Long Range Transportation Planning:

Transportation and Macro Trends By National Park Service Park Area Classifications

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Transportation and Macro Trends By National Park Service Park Area Classifications

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Prepared by the:

Texas A&M Transportation Institute
The Texas A&M University System
College Station, TX 77843-3135
http://tti.tamu.edu/

Principal Investigator

Katherine F. Turnbull, Ph.D.
Executive Associate Director/Research Scientist

Support:

Shawn Turner, P.E.
Senior Research Engineer

Bonnie Duke
Administrative Coordinator

Greg Griffin, AICP
Associate Transportation Researcher

Gary Lobaugh
Assistant Research Specialist

Shuman Tan
Graduate Assistant Research

Sponsored by:

National Park Service Facilities Planning Branch

Wm. Bryce Lloyd, LRTP Program Manager

DISCLAIMER

This research is performed in cooperation with the Gulf Coast Cooperative Ecosystem Studies Unit at Texas A&M University and the National Park Service Facilities Planning Branch. The content of this report reflects the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the National Park Service. This report does not constitute a standard, specification, or regulation.

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TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

EXECUTIVE SUMMARY

Project Scope

The National Park Service (NPS) enlisted the services of the Texas A&M Transportation Institute (TTI) to explore factors and trends that might influence future visitation levels and transportation needs at national parks and to assist with developing the NPS Long-Range Transportation Plan and future planning activities. The macro trends explored include changes in population and socio-demographic characteristics, the emergence of megaregions, changes in travel behavior, leisure travel and tourism trends, international visitors, the continued rapid advancements in technology, and extreme weather events and climate change. The implications of these trends on the NPS in general and on NPS units by the park area classification system utilized by the NPS were examined.

The six major implications for the NPS emerging from the macro trend analysis were providing multimodal transportation options, supporting active transportation alternatives, using technology to promote park use and to enhance visitor transportation, conducting outreach activities to individuals under the age of 19 and to the Millennial Generation, utilizing partnerships involving multiple agencies and organizations, and developing resilient transportation facilities.

The NPS uses six park area classifications – urban, suburban, outlying, rural, remote, and mixed. Parks in the rural park area classification represent 45 percent of the total NPS units, followed by 21 percent in the urban park area classification, 14 percent in the outlying park area classification, and 10 percent in the suburban park area classification. Eight percent of the NPS units are in the remote park area classification and 2 percent are in the mixed park area classification.

Summary of Macro Trends

The following macro trends and their impacts on NPS units by park area classifications are highlighted in the report.

- Population and Socio-Demographic Characteristics. Major trends include the steady increase in the U.S. population, especially in the south and west, and increasing urbanization. Other major trends focus on the aging of the Baby Boom Generation, the emergence of the Millennium Generation, and the diversification of the population, especially individuals of Hispanic or Latino origin. These trends indicate that those parks within, and adjacent to, high-density areas and those in high growth states – primarily those in the urban, suburban, and outlying park area classifications – will have a large diverse population base from which to draw visitors. This density provides opportunities for multimodal transportation options, but also increases traffic congestion on roads within or adjacent to parks. The aging of the Baby Boom Generation, the emergence of the Millennial Generation, and the increasing diversity of the population indicate a need to provide multimodal options to NPS units in all park area classifications.
- Emerging Megaregions. America 2050 identified 11 megaregions in the country. These megaregions are characterized by interlocking economies, common

transportation systems, and shared natural resources, ecosystems, culture, and history. Most of the NPS units in the urban, suburban, and outlying park area classifications are within a megaregion. Planning, constructing, and operating rail systems, highways, and other transportation modes in megaregions is complex, involving numerous state, local, and federal agencies. This complexity also brings opportunities for new and existing transportation systems. Residents and visitors typically have more travel options available in megaregions, providing alternatives to NPS unit visitors.

- Changes Travel Behavior. Recent trends in this area include slower growth in vehicle miles of travel (VMT), increases in traffic congestion for longer periods of time, continued fuel-price increases and volatility, increasing interest in public transit and travel options among the Millennial Generation and international visitors, increases in recreational vehicle sales after years of decline, and interest in active transportation. Increasing traffic congestion impacts NPS units primarily in the urban, suburban, and outlying park area classifications. Visitors to parks in these categories may experience congestion on freeways, roadways, and transit during the peak travel periods, as well as at other times of the day. NPS units in the urban and suburban park area classifications with multimodal travel options are well situated to attract millennials and international visitors. NPS units in the rural park area classification will experience the major impact of increases in RV sales. NPS units in the urban, suburban, and outlying park area classifications may be accessed by walking, hiking, and bicycling, as well as providing opportunities for these activities within the park. Many NPS units in the rural, remote, and mixed park area classifications have always had a focus on active transportation, while others are expanding options for active transportation.

- Leisure Travel and Tourism Trends. Recent trends indicate that Americans have less leisure time and are spending less of their discretionary income on leisure activities far from home, but that recreational travel by retired individuals is increasing and that interest in cultural, heritage, and nature-based tourism is increasing. The travel trends related to shorter vacation trips closer to home, including "stay-cations," may have different impacts on NPS units based on park area classifications. Parks in urban, suburban, and outlying park area classifications may experience increases in visitors based on their close proximity to large population bases. Parks in all area classification may benefit from increased travel by retired individuals and growing interest in cultural, heritage, and eco-tourism.

- International Visitors. International visitors are an important and growing component of the U.S. tourism market. National parks are often part of international visitors' itineraries. International visitors are typically more accustomed to using public transportation than many Americans and may also walk or use bicycles, as well as travel by tour bus.

- Technology Advancements. Rapid advancements in all types of technologies continue, including those that have a direct or indirect impact on transportation. The continuing technology advancements in three areas – the Internet and

personal communication devices, ITS, and vehicle technologies – are influencing NPS units. Parks are using technologies in all three areas to attract visitors to parks and to enhance their experiences after they arrive. While NPS units in all park area classifications may benefit from the use of these technologies, it appears that they are being applied more in urban, suburban, outlying, and mixed park area classifications, with some applications in the rural park area classification, and few in the remote park area classification.

- Extreme Weather Events and Climate Change. Elements associated with climate change include increasing temperatures overall, more extreme temperature and precipitation events (hurricanes, tornados, and heavy rain and snowstorms), and sea level rise and related storm surges. NPS units will be impacted by extreme weather events and climate change based mostly on geographic location. NPS units along the eastern seaboard are susceptible to hurricanes and related storms. NPS units in other areas of the country may experience flooding due to heavy rainfall, tornados, and other events. NPS units in the urban and suburban park area classifications may experience increasing temperatures, regardless of their location.

Implications for NPS Units

As noted, these macro trends present a number of implications for NPS units collectively, as well as by park area classifications. The six major implications highlighted below, with examples of how parks are currently addressing them, are providing multimodal transportation options, supporting active transportation alternatives, using technology to promote park use and enhance visitor transportation, accelerating outreach to individuals under the age of 19 and to the Millennial Generation, fostering partnerships involving multiple agencies and organizations, and developing resilient transportation facilities.

- Multimodal Transportation Options. Many of the macro trends point to the need for providing multimodal transportation options to, from, and within NPS units. Multimodal options are important for all age groups, especially the Baby Boom Generation, the Millennial Generation, individuals under the age of 19, and international visitors. By providing options to driving, multimodal transportation also helps address the macro trends related to increasing traffic congestion, non-recreational use, and gasoline prices. The multimodal options will likely be different based on park area classifications. NPS units in the urban and suburban park area classifications are more likely to have services from local transit agencies. NPS units in the Washington, D.C., Boston, New York, Philadelphia, and San Francisco areas all benefit from local and regional transit services. Bicycle sharing programs, such as those in Washington, D.C. and San Antonio, provide additional travel options to visitors. NPS units in the rural park area classification typically have none or very limited multimodal options to and from the park, but may have internal park transit services or concessionaires and private transportation options. The bus systems at Acadia, Zion, Rocky Mountain, and Glacier National parks provide examples of these types of systems. Meeting these multimodal transportation needs requires partnerships involving multiple agencies and groups.

- Active Transportation Options. The macro trends point to the growing interest in active transportation among all age groups and types of visitors. Bicycling and walking also help address issues associated with increasing traffic congestion and gasoline prices. Active transportation is often the focus of shorter, more frequent visits to many NPS units. Providing active transportation options is appropriate at NPS units in all park area classifications. The bicycle options associated with the National Mall, the San Antonio Missions National Historical Park, Saguaro National Park, and Acadia National Park provide examples of encouraging active transportation within NPS units. The types of facilities, lengths, and connections to other facilities may differ based on the park area classification. As noted previously with the multimodal transportation options, partnerships with multiple agencies and organizations are key to the successful development and use of active transportation alternatives.
- Technology Applications. The macro trends focusing on the continued rapid development of technology and the increased use of personal communication devices all have implications for the NPS. The use of technology, pre-trip planning information and real-time travel conditions, transit status, and related information in NPS units in different park area classifications was highlighted. These and other applications and innovative use of technology will continue to be important at NPS units in all park area classifications. Partnerships with other agencies, groups, and the private sector will be key to developing and deploying these applications. The National Mall and Blue Ridge Parkway Apps, the Island Explorer real-time bus information in Acadia National Park, and the Blue Ridge Parkway Interactive Map all provide examples of different technology applications in use in different park area classifications.
- Outreach to Youth and the Millennial Generation. The macro trends associated with the demographic changes, including the increase in the population under 19 years of age, and the increasing use of technology by this group and the Millennial Generation point to the need for outreach programs to promote the NPS with these age groups. Examples of programs targeting these age groups include the Blue Ridge Parkway Kids in Parks TRACK Trails Program and the Teen Ambassador project, the Ticket to Ride program, and the Hike to Health program at Voyageur National Park. These examples also highlight the partnerships with other agencies and groups, especially national corporations and local businesses, health organizations, and volunteer groups to develop and conduct these programs. These outreach efforts are appropriate at NPS units in all park area classifications, but will take different forms based on the area, park features, and targeted demographic groups.
- Partnerships with Multiple Agencies, Organizations, and Groups. Partnerships with other agencies, organizations, and groups at all levels are needed to respond to the identified macro trends. Partnerships with other agencies, local communities and businesses, non-profit and philanthropic organizations, national corporations, and other groups are highlighted in the case studies. These partnerships are key to planning, funding, constructing, operating, and maintaining a wide range of transportation facilities and services. These types of

partnerships will be even more critical for the NPS in the future given limited resources and increasing demands on transportation facilities and services. The Island Explorer bus system in Acadia National Park and the Mission Reach B-Cycle Bike Share Expansion associated with the San Antonio Missions National Historical Park provide two examples of these innovative partnerships.

- Developing Resilient Transportation Facilities. The macro trends associated with extreme weather events and climate change highlight the importance of resilient transportation facilities. The devastation to the Gateway National Recreation Area from Super Storm Sandy highlights the need to address resiliency in transportation facilities, which is not easy given the historic nature of transportation facilities at many NPS units. Partnerships with other agencies and groups will be needed to promote resiliency in the transportation system.

Possible Follow-Up Activities

The information presented in this report can be used by the NPS and partner agencies and organizations in a number of ways. First, the report can be used to enlighten and enhance the development of the NPS Long-Range Transportation Plan. Second, information in the report can be applied to the development of long-range transportation plans at the regional level. Third, the macro trends analysis and the approach for assessing transportation issues and needs can be used by NPS units in the different park area classifications. Finally, the report may also be used to facilitate ongoing information sharing among NPS units in the different park area classifications, as well as by the type of projects undertaken.

CHAPTER ONE – INTRODUCTION

Introduction

There is an intrinsic link between transportation and national parks. Traveling to, and within national parks is often a key part of the visitor experience. Congested roadways, overcrowded parking lots, vehicles blocking scenic views, and exhaust fumes all detract from the visitor experience and contribute to the environmental degradation of the parks. As a result, providing access to, and travel within national parks is a major concern of the National Park Service (NPS), gateway communities, and other federal, state, and local agencies.

Federal legislation, Presidential directives, and interagency agreements established new directions for transportation in national parks and other federal lands over the past 20 years. Studies of transit and transportation needs have resulted in new and expanded bus systems, hike and bike trails, and other facilities at some parks. The NPS has numerous activities underway related to transportation, including the development of an overall Long-Range Transportation Plan, NPS Region Long-Range Transportation Plans, and park-specific plans. These efforts focus on identifying transportation needs and potential solutions in a wide range of parks.

Study Objectives and Work Activities

The NPS enlisted the services of the Texas A&M Transportation Institute (TTI) to assist with developing the NPS Long-Range Transportation Plan, especially in exploring factors and trends that might influence future visitation at national parks and transportation needs. The Volpe National Transportation Systems Center (Volpe) is also assisting the NPS with the Long-Range Transportation Plan and other activities. TTI worked in cooperation with Volpe on many of these efforts.

The objective of the study documented in this report was to examine macro trends and transportation needs by the park area classification system utilized by the NPS to enhance the Long-Range Transportation Plan and to assist with future planning activities. The project considered all of the different types of NPS units.[1] The terms "NPS units," "national parks," and "parks" are used interchangeable in this report to refer to all types of NPS sites.

Working with NPS staff, TTI researchers undertook a number of activities to accomplish this objective. These activities included examining and mapping parks by the park area classification system, conducting a literature review of macro trends using traditional methods and on-line search engines, examining these macro trends by park area classification, and developing a transportation assessment by park area classification. This assessment was applied to a case study park in each of the six park area classifications. Additional information was obtained and analyzed on the six case studies, including discussions with local NPS and partner agency staff.

[1] The NPS units include the following types of designations – National Battlefields, National Battlefield Parks, National Battlefield Sites, National Military Parks, National Historic Parks, National Historical Sites, National Lakeshores, National Memorials, National Monuments, National Parks, National Parkways, National Preserves, National Reserves, National Recreation Areas, National Rivers, National Wild and Scenic Rivers & Riverways, National Scenic Trails, National Seashores, and other designations.

Organization of this Report

The remainder of this report is divided into five chapters. The NPS park area classification is described in Chapter Two. Chapter Three examines macro trends by park area classifications. Chapter Four presents an approach for assessing transportation needs and opportunities by the park area classification system. Chapter Five applies this assessment to case studies at a park in each park area classification and explores recent transportation projects at some of these parks. Chapter Six summarizes the major topics addressed in the report and describes potential follow-up activities.

CHAPTER TWO – NPS PARK AREA CLASSIFICATIONS

The NPS Public Use Statistics Office established an area classification for parks based on a park's location. The classifications are scientifically grounded based on factors including the definition of a metropolitan statistical area (MSA), physical distance, and objective transportation data. The NPS provided TTI with the definition of the park area classifications and a listing of the 370 NPS units by park area classification (1). The listing was developed approximately 30 years ago by the NPS Public Use Statistics Office. TTI researchers added 20 newer NPS units that were not included in the listing, using the definition provided below to categorize the park area classification. TTI researchers developed a GIS shape file and mapped the parks by area classification. This GIS database was used in the analysis of potential influences of macro trends on parks by park area classifications presented in Chapter Three.

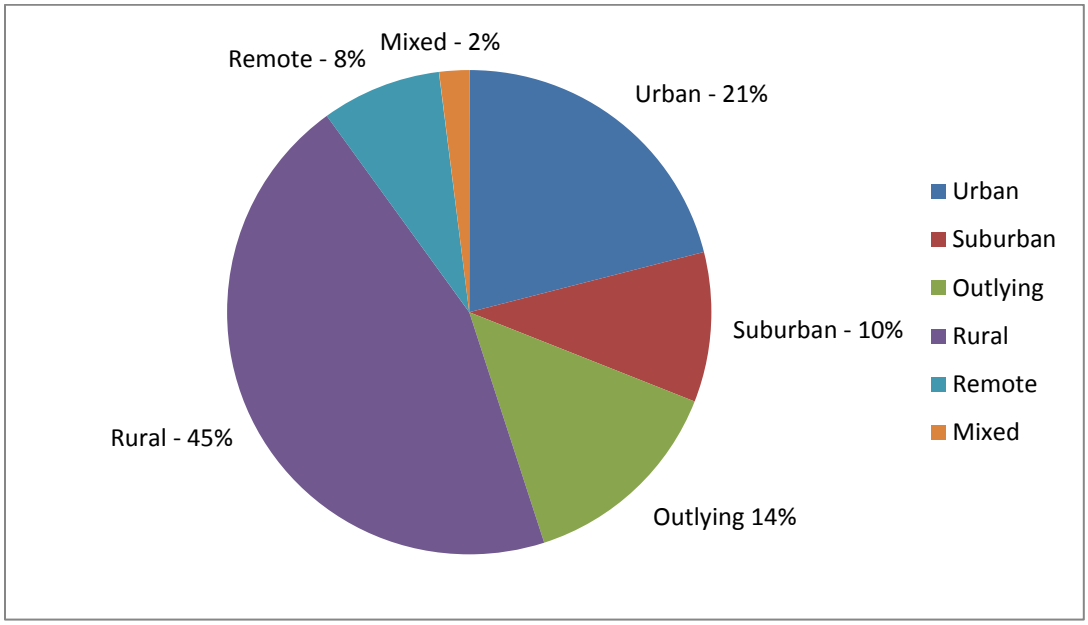
As presented in Table 1, the NPS uses six park area classifications – urban, suburban, outlying, rural, remote, and mixed. The table lists the definition for each classification. The first three area classifications – urban, suburban, and rural – focus on MSA definitions. An access component is added to the definition for rural and remote parks, which are located outside an MSA. Parks in the rural park area classification are accessible by paved highway or scheduled air or marine transportation service. Parks in the remote park area classification require special travel arrangements. The final park area classification is mixed, representing parks – such as the Blue Ridge Parkway – located in some combination of urban, suburban, outlying, or rural areas.

Table 1. NPS Park Area Classification Definitions.

Park Area Classification	Definition
Urban	A park located within the central city of an MSA.
Suburban	A park located outside the central city but still within an MSA with a population of greater than 1 million people.
Outlying	A park located within an MSA with a population of less than 1 million people.
Rural	A park located outside of any MSA and is accessible by paved highway or scheduled air or marine transportation service.
Remote	A park located outside of any MSA and requiring special travel arrangements to reach.
Mixed	A park located in a mixture of outlying, rural, suburban, or urban area.

Source: National Park Service.

Figure 1 presents the percentage of parks in each of the park area classification categories. Parks in the rural park area classification represent 45 percent of the total NPS units, followed by 21 percent in the urban park area classification, 14 percent in the outlying park area classification, and 10 percent in the suburban park area classification. Eight percent of the NPS units are in the remote park area classification and 2 percent are in the mixed park area classification.



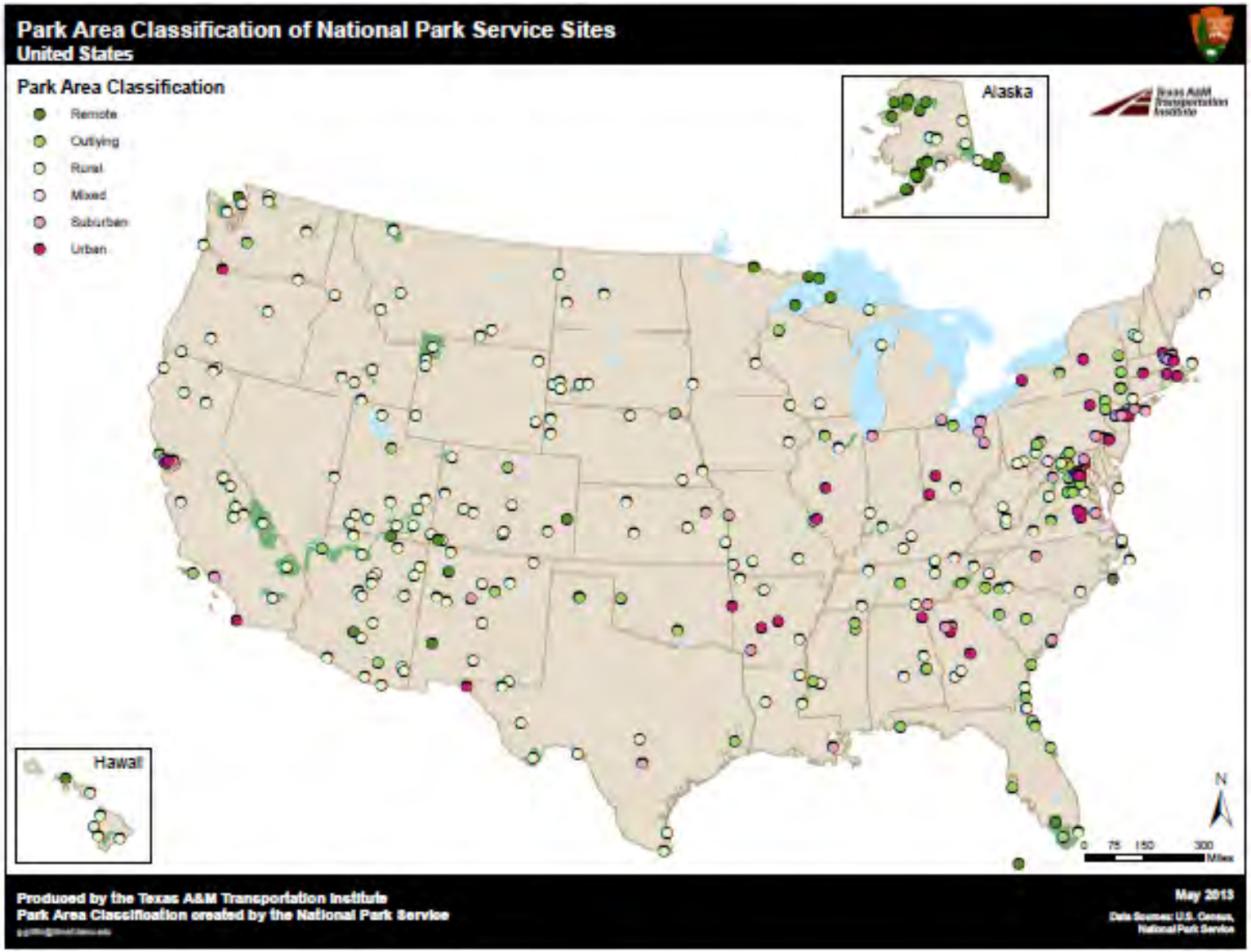
Source: Texas A&M Transportation Institute.

Figure 1. Percentage of NPS Units by Park Area Classification.

Figure 2 illustrates the park area classification for all park units. As illustrated in the figure, Alaska and the western mountain states include the largest number of parks in the rural and remote park area classifications. The highest concentration in the urban park area classification are located in the large eastern seaboard cities.

Based on the definitions, there will probably be little change in the park area classifications of existing NPS units. The exceptions may be parks currently in the outlying classification area that move to a suburban area classification due to the population of the MSA increasing to more than 1 million people, or a park in a remote area classification moving to a rural area classification due to the addition of a paved highway or scheduled air or marine transportation service.

This classification system is used in the remainder of this report. Chapter Three discusses how different macro trends may influence NPS units in the different park area classifications, Chapter Four presents a transportation assessment approach by park area classification, and Chapter Five highlights a case study in each classification.



Source: Texas A&M Transportation Institute, based on information from the National Park Service.

Figure 2. Park Area Classification of NPS Units.

CHAPTER THREE – MACRO TRENDS AND PARK AREA CLASSIFICATIONS

Three broad categories of macro trends were examined in developing the NPS Long-Range Transportation Plan – population and socio-demographic changes, transportation behavior trends, and recreational and leisure trends. In addition, the potential relationship between NPS visitation and local gasoline prices was explored. These trends might influence how the NPS plans, constructs, operates, and maintains transportation facilities and services. The analysis, which TTI contributed to, is documented in a technical paper prepared as part of the NPS Long-Range Transportation Plan development process (2).

For this study, TTI researchers examined these and other macro trends by park area classifications. TTI researchers conducted a literature review on the various macro trends using traditional methods and on-line search engines. The results from this review expanded on the previous work conducted as part of the Long-Range Transportation Plan development. The macro trends explored in this chapter include population and socio-demographic characteristics, the emergence of megaregions, changes in travel behavior, leisure travel and tourism trends, international visitors, the continued rapid advancements in technology, and extreme weather events and climate change. This chapter concludes with a summary of the implications of these trends on the NPS in general and on NPS units by park area classifications.

Population and Socio-Demographic Characteristics

Three major population and socio-demographic trends were identified as part of the NPS Long-Range Transportation Plan development. These trends were the steady increase in the U.S. population, especially in the south and west, the increase in urbanization, and the aging and diversification of the population. For this study, researchers examined 2010 Census data on population density, population 65 years of age and older, population under 18 years of age, African American population, and Hispanic or Latino population (3). These characteristics reflect recent trends relating to growth in the more dense urban areas of the country, the aging of the Baby Boom Generation, the emergence of the next generation, and the continued diversification of the population. These trends may influence visitation at NPS units and transportation needs differently based on park area classifications and other factors.

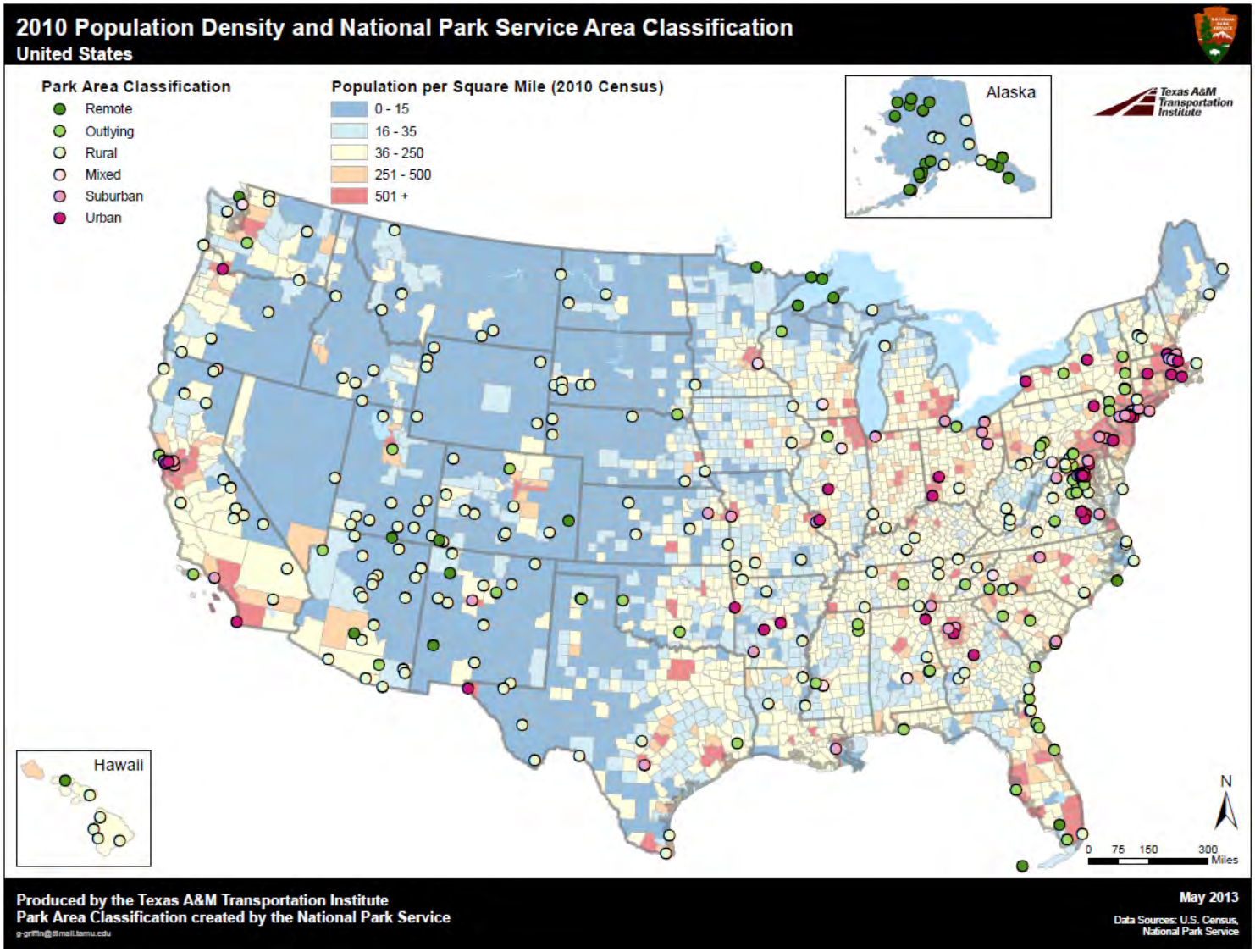
The U.S. population continues to become more urban. In 1960, approximately 70 percent of Americans lived in urban areas. By 2010, approximately 81 percent of the population resided in urban areas (4). Figure 3 presents the NPS area classifications and the population density by county in 2010. As would be expected, parks in urban area classification tend to be located in and near counties with higher population densities. Parks in suburban areas reflect a similar trend of being in or adjacent to more densely-populated counties. On the other hand, rural and outlying parks are located in lower-density counties. Remote parks are typically found in the least dense counties. There are some exceptions to these trends, however. A few rural and outlying parks are close to densely-populated counties and some parks within the urban area classification are located within MSAs, but in lower-density counties.

Parks within and adjacent to high-density areas – those in the urban and suburban park area classifications – have a larger population base to draw visitors from. In addition to these "local" visitors, the dense major cities – such as Washington D.C.; New York; Philadelphia;

Boston; and San Francisco – are also attractions in and of themselves for visitors from throughout the country and the world. These cities also have numerous NPS units.

This density influences transportation to, from, and within NPS units in these areas. On the positive side, multiple transportation options are frequently available in these areas, including highway, heavy rail, commuter rail, light-rail transit (LRT), bus, and bicycle and pedestrian modes. On the negative side, traffic congestion is a major concern in dense urban areas and parking availability may be an issue. Visitors to NPS units in these areas may need to plan extra time for travel to and from parks, but may have more travel options to choose from.

In addition, increasing urbanization and population densities may result in higher volumes of non-recreational trips on park transportation facilities. NPS units in the suburban, outlying, and mixed park area classifications may experience the major impact from increasing non-recreational trips as the surrounding areas become more urban and denser. Concerns over increasing non-recreational travel on park roadways are highlighted in the Saguaro National Park outlying park area case study and the Blue Ridge Parkway mixed park area case study in Chapter Five.

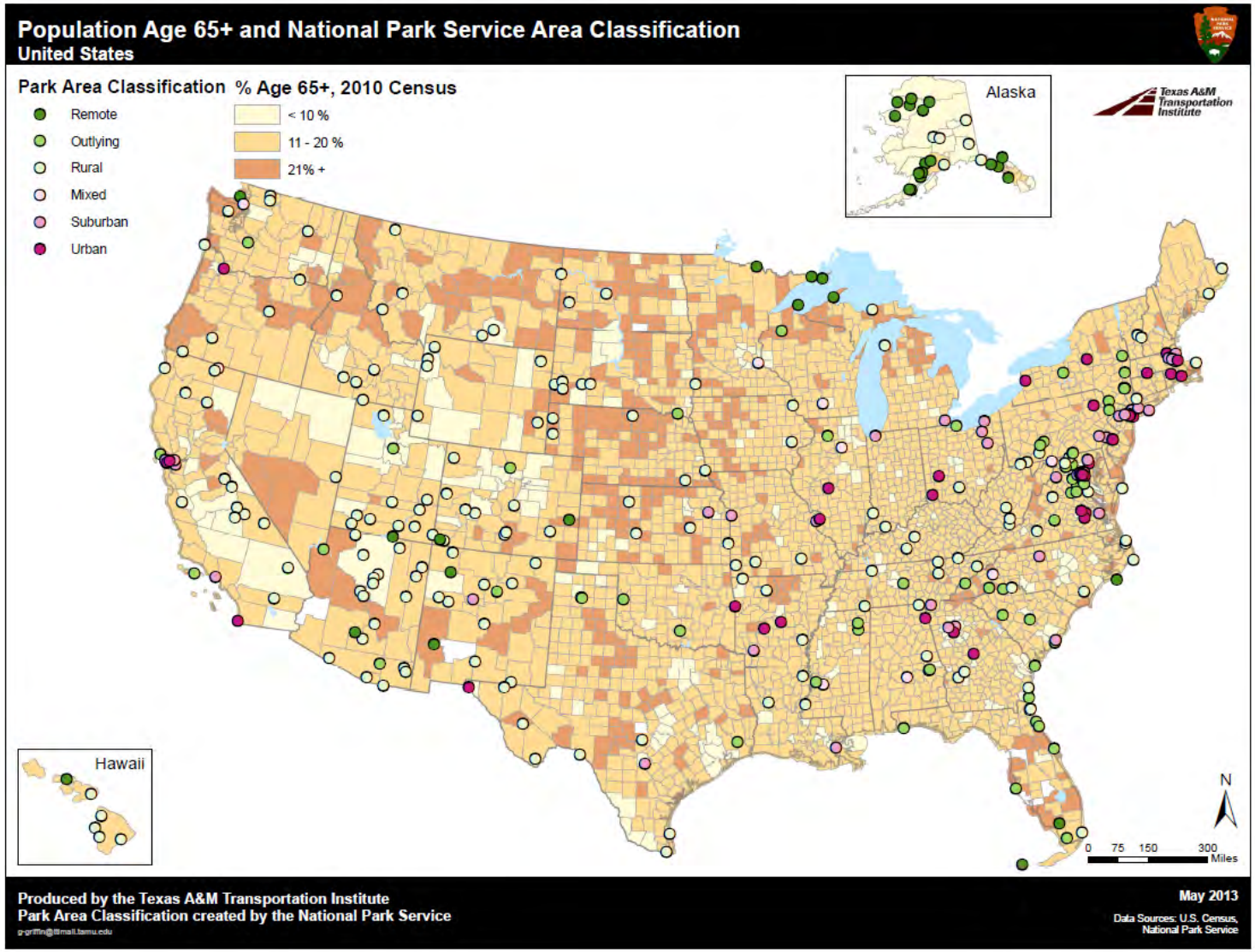


Source: Texas A&M Transportation Institute, National Park Service, and U.S. Census Bureau.

Figure 3. 2010 Population Density and NPS Park Area Classifications.

The percent of the U.S. population 65 years of age and older continues to increase, reflecting the aging of the Baby Boom Generation. In 2010, individuals 65 years of age and older represented approximately 13 percent of the population. Figure 4 illustrates the percent of the population 65 years of age and older by county and NPS units by park area classifications. Counties with higher percentages of individuals 65 years of age and older tend to be in rural areas, largely due to smaller populations in the other age groups.

The travel behavior of this age group is discussed more detail later in this chapter. In terms of possible impacts on NPS units by park area classifications, it could be anticipated that individuals 65 years of age and older will visit parks close to where they live. As noted later, however, it also appears that this age group is traveling for recreation. As a result, visitors from this age group to parks throughout the country and in all park area classifications may increase. According to the 2010 Census, approximately 42 percent of women and 38 percent of men 65 years of age and older have some type of disability. From a transportation standpoint, special considerations may need to be given to these individuals at NPS units.

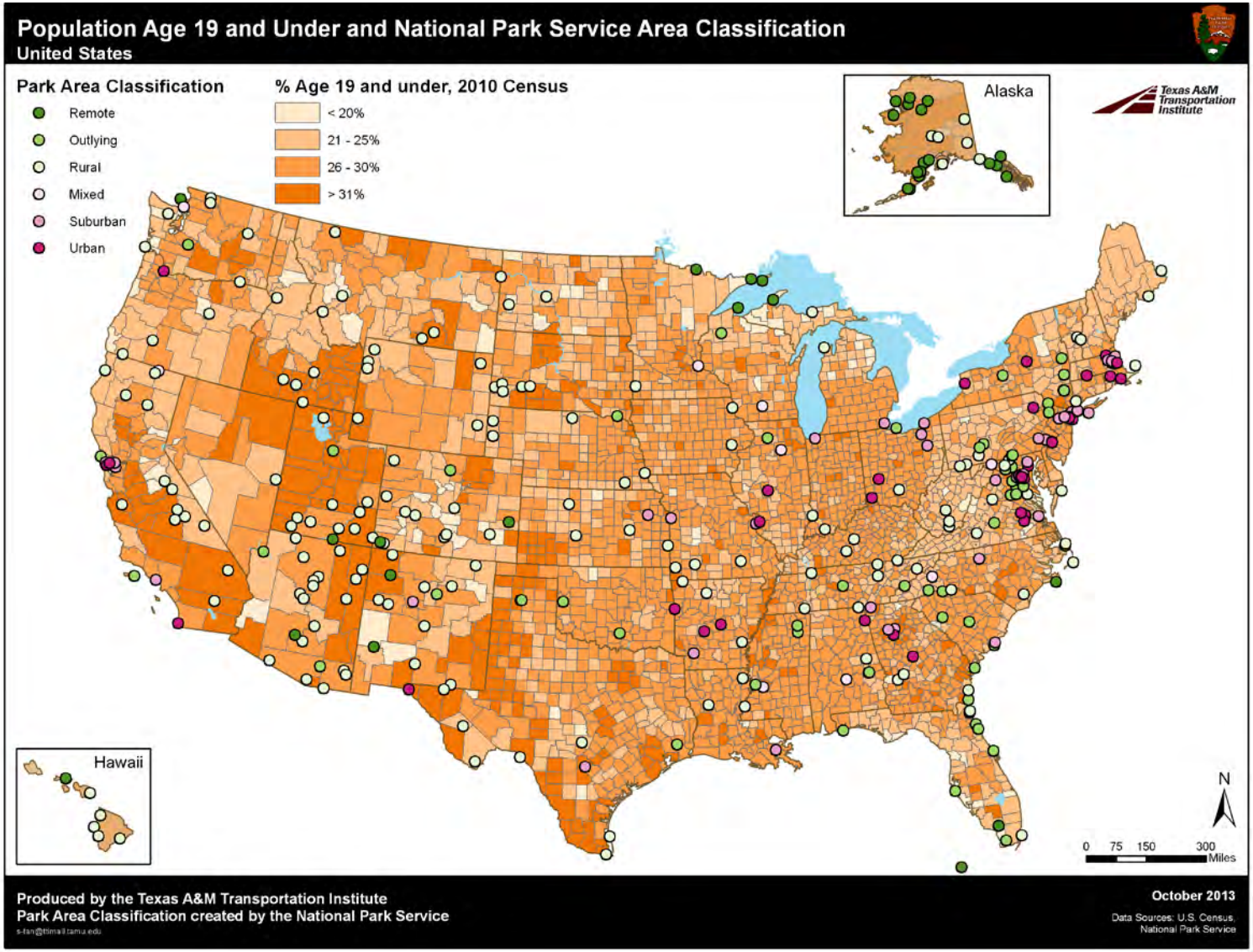


Source: Texas A&M Transportation Institute, National Park Service, and U.S. Census Bureau.

Figure 4. Population Age 65+ and NPS Park Area Classifications.

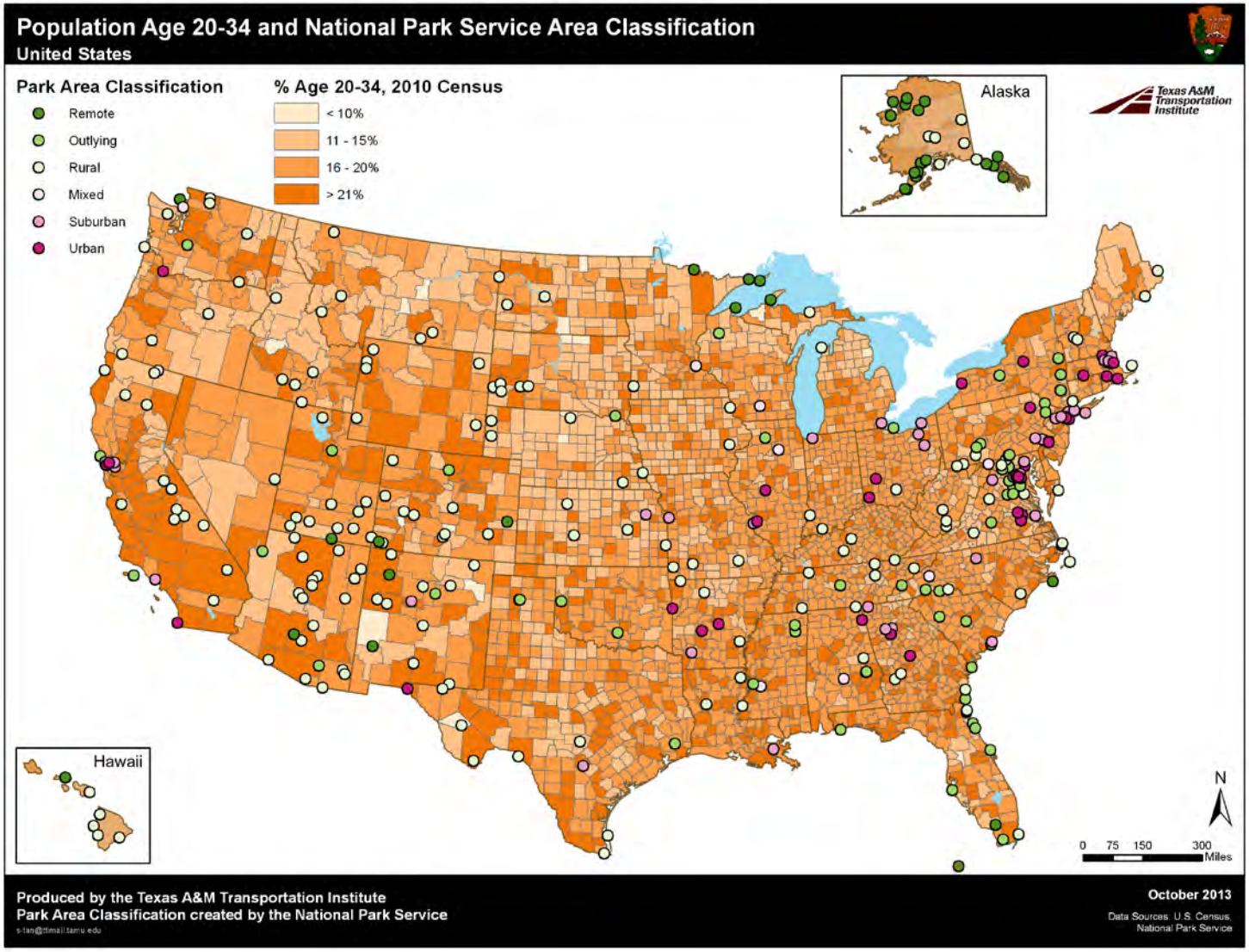
On the other end of the age spectrum, the percent of the population under 19 years of age decreased slightly from almost 26 percent of the population in 2000 to approximately 24 percent in 2010. The growth rate for the population under 19 years of age was 2.6 percent, compared to a 9.7 percent growth rate for the overall population. Figure 5 presents the percent of the population under 18 years of age by county and NPS units by park area classifications and Figure 6 highlights the percent of the population age 20 to 34 by county and NPS units park area classification.

As discussed later in this chapter, there is ongoing research and discussion on the travel behavior of individuals in this age group and the Millennial Generation, representing individuals between 18 and 34 years of age. Suggested trends include lower levels of driving, more use of multimodal options (transit, bicycling, walking, and car-sharing), and substituting technology for travel.



Source: Texas A&M Transportation Institute, National Park Service, and U.S. Census Bureau.

Figure 5. Population Age 19 Under and NPS Park Area Classifications.

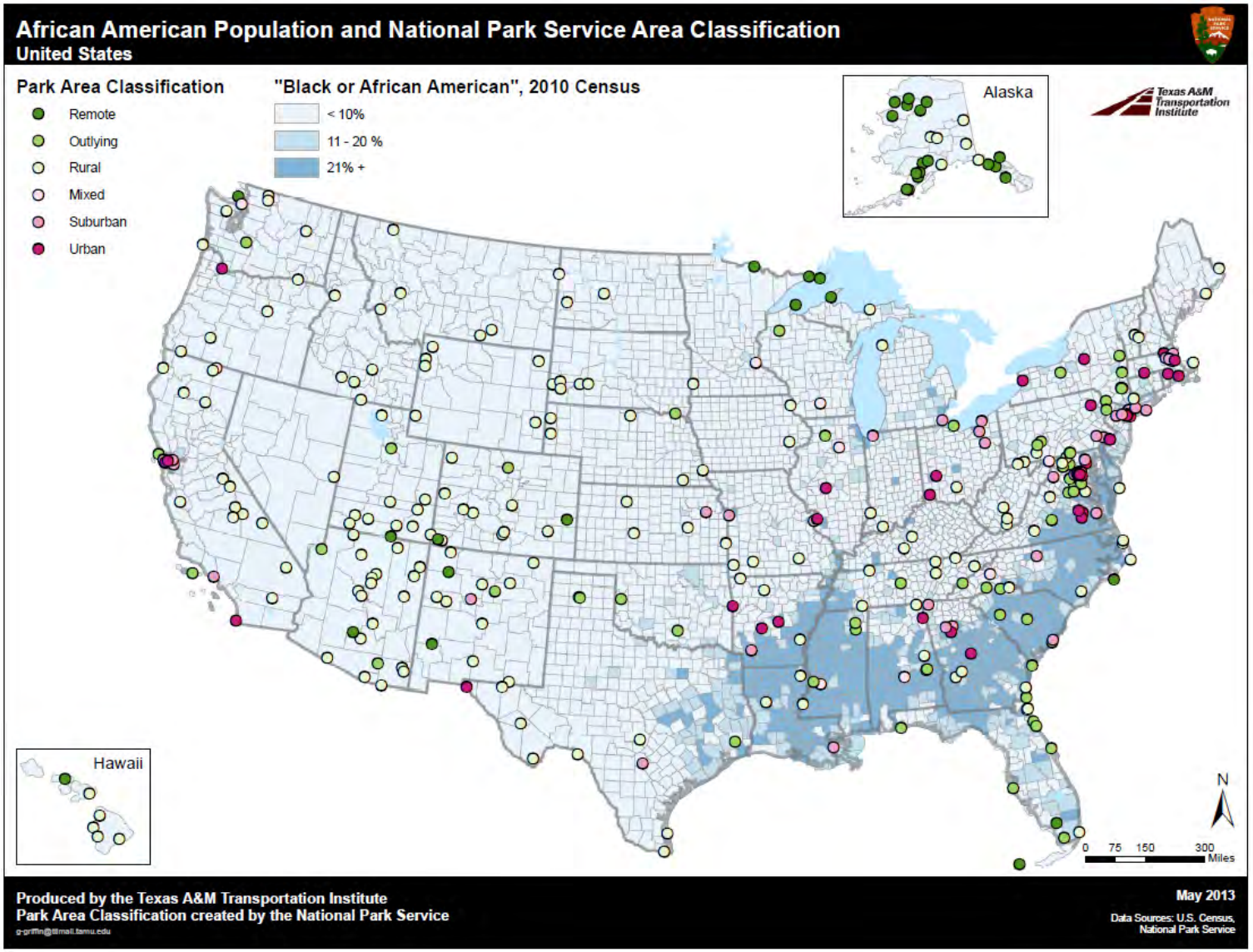


Source: Texas A&M Transportation Institute, National Park Service, and U.S. Census Bureau.

Figure 6. Poplation Age 20-34 and NPS Park Area Classifications.

The potential impact of the increasing diversity of the U.S. population on parks by park area classifications was examined. As discussed next, the potential impact appears to be more geographic-based, with less impact due to park area classifications.

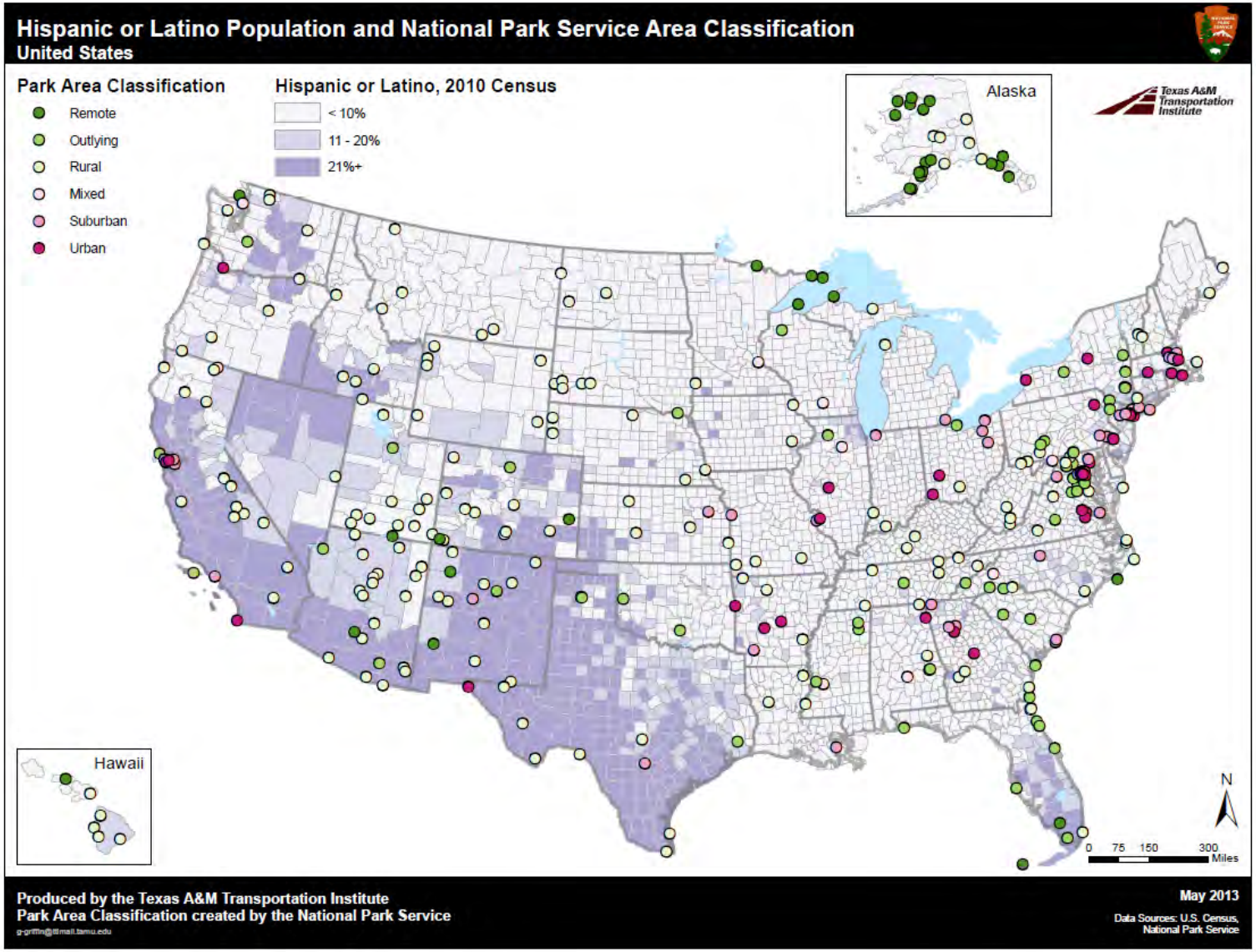
Black or African Americans accounted for approximately 13 percent of the population in 2010. Figure 7 presents the percent of the population by county self-identifying as Black or African- American in the 2010 Census and the NPS units by park area classifications. As illustrated, counties with the largest concentrations of Blacks and African Americans are found the Southeast and Southeastern seaboard states, as well as in major urban areas throughout the country. Based on this distribution, this population group may be more likely to visit NPS sites in all classifications within these areas, but also may travel to other parks, such as the Martin Luther King, Jr. Memorial in Washington, D.C. and the Martin Luther King, Jr. National Historic Site in Atlanta, Georgia.



Source: Texas A&M Transportation Institute, National Park Service, and U.S. Census Bureau.

Figure 7. African American Population and NPS Park Area Classifications.

The Hispanic or Latino population increased by approximately 43 percent between 2000 and 2010. In 2010, this group accounted for approximately 16 percent of the population, compared to 12 percent in 2000. The Hispanic or Latino origin population group further accounts for a larger increase in the under 18 age category. Figure 8 presents the population by county self-identifying as Hispanic or Latino origin in the 2010 Census and NPS units by park area classifications. As illustrated, the largest concentrations of Hispanics and Latinos are in the southwestern and western states, and Florida. Individuals in this population group may be more likely to visit NPS units in these states, regardless of the park area classification. The travel behavior of this population group, including recreation and leisure travel, is just recently being explored in more detail (5).



Source: Texas A&M Transportation Institute, National Park Service, and U.S. Census Bureau.

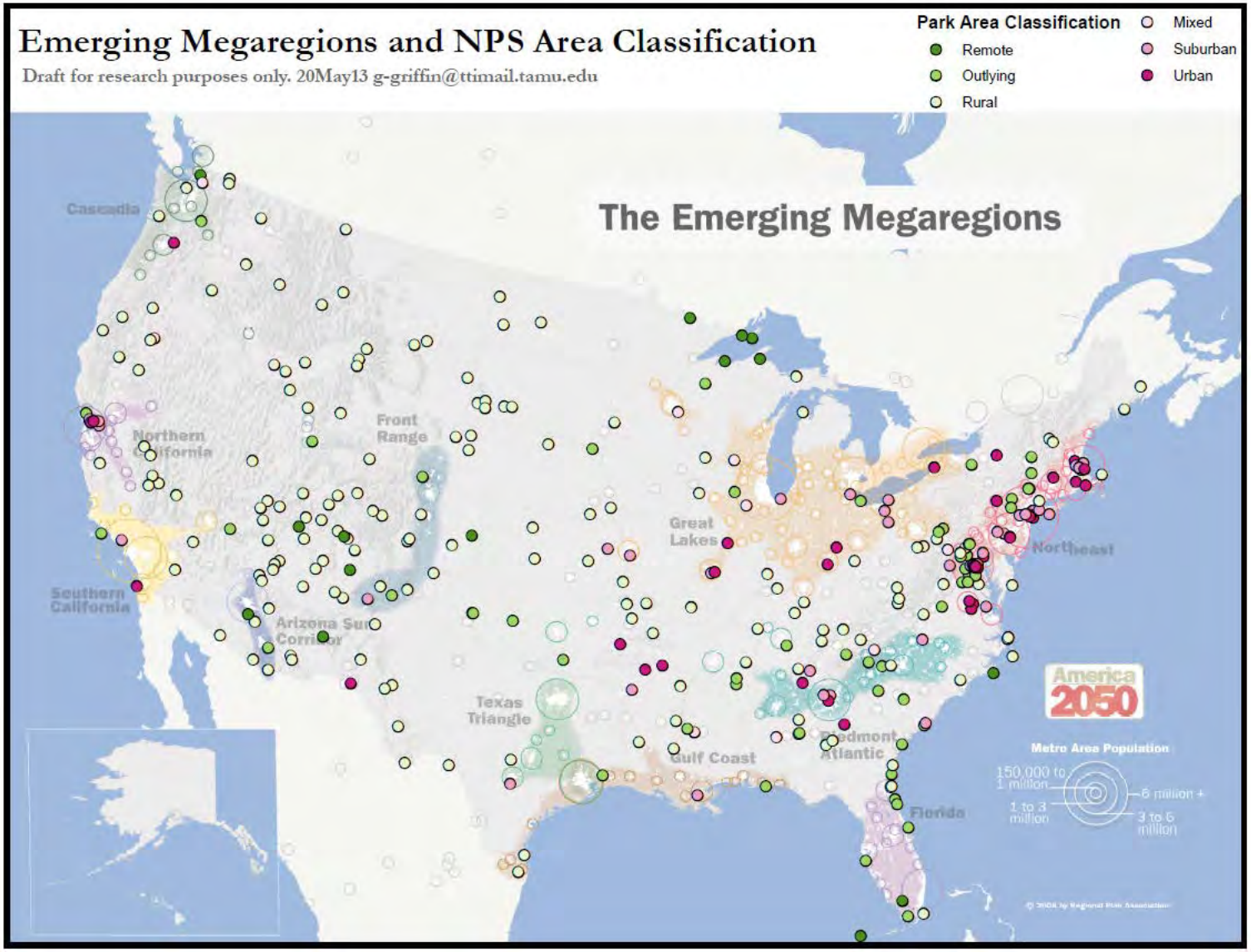
Figure 8. Hispanic or Latino Population and NPS Park Area Classifications.

Emerging Megaregions

Although the general notion of megaregions has existed for decades, the megaregion concept in the U.S. emerged during the early 2000s as metropolitan areas continued to expand and grow closer together. America 2050, a project of the Regional Plan Association and the Lincoln Institute of Land Policy, has been at the forefront of defining and researching megaregions in the U.S. America 2050 has identified 11 megaregions in the country. These megaregions are characterized by interlocking economies, common transportation systems, and shared natural resources, ecosystems, culture, and history (6, 7).

Figure 9 illustrates the location of the megaregions, as defined by the Regional Plan Association, and the NPS park area classifications. The Northeast megaregion, which stretches from Washington, D.C./northern Virginia to New York City/New Jersey contains the largest number of NPS units. The Front Range and Arizona Sun Corridor megaregions include or are close to the numerous national parks in Colorado, Arizona, Utah, and New Mexico. The Piedmont Atlantic and the Florida megaregions also have or are close to many parks. There are a few urban and suburban parks in the Northern and Southern California megaregions, and these regions are close to the numerous parks in the western mountain states. These megaregions are close to many of the iconic western parks. Fewer parks are located in or close to the Texas Triangle, the Gulf Coast, and the Great Lakes megaregions. The numerous NPS units in the central part of the country and the western mountain states are not within a megaregion.

Megaregions provide both challenges and opportunities for the transportation system. As noted previously, common or shared transportation systems are often a defining element of megaregions. For example, Amtrak and I-95 represent two of the common transportation elements in the Northeast megaregion. Planning, constructing, and operating rail systems, highways, and other transportation modes in megaregions is complex, involving numerous state, local, and federal agencies. This complexity also brings opportunities for new and existing transportation systems. Residents and visitors typically have more travel options to select from in megaregions, providing alternatives to NPS unit visitors.



Source: Texas A&M Transportation Institute, National Park Service, and America 2050.

Figure 9. Emerging Megaregions and NPS Park Area Classifications.

Changes in Travel Behavior

The technical report on transportation trends noted that the growth in vehicle miles traveled (VMT) has slowed recently, but that popular parks continue to experience traffic congestion. Five major transportation behavior trends were identified – traffic congestion is affecting more places for larger periods of time, fuel-price increases and volatility may have a net negative effect on visitation, the use of transit among domestic and international travelers is increasing, the sale and use of recreational vehicles is increasing after years of decline, and interest and investment in active transportation in increasing. As discussed in this section, these trends may influence visitation to NPS units differently based on park area classifications.

Traffic congestion in major metropolitan areas, medium-sized urban areas, and small cities continues to increase. The TTI *Urban Mobility Report* has tracked congestion levels for over 20 years. The most recent report indicated that in 2011 traffic congestion resulted in 5.5 billion hours of extra time for travelers and wasted 2.9 billion gallons of fuel, accounting for $121 billion in wasted delay and fuel costs. The report also noted that Fridays were the worst travel days due to the combination of work, school, and recreation and leisure trips. The report also noted that traffic congestion continues to spread throughout the day and is no longer just an issue during the morning and afternoon peak periods (8).

Increasing traffic congestion impacts NPS units primarily in the urban, suburban, and outlying park area classifications. It may also impact NPS units in the mixed park area classification, such as the Blue Ridge Parkway. Visitors to parks in these categories may experience congestion on freeways, roadways, and transit during the peak travel periods, as well as at other times of the day. As a result, visitors may need to plan more time to reach specific NPS sites and to travel between sites in an area.

The results of the 2009 National Household Travel Survey (9), a recent Brookings Institute Report (10), and two recent reports by U.S. PIRG (11, 12) suggest that VMT has leveled off recently and that the country is not experiencing the continued growth in VMT. Numerous factors have been identified as possible contributors to this leveling off of VMT including the recession, high unemployment rates, increased gasoline prices, and increased trip changing and use of transit and other travel modes. There is debate in the transportation community associated with these trends, however, with suggestions that VMT will increase again as the economy recovers.

The potential leveling off in VMT may impact NPS units differently based on park area characteristics. Parks in urban areas with multimodal travel options may be less affected than parks in outlying and rural park area classifications that rely primarily on personal vehicle access. The same situation holds for the potential impacts of increases in gasoline prices – parks with more multimodal transportation options may be less affected than those depending on private vehicles.

Recent studies, including the *Millennials & Mobility: Understanding the Millennial Mindset* sponsored by the American Public Transportation Association (APTA) and the Transit Cooperative Research Program (TCRP), examined the travel behavior of individuals in the 18-to-34 age group, which is more ethnically and racially diverse than previous generations and is living through times of economic dislocation and technology changes (13). The APTA report suggests that the travel behavior of this age group may be different from previous generations.

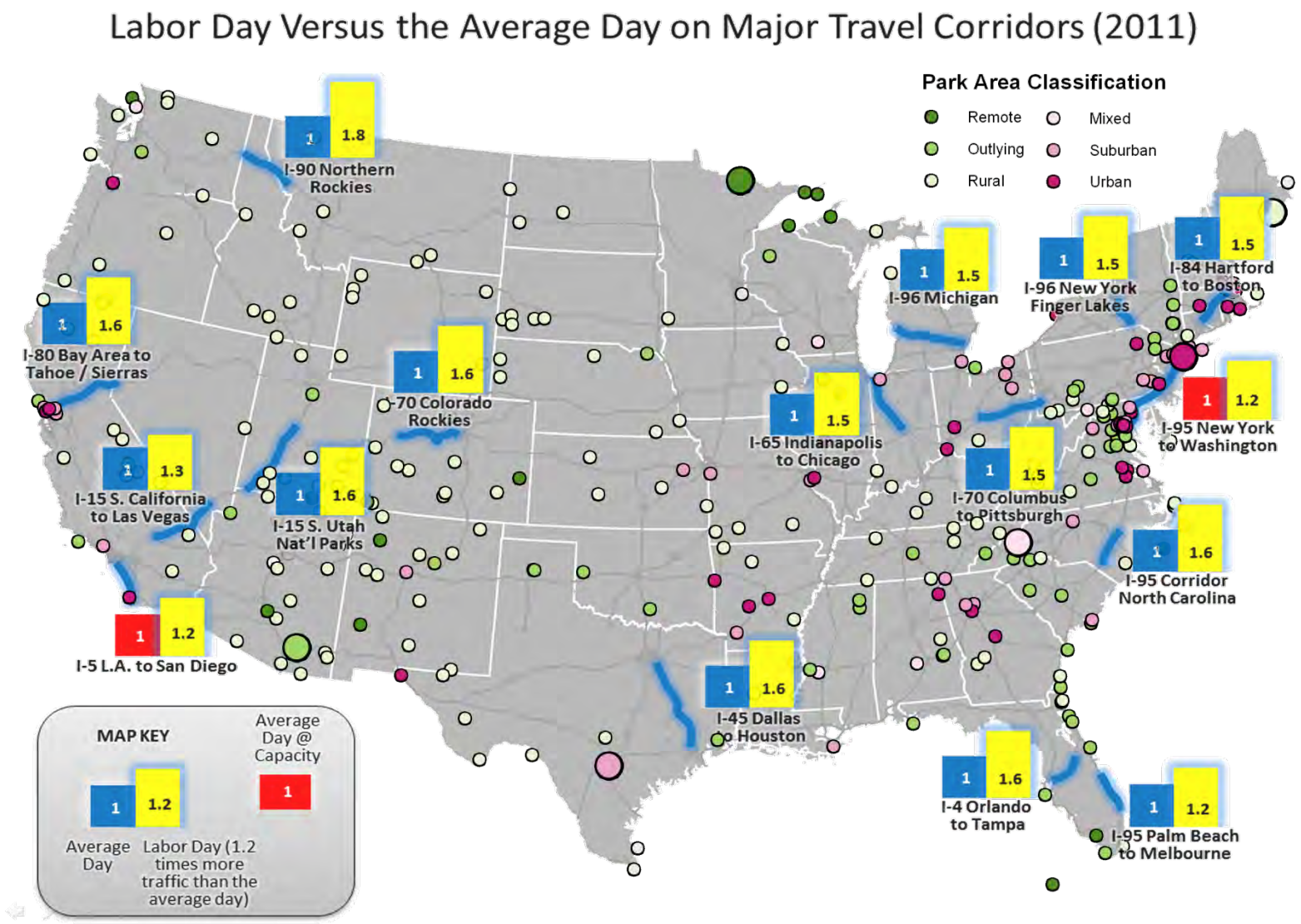
The study included telephone interviews with 11 transit riders from Boston, San Francisco, Austin, Boulder, and Minneapolis, and on-line surveys of 1,000 people in Boston, Chicago, San Francisco, Seattle, Portland, and Washington, D.C. The interview and survey results suggest that urban millennials are multimodal, selecting the best transportation mode – driving, transit, biking or walking – based on the individual trip. Millennials chose to live in areas that support this multimodal lifestyle.

The NPS units in the urban park area classification with multimodal travel options are well situated to attract millennials. Many parks in the area classification are located in cities that all attract millennials. For example, the transportation options in Washington, D.C., which include walking, bicycling, the red bikeshare program, Metro, buses, driving a personal vehicle, and carsharing, are well suited for commuting to work, visiting NPS units, and making other trips. In addition, NPS units in all park area classifications are making outreach efforts to millennials, as well as teenagers and children. Examples of these efforts, which include smart phone apps, the use of Facebook and Twitter, and programs targeted at bringing young people into parks, are highlighted in the case studies in Chapter Five.

The U.S. Travel Association sponsored a study to assess the future performance of travel infrastructure serving the two primary modes of long distance travel – highways and airports. The study, which was conducted by Cambridge Systematics, Inc., examined highway use data for 16 Interstate corridors nationwide (16). Part of the analysis examined highway use on the Labor Day weekend, which is among the busiest travel periods, and air travel over the Thanksgiving holiday, which is the peak for air travel.

The Labor Day weekend highway component of this study is relevant to this project as it includes corridors linking major urban areas to National Parks, other federal lands, and vacation and recreation sites. The study used data from 223 permanent Automatic Traffic Readers [ATRs]) located on major highways and reported to Federal Highway Administration (FHWA) as part of the Vehicle Travel Information System (VTIRIS) database. The study used VTIRIS data from 2011, which is the most recently available. Estimated traffic growth rates derived from state departments of transportation were used to identify when the average day volumes would approach peak day volumes. The state forecasts normalized to common forecast years by FHWA, were weighted and averaged by U.S. Census Divisions.

The data indicated that the Labor Day weekend is among the most heavily traveled periods for long-distance highway travel. The 4th of July holiday, Thanksgiving, and Memorial Day weekends were other heavily traveled periods for long-distance highway travel. The analysis indicates that traffic volumes on these peak weekends are in the range of 140-to-160 percent of average daily demand. Figure 10 presents the Labor Day versus the average day on 16 major travel corridors in 2011. Of interest to this project is that six of the top 16 corridors have a link to a National Park, other federal land, or outdoor recreation area. These links serve NPS units primarily in the urban, suburban, outlying, and rural park area classifications.



Source: U.S. Travel Association.

Figure 10. Labor Day versus the Average Day on Major Travel Corridors (2011).

Fuel prices and NPS visitation levels were explored in the technical report prepared as input to the NPS Long-Range Transportation Plan (2). The potential impact of gasoline prices on leisure and recreational travel is also monitored by the American Automobile Association (AAA) and other travel groups. Overall, the general trends seem to indicate that while individuals may slightly reduce recreational trips during periods of higher gasoline prices, they do not stop traveling. NPS units in the rural and mixed park area classifications may be the most impacted by major increases in gasoline prices as most visitors reach these parks by driving.

RV sales have rebounded recently after a major decline in the late 2000's. According to the Recreational Vehicle Industry Association (RVIA), annual RV shipments declined from approximately 400,000 in 2005 and 2006 to 166,000 in 2009. The recession, high unemployment rates, the housing crisis, and the lack of available loans all contributed to the decline in sales. Recovery in the RV industry began in 2010, with an increase in sales. Almost 290,000 RVs were shipped in 2012, with projections for 310,000 shipped RVs in 2013. While retiring baby boomers are helping fuel increased RV sales, the RVIA reports that average RV owners are around 48 years of age – late-middle-age, but younger than the Baby Boom Generation. Younger families with children are also purchasing RVs and camping trailers (15, 16).

NPS units in the rural park area classification will experience the major impact of increases in RV sales. Camping in tents, trailers, and RVs in these parks is popular. Some NPS units in the mixed and outlying park area classifications may also experience increases in RV traffic. NPS units in the urban, suburban, and remote park area classifications will likely experience little or no impacts from increased RV sales.

Recent interest in active transportation, primarily walking and bicycling, may also influence NPS units differently based on park area characteristics (17). NPS units in the urban, suburban, and outlying park area classifications may be accessed by walking, hiking, and bicycling, as well as providing opportunities for these activities within the park. Many NPS units in the rural, remote, and mixed park area classifications have always had a focus on active transportation, while others are expanding options for active transportation. The case studies in Chapter Five provide examples of new initiatives related to increasing active transportation options, including the expansion of multimodal trails at Saguaro National Park, the bikeshare program at the San Antonio Missions National Historical Park, and the Hike to Health Program at Voyageurs National Park.

Leisure Travel and Tourism Trends

The macro trend analysis conducted for the NPS Long-Range Transportation Plan identified three major findings related to recreation and leisure travel. These findings were that Americans have less leisure time and are spending less of their discretionary income on leisure activities far from home, that recreational travel by retired individuals is increasing, and that interest in cultural heritage and nature-based tourism is increasing. The literature review conducted for this study supported these findings and identified related trends for more frequent shorter vacation trips, extending three-day weekends to four-day weekends, and "stay-cations" (18, 19, 20, 21).

The travel trends related to shorter vacation trips closer to home, including "stay-cations," have different impacts on NPS units based on park area classifications. Parks in urban, suburban, and outlying park area classifications may experience increases in visitors based on their close proximity to large population bases. These trends might limit visitation at some NPS units in rural, remote, and mixed park area classifications, however. The trend toward extending three-day weekends to four-day weekends may increase visitation on Thursdays, Fridays, Mondays, and Tuesdays. Parks which focus on transportation options toward weekends may consider extending service to more of the week to address this trend.

International Visitors

International visitors are an important component of the U.S. tourism market. On a national level, international visitors spent approximately $43 billion on travel to, and tourism-related activities within, the U.S. during the first quarter of 2013 (22). On a state level, international visitors to California continue to increase. Approximately 6.4 million international travelers visited the state in 2012, with an additional 7 million visitors from Mexico and 1.5 million from Canada. All of these figures are increases from 2011. China PRC (not including Hong Kong) accounts for the largest number of overseas visitors, followed by the United Kingdom, Japan, Australia, Germany, South Korea, France, Scandinavia, and India. Approximately 20 percent of the 2012 tourism-related dollars in California were attributed to spending by international travelers (23).

Examining potential relationships between park area classifications and international visitors requires more data than was available for this study. It does appear that NPS units in major urban areas and the iconic rural parks, primarily in the west, receive large numbers of the international visitors. For example, approximately 30-to-40 percent of visitors to Grand Canyon National Park are international travelers (24). The monuments along the National Mall in Washington, D.C., the Statue of Liberty in New York City, and the Liberty Bell in Philadelphia are also popular with international visitors.

International visitors may reflect slightly different travel patterns than U.S. visitors. International visitors are typically more accustomed to using public transportation than many Americans, and may use transit services if available. International visitors may also use bicycles and walk, as well as travel by tour bus.

Technology Advancements

Rapid advancements in all types of technology continue. Many of these technologies have either a direct or an indirect impact on transportation. The influence of technology on young people, including substituting technology for visiting national parks and other outdoor activities has been noted (25, 26). The potential impact of technology advancements in three areas – the Internet and personal communication devices, intelligent transportation systems (ITS), and vehicle technologies – on NPS units based on park area characteristics are examined in this section. As discussed, NPS units are using technologies in all three areas to attract visitors to parks and to enhance their experiences after they arrive.

While NPS units in all park area classifications may benefit from the use of these technologies, it appears that they are being applied more in urban, suburban, outlying, and mixed

park area classifications, with some applications in the rural park area classification, and few in the remote park area classification.

Electronic communication devices, including the Internet, cell phones, other portable communication devices, and digital media are influencing travel behavior. Use of the Internet for planning travel is widespread. People use the Internet to obtain information on destinations and travel options; to make air, hotel, campground, and rental car reservations; and to check the current status of venues, operating hours, weather, and events. The NPS Internet site provides a portal to information on all parks. The individual NPS unit Internet sites use a common format and contain similar information, including travel options to reach the park and available internal travel alternatives. Links may be provided to other sites with more specific information, such as the Island Explorer bus system serving Acadia National Park discussed in the Chapter Five – Park Area Classification Case Studies. Some parks are also using Facebook and Twitter. Figure 11 illustrates the Gateway National Recreation Area Facebook page.

These same devices are also used to obtain real-time information on bus, train, air, and parking services in and around parks. Real-time information is also available on some of these services in parks. Smart Phone Apps have been developed by the NPS for some units, such as the National Mall in Washington, D.C. and by friends groups and other organizations in some parks. Figure 12 illustrates the customized tour feature of the National Map App. Other features includes a map, walking directions, and a per lens to identifying monuments. Cellphone tours narrated by NPS staff are also available. Current topics focus on the Lincoln Memorial, the First Amendment to the Constitution, the Vietnam Veterans Memorial, Hispanic Heroes, and the Cherry Blossom Festival. The Blue Ridge Parkway app developed by the Blue Ridge Parkway Association discussed in the case studies provides one example of this approach.

Source: National Park Service.

Figure 11. Gateway National Parks Facebook Page.

Source: National Park Service.

Figure 12. National Mall Smart Phone App.

Use of the Internet is appropriate for NPS units in all park area classifications. There may be less information and fewer connecting links associated with parks in the remote area classification, however. The use of apps may be more logical at NPS units in urban, suburban, and outlying park area classifications, as well as at more popular parks in the remote and mixed area classifications.

The use of ITS technologies represents a second area that may enhance transportation operations near and within NPS units in some park area classifications. Examples of ITS technologies currently deployed in many metropolitan areas include advanced transportation management systems monitoring freeways, traffic signal timing and priority on major arterial roads, real-time traffic maps, and real-time information on the status of public transit vehicles. These technologies are typically found in urban and suburban park area classifications, but some applications may also be found in outlying, rural, and mixed park area classifications. The real-time road condition map available on the Blue Ridge Parkway, which is discussed in Chapter Five, provides one example of this approach. The real-time bus information provided by Island Explorer in Acadia National Park described provided in the case studies provides an example of an ITS application in a rural park area category.

Changes in vehicle technology will also influence parks differently based on park area classifications. Examples of changing vehicle technologies include the use of alternative fuels, electric vehicles, and connected vehicles. Many transit buses, including those operated by park systems, concessionaires, and private companies use alternative fuels, including propane and

electricity. For example, the Island Explorer service in Acadia National Park uses propane buses, as do other park bus systems. Special fueling stations are needed for these buses.

Plug-in hybrid electric vehicles (PHEVs) are becoming more common in some areas. One of the limiting factors to more widespread use of PHEVs is their limited range and the lack of electric power stations for recharging. National Parks and gateway communities may need to add electric charging infrastructure to accommodate these vehicles in the future. Given the Google car, some forms of connected vehicles or self-driving cars may not be that far off. Infrastructure may be needed in some areas, including parks and gateway communities, to support connected vehicles.

NPS units in urban, suburban, and outlying park area classifications are more likely to experience the impact of these vehicle technologies first, along with the need to provide additional infrastructure. Some NPS units in the rural and mixed park area classification categories may also currently be served by buses using propane or other alternative fuels. NPS units may also incorporate more of these vehicles into park fleets. Parks and gateway communities will need the appropriate recharging or refueling infrastructure to accommodate these and other future vehicle technologies. NPS units in the remote park area classification are less likely to be impacted by these emerging vehicle technologies.

Extreme Weather Events and Climate Change

This section examines the potential impact of more frequent extreme weather events and climate change on transportation facilities in NPS units by park area classification and by geographic area. Elements associated with climate change include increasing temperatures overall, more extreme temperature and precipitation events (hurricanes, tornados, and heavy rain and snowstorms), and sea level rise and related storm surges. The Gateway National Recreation Area case study in Chapter Five illustrates the destruction and rebuilding resulting from a super storm.

Average annual temperatures in the U.S. increased during the 20th Century and temperatures are projected to increase by 4-to-11 degrees Fahrenheit (^{o}F) during this century. The potential of extreme heat events occurring during a year is also increasing. Higher temperatures over longer periods of time may cause transportation infrastructure damage, including reducing the longevity and performance of roadway and parking area pavements, bridge decks and joints, and other assets. Extreme heat may also reduce the operating performance and useful life of buses, trolleys, and park vehicles. Increasing temperatures may be more noticeable and potentially more damaging in areas already experiencing hot weather, including the south and southwestern states. Temperatures in major urban areas are also projected to increase due to the density of buildings, roadways, and other facilities (27).

Increases in precipitation are forecast for the northern portion of the country, while southern sections of the U.S. may continue to experience lower rainfall levels. Extreme weather events, such as Super Storm Sandy, are also forecast to increase. Further, sea levels are projected to rise over the next century, bringing increasing vulnerability from storm surges.

NPS units will be impacted by extreme weather events and climate change based mostly on geographic location. NPS units along the eastern seaboard are susceptible to hurricanes and related storms. NPS units in other areas of the country may experience flooding due to heavy

rainfall, tornados, and other events. NPS units in the urban and suburban park area classifications may experience increasing temperatures, regardless of their location. Considering extreme weather events and climate change in planning, designing, operating, and monitoring transportation assessments and services at all NPS units will be more important in the future.

Implications for NPS Units

The potential impact of these macro trends on NPS units in the park area classifications has been discussed in this chapter. In combination, these macro trends present a number of implications for NPS units collectively, as well as by park area classifications. As highlighted in Table 2 and discussed below, six major implications for the NPS emerge from the macro trend analysis. These implications focus on providing multimodal transportation options, supporting active transportation alternatives, using technology to promote park use and to enhance visitor transportation, outreach to the individuals under the age of 19 and to the Millennial Generation, partnerships involving multiple agencies and organizations, and developing resilient transportation facilities.

- Multimodal Transportation Options. Many of the macro trends point to the need for providing multimodal transportation options to, from, and within, NPS units. Multimodal options are important for all age groups, especially the Baby Boom Generation, the Millennial Generation, and youth under the age of 19. By providing options to driving, multimodal transportation also helps address the macro trends related to increasing traffic congestion, non-recreational use, and gasoline prices. The multimodal options will likely be different based on park area classifications. NPS units in the urban and suburban park area classifications are more likely to have services from local transit agencies. In major urban areas, these services may include commuter rail, heavy rail, LRT, and buses. Bicycle sharing programs may also be offered in some areas. NPS units in urban and suburban areas may also have park transit services or concessionaires and private transportation alternatives. NPS units in the rural park area classification typically have none or very limited multimodal options to and from the park, but may have internal park transit services or concessionaires and private transportation options. Multimodal transportation options are highlighted in the Gateway National Recreation Area, San Antonio Missions National Historic Park, and the Acadia National Park case studies in Chapter Five. Meeting these multimodal transportation needs requires partnerships involving multiple agencies and groups. The need for partnerships is addressed further as an individual implication.

Table 2. Macro Trend Implications for the NPS

Macro Trends	Implication for the NPS
• Aging of the Baby Boomer Generation – Provide Travel Options • Population 20-34 – Desire for Multimodal Transportation • Population Under 18 – Most Cannot Drive • International Visitors – Use Transit at Home • Megaregions – Multimodal Options Available • Increasing Traffic Congestion • Increasing Gasoline Prices and Volatility • Increasing Non-Recreational Use	Multimodal Transportation Options
• Growing Interest in Walking and Bicycling Among All Age Groups • Population 20-34 – Desire for Options • Population Under 18 – Most Cannot Drive • International Visitors • Increasing Traffic Congestion • Increasing Gasoline Prices and Volatility • Shorter, More Frequent Vacations	Active Transportation Alternatives
• Technology Advancements – Internet, Personal Communication Devices, ITS • All Generations Using Technology More, Especially Young People and the Millennial Generation	Technology Applications – Pre-Trip Planning Information and Real-Time Travel Conditions, Transit Status, and Related Information
• Increasing Diversity of the Population • Increasing Population under 19 Years of Age and the Millennial Generation • Increasing Use of Technology by Younger Age Groups	Outreach to Youth and the Millennial Generation
• Megaregions • Providing Multimodal and Active Transportation Options • Addressing Increasing Non-Recreational Travel	Partnerships with Multiple Agencies, Organizations, and Groups
• Extreme Weather Events and Climate Change • Increasing Non-Recreation Use	Resiliency

- Active Transportation Options. Although active transportation can be thought of as a subset of multimodal transportation, it is important enough to highlight as a separate implication for the NPS. The macro trends point to the growing interest in active transportation among all age groups and types of visitors. Bicycling and walking also help address issues associated with increasing traffic congestion and gasoline prices. Active transportation is also often the focus of shorter, more frequent visits to many NPS units. Providing active transportation options is appropriate at NPS units in all park area classifications. The types of facilities, lengths, and connections to other facilities may differ based on the park area classification. All of the case studies in Chapter Five have an active transportation element. As noted above with the multimodal transportation options, partnerships with multiple agencies and organizations are key to the successful development and use of active transportation alternatives.
- Technology Applications. The macro trends focusing on the continued rapid development of technology and the increased use of personal communication devices all have implications for the NPS. The example in this section and the case studies in Chapter Five highlight the use of technology, pre-trip planning information and real-time travel conditions, transit status, and related information in NPS units in different park area classifications. These and other applications and innovative use of technology will continue to be important at NPS units in all park area classifications. Partnerships with other agencies, groups, and the private sector will be key to developing and deploying these applications.
- Outreach to Youth and the Millennial Generation. The macro trends associated with the demographic changes, including the increase in the population under 19 years of age, and the increasing use of technology by this group and the Millennial Generation point to the need for outreach to promote the NPS with these age groups. The case studies in Chapter Five provide examples of numerous programs targeting these age groups. The examples also highlight the partnerships with other agencies and groups, especially national corporations and local businesses, health organizations, and volunteer groups to develop and conduct these programs. These outreach efforts are appropriate at NPS units in all park area classifications, but will take different forms based on the area, park features, and targeted demographic groups.
- Partnerships with Multiple Agencies, Organizations, and Groups. The NPS cannot address the impacts of the macro trends outlined in this report alone. Partnerships with other agencies, organizations, and groups at all levels are needed to respond to these macro trends. The case studies in Chapter Five highlight examples of partnerships with other agencies, local communities and businesses, non-profit and philanthropic organizations, national corporations, and other groups. These partnerships are key to planning, funding, constructing, operating, and maintaining a wide range of transportation facilities and services. These types of partnerships will be even more critical for the NPS in the future given limited resources and increasing demands on transportation facilities and services.

- Developing Resilient Transportation Facilities. The macro trends associated with extreme weather events and climate change highlight the importance of resilient transportation facilities. The devastation to the Gateway National Recreation Area from Super Storm Sandy discussed in Chapter Five highlights the need to address resiliency in transportation facilities. Addressing this need is not easy given the historic nature of transportation facilities at many NPS units. Partnerships with other agencies and groups will be needed to promote resiliency in the transportation system.

CHAPTER FOUR – TRANSPORTATION ASSESSMENT APPROACH BY PARK AREA CLASSIFICATIONS

Traffic Congestion and Mobility Indicators by Park Area Classifications

Transportation serves many purposes and encompasses many facets within NPS units. First, transportation provides access to, and egress from, national parks. Second, transportation provides mobility within parks. Third, transportation – such as historic roads, trolley systems, or water travel – may be a major component or mission of a park. Considering the transportation needs of park visitors, as well as park workers, is important. Further, some NPS units experience high levels of non-recreational travel, which may include local residents, commuters, and commercial vehicles using park roadways.

Transportation needs, issues, and opportunities will vary by park area classification, by geographic location, and by the nature of an individual park. Table 3 presents a general approach for considering two main transportation indicators – traffic congestion and mobility – by park area classification. These indicators are examined for both access and internal circulation. The assignment of indicator levels – high, medium, and low – was based on quantitative and qualitative/anecdotal information.

Table 3. Approach for Considering Traffic Congestion and Mobility Indicators by Park Area Classifications.

Park Area Classifications	Traffic Congestion		Mobility Alternatives	
	Access	Internal	Access	Internal
Urban	High	High	High	High
Suburban	Medium	Medium	Medium	Medium
Outlying	Medium-Low	Medium-Low	Medium-Low	Medium-Low
Rural	Medium-High	Medium-High	Medium-Low	Medium-Low
Remote	Low	Low	Low	Low
Mixed	Mixed	Mixed	Mixed	Mixed

Visitors traveling to and from NPS units in the urban park area classification may be subject to high levels of traffic congestion, as well experiencing traffic congestion within the parks. For example, visitors to NPS units in Washington, D.C.; Boston; Philadelphia; New York; and San Francisco may experience high levels of traffic congestion accessing the parks and traveling within the sites. On the other hand, NPS units in the urban park area classification also have high levels of mobility, with numerous options for travel to, from, and within these parks. These options may include public transit services – commuter rail, heavy rail, LRT, and buses – park concessioner transportation, tour buses, bicycle and pedestrian paths, and segways.

Visitors to NPS units in the suburban park area classification may be subject to moderate or medium levels of traffic congestion and have fewer mobility options. Traffic congestion in many suburban areas is approaching levels experienced in urban areas, especially during the morning and afternoon peak periods. Suburban areas are often not well served by public transit. Available service may be oriented to workers commuting to the downtown area, with little or no service during other times of the day. Mobility options might include automobiles, public transit buses, tour buses, park and concessionaire transportation, walking, and bicycling.

Visitors to NPS units in the outlying park area classification may experience medium-to-low levels of traffic congestion, but also may experience medium-to-low levels of mobility options. Travel to and from these parks may be limited to private vehicles and tour buses. Travel within these parks may be limited to private vehicles, tour buses, park and concessionaire transportation, walking and bicycling.

Visitors to NPS units in the rural park area classification may experience medium-to-high levels of traffic congestion traveling to and from these parks. Roadways leading to many of the more popular parks in the rural park area classification – such as Zion National Park, Acadia National Park, Cape Code National Seashore, and Yosemite National Park – experience significant traffic congestion, especially during peak visitation periods. In general, NPS units in the rural park area classification have medium-to-low mobility options. The development and operation of bus systems at some parks, including Zion National Park, Cape Cod National Seashore, Devils Postpile National Monument, and Glacier National Park, and concessionaire transportation at other parks, provide additional internal travel operations, however.

NPS units in the remote park area classification typically have low levels of traffic congestion and low mobility options. By definition, these parks require special travel arrangements. NPS units in the mixed park area classification may experience mixed levels of traffic congestion and mobility alternatives. For example, travelers on the Blue Ridge Parkway may experience traffic congestion in sections near more populated areas during peak visitation times, but little congestion in other sections. Mobility options may be limited to personal vehicles, tour buses, hiking, and bicycling.

The potential to partner with other agencies, organizations, and groups on transportation projects may also vary by park area classification. In general, NPS units in the urban, suburban, outlying, and rural park area classifications may have more opportunities for partnerships due to more organizations in the area. NPS units in the remote park area classification may have limited opportunities.

Transportation Criteria by Park Area Classifications

The components presented in Table 3 and discussed previously provide a general indication of the transportation elements associated with NPS units in the different park area classifications. TTI researchers identified a set of second-level criteria for assessing the transportation issues, opportunities, and options associated with NPS units in the different park area classifications. In developing the second-level criteria, researchers considered the availability of data needed to assess the criteria and the relevance of the criteria for different park area classifications. It is realized that some data may not be available for every park. Further, not every criterion will be relevant to every park.

Table 4 provides the second-level criteria for NPS units in urban, suburban, and outlying park area classifications while Table 5 presents the criteria for rural, remote, and mixed park area classifications. While the criteria are similar, there are some differences based on the relevance of certain measures to the different park area classifications. For example, the congestion index rank and the travel-time index are not relevant to NPS units in the rural, remote, and mixed park area classifications. The criteria are described next and used in the case studies presented in Chapter Five.

Table 4. Transportation Assessment Second-Level Criteria for Urban, Suburban, and Outlying Park Area Classifications.

Transportation Assessment	Criteria
Traffic Congestion – Access and Internal	• Congestion Index Rank • Travel-Time Index • Traffic Levels • Parking Availability and Use • Recreation versus Non-Recreational Travel • Visitation Levels and Changes in Visitation • MSA and State Population and Changes in Population • Within Megaregion
Mobility Alternatives – Access and Internal	• Density of Attractions within Park • Availability of Public Transit • Availability of Park Transit System • Availability of Park Concessionaire and Private Transportation • Bicycle, Pedestrian, and Other Options

Table 5. Transportation Assessment Second-Level Criteria for Rural, Remote, and Mixed Park Area Classifications.

Transportation Assessment	Criteria
Traffic Congestion – Access and Internal	• Access Roads • Reported or Recorded Congestion • Parking Availability and Use • Recreation versus Non-Recreational Travel • Visitation Levels and Changes in Visitation • State or Regional Population and Changes in Population
Mobility Alternatives – Access and Internal	• Density of Attractions within Park • Access of Modes (Amtrak, etc.) • Availability of Park Transit System • Availability of Park Concessionaire and Private Transportation • Bicycle, Pedestrian, and Tour Buses

Eight criteria are provided for assessing access and internal traffic congestion levels at NPS units in urban, suburban, and outlying park area classifications. The first five criteria – the congestion index rank, the travel-time index, current traffic levels, parking availability and use, and recreation versus non-recreation travel – focus on transportation features. The next three criteria – visitation levels, MSA and state populations, and locations within a megaregion – focus more on the current and future demand for travel. The criteria are defined below with examples from NPS units.

- Congestion Index Rank. This measure provides a general indication of the severity of traffic congestion in the metropolitan area where a park is located. The congestion index rank is provided in the annual TTI Mobility Report. It represents the combined rank of yearly delay per automobile commuter, the Travel-Time Index, excess fuel per automobile commuter, and the congestion cost per automobile commuter. Urban areas are ranked by four size categories to make the comparisons equitable – very large urban areas over 3 million in population, large urban areas with populations over 1 million and under 3 million, medium urban areas with populations over 500,000 and less than 1 million, and small urban areas with populations under 500,000. Many of the most congested very large urban areas are also home to numerous NPS units. These metropolitan areas and their 2012 congestion rank include Washington, D.C., northern Virginia, and Maryland, 1; San Francisco/Oakland, 3; New York City/Newark, 3; and Boston, 5. Visitors to NPS units in these metropolitan areas may need to allow more travel time, especially for trips during the morning and afternoon peak periods.

- Travel-Time Index. The Travel-Time Index for metropolitan areas is also provided in the annual TTI Mobility Report. The Travel-Time Index compares peak period travel times with free-flow travel times on the same segment of roadway. A Travel-Time Index of 1.30 indicates that a 20-minutes free-flow trip takes 26 minutes in the peak period. Examples of the Travel-Time Index for very large urban areas with numerous NPS units include the Washington, D.C. metropolitan area, 1.32; the New York City/Newark metropolitan area, 1.33; the Boston Metropolitan area, 1.28; and the San Francisco/Oakland metropolitan area, 1.22. Visitors to parks in these areas will need to allow more time for travel during the peak periods.

- Current Traffic Levels. Existing traffic levels on roadways leading to and within NPS units provides an indication of current congestions levels and demand, as well as potential impacts on the visitor experience. Traffic counts are available from the NPS for roads within parks, and from state, metropolitan, and local agencies for roads leading to, and adjacent to, parks.

- Parking Availability and Use. The number of parking spaces and the use of those spaces within parks provide an indication of visitor's ability to stop at and enjoy key features in a park. Parking at many parks is in high demand. Further, nearby parking may be limited and expensive in urban and suburban park area classifications. Information on parking availability and use within parks is available from the NPS. Local agencies and Metropolitan Planning Organizations (MPOs) may have information on parking spaces, use, and cost for areas around parks in the urban and suburban park area classifications.

- Recreation Versus Non-Recreational Travel. The NPS monitors recreation and non-recreational travel at some national parks. As noted in the Saguaro National Park case study in Chapter Five, high and growing levels of non-recreational travel are issues at some NPS units. Increasing non-recreational travel may detract from visitor experiences at these parks and may degrade park transportation facilities at a faster rate.

- Visitation Levels and Changes in Visitation. The NPS monitors visitation levels at parks. Information on current visitation and increases or decreases in visitation provides an indication of demand. The lack of transportation options may limit visitation, while congested roadways and parking areas may inhibit visitation.

- MSA and State Population and Changes in Population. Information on population and socio-demographic characteristics from the 2010 Census is available on-line from the U.S. Census Bureau. This information provides an indication of potential demand at NPS units in different park area classifications and different areas of the country.

- Location within a Megaregion. Figure 9 presents the locations of the 11 megaregions identified by America 2050. As discussed previously, NPS units within these megaregions may experience traffic congestion, but have increased mobility options. In addition, there may be more opportunities for multi-agency transportation options in megaregions.

As presented in Table 4, the five criteria for assessing access and internal mobility alternatives are density of attractions within the park, availability of public transit, availability of park transit systems, availability of park concessionaire and private transportation, and bicycle, pedestrian, and other transportation options. These five criteria are highlighted below.

- Density of Attractions within a Park. The density of attractions can be assessed by measuring the distance between attractions within a park. It provides an indication of the ease of visitors traveling from one area to another and the need for travel options within a park. The National Mall in Washington, D.C. provides an example of monuments in an urban park area in closing walking distance. Yellowstone National Park provides an example of natural features that are spread out throughout the rural area park.
- Availability of Public Transit. The availability of public transit can be measured by obtaining route and schedule information from local and regional transit agencies. This measure provides an indication of mobility options for visitors and NPS staff. NPS sites in many urban park area classifications – including Washington, D.C.; Boston; Philadelphia; and New York – are accessible by multiple public transportation modes, including Amtrak, commuter rail, subway, and bus.
- Availability of Park Transit Systems. Park transit systems provide additional mobility options for visitors and park workers. The Presidio Go Shuttle service provided by the Presidio Trust provides an example of a park transit system in an urban area park.
- Availability of Park Concessionaire and Private Transportation. Information on park concessionaires and private transportation services within, to, and from parks is available from the NPS. Examples of park concessionaire transportation include the houseboat rentals in Voyageur National Park and the Red Touring Buses in Glacier National Park.
- Bicycle, Pedestrian, and Other Options. Information on other travel options, including bicycling, walking, and segways is available from the NPS and other agencies and organizations. Examples of these options include the NPS-sponsored bike tours of the National Mall and private bike and Segway tours on the Mall.

As presented in Table 5, the traffic congestion criteria for NPS units in rural, remote, and mixed park area classifications are slightly different. As highlighted next, rather than using the Congestion Index Rank and the Travel-Time Index, the first two measures focus on access roads or modes and reported or recorded congestion. In addition, the state and regional population rather than the MSA population is used as a measure. The remaining traffic congestion and mobility alternatives are similar to those discussed previously for the urban, suburban, and outlying park area classifications.

- Access Roads or Modes. Information is available from the NPS on access options to units in the rural, remote, and mixed park area classifications. Access may be by road, by boat, or by plane and seaplanes.

- Reported or Recorded Congestion. Information may be available from the NPS, state and local agencies, and other groups on congestion levels on roadways approaching and within NPS units in rural, remote, and mixed park area classifications. For example, roadways approaching and within many of the major destination parks, including Yellowstone, Grand Canyon, Yosemite, and Acadia National Parks – which are all in the rural area classification – are congested during the peak visitation season.
- State or Regional Population and Changes in Population. Information from the U.S. Census and from state demographics offices is available for assessing population and socio-demographic characteristics associated with NPS units in rural, remote, and mixed park area classifications.

CHAPTER FIVE – PARK AREA CLASSFICATION CASE STUDIES

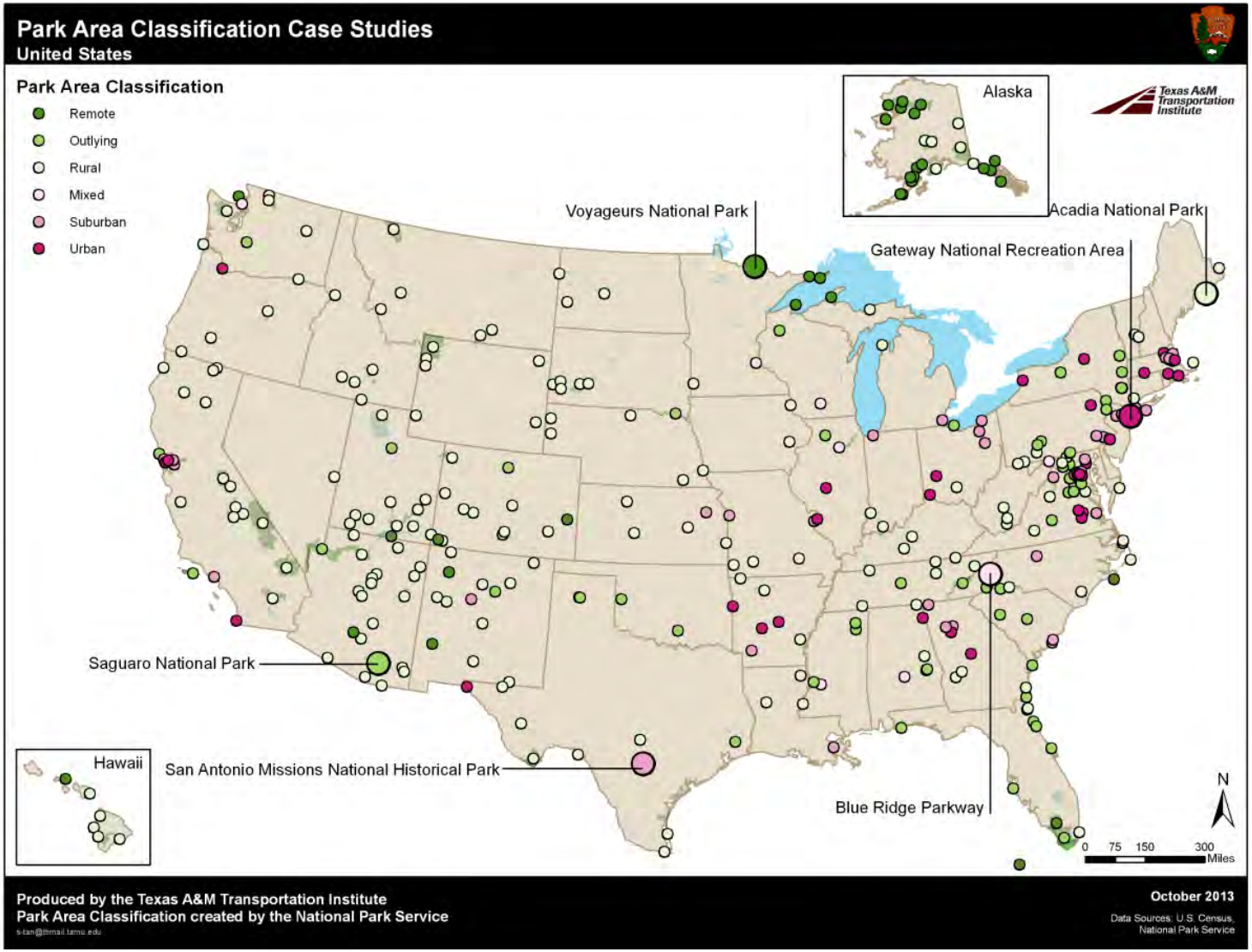
The transportation assessment approach and criteria presented in Chapter Four were applied at case study NPS sites in each of the six park area classifications. Table 6 and Figure 13 present the case study sites, which were identified by NPS staff. Table 6 also includes the macro trends implications highlighted in each case study.

The case studies follow a common format. An overview of the NPS unit is presented first, highlighting the basic characteristics of the park. The transportation assessment criteria are examined and the transportation issues and opportunities are explored. The impact of the macro trends and the implications of these trends are explored. Projects responding to these needs and opportunities are described. These projects include recovering from Super Storm Sandy at Gateway National Recreation Area, a bikeshare program at the San Antonio Missions National Historical Park, a multi-use trail at Saguaro National Park, the Island Explorer bus system at Acadia National Park, programs engaging young people and promoting outdoor activities to all age groups at Voyageurs National Park, and technology applications at the Blue Ridge Parkway. All of these projects and programs involve partnerships with multiple agencies and organizations.

Table 6. Park Area Case Studies

Park Area Classification	NPS Unit Case Study	Macro Trend Implications
Urban	Gateway National Recreational Area	Multimodal Options and Resiliency
Suburban	San Antonio Missions National Historical Park	Active Transportation
Outlying	Saguaro National Park	Non-Recreational Travel and Active Transportation
Rural	Acadia National Park	Multimodal Options
Remote	Voyageurs National Park	Engaging Youth and Active Transportation
Mixed	Blue Ridge Parkway	Technology Applications and Engaging Youth

Information from a variety of sources was used in the case studies. These sources include the park websites, websites of other organizations, and NPS reports. Other sources were papers and articles prepared for the Transportation Research Board (TRB), speakers at mid-year meetings of the TRB Transportation Needs of National Parks and Public Lands Committee, and telephone conversations with NPS staff.



Source: Texas A&M Transportation Institute.

Figure 13. Park Area Classification Case Study Sites.

Urban – Gateway National Recreation Area

The Gateway National Recreation Area urban park area classification case study illustrates the importance of multimodal travel options and the need for resiliency in the face of extreme weather events such as Super Storm Sandy. Information for the case study was obtained through the park website (28) and newsletters (29), NPS reports on the Northeast Region Long-Range Transportation Plan (30, 31), and the Gateway National Recreation Area Draft Management Plan/Environmental Impact Statement (32). Information was also reviewed from other local transportation websites.

Park Overview

Gateway National Recreation Area was established in 1972 to help bring the NPS experience to residents and visitors in the New York and New Jersey metropolitan area. As illustrated in Figure 14, the park includes three units located in New Jersey and New York – the Sandy Hook Unit, the Staten Island Unit, and the Jamaica Bay Unit. Each unit contains different features and provides different recreational activities.

The Sandy Hook Unit is a 2,044-acre barrier beach peninsula on the New Jersey shore. It includes the Sandy Hook Lighthouse, the oldest surviving light house in the country, seven miles of ocean beaches, salt marshes, a maritime holly forest, and hiking trails. Activities include hiking, wind surfing, bird watching, and fishing.

The Staten Island Unit includes Fort Wadsworth, Miller Field, and Great Kills Park. Activities include walking and hiking, biking, birding, boating, swimming, and fishing. The World War Veterans Park at Miller Field includes soccer, football, baseball, softball, and cricket fields. Fort Wadsworth includes seven urban camping sites.

Source: National Park Service.

Figure 14. Gateway National Recreation Area.

The Jamaica Bay Unit includes Floyd Bennett Field, Fort Tilden, Jacob Riis Park, Bergen Beach, Plumb Beach, Canasie Pier, Frank Charles Memorial Park, and Jamaica Bay Wildlife Refuge. Activities include hiking, biking, bird watching, boating, fishing, golfing, horseback riding, picnicking and camping, and team sports.

Transportation Assessment Criteria

Table 7 presents the Gateway National Recreational Area transportation assessment criteria. The New York/New Jersey metropolitan area ranked fourth in the TTI Mobility Index for very large metropolitan areas, with a Travel-Time Index of 1.33. Traffic congestion on freeways and local roadways is congested, especially during the peak periods. Parking at all three units is limited and well used. In 2010, approximately 8.8 million people visited the Gateway National Recreation Area. Visitation declined to 7.7 million in 2011. Visitation levels were highest in 2008, with 9.4 million visitors. The 2010 MSA population was approximately 18.9 million, and the population is projected to increase in the future. The Gateway National Recreation Area is located in the Northeast megaregion.

Table 7. Gateway National Recreation Area Transportation Assessment Criteria

Transportation Assessment/Criteria	Gateway Information
Traffic Congestion – Access and Internal	
• Congestion Index Rank	• 4th – Very Large Urban Areas
• Travel-Time Index	• 1.33
• Current Traffic Levels	• Heavy Congestion
• Parking Availability and Use	• Limited and Well Used
• Current Visitation Levels and Changes in Visitation	• 2010 Visitation – 8.8 Million
• MSA and State Population and Changes in Population	• MSA 2010 Census – 18.9 Million, Increasing
• Within Megaregion	• Northeast Megaregion
• Recreation versus Non-Recreational Travel	• NA
Mobility Alternatives – Access and Internal	
• Density of Attractions within Park	• Fairly Compact
• Availability of Public Transit	• Subway, Commuter Rail, Bus and Ferry Service
• Availability of Park Transit Systems	• Shuttle Bus in Sandy Hook
• Availability of Park Concessionaire and Private Transportation	• Ferry Service
• Bicycle, Pedestrian, and Tour Buses	• Bicycle and Pedestrian Facilities and Tour Bus Access

The density of attractions within all three units is compact. All three units of the Gateway National Recreation Area are accessible by public transportation services. The Sandy Hook Unit is served by New Jersey Transit Bus 834, which stops near the park entrance. Bus 834 also connects to New Jersey Transit's North Jersey Coast Line to Red Bank train. Academy Line bus service operates direct from New York City to Highlands. Ferry shuttle service from Manhattan to Sandy Hook is operated on weekends during the summer. Subway, bus, and ferry services provide access to different parts of the Jamaica Bay Unit. Floyd Bennett Field can be reached by subway and bus. Jacob Riis Park/Fort Tilden is accessible by subway and bus year around, and weekend ferry serviced during the summer. The Jamaica Bay Wildlife Refuge is served by both subway and bus. Fort Wadsworth, Miller Field, and Great Kills Park in the Staten Island Unit are accessible by bus. The Staten Island Ferry also provides access, with buses serving the ferry terminal.

All three units provide bicycle paths or multi-use paths. Maps are available highlighting the bicycle facilities at each unit. In addition, website links are provided to bicycle rental businesses for individuals wishing to rent bicycles. The Jamaica Bay unit also has a kayak paddling trail. A map and guide for kayakers is provided on the NPS website to help plan trips.

The draft Gateway National Recreation Area General Management Plan/Environmental Impact Statement includes three alternatives for future management of Gateway. Alternative A maintains the current status of the park, including no major changes in transportation and access. Alternative B, which is the NPS preferred alternative, would expand transportation options and

access at all three units. Additional transit services to and from the units, internal shuttles, and enhanced bicycle and pedestrian facilities would be provided. Alternative C, which focuses more on preservation, would also improve transportation access and internal mobility, but to a lesser degree than Alternative B (30).

Transportation Projects

Three projects and programs associated with the Gateway National Recreation Area are highlighted in this section. These programs are the agreement between the NPS and the City of New York City Department of Parks and Recreation to cooperatively manage 10,000 acres of federal and city-owned parks, the response and rebuilding after Super Storm Sandy, and the cooperative agreement establishing a new Science and Resilience Institute at Jamaica Bay.

In July 2010, the NPS and the City of New York entered into an agreement to cooperatively manage 10,000 acres of federal and city-owned parks in and adjacent to Jamaica Bay. The agreement focuses on promoting visitation, education programs, scientific research, and opportunities for outdoor recreation. The agreement, which represents an element of President Obama's America's Great Outdoors initiative, allows the two agencies to work on each other's property, to comingle resources, and to conduct joint planning activities (33).

Super Storm Sandy caused major damage to Gateway National Park. All units of the park were closed during and immediately after the storm. While many areas were re-opened in a relatively short time period, other sections took longer to repair. Further, a few facilities were damaged beyond repair and others are still undergoing rehabilitation. Areas of the park, including Floyd Bennett Field, Miller Field, and Riis Park served as emergency staging areas after the storm. The park was without electricity after the storm. Many buildings in the park sustained water damage. Playing fields were flooded, and roads and trails were destroyed. Further, the West and East Ponds at Jamaica Bay were breached by the storm surge, including the West Pond Trail, turning the ponds into saline rather than fresh water.

Jamaica Bay Wildlife Refuge, Frank Charles Park, Hamilton Beach, and Great Kills Park were among the first areas of Gateway to re-open. Hanger 38 was condemned, while Fort Tilden and Canarsie Pier suffered extensive damage. Miller Field was reopened in April 2013 and the Great Kills Park boat ramp was re-opened in May 2013.

The NPS Incident Management Team coordinated the response to the storm and recovery activities for Gateway National Park and other NPS units in the New York/New Jersey metropolitan area. During the peak response period, almost 550 NPS staff from 99 park units in 38 states and Puerto Rico were involved in the recovery activities. Incident Management team members inspected historical, recreational, and natural resources, pumped out and repaired flooded and damaged buildings, and rebuilt trails, walkways, and roads 29).

In partnership with the New York City Parks Department (NYC Parks), approximately 200 workers were hired to assist with the clean-up, restoration, and re-building of Jamaica Bay and Rockaway Parks. The Jamaica Bay/Rockaway Parks Restoration Corps was initiated in May 2013 with funding from a National Emergency Grant administered through the U.S. and New York Departments of Labor. The New York City Department of Small Business Services' Workforce Career Centers assisted with employee recruitment. The full-time jobs lasted six-months, providing on-the-job training in technical and professional areas. Cleaning debris from the Aviation Road Waterfront area of Floyd Bennett Field was one of the first projects conducted

by the Corps. Other projects included restoring existing trails and creating new trails, removing damaged trees and planting new trees, and community outreach activities.

A new Science and Resilience Institute at Jamaica Bay was established in August 2013 through a cooperative agreement among the U.S. Department of Interior, New York City, and The City University of New York. The agreement establishes the new top tier research center to promote the understanding of resiliency in the urban ecosystem and adjacent communities. The Institute, which includes a consortium of universities led by The City University of New York, will develop a framework and programs in partnership with academic institutions, non-profit groups, community organizations, the NPS, New York City Parks, the U.S. Army Corps of Engineers, and other groups to conduct research and other activities to revitalize the Jamaica Bay ecosystem (34).

Suburban – San Antonio Missions National Historical Park

The San Antonio Missions National Historical Park suburban park area classification case study illustrates the active transportation macro trend through the development of a bicycle share system in partnership with local agencies and organizations. Information for the case study was obtained from the park website (35), other websites (36, 37), a TRB paper (38), a NPS report prepared by TTI (39), NPS Intermountain Region Long-Range Transportation Plan reports (24, 40), and a telephone conversation with NPS staff (41).

Park Overview

In 1978, Congress entrusted four historic missions in San Antonio, Texas, to the NPS. The San Antonio Missions National Historical Park was opened in 1983. As illustrated in Figure 15, the four missions – Mission Concepcion, Mission San Jose, Mission San Juan, and Mission Espada – are located south of downtown San Antonio. Portions of the missions are owned by the Archdiocese of San Antonio and continue to be active parishes with regular services and special events. The Alamo Mission in downtown San Antonio, the fifth of the original missions, is owned by the State of Texas. In addition to the four missions, the park includes numerous other historic buildings, such as the Grist Mill, San Juan Dam, Espada Dam, and Espada Aqueduct. The park Visitor Center is located adjacent to Mission San José.

Source: National Park Service.

Figure 15. San Antonio Missions National Historical Park Map.

Transportation Assessment Criteria

Table 8 presents the transportation assessment criteria for the San Antonio National Missions Historical Park. The transportation infrastructure of the park and the transportation needs have been examined in the NPS Intermountain Long-Range Transportation Plan.

Table 8. San Antonio Missions National Historical Park Transportation Assessment Criteria.

Transportation Assessment/Criteria	San Antonio Information
Traffic Congestion – Access and Internal	
• Congestion Index Rank	• 16th – Large Urban Area
• Travel-Time Index	• 1.19
• Current Traffic Levels	• Congested, Especially During Peak Period
• Parking Availability and Use	• Limited and Well Used
• Recreation versus Non-Recreational Travel	• NA
• Current Visitation Levels and Changes in Visitation	• 2010 – 1.3 Million
• MSA and State Population and Changes in Population	• MSA 2010 Census – 2 Million, 16% Increase from 2000
• Within a Megaregion	• Texas Triangle Megaregion
Mobility Alternatives – Access and Internal	
• Density of Attractions within Park	• Spread Out – 2 Miles Apart
• Availability of Public Transit	• Via Bus Service
• Availability of Park Concessionaire and Private Transportation	• None
• Bicycle, Pedestrian, and Tour Buses	• B-Cycle Bikesharing Bicycle and Pedestrian Travel

The linear non-contiguous nature of park, with the missions separated by approximately two miles provides a transportation challenge. Surrounded by developments, the local street system and state highways provide access to the missions. Parking is limited at each mission and the lots are not in the best condition. Public transit service is provided to two of the four missions. The 1995 Visitor Survey found that approximately 82 percent of park visitors traveled by private vehicle.

Local transit service is available to the two northern missions in the park. VIA Metropolitan Transit Route 42 serves Mission Concepcion and Mission San Jose. The service operates seven days a week with 30-minute headways from 4:00 a.m. to 10:30 p.m. on weekdays and from 5:00 a.m. to 10:00 p.m. on weekends. Route 42 provides service to and from downtown San Antonio. Riders can transfer to other routes, including the streetcar circulator, in downtown San Antonio. The VIA base adult fare is $1.20.

A number of approaches have been taken to address the transportation issues associated with the San Antonio Missions National Historical Park. These projects and programs have been conducted through the cooperative and coordinated efforts of the NPS, the City of San Antonio, the Texas Department of Transportation (TxDOT) San Antonio District, Bexar County, the San Antonio River Authority (SARA), and San Antonio Bike Share (SABS). Working together, these agencies and groups have leveraged federal, state, local, and private funding to improve

access to the Missions, to enhance connections to the downtown area and the River Walk, and to provide recreation, active transportation and mobility options to residents and visitors.

Transportation Projects

Projects include adding way finding signs for a driving tour of the missions, developing the Missions Reach Trail, and most recently, the San Antonio B-Cycle Mission Reach Expansion, which is illustrated in Figure 16. This project built on the successful implementation of the first bike share system in the state in San Antonio. It also utilized funding from the Federal Transit Administration (FTA) Paul S. Sarbanes Transit in the Parks (TRIP) program.

Source: Texas A&M Transportation Institute.

Figure 16. San Antonio Missions National Historical Park.

The bike sharing system in San Antonio was initiated in 2010 with the allocation of $2.9 million from the federal American Recovery and Reinvestment Act of 2009 (ARRA) stimulus program. The funding was used for the bicycle station infrastructure and the initial start-up. A competitive procurement process was used to select SABS, a newly-established 501(c) 3 non-program organization, to operate and maintain the system. The ongoing operation of the bike sharing system is funded through membership fees, cooperate sponsorship, advertising, and private donations.

San Antonio B-Cycle was initiated in the downtown area in March 2011, with 13 bike stations and 130 bicycles. Seven additional stations with bicycles were added by October 2011. Visitors and residents can purchase a day pass for $10, a week pass for $24, or an annual pass for $60 ($48 for students, seniors, and military personnel). Riders must be 18 years of age or older. The first 30 minutes of use is free. Each additional 30 minutes is $2, with a daily maximum of $35. The B-Cycle system operating hours are 5:00 a.m. to 11:00 p.m.

Consideration of extending the bike share program from downtown San Antonio along the Mission Reach Trail to the missions was initiated in early 2011. The Mission Reach B-Cycle Bike Share Expansion project was proposed by the City of San Antonio's Office of

Sustainability, SABS, and the NPS Rivers, Trail and Conservation Assistance (RTCA) program to provide alternative transportation to the missions and recreational opportunities for visitors and residents.

The City of San Antonio took the lead in applying for funding from the FTA Paul S. Sarbanes TRIP program, with support from the NPS. The $448,000 funding request included five bike share docking stations, and 60 bicycles. The project was selected for funding, although at a lower levels of $324,000 due to FTA's determination that bicycles were not an eligible transportation expense.

Working with SARA, Bexar County, other land owners, the city and NPS coordinated the design and construction of the bicycle stations with the development of the Missions Reach segment of the SARIP. The park was also awarded a National Park Foundation Transportation Scholar who worked on the project for a year. The planning process identified the need for at least 10 bike stations along the eight-mile trail serving all four missions. The initial phase included six bike share stations and bicycles in the section from downtown to Mission Concepción and Mission San José, the two northern missions. The 60 bicycles were acquired by SABS with other funding (38).

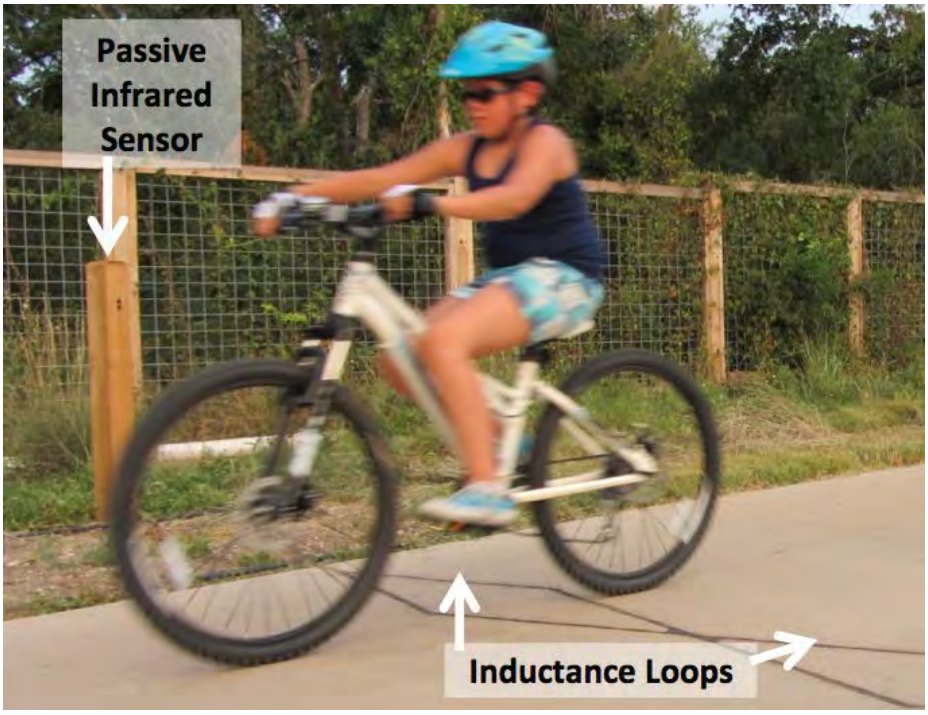
Figure 17 illustrates the promotion for the project. A kick-off event in November 2012 opened the initial segment for use. The city's second application for TRIP funding was also successful, with $295,774 awarded for the additional stations. By August 2013, a total of 12 bicycles share stations were in operation, providing bike share access to all four missions.

Use of the Mission Reach Trail was examined as part of a study conducted by TTI for the NPS Social Service Branch (39). The project developed and refined methods to automatically monitor trail use in national parks. The study objectives were to evaluate commercially available trail counters in typical NPS settings, develop and apply a general process to monitor trail use in different situations, and summarize the trail use data for decision makers. The Mission Reach Trail served as one of the case studies. The Guadalupe Mountains National Park was the other case study.

As illustrated in Figure 18, a permanent counter that combined inductance loops with a passive infrared sensor was installed at Concepcion Park on the Mission Reach Trail. The permanent counter was able to differentiate between bicycles and pedestrians, and the travel direction. Trail use data was collected in the spring and summer of 2012. Figure 19 illustrates how trail use varies by time of day for weekdays, Saturdays, and Sundays. Weekday use is highest in the evenings, while weekend use is highest in the morning. There are more pedestrians than bicyclists during the week, but more bicyclists than pedestrians on weekends. Figure 20 presents the daily pedestrian counts on the Mission Research Trail from February 2012 to January 2013.

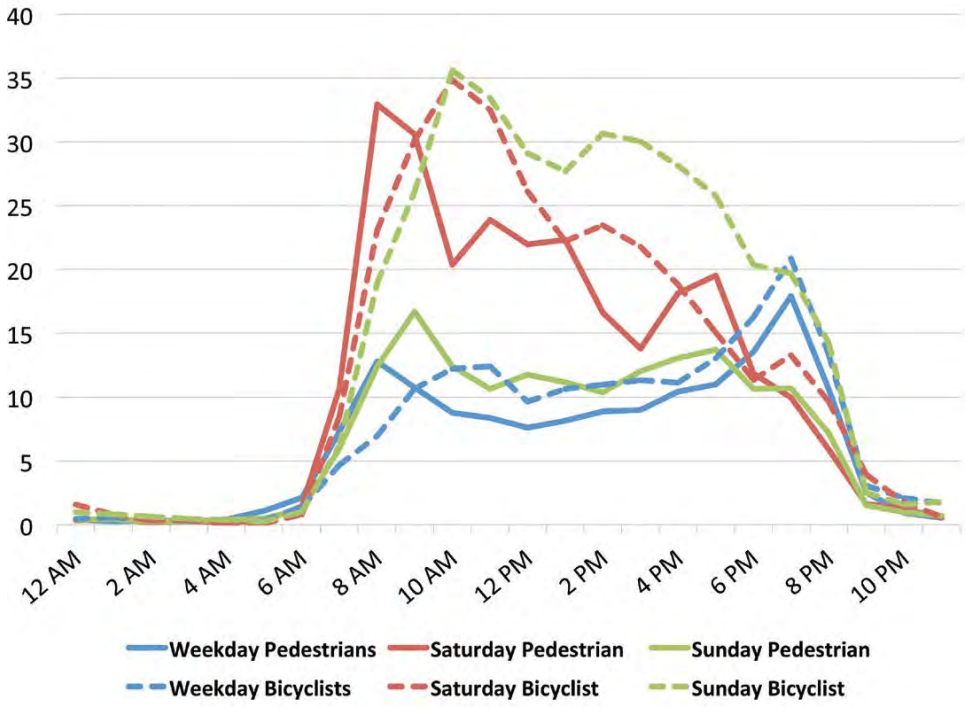
Source: San Antonio B-Cycle.

Figure 17. San Antonio B-Cycle Phase I Launch Flyer.



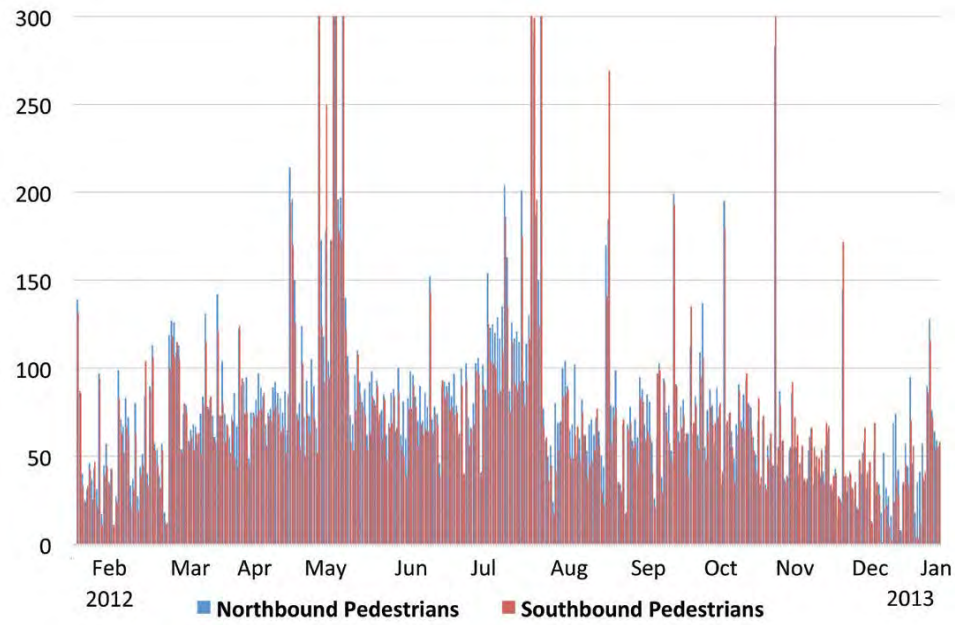
Source: Texas A&M Transportation Institute.

Figure 18. Installations at the SanAntonio Missions National Historical Park.



Source: Texas A&M Transportation Institute.

Figure 19. Mission Reach Trail: Average Hourly Counts.



Source: Texas A&M Transportation Institute.

Figure 20. Mission Reach Trail: Total Daily Count.

Outlying – Saguaro National Park

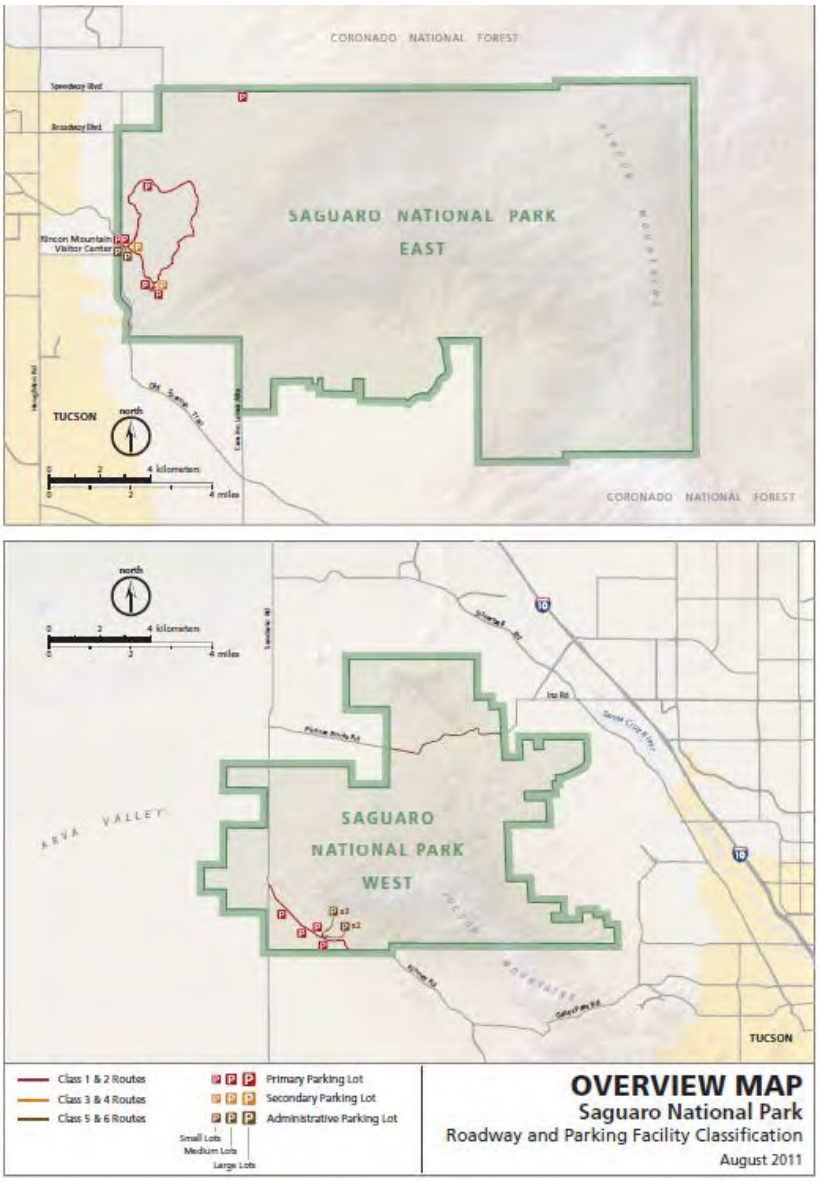
The Saguaro National Park outlying park area classification case study illustrates the macro trends associated with increasing non-recreational travel on roadways accessing NPS units and active transportation through the expansion of a multi-use trail. Information for the Saguaro National Park case study was obtained from the park website (42) and the two NPS Intermountain District Long-Range Transportation Plan reports (24, 40).

Park Overview

Saguaro National Monument was created on March 1, 1933 and was elevated to National Park status in 1994. As illustrated in Figures 21 and 22, the park includes two districts, one on each side of Tucson, Arizona. The Tucson Mountain District (Saguaro West) and the Rincon Mountain District (Saguaro East) are approximately 30 miles apart. The park mission focuses on preservation of the Giant Saguaro cactus and the Sonoran Desert. The Rincon Mountain District contains the 57,930-acre Saguaro Wilderness Area. This roadless back country area was officially designated as wilderness in 1976. Major activities in the park include hiking, bicycling, horseback riding, touring by automobile, and interpretative programs.

Source: National Park Service.

Figure 21. Saguaro National Park Locations in Tucscon.



Source: National Park Service.

Figure 22. Saguaro National Park East and West Districts.

Transportation Assessment Criteria

Table 9 presents the transportation assessment criteria for Saguaro National park. Information on transportation assets and issues in the park is contained in the NPS Intermountain Region Long-Range Transportation Plan Baseline Condition Report and the Macro Trends for Transportation Report. The Tucson area is ranked sixth among medium-sized urban areas in the TTI overall traffic congestion index, with a Travel-Time Index of 1.16. Current traffic levels on roadways adjacent to and through the park are congested during the peak periods, with high levels of non-recreation travel. Picture Rocks Road and Sandario Road in the Tucson Mountain District, which account for much of the non-recreation traffic care maintained by the City of Tucson. In 2010, there were approximately 717,614 recreation visits and 2.28 million non-recreation visits.

Table 9. Saguaro National Park Transportation Assessment Criteria.

Transportation Assessment/Criteria	Saguaro Information
Traffic Congestion – Access and Internal	
• Congestion Index Rank	• 6th – Medium Urban Areas
• Travel-Time Index	• 1.16
• Current Traffic Levels	• Congested Roadways with High Volumes of Non-Recreational Traffic
• Parking Availability and Use	• 160 Public Parking Spaces Are Well Used
• Recreation versus Non-Recreational Travel	• High non-Recreation Travel and Growing
• Current Visitation Levels and Changes in Visitation	• 2010 Recreation Visitation – 727,614; Non-Recreation Visitation – 2.28 Million
• MSA and State Population and Changes in Population	• Pima County 2010 Population – 981,000; Arizona 2010 Population – 6 Million
• Within Megaregion	• Arizona Sun Corridor Megaregion
Mobility Alternatives – Access and Internal	
• Density of Attractions within Park	• Spread Out
• Availability of Public Transit	• None
• Availability of Park Concessionaire and Private Transportation	• None
• Bicycle, Pedestrian, and Tour Buses	• High and Growing Levels of Bicycle and Pedestrian Access and Use, Approximately 17 Tour Buses per Day During Peak Season

Parking is limited within the park and well used. The Baseline Condition report identified a total of 300 parking spaces at 19 parking areas within the park – 180 public spaces and 120 non-public spaces. Most of the public parking areas were reported to be in fair condition, with 20 spaces at the Douglas Springs Trailhead and Waterhole rated in poor condition. Parking was noted as a major problem, especially during the peak winter season. Noted concerns included the mix of personal vehicles, recreational vehicles, horse trailers, and tour buses; inadequate and unsafe parking at the Rincon Mountain District Visitors Center and major trailheads; lack of available space to expand parking; and the NPS policy against purchasing additional off-site parking. Approximately 2,980 visitor vehicles a day entered the park in 2010 during the peak winter season, with March the busiest month.

According to the Baseline Conditions report, there were 723 reported crashes on roads within the park between 1990 and 2005. Over this 15-year period, there has been a decrease of

approximately 10 percent in the numbers of annual crashes, however. While most of these crashes were property damage only, there was a larger proportion of injury crashes than other parks in the Intermountain Region, including one fatality. Most crashes occur on Picture Rocks Road or Sandario Road. Approximately 48 percent of the crashes occur outside of daylight hours. Over three quarters of all crashes are collisions with fixed objects or other vehicles. There are also concerns that hundreds of desert tortoises are killed on park roadways each year.

Saguaro National Park and the City of Tucson are located in Pima County. The 2010 population of the county was approximately 981,000. The population is forecast to increase to 1.45 million by 2041. Arizona recorded a 2010 population of approximately 6 million, representing one of the fastest growing states in the country. The population of Arizona is forecast to increase to approximately 10.7 million by 2030. The state and Pima County have a large and growing Hispanic population. Saguaro National Park and Tucson are located in the Arizona Sun Corridor megaregion.

Saguaro National Park encompasses 143 square miles. The attractions within the park are spread out, but parking at the visitors center and trail heads is limited and congested. SunTran, the city transit system, does not provide service to either of the park districts. There is no park transit service within either district. There is also no park concessionaires or private transportation services in the park. Saguaro National Park is accessible by walking and bicycling. Pedestrian access has increased recently, growing from a little over 10,000 pedestrians in 2001 to approximately 32,000 in 2010. Bicyclists also utilize the park roads on a year-round basis. Tucson is a bicycle-friendly city and bicycles are allowed on all park roads. Bicycle tours are available in the park. Approximately 17 tours buses a day access the park in the peak winter months.

Transportation Projects

Saguaro National Park is a popular destination for bicycling in the Tucson area. Both park districts can be accessed by bicycle and bicycling is allowed on all park roads. The new Hope Camp Trail in the Rincon Mountain District was opened in 2013. This 2.8 mile multipurpose trail originates at the Camino Loma Alta Trailhead and extends southwest to the park boundary approximately .2 miles south of Hope Camp. The trail connects to the Arizona Trail at Hope Camp and continues south into the Rincon Valley. The Hope Camp Trail helps complete a popular bicycle loop on the east side of Tucson. The trial is also open to hikers, trail runners, and horseback riders.

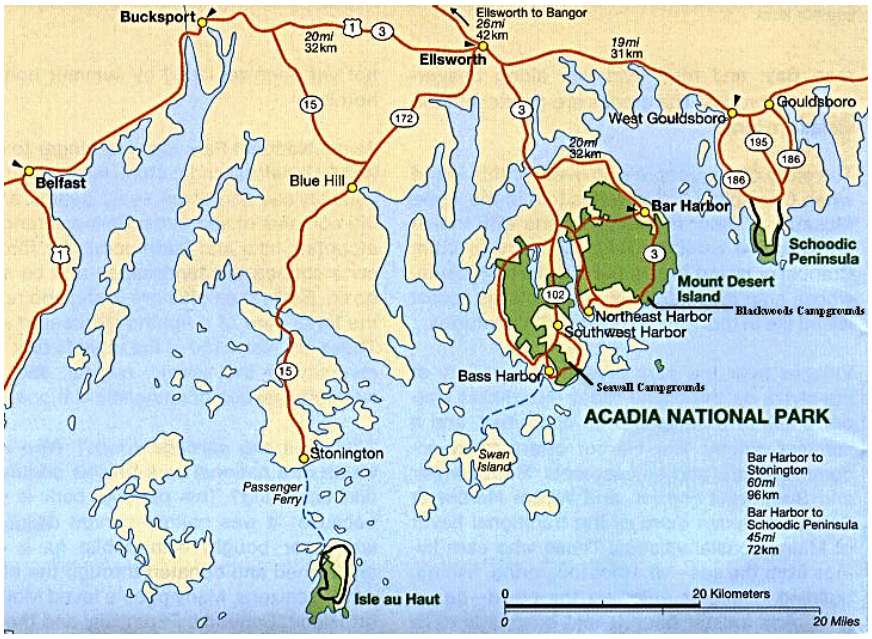
Saguaro National park was selected to receive a 2013 Active Trails grant from the National Park Foundation. The Active Trails program, which is supported by Coca-Cola and the Coca-Cola Foundation, provides funding to maintain and enhance land and water trails in National Parks and encourage healthy lifestyles by offering opportunities for the public to be active in National Parks. The park is using the grant to engage local youth and community members to assist park staff in maintaining the New Hope Camp Trail, and encouraging stewardship, volunteerism, and healthy activity.

Rural – Acadia National Park

The Acadia National Park rural park area classification case study illustrates the need for multimodal options and the importance of partnerships in developing and operating a park transit system. Information for the Acadia National Park case study was obtained from the park website (43), the Island Explorer website (44), and a National Cooperative Highway Research Program (NCHRP) report by TTI (45). In addition, information was obtained by TTI researchers from presentations and tours as part of the TRB Transportation Needs of National Parks and Public Lands Committee mid-year meeting at Acadia National Park in June 2013.

Park Overview

As illustrated in Figure 23, Acadia National Park comprises some 40,000 acres along the coast of Maine, Mount Desert Island, and other islands. Established initially as a National Monument in 1916 and given park status in 1929, Acadia represents one of the older parks in the system. With approximately 2.2 million annual visitors, it is also one of the most popular parks in the country. Rather than clearly defined boundaries, park lands and private lands are intermingled in much of the park, especially on Mount Desert Island. Bar Harbor and other towns are located on the Island and other towns and private lands are interspaced throughout the park.



Source: National Park Service.

Figure 23. Acadia National Park.

Private individuals and groups built much of the infrastructure in the park, including 44 miles of carriage roads constructed under the direction of John D. Rockefeller. Activities in the park include walking and bicycling on the carriage roads, hiking on the 125-mile historic hiking trail system, climbing, horseback riding, bird watching, boating, fishing, and swimming. Winter activities include cross-country skiing, snowshoeing, snowmobiling, ice fishing, and dog sledding.

Transportation Assessment Criteria

Table 10 presents the transportation assessment criteria for Acadia National Park. Highway 3 provides the main access road into the park. It is congested during peak visitation periods. Parking within the park, Bar Harbor, and other communities is limited and well used. Acadia National Park is one of the most heavily visited parks in the country, with 2.4 million visitors in 2012. While the population of Maine is only 1.3 million, the park draws visitors from the Boston metropolitan area, other eastern cities, and other areas throughout the country, as well as international visitors. Attractions within the park are spread out.

Concord Coach Lines and Greyhound provide commercial bus service to gateway communities and connections to AMTRAK service are available. The Hancock County Airport is served by flights from Boston's Logan Airport. Acadia's Island Explorer bus system is one of the better known park transit systems. Oli's Trolley also provides bus tours in the park and Carriages of Acadia provides horse drawn carriage rides. Tour buses can access most areas of the park. Bicycling on the Carriage Roads and hiking on the historic trails are major activities in the park.

Table 10. Acadia Transportation Assessment Criteria.

Transportation Assessment/Criteria	Acadia Information
Traffic Congestion – Access and Internal	
• Access Roads	• Highways 3, 1, 15
• Reported Congestion	• Congested During Peak Times
• Parking Availability and Use	• Both Park and Town Parking is Limited and Well Used
• Recreation versus Non-Recreational Travel	• NA
• Current Visitation Levels and Changes in Visitation	• 2012 Visitation – 2.4 Million
• State Population and Changes in Population	• Maine 2010 Population – 1.3 Million
Mobility Alternatives – Access and Internal	
• Density of Attractions within Park	• Spread Out
• Access Modes – Amtrak/Other Options	• Concord Coach Lines, Greyhound, Amtrak Connections, Hancock County Airport
• Availability of Park Transit Systems	• Island Explorer Bus System
• Availability of Park Concessionaire Transportation	• Oli's Trolley, Carriages of Acadia
• Bicycle, Pedestrian, and Tour Buses	• Bicycling and Hiking on Carriage Roads, Hiking Trails, Tour Buses

Transportation Projects

The Acadia National Park case study focuses on the development and operation of the Island Explorer bus system. Concerns arose in the 1980s with the ability of park roads, small parking lots, and other facilities to accommodate the ever-increasing number of visitors and vehicles in both the park and the communities. Addressing air quality and environmental concerns were also priorities in the area.

In response to these concerns, a coordinated approach involving Acadia National Park, the Maine Department of Transportation (MaineDOT), the Mount Desert Island League of Towns, local communities, local businesses, Friends of Acadia, and other groups was undertaken. A general management planning process for the park, initiated in 1987, identified the potential for an area-wide transportation system. Support from the local communities and businesses for a bus system emerged during the mid-1990s as a way to address current issues and to allow for future growth in visitors, including the cruise ship market, which can bring more than 10,000 visitors to the area on popular weekends.

The transit system concept built on the experience with a campground shuttle bus. A $2 fare was charged on the campground shuttle, which was operated by Downeast Transportation. In response to survey results indicating more people would ride the campground shuttle if it were free, Friends of Acadia provided funding to subsidize the service allowing for free service in 1997. Ridership on the campground shuttle increased by 600 percent during the first year of free service. This experience provided support for the transit system concept and for providing it as a free service for visitors and residents.

The Island Explorer transit system was implemented in the summer of 1999, with eight propane buses operating on six routes, linking hotels and businesses with key destinations in the park. Figure 24 highlights the Island Explorer buses. In response to the popularity of the service, a seventh route was added in 2000. Nine additional buses were also purchased to provide service on the new route and more frequent service on the existing routes. The operating season was extended from Labor Day to mid-October in 2003 with funding from L. L. Bean. An eighth route serving the Schoodic Peninsula was introduced in 2004. The Bicycle Express was added in 2005, providing service between Bar Harbor Village Green and Eagle Lake using a 12-passenger van and a bicycle trailer. Figure 24 illustrates the Bicycle Express service.

Source: Texas A&M Transportation Institute.

Figure 24. Bicycle Express Service.

The Bar Harbor Village Green serves as the focal point for the system. Figure 25 highlights the NPS and Island Express information center at Village Green. Figure 26 illustrates the Island Explorer routes in 2013. Service hours vary by routes. Buses begin operating at 6:45 a.m. on some routes and operate until midnight on many routes.

Source: Texas A&M Transportation Institute.

Figure 25. NPS and Island Express Information Center at Village Green.

Source: Island Explorer.

Figure 26. Island Explorer Bus Routes.

Ridership on the Island Explorer has grown from 142,000 passengers during the first year of operation in 1999 to approximately 439,053 riders in 2012. The service has experienced ridership increases every year. The system averaged some 5,218 passengers per day during the peak season in 2012. The highest one-day total in 2012 was 8,404 riders. In addition, the bicycle express transports over 12,000 bicycles during the summer. The system has served over 4 million riders.

The 1999 agreement establishing the Island Explorer system included 22 signatories, representing the cooperative efforts of Acadia National Park, the MaineDOT, Mount Desert Island League of Towns, Friends of Acadia, local businesses, federal agencies, and other groups. The roles these agencies and groups played in developing the Island Explorer and continue to play in operating the system are highlighted below.

A variety of federal, state, park, local, and private funding has been used to support the capital elements and the operation costs of the Island Explorer. Purchase of the initial propane-powered shuttle buses was funded through the federal CMAQ program. MaineDOT applied for and administered the CMAQ funds. The local match for the Congestion Mitigation and Air Quality (CMAQ) funds was provided by the park, Friends of Acadia, and local towns. Acadia National Park was selected for an ITS Field Operational Test (FOT). Funding for the ITS projects came from the U.S. Department of Transportation ITS Joint Program Office. A federal earmark in 2002 provided additional financial support. Acadia National Park purchased additional buses with funding from the National Park Service Alternative Transportation Program (ATP). The buses are loaned to the MaineDOT and leased to Downeast Transportation through a cooperative agreement. The park has also applied for, and received, funding for additional vehicles through FTA's Transit in the Parks program.

Acadia National Park uses fee-demonstration funds to help support development and operation of the Island Explorer. The park added the transit fee to the daily, weekly, and annual park passes in 2004. The four Mount Desert Island communities provide financial support for operation for the Island Explorer. This support requires annual approval. MaineDOT provides a portioning of the state's FTA 5311 funding to support operation of the Island Explorer. Local businesses contribute for front door service and some provide donations. In addition, private individuals have made donations to support the Island Explorer through Friends of Acadia, including a $100,000 donation from one individual supporting the new Acadia Gateway Center.

The Island Explorer gained a new sponsor in 2002, when L. L. Bean became the single corporate underwriter. With close to 3 million annual visitors to its store in Freeport, L. L. Bean and Acadia share honors as the most popular destinations in the state. Announced as its 90th anniversary gift to the state, the sponsorship reflects the company's values to promote recreation and sound stewardship of the nation's natural resources and their corporate consciousness to help address local issues. The contribution, which has totaled $2 million since 2002, was made to Friends of Acadia, which in turn provides the funds to support the Island Explorer. The funding from L. L. Bean has been used to extend service later in the fall, to introduce a bicycle express service, and to match federal funds.

Acadia National Park was selected for an ITS FOT sponsored by the U.S. Department of Transportation ITS Joint Program Office and the National Park Service. Many of the ITS technologies implemented in the FOT focused on the Island Explorer. Transit-related ITS projects in the FOT included two-way voice communication and automatic vehicle location (AVL) for Island Express buses. Other ITS projects were automated communicator systems and automated passenger counters for buses and real-time, next-bus arrival signs. Parking lot monitors, park entrance traffic volume recorders, automatic range vehicle geo-location, and a traveler information system represent the other Acadia ITS FOT projects.

The ITS projects were implemented in early-to-mid-2002. Real-time bus arrival information is available on electronic message signs at key locations in the park and local communities. This information is also posted on the Island Explorer website, allowing riders to easily check on the status of buses. The information is updated every three minutes.

On-board ridership surveys were conducted on the Island Explorer from 2000 through 2013. These surveys provide a wealth of information about Island Explorer passengers, their likes and dislikes, and their reasons for using the bus. The surveys represent the most comprehensive database of park bus users in the country.

The results from these on-board ridership surveys show strong support for the Island Explorer and high levels of satisfaction among riders. Driver friendliness and helpfulness, clean buses, and free fares all generate high levels of satisfaction. The vast majority of riders indicate that the Island Explorer improves the quality of their visit to the Acadia region. While park visitors represent the majority of riders, local residents also use the Island Explorer, including going to and from work, making recreational trips, and conducting personal business. In the most recent surveys, local residents comprise approximately 20 percent of the Island Explorer ridership. Of the riders who are visitors, residents from Maine and other New England states account for 33 percent, 25 percent are from mid-Atlantic states, 7 percent are from southeastern states, and 7 percent are from the Midwest. Further, 10 percent of riders are international visitors and 5 percent are from Canada.

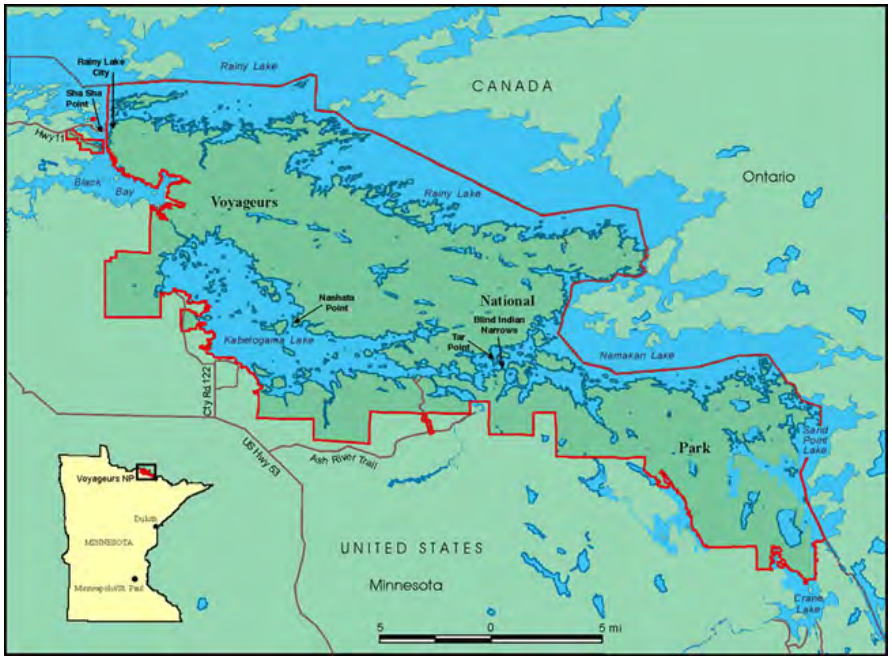
Acadia National Park and its partners in the Island Explorer continue to consider service improvements and opportunities to enhance the overall operation of the system. The Acadia Gateway Center in Trenton represents an ongoing improvement. This facility will include the Acadia National Park transportation information center and an intermodal hub. Completed project components include the Island Explorer bus maintenance and dispatch facility. A visitor complex, parking areas, and park-compatible businesses are also anticipated. MaineDOT is the lead for this project, working with the City of Trenton, the park, Friends of Acadia, and Downeast Transportation. Friends of Acadia acquired 369 acres for the facility since Acadia National Park is prohibited from purchasing land outside the park boundaries established in 1986.

Remote – Voyageurs National Park

The Voyageurs National Park remote park area classification case study highlights the active transportation and involving youth macro trends, as well as the importance of partnerships. Information for the Voyageurs National Park case study was obtained from the park website (46), the National Park Foundation website (47), and a telephone conversation with park staff (48).

Park Overview

Voyageurs National Park was authorized by Congress in 1971 and established in 1975. Located in northern Minnesota, the park borders Canada to the north. The Boundary Water Canoe Area Wilderness (BWCAW) is located to the east of the park. Figure 27 illustrates the location. The park preserves the landscapes and scenic waterways used by North American fur traders and defines the international border between the U.S. and Canada.



Source: National Park Service.

Figure 27. Voyageurs National Park.

Voyageurs National Park encompasses 218,054 acres. It includes four major lakes – Rainy Lake, Kabetogama Lake, Namakan Lake, and Sand Point Lake – which account for 84,000 acres of the park total. Park activities include hiking, canoeing, kayaking, boating, fishing, and camping. Winter activities include driving on the ice road, snowmobiling, cross-country skiing, snowshoeing, ice fishing, and winter camping.

Transportation Assessment Criteria

Table 11 presents the transportation assessment criteria for Voyageurs National Park. The park is accessible by Highway 53 from Duluth and International Falls. Reported traffic congestion approaching the park and at the four visitor centers is low to moderate. In 2012, 214,841 visitors came to the park. From 2000 to 2012 visitation levels ranged from a low of

177,184 in 2011 to a high of 253,891 in 2010. The 2012 population of Minnesota was 5.4 million.

The Minneapolis-St. Paul metropolitan area is approximately five hours away by car. The International Falls Airport provides commercial air service to visitors. Park concessionaire services include house boat rentals, guided tour boats, and canoe and row boat rentals at some interior lakes. Tour buses can access the visitor centers. There are hiking trails at some visitor centers, but to really appreciate and explore the park visitors need to see the park from the water.

Visitors can access the park by private vehicle at four different points on local roadways from U.S. 53 between Duluth and International Falls. The Rain Lake Visitor Center, Kabetogama Lake Visitor Center, Ash River Visitor Center, and the Crake Lake Visitor Center all provide access to the park by water and some hiking trails. Visitors can bring their own boats or canoe/kayaks, take a regularly scheduled boat tour, or rent a houseboat. Canoes and row boats are also available to rent at some interior lakes. The Visitor Center rents cross-country skis and snow shoes in the winter.

Table 11. Voyageurs Transportation Assessment Criteria.

Transportation Assessment/Criteria	Voyageurs Information
Traffic Congestion – Access and Internal	
• Access Roads	• Highway 53 and Local Roads
• Reported Congestion	• Low
• Parking Availability and Use	• NA
• Recreational versus Non-Recreational Travel	• NA
• Current Visitation Levels and Changes in Visitation	• 2012 – 214,841 Visitors
• State Population and Changes in Population	• Minnesota 2012 Population 5.4 Million
Mobility Alternatives – Access and Internal	
• Density of Attractions within Park	• Spread Throughout the Park
• Availability of Amtrak/Other Options	• International Falls Airport
• Availability of Park Transit Systems	• None
• Availability of Park Concessionaire Transportation	• House Boat Rentals, Guided Tour Boats, Row Boats, and Canoe Rentals
• Bicycle, Pedestrian, and Tour Buses	• Hiking Trails, Tour Bus Access

Transportation Projects

The remote location of Voyageurs National Park makes it difficult for young people to visit. The park has initiated a number of efforts to provide more opportunities for young people to visit the park. These programs include the National Park Teen Ambassador project and the Ticket to Ride program.

In 2012, the Voyageurs National Park Associate (VNPA) partnered with the NPS and Wilderness Inquiry to implement the first National Park Teen Ambassador project. Funding for the project came from the National Park Foundation's America's Best Idea Grant program, which is supported by L.L. Bean, DISNEY, the Anschutz Foundation, and the Ahmanson Foundation. Additional local supporters included the Berry Family Foundation, the Charles B. Sweat Foundation, and the Whitney Foundation, with further in-kind support from local businesses.

The Teen Ambassador project engages high school students from urban and rural communities in Minnesota in outdoor learning expeditions to Voyageurs National Park and the Mississippi National River and Recreation Area in the Minneapolis-St. Paul metropolitan area. The Ambassadors canoe, hike, and camp in both parks. They also explore topics including air and water quality, cultural and natural history, wildlife, park service careers, and environmental stewardship and conservation. The project goal is to provide an enduring and transformational outdoor experience and empower a sense of pride, awareness, ownership, and reasonability for national parks and the natural world. Based on the success of the first year, the program continued in 2012 with 18 teenagers from the International Falls, Mankato, and Minneapolis/St. Paul areas.

To help provide more opportunities for visits by students, the park applied for and received a 2013 Ticket to Ride program grant. The Ticket to Ride program is sponsored by the National Park Foundation and DISNEY to provide efficient transportation for 100,000 students to visit national parks annually and to engage in meaningful activities during their visit. The 2013 program focused on engaging students in outdoor activities; reaching out to new schools, teachers, and students; conducting pre-site activities in the classroom, the field day in the park, and post-site activities; and sharing information on the program with external audiences and supporters. Voyageurs National Park is using the Ticket to Ride Grant to provide transportation to park for 800 fourth graders. The students experience the park from the water aboard the Voyageur tour boat, which has been turned into a floating laboratory.

The park is also participating in the Hike to Health program through a partnership with Active Trails Grant, Coca-Cola, the National Parks Foundation, Rainy Lake Medical Center, Jefferson National Parks Foundation, and VNPA. The program encourages people of all ages to get outside and explore the park, engage in hands-on activities, and promote a healthy lifestyle. Examples of activities include the Trails Passport Program, the Fall Foliage 5K Run/Walk, and the Fall Volunteer Rendezvous. Voyageurs National Park is also one of the 36 NPS units participating in the America's Great Outdoors – Let's Move Outside program.

Mixed Park Area – Blue Ridge Parkway

The Blue Ridge Parkway mixed park area classification case study illustrates the technology and involving youth macro trends. Information for the Blue Ridge Parkway case study was obtained from the park website (44), the Blue Ridge Parkway Association Website (50), the Kids in the Parks Website (51), and the NPS Blue Ridge Parkway *Final General Management Plan/Environmental Impact Statement* (52).

Park Overview

The Blue Ridge Parkway, which connects with the Shenandoah National Park in the north and the Great Smokey Mountains National Park in the south, is the most visited NPS unit in the country. The parkway itself is the main park experience. The 469-mile parkway primarily follows the crest of the Blue Ridge Mountains through 29 counties in Virginia and North Carolina. Figure 28 illustrates the route of Blue Ridge Parkway. Access to federal and state highways is provided along the parkway. Visitor centers, historical structures, natural areas, and other sites along the parkway give visitors a glimpse of Native American cultures, European homesteads, industrial landmarks, and geological features. Activities include hiking on trails along the parkway, bicycling on the parkway, visiting historic sites, and stopping at scenic vistas.

Source: National Park Service.

Figure 28. Blue Ridge Parkway.

The parkway was conceived, designed, and constructed as a scenic motor road to help conserve the national and historical features of the area. Begun in 1935 as the Appalachian Scenic Highway, the Blue Ridge Parkway was formally authorized by Congress in 1936. Initial work on the parkway was undertaken by the Works Progress Administration (WPA), the Civilian Conservation Corps (CCC), and the Emergency Relief Administration. Completion of the parkway took 52 years, with the final section opening in 1987. The parkway includes 168 bridges, 26 tunnels, and 6 via ducts.

There is no fee to use the parkway. Commercial vehicles are not allowed to use the parkway without obtaining approval from the NPS. The speed limit on the parkway is typically 35 mph-to-45 mph. Mile post signs begin with zero at the northern end in Virginia and end with 469 at the southern end in North Carolina. The Blue Ridge Parkway Visitors Center at Milepost 384 includes a 70-seat theatre, an interactive map, exhibits, and a retail shop. The parkway is not maintained in the winter and some sections are closed from late fall to early spring due to

freezing of the roadway surface in the tunnels and on bridges. Conditions may change quickly at other times of the year, with closures occurring.

Transportation Assessment Criteria

Table 12 presents the transportation assessment criteria for the Blue Ridge Parkway. Information on transportation issues associated with the parkway was obtained from reviewing the park and related websites and from the 2*013 Blue Ridge Parkway Final General Management Plan/Environmental Impacts Statement*.

Access is provided at key points along the parkway. Initially, approximately 38 grade separated access point were constructed along the parkway. Additional access points, as well as private road accesses, have been added over the year, accounting for approximately 300 access points. Links from I-64, I-81, and I-77 in Virginia and I-40 and I-6 in North Carolina are provided via U.S., state, and county roads. Traffic congestion has been identified as a problem in some sections of the parkway, especially during the peak summer visitation months. Ashville and Boone, North Carolina and Roanoke, Virginia are the largest cities along the parkway. Traffic in these sections, and in areas of scenic interest, can be heavy. Safety concerns were also examined in the management plan. Approximately 80 percent of the 534 crashes between March 2001 and March 2004 involved deer or motorcycles. Most of the deer-related crashes occurred in the northern segments of the parkway, while the majority of motorcycle accidents occurred in the southern sections.

Parking at scenic overlooks and trail heads is limited and well used during peak periods. The parking analysis in the *Management Plan* indicated that parking was not generally a problem on weekdays. Weekend parking, especially at popular overlooks, was reported as a problem, along with illegal roadside parking in sections without parking lots. Most travel along the parkway is recreational, but non-recreational travel by commuters in the Ashville area and other locations appears to be a growing concern. A 2002 roadside survey of parkway visitors indicated non-recreational travel – including commuting, work-related travel, personal business, and dining – accounted for between 15-to-45 percent of summer traffic on different sections of the parkway. There is also concern with increasing residential development around Ashville and other cities.

Table 12. Blue Ridge Parkway Transportation Assessment Criteria.

Transportation Assessment/Criteria	Blue Ridge Parkway Information
Traffic Congestion – Access and Internal	
• Access Roads	• Assess at Major Points Along the Parkway
• Reported Congestion	• Moderate to Heavy Congestion in Sections During Peak Seasons
• Parking Availability and Use	• Limited and Well Used
• Recreational versus Non-Recreational Travel	• Concerns with Non-Recreational Travel in Some Sections
• Current Visitation Levels and Changes in Visitation	• 2013 Visitation – 15.2 Million
• State Population and Changes in Population	• 2010 Virginia Population – 8.0, 2010 North Carolina – 9.5 Million
Mobility Alternatives – Access and Internal	
• Density of Attractions within Park	• Spread Out Along 469 Miles
• Availability of Amtrak/Other Options	• None
• Availability of Park Transit Systems	• None
• Availability of Park Concessionaire and Private Transportation	• None
• Bicycle, Pedestrian, and Tour Buses	• Bicycles Allowed, Hiking Trails, Tour Buses Allowed

The parkway attracted approximately 15.2 million visitors in 2012. Visitation is down slightly from previous years, with a high of approximately 19 million visitors in 2000. The 2010 population of Virginia and North Carolina were 8.0 million and 9.5 million, respectively. Both states experienced population increases since 2000 and the population of both states is forecast to continue growing. The parkway is located within a one-day drive of approximately 75 million people in the 11-state region.

Attractions are spread out along the 469-mile parkway. There is no Amtrak service available in the area and intercity bus service is very limited. There is no bus service along the parkway. While tour buses are allowed to use the parkway, it appears that few tour buses or shuttles access the parkway. Bicycles are also able to use the parkway. Even though the geometrics – including lack of shoulders, limited site distances, and hilly terrain – are not the best for bicycling, many sections of the parkway are popular with bicyclists. Numerous hiking trails are provided along the parkway.

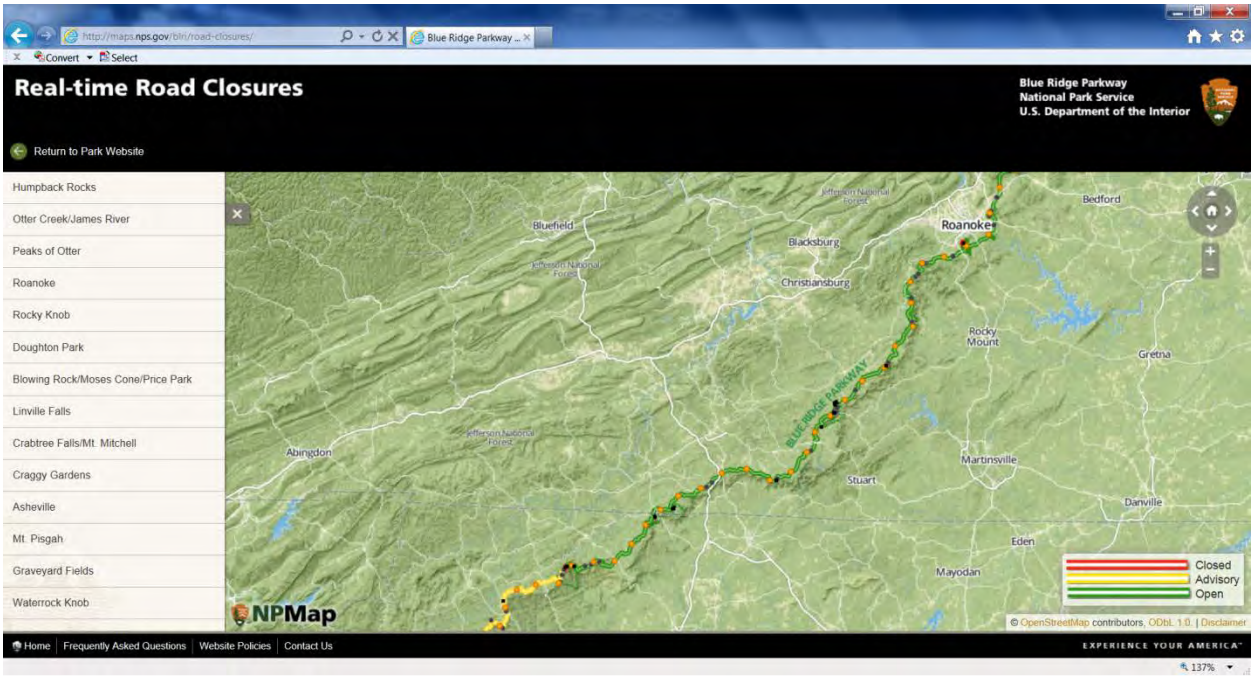
The multistate nature and length of the parkway adds to the complexity of planning, operating, and maintaining the parkway. Two state departments of transportation are involved, along with 29 counties and numerous cities.

Transportation Projects

This section highlights three transportation-related projects associated with the Blue Ridge Parkway. The first project is the development and use of the real-time road closure map available on the park website. The second project is the development of the Blue Ridge Parkway Travel Planner Mobile App and the third project is the Kids in Parks TRACK Trails program.

As illustrated in Figure 29, the real-time road closure map is available on the Blue Ridge Parkway website. The map uses color coding – green for open, yellow for advisory, and red for closed – to highlight the status of parkway sections due to weather or construction activities. The map also displays access points and other features. Users can zoom in on specific sections to obtain information on the status of picnic areas, camp grounds, and other facilities.

The Blue Ridge Parkway Travel Planner Mobile App, highlighted in Figure 30, was developed by the Blue Ridge Parkway Association (BRPA) in cooperation with the Blue Ridge Parkway and the NPS. The app includes maps and navigation guides, hiking trails, interpretive stops, and on- and off-parkway lodging and campgrounds. The app also includes information on wildlife, suggested itineraries, gas availability, and general travel information. Parkway access information is presented by the parkway's four major regions – Ridge, Plateau, Highland, and Pisgah. Information on connections to the Great Smokey Mountains National Park and the Shenandoah National Park regions is also provided.



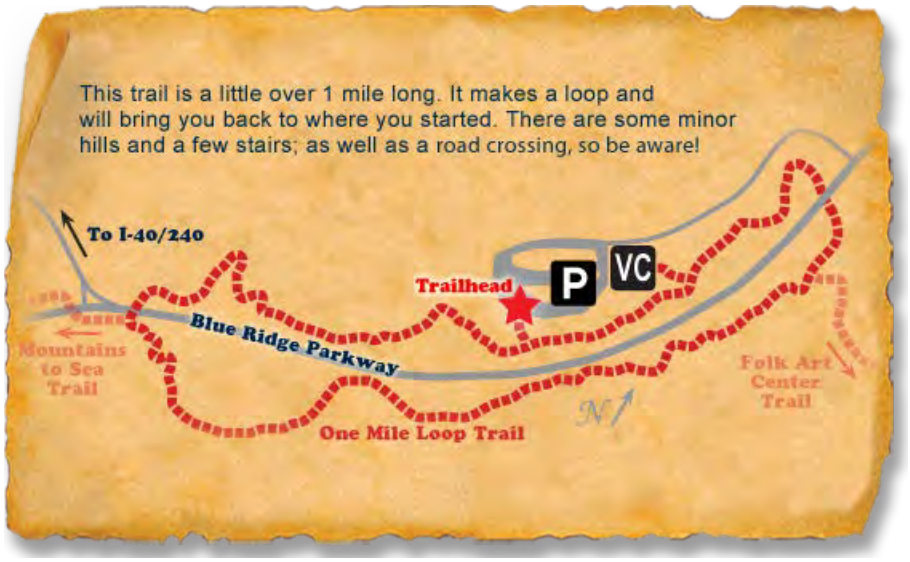
Source: National Park Service.

Figure 29. Screen Capture – Blue Ridge Parkway Interactive Map.

Source: Blue Ridge Parkway Association.

Figure 30. Blue Ridge Parkway Travel Planner Mobile App.

The Kids in Parks TRACK Trails program was initiated in 2008 by the Blue Ridge Parkway Foundation, the Blue Ridge Parkway, and the Blue Cross and Blue Shield of North Carolina Foundation. The program has established 18 TRACK Trails on the Blue Ridge Parkway and in neighboring communities. Figure 31 illustrates one trail example along the Blue Ridge Parkway. Similar to the Junior Ranger Program, the self-guided, brochure-led hiking trails encourage children and their families to become active in the outdoors. Approximately 600 children have registered for the program. The program's website, Kidsinparks.com, includes information on registering for the program, the location of trails, lessons for each trail, tracking progress, and prizes. It also includes information for parents and teachers.



Source: Kids in Parks.

Figure 31. Kids in Parks TRACK Trail Program Map.

CHAPTER SIX – SUMMARY

This research project examined macro trends and transportation needs by the NPS park area classifications – urban, suburban, outlying, rural, remote, and mixed. As documented in this report, TTI researchers explored the potential impacts of changes in population and socio-demographic characteristics, the emergence of megaregions, changes in travel behavior, leisure and tourism trends, international visitors, rapid advancements in technology, and extreme weather events and climate change on NPS units by the park area classifications. The implications of these macro trends on the NPS in general and on NPS units by park area classifications were summarized. TTI researchers also developed an approach for assessing transportation issues and needs by park area classifications. This approach, which included traffic congestion and mobility indicators and criteria, was applied to case studies in each of the park area classifications. This section summarizes the major impacts of the macro trends and implications for the NPS, highlights examples from the transportation assessment approach and case studies, and presents possible follow-up activities.

Summary of Macro Trends

The following macro trends and their impacts on NPS units by park area classifications were examined in the report.

- Population and Socio-Demographic Characteristics. The continued urbanization of the U.S. indicates that parks within, and adjacent to, high-density areas – especially those in the urban, suburban, and outlying park area classifications – will have a large population base to draw visitors from. This density also allows for multimodal transportation options, but may increase traffic congestion on roads within or adjacent to parks. The aging of the Baby Boom Generation, the emergence of the Millennial Generation, and the increasing diversity of the population indicate a need to provide multimodal options to NPS units in all park area classifications and a need to reach out to new and more diverse visitors. The Gateway National Recreation Area illustrates the use of multimodal options serving diverse population groups. These options include personal automobiles, public transportation (bus, rail, ferry), tour buses, private tour boats, bicycling, hiking, and kayaking. The National Mall provides another example, with options including Metro rail and bus, concessionaire buses, tour buses, walking, bicycles, the bike share program, and Segways.
- Emerging Megaregions. Most of the NPS units in the urban, suburban, and outlying park area classifications are within a megaregion. Megaregions provide both challenges and opportunities for the NPS units in different park area classifications. Common or shared transportation systems are often a defining element of megaregions. Planning, constructing, and operating rail systems, highways, and other transportation modes in megaregions is complex, involving numerous state, local, and federal agencies. This complexity also brings opportunities for new and existing transportation systems. Residents and visitors typically have more travel options to select from in megaregions, providing alternatives to NPS unit visitors. Travel options in the Northeast megaregion

includes Amtrak and commercial air service between major cities, local and regional transit services, ferries and tour boats, tour buses, bicycling, and walking.

- Changes in Travel Behavior. Increasing traffic congestion impacts NPS units primarily in the urban, suburban, and outlying park area classifications. It may also impact NPS units in the mixed park area classification, such as the Blue Ridge Parkway. Visitors to parks in these categories may experience congestion on freeways, roadways, and transit during the peak travel periods, as well as at other times of the day. As a result, visitors may need to plan more time to reach specific NPS sites and to travel between sites in an area. NPS units in the urban and suburban park area classifications with multimodal travel options are well situated to attract millennials and international visitors. Many parks in these area classifications are located in cities that all attract millennials. For example, the transportation options in Washington, D.C., which include walking, bicycling, the red bikeshare program, Metro, buses, driving a personal vehicle, and carsharing, are well suited for commuting to work, visiting NPS units, and making other trips. In addition, NPS units in all park area classifications are making outreach efforts to millennials, as well as teenagers and children. Examples of these efforts, which include smart phone apps, the use of Facebook and Twitter, and programs targeted at bringing young people into parks. Voyageurs National Park in the remote area classification has used the Teen Ambassador project, the Ticket to Ride program, and the Hike to Health program to attract young people to the park. RV sales have rebounded recently after a major decline in the late 2000's. NPS units in the rural park area classification will experience the major impact of increases in RV sales. Recent interest in active transportation, primarily walking and bicycling, may also influence NPS units differently based on park area characteristics. NPS units in the urban, suburban, and outlying park area classifications may be accessed by walking, hiking, and bicycling, as well as providing opportunities for these activities within the park. Many NPS units in the rural, remote, and mixed park area classifications have always had a focus on active transportation, while others are expanding options for active transportation. Saguaro National Park, in the outlying park area classification, is a popular bicycling destination and has developed new trails linking to other bicycle facilities in the Tucson area to encourage active transportation. The Mission Reach B-Cycle Bike Share Expansion project involving the San Antonio Missions National Historical Park provides an urban park area classification example of encouraging active transportation.

- Leisure Travel and Tourism Trends. The travel trends related to shorter vacation trips closer to home, including "stay-cations," may have different impacts on NPS units based on park area classifications. Parks in urban, suburban, and outlying park area classifications may experience increases in visitors based on their close proximity to large population bases. These trends might limit visitation at some NPS units in rural, remote, and mixed park area classifications, however. The trend toward extending three-day weekends to four-day weekends may increase visitation on Thursdays, Fridays, Mondays, and Tuesdays. Parks which focus on

transportation options toward weekends may consider extending service to more of the week to address this trend.

- International Visitors. International visitors are an important component of the U.S. tourism market, including visiting national parks. International visitors may reflect slightly different travel patterns than U.S. visitors. International visitors are typically more accustomed to using public transportation than many Americans, and may use transit services if available. International visitors may also use bicycles and walk, as well as travel by tour bus. Many park units in all the park area classifications have efforts targeted toward international visitors. The travel options in the Washington, D.C. area and New York City, which are popular destinations for international travelers, also provide access to and within park units.
- Technology Advancements. Rapid advancements in all types of technology continue. The potential impact of technology advancements in three areas – the Internet and personal communication devices, ITS, and vehicle technologies – on NPS units based on park area characteristics were examined in this report. NPS units are using technologies in all three areas to attract visitors to parks and to enhance their experiences after they arrive. While NPS units in all park area classifications may benefit from the use of these technologies, it appears that they are being applied more in urban, suburban, outlying, and mixed park area classifications, with some applications in the rural park area classification, and few in the remote park area classification. The Blue Ridge Parkway App and Interactive Road Status Map provide examples of technology applications from the case studies.
- Extreme Weather Events and Climate Change. The potential impact of more frequent extreme weather events and climate change on transportation facilities in NPS units by park area classifications and by geographic areas was examined in this report. Elements associated with climate change include increasing temperatures overall, more extreme temperature and precipitation events (hurricanes, tornados, and heavy rain and snowstorms), and sea level rise and related storm surges. The Gateway National Recreation Area case study in Chapter Five illustrates the destruction and rebuilding resulting from a super storm. NPS units will be impacted by extreme weather events and climate change based mostly on geographic location. NPS units along the eastern seaboard are susceptible to hurricanes and related storms. NPS units in other areas of the country may experience flooding due to heavy rainfall, tornados, and other events. NPS units in the urban and suburban park area classifications may experience increasing temperatures, regardless of their location. Considering extreme weather events and climate change in planning, designing, operating, and monitoring transportation assessments and services at all NPS units will be more important in the future.

Implications for NPS Units

Six major implications for the NPS emerging from the macro trend analysis were identified in the report. These implications focus on providing multimodal transportation

options, supporting active transportation alternatives, using technology to promote park use and to enhance visitor transportation, outreach to individuals under the age of 19 and to the Millennial Generation, partnerships involving multiple agencies and organizations, and developing resilient transportation facilities. The following summarizes these implications.

- Multimodal Transportation Options. Many of the macro trends point to the need for providing multimodal transportation options to, from, and within, NPS units. Multimodal options are important for all age groups, especially the Baby Boom Generation, the Millennial Generation, and individuals under the age of 19. By providing options to driving, multimodal transportation also helps address the macro trends related to increasing traffic congestion, non-recreational use, and gasoline prices. The multimodal options will likely be different based on park area classifications. NPS units in the urban and suburban park area classifications are more likely to have services from local transit agencies. Bicycle sharing programs, such as those in Washington, D.C. and San Antonio, may also be offered in some areas. NPS units in urban and suburban areas may also have park transit services or concessionaires and private transportation alternatives. NPS units in the rural park area classification typically have none or very limited multimodal options to and from the park, but may have internal park transit services or concessionaires and private transportation options. Meeting these multimodal transportation needs requires partnerships involving multiple agencies and groups.
- Active Transportation Options. The macro trends point to the growing interest in active transportation among all age groups and types of visitors. Bicycling and walking also help address issues associated with increasing traffic congestion and gasoline prices. Active transportation is also often the focus of shorter, more frequent visits to many NPS units. Providing active transportation options is appropriate at NPS units in all park area classifications. The bicycle options associated with the National Mall, the San Antonio Missions National Historical Park, Saguaro National Park, and Acadia National Park provide examples of encouraging active transportation within NPS units. The types of facilities, lengths, and connections to other facilities may differ based on the park area classification. As noted above with the multimodal transportation options, partnerships with multiple agencies and organizations are key to the successful development and use of active transportation alternatives.
- Technology Applications. The macro trends focusing on the continued rapid development of technology and the increased use of personal communication devices all have implications for the NPS. The use of technology, pre-trip planning information and real-time travel conditions, transit status, and related information in NPS units in different park area classifications was highlighted. These and other applications and innovative use of technology will continue to be important at NPS units in all park area classifications. Partnerships with other agencies, groups, and the private sector will be key to developing and deploying these applications. The National Mall and Blue Ridge Parkway Apps, the Island Explorer real-time bus information in Acadia National Park, and the Blue Ridge

Parkway Interactive Map all provide examples of different technology applications in use in different park area classifications.

- Outreach to Youth and the Millennial Generation. The macro trends associated with the demographic changes, including the increase in the population under 19 years of age, and the increasing use of technology by this group and the Millennial Generation point to the need for outreach programs to promote the NPS with these age groups. Examples of numerous programs targeting these age groups were presented in the report, including the Kids in Parks TRACK Trails program, the Teen Ambassador project, the Ticket to Ride program, and the Hike to Health program. The examples also highlight the partnerships with other agencies and groups, especially national corporations and local businesses, health organizations, and volunteer groups to develop and conduct these programs. These outreach efforts are appropriate at NPS units in all park area classifications, but will take different forms based on the area, park features, and targeted demographic groups.
- Partnerships with Multiple Agencies, Organizations, and Groups. Partnerships with other agencies, organizations, and groups at all levels are needed to respond to the macro trends outlined in the report. The case studies in Chapter Five highlight examples of partnerships with other agencies, local communities and businesses, non-profit and philanthropic organizations, national corporations, and other groups. These partnerships are key to planning, funding, constructing, operating, and maintaining a wide range of transportation facilities and services. These types of partnerships will be even more critical for the NPS in the future given limited resources and increasing demands on transportation facilities and services. The Island Explorer bus system in Acadia National Park and the Mission Reach B-Cycle Bike Share Expansion associated with the San Antonio Missions National Historical Park provide two examples of these innovative partnerships.
- Developing Resilient Transportation Facilities. The macro trends associated with extreme weather events and climate change highlight the importance of resilient transportation facilities. The devastation to the Gateway National Recreation Area from Super Storm Sandy highlights the need to address resiliency in transportation facilities, which is not easy given the historic nature of transportation facilities at many NPS units. Partnerships with other agencies and groups will be needed to promote resiliency in the transportation system.

Possible Follow-Up Activities

The information presented in this report can be used by the NPS and partner agencies and organizations in a number of ways. First, the report can be used to enlighten and enhance the development of the NPS Long-Range Transportation Plan. Second, information in the report can be applied to the development of long-range transportation plans at the regional level. Third, the macro trends analysis and the approach for assessing transportation issues and needs can be used by NPS units in the different park area classifications.

The report may also be used to facilitate ongoing information sharing among NPS units in the different park area classifications, as well as by the type of projects undertaken. The examples and case studies in the report highlights numerous innovative approaches being undertaken by NPS units in all park area classifications throughout the country. Providing opportunities to share experiences and to learn from each other could be built into regular meetings of NPS staff or conferences and meetings sponsored by other groups and organizations, such as TRB, the George Wright Society, and the National Park Foundation.

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