Recreation use on the Skykomish Ranger District: Data compilation and management strategies to inform collaborative recreation planning

December 2021

Project completed by:

USDA Forest Service, Mt. Baker-Snoqualmie National Forest: Michael Schlafmann, Joe Neal, Sarah Lange, Drew Slaney, and Joan Louie

USDA Forest Service, Pacific Northwest Research Station: Monika Derrien and Lee Cerveny

Tulalip Tribes Treaty Rights & Government Affairs: Libby Halpin Nelson and Andrew Gobin

Report editors: Monika Derrien, Lee Cerveny, and Michael Schlafmann

This report was funded by Forterra.

Table of contents

List of Tables

List of Figures

List of Appendices

Overview

This report summarizes a project completed by the USDA Forest Service and the Tulalip Tribes, funded through a grant from Forterra. The report offers insights into the character and dynamics of outdoor recreation on the Skykomish Ranger District of the Mt. Baker-Snoqualmie National Forest, as well as in surrounding areas.

Part A of the report is a compilation of pre-existing recreation data sources relevant to the Skykomish Ranger District. The report summarizes relevant recreation and tourism data at the state, county, national forest, ranger district, and site level.

Part B of the report is a summary of management approaches that have been used to manage the amount, type, and distribution of recreational use throughout public lands in the Pacific Northwest, the United States, and the world. These management approaches include strategies to study, inform, influence, and moderate when and where recreational uses occur, including approaches that encourage sustainable recreation management and reduce undesired ecological, socioeconomic, or cultural effects.

The report is intended to provide helpful resources and insights for ongoing planning collaboratives that seek to manage recreation sustainably.

Prefaces

I. Mt. Baker-Snoqualmie National Forest Preface, by Michael Schlafmann

Along our shared path in this project, we have been challenged, as Forest Service representatives, by recognition of just how incommensurable prevalent land management planning and decision-making are with approaches to knowledge and decision-making specific to the Tulalip Tribes and its members. Bridging cross-cultural and cross-context divides is difficult. The Mt. Baker-Snoqualmie National Forest is an institution with a history built on the ancestral lands of the Snohomish, Snoqualmie, and Skykomish tribes and other tribes signatory to the 1855 Treaty of Point Elliott. Centering Forest Service contributions to this document in a history of settler-colonialism, of oppression, discrimination and broken trust, means recognizing the depth of our biases and the systemic and institutional structures we work within.

Forest Service contributions to this document attempt to make the desires and interests of Tulalip Tribes fit an agency scientific paradigm of what constitutes data, what data is necessary, and how it should be interpreted. Paradoxically, we are simultaneously working to acknowledge and account for the biases of our approaches to knowledge. Measures of visitation, economic or biophysical data reflect the worldview and values of the institutions and entities who choose to collect them. Specific strategies for protecting, systematizing, and disseminating knowledge intentionally benefit specific groups of people (Agrawal, 1994).

Empirically validated knowledge of the characteristics of components of ecological systems, whether plants, animals, or the physical components of soil and water, inform Forest Service approaches to environmental analysis, planning, decision-making and management. The Forest Service has historically viewed trees as commodities to be measured, and more recently as contributors to ecosystem function. As an institution, the Forest Service measures wildlife and plant populations to identify when they cross thresholds from ‘healthy’ to endangered. All of these approaches overtly and subtly marginalize other ideas of environmental governance. They leave little room for decision-making rooted in different worldviews and value sets.

As public land scientists and land managers, we have been given privileged glimpses of a worldview that places humans as part of a larger moral universe, one that encompasses people, plants, and animals and supported by intimate and empirical understanding of place (Hunn et. al., 2003). We wish to acknowledge notions of ‘traditional,’ ‘ecological,’ and ‘knowledge,’ may all denote modes of understanding that subordinate deep experience of place into products, measures and tools, disconnected from the history and understanding of a people gained since time immemorial (Nadasdy, 1999).

It may be difficult for an institution like the Forest Service to incorporate the goals of tribes within federal policy frameworks. We see the possibility of meaningful collaboration as a relatively recent change in how the Forest Service engages with tribal governments. There is little guidance however about how cross-cultural collaboration ought to be done. We find our toolkit as managers and scientists lacking—and remain committed to finding and building bridges across our institutional divides and working to resolve conflicts between Forest Service management paradigms and tribal interests and treaty rights.

II. Pacific Northwest Research Station Preface, by Lee Cerveny and Monika Derrien

The Pacific Northwest (PNW) Research Station is a scientific organization housed within the US Forest Service (US Department of Agriculture). The Research and Development (R&D) arm of the agency serves to 'develop and deliver knowledge and innovative technology to improve the health and use of the Nation's forests and grasslands—both public and private.' Thus, the explicit intent of agency science is to result in data and information that will improve our knowledge of forests and grasslands and their management across jurisdictions. This includes the people who visit forests and grasslands and the activities in which they engage. PNW Research Station scientists represent a diverse array of expertise areas and disciplinary training that guides their empirical approaches to knowledge formation. As government scientists, we conduct research, produce findings, and acknowledge the implications of these findings. The intent of science is to inform decision-making and planning with relevant data and research. It is not within our purview to make policy recommendations. Rather, we gather information, interpret the findings, and identify implications of those findings. Other arms of government agencies use that information to generate policy. This separation of science and policy is a fundamental aspect of how Forest Service R&D functions.

As scientists with the Goods, Services, and Values Program of the PNW Research Station, we conduct and communicate research to advance the understanding of relationships among people and forest and rangeland ecosystems. GSV scientists examine people's relationships with natural environments and resources, including their attitudes, beliefs, values, and behaviors; they consider social, economic, and cultural characteristics from the scale of the individual to society; and they study the outcomes of natural resource management practices. These issues require varied and mixed quantitative and qualitative research approaches that integrate knowledge about cultural, social, and economic dynamics of long-standing and emerging issues.

Because of our work in these areas, we appreciate that ways of knowing ('knowledge systems') vary across cultures, over time, and among institutions. A process for gathering information and drawing conclusions that is valid and valued in one setting may not be relevant in another. Moreover, there are contextual differences in the way knowledge is conveyed, shared, and integrated. It is thus important to situate our knowledge within the context of our institutions and socio-cultural systems.

How science is produced and disseminated in Western (Euro-American) society has been standardized through the process that includes: problem formulation, literature review, conceptual development, establishing propositions or hypotheses, systematic data collection and recording, quality assurance and quality control, analysis and interpretation of findings, peer review, publication, and other forms of science delivery. The process contains built-in opportunities for dialogue and challenges to the scientific process or outcome. While there are disciplinary variations, the scientific process is considered the basic approach to establish facts and make conclusions that may be accepted by other scientists. Behind this process are embedded values, logic models, and assumptions that are culturally based. These include empiricism (that our answers are found in understanding the 'real world' and that these answers are measurable), objectivity or neutrality (that the scientist can be distant, neutral, and detached from the methodological approach and object of study), authority (that the scientist's findings are treated as authoritative), replicability (that something done by one person can be repeated by another using the same approach and that these are comparable), and many others. This Western scientific model has dominated the way that science is created for nearly two centuries, but we recognize that this is but one way of 'knowing.'

We approach our work about outdoor recreation and tourism with a deep appreciation that managing these human uses sustainably requires multi-faceted considerations of social-ecological systems. Opportunities for recreation are one of the most widespread benefits national forests offer the public and are central to the Forest Service's mission. Sustainable recreation management involves 'the provision of desirable outdoor opportunities for all people, in a way that supports ecosystems, contributes to healthy communities, promotes equitable economies, respects culture and traditions, and develops stewardship values now and for future generations' (Cerveny et al., 2020, p. 10). While rare, management approaches that adequately account for these interconnected dimensions are necessary for anticipating the range of potential co-benefits and new challenges that arise from any management intervention, and are foundational for producing truly desirable outcomes for our social-ecological systems. Because of this, we encourage users of this report to think in terms of connections and systems, beyond the allure of isolated site-specific 'fixes.'

III. Tulalip Tribes Preface, by Libby Halpin Nelson and Andrew Gobin

Members of the Tulalip Tribes, together with other Coast Salish tribes, have strong historical and spiritual ties to the forestlands and waters that comprise what is now called the Mt. Baker-Snoqualmie National Forest (MBS). The Tulalip Tribes is a federally recognized sovereign Indian tribe with a reservation in western Washington. Tulalip is the successor in interest to the Snohomish, Snoqualmie and Skykomish peoples, and other tribes and bands signatory to the 1855 Treaty of Point Elliott. The forests of the MBS have been occupied and used by Coast Salish people for millennia. The study area lies within the area ceded by tribes under the 1855 treaty, but the tribes specifically reserved rights in the forest, including fishing, hunting and gathering. The Tulalip Tribes manages fisheries, wildlife and other resources as a component of its reserved treaty rights. We have a profound interest in how these federal lands are managed and protected for future generations, and what we see as our moral obligation to care for the land, water, plants and animals and to carry on our living culture.

Recreation across public lands in western Washington is growing rapidly as the population in the Puget Sound Region expands, and as the popularity of outdoor activities surges. Tribes have witnessed this increasing recreational pressure across the landscape, and its significant growth over the last two decades. As noted in this report, data from the Forest Service national visitor use monitoring surveys (NVUM) show a *63 percent increase* in reported recreational site visits forest-wide between the survey year 2005, and the survey year 2015 for the MBS.

Tulalip has been sounding the alarm on the brisk growth in recreation in our region, and its accumulating ecological impacts, and its distinct negative impacts on tribes and their relationship to the forest. In 2020 and 2021, during the COVID-19 pandemic, recreational pressures on public lands and waterways were made very clear. News sources as well as reports from land managers in our region described extreme crowding and heavy use across all seasons, overflowing parking areas at trailheads and boat launches, litter, human waste, erosion and a near total lack of enforcement.

Tribes and many agency staff view last year's large numbers of recreationists less as an anomaly than a preview of what the future holds in our region. We believe that one way to address growing recreation is to support comprehensive and sustainable recreation planning at the watershed level, across multiple jurisdictions. Planning on a landscape scale that is meaningful for protection and recovery of resources and ecological functions can help evaluate recreation's dispersed impacts and achieve greater

compatibility of recreation with environmental protection. Healthy, biodiverse forests, in turn, support the needs of both treaty tribes and the public.

To address recreational growth in our area, and gather information needed for more holistic recreation planning, we reached out to the US Forest Service, as well as other federal and state land managers who oversee the health of these public lands and manage recreation. We have advocated for development of 1) a better understanding of the environmental impacts of recreation in our region, and 2) baseline information on the numbers of recreational users, types and locations on public lands in our region, and effective tools for managing it.

Earlier this year, Tulalip completed a report and literature review of impacts of recreation, on wildlife, that builds upon our understanding of environmental impacts of recreation in our region, through a tribal lens (Tulalip Tribes, 2021).

This report, 'Recreation use on the Skykomish Ranger District: Data compilation and management strategies to inform collaborative recreation planning,' is a start to addressing the latter—developing better baseline information on recreational use in our area, identifying data gaps, and finding effective tools to manage it sustainably. In collaboration with the US Forest Service, we have compiled available information on visitor numbers and recreational use in the MBS, focusing on the Skykomish Ranger District. We have also reached out to others who manage high levels of recreation for information that might provide us with new tools and approaches to address and improve recreation management in our area.

Some of the approaches listed in Part B of this study may be more legally applicable and/or appropriately applied to our area than others. This report simply provides a summary of what was identified in our outreach and is not what we consider a comprehensive list or an endorsement of any specific approach. Our hope, however, is that this information will contribute to efforts to manage recreation thoughtfully and in a way that supports the long-term ecological health and protection of national forest lands and resources, and the tribal treaty rights that depend on them.

Working in collaboration with the Forest Service—both the local forest and forest research station—was beneficial in approaching this work, given the different skills and expertise each brought to the table. While this collaboration was beneficial, it was not without its challenges. At times during the development of this report, we differed on some of the approaches to the study and their value, relevance and consistency with our chosen scope of work, or our capacity to undertake them. We attribute these challenges primarily to miscommunications that can occur over an 18-month-long effort by three different but well-intentioned entities, each with their own 'institutional culture,' undertaking research collaboratively, but through mostly virtual platforms as necessitated by the COVID-19 pandemic.

Looking to the future, we believe that addressing recreation and the overall sustainable management of public forest lands will benefit from broadened cultural and ecological perspectives. As native plants and animal populations in our region dwindle, it is essential that we rethink our current approach to managing natural areas, integrating new ideas and different worldviews, including especially those of the original stewards of these lands, the Coast Salish peoples.

We look forward to sharing the results of this work with the Snohomish-Skykomish Rivers Coalition and others in support of improved recreation planning and ecological health of these public lands we all cherish and must protect for the sake of our future generations.

Introduction

As the population in the Puget Sound region has grown over the last decade, outdoor recreational uses on the region's public lands have also increased. To improve our understanding of regional public land recreation trends and patterns, the Tulalip Tribes and the US Forest Service, including the Mt. Baker-Snoqualmie National Forest and the Pacific Northwest Research Station, have worked together to compile pre-existing data on recreation and tourism in the area. The Mt. Baker-Snoqualmie National Forest, proximate to the Seattle metropolitan area, is one of the most visited national forests in the country (USDA FS, n.d.-a). With a focus on the forest's Skykomish Ranger District, this study takes advantage of the combined expertise, local knowledge, and experience of all three partner entities to compile and present information that is useful for considering potential management approaches.

The report is divided into two sections. Part A consists of a compilation of outdoor recreation data on the Skykomish Ranger District and surrounding area, including data from National Visitor Use Monitoring (NVUM), Human Ecology Mapping of road use and activity areas, and modeled visitation using social media data. Part B consists of a summary of management approaches that have been used to study, inform, influence, and moderate recreational uses, including those that seek to mitigate undesired ecological, socioeconomic, or cultural effects, consistent with sustainable recreation management goals.

IV. Skykomish Ranger District Recreation Setting

Encompassing the upper watershed of the Skykomish River, the Skykomish Ranger District on the Mt. Baker-Snoqualmie National Forest is characterized by glacier-fed rivers flowing through dramatic terrain, with elevations rising from 500 feet above sea level to the 7,899-foot peak of Mt. Daniel. Forests contain Douglas fir, western red cedar, and western hemlock at lower elevations, transitioning to silver fir and mountain hemlock in the mid elevations and to subalpine parklands in the upper elevations. The district encompasses 316,522 acres of National Forest System land intermingled with another 41,363 acres of private and state-owned lands. Over 69 percent of the district is congressionally designated wilderness, including lands within the Alpine Lakes Wilderness, Henry M. Jackson Wilderness, and Wild Sky Wilderness. These protected areas are part of the 2.6-million-acre wilderness complex that straddles the North Cascade Range from Canada to Snoqualmie Pass.

Within an hour's drive of the Seattle metropolitan area, the district is bisected by the heavily traveled Highway 2. Over 225 miles of forest roads network the district and two dozen trailheads connect visitors to 150 miles of trail, providing opportunities for hiking and stock use. The Pacific Crest National Scenic Trail traverses 47.5 miles of the district. Whitewater boating, including commercial rafting, occurs on the Skykomish and North Fork Skykomish Rivers. The district contains over 150 high-elevation lakes, some of which are stocked for recreational fishing. Overnight facilities include five campgrounds that offer 103 campsites and two fire lookouts available for rental. Forest roads and trails are used for snowshoeing, cross-country skiing and snowmobiling in winter months. The Stevens Pass Ski Area operates under special use permit on the district and attracts approximately 450,000 visits annually for downhill and Nordic skiing and provides lift-assisted downhill mountain biking opportunities in the summer.

It is important to note that the entire district lies within the 1855 Treaty of Point Elliott ceded territory, within which signatory tribes reserved their rights to continue to fish, hunt, and gather resources in perpetuity.

Part A: Recreation Data Compilation

V. Guiding Questions

Our group's approach to recreation data compilation was guided by five overarching questions about recreational uses on the Skykomish Ranger District. We were interested in compiling pre-existing data that would help us answer these questions with as much specificity as possible, knowing that all available data sources have advantages and disadvantages in their coverage, granularity, richness, and biases. These guiding questions each include two parts: a question about the current state of recreation use on the district, as well as a question of how this state has changed in recent decades. We asked:

1. **What:** What types of recreation uses are happening across the Skykomish Ranger District, and how have these types of uses changed across the district in recent decades?
2. **Where**: Where on the Skykomish Ranger District are these uses happening, and how has the distribution of these uses changed across the district in recent decades?
3. **When:** When throughout the year are these uses happening across the Skykomish Ranger District, and how has the seasonal pattern of these uses changed across the district in recent decades?
4. **How much:** How much recreation use is occurring across the Skykomish Ranger District, and how has the amount of this use changed across the district in recent decades?
5. **Who:** What are the demographic characteristics of recreational users on the Skykomish Ranger District, and how have the characteristics of this population changed in recent decades?

These questions, like a Rubik's cube, can be aligned in different ways to ask increasingly specific questions about the intersections of activities, place, time, intensity, and people. These questions can also be asked at increasingly fine spatial or temporal scales, or even at the scale of more specifically defined activities or recreation user groups. For example, we might want to know where and when mushroom foraging is taking place for a particular user group, and whether this activity has experienced seasonal or spatial shifts. Or we might want to know all the locations on the district that have a certain concentration of overnight use in a particular month. Or we might want to know the sites on the district that are most used by groups that are underrepresented in national forest visitation based on race, ethnicity, gender, or socioeconomic status. We might want to know how all of these activities intersect in space and time with elk calving season, or human-caused wildfires. Because of the limitations of pre-existing data, we may only be able to partially answer some of these questions, offering insights at broader spatial scales (for example, forest-level patterns rather than a recreation-site patterns) or broader temporal scales (for example, annual use patterns rather than monthly use patterns) than we would ideally be able to answer.

Questions of general interest that we did not pursue for this report include questions of **why** people are engaging in recreational activities on the Skykomish Ranger District. These include question such as 'Why these activities at these sites, and not other sites?' and 'Why visit monthly instead of weekly?' These were outside of the scope of our questions and data sources for this project, though for broader planning efforts they will be important ones to ask.

To begin to answer our guiding questions, we identified and compiled data available from sources at various spatial and temporal scales/intervals, including state-level, forest-level, district-level, and site-level data. Available reports and data came from the following sources: the Washington Office of Financial Management, the Puget Sound Regional Council, tourism studies prepared for Snohomish County, visitation studies conducted for Washington's Statewide Comprehensive Outdoor Recreation Plan (SCORP), the Forest Service's NVUM program, Human Ecology Mapping completed for the 2015

Sustainable Roads Project, and modeled visitation from the University of Washington's Outdoor Recreation and Data Lab. These offered insights ranging from monthly intervals to five-year monitoring. The following summarizes these sources from the broadest to smallest spatial scales.

VI. State- and County-level Data Related to Population, Recreation, and Tourism Trends

Statewide Population Trends in Washington

The Forecasting Division of the Washington State Office of Financial Management provides demographic data for Washington counties, cities, and towns. The latest update, published in April 2020, estimated Washington's population at 7,656,200 (Figure 1; OFM, 2020a). Although the population growth rate declined slightly (-0.1 percent) over the prior year, state population still grew by 109,800 people or 1.5 percent (Figure 2; OFM, 2020a). Net migration (more people moving to Washington than leaving the state) remains the primary driver of population growth, and has been linked closely to quality of life, favorable business climate, and other factors driving population growth (PSRC, 2020). Net migration accounted for approximately 64 percent of population growth between 2010 and 2020 and reached 74 percent of population growth or over 83,000 persons in 2020. Over the last decade, Washington's population grew by nearly 15 percent, almost twice the national average (Figure 1; OFM, 2020a).

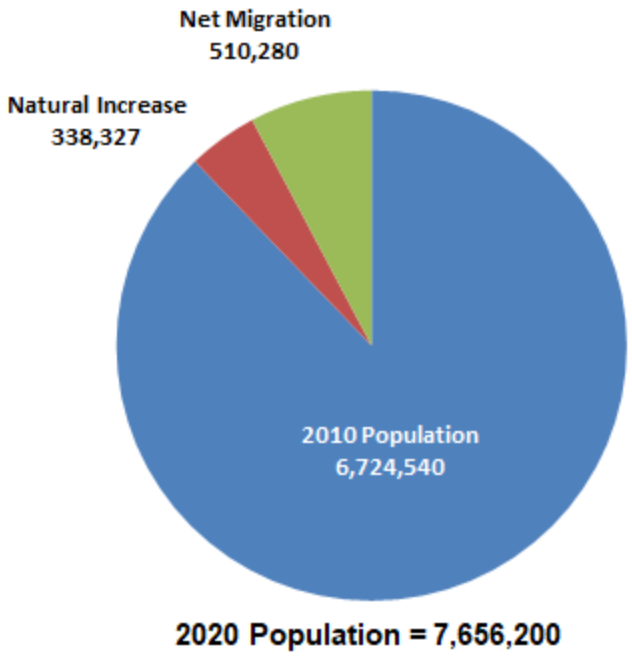


Figure 1. Components of population change, 2010-2020 (reproduced from OFM, 2020a, p. 7)

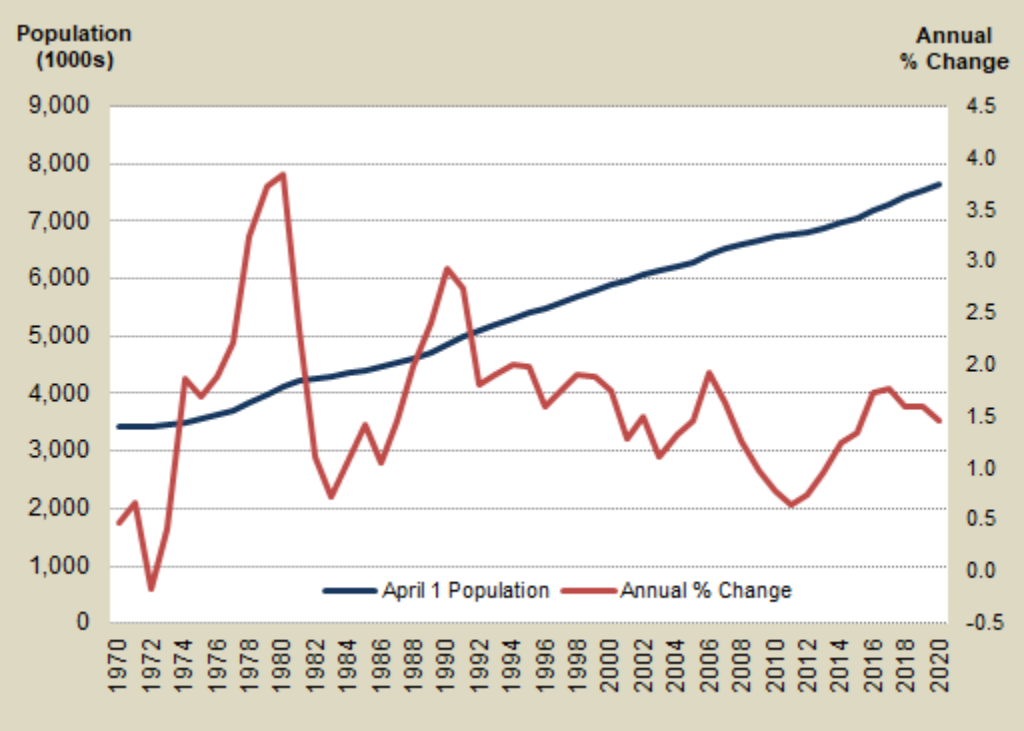


Figure 2. Total population and percentage change in Washington, 1970-2020 (reproduced from OFM, 2020a, p. 7)

Puget Sound Region Population Trends

The Puget Sound region is expected to grow by 1.8 million people by 2050, reaching a total population of 5.8 million (Figure 3; PSRC, 2020). The region has gained one million people since 2000 (OFM, 2020b). More than half of the region's population growth has occurred in King County each year since 2011. Figure 4 shows that in 2020, King County added 34,500 people, which was 57 percent of the region's increase. Pierce County added 12,400 people and Snohomish added 11,800 in 2020, together accounting for 40 percent of the region's annual population growth.

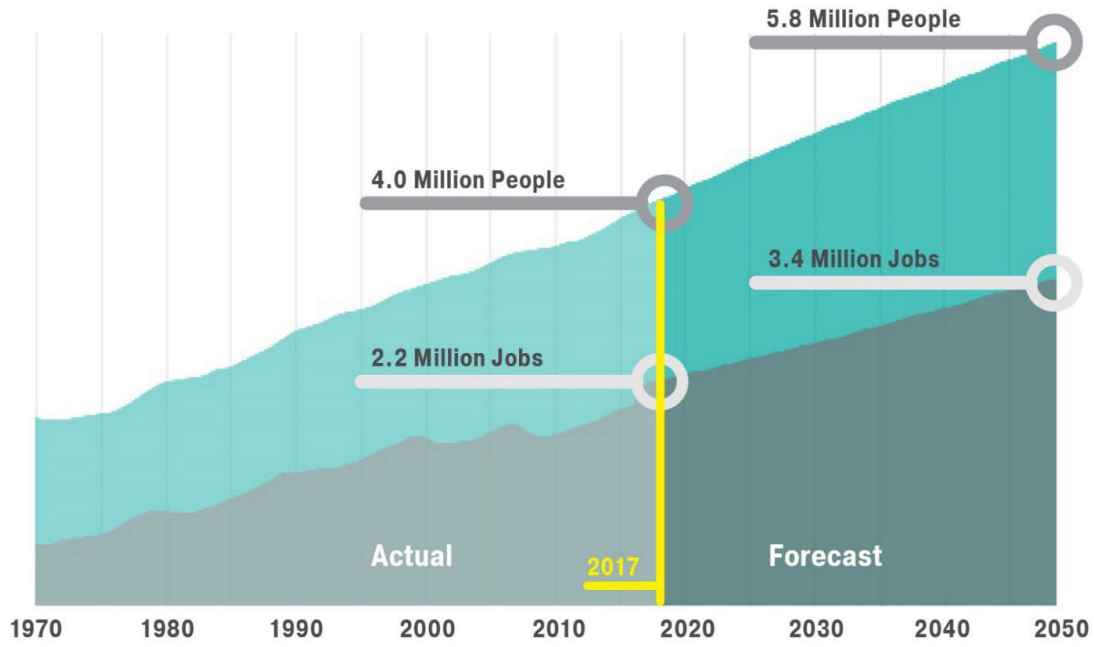


Figure 3. Historical growth and forecast job and population growth (reproduced from PSRC, 2020, p. 18)

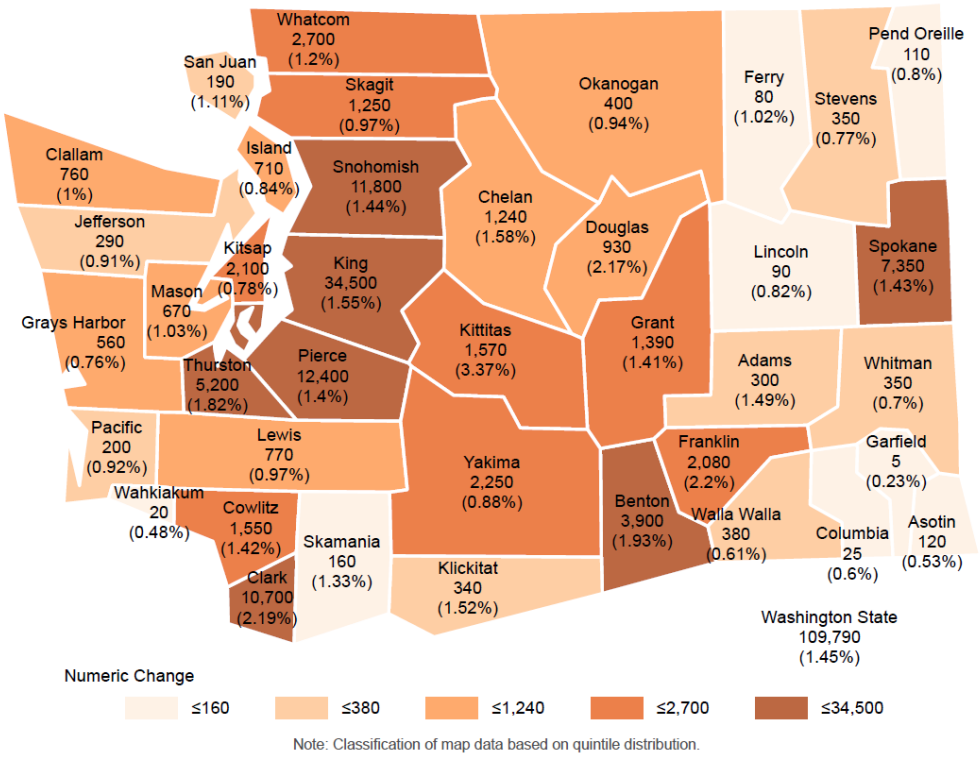


Figure 4. County share of population growth in 2020 (reproduced from OFM, 2020b, p. 6)

Snohomish County Tourism Data

The Skykomish Ranger District is located in Snohomish County. Some recreation and tourism information exists from recent county-level plans, surveys, and reports that is informative for our interests. Snohomish County tourism has grown in recent years: from 2000 to 2015, direct travel impacts from spending, earnings, employment, and tax revenue all increased; in 2015, visitors spent just under one billion dollars ($934.5 million) in Snohomish County, spending which supported 3 percent of employment in Snohomish County (10,750 jobs) (Future iQ, 2018). Outdoor recreation is a major draw for visitors to Snohomish County. The Strategic Tourism Plan Visitor Survey (Resonance, 2016) found that more than 25 percent of visitors to the county came for 'nature/outdoor' or 'hiking' (Figure 5). The Snohomish County Strategic Tourism Plan identifies 'recreational and adventure travel' as a prime target market (Resonance, 2018).

Figure 5. Visitors' main reasons for visiting Snohomish County (reproduced from Future iQ, 2018, p. 19)

Over one third (37.7 percent) of visitors to Snohomish County are day-trippers, while a smaller proportion come for one-night trips (13.6 percent), two- to four-night trips (22.7 percent), or trips that are five nights or longer (25.9 percent) (Resonance, 2016). For overnight visitors, home origins in Seattle (18.7 percent) and Vancouver, BC (9.4 percent) are the most common (Northstar, 2018). While the current main tourism season in Snohomish County is May through September—with lodging occupancy ranging from 65 percent to over 90 percent (Figure 6)—the Snohomish County Strategic Tourism Plan targets increasing tourism in the shoulder season, from October through April (Resonance, 2018). Overnight visitors tend to be from rather affluent market segments that live active and fitness-oriented lifestyles (Northstar, 2018).

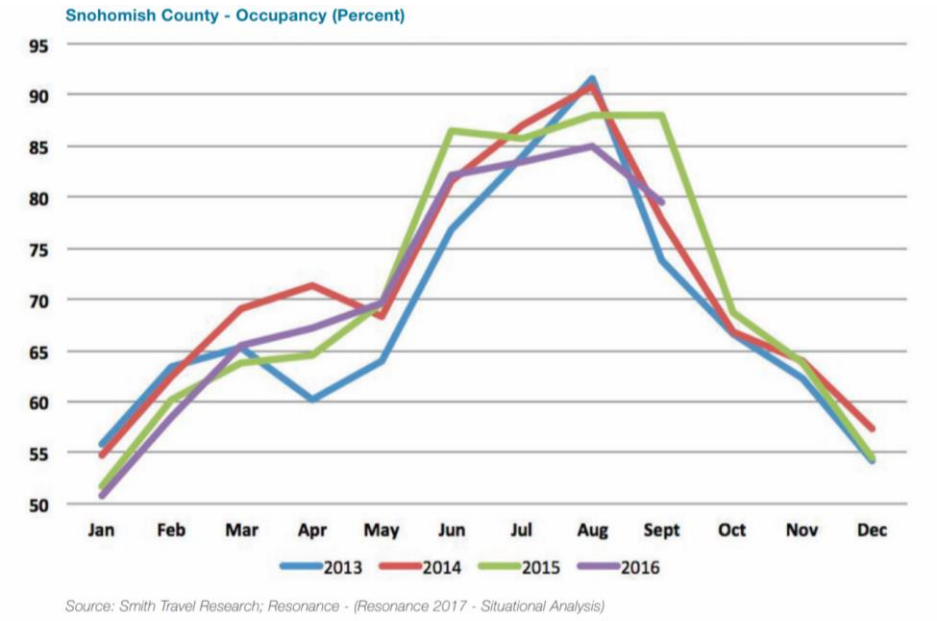


Figure 6. Lodging occupancy by month, 2013-2016 (reproduced from Future iQ, 2018, p. 17)

State-level Recreation Estimates

Washington's population growth and changing demographics will likely have a significant effect on outdoor recreation (Fox, 2014). In particular, growth in population may lead to increased demand for recreation facilities and a wider spectrum of recreation opportunities. Demand may exceed designed or functional capacity at recreation sites and facilities. Demographic shift from 10 to 20 percent of Washingtonians over the age of 65 by 2030 may lead to increased demand for accessible recreation opportunities (OFM, 2017).

Like all states, Washington conducts a periodic state-wide assessment of recreation, including participation and visitation trends, which it publishes in a SCORP, that creates eligibility for federal funding for conservation and recreation projects. The most recent outdoor recreation demand report was completed in 2017 (Jostad et al., 2017). The report found that 84 percent of Washington residents participated in the most popular outdoor recreation activity: walking in a park or trail setting. Following walking, the next most popular activities by participation rates were: visiting rivers or streams (66

percent), visiting a beach or tide pools (60 percent), attending an outdoor concert or event (58 percent), gathering or collecting things in a nature setting (54 percent), day hiking (53 percent), sightseeing at a scenic or wilderness area (51 percent), wildlife or nature viewing (50 percent), swimming/wading at a freshwater beach (50 percent), and driving or motorcycling for pleasure (46 percent) (Jostad et al., 2017).

A user day is defined as a day in which a resident participated in an activity for any amount of time, and allows the calculation of 'mean user days,' as an average of the total number of annual user days by all an activity's participants. User days are helpful for understanding the frequency of activity for its participants. Table 1 shows the top 10 activities by mean user days from the 2017 SCORP. The highest mean for user day activity was walking with a pet (75), while technology-based games saw the second highest user day average at 55 mean user days. Bicycling for transportation (44) and running on roads or streets without sidewalks (36) ranked third and fourth, respectively. Nature-based activities such as outdoor photography, painting, or drawing (28) and wildlife or nature viewing (28) also averaged high in user days. Completing the list at the ninth and tenth spots include visiting a dog park (22) and mountain biking on paved or gravel trails (21) (Jostad et al., 2017).

Table 1. Top 10 activities by user days (reproduced from Jostad et al., 2017, p. 41)

Activity	Activity Category	Mean User Days
Walking with a pet	Walking	75
Technology-based games (e.g.,geocaching, Pokémon Go)	Trending activities	55
Bicycling for transportation purposes	Bicycling	44
Running on roads or streets without sidewalks	Running	36
Bicycling on roads or streets	Bicycling	29
Open air stables or grounds	Stock or horsebackriding	29
Outdoor photography, painting, ordrawing	Nature activities	28
Wildlife or nature viewing	Nature activities	28
Visiting a dog park	Leisure activities at apark	22
Mountain biking on paved or gravel trail	Bicycling	21

VII. Mt. Baker-Snoqualmie National Forest National Visitor Use Monitoring Data

Visits to the Mt. Baker-Snoqualmie National Forest

The Forest Service develops estimates of the amount and characteristics of recreation use and users on national forests through NVUM. These surveys help describe recreation-related visits to national forests and the benefits recreation brings to people. Completed in five-year cycles per national forest, NVUM data help the Forest Service manage recreational resources to best meet the needs of visitors while maintaining the quality of natural resources. Starting in 2005, the results provide a snapshot of annual forest visitation; it is not designed to provide statistical reliability at smaller scales (e.g., at the scale of a ranger district). Since trend information is not yet available, it currently cannot be used to make assumptions about changing use patterns (USDA FS, 2020). All NVUM data is available through the NVUM results application (https://apps.fs.usda.gov/nvum/results/).

The Forest Service estimates there were about 168 million recreation visits nationwide to national forests in FY2020 (USDA FS, 2020). That figure reflects an increase in visitation from prior years, likely influenced by the COVID-19 pandemic; dispersed settings experienced large increases in daily visitation as Americans sought outdoor experiences in physically distanced settings on national forests and grasslands. In FY2020, visitation numbers to wilderness areas were estimated to be 75 percent higher than FY2019, and visitation to other dispersed settings was 25 percent higher; visitation to developed day use and developed overnight sites decreased (USDA FS, 2020). Although 2020 data is not yet available from NVUM surveys conducted on the Mt. Baker-Snoqualmie National Forest, data may show a similar visitation pattern.

National forest visit *– The entry of one person upon a national forest to participate in recreation activities for an unspecified period of time. A national forest visit can be composed of multiple site visits. The visit ends when the person leaves the national forest to spend the night somewhere else.*

National forest site visit *– A site visit is the entry of one person onto a national forest site or area to participate in recreation activities for an unspecified period of time. The site visit ends when the person leaves the site or area for the last time on that day.*

The estimated numbers of visits in 2005, 2010, and 2015 to the Mt. Baker-Snoqualmie National Forest are shown in Figure 7. Forest visitation is measured by NVUM in two ways. 'Total national forest visits' measures the number of times a person has entered the national forest being studied. 'Total site visits' measures the number of times a person has arrived at and left a site that is located within the national forest. Examples of sites include campgrounds or day use areas. In one day, a person could visit multiple sites. National forest visits increased from 1.3 million in 2005 to nearly 2.2 million in 2015, representing a 63 percent increase over that 10-year period. The number of site visits increased from 1.6 million in 2005 to 2.4 million in 2015.

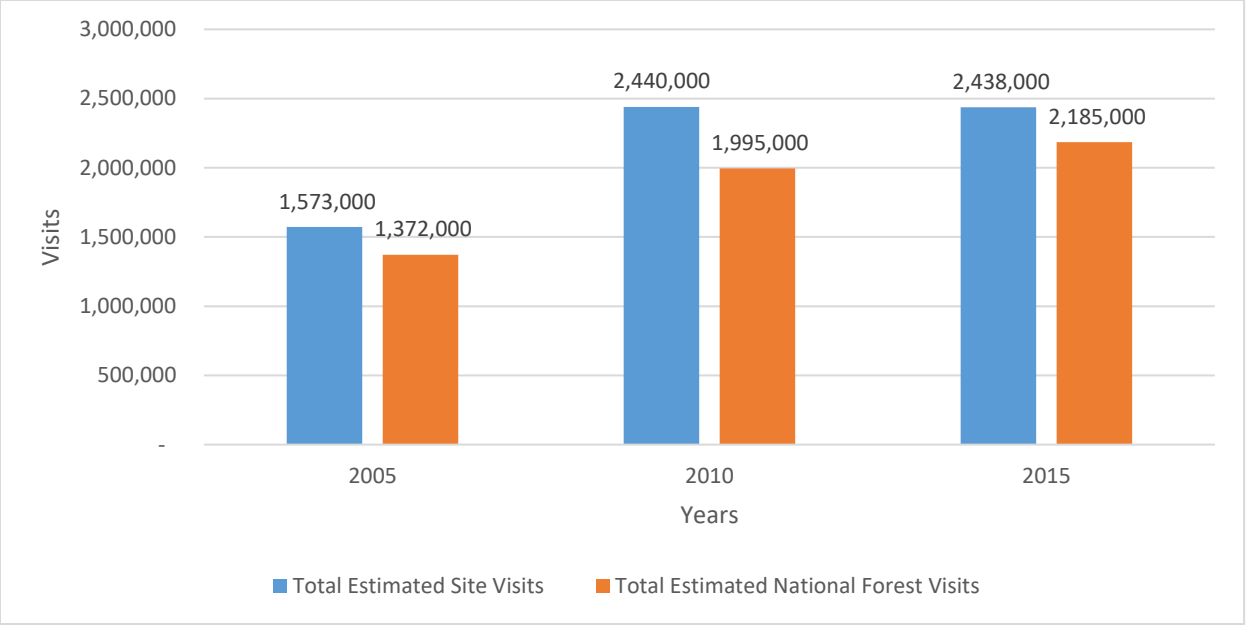


Figure 7. Estimated visits to the Mt. Baker-Snoqualmie National Forest: 2005, 2010, 2015 (data from NVUM, 2005; 2010; 2015)

Site visits are broken down into four types: day use developed site, overnight developed site, general forest area, and designated wilderness. Between 2005 and 2015, there was an increase in visits to day use developed sites to nearly 1.2 million visits in 2015 (Figure 8). There was a decrease in overnight use and general forest area visits between 2010 and 2015. Visits to wilderness areas have increased gradually, with an estimated 406,000 wilderness visits forest-wide in 2015.

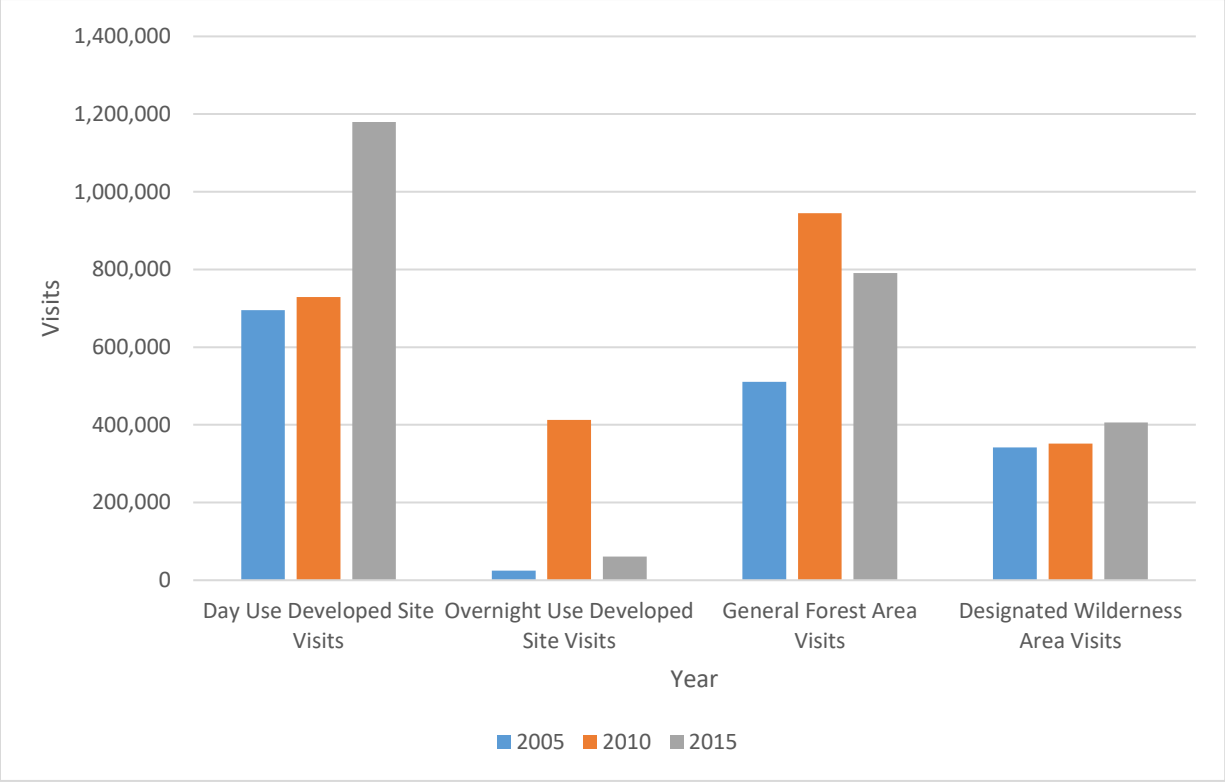


Figure 8. Site visits to the Mt. Baker-Snoqualmie National Forest by visit type: 2005, 2010, 2015 (data from NVUM, 2005; 2010; 2015)

As noted, there are challenges with using NVUM at scales smaller than forest-wide visitation; we present some district-level visitation data here for the sake of general information. For the Skykomish Ranger District in particular, we know that recreation in the general forest area comprises over half of the site visits (Table 2). Day use at developed sites comprise 41.8 percent of visits, while overnight use at developed sites (e.g., campgrounds) accounts for 1.5 percent of visits. More than 90 percent of visits are to just one recreation site (e.g., a trailhead or a day use site). About 3 percent of visits involve using three or more sites on the forest for recreation. If only day trips are considered, about 96 percent of visits involve recreation at only one site on the forest (White, 2020). More than 80 percent of visits are day trips; overnight trips more frequently involve a stay off the national forest (11.3 percent) than on the national forest (5.4 percent) (Table 3). Most overnight trips are associated with recreation from non-locals (White, 2020).

Table 2. Percentage of site visits by site type on the Skykomish Ranger District, from 2015 NVUM (adapted from White, 2020).

Site type	Skykomish Ranger District site visits, 2015
Day use developed sites	41.8%
Overnight use developed sites	1.5%
General forest area	52.5%
Designated wilderness	4.2%
Total	100.0%

Table 3. Types of trip for visitors to the Skykomish Ranger District, from NVUM 2015 (adapted from White, 2020)

Trip type	Skykomish Ranger District site visits, 2015
Day trips	83.3%
Overnight on national forest	5.4%
Overnight off the national forest	11.3%
Total	100.0%

Forest-wide, roughly half the visitors to the Mt. Baker-Snoqualmie National Forest made fewer than six annual visits to the national forest (Figure 9). The percentage of visitors who made between one and five annual visits increased from 41.8 percent in 2005 to 56.3 percent in 2015. The percentage of visitors making more frequent visits declined between 2005 and 2015. Temporally, the amount of time people spend when they visit the Mt. Baker-Snoqualmie National Forest varies by type of visit and type of area visited, and shows fluctuation over the three recent NVUM data collection years (Figure 10).

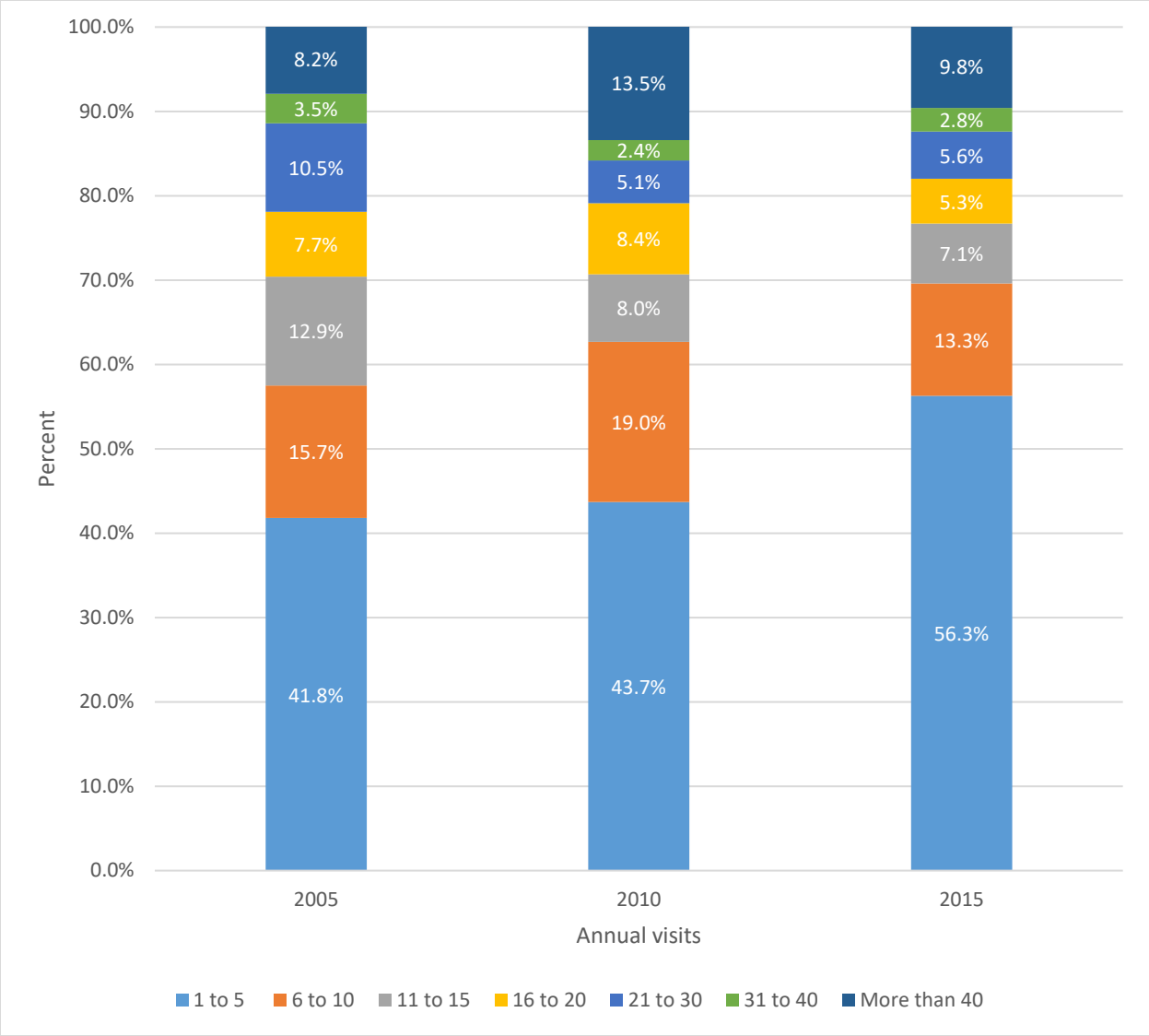


Figure 9. Number of annual visits to the Mt. Baker-Snoqualmie National Forest: 2005, 2010, 2015 (data from NVUM, 2005; 2010; 2015)

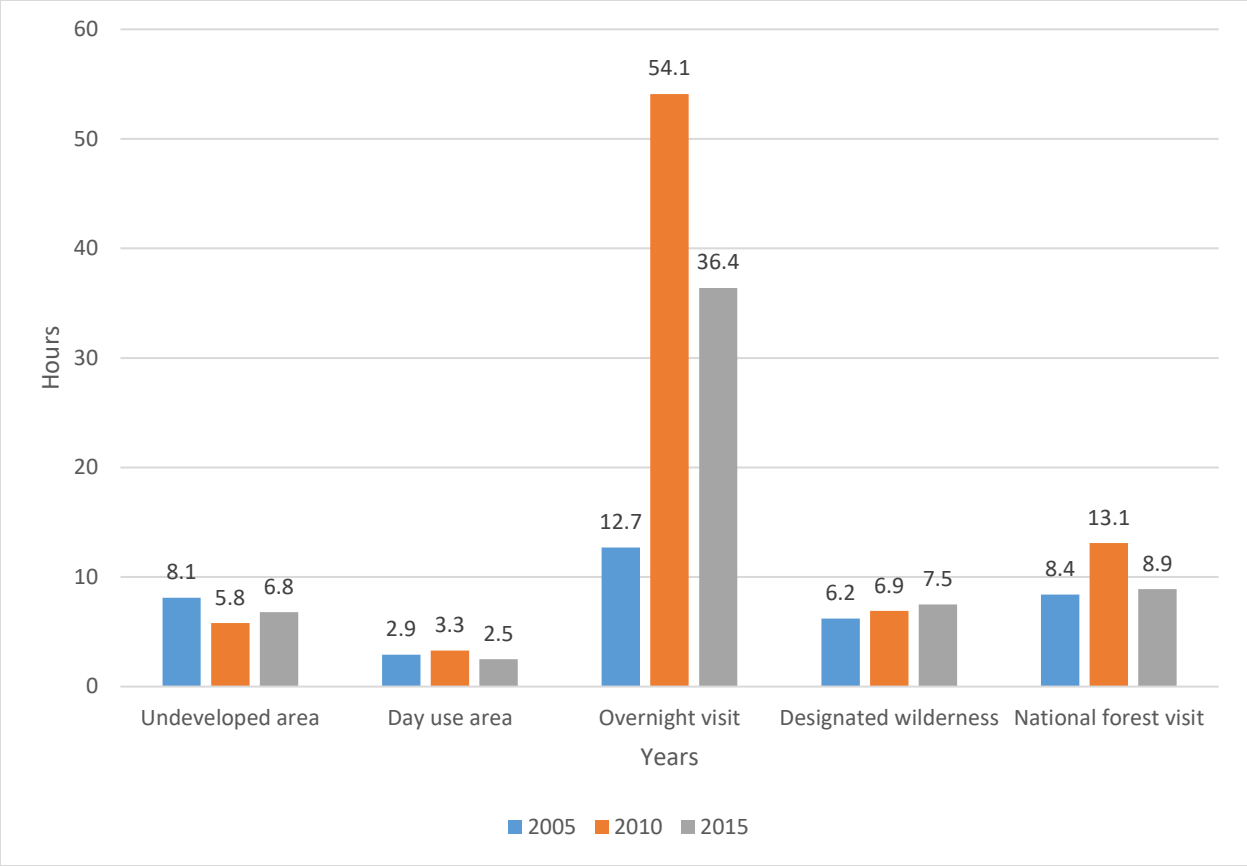


Figure 10. Time spent in national forest sites in hours: 2005, 2010, 2015 (data from NVUM, 2005; 2010; 2015)

Activities on the Mt. Baker-Snoqualmie National Forest

NVUM surveys ask visitors to identify the primary activity they are engaged in during their visit (see Appendix A). Hiking is consistently the most common primary activity on the Mt. Baker-Snoqualmie National Forest, followed by downhill skiing (Table 4). During the three periods of data collection, the percentage of visitors engaging in each of these primary activities has fluctuated, but it is unknown if this is a broader trend or simply indicative of conditions in a particular year (e.g., a data collection year could have unusually low or high snowpack, influencing participation in downhill skiing).

Table 4. Primary outdoor activities for visits to the Mt. Baker-Snoqualmie National Forest: 2005, 2010, 2015 (data from NVUM, 2005; 2010; 2015)

Primary Activity	2005	2010	2015
Hiking	44.8%	33.4%	50.1%
Downhill skiing	29.6%	22.3%	12.6%
Viewing natural features	7.4%	5.7%	8.8%
Relaxing	2.1%	6.4%	4.4%
Viewing wildlife	0.8%	0.9%	0.5%
Driving for pleasure	2.4%	3.8%	1.6%
Picnicking	0.4%	1.2%	1.2%
Other non-motorized activity	1.8%	0.3%	0.1%
Bicycling	0.4%	0.1%	8.1%
Cross country skiing	2.6%	2.5%	3.6%
Nature center activity	0.1%	0.1%	0.0%
Some other activity	1.1%	0.4%	4.5%
Nature study	0.2%	0.1%	0.1%
OHV use	1.6%	1.3%	0.2%
Visiting historical site	0.1%	0.0%	0.0%
Developed camping	1.6%	5.1%	0.9%
Backpacking	0.8%	1.7%	1.7%
Gathering forest products	0.1%	1.2%	0.1%
Resort use	0.0%	0.0%	0.4%
Primitive camping	0.3%	0.9%	0.5%
Fishing	0.6%	2.5%	0.4%
Other motorized	0.0%	0.0%	0.0%
Motorized trail	0.8%	0.3%	0.2%
Non-motorized water	0.0%	0.3%	0.1%
Hunting	0.0%	2.5%	0.1%
Snowmobiling	0.0%	0.0%	0.1%
Horseback riding	0.0%	0.0%	0.0%
Motorized water	0.0%	0.0%	0.0%
No activity reported	0.8%	9.8%	0.6%

To examine how activity participation has changed, we plotted participation in the top 10 activities reported in 2015 for the Mt. Baker-Snoqualmie National Forest, during the three data collection periods (Figure 11). Measures of 'activity participation' describe the percentage of survey respondents that reported participating in a specific outdoor activity, either as a primary or secondary activity. Since 2005, the percentage of visitors participating in these activities has generally increased, except for downhill skiing and nature center activities. Other activities, such as viewing wildlife and driving for pleasure, have shown minor fluctuations.

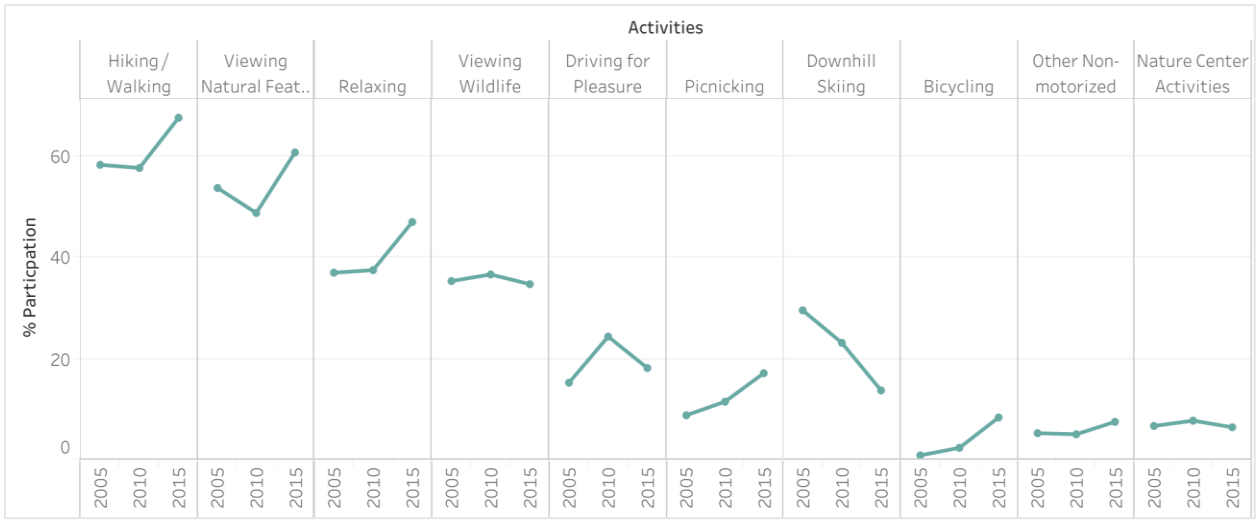


Figure 11. Activity participation over the three data collection periods, for the top 10 activities of 2015 on the Mt. Baker-Snoqualmie National Forest (data from NVUM 2005; 2010; 2015)

For the Skykomish Ranger District, the most common primary recreation activity is hiking/walking (60.7 percent of visits) (Table 5). Bicycling and downhill skiing are the next most common primary activities (22.0 percent and 8.5 percent, respectively). All other primary activities each account for less than 3 percent of visits (White, 2020).

Table 5. Share of visits by primary activity on the Skykomish Ranger District, from 2015 NVUM (adapted from White, 2020).

Primary Activity	Share of visits, 2015
Hiking / Walking	60.7%
Bicycling	22.0%
Downhill skiing	8.5%
Nature-related	< 3%
General/relaxing	< 3%
Other activity	< 3%
Driving for pleasure	< 3%
Developed camping	< 3%
Primitive camping/backpacking	< 3%
Picnicking	< 3%
Other Nonmotorized	< 3%
Boating	< 3%
No Activity	< 3%
Resort Use	< 3%
Fishing	< 3%
Multiple activities	< 3%
Total	100%

There is a gradually increasing percentage of female visitors to the forest, from 38.0 percent of visitors in 2005 to 43.4 percent in 2015 (Figure 12); the majority of visitors are male. Visitation to the Mt. Baker-Snoqualmie National Forest is primarily by those who identify as White (about 94 percent), with very little change in composition across the data collection periods (Table 6). Ethnicity is a separate measure and is used to capture Hispanic/Latino background. In 2005, fewer than 1 percent of forest visits were made by Hispanic/Latino visitors; this increased to 3.7 percent in 2015. Compared to demographics of the county and state, there are far fewer people of color who visit the Mt. Baker-Snoqualmie National Forest than are represented in the population.

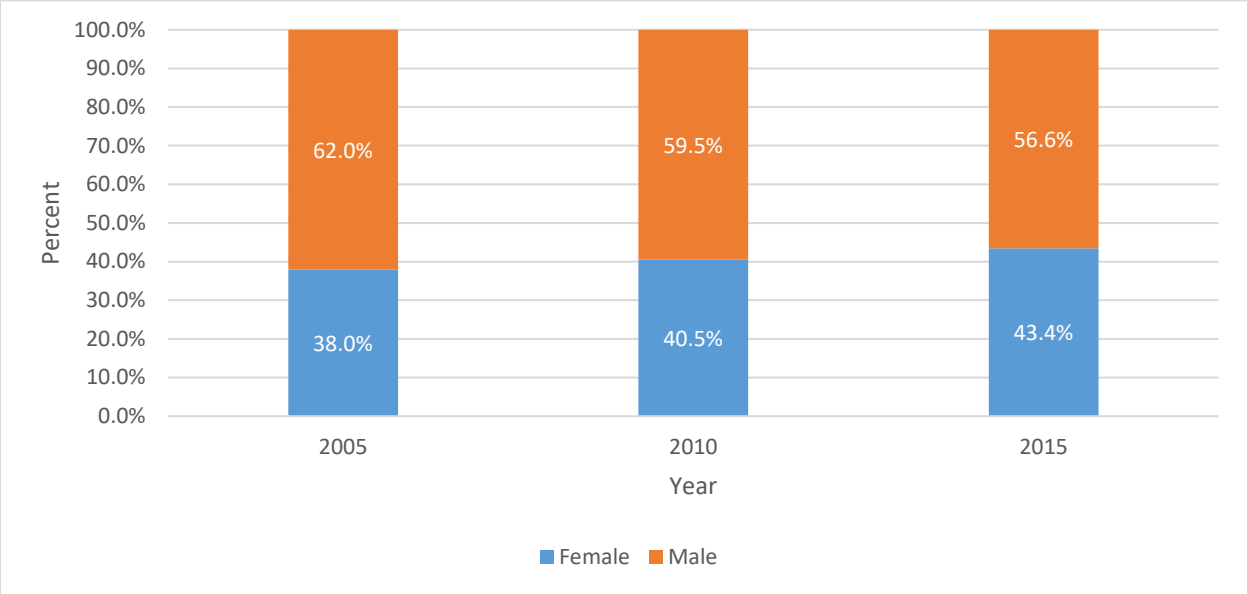


Figure 12. Percent of visits to the Mt. Baker-Snoqualmie National Forest by gender: 2005, 2010, 2015 (data from NVUM, 2005; 2010; 2015)

Table 6. Percentage of visits to the Mt. Baker-Snoqualmie National Forest by race and ethnicity: 2005, 2010, 2015 (data from NVUM, 2005; 2010; 2015)

Race	2005	2010	2015
American Indian / Alaska Native	0.7%	2.3%	2.0%
Asian	5.0%	3.7%	7.0%
Black / African American	1.0%	0.9%	0.9%
Hawaiian / Pacific Islander	0.5%	0.4%	1.4%
White	94.8%	93.8%	94.2%
Ethnicity			
Hispanic / Latino	0.9%	3.7%	3.7%

Across the three data collection periods, the proportion of visitors over 50 years of age increased, along with the 16-to-19 and 20-to-29-year-old brackets (Figure 13). Meanwhile, the proportion of visitors under 16 years of age decreased. The data from the 'middle age' years is more variable.

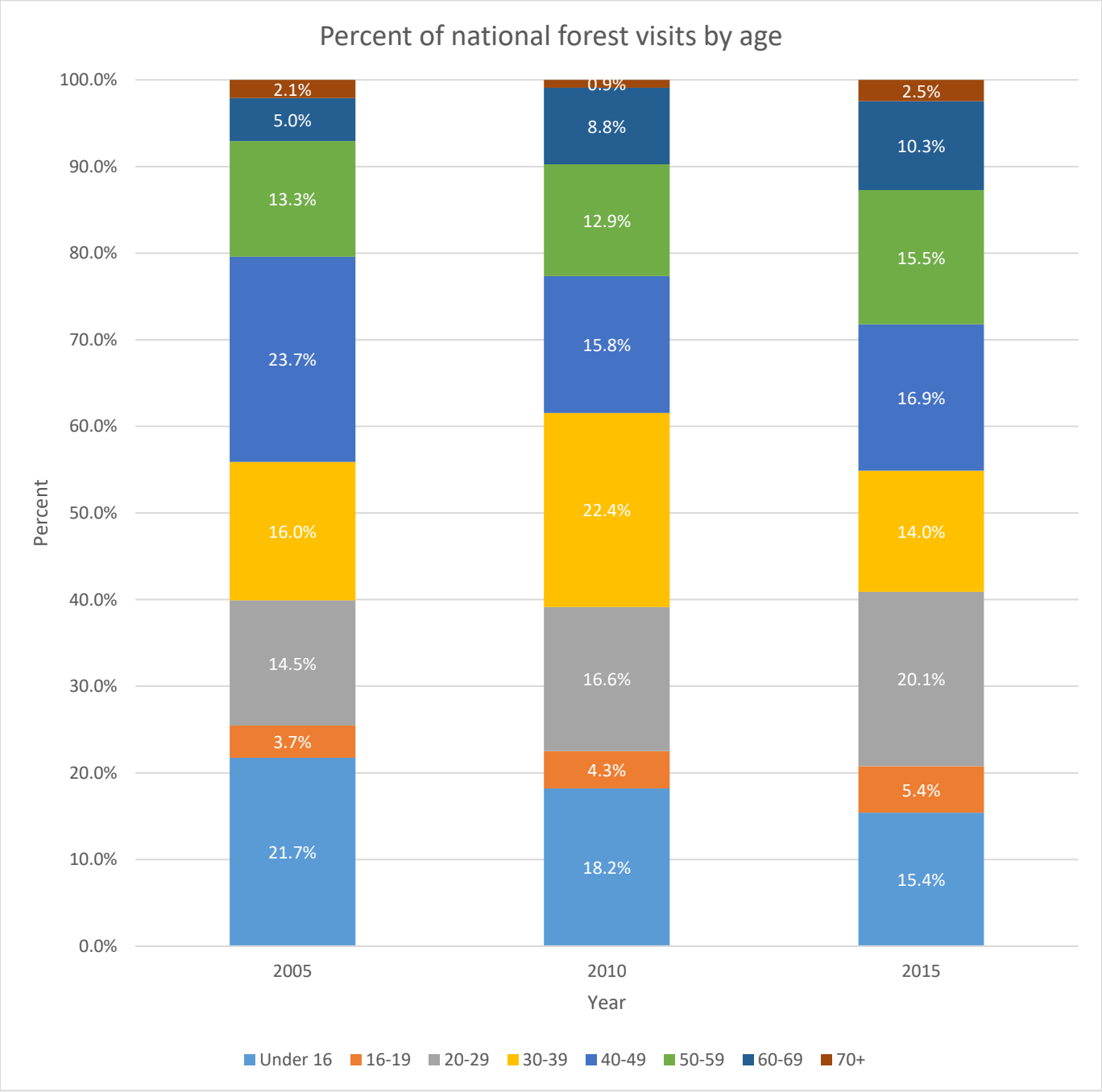


Figure 13. Percentage of visits to the Mt. Baker-Snoqualmie National Forest by age: 2005, 2010, 2015 (data from NVUM, 2005; 2010; 2015)

In the three data collection periods, visitors in the $100,000 to $149,999 annual household income category made up the highest proportions of visits, with one-quarter or more of total forest visits (Figure 14). The proportion of the highest-income visitors (those making $150,000 or more) increased from 6 percent in 2005 to 24 percent in 2015. Meanwhile, the percentage of visitors earning under $25,000 decreased from 7 percent in 2005 to 4.2 percent in 2015. A similar pattern is observed in the $25,000 to $49,000 category, which decreased from 24 percent in 2005 to 10 percent in 2015. It is important to note that these income categories are static and because of inflation, should be interpreted differently for each period.

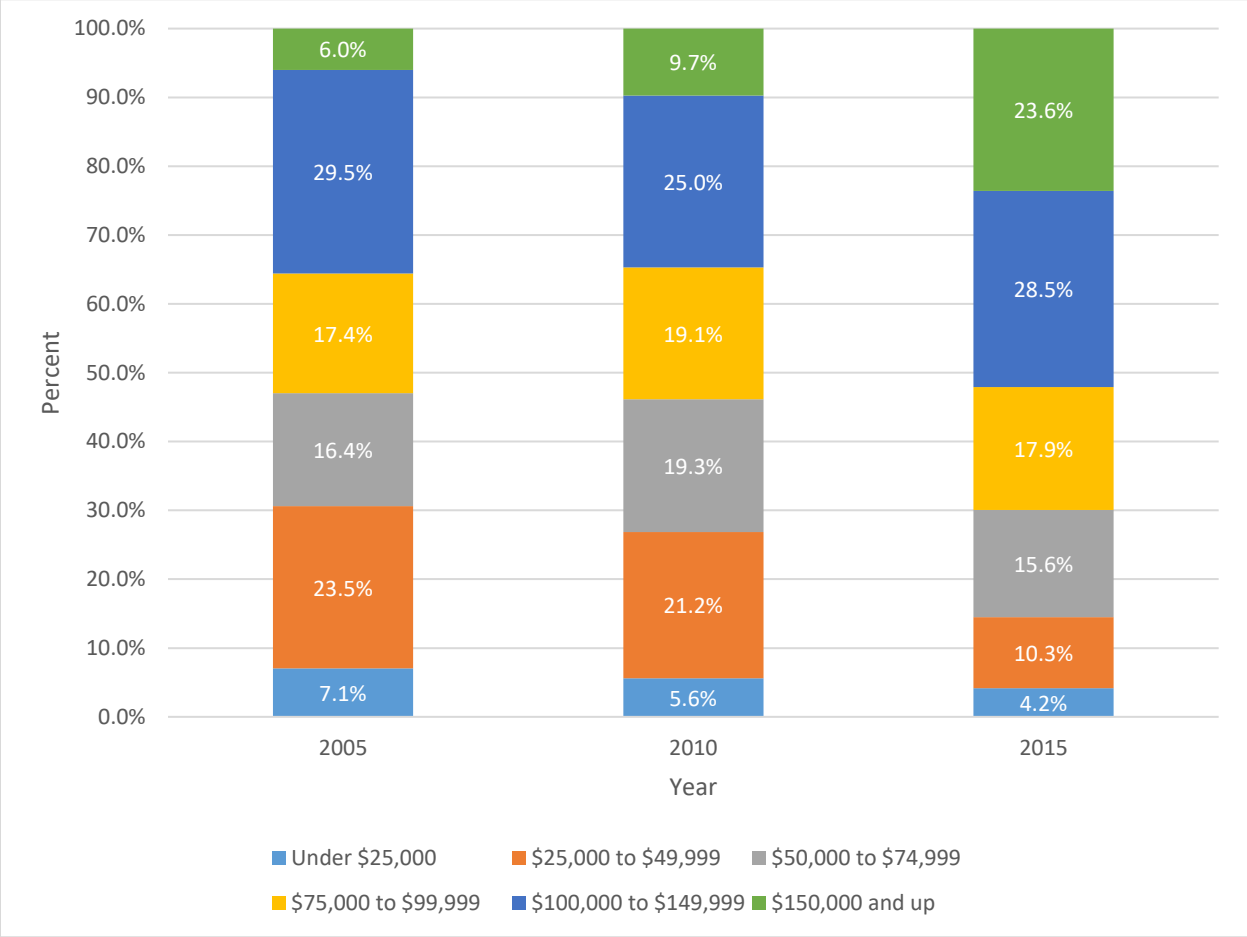


Figure 14. Percentage of visits to the Mt. Baker-Snoqualmie National Forest by household income: 2005, 2010, 2015 (data from NVUM, 2005; 2010; 2015)

Most visits to the Mt. Baker-Snoqualmie National Forest are made by Washington residents (Figure 15). In 2015, 78.6 percent of national forest visits were made by Washington residents, and 64.2 percent of visits were made by residents of the Seattle metropolitan area (King, Pierce, and Snohomish Counties). Out of all visitors, 12.0 percent came from other US states and less than 6 percent were from other countries.

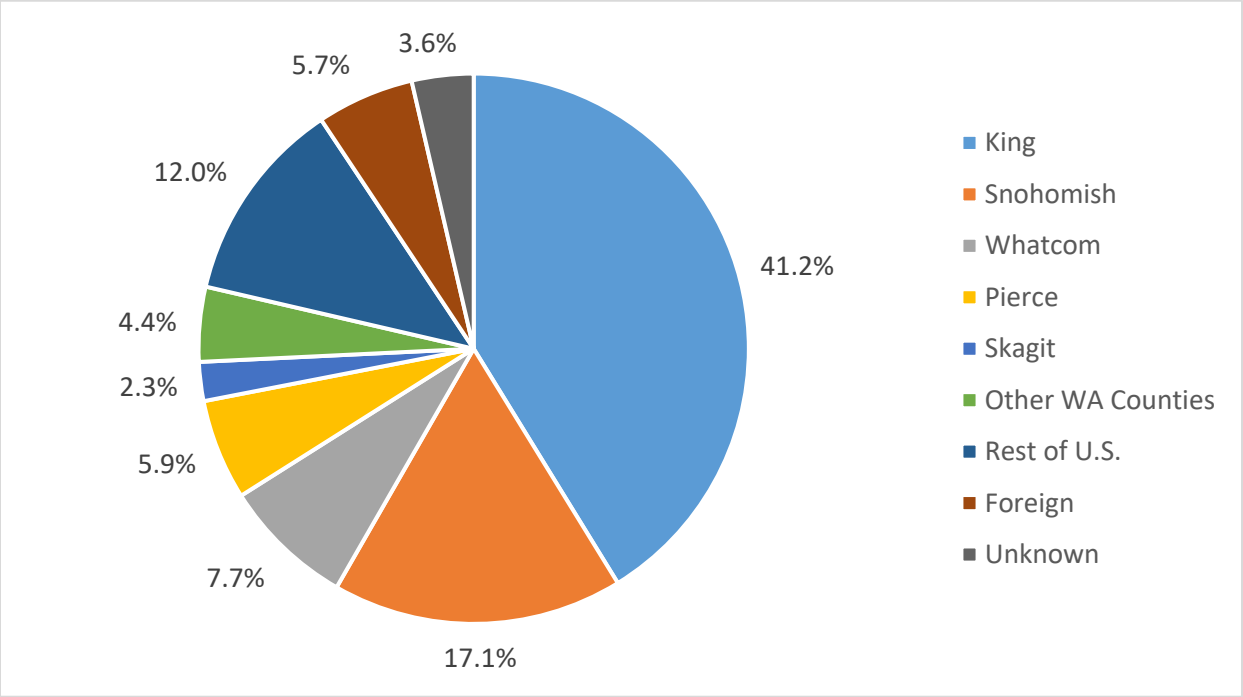


Figure 15. Percentage of visits to Mt. Baker Snoqualmie National Forest visits by origin in 2015 (data from NVUM, 2015)

While some (roughly 10 percent) of visitors travel 20 or fewer miles to the Mt. Baker-Snoqualmie National Forest across the data collection periods, the largest sub-group live within a 26-to-50-mile drive of the national forest (Figure 16). The proportion of visitors driving 26 to 50 miles decreased from nearly half of visitors in 2005 to 29 percent in 2015.

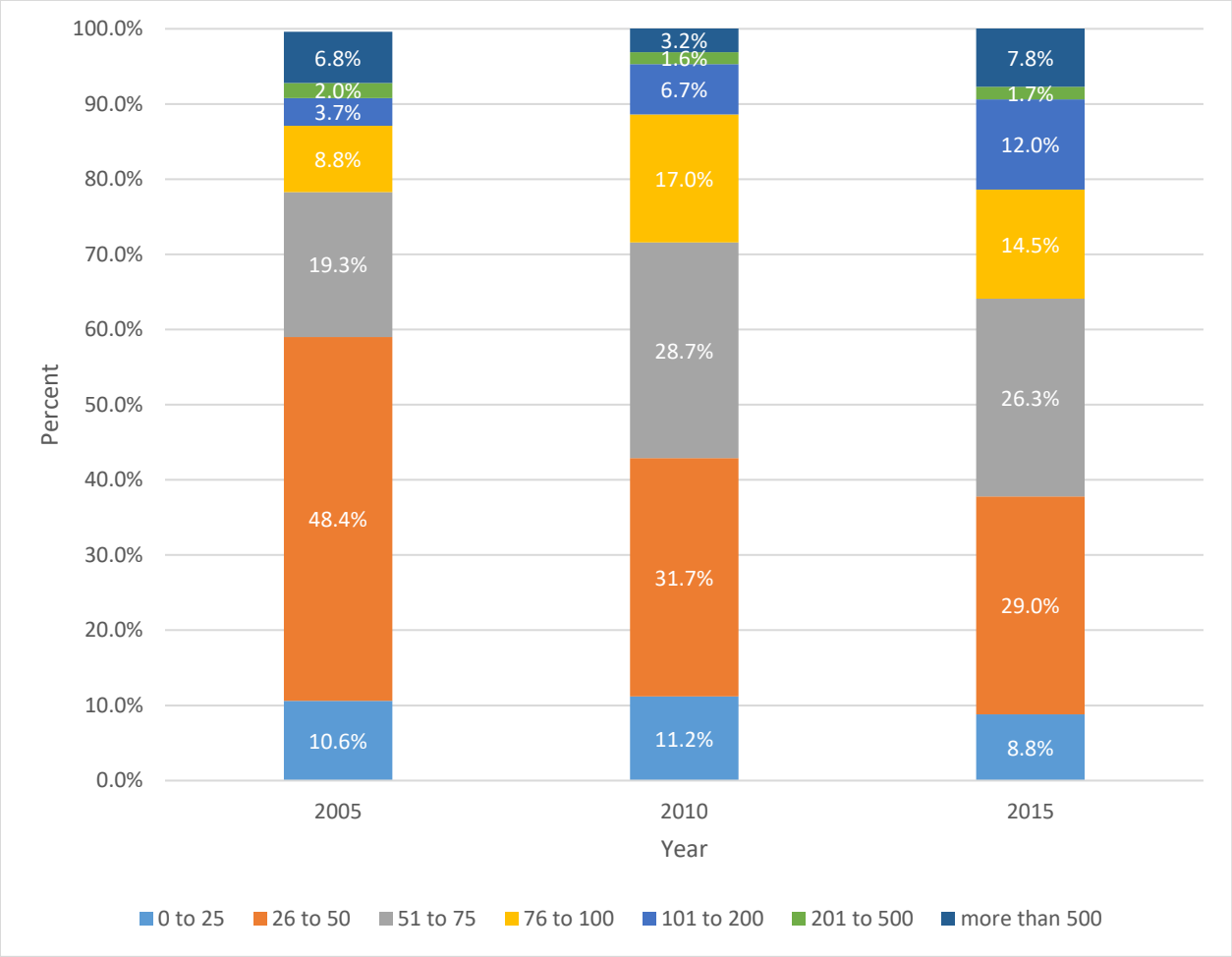


Figure 16. Miles traveled to visit the Mt. Baker-Snoqualmie National Forest: 2005, 2010, 2015 (data from NVUM 2005; 2010; 2015)

For the Skykomish Ranger District in particular, in 2015 over half of visits came from those who live within 60 road miles of the recreation site; visitors who come from 61 or more road miles away constitute 46 percent of visitors (Table 7; White, 2020).

Table 7. Distance visitors travel to the Skykomish Ranger District, from 2015 NVUM (adapted from White, 2020)

Miles from home	District site visits
20 or less	7.7%
21 to 40	16.5%
41 to 60	29.6%
Non-local (>61 miles)	46.1%
Total	100.0%

VIII. Trail and Site-specific Trends

At spatial scales finer than the national forest or district level (such as trends for specific trails or day-use areas), systematic understanding of visitation patterns is challenging for managers. Our best sources for information about site-specific activities and trends are (a) the 2015 Sustainable Roads Report and associated dataset, and (b) modeled visitation estimates from the University of Washington, Outdoor Recreation Data Lab, which has engaged in extensive development and refinement of visitation models that use a variety of data inputs, including the frequency of social media posts. We present data from these two sources here.

Sustainable Roads

Data were collected in 2013 to understand public uses of the Mt. Baker-Snoqualmie road system in support of a strategy to implement the Travel Management Rule of 2005. Results include Human Ecology Mapping data from 285 participants in community workshops and 1,700 respondents to online surveys. Spatial trends for recreation activities are shown in the following series of maps, adapted from the maps and datasets created for the Sustainable Roads Strategy (McLain et al., 2015; USDA FS, 2015)[1]. These maps show the forest destinations that were identified as most important to those surveyed as well as the roads used to access those destinations. Figure 17 shows the destinations and roads that were identified as most important for all outdoor activities combined in the Skykomish Ranger District. The most notable places included the West Cady Ridge area, most likely Blanca Lake Trail, and areas near Rapid River and the North Fork of the Skykomish River. Since hiking is the most common activity on the district, Figure 18 shows destinations and roads that were identified as most important in the district for hiking, most notably the Blanca Lake and Lake Serene trails.

Figures 19-21 show patterns of use for other activities on the district, relative to the entire national forest. Figure 19 shows patterns in motorized recreation activities; motorized use is concentrated in a few areas on the half of the district north of Highway 2, primarily on the Beckler River Road. Figure 20 shows patterns in winter recreation activities mapped by participants in the study, where the area near Steven's Pass is darkest blue. Figure 21 shows patterns for the sociocultural activities mapped by participants in the study, which highlights the West Cady Ridge area.

[1] See Appendix B for details on the recalculation of densities for Figures 17 and 18.

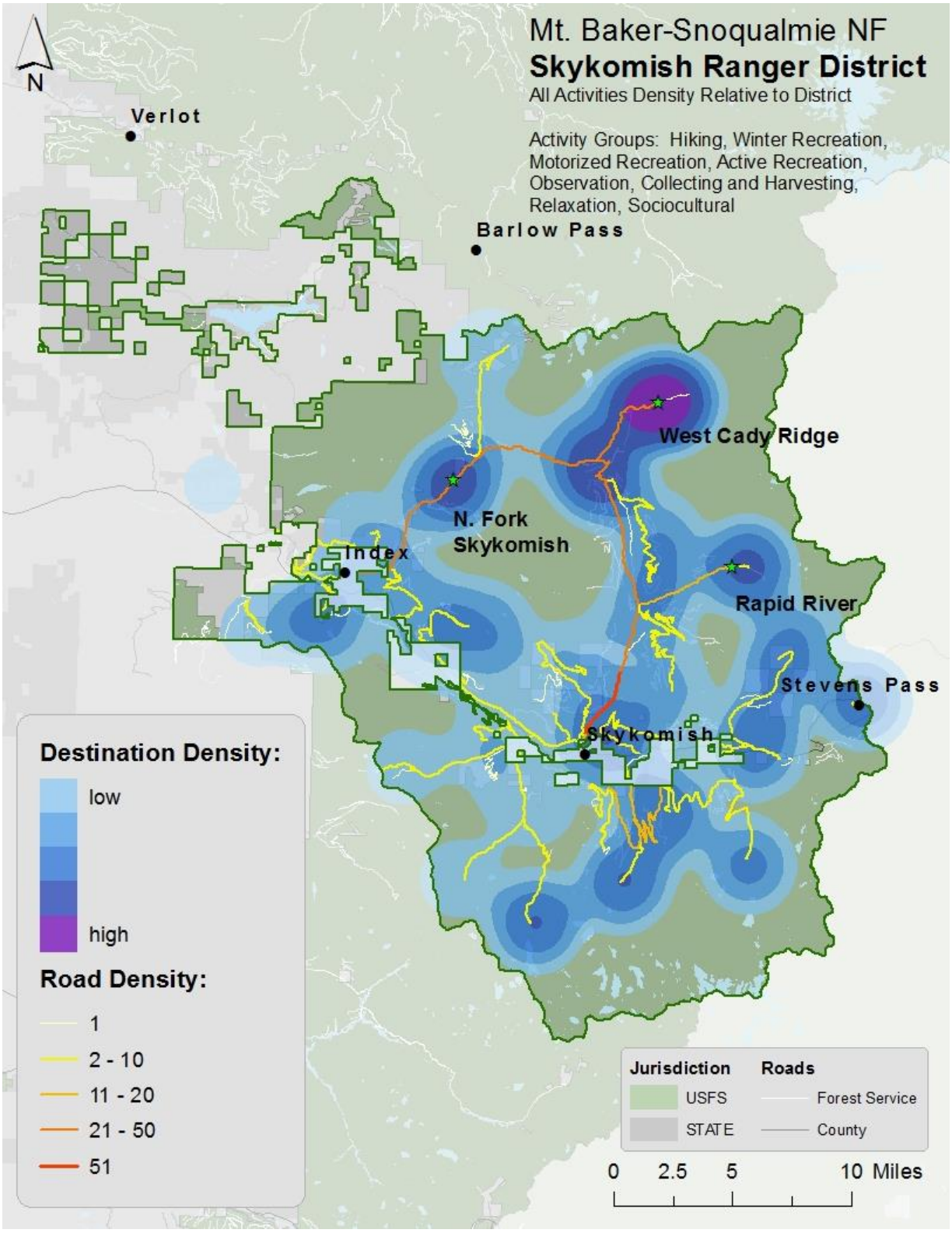


Figure 17. Density of destinations and roads identified as important for all activities on the Skykomish Ranger District (collected through Human Ecology Mapping; data from USDA FS, 2015; district densities re-calculated from forest-wide data)

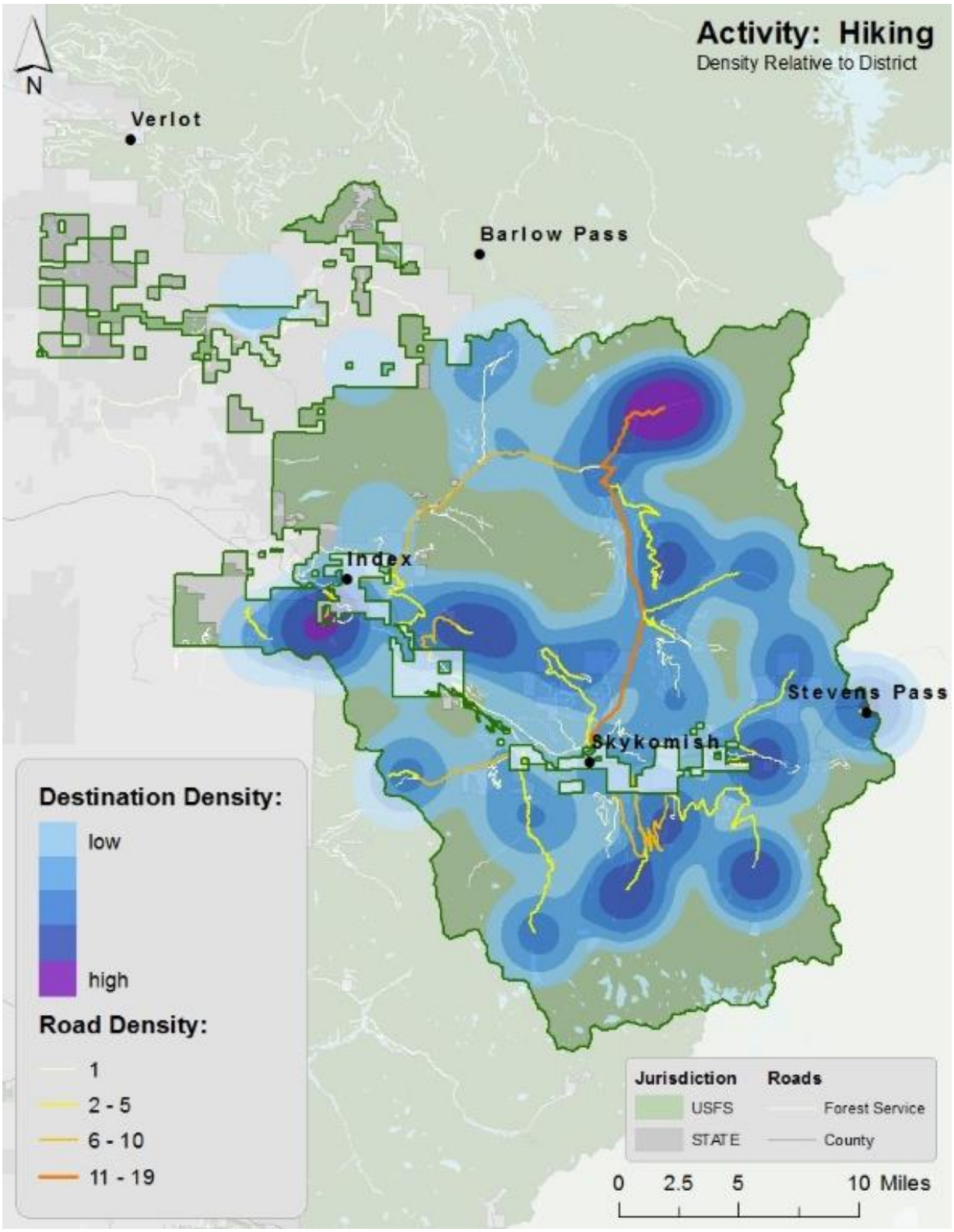


Figure 18. Density of destinations and roads identified as important for hiking on the Skykomish Ranger District (collected through Human Ecology Mapping; data from USDA FS, 2015; district densities re-calculated from subset of forest-wide data)

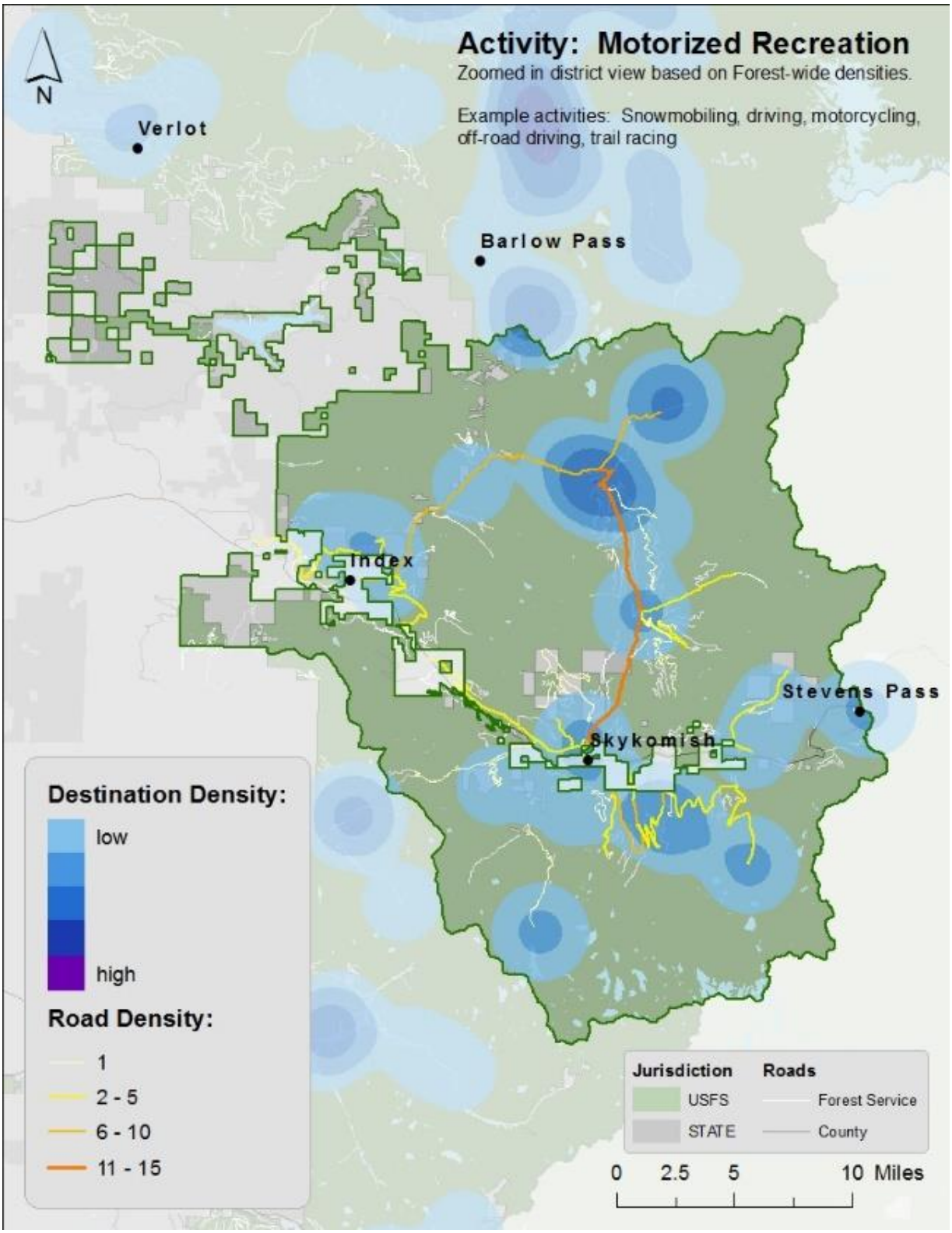


Figure 19. Density of destinations and roads identified as important for motorized activities on the Skykomish Ranger District, relative to the Mt. Baker-Snoqualmie National Forest (collected through Human Ecology Mapping; reproduced from USDA FS, 2015)

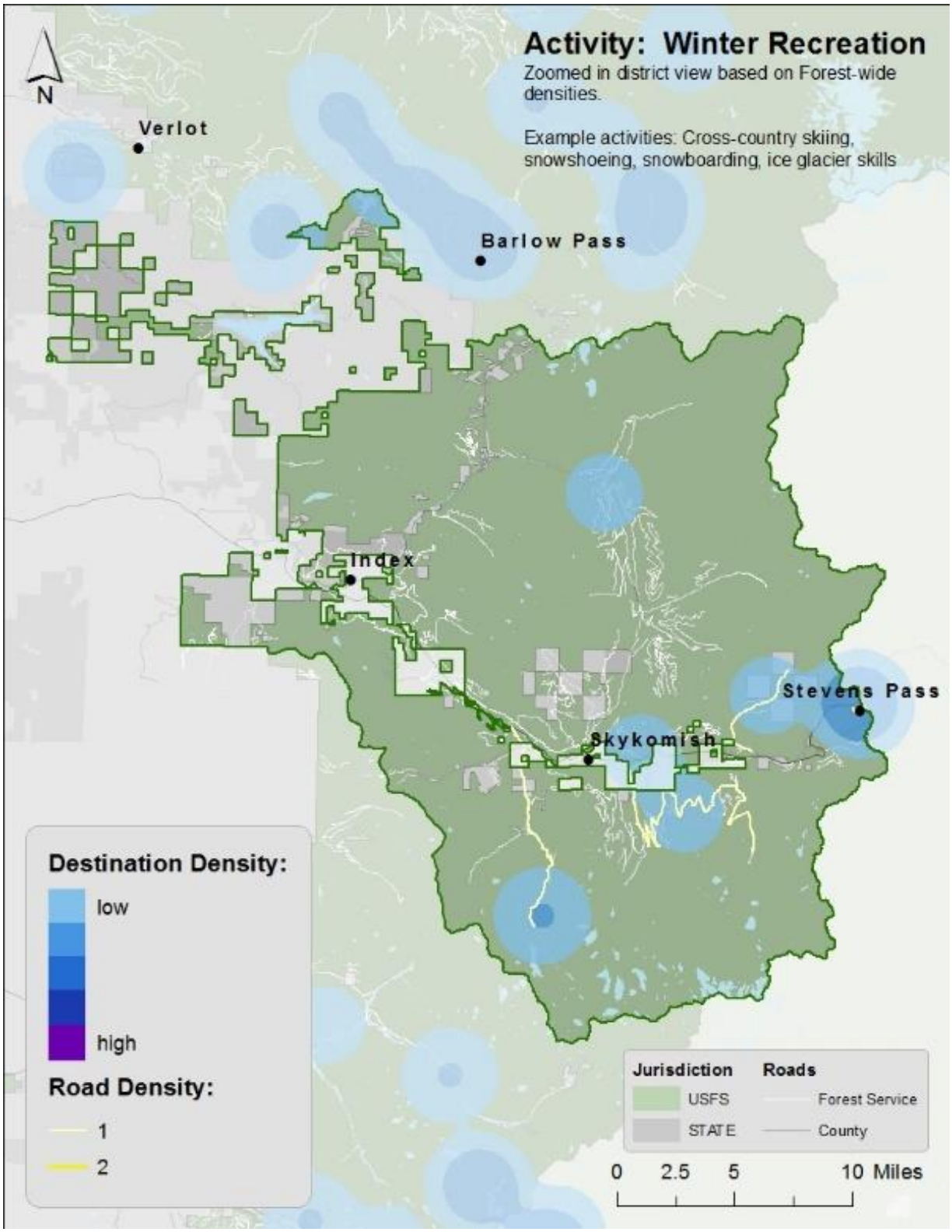


Figure 20. Density of destinations and roads identified as important for winter recreation on the Skykomish Ranger District, relative to the Mt. Baker-Snoqualmie National Forest (collected through Human Ecology Mapping; reproduced from USDA FS, 2015)

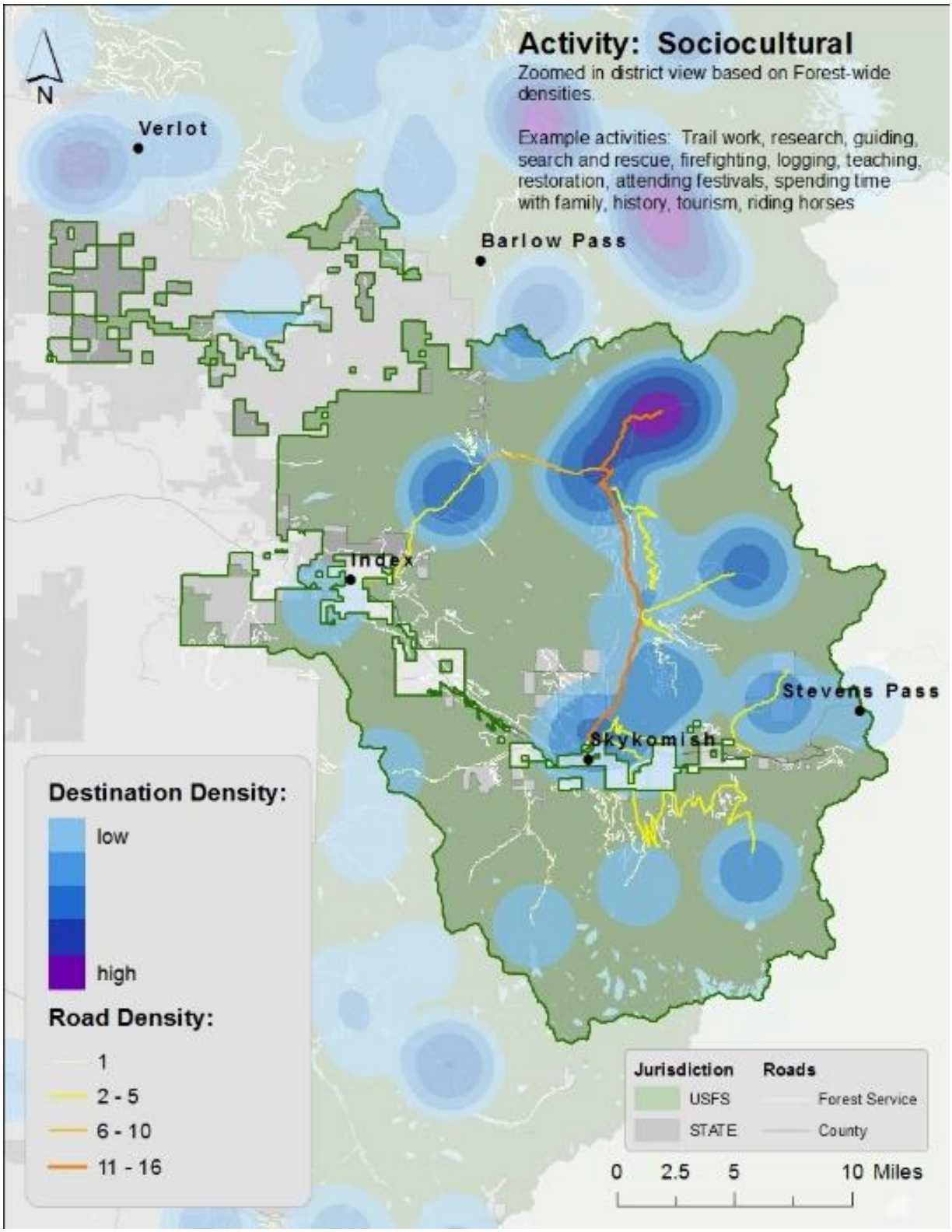


Figure 21. Density of destinations and roads identified as important for sociocultural activities on the Skykomish Ranger District, relative to the Mt. Baker-Snoqualmie National Forest (collected through Human Ecology Mapping; reproduced from USDA FS, 2015)

Modeled visitation

The Outdoor Recreation and Data Lab at the University of Washington has produced modeled visitation estimates for 24 sites on the Skykomish Ranger District over the past five years (2015-2019). See Appendix C for details on methods. Modeled visitation shows that of the 24 sites, the amount of visitation since 2015 has increased at 13 sites, stayed about the same at 5 sites, and decreased at 6 sites (Table 10). Of the 13 sites with increases, 4 increased by 100 percent or more, including the site with the most visitation in 2019: Lake Serene, with an estimated 45,000 visitors (Table 8, Figure 22). Of those 6 sites with decreases, 4 decreased by 10 percent or less. The site with the largest decrease—Surprise Lake—decreased by 40 percent, with about 1,000 visitors in 2019.

Table 8. Sites with estimated visitation in the Skykomish Ranger District based on social media posts, seasonality, weather, and estimated use-levels provided by USFS staff. Estimated 2019 visitors and Estimated % change are both calculated from modeled estimates. Site number corresponds to the labels in Figure 22 (reproduced from Outdoor Recreation and Data Lab, 2020)

Site Number	Trail Name	Estimated 2019 Visitors	Estimated % Change (from 2015)
1	Lake Serene	45,000	+110%
2	Barclay Creek	24,000	+100%
3	Necklace Valley	15,000	+40%
4	West Fork Foss Lakes	14,000	+55%
5	Balance Lake	12,000	-20%
6	Lake Clarice	8,000	+40%
7	Iron Goat	7,000	+100%
8	Jennifer Dunn	7,000	+100%
9	Dorothy Lake	7,000	+30%
10	Evergreen Mtn	7,000	+35%
11	Tonga Ridge	6,000	+25%
12	Deception Creek	5,000	About the same
13	West Cady Ridge	4,000	-5%
14	Johnson Ridge	3,000	+40%
15	Quartz Creek	2,000	About the same
16	Kelly Creek	2,000	About the same
17	North Fork Skykomish	2,000	About the same
18	Pass Creek	2,000	About the same
19	North Fork Skykomish	1,500	+30%
20	Pass Creek	1,000	+25%
21	PCT North Stevens Pass	1,000	-10%
22	Surprise Lake	1,000	-40%
23	Evans Lake	1,000	-10%
24	Meadow Creek	500	-5%

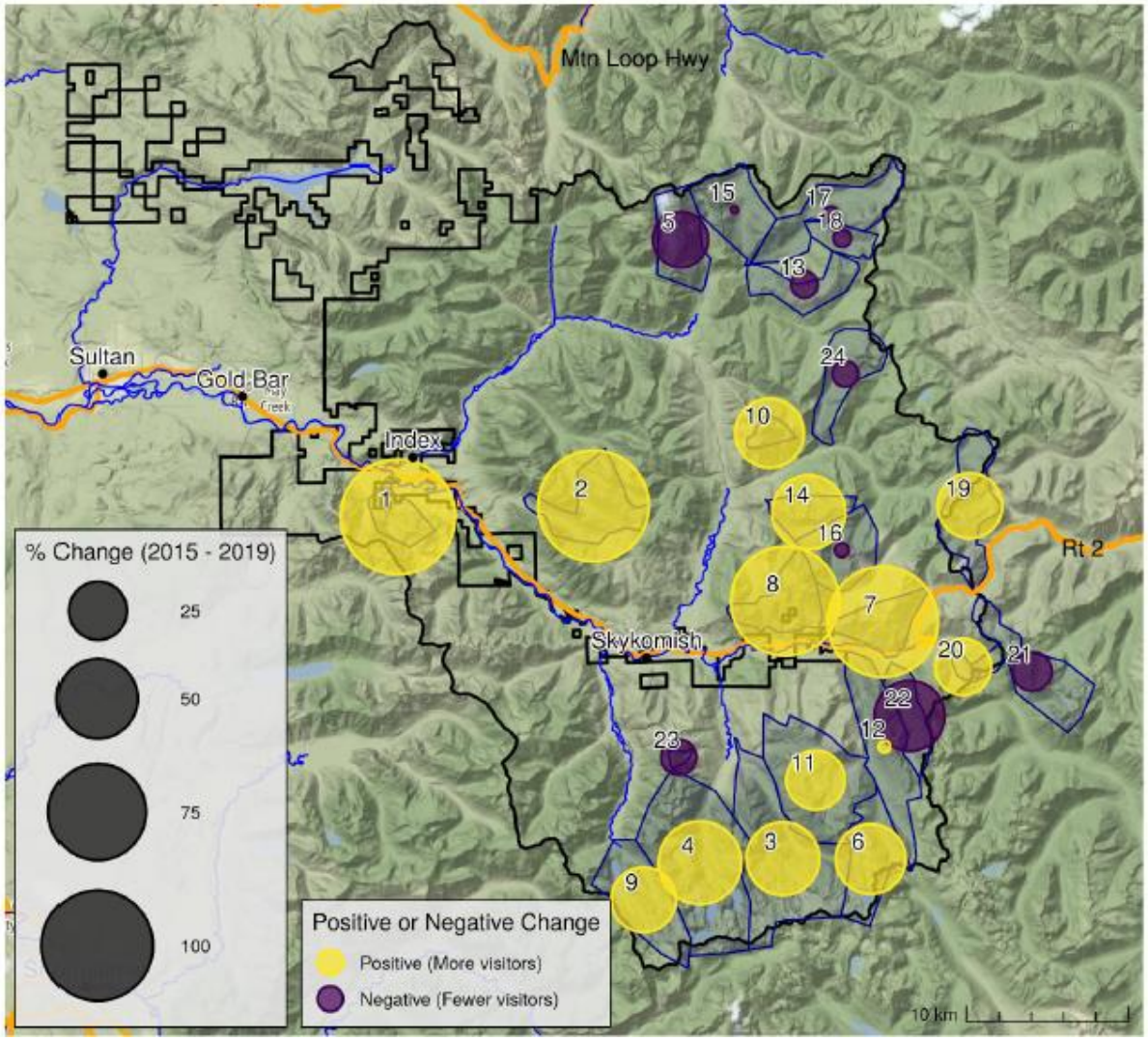


Figure 22. Estimated percentage change in visitation between 2015 and 2019 to non-motorized recreation sites in the Skykomish Ranger District (reproduced from Outdoor Recreation and Data Lab, 2020)

Part B: Governance Approaches

IX. Guiding Questions

Growing populations and increasing recreational use (described in Part A) mean that visitation may be occurring in areas where recreation infrastructure is not designed for such intensive use and where ecological conditions are not protected from its effects. This can affect how people interact with each other, their personal or communal connections to nature, and the overall ecology of these areas. The social, cultural, and ecological effects from these changing visitation patterns can have far-reaching and interconnected effects within social-ecological systems.

These trends can mean the need for new or different management strategies on public lands. An understanding of where population growth is occurring, the shifting demographics of potential visitors to public lands, and the drivers of visitation will help managers select the tools, techniques, and approaches that will provide sustainable recreation opportunities. The goal of the following section is to offer insights on how these dynamics on the Skykomish Ranger District and surrounding area could be influenced through a wide range of governance approaches. Specifically, we focused on answering:

- What management approaches have been used to influence the dynamics and effects of recreational uses on the sustainability of public lands, especially in areas of increasing human populations?
- How could these approaches inform recreation management practices on the Mt. Baker-Snoqualmie National Forest to support desirable outcomes for social-ecological systems?

X. Process

To begin to answer these questions, we conducted a literature review and interviews with key informants. We then developed a table describing the management strategies we learned about through these efforts.

Our key interest for the literature review was to identify and understand strategies public land managers have used to address challenges and opportunities related to recreational uses. The team generated an initial list of publications that included 24 academic journal articles and government and NGO reports that presented models, descriptions, or case studies related to recreation, tourism, protected area management, and tribes/indigenous groups. Then, we expand on our initial list, using various combinations of keywords on Google Scholar and Academic Search Complete including: *tourism, recreation, visitation, visitor, collaboration, co-management, governance, leadership, management, planning, visitor management, park, forest, indigenous, native, aboriginal, ancestral, First Nations, and tribes/tribal*. In total we reviewed 61 peer-reviewed articles, NGO publications, government publications, book chapters, news articles, and theses (see Appendix D). While we included in this review a few recreation ecology review articles examining the ecological effects of various recreation uses and site-level visitor management strategies, we did not exhaustively review this field.

We developed a Google form to record and organize insights from the review of these articles. The form included the following fields: type of publication, location of publication study, key words, brief description of publication, key issues addressed, key strategies, and relevance to the management project. One primary team member read the articles and documented their content in the form.

We also identified six key informants to interview to help refine the framing of our questions, suggest additions to our literature review, and identify key governance approaches and examples of interest. These key informants were scholars and practitioners in protected area management, some of whom had a focus on Indigenous peoples and natural resource governance and co-management. We developed a set of questions to guide the interviews (Appendix E). One team member conducted all the interviews, took notes on the conversations, and shared these with the project team. Key informants' suggested sources and examples were incorporated into the literature review process described above.

After completing the key informant interviews and the literature review, the project team compiled, reviewed, and discussed the key strategies that we had learned about. We used this information to create a strategies table which categorized and summarized the management approaches that were both of broad interest and of specific relevance to our project (Table 9, below).

XI. Management Strategies

We defined a strategy as an approach to understand and/or address the location, volume, seasonality, or effects of recreational use within a public land management unit, or across multiple jurisdictions. Table 9, while not exhaustive, offers an overview of 25 management strategies, which we grouped into five types of approaches managers use to study, inform, influence, or moderate human uses (Table 9, column 1). These types include:

- Data collection/analysis: strategies that require systematic inquiry
- Access limitations: strategies that require controls over where and when access is allowed
- Information and education: strategies that include communications with the public
- Administrative: strategies that require changes in administrative designations
- Co-management/collaborative: strategies that require varying degrees of shared decision-making and authority

For each strategy, we offer a brief description and outline potential co-benefits and challenges.

Table 9. Summary of management strategies that could be used to inform, influence, or moderate human uses on public lands, and related benefits and challenges

Type	Strategy	Description	Potential Co-benefits	Potential Challenge(s)
Data Collection/Analysis	Recreation ecology studies	Evaluate biophysical impacts in a defined area, to understand how recreational uses affect soil, water, air, plants, animals, and/or habitat quality. Study areas can be chosen to investigate specific concerns, with findings to inform management actions.	Can promote cooperative working relationships among researchers, land managers, outdoor recreation organizations, and tribes.	Studies tend to be site or trail specific and generally do not treat study areas as part of a larger social-ecological system.
	Limits of Acceptable Change (LAC) studies	Assess social and resource conditions within a defined area, to help describe the range of acceptable conditions and establish metrics to monitor their change.	Can promote cooperative working relationships among researchers, land managers, outdoor recreation organizations, and tribes.	Sites may have different desired conditions. Insufficient capacity to establish appropriately scaled evaluations and monitoring.
	Cultural resource / sacred site inventory	Inventory and describe cultural sites, resources, and uses within a pre-defined area. Areas of focus can be identified to serve tribal concerns and interests. Intended to create a record of the cultural history of the area and result in more informed management decisions that improve protection of cultural resources.	Can promote cooperative working relationships between public land managers and tribes.	Inventories can be labor intensive due to the size of the area and number of tribes to consult, and the sensitive nature of information.
Access Limitations	Temporary closure	Prohibit activity within a specified area for a given amount of time. May occur seasonally. Intended to decrease the number of people in the area to protect species and habitat and/or help meet federal obligations to protect tribal treaty rights.	Can result in other secondary ecological benefits.	Can result in a negative public response and/or displace activities to other sensitive areas. Limited by capacity for enforcement. Temporary nature of ban may be insufficient for ecosystem restoration or some cultural/treaty uses.
	Decommissioned roads[2]	Decommission 'problem' or lesser used roads and remove infrastructure meant to keep the road intact. Intended to reduce agency costs for road maintenance, reduce potential of culvert failure, and improve water quality and ecological conditions by reducing road-related erosion.	Can result in improved repair capacity and/or improved visitor and employee safety.	May reduce vehicular access for managers, tribes, and visitors. May impact tribal access to exercise treaty-reserved rights.

[2] For example, see example from the Nez-Perce Clearwater National Forest (USDA Forest Service n.d.-b).

	Reduced road/trail maintenance[3]	Re-designate road/trail maintenance levels to manage access; passively limit traffic by reducing maintenance to sites to discourage certain uses. Intended to maximize maintenance of higher priority roads and trails.	Less trafficked roads may serve important ecological and/or treaty access purposes. Less maintained roads and trails may appeal to some recreationists.	May not deter recreation visits in places of high demand. Interactions with parking and other constraints. Potential to increase recreational use and/or displace it other sites.
	Limit parking areas[4]	Reduce number of parking spaces near heavy use sites by decreasing the size of lots and/or installing 'no parking' signs in areas. Intended to passively reduce the number of recreators within areas of heavy use.	May improve ecological conditions and trail experiences for those visitors seeking to encounter fewer people.	Unlawful parking may increase, harming resources and inhibiting emergency response. Adequate enforcement needed to be successful. Visitors may seek alternative sites, increasing use in less-developed areas.
	Restriction of activities to designated sites[5]	Only allow certain activities in designated sites, such as campsites in wilderness or along rivers. Intended to reduce or eliminate disturbance of vegetation and water quality impacts and maintain opportunities for solitude. May include physical barriers and removal of established campsites.	May improve experiences for those who are able to use sites in designated areas.	May promote day trips instead of overnight trips, or entry from different locations to circumvent quotas. May spread peak visitation across a longer season resulting in higher overall visitation. Ensuring compliance is limited by law enforcement capacity.
	Entry quotas/permits[6]	Institute entry quotas and permits for overnight wilderness visits, or in high use, degraded, or other areas of management concern. Intended to reduce undesirable ecological or social effects of high use levels, such as the spread of campsites and impacts to vegetation, wildlife and water quality. Can help meet federal wilderness solitude standards.	Provides opportunity for people to plan ahead to secure permits. Can increase public awareness of ecological concerns.	May promote day trips instead of overnight trips, or entry from different locations to circumvent quotas. May spread peak visitation across a longer season resulting in higher overall visitation. Ensuring compliance is limited by law enforcement capacity.
	Voluntary ban/closure	Encourage the public to temporarily halt recreation activities in a specific area, during a particular time/season. Intended to decrease the number of recreationists in an area and increase privacy for Indigenous cultural practices or other purposes.	May be supported by educational programs, NGOs, outdoor industry groups. Can increase public awareness of Indigenous interests/rights or ecological concerns. May reduce negative ecological effects resulting from public uses.	Can result in a negative public response and/or displace activities to other sensitive areas. May not completely limit activity and does not offer recourse against those who do not comply.

[3] Supports implementation of Travel Management Subpart A & B Decisions; see for example, Mt. Baker-Snoqualmie Sustainable Roads planning process (USDA Forest Service 2015).
[4] For example, see Eightmile Road example from the Okanogan-Wenatchee National Forest (USDA Forest Service 2019).
[5] Examples include the Alpine Lakes Wilderness Plan, Mt. Baker-Snoqualmie & Okanogan Wenatchee National Forests.
[6] Examples include the Alpine Lakes Wilderness Plan, Enchantments Entry Quotas, John Muir, Ansel Adams & Dinkey Lakes Wilderness Plan, Central Cascades Wilderness Plan.

Information & Education	Targeted communications	Promote less-sensitive destinations to re-direct visitors from sensitive or high visitation sites on trip planning platforms, trip report blogs, and other apps. Intended to reduce visitation in areas of management concern.	May encourage visitors to explore new places.	May promote dispersion; increased visitation in less-developed areas may exceed site design or harm resources.
	Interpretive signage[7]	Co-develop and install interpretive signs or displays to communicate the cultural or historical significance of a site. Intended to create space for a tribe or community partner to tell their stories to the public, creating greater awareness of cultural history and connections to the land, and promoting recreation behaviors that support those values.	Process of development can lead to better understanding between land managers and partners.	Visitors may not read the signs. Potential for historical or cultural simplification, and vandalism to signs or displays.
	Resource impact signage	Develop and install signs or displays to teach visitors about the biophysical effects of recreational activities and methods to mitigate impacts on plants, water, and wildlife. Intended to help recreationists reduce their negative effects.	May enhance visitors' outdoor experiences with improved knowledge about indicators or ecosystem health. May build support for other strategies that help manage recreation more sustainably.	Visitors may not read signs or be receptive to messaging. Potential for vandalism to signs or displays.
	Cross-cultural outdoor education programs	Offer outdoor education programs developed and led by tribes, intended to generate greater public understanding of public land connections, and encourage greater environmental respect and compliance with policies.	Process of development may lead to better understanding between land managers and partners.	Funding may be limited to create, promote, and sustain programming. Volunteer interpreters are likely needed.
	Treaty rights / Indigenous history seminars[8]	Offer introductory seminars to educate land managers or NGOs on treaty rights, Indigenous history, and legal authorities. Useful for agencies with high turnover.	May promote improved working relationships between public land managers, tribes, and other organizations.	Potential capacity challenges for tribes, agencies and other participants to provide input for or host seminars.

[7] For example, see Gifford Pinchot National Forest Huckleberry Management Strategy (USDA Forest Service, 2017).
[8] For example, the Tulalip Tribes has developed a "Treaty 101" Curriculum for NGOs and government.

Administrative	Special designated areas[9][10]	Create a special designation such as a Natural Research Area, Experimental Forest, or Wilderness Area. Intended to reduce resource disturbance, increase habitat value for plants and wildlife, and/or create opportunities for scientific study. Generally communicated through signage.	Creates educational opportunity to increase public awareness of ecosystem health, and factors that affect it.	Does not guarantee a significant reduction in disturbances created by public uses. Compliance is often not enforced. Restrictions related to designations may have practical negative effects on tribal access or flexibility in managing for treaty resources. Special designations may require approval by Congress or agency heads.
	Commercial use permit moratorium	Prohibit the issuance of permits for commercial use within a specified area during a specific time period. Intended to decrease disturbance of resources.	May improve experiences for visitors who prefer encountering fewer professionally guided groups.	Potential for negative public response. May result in inexperienced visitors unable to enlist professional outfitters/guides.
	Renaming with culturally appropriate names	Rename or redesignate a site/location/area to be more inclusive of Indigenous peoples and educate the public.	May improve relations with tribes and inclusivity for Indigenous peoples. Could improve compliance and care for these areas.	A site/location/area could have several names that are commonly used (e.g., Mt. Rainier, Devils Tower). Public may not support changes.
	Cooperative law enforcement agreements[11]	Establish cooperative agreement with state/county/tribal law enforcement. Intended to supplement law enforcement capacity to effectively enforce public land policies.	Sharing jurisdictional control may promote mutually beneficial partnerships.	Potential difficulties in maintaining relationships and agreement with staff turnover.
	Cooperative specialist agreements	Establish agreement to collaborate with state/county/tribal specialists. Intended to help augment agency capacity to carry out management strategies.	May improve cooperative working relationships with local entities and interests.	Limited capacity of staff from agencies may not be able to fulfill multiple commitments.
	Memoranda of agreement (MOA) with treaty tribes[12]	Establish government-to-government agreement with treaty tribes to share in the responsibility for the protection and enhancement of the environment, especially as they pertain to treaty rights in traditional aboriginal territory and treaty protected use areas.	May strengthen working partnerships through effective coordination, collaboration, open/timely communications, and the meaningful consideration of tribal interests, rights, and priorities.	Limited staff and funding capacity may make fulfillment of all commitments challenging.

[9] For example, see Gifford Pinchot National Forest Huckleberry Management Strategy (USDA Forest Service, 2017)
[10] For example, the Swedaxali Co-Management Area is a cooperatively managed area in support of enhancing tribal cultural and treaty resources, as designated in Tulalip Tribes-Mt. Baker-Snoqualmie National Forest Memorandum of Agreement.
[11] For example, the Manti-La Sal National Forest & San Juan County Sheriff have a Cooperative Law Enforcement Agreement.
[12] For example, the Tulalip Tribes established the first tribal-federal MOA on the Mt. Baker-Snoqualmie National Forest in 2007. See also MOAs from other treaty tribes, including those from Chippewa and Ojibwe tribes in the Great Lakes region, some of the first in the nation to be established with the U.S. Forest Service.

Co-management and Collaborative Management	Co-managed areas[13]	Share management decision-making in a specified area through an agreement among state/federal/tribal land management agencies. Intended to substantially increase management capacity.	May improve relationships among participating entities. May reduce negative ecological, socioeconomic, or cultural effects of recreation and enhance cultural, treaty resources.	Potential difficulties may arise in deciding on the division of management authority and cost burdens.
	Strong co-management	Work within government-charted structure with strong authority for most decision-making ceded to local entities and interests. A chartered structure could be one comprised of treaty tribes if co-management is the objective. Trust responsibilities remains federal as the signatory to the treaty. Intended to increase management capacity to meet large-scale conservation goals.	May improve relationships among participating entities.	May face challenges with communicating potential project goals and methods.
	Informed decision-making	Establish consultative process to develop goals and strategies, wherein no authority is ceded to local entities or interest.	May improve relationships among participating entities.	Differing values/interests of local entities may complicate management decisions or lead to potential feelings of inadequate representation in decision-making process.
	Weak co-management	Establish government-chartered structure with limited authority ceded, often case by case, to local entities and interests. Intended to increase management capacity to meet small-scale conservation goals.	May improve relationships between participating entities.	Minimal projects may not yield desired progress to meet projected goals.

[13] For example, the Swedaxali Co-Management Area is a cooperatively managed area in support of enhancing tribal cultural and treaty resources, as designated in Tulalip Tribes-Mt. Baker-Snoqualmie National Forest Memorandum of Agreement.

XII. Management Themes

While certain examples that arose through our literature review and interviews described unique management hurdles with very context-specific strategies, we identified several broader recreation management themes related to implementation of these strategies. These included:

- **Community engagement in natural resource management.** Involving members of relevant communities in management policies can be useful in identifying key issues and improving management capacity. Collaboration and communication between agencies, municipalities, and tribes presents an important opportunity to meet management goals as well as federal obligations to treaty tribes. Many collaborative recreation management strategies have been effectively used by domestic and international land managers, with far-reaching benefits for resource management and public service.
- **Efficient structures of communication.** Facilitating interactions between land managers and communities is important for relationship building, understanding concerns and priorities, developing management plans that meet public expectations, and promoting awareness about the potential effects of recreation uses in different areas. Effective and efficient structures for communications are needed to accomplish this.
- **Management capacity challenges.** Limited management capacity is a frequently cited implementation challenge. Increased agency capacity may be needed to effectively carry out many of the strategies outlined here. Capacity can be built internally, through cooperative management, and other partnerships.
- **Effective use of strategies and compliance structures.** Some management strategies require implementation concurrently or in sequence with others to effectively accomplish management goals. Within a Forest Service context, some strategies require using multiple authorities. Furthermore, land managers will need to employ a variety of approaches and partnerships to ensure adherence or compliance with management strategies outlined here.

Conclusion

This report describes recreational use and trends on the Mt. Baker-Snoqualmie National Forest over the past decades. With a particular focus on the Skykomish Ranger District, we compiled various pre-existing data sources to examine multiple dimensions of recreation use from the site to state level, including the number of visitors, the types of activities, the duration of their visits, and other characteristics of people who visit. Recreation information compiled reflects different periods of time, ranging from 2005 to 2020, and is reported at different levels of granularity, including state-wide, national-forest-wide, and district levels.

The Mt. Baker-Snoqualmie National Forest is adjacent to a rapidly growing Seattle metropolitan area, offering relatively easy access for day trips from nearby counties, which comprise the majority of visits. Hiking is most often the primary activity for visitors. NVUM reports show that forest-wide visitation occurred at substantially higher levels in 2015 compared to the 2010 and 2005 data collection periods. Forest-wide estimates are not yet available from NVUM's most recent data collection period (2020), but from 2015-2019, modeled visitation at select trail sites on the Skykomish Ranger District (completed by the University of Washington) shows increases at just over half of the sites estimated; a few of these trail sites demonstrate dramatic increases. Most data sources presented in this report do not yet reflect what many regional land managers have described as an increase in recreational use in recent years, especially in the summers of 2020 and 2021 during the COVID-19 pandemic. Given these extraordinary circumstances, it will be important to continue to assess recreation use patterns and pandemic-related effects on the Skykomish Ranger District as new data become available.

This report can be used to help identify types of data that would offer a richer understanding of recreational uses on the Skykomish Ranger District and surrounding areas. Appreciating data gaps that limit the scale or granularity of understanding can help motivate new research and monitoring projects to produce the data needed to inform planning and management decisions. The report raises questions about what might be expected in the future, given considerable and evolving changes in ecological, social, and cultural conditions in the region. While it is outside the scope of this project to make such projections, recreational uses will certainly be influenced by, and contribute to, these changes. Well-informed projections would help managers understand the range of future social-ecological scenarios that are reasonable to anticipate.

This report also summarized a wide range of management approaches land managers have used to influence the dynamics and effects of recreational uses. We offer examples that help illustrate the potential co-benefits and unexpected challenges that may arise from different approaches. While there is no one-size-fits-all solution to recreation management challenges on public lands, various combinations of these strategies, implemented collaboratively, could contribute to positive outcomes for people, the sustainability of public lands and ecosystems, and valued cultural and natural resources.

References

Agrawal, A. (1995). Dismantling the divide between indigenous and scientific knowledge. *Development and change*, *26*(3), 413-439. https://doi.org/10.1111/j.1467-7660.1995.tb00560.x

Cerveny, L.K., Derrien, M.M., Miller, A.B., eds. (2020). A research strategy for enhancing sustainable recreation and tourism on public lands. Gen. Tech. Rep. PNW-GTR-991. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 102 p. https://www.fs.fed.us/pnw/pubs/pnw_gtr991.pdf

Fox, J. (2014). Washington State Population Trends and Implications for Outdoor Recreation. Prepared for the Washington Blue Ribbon Task Force on Parks and Outdoor Recreation March 2014.

Future IQ. (2018). Regional Baseline Assessment Report, Snohomish County Tourism Industry. https://future-iq.com/wp-content/uploads/2017/10/Snohomish-County-Regional-Baseline-Assessment-Report.pdf

Hunn, E., Johnson, D., Russell, P., & Thornton, T. (2003). Huna Tlingit traditional environmental knowledge, conservation, and the management of a "wilderness" park. *Current Anthropology*, *44*(S5), S79-S103. https://doi.org/10.1086/377666

McLain, R., D. Banis, A. Todd, and M. Psaris. (2014). Where do Mt Baker-Snoqualmie National Forest visitors go and which roads do they use to get there? An analysis of the spatial data from the 2013 Sustainable Roads Workshops. https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1063&context=geog_fac

Nadasdy, P. (1999). The politics of TEK: Power and the" integration" of knowledge. *Arctic Anthropology*, 1-18.

National Visitor Use Monitoring [NVUM] 2020. U.S. Forest Service, National Visitor Use Monitoring Survey Results, National Summary Report. https://www.fs.usda.gov/sites/default/files/2020-National-Visitor-Use-Monitoring-Summary-Report.pdf

National Visitor Use Monitoring [NVUM] (2015). Visitor Use Report Mt Baker-Snoqualmie NF. https://apps.fs.usda.gov/nvum/results/ReportCache/2015_A06005_Master_Report.pdf

National Visitor Use Monitoring [NVUM] (2010). Visitor Use Report Mt Baker-Snoqualmie NF. https://apps.fs.usda.gov/nvum/results/ReportCache/2010_A06005_Master_Report.pdf

National Visitor Use Monitoring [NVUM] (2005). Visitor Use Report Mt Baker-Snoqualmie NF. https://apps.fs.usda.gov/nvum/results/ReportCache/2005_A06005_Master_Report.pdf

Northstar. (2018). Overnight Visitor Origin Study. https://s3.amazonaws.com/snohomish-2018/craft/Files/Consumer_Research_Findings.pdf

Office of Financial Management [OFM]. (2017). GMA Population Projections for Counties, population by age and sex, five-year age groups. https://www.ofm.wa.gov/washington-data-research/population-demographics

Office of Financial Management [OFM]. (2020a). GMA Population and Components of Population Change, 1970-2020. https://www.ofm.wa.gov/washington-data-research/population-demographics

Office of Financial Management [OFM]. (2020b). GMA County Share of Population Growth, 1970-2020. https://www.ofm.wa.gov/washington-data-research/population-demographics

Outdoor Recreation and Data Lab (2020). Visitation Estimates for the Skykomish Recreation Synthesis Project, US Forest Service and the Tulalip Tribes. University of Washington.

Puget Sound Regional Council [PSRC]. (2020). Population Growth by Regional Geography and County, 2017-2050. Vision 2050. Puget Sound Regional Council. Adopted October 29, 2020.

Jostad, J., Schultz, J., & Chase, M. (2017). State of Washington 2017 Assessment of Outdoor Recreation Demand Report. Eastern Washington University. https://www.rco.wa.gov/StateRecPlans/wp-content/uploads/2017/08/Assessment-of-Demand.pdf

Resonance Consultancy. (2018). Snohomish County Strategic Tourism Plan 2018-2022. https://snohomishcountywa.gov/DocumentCenter/View/50354/2018-2022-Snohomish-County-Strategic-Tourism-Plan-PDF.

Resonance Consultancy. (2017). Snohomish County Strategic Tourism Plan - Situational Analysis https://snohomishcountywa.gov/DocumentCenter/View/48529/Snohomish-County-Situational-Analysis-Report-PDF?bidId=

Resonance Consultancy. (2016). Strategic Tourism Plan Visitor Survey. https://snohomishcountywa.gov/DocumentCenter/View/50463/Snohomish-County-Visitor-Survey-Report-PDF

Tulalip Tribes. (2021). The Recreation Boom on Public Lands in Western Washington: Impacts to Wildlife and implications for Treaty Tribes, A Summary of Current Literature, Tulalip Tribes Treaty Rights Office, Tulalip, WA.

USDA Forest Service (n.d.-a). Welcome to the Mt. Baker-Snoqualmie National Forest! https://www.fs.usda.gov/mbs/

USDA Forest Service (n.d.-b). Watershed Restoration Program Success Story. https://www.fs.fed.us/restoration/Watershed_Restoration/success/NezPerceNFRoadDecom.shtml

USDA Forest Service (2015). Sustainable Roads Strategy: Public Engagement Report. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd486467.pdf

USDA Forest Service. (2017). Gifford Pinchot National Forest Huckleberry Management Strategy (draft guide). (2017). Compiled March 2017, unpublished.

USDA Forest Service (2019). Changes to Public Parking on Eightmile Road; 'No Parking' Signs Going Up. https://www.fs.usda.gov/detail/okawen/news-events/?cid=FSEPRD647541

USDA Forest Service. (2020). U.S. Forest Service National Visitor Use Monitoring Survey Results National Summary Report 2020. https://www.fs.usda.gov/sites/default/files/2020-National-Visitor-Use-Monitoring-Summary-Report.pdf

White, E. (2020). Characteristics of recreation visits to Darrington and Skykomish Ranger Districts, 2015. Report for the Mt. Baker-Snoqualmie National Forest.

Appendices

A. National Visitor Use Monitoring Activities and Categories

Fishing – All types

Hunting – All types

Viewing and Learning Nature and Culture

- Viewing/photographing wildlife, birds, fish, etc.
- Viewing/photographing natural features such as scenery, flowers, etc.
- Visiting historic and prehistoric sites/areas
- Nature Study
- Visiting a nature center, nature trail or visitor center

Nonmotorized Activities

- Hiking or walking
- Horseback riding
- Bicycling, including mountain bikes
- Nonmotorized water travel (canoe, sailing, raft, etc.)
- Downhill skiing or snowboarding
- Cross-country skiing, snowshoeing
- Other nonmotorized activities (swimming, games, or sports)

Motorized Activities

- Driving for pleasure on roads (paved, gravel, or dirt)
- Riding on motorized trails (non-snow)
- Riding in designated off-road vehicle areas (non-snow)
- Snowmobile travel
- Motorized water travel (boats, ski sleds, etc.)
- Other motorized activities (endure events, games, plane, etc.)

Camping or Other Overnight

- Camping in developed sites (family or group sites)
- Primitive camping (motorized)
- Backpacking, camping in unroaded areas
- Resorts, cabins, or other accommodations on Forest Service managed lands (private or FS)

Other Activities

- Gathering mushrooms, berries, firewood, or other natural products
- Relaxing, hanging out, escaping heat, noise, etc.
- Picnicking and family day gatherings in developed sites (family or group)

B. Sustainable Roads Kernel Density Calculation

As described on page 58 of the spatial data report:
https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1063&context=geog_fac

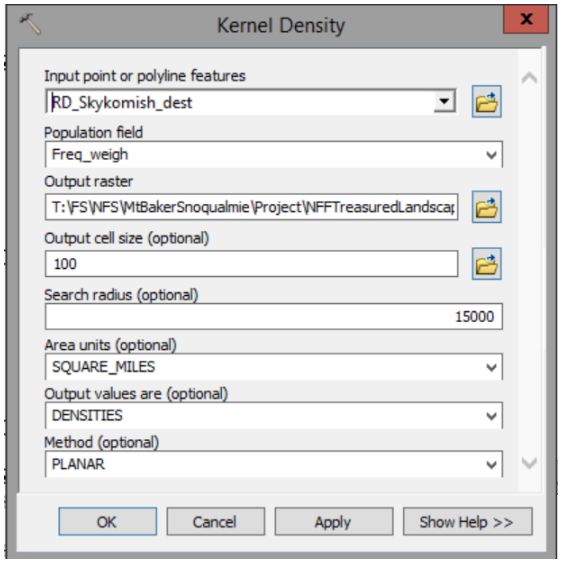
Kernel density

To show the concentration of destination points, we used a kernel density function. This calculation produces an output of destinations per square mile for each cell in a raster dataset. The kernel function is fitted to each destination point with its highest value at that point decreasing to zero at an established search radius distance. The sum of the kernel values overlapping each cell center is divided by the cell area to calculate density. The larger the search radius value used, the more generalized the density pattern. For our calculations, we used a search radius of 15,000 feet at a cell size of 100 feet. We also weighted each point based on the frequency of visits noted in the survey. Destinations listed as being used "several times a week" or "several times a month" were given a weight of 2; those listed as being used "several times a year" or "about once or twice a year or less" were given a weight of 1.

For GIS analyst:

The base data are the raw SRS dataset of destination points. Query out the specific points for a density calculation. For example, extract all points (i.e. all activities) located within the Skykomish Ranger District into a separate dataset.

Run 'Kernel Density' tool in ArcGIS



Input point or polyline features – Select the extracted dataset you created.

Population field – Select the field which identifies the 'frequency of visits.' In this case, the SRS raw dataset's field name for 'frequency of visits' is Freq_weigh.

Output raster – browse to where you want the output and name the output.

Output cell size – 100; the units are based on the projection of your dataset, which should be in State Plane Feet.

Search radius – 15000; again based on projection of your dataset (State Plane Feet).

Area units – Select SQUARE_MILES

Output values are – Keep default (DENSITIES).

Method – Keep default (PLANAR).

For the output raster, go into Layer Properties à Symbology à Classified. Classify into 6 classes, based on Natural Breaks (Jenks) and select desired colors for the density gradient.

C. Report Prepared by Outdoor Recreation and Data Lab, University of Washington

Visitation Estimates for the Skykomish Recreation Synthesis Project, US Forest Service and the Tulalip Tribes

Outdoor Recreation and Data Lab, University of Washington

December 23, 2020

Background

The US Forest Service, Region 6, the USFS Pacific Northwest Research Station (PNW Research Station) and the Tulalip Tribes are partnering in a recreation governance and data synthesis project which aims to gather information on current patterns and trends in recreation on the Skykomish Ranger District of the Mt-Baker Snoqualmie National Forest. As one component of the project, the PNW Research Station and the University of Washington Outdoor Recreation and Data Lab (Outdoor R&D) are collaborating to investigate how social media, and other volunteered information, can supplement existing data on visitation patterns in the region.

Research by Outdoor R&D scientists has shown that visitation at recreation destinations can be approximated based on the popularity of the same destinations on social media platforms. The team has leveraged this finding by developing a statistical model that estimates visitation to outdoor recreation sites based on the number of social media posts shared from each site. The model uses data from 27 non-motorized trails ('sites') in the Mt. Baker-Snoqualmie National Forest in Western Washington, and has been tested and applied on public lands across Washington, New Mexico, and Colorado. The model estimates total weekly visitation based on the relationship between on-site visitor counts gathered in Western Washington and the volume of social media that is posted to AllTrails, Washington Trails Association (WTA), Flickr, Twitter, and Instagram from the same trails. It also includes information about seasonality, holidays, precipitation, and estimated use-levels provided by USFS staff.

Outdoor R&D researchers used this model to estimate the number of visitors to 24 non-motorized trails in the Skykomish Ranger District between January, 2015 and December, 2019.

Key Findings

Since visitation generally corresponds to patterns of social media posts, maps of social media posts across the Skykomish Ranger District provide insights into where visitors are recreating (Figure 1).

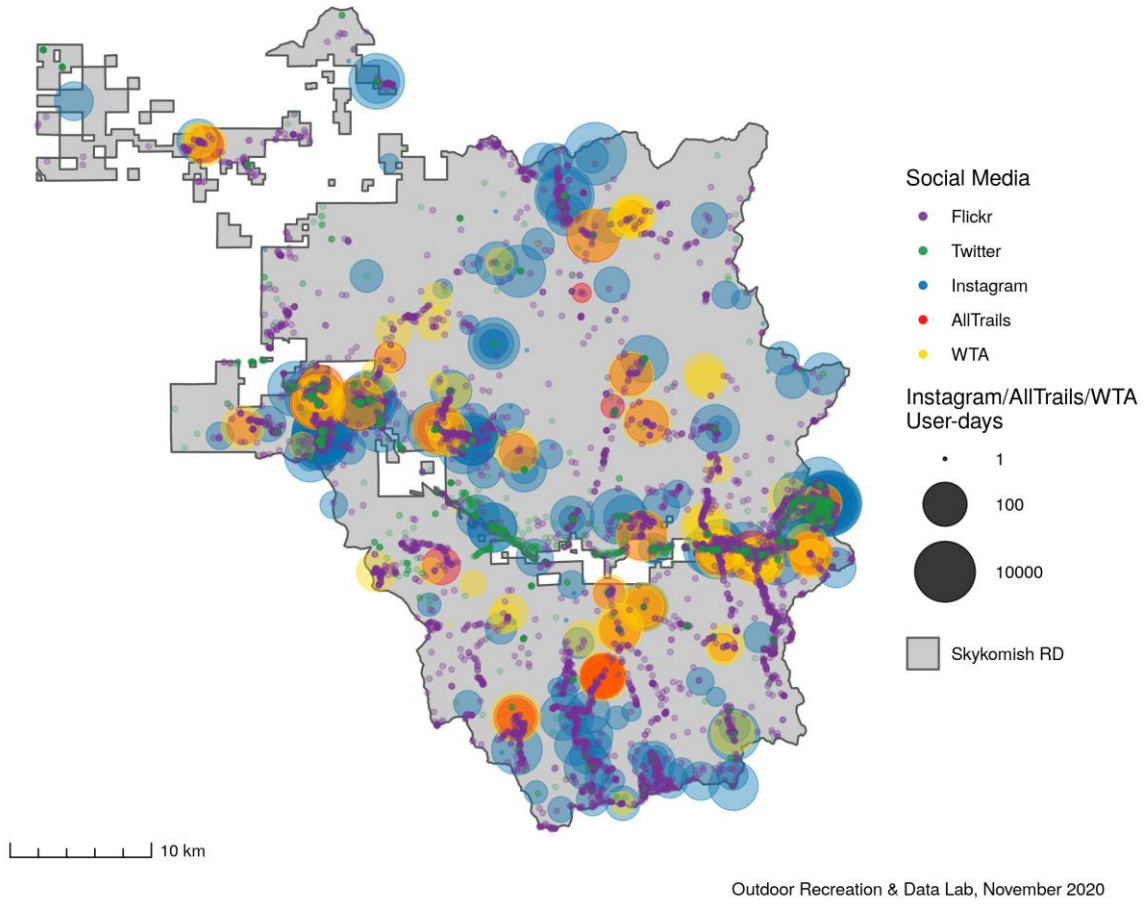


Figure 1. Social media posts in the Skykomish Ranger District. The date range displayed varies by social media platform as follows: Flickr 2005-2020, Twitter 2012-2020, Instagram 2010-2020, AllTrails 2010-2020, WTA 2004-2020.

Figure 2 displays modeled estimates of absolute visitation at 24 non-motorized recreation sites (trails) in 2019. This map is essentially a distillation of the social media map, where we have employed our visitation model to combine the various social media data sets in a statistically sound way. The sites represented in Figure 2 include all USFS NVUM "Wilderness" survey sites designated by district staff, as well as additional trails where visitor use has been monitored by Outdoor R&D and the MBS. Together these represent a sample of all trails in the ranger district, but the list is not exhaustive.

By summing across the 24 non-motorized recreation sites, **we estimate that visitors spent roughly 180,000 days recreating at these trails in the Skykomish ranger district in 2019**. Our results suggest that Lake Serene (site 1) was the most visited trail in the ranger district in 2019, followed by Barclay Creek (site 2). Meadow Creek (site 24) saw the fewest visitors in 2019 (Table 1).

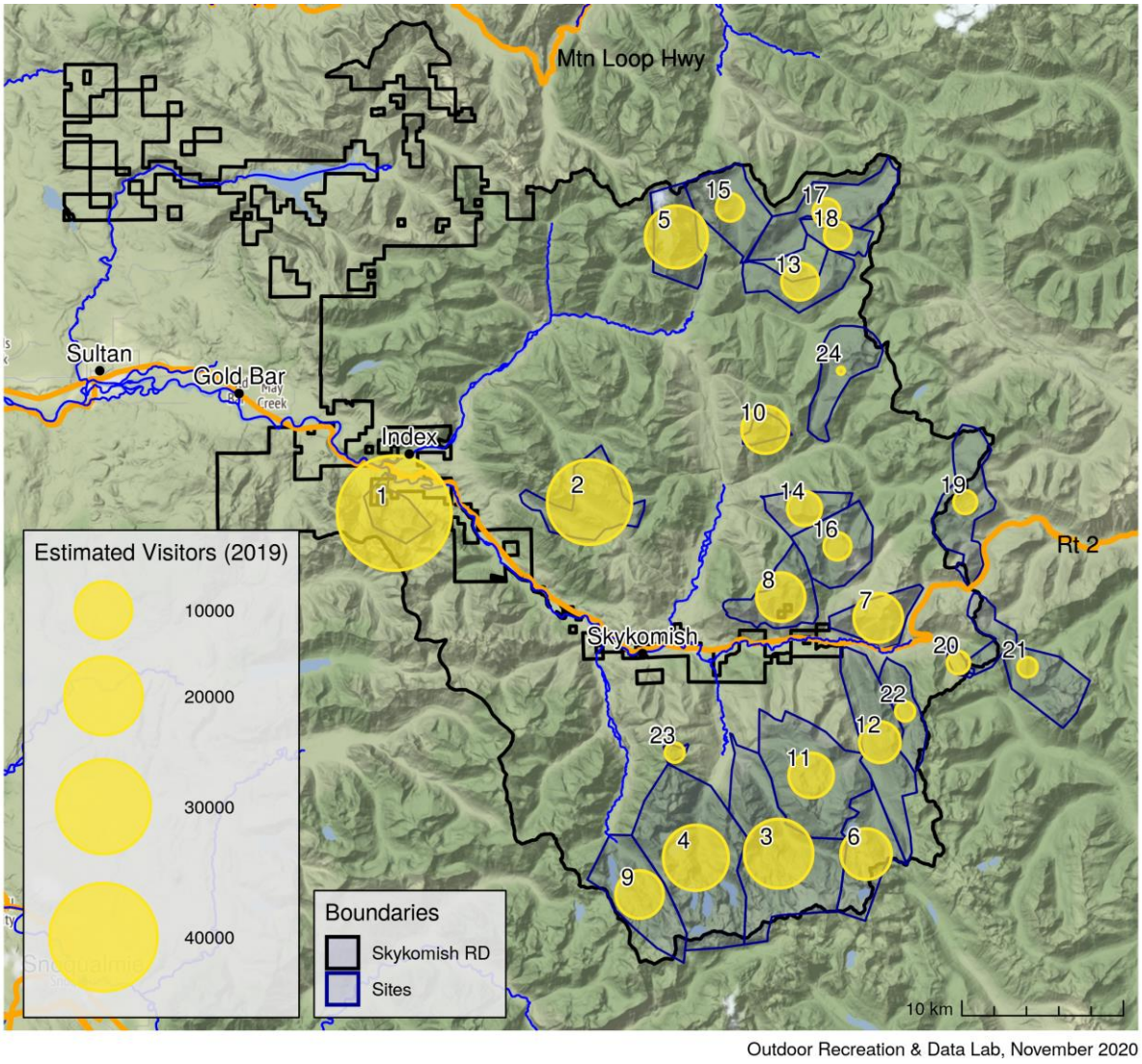


Figure 2. Estimated annual visitation in 2019 to 24 non-motorized recreation sites in the Skykomish Ranger District. Sites are delineated by blue lines, numbered by relative visitation, and named in Table 1.

In order to learn about visitation trends over time, we calculated the percent change in visitation to each of the 24 trails by comparing estimated visitation in 2015 to estimated visitation in 2019. Across the ranger district, we estimate that visitation to these 24 trails grew by approximately 45% during this time (from ~120,000 visitors in 2015 to ~180,000 visitors in 2019). Much of this growth was concentrated along Route 2, with Lake Serene in particular experiencing approximately 110% growth over this period (from ~22,000 visitors in 2015 to ~45,000 visitors in 2019). Our model also suggests that visitation increased at sites in the southern portion of the ranger district, while remaining roughly the same or decreasing slightly at northern sites (Figure 3, Table 1).

Site Number	Trail Name	Estimated 2019 Visitors	Estimated % Change (from 2015)
1	Lake Serene	45,000	+110%
2	Barclay Creek	24,000	+100%
3	Necklace Valley	15,000	+40%
4	West Fork Foss Lakes	14,000	+55%
5	Blanca Lake	12,000	-20%
6	Lake Clarice	8,000	+40%
7	Iron Goat	7,000	+100%
8	Jennifer Dunn	7,000	+100%
9	Dorothy Lake	7,000	+30%
10	Evergreen Mtn	7,000	+35%
11	Tonga Ridge	6,000	+25%
12	Deception Creek	5,000	About the same
13	West Cady Ridge	4,000	-5%
14	Johnson Ridge	3,000	+40%
15	Quartz Creek	2,000	About the same
16	Kelly Creek	2,000	About the same
17	North Fork Skykomish	2,000	About the same
18	Pass Creek	2,000	About the same
19	PCT North Stevens Pass	1,500	+30%
20	Tunnel Creek	1,500	+25%
21	PCT South Stevens Pass	1,000	-10%
22	Surprise Lake	1,000	-40%
23	Evans Lake	1,000	-10%
24	Meadow Creek	500	-5%

Table 1. Sites where we estimated visitation in the Skykomish Ranger District based on social media posts, seasonality, weather, and estimated use-levels provided by USFS staff. Estimated 2019 Visitors and Estimated % Change are both calculated from modeled estimates. Site Number corresponds to the labels on the maps.

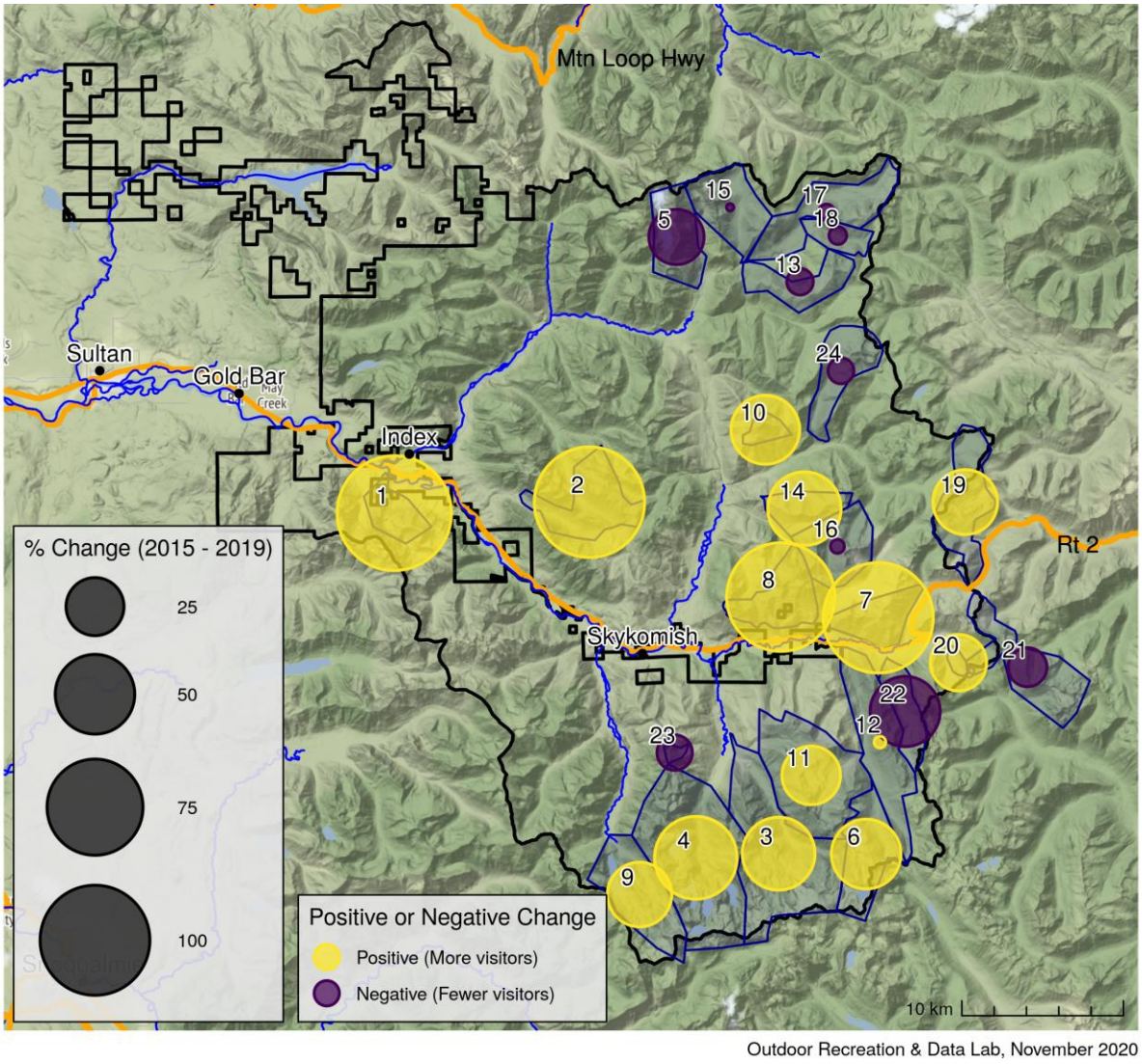


Figure 3. Estimated percent change in visitation between 2015 and 2019 to non-motorized recreation sites in the Skykomish Ranger District.

Technical details

The visitation model described above was developed by measuring how the popularity of 27 trails in Western Washington (13 of which are in the Skykomish RD) corresponds with the popularity of those same trails on several social media platforms. On-site visitor counts were collected between August, 2016 and December, 2019. These total daily counts were generated by counting pedestrians on the trail with infrared counters (IR) or vehicles in the parking lot. Using the relationships that we find between on-site data and the various predictors (social media posts, precipitation, seasonality, holidays, and estimated use-levels provided by MBS staff) at these trails from 2016 - 2019, we then estimated weekly visitation for the sites in the Skykomish Ranger District for the period between January, 2015 and December, 2019.

Site Number	Trail Name	Estimated Use-Level used in model	Onsite Data used in model
1	Lake Serene	Very high	IR counts & Parking lot counts
2	Barclay Creek	High	Parking lot counts
3	Necklace Valley	High	Parking lot counts
4	West Fork Foss Lakes	High	IR counts & Parking lot counts
5	Blanca Lake	Very high	IR counts & Parking lot counts
6	Lake Clarice	High	---
7	Iron Goat	High	Parking lot counts
8	Jennifer Dunn	---	---
9	Dorothy Lake	High	IR counts & Parking lot counts
10	Evergreen Mtn	High	---
11	Tonga Ridge	High	Parking lot counts
12	Deception Creek	Medium	Parking lot counts
13	West Cady Ridge	Medium	IR counts
14	Johnson Ridge	Low	IR counts & Parking lot counts
15	Quartz Creek	Low	---
16	Kelly Creek	Low	---
17	North Fork Skykomish	Low	---
18	Pass Creek	Low	---
19	PCT North Stevens Pass	---	---
20	Tunnel Creek	Low	IR counts & Parking lot counts
21	PCT South Stevens Pass	---	---
22	Surprise Lake	---	---
23	Evans Lake	---	---
24	Meadow Creek	Medium	IR counts & Parking lot counts

Table 2. Site-level data, beyond social media, that were used to create the modeled estimates for each Skykomish trail. Use-levels were estimated by MBS staff. Outdoor R&D is more confident in visitation estimates for sites where we have on-site counts for fine-tuning the model.

We have onsite data for 13 of the 24 Skykomish sites, and estimated use-levels for 19 of the 24 sites (Table 2). We are most confident in our estimates of visitation at sites where we have some on-site data, particularly data from infrared (IR) trail counters. A key assumption of the model is that the relationships between visitation and social media posting rates, seasonality, holidays, and precipitation are the same at unmonitored sites as they are at well-studied sites in Washington. Additionally, we are assuming that the relationships among variables in the model are the same in 2015 as they were in 2016-2019. This visitation model is being actively developed in order to improve its ability to estimate weekly visitation at unmonitored sites over time.

About Outdoor R&D

Outdoor R&D is the University of Washington's Outdoor Recreation and Data Lab. We do data-driven research on the benefits of outdoor recreation and nature-based tourism. Our studies meld methods from environmental science, social science, and computer science – combining visitor surveys and other on-site data with big volunteered data from citizen scientists, social media, and mobile applications. We develop open-source software and reproducible approaches that make big geographic data and models more accessible for decision-makers. The Outdoor R&D team looks for partnerships where novel and innovative methods and data can inform management and improve opportunities for outdoor recreation.

Further Reading

Fisher, D. M., Wood, S. A., White, E. M., Blahna, D. J., Lange, S., Weinberg, A., Tomco, M., & Lia, E. (2018). Recreational use in dispersed public lands measured using social media data and on-site counts. *Journal of Environmental Management*, *222*, 465–474.

Sessions, C., Wood, S. A., Rabotyagov, S., & Fisher, D. M. (2016). Measuring recreational visitation at U.S. National Parks with crowd-sourced photographs. *Journal of Environmental Management*, *183*, 703–711.

Wood, S. A., Winder, S. G., Lia, E. H., White, E. M., Crowley, C. S. L., & Milnor, A. A. (2020). Next-generation visitation models using social media to estimate recreation on public lands. *Scientific Reports*, *10*(1), 15419.

D. Literature Reviewed

Citation	Description
Armstrong, R., Morrison, J., & Yu, P. (2005). Indigenous Land and Sea Management and Sustainable Business Development in Northern Australia. NAILSMA Research Documents. North Australian Indigenous Land and Sea Management Alliance, Charles Darwin University, Darwin, NT.	This publication from the North Australian Indigenous Land & Sea Management Alliance discusses developments in Northern Australia's "culture based economy" as well as greenhouse abatement opportunities. The authors give readers the historical context for Indigenous Australian communities and the difficulties that these communities have had in developing their economies.
Barbour, W., & Schlesinger, C. (2012). Who's the boss? Post-colonialism, ecological research and conservation management on Australian Indigenous lands. Ecological Management & Restoration, 13(1), 36-41.	This article argues for greater representation of Indigenous researchers within natural resource management. The author seeks to have Indigenous people included in all stages of management strategies.
Carr, A., Ruhanen, L. and Whitford, M. (2016). Indigenous peoples and tourism: the challenges and opportunities for sustainable tourism. Journal of Sustainable Tourism, 24(8-9), pp.1067-1079.	This article reviews the work of others who analyzed varying strategies and forms of tourism that has Indigenous interpretive features. The authors and the pieces they point to support the idea that tourism informed and managed by Indigenous communities can be used to bolster the economies of the communities, while shifting the negative perception of Indigenous peoples as exclusively "victims" or prehistoric to a more positive "empowered" and cultured conception.
Carroll, C. (2014). Native enclosures: Tribal national parks and the progressive politics of environmental stewardship in Indian Country. Geoforum, 53, 31-40.	The author discusses the relatively recent creation and popularity of tribal national parks using Ute Mountain Ute Tribal Park and Tla-o-qui-aht Tribal Parks as examples. The author argues that the creation of these parks is changing the idea behind conservation enclosures with merging traditional Indigenous concepts of land use with traditional western management.
Cerveny, L.K, Blahna, D.J., Stern, M.J., Mortimer, M.J., Predmore, A.S., & Freeman, J. (2011). The Use of Recreation Planning Tools in U.S. Forest Service NEPA Assessments. Environmental Management 48, 644-657. https://doi.org/10.1007/s00267-011-9701-9.	This article investigates how science-based decision making in the USDA Forest Service is implemented in the field. To supplement their inquiry, the authors surveyed interdisplinary team leaders of 106 NEPA projects and their perceptions working with recreation and travel management.
Corrigan, C., & Hay-Edie, T. (2013). A toolkit to support conservation by indigenous peoples and local communities:	This publication from the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) is a toolkit for communities that manage

building capacity and sharing knowledge for indigenous peoples and community conserved territories and areas (iccas). UNEP-WCMC, Cambridge, UK.	Indigenous and Community Conserved Areas (ICCAs). The goal of the publication is to provide readily available resources organized into five themes: documenting presence, management planning, monitoring and evaluation, communication, and values & finance.
Dowie, M. (2011). Conservation Refugees. Retrieved from https://orionmagazine.org/article/conservation-refugees/.	This article examines how conservation initiatives have impacted Indigenous communities around the world. With protected area designations and parks being created, Indigenous communities have been barred from practicing their ways of life with western ideas of nature conservation.
Dussias, A. M. (2000). Cultural Conflicts Regarding Land Use: The Conflict Between Recreational Users at Devil's Tower and Native American Ceremonial Users. Vt. J. Envtl. L., 2, 13.	This article reviews the history that led to the creation of the NPS' 1995 Final Climbing Management Plan for Devils Tower National Monument, including the traditional use and historical indifference towards Indigenous ceremonies. The article also delves into the litigation that followed the implementation of the plan including the strategies used by private outdoor outfitters to combat parts of the management plan.
Dyer, P., Aberdeen, L., & Schuler, S. (2003). Tourism impacts on an Australian indigenous community: A Djabugay case study. Tourism management, 24(1), 83-95.	This article explores the impact that the tourism industry has had on the Djabugay Indigenous community. The author looks into the equity partnership that this community has with Tjapukai Aboriginal Cultural Park, and the benefits and disadvantages that have come out of their partnership.
Elías, S. (2012). From Communal Forests to Protected Areas: The Implications of Tenure Changes in Natural Resource Management in Guatemala. Conservation and Society, 10(2), 151-160. Retrieved February 12, 2020, from www.jstor.org/stable/26393072.	This article examines the work that has been put into promoting formal protections for communal forests within the Guatemalan Highlands. The author argues that the efforts to promote conservation have led to a role change for municipal governments that has displaced communal access to traditional resources.
Endress, Bryan & Quaempts, Eric & Steinmetz, Shawn. (2019). First Foods Upland Vision, Confederated Tribes of the Umatilla Indian Reservation. 10.13140/RG.2.2.30561.35689.	This publication from the Confederated Tribes of the Umatilla Indian Reservation Department of Natural Resources, details the vision of the management of traditional food called First Foods and their respective ecosystems. The authors discuss touchstone characteristics of food ecosystems and how historical degradation due to overgrazing or crop production have impacted the connected systems of First Foods.
Farrelly, T.A., 2011. Indigenous and democratic decision-making: Issues from community-based ecotourism in the Boumā National Heritage Park, Fiji. Journal of Sustainable Tourism, 19(7), pp.817-835.	This article explored through Indigenous communication strategies, the breakdown of social bonds in the community as a result of the implementation and popularity of ecotourism in Boumā National Heritage Park. The author found that as a more western-democratic form of decision making and discussion was used to create decisions in the

	community, a greater sense of distance was felt by the majority of community members. This resulted in more informal private discussion within kin groups and general distrust of business ventures that adopt western ideologies.
Freedman, E. (2007). Protecting sacred sites on public land: Religion and alliances in the Mato Tipila-Devils Tower litigation. American Indian Quarterly, 31(1), 1-22.	This article utilizes interviews, judicial decisions, litigation documents, and other public records to investigate the legal alliance formed between tribes and other interest groups during the hearing of Bear Lodge Multiple Use Association v. Babbitt (1998). The author examines the implications of such alliances, and the factors that informed decisions of Indigenous and "public interest" groups, along with how they became allied in the first place.
Ghoghaie, N. (2011). Native/Non-Native Watershed Management in an Era of Climate Change: Freshwater Storage in the Snohomish Basin (Master's thesis, Evergreen State College, Olympia, WA).	This Master's Thesis investigates three cases of Tribe led watershed management and the successes and challenges faced by the tribes. The article explores methods of collaborative management of watersheds to address the impacts of climate change.
Gifford Pinchot, (n.d.). Gifford Pinchot National Forest Huckleberries. Retrieved from https://www.fs.usda.gov/detail/giffordpinchot/passes-permits/forestproducts/?cid=fsbdev3_00507.	This web page from the Gifford Pinchot NF website gives a brief overview of its huckleberry policy. This includes permit information and has a section dedicated to its huckleberry handshake agreement with the Yakama.
Global Environment Facility. (2014). Partnerships in Practice: Engagement with Indigenous Peoples. Retrieved from https://www.thegef.org/publications/partnership-practice-engagement-indigenous-peoples.	This publication by Global Environment Facility works as their policy guide for funding and working within Indigenous communities. GEF also highlights examples of their work and the best practices learned throughout the course of their work with Indigenous peoples.
Grossman, Z. (2012). Indigenous Responses to the International Climate Change Framework. In Z. Grossman & A. Parker (Eds.), Asserting Native Resilience: Pacific Rim Indigenous Nations Face the Climate Crisis (pp. 109-125). Oregon State University Press.	This chapter from Asserting Native Resilience covers many of the responses that Indigenous communities around the globe had towards the United Nations Framework Convention on Climate Change (UNFCCC). Grossman delves into some of the methods that Indigenous communities and land management officials have utilized to mitigate the impacts of climate change.
Grossman, Z. (2017). Water Wars and Breaching Dams. In Unlikely Alliances: Native Nations and White Communities Join to Defend Rural Lands (pp. 64 - 99). Retrieved from http://books.google.com.	This chapter from Unlikely Alliances, examines how tribes and non-tribal communities from the Columbia River Basin have worked together to address the dwindling salmon runs that fuel Indigenous cultures and economies within the region. The author shows how the environment and economies can be stimulated with the creation and sustaining

	of respectful relationship between state/county/city governments and tribal governments.
Guarino, J. (2013). Tribal advocacy and the Art of Dam Removal: The Lower Elwha Klallam and the Elwha Dams. American Indian Law Journal, 2(1), 114-145.	This article is focused on the role of the Lower Elwha Klallam Tribe in the removal process of the Elwha Dam. The authors hoped that the success of the tribe would serve as a role model for future efforts of dam removal and other significant land management initiatives.
Hill, R. (2011). Towards equity in Indigenous co-management of protected areas: cultural planning by Miriuwung-Gajerrong people in the Kimberley, Western Australia. Geographical Research, 49(1), 72-85.	This article reports on the research of the negotiation and delivery of an Indigenous-controlled planning initiative called the Miriuwung-Gajerrong Cultural Planning Framework (MGCPF). The author also analyzes the role of common pool resources and compares/contrasts best-practice standards with enabling factors for the MGCPF.
Hill, R., C. Grant, M. George, C. Robinson, S. Jackson, and N. Abel. 2012. A Typology of Indigenous Engagement in Australian Environmental Management: Implications for Knowledge Integration and Social-ecological System Sustainability. Ecology and Society 17(1): 23 http://dx.doi.org/10.5751/ES-04587-170123.	This article presents a typology of Indigenous engagement in environmental management. The typology is developed through the analysis of 21 Australian case studies with considering the integration of Indigenous Ecological Knowledge (IEK) and western science.
Hill, R., Pert, P. I., Davies, J., Walsh, F. J., & Falco-Mammone, F. (2013). Indigenous land management in Australia: extent, scope, diversity, barriers and success factors. Cairns: CSIRO Ecosystem Sciences.	This report commissioned by the Indigenous Working Group presents information gathered from various projects relating to Australian Indigenous Land Management. The authors work to give the reader an idea of the diversity in Indigenous Land Management along with factors for their success, barriers associated with projects, and best practices.
Hooker, A. M. (1994). American Indian Sacred Sites on Federal Public Lands: Resolving Conflicts Between Religious Use and Multiple Use at El Malpais National Monument. American Indian Law Review, 19(1), 133-158.	This article examines a few cases where American Indian tribes had worked to protect their sacred sites that were within Federal Lands borders and subject to public use with a particular focus on El Malpaís National Monument. The author demonstrates how the Federal government operates under a Euro-American view of religion, and that policy that protects Indigenous sacred sites is often at odds with the U.S. Constitution.
International Union for Conservation of Nature. (2011). Community Conservation in Practice: May 6-8, 2010.	This report from the International Union for Conservation covers the ideas that were discussed during the 12th International Society of Ethnobiology Congress. This report provides an overview of items discussed by representatives at the workshop.

Iximulew Declaration: Indigenous Peoples and Protected Areas. Ak'Tenamit - Guatemala Tomorrow Fund, 2008.	This pamphlet from Ak'Tenamit - Guatemala Tomorrow Fund, lists a set of expectations and demands for the International Union for Conservation of Nature (IUCN). The authors seeks the recognition of Indigenous rights and communities during meetings regarding the creation of protected areas in traditional territories.
Kelly, C. (2019). Bear Ears National Monument: A Monument for the Locals An Interdisciplinary Evaluation of Tribal Involvement in Public Land Planning (Master's Thesis, University of Wyoming, Laramie, WY).	This thesis takes an interdisciplinary approach to examining the conflict surrounding size reduction of Bear Ears National Monument and the local stakeholder interest in public land management. The author argues that the inclusion of tribes within public land management does not mean that other stakeholders will be excluded.
Larson, CL, Reed, SE, Merenlender, AM, Crooks, KR. A meta-analysis of recreation effects on vertebrate species richness and abundance. Conservation Science and Practice. 2019; 1:e93. https://doi.org/10.1111/csp2.93	This article is a meta-analysis of articles related to the effects that varying types of recreation have on the richness and abundance of vertebrate species. The authors use the data present to identify categories of recreation and their impact on specific species.
Leung, Y. F., Spenceley, A., Hvenegaard, G., Buckley, R., & Groves, C. (2014). Tourism and Visitor Management in Protected Areas. *Guidelines for Sustainability, World Headquarters, Gland, Switzerland.* Retrieved from https://portals.iucn.org/library/node/47918.	This publication from the International Union for Conservation of Nature (IUCN) is a set of guidelines directed at professionals working on tourism in protected areas. These guidelines share best practices examples around the world that work to provide visitors with meaningful experiences while conserving the health of a protected area.
Makopondo, R. O. (2006). Creating Racially/Ethnically Inclusive Partnerships in Natural Resource Management and Outdoor Recreation: The Challenges, Issues, and Strategies. Journal of Park & Recreation Administration, 24(1).	This article examines the challenges that the National Park Service faced in attracting partnerships and visitation from racial and ethnic minorities with the Boston Harbor Island Partnership. The author summarizes the efforts of inclusion to a list of best practices when attempting to collaborate with minority groups.
Mannchen, B. (2019, January 4). Our Recreation and Technology Have Environmental Impacts on Our Public Lands. Sierra Club: Lone Star Chapter. Retrieved from https://www.sierraclub.org/texas/houston/blog/2019/01/our-recreation-and-technology-have-environmental-impacts-our-public-lands.	A news article from the Sierra Club Lone Star Chapter which discusses the recreational impacts to the ecology of recreation sites. The author makes management recommendations and points to studies focused on the relationships between recreation and wildlife.
Marion, J. L. (2016). A Review and Synthesis of Recreation Ecology Research Supporting Carrying Capacity and Visitor	This article reviews recreation ecology literature relevant to wilderness and backcountry. The authors stress that land managers must have an understanding of visitor impacts to

Use Management Decisionmaking. Journal of Forestry, 114 (3), 339-351. https://doi.org/10.5849/jof.15-062.	vegetation, soil, wildlife, and water resources for future mangement decisions.
Marion, J. L., Leung, Y. F, Eagleston, H., Burroughs, K. (2016). A Review and Synthesis of Recreation Ecology Reseach Findings on Visitor Impacts to Wilderness and Protected Natural Areas. *Journal of Forestry*, 114(3), 352-362. https://doi.org/10.5849/jof.15-498.	This article reviews recreation ecology studies recent at the time of publication which have been applied in a wildland setting to reduce visitor impacts. The author argues that land managers should determine management decisions utilizing a more diverse toolkit with focuses beyond the carrying capacity of a site.
Martin, C. E., & Chehébar, C. (2001). The national parks of Argentinian Patagonia—management policies for conservation, public use, rural settlements, and indigenous communities. Journal of the Royal Society of New Zealand, 31(4), 845-864.	This article reviews the policies between the Argentinian government and its Indigenous peoples. The author focuses on Indigenous community settlements that often preceded the creation of the nation's land reserve systems along with processes developed to benefit Indigenous communities while promoting tourism within their traditional lands.
McIntyre, G. (2014). The Tension between Biodiversity Conservation and Traditional Hunting in Protected Areas. Retrieved from https://www.pc.gov.au/__data/assets/pdf_file/0020/209162/subdr093-fisheries-aquaculture-attachment.pdf.	This presentation examines the effects of environmental regulations on Indigenous peoples within the Great Barrier Reef Marine Park. The author discusses multiple subjects including stricter penalities included in legislation, Indigenous management, cooparative management, and protected area management benefits for endangered species.
Milholland, S. (2008). Native Voices and Native Values in Sacred Landscapes Management: Bridging the Indigenous Values Gap on Public Lands through Co-Management Policy.	This dissertation investigates the opinions of Diné citizens on the need and form of a co-management model between Federal entities and Tribal governments in regards to managing sacred landscapes.
Monz., C. A., Pickering, C. M., Hadwen, W. L. (2013). Recent Advances in Recreation Ecology and the Implications of Different Relationships Between Recreation Use and Ecological Impacts. *Frontiers in Ecology and the Environment*, 11(8), 441-446. https://doi.org/10.1890/120358.	This article examines recreation ecology literature which commonly descirbes visitor use-impact relationships as curvilinear. The authors argue that this generalization oversimplifies the ecological responses of plant communities, wildlife, soils, and acquatic systems that require more diverse management strategies.
Murray, G. and King, L. (2012). First Nations Values in Protected Area Governance: Tla-o-qui-aht tribal parks and Pacific Rim National Park Reserve. *Human Ecology*, 40(3), 385-395.	This article compares and contrasts models of managing Protected Areas located on Vancouver Island that are adjacent but separately managed by Parks Canada and the Tla-o-qui-aht First Nation. The Tribal Parks management by the Tla-o-qui-aht offers an interesting look into a modern management structure that is based on the cultural identity of this particular nation, while also serving as a way for First Nations to expand their influence in their traditional territories.

Nepal, S. K. (2002). Involving indigenous peoples in protected area management: Comparative perspectives from Nepal, Thailand, and China. Environmental management, 30(6), 0748-0763.	This article examines three examples of Indigenous peoples' involvement in protected areas within Nepal, Thailand, and China. The author compares two national parks and one nature reserve to evaluate how successful efforts to strengthen partnerships between Indigenous peoples and land managers were.
Notzke, C. (1999). Indigenous tourism development in the Arctic. Annals of Tourism Research, 26(1), 55-76.	This article examines trends (circa 1999) of the Indigenous tourist industry within the Northwest Territories of Canada. In this article, the author looks into the methods used by local Indigenous to balance the then emerging eco-tourist industry in their territory and their cultural responsibilities.
Nursey-Bray, M. and Rist, P., 2009. Co-management and protected area management: Achieving effective management of a contested site, lessons from the Great Barrier Reef World Heritage Area (GBRWHA). Marine Policy, 33(1): 118-127.	This article reflects on the effectiveness of co-management regimes within protected areas, and pays great attention to the co-management plan implemented by Girringun Aboriginal Corporation within the Great Barrier Reef. The author argues that management parties must agree upon the distribution/allocation of power before negotiating management strategies to achieve a sustainable and culturally just relationship.
Parker, A. (2012). Recommendations to Native Government Leadership. In Z. Grossman & A. Parker (Eds.), Asserting Native Resilience: Pacific Rim Indigenous Nations Face the Climate Crisis (pp. 189-192). Oregon State University Press.	In this chapter from Asserting Native Resilience, Alan Parker (Chippewa-Cree) makes recommendations to tribal leadership in regards to their land management policies. These recommendations are meant as a way to create bridges between Indigenous communities and their surrounding populations in order to adapt to climate change.
Planterra Foundation. (n.d.). Indigenous People and the Travel Industry: Global Good Practice Guidelines. Retrieved from https://planeterra.org/about-us/publications/indigenous-people-and-the-travel-industry-global-good-practice-guidelines/.	This publication from the Planeterra Foundation is meant to provide guidelines for responsible conduct and promote good business practices. These guidelines have been created to protect the Indigenous communities within the tourism industry while providing an authentic experience for tourists.
Premauer, J.M. and Berkes, F., 2015. A pluralistic approach to protected area governance: indigenous peoples and Makuira National Park, Colombia. Ethnobiology and Conservation, 4.	This article analyzes the co-governance relationship between the Wayúu and Parques Nacionales, and how this relationship has developed over the course of Makuira National Parks existence. In this paper, the social relationships developed between the two governing bodies are shown to be as if not more effective at coming to agreements than formal governmental relationships.
Price, O. F., Russell-Smith, J., & Watt, F. (2012). The influence of prescribed fire on the extent of wildfire in savanna landscapes of western Arnhem Land, Australia.	This article examines the effectiveness of the West Arnhem Land Fire Abatement project. The authors argue that the by empowering Indigenous land owners to continue their

International Journal of Wildland Fire, 21(3), 297-305.	seasonal burning practices, then Australia will see a decrease in the severity of late dry season fires.
Rasmussen, K., Hibbard, M., & Lynn, K. (2007). Wildland fire management as conservation-based development: an opportunity for reservation communities?. Society and Natural Resources, 20(6), 497-510	This article argues that tribal communities could benefit economically and culturally with the development of wildland fire-management program developments. The authors explore the benefits of program development and the hindrances present in resource management.
Riseth, J. Å. (2007). An indigenous perspective on national parks and Sámi reindeer management in Norway. Geographical Research, 45(2), 177-185.	This article explores the history between Norway and the Sámi people who have had series of contentious debates over the land management policies. The author examinines the implications of various management strategy theories.
Robson, J. P., Miller, A. M., Idrobo, C. J., Burlando, C., Deutsch, N., Kocho-Schellenberg, J. E., Pengelly, R.D. & Turner, K. L. (2009). Building communities of learning: Indigenous ways of knowing in contemporary natural resources and environmental management. Journal of the Royal Society of New Zealand. 39:4, 173-177, DOI: 10.1080/03014220909510574.	This article explores how creating creating co-management of natural resources can be facilitated with the creation of "communities of learning." The author argues that creating space for all stakeholders to input their knowledge and understanding of their issues leads to greater opportunity to collaborate.
Sanders, J.M. (1996). A comparative study of the planning and management of Monument Valley Tribal Park and Canyon de Chelly National Monument. Landscape and Urban Planning, 36(2), 171-182.	This article compares and contrasts the management strategies of Canyon de Chelly National Monument and Monument Valley Tribal Park that are both within the boundaries of the Navajo Nation. The author primarily delves into the history of the designated areas, and the benefits and issues that have come about with their creation.
Schmidt, P. M., & Peterson, M. J. (2009). Biodiversity conservation and indigenous land management in the era of self-determination. Conservation Biology, 23(6), 1458-1466.	This article argues that there is a paradoxical relationship between the U.S. Federal government and Tribal governments that is the result of a series of statuettes, treaties, and regulations that has undermined tribal self-determination. The authors call, for the sake of improved biodiversity and tribal self-determination, that a revision of the relationship between the two government structures with clearly outlined goals and definitions regarding land rights.
Sheil, D., Boissière, M., & Beaudoin, G. (2015). Unseen sentinels: local monitoring and control in conservation's blind spots. Ecology and Society, 20(2).	This article focuses on the blind spots that are found in official monitoring of protected areas. The authors argue that these blind spots could be remedied by creating effective relationships with Indigenous peoples within the protected areas to autonomously monitor the area.
Strickland-Munro, J., & Moore, S. (2013). Indigenous involvement and benefits from tourism in protected areas: a study of	This article uses a study of Purnululu National Park in Australia as a way to explore Indigenous involvement in tourism and the benefits that come along with it. The author

Purnululu National Park and Warmun Community, Australia. Journal of Sustainable Tourism, 21(1), 26-41.	seeks methods to further the benefits of tourism for Indigenous peoples and considers that fact that Indigenous peoples may not want to participate in this industry.
Tauli-Corpuz, V., Alcorn, J., and Molnar, A. (2018). Replacing 'Fortress' Conservation with Rights-based Approaches Helps Bring Justice for Indigenous Peoples and Local Communities, Reduces Conflict, and Enables Cost-effective Conservation and Climate Action. Rights and Resources. Retrieved from https://rightsandresources.org/en/publication/cornered-by-protected-areas/#.XmfL7qhKjIW.	This article delves into the human rights disparities present in the international utilization of the conventional "fortress" method of conservation. The authors argue that countries need to begin developing more conservation strategies that are focused on affirming the land use rights of Indigenous peoples.
U.S. Fish & Wildlife Service (2005). Nisqually National Wildlife Refuge: Final Comprehensive Conservation Plan. Olympia, WA.	This publication from the U.S. Fish & Wildlife Service details the management strategy for the Nisqually National Wildlife Refuge. The strategy relies on the support of various Federal, states, volunteer organizations (ex. WCC), and the Nisqually tribe to plan out the management of the refuge while balancing visitor use, educational opportunities, and habitat development in a high trafficked area.
United Nations. (2011). United Nations Declaration on the Rights of Indigenous Peoples.	This publication from the United Nations contains is a series of articles that list out the inherent rights of Indigenous peoples. This promotion of Indigenous rights is a step forward in the recognition of Indigenous rights and further development of international relations.
USDA Forest Service, (n.d.). Watershed Restoration Program Success Story. Retrieved from https://www.fs.fed.us/restoration/Watershed_Restoration/success/NezPerceNFRoadDecom.shtml.	This publication provides an overview of the success that has been found with the Nez Perce-Clearwater NF's road decommissioning projects. Through decommissioning roads with the assistance from the Nez Perce tribe, fish habitat and water quality have been improved.
USDA Forest Service. Columbia River Gorge Commission. (2016). Management Plan for the Columbia River Gorge National Scenic Area. White Salmon, WA: CRGC.	This publication is the management plan developed by the Columbia River Gorge Commission which establishes guidelines and expectations for the commission's interested parties including WA and OR, counties of the scenic area, urban areas, and Tribes with treaty rights in the Gorge (Yakama, Nez Perce, Umatilla, and Warm Springs). The plan works to regulate development along the scenic area while also honoring its trust responsibility to Tribal governments.
USDA Forest Service. Okanogan-Wenatchee National Forest. (n.d.). Changes	This article provides information regarding the Okanogan-Wenatchee's installation of "no parking" signs along the

to Public Parking on Eightmile Road; 'No Parking' Signs Going Up. Retrieved from https://www.fs.usda.gov/detail/okawen/news-events/?cid=FSEPRD647541.	Eightmile Road in an effort to reduce congestion at a popular recreation site.
Wu, T. C., Wall, G., & Tsou, L. Y. (2017). Serious tourists: A proposition for sustainable indigenous tourism. Current Issues in Tourism, 20(13), 1355-1374.Sheil, D., Boissière, M., & Beaudoin, G. (2015). Unseen sentinels: local monitoring and control in conservation's blind spots. Ecology and Society, 20(2).	This article focuses on how tourists interact with Indigenous peoples and their economies. The authors note that the benefits of the Indigenous tourism has much to do with the varied levels of "seriousness" of tourists, authenticity of the experience, and the capacity of the Indigenous community.
WWF International. (2008). Indigenous Peoples and Conservation: WWF Statement of Principles. Gland, Switzerland: WWF International.	This publication from the World Wildlife Fund states their obligations to working with Indigenous communities. WWF states that they wish to further commit to their goals by expanding their commitments.
Zeppel, H. (2010). Managing cultural values in sustainable tourism: Conflicts in protected areas. Tourism and Hospitality Research, 10(2), 93-115.	The article examines the varied amount of cross-cultural conflicts that occur between recreationists and Indigenous communities within sacred areas. It also identifies six types of conflicts and the management strategies developed to address the issues.

E. Questions from Key Informant Interviews

- Are you aware of exemplary cases or best practices related to visitor management on public lands/protected areas that recognize or protect tribal treaty rights, land tenure relationships, or Indigenous connections?
- What prevailing themes or prominent questions or problems are you aware of that have driven this work?
- Do you know of people (scientists, leaders, consultants) or organizations that are working in this realm that would be helpful in informing our project?
- Where else would you suggest we go to learn more about this topic? How would you approach our topics of inquiry?
- Are there any important management approaches that we might miss by just reading the academic literature, government publications, and the popular press? What should we make sure not to overlook (and where should we learn about it)?