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Identifying Values and Benefits of Congaree National Park

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IDENTIFYING VALUES AND BENEFITS OF CONGAREE NATIONAL PARK

by

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DEDICATION

I dedicate this work to Congaree National Park and the people who care of it.

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ABSTRACT

Protected areas are important tools for the conservation of biological diversity. They also support a wide range of ecosystem services and provide economic, cultural and social values and benefits. Many values and benefits of protected areas are poorly understood and greatly under-valued by decision-makers, the business sector, and the general public. Accordingly, identification and assessment of values and benefits of protected areas has been increasingly promoted during recent years.

This research investigates values and benefits of Congaree National Park and provides guidance for the further economic valuation of identified values and benefits. While the ecological significance of Congaree National Park has been well documented, it is also important to identify and study a broader range of social, cultural and economic values and benefits provided by the park in addition to those associated with biodiversity conservation. The research is conceptually based on The Protected Areas Benefit Assessment Tool, a methodology developed by World Wide Fund for Nature for the identification of values and benefits that protected areas bring to a range of stakeholders, from local to global. Key values and benefits of Congaree National Park were identified based on the input of experts who contributed to the research and through an extensive review of corresponding literature and research-based documentary materials.

The research identified the following key values and benefits of Congaree National Park: biodiversity conservation value; recreational value; science, knowledge and educational value; cultural, spiritual and historical value; climate regulation; water quality protection; flood storage and control; erosion control / soil stabilization; coastal protection; and management value. From these identified values and benefits, seven are recommended for further economic valuation. This research provides the guidance for economic valuation through defining categories / types of identified values and proposing possible applicable valuation methods with consideration of their advantages and limitations in the context of Congaree National Park.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

CBD ……..Convention on Biological Diversity

CI ……Conservation International

CSNPA……..Congaree Swamp National Preserve Association

DEFRA……..Department for Environment, Food and Rural Affairs

IBRD……..International Bank for Reconstruction and Development

IUCN……..International Union for Conservation of Nature

MEA……Millennium Ecosystem Assessment

NP……..National Park

NPS……..National Park Service

RMP……Resource Management Plan

SC DHEC……..South Carolina Department of Health and Environmental Control

TEV……Total Economic Value

TNC……The Nature Conservancy

USGS……..U.S. Geological Survey

VSP……..The Visitor Services Project

WB……The World Bank

WWF……..World Wide Fund for Nature

CHAPTER 1

INTRODUCTION

1.1 STUDY RATIONALE

Under the Convention on Biological Diversity (CBD), protected areas are recognized as cornerstones for the conservation of biological diversity at genetic, species and ecosystem levels. Many protected areas also support a wide range of ecosystem services and provide economic, cultural and social benefits (CBD, 2008; IBRD & WB, 2010). For example, nearly 1.1 billion people – around one sixth of the world's population – depend on protected areas for a significant percentage of their livelihoods (UN Millennium Project, 2005). Through conservation of both material and non-material riches, protected areas play a key role in the economic and social welfare of people, as well as the ecological health of the planet. Many values and benefits of protected areas are poorly understood and greatly under-valued by decision-makers, the business sector, and the general public (Mulongoy & Gidda, 2008). A number of international environmental organizations, such as the World Wide Fund for Nature (WWF), The Nature Conservancy (TNC), Conservation International (CI), and the International Union for Conservation of Nature (IUCN) are actively working to increase understanding and communication of the values and benefits of protected areas (Stolton & Dudley, 2009).

Assessment of values and benefits of protected areas has been increasingly promoted during recent years. There is a huge effort to move from theory to practice in

many countries where site-specific and system-wide assessments of protected areas have been carried out. While the ecological significance of Congaree National Park (NP) has been well documented, it is also important to identify and study a broader range of social, cultural and economic values and benefits provided by the park in addition to those associated with biodiversity conservation.

1.2 RESEARCH OBJECTIVES

This research investigates values and benefits of Congaree NP and provides guidance for the further economic valuation of identified values and benefits. In particular, the research has the following two primary objectives:

1. To identify the ecological, economic, social and cultural values and benefits of Congaree NP.
2. To provide initial guidance for further economic valuation of identified values and benefits of Congaree NP.

By addressing these two specific objectives, this research attempts to provide a solid theoretical foundation that will contribute to further economic assessment of the values and benefits of Congaree NP.

CHAPTER 2

BACKGROUND

2.1 Recognition of Values and Benefits of Protected Areas

The importance of wider values and benefits are recognized in the definition of a protected area by IUCN: "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008: 8). Further, realizing that decisions are frequently influenced by economic considerations, identifying values and benefits provided by protected areas may be the most effective way to communicate the right message to various groups of stakeholders.

2.2 Terminology and Definitions

The terms "values and benefits", "ecosystem services", and "goods and services" are often used interchangeably in the field of valuation of nature and ecosystem services. Using different terminology, with the same content and even in similar conditions, creates misunderstandings and uncertainty. The Millennium Ecosystem Assessment Framework considers all kinds of "goods and services" together under one term – "ecosystem services", and this approach is widely accepted (MEA, 2003). Contextually this research is based on principally-accepted key definitions of basic

terms of “values and benefits” and “ecosystem services”, which are provided in this section below.

Ecosystem services are defined as “the benefits people obtain from ecosystems” (MEA, 2003: 3), or “services provided by the natural environment that benefit people” (DEFRA, 2007: 10). While there is no single, agreed upon method of categorizing all ecosystem services, the Millennium Ecosystem Assessment Framework (2003), which is widely recognized and applied in practice, identifies four broad categories of ecosystem services. It is recognized that some of these categories may overlap to some degree. These categories include (MEA, 2003):

- Provisioning Services are products directly obtained from ecosystems such as food (e.g. crops, fruit, fish), fiber and fuel (e.g. timber, wool), bio-chemicals, natural medicines and pharmaceuticals, genetic resources (genes and genetic information used for animal/plant breeding and biotechnology), ornamental resources (e.g. animal products, such as skins and shells, and flowers used as ornaments), and fresh water. The latter is a very good example that demonstrates linkages between two categories of ecosystem services, in this particular case, between provisioning and regulating services.
- Regulating Services are the benefits obtained from the regulation of ecosystem processes such as air-quality maintenance, climate regulation, water regulation and purification / quality control, erosion control, pollination, natural hazard protection (e.g. storms, floods, landslides), and bioremediation of waste.

- ❒ Cultural Services are nonmaterial benefits obtained by people from ecosystems, including spiritual and religious values, knowledge and educational values, inspiration and aesthetic values, cultural heritage values, and recreation and ecotourism.
- ❒ Supporting Services are benefits that are crucial for providing other ecosystem services, including primary production, soil formation, nutrient cycling, water cycling, production of atmospheric oxygen, and habitat provision.

The following definitions represent the main content and practical ideas of values and benefits (Stolton & Dudley, 2009):

- ❒ Value: "refers to the resources of the protected area that could be exploited to produce a benefit. Values are in this context therefore potential benefits." (p. 5).
- ❒ Benefit: "refers to a resource that is being used to provide direct gains (which could be in terms of money earned, or subsistence resources collected or less tangible gains such as spiritual peace or mental well-being) to stakeholders. The resources of the protected area become a benefit when they are successfully used to provide such gains." (p. 4)

Values of protected areas can be theoretical and are converted to benefits when they are used by an individual or a community. For instance, the value of trees in water filtration becomes a benefit to a community that derives its clean drinking water from that source (IBRD & WB, 2010). Values can be classified as use-values and non-use values (DEFRA, 2007), which are discussed in more detail in Chapter 6.

While presenting results, the term "value" is predominantly used and in this case, this term is reserved to refer to characteristics and features of Congaree NP that benefit humans in some way.

2.3 KEY VALUES AND BENEFITS OF PROTECTED AREAS

As mentioned above, protected areas are important tools for the conservation of biological diversity, but there are many other significant values and benefits that need to be recognized. These values and benefits are presented in this section.

2.3.1 WATER SUPPLY

Water is a renewable natural resource, but unsustainable use of water resources, rapid population growth and development, and increasing demands represent major sources of concern to safe supplies of water resources (IBRD & WB, 2010). Protected watersheds show clear and direct links between human welfare, ecological services and conservation (Mulongoy & Gidda, 2008). For example, it is known that natural vegetation in protected areas supports the maintenance of water quality and can increase the quantity of available water through groundwater renewal and maintenance of natural flows. Water from protected areas is important for both non-commercial (subsistence agriculture and potable water) and commercial (large-scale irrigation, bottling plants, hydro-electric power or municipal drinking water source) purposes (Pabon-Zamora et al., 2008). It should be highlighted that: (i) in many parts of the world, adequate supplies of potable water depend on protected, healthy and functioning natural ecosystems; (ii) agriculture is the largest user of fresh water globally for irrigation purposes because irrigated crops yield up to 400% more than naturally /

rain fed crops; and (iii) hydropower is the third largest source of energy worldwide and provides approximately 20% of global energy, which makes protecting sustainable water supplies for electricity generation crucial for countries dependent on hydropower (IBRD & WB, 2010). Some examples of the value that protected areas provide in terms of water resources for drinking, agriculture and hydropower include (Mulongoy & Gidda, 2008; IBRD & WB, 2010)[1]:

- Around 2.7 million people in Peru use water that originates from 16 protected areas with an estimated value of US$ 81 million. The rivers in these protected areas also contribute to 60% of Peru's hydroelectricity generation, with an estimated value of US$ 320 million.
- The fresh water needs of 19 million people of Venezuela's urban population come from 18 national parks. About 20% of the country's irrigated lands depend on protected areas for their irrigation water.
- About 80% of population in Quito, Ecuador receives water supply from two protected areas, Antisana (120,000 ha) and Cayambe-Coca Ecological Reserve (403,103 ha).
- In the Mekong region, over 40 major existing and proposed hydropower projects are linked to protected areas.
- The value of ecosystem services in terms of water regulation and supply alone is worth US$ 2.3 trillion globally. Very little of this potential value is spent on ensuring this ecosystem function.

[1] Indication of the sources at the end of the paragraph means that all these sources were used for the paragraph included key facts. This applies to other parts of the paper with the same style of indication.

- ❒ Around a third (33 out of 105) of the world's largest cities obtains a significant proportion of their drinking water directly from protected areas.

2.3.2 HUMAN HEALTH AND RECREATION

Health benefits from protected areas can be derived through direct and indirect ways. Protected areas are very important recreational places to promote physical and mental health. They can also act as important repositories for medicinal plants for traditional medicines and traditional knowledge: Protected areas with unique and rich biodiversity can, for example, ensure protection and effective management of local medicinal plants, which creates sustainable resources for local use and for pharmaceutical development (Pabon-Zamora et al., 2008; IBRD & WB, 2010). Additionally, there are many examples demonstrating links between human and wildlife health and ecosystem health. For example, there are cases when forest clearings have increased the spread of diseases such as malaria, leishmaniasis, avian flu and ebola. Some examples of the values and benefits provided by protected areas include (Mulongoy & Gidda, 2008):

- ❒ Recently protected areas yielded valuable commercial drug discoveries such as cyclosporine and Taq polymerase. Cyclosporine was first discovered from a soil-sample taken from Hardangervidda National Park in Norway in 1969 and became the 33rd top-selling drug worldwide in 2000, with total sales of US$ 1.2 billion.
- ❒ Taq polymerase, which was isolated from bacteria discovered in the natural hot springs of the Yellowstone National Park in 1966, has been used in a range of biotechnological applications, with annual sales exceeding US$ 200 million.

2.3.3 Natural Disaster Mitigation

Natural, healthy and well-managed ecosystems have a great potential to provide protection against some disasters. Forests can protect against floods, avalanches, heavy storms, desertification, droughts and landslides while wetlands can mitigate flooding, and coral reefs play an important role in protection against storm surges, tsunamis and flooding events (IBRD & WB, 2010). Accordingly, well-managed protected areas provide unique and cost-effective natural solutions that: (i) protect against the disasters; (ii) reduce vulnerability of communities to disasters; and (iii) provide the communities with livelihood resources to recover in a timely fashion from crises (Mulongoy & Gidda, 2008).

2.3.4 Climate Change: Resilience, Adaptation and Mitigation

Protected areas play crucial roles in climate change resilience, adaptation and mitigation. Through conservation of intact sites and habitats, protected areas increase the ecosystems' resilience to climate change since functional and dynamic ecosystems with high biodiversity and richness recover more easily from climatic disturbances. Effectively managed protected areas are the most significant tools for maintaining carbon stored in oceans, forests, soils and wetlands, in order to contribute to climate change mitigation. Protected areas also play an important role in adaptation to climate change as they are better able to help populations adapt to the impacts of climate change, such as flooding, desertification or landslides. Protected areas that contain healthy ecosystems are also in good position to provide adequate environmental goods and services needed for adaptation. A few examples of the demonstrated benefits of

protected areas with regard to climate change resilience, mitigation and adaptation include (IBRD &WB, 2010; Mulongoy & Gidda, 2008):

- In Peru, the total value of protected areas as a carbon sink has been estimated at US$ 127 million per year at a price of US$ 3.5 dollars per ton.
- Approximately 4.43 gigatonnes of carbon are sequestered in Canada's national parks. If society had to replace this stored carbon, it would cost between US$ 11 billion and US$ 2.2 trillion depending upon society's valuation of the carbon sequestration function.
- The value of Uganda's protected areas as a carbon sink is estimated at US$ 20.3 million annually.
- Protected areas globally are estimated to hold 312 gigatonnes of carbon or at least 15% of terrestrial carbon storage.

2.3.5 ECONOMIC BENEFITS

Protected areas have a great potential to provide direct and indirect economic benefits and to significantly contribute to poverty reduction efforts. They create employment opportunities for managers, rangers, wildlife biologists, scientists and guides and thereby provide direct economic benefit to local residents and economies. Tourism is one of the largest industries in the world, in part due to growth in ecotourism and an increasing number of visitors to protected areas. For example, market surveys revealed that 42% of European travelers surveyed in 2000 included a visit to natural parks as part of their vacation activities. The number is even higher in Costa Rica, where 72% of tourists visit a national park. In fact, income potentially generated by ecotourism

can be substantially higher than that from unsustainable use of natural resources. For example, the estimated total economic value of a healthy coral reef for tourism, coastal protection and sustainable fisheries in the Philippines has been estimated at US$3,300 per ha versus unsustainable fishing generating US$870 per ha. Examples of the demonstrated economic benefits of protected areas to ecotourism include (Pabon-Zamora et al., 2008; Mulongoy & Gidda, 2008; IBRD & WB, 2010):

- Park tourism provided 207 million Australian dollars in 2005 to the Southern Forest and Gascoyne Coast Region in Australia.
- Between 2003 and 2005, in New Zealand, tourism specifically targeted to four protected areas (West Coast, Abel Tasman National Park, Queen Charlotte Track, and Fiordland National Park) generated four thousand jobs, up to 15% of total jobs in the areas, 130 million New Zealand dollars in direct household income, and a total tourism revenue of 560 million New Zealand dollars.

Protected ecosystems also provide many raw materials for survival and livelihoods and are particularly important for poor communities. In some categories of protected areas, or in specific zones within them, the harvesting or collection of natural products, including non-timber forest products such as resin or rubber, fuel wood, coral, shells and grass, is legally permitted. Many communities around the world depend on such materials for their subsistence and livelihoods. Examples of the important roles that protected areas play in providing livelihood benefits include (Pabon-Zamora et al., 2008; Mulongoy & Gidda, 2008; IBRD & WB, 2010):

- In Cambodia fuel wood, fishing and other resources provided by mangrove-protected areas, constituted 20-58% of household incomes.
- In Zambia 50,000 residents of Lupande game management area raise annual revenue of US$ 230,000 / 80% of the total revenue from two hunting concessions.
- In India, 35,000 people depend on the Periyar Tiger reserve for natural products: 57% for fuel-wood collection, 28% for grass and 13% for non-wood forest products.

2.3.6 FOOD SECURITY

In a world experiencing food insecurity, protected areas have a crucial role in (i) maintaining wild food supplies, (ii) providing key ecosystem services for food security, such as pollination**,** and (iii) protecting agro-biodiversity**.** Globally, around 150 million people rely directly on wild species for food. Many protected areas maintain stocks of wild food and provide for both humans and livestock, particularly where such protected areas are zoned for appropriate use. Protected areas also provide services that are vital for food production and security, such as pollination. Globally, the annual value of pollination has been estimated at between US$120 billion and US$200 billion. Protected areas also conserve agro-biodiversity as they hold important plant genetic resources for food and agriculture, including endemic and threatened crop wild relatives. Many successful examples of plant agro-biodiversity conservation in protected areas already exist around the world. Wild relatives of globally important crops such as barley, maize, oats, potatoes, rice and wheat are becoming more productive. Studies highlight the

importance of conserving crop wild relatives as sources of novel traits for resistance to disease and drought, and tolerance to extreme temperatures and salinity. Examples of the food security benefits associated with protected areas include (CBD, 2008; Pabon-Zamora et al., 2008; Mulongoy & Gidda, 2008; IBRD & WB, 2010):

- In Armenia, Erebuni State Reserve is known for its diversity of wild wheat, including *Triticum urartu*, *T. boeoticum*, *T. araraticum* and *Aegilops* spp.;
- In Costa Rica, Corcovado National Park (47,563 ha) is a genetic reserve for avocado (*Persea americana*), nance (*Byrsonima crassifolia*) and sonzapote (*Licania platypus*);
- Organ Pipe Cactus National Monument (133,925 ha), located in Southwestern Arizona, protects small populations of wild chili peppers *(Capsicum annuumchili).*

2.3.7 CULTURAL, HISTORICAL AND SPIRITUAL VALUES

Many of the world's oldest protected areas have cultural, spiritual and historical values. They encompass important archaeological sites and historic buildings, and some protected areas include sacred natural sites or landscapes, such as sacred groves, waterfalls and mountains of great symbolic importance to particular faiths. Many Asian religions and the faiths of indigenous people are spiritually linked to certain natural sites, and people may use these places for worship and rites. Some examples of the cultural and spiritual values associated with protected areas include (Pabon-Zamora et al., 2008; Mulongoy & Gidda, 2008; IBRD & WB, 2010):

- ❒ Muntanya de Montserrat National Park in Spain includes 12 Hermitages and two Catholic monasteries, one of which is devoted to the Holy Virgin Mary and has been a pilgrimage centre since the 14th century.
- ❒ Lanin National Park in Argentina is famous for its monkeypuzzle tree (*Araucaria araucana*), which is sacred to the indigenous Mapuche Indians.
- ❒ Boabeng Fiema-Monkey Sanctuary in Ghana is considered as a sacred place because it protects populations of black and white Colobus monkey (*Colobus vellerosus*) and Mona monkey (*Cercopithecus mona*), which are idolized as sons of the gods of the people of Boabeng and Fiema villages.

2.3.8 KNOWLEDGE AND SCIENCE

Protected areas can be used for scientific research, education and monitoring purposes. There are categories of protected areas whose primary focus centers on scientific research, often with a goal of promoting more effective reserve management. Such areas provide opportunities for research on individual species, natural ecosystem functioning, and ecological processes while providing baseline environmental data for further monitoring, educational and research purposes (Pabon-Zamora et al., 2008; IBRD & WB, 2010). Additionally, protected areas can play key roles in supporting environmental education and raising public awareness through relevant place-based connections and educational tours.

CHAPTER 3

STUDY AREA

The focus of this thesis is Congaree National Park, which is located about 20 miles (32km) southeast of Columbia, SC (Figures 3.1 & 3.2). Congaree NP encompasses approximately 24,230 acres (9,806 ha) of land, including around 11,000 acres (4,452 ha) of old-growth forest and the largest intact stand of old growth bottomland hardwood forest in the southeastern United States. The park thus represents a unique environment with a well-preserved, biologically-diverse and dynamic river floodplain ecosystem. The park is also special in that it contains one of the highest forest canopies in the southeastern United States, with a number of national and state champion trees (Jones, 1997). Most park lands are densely forested and lie within the primary river floodplain. A wide variety of forest communities are represented, with dominant tree species ranging from upland pines to deepwater alluvial bald cypress and tupelo swamps (Kupfer et al., 2010). The forest environment is characterized by silty clay soils, oxbow lakes, swales and sloughs, and meandering creeks. The Congaree River and the Wateree River are the major sources of floodwaters, sediment, and nutrients delivered to the park, although several tributary creeks also flow into and across park boundaries (Congaree NP Resource Management Plan [CNP RMP], 2004).

Congaree NP is known and recognized both nationally and internationally for its ecological condition and high levels of floral and faunal biodiversity. It has received a number of special designations during recent decades. Congress recognized the 'Congaree Swamp' as a National Natural Landmark in 1974, and the area was included in the National Park System as Congaree Swamp National Monument in 1976. The monument was later designated as an International Network of Biosphere Reserve (1980), a Wilderness Area (1988), and a Globally Important Bird Area (1988). In 2003, it was recognized as the nation's 57th National Park (CNP RMP, 2004), and in 2012, it was designated as a Ramsar Wetland of International Importance.

Beyond the list of designations for the terrestrial and wetland areas encompassed by the park, the National Park Service listed the Congaree River in a Nationwide Rivers Inventory as possessing scenic, recreational, geologic, fish, wildlife, historic, and culturally outstanding values in 1982 (CNP RMP, 2004). In 2006, the waters within Congaree were reclassified as "Outstanding Resource Waters", and portions of Cedar Creek were reclassified as "Outstanding National Resource Waters" by the South Carolina General Assembly (Mallin & Mclver, 2010).

As stated in the enabling legislation, Congaree NP (under its previous name, Congaree Swamp National Monument) was established "… to preserve and protect for the education, inspiration, and enjoyment of present and future generations an outstanding example of a near-virgin, southern hardwood forest situated in the Congaree River flood plain in Richland County, South Carolina" (H.R. 11891--94th Congress, 1976; Public Law 94–545). According to the Park Management Plan (2004),

“Congaree National Park was established to assure the preservation, conservation, and protection of the natural, scenic, hydrologic, floral and faunal, and recreational values of the Congaree River floodplain and to provide for the enhancement and public enjoyment thereof”.

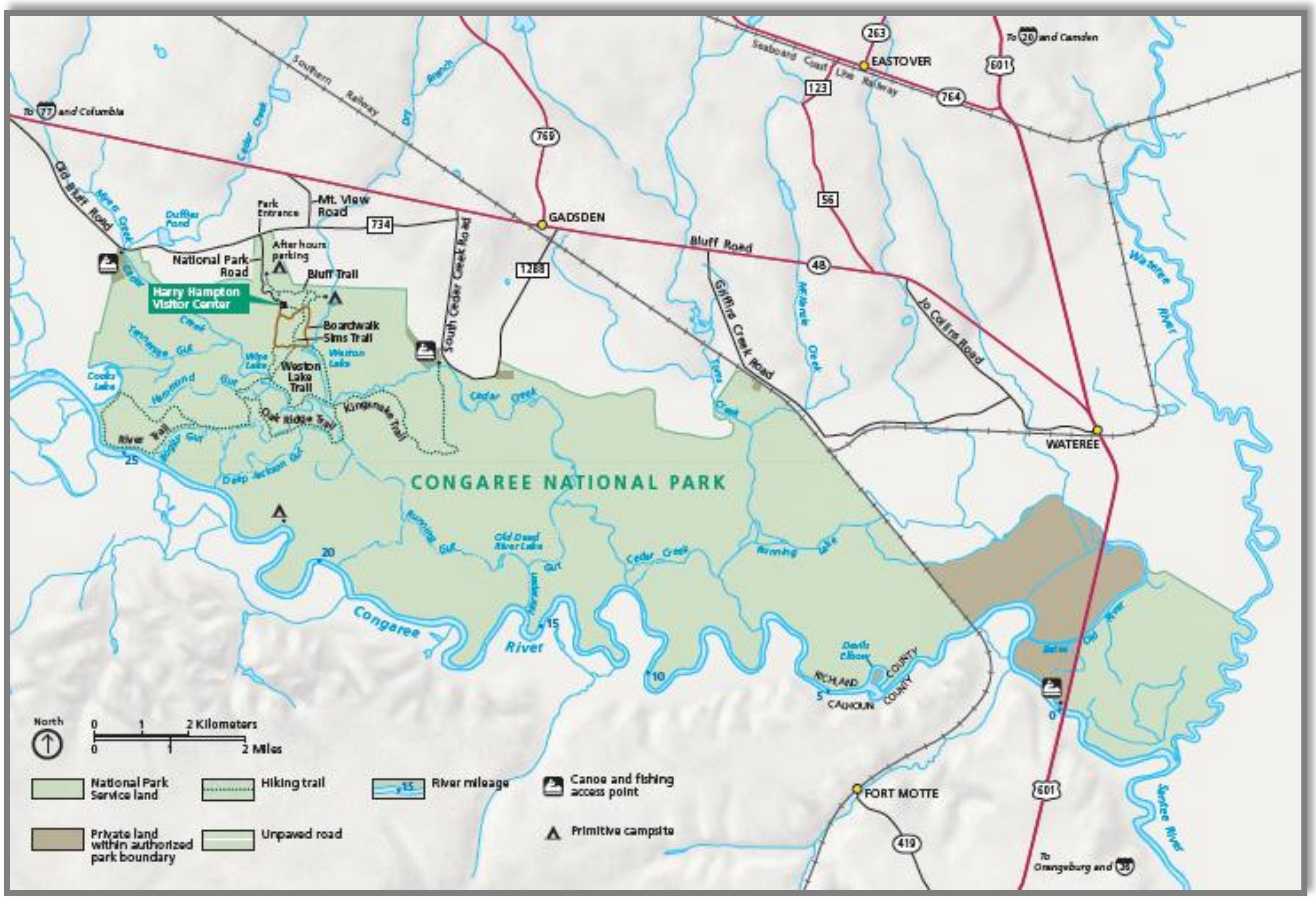

Figure 3.1: Congaree National Park ***(source: National Park Service; www.nps.gov/cong)***

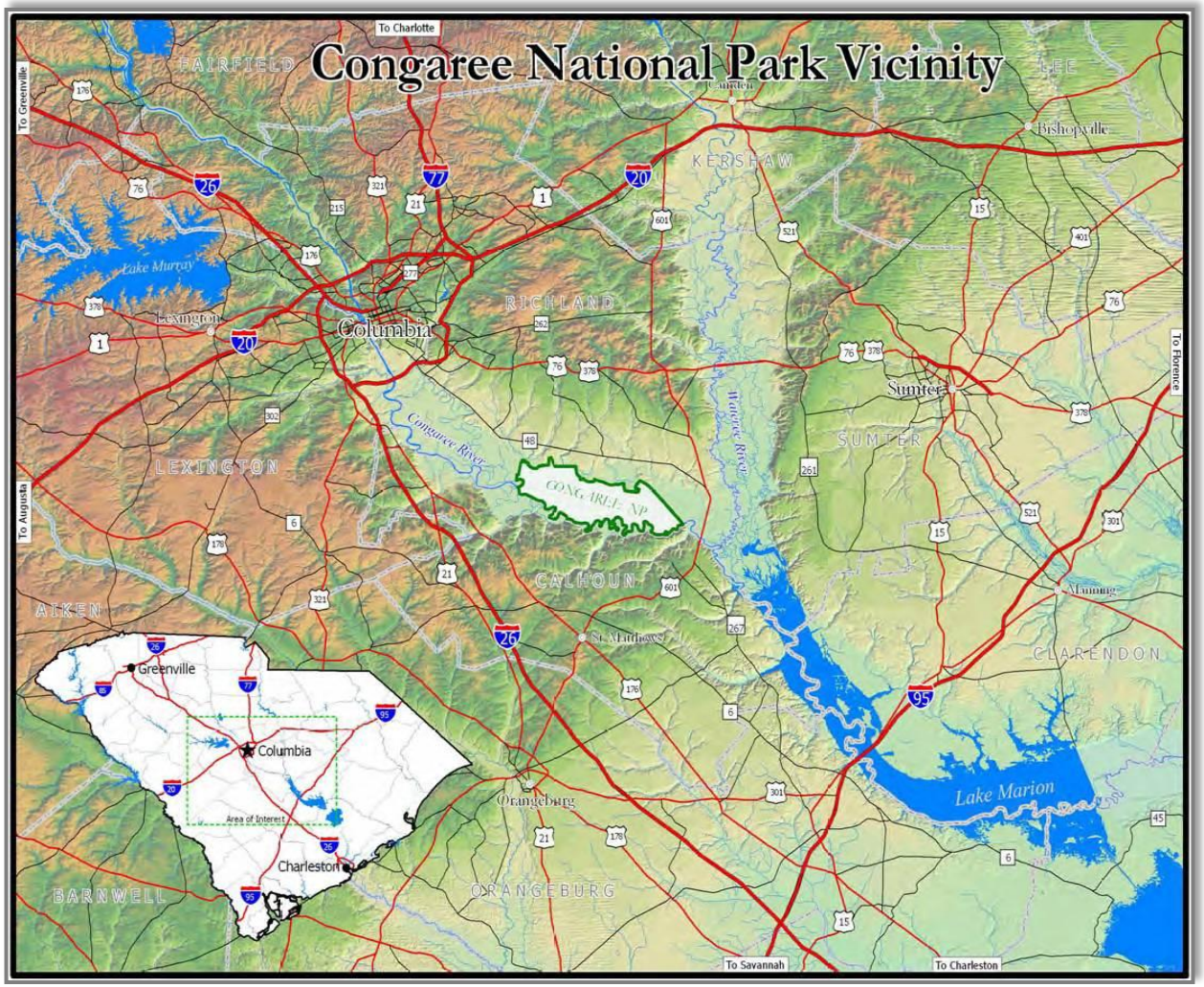

Figure 3.2: Vicinity of Congaree NP ***(source: Congaree NP Management Plan, 2004)***

CHAPTER 4

METHODOLOGY

4.1 Overview of the Original Standard Methodology

The research was conceptually based on The Protected Areas Benefit Assessment Tool (PA-BAT), a methodology developed by the World Wide Fund for Nature through the support of the World Bank to collate and build information about the overall benefits from protected areas (Stolton & Dudley, 2009). The PA-BAT has been designed to identify values and benefits that protected areas bring to a range of stakeholders, from local to global. It is a questionnaire-type assessment tool consisting of the following nine main groups of value-based datasheets which are completed by key stakeholders to the target protected area: (i) Nature Conservation Values; (ii) Protected Area Management Values; (iii) Values related to Food; (iv) Values related to Water; (v) Cultural and Spiritual Values; (vi) Health and Recreation Values; (vii) Knowledge; (viii) Environmental Services; and (ix) Materials. The methodology, which is relatively new, has been tested by Equilibrium Research and WWF and also has been applied in Turkey, Slovenia, Croatia, Montenegro, Bosnia and Herzegovina, and Albania, among others. Also, a modified and shortened version of the methodology is being used for all Natural World Heritage sites as a part of IUCN`s World Heritage Outlook Reporting project (communication with a representative of Equilibrium Research, 2012).

Each group of value-based datasheets has a set of main guiding questions. These questions attempt to provide thematic understanding of the protected area's value and reveal the main benefits of the protected area to a wide range of stakeholders:

- ❒ *Group 1 - Nature Conservation Value:* Is the protected area valued for its nature conservation?
- ❒ *Group 2 - Protected Area Management Value:* Does management of the protected area provide jobs (e.g. for managers, rangers etc.)?
- ❒ *Group 3 - Values Related to Food:* (i) Is the hunting of wild game permitted in the protected area? (ii) Is the use of wild food plants permitted in the protected area? (iii) Are fisheries (permissible fishing and/or contribution to fish stocks by protecting spawning area) an important resource in the protected area? (iv) Is traditional agriculture (i.e. use of locally adapted crops (landraces) and/or practices) undertaken legally in the protected area? (v) Is livestock grazing and fodder collection permitted in the protected area?
- ❒ *Group 4 - Values Related to Water:* Are non-commercial water use (e.g. subsistence agriculture, drinking, washing and/or cooking) or commercial water use (e.g. for large-scale irrigation, waterways, bottling plants, hydro-electric power or municipal drinking water source) permitted in the protected area?
- ❒ *Group 5 - Cultural and Spiritual Value:* (i) Does the protected area have cultural and historical values (e.g. archaeology, historic buildings including temples, pilgrimage routes and/or historic/culturally important land use patterns)? (ii) Does the protected area include sacred natural sites or landscapes (e.g. sacred

groves, waterfalls and/or mountains)? (iii) Does the protected area contain wilderness values or other similar iconic values?

- ❒ *Group 6 - Health and Recreation Value:* (i) Is the collection of medicinal resources (e.g. herbs) for local use or for the pharmaceuticals industry permitted from the protected area? (ii) Is the protected area important for recreation and tourism?
- ❒ *Group 7 – Knowledge:* (i) Is the protected area an important resource for building knowledge? (ii) Does the protected area contribute to education (i.e. formal and informal dissemination of information)? (iii) Is the collection of genetic material (e.g. crop wild relatives, tree species) permitted from the protected area?
- ❒ *Group 8 - Environmental Services:* (i) Can the protected area contribute to climate change mitigation (e.g. by providing significant carbon sequestration or by ameliorating local climate impacts)? (ii) Is the protected area important for soil stabilization (e.g. avalanche prevention, landslide and erosion)? (iii) Is the protected area important for coastal protection (e.g. mangroves, sand dunes, coral reefs)? (iv) Is the protected area important for flood prevention (e.g. mitigation in small watersheds, flood plains and wetland protection)? (v) Is the protected area important for water quality and quantity (e.g. filtration, groundwater renewal, maintenance of natural flows)? (vi) Is the protected area an important resource for pollination of nearby crops or for pollination products such as honey?
- ❒ *Group 9 – Materials:* (i) Is the management and removal of timber, including for fuel wood, permitted from the protected area? (ii) Is the extraction of other

materials (e.g. coral, shells, resin, rubber, grass, rattan, minerals, etc) permitted from the protected area?

For each value, the assessment generally considers the following six issues: (i) who benefits; (ii) what benefits are supplied; (iii) what portion of the protected area provides the benefit; (iv) what is the economic value of the provided benefit, if it was assessed; (v) are activities relating to the particular value / benefit consistent with the area's management objectives, and (vi) what type of management is currently taking place in relation to these values/benefits and what additional management responses are needed. The assessment form also provides users with an opportunity to add any other significant information related to the particular value / benefit.

Although the PA-BAT includes the option to record economic information, the primary purpose of the tool is to record the types of benefits provided by the protected area and to whom they are provided, and not necessarily to put an economic value on these benefits.

4.2 Overview and Application of the Adapted Methodology

As the PA-BAT has been developed to use globally for all protected area types (e.g. in all IUCN management categories) and in any biome, the range of values and benefits they provide is necessarily generic, and not all will apply to every protected areas. Thus, in case of necessity, the PA-BAT can be simplified and adapted before use to make it more relevant to a specific site or particular system of protected areas.

In this research, the PA-BAT methodology has been simplified and adapted to the case of Congaree NP considering its protection category, management regime and

potential values and benefits. As a result, a number of value groups were reduced, and the content of value-based datasheets was modified. In particular, potential values and benefits of Congaree NP were divided under the following six groups: (i) Biodiversity Conservation Value; (ii) Management Value; (iii) Cultural, Historical and Spiritual Value; (iv) Recreational Value; (v) Scientific, Knowledge and Educational Value; and (vi) Regulating Services Value, which included climate regulation, flood storage and control, water quality protection, erosion control / soil stabilization, and coastal protection.

The modified value-based datasheets covered the following issues to be completed by experts: (i) key data and information about the particular value or benefit of the park; (ii) key literature sources to be addressed for more detailed information; (iii) other key experts to be contacted for more specific knowledge and experience for the particular value or benefit; (iv) economic value of this benefit, if it has been assessed; and (v) any additional information, caveats, or details necessary to consider while identifying values and benefits of Congaree NP (Appendix A).

Following the adapted PA-BAT methodology, two-phase approach was used to gather and synthesize information about the potential values and benefits of Congaree NP:

1. Input from experts and stakeholders familiar with the park was gathered through completion of the value-based datasheets. To do so, the value-based datasheets were sent to 22 key experts representing current and former park managers and staff as well as scientists and private citizens with extensive park-based knowledge and experience. Experts` primary research areas and expertise were

considered while sending the value-based datasheets. Of these experts, 12 participated and provided their professional feedback about values and benefits of Congaree NP by completing the datasheets (Appendix B).

2. Key values and benefits of Congaree NP were then identified: (i) by summarizing the experts` contributions as provided in the completed value-based datasheets, and (ii) through an extensive review of corresponding literature and research-based documentary materials (books, articles, reports, analysis, assessments, reviews and legal documents) about potential values and benefits of Congaree NP recommended by experts.

CHAPTER 5

RESULTS

5.1 INTRODUCTION

The wide range of ecosystem values discussed in Chapter 2 is provided by nature throughout the world. However, not all ecosystems provide all those services, and some services are more predominant in certain ecosystems. The effectiveness and level of provided services is very much ecosystem and area specific (Hawkins, 2003) and depends on the geological, ecological and hydrological characteristics and management approaches of the particular area. Besides, many provided services are functionally connected and depend on each other. For example, the conservation of biological diversity is important for providing genetic resources, food, medicine, and raw materials while the nursery function is invaluable to many endangered species as well as for economically important harvested species. Close relationships among provided services clearly demonstrate that the ecosystems need to be considered and managed as an integrated unit even from the perspectives of benefits to the society.

In this chapter, I first provide a brief overview of functions and values of bottomland hardwood forest and then present key values and benefits of Congaree NP identified through this research.

5.2 Overview: Functions and Values of Bottomland Hardwood Forests

Floodplain ecosystems are a definitive feature of the Coastal Plain in the southeastern United States, where they consist mainly of bottomland hardwood forests and other associated wetlands, rivers and streams (King et al., 2009). Bottomland hardwood communities support distinct assemblages of plants and animals that are associated with particular landforms, soils, and continuous hydrologic regime of the functioning ecosystem (Wharton et al., 1982). As the ecosystem at the dynamic boundary between aquatic and terrestrial systems, forested wetlands demonstrate the classic "edge effect" with high species abundance and diversity. Bottomland hardwood forests have relatively high plant productivity, which is reflected in their high carrying capacity for some fish and wildlife species (Taylor et al., 1990).

It has been estimated that bottomland hardwood forests covered 11.8 million acres of the Mississippi Alluvial Plain in 1937, but by 1977, this cover had been reduced to 5.2 million acres (Clark & Benforado, 1981). Changes in coverage of southern bottomland hardwood areas was calculated for the period from 1960 through 1975, and the average annual net loss was about 431,000 acres (175,000 ha). During this period, three states – Alabama, Florida, and Kentucky - gained acreage while major losses occurred in Arkansas, Georgia, Louisiana, Missouri, North Carolina, South Carolina and Virginia (Turner et al., 1981). A large part of the forest area lost in the southern United States from 1962 to 1970 was bottomland hardwoods (Kellison & Young, 1997). Much of the loss of bottomland hardwood forests occurred due to clear cutting and drainage for agricultural purposes. The unsustainable use of bottomland hardwood forested

wetlands, in turn, can result in the loss of functions and values provided by these ecosystems (Taylor et al., 1990).

In the scientific literature, functions and values of bottomland hardwood forests are often discussed from the same perspective, but contextually, they differ. According to accepted definitions, functions are "characteristics of the bottomlands in the absence of any consideration of their importance to humans" (Taylor et al., 1990: 29) while values are "those benefits derived from the functions of bottomland hardwood wetlands" (Taylor et al., 1990: 56) or "characteristics of bottomlands that happen to provide benefit to current human needs" (Taylor et al., 1990: 29). Thus, bottomland forest values may change following changes in society`s perception and technology development while the functions of the forest remain the same in the absence of anthropogenic impact (Harris & Gosselink, 1990).

The functions of bottomland hardwood forests can be divided into four categories: (i) community dynamics; (ii) physio-chemical processes (e.g., the deposition of sediments, retention of nutrients and toxins, and biochemical transformations); (iii) surface water storage through floodplain structure, vegetation cover and soil types; and (iv) groundwater storage (Taylor et al., 1990; Harris & Gosselink, 1990). The ecological functions of bottomland hardwood forests lead to the following values: (i) biomass production; (ii) downstream food chain support through the export of organics; (iii) fish and wildlife habitats that also provide recreation services; (iv) erosion control; (v) water quality protection; (vi) flood storage and control; (vii) climate regulation; (viii) low flow augmentation; and (ix) deep aquifer recharge (Taylor et al., 1990; WRI, 2010). These

values of bottomland hardwood forests are closely linked to healthy functioning of these systems (Figure 5.1).

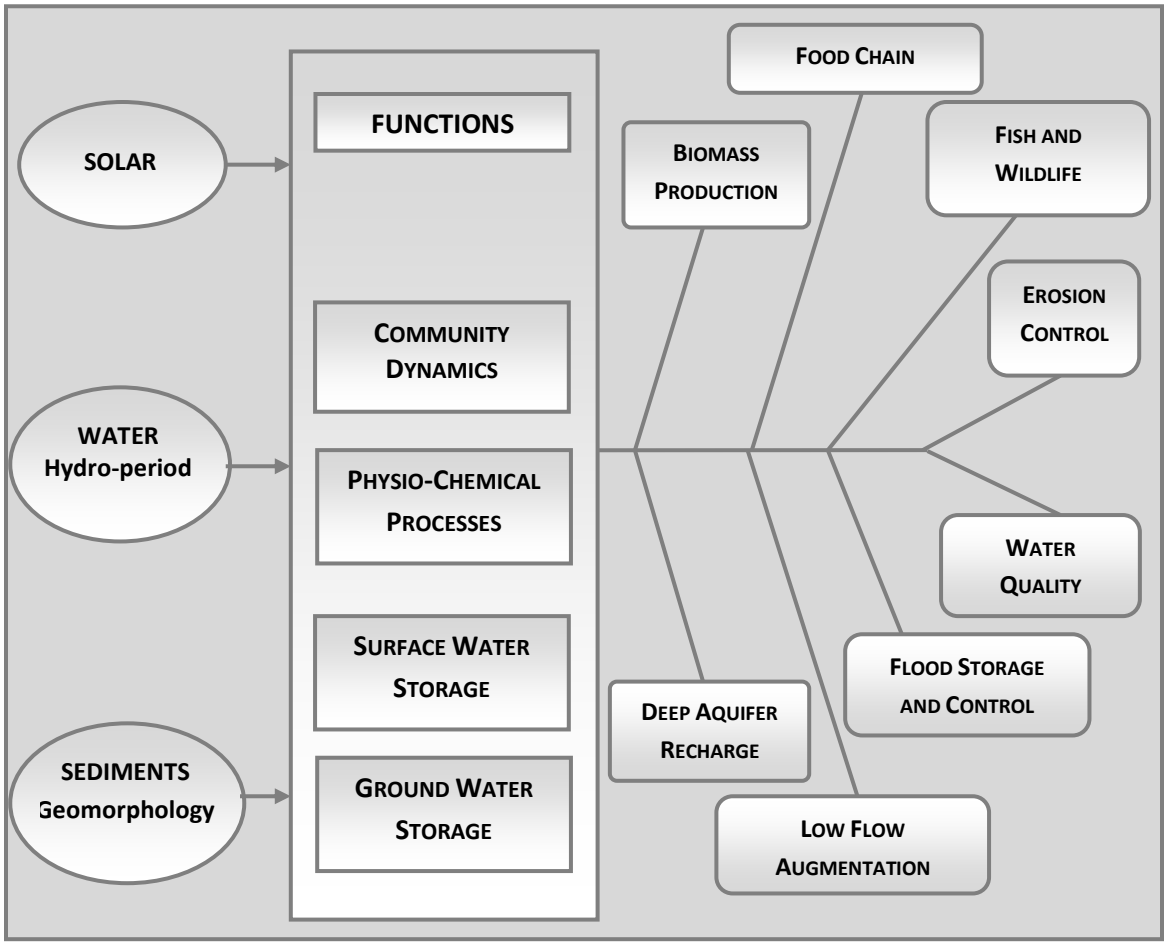

Figure 5.1: Relationship between functions and values of bottomland hardwood forest *(source: Taylor et al., 1990).*

From the above listed values of bottomland hardwood forests, only values of those regulating services applicable to Congaree NP will be discussed in more detail below. Functions and values of bottomland hardwood forest ecosystems are increasingly recognized, and they have been discussed to some extent in a number of publications. However, the discussion below is mainly based on Taylor et al. (1990) and Harris & Gosselink (1990) because these papers provide generalized processual basics of

functions and values of specifically bottomland hardwood wetlands ecosystems and are not linked to any particular target area.

5.2.1 WATER QUALITY PROTECTION

Wetlands are known to be effective in water purification through removal of excess nutrients, sediments, metals and other pollutants from upland runoff and surface water. Bottomland hardwood forests improve water quality in different ways and with varying levels of success. During periods when the forest is not flooded, runoff is filtered as it flows slowly through the bottomland area. Forested wetlands effectively convert inorganic nitrogen and phosphorus into organic forms. Nutrients are adsorbed on the forest floor, taken up by the forest vegetation and then released as organic plant detritus, which also constitutes a food source for organisms. Nutrients are retained by sediments, indefinitely when sediments are buried (Taylor et al., 1990; Harris & Gosselink, 1990).

The protection and improvement of water quality depends not only on vegetative uptake, biochemical transformation, and sediment deposition but also on the hydrology of the particular area. Nutrient retention may be temporary over a period of years with storage in woody biomass, or it may be seasonal, with storage in spring-summer and release in fall-winter (Taylor et al., 1990). As for toxic materials such as heavy metals and chlorinated hydrocarbons, the primary ways for their removal is through adsorption onto suspended solids. Metals are active under anaerobic conditions but will remain trapped in the sediments if an aerobic surface layer is present (Mortimer 1941, cited by Taylor et al., 1990). Generally, very limited research has been

done about a role of bottomland hardwood forests in metal removal (Taylor et al., 1990).

5.2.2 Flood Storage and Control

One of the main values of forested floodplains is flood storage and control. The functional abilities of floodplain wetlands to slow floodwater velocities and temporarily store water are crucial for this value provided to society (Taylor et al., 1990; Harris & Gosselink, 1990), although the value of a forested floodplain for flood storage and control needs to be determined on an individual basis. In some watersheds, wetlands may play a crucial role in flood control while in others the flood prevention value would not override the value of various land-uses on the floodplain (Adamus & Stockwell, 1983 cited by Taylor et al., 1990). There are two main approaches to determine the flood prevention capacity of a particular floodplain: (i) actual measurement of water storage capacity through detailed field studies of inflows and outflows, and (ii) developing mathematical models with realistic coefficients for different wetland types which could be further applied to each individual case considering the wetland type (Taylor et al., 1990).

5.2.3 Erosion Control

Floodplain areas (and especially forested wetlands) significantly contribute to stabilizing land masses and protecting downstream embankments through surface water storage and by reducing water-flow velocities. However this value of floodplain areas has not been determined directly. Most studies that address the capacity of

floodplains to control erosion have focused on how floodplain vegetation acts to hold soils (Taylor et al., 1990).

The biotic community of bottomland hardwood wetlands contributes to erosion prevention by: (i) reducing wave energy and current velocity through friction against the plant structure, and (ii) binding the sediments by vegetation root systems (Adamus & Stockwell, 1983 cited by Taylor et al., 1990). Bottomland hardwood wetlands also protect erodible uplands adjacent to the wetlands because less water with lower current velocity reaches the upland areas. At the same time there are scientific concerns that some types of wetlands may contribute occasionally to downstream erosion through filtering out sediments which, itself, increases the sediment carrying capacity of the water (Taylor et al., 1990).

5.3 KEY VALUES AND BENEFITS OF CONGAREE NATIONAL PARK

As it was mentioned above key values and benefits of Congaree NP were identified based on the experts` contributions as provided in the completed value-based datasheets and through an extensive review of corresponding literature and research-based documentary materials recommended by experts. A major part of this discussion about potential values and benefits of Congaree NP is based on corresponding literature and research-based materials while a certain part of results, for which the literature was limited, heavily borrows from experts` contribution. Appendix C presents quotes from experts` feedback on each identified value and benefit of Congaree NP.

5.3.1 KEY BIODIVERSITY CONSERVATION VALUE

FLORAL DIVERSITY: A vegetation classification for the park identified twenty-two vegetative associations, including twenty forest associations, one woodland association, and one shrubland association. Twelve associations were newly described plant associations, and one was a broadly defined upland successional forest (The Nature Conservancy, 1998). This diversity of habitats is matched by high floral diversity. According to the most recent data of the National Park Service Inventory and Monitoring Program, around 855 vascular plants species are represented within the Park (NPS IMP, 2013). Thus, as Gaddy et al. (2000: 2) noted: Congaree NP "is probably one of the most diverse assemblages of forest communities in North America. The richness of the woody flora … is surpassed in North America only by the Great Smoky Mountain National Park."

CHAMPION TREES AND TALLEST CANOPY: Another distinguishing feature of Congaree NP is its richness in big champion and tallest trees (Bronaugh, 2009). In 1997, 29 state champion trees representing 25 species, and 4 national champion trees representing 3 species were identified (Jones, 1997). There are currently six national- and 29 state-champion trees in Congaree NP (Bronaugh, 2009). In the park, even non-champion trees are notably large and tall. Congaree NP contains one of the tallest broad-leaved forest canopies in North America (Jones, 1997), has the greatest concentration of tall trees in eastern North America, and is among the tallest broad-leaved forests in the world (CNP RMP, 2004).

FAUNAL DIVERSITY: The richness, diversity and productivity of ecosystems at Congaree NP provide a range of habitats that contribute to a remarkably rich faunal diversity. There are roughly 46 mammal species (Byrne & Lagana, 2009; Loeb, 2006) and around 60 fish species in the park (NPS IMP, 2013). Sixty native reptile and amphibian species (Tuberville et al., 2005) and 191 bird species (Carter, 2005) have also been recorded within the park. Thirty-two species of recorded reptiles include one crocodilian (the American alligator), 19 snakes, five lizards and seven turtles while twenty-eight recorded amphibian species include twenty frogs and toads and eight salamanders. As noted by Tuberville et al. (2005) such high taxonomic richness of amphibians and reptiles within the park is strongly supported by the size and high diversity of habitat types.

RARE, THREATENED AND ENDANGERED FAUNA AND FLORA: Congaree NP plays a critical role in the preservation of rare, threatened and endangered species as the park protects and supports plant assemblages typical of increasingly rare old-growth forest ecosystems (CNP RMP, 2004). Although there are no known federally-listed rare, threatened or endangered plant species currently occurring within Congaree NP, there are nine vascular plant species listed as Species of Concern by the State of South Carolina (Mallin & Mclver, 2010). The federally endangered red-cockaded woodpecker (*Picoides borealis)* was known to have active colonies within a small portion of the park as late as 1996, and the federally threatened bald eagle (*Haliaeetus leucocephalus)* is an occasional visitor. Observations of the federally endangered eastern cougar (*Puma concolor couguar)* have been reported in Congaree NP (CNP RMP, 2004), and the park

contains some of the best remaining potential habitat for two critically endangered (and possibly extinct) species, the ivory-billed woodpecker (*Campephilus principalis*) and Bachman's warbler (*Vermivora bachmanii)* (CNP RMP, 2004; USFWS, 2013).

5.3.2 REGULATING SERVICES VALUE

Regulating services of the Congaree floodplain were recognized by scientists decades ago. Charles Wharton, a professor of Biology at Georgia State University who was one of the first scientists studied the ecology of swamp forests in the 1960s-1970s, considered the floodplain as "a laboratory for the future welfare of the common man" (Sierra Club, 1975: 110) and "a resource that we all need and use since it involves such things as drinking water and tertiary sewage treatment" (Sierra Club, 1975: 109). However, after conducting a literature search for studies that address the regulating services of Congaree NP, it became obvious that little specific information existed. Available reports about hydrology, water resources assessment and management, water quality, soils, and flood modeling do not directly address and set forth values of regulating services of Congaree NP. For this reason, this section of the research borrows heavily from the knowledge, experience and opinion of experts who have been working with Congaree NP and have been investigating ecosystems of the park. Based on the expertise of these experts and through review of the limited research materials, the following values of key regulating services provided by Congaree NP have been identified: (i) Climate Regulation; (ii) Flood Storage and Control; (iii) Water Quality Protection; (iv) Erosion Control / Soil Stabilization; and (v) Coastal Protection.

CLIMATE REGULATION: Experts generally consider the Congaree River floodplain as a major carbon storage area. Congaree NP protects an old-growth floodplain forest and thus supports a biologically diverse, structurally complex, and abundantly dense forest that provides significant carbon sequestration in the region (Appendix C - experts` evaluation, 2013: John Kupfer, Kimberly Meitzen, Theresa A. Thom, Rebecca R. Sharitz, Terri Hogan, & William L. Graf). Because Congaree NP contains both deciduous (e.g. bottomland hardwoods and cypress-tupelo) and evergreen (e.g. pine and palmettos) plant diversity, it is especially important to annually permanent carbon sequestration from the atmosphere. In addition, the park provides significant terrestrial carbon sequestration service through accumulation of organic materials in soil development, particularly in the rim-swamp peat deposits. As for source-sink dynamics, the terrestrial and aquatic sequestrations are closely linked to each other through flooding which supports the exchange of carbon between the floodplain and river (Appendix C – expert`s evaluation, 2013: Kimberly Meitzen).

There is very limited study assessing the contributions of Congaree NP to climate regulation and climate change mitigation. Preliminary results of a 2012 study on the spatial variability of soil carbon in park environments demonstrated that bottomland hardwood wetlands ecosystems play a key role in storing carbon (Ricker et al., 2012). According to results of the study, wetland soils stored significantly more carbon in the upper 1 m and had a greater carbon percentage at the 1-2 m depths than non-wetland soils, while root carbon stocks were much greater on the drier floodplain landscapes. On average, total root carbon stock made up 1.2% of total belowground carbon. As these

data suggest, root carbon stocks are minor when compared to wetlands soils carbon stocks. Also, deep soil (below the upper 1m) carbon storage is a very significant function of the floodplain (Ricker et al., 2012).

In addition to carbon sequestration, the park is important for regulating local microclimate. Due to its flooding and precipitation patterns, the park area and its vicinity maintain lower temperature in comparison with the surrounding metropolitan and developed areas (Appendix C - experts` evaluation, 2013: John Kupfer & Terri Hogan).

FLOOD STORAGE AND CONTROL: There is extensive research on flood processes in Congaree NP as well as about the significance of flooding for maintenance of functioning ecosystem within the park. However, there is no specific research that discusses the water storage capacity of the park and its value in terms of flood prevention.

According to experts` opinion, Congaree NP floodplain has the capacity to retain and store a large amounts of flood water on a temporary basis because: (i) the park encompasses quite large area and over 90% of the park is covered by wetlands; (ii) the park locates just below the Fall Line and at the confluence of the Broad and Saluda Rivers; and (iii) the park is characterized with a complex web of water channels which distribute water and sediment throughout the park area. Since the majority of the park's total area functions as temporary flood water retention and storage, it may be particularly important for flood prevention during large floods that inundate the lower valley from main stem flooding while also providing flood prevention from smaller, local events (Appendix C - experts` evaluation, 2013: John Kupfer, Kimberly Meitzen, Rebecca

R. Sharitz & Terri Hogan). “Congaree NP’s capacity to absorb flood waters and provide flood prevention is one of its critical benefits to society” (Appendix C – expert`s evaluation, 2013: Kimberly Meitzen).

WATER QUALITY PROTECTION: Based on expert evaluations, Congaree NP serves as a catch basin for sediments and other pollutants coming from upstream development areas. Due to its location at the confluence of the Wateree and Congaree Rivers, Congaree NP could play a key role in removing pollutants and filtering water. The forested land cover, floodplain depositional features and wetland characteristics of Congaree NP are important for filtering and improving water quality as well as for providing natural patterns of water availability/quantity through flooding and recession. Because Congaree NP spans a hydrologically-sensitive hillslope-to-valley drainage boundary, it is especially important for water quality protection benefits and recharging the shallow water table for further floodplain forest uptake (Appendix C - experts` evaluation, 2013: Kimberly Meitzen, John Kupfer, Theresa A. Thom, Rebecca R. Sharitz & William L. Graf).

There is a lack of knowledge concerning the quantity of water stored and the quantity of water purified by the Congaree NP floodplain forest ecosystem. Ongoing research on water quality by the U.S. Geological Survey (USGS), the South Carolina Department of Health and Environmental Control (SC DHEC), and the National Park Service (NPS) may help to support an evaluation of the park`s contribution to water purification. The USGS National Water Information System (NWIS) supports the compilation, processing, and long-term storage of water data. The water data available

through this system is a part of the USGS investigations of the occurrence, quantity, quality, distribution, and movement of the surface and underground waters that constitute the nation's water resources. This system operates at 16,887 sites in South Carolina and provides access to inventory information about sites at stream reaches, wells, test holes, springs, tunnels, drains, lakes, reservoirs, ponds, excavations, and water-use facilities (USGS NWIS, 2013).

The SC DHEC implements a Watershed Water Quality Assessment program for all of the 8-digit sub-watersheds in the state. One of the major products of this program is a watershed water quality assessment that discusses components of water chemistry, biological monitoring, physical characteristics, natural resources, growth potential, potential nonpoint source contributions and point source discharges (SC DHEC, 2013).

Since 1993, the NPS has implemented the Baseline Water Quality Data Inventory and Analysis Project to provide descriptive water quality information to every national park unit. The project retrieves water quality and related data from the Environmental Protection Agency's database, develops a complete descriptive inventory, and reformats the water quality and other related data for use with the park-based Water Quality Data Management System. In the context of this project, Congaree NP received its Baseline Water Quality Data Inventory and Analysis Report in 1998 (NPS, 2013a).

More locally, assessment of water resources and watershed conditions in Congaree NP was carried out in 2010 by Mallin & McIver (2010), who gave background information on water quality within and around the park area.

EROSION CONTROL / SOIL STABILIZATION: Experts agreed that Congaree NP is important for storing soil and sediments and its natural forested land cover prevents soil erosion. The natural land cover and lack of development support the greatest benefits of soil stabilization. Besides the natural land cover which prevents soil erosion, Congaree NP is an important sediment sink that stores sediments supplied from the upstream watershed (Appendix C - experts` evaluation, 2013: Kimberly Meitzen, John Kupfer, Terri Hogan, & Theresa A. Thom). "The river banks of Congaree NP are highly dynamic and erodible, but these processes are off-set by the collateral transport, deposition, and storage of these sediments in other areas of the floodplain" (Appendix C - expert`s evaluation, 2013: Kimberly Meitzen).

COASTAL PROTECTION: Congaree NP is not located on the coast, but two of the experts noted that the maintenance of the large forested floodplain upriver of the coast plays an important role in coastal protection. In particular, the park provides a natural sink for pollutants and contaminants that would otherwise drain in to the Atlantic through Santee drainage. It also contributes to a source of renewable sediments to the estuaries and ocean (Appendix C - experts` evaluation, 2013: Kimberly Meitzen & Theresa A. Thom). The specific extent of this role, however, is not known.

5.3.3 RECREATIONAL VALUE

The recreational value of protected areas and related economic impact is widely acknowledged and recognized. Realizing the recreational value and significance of potential economic impacts, national parks attempt to provide a wide range of recreational activities to attract visitors and contribute to tourism development. At

Congaree NP, activities available for visitors include hiking, primitive camping, bird watching, picnicking, canoeing & kayaking, recreational fishing, ranger-guided interpretive walks, nature study, and environmental education programs (NPS, 2013b).

There are ongoing initiatives and projects to monitor the number of visitors to parks and to value economic benefits generated by the tourism sector at national, regional and international levels. In the United States, the Public Use Statistics Office of the National Park Service coordinates visitor-counting protocols, and provides visitation statistics and forecasts for protected areas administered by the NPS (NPS PUSO, 2013). The Public Use Statistics Office provides visitors data for Congaree NP for the period of 1985-2012. According to these data, visitation at Congaree NP (including that under its previous name, Congaree Swamp National Monument) increased steadily from less than 20,000 in the mid 1980's through about 2000; since then, visitation has averaged around 100,000-120,000 per year (Figure 5.2).

The Visitor Services Project (VSP), which was initiated in 1982 as a result of close cooperation between the NPS Social Science Program and the Park Studies Unit at the University of Idaho, is an ongoing research project aimed at surveying visitors to national parks. This project provides park managers with key information about visitors' age and residence, their interests and preferred future learning topics in the park, their spending for the park visit, and their evaluations of park resources, facilities and services. Results of the project are valuable because they can be interpreted and considered in the adaptive management and tourism development strategies of the park. Five studies have been conducted for Congaree NP: one study in 2005,

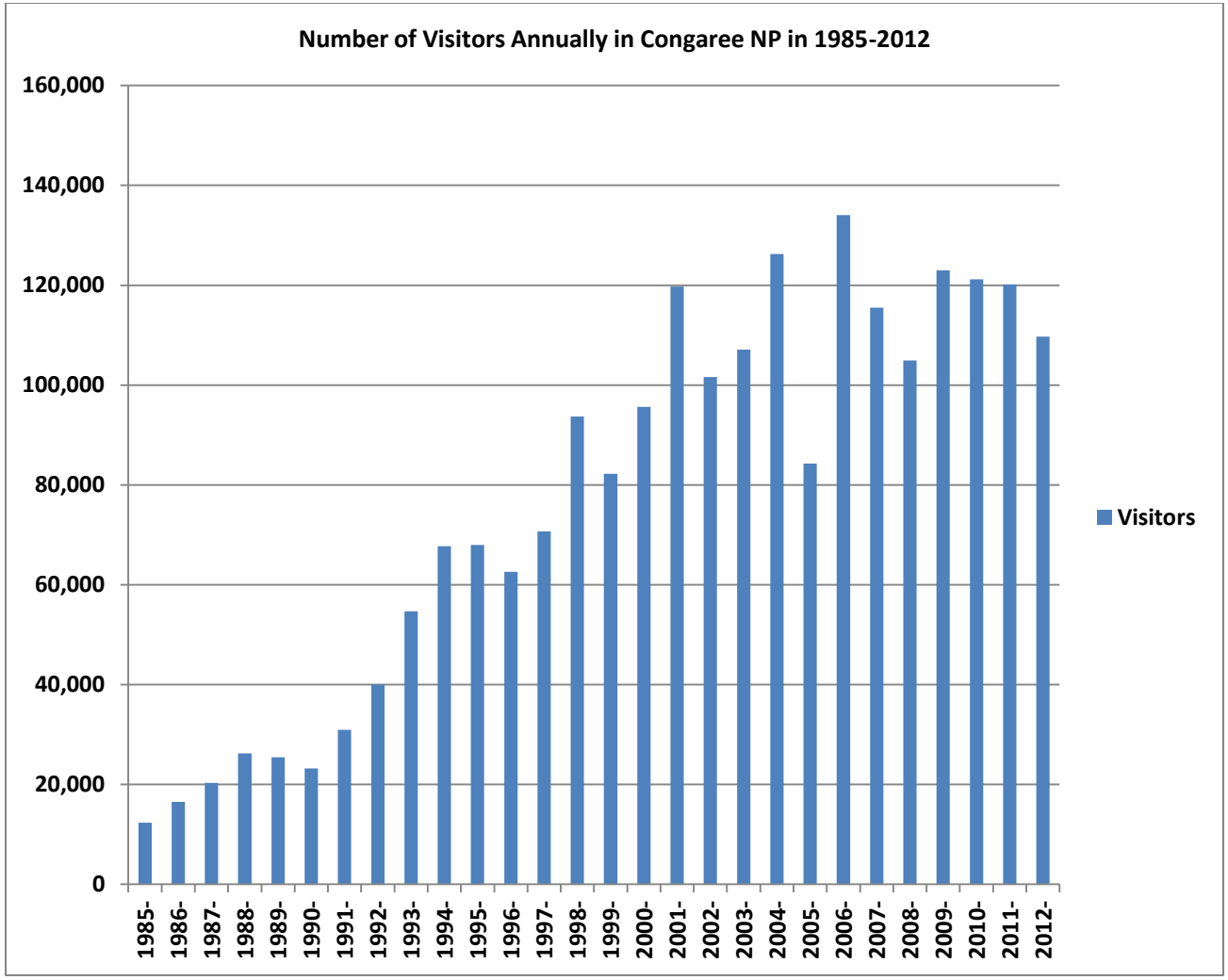

Figure 5.2: Number of visitors annually in Congaree NP, 1985-2012

three studies in 2011 and one study in 2012 (NPS VSP, 2013). Results of surveys carried out in 2011 and 2012 are presented below. All prices correspond to a dollar rate of the year of the study.

In 2011 Congaree NP received 120,166 visitors. According to the visitor studies conducted in spring, summer and fall, U.S. and international visitors comprised around 95% and 5% of the 2,177 surveyed visitors, respectively. The majority of U.S. visitors came from South Carolina (49%), followed by North Carolina (7%), Florida (5%), Georgia (4%), and Pennsylvania (3%), with the other 32% coming from 30 other states and Washington, D.C. (Figure 5.3). As these three studies showed, the average visitor group expenditure (inside and outside the park within a 1-hour drive) was US$ 199 in spring, US$ 221 in summer, and US$ 181 in fall. The average total expenditure per capita was US$ 106 in spring, US$ 98 in summer, and US$ 75 in fall (Kulesza et al., 2012; Samuelson et al., 2012).

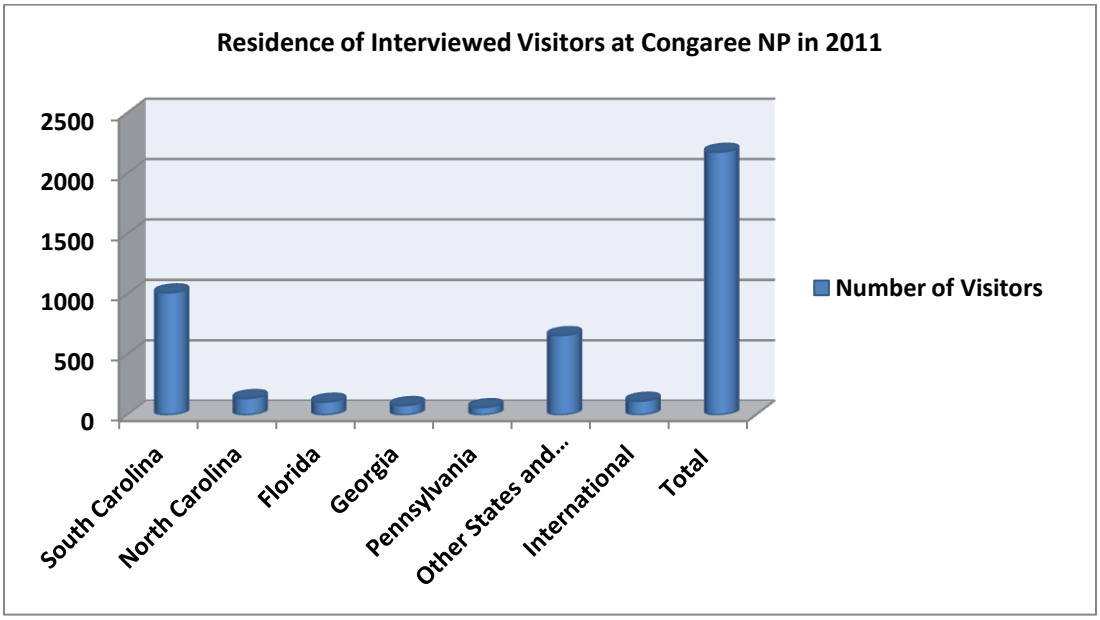

Figure 5.3: Residence of interviewed visitors at Congaree NP in 2011

In 2012 Congaree NP received 109,685 visitors. According to the winter visitor study, U.S. and international visitors comprised around 98% and 2% of the 743 interviewed visitors, respectively. The majority of U.S. visitors came from South Carolina (52%), North Carolina (11%), Ohio (4%), and New York and Georgia (3% each), with another 27% from 29 other states (Figure 5.4). As the study showed, the average visitor group expenditure (inside and outside the park within a 1-hour drive) was US$ 153 and the average total expenditure per capita was US$ 74 (Jette et al., 2012).

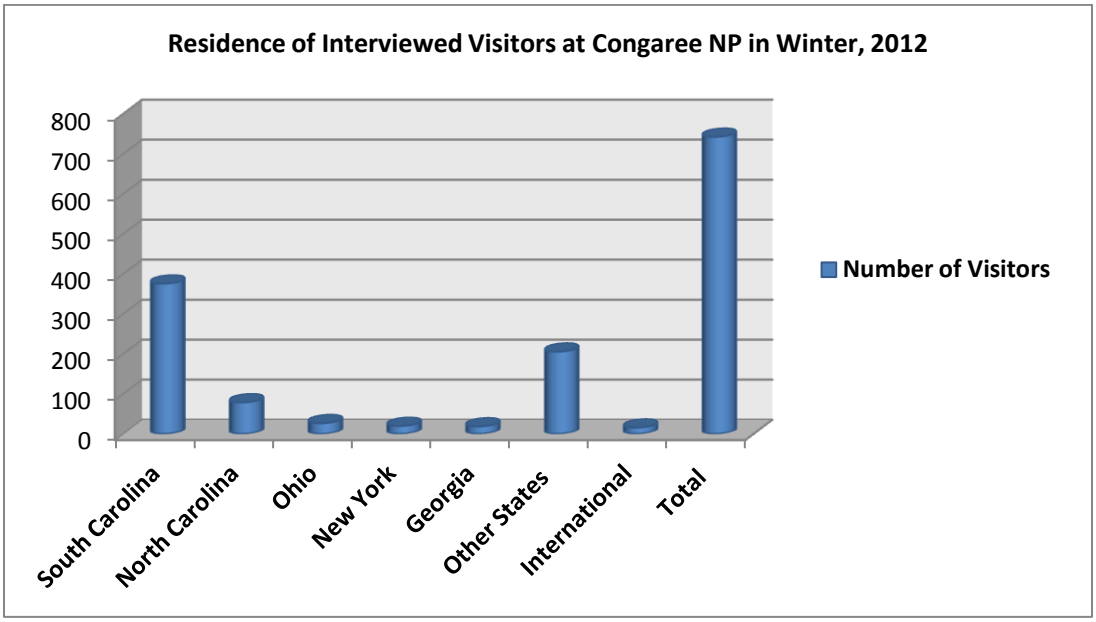

Figure 5.4: Residence of interviewed visitors at Congaree NP in winter, 2012

The Visitor studies clearly show that the majority of visitors come from South and North Carolina, with relatively few visits coming from residents outside of eastern states. International visitors make up a very small percentage of visits and come primarily from Europe and Canada. Travel costs related to park visitation and low recognition and awareness of the significance and values of the park can be considered as two key explanations for the observed visitation patterns. Effective communication of

the ecological, historical and cultural values of the park may significantly increase the recognition of the park and could eventually result in an increased number of visitors and higher economic impact in the region.

The Park Studies Unit at the University of Idaho uses the MGM2 to estimate the economic impacts of park visitor spending by using visitor expenditure data collected in VSP studies along with an input-output economic model (IMPLAN) to model how money spent by visitors flows through the economy to support local jobs and businesses (PSU, University of Idaho, 2013). Through application of the MGM2 model, studies of the annual impacts of visitor spending on the local economy were carried out for Congaree NP in 2005 and in 2011. According to the 2005 economic impact study, the total impact of the park on the local economy was 56 jobs and US$ 2.0 million in value added, including both visitor spending and park operations (Stynes, 2007). The total impacts to the region of visitor spending attributable to the park and NPS payroll had grown to US$ 6.3 million in sales by 2011, which supported 106 jobs with labor income of US$ 3.5 million (Cook, 2013).

At the end of this section, it is worthwhile to mention the value of recreational fishing to local people. According to the park staff, recreational fishing is popular at Congaree NP, but has not been studied and there are no available comprehensive data to analyze its trends over the years. It is assumed, however, that the majority of visitors who fish at the park are local residents from surrounding communities, many of whom likely have a family tradition of fishing in the park area (Appendix C - experts` information, 2013: Theresa A. Thom & Terri Hogan).

5.3.4 SCIENCE, KNOWLEDGE AND EDUCATIONAL VALUE

The scientific and educational values of Congaree NP were among the strongest arguments for creation of the protected area. Robert Janiskee, a physical geographer at University of South Carolina, described the area as "a vast natural laboratory for educational and scientific study" (Sierra Club, 1975: 80). Charles Wharton noted that "the Beidler Tract represents an unparalleled resource for information flow from nature to man via science and education" (Sierra Club, 1975: 110). With its unique old-growth floodplain forest ecosystem, remarkably rich biodiversity, high forest canopies, and number of state and national champion trees, Congaree NP represents a regionally, nationally and globally significant platform for scientific research and education. Considering the increasing pressure on the remnant forest environment, it is critical for baseline research to compare with more disturbed and impacted floodplain ecosystems (Graf, 2003).

Currently, Congaree NP maintains the Old-Growth Bottomland Forest Research and Education Center, one of 21 NPS Research and Education Centers that have been founded to increase public awareness and promote education about park resources and their importance, and to facilitate collaborations between government, education, public institutions and the general public. As mandated, the Old-Growth Bottomland Forest Research and Education Center at Congaree NP (hereafter, 'Research and Education Center') supports scientific research and works in close collaboration with the research community to raise awareness and understanding of natural and cultural

resource issues. Also, the Center offers dormitory-style housing, a small laboratory, and office workspace for park researchers (CNP RMP, 2004).

The Research and Education Center has contributed to the diverse research activities and increased scientific knowledge about the park's unique biodiversity and the functioning of floodplain ecosystem. It has also supported the networking of professionals and researchers interested in conducting and maintaining research projects in the park (Appendix C - expert`s information, 2013: Theresa A. Thom). The uniqueness of the Congaree River floodplain ecosystem, available scientific database, park facilities and support, and the close location to Columbia, make Congaree NP a very attractive area for collaborative floodplain research (Thom & Shelley, 2008). To date, numerous researchers have worked at Congaree NP, with around 150 studies conducted in the period of 1991-2012 alone (NPS IAR, 2013). Research projects have included biodiversity inventories, studies on a range of plant and animal species, geomorphology, surface water and groundwater hydrology, natural history and social science work, and impacts from anthropogenic disturbances and natural catastrophic events (Thom & Shelley, 2008). Research activities in the park have utilized a variety of research tools and approaches, including GIS, modeling, field data collection, meta-analysis, and citizen science (NPS REC, 2013).

The Research and Education Center also fulfills the important role of linking science and education. The educational outreach programs offer a wide variety of educational activities and events, such as guided tours and walks, seminars, junior ranger ecology camp, citizen science programs, undergraduate field science courses,

and teacher workshops (NPS REC, 2013). The park, specifically through the Research and Education Center, contributes to education and public awareness about the importance and unique aspects of the Congaree floodplain ecosystem (Appendix C - expert`s information, 2013: Theresa A. Thom). For instance, from fall 2006 through winter 2008, the Old-Growth Bottomland Forest Research and Education Center organized more than 100 education programs in the park. Programs have targeted four audiences: (i) K-12 school programs, including nature walks, a standards-based science lesson, and a standards-based art lesson; (ii) citizen science programs, which have provided training and tools to volunteers interested in helping with data collection; (iii) university-level programs, which have focused on resource management issues as well as field-experiences in geology, geomorphology, and geo-hydrology; and (iv) professional programs, which have focused on sharing data with educators, scientists, and resource managers. In the same period, the Center has also developed partnerships with the Columbia Museum of Art, the University of South Carolina, and Richland School Districts One and Two (Shelley & Thom, 2008).

From 2009 through 2012, the Center organized roughly 600 educational programs reaching over 8000 participants from various target audiences. Communication activities involved a wide range of educational programs, such as public programs, citizen science programs, standard-based programs, and technical programs (Thom et al., 2009; Thom & Shelley, 2010; Thom and Shelley, 2011; Shelley et al., 2012). In addition, the Center has been helping in integrating results of scientific research into

the adaptive and effective management and conservation of the park`s natural resources (experts` information, 2013: Theresa A. Thom & Rebecca R. Sharitz).

Through research and outreach programs, Congaree NP will continue to gain more scientific knowledge about the park and educate diverse civil-society groups and young people about the national park and its resources. Through further development of partnership and cooperation with universities, government agencies and public organizations, the park will explore more opportunities for science and science-based education.

5.3.5 CULTURAL, HISTORICAL AND SPIRITUAL VALUE

The historical and cultural significance of the park is inherited in its name - Congaree, which was the name of the Native Americans occupying the area of the park before the arrival of Anglo-Americans. From colonial times, Anglo-Americans referred to the area that includes the park territory as the Congaree (Graf, 2003). As for the etymology of the "Congaree", the Catawba translation of this world is said to be "river deep", and it is from the Indian tribe that the river got its name (Hardy, 2008).

ARCHEOLOGICAL WORK: The history of the park area is preserved in its archaeological evidence. Due to the floodplain bottomland environment and relatively frequent flooding events, the Congaree area demanded specific adaptive behavior in terms of resource utilization and extraction and allowed only limited human activities. Historically, exploitation and utilization of the resources have always been focused on short-term habitation and limited activities, which include the extraction of biological resources, cultivation and livestock raising (Michie, 1980).

The first archeological survey in Congaree Swamp National Monument was conducted from November 1978 to July 1979 by archeologists led by James L. Michie, of the University of South Carolina. Only about 10% of the park's original 15,000 acres were covered by this survey, and the majority of the park has not been widely sampled for its archeological significance (CNP RMP, 2004). The Michie survey was followed by several small-scale field archeological investigations of the park area and a theoretical overview and inspections of available documentations and archeological facts (Hardy, 2008).

As a result of the Michie survey, twenty-one archeological sites - twelve prehistoric and nine historic - were identified. According to the final report, the prehistoric archeological sites are limited in number, small in size, and represented by only a few lithic items and occasional pottery sherds. The prehistoric occupations appear relatively smaller since only one large base camp is known to exist in the park area, and activities were associated with stock raising and the cultivation of row crops. The historic sites discovered in the park - cattle mounts, dikes, whiskey stills, earthen bridge abutments and large cypress trees with ax marks - are demonstrations of environmental adaptation. Based on the historic portions of the archeological findings, environmental utilization appears to have involved occasional cultivation, cattle raising, timber removal, and the infrequent manufacture of illegal whiskey.

Two dike systems, one complete and the other unfinished, illustrate efforts of flood control to facilitate cultivation of crops. A number of elevated earthen structures - cattle mounts - provided refuge for livestock during flood events. Several large cypress

trees with ax marks demonstrate that timbering was performed during floods in order to fell trees and allow them to float downstream to sawmills. The earthen bridge abutments prove that there was also an apparent attempt at building a road through the swampy areas (Michie, 1980). Seven historical sites – four cattle mounts, two dike systems and a site of bridge abutments, discovered by Michie`s team were considered as historically significant and they were listed as "classified structures" in the National Register of Historic Places and regulated under the National Historic Preservation Act (1966) and Executive Order 11593 about Protection and Enhancement of the Cultural Environment (1971) (CNP RMP, 2004).

The investigations that have been conducted following Michie's survey have identified eight additional archeological sites within the park's boundaries. Three Cattle Mount sites were considered as historically significant and listed as "classified structures" in the National Register of Historic Places (Hardy, 2008). All ten archeological sites (Figure 5.5) discovered within the boundaries of Congaree NP and listed in the National Register of Historic Places have the potential to educate the public about past life styles and raise an awareness of historic events and the cultural heritage of South Carolina (Michie,1980; CNP RMP, 2004).

The primary repositories of documents and materials from archeological projects conducted at Congaree NP are at the park itself and at the NPS Southeast Archeological Center in Tallahassee, Florida. Additionally, archival materials related to the history of Congaree are kept at the South Caroliniana Library, the University of South Carolina, and the South Carolina Department of Archives (Hardy, 2008).

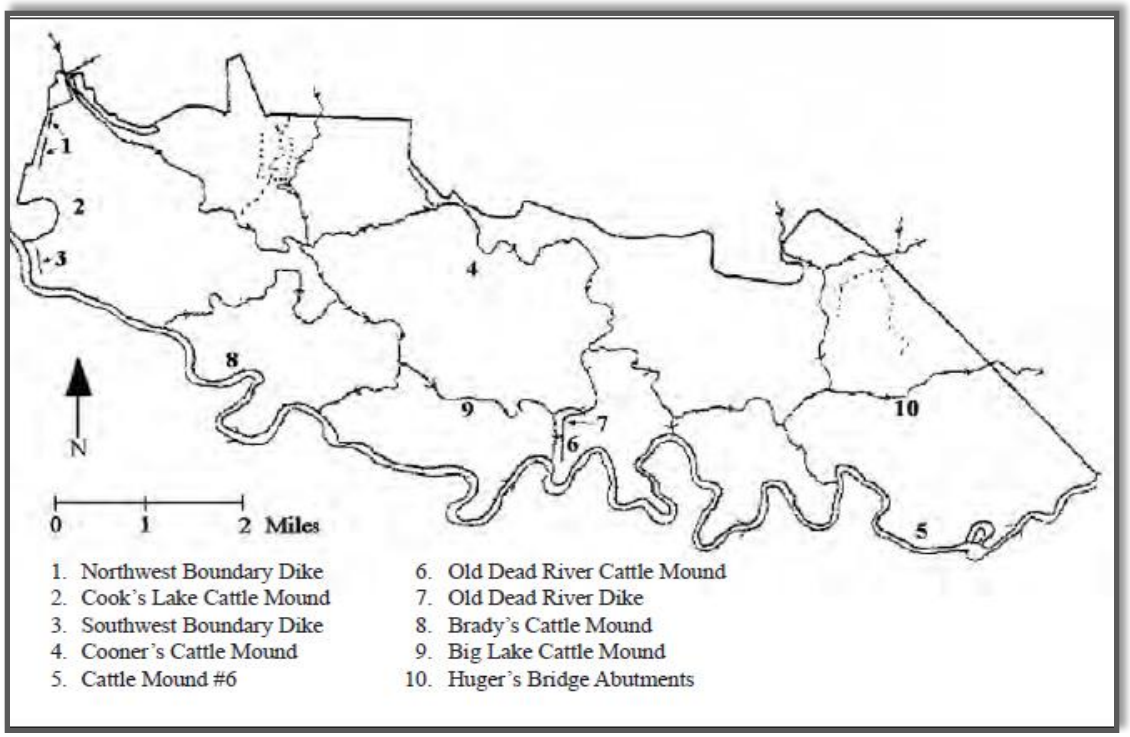

Figure 5.5: Archeological sites listed as "classified structures" in the National Register of Historic Places *(source: Hardy, 2008)*

ETHNO-CULTURAL AND SPIRITUAL CONTEXT: Limited historical research of ethno-cultural traditions and folklore shows that the Congaree area had been part of the Lower Richland County community's culture and life-style, but at the same time, it had been a space of danger and violence (Almlie, 2010). The book *Tales of Congaree* by Edward C.L**.** Adams (1987) compiles stories and shows historical and cultural aspects of the life styles of African-American communities in the surroundings of Congaree NP. This book reproduces Adams's major works, *Congaree Sketches* (1927) and *Nigger to Nigger* (1928), two collections of tales, poems, and dialogues from African-Americans. The short stories of local African-American folklore, collected and retold by Adams, give the first feeling about the local African-Americans' attitude and relations to the area and demonstrate their fishing and hunting traditions as well as food gathering activities

(Adams, 1987; Almlie, 2010). In his book, Adams used real place names for the stories, some of which possibly refer to places within the park. Although the book *Tales of Congaree* is an invaluable ethnographic resource, its purpose and scope are limited. It is not thorough and does not encompass the whole horizon of the historical and cultural life style of Congaree people (Hardy, 2008).

There is very limited research about the significance of Congaree NP for present local communities, especially in terms of cultural and spiritual aspects. Local churches used to conduct baptisms in Cedar Creek located within the park area (Appendix C – expert`s information, 2013: Lauren Gurniewicz). The current spiritual value of this creek, however, is not known.

EARLY EXPLORATION, COLONIAL EXPANSION, AND PRE-1865 HISTORY: Many historians - Charles M. Hudson, Chester B. DePratter, George C. Rogers, and others - have dedicated their research to identifying pathways and understanding the interrelated routes of Spanish expeditions throughout the Southeast. It has been proposed that routes of expeditions by Hernando De Soto in 1540 and Juan Pardo in 1566 partially paralleled each other. In the 1540s, the Hernando De Soto expedition discovered a province or village named Cofitachequi, which was frequently referred to in Spanish and English documents for two centuries. In the 1680s, any information about Cofitachequi ceased without explanations (Waddell, 2005). DePratter (1989) and Hudson et al. (1984) tracked Juan Pardo`s 1566 expedition and assumed that the main town of Cofitachequi was the village of Cofitachequi encountered by Hernando de Soto in 1540. The

southernmost town Cofitachequi, discovered by De Soto in 1540, was reportedly at the confluence of the Congaree and Wateree Rivers (Hardy, 2008).

Following colonization by Europeans, the area that Congaree NP now encompasses served as a gateway for colonial expansion from coastal areas into the interior of the southern Piedmont in the early 1700s. During that period, two important ferry crossings - Huger's Ferry and McCord's Ferry – were located here. This area and the Congaree River served as a main artery for development and trade networking with Europeans (Graf, 2003; CNP RMP, 2004).

There is some, though relatively limited, evidence of the importance of the park area during the American Revolutionary War (1775–1783) and the Civil War (1861-1865) periods. During the Revolutionary War British troops used the swamp areas for changing locations, moving along roads across swamps within the Congaree and across the Congaree River by ferry. There was not much activity within the park area during the Civil War, although it has been proposed that the park territory may have been used as a refuge for runaway slaves (CNP RMP, 2004; Hardy, 2008).

HISTORY OF PARK CREATION: In addition to the cultural and historical values of Congaree NP itself, the park's creation provides a success story for the environmental movement of the 1970's. This part of the section is mainly based on the publication "Congaree Swamp: Greatest Unprotected Forest on the Continent" published by the Sierra Club in close cooperation with the South Carolina Environmental Coalition and Congaree Swamp National Association in 1975. This publication compiles reports and

articles about the Congaree ecosystem as well as stories about advocacy and lobbying work organized by various environmentalists and conservation organizations.

The earliest movement to preserve the Congaree Swamp came in the 1950s from Harry R.E. Hampton, who was a spokesman for the environment for over 45 years. Using his position of Associate Editor at *The State* newspaper in Columbia, SC, his column "Wood and Waters" appeared regularly in the newspaper from 1930 to 1964. As he wrote in his article "Efforts for Congaree: Part I, 1953-1967", initial reactions to preserve the Beidler portion of the Congaree Swamp were met with mixed emotions. Hampton therefore began writing to various conservation organizations and government officials to discuss ways for preservation of the Beidler Tract as public land. In 1959, representatives from the southeastern office of the National Park Service answered the appeals and decided to conduct a suitability study of the Swamp. The study report was published in 1963 and concluded that "a rare remnant" of what was once typical of southern river bottomlands, the Congaree is a "remarkable ecological story deserving protection by the National Park Service" (Sierra Club, 1975: 55).

The idea of preserving Congaree Swamp received interest from many environmentalists and conservation organizations, and they became actively involved in lobbying and advocacy actions and negotiations with the Beidler family. At that time, the family owned 100,000 acres of bottomland hardwood forest and swampland throughout South Carolina, including Congaree Swamp. In 1898 Beidler began logging the massive cypress trees, but due to its unprofitability, logging ceased in 1914, although the Beidler family retained the ownership (Sierra Club, 1975).

From 1960-1975, the proposed protected area was studied by scientists associated with organizations such as the Charleston Museum, the University of South Carolina, and the Nature Conservancy. Despite ongoing active advocacy work, timber cutting was resumed in 1969. It became clear that the Congaree Swamp was in danger of being cleared if immediate action was not taken and that success in preserving the area could only be obtained through a massive demonstration of public support. However, wider public awareness about the significance of Congaree preservation was very limited (Sierra Club, 1975).

In 1972, the Congaree Swamp National Preserve Association (CSNPA), with a close partnership to the local chapter of the Sierra Club, formed and launched a public awareness campaign that included news and magazine articles, brochures, a slide show, appeals to political representatives, a rally in the state capitol, and tours for small groups of potential supporters to see the unique proposed area in person. By the time the issue reached Congress, the CSNPA could call on the support of leaders of major conservation and environmental organizations on local, regional, and national levels, including the Sierra Club, the Wilderness Society, the National Audubon Society, the National Parks and Conservation Association, the National Wildlife Federation, Friends of the Earth, and the League of Women Voters. On September 20, 1975, CSNPA held a "Congaree Action Now!" rally in Columbia, where about 700 people gathered to support environmentalists and researchers and speak in favor of preservation (Almlie, 2010; Sierra Club, 1975).

On October 18, 1976, Congaree Swamp National Monument, which included the Beidler tract, was authorized by Public Law 94-545 (H.R. 11891--94th Congress, 1976). In 2003, Congaree Swamp National Monument was expanded and recognized as the nation's 57th National Park by Public Law 108-108 (S. 1313--108th Congress, 2003).

5.3.6 MANAGEMENT VALUE

Congaree NP provides permanent and seasonal jobs and internship opportunities. This value is directly linked to the official existence and management of Congaree NP unit as such. In response to budget increases, the park has increased its staff over the last decade, growing from approximately eight full time staff to about 20 full time staff from 2002 through 2012. The park also annually provides a number of seasonal jobs as well as opportunities for interns and funding for university students to conduct research (Appendix C - experts` information, 2013: Tracy Swartout & Terri Hogan). According to the 2011 economic impact study, the park employed 24 people in FY 2010, with a total payroll including benefits of US$ 1.4 million. Including secondary effects, the local impacts of the park payroll in FY 2010 were $750,000 in sales, supporting 31 jobs, US$ 1.6 million in labor income, and US$ 1.8 million in value added (Cook, 2013).

CHAPTER 6

GUIDANCE TOWARDS ECONOMIC VALUATION OF CONGAREE NATONAL PARK

6.1 INTRODUCTION

This chapter provides initial recommendations for research on economic valuation associated with the following identified values of Congaree NP: (i) biodiversity conservation value; (ii) recreational value; (iii) science, knowledge and educational value; (iv) cultural, historical and spiritual value; (v) climate regulation value; (vi) flood storage and control value; and (vii) water quality protection value. I briefly discuss the types of values and the main valuation methods that could be applied to estimate these identified values of the park. I also recommend additional resources for valuation principles and techniques with case studies throughout the world.

6.2 TYPES OF VALUES AND VALUATION METHODS

6.2.1 TYPES OF VALUES

Total Economic Value (TEV) refers to the sum of all the potential benefits of an ecosystem. When attempting to estimate the value of ecosystem services it is often useful to sub-divide the TEV into 'use values' and 'non-use values', which are further divided into additional subcategories (Figure 6.1) (DEFRA, 2007).

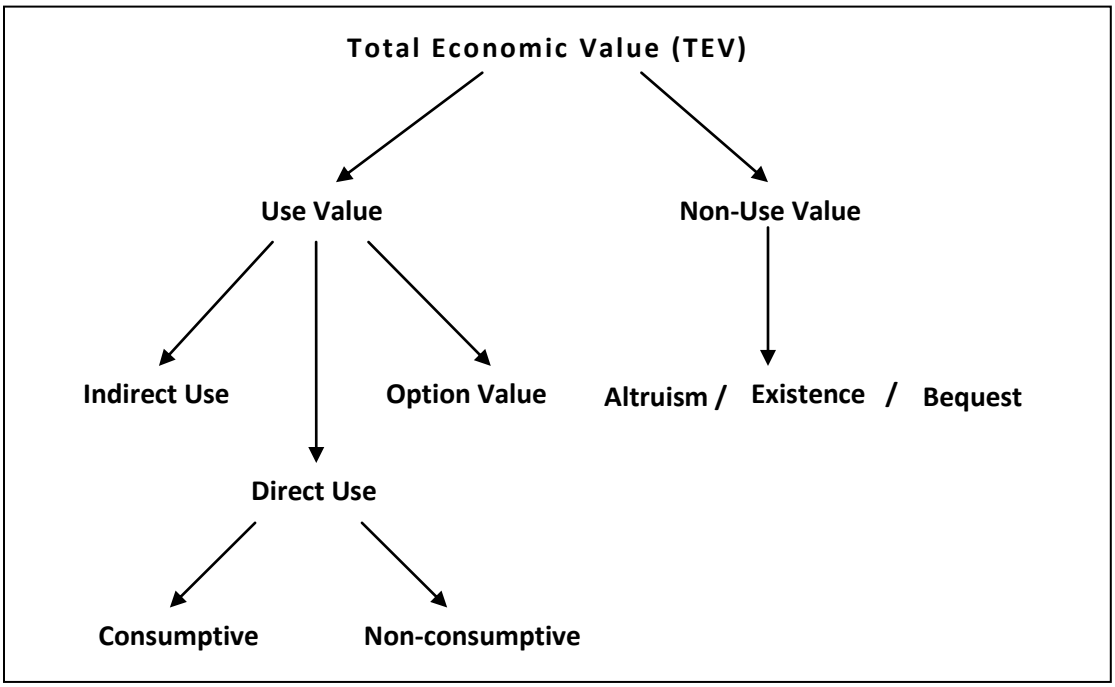

Figure 6.1: Total Economic Value Framework *(source: adapted from DEFRA, 2007)*

USE VALUES: Use values include direct use, indirect use and option values (Pabon-Zamora et al., 2008; DEFRA, 2007). These can be defined as:

- ❒ Direct Use Value: This includes ecosystem goods and services that are used directly and support human life and daily being. These values can be (i) consumptive, for example, those associated with fisheries, forestry, potable water, and the collection of food and medicinal products, or (ii) non-consumptive, including tourism as well as other recreational and cultural uses.
- ❒ Indirect Use Value: These values include ecosystem services that provide indirect benefits to people, such as climate change mitigation, carbon sequestration, soil stabilization, wildlife habitats protection, water quality and quantity, and natural disaster mitigation.

- ❒ Option Value: This is the value that people place on having the option to use a resource in the future, even if they are not using it currently. These future uses can be both direct and indirect. In the case of protected areas, an example would be a national park where people who currently do not visit it may still be willing to pay something in order to keep the park for future generations. From the perspective of ecosystem services, option value describes the value placed on maintaining ecosystems for possible future uses, some of which may not yet be known.

NON-USE VALUES: Non-use values are derived from the existing knowledge that nature is maintained and does not concern the use, either direct or indirect, of the environment, its resources or services (DEFRA, 2007). Such values include bequest, altruistic and existence values that can be defined as:

- ❒ Bequest Value: People attach value from the fact that the ecosystem resource will be passed on to future generations.
- ❒ Altruistic Value: People attach values to the availability of the ecosystem resource to others in the current generation.
- ❒ Existence Value: People are willing to pay for the existence of an ecosystem resource, even though they do not have actual or planned use of it.

6.2.2 VALUATION METHODS

Methods used for valuation of ecosystem services can be divided into three broad groups: (i) Direct Market Price Method; (ii) Revealed Preference Methods; and (iii)

Stated Preference Methods (Berck & Helfand, 2011; DEFRA, 2007; IUCN, 1998; Groot et al., 2006; Pabon-Zamora et al., 2008). These are discussed below.

DIRECT MARKET PRICE METHOD: This method is based on real market prices of environmental goods and services and applies to ecosystem services in trade. It is mainly applicable to production functions, but also possible to use for recreation value and regulating values (e.g., water regulation services). Because most ecosystem services have no direct presence in the economy and protected area services are often not traded in markets, this method is limited to those ecosystem services for which markets do exist.

REVEALED PREFERENCE METHODS: These methods assess actual consumer or producer behavior to identify the value of non-marketed goods through studying complementary or surrogate markets. Under this group a variety of methods exist including replacement cost, cost avoidance, production function, hedonic pricing, travel cost, and averting behavior.

- ❒ Replacement Cost Method: This method measures how much it would cost to replace the value of a target area if it were damaged. For example, the value of a wetland that acts to purify water can be estimated as the cost of constructing and operating an artificial water treatment plant of a similar capacity. A limitation to this method is that it is useful for valuing only those ecosystem services that have man-made or artificial equivalents. Also, this method may overestimate value if society is not ready to pay for human-made replacement

and may underestimate value if human-made replacement does not provide all environmental benefits.

- ❒ Cost Avoidance Method: This method examines costs avoided by the presence of an ecological feature or service. For example, if we lose wetlands and their flood damage reduction benefit, we may have to invest in levees or other man-made constructions to avoid the possible damage. If instead we protect the wetlands, we avoid the costs associated with built infrastructure alternatives. The limitation of this method is that it is difficult to properly define damage levels to ecosystem services. In most cases estimates of damages avoided remain hypothetical.
- ❒ Production Function Method: This method values ecosystem services that serve as inputs in the production of marketed products. For example, a protected forest area is being considered for a clear-cutting operation. As it stands, the forest provides a service to farmers downstream by keeping the river from siltation. The method can measure the current level of productivity, estimate its level after the clear-cutting, and calculate the difference between these levels to derive the loss in production. This loss is a value of the healthy functioning protected area before the negative impact. The limitation of the method is that it is technically difficult or infeasible due to high data input requirements. Also, some data on changes in services and the impact on production are often missing.

- ❒ Hedonic Pricing Method: This method examines prices that people pay for things associated with an environmental component or attribute. For example, when people purchase a home near a pleasing environment, the home price directly reflects the value of that environmental attribute. Hedonic pricing can be used to value environmental damages and their effects on property values, but this method is limited to services related to property and often requires high data input.
- ❒ Travel Cost Method: This method examines the costs paid by people for visiting the protected area through observing the travel distance and related travel costs, and frequency of visits. This method is hard to apply when travel includes multiple destinations.
- ❒ Averting Behavior Method: This method estimates the willingness of people to pay to protect themselves from health risks and environmental risks and damages. It analyses individual or household spending for risk reduction to estimate the value of environmental improvements to the households. This method requires high data input and often expensive to implement.

STATED PREFERENCE METHODS: These methods mainly use surveys to ask people to state their preferences in relation to the provision of environmental goods or services, which is then used to estimate the value. This group includes the contingent valuation and conjoint analysis methods.

- ❒ Contingent Valuation Method: This method generally estimates non-use values, but it potentially can be used to estimate use values as well. It is based on

surveys which ask people questions to identify what they are willing to pay for the good or willing to accept for the loss of the good. The Contingent Valuation Method is very practical since it can estimate values where markets do not exist or where market substitutes cannot be found. For these reasons, this method is widely used to measure existence values, option values, indirect use values and non-use values. However this method has some disadvantages, such as bias in responses, reliability of answers, and the hypothetical nature of the market.

- ❒ Conjoint Analysis Method / Choice Modeling Method: This method also uses a survey-based approach. It gives an opportunity for people to choose among several scenarios which differ in characteristics or attributes. It is increasingly used in valuation cases where researchers want to understand the tradeoffs people might make among different attributes. This method has similar disadvantages to those involved in the Contingent Valuation Method.

VALUE TRANSFER: In addition to the above discussed valuation methods, the "value transfer" approach involves estimating the value of ecosystem services at one location based on the results of valuation studies of services at other locations through transferring values from one site to another. It was developed for situations when the time, human, and financial resources for primary data collection and analysis are limited. A number of requirements need to be met in order to apply to this approach: (I) the value from the "original" area must be theoretically and methodologically valid; (ii) environmental characteristics and the populations in the original and study areas need to be similar; and (iii) the distribution of property rights and other institutions must be

similar across sites. The accuracy of "value transfer" becomes questionable if any of these conditions are not satisfied (Groot et al., 2006; Beukering et al., 2007).

6.3 KEYS TOWARDS THE VALUATION OF CONGAREE NATIONAL PARK

Identification of a potential Total Economic Value of Congaree NP is the first recommended step towards initiation of the economic valuation of park ecosystem services. The research identifies the potential Total Economic Value for Congaree NP (Figure 6.2).

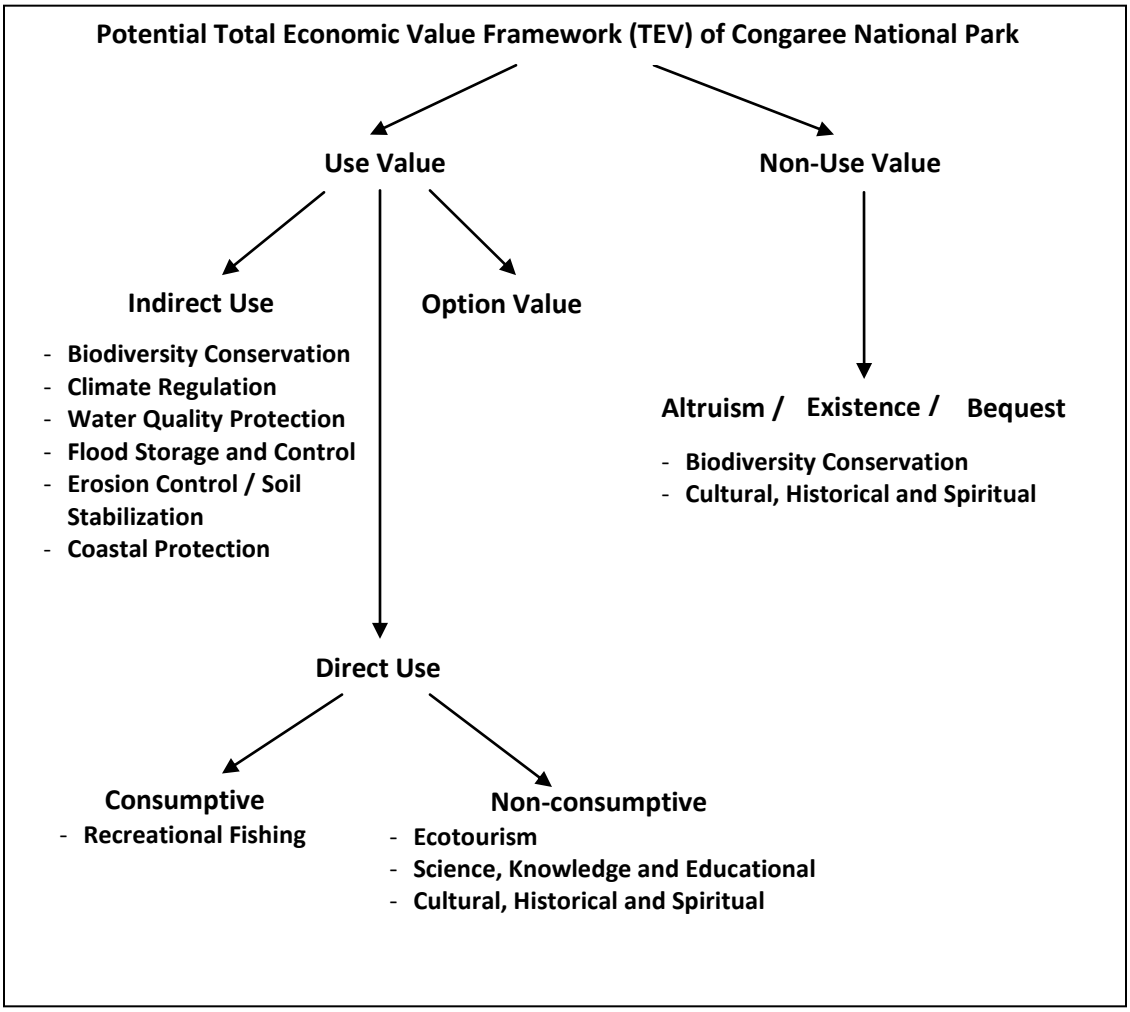

Figure 6.2: Potential Total Economic Value Framework of Congaree NP ***(source: adapted from DEFRA, 2007 & Barbier, 2000)***

To value ecosystem services, a good understanding of ecological processes and those services is required. Also, the appropriate environmental, social, and economic data are key baseline components for the valuation. The lack of adequate data often causes underestimation or overestimation of provided services. Suitable ecological knowledge and understanding coupled with availability of data are prerequisites for high quality valuations of ecosystem services (Hawkins, 2003). At the broader scale there are three main types of data that are used during valuation: (a) local social, environmental and economic information that can be found through actual local field-surveys and research, government statistics, and private and scientific sources; (b) market prices data that can be found from private sector sources, government statistics or international organizations; and (c) preference data that are generated by asking people through questionnaire surveys (Beukering et al., 2007).

Different valuation methods can be used for valuation of each ecosystem service. The final decision on whether to apply all possible methods, some of them, or just one, depends on several factors such as (i) a scale of valuation; (ii) a specific goal and subject of the study; (iii) availability of appropriate data for projected applicable valuation method(s); (iv) available financial and human resources; and (v) the time-frame for the valuation. Considering all these factors, it is possible to decide which method(s) is (are) most appropriate for each value (Beukering et al., 2007).

Based on the surveys conducted for this work and the literature analysis, this research attempts to determine applicable methods for the valuation of seven identified values / ecosystem services of Congaree NP which are proposed for further economic

valuation (Table 6.1) (Berck & Helfand, 2011; Pabon-Zamora et al., 2008; Hawkins, 2003; & DEFRA, 2007).

Table 6.1: Values / Ecosystem Services of Congaree NP for further Economic Valuation

#	Values / Ecosystem Services of Congaree NP for further Economic Valuation	Category / Type of Values	Applicable Methods for Valuation
1	Biodiversity Conservation Value - The largest Intact Stand of Old-growth Bottomland Hardwood Forest - Nursery and Refugium Provision - Habitat Provision - Champion Trees and Tallest Canopy - Endangered and Threatened Species	Indirect use Existence value	Production Function Direct Market Price Contingent Valuation Conjoint Analysis
2	Recreational Value - Hiking - Primitive camping - Bird watching - Picnicking - Canoeing and Kayaking	Direct non-consumptive use	Travel Costs Contingent Valuation
	- Recreational Fishing	Direct consumptive use	
3	Science, Knowledge and Educational Value - The Old-Growth Bottomland Forest Research and Education Center - Diverse and intense research activities - Network of professionals and researchers - Available database of conducted scientific research - Diverse educational outreach programs: ranger-guided tours/walks, seminars and teachers workshops, junior ranger ecology camp, citizen science programs, and undergraduate field science courses	Direct non-consumptive use	Travel Costs Contingent Valuation Conjoint analysis
4	Cultural, Historical and Spiritual Value - Prehistoric and historic archeological sites: lithic items and occasional pottery sherds, cattle mounts, dikes, whiskey stills, earthen bridge	Direct non-consumptive use Existence value	Contingent Valuation Conjoint Analysis

	abutments and large cypress trees with ax marks - Ethno-cultural traditions related to the park - Spiritual aspects linked to the park - A role of the park area in early exploration, colonial expansion and pre-1865 history		
5	Climate Regulation Value - Carbon sequestration - Local climate regulation	Indirect use	Direct Market Price Contingent Valuation
6	Water Quality Protection Value - Catch basin for sediments, excess nutrients, and other chemical contaminants - Transformation of nutrients	Indirect use	Replacement Cost Direct Market Contingent Valuation Conjoint Analysis
7	Flood Storage and Control Value - Capacity to store large amounts of flood water - Complex web of water channels	Indirect use	Cost Avoidance Replacement Cost Contingent Valuation Conjoint Analysis

The methods recommended for valuation of values / ecosystem services of Congaree NP are briefly discussed below by each value:

- ❒ Biodiversity Conservation Value: The Direct Market Method or the Production Function Method coupled with either the Contingent Valuation Method or the Conjoint Analysis Method are recommended for the valuation of biodiversity conservation value. The Production Function Method has substantial data requirements which often are difficult to obtain. It should be considered as less relevant in the context of Congaree NP if the necessary expertise and all required data are not available. Application of Contingent Valuation or Conjoint Analysis will support the evaluation of biodiversity conservation value, focusing on the

largest intact stand of old-growth bottomland hardwood forest, habitat provision, nursery and refugium provision, champion trees, and endangered and threatened species.

- ❒ Recreational Value: The Travel Cost and Contingent Valuation Methods are recommended for assessing recreational value of the park. The Travel Cost Method can be applied to valuation of both tourism and recreational fishing. As discussed in chapter 5 (section 5.3.3 – Recreational Values), studies of the annual impact of tourism on the local economy were carried out for Congaree NP in 2005 and 2011 through application of the MGM2 model, which uses protected area-related expenditures and is mainly based on the Travel Cost Method. Additionally, the Contingent Valuation Method would more thoroughly cover recreational fishing. As it was revealed through this research, recreational fishing is popular at Congaree NP, but it has not been studied, and no comprehensive data are available to analyze its trends over the years. Background information about recreational fishing, including data about the number of visitors involved in recreational fishing, their place of residence, and the most often caught species, would support an economic estimation of this value.
- ❒ Science, Knowledge and Educational Value: Application of two methodologies is recommended – The Travel Cost Method coupled with either the Contingent Valuation Method or the Conjoint Analysis Method. From these last two methods, application of the Contingent Valuation Method is primarily recommended. Through the Travel Cost Method it is possible to examine the

costs paid by stakeholders for visiting Congaree NP for science and educational purposes. For application of the Contingent Valuation Method, a specifically designed survey needs to be developed which will attempt to identify stakeholders` willing to pay for the science, knowledge and educational value of the park. There are several options for the questionnaire format to reveal the price stakeholders place on this value, but the final decision would need to be made at a study design level. Application of the Conjoint Analysis Method also requires development of the special survey which gives an opportunity to stakeholders to choose among proposed several alternatives related to this value. While application of both methods, selection of the right audience, and development of appropriate survey questions are key components for proper assessment of the science, knowledge and educational value. However, there are still some biases associated with these two valuation methods, such as sampling approach, understanding of the value by stakeholders, reliability of answers, and hypothetical nature of the market for this particular value. For additional consideration, the information about: (i) the extent of scientific research and the application of their results in practice, if any; (ii) the number of target audiences reached through educational programs; and (iii) the extent of partnership and cooperation with other governmental, scientific and civil-society groups will be useful. All this information is available at the Old-Growth Bottomland Forest Research and Education Center of Congaree NP.

- ❒ Cultural, Historical and Spiritual Value: The Contingent Valuation Method is primarily recommended to apply. Information discussed about the Contingent Valuation and Conjoint Analysis Methods above applies to the cultural, historical and spiritual value of the park as well.
- ❒ Climate Regulation: The Direct Market Price Method is primarily recommended to apply for assessing climate regulation value. However there is a lack of information about the carbon sequestration capacity of Congaree NP, and extensive research is needed to fill this scientific knowledge gap and to initiate the valuation process. Also, data from the carbon market are required. The Contingent Valuation Method can be considered as a supplementary approach or alternative method in case the carbon stock data within the park will not be available.
- ❒ Water Quality Protection: The Replacement Cost Method or the Direct Market Method is recommended to apply. Application of these valuation methods requires a large input of hydrological data such as: (i) a volume of water inflow and outflow to quantify the quantity of water stored and the quantity of water purified; (ii) water-resource use practices and extent downstream; (iii) the water quality data within and surrounding of the park, especially before entering the park and after leaving the park; (iv) market price of residential water supply; and (v) the cost of constructing and operating an artificial water treatment plant of a similar capacity. There is a lack of required information, and extensive research is needed to fill this scientific knowledge gap and to initiate the valuation process.

However, some hydrological and water quality data available from the U.S. Geological Survey, the SC Department of Health and Environmental Control, and the National Park Service, can support filling the existing information gap to some extent. In addition, the Contingent Valuation Method or the Conjoint Analysis Method can be considered as a supplementary approach to one of the above proposed methods.

- ❒ Flood Storage and Control: The Replacement Cost Method or the Cost Avoidance Method is recommended to apply, although the former is perhaps more applicable for Congaree NP. Data required for application of the Replacement Cost Method involves (i) the water storage capacity of the park and (ii) the cost of constructing and operating a dam or an artificial levee of a similar capacity. The Cost Avoidance Method involves obtaining information on the likelihood of a damaging event occurring and the extent of damage under different scenarios of ecosystem loss. It is also necessary to identify the infrastructure, properties, or human population that would be affected and costs of properties to be affected (Beukering et al., 2007), which will be difficult in the context of Congaree NP. In addition, the Contingent Valuation Method or the Conjoint Analysis Method can be considered as a supplementary approach to one of the above proposed methods.

The above discussion shows that there are gaps in knowledge and data needed for valuation of some ecosystem services of Congaree NP. These gaps need to be filled to be able to carry out the economic valuation. There are four main approaches to

obtaining required baseline environmental, social and economic data (Milanese et al., 2011) and to fill these gaps: (i) conduct ecological field research and computer modeling and simulation; (ii) find and analyze existing data from governmental, private and non-governmental organizations; (iii) find the relevant market prices to define costs for possible alternatives of ecosystem services; and (iv) conduct the stated-preference, and if applicable, other surveys as well, to get appropriate feedback and data from key stakeholders.

Valuation of all proposed values and benefits of Congaree NP in the short term would be a complex challenge and very expensive. Initially, it would be recommended to start with valuation of the primary significant ecosystem services that give the most tangible benefits to society, and at the same time facilitate conservation measures and adaptive management for long-term sustainability of the Congaree ecosystem. From this perspective it would be appropriate to start with valuation of water resources, in particular to attempt valuation of water storage and quality protection service provided by the park. Development of a valuation framework for this particular value will be very helpful. This framework should clearly define an entire scope of the work and cover key components such as the time-frame for the valuation, required financial and human resources, knowledge and information gap, possibilities to fill the gap, and key partner organizations and other key stakeholders to be involved in the valuation process.

The following key literature is recommended to have more comprehensive, specific and detailed information on the valuation of ecosystem services (Table 6.2). In particular, these sources provide detailed information about ecosystem services and

valuation techniques and methods. These sources discuss advantages and limitations of applied valuation methods as well as uncertainties associated with them. They also share valuation case-studies from different parts of the world.

Table 6.2: Recommended Literature and Additional Sources

#	Recommended Literature	Contextual Brief
1	National Research Council of the National Academies. (2004). Valuing Ecosystem Services Toward Better Environmental Decision-Making. The National Academies Press. Washington, DC.	Introduction of ecosystem services and valuation methods. Importance of valuation from the perspective of better environmental decision-making. A number of valuation case-studies and lessons-learned. Uncertainties in valuation of ecosystem services and future recommendations.
2	Russi D., ten Brink P., Farmer A., Badura T., Coates D., Förster J., Kumar R. and Davidson N.(2013). The Economics of Ecosystems and Biodiversity for Water and Wetlands. IEEP, London and Brussels; Ramsar Secretariat, Gland.	Introduction of critical water-related ecosystem services and the wider services from wetlands, in order to encourage additional policy momentum, business commitment, and investment in the conservation, restoration, and wise use of wetlands.
3	Groot, R., Stuip, M., Finlayson, M., and Stuip, M. (2006). Valuing Wetlands: Guidance for Valuing the Benefits Derived from Wetland Ecosystem Services. Ramsar Technical Report No. 3. CBD Technical Series No. 27.	Description of a whole process of wetlands valuation: policy analysis, stakeholder analysis and involvement, wetlands inventory, and valuation methods.
4	International Union for Nature Conservation (IUCN). (1998). Economic Values of Protected Areas: Guidelines for Protected Area Managers. Gland,Switzerland & Cambridge, UK.	Introduction of protected areas values and valuation method. Case-studies demonstrating application of different methods for valuation of ecosystem services provided protected areas.
5	Murray, B., Jenkins, A., Kramer, R., and Faulkner S.P. (2009). Valuing Ecosystem Services from Wetlands Restoration in the Mississippi Alluvial Valley. Ecosystem Services Series.	Detailed explanation of how different methods were applied for valuation of ecosystem services provided by restored wetlands in the Mississippi alluvial valley.
6	The Natural Capital Project http://www.naturalcapitalproject.org	For a broader perspective of nature valuation.
7	The Economics of Ecosystems and Biodiversity: www.teebweb.org	For a broader perspective of nature valuation and a large number of case-studies across the world.
8	The Environmental Valuation Reference Inventory: www.evri.ec.gc.ca	A comprehensive database for environmental valuation case-studies.

CHAPTER 7

CONCLUSIONS

Congaree National Park supports a wide range of ecosystem services that benefit civil society and contribute to quality of life well beyond the park's immediate boundaries. In particular, this research identified the following key values and benefits of the park: biodiversity conservation value; recreational value; science, knowledge and educational value; cultural, spiritual and historical value; climate regulation; water quality protection; flood storage and control; erosion control / soil stabilization; coastal protection; and management value.

Assessment of ecosystem services of protected areas has been increasingly promoted during recent years. Realizing that decisions are frequently influenced by economic considerations, the identification and demonstration of economic values of ecosystem services provided by protected areas may be the most effective way to communicate the right message to various groups of stakeholders. The valuation approach will help to increase (i) social visibility of values and benefits provided by Congaree NP, (ii) recognition of provided benefits by the public, and (iii) understanding of a real value of the park to the society.

The research proposes seven identified values and benefits for further economic assessment and provides an initial guidance towards the valuation. These values and benefits can be quantified through different valuation methods such as Production

Function, Direct Market Price, Contingent Valuation, Conjoint Analysis, Travel Costs, Cost Avoidance, and Replacement Cost. Each method has its advantages and limitations. The relevant method(s) should be carefully chosen considering key factors such as the understanding of ecological processes related to the particular value, scale and time-frame for valuation, accessibility of required data, and availability of financial and human resources.

Valuation of all proposed values and benefits of Congaree NP in the short term will be a complex challenge and very expensive. Initially, it would be recommended to start with valuation of the primary significant ecosystem services that give the most tangible benefits to society. From this perspective it would be appropriate to start with valuation of water resources to attempt valuation of water storage and quality protection service provided by the park.

Despite a lack of essential baseline ecological information and data, Congaree NP is the appropriate area to apply valuation of key ecosystem services and demonstrate the value of bottomland hardwood forest ecosystems. Key reasons for that are (i) an established partnership and cooperation with scientific institutions and individual scientists; (ii) existing facilities and resources, including the Old-Growth Bottomland Forest Research and Education Center, internship opportunities, students interested in working for Congaree NP, and volunteers; (iii) some already available background data and information; and (iv) existing valuation efforts for recreational values.

From a longer-term and larger-scale perspective, the valuation of Congaree NP gains more importance. Through application of the “value transfer” approach, it may be

possible to transfer or compare the economic value of certain ecosystem services at Congaree NP to other areas of present or former bottomland hardwood forest. This will extend the understanding and recognition of relevant values and benefits across the region.

REFERENCES

Adams, E. C. L., & O'Meally, R. G. (1987). *Tales of the Congaree*. The University of North Carolina Press.

Almlie, E. J. (2010). *Seeing history in a wilderness landscape: valuing cultural resources during the establishment of Congaree National Park, South Carolina (Master thesis).* University of South Carolina. Available from ProQuest Dissertations and Theses database. (UMI No. 1475667).

Barbier, E. B. (2000). Valuing the environment as input: review of applications to mangrove-fishery linkages. *Ecological Economics*, *35*(1), 47-61.

Berck P., & Helfand G. (2011). *The economics of the environment*. Boston, Massachusetts: Pearson Education, Inc.

Beukering, P., Brander, L., Tompkins, E., & McKenzie, E. (2007). *Valuing the environment in small islands: an environmental economics toolkit*. Peterborough, Great Britain: Joint Nature Conservation Committee.

Bronaugh, W. (2009). Congaree where the trees are still tall. *American Forests*, *115*(2), 40-45.

Byrne, M. W., & Lagana, D. M. (2009). *Live-specimen key for the mammals of Southeast Coast Network parks* (NPS/SECN/NRR—2009/122). National Park Service, Fort Collins, Colorado.

Carter, R. M. (2005). An annotated checklist of the birds of Congaree National Park. *The Chat, 69*(1), 1–28.

Clark, J. R., & Benforado, J. (Eds.). (1981). *Wetlands of bottomland hardwood forests: proceedings of a workshop on bottomland hardwood forest wetlands of the Southeastern United States*. New York: Elsevier Scientific Publishing Company.

Congaree National Park (CNP). (2004). *Resource Management Plan (RMP)*. Retrieved from Congaree National Park archive.

Convention on Biological Diversity (CBD). (2008). *Protected areas in today's world: their values and benefits for the welfare of the planet* (Technical Series No. 36). Montreal, Canada: the Secretariat of the Convention on Biological Diversity.

Cook, P. S., (2013). *Impacts of visitor spending on the local economy: Congaree National Park, 2011* (NPS/NRSS/EQD/NRR—2013/613). Retrieved from http://psu.uidaho.edu/c5/vsp/vsp-reports/

Department for Environment Food and Rural Affairs (DEFRA). (2007). *An Introductory guide to valuing ecosystem services*. London, UK: Department for Environment, Food and Rural Affairs.

Dudley, N. (Ed.). (2008). *Guidelines for applying protected area management categories*. Norwich, United Kingdom: Page Bros.

Gaddy, L.L., Nelson, J.B., & Pitman, A.B. (2000). *Endangered, Threatened, and Rare Plants of Congaree Swamp National Monument, Richland County, South Carolina*. Retrieved from Congaree National Park archive.

Graf, W. L. (2003). Testimony in Support of the Congaree National Park Act of 2003. In *Hearing before the subcommittee on national parks of the committee on energy and natural resources, United States Senate* (pp.35-38). Washington, DC: U.S. Government Printing Office.

Groot, R., Stuip, M., Finlayson, M., & Stuip, M. (2006). *Valuing wetlands: guidance for valuing the benefits derived from wetland ecosystem services* (Ramsar Technical Report No. 3. / CBD Technical Series No. 27).

Hardy, M.D. (2008). *Congaree National Park: archeological overview and assessment*. Southeastern Archeological Center. Retrieved from Congaree National Park archive.

Harris, L. D., & Gosselink, J. G. (1990). Cumulative impacts of bottomland hardwood forest conversion on hydrology, water quality, and terrestrial wildlife. In J.G. Gosselink, L.C. Lee, & T.A. Muir (Eds.), *Ecological processes and cumulative impacts illustrated by bottomland hardwood wetland ecosystems* (pp.13-86). Chelsea, Michigan: Lewis Publishers.

Hawkins, K. (2003). Economic valuation of ecosystem services. *University of Minnesota*, *23*. Retrieved from http://www.frc.state.mn.us/documents/council/landscape/SE%20Landscape/MFRC_Economic_Valuation_EcosystemServices_SE_2003-10-01_Report.pdf

H.R. 11891--94th Congress: An Act to authorize the establishment of the Congaree Swamp National Monument in the State of South Carolina, and for Other Purposes (1976). Retrieved April 20, 2013, from http://www.govtrack.us/congress/bills/94/hr11891

International Bank for Reconstruction and Development (IBRD) & the World Bank (WB). (2010). *Valuing protected areas*. Retrieved from http://www.cropwildrelatives.org/fileadmin/www.cropwildrelatives.org/documents/Valuing%20Protected%20Areas.pdf

International Union for Nature Conservation (IUCN). (1998). *Economic values of protected areas: guidelines for protected area managers*. Norwich, United Kingdom: Page Bros.

Jette, C., Le, Y., & Hollenhorst, S. J. (2012). *Congaree National Park visitor study: winter 2012* (NPS/NRSS/EQD/NRR—2012/608). National Park Service, Fort Collins, Colorado. Retrieved from http://psu.uidaho.edu/c5/vsp/vsp-reports/

Jones, R. H. (1997). Status and habitat of big trees in Congaree Swamp National Monument. *Castanea*, *62*(1), 22-31.

Kellison, R. C., & Young, M. J. (1997). The bottomland hardwood forest of the southern United States. *Forest Ecology and Management*, *90*(2), 101-115.

King, S. L., Sharitz, R. R., Groninger, J. W., & Battaglia, L. L. (2009). The ecology, restoration, and management of southeastern floodplain ecosystems: a synthesis. *Wetlands*, *29*(2), 624-634.

Kulesza, C., Le, Y., & Hollenhorst, S. J. (2012). *Congaree National Park visitor study: spring 2011* (NPS/NRSS/EQD/NRR—2012/490). National Park Service, Fort Collins, Colorado. Retrieved from http://psu.uidaho.edu/c5/vsp/vsp-reports/

Kulesza, C., Le, Y., & Hollenhorst, S. J. (2012). *Congaree National Park visitor study: summer 2011*(NPS/NRSS/EQD/NRR—2012/565). National Park Service, Fort Collins, Colorado. Retrieved from http://psu.uidaho.edu/c5/vsp/vsp-reports/

Kupfer, J. A., Meitzen, K. M., & Pipkin, A. R. (2010). Hydrogeomorphic controls of early post-logging successional pathways in a southern floodplain forest. *Forest Ecology and Management*, *259*(10), 1880-1889.

Loeb, S. (2006). *Bat Inventories of Congaree National Park* (Technical Report on file at Congaree National Park).

Mallin, A.M., & McIver, M.R. (2010). *Assessment of water resources and watershed conditions in Congaree National Park, South Carolina* (NPS/SECN/NRR—2010/267). National Park Service, Fort Collins, Colorado.

Michie, J. L. (1980). *An archeological survey of Congaree Swamp: cultural resources inventory and assessment of a bottomland environment in central South Carolina*. Research Manuscript Series 163.

Milanese, M., Sara, A., Sara, G., & Murray, J. H. (2011). Climate change, marine policy and the valuation of Mediterranean intertidal ecosystems. *Chemistry and Ecology*, *27*(2), 95-105.

Millennium Ecosystem Assessment (MEA). (2003). *Ecosystems and human well-being: a framework for assessment*. Washington, DC: Island Press.

Mulongoy, K.J. & Gidda, S.B. (2008). *The value of nature: ecological, economic, cultural and social benefits of protected areas*. Montreal, Canada: Secretariat of the Convention on Biological Diversity.

National Park Service, Investigator`s Annual Report (NPS IAR). (2013). Retrieved from https://science.nature.nps.gov/research/ac/search/iars/IarSearch

National Park Service, Inventory and Monitoring Program (NPS IMP). (2013). Retrieved from https://irma.nps.gov/App/Species/Search

National Park Service, Public Use Statistics Office (NPS PUSO). (2013). Retrieved from http://www.nature.nps.gov/socialscience/stats.cfm

National Park Service, the Research and Education Center (NPS REC). (2013). Retrieved from http://www.nature.nps.gov/rlc/ogbfrec.cfm

National Park Service, the Visitor Services Project (NPS VSP). (2013). Retrieved from http://www.psu.uidaho.edu/

National Park Service. (2013a). Retrieved from http://www.nature.nps.gov/water/horizon.cfm

National Park Service. (2013b). Retrieved from http://www.nps.gov/cong/planyourvisit/things2do.htm

Pabon-Zamora, L., Bezaury, J., Leon, F., Gill, L., Stolton, S., Grover, A., Mitchell, S. & Dudley, N. (2008). *Valuing nature: assessing protected area benefits*. Arlington, Virginia: The Nature Conservancy.

Park Studies Unit at University of Idaho (PSU University of Idaho). (2013). Retrieved from http://www.psu.uidaho.edu/

Ricker, M. C., Lockaby, G.B., & Behnke, L.D. (2012). Belowground carbon stocks in an old-growth floodplain forest: Congaree National Park, South Carolina. In *Geological Society of America Abstracts with Programs, 44*(7), 424.

S. 1313--108th Congress: Congaree National Park Act of 2003. (2003). Retrieved April 20, 2013, from http://www.govtrack.us/congress/bills/108/s1313.

Samuelson, M., Le, Y., & Hollenhorst, S. J. (2012). *Congaree National Park visitor study: fall 2011* (NPS/NRSS/EQD/NRR—2012/607). National Park Service, Fort Collins, Colorado. Retrieved from http://psu.uidaho.edu/c5/vsp/vsp-reports/

Shelley, D.C., & Thom, T.A. (2008). Recent developments in education programs at the Old-growth Bottomland Forest Research and Education Center, Congaree National Park, SC. In *2008 Congaree National Park Research Symposium Abstracts with Programs* (p.49).

Shelley, D.C., Thom T.A., & Henning F. (2012). *Old-Growth Bottomland Forest Research and Education Center Report to Congress – FY2012*. Retrieved from Congaree National Park archive.

Sierra Club, LeConte Chapter (SC); South Carolina Environmental Coalition; Congaree Swamp National Association. (1975). *Congaree swamp: greatest unprotected forest on the continent*. Columbia, SC. Research Manuscript Series.

South Carolina Department of Health and Environmental Control (SC DHEC). (2013). Retrieved from http://www.scdhec.gov/environment/water/shed/shed.htm

Stolton, S., & Dudley, N. (2009). *The protected areas benefits assessment tool.* Gland, Switzerland: WWF International.

Stynes, D. J., (2007). *Impacts of visitor spending on the local economy: Congaree National Park, 2005.* Retrieved from http://psu.uidaho.edu/c5/vsp/vsp-reports/

Taylor, J. R., Cardamone, M. A., & Mitsch, W. J. (1990). Bottomland hardwood forests: their functions and values. In J.G. Gosselink, L.C. Lee, & T.A. Muir (Eds.), *Ecological processes and cumulative impacts illustrated by bottomland hardwood wetland ecosystems* (pp.13-86). Chelsea, Michigan: Lewis Publishers.

The Nature Conservancy (TNC). (1998*). USGS-NPS vegetation mapping program - classification of the vegetation of Congaree National Park.* Retrieved from http://www1.usgs.gov/vip/cong/congrpt.pdf

Thom, T.A., & Shelley, D. C. (2010). *Old-Growth Bottomland Forest Research and Education Center Report to Congress – FY2010*. Retrieved from Congaree National Park archive.

Thom, T.A., & Shelley, D. C. (2011). *Old-Growth Bottomland Forest Research and Education Center Report to Congress – FY2011*. Retrieved from Congaree National Park archive.

Thom, T.A., & Shelley, D.C. (2008). Floodplain research at the Old-growth Bottomland Forest Research and Education Center, Congaree National Park, SC. In *2008 Congaree National Park Research Symposium Abstracts with Programs* (p.51).

Thom, T.A., Shelley, D. C., & Hulslander, B. (2009). *Old-Growth Bottomland Forest Research and Education Center Report to Congress – FY2009*. Retrieved from Congaree National Park archive.

Tuberville, T. D., Willson, J. D., Dorcas, M. E., & Gibbons, J. W. (2005). Herpetofaunal species richness of southeastern national parks. *Southeastern Naturalist*, *4*(3), 537-569.

Turner, R. E., Forsythe, S. W., & Craig, N. J. (1981). Bottomland hardwood forest land resources of the southeastern United States. In J.R. Clark, & J. Benforado (Eds.), *Wetlands of bottomland hardwood forests: proceedings of a workshop on bottomland hardwood forest wetlands of the Southeastern United States* (pp. 13-28). New York: Elsevier Scientific Publishing Company.

UN Millennium Project. (2005). *Environment and human well-being: a practical strategy.* Report of the task force on environmental sustainability. London, United Kingdom: Earthscan.

U.S. Geological Survey, National Water Information System (USGC NWIS). (2013). Retrieved from http://waterdata.usgs.gov/sc/nwis/si

U.S. Fish and Wildlife Service (USFWS). (2013). Retrieved from http://ecos.fws.gov

Waddell, G. (2005). Cofitachequi: A distinctive culture, its identity, and its location. *Ethnohistory*, *52*(2), 333-369.

Wharton, C. H., Kitchens, W. M., Pendleton, E. C., & Sipe, T. W. (1982). *Ecology of bottomland hardwood swamps of the southeast: a community profile* (No. FWS/OBS-81/37). Fish and Wildlife Service, U.S. Department of the Interior. Lafayette, Louisiana.

World Resources Institute (WRI). (2010). *Southern forests for the future*. Retrieved from http://www.wri.org/publication/southern-forests-for-the-future

APPENDIX A: VALUE-BASED DATASHEETS

Group 1 –Nature / Biodiversity Conservation Value				
Is Congaree NP valued for its biodiversity conservation? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please provide some highlights about the biodiversity conservation value of Congaree NP *(e.g. how much it is important; is wilderness protected by the park; what unique ecosystems and biodiversity protected; who benefits):*				
Please, provide a few key literature sources (e.g. articles, reports, assessments) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or scientists with research experience at Congaree NP):*				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 2 - Management Value				
Does Congaree NP provide employment (e.g. for managers, rangers, etc.)? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please, provide some highlights about the management value / benefit of Congaree NP: *(e.g. what kinds of jobs / positions are provided; are all those jobs regular or seasonal; how many people are currently employed; any plan and / or potential to increase the employment in future; what is a general trend of employment during the last 5 years – increasing or decreasing):*				
Please, provide a few key information sources (e.g. reports, evaluations) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. from park staff):*				
Any further information, details or caveats:				
Please, indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 3 - Cultural, Historical and Spiritual Value: (1) Cultural and Historical Aspects				
Does Congaree NP have cultural and historical values (e.g. archaeological sites, historic buildings, etc..)? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please, provide some highlights about the cultural and historical value/benefit of Congaree NP *(e.g. how much it is important; what sites / areas they are; who benefits; general awareness about this value):*				
Please, provide a few key literature sources (e.g. articles, reports, assessments) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or scientists with research experience at Congaree NP):*				
Any further information, details or caveats:				
Please, indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 3 - Cultural, Historical and Spiritual Value: (2) Spiritual Aspects				
Does Congaree NP have a spiritual value (e.g. sacred natural sites, iconic sites or landscapes)*? (first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please, provide some highlights about the spiritual value /benefit of Congaree NP *(e.g. how much it is important; what sites / areas they are; who benefits; general awareness about this value):*				
Please, provide a few key literature sources (e.g. articles, reports) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or scientists with research experience at Congaree NP):*				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 4 - Recreational Value: (1) Tourism and Recreation				
Is Congaree NP important for recreation and tourism? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please provide some highlights about the recreational value/benefit of Congaree NP *(e.g. how much it is important; who benefits; does this value /benefit have a major economic importance and does it represent a source of revenue for some groups of people; is there any potential to increase the importance of recreation and tourism in future; what is the main trend in tourism during the last 5 years – increasing or decreasing):*				
Please, provide a few key literature sources (e.g. articles, reports, evaluations) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or researchers working on this issue):*				
If the economic value of this benefit has been assessed, please, indicate the US$ value and the date the assessment of value was made:				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 4 - Recreational Value: (2) Recreational Fishing				
Is Congaree NP important for recreational fishing? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please, provide some highlights about the recreational fishing value/benefit of Congaree NP *(e.g. how much it is important; who benefits; main trends in recreational fishing – increasing or decreasing):*				
Please, provide a few key literature sources (e.g. articles, reports, assessments) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff, local volunteers and/or scientists with research experience at Congaree NP):*				
If the economic value of this benefit has been assessed, please, indicate the US$ value and the date the assessment of value was made:				
Any further information, details, or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 5 – Scientific, Knowledge and Educational Value: (1) Science and Knowledge Building Aspects				
Is Congaree NP an important resource for building knowledge (e.g. through scientific researches and investigations within the park)? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please provide some highlights about the science and knowledge value / benefit of Congaree NP *(e.g. how much it is important; which kind of research is mainly conducted; how the park benefits from the research; is any payment require for scientific research, etc.)*				
Please, provide a few key literature sources (articles, reports, reviews) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or scientists with research experience at Congaree NP):*				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 5 - Scientific, Knowledge and Educational Value: (2) Educational Aspects				
Does Congaree NP contribute to education and public awareness raising (e.g. through formal and informal dissemination of information and different campaigns)? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please provide some highlights about the educational value /benefit of Congaree NP *(e.g. who conducts educational programs and campaigns; who are recipients and who benefits; which communication ways are applied, etc.)*				
Please, provide a few key literature sources (articles, reports, reviews) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff):*				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 6 - Values of Regulating Services: (1) Climate Regulation				
Does Congaree NP contribute to climate regulation? (i.e. by providing significant carbon sequestration and / or by ameliorating local climate impacts)? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please provide some highlights about the climate regulation value/benefit of Congaree NP *(e.g. how much it is important, scales of benefits, does this benefit have an economic value, etc.)*				
Please, provide a few key literature sources (articles, reports, reviews, assessments) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or scientists with research experience at Congaree NP):*				
If the economic value of this benefit has been assessed, please, indicate the US$ value and the date the assessment of value was made:				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 6 - Values of Regulating Services: (2) Flood Storage and Control				
Is Congaree NP important for flood prevention? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please provide some highlights about the flood storage and control value/benefit of Congaree NP *(e.g. how much it is important, scales of benefits, does this benefit have an economic value, etc.)*				
Please, provide a few key literature sources (articles, reports, reviews, assessments) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or scientists with research experience at Congaree NP):*				
If the economic value of this benefit has been assessed, please, indicate the US$ value and the date the assessment of value was made:				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 6 - Values of Regulating Services: (3) Water Quality Protection				
Is Congaree NP important for water quality protection (e.g. filtration, purification, groundwater renewal)? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please provide some highlights about the water quality protection value/benefit of Congaree NP *(e.g. how much it is important, scales of benefits, does this benefit have an economic value, etc.)*				
Please, provide a few key literature sources (articles, reports, reviews, assessments) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or scientists with research experience at Congaree NP):*				
If the economic value of this benefit has been assessed, please, indicate the US$ value and the date the assessment of value was made:				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 6 - Values of Regulating Services: (4) Erosion Control / Soil Stabilization				
Is Congaree NP important for erosion control / soil stabilization? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please provide some highlights about the erosion control / soil stabilization value/benefit of Congaree NP *(e.g. how much it is important, scales of benefits, does this benefit have an economic value, etc.)*				
Please, provide a few key literature sources (articles, reports, reviews, assessments) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or scientists with research experience at Congaree NP):*				
If the economic value of this benefit has been assessed, please, indicate the US$ value and the date the assessment of value was made:				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

Group 6 - Values of Regulating Services: (5) Coastal Protection				
Is Congaree NP important for coastal protection? *(first mark yes or no; if yes, complete the sections below)*	**YES**		**NO**	
Please provide some highlights about the coastal protection value/benefit of Congaree NP *(e.g. how much it is important, scales of benefits, does this benefit have an economic value, etc.)*				
Please, provide a few key literature sources (articles, reports, reviews, assessments) about this value / benefit of Congaree NP:				
Please, recommend who else can be consulted about this value / benefit of Congaree NP *(e.g. park staff and/or scientists with research experience at Congaree NP):*				
If the economic value of this benefit has been assessed, please, indicate the US$ value and the date the assessment of value was made:				
Any further information, details or caveats:				
Please indicate years of your experience working with Congaree NP:				
Your Name and Position:	**Date:**			

APPENDIX B: EXPERTS WHO CONTRIBUTED TO THE RESEARCH

#	Experts	Position	Values and Benefits addressed by Experts
Current Staff of Congaree NP			
1	David C. Shelley	Education Coordinator, Old-Growth Bottomland Forest Research and Education Center	Provided overall introduction and guidance about research work at Congaree NP. Also provided a list of research-based documentary materials corresponding to values and benefits of Congaree NP and a number of available documentary materials from Congaree NP database.
2	Terri Hogan	Chief of Integrated Resource Management	- Biodiversity Conservation Value - Management Value - Recreational Value - Values of Regulating Services: Climate Regulation, Water Quality Protection, Flood Prevention and Control, and Erosion Control / Soil Stabilization
3	Corinne Fenner	Park Ranger	- Cultural, Historical and Spiritual Value
4	Lauren Gurniewicz	Chief of Interpretation	- Cultural, Historical and Spiritual Value - Recreational Value
Former Staff of Congaree NP			
5	Tracy Swartout	Former Superintendent	- Biodiversity Conservation Value - Management Value - Cultural, Historical and Spiritual Value - Recreational Value - Science, Knowledge and Educational

			Value
6	Theresa A. Thom	Former Director of the Old-Growth Bottomland Forest Research and Education Center	- Recreational Value - Science, Knowledge and Educational Value - Values of Regulating Services: Climate Regulation, Water Quality Protection, Erosion Control / Soil Stabilization, and Coastal Protection
Scientists working on Congaree NP			
7	John A. Kupfer	Professor, Department of Geography, University of South Carolina	- Values of Regulating Services: Climate Regulation, Water Quality Protection, Flood Prevention and Control, and Erosion Control / Soil Stabilization
8	Kimberly Meitzen	Post-doctoral Associate, The Nature Conservancy North Carolina Chapter; Nicholas School of the Environment Duke University, North Carolina	- Values of Regulating Services: Climate Regulation, Water Quality Protection, Flood Prevention and Control, Erosion Control / Soil Stabilization, and Coastal Protection
9	William L. Graf	Professor, Faculty Emeritus, Department of Geography, University of South Carolina	- Values of Regulating Services: Climate Regulation and Water Quality Protection
10	Rebecca R. Sharitz	Professor, Department of Plant Biology, University of Georgia; Research ecologist at the Savannah River Ecology Laboratory	- Science, Knowledge and Educational Value - Values of Regulating Services: Climate Regulation, Water Quality Protection, and Flood Prevention and Control
11	John Grego	President, Friends of Congaree Swamp; Professor, Department of Statistics, University of South Carolina	- Cultural, Historical and Spiritual Value
12	Adam King	Research Associate Professor, the South Carolina Institute for Archaeology and Anthropology, University of South Carolina	- Cultural, Historical and Spiritual Value

APPENDIX C: QUOTES FROM EXPERTS` FEEDBACK ABOUT VALUES AND BENEFITS OF CONGAREE NP

1. Biodiversity Conservation Value
"Congaree National Park has been protected as a unit of the National Park Service to conserve its natural (and cultural) values. This park was designated as a National Monument through a grassroots preservation effort because of the remnant southeastern old-growth bottomland hardwood forest that occurs here. It was recognized by the local community and others throughout the state of South Carolina as an irreplaceable resource. The cultural uses, fishing and boating, were also recognized by the surrounding community of worthy of protection. Approximately 15,000 acres of the park are designated wilderness and approximately 6,800 acres of the park are proposed wilderness. Unique ecosystems include those associated with the near-virgin southern hardwood forest for which Congaree National Monument was initially preserved and the upland Longleaf pine community of which only 3% of the approximately 90 million acres remains on the landscape. The park protects substantial diversity. Protection of this park benefits everyone by preserving diversity, a large contiguous area of a disappearing ecosystem (old-growth bottomland hardwood forest), wetlands that provide invaluable services and benefits." *By Terri Hogan, Chief of Integrated Resource Management, Congaree NP*
"Congaree NP provides protection to nearly 27,000 acres of floodplain forest habitat, adjacent to two major rivers. Within this protected area exists significant stands of old growth bottomland hardwood forest that provide a glimpse into the kind of physical environment that once covered much of the southeastern United States. Due to its significant biodiversity, Congaree is recognized as a globally-important birding area, and the significance of its wetland areas has been recognized by the international RAMSAR Convention. Congaree NP plays an important part in the regional protection of wildlife habitat as it is but one of a network of hundreds of thousands of acres of lands along South Carolina's rivers that are protected by federal, state, local and private landowners through ownership and conservation easement in the bird migration area, known as the Atlantic Flyway. Within the park are important examples of some of the largest (state and national champion)

examples of a number of tree species. In addition, much of the park land is either designated Wilderness or proposed Wilderness, which provides an opportunity for visitors to experience "untrammeled" natural area."

By Tracy Swartout, Former Superintendent, Congaree NP

2. Recreational Value
"Congaree is incredibly important for providing a unique location for recreation and tourism, specifically because the park is open to the public 365 days a year. The boardwalk provides ADA compliant access to a unique floodplain ecosystem. Park canoe tours provide a unique low-impact way to visit the park, and the canoe trails and waterways provide a low-impact, quiet way to explore the park – there are also broader connections to other canoe trails in the state, like the Blue River Trails on the Congaree and Wateree Rivers. More than 22 miles of trail network also provide access to old-growth floodplain forest. Camping is also available, both within campsites and with backcountry camping. Overall, these opportunities create recreation and tourism opportunities that are unique compared with other parks – mainly due to limited vehicle access to the interior floodplain (there are no roads). Both day and night-time hikes and activities showcase the floodplain ecosystem. Citizen science activities (Great Backyard Bird count, Christmas Bird Count, NABA Butterfly Count, Bio Blitz events, etc.) provide recreational events that link to active research at the park, making park research more visible to the public. Special events at the park that draw visitors also incorporate local community events and celebrations that potentially benefit from increased park visitation (Swamp Fest, Kingville Reunion, etc.). " "Predominantly it is the local community that uses Congaree for recreational fishing (mainly for largemouth bass and several species of *Lepomis* = sunfish). The Congaree floodplain is important for supporting larger recreational fishing for striped bass on the mainstream of the river." "Recreational fishing hasn't been studied, but there are lots of reports and assessments on water quality and fishes." *By Dr. Theresa A. Thom, Former Director of the Old-Growth Bottomland Forest Research and Education Center, Congaree NP*
"Congaree NP provides a wilderness recreation oasis in close proximity to one of our nation's capital cities, Columbia, SC. Visitors have opportunities for hiking, camping, paddling, and sightseeing in an undeveloped bottomland hardwood forest that serves as an active floodplain. Recreation includes both guided and unguided recreational opportunities. The park's free guided canoe tours are among the park's most popular, and the evening "owl prowls" have also been highly attended for decades. Tourism and visitation to the park are increasing over the last decade, and at a greater rate since the conversion of the park from a National Monument to a National Park. " *By Tracy Swartout, Former Superintendent, Congaree NP*

2. Recreational Value
"Congaree National Park is less visited than many national parks with an estimated 120,166 visitors in 2011. However, visitation has increased by 983% since 1980. We anticipate a continuing increase in visitation over time. Congaree provides a variety of recreational opportunities: Wilderness experience within 20 miles of the state capital of South Carolina, paddling opportunities within the park including on SC's only outstanding national resource waters (Cedar Creek), hiking, birding, other nature activities, camping, guided tours on foot and by canoe. Concessionaires also conduct guided tours within the park. Congaree has two primitive campgrounds for visitors and no restaurants on site. The park likely has a positive economic impact within Richland County where Congaree is located but also the surrounding counties of Calhoun, Orangeburg, Clarendon, Sumter, and Lexington. Visitors not staying in the campgrounds seek lodging in the surrounding area, particularly in Columbia. They also eat at restaurants in the Columbia or immediate area and are more likely to visit other tourist destinations in the immediate area as a consequence." "We anticipate more opportunities for park visitors primarily interested in history and cultural resources. This will, undoubtedly, increase both the number and types of visitors in the future." About recreational fishing: "This activity is popular at Congaree. However, we have no good data on this as park visitors who come to the park to fish are dispersed throughout the park and access it from multiple access points. Some information is collected by the park's Law Enforcement Officers when they encounter individuals fishing at the park. We cannot provide trends. The majority of people who fish at the park are local citizens. Many have a long history, including family history, of fishing in the waters of Congaree. " *By Terri Hogan, Chief of Integrated Resource Management, Congaree NP*

2. Recreational Value
"Places like Congaree provide visitors with an opportunity to experience the outdoors and escape from the daily grind. It has a major economic benefit to the local area, as visitors come from all over the country and world and spend money in Richland County during their visit. There is great potential to increase the importance of recreation and tourism in the future, park visitation remains steady, but the park can do more in spreading the word about the recreational opportunities here." About recreational fishing: "The local community benefits from having a place to fish in their "backyard".... Fishing is not permitted in many national park units, so it is somewhat unique that it is permitted at Congaree." *By Lauren Gurniewicz, Chief of Interpretation, Congaree NP*

3. Science, Knowledge and Educational Value
"Research is CRITICAL for Congaree National Park. Data generated from robust research projects can inform management decision, and enhance the conservation, preservation, and restoration activities not only in the park, but within other floodplain forest ecosystems. Congaree National Park protects old-growth floodplain forest, so it serves as a baseline – useful for comparisons with other floodplain forests and river systems that are more disturbed and manipulated. Research at the park also enhances educational opportunities and overall knowledge of the park that can be shared with the local community and park staff, and park visitors. Research has played an essential role in even founding the park – mainly through original botanical surveys of the area acknowledging the botanical treasures in the area. Having a Research and Education Center (one of only 21 across the country) based at Congaree National Park has also significantly contributed to the importance of research at the park, and developing a large network of professionals interested in conducting and maintaining research projects in the park. The Center also provides a unique way of linking research and education. Citizen science programs at the park enhance visitor awareness of the importance of scientific research, but also enable visitors to participate in actual data collection. Topics of research are very diverse, but main topics include vegetation, hydrology, social science, etc. Hundreds of partners have worked at Congaree." "Fees are not charged to researchers. Many researchers have benefitted from housing provided at the park free of charge to scientists and students conducting research at the park." "Congaree National Park, specifically through the Research and Education Center, definitely contributes to education and public awareness of various aspects of river quality, quantity, floodplain dynamics, and unique aspects of the floodplain ecosystem. This is predominantly conducted through information and formal educational activities and events." *By Dr. Theresa A. Thom, Former Director of the Old-Growth Bottomland Forest Research and Education Center, Congaree NP*

3. Science, Knowledge and Educational Value
"The Congaree NP is one of the finest (if not the very finest) remaining example of old-growth bottomland forest in the US. Numerous studies in the last 20 or so years have examined recovery of the forest following Hurricane Hugo in 1989, as well as examining other aspects of the ecology of this forest. Several Ph.D. students have conducted their graduate research there." "The Park benefits from such research in applying the findings to management activities, and also in communicating the value of this old-growth forest to various audiences, including visitors." "Researchers are not required to pay for the privilege of working in the Congaree NP. In fact, the Park provides resources in the form of a small laboratory and overnight accommodations for visiting researchers." *By Dr. Rebecca R. Sharitz, Research ecologist at the Savannah River Ecology Laboratory; Professor at University of Georgia*

4. Cultural, Spiritual and Historical Value
About the Cultural and Historical Value: "Congaree National Park contains a historical record that spans the coming of the first people to this continent to the coming of Europeans to American wars to Euro-American attempts to rationalize a wild landscape. All that in its archaeological record, most of which lies buried and largely unexplored. Because the park has the identity as a wilderness area, the significance of its cultural record is often lost to the broader management of National Parks and to visitors (despite the best efforts of local park staff)." About the Spiritual Value: "I don't know for sure, but I suspect it probably does. There are descendants of the Native Americans that once lived in the Congaree Floodplain still in South Carolina. This would be a good question to ask them. You can find them through the SC Commission on Minority Affairs or through Jonathan Leader, SC State Archaeologist." *By Dr. Adam King, Research Associate Professor, the South Carolina Institute for Archaeology and Anthropology, University of South Carolina*
Highlights of the Cultural and Historical Value: "Archaeology, historic structures (dikes, cattle mounds), potential Maroon Community site(s), Revolutionary War sites nearby, logging, hunting/fishing (traditional land use), moon-shining, spiritual connections in local community (baptisms in Cedar Creek), environmental movement history (advocacy to save the park)." About the Spiritual Value: "Local churches used to conduct baptisms in Cedar Creek." "The park can do more to communicate its cultural, historical, and spiritual values. Traditionally, the staff has shared information about the park's natural resources with visitors, but there hasn't been a significant effort to share cultural resource stories until recently. The park can do more with publications, programs, web, and social media." *By Lauren Gurniewicz, Chief of Interpretation, Congaree NP*
"Congaree National Park provides a glimpse into human occupation of the area for more than five hundred years. There are locally-significant baptism sites, nationally-significant cattle mounds, and regionally significant uses related to hunting and fishing." *By Tracy Swartout, Former Superintendent, Congaree NP*

4. Cultural, Spiritual and Historical Value
About the Spiritual Value: “Some of the old-growth cypress trees are sacred in my opinion. To be able to hug a tree that is 1, 000 years old is an amazing experience. I think the old-growth cypress trees are iconic of the Southeast. I think we have more to learn concerning the cultural history of the park related to sacred places visited by the American Indians.” *By Corinne Fenner, Ranger, Congaree NP*
Highlights of the Cultural, Spiritual and Historical Value: “Historic ferries and roads; 19th and 20th century railroads; Cattle mounds; Indian mounds; Native American sites; Agriculture dikes; Whiskey stills; Maroon communities; 19th and 20th century logging; 19th and 20th century farmsteads/home-sites; 18th and 19th century farms and plantations; 16th and 18th century exploration; Old fields; Hunt clubs; 19th century hunting; Subsistence hunting and fishing; Recreational hunting and fishing; Baptisms; Livestock grazing; 20th century fiction; 1950s and 1970s conservation efforts; 19th century and 20th century folklore; 18th century and 19th century river transportation; Revolutionary War history; Civil War history.” *By Dr. John Grego, President, Friends of Congaree Swamp; Professor at University of South Carolina*

5. Climate Regulation Value
"Congaree NP supports a biologically diverse, structurally complex, and abundantly dense forest cover that provides significant carbon sequestration for the region. Because Congaree NP contains both deciduous (bottomland hardwoods, cypress-tupelo, etc.) and evergreen (pine, palmettos, etc.) plant species it is especially important to annually continuous carbon sequestration from the atmosphere. In addition to Congaree NP's contribution via forest growth and removal of atmospheric carbon, accumulations of organic materials in soil development (particularly the rim-swamp peat deposits) provide another significant terrestrial carbon sequestration service. With regard to source-sink dynamics the terrestrial sequestration is closely linked to aquatic sequestration through flood processes and the exchange of carbon between the floodplain and river and subsequent downstream transport and storage." *By Dr. Kimberly Meitzen, Post-doctoral Associate, The Nature Conservancy North Carolina Chapter; Nicholas School of the Environment Duke University, North Carolina*
"Congaree National Park protects an old-growth floodplain forest and functional floodplain ecosystem. These old-growth trees provide significant carbon sequestration (and have provided this service for a very long time). There are also lots of benefits/ecological services provided by the functioning forested wetland/floodplain ecosystem protected by Congaree National Park." *By Dr.Theresa A. Thom, Former Director of the Old-Growth Bottomland Forest Research and Education Center, Congaree NP*
Certainly a substantial amount of carbon is bound within the old-growth trees at Congaree National Park. Old-growth forests store carbon over the life of the trees and contain large quantities of it. When these giants die, carbon is slowly released to the atmosphere as they decay. Gaps are created bringing light to the ground layer and providing the opportunity for seed germination and growth of individuals that were suppressed under the canopy. Rapid growth of trees released from competition requires carbon. In addition to carbon sequestration, this large acreage of forest results in lower temperatures than found in the surrounding metropolitan and developed areas. *By Terri Hogan, Chief of Integrated Resource Management, Congaree NP*

5. Climate Regulation Value
"Sequestration of carbon is important; there is a need for information / data on how Congaree ecosystems do this." Congaree ecosystems are "also important in local microclimate." "We are looking at climate change impacts on river flows, flooding and bio-indicator species, but not carbon." *By Dr. John A. Kupfer, Professor, Department of Geography, University of South Carolina*
"A large amount of carbon is stored in the forests of the Congaree NP." *By Dr. Rebecca R. Sharitz, Research ecologist at the Savannah River Ecology Laboratory; Professor at University of Georgia*
"The Congaree River floodplain is a major carbon storage area, and it covers almost 30,000 acres so it is significant." *By Dr. William L. Graf, Professor, Faculty Emeritus, Department of Geography, University of South Carolina*

6. Water Quality Protection Value
"The forested land cover of Congaree NP and floodplain depositional features are important for filtering and improving water quality in the main stem Congaree River, the floodplain, and tributaries — particularly Cedar Creek and Tom's Creek. The wetland characteristics of Congaree NP are important for providing 'natural' patterns of water availability/quantity through flooding and recession of hydro-period and hydro-pattern processes — which are important to shallow groundwater renewal. The preservation of forest between the bluffs and floodplain facilitates hillslope to valley groundwater recharge and filtering. Because Congaree spans this hydrologically sensitive hillslope to valley drainage boundary it is especially important for water quality benefits and recharging the shallow water table for floodplain forest uptake." *By Dr. Kimberly Meitzen, Post-doctoral Associate, The Nature Conservancy North Carolina Chapter; Nicholas School of the Environment Duke University, North Carolina*
"A functioning forested wetland ecosystem, along with the native biota protected within both the river and floodplain, provides significant services related to water quality and quantity. The park and the Inventory and Monitoring Network recognize the importance of monitoring both surface water and groundwater quality. Various research has been conducted and is currently on-going at the park. Having access to clean freshwater is priceless." *By Dr. Theresa A. Thom, Former Director of the Old-Growth Bottomland Forest Research and Education Center, Congaree NP*
"The floodplain ecosystem likely acts to filter pollutants and provide a more constant flow of water to the river." *By Dr. John A. Kupfer, Professor, Department of Geography, University of South Carolina*
"I am sure that the CNP is important for water quality and quantity, but I do not have data to support this." *By Dr. Rebecca R. Sharitz, Research ecologist at the Savannah River Ecology Laboratory; Professor at University of Georgia*

6. Water Quality Protection Value
"The Congaree floodplain and its vegetation help sequester undesirable contaminants, particularly phosphorous and thus reducing concentrations in river water. The floodplain is also critical because it stores sediments that otherwise would go into the reservoir and reduce its storage capacity. These sediments are also carriers of chemical contaminants, so keeping them out of the reservoir is important." *By Dr. William L. Graf, Professor, Faculty Emeritus, Department of Geography, University of South Carolina*
"Wetlands play a key role in flood prevention by absorbing and slowing the movement of flood waters, purify and filter surface water by trapping sediment and excess nutrients, replenish groundwater, provide habitat for a wide range of plants and animals including the old-growth wetland tree species for which Congaree was first recognized, and provide innumerable economic and recreational benefits and opportunities." "The Congaree, which is formed by the Broad and Saluda rivers, drains the urban landscape occupied by the metropolitan area that includes the City of Columbia and represents 17.9% of the watershed (http://www.scdhec.gov/environment/water/shed/congaree.htm). The Charlotte, NC metropolitan area is upstream of the Wateree River from Congaree National Park. Both the Columbia and Charlotte metropolitan areas are large, highly developed areas upriver from Congaree. Congaree serves as a catch basin for sediments and other pollutants coming downriver and a site of water purification." *By Terri Hogan, Chief of Integrated Resource Management, Congaree NP*

7. Flood Storage and Control Value
"The majority of Congaree NP's total area functions as temporary flood water retention and storage. Congaree NP's capacity to absorb flood waters and provide flood prevention is one of its critical benefits to society. It is important to flood prevention during large floods that inundate the lower valley from main stem flooding as well as providing flood prevention from smaller, local events which may only involve tributaries draining from the north and south bluffs into the lowland valley. Not only is Congaree NP important for flood protection, but it is the continuity of lowland floodplain area below the fall line that connects to Congaree NP that enables the park area to function at optimal flood prevention capacity." *By Dr. Kimberly Meitzen, Post-doctoral Associate, The Nature Conservancy North Carolina Chapter; Nicholas School of the Environment Duke University, North Carolina*
"As Congaree is the 'best' floodplain remnant of its type, it can store a huge amount of water and it is important in flood-wave attenuation: benefits are probably local or regional. There would be some economic benefits." *By Dr. John A. Kupfer, Professor, Department of Geography, University of South Carolina*
"Because of its large size, and position just below the fall line and the confluence of the Broad and Saluda Rivers, the Congaree NP floodplain has the capacity to store large amounts of flood water on a temporary basis, thus mitigating potential flooding in areas downstream." *By Dr. Rebecca R. Sharitz, Research ecologist at the Savannah River Ecology Laboratory; Professor at University of Georgia*
"The majority of Congaree National Park's acreage falls within the floodplain of the Congaree River. The eastern most portion is within the Wateree River floodplain. As a result, over 90% of the park's acreage is wetland and located at the confluence of the Congaree and Wateree rivers. A complex web of water channels distributes water and sediment throughout CONG. This vast network of channels and large wetland acreage plays a very important role in flood prevention. In fact, the Ramsar Convention recently designated Congaree National Park a Wetland of International Importance because of the vital role it plays within the watershed." *By Terri Hogan, Chief of Integrated Resource Management, Congaree NP*

8. Erosion Control / Soil Stabilization Value
"Congaree NP is important for storing soil and sediments and the natural forested land cover prevents soil erosion to a degree – except during intense, localized high-flow scouring. The natural land cover and lack of development equated to the greatest benefits regarding soil stabilization. In addition to the natural land cover preventing soil erosion, Congaree NP is a significant sediment sink that stores sediments sourced from the upstream watershed. The river banks of Congaree NP are highly dynamic and erodible, but these processes are off-set by the collateral transport, deposition, and storage of these sediments on other areas of the floodplain." *By Dr. Kimberly Meitzen, Post-doctoral Associate, The Nature Conservancy North Carolina Chapter; Nicholas School of the Environment Duke University, North Carolina*
"Congaree ecosystems are important for 1) limiting erosion => effects water quality and 2) trapping and storing sediments. We have a current study looking at sediment deposition." *By Dr. John A. Kupfer, Professor, Department of Geography, University of South Carolina*
"Congaree is a forested floodplain that lies along the Congaree River and the Wateree River. The complex structure both above and below ground of the large forested area that comprises the Congaree floodplain serves to stabilize the soil along the banks of the Congaree and Wateree. That Congaree is at the confluence of the Wateree and Congaree rivers where the Santee forms, removing pollutants, stabilizing the banks, and reducing erosion is important and certainly there is a substantial economic value for these services." *By Terri Hogan, Chief of Integrated Resource Management, Congaree NP*
"Bank stabilization along the river, soil erosion, etc. is an issue. Rivers naturally migrate and will erode and accrete sediment across the floodplain. Obviously upstream development and increased impervious surface in the watershed will change the erosive capacity of the river, along with changes in precipitation and intensity / frequency of tropical storms and/or hurricanes from climate change." *By Dr. Theresa A. Thom, Former Director of the Old-Growth Bottomland Forest Research and Education Center, Congaree NP*

9. Coastal Protection Value
"Congaree NP is important to coastal protection by providing a natural sink for pollutants and contaminants that would otherwise drain in to the Atlantic, and it also provides a source of renewable sediments to the estuaries and ocean." *By Dr. Kimberly Meitzen, Post-doctoral Associate, The Nature Conservancy North Carolina Chapter; Nicholas School of the Environment Duke University, North Carolina*
"Congaree National Park provides important coastal protection as it serves as a natural, undeveloped floodplain forest in the Santee drainage. This river system flows directly to coastal South Carolina and influences the water quantity and quality, as well as the sediment availability for downstream coastal systems." *By Dr. Theresa A. Thom, Former Director of the Old-Growth Bottomland Forest Research and Education Center, Congaree NP*

10. Management Value
"Approximately 25-30 people annually work for the park, a mix of permanent and seasonal/term/temporary. In addition, the park is supported with a team of interns, students, Teacher-Ranger-Teachers (numbering about a dozen a year), and volunteers (over a hundred each year)." "The park has increased its staff along with the budget increases over the last decade. The park grew from approximately 8 full time staff to about 20 full time staff from 2002-2012." *By Tracy Swartout, Former Superintendent, Congaree NP*
"The park provides permanent and seasonal jobs as well as opportunities for interns and funding for university students to conduct research on the park. Seasonal jobs have often been filled by students that live or attend college within the local area. The park currently employs 19 permanent full-time employees, two seasonal full-time employees, and three or four seasonal part-time employees. Three Student Conservation Association interns are also working at Congaree and will be at the park through June of 2013. The number of interns and seasonal employees varies greatly over the years. In 2012, Congaree funded at least 13 interns with internships ranging from 3 to 6 months and provided funding to help support more than five students working on research projects at the park. Much of the funding for interns comes from soft money awarded through an internal NPS grant proposal process. Approximately 80 to 85% of the park's base funding will be required to support the current staff. All programs (Maintenance, Resource Management, Law Enforcement, Interpretation, Administration) at Congaree would benefit from additional staff. The staff has increased over the past 5 years." *By Terri Hogan, Chief of Integrated Resource Management, Congaree NP*