



Scenario Planning Discussions for the Future Frontcountry Management Plan

Kenai Fjords National Park

2018



2005

April 2020



ON THIS PAGE

Exit Glacier in 1992 and 2018. NPS Photos.

ON THE COVER

Exit Glacier and visitors taken near the same wayside exhibit in 2005, 2009, 2010, and 2018. The wayside exhibit is cemented into the ground. NPS Photos.

Scenario Planning Discussions for the Future Frontcountry Management Plan

Kenai Fjords National Park

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Executive Summary

The frontcountry area of Kenai Fjords National Park is the most frequently visited part of the park and where many visitors come with long-standing expectations of touching Exit Glacier. In the 2004 Exit Glacier Area Management Plan, the park discussed managing the trails to provide “visitors with a rare opportunity to easily approach a glacier on foot.” Exit Glacier, however, has experienced substantial changes in extent and, since the 2004 plan, has retreated over 441 meters (482 yards, over 4 football field lengths as of 2017). The glacier is no longer easily accessible. This substantial retreat of Exit Glacier, not foreseen in the 2004 plan, has triggered numerous park management issues.

In summer/fall 2018, Kenai Fjords National Park hosted a number of scenario planning workshops with park staff, the public, and affiliated tribal groups. Scenario planning can offer a structured way of considering a broad set of actions related to different possible futures, ideal when the future is difficult to predict. This approach is also a useful way to identify robust actions and solutions that can work across multiple scenarios. The workshop discussions revolved around four scenarios that used two key variables: Exit Glacier rate of retreat and visitation numbers. Suggestions about how the park could respond to these four specific scenarios and activities that could work across various scenarios were generated in these workshops. This report summarizes the scenarios and workshop ideas that were then vetted by the park management team, and eventually will be used to inform a future Kenai Fjords National Park’s Frontcountry Management Plan.

Acknowledgments

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Background



Chapter 1 - Background

INTRODUCTION

Kenai Fjords National Park is a world-renowned destination for glaciers, wildlife, and coastal fjords. The Harding Icefield blankets much of the park and the park's frontcountry is at the north end, the only park area accessible by road (see Figure 1,

Official Map). The frontcountry is located around ten road miles northeast of Seward, Alaska and approximately 125 road miles south of Anchorage, the largest city in Alaska. A popular visitor attraction in the frontcountry area is Exit Glacier, one of the most accessible glaciers in Alaska, and the frontcountry area hosted 169,740 visitors in 2018.



Figure 1 — Official Map of Kenai Fjords National Park
The frontcountry area is shown in the red oval.



Figure 2 — Park Entrance Sign along the Park Road
The entrance sign specifically identifies “Exit Glacier Area.” NPS photo.

The National Park Service (NPS) has managed the frontcountry by focusing on Exit Glacier as the main visitor destination. Several management plans from the 1980s into the 2000s discuss managing the trails “so the glacier can be touched” (NPS 1984) and providing “visitors with a rare opportunity to easily approach a glacier on foot” (NPS 2004). The 2004 Exit Glacier Area Management Plan (NPS 2004) focused closely on visitor experience and resource conditions in the Exit Glacier Developed Area and the Harding Icefield Trail.

Visitors are primed for Exit Glacier before arriving in the park. Driving on the Seward Highway (Alaska Route 9), visitors can see a highway sign at the Sterling Highway junction and another at the Herman Leirer Road intersection that identify “Exit Glacier” at Kenai Fjords National Park. Entering into the park along the road, visitors encounter the park’s entrance sign for “Exit Glacier Area” (see Figure 2, Park Entrance Sign). Even after arriving at the park and traveling toward Exit Glacier, visitors pass prominent year signs along the park road and trails indicating the specific year that the terminus/end of Exit Glacier was found in that location (see Figure 3, Exit Glacier Terminus Extent Year Signs).



Figure 3 — Exit Glacier Terminus Extent Year Signs
Four examples of the signs in the park’s frontcountry showing where the terminus of Exit Glacier was for that year. NPS photos.

Frontcountry Facilities

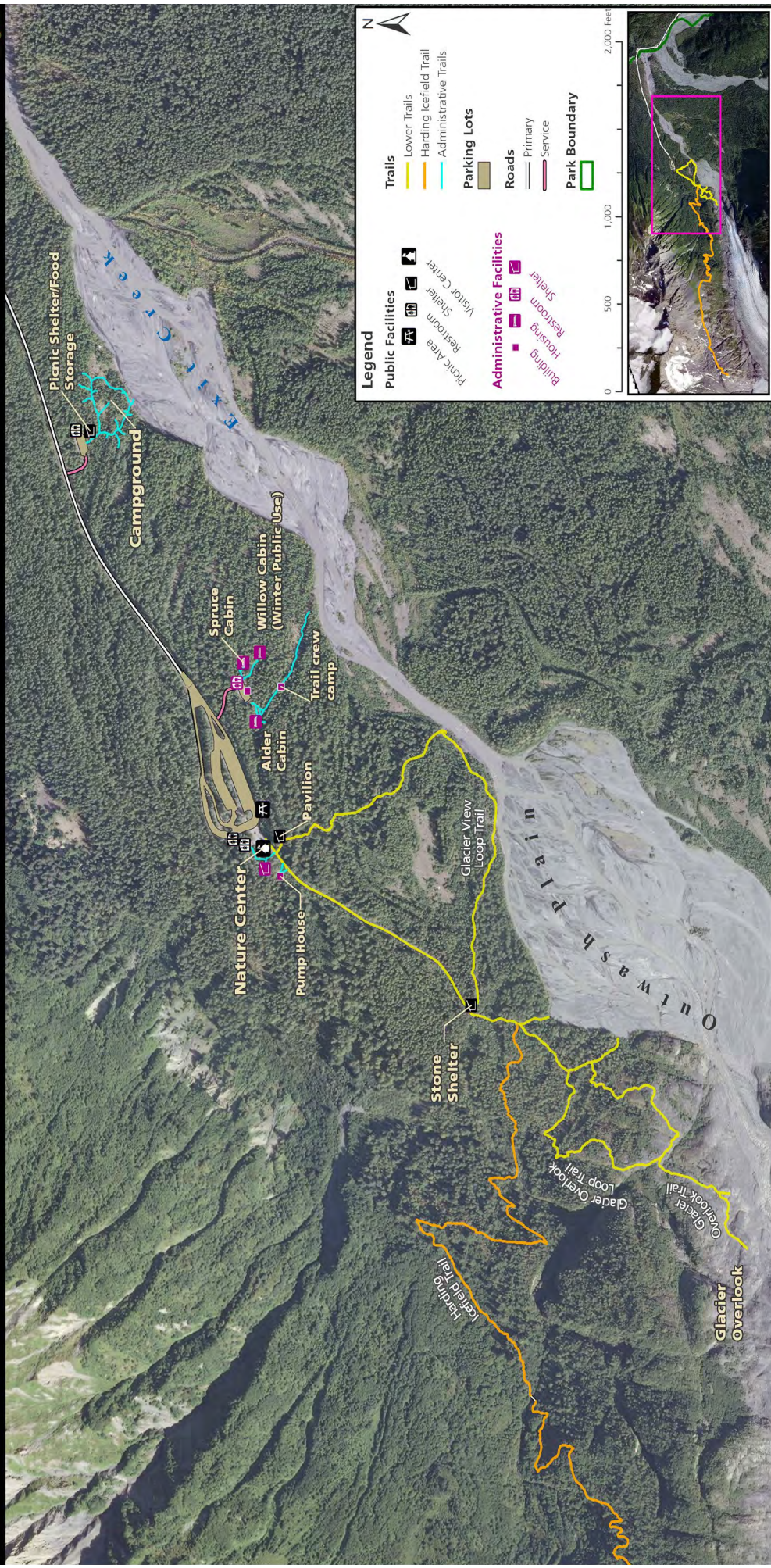


Figure 4 — Map of Frontcountry Facilities
Major buildings and trails in the frontcountry are identified. Exit Glacier and park road are shown in the inset.

All of these signs contribute toward establishing Exit Glacier as the park’s primary visitor destination in the frontcountry.

The public facilities in the frontcountry area (see Figure 4, Map of Frontcountry Facilities) consist of the Resurrection River bridge, the park road, a campground with a food storage building, the parking lot, the Nature Center (visitor center), bathrooms, pavilion, picnic area, stone shelter, and several trails: the Glacier View Loop Trail, the Glacier Overlook Loop Trail, and the Harding Icefield Trail. A number of administrative buildings that are not open to the public include the Nature Center pump house, employee cabins and associated out-house, and a trailbuilders’ camp area. Most building facilities are only open from May to September for the summer season, and are closed the rest of the year. The officially designated Exit Glacier Developed Area (36 CFR 13.1318) is a part of the frontcountry area of the park.

CURRENT CONDITIONS

Exit Glacier

Exit Glacier has experienced substantial changes in its size and extent and, since the adoption of the 2004 Exit Glacier Area Management Plan (NPS 2004), has retreated over 513 meters (561 yards, over 5 football field lengths) as of 2018. With Exit Glacier greatly receding in this relatively short period of time (see Figure 5, Exit Glacier Terminus Positions), there have been numerous consequences for visitor experience and infrastructure, along with impacts to resources and pressures on park management.

Park regulations are directly affected by the extent of Exit Glacier: the legal definition of the Exit Glacier Developed Area specifically references the Exit Glacier terminus position for its boundary (36 CFR 13.1318). The Exit Glacier Developed Area regulations were created when the glacier terminus was relatively stable and while the other sides

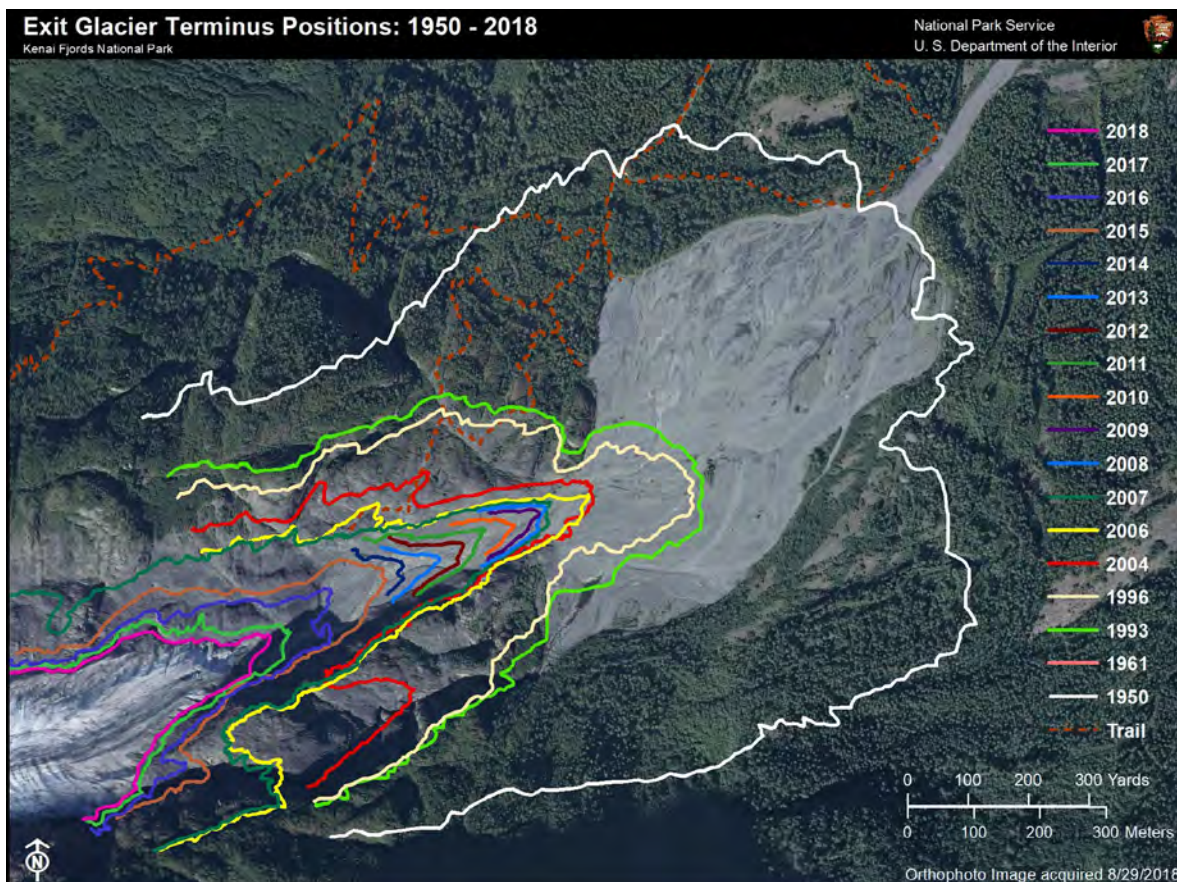


Figure 5 — Exit Glacier Terminus Positions, 1950-2018

Exit Glacier terminus location shown for the corresponding year, starting with 1950 and ending in 2018. Earlier years were photo-delineated. More recent lines were walked with a GPS; this method may change with steep slopes.

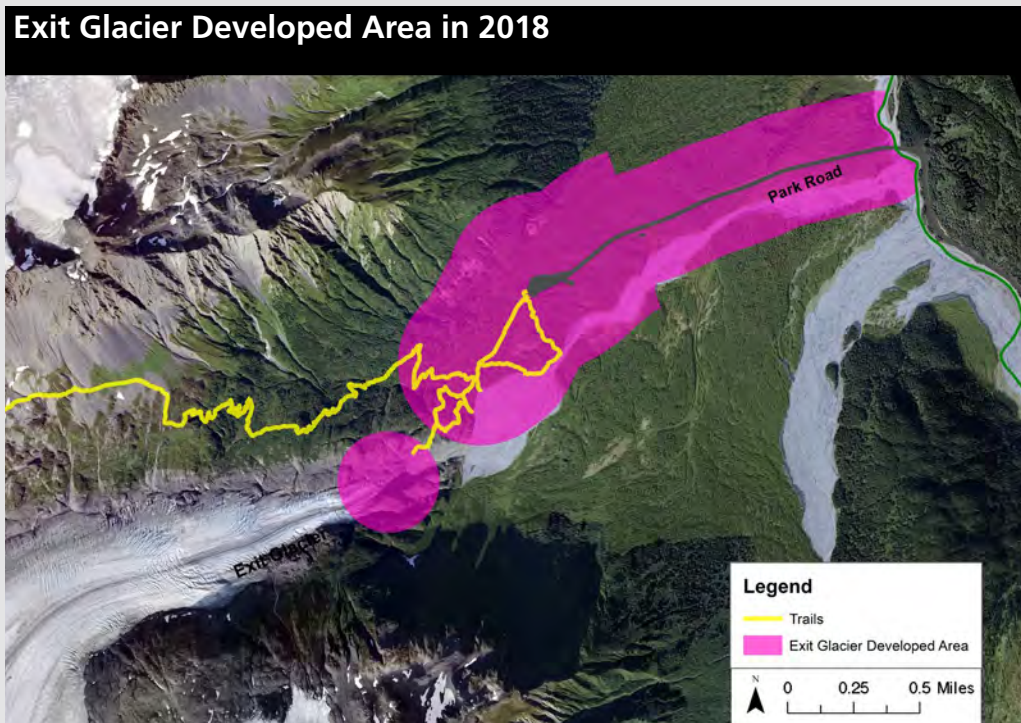
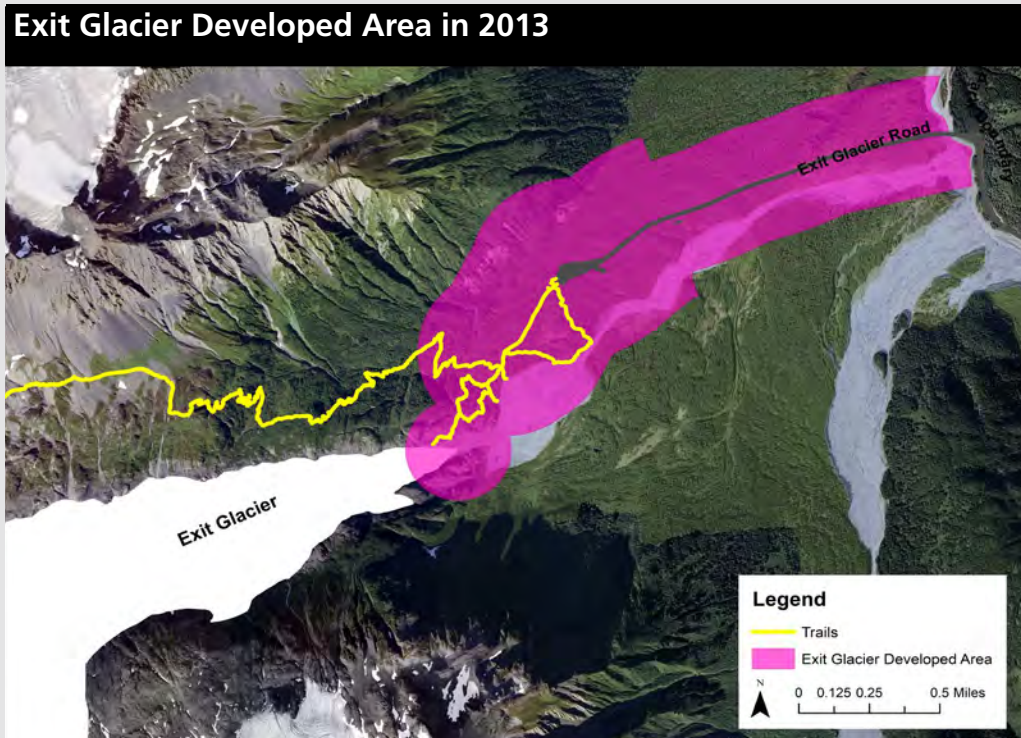


Figure 6 — Exit Glacier Developed Area in Two Polygons

The legal definition of the Exit Glacier Developed Area (EGDA) is bound on one side by the terminus of Exit Glacier and on other sides by permanent features such as the road and paved trail. As Exit Glacier has retreated, the part of the EGDA tied to the terminus has also moved. Prior to 2017, the polygon defining EGDA was a single polygon (see top photo), but 2017 began the onset of separation into two polygons as shown in the 2018 map (see bottom photo). [NOTE: The underlying aerial photo for both maps is from 2018, and for the 2013 map, Exit Glacier's extent for that year was drawn in.]

are defined by stationary features such as paved trails, one side is defined as “All park areas within 300 meters (328 yards) of the terminus of Exit Glacier.” Until 2017, the Exit Glacier Developed Area was a single large polygon. As Exit Glacier continued receding, this single polygon split into two discrete polygons in 2017 (see Figure 6, Exit Glacier Developed Area in Two Polygons). The gap between these two separated polygons has widened as the glacier continues to recede. The Glacier Overlook Loop Trail traverses the gap, and whether rules and regulations for the Exit Glacier Developed Area now apply in this gap are unclear. The gap is expected to grow; it widened an additional 54 m (59 yards) between 2017 and 2018.

Many visitors coming to the Kenai Fjords frontcountry area are expecting to experience Exit Glacier close up. While the NPS has updated Exit

Glacier photos on park websites and exhibits to reflect current conditions, many photos from past years still available on the internet show visitors experiencing Exit Glacier close up, including when the glacier towered next to standing visitors (see report cover) and could be touched (see Figure 7, Changes in Visitor Experience at Exit Glacier).

The NPS last extended the Glacier Overlook Loop trail to Exit Glacier in 2010, and while visitors could not touch the glacier from the trail, they still seemed to feel that they were at the edge of the glacier. After the 2010 trail extension occurred, the glacier greatly receded and due to the rugged, steep terrain, the NPS chose not to extend the trail to reach the glacier.

Numerous visitors are still coming to the park and going off-trail hoping to touch Exit Glacier, creating visitor safety concerns. Visitors stay-



Figure 7 — Changes in Visitor Experience at Exit Glacier

Paired photos showing the change in visitor experience for Exit Glacier. All NPS photos.

ing on the Glacier Overlook Loop Trail can only experience the glacier from a distance. Visitors can also access the Outwash Plain (see Figure 4, Map of Frontcountry Facilities) to view the glacier, although conditions can change frequently due to fluctuations in Exit Creek’s flow, sedimentation, and meandering. While “climbing or walking on, in, or under Exit Glacier is prohibited within 1/2 mile [0.8 km] of the glacial terminus from May 1 through October 31” (CFR 13.1312), there are still opportunities to explore the Outwash Plain area traveling cross-country without trails.

Parking Lot Congestion

Visitors primarily access the frontcoun-

try by personal vehicle, and they often experience traffic congestion in the parking lot before reaching the trails. The parking lot has 75 passenger vehicle spaces, 24 longer recreational vehicle spaces, and 6 tour bus spaces. All of these spaces are typically full between 10 a.m. to 4 p.m. in June, July, and August, often leading to pedestrian-vehicle safety issues. On many summer days, vehicles will park off the pavement in brush-free areas due to the lack of available designated parking spaces (see Figure 8, Parking Issues). Furthermore, as of 2018, there were limited non-motorized or shuttle opportunities for visitors to access the frontcountry area. All of these conditions have led to frequent vehicle crowding in the parking lot.



Figure 8 — Parking Issues

The cars above are parked along the road outside of the full parking lot due to lack of open parking spaces. NPS photo.



Figure 9 — Erosion at Glacier View Loop Trail in 2014

Exit Creek has occasionally eroded frontcountry infrastructure. The Glacier View Loop Trail eroded twice in 2014; this photo is from the first erosion event. After the trail was temporarily rebuilt, it eroded again in eight days. As of 2019, the trail has remained in the second rebuilt location. NPS photo.

Infrastructure

Outside of the parking lot, the frontcountry visitor infrastructure such as the Nature Center, park road, restrooms and trails currently appear to be adequate for the existing visitation levels, although peak visitation windows can be more crowded. The Nature Center has steady visitation from 10 a.m. to 4 p.m. daily from mid-June to mid-August. It is not unusual for the Nature Center to reach its full capacity of 50 people when a bus tour brings a full busload of 40 visitors, which can happen two to three times a week during June to August. Visitors typically spend around 20-30 minutes in the Nature Center viewing exhibits and attend ranger-led programs that have focused on science and climate change messaging. Ranger tours of up to 25 visitors are typically full several times a week. The frontcountry campground's twelve sites can be full in July, but is usually not at capacity the rest of the year. Visitor comment cards have shown visitor satisfaction with park facilities

between 98%-100% satisfied over the past decade.

The frontcountry facilities are located in a floodplain for Exit Creek that can quickly shape local conditions by eroding or flooding. The Glacier View Loop Trail is located adjacent to Exit Creek and frequently erodes. In July 2014, the trail needed to be reconstructed twice: on July 4th, the creek eroded 75 feet (23 m) at a point on the trail (see Figure 9, Erosion at Glacier View Loop Trail), and then eight days later eroded another 40 ft (12 m) on July 12th. As of 2018, the reconstructed trail has not needed to be rebuilt. Sedimentation from high rainfall and localized flooding events can also impact the area and infrastructure, where large amounts of debris are deposited onto trails that need to be cleared for visitor access. Prior to 2016, the park road was also undergoing these similar flooding issues, and in 2016, the road elevation was raised by 5 feet (1.5 m) over a 5220 linear feet (1591 m) length of road in order to address flooding and road closure issues (NPS 2015).

Visitation

The frontcountry area has been able to provide a substantial range of conditions and visitor experiences that can be accessible from a road or trail. Wildlife viewing is popular with frequent sightings at a distance and only occasional close encounters with bears, moose, and mountain goats.

Visitation to the frontcountry is increasing, likely due to changes in Seward tourism and an extended visitor season (Figure 10, Frontcountry Visitation Numbers). The summer shoulder seasons appear to be expanding as temperatures have become milder in spring and fall due to climate change, affecting park visitation. The warmer spring seasons in the past decade have also promoted early melting of roads and trails. Cruise ships have also begun expanding their season and have started to

come to port in Seward earlier in April instead of May. More cruise ships are visiting Seward, and in 2019, one cruise ship company began offering trips with multiple night stays in Seward. The NPS has typically opened and staffed the Nature Center facility from Memorial Day weekend through Labor Day weekend, and this lengthening of the shoulder season affects the park.

Hiker use on Harding Icefield Trail also appears to be increasing (Figure 11, Harding Icefield Trail Map). The NPS has collected data related to hiker numbers since 1991, and numbers taken from the trail register and hiker encounter surveys have been used to help determine an estimate for Harding Icefield Trail user numbers. These numbers show that from 1991-2015, the use has most likely increased 830% from around 1720 to 14,260

Frontcountry Visitors

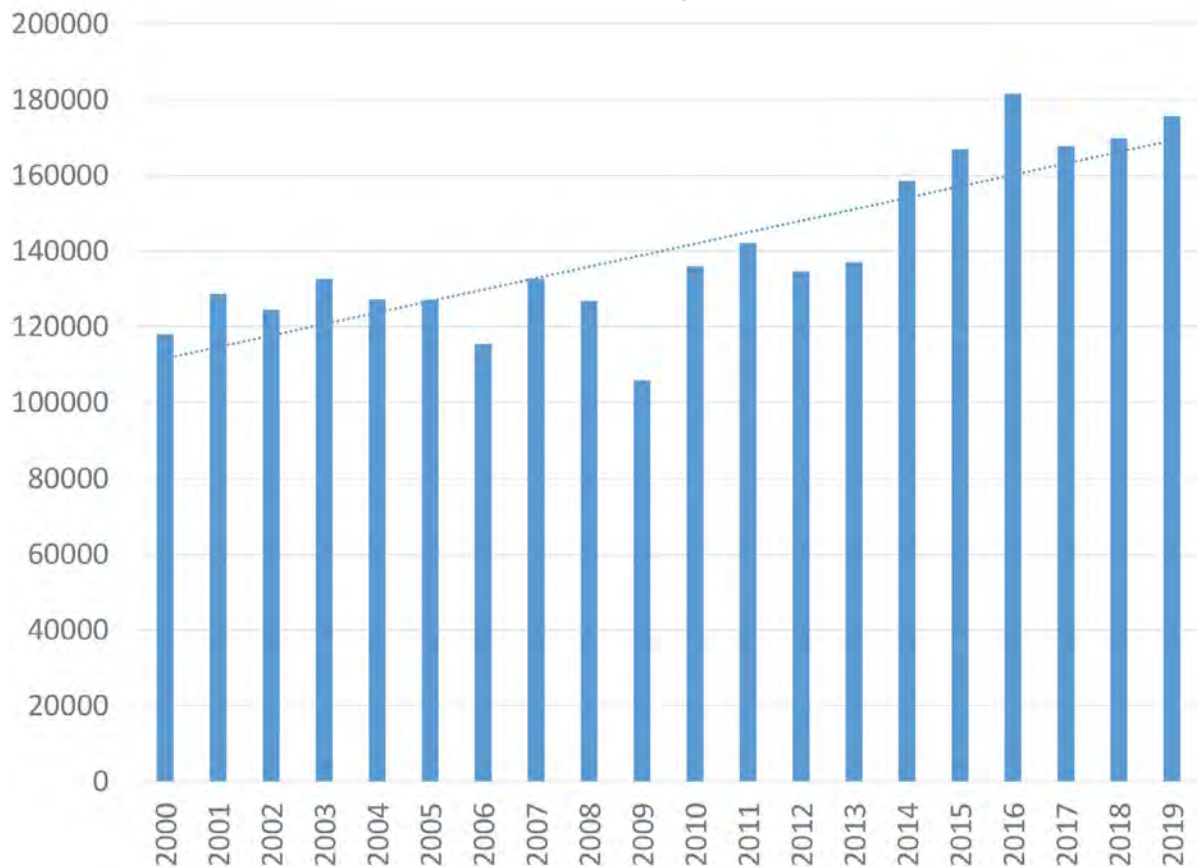


Figure 10 — Frontcountry Visitation Numbers

Visitor number to the frontcountry area from National Park Service Visitor Use Statistics website, <https://irma.nps.gov/STATS/Reports/Park/KEFJ>.

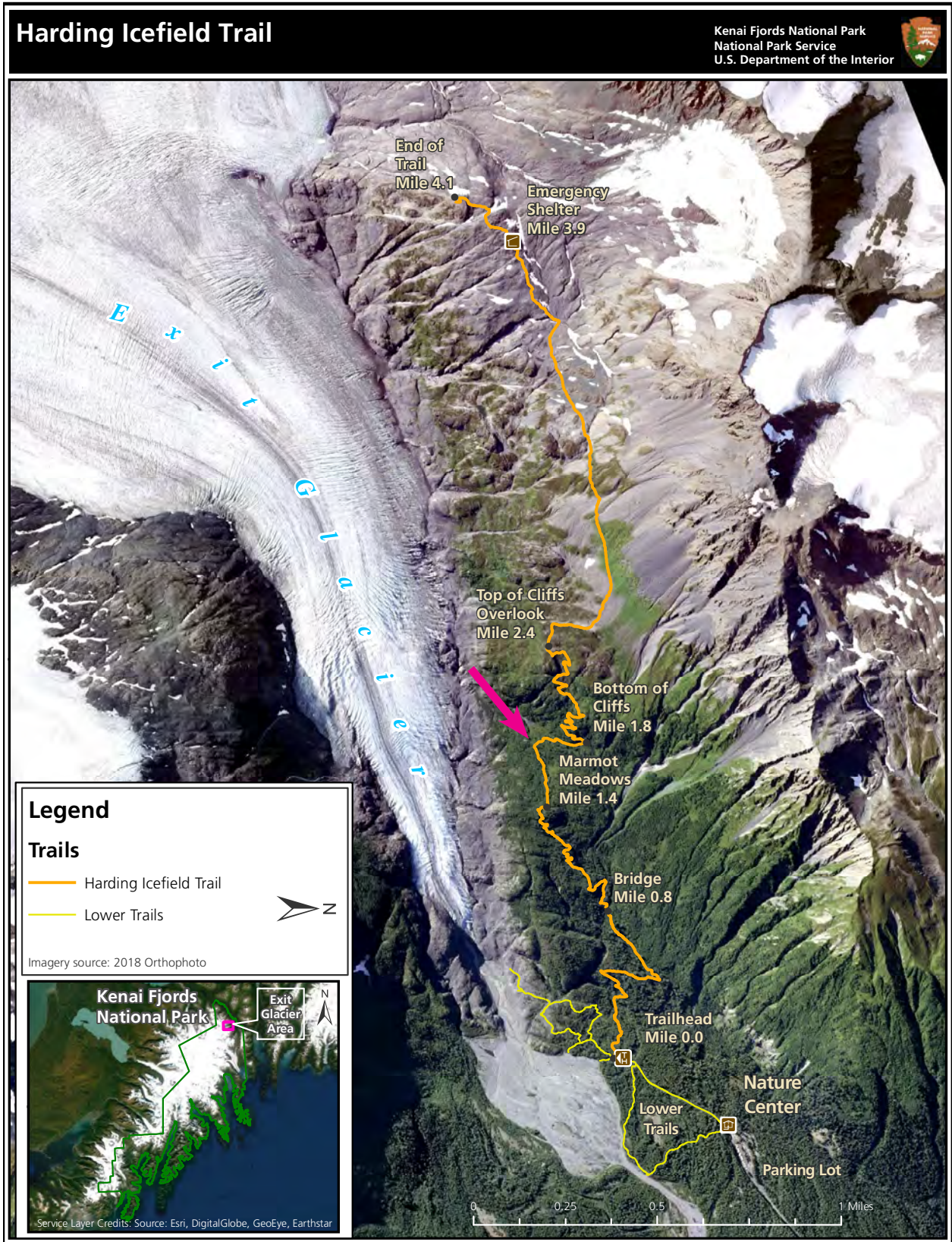


Figure 11 — Harding Icefield Trail Map

The Harding Icefield Trail is a relatively steep 4.1 mile trail. The start to the unmaintained mountaineering route to access Exit Glacier is shown by the pink arrow.

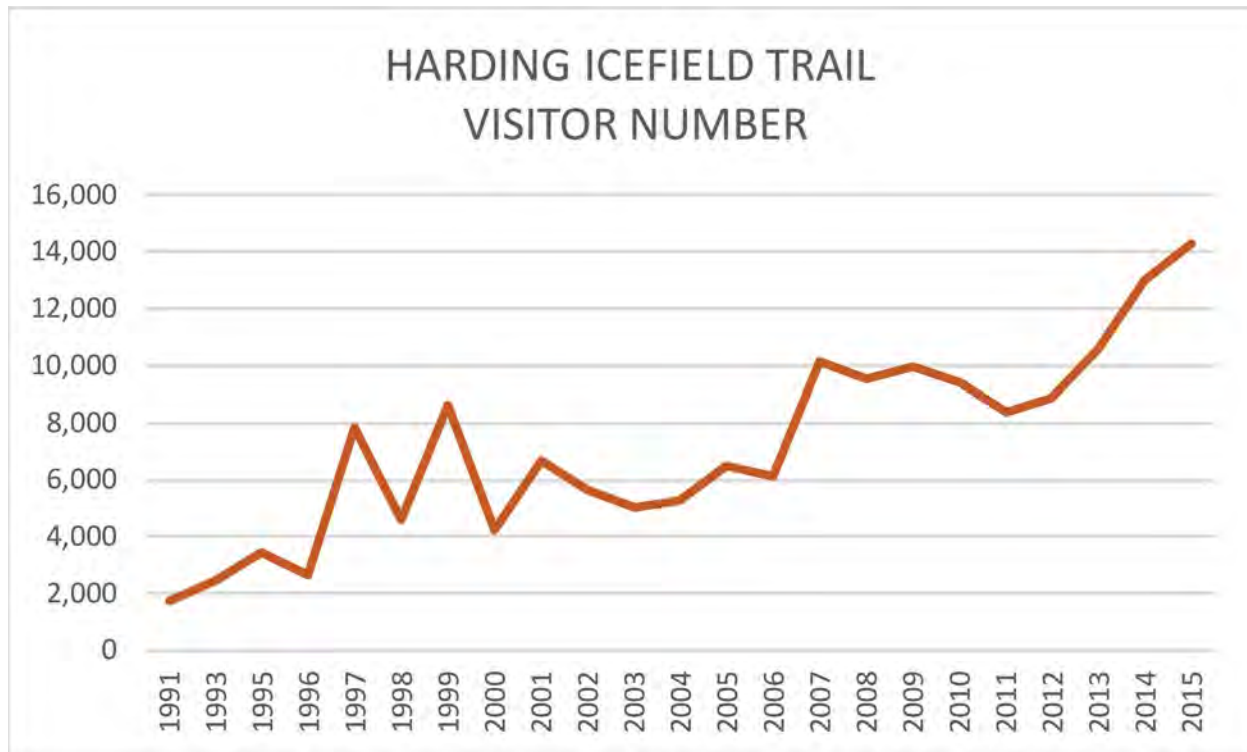


Figure 12 — Harding Icefield Trail Hiker Number

Estimated number of hikers that have annually used the trail from 1991-2015.

visitors (NPS 2018; see Figure 12, Harding Icefield Trail Hiker Number). In 2017, two- or three-person groups were encountered on the Harding Icefield Trail around every 7 minutes between the hours of 10:00 a.m. and 4 p.m. in July and August (data was not collected in June). The NPS is currently testing electronic trail counters to better measure hiker numbers throughout the summer. The ranger-led hike up to Marmot Meadows on the Harding Icefield has usually been full at the 12-person capacity from June through August.

The NPS has also seen a corresponding increase in the number of visitors participating in commercial operations in the frontcountry area for guided hiking on established trails and mountaineering on Exit Glacier proper. Access onto Exit Glacier is currently through an undesignated and unmaintained mountaineering route off the Harding Icefield Trail near Marmot Meadows (see Figure

11, Harding Icefield Trail Map).

Increased visitor number and use can frequently lead to proportional natural resource impacts. Visitors have created extensive social trails as they try to reach Exit Glacier beyond the established trail. With the increased visitation, additional trash and food waste can lead to negative human-bear interactions. There were occasional 1-2 hour temporary trail closures during recent summer months due to bears frequenting trail areas. To combat invasive plants spreading along the edges of established trails and social trails, the park has a robust exotic plant management program.

Housing

Employee housing has been a concern for park management. Seasonal housing in Seward is limited and expensive, and most staff who are not local year-round residents live in NPS employee

housing. The NPS rents apartments year-round in Seward and also has employee cabins with no water or power in the frontcountry.

Recreation

Visitors, including local Seward residents, have requested additional recreational opportunities in the frontcountry. Currently, the increased number of vehicles on the road is creating safety issues for non-motorized bikers using the narrow road shoulder to access the park. The NPS went through a conceptual planning effort finalized in 2013 for a multi-modal trail along the road leading

into the park (NPS 2013) that was well supported by the City of Seward and Kenai Peninsula Borough with city and borough resolutions.

CONCLUSION

Many of these changes were unforeseen in the last management plan that was written for the frontcountry in 2004 and which focused on Exit Glacier as the primary visitor destination (NPS 2004). The NPS is looking to proactively manage the frontcountry recognizing that conditions are changing more rapidly than ever before (see Figure 13, Stone Shelter).



Figure 13 — Stone Shelter

This permanent stone shelter was built in 1986 when this location had a prime view of Exit Glacier. The glacier can no longer be seen from the stone shelter, but does provide visitors shelter from rain.



Scenario Discussions



Chapter 2 - Scenario Discussions

SCENARIO PLANNING

Scenario planning is a structured way of recognizing that the future is not always clear and provides a way to think through actions related to different possible futures (Schoemaker 1995). By exploring multiple possible futures instead of focusing on a single future, scenario planning can be particularly useful in conditions of high uncertainty. This process is also a way to identify actions that can work across all the various scenarios, leading to a more robust set of solutions.

In February 2011, Kenai Fjords National Park staff took part in a Climate Change Scenario Planning workshop that was held for southwest Alaska Parks (Winfrey et al. 2014), recognizing that climate change effects were being seen across the parks in southwest Alaska. One of the “Common No Regrets Actions” from this workshop was identified as “Tune planning process to account for multiple possibility.” This 2011 workshop provided the groundwork for the 2018 Kenai Fjords scenario discussions that were held in anticipation of a future Frontcountry Management Plan. The 2011 plan used a scenario matrix with two key drivers of change to create a four-quadrant matrix (in addition to more detailed sub-matrices within each of the quadrants).

In 2018, the broader, overall four-quadrant matrix with two axes from the 2011 Climate Change Scenario Planning workshop plan was adopted by the park management team as a good framework for the Kenai Fjords National Park frontcountry scenario planning discussions (see Figure 14, Four Quadrant Matrix). While several different axes were discussed, two highly unpredictable variables identified by the park that would most greatly affect the management of the frontcountry area were the rate of Exit Glacier terminus change and frontcountry visitation number.

As discussed earlier, Exit Glacier has receded at an unprecedented amount since the park’s creation in 1980 (see Figure 15, Exit Glacier Annual Rate of Retreat). The annual rate of recession for the glacier has ranged greatly: from 1974-2004, Exit Glacier only receded 56.2 meters (61 yards) in total over the thirty years; while in a single year (September 2015-September 2016), the glacier receded 76.8 meters (84 yards) (Kurtz and Baker, 2016; per D. Kurtz, Kenai Fjords National Park Physical Science Program Manager). This unpredictable rate of Exit Glacier terminus retreat has a direct impact on visitor experience and expectations.

Additionally, while visitor numbers have steadily increased overall, the number does vary on an annual basis (see Figure 10, Frontcountry Visitation Numbers). Since the last management plan in 2004, visitation in the frontcountry has increased



Figure 14 — Four Quadrant Matrix

A four quadrant matrix is directly affected by two key variables.

over 30% (167,600 visitors in 2017 compared to 127,178 visitors in 2004). Visitation could change in the future, however, as transportation patterns

Exit Glacier Annual Rate of Retreat (2004-2017)

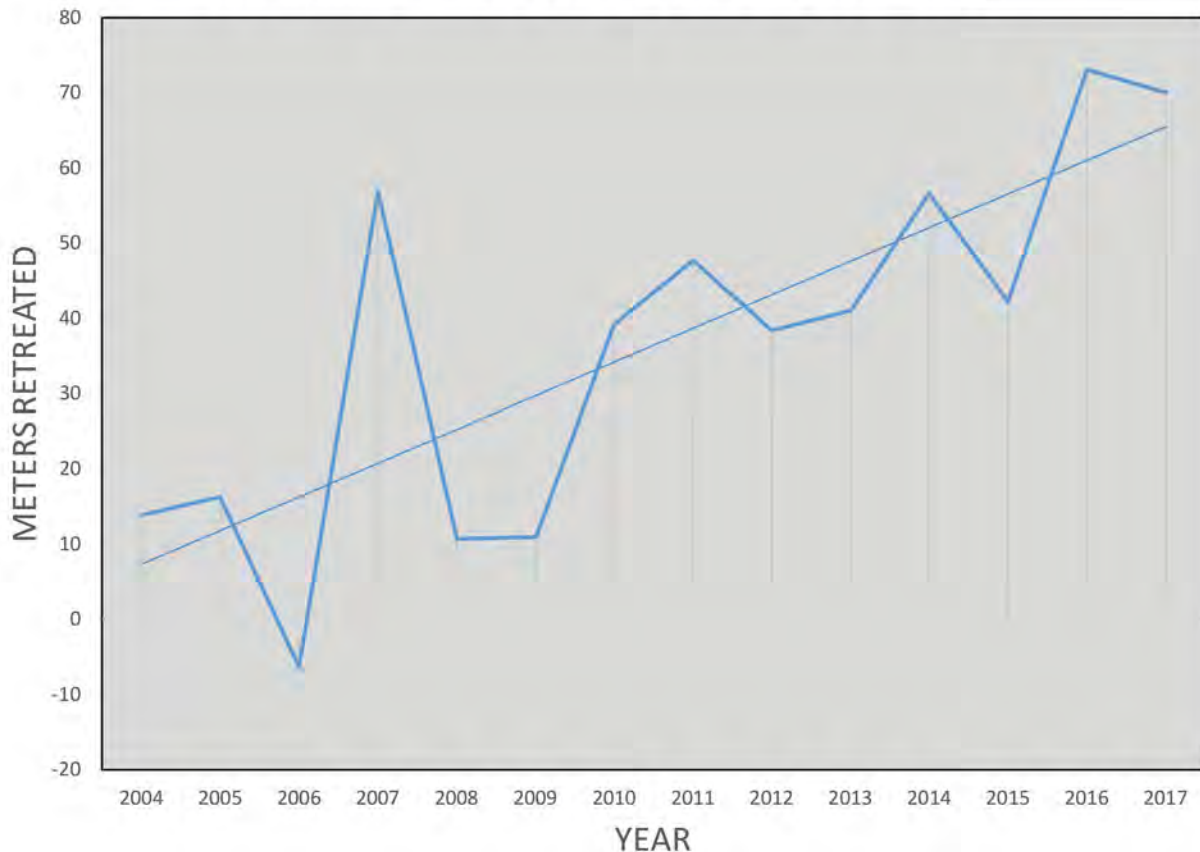


Figure 15 — Exit Glacier Annual Rate of Retreat

Annual retreat for Exit Glacier terminus between 2004-2017. Higher numbers mean larger amount of retreat. A negative number means the glacier terminus surged forward. Overall trend is an increase in amount of retreat.

such as tour buses and cruise ships shift—in 2019, a cruise ship company began using Seward as a multi-day port-of-call instead of a single-day onload/offload point and the Port of Seward is planning on expanding their cruise ship dock to accommodate additional cruise ships simultaneously. These and other factors can greatly shape the park’s front-country visitation numbers.

In summer and fall 2018, Kenai Fjords National Park hosted a total of seven public, tribal, and park staff workshops to discuss current conditions and different future scenarios. The focus of the workshops was to discuss the scenarios and have everyone think of ways that the park could respond to the specific scenarios were discussed in these workshops. The objective of the meeting was described by the strategic challenge: how will the NPS best manage the Exit Glacier/frontcountry area in the future, in light of uncertain rate of glacial retreat and unknown changes in visitation? Workshop participants were also told that the desired outcomes

of the Scenario Planning were to determine (a) a set of “common to all” management ideas that the park could employ regardless of future scenario and (b) actions that work over multiple scenarios.

At these workshops, NPS made it clear that winter recreation would not be the focus. This was because the primary drivers of the rate of Exit Glacier change and visitation numbers that greatly influence the summer season did not apply in the winter.

FRONTCOUNTRY SCENARIOS

Four scenarios were identified by creating a four-quadrant matrix with the rate of Exit Glacier retreat and visitation number placed on an axis with a minimum and maximum number (see Figure 16, Frontcountry Scenario Matrix). The minimum end point number was created by having the glacier be stationary with zero retreat and halving the visitation number, and the maximum number end point was created by doubling the current rate or visita-

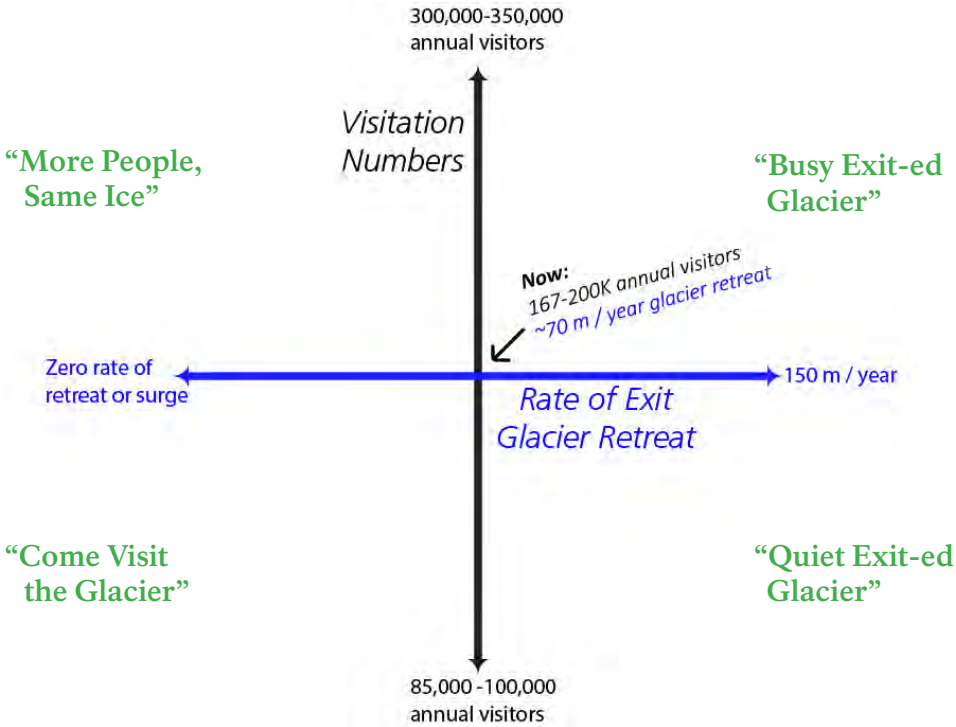


Figure 16 — Kenai Fjords Scenario Planning Matrix
Four quadrant matrix made from two variables: Rate of Exit Glacier Retreat and Visitation Numbers. Four scenarios were discussed, shown in green. The origin is what was occurring in 2017 (the “now”).

tion number, with the 2017 conditions identified at the origin. Specifically, there are currently approximately 167,000 to 200,000 annual visitors a year, and the minimum annual visitor number was 85,000 to 100,000 visitors, while the maximum number was 300,000 to 350,000. The current rate of Exit Glacier retreat is around 70 m (77 yards) per year, and the minimum rate was considered to be either zero rate of retreat or a surge, and the maximum rate of retreat was 150 m (164 yards) per year.

The four scenarios were called: (1) More People, Same Ice; (2) Busy Exit-ed Glacier; (3) Quiet Exit-ed Glacier; and (4) Come Visit the Glacier. Workshop participants were asked specifically, “What would you see at the park in each scenario?” The following colored sections describe the expected changes to visitor experience, infrastructure, and other topics under each of the four scenarios that resulted from the workshops and were vetted by the park’s management team.

Scenario One: More People, Same Ice

The scenario of “More People, Same Ice” describes the park’s frontcountry area as having an annual number from 167,000 visitors (seen in 2017) up to 350,000 visitors, combined with little change in the Exit Glacier terminus position (see Figure 17, More People, Same Ice Scenario). In this scenario, the terminus of Exit Glacier has either stayed near the same location as it was in 2017, or has not retreated any faster than 70 m/year which was the 2017 rate.

Visitor Experience

Under this scenario, visitor experience is affected by the higher number of people using the frontcountry of the park, especially if park staffing levels remain the same. With the increased visitation, the park would likely see a corresponding increase in the need for emergency services including search and rescue operations. Custodial needs would be expected to increase and demand for interpretive services may grow and create new opportunities. Having more visitors would likely contribute to an increased demand for commercial services, also leading to additional viable commercial ventures.

As in 2017, NPS expects that visitors to the park’s frontcountry would continue to expect to reach and touch Exit Glacier. The terminus of Exit Glacier would remain closed during the visitor season, but hikers may be able to access the glacier from the Harding Icefield Trail.

Infrastructure

Under this scenario, visitors to the Nature Center, restrooms, and parking lot could exceed infrastructure capacity. The Nature Center is expected to be at its 50-person capacity from opening until closing with visitors waiting in line to talk to rangers. Over the approximately 120 day-season, the current septic system capacity designed for 2500 people per day would be exceeded after visitation passes 300,000 visitors. Visitors would likely be using the Romtec portable toilets frequently

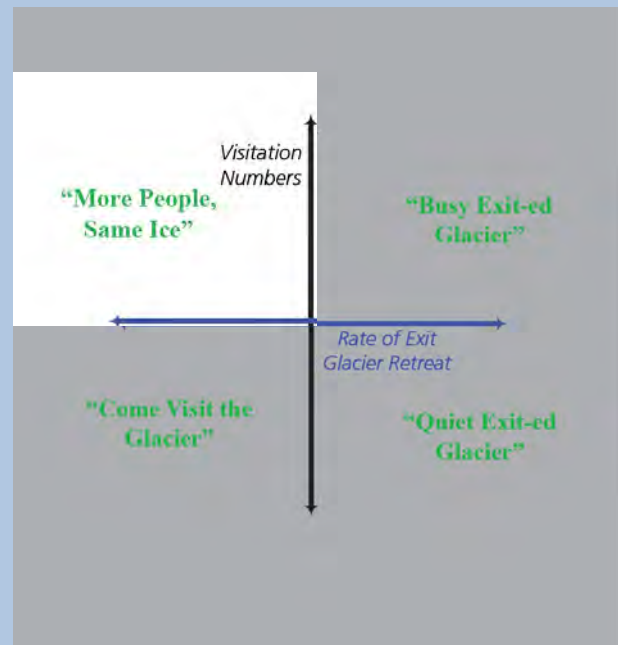


Figure 17 — More People, Same Ice Scenario
 This quadrant has twice the current number of visitors but Exit Glacier has not retreated.

because of long restroom lines, and lines may form outside of the Romtecs as well. The parking lot would be full from early morning until late evening throughout the summer. Similar to 2017 during the busiest hours, visitors would likely drive around the parking lot multiple times until they find a place to park, even outside of designated parking areas.

All of the trails are very busy with people in this scenario and would require additional maintenance. On the Harding Icefield Trail, hikers would likely see a group of 2-3 persons every 3 minutes from early morning to late evening. Hikers would be expected to start earlier or later in the day to avoid peak times, spreading the use across the day, but also creating a continuous high number of hikers in daylight hours. With these busy trails, the NPS expects that there would likely be an increase in social trails and other associated resource impacts.

Demand for the existing walk-in campground would likely exceed the current capacity of the campground as the twelve tent spaces would be expected to be full from the beginning of June through mid-September.

Other

The larger number of visitors may increase the potential for negative bear-human interactions as current food storage/trash capacities would likely be exceeded. Fewer moose and mountain goats may be seen in the heavily visited areas than in the past as they can be deterred by human presence. With more visitors and the same number of staff, the park may see an increase in the number of regulatory violations that are not addressed, although the visitors may self-regulate. Noise may increase due to additional vehicles and visitors, impacting natural soundscapes.

For the Exit Glacier Developed Area, the gap between the end of the paved trail (defining one edge of the gap) and Exit Glacier terminus would create an area where visitors frequent, but is technically outside of the Exit Glacier Developed Area. Regulations that are specific to the Exit Glacier Developed Area, such as the prohibition of pets, would not apply in the gap unless the regulatory definition of the Exit Glacier Developed Area was adjusted.

Under this scenario, the NPS expects that Exit Glacier would remain relevant in branding the frontcountry area, and local businesses would continue to use Exit Glacier to attract clients. Social media posts by visitors would likely attract additional people to come to the park's frontcountry.



Figure 18 — Parking Lot Overflow

Vehicles parked along the road in undesignated areas.

Scenario Two: Busy Exit-ed Glacier

The scenario of “Busy Exit-ed Glacier” describes the park’s frontcountry area as having an annual number from 167,000 visitors to up to 350,000 visitors (around twice the number seen in 2017), and the Exit Glacier terminus rapidly retreating up the mountainside between 70 m to 150 m per year (see Figure 19, Busy Exit-ed Glacier Scenario). Exit Glacier is smaller than it was in 2017—it is shorter and narrower, and has less volume overall.

Visitor Experience

Under this scenario, many more visitors than in 2017 come to the park’s frontcountry expecting to touch or reach the ice. Many of these visitors would likely be disappointed that they can only see Exit Glacier from a far distance. With Exit Glacier diminishing in size, the NPS may see changes in visitor destinations in the area as well as a redistribution of visitors along trails. Demand for additional trails and new glacier viewpoints that are easily accessible may increase, and visitors may seek additional recreational opportunities.

The NPS anticipates greater numbers of people hiking up the more challenging Harding Icefield Trail to get better views of Exit Glacier. The Marmot Meadows area on the Harding Icefield Trail would likely see increased use and the mountaineering route to access the glacier would be expected to become very popular. The NPS anticipates that Harding Icefield Trail hikers would need to frequently stop in order to let other trail users pass on the narrow, steep trail. All of the trails are very busy with people in this scenario, and as more people go up the more difficult trail and routes, the number of minor and major medical incidents and search and rescue events would likely increase as well.

In the lower frontcountry area, the increased number of people would be expected to frequent the more accessible trails. Many visitors would likely explore the Outwash Plain in order to get a better view of the glacier, especially those visitors unable to hike the more challenging Harding Icefield Trail. A higher number of visitors would likely contribute to an increased demand for commercial services, especially related to the Harding Icefield Trail and reaching Exit Glacier on mountaineering routes, leading to additional viable commercial ventures. Custodial needs would be expected to increase. Demand for interpretive services may increase and create new opportunities for commercial operators to lead guided hikes if the NPS staff are unable to meet that demand.

Infrastructure

Under this scenario, visitors to the Nature Center, restrooms, and parking lot could exceed infrastructure capacity. The Nature Center is expected to be at its 50-person capacity from opening until closing with visitors waiting in line to talk to rangers. Over the approximately 120 day-season, the current septic system capacity designed for 2500 people per day would be exceeded after visitation passes 300,000 visitors. Visitors would likely be using the Romtec portable toilets frequently because of long restroom lines, and lines may form outside of the Romtecs as well. The parking lot

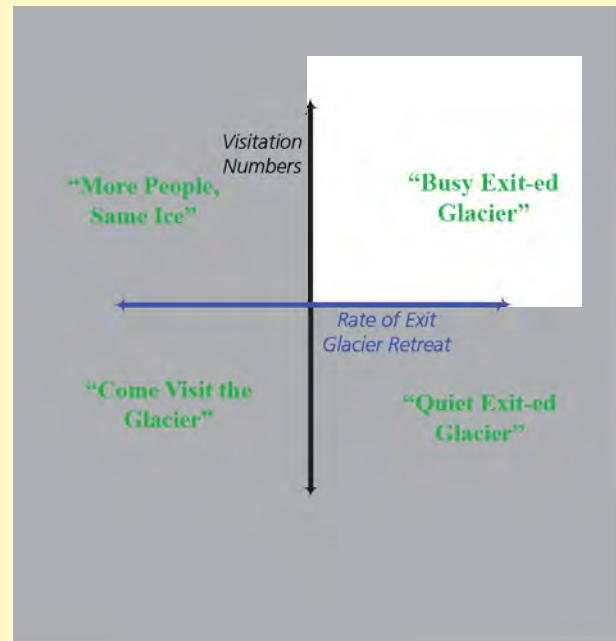


Figure 19 — Busy Exit-ed Scenario

This quadrant has up to twice the current number of visitors and Exit Glacier has retreated substantially.

would be full from early morning until late evening throughout the summer. Similar to 2017 during the busiest hours, visitors would likely drive around the parking lot multiple times until they find a place to park, even outside of designated parking spaces.

All of the trails are very busy with people in this scenario and would require additional maintenance. On the Harding Icefield Trail, hikers would likely see 2-3 people every 3 minutes from early morning to late evening. Visitors are likely to start earlier or later in the day to avoid peak periods, spreading the use but also creating a steady high number of hikers throughout the day. With these busy trails, the NPS expects there would likely be an increase in social trails and other associated resource impacts.

Demand for the existing walk-in campground would be expected to exceed the current capacity of the campground as the twelve spaces would likely be full from beginning of June through mid-September.

Other

The NPS expects that as visitors increase, the potential for negative bear-human interactions would also increase and current food storage/trash capacities may be exceeded. Fewer moose and mountain goats would be expected to be seen in the heavily visited areas than in the past as they can be deterred by human presence. With more visitors, the NPS would expect a lower percentage of detected violations and enforced regulations, although there is the possibility that visitors might police themselves. Noise may increase due to additional vehicles and visitors, impacting natural soundscapes.

The NPS anticipates that commercial services would lead visitors to view Exit Glacier on more challenging routes off of Harding Icefield Trail, and that access for mountaineering ice-hiking or ice-climbing trips would likely become more difficult as Exit Glacier narrows and recedes. With the glacier receding and the length of time to get to these viewing areas by foot continues to grow, commercial day use tours may require additional time to provide an experience similar to what is offered in 2017.

Under this scenario, the Exit Glacier Developed Area, as defined in 2017, would have an expanding large gap between the two separated polygons, with the smaller polygon surrounding the retreating Exit Glacier terminus. The gap between the end of the paved trail (defining one edge of the gap) and Exit Glacier terminus would create an area that is technically outside of the Exit Glacier Developed Area, but where visitation is high. Regulations that are specific to the Exit Glacier Developed Area, such as the prohibition of pets, would not apply to this gap unless the regulatory definition of the Exit Glacier Developed Area was adjusted.



Figure 20 — Visitors along Exit Creek
Visitors at the 1926 Exit Glacier extent sign.

Scenario Three: Quiet Exit-ed Glacier

The scenario of “Quiet Exit-ed Glacier” describes the park’s frontcountry area as having an annual number between 85,000 visitors, around half the number currently seen in 2017, and 167,000 visitors (the 2017 visitation number). The Exit Glacier terminus is rapidly retreating (see Figure 21, Quiet Exit-ed Glacier Scenario) between 70 m to 150 m per year, with the glacier toe moving quickly up the mountain-side. Exit Glacier is much smaller than it was in 2017— it is shorter and narrower, and has less volume overall.

Visitor Experience

Under this scenario, fewer visitors are coming to the park’s frontcountry area. Visitors would likely be disappointed that they can only see Exit Glacier from a far distance as Exit Glacier continues to recede up the hill and farther away from the lower trails. With Exit Glacier diminishing in size, the NPS may see changes in visitor destinations in the area as well as a redistribution of visitors along trails. Demand for additional trails and new glacier viewpoints that are easily accessible may increase, although the lower visitation would also balance the demand.

In order to get closer and have better views of Exit Glacier, the NPS anticipates that people would hike up the more challenging Harding Icefield Trail. Similarly, the Marmot Meadows area along the Harding Icefield Trail would likely continue to attract visitors and a mountaineering route would be used by people to get closer views of Exit Glacier. Decreasing visitation would likely reduce the frequency of emergency and search and rescue responses, although this may be offset by people seeking to reach the ice farther off the trails. A small number of visitors may try to access Exit Glacier by hiking up the Harding Icefield Trail and then route-finding their way across loose scree slopes to touch the glacier.

In the lower frontcountry area, the NPS expects that visitors would continue using the existing trails despite Exit Glacier being far away. In this scenario, the best view of Exit Glacier near the lower trails would likely be from the Outwash Plain, and visitors would be expected to traverse the area to get better pictures, especially people who cannot access the more challenging Harding Icefield Trail.

The NPS anticipates that a higher proportion of visitors would interact with interpretative staff and experience interpretive programs, even if the overall numbers are lower. The overall demand for commercial services is also expected to decrease with the overall number of visitors.

Infrastructure

Under this scenario, the Nature Center, trails, parking lot, and restrooms are rarely busy throughout most of the summer. With the lower visitor numbers, the Nature Center staff would be able to interact closely with nearly everyone who comes into the facility. Down to around 125,000 visitors, the NPS anticipates visitor use of infrastructure would remain similar to 2017. The bathrooms are rarely full and sewer capacity is not a concern. Most visitors driving to the park would

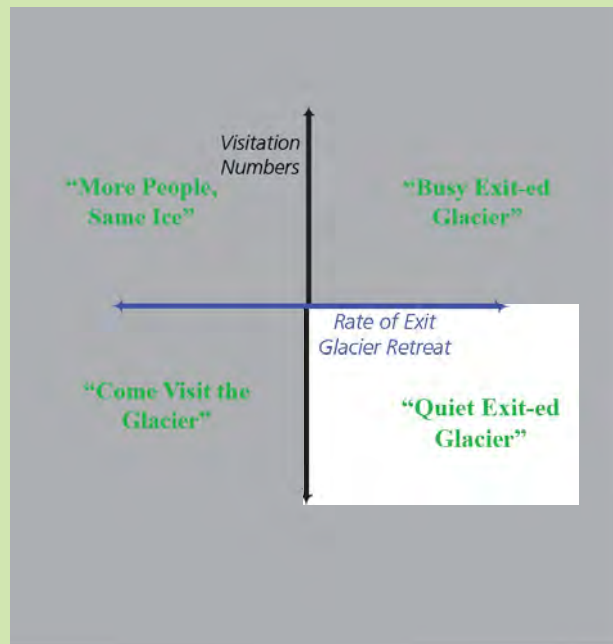


Figure 21 — Quiet Exit-ed Glacier Scenario

This quadrant has down to half the current number of visitors and Exit Glacier has retreated greatly.

likely get a space in the parking lot. The trails would be regularly used, but are not expected to be crowded. While the Harding Icefield Trail may get higher use proportionally among visitors than in 2017 to get closer to Exit Glacier, the overall trail use would be relatively sparse. Hikers on the Harding Icefield Trail would expect to see other groups approximately every 15 minutes during the peak hours of the day. The Park anticipates an increase in social trails from people route-finding to get to Exit Glacier and seeking good viewpoints, but these social trails are not used very frequently.

Other

While a higher percentage of visitors may hike the steeper Harding Icefield Trail and associated routes to Exit Glacier, park staff can educate visitors first-hand on proper food storage and garbage management to prevent negative bear-human interactions. Wildlife sightings of bear, moose, and mountain goats are expected to increase, with fewer negative wildlife interactions.

The NPS expects that mountaineering ice-hiking or ice-climbing trips led by commercial guides would become more difficult as Exit Glacier narrows and recedes. With the glacier receding, commercial day use tours would be expected to change their operations, as the length of time to get to these view areas by foot continues to grow.

For the Exit Glacier Developed Area, the increasing gap between the end of the paved trail (defining one edge of the gap) and Exit Glacier terminus would create an area where visitors frequent that is technically outside of the Exit Glacier Developed Area. Regulations that are specific to the Exit Glacier Developed Area, such as the prohibition of pets, would not apply in the gap unless the regulatory definition of the Exit Glacier Developed Area was adjusted.



Figure 22 — Scenery off the Harding Icefield Trail.
Where Exit Glacier once was. NPS photo.

Scenario Four: Come Visit the Glacier

The scenario of “Come Visit the Glacier” specifically describes the park’s frontcountry area as having an annual visitation number from 85,000 visitors (around half the number seen in 2017) to 167,000 visitors (the 2017 visitation number). In this scenario, the terminus of Exit Glacier has either stayed near the same location as it was in 2017, or has not retreated at a rate of more than 70 m/year which was the 2017 rate (see Figure 23, Come Visit the Glacier Scenario).

Visitor Experience

Under this scenario, fewer visitors are coming to the park’s frontcountry. The NPS anticipates that people coming to the frontcountry would continue to want to touch and reach the ice. Exit Glacier can be seen from the lower trails and would still be a visitor destination.

While occasional search and rescue events would be expected to occur to assist people getting into challenging situations in the frontcountry, the overall number would be limited due to the reduced number of visitors. Most people would be expected to focus on the lower accessible trails which would continue to have good views of Exit Glacier. With fewer visitors, a higher proportion of visitors could experience interpretive programs, although overall numbers would be lower.

Infrastructure

Under this scenario, the Nature Center, trails, parking lot, and restrooms are not very busy. With the lower visitor numbers, the Nature Center staff would likely interact closely with nearly everyone who comes into the facility. Down to around 125,000 visitors, the NPS anticipates visitor use of infrastructure would be similar to 2017. Bathrooms are rarely full and sewer capacity is not a concern. Most park visitors would likely get a parking space in the parking lot. The trails would be regularly used, but would not be expected to be crowded. Hikers on the Harding Icefield Trail would likely see other groups on average every 15 minutes during the peak hours of the day. Because in this scenario visitors are still able to see Exit Glacier well from the lower trails, use of the Harding Icefield Trail is expected to be similar or lower than use in 2017.

Other

With fewer visitors, park staff would be able to educate visitors first-hand on proper food storage and garbage management in order to prevent negative bear-human interactions. Wildlife sightings of bear, moose, and mountain goats are expected to increase, with fewer negative wildlife interactions.

Commercial day use tours are likely to remain popular, even with fewer visitors. People are expected to enjoy viewing the glacier, with some people choosing to take commercial operator trips onto the Exit Glacier ice. The overall demand for commercial operations may decrease with fewer people.



Figure 23 — Come Visit the Glacier Scenario

This quadrant has half the current number of visitors but Exit Glacier has not retreated.

For the Exit Glacier Developed Area, the gap between the end of the paved trail (defining one edge of the gap) and Exit Glacier terminus would create an area where visitors frequent that is technically outside of the Exit Glacier Developed Area. Regulations that are specific to the Exit Glacier Developed Area, such as the prohibition of pets, would not apply in the gap unless the regulatory definition of the Exit Glacier Developed Area was adjusted.

The Park expects that Exit Glacier would remain relevant in branding the frontcountry area and local businesses would still use Exit Glacier as a draw.



Figure 24 — Exit Glacier
Exit Glacier in 2018.

Table 1 — Comparison of Impacts and Actions for each Scenario

VARIATION	SCENARIO
Increasing Visitation	Slowly Retreating or Static Glacier <i>"More People, Same Ice"</i>
	Rapidly Retreating Glacier <i>"Busy Exit-ed Glacier"</i>
Decreasing or Static Visitation	Rapidly Retreating Glacier <i>"Quiet Exit-ed Glacier"</i>
	Slowly Retreating or Static Glacier <i>"Come Visit the Glacier"</i>

POTENTIAL IMPACTS	POTENTIAL ACTIONS
<ul style="list-style-type: none"> • Increased demand for interpretive and commercial services • Nature Center beyond capacity • Septic system beyond capacity • Parking lot congested/beyond capacity • Campground Full • Social trails • Negative bear-human interactions • Wildlife Impacts • Exit Glacier Developed Area in two polygons with gap slowly increasing • Trail and traffic congestion 	<ul style="list-style-type: none"> • Encourage commercial operators to provide additional guided offerings • Expand Nature Center hours • Expand restroom facilities • Add additional parking lot capacity and/or coordinate shuttle system • Add new campground sites • Revegetate/watch for invasive plants • Increase bear aware education • Encourage best management practices • Revise regulations for Exit Glacier Developed Area • Visitor Carrying Capacity Study
<i>(In addition to the above list):</i>	<i>(In addition to the above list):</i>
<ul style="list-style-type: none"> • Demand for new glacier viewpoints and trails • Higher use of the Harding Icefield Trail and mountaineering route • Increased demand for commercial services on the Harding Icefield Trail • Exit Glacier Developed Area in two polygons with gap rapidly increasing • Glacier access difficult • Commercial day trips no longer feasible? • Increase numbers of search and rescue incidents • Increased use of Outwash Plain area 	<ul style="list-style-type: none"> • Build new viewpoints and expand trail opportunities • Formalize mountaineering route into an official trail • Encourage commercial operators to provide additional guided offerings • Revise regulations for Exit Glacier Developed Area
<ul style="list-style-type: none"> • Demand for new glacier viewpoints and trails • Some increase in use of the Harding Icefield Trail and mountaineering route • Social trails • Exit Glacier Developed Area in two polygons with gap rapidly increasing • Some increase in use of Outwash Plain area • Glacier access difficult • Less demand for commercial activities 	<ul style="list-style-type: none"> • Build new viewpoints and expand trail opportunities • Formalize mountaineering route • Revegetate/watch for invasive plants • Revise regulations for Exit Glacier Developed Area
<ul style="list-style-type: none"> • Exit Glacier Developed Area in two polygons with gap slowly increasing • Less demand for commercial activities. 	<ul style="list-style-type: none"> • Revise regulations for Exit Glacier Developed Area





Robust Ideas



Chapter 3 - Robust Ideas

The next step of scenario planning is identifying cross-cutting suggestions covering multiple scenarios. This is where the power of scenario planning resides, from generating robust solutions across numerous scenarios that make sense to invest in.

VISITOR EXPERIENCE

Manage Visitor Expectations through Rebranding and Messaging

In all four scenarios, the park benefits by shifting the focus away from closely approaching or touching Exit Glacier. Expanding the focus to include the Harding Icefield and other parts of the frontcountry beyond Exit Glacier helps to broaden visitor expectations when they reach the park. Emphasizing the park's frontcountry connection to the Harding Icefield, highlighting the eligible wilderness that surrounds the Exit Glacier Developed Area, and renaming the Nature Center as the "Wilderness Center" are three examples of shifting the focus. In order to achieve this frontcountry rebranding, the park would need to greatly change the messaging to the public and partners including numerous signs inside the park, and outside of the park along the highway that refer to Exit Glacier as the primary destination for Kenai Fjords National Park. The main park entrance sign once the road crosses the bridge would also need to remove "Exit Glacier Area." The park will need to continue to remove references and photos to touching the ice, and work with internet and media companies to make the message clear. Spending quality time in a national park would be emphasized, not just seeing Exit Glacier.

Continuing to emphasize Kenai Fjords National Park as a place to view the dynamic movement of glaciers over time may also help to change visitor expectations, and the frontcountry could be

touted for seeing this change and plant succession first-hand. Climate change should continue to be a park message, updated with new information and park details—Exit Glacier retreat would continue to be showcased as an example of climate change effects. Additional interpretive sites could be created focusing on themes such as geology and changes in Exit Glacier.

Messaging to set expectations should continue to focus on reaching as many audiences as possible through various media outlets including social media and local media. Visitor messaging opportunities exist at the Kenai Fjords Visitor Center located at the Seward Small Boat Harbor to set visitor expectations for Exit Glacier and discuss the sea-to-ice route that they can travel. The goal of the park would be to expand visitor focus and interest beyond Exit Glacier proper to encourage visitor explorations in the frontcountry and eligible wilderness areas. Instead of reaching or touching Exit Glacier, visitor expectations would be focused on other frontcountry experiences.

Decrease Crowding

Crowding was perceived as a current issue as well as a likely scenario in the future. Many suggestions focused on diffusing visitor use geographically or temporally. Geographic suggestions included encouraging people to focus beyond Exit Glacier, expanding park trails and access points, and working with neighboring agencies to promote their trails. Ideas such as connecting interpretive opportunities with the less heavily used Resurrection River trail could also help to disperse use. Having programs and pavilion talks spread throughout the day could help spread people out temporally, and having specialized walks/talks could help attract visitors at particular times of day. Expanding hours for the Nature Center to provide opportunities to accommodate longer visitor use times

were proposed to decrease visitor concentrations in shorter opening hours. Commercial operator coordination was also discussed as a way to manage traffic, where buses would arrive at different times instead of at the same time. Social media was also suggested for close to real-time messaging to manage parking and trail expectations.

Exploring opportunities to increase safety and mitigate limiting factors like narrow road shoulders for non-motorized vehicles such as bikes were also suggested across scenarios. The park could work with neighboring agencies and the local community to see what biking opportunities could be enhanced. (Specific suggestions for parking lot congestion relief and trails are provided below under the Infrastructure section below.)

Visitor Opportunities and Programs

In order to broaden the visitor experience

beyond visiting the glacier, additional opportunities and programs were suggested across multiple scenarios. Interpretive program offerings such as wilderness hikes and other naturalist activities were suggested to spread visitor use and reframe the Exit Glacier area as a whole. Encouraging commercial operators to provide additional guided offerings could help to offer different visitor opportunities and help to manage visitors.

Improve Visitor Use and Vehicle Count Data

Understanding visitor numbers is important to better manage the park. Directly related to understanding visitor use is obtaining more accurate visitor numbers that reflect the current conditions through updated traffic and/or trail counting technology. (In 2019, the park began testing a new traffic classifier system to get better visitor numbers for the frontcountry.)



Figure 25 — 2016 Bioblitz Event

Local kids participated in an invertebrate pollinator bioblitz in summer 2016. NPS photo.



INFRASTRUCTURE

With the changes in hydrology and glacier terminus, frontcountry structures and trails in the wetlands and floodplain should be considered carefully before being built. Existing facilities, including trails, should be relocated outside of wetlands and floodplain areas to restore ecological function. The structures may be more beneficial if they are not permanent, but can be moved. The NPS should continue to keep operations as environmentally friendly as feasible to limit carbon footprint.

Manage Parking Lot Congestion

Because visitor parking needs often exceed the current parking lot capacity, multiple scenario solutions focused on adding more parking lot capacity and coordinating alternative transportation. A recent Volpe Study (U.S. Department of Transportation 2019) discussed various alternative transportation options that included increasing parking, adding shuttle options, and changing RV parking. Having shuttle buses come from town could decrease pressure in the park's parking lot. Another configuration of parking spaces may also be better for the most vehicles, and could involve changing the RV parking lot area.

Invest in Trails

The park should focus on creating additional trail capacity for visitors. Promoting other local trails through partnerships with U.S. Forest Service or State of Alaska would take advantage of existing trails, and would allow for more dispersed use with little new capital investment. The NPS could also rebrand, divert, or provide appropriate and safe experiences to address the visitor expectation of touching ice—formalizing the mountaineering route off of the Harding Icefield may be one solution. Additional accessible trails should be considered, given the potential increase and diversity of visitors.

Ideas for new trails that were discussed in workshops for different scenarios included connections to existing trails, standalone trails, and an interagency multi-day connected trail system. Different starting points for trails and final destinations beyond Exit Glacier were suggested. One recurring idea was to create a new accessible trail extending along the park entrance road from the bridge to the parking lot that could eventually become incorporated as part of the Herman Leirer Multi-modal Trail; this trail could also be an interpretive trail that would have orientation and other park information. The park could also focus on expanding trails, trailheads, and interpretive waysides along the Herman Leirer Road by working with other agencies and looking at the Kenai Fjords' General Management Plan (1984).

Housing

With the high demand for housing in Seward, the park should focus on best ways to maximize employee housing. The park should continue to look into Seward options such as leases, or partner with local agencies. Existing employee cabins in the frontcountry could be turned into public use cabins if staffing levels decreased. With the various scenarios, the park should be maintaining flexibility for housing options.

OTHER

Redefine Exit Glacier Developed Area

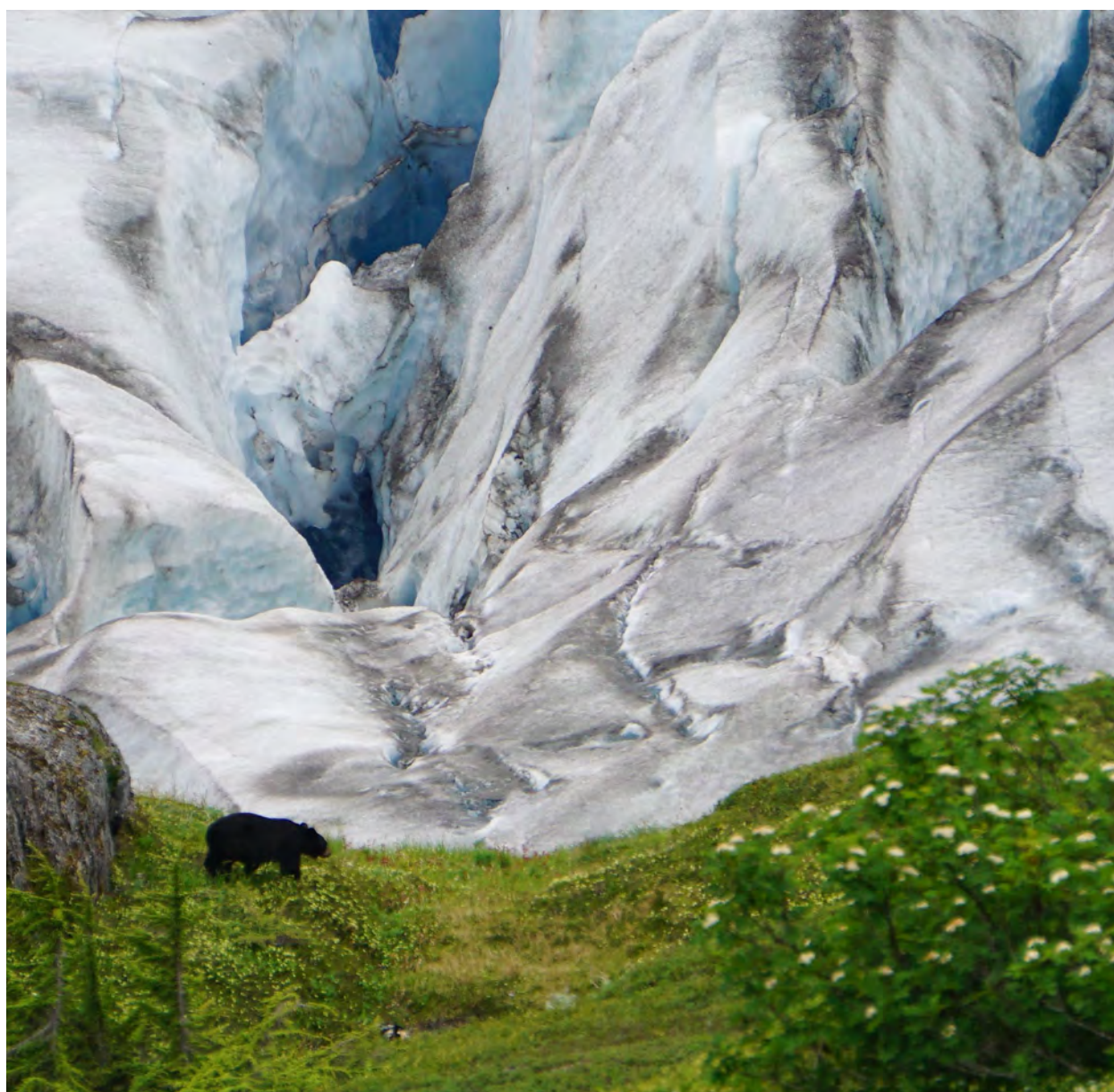
Over all scenarios, redefining the Exit Glacier Developed Area with stationary points and addressing the current polygon gap was considered important. A number of regulations are directly tied to the Exit Glacier Developed Area, and having the developed area boundaries tied to a moving glacier terminus has been problematic. Redefining the developed area with stationary points would resolve the gap where Exit Glacier Developed Area regulations may or may not currently apply.

Monitoring

Monitoring changes to vegetation and wildlife resources from human impacts is important under all of the scenarios. This includes bear-human interactions from safety-related viewpoint. Adding a bear box on the Harding Icefield Trail was given as an example of decreasing bear-human interactions that involve food.

In order to convey current visitor information about Exit Glacier as a climate change example,

the glacier's terminus and extent should continue to be monitored annually. New technology such as structure-from-motion could be used to determine the three-dimensional change of the glacier tracked over time. With the high rapid rate of retreat, Exit Glacier aerial photos have been, and would likely continue to be, useful to show the annual changes on maps, especially to show visitors more recent conditions.



CONCLUSION

The National Park Service has traditionally managed for visitor destinations that are relatively stable and permanent, such as Denali, the Grand Canyon, or Yosemite's Half Dome. For Kenai Fjords National Park, Exit Glacier was relatively stable from 1974 until 2004 and there was little foresight that the glacier would recede to its current location. Siting facilities near the Exit Glacier terminus and tying regulations to Exit Glacier made sense when the glacier was relatively static, but makes less sense with the dynamic glacier recession being seen.

Exit Glacier's retreat cannot be predicted for the future. Accepting that uncertainty leads to more prudent and robust future planning. Visitation numbers too can vary depending on changes on the tourism industry, changes in visitor shoulder seasons, and economic conditions.

Kenai Fjords National Park used scenario planning in public workshops to broaden the discussions about the park's frontcountry and identify potential actions that made sense in multiple possible futures. These robust actions will ultimately be considered in a future Frontcountry Management Plan effort.



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