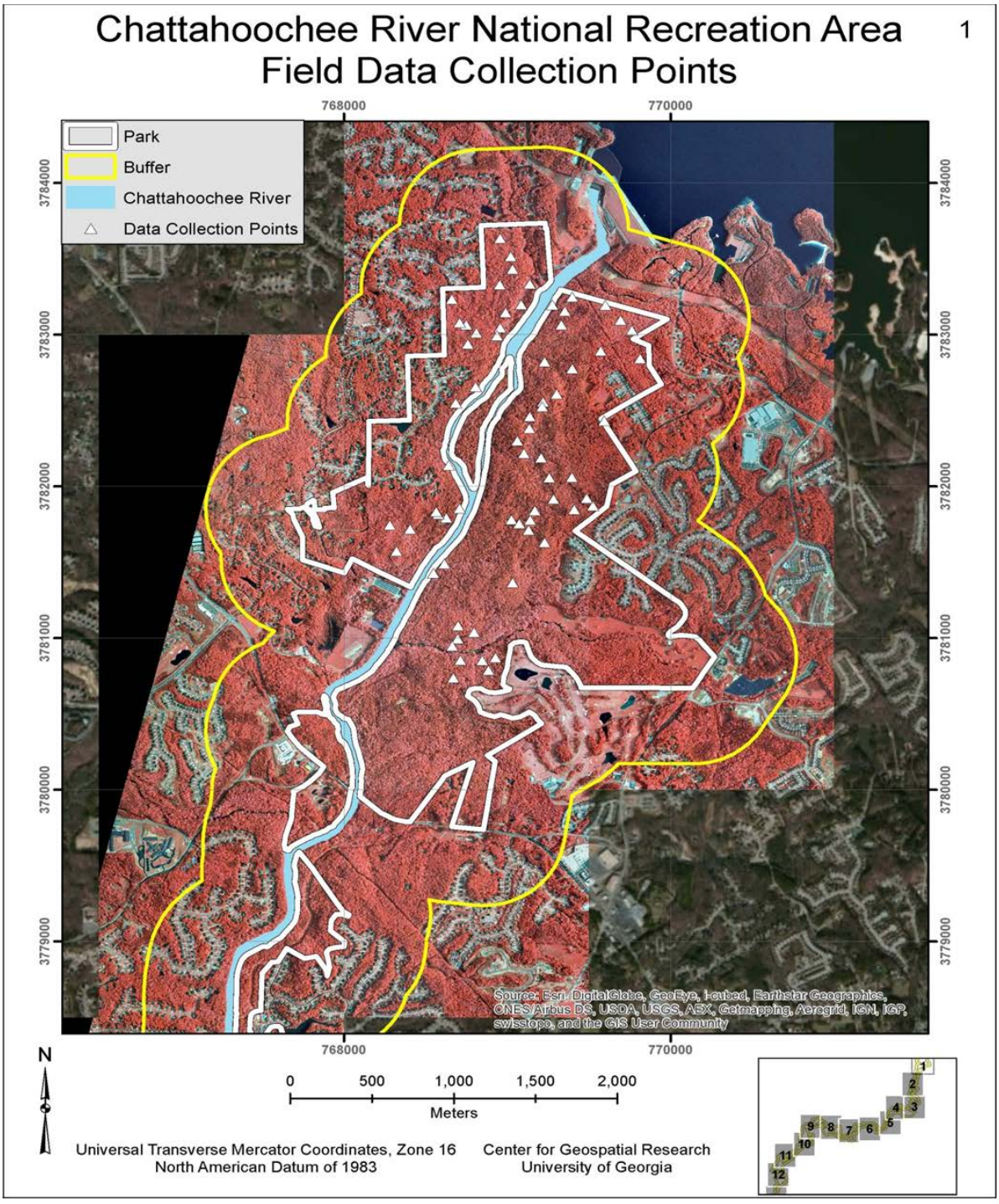
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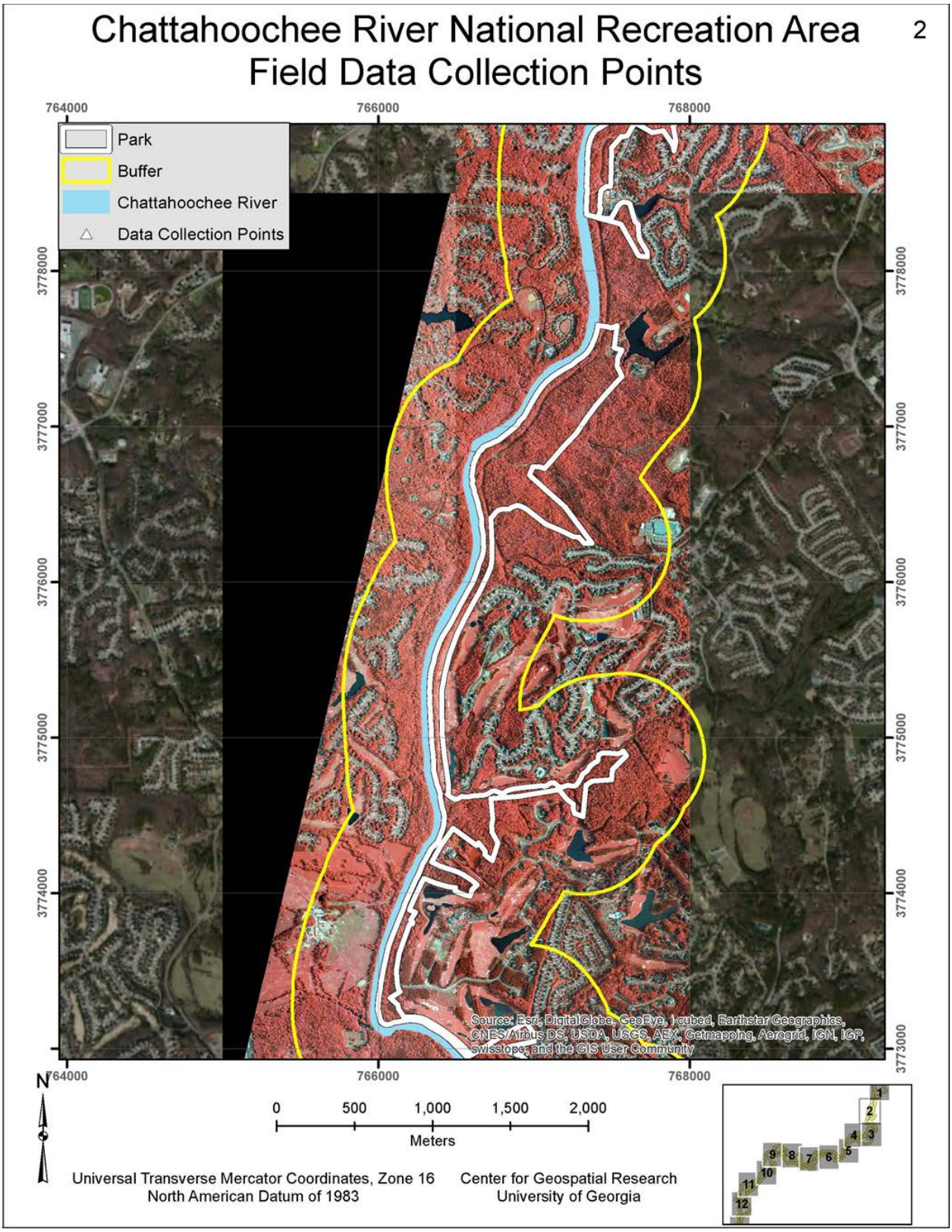
Appendix E – Field Data Point Locations

Location of field data collection points within Chattahoochee River National Recreation Area overlaid on CIR and visible imagery. [Recreation Area divided into 13 sections for this report].

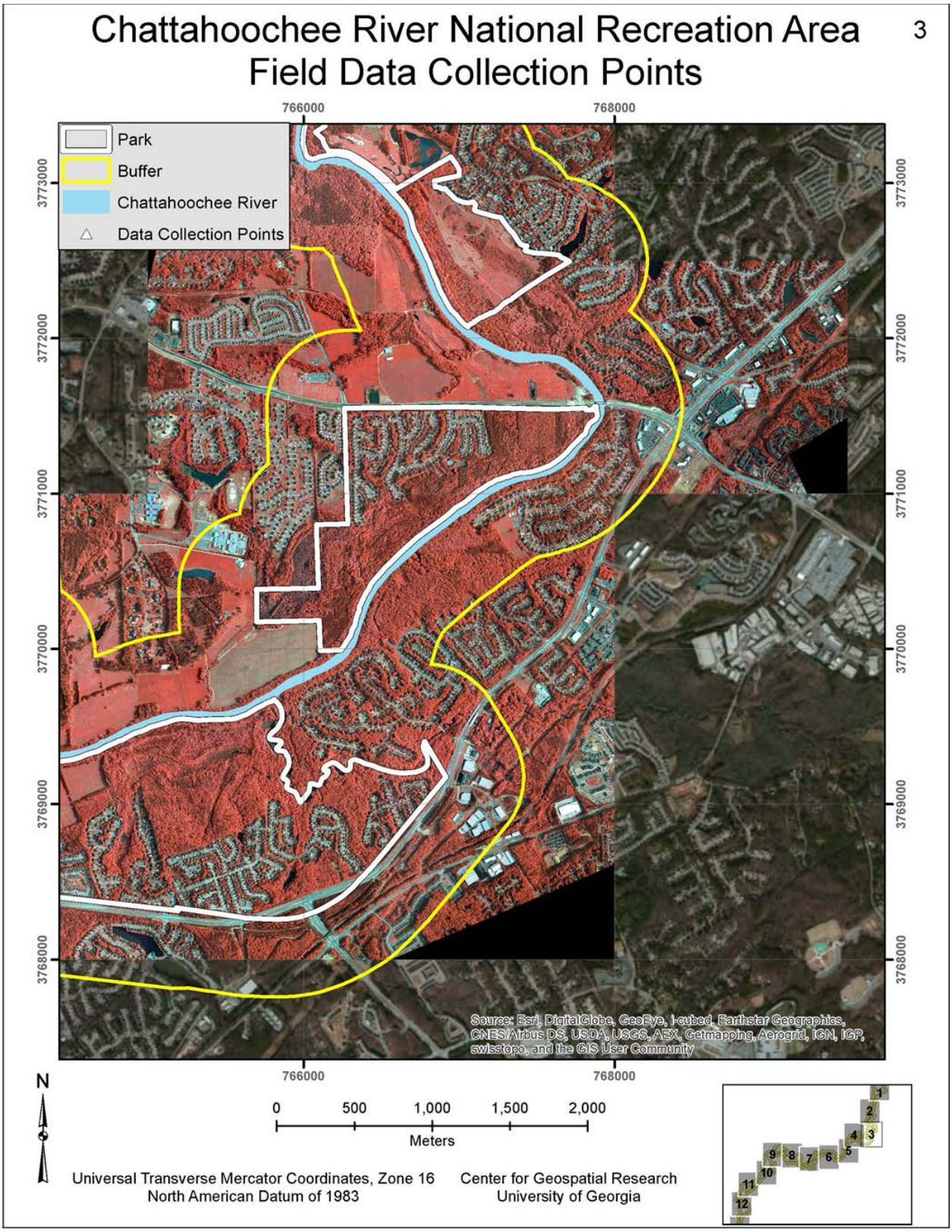
Section 1



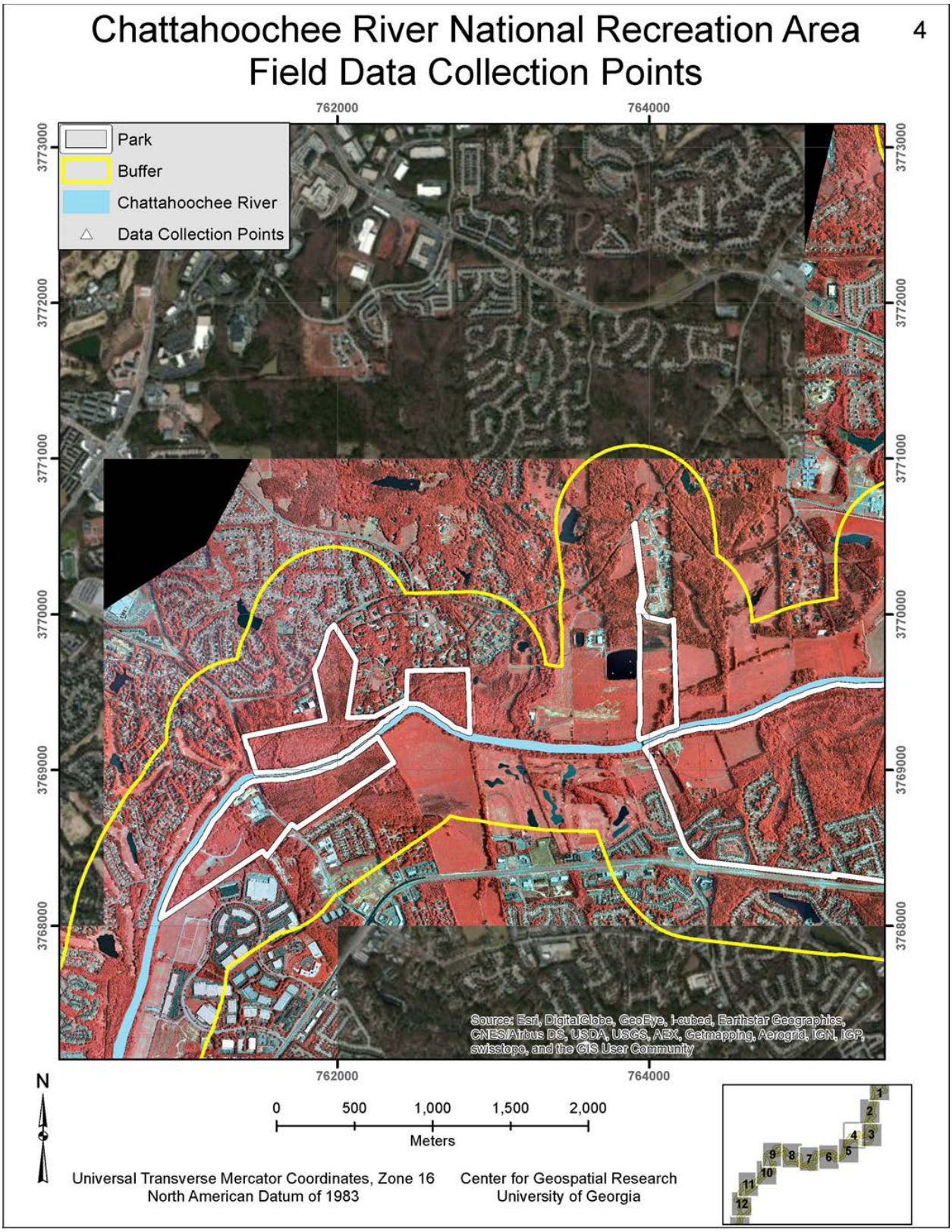
Section 2


Chattahoochee River National Recreation Area
Field Data Collection Points
2
Park
Buffer
Chattahoochee River
Data Collection Points
764000
766000
768000
3778000
3777000
3776000
3775000
3774000
3773000
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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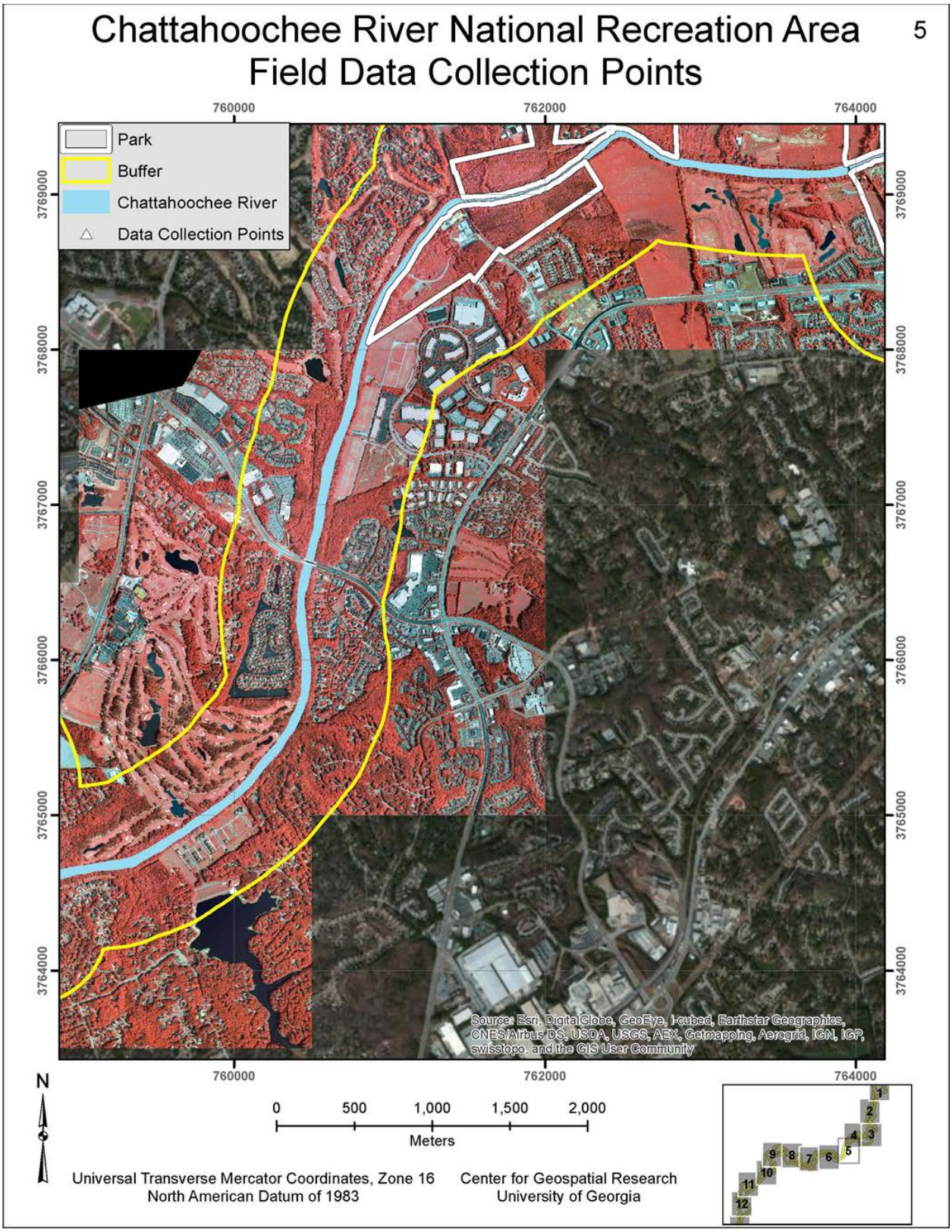
Section 3


Chattahoochee River National Recreation Area
Field Data Collection Points
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Data Collection Points
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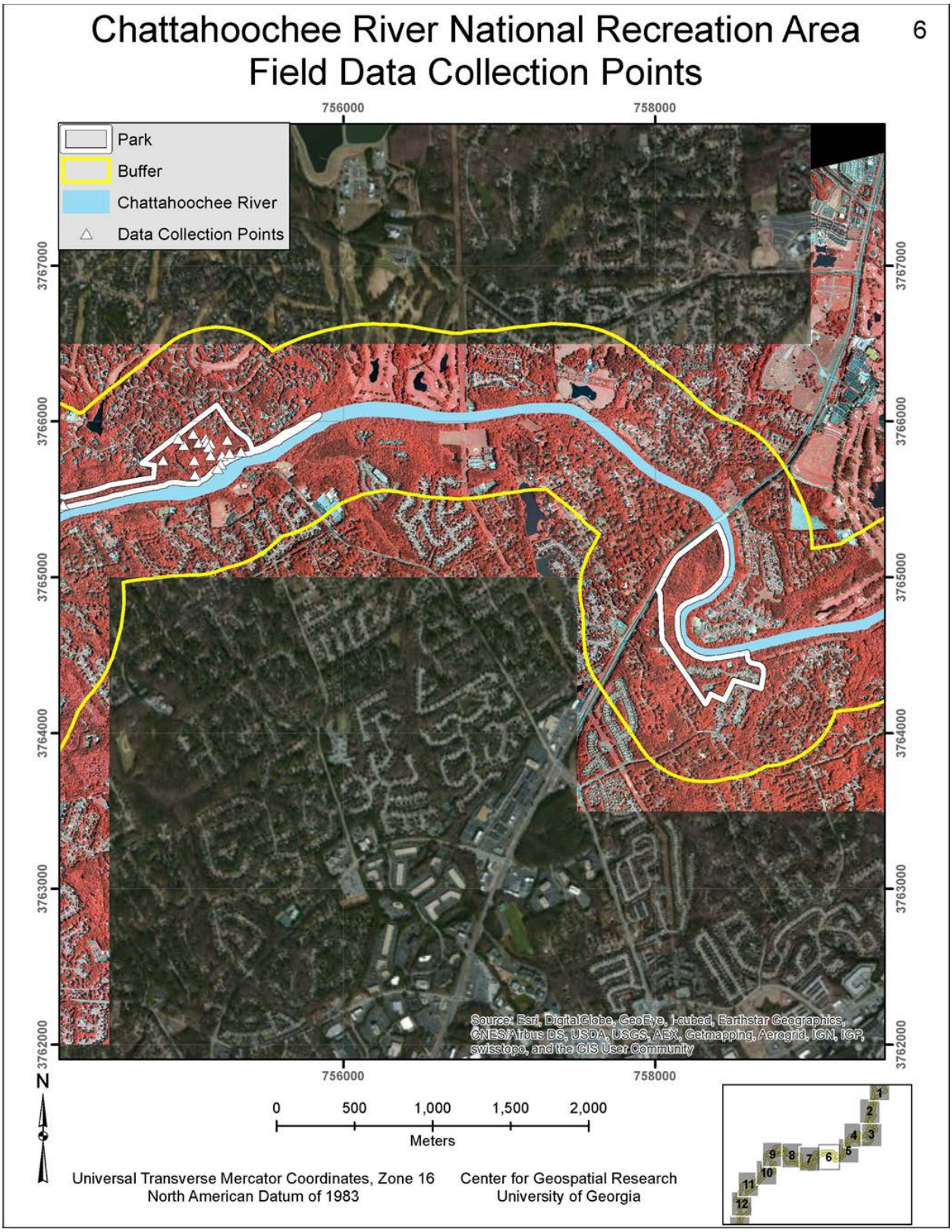
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Chattahoochee River National Recreation Area
Field Data Collection Points
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Data Collection Points
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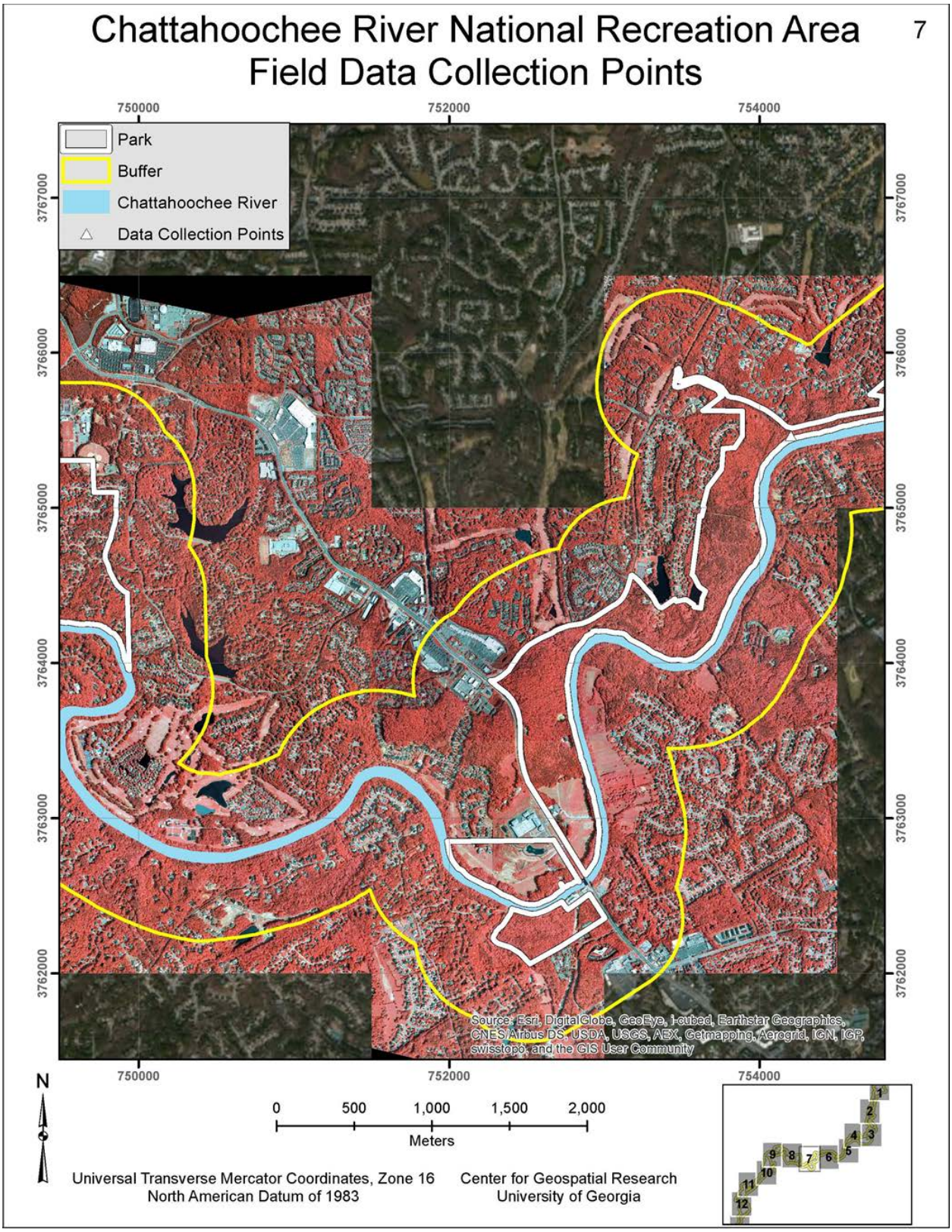
Section 5


Chattahoochee River National Recreation Area
Field Data Collection Points
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Data Collection Points
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3764000
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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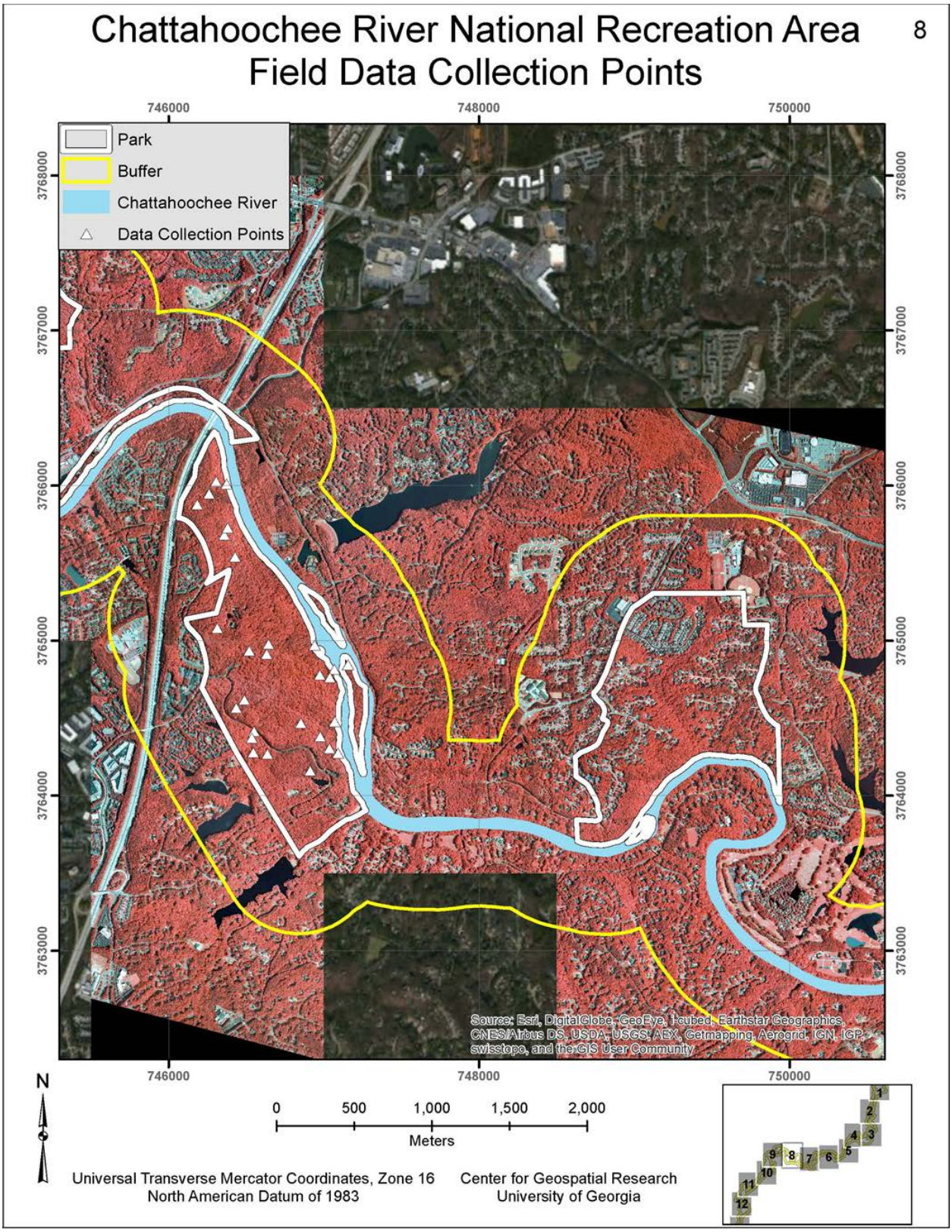
Section 6


Chattahoochee River National Recreation Area
Field Data Collection Points
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Chattahoochee River
Data Collection Points
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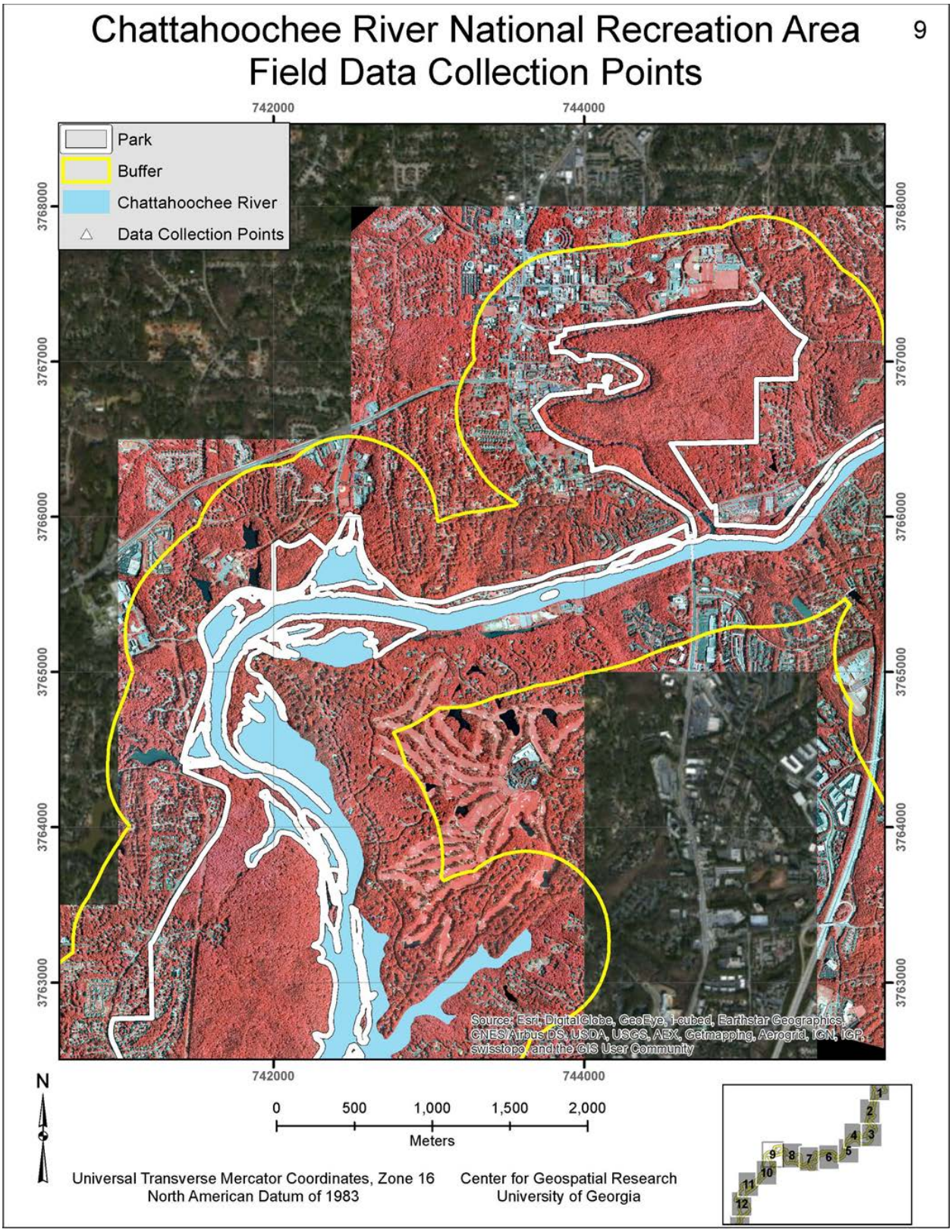
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Chattahoochee River National Recreation Area
Field Data Collection Points
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Park
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Chattahoochee River
Data Collection Points
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3762000
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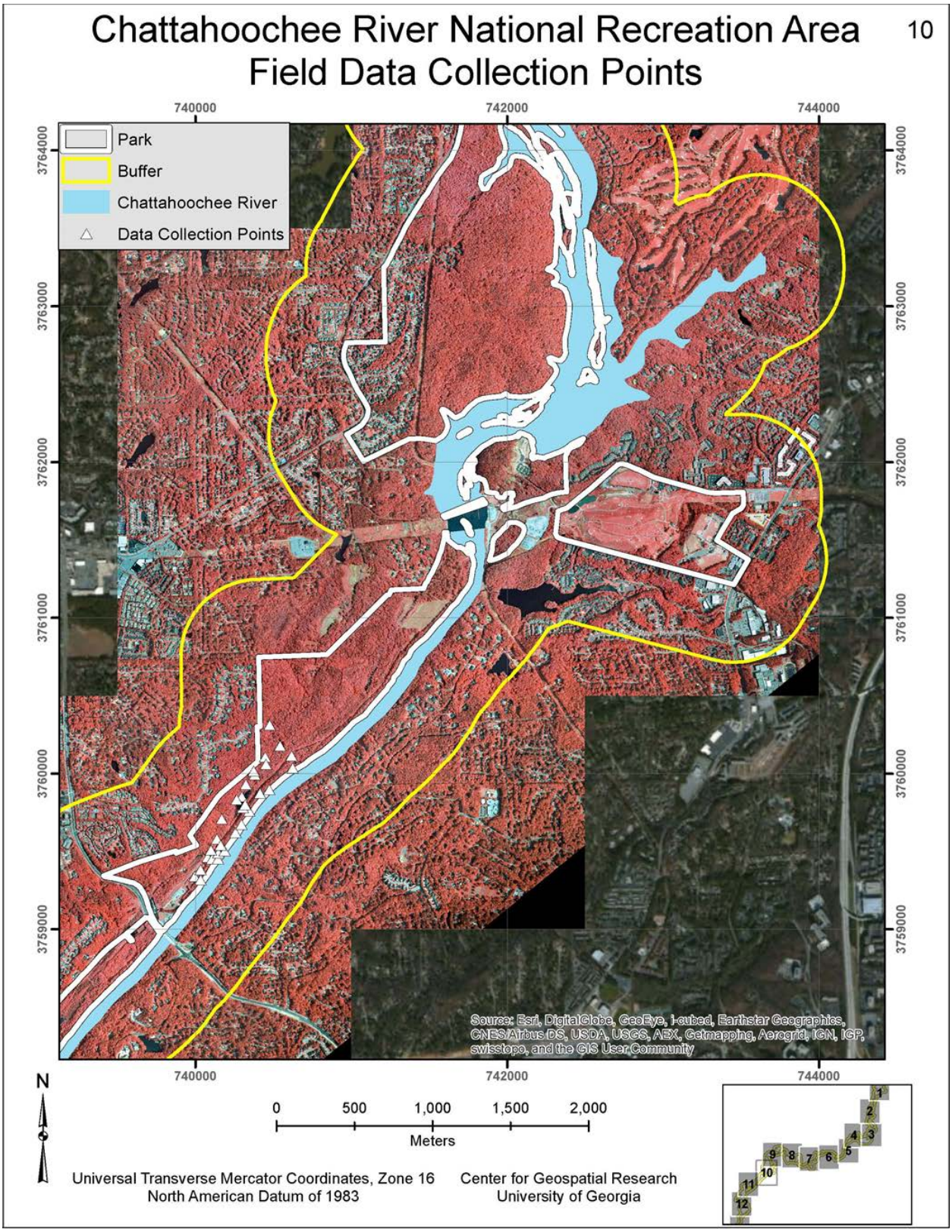
Section 8


Chattahoochee River National Recreation Area
Field Data Collection Points
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Data Collection Points
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Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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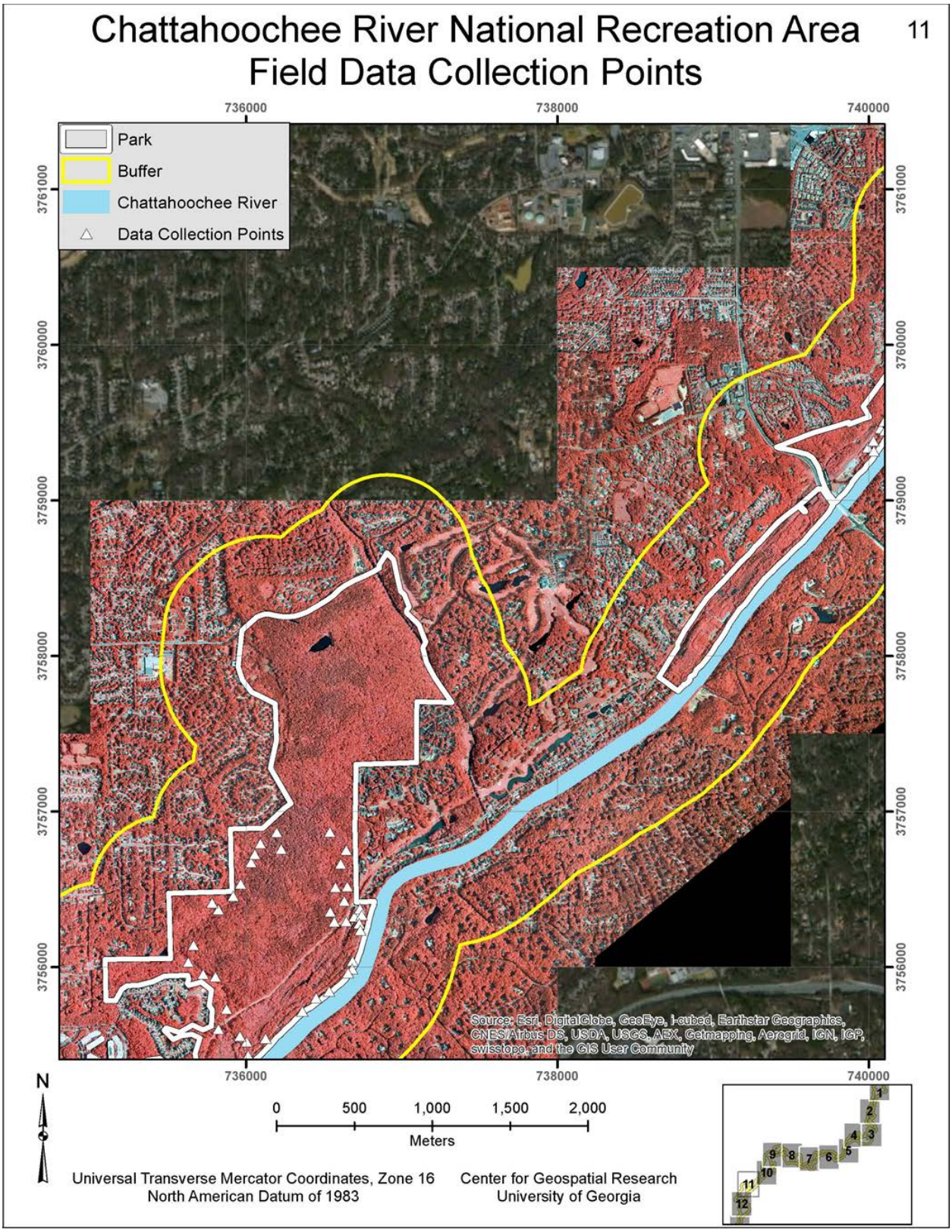
Section 9


Chattahoochee River National Recreation Area
Field Data Collection Points
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Chattahoochee River
Data Collection Points
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3763000
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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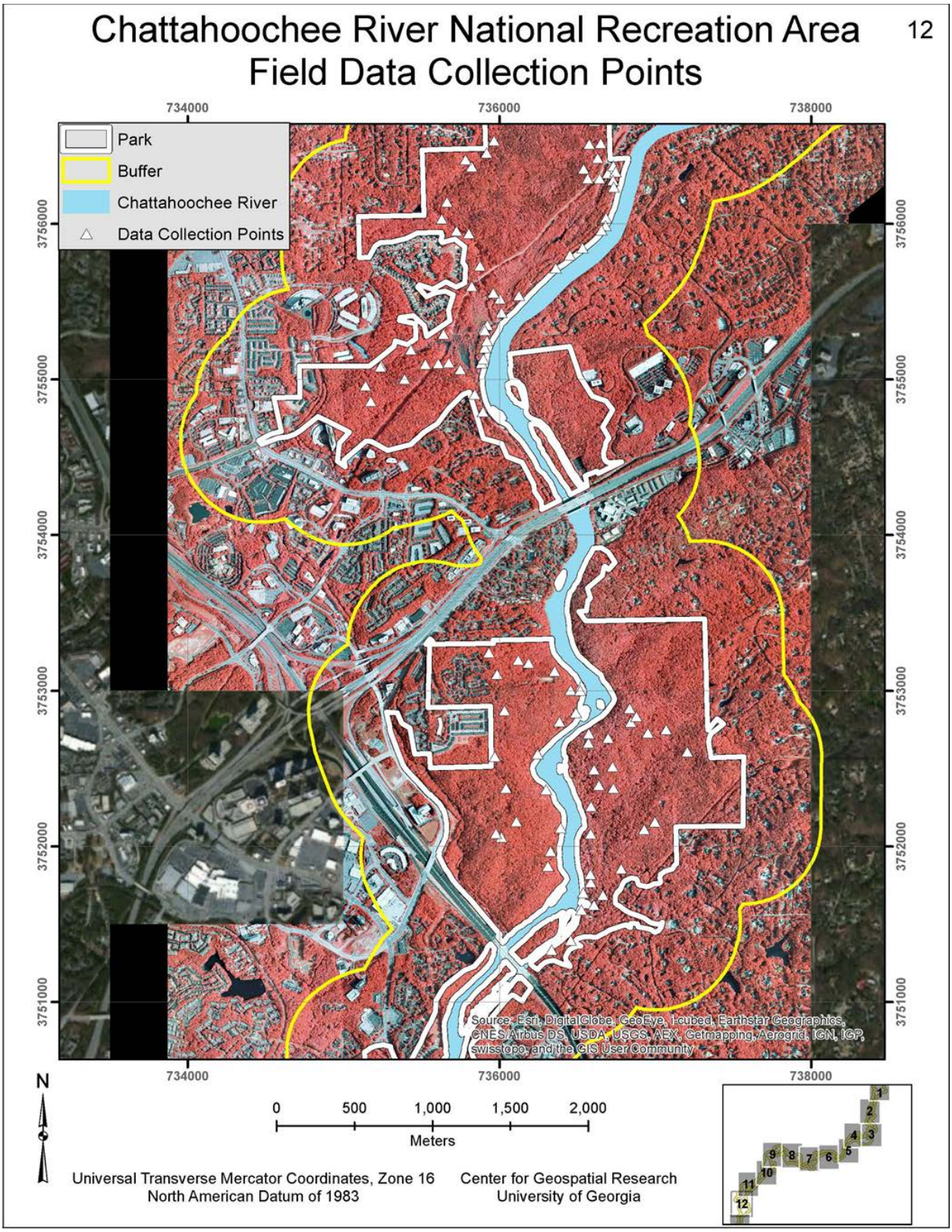
Section 10


Chattahoochee River National Recreation Area
Field Data Collection Points
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Park
Buffer
Chattahoochee River
Data Collection Points
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3759000
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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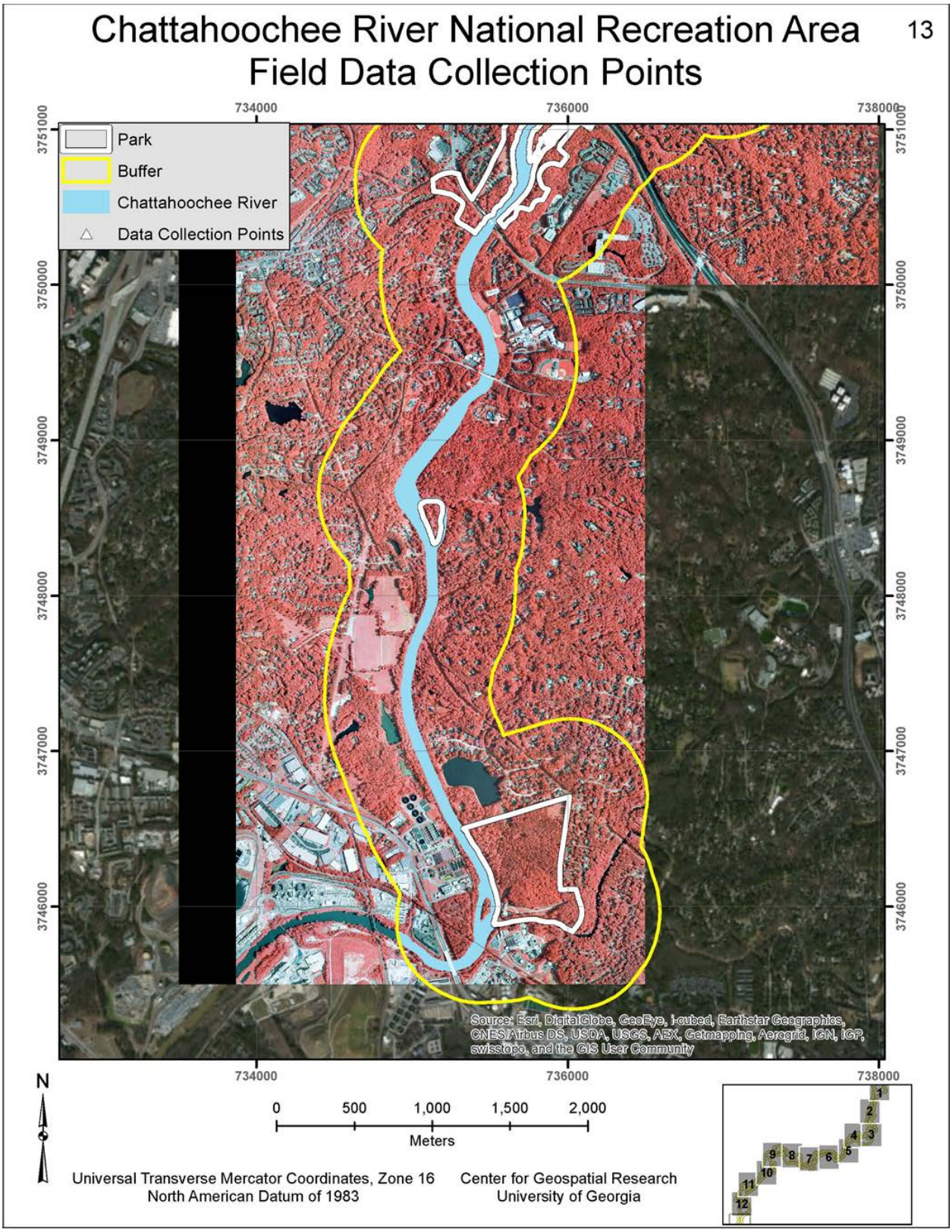
Section 11


Chattahoochee River National Recreation Area
Field Data Collection Points
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Data Collection Points
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3761000
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3759000
3758000
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Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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North American Datum of 1983
Center for Geospatial Research
University of Georgia
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Section 12


Chattahoochee River National Recreation Area
Field Data Collection Points
12
Park
Buffer
Chattahoochee River
Data Collection Points
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738000
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3755000
3754000
3753000
3752000
3751000
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Center for Geospatial Research
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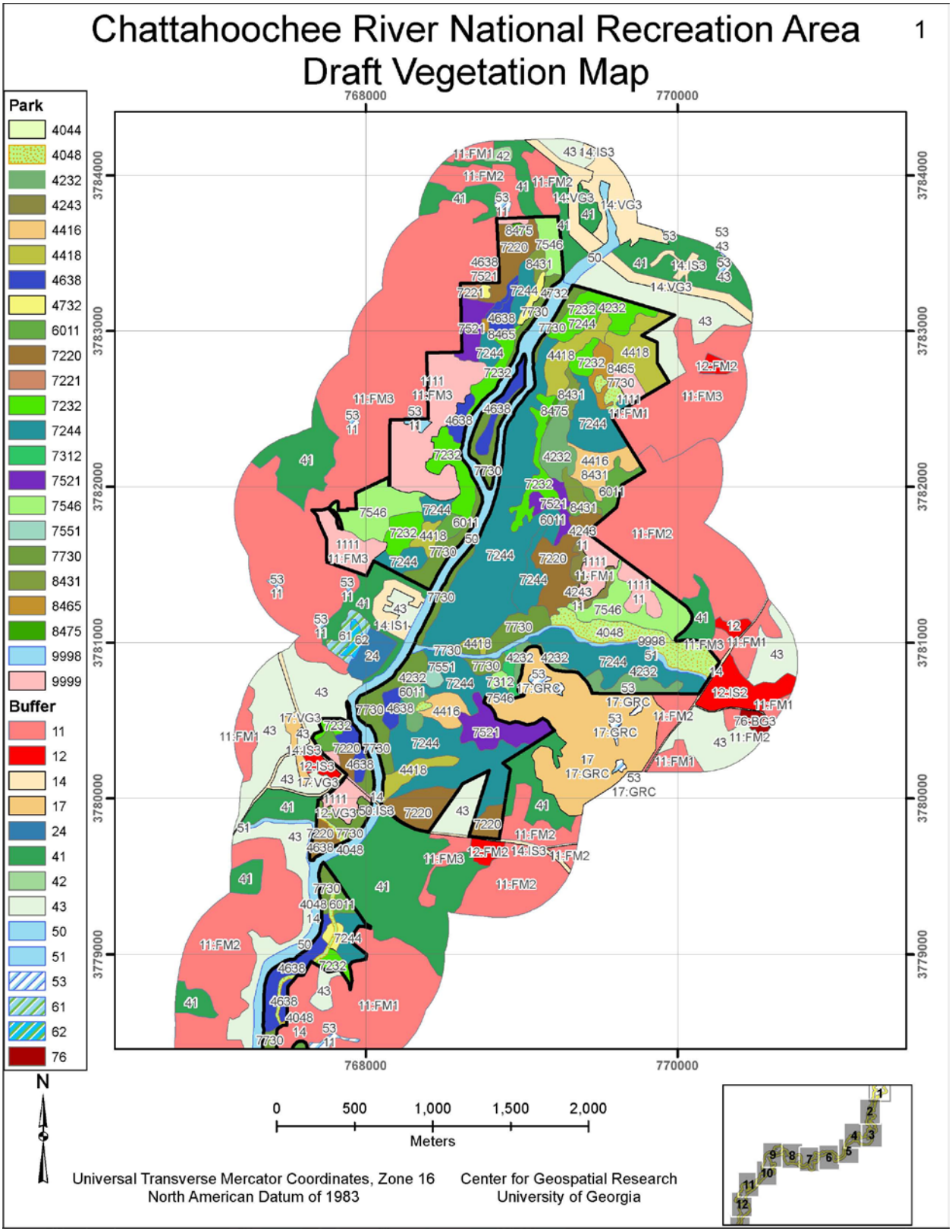
Section 13


Chattahoochee River National Recreation Area
Field Data Collection Points
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Chattahoochee River
Data Collection Points
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3747000
3746000
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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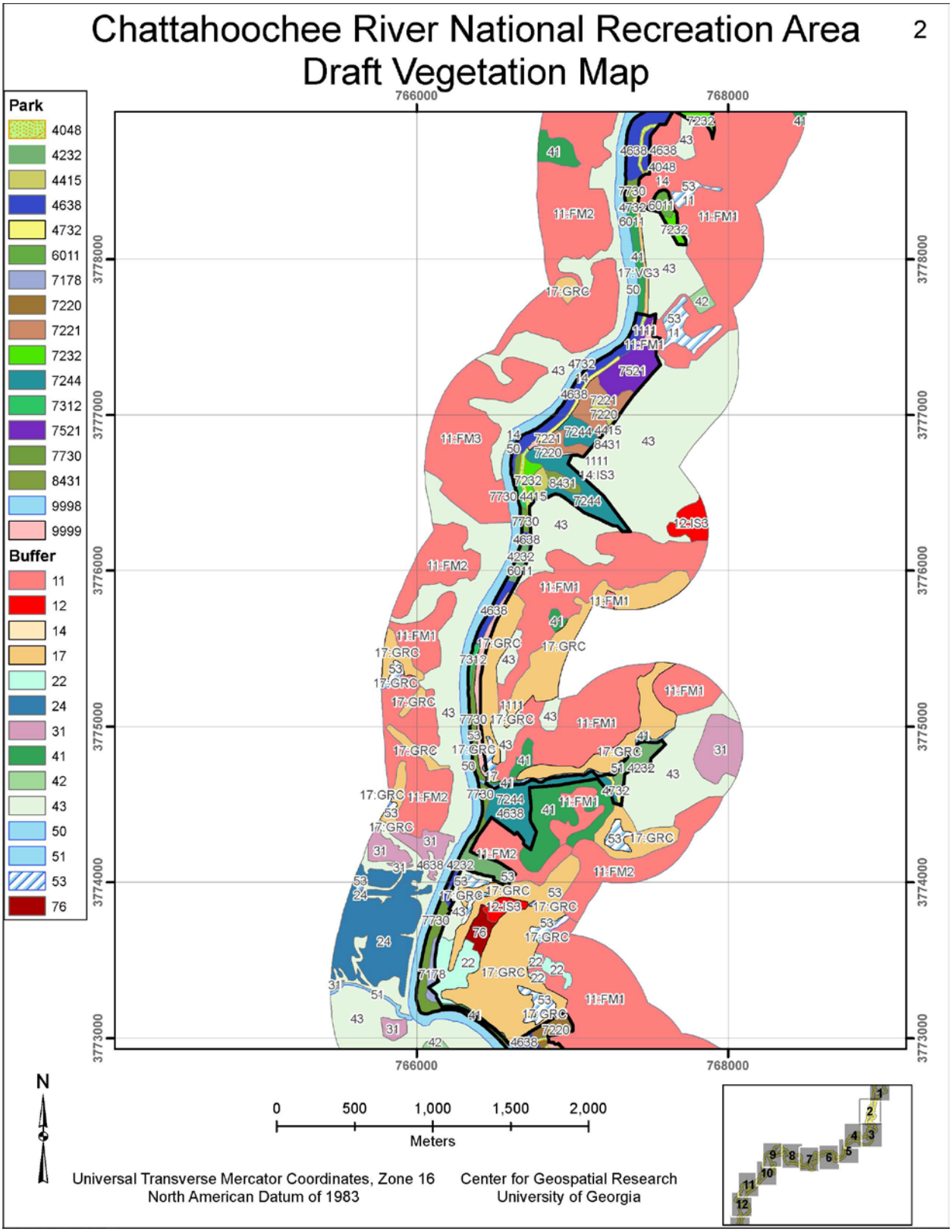
Appendix F – Draft Vegetation Maps

Chattahoochee River National Recreation Area draft vegetation map. [Recreation Area divided into 13 sections for this report].

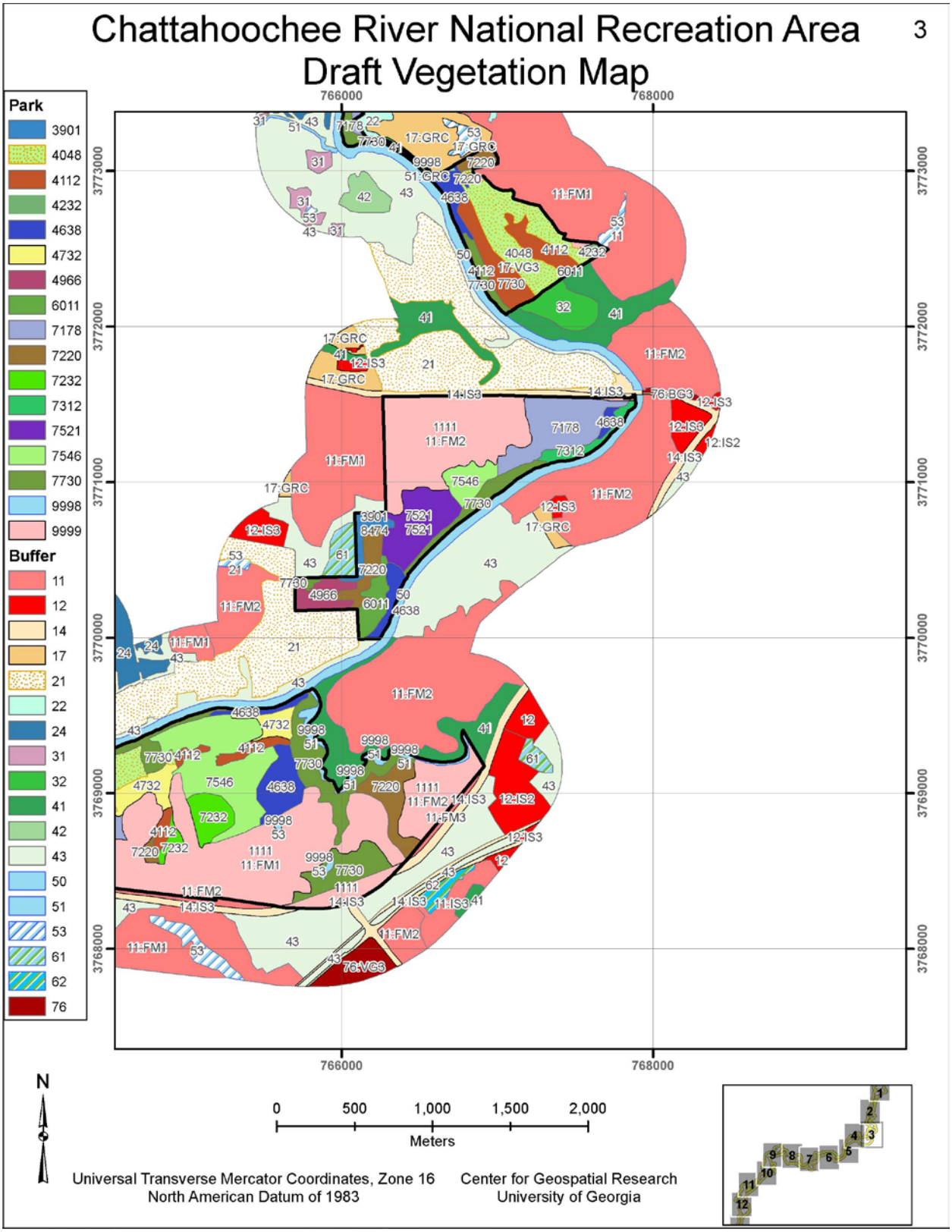
Section 1


Chattahoochee River National Recreation Area
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4232
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4732
6011
7220
7221
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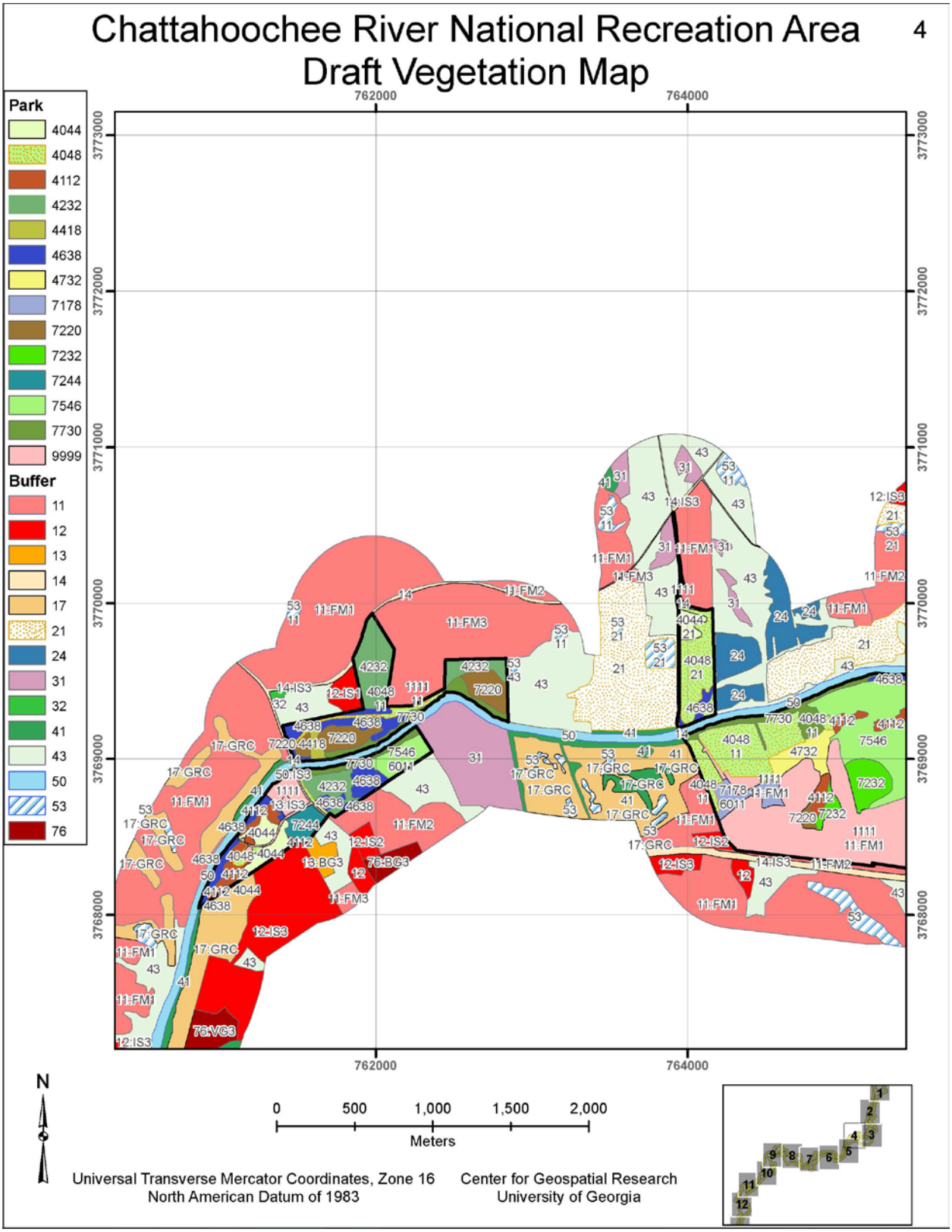
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Chattahoochee River National Recreation Area
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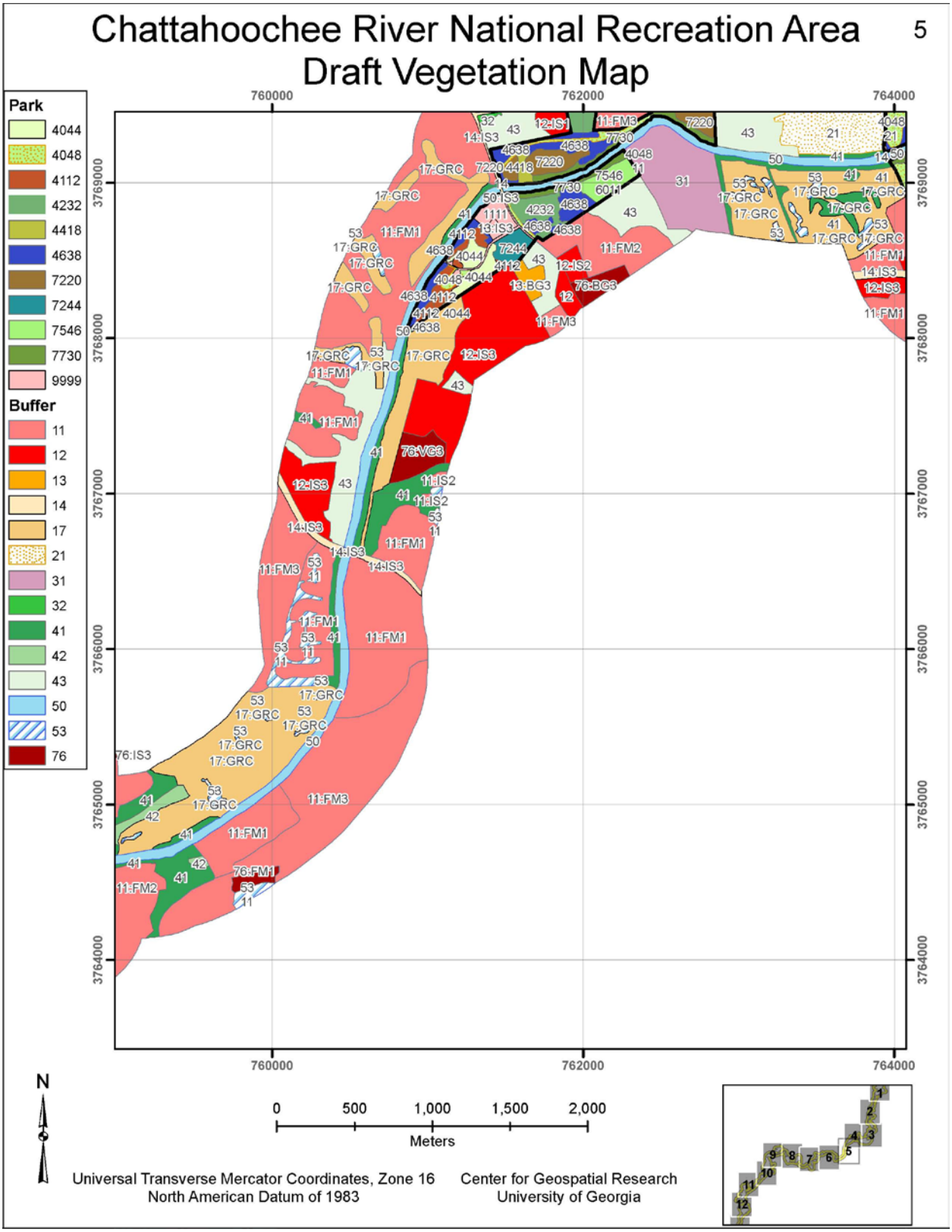
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Chattahoochee River National Recreation Area
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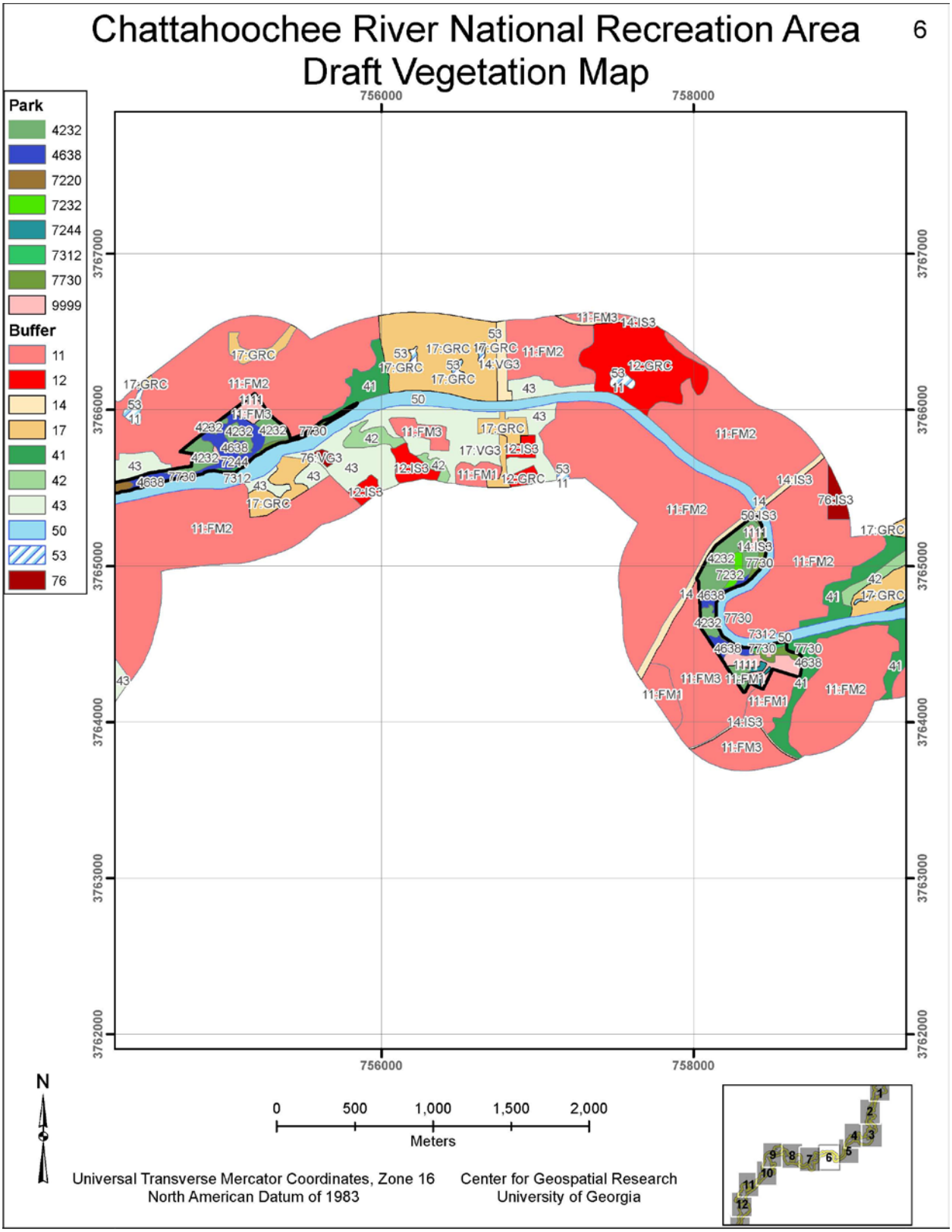
Section 4


Chattahoochee River National Recreation Area
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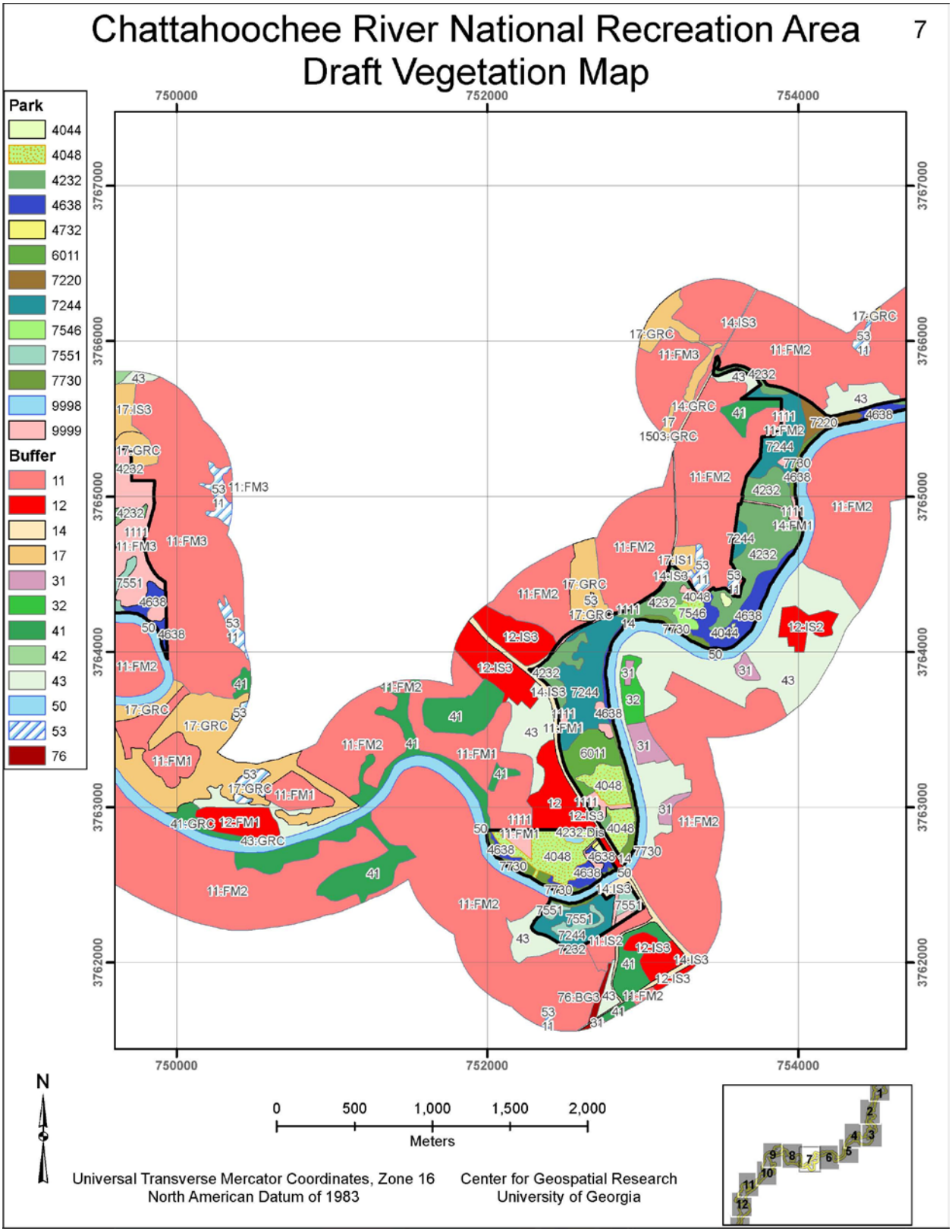
Section 5


Chattahoochee River National Recreation Area
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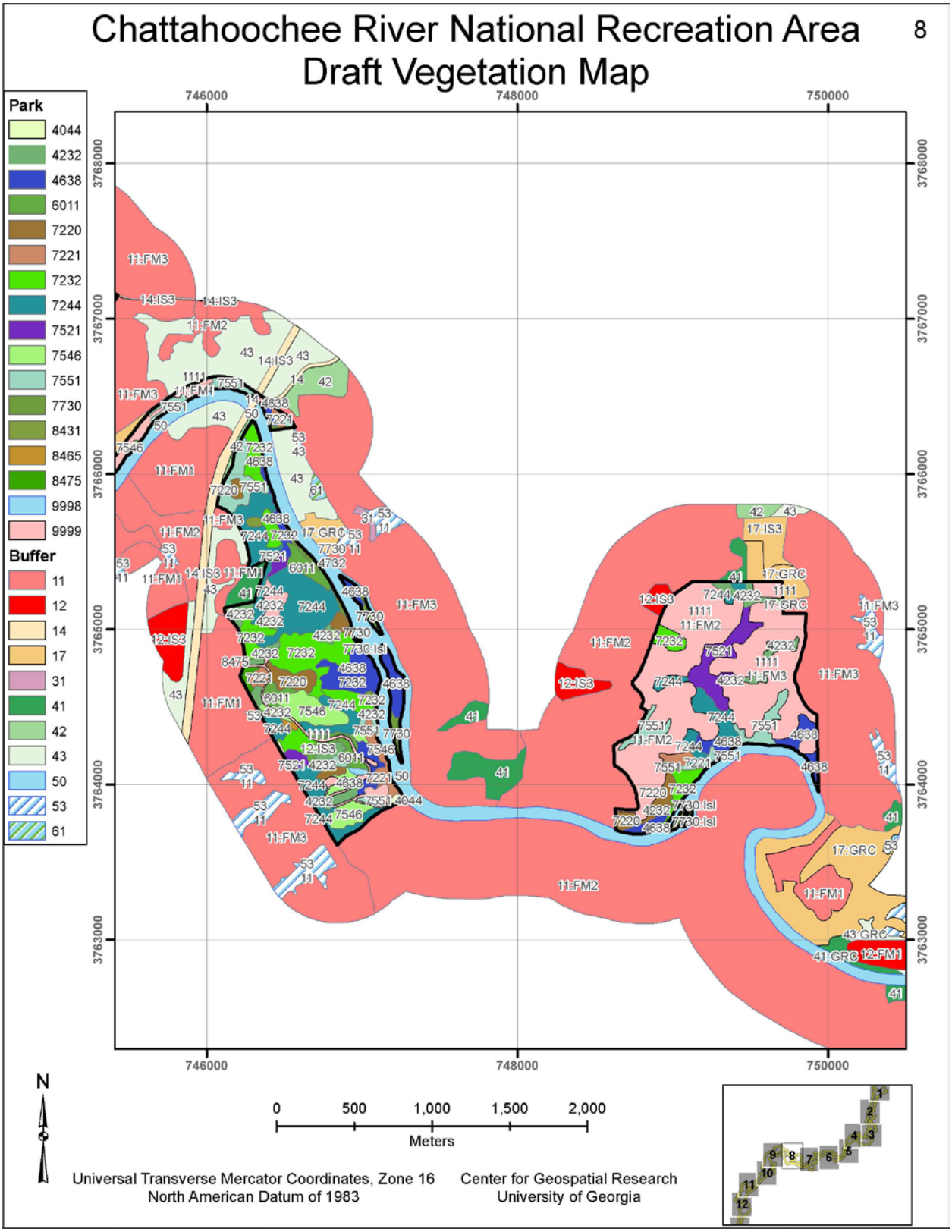
Section 6


Chattahoochee River National Recreation Area
Draft Vegetation Map
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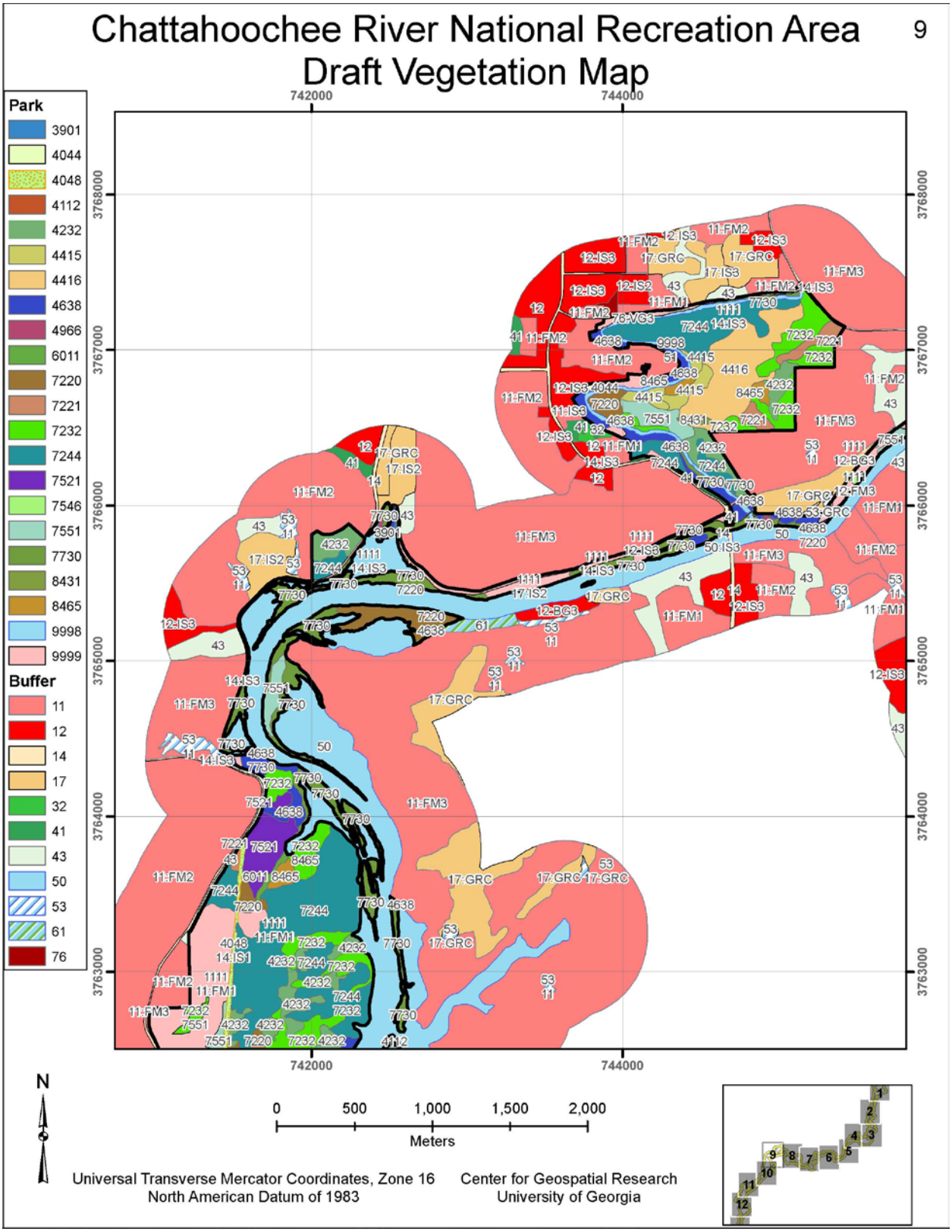
Section 7


Chattahoochee River National Recreation Area
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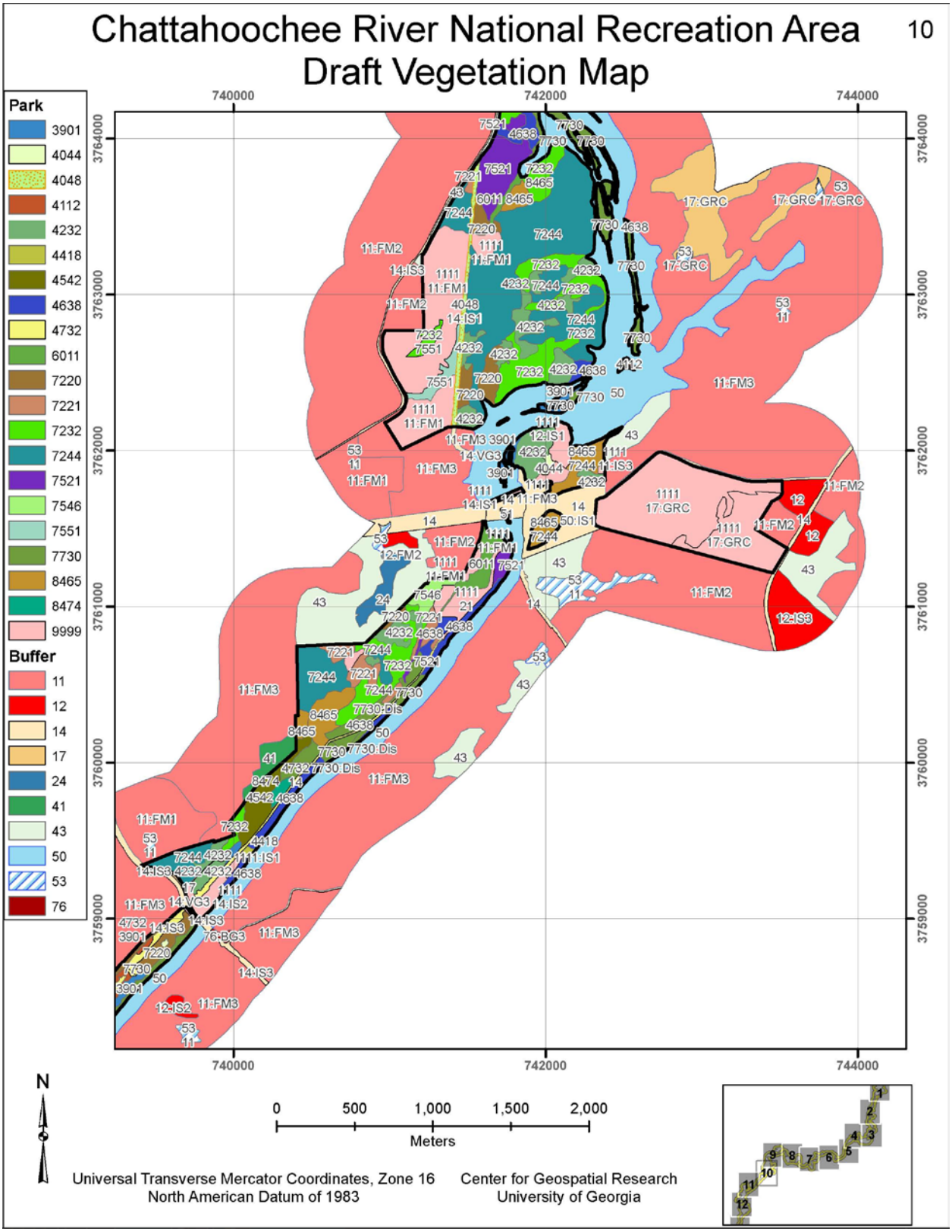
Section 8


Chattahoochee River National Recreation Area
Draft Vegetation Map
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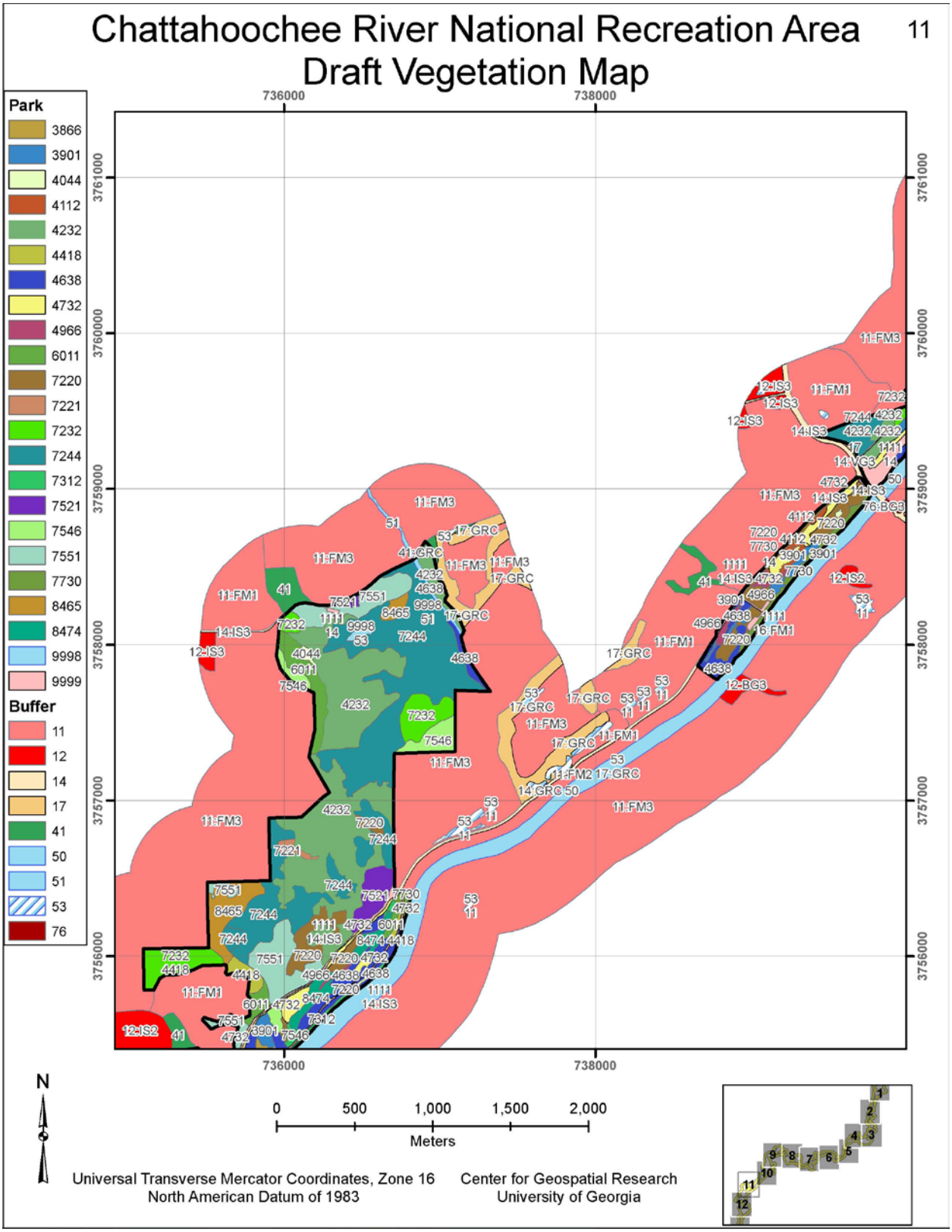
Section 9


Chattahoochee River National Recreation Area
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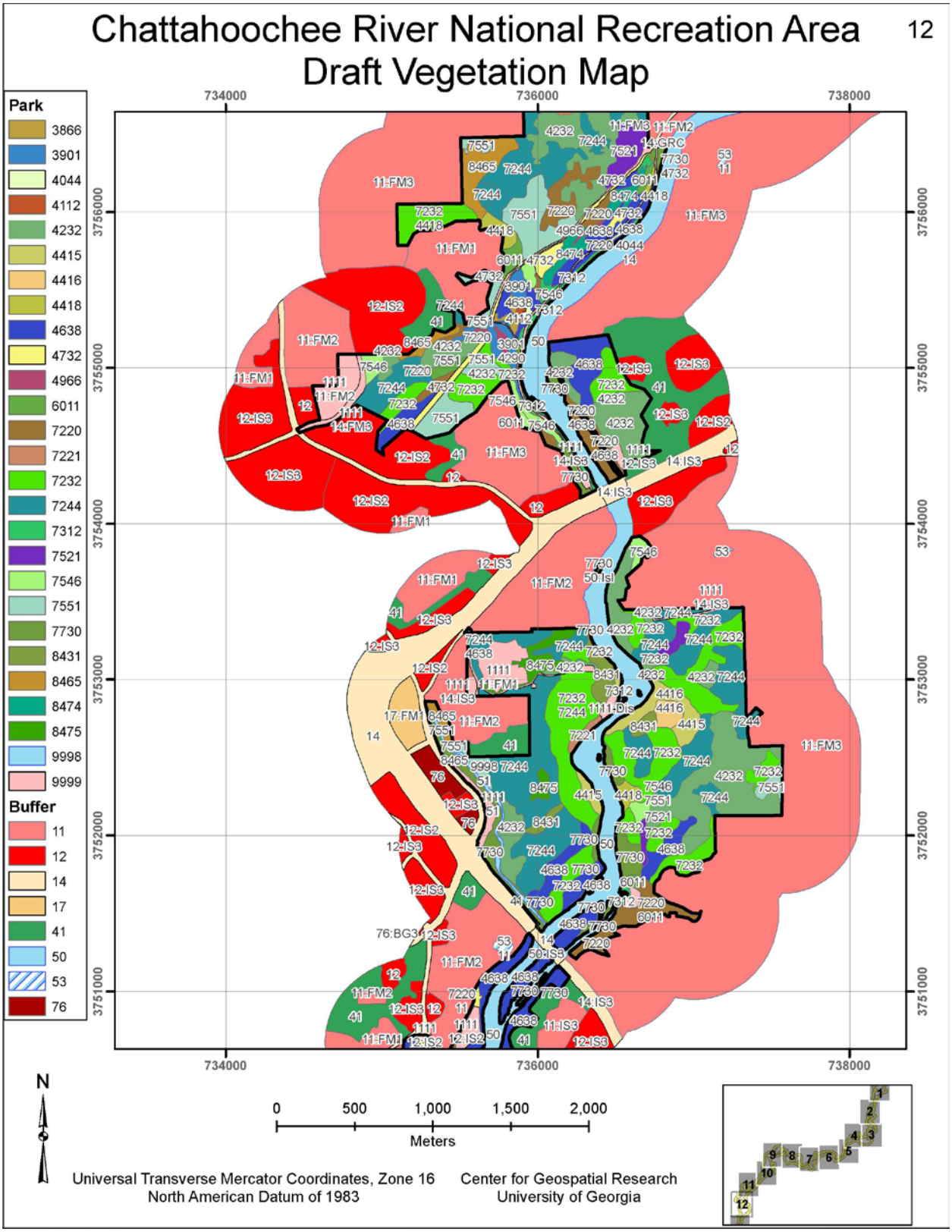
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Chattahoochee River National Recreation Area
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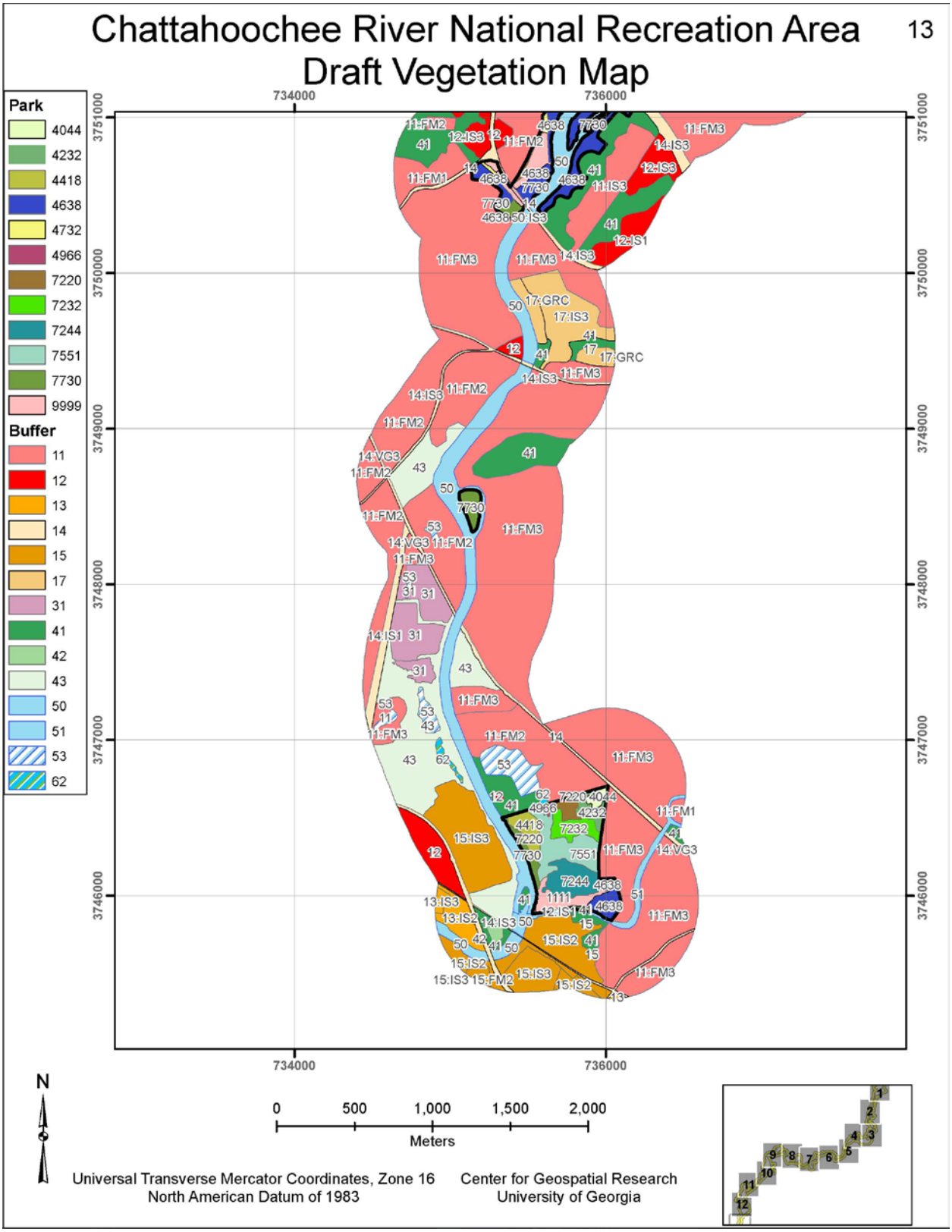
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Chattahoochee River National Recreation Area
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Meters
Universal Transverse Mercator Coordinates, Zone 16
North American Datum of 1983
Center for Geospatial Research
University of Georgia

Section 12


Chattahoochee River National Recreation Area
Draft Vegetation Map
12
Park
3866
3901
4044
4112
4232
4415
4416
4418
4638
4732
4966
6011
7220
7221
7232
7244
7312
7521
7546
7551
7730
8431
8465
8474
8475
9998
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Buffer
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Meters
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The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 636/126788, October 2014

National Park Service
U.S. Department of the Interior

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