PHOTO INTERPRETATION REPORT

USGS-NPS VEGETATION AND INVENTORY AND MAPPING PROGRAM

CONGAREE NATIONAL PARK

OCTOBER 12, 1998

Aerial Information Systems
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Table of Contents

Section **Page**

Section **Page**

Section **Page**

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I. INTRODUCTION

The National Park Service (NPS), in conjunction with the Biological Resources Division (BRD) of the U.S. Geological Survey (USGS), has implemented a program to "develop a uniform hierarchical vegetation methodology" at a national level. This effort will also create a geographic information system (GIS) database for the parks within the program. The purpose of the data is to document the state of vegetation within the NPS service area during the 1990's, thereby providing a baseline study for further analysis at the Regional or Service-wide level. Aerial Information Systems (AIS) was subcontracted by Environmental Systems Research Institute (ESRI), the prime contractor, to perform the photointerpretation for the program. ESRI subcontracted The Nature Conservancy (TNC) to conduct the field sampling effort and to support the development of the National Standard Classification.

Several parks representing different regions, environmental conditions, and vegetation types, were chosen by BRD to be part of the prototype phase of the program. The initial goal of the prototype phase is to "develop, test, refine, and finalize the standards and protocols" to be used during the production phase of the project. This includes the development of a standardized vegetation classification system for each park and the establishment of photointerpretation, field, and accuracy assessment procedures.

Congaree National Park, established in 1976, was designated as one of the prototypes within the National Park System. The park contains approximately 22,200 acres (34 square miles). Congaree National Park is located approximately 15 miles southeast of Columbia, the state capitol of South Carolina. The Congaree River, draining over 8,000 square miles of Piedmont land to the northwest, forms the southern border. Old Bluff Highway (old Highway 48) lies just north of the Monument boundary. The eastern boundary is located just northwest of the confluence of the Congaree and Wateree Rivers. The Monument extends west to where Cedar Creek and Myers Creek join (see Figure 1.1 – Map of Congaree National Park).

On June 30, 1983, Congaree National Park became an International Biosphere Reserve. Congaree is noted for containing one of the last significant stands of old growth bottomland hardwood forest, over 11,000 acres in all. The Monument contains over 90 species of trees, 16 of which hold state records for size (Congaree Official Map and Guide). Included in this list of records is a national record sweet gum with a basal circumference of nearly 20 feet.

In September 1989, Congaree lost several National Champion Trees to the effects of Hurricane Hugo. Damage was extensive; numerous canopy openings were formed, allowing areas of new growth to occur throughout the Monument. Some of these areas are noted within a mile from the Visitor Center.

II. CONGAREE NATIONAL PARK - GENERAL DESCRIPTION

Over three quarters of Congaree National Park is located on the Congaree River floodplain ranging in elevations from around 80 feet in the southeast to over 100 feet in the northwestern most portions. The Monument lies several miles southeast of the fall line, between the Atlantic Coastal Plain and the Piedmont. The extreme northern portions of the Monument lie primarily in uplands that are occasionally flooded when tropical storms or hurricanes pass through. Two major blackwater creeks enter the Monument from the north. These creeks have their origins within the Atlantic Coastal Plain, and therefore contain a minimal amount of sediment. Cedar Creek enters the Monument from the northwest near Old Bluff Highway. Tom's Creek flows into the northeastern portion of the Monument near the town of Kingville. A small intermittent creek (Dry Branch) flows into the swamp from the north and eventually into Weston Lake.

The northern extremities of Congaree National Park contain primarily uplands, with several small depressions that are temporarily flooded during the growing season. Just to the south, a fairly steep bluff, averaging 10 to 15 feet high runs most of the length of the Monument along its northern frontier, and is especially pronounced in the western portion. A trail runs along this bluff both east and west of the Monument Headquarters. Immediately adjacent to the bluff, a muck soil (high in organic content) supports a saturated community containing significant stands of *Nyssa biflora*. This community, lying on a Dorovan Muck organic soil, is produced by seepage from the nearby bluff. Four of these sites are over 10 acres in size. Most of Congaree National Park supports several bottomland hardwood communities that receive temporary flooding from the Congaree River on an average of ten times a year. The lower portions of the Congaree River floodplain, (often just ½ to 1 foot lower than the surrounding "ridges") contain semi-permanently flooded swamps, where extensive stands of *Nyssa aquatica* and/or *Taxodium distichum* are found.

Much of the eastern third of Congaree National Park has undergone recent timbering and agriculture activities in the past twenty years. Tree heights are significantly lower here than stands in the western portions of the swamp. The National Park Service has recently acquired the land east of the 1976 Monument boundary (as depicted on the USGS 7.5' quadrangle map – Wateree) and to the west of the Southern Railway tracks.

Flooding within the Congaree

There are several ways in which inundation occurs within the boundaries of the Congaree National Park. Seasonal flooding occurs on approximately 80% of the Monument each year. Soils are either nutrient rich or rich in organic material depending on the nature and source of the inundation. The following examples list several ways in which portions of the Monument are inundated each year:

1) Temporary and seasonal flooding from the Congaree River
2) Semi-permanent flooding in the numerous swales and oxbows which occur on the floodplain
3) Flooding by the release of water from above source dams
4) Saturation (through lateral or ground seepage) in areas near the bluff

5) Local flooding from the smaller creeks (Tom's and Cedar Creek)
6) Temporary flooding of upland depressions primarily from rainwater

Congaree National Park – Vegetation Mapping Zones

For purposes of vegetation mapping, Congaree National Park was divided into five sections pertaining primarily to its location and flooding regime. The five regions of the Monument are: (see Figure 1.2)

1) Upland Zone
2) Transitional Zone
3) Floodplain Zone
4) Congaree River Bank and Natural Levee Zone
5) Disturbance Areas

The following paragraphs briefly describe the vegetation and ecology for each of the five zones:

The Upland Zone

This zone lies along the northern boundaries of the Monument, on the coastal plain, usually above 110 feet in elevation. Included in this area are small depressions that are temporarily flooded from rainwater during a portion of the year. Most of this zone is normally outside the floodplain, however flooding occasionally does occur in wet years within portions of the upland zone. Two upland and one wetland community occur within the boundaries of this zone. In addition, several land use types and extensive areas of plantation pine occur in areas recently acquired by the National Park Service. Just outside the Monument boundary, several Carolina Bay's can be found in swales just south of Highway 48.

The most extensive natural community in the upland zone is the *Liquidambar styraciflua – Quercus (nigra, phellos) – Pinus taeda / Vaccinium elliottii – Myrica cerifera* Forest. Much of the areas within this community appears to contain a significant component of *Pinus taeda* as an emergent overstory. Based on observations from field reconnaissance and verification, significant stands of this community also appeared to be quite disturbed. This upland forest type is quite often adjacent to intensive landuse, including agriculture and clear-cutting activities.

The upland zone contains some disturbed examples of a *Pinus palustris – Pinus taeda / Schizachyrium scoparium* Woodland. This woodland type occurs in two areas, one at the south end of Garrick Road, the other about one mile to the east off of Cedar Creek Road. The area to the east is currently under consideration for acquisition. As of 1999, the area south of Garrick Road is currently undergoing vegetation management to enhance through prescribed fire the seedling growth of *Pinus palustris*.

In addition to the two upland communities described above, a seasonally flooded community *(Quercus phellos / Carex (intumescens, joorii) – Chasmanthium sessiliflorum / Sphagnum lescurii Forest)* occurs on about a dozen small depressional features throughout this zone. All sites are below three acres in size and are usually oval to circular in shape but are not typical of Carolina Bays.

Transitional Zone

For mapping purposes, the transitional zone is defined as a somewhat narrow band lying between the Congaree River floodplain and the upland portions of the Monument. Several communities occur within this zone, one upland type and several saturated types along the edge of the floodplain receiving most of their water from groundwater or lateral seepage.

The upland community *(Fagus grandifolia – Quercus nigra* Forest) is best represented along the bluff that divides the floodplain edge from the upland communities of the Monument. This is a mesic community with most examples containing substantial amounts of *Quercus alba* in the overstory. Good examples of these bluff forests are noted within a short walking distance from the Monument Headquarters.

Dorovan muck soil, high in organic material, support forest along the Congaree River floodplain edges in several locations. A good example of this community (*Nyssa biflora - (Acer rubrum) / Ilex opaca / Leucothoe axillaris / Carex atlantica ssp. capillacea* Forest) occurs along the lower boardwalk trail just north of Weston Lake.

Another saturated community type, the *Liquidambar styraciflua - Quercus laurifolia / Magnolia virginiana / Carex folliculata* Forest was sampled just south of where Dry Branch crosses the Old Bluff Highway. Other examples of this community may follow slowly meandering streams as they enter the Monument from the north.

Examples of a seasonally flooded community containing *Taxodium distichum, Nyssa biflora,* and hardwood species in the overstory *(Taxodium distichum – Fraxinus pennsylvanica – Quercus laurifolia/Acer rubrum/saururus cernuus* Forest) occur along Cedar Creek where it enters the Monument south of Duffies Pond.

Floodplain Zone

By far the most extensive portions of the Congaree National Park lie within the floodplain of the Congaree River. As per National Wetland Inventory Maps, flooding ranges from temporary to semi-permanent, depending on subtle differences in elevation of usually less than two feet. A majority of the communities sampled in this zone contain river bottom hardwood species, including *Liquidambar styraciflua, Fraxinus caroliniana, Celtis laevigata* and *Quercus laurifolia.* Differences within these communities are defined primarily on the vegetation understory components and flooding regimes.

Within the floodplain zone, on oxbow lakes, sloughs and swales, a semi-permanently flooded community occurs, usually only a foot or two below the adjacent hardwoods. This community is defined as a *Taxodium distichum - Nyssa aquatica / Fraxinus caroliniana* Forest. Examples of this type are represented by sloughs containing either pure stands of *Taxodium distichum,* a mix of *Taxodium distichum* and *Nyssa aquatica,* or pure stands of *Nyssa aquatica*. One very large bald cypress swamp was noted about 1/2-mile southwest of Wise Lake. Trees in this swamp were over 100 feet high with cypress knees up to 4 feet high in places. Standing water occurs most of the year in these swamps, drying out primarily in late summer.

A community that occurs in slightly higher areas than slough types described in the above paragraph was sampled along Cedar Creek towards the southern portion of the floodplain. This community, the

Taxodium distichum – fraxinus pennsylvanica – quercus laurifolia / acer rubrum / saururas cernuus Forest differs primarily in that it contains a significant component of hardwoods in the overstory, primarily *Fraxinus pennsylvanica*. Because this community occurs on slightly higher ground, flooding occurs on a seasonal basis, extending well into the growing season, but usually drying out by early summer.

Congaree River Bank and Natural Levee Zone

This zone lies usually within a few hundred feet of the banks of the Congaree River, extending further inland where the river makes sharp bends over a small area. Most of the area is higher than the adjacent floodplain to the north, and flooding, although frequent, is on a temporary basis. Where levee development is minimal, the zone is extremely narrow, or non-existent, and floodplain communities extend to the river edge. The natural levee supports several communities. The most frequently occurring community on the natural levee is the *Celtis laevigata - Fraxinus pennsylvanica - Acer negundo - (Juglans nigra) / Asimina triloba / Carex grayi* Forest.

Several communities adjacent to the Congaree River and the natural levee occur in bands often too narrow to map. They are defined as: *Populus deltoides / Acer negundo / Boehmeria cylindrica* Forest, *Acer saccharinum / Leersia lenticularis - Commelina virginica* Forest and *Salix nigra - Fraxinus pennsylvanica* Forest. The most dynamic of these types is the *Salix nigra - Fraxinus pennsylvanica* Forest. Numerous riverbank sites are affected by flooding and undergo extensive change on a yearly basis. Therefore, in several incidences, the existing 1996 aerial photography cannot accurately represent the presence of this community today.

Disturbance Areas

Throughout the Monument, especially along its peripheries and recently acquired lands, extensive tracts of highly disturbed vegetation, where the canopy and subcanopies have been recently removed can be found. Several large private inholdings just north of the Congaree River also contain areas where highly disturbed vegetation occurs. These areas are often shrubby, or viney in nature. The community *(Vitis rotundifolia - Ampelopsis arborea - Campsis radicans* Vine-Shrubland) is described to accommodate much of these disturbed areas within the Monument.

Extensive areas along the northern border of the Monument contain stands of plantation pine. These areas are described as a Successional Pine - Mixed Hardwood Upland Forest. Variability within these stands is high, often with a significant component of hardwood species both in the canopy and understory layers of vegetation. Several of these more open pine stands are suitable for conversion to longleaf pine communities through fire management practices.

III. SUMMARY OF THE MAPPING EFFORT AT CONGAREE

The following section is a short outline, listed in chronological order, of the vegetation mapping effort at Congaree National Park. For a detailed description of the tasks listed below, refer to sections IV, V, and VI.

April 27, 1996
- Aerial photography for the Congaree National Park (CONG) flown

June 13-14, 1996
- Initial project planning meeting held in Columbia

June 26, 1996
- First cut aerial photo delineations for the Focused Transect Study delivered to the Savannah River Ecological Laboratory (SREL)
- Preliminary photointerpretation key delivered to SREL
- Received CONG GIS data sets from Department of Natural Resources
- Received initial list of alliances possibly occurring at CONG from TNC

July 1, 1996
- Received NAPP 1996 aerial photography for Congaree from NPS

July 15-19, 1996
- CONG field reconnaissance trip

July 24, 1996
- Received vegetation "zone" map stratified by general creek drainages from NPS

August 23, 1996
- Received first preliminary classification of alliances from TNC
- Received first set of plot locations from TNC
- Delivered preliminary signature key to TNC and SREL

September 4, 1996
- Aerial photo delineations covering the remainder of the Monument delivered to SREL
- Delineations of Hurricane Hugo damage off 1976 aerial photography
- Delineations of pine loss areas off 1976 aerial photography

September 18, 1996
- Received breakdown of plots by signature code from TNC

November 11, 1996
- Received second preliminary classification of alliances, based on data from 126 plots sampled at Congaree from TNC

April 21, 1997
- Received GPS coordinates for the plots from SREL

April 4, 1998
- Received preliminary classification of community types and plot data for Congaree from TNC

April 28, 1998
- Received digital orthophoto quarter quads (DOQQ's) for the Wateree and Gadsden USGS 7.5 minute quadrangles.

May 5, 1998
- Received updated classification of community and revised list of plot assignments from TNC

June – July 1998
- Refined initial delineations, labeled polygons with preliminary community code based on plot data and updated photointerpretation signature key
- Prepared for field verification trip, selected sites and routes for the 1 week effort

July 13-17, 1998
- Field verification trip

July-August 1998
- Refined PI delineations and community code assignments based on field verification
- Rectified (geo-reference) line work to DOQQ's
- Generated manuscript (digital quality) maps for scanning

September 8-10
- TNC (Sally Landaal) at AIS for vegetation map review

September 1998
- Received final classification and plot assignments from TNC
- Final refinement to PI delineations and community code assignments based on TNC/AIS review

October 1998
- Data conversion efforts
- Final documentation

IV. VEGETATION MAPPING AT CONGAREE

USGS-NPS Vegetation Mapping Program - Servicewide Development

One of the most important mandates of the Vegetation Mapping Program is the consistent capture and classification of vegetation types through photointerpretation and field sampling methodologies. Mapping criteria and procedures developed during the prototype parks are currently being tested and revised.

The first two parks mapped - Assateague Island National Seashore and Tuzigoot National Monument utilized a vegetation layer mapping approach. Layer mapping consists of photointerpretation of multiple canopies of vegetation that are visible on the aerial photography. Canopies are normally defined by the structure of the vegetation (trees, shrubs, or herbaceous growth). Where possible, individual plant species were interpreted for each layer of vegetation. These data layers were then aggregated up into the appropriate alliance or community. Subsequent parks, including the Nebraska prairie parks and Rock Creek Park involved mapping an initial photo signature type describing multiple vegetation canopies. These photo signature types were then translated into a community type or alliance. Height, density and pattern were additionally assigned to each polygon. Photointerpretation signature types were retained to further describe at a more detailed level the attributes visible on the aerial photography for each polygon.

Congaree National Park - Initial Meeting

A two-day meeting was held June 13 and 14, 1996 at the Days Inn in Columbia to bring together project team members from the National Park Service, ESRI, AIS, TNC, SREL and DNR. This meeting focused primarily on discussing the Vegetation Inventory and Mapping Program, existing park data, and specific interests and issues of the park.

During the meeting, imagery, basemaps, and other pertinent collateral materials were reviewed and evaluated. Included in this inventory were the following data:

- Gaddy/Smathers 1980 vegetation map
- Soils data & maps
- GIS data including SREL field study plots, USGS 7.5' topographic quadrangles (Wateree SC, Gadsden SC), National Wetlands Inventory maps, Hydrologic data, Monument boundary and trails, and the Gaddy/Smathers vegetation map
- 1989 SPOT imagery
- 1990 Landsat imagery (Leaf off)
- 1992 Thematic Mapper imagery (Leaf on)

Park specific issues were also discussed. These issues will be addressed later in the general mapping criteria.

Development of Photointerpretation Mapping Procedures

The normal process in vegetation mapping is to conduct an initial field reconnaissance, map the vegetation units through photointerpretation, and then conduct a field verification. The field reconnaissance visit serves two major functions.

First, the photointerpreter keys the signature on the aerial photos to the vegetation on the ground at each signature site. Second, the photointerpreter becomes familiar with the flora, vegetation communities and local ecology that occur in the study area. Park and/or TNC field biologists that are familiar with the local vegetation and ecology of the park are present to help the photointerpreter understand these elements and their relationship with the geography of the park.

Upon completion of the field reconnaissance, photo interpreters delineate vegetation units on mylar that overlay the 9x9 aerial photos. This effort is conducted in accordance with the TNC vegetation classification and criteria for defining each community or alliance. The initial mapping is then followed by a field verification session, whose purpose is to verify that the vegetation units were mapped correctly. Any PI related questions are also addressed during the visit.

The vegetation mapping at Congaree National Park in general followed the normal mapping procedure as described in the above paragraph with two major exceptions:

1) Preliminary delineations for most of the park, including a set of Focused Transect overlays that were labeled with an initial PI signature commenced prior to the field reconnaissance visit.

2) A TNC classification did not exist at the time the initial delineations began. TNC ecologist and AIS photo interpreters worked together to develop an interim signature key which addressed what was known at the time. At that time, no comprehensive study containing plot data was available to create an interim classification.

Development of Photointerpretation Mapping Criteria

From the onset of the Vegetation Inventory and Mapping Program, a standardized program-wide mapping criteria has been used. The mapping criteria contains a set of documented working decision rules used to facilitate the maintenance of accuracy and consistency of the photointerpretation. This criteria assists the user in understanding the characteristics, definition and context for each vegetation community.

The mapping criteria for Congaree National Park was composed of four parts:

- The standardized program-wide general mapping criteria
- A park specific mapping criteria
- A working photo signature key
- The TNC classification, key and descriptions

The following sections detail the mapping criteria used during the photointerpretation of Congaree.

General Mapping Criteria

The mapping criteria at Congaree are a modified version from previously mapped parks. The criteria differ primarily in that the height and density variables were not mapped at Congaree. Instead, two additional variables were addressed: pre-hurricane Hugo community types and areas of pine that have been logged since the time of the 1976 aerial photography. These two categories will be addressed in the Park Specific Mapping Criteria section of this report.

Since forest densities within the Monument are nearly always greater than 60%, it served little or no purpose in addressing this element as a separate attribute in the database. In addition it was also determined that height categories are extremely difficult to map in the Monument due to variability of the tree emergent layer, and lack of any significant reference points that help in determining canopy heights. Tree canopy heights could not be determined because the photointerpreters were unable to consistently identify the forest floor through the dense forest canopy.

Alliance / Community Associations

The assignment of alliance and community association to the vegetation is based on criteria formulated by the field effort and classification development. In the case of Congaree National Park, TNC provided AIS with a tentative community classification in April 1998. A final vegetation classification, key, and descriptions of each alliance and community, was provided in October 1998. In addition, TNC provided AIS with detailed plot data showing how the communities were developed in the Monument.

Park Specific Mapping Criteria

Pre-Hurricane Hugo Communities

In 1989, SREL under the direction of Rebecca Sharitz began a long term monitoring program to study the recovery of vegetation from natural disturbance. Several days after Hurricane Hugo, SREL biologists laid transects to assess damage to the canopy layer. During the winter of 1989-1990, ten one-hectare plots were created in order to capture the damage incurred within the major vegetation communities. SREL used the 1980 Gaddy/Smathers vegetation map, aerial photography and ground surveys to set the plots. Six of these plots are currently under study within the river bottom hardwood types, three are located in sloughs, and one in an area containing a significant stand of large pine.

A primary concern of the Monument is the creation of a comprehensive long-term management plan that will monitor the recovery of these damaged areas. AIS acquired an additional set of 1976 aerial photography from the Monument flown prior to Hurricane Hugo. A total of 150 9"x9" near color infra red (CIR) prints flown in late spring cover over 90% of the existing Monument boundary. For each mapped unit labeled as hurricane damage, an additional community assignment was interpreted off the 1976 photography. This data will be added as an additional field in the final vegetation database.

Pine-Loss Areas and Current Stands of Emergent Pine

Within the floodplain, significant stands of emergent loblolly pine, some nearly 150 feet tall, occur among the hardwood species. Although past disturbance is probably responsible for the existence of these old pines, biologists within the park have expressed an interest in quantifying these stands. Several very old trees were lost from the hurricane and logging efforts have reduced some of the pine in the northern portions of the Monument. A field will be added in the final vegetation database identifying polygons that have incurred pine loss since the time of the 1976 aerial photography.

The photointerpretation signature key also addresses stands of existing emergent pine for each polygon mapped in addition to the vegetation community.

Working Photo Signature Key

A photo signature key is an important tool for maintaining consistency in interpretation. It correlates the physical descriptions of the photo signature with the appropriate vegetation community. A key may also describe other useful information that would be helpful in the interpretation.

For Congaree National Park, a preliminary or working photo signature key was developed during the initial mapping phase. The key was used to label the mapped units within Focused Transect Study. The Focused Transect Study was an effort by SREL biologists to stratify and sample vegetation within the swamp. Since the initial delineations were interpreted prior to any field reconnaissance effort, only a rudimentary working key describing color and texture was developed. These overlays were used by SREL biologists in the initial selection process of the plot sites.

Field data collected during the reconnaissance effort were analyzed and compared with the aerial photos and a consistent correlation between the photo signatures and vegetation types were noted. Each photo signature was then assigned a generalized vegetation type. This signature key was later modified to accommodate the final classification and further knowledge gained on the field verification trip and TNC/AIS follow-up meeting.

The final signature key is in a table format, and contains the photo signature name, photo signature characteristics, geographic settings, specific park example locations and the associated vegetation community.

Vegetation Classification, Vegetation Key and Descriptions

In September 1998, AIS received a detailed description of the vegetation of Congaree National Park using the National Vegetation Classification System developed in conjunction with the Federal Geographic Data Committee and the Ecological Society of American Vegetation Subcommittee. The Nature Conservancy, in partnership with the network of Natural Heritage Programs, developed this classification of vegetation of the United States as the national vegetation classification standard.

The descriptions, keys and plot descriptions generated for Congaree along with the working photo signature key enable the photointerpreters to delineate, refine and label the vegetation units interpreted off the aerial photography.

Project Set-Up

One complete set of aerial photography was provided for the project. The specifications for the aerial photography are listed below:

- Color infrared photography (diapositives only)
- Flown April 27 1996 – (Slightly later than prime leaf flush conditions)
- Nominal scale – 1:12,000 (Nominal refers to the photo scale variability within each aerial photo and across flight lines. In this case from approximately 1:11,950 to 1:12,050)
- Approximate photo size – 9” x 9”
- Overlap between photos and across flight paths met the standards for photo interpretation using a mirror stereoscope. (Approximately 60% between photos and 10% - 20% between the flight lines)

An additional set of aerial photography was provided for the project to assist in labeling community types prior to Hurricane Hugo. The specifications for this set of aerial photography are listed below:

- Color infrared photography (prints only) – The Freeway Series
- Flown May 3, 1976 – (Slightly later than prime leaf flush conditions)
- Nominal Scale – 1:12,000
- Approximate photo size – 9” x 9”
- Overlap between photos and across flight paths met the standards for photo interpretation using a mirror stereo scope. (Approximately 60% between photos and 10% - 20% between the flight lines)
- Existing coverage approximately 90% of Congaree National Park

Upon receipt of the project materials, it was determined that the current version of the Monument boundary did not meet the accuracy requirements for this mapping effort. Therefore, delineation onto the aerial photographs extended approximately ¼" beyond the boundary to assure that all portions of the Monument were interpreted. It was decided that the USGS 7.5 minute quadrangle maps along with supplemental information from GIS data layers and park brochures would aid in interpretation of the existing boundaries.

A flight line index (see figure 1.3) showing the relationship of the aerial photos to the preliminary study boundary was created on an 8 ½” by 11” sheet of paper. This index was used for quick reference to photo locations and as a status tool showing work completed on various portions of the project.

Preliminary Photo Signature Delineations

A total of 42 photos were needed to provide full photo coverage of the study area. Because of adequate control and sufficient overlap between flight lines and photos, it was determined that interpretation would be done on every other photograph.

Each photo was prepared with a 9" x 9" frosted mylar overlay for the photo signature delineations. Photo overlay were then pin-registered to the photos; project labels were affixed to each overlay identifying the photo number, status of work (Initial PI, QC), and photo interpreters responsible for that task. Study area boundaries were drafted onto each photo overlay, defining the area within the photograph to be interpreted. The study area boundaries were edge matched to adjacent photos to ensure full coverage.

Using a mirror stereoscope, with a 3X0 lens, photo signature units were delineated onto the mylar overlays. These initial photo delineations were based on a number of signature characteristics including color, tone, texture, relative height and density. The signature units were then edge matched to the adjoining photo before it was to be interpreted.

Initial attribute codes (photointerpretation signatures) were assigned to the polygons within the Focused Transect Study prior to any field reconnaissance effort. After the initial field reconnaissance, the Focused Transect Study was refined and the remaining photos were assigned signature codes.

Approximately 50% of the entire area of the swamp was delineated prior to any field reconnaissance effort. This was done primarily to facilitate the Focused Transect Study effort and project deadlines. Because differences in the canopy layer among the plant communities at Congaree is often undetectable on the aerial photography, numerous changes to existing line work were performed after the reconnaissance effort. Based on these photo revisions, it was determined that a reconnaissance effort was needed before any substantial delineation began. Photointerpreters used the reconnaissance trip as a tool to train on the signatures that were pertinent either to the interests of the Park, or to differentiate the communities and alliances.

Field Reconnaissance Effort

A four day photointerpretation field reconnaissance effort was conducted in July 1996 (see section III) to tie the photo signatures delineated on the aerial photographs with units on the ground. Initial descriptions of the units were soon after formulated into a working interim signature key to be used in labeling the polygons. The field crew consisted of Rick Clark (CONG Chief of Resource Management), L.L. Gaddy (Regional Ecologist), Sally Landaal (TNC Ecologist), Rebecca Sharitz (SREL Ecologist) and John Menke (AIS photointerpreter).

Prior to the field reconnaissance, several in-house preparations were performed in order to facilitate a more organized trip. Each photo was prepared with a separate field overlay. Registration features (roads, buildings, etc) were drafted onto the overlays. Each photo was reviewed and field transect sites were chosen representing different signatures types, geographic variables (flooding regime, flooding sources), and other abiotic variables noted on the photography. These sites were drafted onto the field overlays with notations to each site as needed. Multiple sites were chosen to provide alternatives if one or more sites proved inaccessible.

The field crew conducted on-site investigations over the four-day period. During the field visit, the photointerpreter worked with the field biologists to identify the plant species, preliminary vegetation communities, and their photo signature throughout the park. Field site numbers were annotated directly onto the photo field overlay, thereby correlating the field site to a specific location and photo signature. A field notebook was used to record pertinent information (canopy dominance, understory species present, abiotic features, disturbance history) for each site visited. Several ground photos were taken at selected locations that were later tied back to the aerial photographs and the field sites. Sites not previously identified on the aerial photos were also visited. These sites included areas between initially selected sites, areas of noteworthy or unusual significance as determined by park personnel, and areas the photointerpreter deemed important in transit from site to site.

Photointerpretation of Vegetation

Photointerpretation is the process of identifying map units based on their photo signature. All land cover features have a photo signature. These signatures are defined by the color, texture, tone and pattern they represent on the aerial photography. By observing the context and extent of the photo signatures associated with specific vegetation types, the photointerpreter is able to identify and delineate the boundaries between plant communities or signature units. Additional collateral sources (existing vegetation maps, supplemental photography, soil data, etc.) can be of great utility to the photointerpreter. Understanding the relationship between the vegetation and the context in which it appears is useful in the interpretation process. Familiarity with regional differences also aids interpretation by establishing a context for a specific area.

Initial photointerpretation of vegetation normally takes place after an interim classification has been developed. After the draft linework is complete, a second field effort is undertaken in order to verify the accuracy of the preliminary linework and to verify initial photointerpretation signature calls. A rudimentary classification was not in place at the time the photointerpretation started. In order to meet deadlines pertaining to contract schedule and the Focused Transect study, draft line work was performed on a number of photo overlays prior to the initial field visit. Copies of the photo overlays with their first cut delineations and signature calls were sent to SREL biologists to aid in selecting field sample sites. Sampling and development of the classification continued after the initial linework was completed in the late summer and early fall of 1996.

A working classification was completed in April 1997, several months prior to the field verification. Each polygon was then labeled with a preliminary community code in addition to the existing signature code already coded in the polygon. Photos were again edge matched to assure consistency of linework and labels across photo boundaries.

Photointerpretation Field Verification

A five-day photointerpretation field verification was held in July 1998 (see Section III). This effort focused primarily on verifying and/or refining photo signature units and substantiating the associations attached to each polygon.

Preparation for the field verification involved three steps. 1) Locating the sample plots on the photo overlays, 2) Choosing representative areas for each community type to review in the field, and 3) Compiling photo interpretation question forms in order to plan a strategy for the two-day effort. Although AIS chose specific areas of focus, other portions of the Monument were checked for both line and label accuracy.

While in the field, notes were made directly onto the photointerpretation overlays using a red Pentel. This helped in establishing which polygons were actually visited during field verification and assisted in refinements of the codes and line-work back at the office.

For the most part, a satisfactory correlation between the photo interpretation calls and plots were established in the field. A few plots were of questionable location and could not reliably be tied to the PI signature polygons. Three vegetation communities had only one or two plots associated with them, and signature correlations could not be attained consistently in the field. These included the 1) *Acer saccharinum / Leersia lenticularis – Commelina virginica* Forest, 2) *Quercus michauxii / Carpinus caroliniana – Ilex opaca / Leucothoe racemosa* Forest, and 3) *Liquidambar styracifula – Quercus laurifolia / Magnolia virginia / Carex follicutata* Forest.

The most difficult effort in the floodplain area was to train on the subtle signature differences between the communities within the *Fraxinus pennsylvanica – Ulmus americana – Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance. Since species in the canopy and emergent layer common to the four communities within this alliance often overlapped, a reliable signature could not be acquired for most of these types. One community within this alliance, the *Celtis laevigata – Fraxinus pennsylvanica – Acer negundo –(Juglans nigra) / Asimina triloba / Carex grayi* Forest can be interpreted using signatures keyed from the presence of *Celtis laevigata* in the canopy in addition to its location along the Congaree River levees.

Other difficult signature types were resolved with a much greater degree of confidence based on further training and the local ecological constraints of the community. The distinctions between the southern edges of the Dorovan Muck community *Nyssa biflora – (Acer rubrum) / Ilex opaca / Leucothoe axillaris / Carex atlantica ssp. capillacea* Forest and the *Taxodium distichum – Nyssa aquatica / Fraxinus caroliniana* Forest type is quite vague. The existing interpretations between these two communities were reviewed by experienced field biologists and refinements made based on their comments.

One type *(Quercus lyrata – Quercus laurifolia – Taxodium distichum / Saururus cernuus* Forest) that probably occurs in small stands throughout the seasonally flooded portions of the floodplain could not be identified on the aerial photography. Although several sites were observed in the field, and both species of oak were present in the canopy, a reliable photo signature could not be consistently established. Several of these sites probably fell below the minimum mapping resolution of .5 hectare.

Several photointrepretation signatures that did not meet the criteria for TNC community distinctions were observed in the field and will be retained as a PI signature type on the final vegetation database. The following list includes the more significant examples substantiated in the field verification effort:

- Bald cypress dominant sloughs
- Water tupelo dominant sloughs
- Polygons containing an emergent pine layer
- Stands of even age sweet gum in the canopy overstory
- Hurricane Hugo damaged areas

It should be noted that these and other photo interpretation signature codes are an important supplement to the TNC association, and could prove valuable to park management decisions in the future. Therefore, all mapped units will contain a PI signature code to be maintained in a separate field in the database.

In-house Vegetation Map Review Meeting

A three-day meeting in early September 1998 was held at AIS attended by Sally Landaal (TNC) and John Menke (AIS). Several issues were resolved successfully, based on an intensive review of the vegetation map and plot data. The meeting proved extremely effective in bringing the photointerpretation and classification efforts to a common ground. As a result of the meeting, several TNC communities were dissolved into other types, enabling successful photointerpretation to a community level to be possible in most cases.
It was also determined based on plot data, that an additional community addressing the even age sweet gum stands could not be justified. These areas will be retained through a photo signature label in a separate variable in the final vegetation database. It will also be addressed as a separate variant within the *Celtis laevigata - liquidambar styraciflua - Quercus laurifolia / Carpinus caroliniana / Arundinaria gigantea / Carex lupulina* Forest.

Final Photointerpretation

After the TNC/AIS meeting in September 1998 AIS proceeded with the final revisions to the photointerpretation linework and community calls. Each polygon was reviewed in conjunction with the notes taken during the field reconnaissance effort and vegetation map review meeting. In addition to the community descriptions, TNC keys and plot descriptions aided the photointerpreter in defining boundaries between the more difficult communities within the floodplain.

Photo overlays were then edge matched to the adjacent photo to ensure a seamless coverage in the database. Delineations and codes were compared and discrepancies between photos were resolved and corrected on mylar overlays. Any uncertain interpretations were flagged on the mylar overlays for review during the quality control task.

Quality Control of the Photointerpretation

A separate quality control step was performed for each photo upon completion of the photointerpretation. A senior photointerpreter on staff reviewed each photo for linework accuracy and accuracy regarding the PI signature and community codes. The photo overlays were also checked for completeness, consistency, and adherence to the mapping criteria and guidelines. For those polygons flagged by the photointerpreter, the quality control reviewer either assigned the appropriate vegetation code and/or discussed the change with the interpreter.

V. DATA CONVERSION

Converting the vegetation delineations to a digital format involved several steps that fall within four main procedures:

- Geo-referencing (rectifying) photo overlay linework to the orthophotography.
- Creating manuscript (digital quality) overlays and related attribute files.
- Input of spatial data into digital format (scanning).
- Linking the spatial data with the fields from the attribute files.

Basemap Production

In order to begin the data conversion process, a hardcopy version of the base was needed. The designated base was the USGS digital orthophoto quarter quads (DOQQ's) series for the Wateree and Gadsden 7.5 minute quadrangles.

Creation of the DOQQ's required having the image plotted onto clear mylar at the mapping input scale, approximately 1:12,000. To facilitate the geo referencing of the polygons, it was determined that the average (nominal) scale of the aerial photography was also approximately 1:12,000. Seven plots were generated at the normal scale on mylar overlays to cover the entire Monument and its environs.

Manual Rectification

Manual rectification was conducted by attaching a new mylar overlay to each base. The photo signature delineations were transferred to the overlays through local registration of the photos containing the attached photo signature delineation overlay. A small area of the photo was registered to the base at a time. By matching photo image to orthophoto image, the delineations were transferred to the base overlay. Because the parallax of the photo differs from that of the orthophoto base, care was required in transfer. Inconsistent stretching or shortening of the images was common from the photo to the base. When one area was completed, the photo was shifted to register to another small area. The process continued until the manual rectification and transfer of polygons was complete. Four code attributes were placed on the overlays, 1) code containing alliance/community association codes, 2) land use code, 3) pre-hurricane community code, and 4) pine loss code. These codes were transferred from the corresponding photo overlays.

A quality control step was performed in order to assure accuracy of the rectification and delineation, and transfer of the codes. A senior interpreter reviewed the overlays for accuracy and completeness of transfer and made the appropriate changes where needed.

DOQQ Edge Problems

While rectifying the delineations to the DOQQ's, severe spatial discrepancies between the quarter quads were noted. In addition, it was determined that this "data shift" did not occur on a consistent basis across module boundaries. Portions of a DOQQ were off by as much as ½" when plotted at the 1:12,000 scale. USGS staff reviewed the problem, determined that the DOQQ's were sub standard and requested an alternative plan to meet project deadlines and accuracy assessment needs.

A solution was agreed upon by ESRI, AIS and USGS to select points off the USGS 7.5 minute topographic maps and use them for control. It was not determined, however, how the data would register with any new generation of DOQQ's produced in the future. It is important to note that because of this work-around, spatial accuracy requirements will be met only at a 1:24000 or smaller scale and will be tied to the USGS 7.5 minute quadrangle maps.

Manuscript Map Preparation

Seven manuscript maps, suitable for automation, were created to input the spatial component of the vegetation mapping units. The manuscripts were produced by pin-registering a clean sheet of mylar to the base. The vegetation delineations from the manually rectified overlays were transferred to the new overlays. The manuscript maps were carefully edited to ensure completeness and correctness. The editing included comparing the manuscripts with the original delineations on the aerial photos.

Quality Assurance of the Manuscript Maps

The final manuscript maps underwent a quality assurance review. The manuscript maps were compared to geo referenced (rectified) overlays to ensure that all line-work was transferred correctly. Particular attention was given to the quality of the line delineations with respect to gaps and other irregularities.

Sequence Number Assignment

Sequential identification number overlays were produced for the manuscript maps. A clean sheet of mylar was pin-registered to each manuscript, and each polygon was labeled with a unique sequence number. These sequence numbers were used to tie the spatial files to the keypunched attribute files.

Polygon Attribute Encoding

To expedite the encoding of the vegetation attributes for each polygon, a Quattro Pro spreadsheet file was created for each sheet. A separate field was created for the polygon sequence number, community association code, pre-hurricane community code, pine loss code, and land use code attributes. The manuscript maps, sequence number overlays and attribute overlays were pin-registered together on a light table. The coder, following the numbers on the sequence number overlays, entered the vegetation attributes for each polygon. During this task, the coder verified the accuracy of the sequence number labels. Any errors found on the sequence number overlay were corrected to ensure that each polygon had a unique identifier.

Spatial Data Input/Scanning

The manuscript maps were scanned and converted into ARC/INFO coverages at ESRI. Prior to any production scanning, test scans of small areas of the data map were conducted to determine the optimum raster to vector conversion settings. The critical settings that determine the output resolution and completeness are the TOLERANCE and THRESHOLD. The TOLERANCE, which governs the output resolution and is comparable to fuzzy tolerance, would be set to .01 inches (10 feet at 1:12,000

scale). The THRESHOLD is a reflectance measure. It is dependent on the physical characteristics of the data maps and their contents and is determined through testing. Once the THRESHOLD was derived, production scanning of manuscript maps began.

Assigning Polygon Identifiers

In an earlier step, the vegetation polygons were assigned a unique identifier. The numbers were sequenced 1 through "n" (4-digit item width) and were drawn on the sequence number overlays. The manuscript maps and the sequence number overlays were registered together on the digitizing board. The polygon identifiers were sequentially input as label points. To ensure that all labels points were entered, the processor marked off each label as it was digitized.

Creation of Topology

Topology is the mathematical procedure for explicitly defining spatial relationships. In the case of maps, topology defines connections between features, identifies adjacent polygons, and can define one feature such as an area, as a set of other feature types (i.e., lines). A topological database has several advantages: efficient data storage, faster processing, and the ability to perform analysis, such as modeling transportation networks or overlaying geographic features on one another.

Once the manuscript map's polygon boundaries and label points had been input into the computer, the ARC/INFO software CLEAN command was used to create the "coverage topology." The CLEAN fuzzy tolerance was set to .002 inches to preserve the required data resolution. When other coordinate edits were made to a coverage after the CLEAN command was run, topology was recreated utilizing the BUILD command.

Label Entry Error Processing

Label errors were identified by using the LABELERRORS command in ARC. Using ARCEDIT, any label errors identified were corrected by entering the missing label number and placing it within the correct polygon. Once all the errors were corrected, the coverages were joined with the attribute files.

Joining of Attribute and Spatial Data

The Quattro Pro code file was converted into an INFO file. Once converted it was related to the feature attribute table by the sequence number found in both files. An INFO item, named "SEQNO" was added to the feature attribute table. The sequence number for each polygon was calculated to equal its coverage I.D. number. The ARC/INFO command JOINITEM was used to join the code file to the feature attribute table. The spreadsheet file was joined with its corresponding coverage. Each variable interpreted from the aerial photography was assigned a unique item (field).

Code Verification and Edit Plot Quality Assurance

Code verification involved running each coverage attribute file through a series of ARC/INFO commands that checked for invalid codes. These commands produced listings that aided in identifying abnormal codes. The errors were checked against the vegetation delineation and attribute overlays. Corrections were made to the listings and input into the database.

ESRI produced a plot of the converted spatial data and sequence numbers (label I.D.s) for each manuscript. The plot was checked by AIS for cartographic quality of the arcs defining the polygon features and the accuracy of the label I.D. assignments. The plots was overlaid to the manuscript maps to verify that the scanned data was not distorted beyond .02 map inches. Other problems were noted on the plots, including line overshoots and undershoots, missing lines, premature convergence of polygon boundary lines that intersected arcs at acute angles, and incorrect sequence number assignments.

ESRI also produced code verification plots of the community association codes, pre-hurrican communities, pine loss codes, and land use code attributes. The plots were checked by AIS for coding errors that may have occurred during the polygon attribute encoding step. The plots were overlaid on the corresponding manual rectification code attribute overlay. Code changes were noted on the plot. The edited plots were delivered back to ESRI for correction of the attribute files. Processors conducted interactive ARCEDIT sessions to make the necessary corrections to the coverages. Revised coverages were mapjoined to create a single coverage.

Georeferencing and Digital Registration of Data

The georeferencing and digital registration of the data to existing orthophotography is not possible at this time because of the aforementioned problems with the DOQQ files. The data will be transformed into real world coordinates that will overlay the USGS 7.5 minute quadrangle maps of Wateree and Gadsden.

- Conversion to "Real-World" Coordinates

  This task involved the transformation of the database from "digitizer inches" into "real world" coordinates. The initial vector file contained coordinates stored as digitizer inches. This format does not allow the data to be used in conjunction with other spatial overlays. To utilize geographic data, it must be converted into a common coordinate system. The coordinate system used is a UTM grid based, Datum NAD83

  The first step was the creation of a master tic file, linking features on the orthophoto to the same features in the polygon coverages. Wherever possible, easily identified points were chosen to ensure a more accurate transformation. Four to six points were chosen per coverage and labeled with a tic number I.D. The points were then transformed into real world coordinates, x and y values only (the orthophotos did not have a z value).

Final Quality Assurance of the Vegetation Map

Once the mapping of the alliance/community association classes was completed and the attribute items populated, a final community association plot was created. The plot was compared back to the original natural color photos and photo overlays and reviewed for accuracy and consistency of community association class assignments. Corrections to the community association assignments were then made to the database. The final coverage of the vegetation database was delivered to ESRI for input into the final project database structure

VI. DATA DICTIONARY – CONGAREE NATIONAL PARK

Data Format Outline:

Variable Coverage Related Variables:				Definitions
Area	8	18	F	Arc/Info Defined Variable
Perimeter	8	18	F	Arc/Info Defined Variable
Veg#	4	5	B	Arc/Info Defined Variable
Veg-id	4	5	B	Arc/Info Defined Variable
Defined Variables:				
Seqno	3	3	I	AIS Sequence Number
Mod#	4	4	C	AIS Module Number
PI	2	2	C	Photo Interpretation Signature Code
TNC	5	5	I	TNC Association or Alliance
Stand_Dis	1	1	I	Disturbance Indicator
Hursig	2	2	C	Pre Hurricane Signature Types
Hurtnc	5	5	I	Pre Hurricane TNC Associations
Pine	1	1	I	Pine Loss Areas
Landuse	3	3	I	Land Use Categories

Data Dictionary:

Defines AIS Internal Sequence Number (SEQNO)

Defines the Modules Corresponding to DOQQ File Name. (MOD#)

0101 - Gadsden NW
0102 - Gadsden NE
0103 - Wateree NW
0105 - Gadsden SW
0106 - Gadsden SE
0107 - Wateree SW
0108 - Wateree SE

Defines Mapping Classification Communities and Variants (TNC)

7211 *Fagus grandifolia - Quercus nigra* Forest

7726 *Liquidambar styraciflua - Quercus (nigra, phellos) - Pinus taeda / Vaccinium elliottii - Myrica cerifera* Forest

7727 *Acer saccharinum / Leersia lenticularis - Commelina virginica* Forest

4740 *Celtis laevigata - Fraxinus pennsylvanica - Acer negundo - (Juglans nigra) / Asimina triloba / Carex grayi* Forest

24271 *Celtis laevigata - liquidambar styraciflua - Quercus laurifolia / Carpinus caroliniana / Arundinaria gigantea / Carex lupulina* Forest

24272 *Celtis laevigata - liquidambar styraciflua - Quercus laurifolia / Carpinus caroliniana / Arundinaria gigantea / Carex lupulina* Forest - Sweet Gum component

7730 *Platanus occidentalis - Celtis laevigata - Fraxinus pennsylvanica / Lindera benzoin - Ilex decidua / Carex retroflexa* Forest

7731 *Populus deltoides / Acer negundo / Boehmeria cylindrica* Forest

7732 *Liquidambar styraciflua - Quercus nigra - Quercus laurifolia / Arundinaria gigantea / Carex abscondita* Forest

7734 *Salix nigra - Fraxinus pennsylvanica* Forest

7728 *Fraxinus pennsylvanica / Leersia lenticularis - Carex lupulina* Forest

7394 *Planera aquatica* Forest

4735 *Quercus lyrata - Quercus laurifolia - Taxodium distichum / Saururus cernuus* Forest

7403 *Quercus phellos / Carex (intumescens, joorii) - Chasmanthium sessiliflorum / Sphagnum lescurii* Forest

7719 *Taxodium distichum - Fraxinus pennsylvanica - Quercus laurifolia / Acer rubrum / Saururus cernuus* Forest

7431 *Taxodium distichum - Nyssa aquatica / Fraxinus caroliniana Forest*

7432 *Taxodium distichum - Nyssa aquatica / Nyssa biflora / Fraxinus caroliniana / Itea virginica* Forest

4631 *Liquidambar styraciflua - Quercus laurifolia / Magnolia virginiana / Carex folliculata* Forest

4427 *Nyssa biflora - (Acer rubrum) / Ilex opaca / Leucothoe axillaris / Carex atlantica ssp. capillacea* Forest

7737 *Quercus michauxii / Carpinus caroliniana - Ilex opaca / Leucothoe racemosa* Forest

7738 *Pinus palustris - Pinus taeda / Schizachyrium scoparium* Woodland

4620 *Vitis rotundifolia - Ampelopsis arborea - Campsis radicans* Vine-Shrubland

8000 Plantation Pine

8100 Successional Pine - Mixed Hardwood Upland Forest

7000 Water

9000 Landuse

PI Signature Types & Associated Vegetation Communities

Note: Overlap between vegetation associations and signature types occurs.

A. Mixed bottomland hardwoods (24271, 4740, 7732)
B. Category lumped with type A
C. Water tupelo dominant (at least 75%) (7431)
D. Bald cypress dominant (at least 75%) (7431)
E. Mixed bottomland hardwoods with emergent pine (7732)
F. Swamp tupelo (4427)
G. Swamp tupelo / mixed hardwoods - riparian associated (4427)
H. Young plantation pine - even stands (pole or saplings) (8000, 8100)
I. Mature plantation pine - often with a minor hardwood component (8100)
J. Upland hardwoods and hardwoods in small depressions (7403)
K. Mixed stands of upland hardwood and pine (7726, 7732 8100)
L. Hurricane damaged areas (open canopy, vines, shrubs, downed trees) (4620, other types with at least 10% trees standing)
M. Stands of even aged sweet gum (24272)
N. Category lumped with type A
O. Land use (9000)
P. Clear and selectively cut areas (8000, 9000)
Q. Category lumped with type A
R. Category lumped with type A
S. Category eliminate (use * instead)
T. Category lumped with type C
U. Riverbank & levee forests associated with the Congaree (4740, 7730)
V. Category lumped with type A
W. Category lumped with type C
X. Willow - Sand bars & young trees at the edge of the Congaree (7734)
Y. Predominantly cottonwood near the edge of the Congaree (7731)

Common Mixes:
A/C Hardwoods mixing with water tupelo (7431, 7432)
C/D Tupelo & bald cypress mix (7431)
D/A Hardwoods & bald cypress (7719)
F/A Hardwoods & swamp tupelo (4427 7432)

*Indicates stands are significantly lower in height, crown size smaller and overall crown signature (texture) more uniform.

Defines Disturbance (STAND_DIS)

0 = No disturbance noted
1 = Disturbance in the canopy

Defines Pre-Hurricane Hugo Signature Types (HURSIG)

Same as PI signature code

Defines Pre-Hurricane Hugo Community Types (HURTNC)

Same as TNC code

Defines Land Use (LANDUSE)

100 = Urban
- 110 = Residential
- 120 = Commercial and Services
  - 121 = Park Headquarters
  - 122 = Miscellaneous Park Structure
- 130 = Industrial
- 140 = Transportation and Utilities
  - 141 = Road
  - 142 = Parking
  - 143 = Utility Line
- 150 = Mixed Urban or Built Up
- 160 = Other Urban or Built Up

200 = Agriculture
- 210 = Active Field
- 220 = Abandoned Field

300 = Natural Vegetation
400 = Water

Defines Pine Loss Areas (PINE)

0 = No Pine Loss
1 = Pine Loss

File Specifications

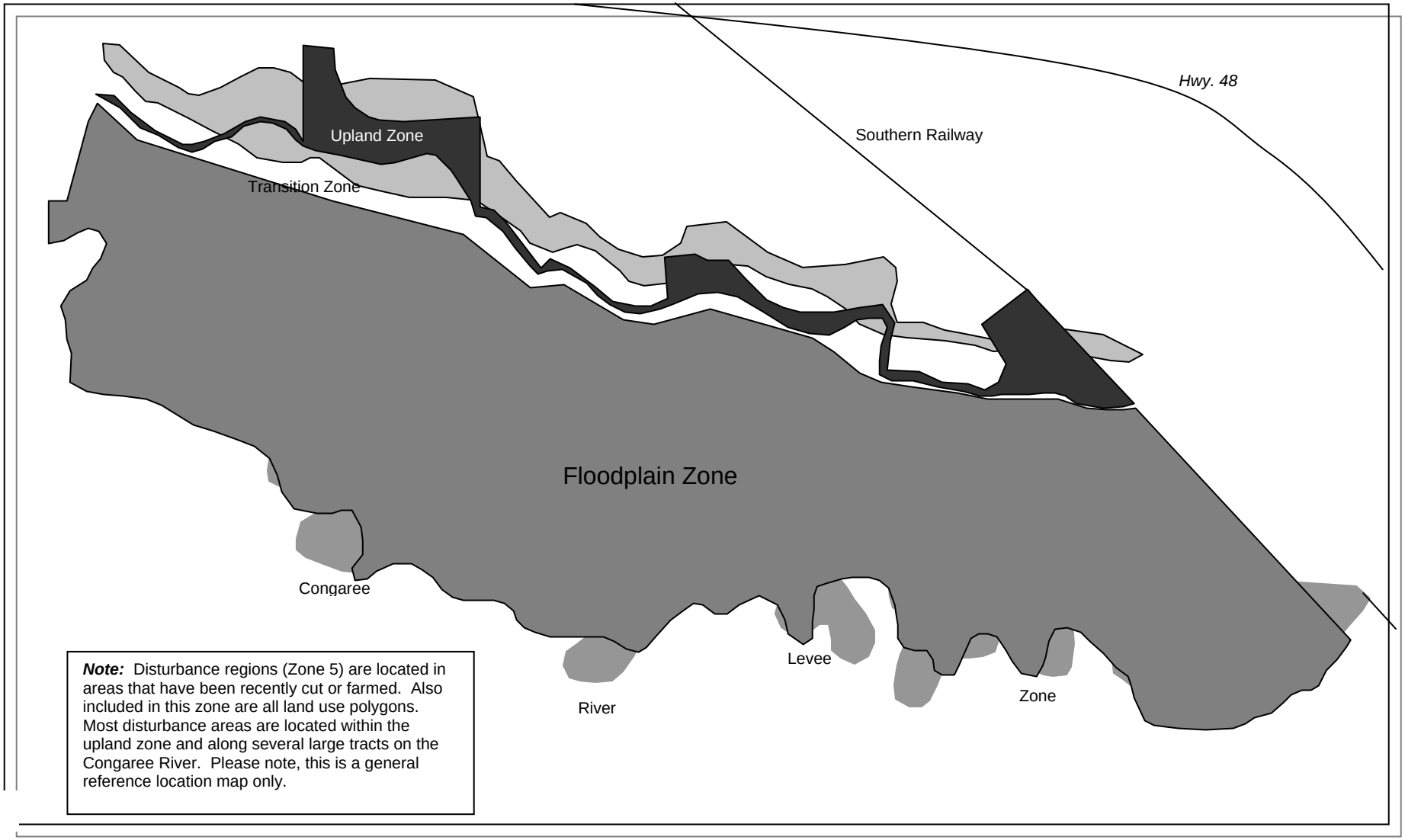
Coordinate system: NAD83 UTM projection – Meters

Congaree National Park
Photo Interpretation Report
Appendices

CONGAREE NATIONAL PARK
Park Boundary Map

Appendix A - Figure 1.1

CONGAREE NATIONAL PARK
Vegetation Mapping Zones



Note: Disturbance regions (Zone 5) are located in areas that have been recently cut or farmed. Also included in this zone are all land use polygons. Most disturbance areas are located within the upland zone and along several large tracts on the Congaree River. Please note, this is a general reference location map only.

Appendix B - Figure 1.2

CONGAREE NATIONAL PARK
Photo Index Map

Appendix C - Figure 1.3