



NEEDS ASSESSMENT TO SUPPORT DAY USE PLAN FOR ROCKY MOUNTAIN NATIONAL PARK



PREPARED FOR:
ROCKY MOUNTAIN NATIONAL PARK

SUBMITTED BY:
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EXECUTIVE SUMMARY

Visitation to Rocky Mountain National Park (RMNP) has grown dramatically in recent years, increasing from fewer than three million visits in 2010 to well over four and a half million visits in 2016. The overwhelming majority of this visitation is day use. In 2016, RMNP contracted with RSG to conduct a visitor day use management needs assessment. The purpose of the needs assessment was to gather park staff perspectives on management issues associated with visitor day use and information needs for visitor day use management planning, identify gaps in existing information needed to inform visitor day use management planning, and summarize available social science information related to visitor day use in RMNP.

Park leadership and staff described many interconnected issues associated with visitor day use management. These include resource protection, visitor experience, transportation system, visitor safety and law enforcement, and park operations and administration issues. It is important to understand that these issues are not mutually exclusive; the effects of one issue cascade to cause or exacerbate additional issues.

When considering how to address these issues, park leadership and staff expressed needs for information about visitor day use patterns, the capacity of RMNP to accommodate visitor day use while accomplishing its resource protection and other missions, and the attitudes of visitors and other public stakeholders toward visitor day use and its management. These information needs can be summarized in four basic questions:

- How many day use visitors can RMNP accommodate?
- How does visitor day use affect park conditions, and what are the tolerances for these effects?
- How is visitor day use distributed throughout RMNP?
- What are the attitudes of day use visitors and other public stakeholders toward visitor day use management in RMNP?

Information is required to satisfy the needs expressed by park leadership and staff. Some of this information is readily available from social science research studies and data that are compiled and summarized in Section 3.0 through Section 6.0 of this technical memorandum; however, there are gaps in the body of needed information as well. These gaps exist for one of two reasons: 1) the required information has been collected but not compiled and analyzed in a format that is useful for visitor day use planning and management; or 2) the required information has not yet been collected. Primary information gaps include:

- Descriptive and evaluative information on the relationships between visitor day use amounts and park conditions, particularly for areas other than the Bear Lake Road corridor and on park operations like emergency response, custodial and maintenance services, and transportation systems.
- Systematic and coordinated data on the spatial and temporal patterns of visitor day use and their response to potential visitor day use management actions like closure of the Bear Lake Road to private vehicles.
- Visitor and public stakeholder attitudes toward visitor day use management, including how tradeoffs among competing objectives are made.



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CONTENTS

1.0	INTRODUCTION.....	1
2.0	ISSUES AND INFORMATION NEEDS AND GAPS ASSOCIATED WITH VISITOR DAY USE	2
2.1	Issues Associated with Visitor Day Use Identified by RMNP Staff	2
2.2	Information Needs for Visitor Day Use Management Identified by RMNP Staff	5
	How many day use visitors can RMNP accommodate?	5
	What are the attitudes of day use visitors and other public stakeholders toward visitor day use management in RMNP?	5
2.3	Information Gaps for Visitor Day Use Management.....	6
2.4	Summary	7
3.0	ASSESSMENT OF AVAILABLE SOCIAL SCIENCE INFORMATION	8
4.0	LITERATURE REVIEW	15
4.1	Visitor Studies.....	17
	Visitors and Visits	17
	Crowding	17
	Visitors and Management Action	18
4.2	Visitor Use Studies	38
4.3	Recreation Ecology Studies	46
	Impact Monitoring.....	46
	Impact Mitigation	47
4.4	Transportation Studies	58
	Transportation Use Surveys	58



Transportation Planning Studies	58
4.5 Additional References	75
5.0 CHARACTERISTICS OF AND TRENDS IN VISITOR USE IN ROCKY MOUNTAIN NATIONAL PARK	77
5.1 Introduction	77
Notes on Identifying Trends in Historical Visitor Use Data	77
Notes on Historical Events Affecting Patterns and Volumes of Visitor Use.....	77
5.2 Visitor Use Data.....	78
Visitation Analysis	78
<i>Item 1: Annual recreation visits, 1979–2015.....</i>	<i>79</i>
<i>Item 2: Monthly recreation visits, 1979–2015</i>	<i>80</i>
<i>Item 3: Monthly recreation visits as a percentage of annual visitation, 1979–2015</i>	<i>82</i>
<i>Item 4: Kurtosis of monthly recreation visits, 1979–2015</i>	<i>83</i>
<i>Item 5: Monthly overnight stays, 1979–2015.....</i>	<i>84</i>
<i>Item 6: Monthly ratio of recreation visits to overnight stays, 1979–2015</i>	<i>85</i>
Transportation Analysis.....	86
<i>Item 7: Annual arriving vehicle volume, 1996–2015.....</i>	<i>87</i>
<i>Item 8: Annual arriving vehicle volume by entrance, 1996–2015.....</i>	<i>88</i>
<i>Item 9: Percentage of annual arriving vehicle volume by entrance, 1996–2015.....</i>	<i>89</i>
<i>Item 10: Percentage of monthly vehicle volume by entrance, 1996–2015.....</i>	<i>90</i>
<i>Item 11: Ratio of annual recreational visits to annual arriving vehicles, 1996–2015.....</i>	<i>91</i>
<i>Item 12: Annual shuttle bus ridership, 1999–2016.....</i>	<i>92</i>
<i>Item 13: Monthly shuttle bus ridership, 1999–2016</i>	<i>93</i>
<i>Item 14: Percentage monthly shuttle ridership by route, 1999–2016.....</i>	<i>94</i>
<i>Item 15: Ratio of recreation visits to annual shuttle bus ridership, 1999–2016.....</i>	<i>95</i>
Trail Use Summary	96
<i>Item 16: Approximate locations of trail counters included in analysis.....</i>	<i>97</i>
<i>Item 17: Average daily visitor use, Wild Basin trailhead</i>	<i>98</i>
<i>Item 18: Average daily visitor use, Deer Mountain trailhead.....</i>	<i>99</i>
<i>Item 19: Average daily visitor use, Estes Cone Trail</i>	<i>100</i>
<i>Item 20: Average daily visitor use, Finch Lake trailhead.....</i>	<i>101</i>
<i>Item 21: Average daily visitor use, East Shore trailhead</i>	<i>102</i>

5.3 Geographic Regions of Rocky Mountain National Park	103
Bear Lake Road Corridor	103
Item 22: Visitor use along the Glacier Gorge Trail to Alberta Falls, 2002–2008	104
Item 23: Visitor use along the Emerald Lake Trail, 2008	106
Item 24: Mean daily vehicle traffic volumes in Bear Lake Road corridor, summer 2008.....	108
Item 25: Average parking lot usage, Bear Lake Road corridor, summer 2008	110
Item 26: Mode of travel to trailhead of arriving visitors to Glacier Gorge Trail and Emerald Lake Trail, July 2008	112
Longs Peak	114
Item 27: Visitation to the summit of Longs Peak, 1931–2002.....	115
Item 28: Average daily visitor use, Longs Peak trailhead, 2011–2013	116
Item 29: Visitor group encounter rates, Longs Peak Trail to Chasm Lake, 2012 and 2014.....	117
Item 30: Annual vehicle volume, Longs Peak Road, 1996–2015.....	119
5.4 Visitors and Visits	120
Item 31: Percentage of visitors who reside in Colorado.....	121
Item 32: Prior visits to Rocky Mountain National Park	123
Item 33: Day and overnight visitation.....	124
Item 34: Length of stay in Rocky Mountain National Park	125
Item 35: Off-trail visitor activity.....	126
Item 36: Most frequently reported visitor activities.....	127
6.0 SOCIOECONOMIC TRENDS	128
6.1 Population Projections	128
Item 37: Population projections for local counties, 2000–2050.....	129
Item 38: Population projections for regional counties, 2000–2050	130
Item 39: Age group projections for local counties, 2000–2050	132
Item 40: Age group projections for regional counties, 2000–2050.....	134
Item 41: Racial and ethnic group population projections for local counties, 2010–2050.....	136
Item 42: Racial and ethnic group population projections for regional counties, 2010–2050	138
6.2 Economic Trends.....	140
Item 43: Total projected number of jobs in adjacent State Planning Areas, 1990–2040.....	141
Item 44: Total projected number of tourism-related jobs in adjacent State Planning Areas, 1990– 2040	143
Item 45: Median household income, local and regional counties, 2009–2014.....	145

6.3 Outdoor Recreation	147
<i>Item 46: Participation in outdoor recreation activities, Colorado residents, 2013.....</i>	<i>148</i>
<i>Item 47: Outdoor recreation-related travel behavior and patterns, Colorado residents, 2013</i>	<i>150</i>
6.4 Economic Impacts of RMNP Visitation and Regional Outdoor Recreation	152
<i>Item 48: Economic impacts of RMNP visitation, 2015</i>	<i>153</i>
<i>Item 49: Economic impacts of outdoor recreation, North Central Colorado Region, 2013.....</i>	<i>154</i>

1.0 INTRODUCTION

Visitation to Rocky Mountain National Park (RMNP) has grown dramatically in recent years, increasing from fewer than three million visits in 2010 to well over four and a half million visits in 2016. The overwhelming majority of this visitation is day use. Unlike overnight visitor use, which is monitored and managed via campground infrastructure and the park's overnight permit system, RMNP currently has comparatively few mechanisms for monitoring and managing visitor day use.

In 2016, RMNP contracted with RSG to conduct a visitor day use management needs assessment, which included the following objectives:

- Identify issues associated with visitor day use.
- Identify information needs for visitor day use management planning.
- Compile and summarize available social science research and data on visitor day use in RMNP including:
 - Social science literature;
 - Visitor use data and trends; and
 - Socioeconomic data and trends.
- Identify information gaps for visitor day use management planning.

RSG conducted the needs assessment through four phases of work. First, RSG staff visited RMNP to collect social science research literature and data from park staff, staff of the National Park Service Social Science Program (NPS SSP), RMNP's library, and the National Park Service's (NPS) Integrated Resource Management Application system. Second, RSG compiled, summarized, and analyzed the social science research literature and data collected during the first phase of work; this included additional literature and data collected by RSG. Third, RMNP held a visitor day use management workshop from November 1, 2016 to November 2, 2016 to identify and document park issues associated with visitor day use and information needed to effectively plan for and manage visitor day use. Staff from RMNP, NPS SSP, and RSG participated in this workshop. Forth, RSG identified visitor day use management information gaps by comparing needed information for visitor day use management planning with existing social science research literature and data.

The following sections of this technical memorandum report the results of the visitor day use management needs assessment. Section 2.0 summarizes the issues and information needs associated with visitor day use management as reported by park staff during the visitor day use management workshop and the information gaps for visitor day use management planning identified by RSG. Section 3.0 presents a summary and assessment of the existing social science literature and data compiled and reviewed in this project. Section 4.0 reviews available visitor use-related social science research literature, including summaries of key findings and annotated bibliographic entries. Section 5.0 summarizes and reports the results of trend analyses of visitor day use-related data collected by RMNP and extracted by RSG from the social science research literature. Section 6.0, the final section of this technical memorandum, summarizes socioeconomic and outdoor recreation participation trends for the local and regional areas surrounding RMNP.

2.0 ISSUES AND INFORMATION NEEDS AND GAPS ASSOCIATED WITH VISITOR DAY USE

RMNP held a visitor day use management workshop from November 1, 2016 to November 2, 2016 to identify and document issues associated with visitor day use and information needed to effectively plan for and manage visitor day use. Participants included leadership and field staff from RMNP, with representation from all park divisions, NPS SSP, and RSG. The results of this workshop and subsequent information gaps analysis are presented in the following subsections that address: 1) the issues associated with visitor day use in RMNP as expressed by park staff during the workshop; 2) the information needs for visitor day use management as expressed by park staff during the workshop; and 3) gaps in the body of information needed for visitor day use management planning identified by RSG following the workshop through comparison of the information needs expressed by park staff with existing social science research literature and data.

2.1 | ISSUES ASSOCIATED WITH VISITOR DAY USE IDENTIFIED BY RMNP STAFF

At the workshop, park leadership identified visitor day use as the top management priority for RMNP. It is the park's top priority because of the dramatic and sustained growth in visitor day use, the range of issues associated with visitor day use, and the increasing severity and potential consequences of the issues. Figure 1 illustrates the dramatic growth in visitor use of RMNP, the clear majority of which is day use. This growth is likely to continue given population and socioeconomic trends in the RMNP region and national trends in park visitation and outdoor recreation participation.



FIGURE 1: ANNUAL VISITATION TO RMNP (2006–2016)

Park leadership and staff reported during the workshop that the magnitude of visitor day use to RMNP is causing several issues. These issues—enumerated by park leadership at the beginning of and reiterated by park leadership and staff throughout the day use management workshop—affect a range of park resources, visitor experiences, transportation systems, visitor safety and law enforcement concerns, and park operations. Furthermore, these issues are not mutually exclusive; the effects of one issue cascade to cause or exacerbate additional issues. For example, a transportation-related issue like parking lot congestion can lead to park resource issues like vegetation and soil damage from unauthorized roadside parking; visitor experience issues, including frustration and conflict among visitors; safety issues like the creation of hazardous road conditions and delays in emergency response; and operational issues like staff fatigue and retention challenges from frequent interactions with unhappy and aggressive visitors. The recent increase in visitor use, and the associated increase in visitor use management issues is not unique to RMNP. Many units of the National Park System have experienced similar increases in visitor use and visitor use management issues in recent years. Table 1 includes a representative list of the issues associated with the recent dramatically increased levels of visitor day use in RMNP expressed by park staff during the day use management workshop. The list of issues is not ordered or ranked.

TABLE 1: ISSUES ASSOCIATED WITH VISITOR DAY USE IDENTIFIED BY RMNP STAFF

RMNP MANAGEMENT CONTEXT	ISSUES ASSOCIATED WITH VISITOR DAY USE (AS IDENTIFIED BY RMNP STAFF)
Resource Protection	• Unauthorized roadside parking is proliferating. • Improperly disposed human waste is proliferating and extensive along trails and around recreation areas. • Unauthorized fires and fire impacts are proliferating from illegal camping and other activities along lakes, at climbing areas, and elsewhere. • Dog presence on trails is proliferating. • Social/informal trails are proliferating. • Environmentally sensitive behavior (e.g., Leave No Trace compliance) is less common among visitors. • Exotic plant species infestations are proliferating, especially at visitor use areas and along trails. • Cultural resources impacts are proliferating and beyond the ability of RMNP staff to monitor or prevent them. • Park soundscapes impacts are proliferating. • Impacts to wildlife such as shifts in habitat use, area avoidance, and behavioral changes are likely to increase. • The risk of aquatic invasive species occurring in park waters may be increasing.
Visitor Experiences	• Crowding is degrading the quality of visitor experiences. • Frustration and displeasure among visitors due to traffic congestion and restricted access to crowded park areas is increasing. • Displacement of visitors due to crowding and restricted access (i.e., no longer visiting at all, or no longer visiting certain places or at certain time) is more common. • Conflict among visitors is increasing. • Access to the Bear Lake corridor is often restricted because visitor use of transportation infrastructure is at or over capacity. • Experiential opportunities are homogenizing as visitor use in more areas of the park and off-season times increases. • Programs and visitor centers are sometimes crowded beyond their ability to effectively provide interpretive opportunities.

RMNP MANAGEMENT CONTEXT	ISSUES ASSOCIATED WITH VISITOR DAY USE (AS IDENTIFIED BY RMNP STAFF)
Transportation Systems	- Entrance station lines are more frequent and often excessively long. - Parking lots and shuttle buses fill to capacity more frequently. - Lines to board shuttle buses are more frequent and longer. - Roadway congestion is more frequent and intense, leading to increased vehicle idling and associated increased exhaust emissions.
Visitor Safety and Law Enforcement	- Crime and law enforcement incidents (e.g., theft, drug and alcohol abuse, visitor aggression) is increasing. - Backcountry patrols frequency is decreasing because of increasing demand for frontcountry law enforcement presence and response. - Response time for emergency services is being prolonged by roadway congestion and visitor crowding. - Evacuation speed and safety are being compromised by visitor crowding and congestion.
Park Operations and Administration	- Staff retention and wellbeing is declining due to stress and conflict resulting from increases in the volume and changes in the character of visitor use. - Staff are endangered by increasing visitor aggression and intensification of vehicular traffic. - Staff fatigue is constant and increasing as the demands of visitor management increase disproportionately to operational resources. - Requirements for year-round park operations (e.g., custodial, visitor management, law enforcement) are increasing. - Toilet facilities capacity, particularly during winter months, is more frequently exceeded. - Opportunities for backcountry patrols and resource protection activities are becoming more limited. - Custodial services are more frequently overwhelmed by the volume of visitor use. - Roadway congestion is more frequently impeding park staff travel and parking throughout RMNP, which prevents staff from providing services to visitors and accomplishing administrative duties. - Park operational capacity has declined over the last five years, and employees and volunteers have consistently been overwhelmed.

2.2 | INFORMATION NEEDS FOR VISITOR DAY USE MANAGEMENT IDENTIFIED BY RMNP STAFF

RMNP park leadership and staff raised many questions about the patterns of visitor use in the park during the discussion of issues associated with visitor day use. Questions raised included the impact of visitor day use on park resources and experiences, the motivations and perceptions of day visitors, the ability of park operations and administration to effectively manage visitor day use, and the tolerances of day visitors, public stakeholders, and park resources for visitor use-related impacts. Contained within these questions—which are summarized below—were expressions of need for information about visitor day use in RMNP.

HOW MANY DAY USE VISITORS CAN RMNP ACCOMMODATE?

The most fundamental information need expressed by park leadership and staff was for information about the park's ability to accommodate visitor day use while achieving management objectives for visitor safety, experiential quality, resource protection, and operational effectiveness. RMNP staff acknowledged that the number of day use visitors that can be accommodated within the park is dependent upon multiple factors, including the behaviors, tolerances, and distribution of these visitors; the response of park conditions to visitor use; park operational capabilities; and management objectives for park conditions.

This fundamental information need was often framed in one of two ways when expressed by park staff:

How does visitor day use affect park conditions, and what are the tolerances for these effects?

Park staff frequently expressed a need for specific information about the relationships between visitor day use and park conditions. Although the existence of such relationships was generally agreed upon, park staff identified a need for information to quantify and document the character, strength, and current state of these relationships in the park; help evaluate the tolerances of visitors and other public stakeholders for visitor day use and its negative impacts to park resources and conditions; monitor the response of park resources to visitor day use levels and patterns; support the selection of desired conditions for park experiences, resources, and operations; and to identify visitor day use levels associated with desired park conditions.

How is visitor day use distributed throughout RMNP?

Park staff raised two types of questions about the distribution of visitor day use in RMNP during the day use management workshop. The first of these identified a need for descriptive information about the places where and times during which visitor day use is concentrated in the park, and how this distribution might change with increasing visitor day use. The second type of question identified a need for information about how the distribution of visitor day use changes in response to management actions. A specific example of the need for this type was the need for information about the response of visitors to the closure of the Bear Lake Road to private vehicles at times when parking along the road corridor is full.

WHAT ARE THE ATTITUDES OF DAY USE VISITORS AND OTHER PUBLIC STAKEHOLDERS TOWARD VISITOR DAY USE MANAGEMENT IN RMNP?

RMNP staff also identified a need for information about the attitudes of day visitors and other public stakeholders toward visitor day use management. Park leadership and staff specifically identified information about how visitors and public stakeholders perceive and reconcile tradeoffs among park conditions, visitor

experiences, visitor access, and park operations as necessary for developing visitor day use management plans that are both technically effective and feasible to implement.

2.3 | INFORMATION GAPS FOR VISITOR DAY USE MANAGEMENT

Information is required to satisfy the needs expressed by park leadership and staff. Some of this information is readily available from social science research studies and data that are compiled and summarized in Section 3.0 through Section 6.0 of this technical memorandum; however, there are gaps in the body of needed information as well. These gaps exist for one of two reasons: 1) the required information has been collected but not compiled and analyzed in a format that is useful for visitor day use planning and management; or 2) the required information has not yet been collected. Table 2 lists the gaps in information needed to inform visitor day use planning for RMNP.¹

TABLE 2: INFORMATION GAPS FOR VISITOR DAY USE MANAGEMENT

HOW MANY DAY USE VISITORS CAN RMNP ACCOMMODATE?
<i>HOW DOES VISITOR DAY USE AFFECT PARK RESOURCES AND EXPERIENCES, AND WHAT ARE THE TOLERANCES FOR THESE EFFECTS?</i>
• Descriptive data on the relationships between visitor day use amounts and the conditions of park resources and experiences at recreation sites and along trails for areas other than the Bear Lake Road corridor. • Descriptive data on the relationships between visitor day use amounts and park operational capacities not included or analyzed in previous studies, including visitor safety/emergency response, custodial/maintenance services, and transportation systems. • Evaluative data on the physical capacities of recreation, visitor service, and transportation facilities and infrastructure to accommodate visitor day use for areas other than the Bear Lake Road corridor. • Evaluative data on visitor and public stakeholder preferences and tolerances for park resource and experience conditions for areas other than the Bear Lake Road corridor.
<i>HOW IS VISITOR DAY USE DISTRIBUTED THROUGHOUT RMNP?</i>
• Systematic and coordinated descriptive data on the spatial and temporal distribution of visitors throughout RMNP. • Analytical data describing how the distribution of visitor day use changes in response to potential visitor day use management actions (e.g., closure of the Bear Lake Road corridor).
<i>WHAT ARE THE ATTITUDES OF DAY VISITORS AND OTHER PUBLIC STAKEHOLDERS TOWARD VISITOR DAY USE MANAGEMENT IN RMNP?</i>
• Visitor attitudes toward visitor day use management, including data on how visitors make tradeoffs among interrelated aspects of visitor day use management like freedom, access, convenience, and the quality of park conditions. • Public stakeholder attitudes toward visitor day use management, including data on how public stakeholders make tradeoffs among interrelated aspects of visitor day use management like freedom, access, convenience, and the quality of park conditions.

¹ An addendum to this technical memorandum contains a list of recommended data collection and analysis projects that address information gaps for visitor day use management.

2.4 | SUMMARY

RMNP leadership identified visitor day use management as the park's top management priority because of the proliferation and increasing severity of issues associated with visitor day use. Park leadership and staff have also expressed a need for information about RMNP's ability to accommodate visitor day use—based on the relationships between visitor day use and park conditions, and the distribution of visitor day use throughout the park—and information about public attitudes toward visitor day use management. Park leadership and staff need this information to develop and implement effective and feasible visitor day use management plans. Some needed information is available, but several information gaps exist. These information gaps should be addressed, either with collection of new data or analysis of existing information, prior to the development and implementation of visitor day use management plans.

3.0 ASSESSMENT OF AVAILABLE SOCIAL SCIENCE INFORMATION

Compilation and summary of available social science research and data on visitor day use in RMNP was, along with conduct of the visitor day use management workshop and its information needs and gaps analysis, one of the primary purposes of this project. The following section of this technical memorandum provides an assessment of the available social science research and data provided by RMNP and compiled and summarized in Section 4.0 and Section 5.0 of this technical memorandum.

The assessment of available social science research and data is presented using symbols that depict a subjective evaluation of the quantity of available information, its relative recentness or antiquity, and its usefulness in identifying trends or creating time-series comparisons. Table 3 explains these symbols, which are adapted from those used in NPS Natural Resource Condition Assessments and RMNP State of the Park reports.

TABLE 3: KEY TO SYMBOLS USED IN THE ASSESSMENT OF AVAILABLE SOCIAL SCIENCE INFORMATION ON VISITOR USE IN RMNP

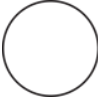
QUANTITY OF AVAILABLE INFORMATION		HISTORY OF AVAILABLE INFORMATION		COMPARABILITY OF AVAILABLE INFORMATION	
	Little information is available		Recent and historical information is available		Robust trends can be made through time
	Some information is available		Only recent information is available		Some comparisons can be made through time
	Much information is available		Only historical information is available		No comparisons can be made through time

Table 4 presents the assessments of the availability of social science research and data, categorized by visitor uses, issues, and areas. For each category, two assessments are provided: one for published research studies reviewed in the literature review (Section 4.0) and one for visitor use-related data compiled in Section 5.0.

TABLE 4: ASSESSMENT OF AVAILABLE SOCIAL SCIENCE INFORMATION ON VISITOR USE IN RMNP

ITEM	VISITOR STUDIES	AVAILABLE QUANTITATIVE DATA
Management topics		
Visitor day use		
	• Most visitor studies have included a limited number of questions about visitor day use. • Few visitor studies specifically focus on visitor day use specifically. • Studies that do exist are historical. • Comparisons among visitor studies must be made with care to account for differences in study design.	• Most visitor studies have included a limited number of questions about visitor day use.
Overnight visitor use		
	• Most visitor studies have included some questions about overnight use. • Several visitor studies have focused on overnight visitors in both frontcountry and backcountry/Wilderness settings. • Comparisons among visitor studies must be made with care to account for differences in study design.	• Several overnight visitor use data sources exist, including RMNP camping permit data.
Visitor attitudes toward visitor use management		
	• Some studies have focused on visitor attitudes toward visitor use management. • Studies that do exist are largely historical.	• No recent datasets on RMNP visitor attitudes toward visitor use management exist.

ITEM	VISITOR STUDIES	AVAILABLE QUANTITATIVE DATA
Visitor crowding/social experience	 • Visitor crowding and social experiences have been the subject of visitor studies since the 1970s. • Comparisons among visitor studies must be made with care to account for differences in study design.	 • Several recent datasets on visitor crowding and social experience are available. • The ability to identify trends among datasets is limited by methodological differences and the lack of multiple years of data. • Strong trends could be drawn with additional data collection.
Visitor impacts to vegetation and soils	 • Visitor impacts to vegetation and soils have been the subject of research studies since the 1960s. • Comparisons among studies of visitor impacts to vegetation and soils must be made with care to account for differences in study design.	 • Several recent datasets on visitor impacts to vegetation and soils are available. • Some comparisons can be made within vegetation and soil impact datasets. • Regular monitoring with previously used data collection methods would enable strong trends to be drawn.
Visitor experience of visitor impacts to vegetation and soils	 • Many visitor studies have collected minimal, general information on visitors' experiences of visitor impacts to park vegetation and soils. • Comparisons among visitor studies must be made with care to account for differences in study design.	 • A recent and rich dataset is available on visitors' experiences of visitor impacts to vegetation and soils in the Bear Lake area.

ITEM	VISITOR STUDIES	AVAILABLE QUANTITATIVE DATA
		
Transportation	• Transportation related to visitor use has been the subject of recent and intensive study.	• Studies and data integrate visitor use, park resource, and transportation planning. • Park-wide data on vehicle arrival volume and shuttle bus ridership are collected and reported annually.
		
Visitor protection/ search and rescue	• Both historical and recent research and incident reports on visitor protection, particularly search and rescue, are available.	• Incompleteness of incident reports and incompatibility between historical and recent reporting systems limits direct comparisons and development of trends.
		
Bouldering/rock climbing/mountaineering	• Mountaineering, particularly on Longs Peak, has been the subject of periodic study and anecdotal reporting. • Bouldering, boulderers, and bouldering impacts have been the subject of recent studies.	• Some comparisons could be made with additional data collection.

ITEM	VISITOR STUDIES	AVAILABLE QUANTITATIVE DATA
Backcountry/ Wilderness	 • Backcountry and Wilderness use have been the subject of several historical and recent visitor studies. • Comparisons among visitor studies must be made with care to account for differences in study design.	 • A variety of backcountry and Wilderness visitor use data sources exist, including trail counter and overnight permit data. • Comparison among visitor use datasets must be made with care to account for differences in data collection.
Locations*		
Bear Lake area	 • The Bear Lake area is the most heavily studied areas in RMNP. • Bear Lake area visitor studies include both historical and recent descriptive and crowding-related information. • Comparisons among visitor studies must be made with care to account for differences in study design.	 • Visitor use data for the Bear Lake area includes trail counter and transportation-related data. • Strong trends could be drawn with additional data collection.
Longs Peak	 • Longs Peak is the second most heavily studied area in RMNP with respect to visitor use. • Visitor studies include mostly historical descriptive and crowding-related information. • Comparisons among visitor studies must be made with care to account for differences in study design.	 • Visitor use data includes trail counter and some transportation-related data. • Comparisons from year to year could be made with additional data collection.

ITEM	VISITOR STUDIES	AVAILABLE QUANTITATIVE DATA
		
Trail Ridge Road	Limited and mostly historical information is available for visitor use and experiences for Trail Ridge Road.	Some mostly transportation-related visitor use data are available for Trail Ridge Road.
		
Wild Basin	Most information available in visitor studies for Wild Basin is from general, park-wide visitor studies.	- Some recent visitor use data are available for the Wild Basin area. - Comparisons from year to year could be made with additional visitor use data collection.
		
Moraine Park	Most information available in visitor studies for Moraine Park is from general, park-wide visitor studies.	- Some recent visitor use data are available for the Moraine Park area. - Comparisons from year to year could be made with additional visitor use data collection.
		
Fall River	Most information available in visitor studies for Fall River is from general, park-wide visitor studies.	- Some recent visitor use data are available for the Fall River area. - Comparisons from year to year could be made with additional visitor use data collection.

ITEM	VISITOR STUDIES	AVAILABLE QUANTITATIVE DATA
		
Grand Lake	• Most information available in visitor studies for Grand Lake is from general, park-wide visitor studies.	• Some recent visitor use data are available for the Grand Lake area. • Comparisons from year to year could be made with additional visitor use data collection.

* In addition to these locations, some visitor use information is available for Lumpy Ridge, Alluvial Fan, Deer Ridge, Hidden Valley, and Sprague Lake in Bricker, 2014.

4.0 LITERATURE REVIEW

This section presents an annotated bibliography of published and unpublished social science research—or literature review—related to visitor day use conducted in RMNP. The literature review is organized into the following subsections:

- 2.1 Visitor Studies:** survey and qualitative research on visitors and visitor characteristics.
- 2.2 Visitor Use Studies:** research studies characterizing and quantifying visitor use levels, distributions, and patterns.
- 2.3 Recreation Ecology Studies:** research studies focusing on the interaction between visitor use and park resource conditions and quality, with an emphasis on vegetation and soils.
- 2.4 Transportation Studies:** research studies focusing on the interaction of transportation systems, visitor use, visitor experiences, and park resources.
- 2.5 Additional Resources:** a list of additional references that are not specifically reviewed in the preceding subsections of the annotated bibliography but help to describe the history of social science and visitor use management research in RMNP.

Within this body of literature, several eras or groupings of science research can be identified. These eras are presented along a timeline in Figure 2. Patterns of social science research in RMNP have largely followed patterns of visitor use and the implementation of visitor use management in the park. As visitor use increased throughout the 1960s and 1970s, the body of social science research also grew. Initially, the social science research being conducted was largely descriptive of both recreation users and their impacts on park resources and experiences. But in the 1970s and 1980s—when increases in visitor use and associated resource and experiential impacts warranted management action (e.g., backcountry overnight permit system, shuttle bus system, backcountry and trails management plans)—social science research began investigating visitor attitudes about park management and transportation system use. As social science for parks and outdoor recreation matured as a discipline from the mid-1980s to the early 2000s, research in RMNP reflected this development with efforts to implement systematic and coordinated social science research. In recent years, these efforts have culminated in quantitative, model-based applied social science that integrates visitor experiences, park resource conditions, and transportation systems to directly inform park planning and management.

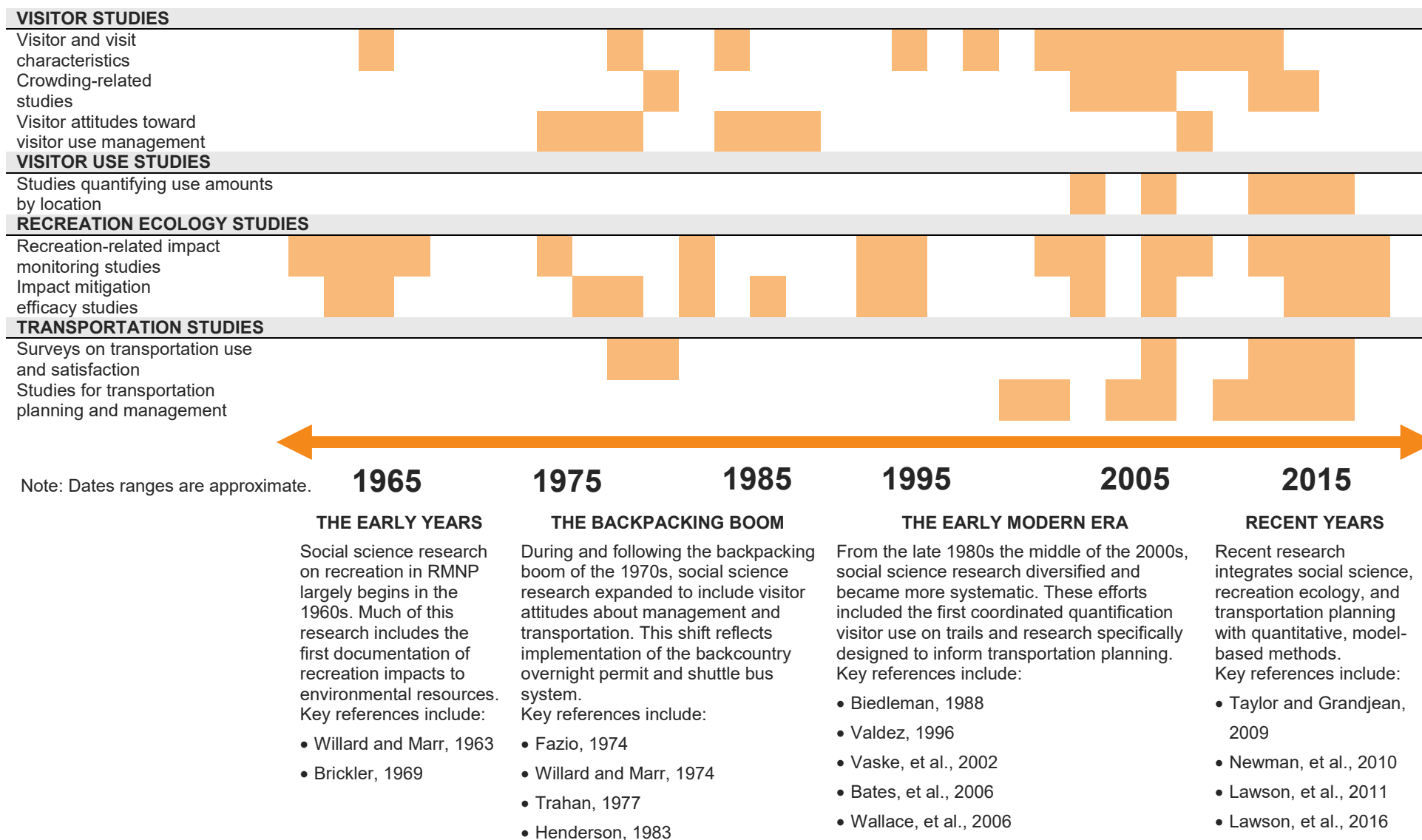


FIGURE 2: TIMELINE OF VISITOR USE MANAGEMENT SOCIAL SCIENCE RESEARCH IN RMNP

4.1 | VISITOR STUDIES

Three common themes are prominent within the visitor studies reviewed here: visitors and visits, crowding, and visitors and management action. The following subsections briefly summarize key findings within each of these themes, along with observations and recommendations relevant to each theme.

VISITORS AND VISITS

Nearly all visitor use studies cited in this technical memorandum contain information describing visitors and their visits. The body of studies specifically targeted at collecting descriptive data on visitors and their visits for general park planning vary widely in their design, particularly with respect to respondent population and sampling approach. This variation limits direct comparison of results among studies. In 1995—and again in 2009 to 2010—RMNP engaged in general social survey research based on the widely applied Visitor Services Project approach (Valdez, 1996; Blotkamp, et al., 2010; and Papadogiannaki, Le, and Hollenhorst, 2001). Replication of a similar, and potentially enhanced, survey approach every 5 to 10 years would build upon the existing efforts to describe RMNP visitors and visits, effectively implementing a long-term socioeconomic program for the park.

- **Brickler, 1969:** In a survey distributed at entrance stations with very low response rate, most respondents were day users and respondents commonly reported that park facilities were inadequate.
- **Flick and Taylor, 1998:** The survey of summer day users and backpackers highlights that day users were more likely than backpackers to rate park facilities as important to their quality of experience and less likely to rate park resources in visitor use areas as being in poor condition.
- **Taylor and Grandjean, 2006:** Visitors to RMNP locations along Route 7 were satisfied with their park experiences, with Colorado residents and visitors with longer stays being more satisfied with their experiences than residents of other states or visitors with shorter stays, respectively.
- **Erickson, Johnson, and Kivel, 2009:** African-American residents of the Denver, Colorado, area are underrepresented among RMNP visitors because of historical and cultural factors that could be addressed—in some ways—by park management.
- **Cook, 2010:** Visitors to RMNP from 2009 to 2010 contributed approximately \$350 million to the economies of Boulder, Grand, and Larimer counties.

CROWDING

Since 1979, a series of visitor studies have focused on crowding-related aspects of visitor experiences in RMNP. By and large, these crowding-related studies suggest that visitors to RMNP do not feel crowded, although “overuse” is often cited by visitors as a primary management concern for the park. This general pattern of satisfaction with visitor use level runs counter to findings from recent transportation-related visitor use research conducted in RMNP (Newman, et al., 2010; Lawson, et al., 2011; Lawson, et al., 2016) and the impressions of park managers developed from visitation records and their experiences in the park. There are several possible factors contributing to this discrepancy, including limitations in the ways crowding was measured (i.e., use variables that were not sensitive to changes in visitor use or poorly matched to visitor use levels), employment of psychological coping mechanisms by visitors who experience high levels of visitor use, and changes in crowding-related conditions and tolerances over time. Several of these issues, particularly the methodological issues, were effectively addressed and mitigated in the recent transportation-related research. This research provides the most recent, rigorous, and integrated information on visitor crowding-related experiences and effects in the highest use areas of RMNP.

- **Landreth, 1979:** Summer backpackers expressed that backcountry use levels were not too high at present but did think that use should not be permitted to increase indefinitely, and some respondents reported a desire to see moderate amounts of other users in the backcountry for social reasons.
- **Flick and Taylor, 1998:** Day users reported that some encounters with other hikers had a positive impact on their experiences.
- **Vaske, Donnelly, and Lehto, 2002:** Summer visitors to Longs Peak, the Alpine Visitor Center, and the Bear Lake area reported feeling little crowding and perceived crowding exceeded crowding norms.
- **Schuster, Johnson, and Taylor, 2004:** Summer visitors to backcountry areas placed high importance on solitude and silence and rated instances of crowding and human-generated noise negatively when experienced.
- **Wallace, Brooks, and Bates, 2006:** Summer backcountry and Wilderness users did not report feeling crowded, regardless of whether they were day or overnight users.

VISITORS AND MANAGEMENT ACTION

Research on the acceptability of visitor use management actions to visitors is of comparable importance to research on the efficacy of visitor use management. Research into visitors' perceptions of and attitudes toward visitor use management began early in the history of social science in RMNP. Throughout this history, visitors have expressed acceptance of existing management actions and reluctance to support new or additional management action. This reluctance is somewhat caveated by visitors' near-universal support for protection of park resources and recognition that active or restrictive visitor use management is required, at some point, to protect park resources. Visitors have not, however, expressed any general support for active or restrictive visitor use management to protect the quality of recreational experiences. Research on visitor support for and attitudes about visitor use management has not kept pace in recent years with other social science research in RMNP. Reinvigorating this line of social science research will be important to support the public acceptability—and ultimate efficacy—of any future RMNP visitor use management planning.

- **Fazio, 1974:** Summer backcountry visitors on the east side of RMNP supported a backcountry overnight permit system, but did not support a day use permit system.
- **Trahan, 1977:** Summer hikers were “protective” of the RMNP environment, recognized resource impacts and visitor safety as valid reasons for day use management, were not opposed to all types of use limits, and preferred “noncoercive” forms of management.
- **Henderson, 1983:** Summer visitors to Longs Peak generally supported day use limits to protect the quality of environmental resources, but did not generally support day use limits to increase the quality of visitor experiences.
- **Beidleman, 1988:** Frontcountry campers perceived overuse as the greatest problem facing RMNP, supported existing visitor use management actions, and expressed opposition to additional visitor use management unless visitor-caused impacts were severe and management strategies effective at mitigating impacts.
- **Wallace, Brooks, and Bates, 2006:** Summer backcountry and Wilderness users expressed priorities for visitor use management to address environmental—rather than experiential—impacts from visitor use.
- **Taylor and Grandjean, 2009:** Visitors to RMNP locations along the Route 7 corridor were most supportive of park fees to fund management actions when information about the need for and efficacy of management was clearly and prominently communicated.

Brickler, S. (1969). **Park Visitor Classification Matrix**. Colorado State University: Fort Collins, CO.

The purpose of this research was to develop a classification of visitors to RMNP to understand visitor characteristics, preferences, and tolerances to inform park planning and management. A self-administered survey was distributed by park rangers to visitors entering the park by private vehicle. Of the approximately 2,700 surveys distributed, 712 (approximately 20%) were returned to drop-boxes stationed at park exits. Tabular data are presented for visitors categorized as “curious,” “moderate,” or “enthusiast” based on their responses. The respondent sample was well-educated, professional, high-income, satisfied with park scenery, and somewhat dissatisfied with inadequate facilities in the park. Most respondents were day visitors. Approximately 30% of respondents lived within 100 miles of RMNP. These respondents were more likely to be concerned by traffic, crowds, and litter than respondents who resided farther away. Those respondents who resided farther than 100 miles from RMNP were primarily concerned about inadequate visitor facilities.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1969
Source Location	RMNP Library (Thesis 796 Brickler)
Purpose	To develop a classification of visitors to RMNP to understand of visitor characteristics, preferences, and tolerances to inform park planning and management.
Population	Summer visitors in 1968.
Sample Technique	Survey distributed by park rangers at entrance stations to every 10th visitor group between the hours of 7:00 a.m. and 5:00 p.m.
Data Collection	Self-administered, on-site survey.
Data Presented	Tabular data are presented for visitors categorized as “curious,” “moderate,” or “enthusiast” based on their responses.
Results	The respondent sample was well-educated, professional, high-income, satisfied with park scenery, and somewhat dissatisfied with inadequate facilities in the park. Most respondents were day visitors. Approximately 30% of respondents lived within 100 miles of RMNP. These respondents were more likely to be concerned by traffic, crowds, and litter than respondents who resided farther away. Those respondents who resided farther than 100 miles from RMNP were primarily concerned about inadequate visitor facilities.
Recommendations	No explicit recommendations to park managers specified.

Fazio, J. (1974). **A Mandatory Permit System and Interpretation for Backcountry User Control in RMNP: An Evaluative Study**. Colorado State University: Fort Collins, CO.

Research was conducted by a Colorado State University graduate student during the summer of 1973 to evaluate RMNP visitors': 1) support for and attitudes about backcountry use permit systems; 2) attitudes about backcountry facility development; 3) wilderness values, and knowledge of and support for low-impact backcountry travel practices; and 4) the potential for interpretive programs to increase support for and compliance with backcountry permit systems, and adoption of low-impact backcountry travel practices. Research was conducted using on-site and mail surveys, and experimental interpretive treatments. Prior to their backcountry trip, visitors completed an on-site survey eliciting visitor and trip characteristics, and knowledge and attitude measures about the backcountry permit system, backcountry facilities, and low-impact backcountry travel practices. A mail survey was administered to overnight backcountry users approximately five weeks after completion of the on-site survey to evaluate the effects of experimental interpretive treatments.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1974
Source Location	RMNP Library (Thesis 796 Fazio)
Purpose	Evaluate existing support for backcountry permit systems among backcountry users and test interpretive approaches to increase support for and compliance with permit systems.
Population	Summer backcountry visitors to East District of RMNP in 1973.
Sample Technique	Pre- and post-visit questionnaires with experimental interpretive treatments.
Data Collection	Visitors responded to on-site and mail-back survey questions.
Data Presented	Dissertation includes visitor and trip characteristics, measures of support for and compliance with backcountry permit system, levels of knowledge of and attitudes toward low-impact and other backcountry travel procedures, and efficacy of interpretive measures to increase knowledge of and change attitudes about backcountry travel procedures.
Results	Respondents supported existing overnight backcountry permit system. Day use permits were not acceptable to survey respondents. Interpretive programs were more effective at improving knowledge of reasons for permit systems than changing attitudes toward permit systems.

STUDY COMPONENT	DETAILED DESCRIPTION
Recommendations	1) Permit systems should be standardized and consistent throughout the park and across seasons. 2) Have both advanced and day-of permit application and issuance. 3) Convenience and fairness of permit issuance is important to visitors' experiences and support of the system. 4) Park staff should be knowledgeable about the permit system and information should be kept up-to-date and easily accessible. 5) An active interpretive program emphasizing the "why and how" of permit systems should be implemented.

Trahan, R. (1977). **Day use Limitations in National Parks: Visitor and Park Personnel Attitudes Toward Day use Limitations Systems for Rocky Mountain National Park.** University of Northern Colorado: Greeley, CO.

A survey of day hikers was conducted by the University of Northern Colorado along six trail systems in RMNP in 1977 to gauge levels of support for alternative day use management options. Park users were protective of the RMNP environment and recognized resource protection and visitor safety as important reasons for day use management, including limiting use. Visitors preferred “noncoercive” forms of day use management. Signs directing visitors toward less-used trails, signs directing visitors away from more heavily used trails, and development of more trails were the three most supported day use management actions. A lottery system for access to trails, alternate day use restrictions, tickets to use trails, and blocking off access so hikes become longer were the least supported day use management actions. The one exception to these general patterns was seen among visitors to Specimen Mountain—the lowest use level sampling location—who supported first come, first served access restrictions for day users.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1977
Source Location	Northern Colorado University.
Purpose	Evaluate visitors' perceptions of attitudes toward day use limits in RMNP.
Population	Summer hikers on six trails in RMNP.
Sample Technique	Random sample of hikers on randomized days of week.
Data Collection	Self-administered, on-site questionnaire.
Data Presented	Visitor and visit characteristics, visitor perception of and experience with RMNP natural resources and crowding, attitudes toward day use management.
Results	Park users were protective of the RMNP environment and recognized resource protection and visitor safety as important reasons for day use management, including limiting use. Visitors preferred “noncoercive” forms of day use management. Signs directing visitors toward less-used trails, signs directing visitors away from more heavily used trails, and development of more trails were the three most supported day use management actions. A lottery system for access to trails, alternate day use restrictions, tickets to use trails, and blocking off access so hikes become longer were the least supported day use management actions. The one exception to these general patterns was among visitors to Specimen Mountain—the lowest use level sampling location—who supported first come, first served access restrictions for day users.
Recommendations	If implemented, day use limits should be directed toward protection of park resources and designed to maximize visitor freedom of behavior.

Landreth, L. (1979). **A Comparative Analysis of Backpackers Using Designated Sites and Crosscountry Zones in RMNP**. Colorado State University: Fort Collins, CO.

Data collected during the summer of 1977 illustrate similarities and differences among backcountry overnight users to RMNP. Backcountry overnight users were differentiated based on their use of designated backcountry campsites or cross-country travel and camping zones. A random sample of backcountry permit holders was surveyed by mail. Designated site users had high expectations for and more favorable attitudes about backcountry facilities and social interactions on the trail and in camp than cross-country site users. Cross-country site users had higher levels of backcountry experience and knowledge of low-impact backcountry travel than other users. Both groups supported the existing backcountry permit system, management of backcountry visitor use, and the use of interpretive information and education to manage visitor use and improve visitors' knowledge of low-impact backcountry travel practices.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1979
Source Location	RMNP Library (Thesis 917.89)
Purpose	Describe and compare designated site and cross-country backpacker characteristics, knowledge, and attitudes with respect to RMNP backcountry use.
Population	Summer (June–September) RMNP backpacking permit registrants in 1977.
Sample Technique	A random sample of backpacking permit holders.
Data Collection	Mail-back questionnaire.
Data Presented	Thesis includes visitor and trip characteristics; attitudes about backcountry management, including facilities, regulations, and policies; and evaluations of experiences, including social, administrative, and biophysical conditions.
Results	Respondents supported the existing backcountry overnight permit system and found it convenient and fair. While respondents generally did not evaluate backcountry use as too high, an overwhelming majority agreed that it was necessary to prevent visitor use from increasing indefinitely. A substantial minority of backcountry users, particularly those to designated sites, desired seeing a moderate number of other users.
Recommendations	Zoned management of backcountry use can help to satisfy the diversity of desired experiences among backcountry users.

Henderson, S. (1983). **Decision Making Information for a Carrying Capacity Based Management System: A Case Study of Day Users on Longs Peak, RMNP.** Colorado State University: Fort Collins, CO.

A visitor survey was conducted by Colorado State University in the summer of 1981 to collect descriptive information on day use visitation of Longs Peak and to assess day use visitors' levels of satisfaction and attitudes toward day use management actions. Sixty-one percent (61%) of respondents surveyed at the Longs Peak trailhead indicated that Longs Peak was their primary destination. Seventy-four percent (74%) did not report difficulty finding parking. Thirty-nine percent (39%) of respondents were residents of Colorado. Eighty-seven percent (87%) supported or strongly supported day use limits if conditions on Longs Peak were determined to be deteriorating beyond an acceptable level. Nearly 80% of respondents reported that environmental protection was more important than public enjoyment. Just over one-third of respondents supported day use limits to increase the quality of hiking experiences. Approximately 221 day use visitors agreed to participate in the survey (96% acceptance rate) at the end of their hike at the Longs Peak trailhead on 11 randomly selected days between August 1 and September 14, 1981. All visitors exiting the trail were intercepted and asked to participate in the survey. Questionnaires were completed by 202 visitors (91% response rate), answering questions related to patterns of use on the Longs Peak trail, preferred recreational experiences on the peak, satisfaction of visitors' experiences on Longs Peak, visitors' attitudes toward day use limitation on Longs Peak, and demographics.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1983
Source Location	Colorado State University.
Purpose	To determine patterns of day use visitation of Longs Peak and assess day use visitors' levels of satisfaction with and attitudes toward day use management.
Population	Visitors to the Longs Peak trailhead in the summer of 1981.
Sample Technique	On-site intercept of every visitor exiting the Longs Peak trail on 11 randomly selected days between August 1 and September 14, 1981.
Data Collection	On-site intercept and survey administration.
Data Presented	Report includes descriptive information on patterns of use on the Longs Peak trail, preferred recreational experiences on the peak, satisfaction of visitors' experiences on Longs Peak, visitors' attitudes toward day use limitation on Longs Peak, and demographics.
Results	Eighty-seven percent (87%) supported or strongly supported day use limits if conditions on Longs Peak were determined to be deteriorating beyond an acceptable level. Nearly 80% of respondents reported that environmental protection was more important than public enjoyment. Just over one-third of respondents supported day use limits to increase the quality of hiking experiences.

STUDY COMPONENT	DETAILED DESCRIPTION
Recommendations	Park managers should establish specific management objectives for the Long's Peak area, select appropriate management tools and techniques, and evaluate and modify the resulting management framework accordingly.

Beidleman, C. (1988). **Visitor Attitudes and Perceptions of Use Management in Rocky Mountain National Park**. University of Arizona: Tucson, AZ.

A survey of frontcountry campers was conducted by the University of Arizona to evaluate the level of support among park visitors for existing and alternative visitor use management actions designed to protect the quality of park resources and experiences under pressure from increasing visitor use. While respondents favored most existing management actions, most respondents opposed additional management. Nearly half of all respondents identified overuse as the greatest problem facing RMNP. Approximately one-quarter to one-third of respondents expressed support for day-hiker or park-wide visitor use limits. More than three-quarters of respondents reported tolerance for additional visitor use restrictions on the condition that visitor use-related impacts were serious and the restrictions effectively addressed problems. The survey included 120 complete questionnaires (83% response rate) that were administered on site via an interview conducted in August 1987. Results of the survey suggest that park managers need to understand the motivations for visitor opposition to visitor use restrictions and clearly and actively communicate the reasons for and benefits of visitor use management.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1988
Source Location	University of Arizona.
Purpose	To evaluate the level of support among park visitors for existing and alternative visitor use management actions designed to protect the quality of park resources and experiences under pressure from increasing visitor use.
Population	Frontcountry campers in August, 1987.
Sample Technique	Convenience sample, stratified across two frontcountry campgrounds.
Data Collection	Survey questionnaire administered via on-site interview.
Data Presented	Data are presented in tabular format for visitor and trip characteristics, evaluations of park problems, use-of-park information, support for existing visitor use management, and support for alternative visitor use management.
Results	While respondents favored most existing management actions, most respondents opposed alternative management actions. Nearly half of all respondents identified overuse as the greatest problem facing RMNP. Approximately one-quarter to one-third of respondents expressed support for day-hiker or park-wide visitor use limits. More than three-quarters of respondents reported tolerance for additional visitor use restrictions on the condition that visitor use-related impacts were serious and the restrictions effectively addressed problems.
Recommendations	Park managers need to understand the motivations for visitor opposition to visitor use restrictions and clearly and actively communicate the reasons for and benefits of visitor use management.

Valdez, S. (1996). **Rocky Mountain National Park Visitor Use Study: 1994–1995**. National Park Service, Rocky Mountain National Park.

RMNP sought to better understand visitor views of the park and how to better accommodate these visitors and verify counting instructions for the monthly public use statistics. A wide array of information was collected on visitor and trip characteristics; evaluations of park conditions, facilities, services, and management; economic expenditures; crowding and conflict; and values for park resources and experiences. The survey was administered at three locations, including two entrance stations and a visitor center. A total of 4,148 visitors were contacted to participate in the survey, with 3,405 agreeing to complete a survey (82% response rate). Results were reported in tabular format with accompanying figures. Key findings included approximately 38% of visitors resided in Colorado, approximately 82% of respondents were visiting for the day, and less than 20% of respondents reported feeling crowded in the park.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1996
Source Location	RMNP internal document.
Purpose	To better understand visitor views of the park and how to better accommodate these visitors and verify counting instructions for the monthly public use statistics.
Population	Visitors to RMNP in 1994–1995.
Sample Technique	On-site survey administration at the Beaver Meadows and Fall River Entrances and at the Kawaneche Visitor Center.
Data Collection	Survey questionnaire.
Data Presented	Data are presented in tabular format and figures for visitor and trip characteristics; evaluations of park conditions, facilities, services, and management; economic expenditures; crowding and conflict; and values for park resources and experiences.
Results	Key findings included approximately 38% of visitors resided in Colorado, approximately 82% of respondents were visiting for the day, and less than 20% of respondents reported feeling crowded in the park.
Recommendations	No explicit recommendations to park managers specified.

Flick, S., and Taylor, J. (1998). **Attitudes of Backpackers and Casual Day Visitors in Rocky Mountain National Park.** *Park Science*. 18, pp. 18-20.

In summer of 1993 a study was conducted to assess attitudes of backpackers and casual day visitors toward natural features, park management, human-habituated wildlife, and human impacts on the environment. Both backpackers and day users reported far more positive experiences than negative experiences. Day users were more likely than backpackers to rate paved roads, campgrounds, well-maintained trails, and wildlife sightings as important to their experiences. Backpackers were more likely to photograph instances of visitor impacts to natural resources, and rated these impacts far more negatively than day users. Some day visitors also reported positive ratings for encounters and interactions with human-habituated wildlife. Single-use, 12-exposure cameras were given to 50 backpackers and 50 day use visitors at the beginning of their visit during July and September 1993. Participants were also given logs in which to record—for each photograph—location, subject, why it was taken, and if the subject had a positive or negative effect on the visitor’s trip. Participants also rated the importance of park features to their trips in a follow-up survey.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1998
Source Location	Park Science.
Purpose	To assess attitudes of backpackers and casual day visitors toward natural features, park management, human-habituated wildlife, and human impacts on the environment.
Population	Visitors to RMNP in July and September 1993.
Sample Technique	Not reported.
Data Collection	Visitors were assigned single-use, 12 exposure cameras with logs to record attributes of photographs. Follow-up surveys were distributed for visitors to rate the importance of park features to their visits.
Data Presented	Report included descriptive results for attitudes of backpackers and casual day visitors toward natural features, park management, human-habituated wildlife, and human impacts on the environment.
Results	Both backpackers and day users reported far more positive experiences than negative experiences. Day users were more likely than backpackers to rate paved roads, campgrounds, well-maintained trails, and wildlife sightings as important to their experience. Backpackers were more likely to photograph instances of visitor impacts to natural resources, and rated these impacts far more negatively than day users. Some day visitors also reported positive ratings for encounters and interactions with human-habituated wildlife.
Recommendations	No explicit recommendations to park managers specified.

Vaske, J., Donnelly, M., and Lehto, X. (2002). **Visitor Crowding and Normative Tolerances at Congested Areas of Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

RMNP conducted a study in the summer of 2001 to describe visitors' perceptions of crowding and normative tolerances for crowding, and to evaluate these perceptions and norms relative to visitor use densities experienced on site. A total of 1,643 surveys (95% response rate) were completed by visitors to Longs Peak, the Alpine Visitor Center, and the Bear Lake area. Results of the study suggested that perceptions of crowding vary in intensity by location, with visitors feeling most crowded at the summit of Longs Peak and at the Alpine Visitor Center, and least crowded at the Longs Peak trailhead. At all three sampling locations, average visitor perceptions of crowding did not exceed average expressed normative tolerances for crowding. Descriptive results were presented in tabular format by location for visitor and trip characteristics, parking-related issues, and crowding-related variables, including encounters, perceived crowding, and normative tolerances.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2002
Source Location	RMNP internal document.
Purpose	To describe visitors' perceptions of crowding and normative tolerances for crowding, and to evaluate these perceptions and norms relative to visitor use densities experienced on site.
Population	Visitors to RMNP in the summer of 2001.
Sample Technique	On-site intercept of visitors at three locations.
Data Collection	Self-administered, on-site survey questionnaire.
Data Presented	Descriptive results are presented in tabular format by location for visitor and trip characteristics, parking-related issues, and crowding-related variables, including encounters, perceived crowding, and normative tolerances.
Results	Results of the study suggest that perceptions of crowding vary in intensity by location, with visitors feeling most crowded at the summit of Longs Peak and at the Alpine Visitor Center, and least crowded at the Longs Peak trailhead. At all three sampling locations, average visitor perceptions of crowding did not exceed average expressed normative tolerances for crowding.
Recommendations	The authors recommend continued monitoring of perceived crowding and suggest that no management action is needed at the time of study since perceptions of crowding do not violate crowding norms.

Schuster, E., Johnson, S., and Taylor, J. (2004). **Wilderness Experience in Rocky Mountain National Park, 2002: Report to RMNP**. US Geological Survey, Rocky Mountain National Park. NPS Study # ROMO 02034.

RMNP conducted a study in the summer of 2002 to use visitor-employed photography to assess visitors' experiences in backcountry areas of RMNP. Respondents placed high importance on wilderness aesthetics, solitude, and silence, and rated instances of crowding, human-generated sounds, and other human impacts negatively. Single-use, 10-exposure cameras were distributed to 293 randomly selected visitors, with 254 visitors (87% response rate) completing and returning cameras and associated logs in which visitors were asked to record the location and subject for each photograph, the reason why it was taken, how the photographic subject affected the visitor's experience, what sounds were audible at the photograph location, and how the sound(s) affected the visitor's experience. Participants were mailed a follow-up survey with questions regarding demographics and visitors' wilderness experiences in RMNP, with 140 participants returning their surveys (56% response rate).

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2004
Source Location	RMNP internal document.
Purpose	To assess visitors' experiences in backcountry areas.
Population	Visitors to RMNP in July 2002.
Sample Technique	On-site intercept of visitors entering sample location; specified interval used to select participants (every n th method).
Data Collection	Visitors were assigned single-use, 10-exposure cameras with logs to record attributes of photographs. Follow-up surveys were distributed for visitors to provide demographic information and answer questions regarding wilderness experiences.
Data Presented	Report included descriptive information on subjects of photos, observed sounds, and visitors' attitudes toward photo subjects and observed sounds.
Results	Respondents placed high importance on wilderness aesthetics, solitude, and silence, and rated instances of crowding, human-generated sounds, and other human impacts negatively.
Recommendations	No explicit recommendations to park managers specified.

Taylor, P., and Grandjean, B. (2006). **Visitor Satisfaction Along the Highway 7 Corridor to Rocky Mountain National Park**. Wyoming Survey & Analysis Center: Laramie, WY.

Interview-based surveys of visitors to RMNP were conducted to assess visitor satisfaction with park experiences, resources, and facilities. Sampling occurred between October 2004 and October 2005, with an additional sampling period between August and September 2006. Descriptive results were presented for each sampling location and all sampling locations. Data were analyzed by demographic group (i.e., age, race, sex), frequency of visits, state of residence (Colorado and non-Colorado residents), and whether the respondent paid an entry fee or not. Approximately 1,283 visitors participated in survey interviews (93% response rate) at three contact locations: Lily Lake, Longs Peak, and Wild Basin.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2006
Source Location	RMNP internal document.
Purpose	Survey of visitor perceptions of and satisfaction with park experiences, resources, and facilities.
Population	Visitors to Lily Lake, Longs Peak, and Wild Basin between October 2004 and September 2006.
Sample Technique	On-site intercept of every-other passing groups.
Data Collection	On-site survey interviews with visitor groups.
Data Presented	Report includes descriptive information on visitor satisfaction; support for increasing, reducing, or maintaining access, services and/or facilities; and demographic information. Report also presents comparisons between respondents across sample locations, respondent demographics, frequency of visits, state of residence, and whether an entry fee was paid.
Results	Overall, visitors were most satisfied with the number of developed hiking trails, roads in the park, and trail signs for hiking. Visitors were least satisfied with availability of drinking water, distance to campsites from parking areas in Wild Basin, and availability of park literature and/or exhibits. Significant differences were observed for most satisfaction-related variables across the three sampling locations. White respondents were significantly more satisfied overall compared to nonwhite respondents, as were Colorado residents compared to non-Colorado residents. Respondents who spent more time in the park were more likely to be satisfied with park resources. Paying a park fee was determined to have a positive relationship to satisfaction. Over 50% of respondents supported increasing entrance fees to help improve park resources.
Recommendations	No explicit recommendations to park managers specified.

Wallace, G., Brooks, J., and Bates., M. (2006). **Visitor Use in Wilderness Study Phase II: A Survey of Day and Overnight Backcountry/Wilderness Visitors in Rocky Mountain National Park.** Colorado State University: Fort Collins, CO.

Following development of a backcountry and Wilderness management plan in 2001, RMNP sought updated information on visitors and visitor use in the backcountry and Wilderness of the park. This on-site survey, distributed to visitors exiting backcountry and Wilderness trailheads and the Backcountry Office from late July 2002 through September 2002, gathered information on: visitor sociodemographic characteristics, trip characteristics, motives for visiting RMNP, visitor activities in RMNP, things that added to or detracted from visitor experiences, and perceptions about backcountry and Wilderness management. Results of the survey suggested that most visitors to RMNP backcountry and Wilderness did not feel crowded and that visitors' priorities for backcountry and Wilderness management primarily address environmental impacts from recreation like littering, evidence of human waste, illegal campsites, and informal trails. Additionally, few differences were found in responses between overnight and day visitors. Just over 1,000 surveys were distributed on site, with 685 surveys completed (67% response rate).

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2006
Source Location	RMNP internal document.
Purpose	To gather updated baseline information on the characteristics and perspectives of RMNP backcountry and Wilderness visitors.
Population	Backcountry and Wilderness visitors during the summer of 2002.
Sample Technique	On-site survey administration at backcountry and Wilderness trailheads and the Backcountry Office.
Data Collection	Survey questionnaire.
Data Presented	Data are presented on visitor sociodemographic characteristics, trip characteristics, motives for visiting RMNP, visitor activities in RMNP, things that added to or detracted from visitor experiences, and perceptions about backcountry and Wilderness management. Data were analyzed by overnight vs. day use.
Results	Few differences were found in responses between overnight and day visitors. Most visitors to RMNP backcountry and Wilderness did not feel crowded. Visitors' priorities for backcountry and Wilderness management primarily address environmental impacts from recreation like littering, evidence of human waste, illegal campsites, and informal trails.
Recommendations	No explicit recommendations to park managers specified.

Erickson, B., Johnson, C., and Kivel, B. (2009). **Rocky Mountain National Park: History and Culture as Factors in African-American Park Visitation.** *Journal of Leisure Research*. 41, pp. 529-545.

The research examined the experiences of African-Americans living in the Denver, Colorado, metropolitan area and identified historical and cultural factors that result in low rates of visitation to RMNP by African-Americans. From semistructured interviews with 36 African-American individuals in the Denver metropolitan area, and archival research, three factors contributing to low visitation were identified. The “embodied” factor pointed to a lack of cultural knowledge about how to visit and recreate in RMNP. The “objectified” factor pointed to a lack of means or resources required to visit and recreate in RMNP. The “institutionalized” factor pointed to a lack of knowledge about or appreciation of the benefits that flow from visiting and recreating in RMNP. Awareness among RMNP managers of these factors and their contribution to low African-American visitation rates would support the design and implementation of programs to encourage visitation among the relatively large and nearby population of African-American potential visitors.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2009
Source Location	Journal of Leisure Research.
Purpose	To examine the experiences of African-Americans living in the Denver, Colorado, metropolitan area and identify historical and cultural factors that result in low rates of visitation to RMNP by African-Americans.
Population	African-Americans living in and around Denver, Colorado.
Sample Technique	Convenience and snowball sampling.
Data Collection	Semistructured, in-depth interviews.
Data Presented	Excerpts of qualitative interviews, organized into factors influencing low visitation rates by African-Americans.
Results	The “embodied” factor pointed to a lack of cultural knowledge about how to visit and recreate in RMNP. The “objectified” factor pointed to a lack of means or resources required to visit and recreation in RMNP. The “institutionalized” factor pointed to a lack of knowledge about or appreciation of the benefits that flow from visiting and recreating in RMNP.
Recommendations	Awareness among RMNP managers of these factors and their contribution to low African-American visitation rates would support the design and implementation of programs to encourage visitation among the relatively large and nearby population of African-American potential visitors.

Taylor, P., and Grandjean, B. (2009). **Visitor Satisfaction and Support for Park Fees: Examining the Effects of Frontcountry, Backcountry, and Information in Rocky Mountain National Park.** *The George Wright Forum*. 26:2, pp. 12-21.

The purpose of the research was to develop insights into RMNP visitors' support for and willingness to pay fees to support park management and to assess the role that visitors' satisfaction with park experiences plays in their willingness to pay park fees. An on-site survey (N = 1,283, 92.8% response rate) was used to assess visitors' satisfaction with frontcountry experiences, backcountry experiences, and the quality and quantity of park information. Survey respondents were also asked questions about their willingness to pay park fees. Logistic regression models were developed to predict visitors' willingness to pay fees based on their experiences in the frontcountry, backcountry, and with park information. Of the variables included in the models, the presence of clear and relevant park information was the primary driver of visitors' willingness to pay park fees.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2009
Source Location	George Wright Forum.
Purpose	To evaluate factors that influence park visitors' willingness to pay park fees.
Population	Visitors to RMNP along the Route 7 corridor.
Sample Technique	On-site interview-based survey.
Data Collection	Park visitors' support for and willingness to pay fees to support park management, assessment of the role that visitor satisfaction plays in their willingness to pay park fees.
Data Presented	Descriptive results for visitor satisfaction with multiple elements of visitor experience and logistic regression model results for willingness to pay park fees.
Results	On average, visitors were satisfied with all aspects of their experiences. Improvement in the quality and quantity of information visitors receive about the park and its resources was the factor most influential in supporting willingness to pay park fees.
Recommendations	Improvement in the availability and delivery of information about park resources and the use of park fees protect resources and improve visitor experiences will be helpful in increasing support for park fees.

Blotkamp, A., Boyd, W., Eury, D., and Hollenhorst, S. (2010). **Rocky Mountain National Park Visitor Study: Summer, 2010**. National Park Service: Fort Collins, CO.

A mail-back Visitor Services Project (VSP) survey was conducted by the University of Idaho at RMNP in 2010 between July 18 and July 24. Visitor groups answered questions related to visitor and trip characteristics, importance of services and facilities, information use prior to visit, expenditures, and preferences for future visits. Approximately 1,099 visitor groups accepted survey questionnaires (95% acceptance rate) at one of three potential contact locations: Beaver Meadows Entrance, Fall River Entrance, or Grand Lake Entrance. A three-phase follow-up approach—including a postcard and two reminder mailings—was used to increase return rates. Questionnaires were completed and returned for 755 visitors groups (69% response rate).

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2010
Source Location	RMNP internal document.
Purpose	Collection of general sociological data on park visitors.
Population	Summer visitors passing through Beaver Meadows Entrance, Fall River Entrance, and Grand Lake Entrance.
Sample Technique	On-site intercept of visitors entering sample location using random and systematic selection method.
Data Collection	A 27-question mail-back, paper survey booklet was used to collect information. A reminder postcard and two full follow-up mailings were used to increase response rates.
Data Presented	Report included descriptive information on visitor demographics, trip characteristics, and visitor preferences and opinions related to services, facilities, information use, expenditures, and preferences for future visitors.
Results	Report presented descriptive results in tabular format with figures.
Recommendations	No explicit recommendations to park managers specified.

Cook, P. (2010). **Impacts of Visitor Spending on the Local Economy**. National Park Service NPS/NRSS/EQD/NRR-2012/510.

This research sought to estimate the economic contribution of RMNP visitation to the local economy. Results were generated by economic models based on data collected by Blotkamp, et al., 2010 and Papadogiannaki, et al., 2011. Results suggest that visitor spending contributed approximately \$178 million to the local economy through direct sales, with additional contributions of approximately \$63 million and \$105 million from park payroll and value added effects, respectively. The local area for these economic effects was defined as the three-county area, including Boulder, Grand, and Larimer counties.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2010
Source Location	National Park Service.
Purpose	Estimate the economic contribution of RMNP visitation to the local economy.
Population	RMNP visitors in the summer of 2009 and the winter of 2010.
Sample Technique	On-site survey, stratified random sample.
Data Collection	On-site intercept of visitors entering sample location using random and systematic selection method.
Data Presented	A 27-question mail-back, paper survey booklet was used to collect information. A reminder postcard and two follow-up mailings were used to increase response rates.
Results	Results suggested that visitor spending contributed approximately \$178 million to the local economy through direct sales, with additional contributions of approximately \$63 million and \$105 million from park payroll and value added effects, respectively.
Recommendations	No explicit recommendations to park managers specified.

Papadogiannaki, E., Le, Y., and Hollenhorst, S. (2011). **Rocky Mountain National Park Visitor Study: Winter, 2011**. National Park Service: Fort Collins, CO.

A mail-back VSP survey was conducted by the University of Idaho at RMNP in 2011 between February 19 and February 27. Visitor groups answered questions related to visitor and trip characteristics, importance of services and facilities, information use prior to visit, expenditures, and preferences for future visits. Approximately 790 visitor groups accepted survey questionnaires (95% acceptance rate) at one of four potential contact locations: Beaver Meadows Entrance, Fall River Entrance, Grand Lake Entrance, or Kawuneeche Visitor Center. Visitors were randomly and systematically selected at each location. A three-phase follow-up approach, including a postcard and two reminder mailings, was used to increase return rates. Questionnaires were completed and returned for 579 visitors groups (73% response rate).

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2011
Source Location	RMNP internal document.
Purpose	Collection of general sociological data on park visitors.
Population	Winter visitors passing through Beaver Meadows Entrance, Fall River Entrance, and Grand Lake Entrance, or visiting Kawuneeche Visitor Center.
Sample Technique	On-site intercept of visitors entering sample location using random and systematic selection method.
Data Collection	A 27-question mail-back, paper survey booklet was used to collect information. A reminder postcard and two follow-up mailings were used to increase response rates.
Data Presented	Report included descriptive information on visitor demographics; trip characteristics; visitor preferences and opinions related to services, facilities, information use, expenditures; and preferences for future visitors.
Results	Descriptive results in tabular format with figures were presented.
Recommendations	No explicit recommendations to park managers specified.

4.2 | VISITOR USE STUDIES

The visitor use studies reviewed here are specific—and often purpose-oriented—studies that characterize and quantify visitor use levels, distributions, and patterns in RMNP. These studies supplement the extensive and detailed visitor use data that are collected by RMNP as part its operations, which is summarized and reported in the Section 5 of this technical memorandum. In addition to these specific visitor use studies, visitor use data are also presented in the social science reviewed in the other subsections of this annotated bibliography. The following is a summary of key findings from the visitor use studies reported in this subsection:

- **Richardson and Loomis, 2004:** Reduced snowpack, associated earlier openings of park roads, and more temperate shoulder seasons likely to result from changing climate conditions will contribute to increases in RMNP visitation.
- **Bates, Wallace, and Vaske, 2006:** An initial, widespread trail use monitoring program was established using active beam infrared trail counters. Documented results indicated that trails in the Bear Lake are the most heavily use, with the trail to Alberta Falls being the busiest trail in the Bear Lake area.
- **Kedrowski, 2009:** Proximity to Denver, accessibility via paved roads and short hikes on easy trails, and maximum elevation were the drivers of visitor use level for Colorado mountains higher than 14,000 feet, including those in RMNP.
- **Alexander and Moore, 2010:** Visitor use on Longs Peak increased from approximately 2,000 visitors per year in the 1930s to approximately 35,000 in 2002.
- **D'Antonio, et al., 2010:** On average, visitors spent 2.5 hours in the Bear Lake area, with 28% of visitors departing from the Bear Lake trailhead destined for a location along the Emerald Lake Trail.
- **Reynolds, Beseler, and Stallones, 2012:** Search and rescue activities occurred most frequently during the evening hours of the summer weekend days, in concurrence with the highest use times in RMNP.

Richardson, R., and Loomis, J. (2004). **Adaptive Recreation Planning and Climate Change: A Contingent Visitation Approach.** *Ecological Economics*. 50, pp. 83-99.

A study was conducted in the summer of 2001 to estimate the effects of climate change on RMNP visitation. Results suggest that changes in climate (e.g., lower snowpack, earlier opening dates for park roads) would lead to an increase in visitation for baseline and moderate climate scenarios. However, in an extreme heat climate scenario (greater than 50 days exceeding 80 degrees Fahrenheit), visitation would decline. Models depicting a baseline scenario, hypothetical climate scenarios developed by the Hadley Climate Center (HCC) and Canadian Climate Center (CCC), and an extreme heat scenario were developed and used to predict climatic variables and associated impacts to park resources. Mail-back surveys were administered to 1,266 visitors (92% acceptance rate) to five locations in RMNP in the summer of 2001. Of these, completed surveys were returned by 967 visitors (70% response rate). Survey respondents indicated the effect that each scenario would have on the frequency and duration of trips to RMNP. Respondents also answered questions related to distances traveled, number of nights stayed, and travel expenditures per household.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2004
Source Location	Ecological Economics.
Purpose	To estimate the effects of climate change on visitation.
Population	Visitors to RMNP in the summer of 2001.
Sample Technique	On-site intercept of random groups at five sampling locations.
Data Collection	<i>Visitor surveys:</i> A mail-back, paper survey booklet was used to collect information. A reminder postcard and one follow-up mailing were used to increase response rates. <i>Climate models:</i> Global circulation climate models from Hadley Climate Center and Canadian Climate Center.
Data Presented	<i>Changes in park conditions within climate scenarios:</i> number of high and low temperature days, number of days with >0.25 inches of precipitation, number of days with snow-free trails, number of days Trail Ridge Road is open for driving, average number of daily visitors in July and October, elk and ptarmigan populations, vegetation composition. <i>Survey results for HCC, CCC, and extreme heat climate scenarios:</i> average additional trips per visitors, projected visitation, mean change in annual visitor days, changes in visitor expenditures. <i>Econometric model:</i> economic impacts of changes in visitation in terms of revenue and number of jobs. <i>Contingent visitation analysis:</i> Impact of specific variables (e.g., change in number of extreme heat days) on respondents' visitation behavior.

STUDY COMPONENT	DETAILED DESCRIPTION
Results	The average distanced traveled to RMNP was 643 miles, the average length of stay was 3.04 days, and over 60% of respondents were from outside of Colorado. Results suggest that visitation to RMNP would increase by approximately 13.6% in the HCC scenario and 9.9% in the CCC scenario, and would decline by 8.8% in the extreme heat scenario.
Recommendations	The authors suggested that the contingent visitation method used in this paper may be useful for park managers to plan for the possible effects of climate change on park visitation.

Bates, M., Wallace, G., and Vaske, J. (2006). **Visitor Use in Wilderness Phase II: Estimating Visitor Use in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

Trail use data were collected at several locations throughout RMNP during the summer and fall of 2002 through 2004. The purpose of the research was to develop baseline data on trail use to inform park planning and management, and for application to an associated visitor use study (Wallace, Brooks, and Bates, 2004). Trail use volumes were collected using Trailmaster brand active beam electronic trail counters and corrected to account for measurement error associated with electronic trail counters. Data collection areas included: Bear Lake, western RMNP, the Highway 7 corridor, Moraine Park, northeastern RMNP, Wild Basin, Trail Ridge Road, and Fall River Road. Results of trail use monitoring suggested that the Bear Lake area receives greater trail use than other locations within the park, with Alberta Falls being the busiest location within the Bear Lake area.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2006
Source Location	RMNP internal document.
Purpose	The purpose of the research was to develop baseline data on trail use to inform park planning and management, and for application to an associated visitor use study (Wallace, Brooks, and Bates, 2004).
Population	Summer and fall trail users, 2002 through 2004.
Sample Technique	N/A
Data Collection	Active beam infrared trail counters.
Data Presented	Trail use volumes by location and month, calibration correction factors for electronic trail counters.
Results	Results present counts of trail use by location and time in tabular format. Results of trail use monitoring suggested that the Bear Lake area receives greater trail use than other locations within the park, with Alberta Falls being the busiest location within the Bear Lake area.
Recommendations	No explicit recommendations to park managers specified.

Kedrowski, J. (2009). **Determining the Relative Annual Mountain Climbing Frequency on Colorado's 14,000-foot Peaks.** *BioOne*. 29, pp. 82-92.

A study was conducted in 2005 to identify variables that significantly affect frequency of visits to 14,000-foot peaks in Colorado. Five explanatory factors (linear distance from summit to Denver, linear distance from the summit to the nearest paved road, length of trail from most accessible trailhead on the standard or easiest summit, level of difficulty, and elevation of the trailhead for the standard route) were all found to have a significant relationship to frequency of summit visits on peaks with low, moderate, and high levels of visitation. Peaks with high levels of visitation tend to be closer to Denver, closer to paved roads, have shorter and easier access trails, and higher elevation trailheads. Summit visit frequency was estimated using archival summit register data from the Colorado Mountain Club. Distances from summits to Denver and nearest paved roads and trail lengths and trailhead elevations were measured using geospatial data. Levels of difficulty of peaks were assigned using ratings from *Colorado's Fourteeners*, a guidebook.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2009
Source Location	BioOne.
Purpose	To determine explanatory variables for frequency of visits to 14,000-foot summits in Colorado.
Population	Colorado peaks of 14,000-foot elevation or higher.
Sample Technique	Census.
Data Collection	<i>Frequency of visits:</i> Estimated using Colorado Mountain Club summit register archives. <i>Distance-related variables:</i> Distances were measured with handheld GPS units.
Data Presented	Means and statistical tests for peaks with low, moderate, and high frequency of visitation in relation to five explanatory factors (linear distance from summit to Denver, linear distance from the summit to the nearest paved road, length of trail from most accessible trailhead on the standard or easiest summit, level of difficulty, and elevation of the trailhead for the standard route).
Results	Each of the five explanatory factors was found to bear a significant relationship to frequency of visitation. Peaks with high levels of visitation tend to be closer to Denver, closer to paved roads, have shorter and easier access trails, and higher elevation trailheads.
Recommendations	No specific recommendations to park managers specified.

Alexander, R., and Moore, C. (2010). **People and Nature on the Mountaintop: A Resource and Impact Study of Longs Peak in Rocky Mountain National Park**. Rocky Mountain Cooperative Ecosystem Studies Unit, Rocky Mountain National Park, and Colorado State University.

A study was conducted to describe historical patterns of visitor use, associated visitor impacts, and management efforts on Longs Peak in RMNP. Longs Peak has been a popular destination for visitors since the founding of RMNP. The number of annual visitors reaching the summit has grown from nearly 2,000 in the early 1930s to an estimated 35,000 in 2002. The increasing popularity of the peak has led to a variety of management efforts, including closing or requiring registration for certain technical routes, the installation (and subsequent removal) of cables on the north face of the peak, wilderness ethics and Leave No Trace education efforts, and backcountry management planning. The study summarizes historical documents, the results of past studies and visitor surveys, and other published and unpublished pieces of literature.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2010
Source Location	RMNP internal document.
Purpose	To describe historical visitor use patterns, impacts, and management efforts on Longs Peak.
Population	N/A
Sample Technique	N/A
Data Collection	Review of historical literature and data sources.
Data Presented	Annual visitor volumes to the summit of Longs Peak.
Results	The study describes historical visitor use volumes, and associated resource impacts and management efforts on Longs Peak.
Recommendations	No specific recommendations for park managers.

D’Antonio, A., Monz, C., Lawson, S., Newman, P., Pettebone, D., and Courtemanch, A. (2010). **GPS-Based Measurements of Backcountry Visitors in Park and Protected Areas: Examples of Methods and Applications from Three Cases Studies.** *Journal of Park and Recreation Administration*. 28, pp. 42-60.

Three case studies were conducted to assess the potential applications of GPS-based tracking for visitor use monitoring, including one case study in the Bear Lake Road corridor of RMNP in 2008. Visitors to the Bear Lake Road corridor in the case study spent an average of 2 hours and 30 minutes in the Bear Lake Road corridor trail system. At Alberta Falls, 46% of visitors left the established trail, with these visitors spending an average of 17 minutes off trail. From the Bear Lake trailhead, 28% of all visitors traveled to destinations along the Emerald Lake Trail. The study included 350 visitors to the Bear Lake, Glacier Gorge, and Bierstadt Lake trailheads were randomly selected across 13 randomly selected days in July and August 2008 (80% response rate). GPS units recorded visitor movements using a 15-second point recording interval. Of the 350 tracks collected, 49 were discarded because of poor GPS performance in areas of dense trees cover or extreme topography. The authors conclude that GPS-based tracking allows for the tracking of subtle visitor movements (e.g., off-trail travel) with minimal burden placed on study participants.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2010
Source Location	Journal of Park and Recreation Administration.
Purpose	Examine potential applications of GPS-based tracking for visitor use monitoring.
Population	Visitors to Bear Lake, Glacier Gorge, and Bierstadt Lake trailheads in July and August 2008.
Sample Technique	On-site random intercept of visitors entering Bear Lake, Glacier Gorge, and Bierstadt Lake trailheads.
Data Collection	GPS trackers affixed to visitors’ backpacks recorded visitor movements at a defined time interval (15 seconds).
Data Presented	Mean, maximum, and minimum time spent by visitors in the Bear Lake Road corridor trail system. Percentage of visitors to Bear Lake trailhead who traveled to locations on Emerald Lake Trail. Percent of visitors who traveled off trail at Alberta Falls, including average time spent off trail.
Results	Visitors spent an average of 2 hours and 30 minutes in the Bear Lake Road corridor trail system. At Alberta Falls, 46% of visitors left the established trail, with these visitors spending an average of 17 minutes off trail. From the Bear Lake trailhead, 28% of all visitors traveled to destinations along the Emerald Lake Trail.
Recommendations	GPS tracking is an effective way to monitor visitor use.

Reynolds, S., Beseler, C., and Stallones, L. (2012). **Preventative Search and Rescue for Rocky Mountain National Park Phase 1 Report**. Mountain and Plains Education Research Center, University of Colorado: Denver, CO.

RMNP incident reports were analyzed to identify sources of and trends in visitor injury incidents. Incidents occurred most frequently during peak visitation times (summer weekend days). Most incidents involved males between the ages of 20 and 29 and males and females between the ages of 50 and 59. Most incidents involved visitors who were hiking; however, rock climbing was identified as the most incident-prone activity. Human error was the primary contributing factor to most incidents, followed by nature and weather. Data from incident reports were used to perform comparisons of incidents across several criteria, including visitor demographics, activities, contributing factors, and temporal factors. Researchers noted that many incident reports had missing information. Targeted injury prevention programs aimed at visitors between the ages of 20 and 29 and over the age of 50, hikers, and rock climbers are warranted based on available data. The authors recommend that RMNP collect more detailed information as part of their incident reporting procedures, and ensure that incident reports are fully completed.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2012
Source Location	Mountain and Plains Education Research Center, University of Colorado–Denver
Purpose	To develop recommendations for improving reporting protocols and implementing targeted safety programs.
Population	2009–2011 RMNP incident reports.
Sample Technique	N/A
Data Collection	Emergency Medical Services Reports and Search and Rescue Reports (SARs), 2009–2011
Data Presented	Incident rates by year, month, day of week, and time of day. Comparisons of injury and noninjury incidents by demographics, characteristics of the search, activities, and contributing factors.
Results	The number of reported incidents between 2009 and 2011 corresponded with peak use times (summer weekend days) and most frequently occurred in evening hours. Most incidents involved males between the ages of 20 and 29 and males and females between the ages of 50 and 59. Most incidents involved visitors who were hiking; however, rock climbing was identified as the activity most commonly associated with incidents. Human error was identified as the primary factor for most incidents.
Recommendations	The authors strongly recommended that incident reports be completed and submitted in a timely manner. The authors recommended that injury prevention programs, targeting hikers and park visitors between ages 20 and 29 and over the age of 50, be established using signage.

4.3 | RECREATION ECOLOGY STUDIES

Two common themes are prominent within the recreation ecology studies reviewed in this technical memorandum: impact monitoring and impact mitigation. These studies primarily focus on visitor impacts to vegetation and soils in or proximate to recreation areas or facilities (e.g., visitor attraction sites, trails). A full assessment of assessment of resource impacts from visitor use was outside the scope of this study. The following subsections include brief summaries of key findings within each of these themes, along with observations relevant to each theme.

IMPACT MONITORING

Monitoring visitor use-related impacts to environmental resources was the first concerted social scientific effort directly related to visitors undertaken in RMNP. This work was conducted by Willard and Marr as part of a multiyear project that started in 1959. Since then, visitor impacts have been regularly monitored and documented by several researchers. Researchers express similar concerns about the level and proliferation of visitor use impacts with each new generation of study. Recent efforts, particularly those of D'Antonio, et al., 2013, have incorporated the experience of environmental impacts into research previously dominated by strictly administrative and ecological perspectives. Understanding the experience of visitor use-related impacts will greatly help park managers more effectively communicate the need for visitor use management to mitigate impacts and bolster support for and compliance with visitor use management actions when such actions are necessary.

- **Willard and Marr, 1963:** Visitor use-caused impacts, including trail widening and braiding, meadow trampling, and campfire impacts were proliferating to managerially unacceptable levels in the Bear Lake area.
- **Willard and Marr, 1974:** Alpine and tundra vegetation in RMNP was more heavily impacted by “concentrated walking” (i.e., high-density visitor use like that found along trails or at recreation sites) than by “unchanneled walking” (i.e., dispersed or low-density visitor use).
- **Reynolds, 1982:** Off-trail visitor use was associated with lack of clear definition of trails, lack of stable and adequate off-trail visitor use areas, and proliferation of prominent but unauthorized trails.
- **Pettebone, Newman, and Theobald, 2006:** Visitor use volume on trails was significantly correlated with trail width, and visitor use-related impacts along trails are concentrated primarily at trail junctions and recreation sites (e.g., lake shores, vistas).
- **Willard and Marr, 2007:** Vegetation cover in visitor-impacted areas recovered after exclosures were installed; however, vegetation cover later declined dramatically for unexplained reasons not directly connected to visitor use.
- **Pettebone, Newman, and Theobald, 2009:** Spatially sampling approaches for monitoring trail condition that were based on visitor accessibility along trails more accurately accounted for changes in trail width than simple interval-based samples.
- **Lukens, 2012:** Boulderizing specific visitor use-related impacts like proliferation of social trails and modification of soils and vegetation in landing zones existed at boulderizing locations.
- **D'Antonio, et al., 2013:** Visitor standards for visitor use-caused environmental impacts were rarely exceeded for social trails, exceeded approximately half of the time in dispersed recreation areas, and nearly always exceeded at visitor-created recreation sites.
- **Svajda, 2016:** Visitor use type and level were statistically related to trail width, with stock and high-use levels being related to wider trails.

IMPACT MITIGATION

Nearly all impact monitoring studies cited in the preceding subsection included statements about mitigation of visitor use-related impacts to RMNP environmental resources. This is also true for many of the visitor studies reviewed, particularly those conducted prior to 1995. However, many of these statements rarely extended beyond general calls for visitor “education” about environmental impacts from visitor use. Results of visitor studies suggest that visitors are and have been aware of and concerned about environmental impacts from visitor use. Further, environmental impact from visitor use is the one generally supported rationale for restrictive, active, or coercive visitor use management. This recognition highlights the potential, in terms of both efficacy and visitor acceptability, for visitor impact mitigation strategies that are more direct and active than generalized education programs. The following findings are from specific and actionable impact mitigation research from RMNP that employed techniques other than education. Please note that, in addition to these specific sources, much of the research on visitor impact mitigation conducted elsewhere is likely applicable to RMNP.

- **Willard and Marr, 1963:** Visitor-impacted environmental resources can be effectively restored with exclosures.
- **Reynolds, 1982:** Provision of clearly defined trails, stable and adequate off-trail visitor use areas, and recreational opportunities is necessary to mitigate the effects of off-trail trampling of vegetation.
- **Willard and Marr, 2007:** Visitor exclosures were effective in restoring previously trampled vegetation.

Willard, B., and Marr, J. (1963). **Effects of Visitors on Natural Ecosystems in Rocky Mountain National Park**. Institute of Arctic and Alpine Research, University of Colorado: Boulder, CO.

A multiyear (1959 through 1963) study was conducted to document the extent of visitor-caused natural resource impacts in high-use recreation areas, and evaluate the efficacy of approaches to mitigate impacts. The study documented extensive environmental impacts in the Bear Lake area, including the trail to Nymph and Emerald Lakes. Environmental impacts documented include social trail and shortcut proliferation, trail braiding and widening, meadow and bog plant trampling, and campfire impacts. Exclosures and hardening of trails (paving in this case) were found to be effective in helping to mitigate impacts.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1963
Source Location	RMNP internal document.
Purpose	To assess visitor impacts to vegetation and evaluate the efficacy of approaches to mitigate impacts.
Population	Vegetation and soils in the Bear Lake area, including the trail to Nymph and Emerald Lakes.
Sample Technique	N/A
Data Collection	Type of visitor impact, degree of vegetation cover loss, degree of vegetation recovery.
Data Presented	Descriptive narratives of resource impacts and mitigation approaches.
Results	Environmental impacts documented included social trail and shortcut proliferation, trail braiding and widening, meadow and bog plant trampling, and campfire impacts. Exclosures and hardening of trails (paving in this case) were found to be effective in helping to mitigate impacts.
Recommendations	Exclosures and hardening of trails (paving in this case) were found to be effective in helping to mitigate impacts.

Willard, B., and Marr, J. (1974). **Effects of Human Trampling on Alpine Tundra Ecosystems in RMNP, Colorado.** *Biological Conservation*. 2, pp. 257-265.

A study was conducted to assess visitor impacts to alpine vegetation along Trail Ridge Road in RMNP. Areas of “unchanneled walking,” where visitors dispersed across the tundra, were observed to be resilient to trampling, whereas areas of “concentrated walking” exhibited far greater impacts. Study results suggest that trampling by large volumes of visitors in a single area can destroy an alpine ecosystem in just several weeks. Other observed impacts included flower picking, littering, and driving of vehicles across tundra; however, none were observed to be as frequent or impactful as trampling. Sampling occurred primarily around four major parking areas above tree line along Trail Ridge Road. Vegetation impacts were assessed on a scale from Degree 0 to Degree 5, with the former describing areas with no known vegetation impacts, and the latter describing areas where ecosystems had been nearly or completely destroyed.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1974
Source Location	Biological Conservation.
Purpose	To assess visitor impacts to alpine vegetation.
Population	Vegetation adjacent to parking areas on Trail Ridge Road.
Sample Technique	Sampling of alpine vegetation using Braun-Blanquet method.
Data Collection	Degree of visitor impact, degree of vegetation cover loss.
Data Presented	Degree of overall vegetation impact (scale of Degree 0 to Degree 5) for each sampling area.
Results	Areas of “unchanneled walking,” where visitors dispersed across the tundra, were observed to be resilient to trampling, whereas areas of “concentrated walking” exhibited far greater impacts. Trampling by large volumes of visitors in a single area can destroy an alpine ecosystem in just several weeks. Other observed impacts included flower picking, littering, and driving of vehicles across tundra; however, none were observed to be as frequent or impactful as trampling.
Recommendations	No explicit recommendations to park managers specified.

Reynolds, B. (1982). **Effectiveness of Restoration, Signing, and Interpretation in Reducing Environmental Impact Due to Trampling at Bear Lake**. Colorado State University: Fort Collins, CO.

A study was conducted by Colorado State University to examine and identify the causes trampling impacts to park vegetation from visitor use and evaluate the effectiveness of alternative management approaches for reducing trampling. Primary drivers of off-trail trampling included: lack of park communication about damage caused by off-trail visitor use and reasons for staying on trail; inadequate development of resistant and stable areas that can accommodate visitor use; and proliferation of prominent, but unauthorized, informal trails and visitor use areas. Alternative management actions evaluated included signs, literature, and site developments designed to reduce off-trail use. Effective management actions for reducing off-trail visitor use identified by the research included: clear definition of authorized trails and visitor use areas, development of appropriate off-trail areas sufficient to accommodate visitor use, and improved communications to educate visitors about the effects of off-trail vegetation trampling.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	1982
Source Location	RMNP Library.
Purpose	To examine and identify the causes trampling impacts to park vegetation from visitor use and evaluate the effectiveness of alternative management approaches for reducing trampling.
Population	Visitor use in the Bear Lake area in summer, 1980.
Sample Technique	Direct observation of visitor use during the summer, 1980.
Data Collection	Direct observations of visitor behaviors on trail and off trail in the Bear Lake area following implementation of alternative management actions.
Data Presented	Frequencies and percentages of visitor use on trail and off trail in the Bear Lake area, and visitor utilization of signs, pamphlets, and facility developments.
Results	Primary drivers of off-trail trampling included: lack of park communication about damage caused by off-trail visitor use and reasons for staying on trail; inadequate development of resistant and stable areas that can accommodate visitor use; and proliferation of prominent, but unauthorized, informal trails and visitor use areas.
Recommendations	Effective management actions for reducing off-trail visitor use identified by the research included: clear definition of authorized trails and visitor use areas, development of appropriate off-trail areas sufficient to accommodate visitor use, and improved communications to educate visitors about the effects of off-trail vegetation trampling.

Pettebone, D., Newman, P., Theobald, D. (2006). **Quantifying Impacts Along the Glacier Gorge Trail.** Colorado State University: Fort Collins, CO.

A study was conducted by Colorado State University in the summer and fall of 2005 to estimate visitor use and trail conditions and identify the type, location, and extent of visitor impacts along the Glacier Gorge Trail in RMNP. Most visitors use the Glacier Gorge Trail to access Alberta Falls, with fewer visitors continuing to Mills Lake and Black Lake. Visitor impacts (e.g., informal trails, litter, and vandalism) were primarily clustered at lakes, trail junctions, and Alberta Falls. A significant relationship was identified between visitor volume and trail width. No significant relationship was found between visitor volume and trail depth. Visitor use of the trail in August, September, and October of 2005 was estimated using infrared trail counters. Three hundred sixty-seven sampling locations for trail conditions were selected using a spatially balanced sampling plan based on visitor accessibility to locations within the study area. Data were collected for topographic variables (e.g., trail slope, elevation), physical features (e.g., dominant tree types, canopy cover), trail impacts (e.g., trail width, trail depth, distance to nearest uphill water bar), and visitor impacts (e.g., informal trails, litter).

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2006
Source Location	RMNP internal document.
Purpose	To quantify and identify explanatory variables for trail and resource conditions.
Population	Glacier Gorge Trail and visitor use on the trail in the summer and fall of 2005.
Sample Technique	Spatially balanced sampling plan based on visitor accessibility.
Data Collection	<i>Visitor use:</i> Visitor volumes were collected using 15 infrared trail counters deployed between August and October of 2005. <i>Resource impacts:</i> Physical and geographic trail features.
Data Presented	<i>Visitor use:</i> Visitor volumes along trail segments and at key locations in Glacier Gorge area, percentage of overall visitation recorded at key locations (e.g., Alberta Falls). <i>Resource impacts:</i> Percentage of vegetation loss caused by informal trails; proliferation, width, and depth of informal trails; occurrences of litter and vandalism; vegetation types in areas with high proliferation of informal trails; mean distance to occurrences of informal trails, litter, and vandalism. <i>Trail impacts:</i> Mean, minimum, and maximum trail width and depth (overall sample); mean trail width and depth (specific trail segments); regression factors for explanatory variables for trail width and depth (e.g., mean daily visitation, distance to nearest water bar).
Results	Visitor impacts (e.g., informal trails, litter, and vandalism) were primarily clustered at lakes, trail junctions, and Alberta Falls. A significant relationship was identified between visitor volume and trail width. No significant relationship was found between visitor volume and trail depth.
Recommendations	No explicit recommendations to park managers specified.

Willard, B., Cooper, D., and Forbes, B (2007). **Natural Regeneration of Alpine Tundra Vegetation after Human Trampling: a 42-year Data Set from Rocky Mountain National Park, Colorado, USA.** *Arctic, Antarctic, and Alpine Research*. 39, pp. 177-183.

The results from studies conducted in 1959 and 2001 were compared to evaluate the vegetation restoration that occurred after cessation of over two decades of human trampling in an area of alpine tundra near the Rock Cut parking lot along Trail Ridge Road in RMNP. Total plant canopy cover improved from a range of 20% to 55% in 1959 to 100% in three of the four plots by 1961. An overall decline in cover occurred starting in the mid-1980s through 2001, with total cover ranging from 6% to 61% in 2001. Authors did not identify a specific cause for the decline, but suggested that climactic factors, soil erosion from uphill sources, and possible occurrences of visitor trampling may have contributed. Species richness varied greatly throughout the study, ranging from between 23 to 42 observed taxa. The results of the study had suggested that restoration of alpine vegetation following trampling from recreation was possible with long-term planning and ongoing care.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2007
Source Location	Arctic, Antarctic, and Alpine Research.
Purpose	To evaluate recovery of alpine vegetation after human trampling.
Population	Four vegetation plots near the Rock Cut parking lot along Trail Ridge Road.
Sample Technique	Longitudinal sampling in 1959 and 2001.
Data Collection	Delineation and observation of four sample plots between 1959 and 2001.
Data Presented	Vegetation cover, species richness (number of taxa per plot), species abundance, detrended correspondence analysis of vegetation composition.
Results	Overall vegetation cover increased rapidly between 1959 and 1961 after the closure of the plots to visitors, but declined between the mid-1980s and 2001. Species richness varied greatly through the study.
Recommendations	Restoration of alpine vegetation following trampling from recreation is possible with long-term planning and ongoing care.

Pettebone, D., Newman, P., and Theobald, D. (2009). **A Comparison of Sampling Design for Monitoring Recreational Trail Impacts in Rocky Mountain National Park.** *Environmental Management*. 43, pp. 532-532.

A study was conducted by Colorado State University to compare the efficiency of alternative sampling methods for measuring visitor impacts to park resources in in the Glacier Gorge area of RMNP. The two alternative methods tested were a spatially based sampling design (based on visitor accessibility along the length of trails) and a traditional systematic sampling design (based on 100-meter intervals). Both methods produced comparable results for trail widths. The spatially based method produced more accurate results for trail depths. When sampling points were removed from the dataset for each method, the spatially based sampling design retained a higher accuracy, suggesting that it may be a more efficient method than the traditional systematic sampling design.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2009
Source Location	Environmental Management.
Purpose	To compare efficiency of two sampling designs for monitoring visitor impacts to park resources along trails.
Population	Trails in the Glacier Gorge area of RMNP.
Sample Technique	The two alternative methods tested were a spatially based sampling design (based on visitor accessibility along the length of trails) and a traditional systematic sampling design (based on 100-meter intervals).
Data Collection	Measurements of trail width and depth at regular intervals (systematic sampling design) and based on visitor accessibility (spatially based sampling design).
Data Presented	Descriptive statistics and statistical tests for trail width and depth of overall sample using systematic sampling design and spatially based sampling design.
Results	Both methods produced similar results for trail width, with the spatially based sampling design being the more efficient method. The spatially based sampling design produced more accurate results for trail width, and was the more efficient method.
Recommendations	No explicit recommendations to park managers specified.

Lukens, M. (2012). **Bouldering impacts Rocky Mountain National Park: An Initial Assessment.**

An observational study was conducted in 2012 to assess natural resource impacts from bouldering activity in several areas in RMNP. The study identified numerous instances of natural resource damage associated with bouldering activity, and provided GPS coordinates of popular bouldering problems in RMNP. Common examples of visitor impacts had included the proliferation of social trail networks, flattening of vegetation in landing zones, and modification of landing zones via stacking of wood debris or loose rock. Information on bouldering problems and natural resource impacts was collected via direct observation, with location coordinates collected via GPS units. The authors had recommended that park staff increase educational efforts to inform boulderers of and enhance compliance with park regulations and wilderness ethics, and maintain ranger patrols of popular bouldering areas.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2012
Source Location	RMNP internal document.
Purpose	To locate and document popular bouldering problems and associated natural resource impacts.
Population	Bouldering sites within RMNP.
Sample Technique	Purpose sampling of bouldering sites within RMNP.
Data Collection	Field observations of bouldering problems and associated natural resource impacts.
Data Presented	Data presented included observations of natural resource impacts and GPS coordinates of popular bouldering problems.
Results	Many popular bouldering problems have associated natural resource impacts, with the degree of impacts varying between sites.
Recommendations	The authors recommended that park staff increase educational efforts to inform boulderers of and enhance compliance with park regulations and wilderness ethics, and maintain ranger patrols of popular bouldering areas.

D'Antonio, A., Monz, C., Newman, P., and Taff, D. (2013). **Enhancing the utility of visitor impact assessment in parks and protected areas: A combined social-ecological approach.** *Journal of Environmental Management*. 124c, pp 72-81.

This study combined ecological measures of off-trail visitor use impacts with social science techniques to understand if and how ecological impacts from visitor use affect visitor experience in the Bear Lake Road corridor of RMNP. The proliferation of informal trails only infrequently (13% of the time) exceeded visitor standards for environmental quality. Ecological impacts associated with dispersed recreational use areas exceeded visitor standards approximately half of the time (48%). At visitor-created recreation sites (e.g., vistas, geographic features) ecological impacts almost always (97% of the time) exceeded visitor standards. When visitor standards are exceeded, visitor experiences are often degraded because of unacceptable ecological conditions. Visitor-based standards of resource conditions were derived using visual survey techniques. Survey results had suggested that the minimum acceptable vegetation loss was 53% from the control photograph, and that the minimum acceptable proliferation of informal trails was 5.7% of the total area in the control photograph, which corresponds to approximately two informal trails per viewscape. Survey results were paired with resource condition observations using GIS to determine where unacceptable resource conditions currently existed. GPS trackers were then distributed to visitors to record visitor use patterns within the study area. Researchers recommended that visitor judgments be paired with future ecological resource assessments to direct management efforts to specific locations or resource impact types that are most relevant to visitors.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2016
Source Location	Journal of Environmental Management.
Purpose	Integrate visitor judgments with ecological resource impact assessments.
Population	Summer visitors to Bear Lake Road corridor.
Sample Technique	<i>Visitor surveys:</i> On-site intercepts of visitors upon exit from Bear Lake and Glacier Gorge trails using timed-interval approach over eight days in July and August of 2009. <i>GPS tracking study:</i> Random intercepts of Bear Lake Road corridor visitors arriving to trailheads.
Data Collection	Visitor judgments of resource conditions were assessed using visual survey techniques. Visitor use levels and travel patterns in Bear Lake Road corridor were recorded using GPS trackers. Resource conditions were assessed using radial transects and GPS units.
Data Presented	Ecological characteristics of visitor-created nodes, informal trails and spurs, and dispersed use sites. Visitor-based acceptability standards for percent vegetation cover and informal trail proliferation.

STUDY COMPONENT	DETAILED DESCRIPTION
Results	The proliferation of informal trails only infrequently (13% of the time) exceeded visitor standards for environmental quality. Ecological impacts associated with dispersed recreational use areas exceeded visitor standards approximately half of the time (48%). At visitor-created recreation sites (e.g., vistas, geographic features) ecological impacts almost always (97% of the time) exceeded visitor standards. Survey results had suggested that the minimum acceptable vegetation loss was 53% from the control photograph, and the minimum acceptable proliferation of informal trails was 5.7% of the total area in the control photograph, which corresponds to roughly two informal trails per viewscape.
Recommendations	Researchers recommended that visitor judgments be paired with future ecological resource assessments to direct management efforts to specific locations or resource impact types that are most relevant to visitors.

Svajda, J. (2016). **Trail impact monitoring in Rocky Mountain National Park**. *Solid Earth*. 7, pp. 115-128.

This study assessed impacts of increased visitation on ecological resources along several trails in RMNP. Significant relationships were identified between different visitor use types and levels (low, medium, and high) and certain impacts to trails, particularly trail width. Trails with horseback riding were found to have greater impacts than those used only by hikers. Geographic factors, including grade, elevation, surface type, and trail slope alignment were found to have significant relationships to trail degradation. Trail assessments collected data on both inventory indicators and impact indicators. Inventory indicators comprised possible independent variables, including elevation, mean grade, use level, use type(s), and slope ratio. Impact indicators included possible dependent variables, including mean trail width, mean trail width difference, cross-sectional area (a method of quantifying soil loss), and maximum incision (depth of trail). Transects were located on eight trails at defined intervals in order measure trail conditions. The results of the study provided a baseline assessment of trail conditions in RMNP, and provided a list of indicators and metrics by which trail conditions may be monitored.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2016
Source Location	Solid Earth.
Purpose	Determine trail condition indicators by identifying significant relationships between trail characteristics and impacts.
Population	Eight trails in RMNP.
Sample Technique	Transects spaced at 152-meter intervals.
Data Collection	Recording trail conditions along transects at defined intervals.
Data Presented	<i>Inventory indicators:</i> elevation, trail grade, landform grade, slope alignment angle, use level, use type(s), slope ratio, rugosity. <i>Impact indicators:</i> trail width, trail width difference, cross-sectional area, maximum incision.
Results	Significant relationships were identified between different visitor use types and levels (low, medium, and high) and certain impacts to trails, particularly trail width. Trails with horseback riding were found to have greater impacts than those used only by hikers. Geographic factors, including grade, elevation, surface type, and trail slope alignment were found to have significant relationships to trail degradation.
Recommendations	Monitor indicators of trail condition recommended in the study.

4.4 | TRANSPORTATION STUDIES

Recent social science in RMNP addresses two aspects of transportation as it relates to visitor use: 1) descriptive data on transportation system use by visitors; and 2) analytical information for transportation system planning. However, these sets of information are not exclusive; many of the planning-focused studies also provide descriptive information. In addition to the studies specifically reviewed here, a set of transportation-related studies and documents were produced in the early 2000s (National Park Service, 2006; Parsons, Brinkerhoff, Quade, and Douglas, 2000). These studies, and observations on the use and effects of the park's transportation system stretching back to the 1970s, help to tell the history of transportation-related social science in RMNP; however, this literature review focuses on recent transportation studies that provide more relevant and actionable information.

TRANSPORTATION USE SURVEYS

Transportation use studies describe patterns of high use of most elements of the RMNP transportation system, including both private vehicle-related and shuttle bus-related elements. Visitors generally prefer to use their private vehicles (if possible), but they are willing to ride shuttle buses if traffic and visitor use congestion reduction benefits are realized.

- **Pettebone, et al., 2011:** Visitors to RMNP preferred to travel within the park by private vehicle rather than use the shuttle bus.
- **Villwock-Witte and Collum, 2012:** An intelligent transportation system in RMNP and Estes Park did increase ridership on some shuttle bus routes, but no conclusions could be drawn on its efficacy at reducing traffic congestion.
- **Taff, et al., 2013:** Ease of use, freedom of movement, and reduction of stress, in comparison with private vehicle use, were characteristics of shuttle bus systems that resulted in higher intentions to use the shuttle bus system rather than drive a personal vehicle for in-park travel.

TRANSPORTATION PLANNING STUDIES

Most recent and substantive transportation planning research has focused on the Bear Lake Road corridor. The overarching conclusion of this body of research is that the transportation system in the Bear Lake Road corridor has a capacity to deliver visitors to recreation sites in the area that exceeds the environmental resource and visitor experience-based capacities of these sites. Consequently, transportation planning and management in RMNP should shift focus from reducing traffic and parking congestion to monitoring and maintaining high-quality visitor use conditions on trails and at recreation sites served by the transportation system.

- **Park, et al., 2009:** Visitors in the Bear Lake Road corridor must have hiked a minimum of 200 meters from Bear Lake, or a minimum of 1,300 meters from other locations, to experience a RMNP soundscape outside the noise impacts of transportation on the Bear Lake Road.
- **Theobald, Norman, and Newman, 2010:** Half of RMNP was accessible by travel of four hours or less on the park's road and trail network.
- **Lawson, et al., 2011:** Shifting visitor use to the shuttle system from private vehicles would have a mixed overall effect on parking congestion and would increase—potentially doubling—the number of visitors using already high-use trail and recreation sites.

- **Pettebone, et al., 2011:** Visitors were willing to shift transportation mode from private vehicle to shuttle bus if high traffic volumes were present in the park and if the shuttle bus offered opportunities to avoid crowds.
- **Lawson, Newman, and Monz, 2016:** The shuttle bus system in the Bear Lake Road corridor, in combination with private vehicle access, enabled more visitors to access recreation site in the area than could be accommodated on trails and at recreation sites without exceeding visitor tolerances for visitor use density or crowding.

Park, L., Lawson, S., Kaliski, K., Newman, P, and Gibson, A. (2009). **Modeling and Mapping Hikers' Exposure to Transportation Noise in Rocky Mountain National Park.** *Park Science*. 26, pp. 59-64.

A study was conducted in the summer of 2008 to assess visitors' exposure to transportation noise in the Bear Lake RMNP. To experience sound levels equivalent to daytime ambient natural sounds, visitors must hike for at least 40 minutes (or 1,300 meters) on the Bierstadt Lake, Glacier Gorge, or Storm Pass Trails, and at least 6.2 minutes (or 206 meters) on the Bear Lake Trail. Overall, hikers in the study area experienced sound levels equivalent to daytime natural sounds for approximately 64% of their hiking time, with 34% of hikers experiencing at least 15 minutes of sound levels equivalent to daytime natural sounds. Traffic volumes were recorded using automated traffic recorders (ATRs), and were incorporated, along with a digital terrain model, into a soundscape modeling program to determine the geographic extent and A-weighted decibel (dB(A)) level of traffic sounds. Visitor hiking routes and times were collected using GPS recorders affixed to visitors' backpacks, and daily trailhead visitation was measured using mechanical traffic counters. Spatial statistics tools in GIS software were then used to generate measures for visitors' exposure to transportation noise. Study authors recommended that empirically based, soundscape-related indicators of quality be developed as a component of the modeling tool developed in the study.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2009
Source Location	Park Science.
Purpose	To assess visitors' exposure to transportation noise in the Bear Lake Road corridor of RMNP.
Population	Visitors to trailheads in Bear Lake Road corridor in the summer of 2008.
Sample Technique	<i>GPS survey:</i> GPS recorders distributed to randomly selected groups entering Bear Lake, Bierstadt Lake, Glacier Gorge, and Storm Pass trailheads.
Data Collection	<i>Traffic volumes:</i> Collected using ATRs. <i>Hiking routes and times:</i> Collected using GPS recorders affixed to visitors' backpacks. <i>Trailhead visitation:</i> Collected using mechanical traffic counters.
Data Presented	Study area visitation by trailhead, hiking distance from each trailhead required to closest natural quiet, average hiking time from trailhead required to reach closest natural quiet, percentage of hiking time visitors experience natural quiet (by trailhead), percentage of visitors who experience at least 15 minutes of natural quiet (by trailhead). Results were presented for four noise thresholds associated with varying levels of ambient natural sound.

STUDY COMPONENT	DETAILED DESCRIPTION
Results	To experience sound levels equivalent to daytime ambient natural sounds, visitors must hike for at least 40 minutes (or 1,300 meters) on the Bierstadt Lake, Glacier Gorge, or Storm Pass Trails, and at least 6.2 minutes (or 206 meters) on the Bear Lake Trail. Overall, hikers in the study area experienced sound levels equivalent to daytime natural sounds for approximately 64% of their hiking time, with 34% of hikers experiencing at least 15 minutes of sound levels equivalent to daytime natural sounds.
Recommendations	The authors recommended that empirically based standards of quality for indicators of natural soundscapes be developed.

Newman, P., Lawson, S., and Monz, C. (2010). **Integrated Approach to Transportation and Visitor Use Management at Rocky Mountain National Park**. RSG Inc., Colorado State University, and Utah State University.

A study was conducted to inform transportation planning at RMNP to optimize the operational efficiency of the system while protecting park resources and the quality of visitors' experiences. The study addressed visitor-based standards for crowding, transportation, and experiential quality; visitor perceptions of recreation impacts; ecological impacts associated with recreation; transportation system use and performance; visitor use levels and patterns; and noise and park soundscape conditions resulting from visitor use and transportation.

Comprehensive detail on the methods and results of this study are presented in this technical memorandum. The research is also reported in a series of published journal articles, including the following:

D'Antonio, A., Monz, C., Lawson, S., Newman, P., Pettebone, D., and Courtemanch, A. (2010). **GPS-Based Measurements of Backcountry Visitors in Park and Protected Areas: Examples of Methods and Applications from Three Cases Studies**. *Journal of Park and Recreation Administration*. 28, pp. 42-60.

Lawson, S., Chamberlain, R., Choi, J., Swanson, B., Kiser, B., Newman, P., Monz, C., Pettebone, D., and Gamble, L. (2011). **Modeling the Effects of Shuttle Service on Transportation System Performance and Quality of Visitor Experience in Rocky Mountain National Park**. *Transportation Research Record*. 2244, pp. 97-106.

Lawson, S., Newman, P., & Monz, C. (2016). **A systems-based approach to address unintended consequences of demand-driven transportation planning in national parks and public lands**. *International Journal of Sustainable Transportation*.

Park, L., Lawson, S., Kaliski, K., Newman, P., and Gibson, A. (2009). **Modeling and Mapping Hikers' Exposure to Transportation Noise in Rocky Mountain National Park**. *Park Science*. 26, pp. 59-64.

Pettebone, D., Newman, P., Lawson, S., Hunt, L., Monz, C., and Zwiefka, J. (2011). **Estimating visitors' travel mode choices along the Bear Lake Road Corridor in Rocky Mountain National Park**. *Journal of Transport Geography*. 19, pp. 1210-1221.

Taff, D., Newman, P., Pettebone, D., White, D., Lawson, S., Monz, C., and Vargias, W. (2013). **Dimensions of alternative transportation experience in Yosemite and Rocky Mountain National Parks**. *Journal of Transport Geography*. 30, pp. 37-46.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2010
Source Location	RMNP internal document.
Purpose	Inform transportation planning in RMNP to optimize the operational efficiency of the system while protecting park resources and the quality of visitors' experiences.
Population	Visitors to Bear Lake Road corridor in the summer of 2008.
Sample Technique	On-site intercepts at multiple locations within the Bear Lake Road corridor.
Data Collection	Visitor surveys and GPS tracking of visitor travel patterns.
Data Presented	Data presented on visitor-based standards for crowding, transportation, and experiential quality; visitor perceptions of recreation impacts; ecological impacts associated with recreation; transportation system use and performance; visitor use levels and patterns; and noise and park soundscape conditions resulting from visitor use and transportation.
Results	Results for visitor-based standards for crowding, transportation, and experiential quality; visitor perceptions of recreation impacts; ecological impacts associated with recreation; transportation system use and performance; visitor use levels and patterns; and noise and park soundscape conditions resulting from visitor use and transportation.
Recommendations	Recommendations are outlined in sections for individual papers included in this report (cited above).

Theobald, D., Norman, J., and Newman, P. (2010). **Estimating Visitor Use of Protected Areas by Modeling Accessibility: A Case Study in Rocky Mountain National Park.** *Journal of Conservation Planning*. 6, pp. 1-20.

A study was conducted to estimate spatial patterns of visitor use of RMNP by modeling “accessibility,” defined as the one-way travel time for the average visitor to any location within the park. Results suggested that 7% of the park is accessible with a one-hour travel time from park entrances, 50% of the park is accessible within a four-hour travel time, and 80% of the park is accessible within an eight-hour travel time. The most accessible ecosystem types are savannah and lower montane. Frontcountry accessibility is more strongly related to the presence of roads than the presence of trails, while backcountry accessibility is more strongly related to the presence of trails. Accessibility modeling was performed using volumes of visitors entering the park, travel times along park roads as a function of assumed vehicle speeds, travel times along park trails a function of slope, and travel times through off-trail areas as a function of slope and “permeability” of vegetation cover types (i.e., the degree to which vegetation cover inhibits travel).

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2010
Source Location	Journal of Conservation Planning.
Purpose	To estimate spatial patterns of visitor use by modeling accessibility.
Population	RMNP visitors.
Sample Technique	N/A
Data Collection	The study was completed using previously developed spatial datasets.
Data Presented	Accessibility scores (average one-way travel time) for geographic areas, Research Natural Areas, and ecological systems in RMNP. Maps depicting accessibility in RMNP.
Results	Seven percent of the park is accessible with a one-hour travel time from park entrances, 50% is accessible within a four-hour travel time, and 80% is accessible within an eight-hour travel time. The most accessible ecosystem types are savannah and lower montane. Frontcountry accessibility is more strongly related to the presence of roads than the presence of trails, while backcountry accessibility is more strongly related to the presence of trails.
Recommendations	No explicit recommendations to park managers specified.

Lawson, S., Chamberlain, R., Choi, J., Swanson, B., Kiser, B., Newman, P., Monz, C., Pettebone, D., and Gamble, L. (2011). **Modeling the Effects of Shuttle Service on Transportation System Performance and Quality of Visitor Experience in Rocky Mountain National Park.** *Transportation Research Record*. 2244, pp. 97-106.

Integrated transportation and visitor use modeling was performed to evaluate and quantify transportation system performance and visitor crowding at key attractions in the Bear Lake Road corridor of RMNP following expansion of shuttle service operations. Results indicated that shifting visitors from personal vehicles onto the park's shuttle system improved certain transportation conditions in the park (e.g., vehicle miles traveled), but would have a mixed overall effect on parking conditions. These mixed results included decreased parking demand at trailhead parking lots in the Bear Lake Road corridor but increased parking demand at the Bear Lake park-and-ride lot. This mode shift would not reduce visitor crowding at key attractions in the Bear Lake Road corridor. The park's shuttle service has had the effect of enabling levels of visitation to trailheads in the Bear Lake Road corridor that are approximately double what they would be with auto access only. Visitor use would need to be reduced by approximately 4% at Alberta Falls and 38% at Emerald Lake to achieve management objectives. Modeling of transportation and visitor use included the development of a microsimulation traffic model of Bear Lake Road corridor using vehicle traffic from the summer of 2008. Traffic model results were integrated with a pedestrian simulation model of visitor use for the Glacier Gorge Trail to Alberta Falls and the Dream Lake Trail to Emerald Lake. The pedestrian simulation model was developed using visitor survey data from the summer of 2008. The authors included several potential management strategies to address crowding in the Bear Lake Road corridor that results from shuttle service, including using shuttle service to direct visitors to less crowded areas of the park.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2011
Source Location	Transportation Research Record.
Purpose	Assess impacts to transportation system performance and visitor crowding in Bear Lake Road corridor following expansion of shuttle service.
Population	Visitors to Bear Lake Road corridor in the summer of 2008.
Sample Technique	On-site intercepts at multiple locations within the Bear Lake Road corridor.
Data Collection	<i>Transportation data:</i> Vehicle and shuttle service origin-destination data. <i>Visitor survey data:</i> Hiking times on trails, lingering times at attractions, transportation mode of arrival and departure.
Data Presented	<i>Transportation data:</i> Values and percent change from baseline for three scenarios (baseline, 10% capture, and 25% capture) for vehicle miles traveled (VMT), vehicle hours traveled, greenhouse gas emissions, fuel consumption, trailhead parking lot utilization, and park-and-ride parking lot utilization. <i>Transit data:</i> Values and percent change from baseline for three scenarios (baseline, 10% capture, and 25% capture) for operating hours, operating cost, passenger

STUDY COMPONENT	DETAILED DESCRIPTION
	volumes, transit miles per day, passengers per transit mile traveled, and cost per passenger. <i>Visitor use data:</i> Values for three scenarios (baseline, 10% capture, and 25% capture) for hourly arrivals per trailhead by mode of arrival, percent of time crowding exceeds visitor-based thresholds at key attractions, and required reductions in shuttle bus ridership needed to achieve management standards for crowding.
Results	Results indicate that shifting visitors from personal vehicles onto the park's shuttle system improves certain transportation conditions in the park (e.g., VMT), but would have a mixed overall effect on parking conditions. These mixed results include decreased parking demand at trailhead parking lots in the Bear Lake Road corridor but increased parking demand at the Bear Lake park-and-ride lot. This mode shift would not reduce visitor crowding at key attractions in the Bear Lake Road corridor. The park's shuttle service has had the effect of enabling levels of visitation to trailheads in the Bear Lake Road corridor that are approximately double what they would be with auto access only.
Recommendations	The authors identify two possible management strategies to reduce visitor crowding related to shuttle service operations: 1) Use travel demand management to direct visitors to less crowded areas of the park and encourage visitation to periods of lower visitor use. 2) Establish new shuttle routes to divert visitors from crowded areas of the Bear Lake Road corridor.

Pettebone, D., Newman, P., Lawson, S., Hunt, L., Monz, C., and Zwiefka, J. (2011). **Estimating visitors' travel mode choices along the Bear Lake Road Corridor in Rocky Mountain National Park.** *Journal of Transport Geography*. 19, pp. 1210-1221.

A stated-choice survey was administered to visitors to RMNP in the summer of 2008 to assess visitor acceptance of alternative transportation-related management actions. The study suggests that visitors generally prefer to use their private vehicles instead of the park's shuttle system, but would be willing to ride the shuttle if vehicle traffic along the Bear Lake Road corridor and crowding along the trail at Bear Lake could be avoided. Visitors, particularly those under the age of 40, are most inclined to choose a transportation mode that enhance their chances of encountering fewer people on the Bear Lake Trail system. Visitors are also inclined to choose to use shuttle service from Estes Park if they perceive high volumes of vehicle traffic will be present when driving to and through RMNP. Approximately 514 visitor groups (59% response rate) completed on-site surveys using laptop computers as they departed the Bear Lake trailhead on 16 randomly selected days in 2008 between July 28 and August 19. Visitors were asked to evaluate transportation-related management scenarios by selecting their preferred scenario for seven randomly selected choice sets (out of 28 total). The authors had suggested that intelligent transportation systems (ITS) could be used to provide visitors with real-time information about vehicle traffic and parking conditions, bus schedules, and visitor use levels along trails to inform visitors' transportation choices.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2011
Source Location	Journal of Transport Geography.
Purpose	To assess visitor acceptance of transportation-related management actions.
Population	Visitors departing Bear Lake trailhead in the summer of 2008.
Sample Technique	On-site intercept of visitors departing sample location.
Data Collection	A laptop-based survey was used to collect information.
Data Presented	Coefficients for aggregated stated-choice variables for overall survey respondents and broken down by age group (under the age of 40, between the ages of 40–59, and over the age of 60). Mean values for respondents' evaluation of attributes.
Results	Visitors generally prefer to use private vehicles instead of the park's shuttle system. Visitors are more likely to switch to riding the shuttle from private vehicles if opportunities for greater solitude are perceived, particularly if they are under the age of 40. Visitors are more likely to use shuttle service from Estes Park if they perceive high vehicle traffic volumes in the park.
Recommendations	The use of ITS could inform and influence visitor transportation choices with real-time information on vehicle traffic and parking conditions, bus schedules, and visitor use levels along trails.

Villwock-Witte, N., and Collum, K. (2012). **Evaluation of an Intelligent Transportation System for Rocky Mountain National Park and Estes Park**. Paul S. Sarbanes Transit in Parks Technical Assistance Center: Bozeman, MT.

A multimethods (visitor surveys and stakeholder interviews) approach was used to evaluate the effectiveness of a pilot ITS for reducing vehicle congestion in RMNP and Estes Park. Results of the pilot suggested that the ITS was partially successful at meeting project goals. Ridership of the Hiker Shuttle linking Estes Park with RMNP increased following implementation of ITS and stakeholder understanding of ITS was developed. Although the primary stated goal of this research was to reduce traffic congestion in RMNP and Estes Park, little data to quantify or describe traffic congestion during the study period were provided and results with respect to reduction of traffic congestion were largely inconclusive. Study results were based on a sample of 63 responses (82% response rate) to the on-bus survey, 490 responses (61% response rate) to the visitor intercept survey, and 163 responses (71% response rate) to the mail-back survey.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2012
Source Location	Paul S. Sarbanes Transit in Parks Technical Assistance Center.
Purpose	Evaluate the efficacy of the RMNP/Estes Park ITS system for vehicle congestion reduction.
Population	Summer visitors to RMNP.
Sample Technique	<i>On-bus survey:</i> Surveys distributed to all rider groups. <i>Visitor intercept survey:</i> Surveys distributed to every 6th visitor. <i>Mail-back survey:</i> Voluntary participation of on-bus and visitor intercept survey participants.
Data Collection	On-site and mail-back survey questionnaires, stakeholder interviews.
Data Presented	Shuttle bus ridership and fleet usage, vehicle counts, survey responses.
Results	Ridership of the Hiker Shuttle linking Estes Park with RMNP increased following implementation of ITS. Little data to quantify or describe traffic congestion during the study period are provided and results with respect to reduction of traffic congestion were largely inconclusive.
Recommendations	Continue operation of ITS systems in RMNP and Estes Park.

Taff, D., Newman, P., Pettebone, D., White, D., Lawson, S., Monz, C., and Vargias, W. (2013). **Dimensions of alternative transportation experience in Yosemite and Rocky Mountain National Parks.** *Journal of Transport Geography*. 30, pp. 37-46.

Survey research was performed to examine differences in visitor attitudes toward alternative transportation systems (ATS) in Yosemite National Park and RMNP. An exploratory analysis of attitudes toward ATS suggest that ease, freedom, and stress are important factors in ATS design and operation for the quality of visitor experiences. The “ease” factor consisted of variables representing safety, wayfinding, and pleasant interactions with other visitors. The “freedom” factor consisted of variables representing access to scenic vistas, diversity among park locations, and having a sense of freedom. The “stress” factor consisted of variables representing conflict, crowding, congestion, and parking availability. The results of the study indicated that visitors to both Yosemite and Rocky Mountain National Parks have similar attitudes regarding ease, freedom, and stress associated with ATS use. Visitors indicated that each factor was an important component of the visitor experience when using ATS service in national parks. On-site surveys were administered in RMNP in the summer of 2008 at four trailheads: Glacier Gorge, Emerald Lake, Dream Lake, and Alberta Falls. A sample of 811 visitors was obtained in RMNP (73% response rate), with visitors being asked to evaluate attitudes on a 4-point scale toward 21 variables.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2013
Source Location	Journal of Transport Geography.
Purpose	Identify factors that contribute to attitudes about and experiences of using ATS in RMNP.
Population	Visitors to Glacier Gorge, Emerald Lake, Dream Lake, and Alberta Falls trailheads in the summer of 2008.
Sample Technique	On-site intercept of visitors at sample locations.
Data Collection	On-site surveys were conducted of visitors to evaluate attitudes toward ATS based on 21 variables.
Data Presented	Data presented included attitudinal variables with respect to ATS for Yosemite National Park and RMNP.
Results	The results of the study indicated that ease, freedom, and stress are important factors in visitors' attitudes about and experience of ATS in Yosemite and RMNP.
Recommendations	Researchers concluded that ease, freedom, and stress were important factors when developing indicators and standards of quality for ATS service in national parks. These factors can also inform the how park manages ATS services to address key visitor concerns. These factors can also be integrated into the decision-making process for future ATS infrastructure projects.

Bricker, K. (2014). **Develop Solutions to Reduce Crowding and Resource Impacts in the Bear Lake Road Corridor: Rocky Mountain National Park (ROMO PMIS #193164)–Visitor Use Survey for Alternative Sites to the Bear Lake Road Corridor: Data and Analysis**. National Park Service, Rocky Mountain National Park.

The purpose of this project was to collect information to provide baseline data on visitor use patterns, preferences for social and natural resource conditions, and potential management actions to inform transportation planning to reduce crowding and congestion in the Bear Lake Road corridor of RMNP. Data were collected using an on-site survey administered at five locations within the park: Lumpy Ridge, Alluvial Fan, Deer Ridge, Hidden Valley, and Sprague Lake. A total of 992 visitor groups were contacted to participate in the survey, 96.7% of whom agreed to participate. Survey results are reported by location for visitor demographics, trip characteristics, park information use, perceptions of crowding, and visitor evaluations of visitor use levels expressed in terms of people at one time within recreation areas and encounters with other hikers along trails. Results of the analysis suggested that visitor use levels at most sites were acceptable to most visitors and few visitors experienced crowding or visitor use levels that detracted from their experiences. In addition to visitor surveys, this research also sought to correlate data from electronic trail counters with observation of visitor use levels at nearby recreation sites. This effort was unsuccessful because of methodological limitations.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2014
Source Location	RMNP internal document.
Purpose	The purpose of this project was to collect information to provide baseline data on visitor use patterns, preferences for social and natural resource conditions, and potential management actions to inform transportation planning to reduce crowding and congestion in the Bear Lake Road corridor of RMNP.
Population	Visitor to RMNP during the summer of 2013.
Sample Technique	On-site intercept of every N th exiting visitor on stratified weekdays and weekend days between 8:00 a.m. and 6:00 p.m.
Data Collection	On-site, self-administered survey questionnaire.
Data Presented	Survey results were reported by location for visitor demographics, trip characteristics, park information use, perceptions of crowding, and visitor evaluations of visitor use levels expressed in terms of people at one time within recreation areas and encounters with other hikers along trails.

STUDY COMPONENT	DETAILED DESCRIPTION
Results	Results of the analysis suggested that visitor use levels at most sites were acceptable to most visitors and few visitors experienced crowding or visitor use levels that detracted from their experiences. In addition to visitor surveys, this research also sought to correlate data from electronic trail counters with observation of visitor use levels at nearby recreation sites. This effort was unsuccessful because of methodological limitations.
Recommendations	Indicators of visitor use level should be directly monitored on a regular schedule.

HDR, Inc. (2015). **Develop Solutions to Reduce Crowding and Resource Impacts in the Bear Lake Road Corridor: Rocky Mountain National Park (ROMO PMIS #193164)**. National Park Service, Rocky Mountain National Park.

The purpose of this project was twofold: 1) to understand the capacity implications of diverting visitors to other locations outside the Bear Lake Road corridor during peak periods to address congestion and resource impacts; and 2) to evaluate the operational, financial, and resource management-related feasibility of refining the existing shuttle service and messaging to reduce crowding and resource impacts in RMNP. Several strategies to accomplish these objectives were considered, including ITS, travel demand management, active strategies to shift visitation in space and time, and modification of the existing shuttle bus system. This research used a visitation scenario management tool to evaluate the planning level costs and project implementation considerations of alternative transportation strategies. Evaluations were expressed in terms of timeframe, magnitude of effort, and class of National Environmental Policy Act (NEPA) action required.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2015
Source Location	RMNP internal document.
Purpose	1) Understand the capacity implications of diverting visitors to other locations outside the Bear Lake Road corridor during peak periods to address congestion and resource impacts. 2) Evaluate the operational, financial, and resource management-related feasibility of refining the existing shuttle service and messaging to reduce crowding and resource impacts in ROMO.
Population	Visitors to RMNP during peak use times.
Sample Technique	N/A
Data Collection	<i>Transportation system data</i>: collected by direct observation and electronic counter. <i>Visitor use and experience information</i>: presented in (2014). Develop Solutions to Reduce Crowding and Resource Impacts in the Bear Lake Road corridor: Rocky Mountain National Park (ROMO PMIS #193164)–Visitor Use Survey for Alternative Sites to the Bear Lake Road corridor: Data and Analysis. National Park Service, Rocky Mountain National Park.
Data Presented	Data presented included summaries of existing transportation system conditions; site-specific information, including features and characteristics, transportation system elements, visitor use and experience information, and natural resource information; evaluation of alternative strategies; cost estimates for alternative strategies; and implementation considerations for alternative strategies.
Results	Results, expressed in terms of timeframe, magnitude of effort, and class of NEPA action required, are presented for alternative transportation management strategies.
Recommendations	No explicit recommendations to park managers specified.

Lawson, S., Newman, P., & Monz, C. (2016). **A systems-based approach to address unintended consequences of demand-driven transportation planning in national parks and public lands.**

International Journal of Sustainable Transportation.

A study was conducted to quantify the unintended impacts of park-and-ride lot expansion and the purchase of additional shuttle buses for the for the ATS in the Bear Lake Road corridor in RMNP. Study results suggest that to conform to daily crowding-related capacities, visitor use of the Glacier Gorge Trail to Alberta Lake would need to be reduced by 4%. This reduction would displace 7% of shuttle bus riders heading to this trail. Visitor use of the Dream Lake Trail to Emerald Lake would need to be reduced by 38%. This reduction would displace 100% of shuttle bus riders heading to this trail. First, the study identified visitor-based “acceptability” standards of quality for crowding on selected trails and at popular attractions in the Bear Lake Road corridor. Next, a traffic microsimulation model was developed to model personal vehicle and ATS vehicle traffic in the Bear Lake corridor. Then a corresponding visitor use model to estimate visitor crowding in relation to ATS operations and visitor use levels, and provide estimates for crowding-related capacities, was developed. Last, spatial models of resource impacts were integrated with visitor use models to provide a means for estimating the visitor-related resource impacts associated with ATS operations and visitor use levels. Study findings suggested that demand-driven growth of the ATS enabled levels of visitation that caused unacceptable levels of crowding at attractions in the Bear Lake Road corridor, and that an integrated approach to transportation planning and visitor use management could be used to anticipate these types of unintended impacts.

STUDY COMPONENT	DETAILED DESCRIPTION
Year	2016
Source Location	International Journal of Sustainable Transportation.
Purpose	Identify and address unintended consequences of demand-driven transportation planning in ROMO.
Population	Summer visitors to RMNP.
Sample Technique	On-site visitor intercepts.
Data Collection	<i>Visitor-based standards of quality:</i> Visitors provided visual evaluations of photosimulations depicting people at one time and people per view at attractions and on trails in Bear Lake Road corridor. <i>Visitor travel patterns:</i> Observations of visitor arrivals and departures, hiking, and lingering times on trails and at attractions in Bear Lake Road corridor.

STUDY COMPONENT	DETAILED DESCRIPTION
Data Presented	Visitor-based standards of quality for PPV on trails and PAOT at visitor destinations in Bear Lake Road corridor. Number of visitors at Bear Lake Trailhead by time of day and transportation mode of access. Daily crowding-related capacity estimates for Glacier Gorge Trail to Alberta Falls and Dream Lake Trail to Emerald Lake, and percent reduction from current use levels. Number and percentage of shuttle bus riders per day on busy summer weekend days needed to be displaced to conform to crowding-related capacities.
Results	To conform to daily crowding-related visitor use capacities: 1) Visitor use of the Glacier Gorge Trail to Alberta Lake would need to be reduced by 4%, and 7% of shuttle bus riders heading to this trail would need to be displaced. 2) Visitor use of the Dream Lake Trail to Emerald Lake would need to be reduced by 38%, and 100% of shuttle bus riders heading to this trail would need to be displaced.
Recommendations	Transportation improvements should be designed and implemented in a manner that helps manage visitor use according to thresholds for visitor crowding and resource impacts. Modeling approaches can help to address unintended consequences of demand-driven transportation.

4.5 | ADDITIONAL REFERENCES

The following is a list of additional references that are not reviewed in the preceding annotated bibliography but help to describe the history of social science and visitor use management research in RMNP. Sources are included in this list, rather than reviewed above, for one of several reasons:

- Information presented in the references below is duplicative of information presented in annotated bibliographic entries (e.g., D’Antonio, 2015 below and D’Antonio, et al., 2013 above).
- The specific methods and findings of the references below are no longer directly relevant to management, but RMNP should be aware of the work that was done and its place in the park’s planning and management history (e.g., Ormrod. 1978).
- The referenced source provides contextual or supporting information, but does not specifically address day use or visitor management in RMNP (e.g., Marion and Reid, 2007).
- The referenced source is relevant to day use management at RMNP, but was not able to be located for inclusion in the annotated bibliography (e.g., Huddleston, 1981).

Aukerman, R. (1985). **The Effectiveness of Signing, Pamphlets, and Restoration in Reducing Off-Trail Trampling.** *Tourism Recreation Research*. 10.

Brooks, J., and Trite, J. (2003). **A Multi-Method Assessment of Recreation Impacts at Rocky Mountain National Park, Phase I.** Colorado State University: Fort Collins, CO.

Cordova, K., (2000). **Park Visitor’s Beliefs, Attitudes, and Preferences for Elk Management at Rocky Mountain National Park, Colorado.** Colorado State University: Fort Collins, CO.

D’Antonio, A. (2015). **Modeling the Ecological Consequences of Visitor Behavior in Off-Trail Areas of Dispersed Use.** Utah State University: Logan, UT.

D’Antonio, A., & Monz, C. (2016). **An assessment of informal trails and visitor-created sites in Rocky Mountain National Park, Colorado: Bouldering impacts in the Chaos Canyon and Emerald Lake Areas.** Utah State University, Logan, UT.

Dotzenko, A., Romine, D., and Papamichos, N. (1967). **Effect of recreational use on soil and moisture conditions in Rocky Mountain National Park.** *Journal of Soil and Water Conservation*. pp. 196-197.

Eisenberger, R., and Loomis, R. (2003). **Visitor Experience and Media Effectiveness: Rocky Mountain and Yellowstone National Parks.** Colorado State University: Fort Collins, CO.

Gossling, S., Peeters, P., Ceron, J., Dubois, G., Patterson, T., and Richardson, R. (2005). **The Eco-Efficiency of Tourism.** *Ecological Economics*. 54, pp. 417-434.

Huddleston, M. (1981). **Day Use Impacts Study of the Nymph to Emerald Lake Trail Corridor.** Colorado State University: Fort Collins, CO.

Kidd, A., Graham, R., & Monz, C. (2016). **Visitor use on Longs Peak: A preliminary assessment in Rocky Mountain National Park, Colorado.** Utah State University: Logan, UT.

Manley, J. (1991). **Boundary Setting to Minimize Visitor Impacts in Rocky Mountain National Park, Colorado.** Colorado State University: Fort Collins, CO.

Marion, J. and Reid, S. (2007). **Minimizing Visitor Impacts to Protected Areas: The Efficacy of Low Impact Education Programs.** *Journal of Sustainable Tourism*. 15, pp. 5-27.

- Ormrod, R. (1978). **An Assessment of Selected Elements of the Visitor Information System for Rocky Mountain National Park.** University of Northern Colorado: Greeley, CO.
- National Park Service. (2006). **Draft Environmental Assessment for the Rocky Mountain National Park Transportation Management Plan–Rocky Mountain National Park.** US Department of the Interior.
- Parsons, Brinkerhoff, Quade, & Douglas. (2000). **Rocky Mountain National Park Transportation Plan.**
- Roberts, N., and Rodriguez, D. (2008). **Use of multiple methods: An examination of constraints effecting ethnic minority visitor use of national parks and management implications.** *Ethnic Studies Review*. 31:2, pp. 35-70.
- Taff, D. (2012). **Messaging and National Park Visitor Attitudes.** Colorado State University: Fort Collins, CO.
- Taff, D., and Schwartz, F. (2016). **Boulderer's Perceptions of Leave No Trace in Rocky Mountain National Park.** Pennsylvania State University: State College, PA.
- Trahan, R. (1978). **Social Science Research, Rocky Mountain National Park.** University of Northern Colorado: Greeley, CO.
- Villwock-Witte, N., Eidswick, J., and Miskimins, L. (2015). **Rocky Mountain National Park: Three years of ITS.** *Transportation Research Board 94th Annual Meeting Compendium of Papers.*
- Wagar, J., and Knox, V. (1941). **Visitor Concepts of National Park Policies and Conservation Needs: A Report Upon Observations and Studies Made During the Summer of 1939 in Collaboration with the US National Park Service in Rocky Mountain National Park.** Colorado State College: Fort Collins, CO

5.0 CHARACTERISTICS OF AND TRENDS IN VISITOR USE IN ROCKY MOUNTAIN NATIONAL PARK

5.1 | INTRODUCTION

The following section presents compiled data on visitor use in RMNP. This presentation includes visitation statistics, vehicle traffic volumes, shuttle bus ridership data, trail use data, area-specific summaries for the Bear Lake and Longs Peak areas, and compiled data on visitor and visit characteristics.

NOTES ON IDENTIFYING TRENDS IN HISTORICAL VISITOR USE DATA

Trends in visitor use over time were analyzed and compared for variables with data available and appropriate for comparison. In some cases, trends were drawn using similar—but not identical—data. These comparisons have been presented to illustrate general trends and document available data. Care should be taken when drawing conclusions from such comparisons. Notes are included with each item; these notes describe any differences in data source or variable formulation that should be considered. The most common sources of these differences are the following:

- Differences in study design or methodology (e.g., survey sampling plan, counting procedures).
- Differences in geographic location or time of year (e.g., counter location, sampling period).
- Differences in spatial or temporal scale, or range of visitor use (e.g., park-wide vs. backcountry only, day use vs. overnight users).

NOTES ON HISTORICAL EVENTS AFFECTING PATTERNS AND VOLUMES OF VISITOR USE

Visitor use in RMNP is influenced by outside—sometimes unexpected—events. Evidence of these events is occasionally apparent in visitor use data, and consequently affects the trends presented here. While there are many outside influences that affect volumes and patterns of visitor use, the following recent events coincide with noticeable anomalies in RMNP visitor use data:

- **2003, 2004:** Construction along Bear Lake Road in the summer of 2003 and 2004, during which time the road was closed to private vehicles beyond Sprague Lake.
- **2012, 2013:** Reconstruction of Bear Lake Road in the summers of 2012 and 2013, which necessitated the restriction on private vehicle travel along the road, and led to frequent traffic delays.
- **2013:** Destructive flooding along the Colorado Front Range in mid-September of 2013, which caused major damage to communities, bridges, and access roads east of RMNP.
- **2013:** Shutdown of the federal government in early October 2013, which resulted in the closure of RMNP to the public for 11 days.

5.2 | VISITOR USE DATA

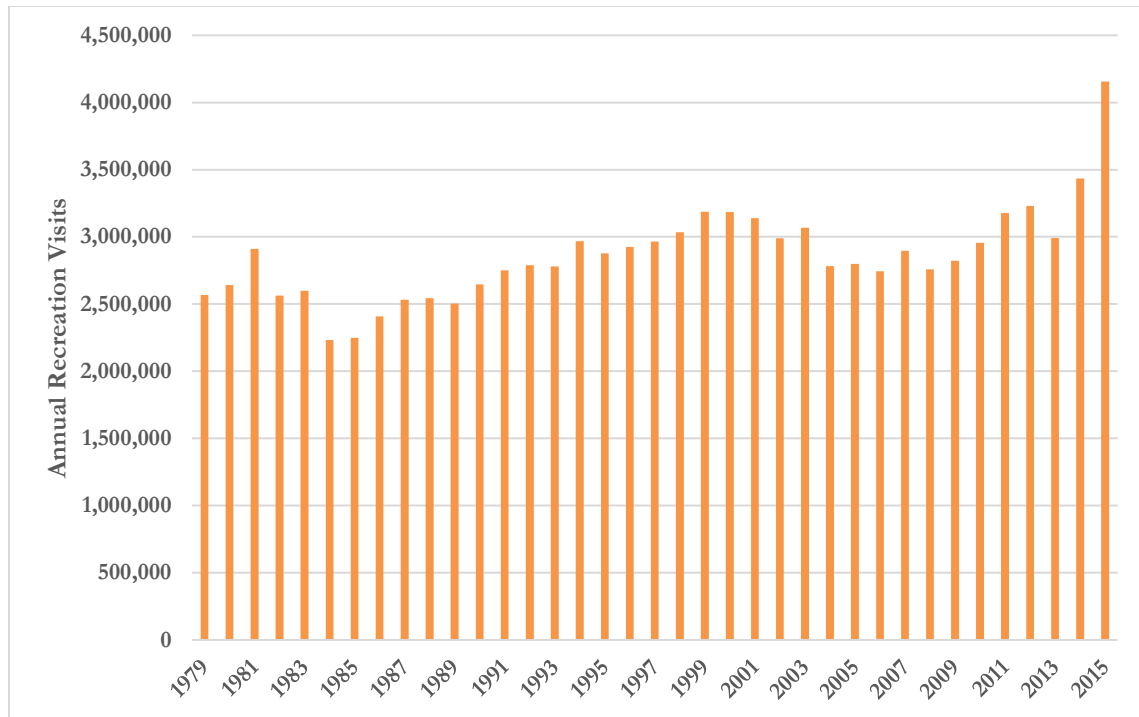
The following subsection presents analyses of park-wide trends in visitation, transportation use, and trail use. The visitation analysis subsection reports trends in recreation visits and overnight stays using NPS public use statistics. The transportation analysis subsection reports trends in private vehicle use and shuttle bus ridership from a combination of NPS public use statistics and data provided by RMNP. The trail use summary subsection summarizes trail use for selected areas using data provided by RMNP.

VISITATION ANALYSIS

Analyses of public use statistics suggest several trends in visitation to RMNP. At the highest level, these trends include dramatically increasing visitor use in recent years, expansion of high-use times of year from summer into the spring and fall, and an increasing dominance of day use. Key highlights of specific visitor use trends include the following:

- Recreation visits to RMNP increased by 50% between 2008 and 2015, with over half of the increase occurring between 2014 and 2015.
- Recreation visits in recent years are at historically high levels for all months.
- Annual high-visitation periods have lengthened from 2 to 3 months in the 1980s to 4 to 5 months in recent years.
- Visitor use is spreading across months, shifting primarily from August to May, September, and October.
- From 1979 until recent years, monthly overnight stays in RMNP have declined steadily in July, August, and September.
- Overnight stays in RMNP have increased sharply over the past two years (2014 and 2015) in June, July, August, September, and October.
- The relative proportion of visitors to RMNP who are day users has been steadily increasing since 1979, and dramatically increasing during high-visitation months.

ITEM 1: Annual recreation visits, 1979–2015



Summary

- Recreation visits to RMNP declined between the mid-1990s and mid-2000s, but have increased steadily since, with a dramatic spike in visitation in 2015.
- Recreation visits to RMNP increased by 50% between 2008 and 2015 (nearly 1.4 million visits), with over half of the increase occurring from 2014 to 2015.

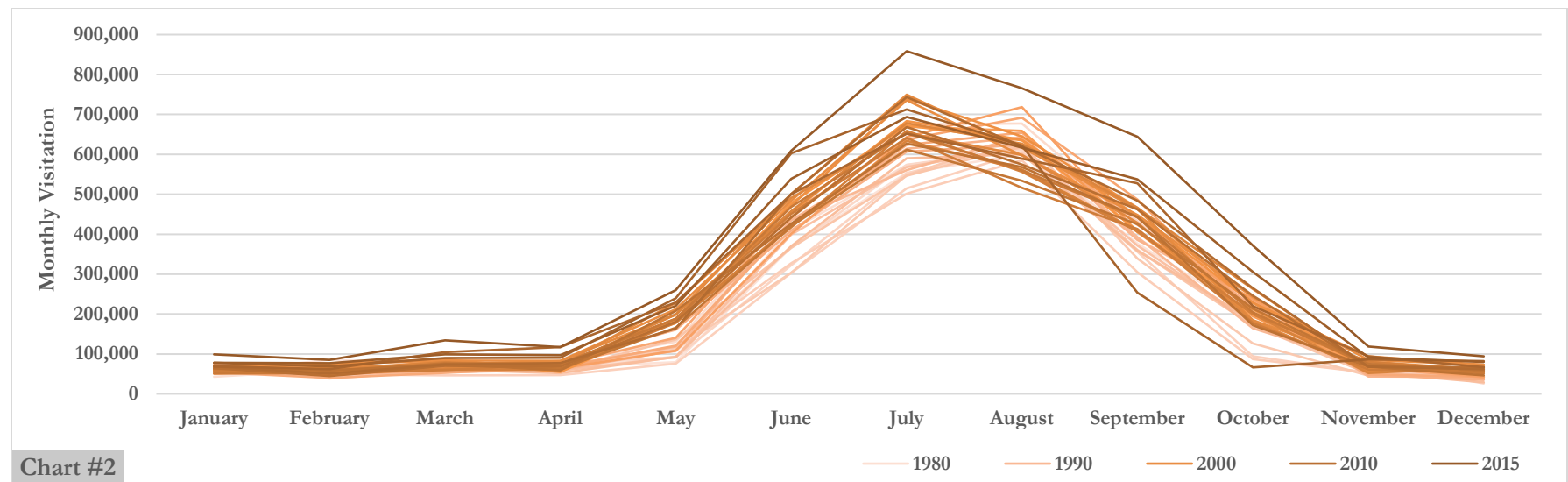
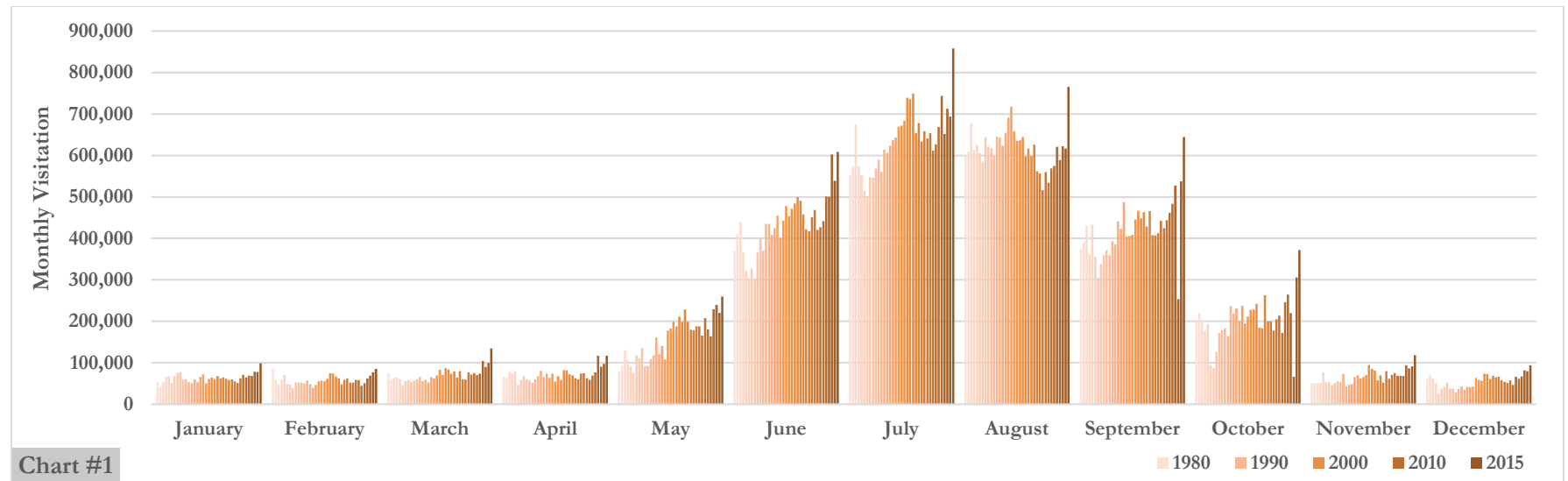
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Recreation Visits.**

ITEM 2: Monthly recreation visits, 1979–2015



Summary

Chart #1:

- Recreation visits to RMNP are concentrated in June, July, August, and September.
- Recreation visits in recent years are at historically high levels for all months, with the most dramatic increases occurring in late summer and early fall months (July, August, September, and October).
- May and October have traditionally experienced similar volumes of recreation visits. However, in recent years, recreation visits in October have far exceeded recreation visits in May.

Chart #2:

- From 1979 to 1995, visitation to RMNP peaked in the month of August each year. After 1995, visitation to RMNP has peaked in the month of July each year.
- Annual high-visitation periods have lengthened from 2 to 3 months in the 1980s to 4 to 5 months in recent years.

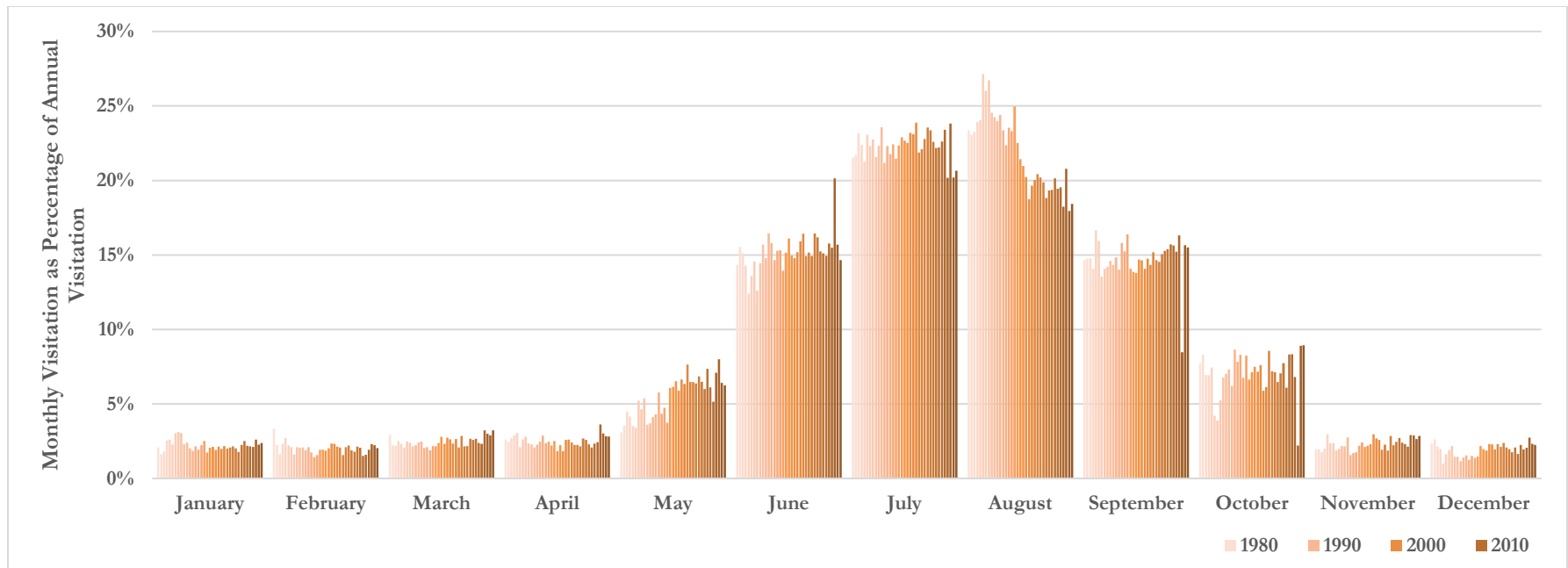
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Recreation Visits.**

ITEM 3: Monthly recreation visits as a percentage of annual visitation, 1979–2015



Summary

- This chart presents the percentage of annual recreation visitation to RMNP occurring during each month of the year.
- In the 1980s and 1990s, recreation visits to RMNP were concentrated in August, with 23% to 27% of all annual visitation occurring in August. Since then, the relative percentage of monthly recreation visits has declined significantly for August, increased substantially for May and slightly for September and October, and remained relatively consistent for June and July. This pattern indicates that recreation visitor use is spreading across months, primarily from August into May, September, and October.

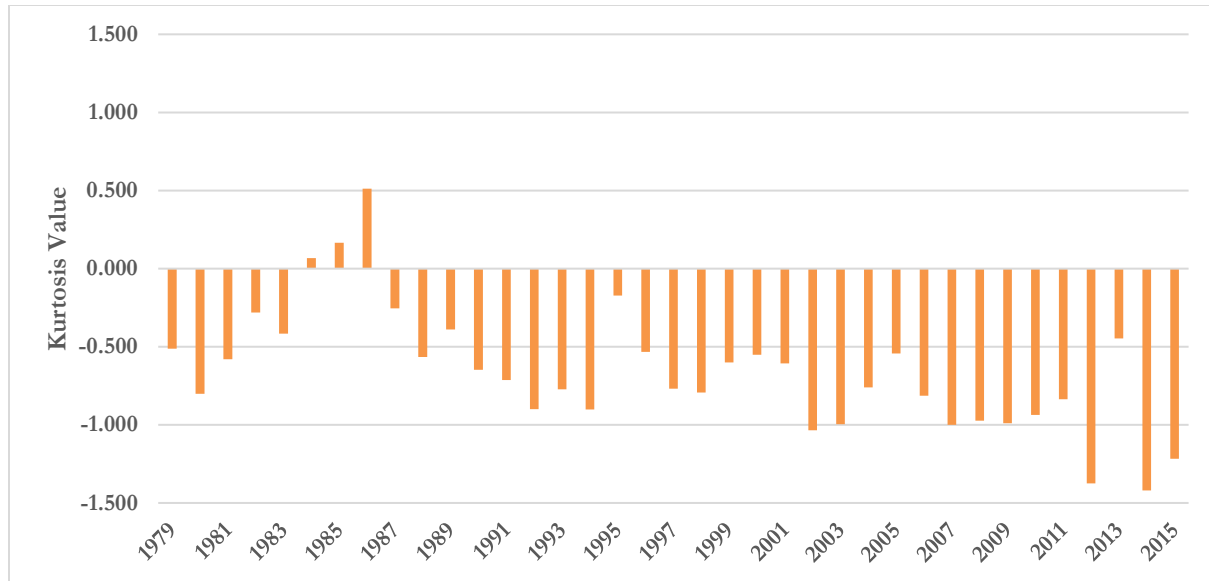
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Recreation Visits.**

ITEM 4: Kurtosis of monthly recreation visits, 1979–2015



Summary

- Kurtosis is a measure that describes the “peakedness” of a set of data. Kurtosis can describe the degree to which visitation to RMNP is concentrated in time. A positive kurtosis value indicates more peaked visitation. A negative kurtosis value indicates a more evenly distributed visitation. This measure can be used to compare the degree of temporal peakedness of visitation to RMNP. A kurtosis value was computed for each year based on monthly visitation data.
- Kurtosis values for recreation visits to RMNP have grown larger in a negative direction from 1979 to 2015, indicating that recreation visits are becoming more evenly distributed throughout the year. This is consistent with trends in monthly percentage of annual visitation.

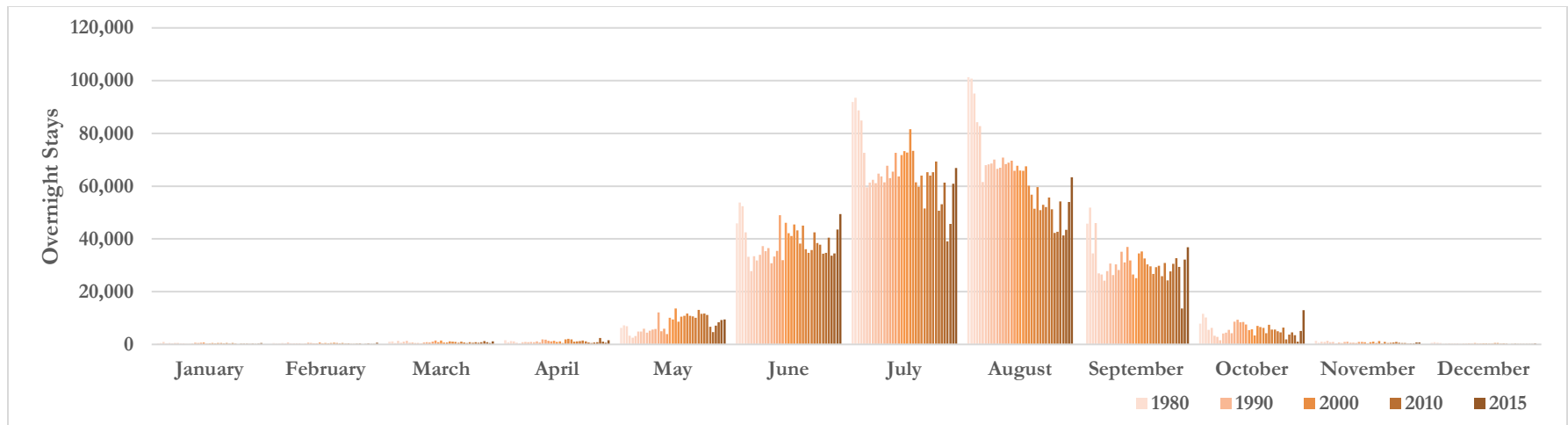
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Recreation Visits.**

ITEM 5: Monthly overnight stays, 1979–2015



Summary

- From 1979 until recent years, monthly overnight stays in RMNP have declined steadily in July, August, and September.
- Overnight stays in RMNP have increased sharply over the past two years (2014 and 2015) in June, July, August, September, and October.

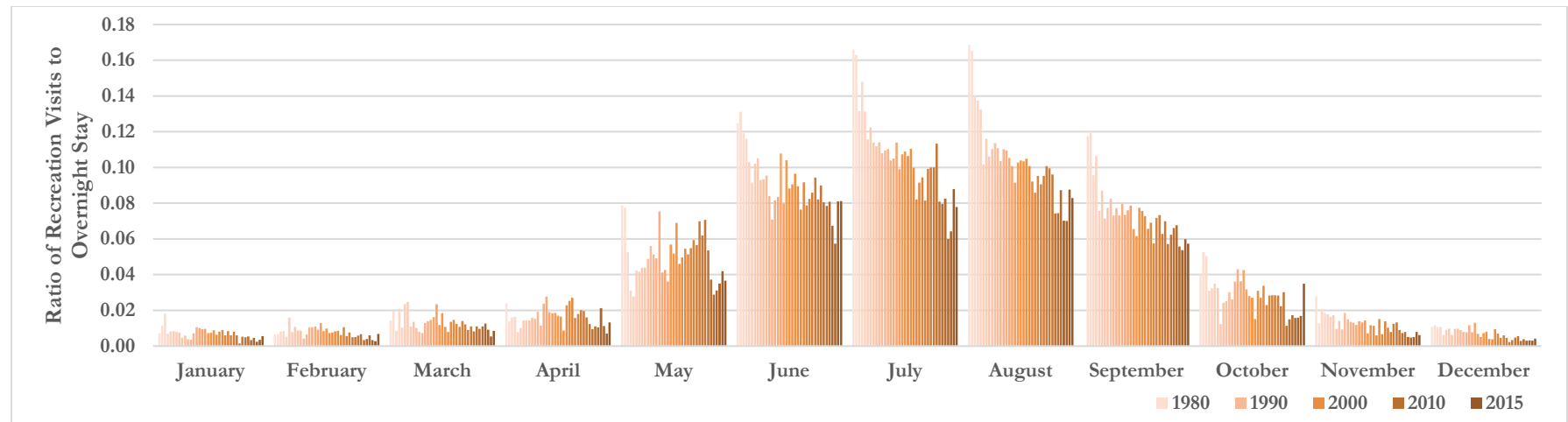
Notes

- The number of monthly overnight stays in September 1979 was determined to be an extreme outlier and was removed from analysis.
- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Recreation Visits.**

ITEM 6: Monthly ratio of recreation visits to overnight stays, 1979–2015



Summary

- RMNP does not report data on numbers of day use visitors. However, the ratio of monthly recreation visits to monthly overnight stays can serve as a proxy for analyzing trends in day use visitation.
- The ratio of recreation visits to overnight stays in RMNP has steadily declined since 1979, with dramatic declines in high-visitation months (June, July, August, and September). This trend suggests that the relative proportion of visitors to RMNP who are day users has been steadily increasing since 1979, and dramatically increasing during high-visitation months.
- In August 1979, there were approximately six recreational visits per overnight stay (1:0.17). In August 2015, there were approximately 13 recreational visits per overnight stay (1:0.08).

Notes

- Monthly overnight stays are reported as the total number of visitor nights spent in RMNP, inclusive of both frontcountry and backcountry overnight stays. Monthly overnight stays in RMNP are compared to monthly visitation using a ratio rather than a percentage.
- The number of monthly overnight stays in September 1979 was determined to be an extreme outlier and was removed from analysis.
- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

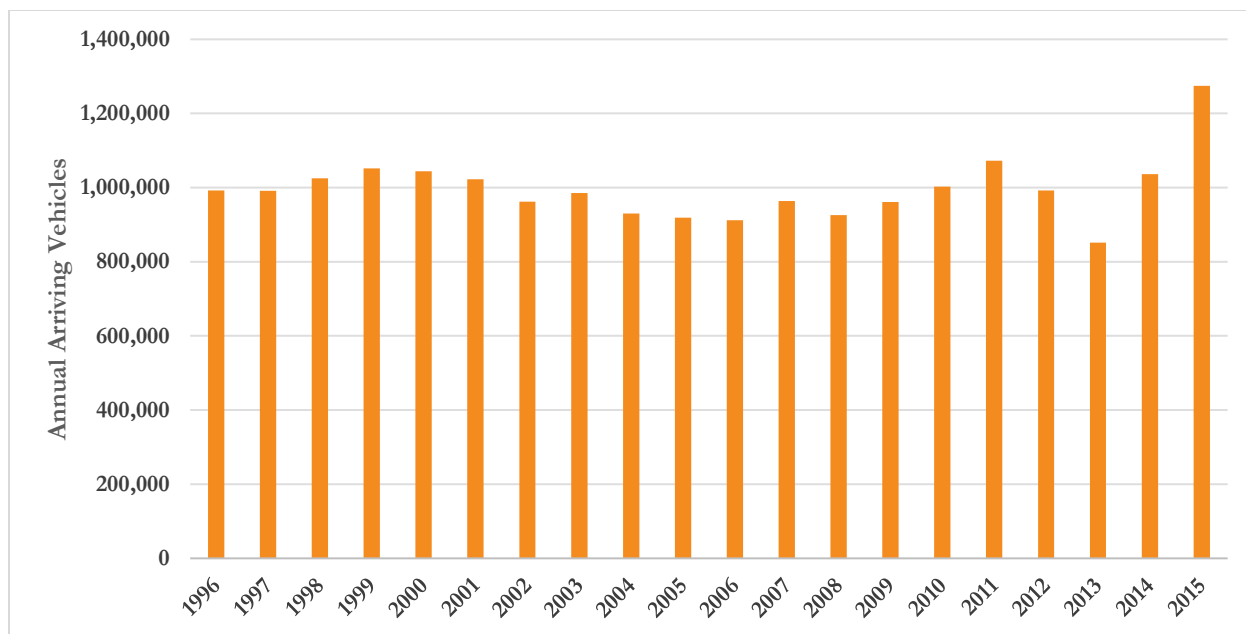
- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Recreation Visits.**

TRANSPORTATION ANALYSIS

Analyses of public use statistics and shuttle bus ridership data suggest several characteristics and trends in transportation use in RMNP. At the highest level, these trends include concentration of visitor access via the Beaver Meadows Entrance, parallel trends between overall visitation to RMNP and vehicle arrival volumes at RMNP entrances, and increasing proportional ridership of park shuttle buses. Key highlights of specific transportation use trends include the following:

- Annual arriving vehicle volume to the four park entrances in 2015 was approximately 30% greater than the average arriving vehicle volume from 1996 through 2014 (excluding 2013).
- Vehicle arrivals at the Beaver Meadows, Fall River, and Grand Lake entrances increased dramatically in 2015.
- Approximately half of arriving vehicles to RMNP arrive at the Beaver Meadows Entrance.
- The percentage of all vehicle arrivals to RMNP during the months from November through April that arrived via the Bear Meadows Entrance steadily increased since 1996, from approximately 50% to approximately 60%.
- Vehicle arrivals via the Grand Lake Entrance accounted for a greater percentage of all RMNP vehicle arrivals during the summer and fall than during the winter and spring.
- The ratio of recreation visits to arriving vehicles at the four entrances to RMNP held steady at or just under three recreational visits per arriving vehicle from 1996 through 2012, and increased slightly to 3.2 visits per vehicle since 2014.
- Excepting years during which outside factors affected visitor travel patterns (e.g., road construction, park closures), annual ridership of RMNP shuttles has increased steadily since 1999.
- Most monthly shuttle bus ridership occurs on the Bear Lake route. Although it has accounted for a relatively low percentage of total ridership (< 10%), the percent of shuttle users riding the Hiker Express route has steadily increased since its introduction.
- The ratio of recreation visits to annual shuttle bus ridership generally decreased between 1999 and 2015, from approximately 17 recreation visits per shuttle bus ride to approximately five recreation visits per shuttle bus ride.

ITEM 7: Annual arriving vehicle volume, 1996–2015



Summary

- Annual arriving vehicle volumes to the Bear Meadows, Fall River, Grand Lake, and Wild Basin entrances remained relatively constant, fluctuating no more than approximately +/- 10% from the average between 1996 and 2014 (excluding 2013).
- 2015 Annual arriving vehicle volume to the four entrances was approximately 30% greater than the average arriving vehicle volume from 1996 through 2014 (excluding 2013).

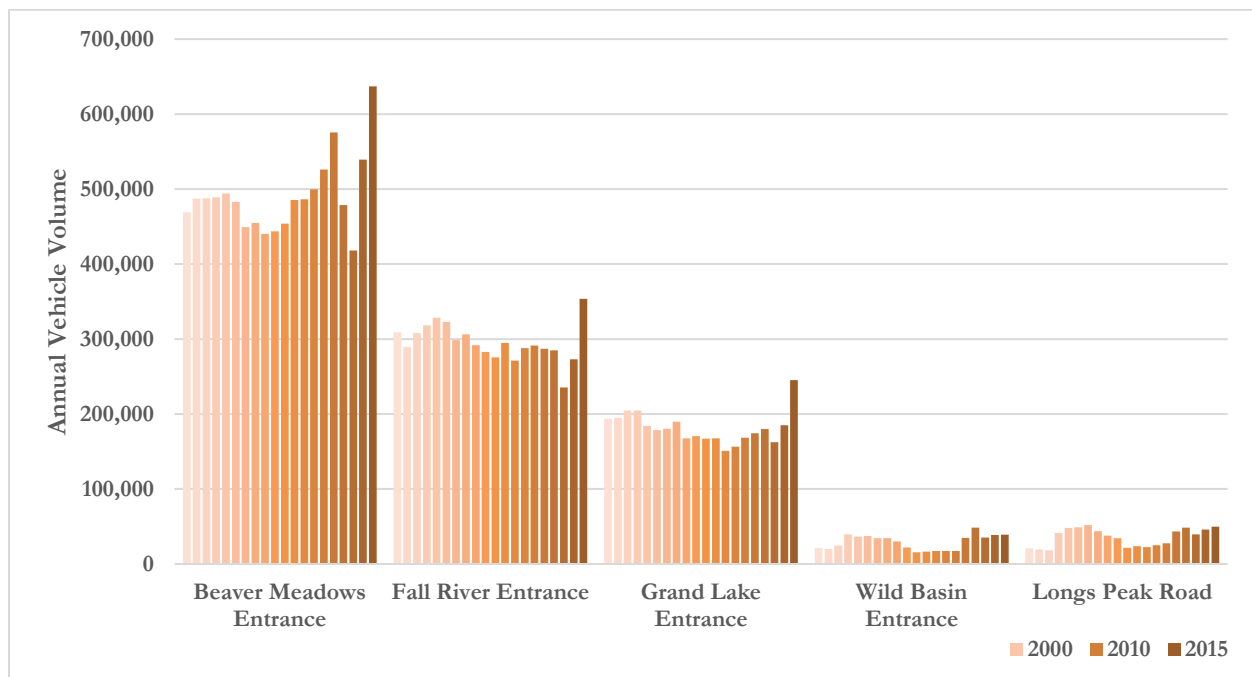
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Traffic Counts by Location.**

ITEM 8: Annual arriving vehicle volume by entrance, 1996–2015



Summary

- Vehicle arrivals at the Beaver Meadows Entrance, Fall River Entrance, and Grand Lake Entrance increased dramatically in 2015.
- Before 2014, vehicle volumes recorded at the Beaver Meadows Entrance rose steadily from the mid-2000s.

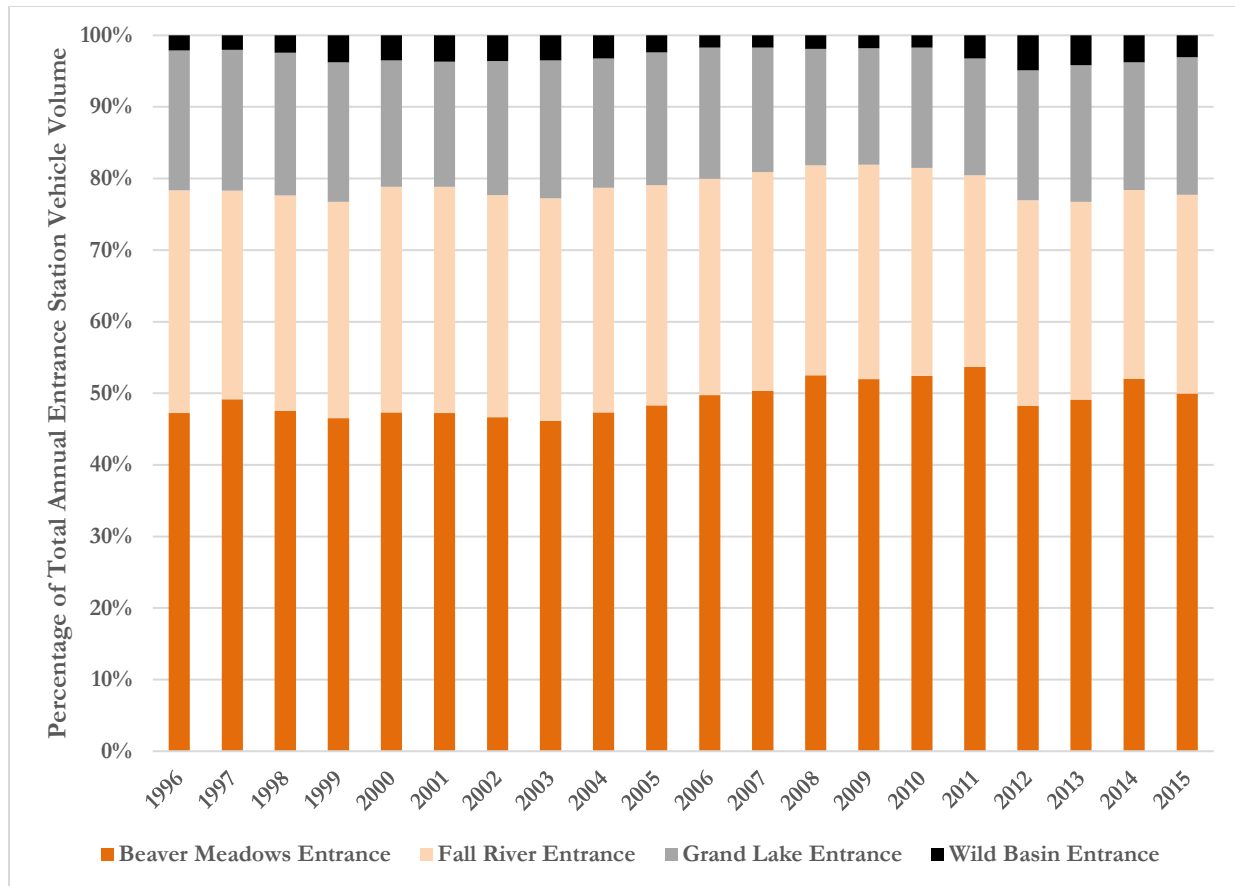
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Traffic Counts by Location.**

ITEM 9: Percentage of annual arriving vehicle volume by entrance, 1996–2015



Summary

- Approximately half of arriving vehicles to RMNP arrived at the Beaver Meadows Entrance.
- The distribution of vehicle arrivals across the four entrances remained relatively constant since 1996.

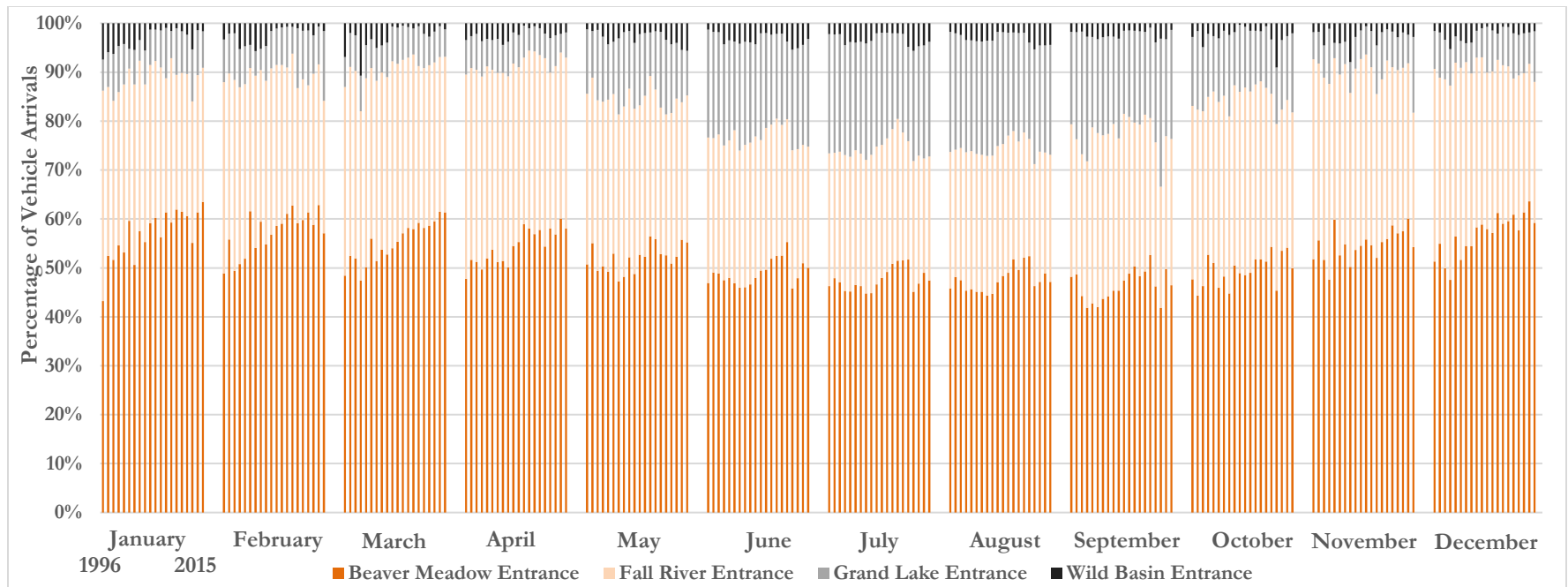
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Traffic Counts by Location.**

ITEM 10: Percentage of monthly vehicle volume by entrance, 1996–2015



Summary

- The percentage of all vehicle arrivals to RMNP during the months from November through April that arrived via the Bear Meadows Entrance steadily increased since 1996, from approximately 50% to approximately 60%.

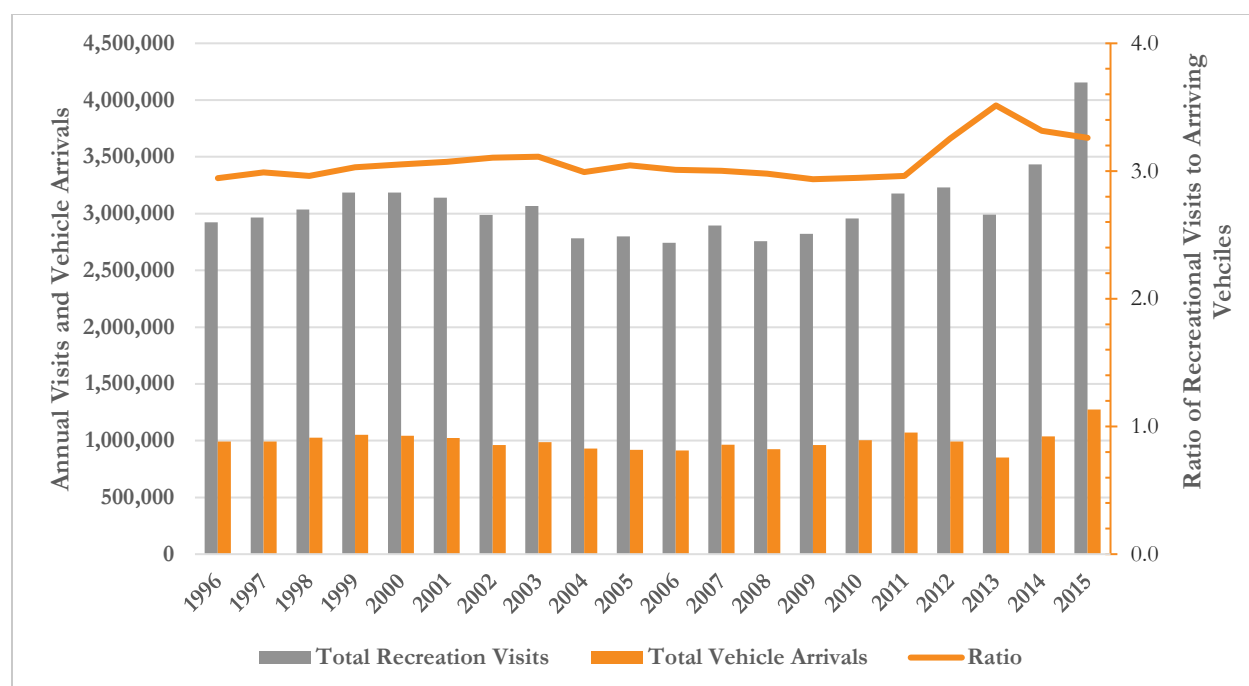
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Traffic Counts by Location.**

ITEM 11: Ratio of annual recreational visits to annual arriving vehicles, 1996–2015



Summary

- The ratio of annual recreation visits to annual arriving vehicles at the four entrances to RMNP held steady at or just under three recreational visits per arriving vehicle from 1996 through 2012.
- The ratio rose slightly, to approximately 3.2 recreational visits per arriving vehicle, in recent years.
- In general, the number of annual recreational visits and the number annual private vehicle arrivals have varied in unison.

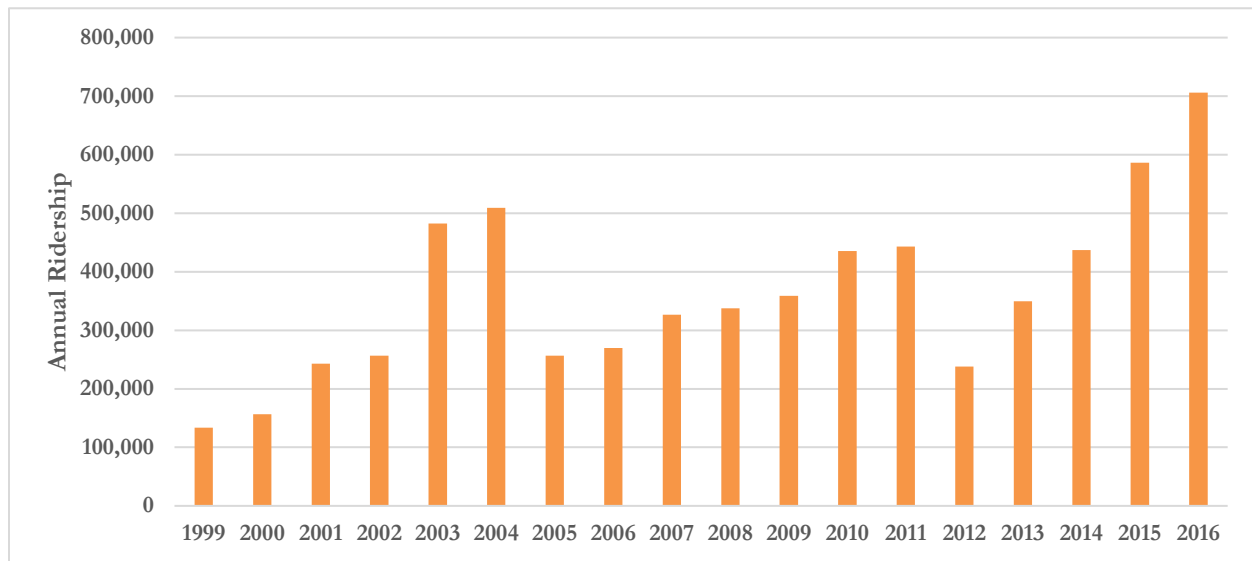
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Sources

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Traffic Counts by Location.**
- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Recreation Visits.**

ITEM 12: Annual shuttle bus ridership, 1999–2016



Summary

- RMNP operates three shuttle bus routes: Moraine Park, Bear Lake, and Hiker Shuttle Express. The Hiker Shuttle Express opened in July 2006.
- Excepting years during which outside factors affected visitor travel patterns (e.g., road construction, park closures), annual ridership of RMNP shuttles has increased steadily since 1999.
- The dramatic ridership increase in 2003 and 2004 suggests that RMNP visitor shifted travel mode from private vehicle to shuttle bus when private vehicles were restricted from Bear Lake Road due to construction.

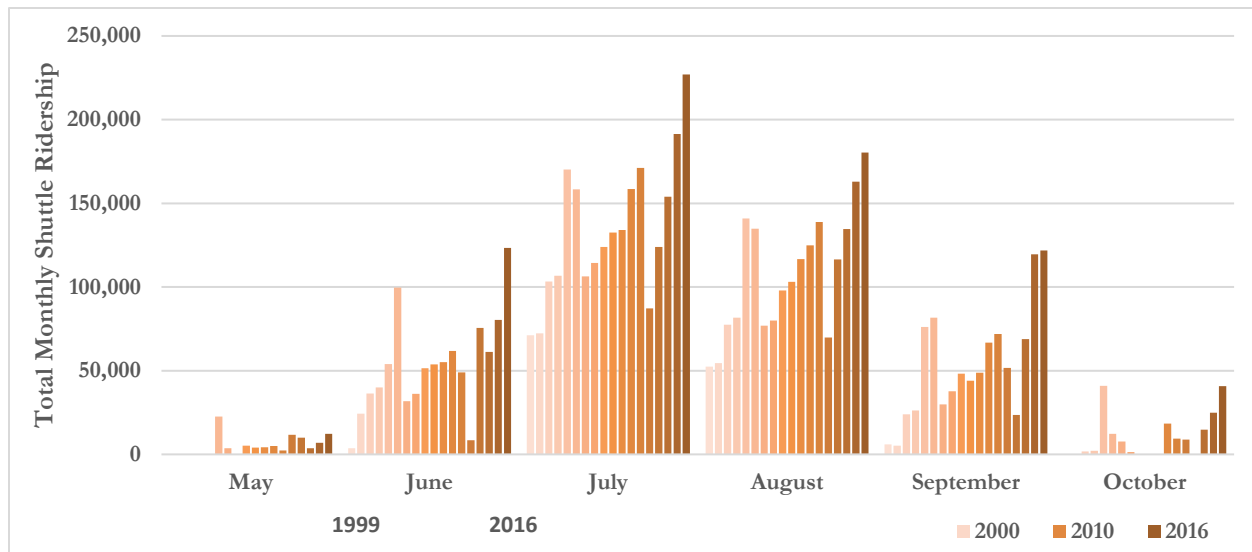
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Source

- Shuttle bus ridership data provided by RMNP.

ITEM 13: Monthly shuttle bus ridership, 1999–2016



Summary

- From 1999 to 2016, monthly ridership of RMNP shuttles has increased steadily in June, July, August, and September.
- There was a substantial increase in shuttle bus ridership in September 2015.

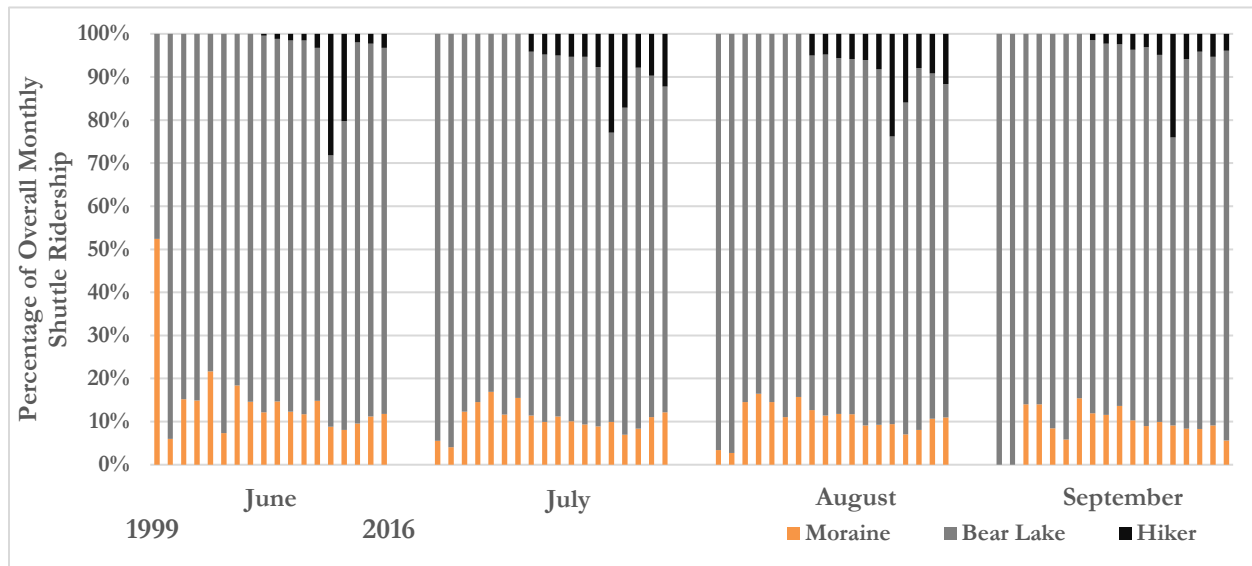
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Source

- Shuttle bus ridership data provided by RMNP.

ITEM 14: Percentage monthly shuttle ridership by route, 1999–2016



Summary

- Most monthly shuttle bus ridership occurs on the Bear Lake route.
- The percentage of shuttle system ridership that occurred on the Moraine Park route decreased following introduction of the Hiker Shuttle Express route.
- Although it has accounted for a relatively low percentage of total ridership ($< 10\%$), the percent of shuttle users riding the Hiker Express route has steadily increased since its introduction.

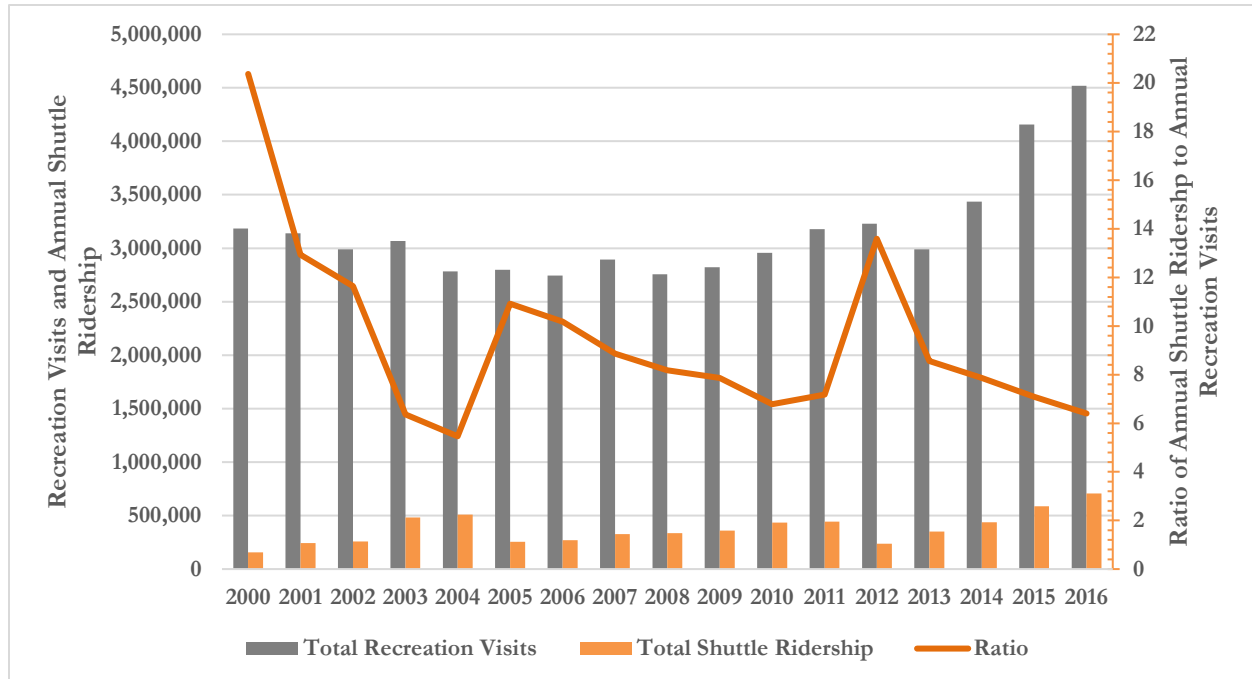
Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

Source

- Shuttle bus ridership data provided by RMNP.

ITEM 15: Ratio of recreation visits to annual shuttle bus ridership, 1999–2016



Summary

- The ratio of recreation visits to annual shuttle bus ridership generally decreased between 1999 and 2015, from approximately 20 recreation visits per shuttle bus ride to approximately six recreation visits per shuttle bus ride.
- The greatest ridership rates in comparison to recreation visits were observed during 2003, 2004, and 2016, when approximately one out of every six RMNP visits was associated with a shuttle bus ride.

Notes

- Recreation visits presented here include RMNP recreation visits from June, July, August, and September for each year.
- See preceding notes on historical events affecting patterns and volumes of visitor use.

Source

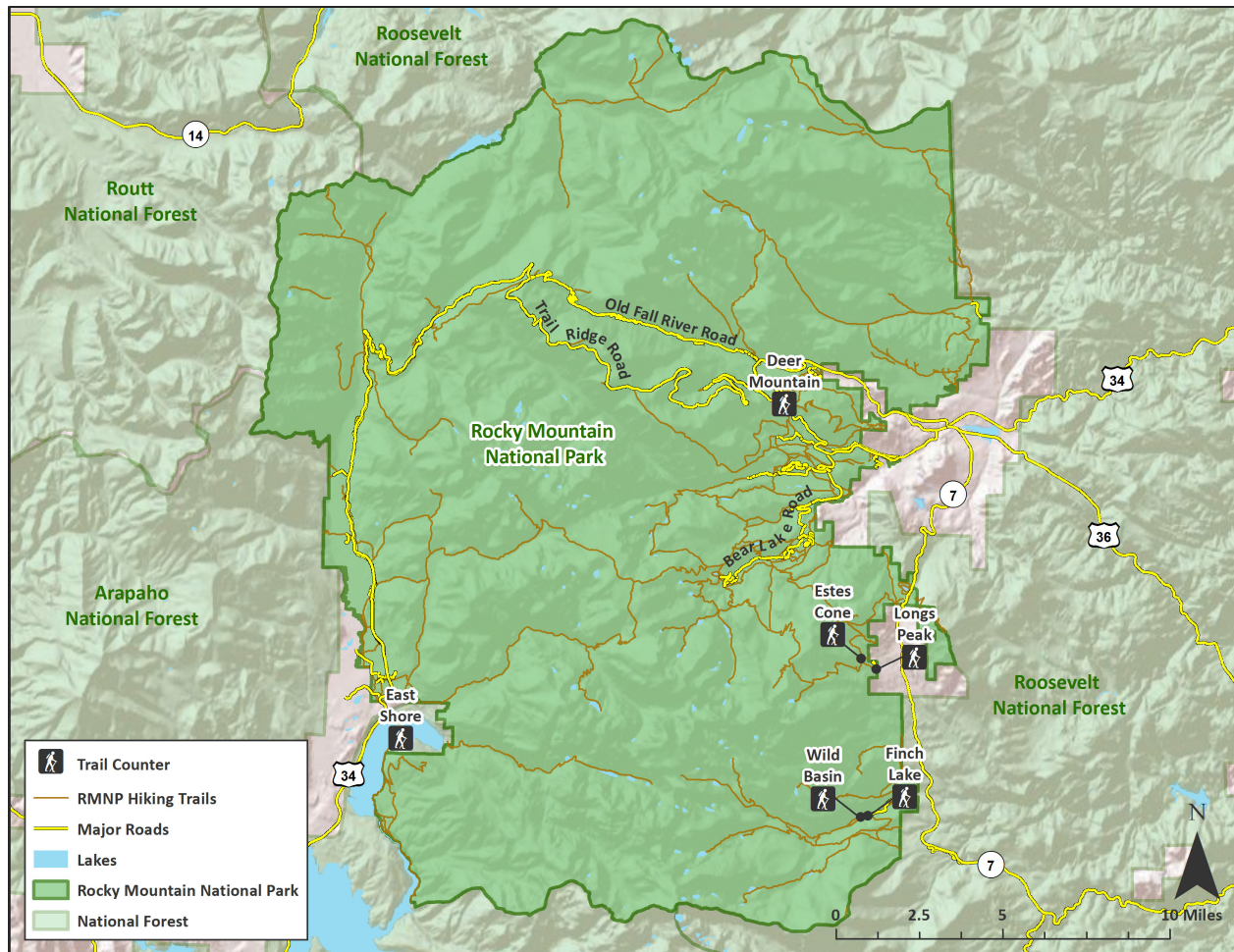
- Shuttle bus ridership data provided by RMNP.
- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Recreation Visits.**

TRAIL USE SUMMARY

This subsection presents average daily visitor use data by month collected using electronic infrared trail counters at various trailheads in RMNP. Average daily visitor use is the estimated number visitors accessing each area per day. Average daily visitor use volumes are presented for trailheads for which multiple years of trail counter data are available. Key highlights of trail use data summarized below include the following:

- Recorded visitor use of the Wild Basin trailhead was significantly lower in 2014 than in 2012 and 2013 for all months except October.
- Available visitor use data for the Deer Mountain trailhead suggest that monthly visitor use levels remained steady from year to year between 2012 and 2015.
- Available data suggest that average daily visitor use of the Estes Cone Trail declined between 2014 and 2015.
- Average daily visitor use of the Finch Lake trailhead was similar between 2012 and 2014 for July, August, and October.
- Average daily visitor use of the East Shore trailhead was similar in August 2012 and August 2013, and was lower in September 2012 than it was in September 2013.

ITEM 16: Approximate locations of trail counters included in analysis



References

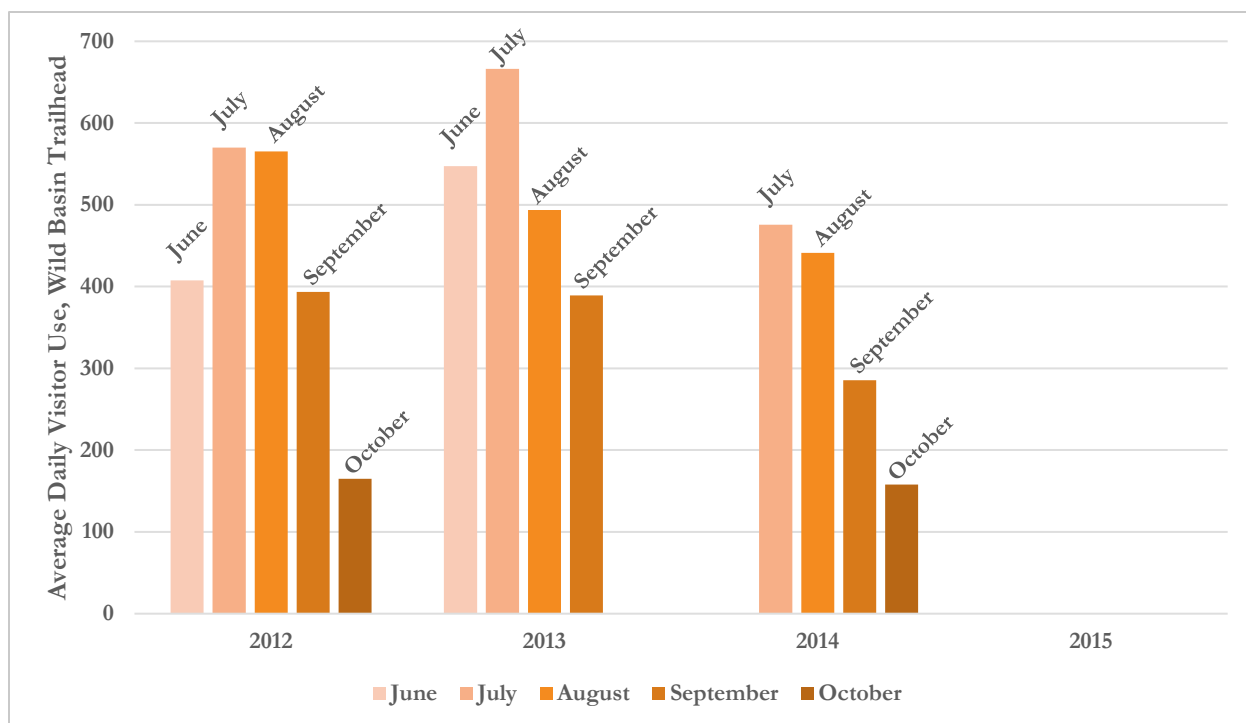
Pettebone, D. (2012). **Rocky Mountain National Park: State of the Wilderness Report 2012**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2013). **Rocky Mountain National Park: State of the Wilderness Report 2013**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2014). **Rocky Mountain National Park: State of the Wilderness Report 2014**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2015). **Rocky Mountain National Park: State of the Wilderness Report 2015**. Rocky Mountain National Park: Estes Park, CO.

ITEM 17: Average daily visitor use, Wild Basin trailhead



Summary

- Recorded visitor use of the Wild Basin trailhead was significantly lower in 2014 than in 2012 and 2013 for all months except October.
- Average daily visitor use for July increased between 2012 and 2013, but declined in 2014.
- Average daily visitor use for August declined slightly from the 2012 level in 2013, and again in 2014.
- Average daily visitor use for September remained steady from 2012 to 2013, and declined in 2014.

Notes

- Data are not available for October 2013, June 2014, and 2015.
- Recorded vehicle volumes at the Wild Basin Entrance station increased between 2013 and 2014. This contradicts trends observed in the trail counter data, where recorded visitor use declined between 2013 and 2014.
- See preceding notes on historical events affecting patterns and volumes of visitor use.

References

Pettebone, D. (2012). **Rocky Mountain National Park: State of the Wilderness Report 2012**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2013). **Rocky Mountain National Park: State of the Wilderness Report 2013**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2014). **Rocky Mountain National Park: State of the Wilderness Report 2014**. Rocky Mountain National Park: Estes Park, CO.

ITEM 18: Average daily visitor use, Deer Mountain trailhead



Summary

- Available visitor use data for the Deer Mountain trailhead suggest that monthly visitor use levels remained steady from year to year between 2012 and 2015.
- In the summer of 2004, an average daily volume of 92 visitors per day were recorded at the Deer Mountain trailhead.

Notes

- Data are not available for June and July 2012, October 2013, June 2014, and October 2015.
- See preceding notes on historical events affecting patterns and volumes of visitor use.

References

Bates, M., Wallace, G., and Vaske, J. (2006). **Visitor Use in Wilderness Phase II: Estimating Visitor Use in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

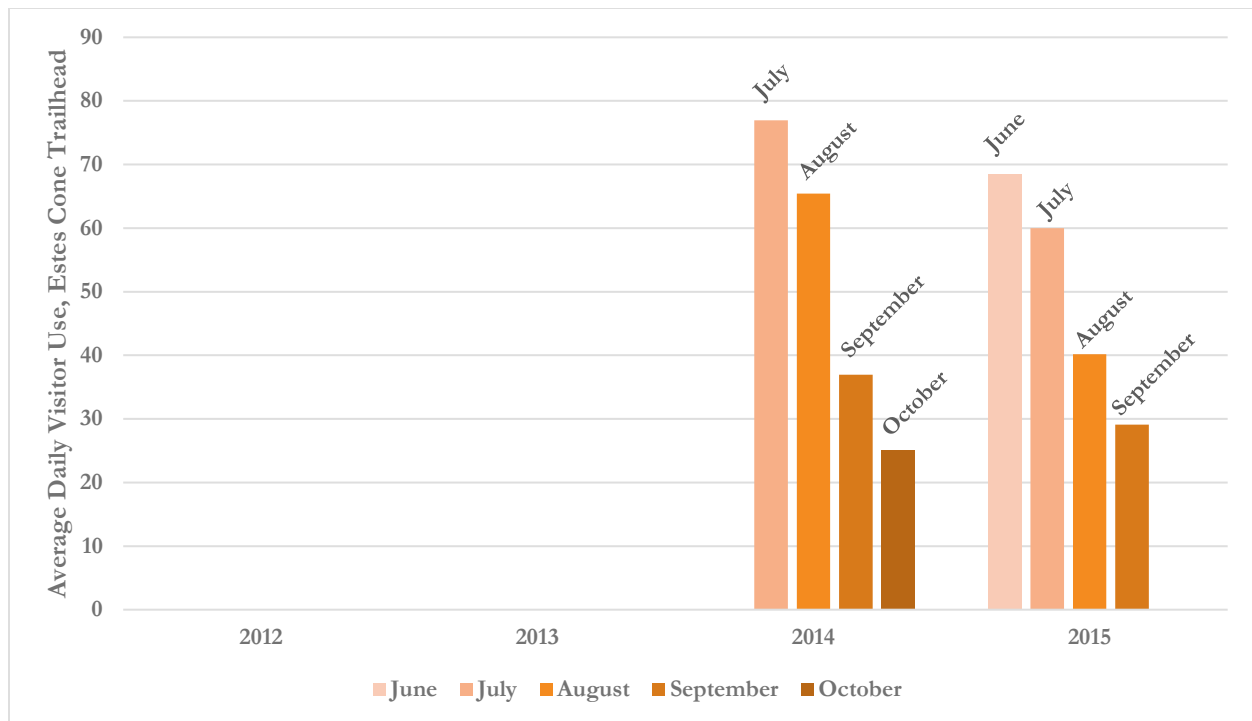
Pettebone, D. (2012). **Rocky Mountain National Park: State of the Wilderness Report 2012**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2013). **Rocky Mountain National Park: State of the Wilderness Report 2013**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2014). **Rocky Mountain National Park: State of the Wilderness Report 2014**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2015). **Rocky Mountain National Park: State of the Wilderness Report 2015**. Rocky Mountain National Park: Estes Park, CO.

ITEM 19: Average daily visitor use, Estes Cone Trail



Summary

- Available data suggest that average daily visitor use of the Estes Cone Trail declined between 2014 and 2015.

Notes

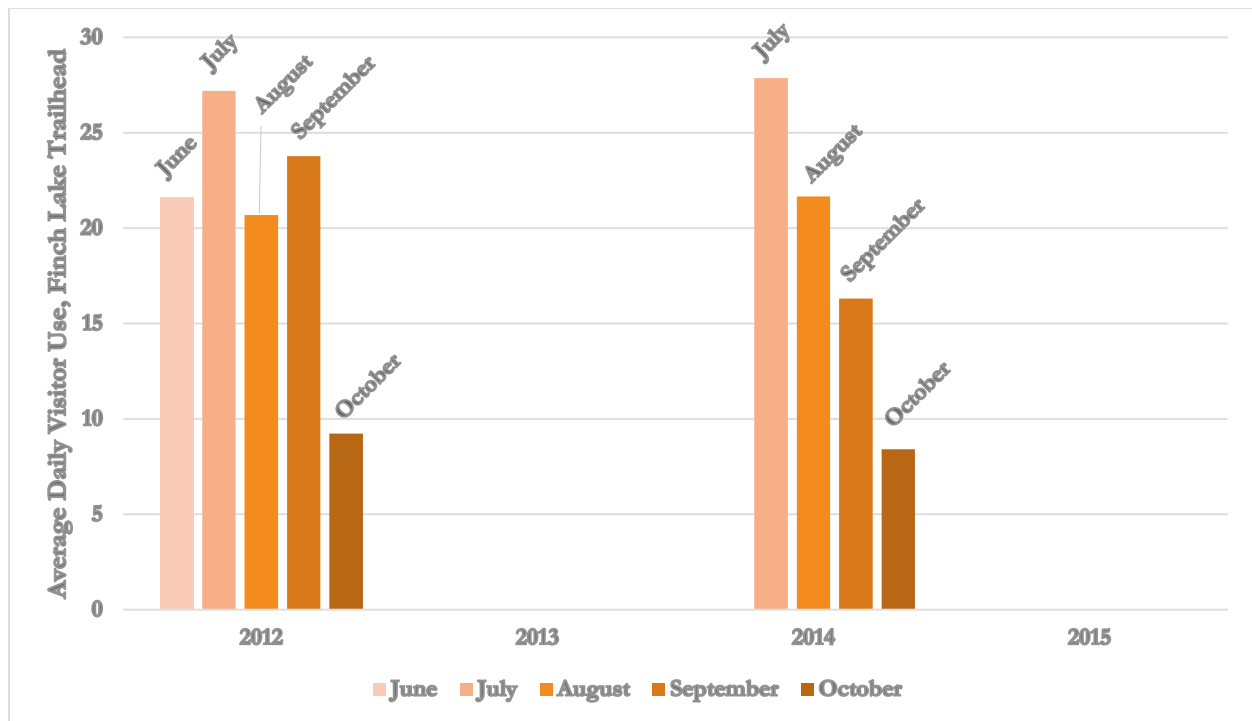
- Data are not available for 2012, 2013, June 2014, and October 2015.

References

Pettebone, D. (2014). **Rocky Mountain National Park: State of the Wilderness Report 2014**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2015). **Rocky Mountain National Park: State of the Wilderness Report 2015**. Rocky Mountain National Park: Estes Park, CO.

ITEM 20: Average daily visitor use, Finch Lake trailhead



Summary

- Average daily visitor use of the Finch Lake trailhead was similar between 2012 and 2014 for July, August, and October.
- Average daily visitor use was substantially higher in September 2012 than in September 2014.
- Data from the summer of 2003 indicated that the Finch Lake trailhead had an average daily visitor use volume of 15 visitors per day.

Notes

- Average daily visitor arrivals reported in Pettebone, 2012 were corrected to assign values to the proper month.
- Data are not available for 2013, June 2014, and 2015.

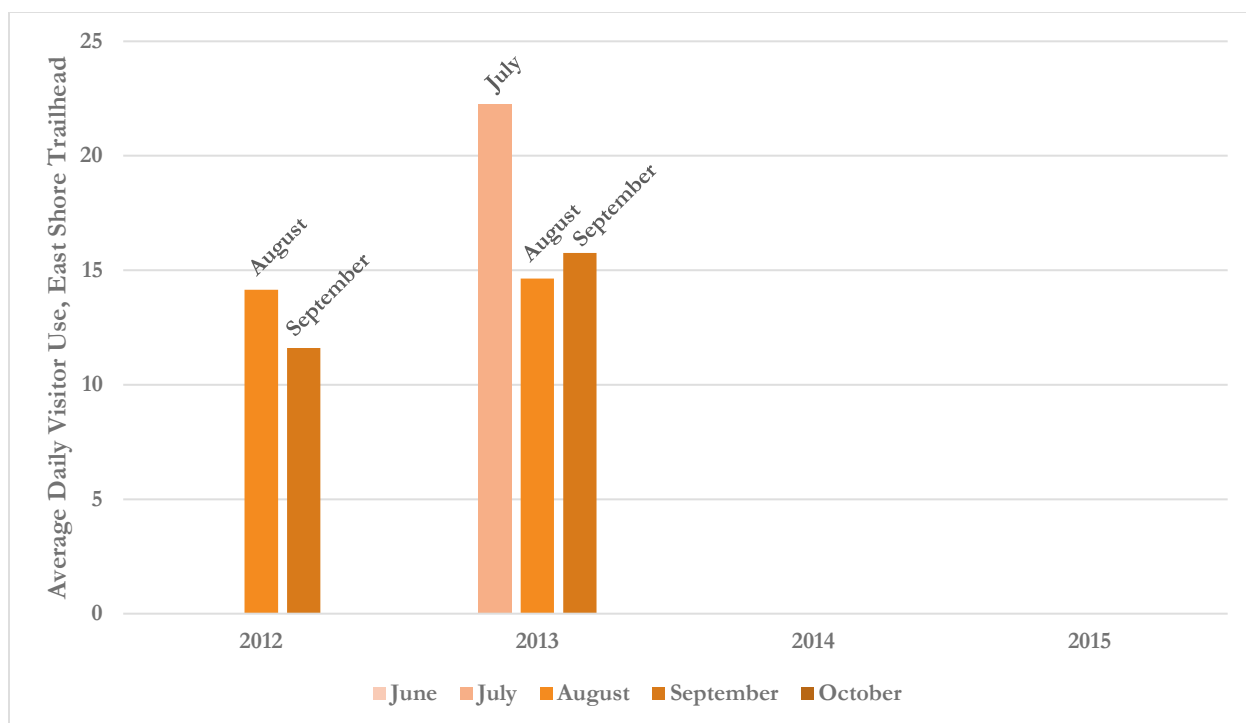
References

Bates, M., Wallace, G., and Vaske, J. (2006). **Visitor Use in Wilderness Phase II: Estimating Visitor Use in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

Pettebone, D. (2012). **Rocky Mountain National Park: State of the Wilderness Report 2012**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2014). **Rocky Mountain National Park: State of the Wilderness Report 2014**. Rocky Mountain National Park: Estes Park, CO.

ITEM 21: Average daily visitor use, East Shore trailhead



Summary

- Average daily visitor use of the East Shore trailhead was similar in August 2012 and August 2013, and was higher in September 2013 than it was in September 2012.

Notes

- Data are not available for June, July, and October 2012; June and October 2013; 2014; and 2015.
- See preceding notes on historical events affecting patterns and volumes of visitor use.

References

Pettebone, D. (2012). **Rocky Mountain National Park: State of the Wilderness Report 2012**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2013). **Rocky Mountain National Park: State of the Wilderness Report 2013**. Rocky Mountain National Park: Estes Park, CO.

5.3 | GEOGRAPHIC REGIONS OF ROCKY MOUNTAIN NATIONAL PARK

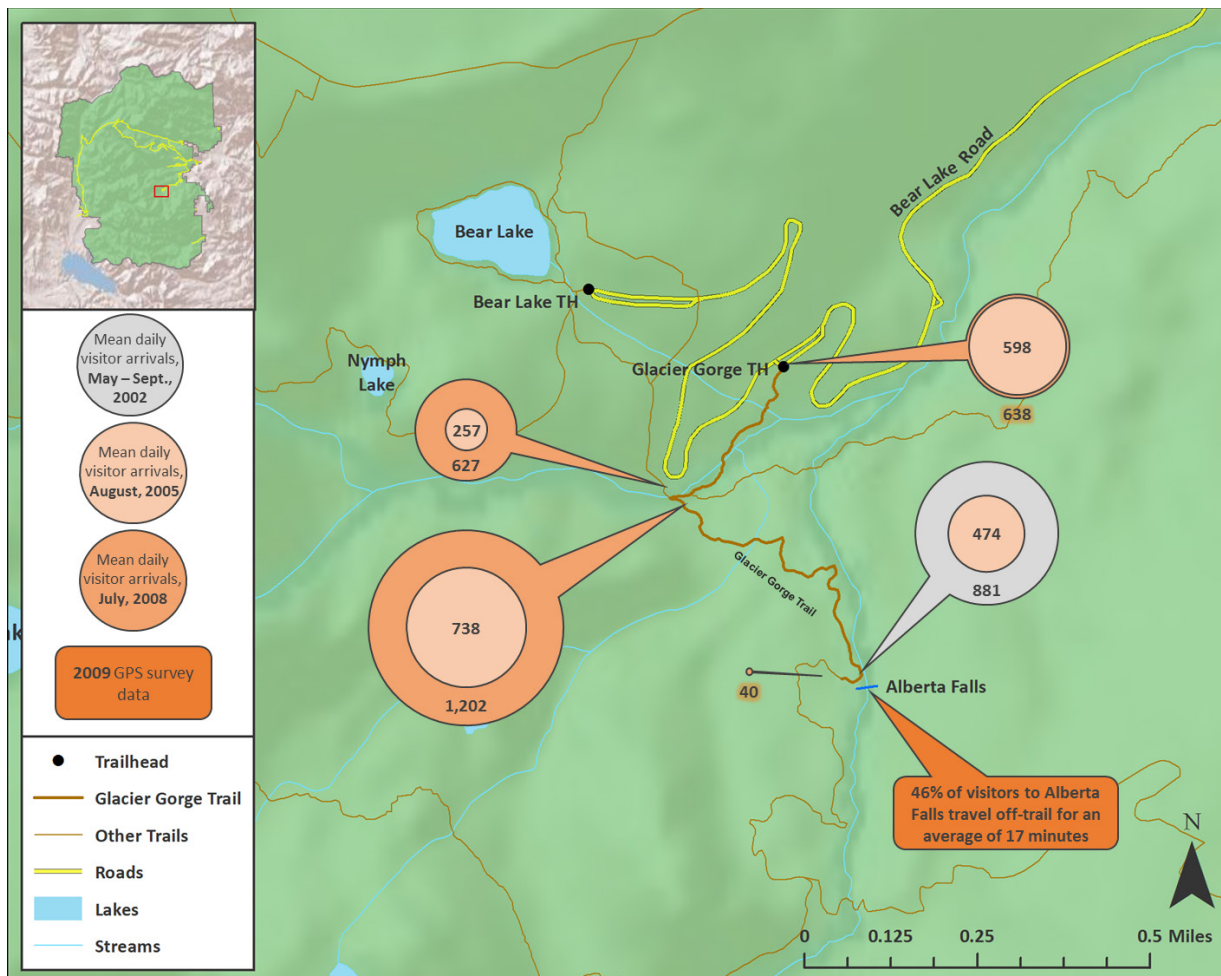
Visitor use in the Bear Lake Road corridor and Longs Peak area has been the subject of a relatively substantial body of social science data collection. The following subsection summarizes these data and presents visitor use trends when possible for these two areas.

BEAR LAKE ROAD CORRIDOR

The Bear Lake Road provides access to several popular trailheads and iconic park features, including Bear Lake, Dream Lake, Emerald Lake, and Alberta Falls. Visitors traveling beyond the Glacier Basin campground on the Bear Lake Road have the option of driving and parking their personal vehicles at trailheads or parking their vehicles at the park-and-ride near the Glacier Basin campground and riding a RMNP shuttle bus up Bear Lake Road. The combination of high visitor use volumes and multiple transportation options motivated an integrated study of visitor use and transportation and is summarized in Newman, Lawson, and Monz, 2010 and subsequent journal articles. Key highlights from this study include the following:

- The Glacier Gorge Trail to Alberta Falls experienced high levels of visitation, with most visitors traveling to—but not beyond—Alberta Falls.
- The Emerald Lake Trail experienced high levels of visitor use, the clear majority (96%) of which originated at the Bear Lake trailhead in July 2008.
- Mean daily vehicle traffic volumes on weekends and holidays were approximately 33% higher at Beaver Meadows Entrance, 17% higher at the traffic counter north of the Bear Lake Road Park-and-Ride, and 22% higher at the traffic counter south of the park-and-ride than on weekdays.
- In July 2008, the average parking lot usage rates on data collection days between the hours of 7:00 a.m. and 4:00 p.m. for the Bear Lake Road Park-and-Ride lot, the Glacier Gorge trailhead parking lot, and the Bear Lake trailhead parking lot were 75%, 86%, and 73%, respectively.
- Visitors to the Glacier Gorge trailhead were more likely to have arrived via a RMNP shuttle bus than visitors to the Bear Lake trailhead.

ITEM 22: Visitor use along the Glacier Gorge Trail to Alberta Falls, 2002–2008



LOCATION	DATA COLLECTION PERIOD	MEAN DAILY VISITOR ARRIVALS
Glacier Gorge trailhead	August 2005	598
	July 2008	638
Bear Lake–Glacier Gorge connector	August 2005	257
	July 2008	627
Glacier Gorge Trail, south of junction with Bear Lake connector	August 2005	738
	July 2008	1,202
Alberta Falls	May–September 2002	881
	August 2005	474
Glacier Gorge Trail, southwest of Alberta Falls (visitors originating south of Alberta Falls)	July 2008	40

Summary

- The Glacier Gorge Trail to Alberta Falls experienced high levels of visitation, with most visitors traveling to—but not beyond—Alberta Falls.
- Trail count data suggest that volume of visitor use on the Glacier Gorge Trail south of Alberta Falls is less than one-tenth the volume of visitor use on the trail north of Alberta Falls.
- Between the summer of 2005 and the summer of 2008, mean daily arrivals to the Glacier Gorge trailhead increased modestly (7%), while mean daily arrivals to the Glacier Gorge Trail from the Bear Lake connector trail increased dramatically (149%). This suggests that visitor use originating from the Bear Lake trailhead was the primary driver of increases in visitor use on the Glacier Gorge Trail in the Alberta Falls area between 2005 and 2008.
- Nearly half of all visitors to Alberta Falls travel off-trail in the immediate vicinity of the falls.

Notes

- Visitor volumes in the summer of 2002 were recorded 24 hours per day using infrared trail counters between May and September 2002.
- Visitor volumes in August 2005 were recorded 24 hours per day using infrared trail counters between August 7 and August 31.
- Visitor volumes in July 2008 were collected by direct observations conducted between 8:00 a.m. and 4:00 p.m. on five days between July 14 and July 25.
- Differences in survey design and sampling procedures should be considered when comparing data from 2002, 2005, and 2008.

References

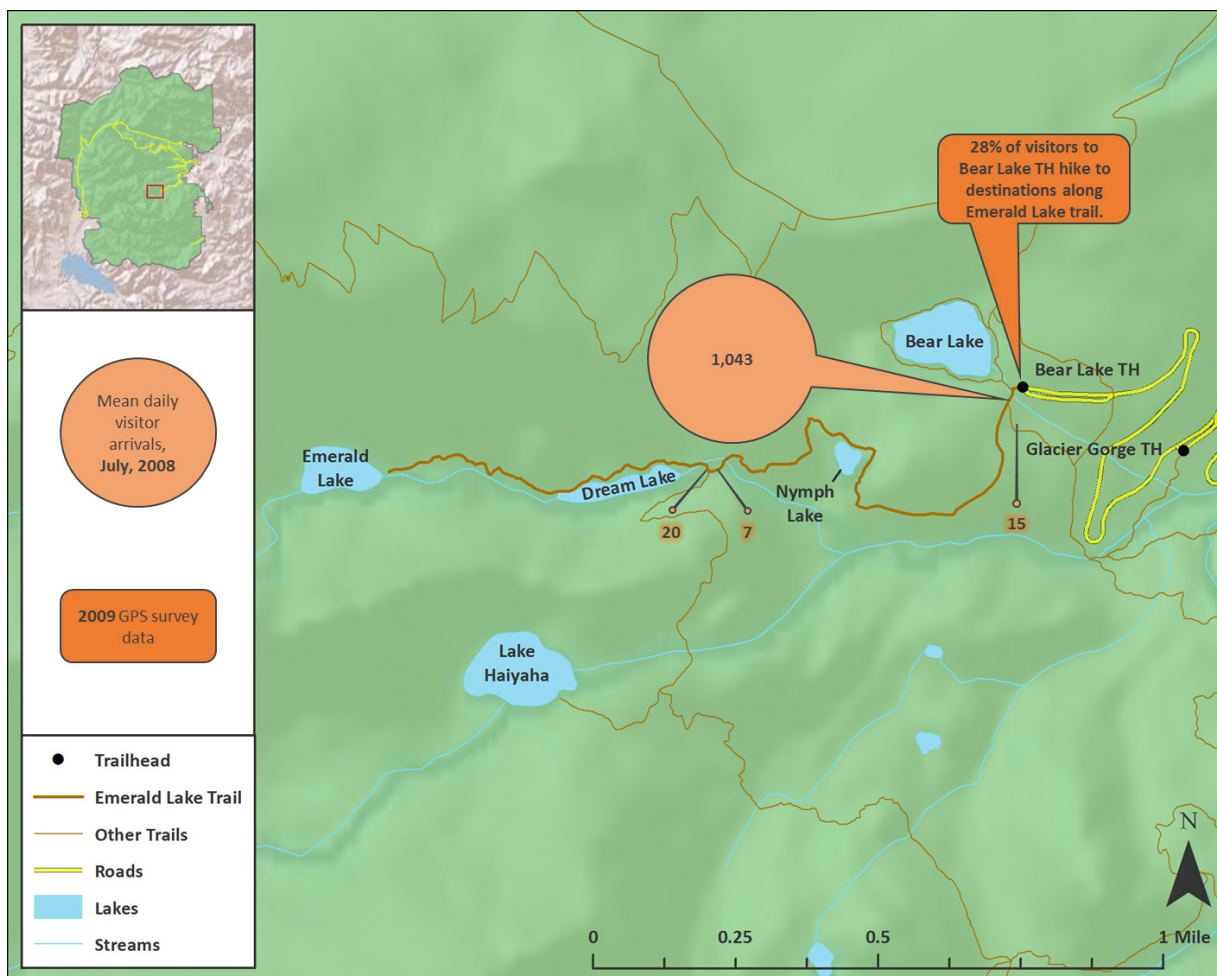
Bates, M., Wallace, G., and Vaske, J. (2006). **Visitor Use in Wilderness Phase II: Estimating Visitor Use in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

Pettebone, D., Newman, P., Theobald, D. (2006). **Quantifying Impacts Along the Glacier Gorge Trail**. Colorado State University: Fort Collins, CO.

Newman, P., Lawson, S., and Monz, C. (2010). **Integrated Approach to Transportation and Visitor Use Management at Rocky Mountain National Park**. RSG Inc., Colorado State University, and Utah State University.

D'Antonio, A., Monz, C., Lawson, S., Newman, P., Pettebone, D., and Courtemanch, A. (2010). **GPS-Based Measurements of Backcountry Visitors in Park and Protected Areas: Examples of Methods and Applications from Three Cases Studies**. *Journal of Park and Recreation Administration*. 28, pp. 42-60.

ITEM 23: Visitor use along the Emerald Lake Trail, 2008



ENTRANCE LOCATION	DATA COLLECTION PERIOD	MEAN DAILY VISITOR ARRIVALS
Bear Lake trailhead	July 2008	1,043
Bear Lake–Glacier Gorge connector	July 2008	15
Lake Haiyaha Trail–Eastbound (visitors entering Emerald Lake Trail and turning east)	July 2008	7
Lake Haiyaha Trail–Westbound (visitors entering Emerald Lake Trail and turning west)	July 2008	20

Summary

- The Emerald Lake Trail experienced high levels of visitor use, the clear majority (96%) of which originated at the Bear Lake trailhead in July 2008.

- Twenty-eight percent (28%) of visitors to the Bear Lake trailhead in the summer of 2009 hiked at least part of the Emerald Lake Trail.
- A rough estimate of visitation to the Bear Lake trailhead can be calculated using the mean daily visitor arrivals for the Emerald Lake Trail (1,043) and the percentage of overall visitation to the Bear Lake trailhead that these visitors represent (28%). This yields an estimate of 3,725 daily visitors to the Bear Lake trailhead between 8:00 a.m. and 4:00 p.m.

Notes

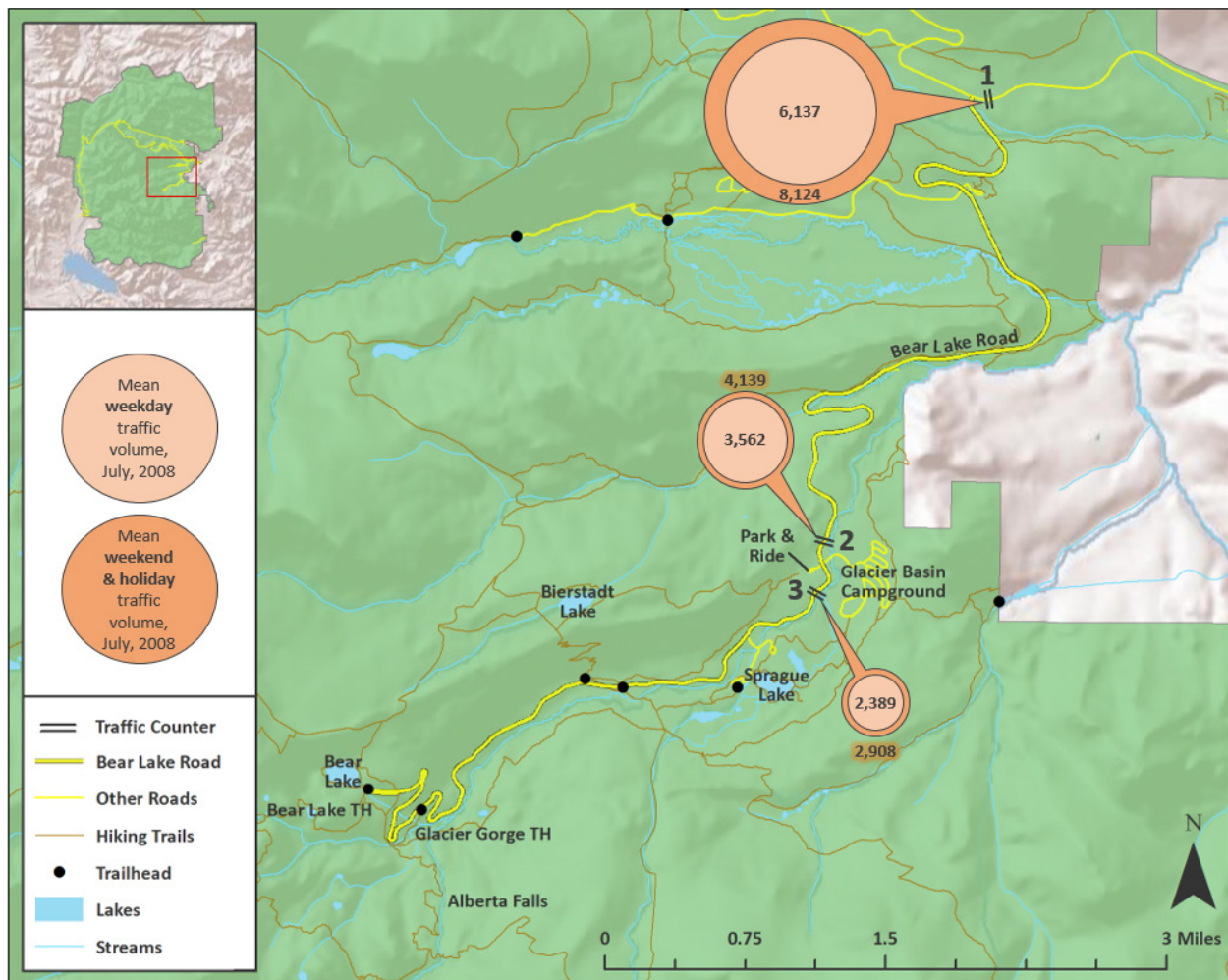
- Visitor volumes in July 2008 were collected by direct observations conducted between 8:00 a.m. and 4:00 p.m. on five days between July 14 and July 25.
- Differences in survey design and sampling procedures should be considered when comparing data from multiple studies.

References

Newman, P., Lawson, S., and Monz, C. (2010). **Integrated Approach to Transportation and Visitor Use Management at Rocky Mountain National Park**. RSG Inc., Colorado State University, and Utah State University.

D'Antonio, A., Monz, C., Lawson, S., Newman, P., Pettebone, D., and Courtemanch, A. (2010). **GPS-Based Measurements of Backcountry Visitors in Park and Protected Areas: Examples of Methods and Applications from Three Cases Studies**. *Journal of Park and Recreation Administration*. 28, pp. 42-60.

ITEM 24: Mean daily vehicle traffic volumes in Bear Lake Road corridor, summer 2008



TRAFFIC COUNTER LOCATION (# ON MAP)	DATA COLLECTION PERIOD	MEAN WEEKDAY TRAFFIC VOLUME	% OF BEAVER MEADOWS ENTRANCE VOLUME	MEAN WEEKEND & HOLIDAY TRAFFIC VOLUME	% OF BEAVER MEADOWS ENTRANCE VOLUME
Beaver Meadows Entrance (#1)	July 2008	6,137	100%	8,124	100%
Bear Lake Road, north of Park & Ride (#2)	July 2008	3,562	58%	4,139	51%
Bear Lake Road, south of Park & Ride (#3)	July 2008	2,389	39%	2,908	36%

Summary

- Mean daily vehicle traffic volumes on weekends and holidays were approximately 33% higher at Beaver Meadows Entrance, 17% higher at the traffic counter north of the Bear Lake Road Park-and-Ride, and 22% higher at the traffic counter south of the park-and-ride than on weekdays.
- The number of vehicles crossing the traffic counters on either side of the park-and-ride were lower, in percentage terms, on weekends and holidays than on weekdays. This suggests that weekend and holiday visitors were less likely to access the Bear Lake corridor via private vehicles than weekday visitors.

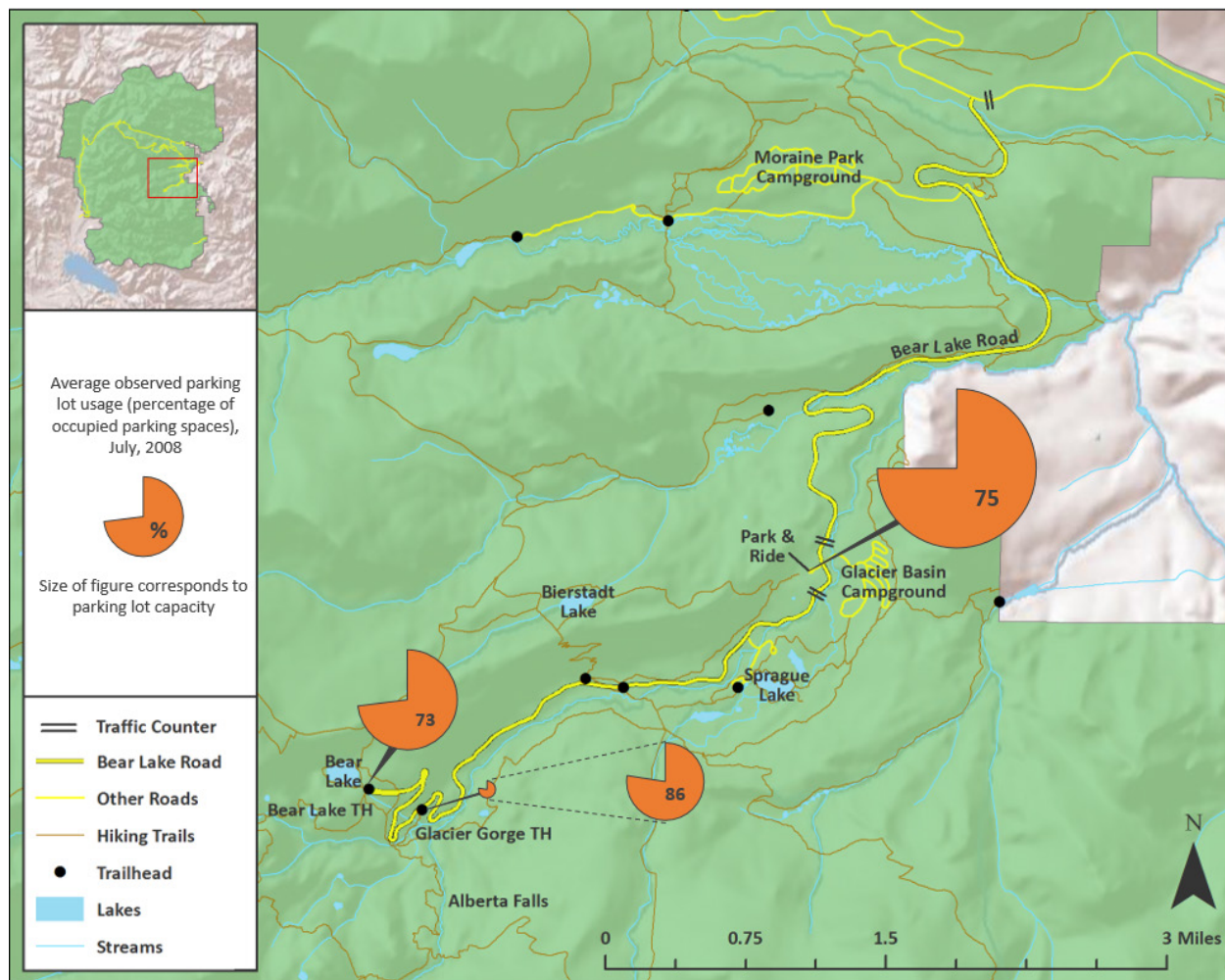
Notes

- Vehicle volumes were recorded 24 hours per day in 2008 between July 3 and July 17 using ATRs.

References

Newman, P., Lawson, S., and Monz, C. (2010). **Integrated Approach to Transportation and Visitor Use Management at Rocky Mountain National Park**. RSG Inc., Colorado State University, and Utah State University.

ITEM 25: Average parking lot usage, Bear Lake Road corridor, summer 2008



PARKING LOT	DATA COLLECTION PERIOD	PARKING CAPACITY	AVERAGE PARKING LOT USAGE (%)
Bear Lake Road Park & Ride	July 2008	350	75
Glacier Gorge trailhead	July 2008	40	86
Bear Lake trailhead	July 2008	245	73

Summary

- In July 2008, the average parking lot usage rates on data collection days between the hours of 7:00 a.m. and 4:00 p.m. for the Bear Lake Road Park-and-Ride lot, the Glacier Gorge trailhead parking lot, and the Bear Lake trailhead parking lot were 75%, 86%, and 73%, respectively.

Notes

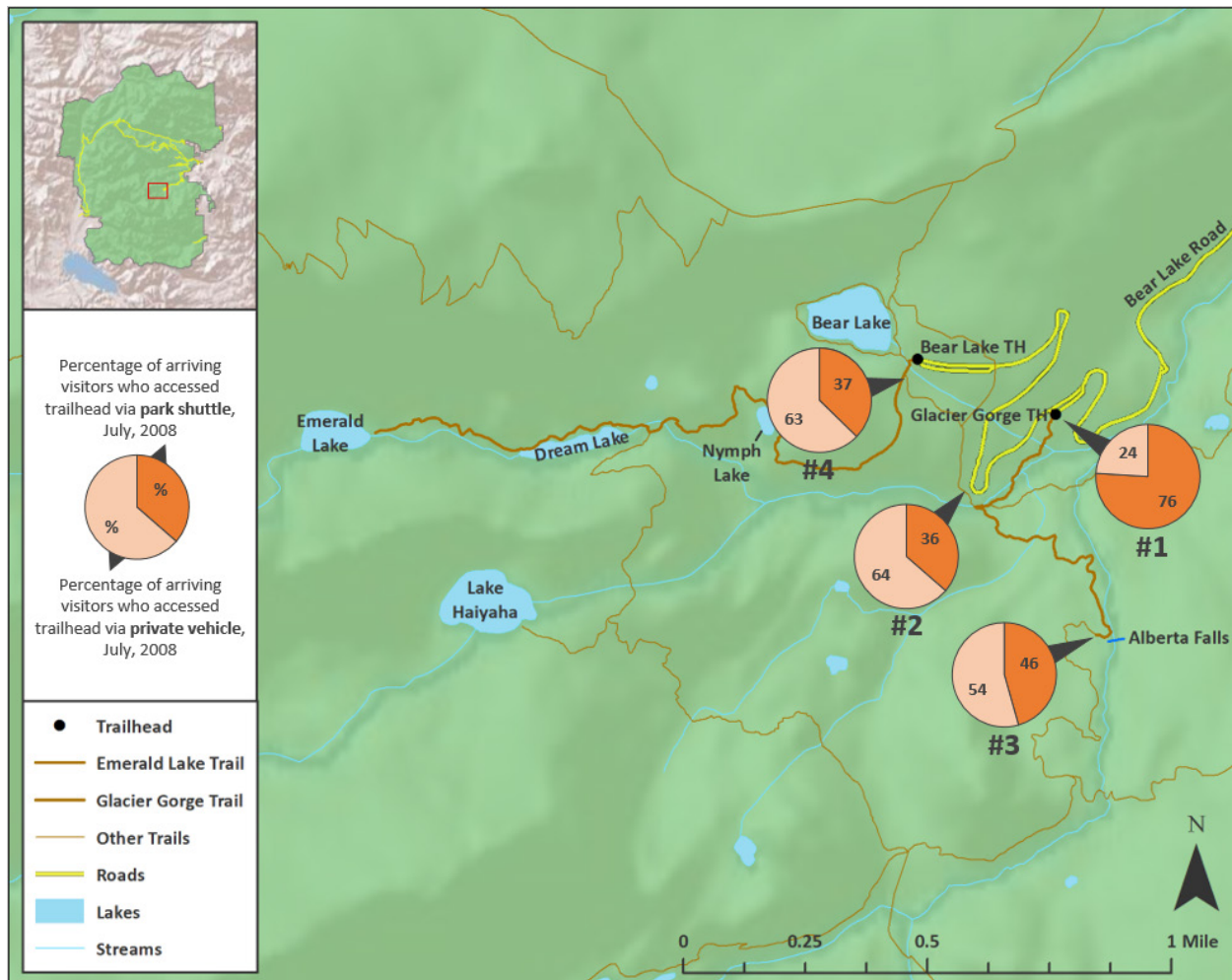
- The Bear Lake Road Park-and-Ride contains 300 striped parking spaces, but has adequate space for approximately 350 vehicles to park legally.

- Data collection included hourly counts of vehicles arriving to and departing from parking lots in 2008 between 7:00 a.m. and 4:00 p.m. on July 10 and July 12.

References

Newman, P., Lawson, S., and Monz, C. (2010). **Integrated Approach to Transportation and Visitor Use Management at Rocky Mountain National Park**. RSG Inc., Colorado State University, and Utah State University.

ITEM 26: Mode of travel to trailhead of arriving visitors to Glacier Gorge Trail and Emerald Lake Trail, July 2008



LOCATION (# ON MAP)	DATA COLLECTION PERIOD	PERCENTAGE ARRIVING BY PRIVATE VEHICLE	PERCENTAGE ARRIVING BY SHUTTLE BUS
Glacier Gorge trailhead (#1)	July 2008	24	76
Bear Lake connector (#2)	July 2008	64	36
Glacier Gorge Trail, southwest of Alberta Falls (visitors originating south of Alberta Falls) (#3)	July 2008	54	46
Emerald Lake Trail (#4)	July 2008	63	37

Summary

- Visitors to the Glacier Gorge trailhead are more likely to have arrived via a RMNP shuttle bus than visitors to the Bear Lake trailhead. This is likely influenced by the constrained nature of the Glacier Gorge trailhead parking lot (parking capacity of 40 vehicles) compared to the Bear Lake trailhead (parking capacity of 245 vehicles).

References

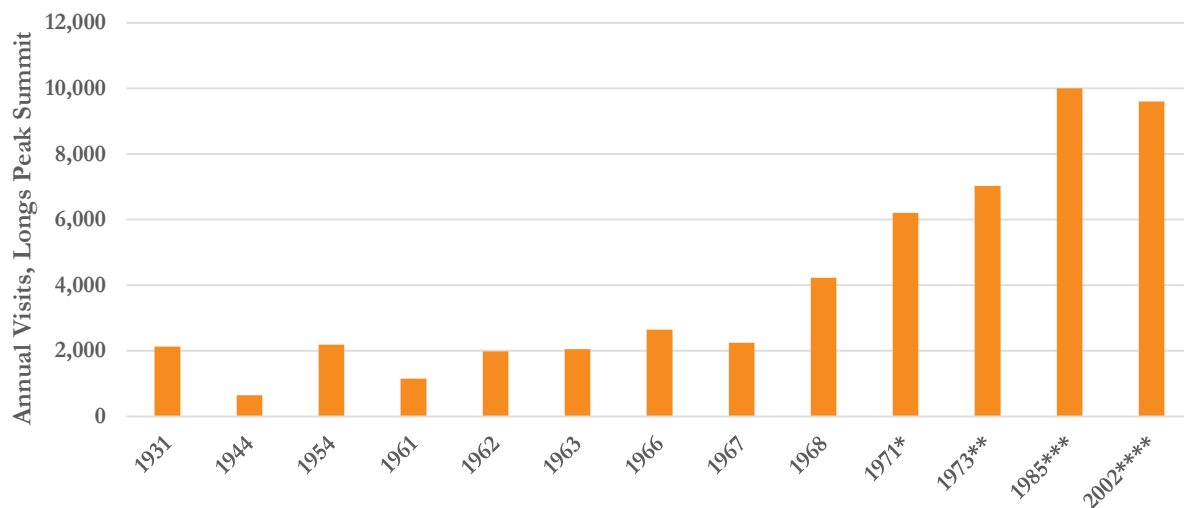
Newman, P., Lawson, S., and Monz, C. (2010). **Integrated Approach to Transportation and Visitor Use Management at Rocky Mountain National Park**. RSG Inc., Colorado State University, and Utah State University.

LONGS PEAK

Longs Peak is an iconic feature of RMNP. It is the only 14,000-foot peak within the boundaries of the park and is the northernmost 14,000-foot peak in Colorado. The Keyhole and Cables routes are historically popular routes, which have attracted the largest volumes of visitors. The following subsection presents and describes the relevant visitor use, transportation, and survey research data available for Longs Peak. Key highlights of data summarized for Longs Peak include the following:

- Estimated visitation to the summit of Longs Peak increased dramatically from the late 1960s through the 1980s.
- Trail counter data describe a distinctly different monthly pattern of visitor use at Longs Peak in 2011 than in 2012 and 2013.
- Observed visitor group encounter rates along the Longs Peak Trail (between the trailhead and Chasm Lake) in 2012 were dramatically higher on weekends than on weekdays.
- After declining steadily in the early 2000s, annual vehicle volume on the road to Longs Peak has increased steadily since 2006.

ITEM 27: Visitation to the summit of Longs Peak, 1931–2002



Summary

- Estimated visitation to the summit of Longs Peak increased dramatically from the late 1960s through the 1980s.
- In 2002, approximately 9,600 visitors reached the Longs Peak summit via the Keyhole Route. This number does not include visitors who arrived to the summit via other technical and nontechnical routes.
- In 2002, between July and October, approximately 92 visitors per day reached the summit of Longs Peak.

Notes

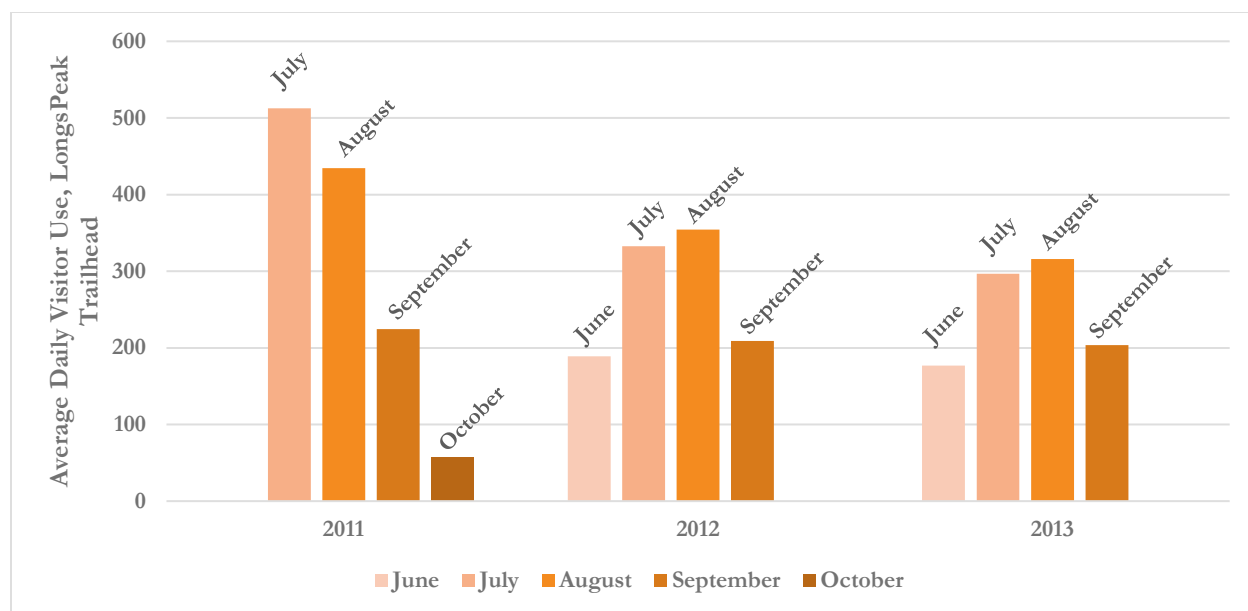
- *The estimate for the year 1971 includes only the Keyhole and Cables routes.
- **The cables were removed from Cables route in 1973.
- ***Alexander, 2010 reports visitation as an estimated 10,000 visitors in the mid-1980s.
- ****The volume of visitors reaching the summit of Longs Peak via the Keyhole Route in 2002 was recorded using infrared trail counters.

References

Alexander, R., and Moore, C. (2010). **People and Nature on the Mountaintop: A Resource and Impact Study of Longs Peak in Rocky Mountain National Park**. Rocky Mountain Cooperative Ecosystem Studies Unit, Rocky Mountain National Park, and Colorado State University.

Bates, M., Wallace, G., and Vaske, J. (2006). **Visitor Use in Wilderness Phase II: Estimating Visitor Use in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

ITEM 28: Average daily visitor use, Longs Peak trailhead, 2011–2013



Summary

- Trail counter data describe a distinctly different monthly pattern of visitor use at Longs Peak in 2011 than in 2012 and 2013.
- In the summer of 2012, the Longs Peak trailhead experienced an average daily visitor use volume of approximately 270 visitors per day.

Notes

- Data are not available for June 2011, October 2012, and October 2013.
- Data were collected via infrared trail counters.
- See preceding notes on historical events affecting patterns and volumes of visitor use.

References

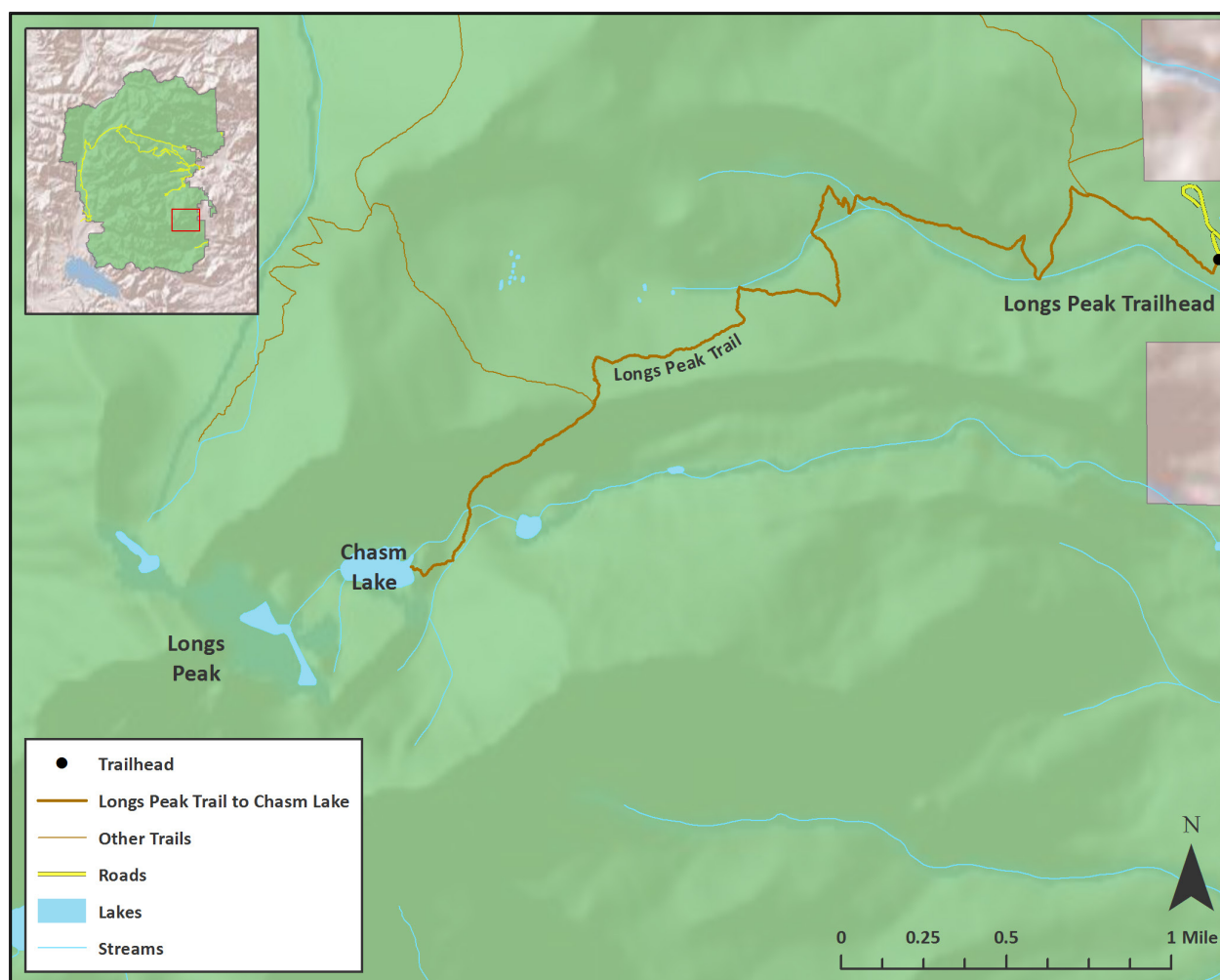
Bates, M., Wallace, G., and Vaske, J. (2006). **Visitor Use in Wilderness Phase II: Estimating Visitor Use in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

Pettebone, D. (2011). **Rocky Mountain National Park: State of the Wilderness Report 2011**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2012). **Rocky Mountain National Park: State of the Wilderness Report 2012**. Rocky Mountain National Park: Estes Park, CO.

Pettebone, D. (2013). **Rocky Mountain National Park: State of the Wilderness Report 2013**. Rocky Mountain National Park: Estes Park, CO.

ITEM 29: Visitor group encounter rates, Longs Peak Trail to Chasm Lake, 2012 and 2014



TIME OF WEEK	GROUP ENCOUNTERS PER HOUR (2012)	GROUP ENCOUNTERS PER HOUR (2014)
Weekday	8.2	14.7
Weekend	22.0	--

Summary

- Observed visitor group encounter rates on weekdays along the Longs Peak Trail (between the trailhead and Chasm Lake) were significantly higher in 2014 than in 2012.
- Observed visitor group encounter rates along the Longs Peak Trail (between the trailhead and Chasm Lake) in 2012 were dramatically higher on weekends than on weekdays.

Notes

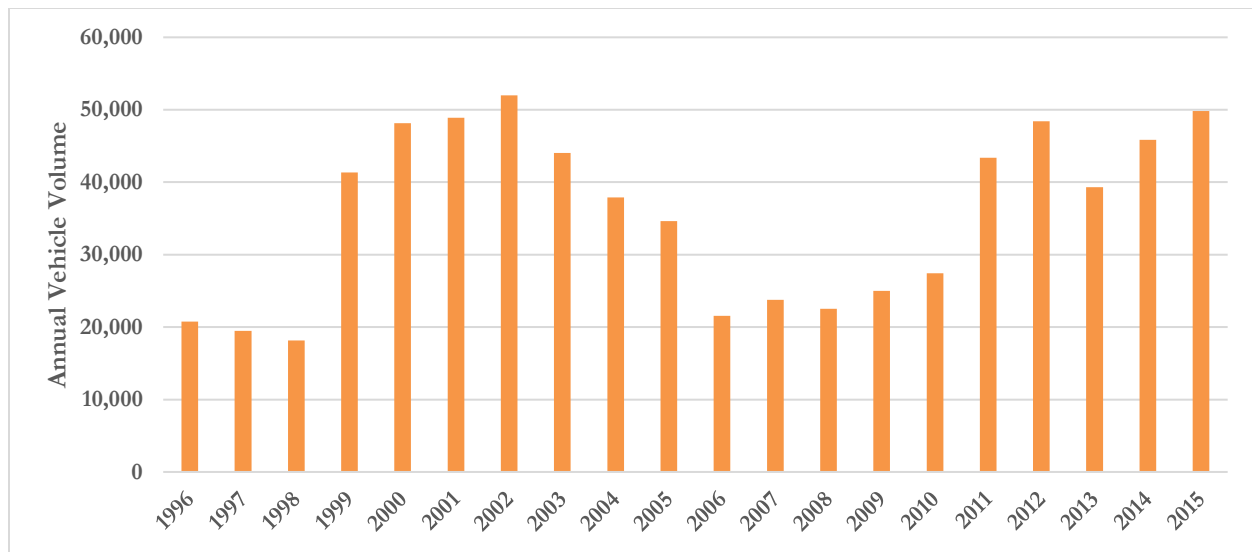
- Weekday wilderness encounters monitoring observations were performed in 2012 on June 15 and June 18, and in 2014 on July 10 and July 21. Visitation of RMNP is typically higher in July than in June (see Item 2), which likely influenced differences observed in visitor group encounter rates between 2012 and 2014.

- Weekend wilderness encounters monitoring observations were performed in 2012 on August 18 and August 25. Weekday wilderness encounters monitoring observations were performed in 2012 on June 15 and June 18. Visitation of RMNP is typically slightly higher in August than in June, which likely influenced differences in observed visitor group encounter rates on weekends and weekdays in 2012.
- Wilderness encounters monitoring observations were started in 2012 between 7:00 a.m. and 8:00 a.m., and in 2014 between 9:45 a.m. and 10:00 a.m. Differences in time of day during which observations were collected likely influenced differences in observed visitor group encounter rates between 2012 and 2014.
- Insufficient encounter data existed to develop an average intergroup encounter rate for weekends in 2014.

References

- Wilderness encounters data provided by RMNP.

ITEM 30: Annual vehicle volume, Longs Peak Road, 1996–2015



Summary

- After declining steadily in the early 2000s, annual vehicle volume on the road to Longs Peak has increased steadily since 2006.

Notes

- See preceding notes on historical events affecting patterns and volumes of visitor use.

References

- Public Use Statistics Office, National Park Service. **Rocky Mountain NP Traffic Counts by Location.**

5.4 | VISITORS AND VISITS

Many of the visitor, visitor use, recreation ecology, and transportation studies presented in Section 4 of this report include data describing characteristics of visitors and their visits. The following subsection compiles these data, as appropriate. These data support the trend of increasing day use of RMNP suggested within the preceding visitation data analysis. In addition to this specific trend, key findings from the compilation of study data included:

- From data available through 2011, most visitors to RMNP in winter months were residents of Colorado, while most visitors to RMNP in summer months were residents of other states.
- Survey data suggest that first-time and infrequent visitors have accounted for a greater proportion of summer visitation in 2010 than in 1994 or 2002.
- Most park users are day users.
- Responses to park-wide surveys suggest that the average length of stay for visitors in RMNP declined between 1994 and 2011 from just over three nights to just under two nights.
- Nearly half of visitors to Alberta Falls traveled off trail, while approximately one-fifth of visitors to backcountry and Wilderness areas in RMNP traveled off trail.
- Viewing scenery and hiking have been the most common visitor activities in RMNP regardless of season or area of visit.

ITEM 31: Percentage of visitors who reside in Colorado

SAMPLING PERIOD	SURVEY POPULATION	% COLORADO RESIDENTS	% NON-COLORADO RESIDENTS
Summer 1969	Visitors to RMNP backcountry and Wilderness areas	17	83
Summer 1974	Visitors to RMNP backcountry and Wilderness areas	33	66
Summer 1981	Visitors to Longs Peak trailhead	41	59
All Year 1994	Park-wide	38	62
Summer 2002	Visitors to RMNP backcountry and Wilderness areas	60	40
Summer 2008	Bear Lake Road corridor	31	69
Summer 2010	Park-wide	23	77
Winter 2011	Park-wide	76	24

Summary

- From data available through 2011, most visitors to RMNP in winter months were residents of Colorado, while most visitors to RMNP in summer months were residents of other states.
- Data suggest that the percentage of visitors to RMNP's backcountry and Wilderness areas who are Colorado residents has increased steadily since the late 1960s.

Notes

- Differences in survey design and sampling procedures should be considered when comparing data from multiple studies.

References

Brickler, Stanley K. (1969). **Park Visitor Classification Matrix**. Colorado State University: Fort Collins, CO.

Fazio, James R. (1974). **A mandatory permit system and interpretation for backcountry user control in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

Henderson, S. (1983). **Decision Making Information for a Carrying Capacity Based Management System: A Case Study of Day Users on Longs Peak, Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

- Valdez, S. (1995). **Rocky Mountain National Park Visitor Use Survey: 1994-1995**. Socio-economic Studies Division, National Park Service: Denver, CO.
- Wallace, George N., Brooks, J., and Bates, M. (2004). **A Survey of Day and Overnight Backcountry Wilderness Visitors in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.
- Newman, P., Lawson, S., and Monz, C. (2010). **Integrated Approach to Transportation and Visitor Use Management at Rocky Mountain National Park**. RSG Inc., Colorado State University, and Utah State University.
- Blotkamp, A., Boyd, W., Eury, D., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Summer 2010**. National Park Service: Fort Collins, CO.
- Papadogionnaki, E., Le, Y., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Winter 2011**. National Park Service: Fort Collins, CO.

ITEM 32: Prior visits to Rocky Mountain National Park

SAMPLING PERIOD	SURVEY POPULATION	% PREVIOUSLY VISITED IN LIFETIME	% THAT VISITED IN PREVIOUS 12 MONTHS	% WITH 5+ PREVIOUS VISITS IN LIFETIME	% WITH 5+ VISITS IN PREVIOUS 12 MONTHS
All Year 1994	Park-wide	--	45	--	--
Summer 2002	Visitors to RMNP backcountry and Wilderness areas	78	47	47	19
Summer 2002	Visitors to RMNP frontcountry areas	82	48	52	19
Summer 2010	Park-wide	61	25	32	7
Winter 2011	Park-wide	--	73	66	39

Summary

- Survey data suggest that first-time and infrequent visitors have accounted for a greater proportion of summer visitation in 2010 than in 1994 or 2002.
- Survey data from 2002 indicate that visitors to frontcountry, Wilderness, and backcountry areas of RMNP visited with similar frequency.
- Survey data from 2010 and 2011 indicate that visitors to RMNP in the winter were far more likely to have made prior visits to the park than visitors to RMNP in the summer.

Notes

- Data presented in the Wallace, 2004 survey of visitors to frontcountry, backcountry, and Wilderness areas of RMNP indicate that a portion of respondents may not have understood the question regarding past visits to RMNP.
- Differences in survey design and sampling procedures should be considered when comparing data from multiple studies.

References

- Valdez, S. (1995). **Rocky Mountain National Park Visitor Use Survey: 1994-1995**. Socio-economic Studies Division, National Park Service: Denver, CO.
- Wallace, G., Brooks, J., and Bates, M. (2004). **A Survey of Day and Overnight Backcountry Wilderness Visitors in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.
- Blotkamp, A., Boyd, W., Eury, D., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Summer 2010**. National Park Service: Fort Collins, CO.
- Papadogiannaki, E., Le, Y., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Winter 2011**. National Park Service: Fort Collins, CO.

ITEM 33: Day and overnight visitation

SAMPLING PERIOD	SURVEY POPULATION	% OVERNIGHT VISITORS	% DAY USE VISITORS
Summer 2002	Visitors to RMNP backcountry and Wilderness areas	24%	76%
Summer 2010	Park-wide	10%	90%
Winter 2011	Park-wide	2%	98%

Summary

- Most park users are day users.

Notes

- Differences in survey design and sampling procedures should be considered when comparing data from multiple studies.

References

Wallace, G., Brooks, J., and Bates, M. (2004). **A Survey of Day and Overnight Backcountry Wilderness Visitors in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

Blotkamp, A., Boyd, W., Eury, D., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Summer 2010**. National Park Service: Fort Collins, CO.

Papadogionnaki, E., Le, Y., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Winter 2011**. National Park Service: Fort Collins, CO.

ITEM 34: Length of stay in Rocky Mountain National Park

SAMPLING PERIOD	SURVEY POPULATION	MEAN LENGTH OF STAY IN RMNP—ALL VISITORS	MEAN LENGTH OF STAY IN RMNP—OVERNIGHT VISITORS
All Year 1994	Park-wide	3.3 nights	--
Summer 2002	Visitors to RMNP backcountry and Wilderness areas*	--	1.9 nights
Summer 2010	Park-wide	1.6 days	4.0 days
Winter 2011	Park-wide	1.6 days	3.3 days

Summary

- Responses to park-wide surveys suggest that the average length of stay of visitors to RMNP declined between 1994 and 2011.
- Visitors to RMNP in the winter have considerably shorter stays than visitors in the summer.

Notes

- *Data represent only time spent within backcountry and Wilderness areas, not all time spent in RMNP.
- Differences in survey design and sampling procedures should be considered when comparing data from multiple studies.

References

- Valdez, S. (1995). **Rocky Mountain National Park Visitor Use Survey: 1994-1995**. Socio-economic Studies Division, National Park Service: Denver, CO.
- Wallace, G., Brooks, J., and Bates, M. (2004). **A Survey of Day and Overnight Backcountry Wilderness Visitors in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.
- Blotkamp, A., Boyd, W., Eury, D., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Summer 2010**. National Park Service: Fort Collins, CO.
- Papadogionnaki, E., Le, Y., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Winter 2011**. National Park Service: Fort Collins, CO.

ITEM 35: Off-trail visitor activity

SAMPLING PERIOD	POPULATION	% OF VISITORS HIKING OFF TRAIL
Summer 2002	Visitors to RMNP backcountry and Wilderness areas	20
Summer 2008	Visitors to Alberta Falls	49
Summer 2009	Visitors to Alberta Falls	46

Summary

- Nearly half of visitors to Alberta Falls traveled off trail, while approximately one-fifth of visitors to backcountry and Wilderness areas in RMNP traveled off trail.
- Of visitors traveling off trail in backcountry and Wilderness areas in 2002, 47% reported that they traveled off trail only once, while 42% reported that they traveled off trail two or three times.

Notes

- Differences in survey design and sampling procedures should be considered when comparing data from multiple studies.

References

Wallace, G., Brooks, J., and Bates, M. (2004). **A Survey of Day and Overnight Backcountry Wilderness Visitors in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.

Newman, P., Lawson, S., and Monz, C. (2010). **Integrated Approach to Transportation and Visitor Use Management at Rocky Mountain National Park**. RSG Inc., Colorado State University, and Utah State University.

D'Antonio, A., Monz, C., Lawson, S., Newman, P., Pettebone, D., and Courtemanch, A. (2010). **GPS-Based Measurements of Backcountry Visitors in Park and Protected Areas: Examples of Methods and Applications from Three Cases Studies**. *Journal of Park and Recreation Administration*. 28, pp. 42-60.

ITEM 36: Most frequently reported visitor activities

SAMPLING PERIOD	SURVEY POPULATION	TOP FIVE MOST FREQUENTLY REPORTED VISITOR ACTIVITIES (% OF RESPONDENTS PARTICIPATING)
All Year 1994	Park-wide	Scenery (73%), Photography (49%), Hike (48%), Drive Trail Ridge Road (29%), Birdwatch (17%)
Summer 2002	Visitors to RMNP backcountry and Wilderness areas	Hiking (95%), Photography (64%), Nature Study (41%), Picnicking (31%), Backcountry/Wilderness Camping (20%)
Summer 2010	Park-wide	Viewing Scenery (93%), Driving Trail Ridge Road (75%), Wildlife Viewing/Bird Watching (73%), Day Hiking (57%)
Winter 2011	Park-wide	Viewing Scenery (66%), Wildlife Viewing/Bird Watching (45%), Snowshoeing (42%), Driving Bear Lake Road (28%), Day Hiking (23%)

Summary

- “Scenery” or “viewing scenery” was the most frequently reported visitor activity of visitors to RMNP in 1994, in the summer of 2010, and in the winter of 2011. “Scenery” or “viewing scenery” was not provided as a response option in the 2002 survey of visitors to RMNP backcountry and Wilderness areas.
- Of visitors to RMNP in the summer of 2010, 57% reported day hiking in the park, compared to 48% of visitors in 1994 and 23% of visitors in the winter of 2011.

Notes

- Differences in survey design and sampling procedures should be considered when comparing data from multiple studies.

References

- Valdez, S. (1995). **Rocky Mountain National Park Visitor Use Survey: 1994-1995**. Socio-economic Studies Division, National Park Service: Denver, CO.
- Wallace, G., Brooks, J., and Bates, M. (2004). **A Survey of Day and Overnight Backcountry Wilderness Visitors in Rocky Mountain National Park**. Colorado State University: Fort Collins, CO.
- Blotkamp, A., Boyd, W., Eury, D., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Summer 2010**. National Park Service: Fort Collins, CO.
- Papadogionnaki, E., Le, Y., Hollenhurst, S. (2011). **Rocky Mountain National Park Visitor Study: Winter 2011**. National Park Service: Fort Collins, CO.

6.0 SOCIOECONOMIC TRENDS

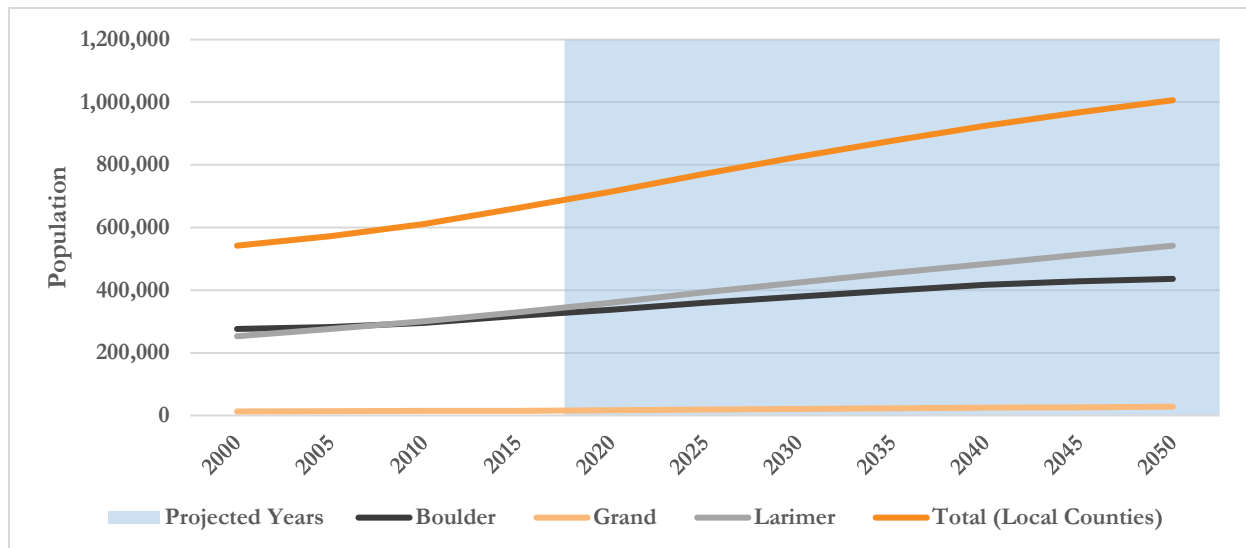
The following section presents data and trends on local and regional population projects, economic development, outdoor recreation activities, and the economic impacts of RMNP visitation and regional outdoor recreation.

6.1 | POPULATION PROJECTIONS

Population projections are presented for two areas: the local area and the regional area. The local area includes Boulder, Grand, and Larimer counties, which are the three counties that contain parts of RMNP. The regional area includes the 14 counties within 50 miles of RMNP, excluding the three counties included in the local area. Population projections suggest a dramatically increasing area population (52%–60% increase) between now and 2050, with the Hispanic population projected to grow at a greater rate than other racial or ethnic groups. Highlights from local and regional population projections include the following:

- Population projections from the Colorado Department of Local Affairs predict a rise in population of local counties (Boulder, Grand, and Larimer) of over 340,000 people by 2050, an increase of approximately 52%.
- Population projections predict a rise in population of regional counties (i.e., counties within 50 miles of RMNP) of over 2.3 million people by 2050. This would be an increase of approximately 60% of the existing regional population.
- Residents between the ages of 18 and 34 and residents between the ages of 35 and 54 are the two largest cohorts now living in local counties (Boulder, Grand, and Larimer), and are projected to remain the largest age cohorts in 2050.
- Residents between the ages of 18 and 34 and residents between the ages of 35 and 54 are the two largest age cohorts now living in counties within 50 miles of RMNP. In 2050, residents under the age of 18 and residents between the ages of 35 and 54 are projected to be the two largest age cohorts in the region.
- The number of Hispanic and Asian residents of local counties is projected to more than double between 2015 and 2050, with whites, Hispanics, and Asians expected to represent 69%, 22%, and 7% of the population, respectively, in 2050.
- The percent of regional residents who identify as white is projected to decrease from 68% to 52% between 2015 and 2050, while the percent of regional residents who identify as Hispanic is projected to increase from 23% to 36% between 2015 and 2050.

ITEM 37: Population projections for local counties, 2000–2050



PROJECTED POPULATION (LOCAL COUNTIES)						
COUNTY	2015	2020	2030	2040	2050	% CHANGE 2015–2050
Boulder	317,814	337,897	379,714	416,942	436,166	37.2%
Grand	14,847	16,544	20,809	24,731	28,249	90.3%
Larimer	329,559	360,434	424,882	483,322	542,039	64.5%
Total, Local Counties	662,220	714,876	825,405	924,995	1,006,454	52.0%

Summary

- Population projections from the Colorado Department of Local Affairs predict a rise in population of local counties (Boulder, Grand, and Larimer) of over 340,000 people by 2050, an increase of approximately 52%.
- Most of the projected increase is expected to occur in Larimer and Boulder Counties. The Larimer County population is projected to increase by 212,480 people (64.5% increase), which represents approximately 62% of the overall projected increase in population in the three counties combined.

Notes

- Local counties include Boulder, Grand, and Larimer counties.
- Projections were performed by the Colorado State Demography Office using data from the 2010 Census.

References

Colorado State Demography Office. (2015). **Population Forecasts: Years 2000 to 2050**. Colorado State Demography Office: Denver, CO.

ITEM 38: Population projections for regional counties, 2000–2050



PROJECTED POPULATION (REGION)						
COUNTY	2015	2020	2030	2040	2050	% CHANGE 2015–2050
Adams	490,066	545,237	665,364	787,411	893,563	82.3%
Arapahoe	628,323	687,520	810,672	935,138	1,016,184	61.7%
Broomfield	63,423	72,388	92,051	95,453	95,658	50.8%
Clear Creek	9,125	9,627	12,088	14,344	16,419	79.9%
Denver	677,861	734,079	804,797	867,545	922,512	36.1%
Douglas	319,920	352,955	425,395	482,079	494,181	54.5%
Eagle	53,303	57,226	74,776	94,085	107,312	101.3%
Gilpin	5,875	6,054	6,286	6,699	6,944	18.2%
Jackson	1,405	1,483	1,579	1,673	1,692	20.4%
Jefferson	565,106	595,849	652,326	686,319	700,173	23.9%
Park	16,865	20,339	28,101	32,176	32,928	95.2%
Routt	24,443	27,060	34,488	42,905	50,764	107.7%
Summit	29,777	33,366	42,197	49,704	56,606	90.1%

PROJECTED POPULATION (REGION)						
COUNTY	2015	2020	2030	2040	2050	% CHANGE 2015–2050
Weld	286,576	340,265	466,717	605,605	738,396	157.7%
Total, Other Regional Counties (Nonlocal)	3,172,068	3,483,449	4,116,838	4,701,136	5,133,333	61.8%
Total, Local Counties	662,220	714,876	825,405	924,995	1,006,454	52.0%
Total, Region	3,834,287	4,198,325	4,942,243	5,626,132	6,139,786	60.1%

Summary

- Population projections from the Colorado Department of Local Affairs predict a rise in population of regional counties (i.e., counties within 50 miles of RMNP) of over 2.3 million people by 2050. This would be an increase of approximately 60% of the existing regional population.
- Outside of local counties, the largest projected increases in population are predicted to occur in Weld County (approximately 450,000 new residents), Adams County (approximately 400,000 new residents), Arapahoe County (approximately 390,000 new residents), and Denver County (approximately 245,000 new residents).

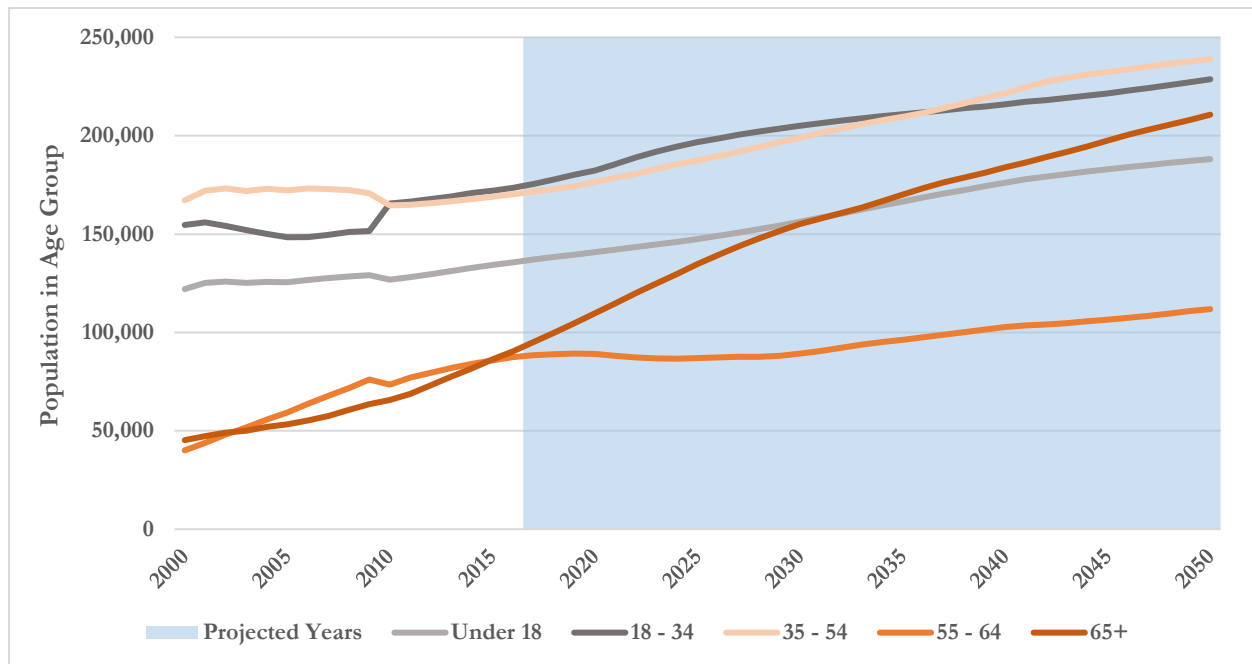
Notes

- Regional counties are defined as counties with a 50-mile radius of RMNP, excluding local counties.
- Projections were performed by the Colorado State Demography Office using data from the 2010 Census.

References

Colorado State Demography Office. (2015). **Population Forecasts: Years 2000 to 2050**. Colorado State Demography Office: Denver, CO.

ITEM 39: Age group projections for local counties, 2000–2050



PROJECTED POPULATION BY AGE GROUP (LOCAL COUNTIES)						
AGE GROUP	2015	2020	2030	2040	2050	% CHANGE 2015–2050
Under 18	134,317	140,746	156,297	176,076	188,085	40.0%
18–34	172,054	182,360	205,056	216,017	228,684	32.9%
35–54	168,874	176,368	198,954	221,476	238,900	41.5%
55–64	85,859	89,027	89,227	102,707	111,854	30.3%
65+	86,268	109,829	155,060	183,986	210,680	144.2%

PROJECTED PERCENT OF POPULATION BY AGE GROUP (LOCAL COUNTIES)						
AGE GROUP	2015	2020	2030	2040	2050	CHANGE 2015–2050
Under 18	20.7%	20.2%	19.4%	19.6%	19.2%	-1.5%
18–34	26.6%	26.1%	25.5%	24.0%	23.4%	-3.2%
35–54	26.1%	25.3%	24.7%	24.6%	24.4%	-1.7%
55–64	13.3%	12.7%	11.1%	11.4%	11.4%	-1.8%
65+	13.3%	15.7%	19.3%	20.4%	21.5%	8.2%

Summary

- Residents between the ages of 18 and 34 and residents between the ages of 35 and 54 are the two largest age cohorts now living in local counties (Boulder, Grand, and Larimer), and are projected to remain the largest age cohorts in 2050.
- The number of residents under the age of 34 in local counties are projected to increase by approximately 36% between 2016 and 2040.
- The number of residents over the age of 65 in local counties is projected to increase dramatically from approximately 86,000 residents to approximately 211,000 residents between 2015 and 2050.

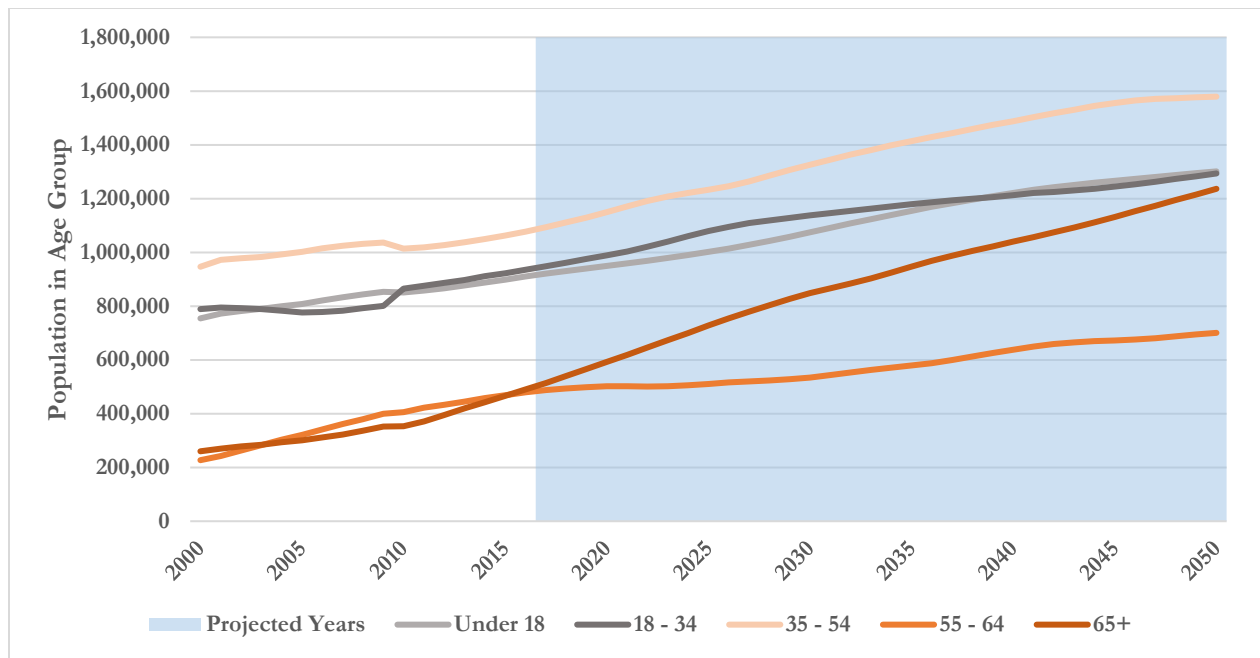
Notes

- Local counties include Boulder, Grand, and Larimer counties.
- Projections were performed by the Colorado State Demography Office using data from the 2010 Census.

References

Colorado State Demography Office. (2015). **Population by Single Year of Age—County**. Colorado State Demography Office: Denver, CO.

ITEM 40: Age group projections for regional counties, 2000–2050



PROJECTED POPULATION BY AGE GROUP (REGION)						
AGE GROUP	2015	2020	2030	2040	2050	% CHANGE 2015–2050
Under 18	898,613	949,816	1,075,156	1,221,340	1,301,329	44.8%
18–34	922,549	988,393	1,137,644	1,213,153	1,293,626	40.2%
35–54	1,062,665	1,149,220	1,325,727	1,488,232	1,579,374	48.6%
55–64	469,296	501,801	534,737	638,174	700,689	49.3%
65+	466,302	592,536	848,155	1,040,487	1,236,505	165.2%

PROJECTED PERCENT OF POPULATION BY AGE GROUP (REGION)						
AGE GROUP	2015	2020	2030	2040	2050	CHANGE 2015–2050
Under 18	23.5%	22.7%	21.8%	21.8%	21.3%	-2.2%
18–34	24.2%	23.6%	23.1%	21.7%	21.2%	-3.0%
35–54	27.8%	27.5%	26.9%	26.6%	25.8%	-2.0%
55–64	12.3%	12.0%	10.9%	11.4%	11.5%	-0.8%
65+	12.2%	14.2%	17.2%	18.6%	20.2%	8.0%

Summary

- Residents between the ages of 18 and 34 and residents between the ages of 35 and 54 are the two largest age cohorts now living in counties within 50 miles of RMNP. In 2050, residents under the age of 18 and residents between the ages of 35 and 54 are projected to be the two largest age cohorts in the region.
- The number of residents over the age of 65 in regional counties is projected to increase dramatically, from approximately 466,000 residents to over 1.2 million residents, between 2015 and 2050.

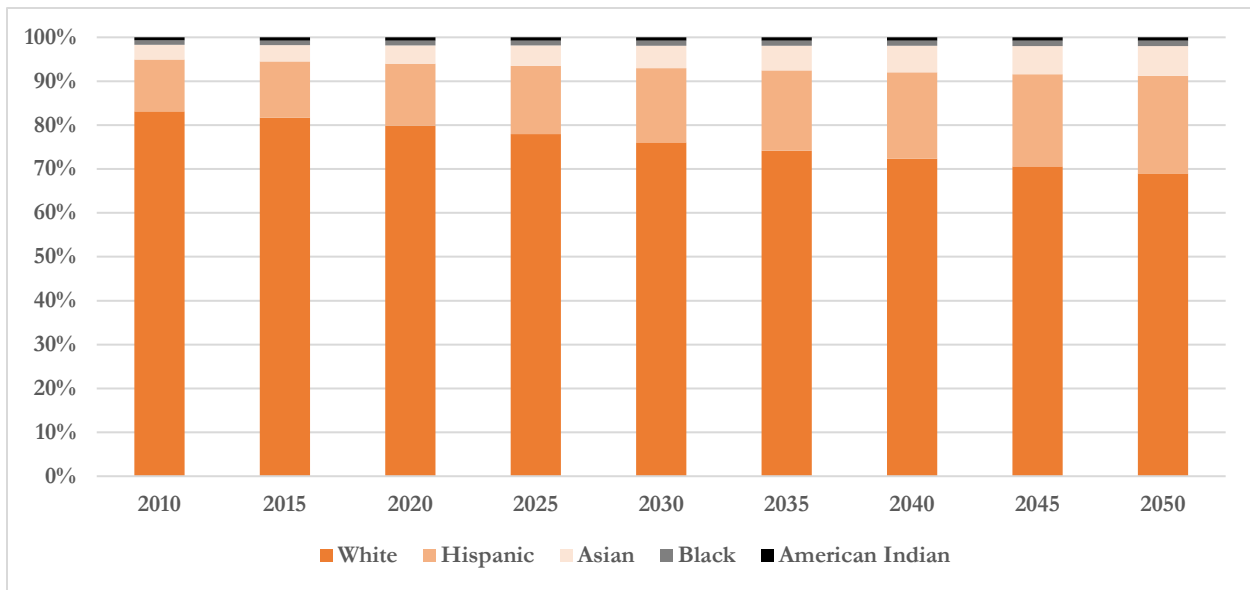
Notes

- Regional counties are defined as counties with a 50-mile radius of RMNP, excluding local counties.
- Projections were performed by the Colorado State Demography Office using data from the 2010 Census.

References

Colorado State Demography Office. (2015). **Population by Single Year of Age–County**. Colorado State Demography Office: Denver, CO.

ITEM 41: Racial and ethnic group population projections for local counties, 2010–2050



PROJECTED POPULATION BY RACIAL OR ETHNIC GROUP (LOCAL COUNTIES)						
GROUP	2015	2020	2030	2040	2050	% CHANGE 2015–2050
White	540,638	570,942	627,924	668,876	693,974	28.4%
Hispanic	85,207	101,015	139,615	182,357	224,320	163.3%
Asian	24,634	29,955	42,314	55,824	68,248	177.0%
Black	6,980	7,719	9,306	10,862	12,249	75.5%
American Indian	4,761	5,244	6,246	7,077	7,663	61.0%

PROJECTED PERCENT OF POPULATION BY RACIAL OR ETHNIC GROUP (LOCAL COUNTIES)						
GROUP	2015	2020	2030	2040	2050	CHANGE 2015–2050
White	81.6%	79.9%	76.1%	72.3%	69.0%	-12.7%
Hispanic	12.9%	14.1%	16.9%	19.7%	22.3%	9.4%
Asian	3.7%	4.2%	5.1%	6.0%	6.8%	3.1%
Black	1.1%	1.1%	1.1%	1.2%	1.2%	0.2%
American Indian	0.7%	0.7%	0.8%	0.8%	0.8%	0.1%

Summary

- The number of Hispanic and Asian residents of local counties (Boulder, Grand, and Larimer) is projected to more than double between 2015 and 2050, with whites, Hispanics, and Asians expected to represent 69%, 22%, and 7% of the population, respectively.

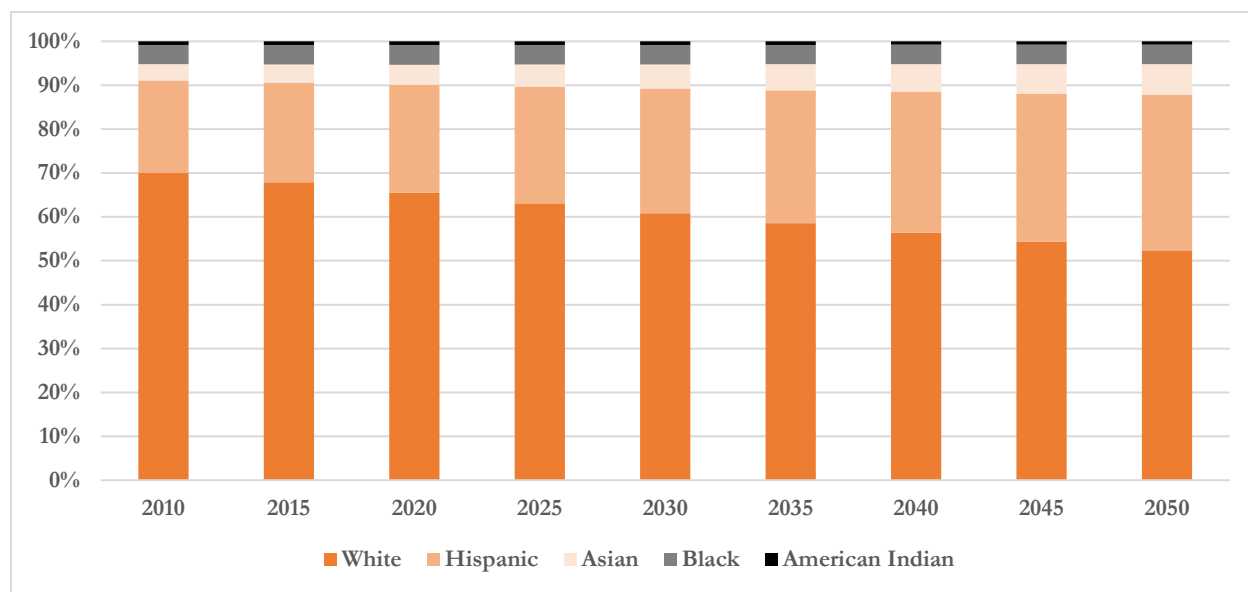
Notes

- Local counties include Boulder, Grand, and Larimer counties.
- Projections were performed by the Colorado State Demography Office using data from the 2010 Census.

References

Colorado State Demography Office. (2015). **Race by Age Forecast—County**. Colorado State Demography Office: Denver, CO.

ITEM 42: Racial and ethnic group population projections for regional counties, 2010–2050



PROJECTED POPULATION BY RACIAL OR ETHNIC GROUP (REGION)						
GROUP	2015	2020	2030	2040	2050	% CHANGE 2015–2050
White	2,602,641	2,748,506	3,004,763	3,170,318	3,215,317	23.5%
Hispanic	870,891	1,033,226	1,404,786	1,805,664	2,177,987	150.1%
Asian	158,350	193,629	272,911	357,366	428,999	170.9%
Black	171,398	188,916	220,022	248,583	270,934	58.1%
American Indian	31,006	34,047	39,760	44,199	46,548	50.1%

PROJECTED PERCENT OF POPULATION BY RACIAL OR ETHNIC GROUP (REGION)						
GROUP	2015	2020	2030	2040	2050	CHANGE 2015–2050
White	67.9%	65.5%	60.8%	56.3%	52.4%	-15.5%
Hispanic	22.7%	24.6%	28.4%	32.1%	35.5%	12.8%
Asian	4.1%	4.6%	5.5%	6.4%	7.0%	2.9%
Black	4.5%	4.5%	4.5%	4.4%	4.4%	-0.1%
American Indian	0.8%	0.8%	0.8%	0.8%	0.8%	-0.1%

Summary

- The percent of regional residents who identify as white is projected to decrease from 68% to 52% between 2015 and 2050.
- The percent of regional residents who identify as Hispanic is projected to increase from 23% to 36% between 2015 and 2050.

Notes

- Regional counties are defined as counties with a 50-mile radius of RMNP, excluding local counties.
- Projections were performed by the Colorado State Demography Office using data from the 2010 Census.

References

Colorado State Demography Office. (2015). **Race by Age Forecast—County**. Colorado State Demography Office: Denver, CO.

6.2 | ECONOMIC TRENDS

Economic trends presented in the following subsection are based on Colorado State Department of Local Affairs State Planning Regions and the local and regional county areas described in the preceding population projection subsection. The three State Planning Regions for which trends are presented include the following:

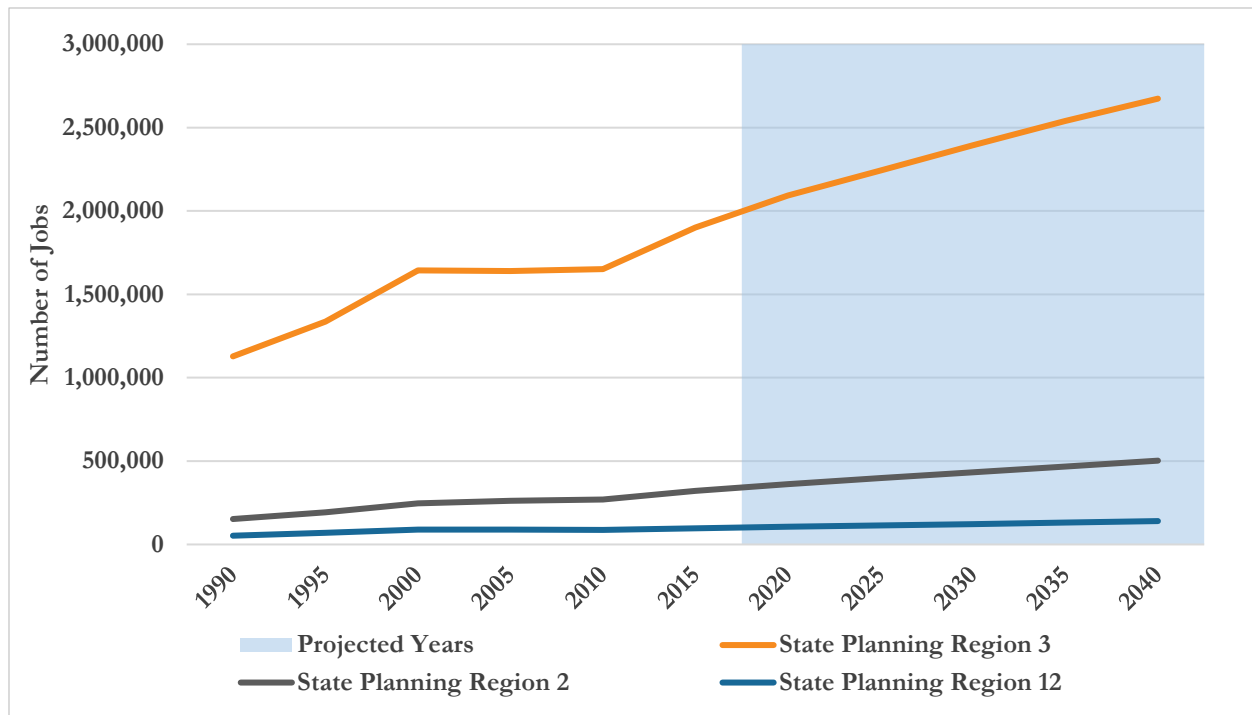
- State Planning Region 2: Larimer and Weld counties.
- State Planning Region 3: Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Gilpin, and Jefferson counties.
- State Planning Region 12: Eagle, Grand, Jackson, Pitkin, and Summit counties.

Although county-level median household incomes fell slightly between 2009 and 2014, the number of jobs available in the local and regional area surrounding RMNP is projected to grow in the coming decades.

Highlights from local and regional economic trends include the following:

- The total number of jobs in the three Colorado State Planning Regions adjacent to RMNP is projected to increase by approximately 43% between 2015 and 2040.
- The total number of tourism-related jobs in the three Colorado State Planning Regions adjacent to RMNP is projected to increase by approximately 34% between 2015 and 2040.
- Median household incomes declined slightly between 2009 and 2014 for the three local counties, and 11 of the 14 nonlocal regional counties.

ITEM 43: Total projected number of jobs in adjacent State Planning Areas, 1990–2040



TOTAL PROJECTED NUMBER OF JOBS							
STATE PLANNING REGION	2015	2020	2025	2030	2035	2040	% CHANGE, 2015–2040
Region 2	320,723	362,206	398,142	432,773	467,716	502,647	56.7%
Region 3	1,900,215	2,092,671	2,242,371	2,394,928	2,539,053	2,673,768	40.7%
Region 12	96,466	107,006	114,623	122,526	131,347	140,214	45.4%
Total	2,317,404	2,561,883	2,755,136	2,950,227	3,138,116	3,316,629	43.1%

Summary

- The number of jobs in the three Colorado State Planning Regions adjacent to RMNP is projected to increase by approximately 43% between 2015 and 2040.
- The greatest projected job growth (57% increase by 2040) is expected to occur in State Planning Region 2, which includes Larimer and Weld Counties.

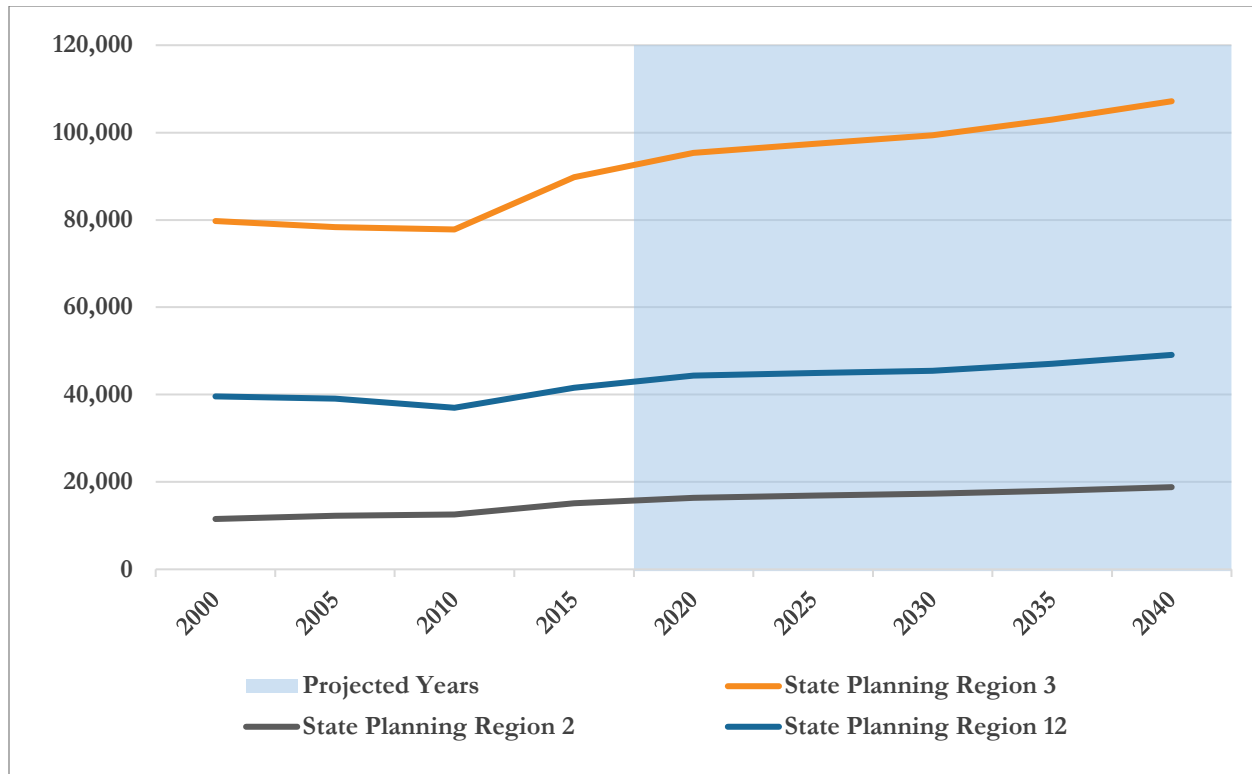
Notes

- The State Planning Regions used in the analysis cover the following counties:
 - Region 2: Larimer and Weld Counties.
 - Region 3: Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Gilpin, and Jefferson counties.
 - Region 12: Eagle, Grand, Jackson, Pitkin, and Summit counties.
- Projections were performed by the Colorado State Demography Office using data from the 2010 Census.

References

Colorado State Demography Office. (2015). **Economic Forecast**. Colorado State Demography Office: Denver, CO.

ITEM 44: Total projected number of tourism-related jobs in adjacent State Planning Areas, 1990–2040



TOTAL PROJECTED NUMBER OF TOURISM JOBS							
STATE PLANNING REGION	2015	2020	2025	2030	2035	2040	% CHANGE 2015–2040
Region 2	15,089	16,353	16,867	17,296	18,015	18,813	24.7%
Region 3	89,780	95,340	97,409	99,371	102,996	107,171	19.4%
Region 12	41,608	44,363	44,930	45,473	47,066	49,095	18.0%
Total	146,478	156,056	159,206	162,140	168,077	175,079	19.5%

Summary

- The total number of tourism-related jobs in the three Colorado State Planning Regions adjacent to RMNP is projected to increase by approximately 20% between 2015 and 2040.
- The greatest projected job growth (25% increase by 2040) is expected to occur in Region 2, which comprises Larimer and Weld counties. This growth rate exceeds the overall projected job growth rate for the region.

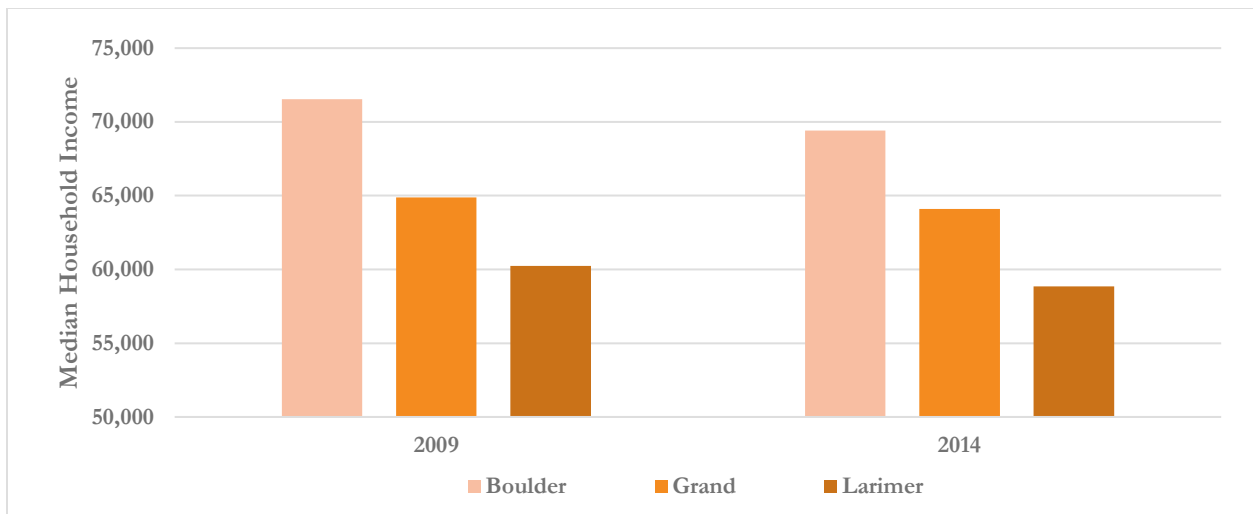
Notes

- The State Planning Regions used in the analysis cover the following counties:
 - Region 2: Larimer and Weld Counties.
 - Region 3: Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Gilpin, and Jefferson counties.
 - Region 12: Eagle, Grand, Jackson, Pitkin, and Summit counties.
- Projections were performed by the Colorado State Demography Office using data from the 2000 Census.

References

Colorado State Demography Office. (2015). **Economic Forecast**. Colorado State Demography Office: Denver, CO.

ITEM 45: Median household income, local and regional counties, 2009–2014



MEDIAN HOUSEHOLD INCOME (2014 DOLLARS)				
LOCAL OR REGIONAL	COUNTY	2009	2014	% CHANGE 2009–2014
Local Counties	Boulder	71,544	69,407	-3.0%
	Grand	64,879	64,109	-1.2%
	Larimer	60,231	58,844	-2.3%
Regional Counties	Adams	60,784	57,421	-5.5%
	Arapahoe	64,865	62,213	-4.1%
	Broomfield	83,864	80,430	-4.1%
	Clear Creek	69,105	68,531	-0.8%
	Denver	49,982	51,800	3.6%
	Douglas	109,474	102,626	-6.3%
	Eagle	76,053	73,774	-3.0%
	Gilpin	61,001	65,851	8.0%
	Jackson	36,067	45,606	26.4%
	Jefferson	72,480	69,698	-3.8%
	Park	66,205	60,800	-8.2%
	Routt	70,451	61,095	-13.3%
	Summit	74,062	64,521	-12.9%
	Weld	61,375	58,100	-5.3%

Summary

- Median household incomes declined slightly between 2009 and 2014 for the three local counties (Boulder, Grand, and Larimer), and 11 of the 14 nonlocal regional counties.

Notes

- Dollar values for median household income in 2009 were adjusted for inflation and converted to 2014 dollars using the US Bureau of Labor Statistics Consumer Price Index Inflation Calculator.
- Local counties include Boulder, Grand, and Larimer counties.
- Regional counties are defined as counties with a 50-mile radius of RMNP, excluding local counties.

References

US Census Bureau (2009). **Median income in the last 12 months (in 2014 inflation-adjusted dollars), 2005-2009 American Community Survey 5-year estimates.** United State Census Bureau: Washington, DC.

US Census Bureau (2014). **Median income in the last 12 months (in 2014 inflation-adjusted dollars), 2010-2014 American Community Survey 5-year estimates.** United State Census Bureau: Washington, DC.

6.3 | OUTDOOR RECREATION

In 2013, the Colorado Department of Parks and Wildlife released the 2014–2018 Statewide Comprehensive Outdoor Recreation Plan. The plan describes the North Central region of Colorado, which includes RMNP, as “by far” the most popular area of the state for outdoor recreation, with nearly one hundred forty million user days of outdoor recreation activity in 2013. The plan includes data describing trends in outdoor recreation, and outdoor recreation-related travel patterns and associated economic activity. Highlights from the plan are presented below and include the following:

- Two-thirds of Colorado residents participate in outdoor recreation once per week, with 60% expressing an expectation to increase their participation in the coming year.
- One-third of Colorado residents report traveling 50 miles or more on weekends to participate in outdoor recreation.

ITEM 46: Participation in outdoor recreation activities, Colorado residents, 2013

VARIABLE	RESULT
Percent of residents who participated in outdoor activities more than one time in past year.	90%
Percent of residents who participated in outdoor activities more than once per week in past year.	66%
Percent of residents who participated in specific outdoor recreation activities in past year (five most frequently reported).	Walking–66% Hiking/backpacking–52% Picnicking–37% Fishing–36% Tent camping–36%
Percent of residents who participated in trail-based activities.	83%
Number of activity days for specific outdoor recreation activities.	Walking–103,861,714 Hiking/backpacking–47,600,791 Jogging/running–46,888,810 Fishing–26,411,408 Wildlife viewing–14,456,827 Tent camping–14,158,319 Snowshoeing or cross-country skiing–7,108,319 Rock climbing–3,911,605
Number of outdoor recreation activity days, North Central Region (includes RMNP).	Approximately 140 million
How do you think your participation in outdoor recreation will change in the next five years?	Increase greatly–16% of respondents Increase somewhat–44% Stay the same–30% Decrease somewhat–3% Decrease greatly–2% Not Sure–4%

Summary

- Two-thirds of Colorado residents participate in outdoor recreation once per week, with 60% expressing an expectation to increase their participation in the coming year.

References

Babcock, S., and Kachur, K. (2014). **2014 Colorado Statewide Comprehensive Outdoor Recreation Plan**. Colorado Park and Wildlife: Denver, CO.

ITEM 47: Outdoor recreation-related travel behavior and patterns, Colorado residents, 2013

VARIABLE	PERCENTAGE OF COLORADO RESIDENTS
Distance traveled to participate in outdoor recreation activities (Friday–Sunday).	100+ miles—12%
	50-99 miles—21%
	20-49 miles—26%
	10-19 miles—15%
	5-9 miles—10%
	0-4 miles—15%
	Not Sure—2%
Distance traveled to participate in outdoor recreation activities (Monday–Thursday).	100+ miles—4%
	50-99 miles—8%
	20-49 miles—12%
	10-19 miles—15%
	5-9 miles—15%
	0-4 miles—44%
	Not Sure—2%
Percent of outdoor recreation outings that were day trips.	80%

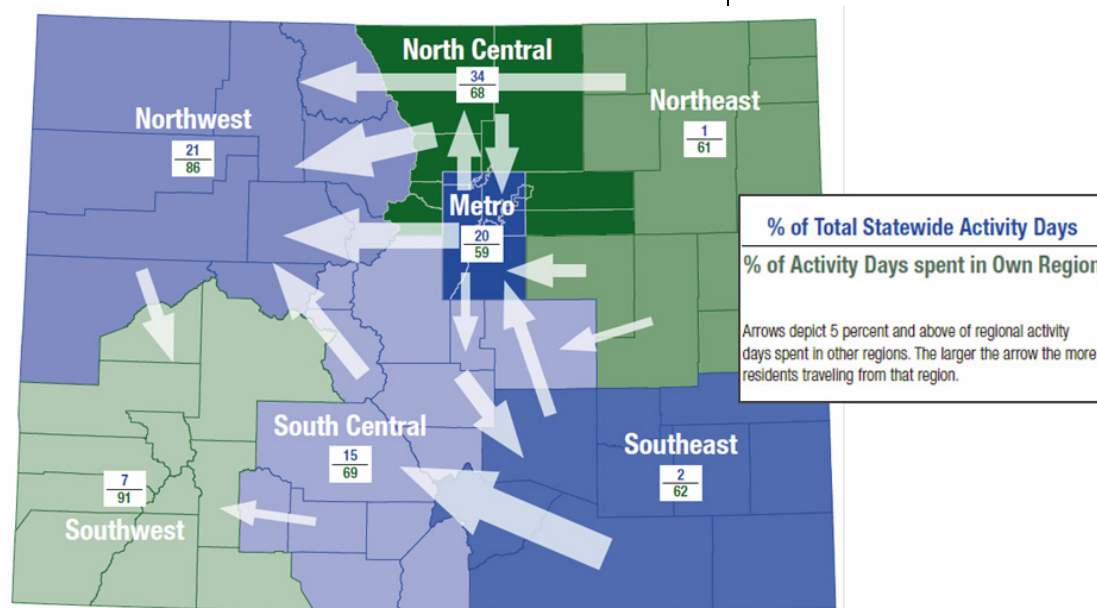


FIGURE 3: OUTDOOR RECREATION-RELATED TRAVEL BEHAVIOR AND PATTERNS, COLORADO RESIDENTS, 2013

Summary

- One-third of Colorado residents report traveling 50 miles or more on weekends to participate in outdoor recreation.

References

Babcock, S., and Kachur, K. (2014). **2014 Colorado Statewide Comprehensive Outdoor Recreation Plan**. Colorado Park and Wildlife: Denver, CO.

6.4 | ECONOMIC IMPACTS OF RMNP VISITATION AND REGIONAL OUTDOOR RECREATION

Data on the economic impact of RMNP visitation and outdoor recreation in the RMNP region is available from NPS and the Colorado Department of Parks and Wildlife released the 2014–2018 Statewide Comprehensive Outdoor Recreation Plan. These data characterize direct spending, job creation, and economic impacts from RMNP visitation specifically and regional outdoor recreation generally.

- Visitors to RMNP, both local and non-local, spent approximately \$268 million on their visits to the park.
- All visitation to RMNP (local and non-local) generated more than \$400 million worth of economic output and created more than 4,000 full and part time jobs.
- Nearly all the economic impacts from RMNP visitation are generated by non-local visitors.
- Outdoor recreation in the North Central Colorado Region (including RMNP) contributes \$8.3 billion to the regional economy and generates over 78,000 jobs.

ITEM 48: Economic impacts of RMNP visitation, 2015

VARIABLE	ALL VISITORS	NON-LOCAL VISITORS ONLY
Total RMNP visitor spending on RMNP visit.	\$268,391,400	\$260,133,000
Jobs generated by RMNP visitation (measured as annualized full and part time jobs that are supported by RMNP visitor spending).	4,144	4,022
Labor income generated by RMNP visitation (includes employee wages, salaries and payroll benefits, as well as the incomes of sole proprietors that are supported by RMNP visitor spending).	\$152,167,600	\$148,172,000
Value added to the regional economy by RMNP visitation (measured as the contribution of RMNP visitor spending to the regional economy).	\$246,198,300	\$240,020,900
Economic output generated by RMNP visitation (measured as the total estimated value of the production of goods and services supported by RMNP visitor spending).	\$408,311,000	\$398,066,700

Summary

- Visitors to RMNP, both local and non-local, spent approximately \$268 million on their visits to the park.
- All visitation to RMNP (local and non-local) generated more than \$400 million worth of economic output and created more than 4,000 full and part time jobs.
- Nearly all the economic impacts from RMNP visitation are generated by non-local visitors (i.e., visitors who traveled to RMNP from outside of the local gateway region).

References

Cullinane Thomas, C., and Kootz, L. (2016). **2015 National Park Visitor Spending Effects - Economic Contributions to Local Communities, States, and the Nation**. National Park Service Natural Resource Report NPS/NRSS/EQD/NRR—2016/1200.

ITEM 49: Economic impacts of outdoor recreation, North Central Colorado Region, 2013

VARIABLE	RESULT
Economic contribution of outdoor recreation activity, North Central Colorado Region (includes RMNP).	\$8.3 billion 78,521 jobs
Outdoor recreation direct expenditures, North Central Colorado Region (includes RMNP).	\$5.6 billion total \$4.1 billion trip-related \$1.5 billion equipment

Summary

- Outdoor recreation in the North Central Colorado Region (including RMNP) contributes \$8.3 billion to the regional economy and generates over 78,000 jobs.

References

Babcock, S., and Kachur, K. (2014). **2014 Colorado Statewide Comprehensive Outdoor Recreation Plan**. Colorado Park and Wildlife: Denver, CO.