December 2019

Barriers and Facilitators to Engagement with Environmental Education Field-Trips in the Congaree Biosphere Reserve: A Spatial Perspective

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BARRIERS AND FACILITATORS TO ENGAGEMENT WITH ENVIRONMENTAL EDUCATION FIELD-TRIPS IN THE CONGAREE BIOSPHERE RESERVE: A SPATIAL PERSPECTIVE

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Wildlife and Fisheries Biology

by
Toby Story
December 2019

Accepted by:
Dr. Robert B. Powell, Committee Co-chair
Dr. Robert Baldwin, Committee Co-chair
Dr. Betty Denis Baldwin
Abstract

This study was conducted in the Congaree Biosphere Reserve (CBR), a UNESCO designated Biosphere Reserve (BR), and is geographically situated at the nexus of conservation, sustainable development and Environmental Education (EE). We conducted semi-scripted interviews with providers of EE programs and administrators of middle schools in combination with Geographic Information System (GIS) analysis in a case study approach to elicit any barriers and facilitators to participation in EE field trips that exist in this specific context. We find that curriculum constraints, time, matters of human capacity, and access to finance and transportation present as barriers and are often interlinked. We find that access to EE Field Trips is disproportionately allocated to students in private education and urban settings and that poor, minority, underperforming and Language Other Than English (LOTE) students face additional hurdles to access in some cases. We suggest a range of solutions to these problems and recommend a systematic biosphere wide approach in addition to ongoing research to fully comprehend the scope and mechanisms that reduce participation in EE Field Trips amongst minority and rural students in the CBR.
Dedication

I would like to dedicate this work firstly to my friends, colleagues and family who provided ongoing encouragement, advice and good company throughout my research journey. Additionally, I would like to dedicate this work to the people of the CBR who gave me their time and support in completing this project. I hope these musings can contribute to the important work that you do.

Acknowledgments

Firstly, my sincere gratitude to Margaret H Lloyd and the Margaret H Lloyd Smart State Endowment for providing the funds to make this project possible. Not only was the funding drawn from the Margaret H Lloyd Smart State endowment but the Hardscramble property that was gifted to Clemson University by Margaret H Lloyd in part to fulfill her vision of increasing opportunities for Environmental Education in the region was the primary motivation in pursuing this topic. Likewise I would like to thank my Committee members, Betty Baldwin, Rob Baldwin and in particular my supervisor Bob Powell for continuing to provide support and advice throughout all stages of my academic journey. A special mention also goes to Blake Lytle in the GIS lab and David Shelly for giving generously of their time in times of need and answering important questions.
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List of Abbreviations

EE  Environmental Education
EL  Environmental Literacy
UNESCO  United Nations Educational Scientific and Cultural Organization
BR's  Biosphere Reserves
CBR  Congaree Biosphere Reserves
GIS  Geographic Information Systems
NCES  National Center for Educational Statistics
SCDE  South Carolina Department of Education
PPE  Per Pupil Expenditure
I. Introduction

UNESCO Biosphere Reserves (BRs) are protected areas designed to reconcile human development with conservation. Amongst the core goals of BRs are to provide opportunities for Environmental Education and to develop Environmental Literacy in the public. Environmental Education (EE) is widely extolled as a key method for developing Environmental Literacy (EL), which is considered essential for achieving a sustainable future (UNESCO, 1977). Despite the designation of 701 BR’s in 124 countries, a global assessment of BR’s has found that only 53% are meeting their multiple goals (UNESCO, 2018; Schultz & Lundholm, 2010). There are numerous reasons cited for this lack of success with the most salient being a lack of community support and engagement, in addition to issues of human capacity; in other words the attributes most commonly attributed to EL (Coetzer, Witkowski, & Erasmus, 2014; Stoll-Kleemann, Susanne; Welp, 2008; Van Cuong, Dart, & Hockings, 2017a).

Research on cognitive and moral development indicates that the ideal age to develop the skills and dispositions associated with EL is middle childhood (Douglas & Stack, 2010; Inhelder & Piaget, 1958; Kellert, 2005; Maller, 2009; Wells & Lekies, 2006). One of the most popular forms of EE for middle childhood are field-trips for school groups. While not the only method of providing EE, field trips provide the
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greatest opportunity for education in novel settings and environments that are touted to have a higher degree of impact on youth (DeWitt & Storksdieck 2008). Despite the potential of EE field trips for developing EL amongst youth as well as supporting educational standards and increasing positive youth development there are potential barriers to participation in these programs ranging from issues of human capacity, logistical considerations and access to resources (Stern, Powell, & Hill, 2014). Therefore, this study examines the scope of EE field trip participation as well as seeks to identify the barriers and facilitators to participation within one BR, the Congaree Biosphere Reserve (CBR) in the SE U.S. We conducted semi-structured interviews with administrators of middle schools (grades 6-8) and EE centers in and around the CBR. Simply stated, the two broad questions we sought to address are: 1) do middle schools within the CBR participate in EE field trip programs? And 2) what are the barriers and facilitators to participation in EE field trips?

**The Congaree Biosphere Reserve**

The Congaree Biosphere Reserve (CBR) was designated as a UNESCO Biosphere reserve in 1983 following recognition of its unique attributes including the largest remaining tract of bottomland Hardwood forest in the South Eastern US. Congaree National Park serves as the core of the BR. Within the Buffer zone, conservation easements on private lands, rural farmlands and timberland serve to help balance the human settlements ranging in size from hamlets to cities including the Eastern section of the city of Columbia. The CBR incorporates 4 counties including Lower Richland County, Western Sumter County, Lower Kershaw County
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and Upper Calhoun County. Economic disparity within the CBR is high. Sections of Richland, Calhoun and Sumter counties have poverty rates above national averages and two of these counties, (Sumter and Calhoun) have poverty rates above state averages (USCB, 2019). Within these counties, 8 school districts are partially or completely contained within the boundary of the CBR. These include, Richland 1, Richland 2, Calhoun, Lexington 2, Clarendon 1, Clarendon 2, Sumter and Kershaw. Including public, private, and charter schools, there are a total of 21 schools serving middle school students (age range 11-14) within the reserve. The ethnic profile of the counties varies slightly but Richland, Sumter and Calhoun counties are approximately 45% African American and 45% white with single digit percentages of other races including LatinX/Hispanic, Native American, Asian and other (USCB, 2019).

II. Literature Review

**Biosphere Reserves**

BR's are areas designated by UNESCO that through management, science, and education seek the attainment of both environmental conservation and economic development (Fraser & Jamieson, 2002; UNESCO, 2018). UNESCO (2018) defines BR's as “special places for testing interdisciplinary approaches to understanding and managing changes and interactions between social and ecological systems, including conflict prevention and management of biodiversity.” One of the greatest assets of the BR concept is this acknowledgement that the conservation of biodiversity and ecosystems is unable to be achieved in isolation from social, cultural, economic and
political forces and systems (Schultz & Lundholm, 2010). BR’s are designed to accommodate varied levels of protection and development through the use of three zones with decreasing levels of protection: a core, a buffer and a transition zone (Van Cuong et al., 2017). Many argue that a key tenet of a successful BR includes the collaboration of social and natural scientists; management authorities; development and conservation groups, and local communities to test, refine, and adopt ecologically sound human activities (Schultz & Lundholm, 2010; UNESCO, 1996; Van Cuong et al., 2017). EE is therefore fundamental to supporting the basic functioning of BR’s by motivating stakeholders and through the development of skills necessary to solve complex issues relating to the management and reconciliation of social and ecological systems (Schultz & Lundholm, 2010).

**Environmental Education**

EE is described by the North American Association for Environmental Education (NAAEE) as “a process that helps individuals, communities, and organizations learn more about the environment, and develop skills and understanding about how to address global challenges” (NAAEE, 2019). At the core of this goal is the development of Environmental Literacy (EL) (Stevenson, 2013; NAAEE, 2018; UNESCO, 2018). EL is described as the “knowledge, skills, dispositions, and behaviors that allow individuals to recognize, assess, and then address environmental issues facing their local communities and more broadly support a sustainable global future” (UNESCO, 1977). Characteristically EE is interdisciplinary, immersive, experiential, often informal in nature and regularly
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delivered in natural or near natural settings (Ardoin, Biedenweg, & O’Connor, 2015; NAAEE, 2014). In the formal school context, participation in EE involves leaving the school campus to go on field trips. DeWitt & Storksdieck (2008), note that field trips to novel locations, often associated with natural environments, is a strong predictor of enhancing excitement in learning and the development of meaningful and memorable experiences. Thus this research will examine the extent of EE field trips for middle school aged students as well as explore the potential barriers and facilitators to participation in EE field trips within the context of the CBR.

What are the Facilitators and Barriers to Participation in EE Field Trip Programs?

According to the literature, there are a range of distinct barriers to participation in EE field trips (e.g., Ham & Sweing, 1988; Stern et al., 2012). These barriers (and potential facilitators) may be grouped into three broad headings: structural; diversity, equity and inclusion; and spatial. Structural barriers include any organizational and administrative barrier inclusive of attitudinal barriers associated with teachers and administrators (Ham & Sweing, 1988; Stern et al., 2012). Researchers have also identified barriers relating to Diversity, Equity, and Inclusion (DEI) in particular issues stemming from broad inequities in wealth distribution at both personal and institutional levels as well as perceived psychological and or attitudinal barriers such as perceptions of discrimination and cultural exclusion (Devine, 2017; Hong & Anderson, 2006; Kapila, Hines, & Searby,
Several barriers, such as access to personal finance and educational opportunity (Tate, 2008); the financial resources of individual schools and school districts (Baker & Green, 2005) and specific climactic considerations vary on the basis of location (Ernst, 2014).

**Structural barriers** refer to organizational and administrative barriers and are the most commonly reported (Stern et al. 2012). The structural barriers identified in past research include Transportation, Curricular demands, Time, Logistics, Standard approaches to teaching, Liability issues, Student Behavior, Lack of Knowledge of programs, Finance, and Teacher Efficacy and Ability (e.g., DeWitt & Storksdieck, 2008; Ham & Sweing, 1988; Stern et al., 2012). Issues relating to transportation included both limitations to procuring or time constraints placed on the use of transportation (Stern et al., 2012; Xiao et al., 2017; Anderson, Kisiel, & Storksdieck, 2006). Curriculum demands generally refer to the priority being placed on preparing for standardized tests (DeWitt & Storksdieck, 2008; Ham & Sweing, 1988; Stern et al., 2012). Standard approaches to teaching refers to challenges integrating core subjects such as Math, English, etc. with the experiential pedagogies often used in EE field trips (Gruenewald & Manteaw, 2007; Smith, 2007; Stevenson, 2007). Time as a barrier relates to the time available to individuals including students, teachers and or administrators within the school day to either engage in or prepare for EE field trips (Anderson et al., 2006; Ernst, 2014; Ham & Sweing, 1988).
Logistical barriers included constraints as a result of planning, coordination or organization (Ham & Sweing, 1988). Barriers relating to student behavior included actual behavioral issues as well as the perceived risk of problems associated with student behavior (Smith 2007). Liability issues included any administrative barriers, whether real or perceived, relating to legal responsibility for the safety and security of students (Ernst, 2014; Stern et al., 2012). Lack of knowledge of programs has been identified by Stern et al., (2012) as a potential barrier to involvement in EE field trips. Access to adequate finance has been extensively documented as a barrier to engagement with EE field trips and included an inability to pay for programs, materials, and transportation fees as well as to subsidize these costs for low income students (Ham & Sweing, 1988; Stern et al., 2012; Xiao et al., 2017). Finally, teacher’s beliefs regarding their ability to facilitate a field trip is also a barrier and related to teacher training, knowledge and or confidence (Anderson et al., 2006; Ham & Sweing, 1988; Stern et al., 2014).

Structural barriers are often interrelated and have been identified as the most persistent barriers to participation in EE field trips. For example transportation is closely aligned with financial barriers (Stern et al., 2012; Xiao et al., 2017); time and curriculum constraints (Anderson, Kisiel, & Storksdieck, 2006); and the predominant pedagogies and emphasis on testing in mainstream education (Gruenewald & Manteaw, 2007; Smith, 2007).
**DEI Barriers** include issues pertaining to diversity, equity, and inclusion and the ways in which they influence access and participation in EE. Diversity simply relates to the ways in which people differ; Equity is the fair treatment and access to all peoples irrespective of differences with special consideration of inherent advantages and disadvantages between people; and Inclusion relates to the degree to which these differences are recognized, accepted and supported (Kapila et al., 2016). Barriers associated with DEI, can be identified as those that do not adequately address or account for psychological, physical, and or social differences that occur among any and all individuals. These differences may include but are not limited to, race, ethnicity, nationality, religion, socioeconomic status, education, marital status, language, age, gender, sexual orientation, and or mental or physical ability (Lawrance Hall of Science & University of California Berkley, 2019). Research suggests that lowered participation for minority groups is apparent in numerous environmentally focused locations and activities including outdoor recreation; national parks and wilderness areas (Manning, 2011), expeditionary learning (Rose & Paisley, 2012), nature centers (Hong & Anderson, 2006) and conservation groups (Taylor, 2015). The specific barriers associated with this reduced participation include language barriers (Hong & Anderson, 2006), perceived and actual racial discrimination (Le & Holmes, 2012), and marginality (Manning 2011). Language barriers related either to a lack of fluency with the English language or a lack of provision of second language services or programs (Hong & Anderson, 2006). Racial discrimination has been noted as a barrier where there is actual, perceived or a fear
of unjust or prejudicial treatment based on race or ethnicity (Le & Holmes, 2012). Marginality relates to modern-day disparities in education, income and opportunity stemming from historic policies and inequalities (Manning, 2011). 

**Spatial barriers** are those barriers that display a spatial dimension or vary in intensity on the basis of location. Beyond proximity and specific settings, spatial barriers have received limited attention specifically in relation to EE field trips. However, it is important to note that the economic and social attributes of one’s place of origin has significant implications for an individuals’ educational opportunity and attainment and is considered by some researchers to be the most salient predictor of your life path (Tate, 2008). Tate, (2008) notes that poverty and its associated disadvantages are often spatially delineated, a phenomenon he describes as the geography of opportunity. Geographic opportunity can vary in scale from country to state to region to suburb and even to block (Jonas, 2006). In the context of education, school districts with higher poverty rates have traditionally had less local funds to support their schools (Baker & Green, 2005; Monarrez, 2017). This is because a significant portion of funding for individual schools is drawn directly from local property taxes although this is complicated by the fact that additional supplementary funding from state and federal sources is applied in some instances. In certain circumstances the delineation of school boundaries has been found to be drawn following largely ethnic divides (Baker & Green, 2005; Monarrez, 2017) with the subsequent funding inequalities argued to be a perpetuation of deliberately discriminatory policies based on ethnicity (Monarrez, 2017). Therefore,
the list of relevant spatial barriers include poverty or the varied geographies of opportunity (Tate, 2008), school districts, (Baker & Green, 2005; Monarrez, 2017); the availability and proximity of suitable venues or settings for EE (Ernst, 2014; Simmons, 1998) and local weather and climate conditions (Ernst, 2014). Proximity of suitable venues has been noted as a barrier especially when no suitable providers are available within an acceptable distance (Ernst, 2014). Barriers associated with weather and climate relate to local seasonal variations in weather and climate or localized weather phenomena and events (Ernst, 2014).

III. Methods

This study employed a case study approach and data were collected and analyzed using interviews, census data and GIS analysis (Creswell, 2014; Hatch, 2002). This study focused on EE field trips conducted in South Carolina within one hours drive of the center of the CBR in order to answer the following questions:

1. *What is the availability of EE field trips in and within a one hour drive of the CBR?*

2. *How frequently are the middle schools in CBR participating in EE field trips?*

3. *What are the structural facilitators and barriers to Middle school participation in EE field trips within the CBR?*

4. *How do issues relating to DEI limit or facilitate engagement with EE field trips within the CBR?*
5. Are there other unique barriers and or facilitators associated with this study site?

6. Are there spatial patterns associated with the levels of engagement or the distribution of barriers to participation in EE field trips?

Research Phases

The research was conducted in three phases. The first stage of the study focused on answering RQ1 and 2. The second stage focused on answering RQ 2, 3,4, and 5 and the final stage used GIS to explore the spatial patterns associated with participation as well as the barriers to participation in EE field trips (RQ6).

Phase One

Phase one involved identifying all venues and organizations that provide EE programs for formal school groups within a one-hour drive of the boundary of the CBR. As the focus of this research is EE within the CBR, we limited the study area to a one-hour drive of the boundary. We then conducted semi-structured phone interviews with administrators of these organizations to identify the characteristics of their programs as well as perceived barriers to participation. These EE field trip providers were identified through searches of South Carolina Outreach and Informal Educators Summit (SCOIES) and Environmental Education Association of South Carolina (EEASC) data bases and subsequent discussions with local experts. A total a total 22 providers were identified of which 17 participated in the interviews. The
interviews focused on identifying key characteristics of both the programs and the program participants. Data gathered included the cost, content and objectives of the programs including any links to relevant curriculum; the timing, frequency and duration of programs; the age range and origin of the program participants as defined by school district; and finally perceptions of barriers to participation. During the interviews the researcher took strategic written notes (Tinny, 2013). These notes were then coded to capture “emergent” themes related to barriers to EE field trips for formal school groups (Creswell, 2007, 152). We also used Arc GIS to map the extent of EE participation as well as the frequency and extent of engagement based on location (Fig 1.) and school (Fig. 2).

Phase Two

Phase two involved identifying and contacting all middle schools inside and within a 3 mile radius of the CBR, then scheduling and conducting semi-structured face to face interviews with primary administrators of those schools. These schools were located in the following school districts: Richland 1, Richland 2, Calhoun, Lexington 2, Clarendon 1, Clarendon 2, Sumter, and Kershaw.

Sampling and recruitment

Potential middle schools were identified using the business analyst database in ARCGIS and checked with the National Center for Educational Statistics (NCES) database (NCES, 2017). As only 21 schools serving middle school age students were situated within the CBR, our study area was expanded by 3 miles to increase the
number of potential interviewees. There is a total of forty schools serving middle school students situated inside and within 3 miles of the CBR including 21 public schools (4 of which had title one status), 17 private schools, and 3 charter schools. Contact details for all principals of public schools were obtained through the South Carolina Department of Education (SCDE, 2019 school data) and the contact details of all private and charter schools were obtained through internet searches. The interviews were scheduled so as not to interfere with key periods of testing or to coincide with school breaks. Each school was contacted by phone, email and in some cases with direct site visits. Up to five attempts to arrange a suitable time for an interview were made with each school. If there was no response from the institution after 5 attempts it was assumed they were unable or unwilling to participate. A total of 20 administrators participated in the study including 9 from public schools, (one of whom was from a title one school), one from a charter school, and 10 from private schools.

Interview methods and data analysis

Interviews were conducted face to face using a semi-structured interview script that followed a modified Seidman approach involving a mix of open and closed questions (Peterson, Brownlee, & Marion, 2018; Seidman, 2013 ). The interview script was designed using themes from the literature (Marshall and Rossman 2006; Crabtree and Miller 1992). The interviews ranged from 13 minutes to one hour with an
average of 26 minutes. The interviews were recorded and transcribed verbatim using transcription services. Completed interview scripts were transferred into a software data analysis program, MaxQDA, for semi-inductive coding. Interview responses were examined to identify both “a-priori” and “emergent” codes (Creswell, 2007). The a priori codes reflected the barriers identified in the literature (Table 1) (Marshall and Rossman 2006; Crabtree and Miller 1992).

Table 1. A priori List of Barriers with Associated References.

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<th>Structural Barriers</th>
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<td>Transportation</td>
<td>Limitations to procuring transportation or time constraints on the use of transportation (Stern et al., 2012; Xiao et al., 2017; Anderson, Kisiel, &amp; Storksdieck, 2006)</td>
</tr>
<tr>
<td>Curricular demands</td>
<td>Limitations related to preparing for and administering standardized tests (DeWitt &amp; Storksdieck, 2008; Ham &amp; Sweing, 1988; Stern et al., 2012).</td>
</tr>
<tr>
<td>Time</td>
<td>Limitations as a result of time available within the school day and or time available to individuals including students, teachers and or administrators (Ham &amp; Sweing, 1988; Anderson, Kisiel, &amp; Storksdieck, 2006).</td>
</tr>
<tr>
<td>Logistics</td>
<td>Limitations as a result of planning or coordination (Ham &amp; Sweing, 1988).</td>
</tr>
<tr>
<td>Standard approaches to teaching</td>
<td>Limitations as a result of the presentation of standardized knowledge associated with established disciplines and reliance on teachers as primary information sources (Smith 2007).</td>
</tr>
<tr>
<td>Behavior and control of students:</td>
<td>Barriers relating to student behavior and control were coded when either actual behavioral issues as well as perceived risk of problems associated with student behavior and or control was mentioned as a potential barrier (Smith 2007).</td>
</tr>
<tr>
<td>Liability Issues</td>
<td>Limitations resulting from concerns around the safety and security of students or actions that could be perceived to jeopardize student safety (Stern et al., 2012).</td>
</tr>
<tr>
<td>Lack of knowledge of programs</td>
<td>Limitations due to a lack of knowledge of available EE programs or resources (Stern et al., 2012).</td>
</tr>
<tr>
<td>Finance</td>
<td>Limitations as a result of financial ability at either an...</td>
</tr>
<tr>
<td><strong>Teacher efficacy and/or ability</strong></td>
<td>Limitations that directly related to issues surrounding teacher training, knowledge and or confidence (Ham &amp; Sweing, 1988; Stern et al., 2012; Xiao et al., 2017).</td>
</tr>
<tr>
<td><strong>Diversity, Equity, Inclusion Barriers</strong></td>
<td><strong>Definition and References</strong></td>
</tr>
<tr>
<td><strong>Language barriers</strong></td>
<td>Limitations as a result of a lack of fluency with the English language or a lack or provision of second language services or programs (Le &amp; Holmes, 2012).</td>
</tr>
<tr>
<td><strong>Racial discrimination</strong></td>
<td>Limitations as a result of unjust or prejudicial treatment, either perceived or actual as a result of an individual’s race or ethnicity (Le &amp; Holmes, 2012).</td>
</tr>
<tr>
<td><strong>Marginality</strong></td>
<td>Limitations as a result of modern-day disparities in education, income and opportunity in particular for minority groups (Manning, 2011).</td>
</tr>
<tr>
<td><strong>Poverty/inequality</strong></td>
<td>Issues to do with inequality in access was coded as a spatial barrier whenever it was related to a distinct divide within the local population (Tate, 2008).</td>
</tr>
<tr>
<td><strong>School districts</strong></td>
<td>Limitations resulting from acknowledged disadvantages (primarily financial) for students that related to being situated in a particular school district. (Baker &amp; Green, 2005; Monarrez, 2017).</td>
</tr>
<tr>
<td><strong>Spatial Barriers</strong></td>
<td><strong>Definition and References</strong></td>
</tr>
<tr>
<td><strong>Proximity of suitable venues:</strong></td>
<td>Limitations as a result of the distance between a particular school and identified venues for EE (Simmons, 1988; Ernst, 2014).</td>
</tr>
<tr>
<td><strong>Weather and Climate</strong></td>
<td>Limitations as a result of local seasonal variations in weather and climate or localized weather phenomena and events (Ernst, 2014).</td>
</tr>
</tbody>
</table>
Phase Three: Analysis of Barrier Data Using Arc GIS

To investigate a series of spatially related sub questions, we used Arc GIS in combination with a selection of primary data derived from interviews and secondary data relating to ethnicity and income (NCES, 2017; USCB, 2019) and Per Pupil Expenditure (PPE) (SCDE 2019, school data).

These questions assessed the spatial distribution of barriers and included:

1. What is the relationship between participation in EE field trips and the location of the school?
2. What is the relationship between Per Pupil Expenditure or annual tuition and the location of a school?
3. What is the relationship between participation in EE field trips and the school’s distance from EE providers?
4. What is the relationship between percent of black students in a school and PPE or annual tuition?
5. What is the relationship between percent of black students in a school and participation in EE field trips?
6. For public schools, is district PPE related to the racial profile of the district?

In order to answer the above questions, each participating middle school was converted to a point file and assigned two attributes. The first was the level of participation in EE field trips that each administrator reported had been run in the previous 12 months. The second was the PPE for public institutions and annual
tuition for private schools. PPE was obtained directly from the SCDE and annual tuition for each private school was derived from each school’s website. These point files with associated attributes were independently exhibited over two separate base maps of our study site. Additionally, we used the OD cost Matrix tool in ArcGis Pro to derive mean travel times between all centers and all schools as well as the minimum travel time to the nearest center from each school (Comber, Brunsdon, & Green, 2008).

IV. Results

What is the Extent of EE in the CBR?

According to providers, the total number of students annually participating in EE was 63,778. This number represented students from the following districts; Calhoun 01, Charleston 01, Orangeburg 03, Orangeburg 04, Orangeburg 05, McCormick 01, Fairfield 01, Newberry 01, Kershaw 01, Berkeley 01, Dorchester 02, Dorchester 04, Lexington 01, Lexington 02, Lexington 03, Lexington 04, Lexington 05, Richland 01, Richland 02, Florence 01, Florence 02, Florence 03, Florence 04, Florence 05, Darlington 01, Sumter 01, Lee 01, Clarendon 01, Clarendon 02, Clarendon 03, Williamsburg 01, Georgetown 01, Colleton 01, Jasper 01, Beaufort 01. The total enrolled student population in these districts is 359,678 (NCES, 2019).

Approximately 17% of this total student population participates in some form of EE field trips on at least an annual basis in the vicinity of the CBR. Although all districts
intersecting with the CBR were reported to have some level of participation in EE field trips, the exact number of students from these districts was unavailable due to a lack of accurate record keeping. For those students attending programs, Congaree National Park (CNP), the core of the CBR, is the most frequented location (Fig 1.). Interestingly, the results from our interviews with providers showed that many of the middle schools were not choosing to access the EE resources available within the CBR and were instead travelling to locations in the “upstate” and coastal regions (Fig. 2).
Figure 1. Reported Frequency of Use of EE Centers by School District.

Figure 1. EE centers: Estimated annual number of students served and frequency of trips by school district.
**Figure 2.** Location of EE Sites Accessed by Schools

*Figure 2.* Represents the links (green lines) between the range of locations accessed for the purposes of EE by middle schools in our study.
According to EE Providers, What Are the Barriers to Participation?

All EE administrators with the exception of one reported barriers to participation. Barriers were primarily structural in nature and included Transportation, cost, time, testing, a limited number of field trips, and high demand at key times of year. Teacher’s attitudes, confidence and ability were also noted in addition to lower levels of engagement from members of the African American community. The specific settings were also considered by some providers to reduce participation as they lacked novelty for local students. A complete summary of results is provided below (Table 2).

Table 2. Barriers to EE Participation Reported by EE Providers.

<table>
<thead>
<tr>
<th>Reported barrier</th>
<th>Total percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>25%</td>
</tr>
<tr>
<td>Cost</td>
<td>17%</td>
</tr>
<tr>
<td>Time</td>
<td>11%</td>
</tr>
<tr>
<td>Testing</td>
<td>8%</td>
</tr>
<tr>
<td>Teacher motivations</td>
<td>8%</td>
</tr>
<tr>
<td>One Trip per Term</td>
<td>8%</td>
</tr>
<tr>
<td>High Demand</td>
<td>8%</td>
</tr>
<tr>
<td>Staffing/Facilities</td>
<td>6%</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>6%</td>
</tr>
<tr>
<td>Location lacks Novelty</td>
<td>4%</td>
</tr>
<tr>
<td>None</td>
<td>2%</td>
</tr>
</tbody>
</table>
School Administrators’ Perceptions Regarding Barriers to Participation in EE Field Trips

To investigate school administrators’ opinions regarding barriers and facilitators to participation in EE field trips, we attempted to interview all middle school administrators within the CBR. We interviewed 20 of 40 administrators and the results identified a range of barriers that can be categorized under three broad headings being structural, DEI and Spatial.

**Structural barriers.**

**Transportation:**

Transportation, which is often linked to lack of finance, was often considered the primary barrier to participating in EE field trips.

“Increase transportation availability. Really, that’s the number one thing holding us back.

Issues relating to transportation had two primary dimensions, time and cost. One respondent succinctly reported it in this way.

“You only have about that much time if you’re using school transportation, maybe it’s 9:00 to 2:00, but it’s not lengthy. And if you’re going outside those hours, then you have to use private transportation and that jumps up the cost pretty quickly”.
Interestingly, while all public schools had some level of access to transportation albeit limited by time, and well-resourced private schools often had additional resources to pay for busses, it was the small private schools that were the most restricted in terms of access to transportation. Some small private schools were utilizing private vehicles (parents) to address this hurdle and access off campus activities, while others reported this was unavailable to them due to regulations.

“...for us, our main thing is transportation. [...] because the state of South Carolina’s got Jacobs law, that says that we have to have a hard bus with a stop sign to transport kids. So the transportation is the most difficult thing for us.”

Curricular demands: Preparing for and administering standardized tests was perceived as a barrier to participation in EE field trips. One informant from a public school put it this way.

“The curriculum is so structured that we have a hard time fitting in field trips because the work load is so heavy when we take a day off. In history and science alone, almost daily, you’re either gonna have a quiz or a test”.

The structure of the curriculum also focuses field trip activity into specified seasons, resulting in greater competition for quality programs at certain times of year. While the curriculum demands were high at all schools, public schools face an added challenge where standardized testing is mandated and access to finances is in part reliant on student performance on standardized tests.
“Administration can be a little bit reluctant to approve trips …[during spring]… because they want full focus on getting ready for testing…”

**Time:** In the public school setting, it appeared that it was the teachers who had the greatest constraints on their time.

“Oh, barriers, the amount of time that it takes to organize a field trip for 18 teachers in the sixth grade, "Here are your permission slips, here are yours, here are yours, here are yours,” administration doesn’t do that. So, it’s left to fall on the teachers”.

While in the private school setting it was the students who often have competing demands that limited the possibility of participating in EE field trips.

“Our children are so busy, so busy after school. If we do something like an academic team, like a quiz bowl team, we’re competing for their time. So that makes it difficult”.

**Logistics:** Logistical considerations were also clearly evident.

“It's just logistics, planning. The devil's in the details, right?”

**Standard approaches to teaching:** These approaches are described by (Smith 2007) as the presentation of standardized knowledge associated with established disciplines and a reliance on teachers as primary information sources. Results
indicated that some teachers viewed and approached teaching in this way, which limited their desire or ability to engage in alternate forms of teaching practice and locations, including field trips even when the entrance barriers appeared to be very low.

“I will tell you, the science teachers are going to say it's a valuable use of time. I don’t know that the social studies or the English people or math are gonna say that it's a valuable use of time taking them out of their classes...”

**Behavior and control of students:** While student behavior was not commonly mentioned, one administrator of a school for students with learning disabilities did express some concern.

“It's hard to take some of our kids on field trips because of behaviors because of, um, you know, but for the most part they’re good about. Um, but we never know what They’re gonna say too...”.

Concern over potential behavioral issues for older students was also raised as a barrier in relation to overnight trips.

“Actually, our eighth grade is looking at going to Camp Bob Cooper .... next year. But in the past, the teachers who taught eighth grade thought that taking those students out of town overnight was scary, so they didn't opt to do that”.

**Liability Issues:** Concern over a range of liability issues was raised on several occasions and limited both the timing and scope of EE field trips. One respondent
when asked why they ran trips in the winter time to the Congaree National Park replied.

“that way you don't have to worry about venomous snakes”.

Liability issues were noted by two separate public schools as being of greater consideration in relation to overnight field trips.

“You used to be able to do that. In our prior school we did that a lot in our magnet program. But enter the gender questioning phase and, "I don't want my kid to room in a room with that kid who may or may not be questioning their sexual orientation," and "How are you gonna keep my child safe with... " So everybody's just... Doesn't even wanna deal with that anymore because of the litigious nature of our society”.

And.

Interviewee: “District administration, they are weary of overnight trips because of the risks and so many things that have been occurring nationally. [...]”

Interviewer: What do you mean by "happening nationally?"

Interviewee: Safety and security and things of that sort, you know.

Interviewer: So they're primarily worried about the safety of the children.

Interviewee: Yeah, being out of the school district with the shootings and things of that sort”.

It should be noted that this sentiment was far from universal and seemed primarily a result of the attitude and or personal perception of this school’s administrator.
Environmental Education in the Congaree Biosphere Reserve

Other schools did participate in overnight programs and there were no schools that were disallowed from delivering overnight trips.

**Lack of knowledge of programs:** Lack of knowledge about the existence of programs was reported as a key barrier. Similar statements to the one below were repeated on numerous occasions at both public and private schools.

“I would say the biggest barrier is just us not knowing what's out there”.

**Finance:** Finance was reported as a barrier to accessing EE programs. The constraints associated with finance were closely related to transportation costs in addition to general access fees and material costs.

“So then I looked at the transportation for chartered buses, it's just... It's too much, too much money. I'm gonna have to be giving up buying supplies for students who can't buy them themselves or go to a field trip”.

“We even have contracts with bus companies, but the amount of money it cost to charter a bus to get somewhere is astronomical, so we haven't been able to do that yet either”.
School size: The number of enrolled students was found to present additional hurdles in isolated cases. One of the smaller private schools reported their small size prevented access due to high per-person access cost.

“sometimes […], cause we are so small it prevents us from going because the cost of it, if it’s like a bulk costs and you have to have a minimum of 20 people or something and we don’t have that many, they don’t allow us to come”.

On the other hand, one of the larger public schools reported the large size of the school was a hinderance due to a combination of access to district transportation and issues of capacity at the EE venues. While they had considered doing the field trips with smaller groups of students this caused too much disruption to regular scheduled classes.

“So because our individual grade levels are so large, we have not been successful in planning a field trip yet”.

Underachievement/ student performance: In certain cases the performance of a certain student was noted as preventing participation in EE field trips.

“… a lot of times we will limit it, you want all kids to have the opportunity all kids but um, but we may not let them go to two or three if they’re behind on the grades or you know, maybe you have a “D” in math or something. You shouldn’t be off campus a lot”.
Diversity, equity and inclusion.

DEI. DEI Barriers identified by administrators included language barriers (Hong & Anderson, 2006) and Marginality (Manning 2011).

Language barriers: At one school the interviewee noted a rapid increase in the hispanic population in the school. While not expressed directly in relation to EE field trips this lack of english language fluency impacted engagement with EE field trips for this subset of the population.

“So that’s changed the way we do business a lot, greatly increased our need for a Spanish-speaking staff, of which currently I have one, which is not nearly enough”

Marginality: In at least one case a current disparity in income impacted the educational opportunity for members of a minority group (Manning, 2011).

“In our school, it’s very much split where we have students who have a good bit of money and then students who come from pretty significant poverty. So it almost leads to a segregation effect where you have half the kids who can, and half the kids who can’t. And it really is a very split situation where it doesn’t seem terribly fair and that’s as evidenced by this field trip that’s going on next week”.
In this particular instance the interviewee stated that it was almost exclusively African American students who were unable to access the field trip due to lack of finance. It was not clear if this was an isolated incident or an ongoing issue. While income disparity was most commonly reported in the public school system, private schools reported issues with subsets of their population having insufficient access to finance also.

“Half of our parents would. The other half may struggle”

“Yeah. We can’t just come up and say, “Okay, next week we’re taking a field trip and your child needs 40 bucks.” Most of them are not gonna have that. So…”

**Spatial dimensions.**

**Spatial dimensions:** Respondents also indicated that several barriers with spatial dimensions existed including poverty or wealth disparity (Tate, 2008), school districts, (Baker & Green, 2005; Monarrez, 2017); and the availability and proximity of suitable venues or settings for EE (Ernst, 2014; Simmons, 1998).

**Poverty/inequality:** Issues to do with wealth inequality within the local population was noted in several locations (Tate, 2008).

“...like I said, we’ve got… We’re on the, we have the full scale. Not just here at my school, but district-wide. So we have some very affluent, and then, we
have some that are right there with our poverty index. So, sometimes that
does provide a couple of extra challenges ’cause you do want all of the
students to have the opportunity, so…”

**School districts:** Respondents reported disparities in funding related to school
district:

“I think one advantage of being in this district is the fact that the revenue
comes from basically the entire city of Columbia, the tax revenue. We're not a
rural school district where land is cheap out in the country. Here in town […]
the property values are higher. So the income to the district, the revenue, is
much higher. So there is more money to spend on things like that being here as
opposed to maybe out in Saluda County where there's peach orchards and
cattle”.

**Proximity of suitable venues:** Two respondents noted issues with access based on
their location or a lack of suitably sized venues:

“I don’t think we have enough opportunities. I would love for us to have more
opportunities for places to take students”.

“It’s funny, some of the larger ones can, but I think many can’t. For example, the
water treatment plant, they can't take one of our whole grade levels at a time,
which means we would have to split our grade levels in half and use up two
instructional days to be able to get that done. So they're missing the other subject areas”.

Reported Facilitators

Overcoming barriers and motivating participation: Actions and opinions of EE providers.

EE providers reported a number of specific actions they were taking to overcome barriers to participation. These are reported by percentage and included; offering free programs (35%), subsidizing access (including transportation)(29%); increasing their marketing efforts (24%) and seeking to increase engagement with the local African American community through targeted marketing and enlisting African American staff (10%).

Primary motivators.

According to a high proportion of EE providers, high quality experiential programs that were well run and managed, delivered in outdoor settings, reinforced classroom content, met curriculum standards and were enjoyable for the students helped motivate participation and increased demand. Providers also noted that individual teachers were often responsible for facilitating participation in their programs (Table 3).
**Table 3. Motivations for Participation According to EE Providers.**

<table>
<thead>
<tr>
<th>Reported Motivators</th>
<th>Total percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Outdoor learning environment</em></td>
<td>47%</td>
</tr>
<tr>
<td><em>Reinforced classroom learning</em></td>
<td>47%</td>
</tr>
<tr>
<td><em>The quality of the program</em></td>
<td>37%</td>
</tr>
<tr>
<td><em>Meeting curriculum standards</em></td>
<td>35%</td>
</tr>
<tr>
<td><em>Fun programs</em></td>
<td>24%</td>
</tr>
<tr>
<td><em>Motivated by individual teachers</em></td>
<td>17%</td>
</tr>
<tr>
<td><em>Learning style</em></td>
<td>17%</td>
</tr>
<tr>
<td><em>General environmental interest</em></td>
<td>11%</td>
</tr>
</tbody>
</table>

**Primary facilitators as reported by middle school administrators**

The interviewees broadly reported a number of factors that had or would aid in supporting and or facilitating participation in EE field trips. The majority of these were structural in nature and included access to transportation and or finance; curriculum considerations and knowledge of programs. Other pertinent facilitators included spatial factors including proximity, school districts, and those related to intra-school cultures and individual actors.
Structural facilitators.

Transportation: Access to transportation was mentioned frequently as a basic requirement to facilitate engagement in EE field trips. As previously mentioned this is closely tied to finance.

“That’s another advantage of being ...[associated with this institution] ... We get to borrow, their bus.”

Financial considerations:

There were a broad number of factors that aided access to adequate funds to cover the costs associated with EE field trips. These included a lack of budgetary constraints, access to supplementary funding streams including fundraisers and philanthropy and the size of the budget itself. While the public schools had stringent restrictions on the allocation of funds, private schools generally had a high degree of budgetary freedom. One head of a private middle school reported the following.

“I get a chunk of money that's the middle school budget, and then I can make decisions about how we use that, whether we're buying supplies for a science lab, or I need to offset... I have discretion to decide like, "Timmy needs to go on the trip, but he doesn't have any money, so I'll pay for Timmy to go on the trip."
The public school administrators used a variety of creative approaches to access unconstrained funds that could be used offset the cost of EE field trips. Sources of discretionary funding included monies from PTO’s and other school based foundations; fundraising events; vending machines sales, and revenues from advertising space and or letting out rooms to individuals or commercial enterprises.

“The student funds [...] usually that’s your fund raisers or your [...] vending machine or whatever”

Various interviewees also reported philanthropic donations from within the school community as a crucial financial facilitator. Philanthropic behavior was noted at both public and private schools.

“One of our parents [...] donated $2500 to the school just to supplement field trips for kids who can’t afford to go...”

Responsive management:

Empowering teachers and flexible and responsive management by administrators may remove certain barriers to participation in field trips and acts as a facilitator:
“The beautiful part about being an independent school is we certainly follow standards and guidelines for good practice, but if the teacher comes to me, for example, the fifth grade Science teacher just came and said, "We just did this unit on water in the biosphere, and we wanna take a field trip," [...] I said, [...] What do you wanna accomplish? What will the children be doing there?” We just work it out, and we just make it happen. That’s what we do”.

Knowledge of programs:

Several principles stated that simply having knowledge of the programs, in particular ones that could be tied to curriculum, would significantly increase their chances of participating. When asked about how to increase their participation in EE field trips several interviewees responded with statements similar to below.

“Have us know what’s available out there, really. Honestly, just information that is tied to any of the standards that we have. Really, that’s it”.

Spatial facilitators.

Specific facilitators related to geography included the school’s proximity to suitable venues as well as the school district in which it was situated. The vast majority of respondents believed their location provided opportunities for access to a broad range of venues:
“The nice thing about Columbia is that it’s central, so we can go in any direction and be there in the state in about two hours, which is perfect”.

The advantages related to school district were financial in nature.

“I think one advantage of being in this district is the fact that the revenue comes from basically the entire city of Columbia, the tax revenue. We’re not a rural school district where land is cheap out in the country. [...] Here in town, the property values are higher. So the income to the district, the revenue, is much higher. So there is more money to spend on things like that being here”

Other facilitators.

Intra-school cultures and Individual Actors.

Administrators:

The skills, attitudes, motivations and beliefs of both individuals and groups have been widely acknowledged as being highly influential in facilitating participation in EE field trips (Ham & Sweing, 1988; Stern et al., 2012). The results from our interviews revealed that individual actors including administrators and teachers as well as intra-school culture were important as enabling factors. One
administrator described efforts to support EE field trips that created a cultural shift within their school.

“There was a period of time when I had teachers who just didn’t even bother, they’re like, "I’m not even... It’s gonna take too much." And I begged one teacher, [...] I said, "If you do it, I’ll give you $3,000 or $4,000 out of this account, to help put it together." And he did it, and it kind of opened the eyes of several of the other teachers, [...] it just kind of made them go, "Wow. It can happen." So now, [...], I’m like, "Another trip? Oh, my God!"

Administrators also reported widely on the challenges with the socio-economic background of students which had important implications for engagement with EE field trips. While the poverty level of some student’s families were commonly mentioned, administrators generally claimed that they had strategies in place to accommodate those with less financial ability.

“If there were any monetary things we still like I said, we still have a part of our population that is impoverished and we would find ways to be able to provide scholarship type opportunities for them, and so that they would be able to attend”.

“We have kids coming from million-dollar homes, and we have kids that are McKinney-Vento, almost homeless. And we try to provide the same type of
learning experiences for all students, when it comes to trips, lesson activities, speakers, activities that we bring from the outside, we make sure that all of our kids have access to these opportunities".

Private schools reported that experiential learning and experimentation was a cornerstone of their school’s curriculum.

“We have always prided ourselves on being a school that is experiential in nature”.

“There are no boundaries, you could try anything. If you can prove that it worked, you give it a try. I want teachers to come up with neat ideas, so we just let it roll”.

Teachers:

Interviewees often acknowledged the key role that teachers play in facilitating EE field trips.

“It is really the passion of one of our teachers here, and she comes to me, and when she says, "Can I... " and she’s one of those that I can’t say, "No" to".
“When our teachers see it they get really excited. And they pretty much drive the trips”.

“I think just knowing what opportunities are available and then having a teacher who’s enthusiastic about taking on the logistics of it”.

“…like I said before and we always look at time and money, you know, but, [...] people find money for what they want to do”.

**Spatial Analysis**

The following tables and figures comprises the results from our spatial analysis of barriers relating to location, distance to EE centers, the financial means of districts and individual schools in addition to any relationship with the ethnic profile of districts or schools.

Figure 3 (below) represents spatial patterns related to the level of participation in EE field trips and helps to answer the following question:

*What is the relationship between participation in EE field trips and the location of the school?*

Schools running the highest number of EE field trips were generally clustered closest to the city of Columbia with rural schools having the lowest levels of engagement (Fig. 3).
Figure 3. Annual Number of Field Trips by School Type and Location.
Figure 4 explores the spatial patterns associated with per student expenditures and location. To examine this we used the PPE for public schools and the annual tuition for private schools. The results suggest that the schools with the highest tuition and PPE are near the city of Columbia and the schools with lower levels of PPE/tuition are rural schools (Figure 4).
Figure 4. Annual PPE or Tuition by school type and location.
The Tables below display individual school data for private schools (Table 4) and public schools (Table 5). Data includes, mean travel times between all schools and EE centers within the study area; travel time to the nearest EE center; PPE and annual tuition of each school; the ethnic profile of each school; access to busses and the annual number of EE field trips. This exploration was aimed at answering the following questions:

1. What is the relationship between participation in EE field trips and the school’s distance from EE providers?

2. What is the relationship between percent of black students in a school and PPE or annual tuition?

3. What is the relationship between percent of black students in a school and participation in EE field trips?

While the majority of highly engaged schools were located only a short distance from at least one EE center, there were also schools located short distances that did not participate in EE field trips while others with long travel times were accessing EE field trips. While the results do reflect significant variation in school funding, the relationships between the ethnic profile of individual schools and finance is complex. When reviewing the data on minority percentages and school finance for all schools, the schools with the lowest financial means were majority white schools (Table 4) and the highest resourced public school was a majority black school (Table 5).
Environmental Education in the Congaree Biosphere Reserve

However, when looking at averages for public schools vs private schools the pattern was much clearer. Private schools had much higher percentages of white students, larger budgets and were more than 3 times as likely to be participating in EE field trips than public schools (Figure 5).

Table 4. Tuition, field trip participation, student demographics, and proximity to EE venue of Private schools in CBR.

<table>
<thead>
<tr>
<th>School Type</th>
<th>Tuition</th>
<th>No: EE Field Trips</th>
<th>% Black Students</th>
<th>% White Students</th>
<th>Nearest EE Venue</th>
<th>Mean Travel time</th>
<th>Bus Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private 1</td>
<td>$2,600</td>
<td>0</td>
<td>10</td>
<td>90</td>
<td>21mins</td>
<td>50mins.</td>
<td>N</td>
</tr>
<tr>
<td>Private 2</td>
<td>$3,800</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>36mins</td>
<td>60mins.</td>
<td>N</td>
</tr>
<tr>
<td>Private 3</td>
<td>$5,354</td>
<td>0</td>
<td>ND</td>
<td>ND</td>
<td>33mins</td>
<td>59mins.</td>
<td>Y</td>
</tr>
<tr>
<td>Private 4</td>
<td>$5,604</td>
<td>3</td>
<td>7.5</td>
<td>92.5</td>
<td>39mins</td>
<td>60mins.</td>
<td>y</td>
</tr>
<tr>
<td>Private 5</td>
<td>$7,245</td>
<td>3+</td>
<td>0</td>
<td>98</td>
<td>44mins</td>
<td>58mins.</td>
<td>y</td>
</tr>
<tr>
<td>Private 6</td>
<td>$15,750</td>
<td>3+</td>
<td>30</td>
<td>70</td>
<td>13mins</td>
<td>43mins.</td>
<td>y</td>
</tr>
<tr>
<td>Private 7</td>
<td>$16,200</td>
<td>0</td>
<td>14</td>
<td>75</td>
<td>7mins</td>
<td>41mins.</td>
<td>y</td>
</tr>
<tr>
<td>Private 8</td>
<td>$16,724</td>
<td>6+</td>
<td>10</td>
<td>85</td>
<td>15mins</td>
<td>43mins.</td>
<td>y</td>
</tr>
<tr>
<td>Private 9</td>
<td>$18,445</td>
<td>15+</td>
<td>25</td>
<td>75</td>
<td>15 mins</td>
<td>45mins.</td>
<td>y</td>
</tr>
<tr>
<td>Private 10</td>
<td>$19,250</td>
<td>3</td>
<td>5.0</td>
<td>95</td>
<td>7mins</td>
<td>44mins.</td>
<td>y</td>
</tr>
<tr>
<td>Averages:</td>
<td>$11,097</td>
<td>3.3</td>
<td>11.5</td>
<td>85</td>
<td>10mins</td>
<td>50mins.</td>
<td>-</td>
</tr>
</tbody>
</table>
Table 5. Per-Pupil Expenditure, field trip participation, student demographics, and proximity to EE venue of Public schools in CBR.

<table>
<thead>
<tr>
<th>School Type and ID.</th>
<th>PPE or Tuition$</th>
<th>No: EE Field Trips</th>
<th>% Black Students</th>
<th>% White Students</th>
<th>Nearest EE Venue Mins.</th>
<th>Mean Travel time</th>
<th>Bus Access.</th>
</tr>
</thead>
<tbody>
<tr>
<td>public 1.</td>
<td>$7,401</td>
<td>2</td>
<td>48</td>
<td>42</td>
<td>41</td>
<td>58mins.</td>
<td>y</td>
</tr>
<tr>
<td>public 2.</td>
<td>$7,651</td>
<td>0</td>
<td>18</td>
<td>63</td>
<td>23</td>
<td>50mins.</td>
<td>y</td>
</tr>
<tr>
<td>public 3.</td>
<td>$8,617</td>
<td>0</td>
<td>53</td>
<td>38</td>
<td>51</td>
<td>70mins.</td>
<td>y</td>
</tr>
<tr>
<td>public 4.</td>
<td>$9,155</td>
<td>2</td>
<td>25</td>
<td>39</td>
<td>8</td>
<td>45mins.</td>
<td>y</td>
</tr>
<tr>
<td>public 5.</td>
<td>$9,918</td>
<td>2</td>
<td>62</td>
<td>15.4</td>
<td>8</td>
<td>42mins.</td>
<td>y</td>
</tr>
<tr>
<td>public 6.</td>
<td>$10,547</td>
<td>0</td>
<td>49</td>
<td>38</td>
<td>32</td>
<td>54mins</td>
<td>y</td>
</tr>
<tr>
<td>Title One 7.</td>
<td>$11,044</td>
<td>0</td>
<td>74</td>
<td>16</td>
<td>38</td>
<td>58mins.</td>
<td>y</td>
</tr>
<tr>
<td>public 8.</td>
<td>$12,920</td>
<td>0</td>
<td>39</td>
<td>47</td>
<td>11</td>
<td>43mins.</td>
<td>Y</td>
</tr>
<tr>
<td>public 9.</td>
<td>$16,986</td>
<td>1</td>
<td>52</td>
<td>34</td>
<td>8</td>
<td>43mins.</td>
<td>Y</td>
</tr>
<tr>
<td>Charter 10.</td>
<td>$5890</td>
<td>2</td>
<td>26</td>
<td>ND</td>
<td>29</td>
<td>53mins.</td>
<td>N</td>
</tr>
<tr>
<td><strong>Averages:</strong></td>
<td><strong>$10,012</strong></td>
<td><strong>0.9</strong></td>
<td><strong>44%</strong></td>
<td><strong>37%</strong></td>
<td><strong>25</strong></td>
<td><strong>57mins.</strong></td>
<td><strong>-</strong></td>
</tr>
</tbody>
</table>

Table 5 compares the Per-Pupil Expenditure, the ethnic profile, the total number of EE field trips, access to busses, travel times to the nearest EE center, and mean distances from all EE venues for each public school. Charter schools and schools with Title One status are included.
Environmental Education in the Congaree Biosphere Reserve

**Figure 5:** Comparisons of Public and Private Schools using Average PPE/Tuition, % Black and % White Students, and Total Number of EE Field Trips.

While finance was the most commonly reported barrier, having greater financial resources did not always result in a larger number of field trips (See Figure 6 below).

**Figure 6:** Number of Field Trips in Relation to Average PPE/Tuition for Public and Private Schools.
Table 6 displays fiscal and demographic data of each school district within the CBR and helps to answer the following question.

For public schools, is district PPE related to the racial profile of the district?

The pattern for the school districts within the CBR in which districts with marginally higher percentages of black students receive both the highest and lowest PPE would best be described as lacking definition (Table 6).

Table 6. Per Pupil Expenditure and Demographic data of students from school districts in the CBR.

<table>
<thead>
<tr>
<th>Districts</th>
<th>PPE (total)</th>
<th>%Black</th>
<th>%White</th>
<th>$Local %</th>
<th>$Fed. %</th>
<th>$State %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarendon 1</td>
<td>$17,715.00</td>
<td>51%</td>
<td>48%</td>
<td>43%</td>
<td>18%</td>
<td>39%</td>
</tr>
<tr>
<td>Richland 1</td>
<td>$16,602.00</td>
<td>51%</td>
<td>41%</td>
<td>60%</td>
<td>7%</td>
<td>32%</td>
</tr>
<tr>
<td>Calhoun</td>
<td>$13,371.00</td>
<td>42%</td>
<td>54%</td>
<td>41%</td>
<td>13%</td>
<td>45%</td>
</tr>
<tr>
<td>Richland 2</td>
<td>$13,242.00</td>
<td>50%</td>
<td>38%</td>
<td>45%</td>
<td>7%</td>
<td>48%</td>
</tr>
<tr>
<td>Lexington 2</td>
<td>$12,776.00</td>
<td>22%</td>
<td>66%</td>
<td>47%</td>
<td>8%</td>
<td>45%</td>
</tr>
<tr>
<td>Clarendon 2</td>
<td>$12,188.00</td>
<td>51%</td>
<td>43%</td>
<td>23%</td>
<td>31%</td>
<td>46%</td>
</tr>
<tr>
<td>Kershaw</td>
<td>$11,069.00</td>
<td>24%</td>
<td>69%</td>
<td>37%</td>
<td>9%</td>
<td>54%</td>
</tr>
<tr>
<td>Sumter</td>
<td>$10,511.00</td>
<td>47%</td>
<td>46%</td>
<td>30%</td>
<td>13%</td>
<td>57%</td>
</tr>
</tbody>
</table>

Table 6. Includes the percent of black and white students; the total Per Pupil Expenditure (PPE) per-district in addition to the percentage of PPE that is derived from local, federal and state sources.
V. Discussion

Biosphere reserves represent unique locations in which the development of EL through EE is both a foundational goal and integral to supporting ongoing success. Middle school represents an important stage of life in which to develop EL (Inhelder & Piaget, 1958). Despite this, there are many barriers to participation in EE field trips in formal education settings. This study was focused on understanding the scope of EE field trip participation as well as the barriers and facilitators to participation in EE field trips for middle school students within the context of the CBR.

Our results indicate broad engagement with EE field trips across the CBR with higher levels of engagement in urban areas. Numerous barriers to participation were reported during interviews. Structural barriers including transportation and finance; time; curriculum constraints; knowledge of programs; logistics; liability issues and the motivations of teachers were reported by both providers and administrators. Factors relating to DEI were present in our findings and included language barriers and lowered participation rates amongst African Americans and students from low income families. While individual schools and providers were variously aware of and addressing individual barriers at institutional levels, despite these good intentions, many students, in particular less enabled students, continue to be underserved.
Environmental Education in the Congaree Biosphere Reserve

The Extent of EE

Our results with providers indicated an average of 17% of students from all grade levels were accessing some form of EE in the districts surrounding the CBR. However, interviews with administrators revealed that a large proportion of students were leaving the CBR to access EE programs meaning this figure could be significantly higher (Figure 2).

Understanding and Overcoming Barriers

Transportation and finance.

Access to transportation and or adequate financial resources with which to obtain it were the most commonly mentioned hurdles by both providers and administrators. While no institution had unlimited resources, barriers associated with transportation and finance were most apparent at public and small private schools.

Due to a combination of a lack of a financial allocation for EE field trips and limited budgetary freedom, public school administrators relied on parents and the creative use of discretionary or supplementary funds to support EE field trips. Private school administrators utilized similar mechanisms, although on balance relied more heavily on parents and tuition monies and tended to have greater budgetary flexibility. These approaches are effective in certain instances, however funding for EE field trips remains disparate, unstable and unobtainable in many
circumstances. A specific financial allocation for EE field trips in public schools would afford access to EE field trips, however the smallest of the private schools would remain excluded. Specific transportation grants have been furnished by individual providers in the CBR and in other contexts such as the state of Florida where a statewide program “yellow busses in the parks” provides grants to cover transportation costs to access National and State parks (FSPF, 2019). In the context of the CBR, without access to reliable funding for EE field trips or a needs based access fund specifically for transportation, access will remain difficult for the least able students.

Curriculum constraints.

The curriculum was mentioned by both providers and administrators as a significant hurdle to participating in EE field trips. Curriculum demands resulted in time constraints for teachers and students, while also focusing EE field trip activity into specified times of year and limiting availability at high demand sites. Curriculum related barriers were most pronounced at public schools and further compounded by a reliance on standard approaches to teaching and lack of skills, motivation or confidence on the part of teachers and or administrators to adopt alternate pedagogies. While these issues have been reported as near universal (Anderson et al., 2006) and are due in part to limitations in undergraduate teaching programs (Wendel & Mantil, 2008) research indicates that both EE and experiential based pedagogies are compatible with numerous disciplines. In fact, one specific
model labeled “using the Environment as an Integrating Context (EIC)”, that uses place, community and project based learning in order to integrate knowledge and understanding of both social and ecological systems, has been found to improve outcomes on standardized tests (State Education and Environment Roundtable (SEER), 2005). EIC, which was piloted at several schools by the SCDE, is known for improving outcomes across a range of traditional disciplines including math, reading, writing, social studies and science while also improving student behavior and motivation (Falco, 2004). Students then are not so much restricted by the curriculum per-se but more with practical matters of teacher training and psychological matters of confidence, personal motivation, the collective consciousness of bureaucracy and lack of a bold vision to implement creative approaches to education. Without broader adoption of alternate pedagogies including teacher training programs curriculum associated barriers will continue to limit broader engagement.

Diversity, equity and inclusion.

Despite funding disparity widely reported as having a disproportionate impact on minorities in public education (Baker & Green, 2005; Saporito, 2017; SC Appleseed, 2016) our analysis of school and district PPE did not indicate lower levels of funding for minority dominated districts or schools (Tables 4,5 and 6). A recent nation-wide study reported similar conclusions although warned that supplementary funding streams intended to address this divide remain vulnerable (Ryan, 2018). Our
findings did however indicate lower levels of enrolment in private schools for minorities relative to public and district enrolment data (Figure 5). Some of this enrolment disparity is likely a consequence of the phenomenon of “white-flight” where Anglo-American students leave low performing schools in higher numbers than minority students (Zhang, 2008). As private schools tended to participate in more EE field trips, in the context of CBR this represents lower participation for minorities.

While PPE distribution was not correlated with ethnicity, our results indicated that Language Other than English (LOTE), African American, poor and underperforming students are at risk of being excluded from EE field trips within individual schools. In one instance an almost exclusively Black student group was incapable of participation due to cost, leading to what our respondent termed “a [virtual] segregation effect”. Low performing students, who disproportionately come from backgrounds of poverty (Saporito, 2017; Van der Klaauw, 2008) were reported to be restricted from EE field trips at times. Additionally, a lack of English language fluency amongst a growing Hispanic student population presented a barrier to participation in EE field trips. Some of the above may help explain why several providers reported lowered participation rates amongst African Americans and Latinx students. While these observations remain unquantified in our study, other research in the region has reported similar findings in the context of the CNP (Davis, 2015). Le & Holmes, (2012) found that perceived discrimination, a lack of interest in the park and nature generally and personal financial constraints, traits associated
with marginality, were all contributing factors (Manning, 2011). While EE providers and school administrators were aware of and responding to these issues, it remains vital to continue to address key issues including adequate funding for students in need, developing LOTE programs and supporting the development of EE field trips with academic outcomes. We are also forced to examine and address the “larger social, historical and political structures that have created the current situations” (Tzou & Bell, 2012).

**A spatial perspective.**

Our spatial analysis indicated both funding and participation varied based on geography with rural students having both lowered participation rates in EE field trips in addition to lower budgets. EE providers also reported lowered interest in EE from rural schools although the reasons for this remain unclear.

While the patterns of financial disparity were not linked with higher percentages of African American students, census block data relating to median household income indicates high income disparity in some school attendance zones focused primarily around the City of Columbia. Given the reports of lowered participation rates amongst the poorest members of the school community in some cases, access to EE field trips can be based on personal geography with urban students potentially more vulnerable. While in rural areas the whole student population is not participating, in the urban areas it may be that it is only certain groups of students who are not participating. While inconclusive, it may be that
different approaches are required to encourage or facilitate engagement in EE field trips for students from rural and urban areas. In regards to location, our reports from administrators were varied, with the perception of access not actually correlating with distance from EE venues. While there was higher levels of engagement when schools were located near EE venues (Table 4 and 5.), the range of locations utilized for EE by middle schools indicates that those who are engaging in EE field trips are willing to travel significant distances to do so (Figure 2.). The results displayed in Figure 2 also indicate a general outward trend with many middle students accessing EE in locations outside the CBR.

Facilitators
Clearly greater access to financial resources and transportation were significant in accessing EE field trips. Likewise the freedom from the constraints of the public education system certainly aided in facilitating engagement with EE field trips. However, while a broader policies and approaches remain in short supply beyond individual institutions the most apparent facilitator was the motivation, enthusiasm and dedication of key individuals.

Research Implications
The implications for all involved are wide ranging. Below is a non-exhaustive list of potential practical actions and or approaches to boosting engagement and or overcoming many of the identified barriers.
• Facilitate the co-creation of an EE framework that is responsive to the specific goals and needs of the CBR specifically and BR’s generally.

• Develop a biosphere wide fund specifically to address issues of access to transportation.

• Training for teachers in the utilization of non-traditional locations and pedagogies to facilitate educational experiences incorporating a range of disciplines that is linked to a suitable EE framework.

• Lobby for greater equity in funding distribution as well as a specific budgetary allocation for EE field trips.

• Consider the broad adoption of EIC or similar methods at schools within the CBR.

**Providers.**

• Develop programs that link to a verity of subjects within the curriculum and incorporate both pre and post trip activities.

• Marketing directly to teachers and schools to ensure they are aware of the opportunities in their local areas.
• Outreach programs as a showcase of their programs and to develop personal relationships and motivate and inspire the teachers.

• Seek grants for subsidies for access and transportation fees.

• Ensuring marketing material accurately reflects the range of ethnicities within the region.

• Hire diverse staff.

• Development of programs in LOTE.

Limitations and Future Research

Not all identified schools were able to participate in our study. It is also possible that only those administrators with interest in EE or research generally participated in our study. We were also unable to incorporate the views of teachers who are generally responsible for the delivery of EE which limited our scope of understanding the nature of the content of EE programs.

Perhaps the limited number of participants in this study is its greatest strength in pointing out a direction for future research. The methods employed in this study could productively be extended to incorporate all schools at all grade levels within the CBR or to all middle schools at a state or national level. Our results relating to lowered access to school finance and lowered participation rates amongst rural schools is interesting but limited in scope. Using newly available PPE for individual schools with a simple questionnaire aimed at deriving the total number of EE field trips completed at each school on an annual basis would help to
answer more definitely questions of access and participation based on geography. Furthermore two questions of fundamental importance in the context of the CBR specifically and BR’s generally are: Do the EE programs support the goals of the CBR? And How can we develop a framework of EE that supports the goals of the global network of BR’s?

**VI. Conclusion**

What are the barriers and facilitators to providing and engaging in EE field trips for middle school students within the CBR?

Our study within the CBR revealed a unique location with a wide array of barriers to participation in EE field trips. Previously reported structural barriers associated with time, transportation, finance and the curriculum were commonly reported and widespread. Barriers related to DEI, while less pronounced, suggest access to EE field trips follows broader patterns of social and financial disadvantage including lowered participation rates for public school students and African Americans as well as additional access hurdles for poor, low performing and LOTE students. GIS analysis revealed a clustering of engagement with EE field trips focused in urban areas in addition to greater utilization of EE venues outside the CBR by middle school students. EE remains a core goal of the CBR with Middle school students an important group to engage in order to foster understanding and motivation for action on the reconciliation of conflicts and interrelationships between social and
ecological systems (Schultz & Lundholm, 2010). Barriers associated with transportation, can be solved through relatively simple financial means while curriculum related barriers require a broader adoption of alternate pedagogical approaches. Issues relating DEI require broader divisions within society are continuously recognized and addressed. While many individuals and institutions are addressing various barriers, the CBR with its multifaceted goals and unique setting perhaps best calls for a systematic biosphere wide approach to collaboratively addressing the barriers while testing and refining a framework of EE that is cogent with the goals of the CBR.
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Appendix A.

Interview Script: Phase 1.

Interview Script for Institutions.

Research Survey script:

Organization:

Phone number:

Address:

Name of informant:

Hello, my name is Toby Story and I am a Graduate Student at Clemson University. I am calling because I am conducting a study about Environmental Education in the Congaree Biosphere Reserve and would like to ask you a few questions about your programs. We are trying to get a picture of who is accessing Environmental Education Programs in the area and who is not as well as the frequency with which these programs occur. This is completely voluntary and your may opt out at any point during the interview. The questions will take about 10 minutes and the information you provide will only be reported in broad statistical and spatial terms. Would it be ok to begin with the questions?

Questions Outlined below.
Can you give me a brief overview of the Environmental Education programs you are running for school age groups from k-12?

Who:
What:
Where:

<table>
<thead>
<tr>
<th>Field trips for schools and formal groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal groups (boy scouts, church groups, families, etc.)</td>
</tr>
<tr>
<td>Can you describe (location, topics of interest, the typical programs that you offer?)</td>
</tr>
<tr>
<td>What are the stated goals and objectives for your programs?</td>
</tr>
<tr>
<td>Content area goals, Cross-cutting outcomes like personal development, env. Literacy, etc., and meeting state standards?</td>
</tr>
<tr>
<td>Can you describe the specific curriculum and is it linked to state or national educational standards?</td>
</tr>
<tr>
<td>What specific standards?</td>
</tr>
<tr>
<td>How frequently is your organization providing programs? seasonally?</td>
</tr>
<tr>
<td>What are the size of the groups you are catering to?</td>
</tr>
<tr>
<td>how many site visits does your organization have on an annual basis?</td>
</tr>
<tr>
<td>Question</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Who are your organization’s primary customers? Age groups served?</td>
</tr>
<tr>
<td>Where are they from i.e. which schools/school districts?</td>
</tr>
<tr>
<td>Has the number of people you serve remained the same, increased or decreased in recent years?</td>
</tr>
<tr>
<td>Are there any barriers to school/field trip participation?</td>
</tr>
<tr>
<td>Are there any things your organization are doing to overcome these barriers?</td>
</tr>
<tr>
<td>What is the primary motivation for these groups to attend these programs?</td>
</tr>
<tr>
<td>Finally, would you mind sharing with me a list of the last school years programs, grades, and schools served?</td>
</tr>
</tbody>
</table>
Appendix B.

*Interview Script: Phase 2.*

**Interview script for Principals**

**Introduction:**
Hello, my name is Toby Story and I am a Graduate Student at Clemson University. I am conducting a study about middle schools in the Congaree Biosphere Reserve and their participation in Environmental Education field trips. We are trying to understand which schools are participating in EE field trips as well as what helps or hinders participation. This interview is completely voluntary and you may opt out at any point. Your name and/or the name of your institution will not be included in any published results. The interview should take no more than 30 minutes and the information that you provide will only be reported in broad statistical and spatial terms. This interview will also be recorded and then transcribed for the purposes of accuracy. Would it be ok to begin with the questions?

**Interview script:**

School Name:

Interviewee position:

Number:

Email:
Questions:

Participant history:

1. How long have you been in your current role?

2. Do you have any personal or professional experience with Environmental Education (EE) field trips generally?

Descriptive

School data:

1. Can you tell me a bit about this school?
   - Who you serve, any special focus of the school or other background data.

Program data:

1. Does your school have an active EE program at the school and how is it incorporated into the curriculum?

2. Do any of the teachers at your school take middle school students on Environmental Education field trips or field trips for any other purpose?

Who? What grades participate in these programs? How many students?

Why? Are there specific objectives of these programs? What do the program/s cover?

Where? Where specifically are these programs delivered?

When? What time of year? How often? How long?

Costs? How much does a typical field trip cost? How are the costs of field trips typically covered? Does the school cover costs or is the teacher or parent
responsible for raising funds to cover costs such as transportation and program costs?

Are there grants and other outside funding opportunities that you are aware of to support EE field trips?

Does the school apply for these or are the individual teachers responsible for this?

Does the school currently have any grant or outside support for off campus learning of any kind?

What other off-campus activities do your students participate in as a part of their regular school program? Sports, art, dance etc. How are the costs covered for these events and activities?

**Going into details:**

**Open questions:**

1. *What steps need to be taken to facilitate Field trips of any duration for your students?*

2. *What would need to be done in order to increase the number of EE field trips at this school?*

3. *What factors prevent your teachers or students from organizing or participating in EE field trips?*

**Socio-cultural:**
Environmental Education in the Congaree Biosphere Reserve

1. In your opinion, do the teachers consider EE field trips to be an important component of the education of the students?

2. Is EE supported by the parents of the students who go to this school?

3. Are the parents able to afford any additional costs associated with extra-curricular activities such as field trips?

4. Do you feel the EE programs and venues in the region are able to accommodate the needs of your students?

5. Do you think that EE field trips are a valuable use of time for your teachers and students? Why do you think that it is or is not a valuable use of time?

**Structural:**
Are there any barriers to organizing or participating in Environmental Education field trips as a result of:

1. The primary aims and objectives of the school including curriculum demands, testing, risk management and/or other administrative considerations?

2. Financial constraints including fees for access to programs or venues and or transportation costs?

**Geographic:**
Are there any barriers to organizing or participating in Environmental Education field trips as a result of:

1. The location of the school, including the location or proximity of appropriate venues?
2. Does the school district in which you are situated influence in any way your engagement with EE field trips?

3. Are there advantages or disadvantages, administratively, financially or otherwise to being situated in this particular school district?

Other:

1. Is there anything else that you think I should know that relates to engagement with EE field trips or field trips generally?

2. Out of all the hurdles to running or increasing the scope of field trips for the purposes of EE that we have discussed which one/s would you consider to be the most difficult to overcome and what would be required to overcome it/them?

3. What is the maximum travel time you would be able to allocate for EE field trips?

Lastly, do you have or are you willing to share any of the following data relating to this school?

1. What is the percent of students that meet state grade standards by grade?

2. How many students are you serving between grade 6 and 8 in total?

3. What percent of students are receiving free and reduced lunches/meals?

4. What is the racial makeup of your school?

5. What is the annual per student budget?

6. Is there an annual budget for field trips?
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7. What is the total number of middle school students currently enrolled at this school?

Thank you sincerely for your participation in this project and if you have any study related questions or if any problems arise, please contact Dr. Bob Powell at Clemson University at rbp@clemson.edu, 864-784-7974. If you have any additional questions or concerns about your rights in this research study, or the research staff cannot be reached please contact the Clemson University Office of Research Compliance (ORC) at 864-656-0636 or irb@clemson.edu.