National Park Service
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Natural Resource Stewardship and Science

Winter Road Plowing in Denali National Park and Preserve

Monitoring Results 2018

Natural Resource Report NPS/DENA/NRR—2018/1794

ON THE COVER

A winter mountain view facing east from the Denali Park Road March 2018. NPS Photo (M. Aberg)

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Monitoring Results 2018

Natural Resource Report NPS/DENA/NRR—2018/1794

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Abstract

Denali National Park and Preserve completed an Environmental Assessment in 2013 that evaluated opening the park road to private vehicle traffic earlier than the typical mid-March date to increase the range of recreational opportunities along the Denali Park Road during winter months. The Finding of No Significant Impact, signed June 2013, identified the alternative which allows road plowing from mile 3 to mile 12.6 (Mountain Vista Rest Area) as the preferred alternative. The Early Road Opening (ERO) period begins annually near February 1 and occurred on a trial basis for three to five years from 2013 while the effects on natural resources, park program finances, and visitor experience and opportunities are monitored. Here we report findings from the 2018 ERO, the final year of the original trial period (a Categorical Exclusion was signed in summer 2018 to continue the plowing period another two years).

Principal findings include:

1. The amount of traffic during 2018 ERO was the most observed during the trial period (at least 1,033 vehicles); an average of 36 vehicles traveled the Denali Park Road each day.
2. Total road use during ERO increased by 15% compared to 2017. Part of this increase is likely in part due to several weather-related road closures in 2017.
3. Nearly 80% of ERO traffic was from private vehicles, 58% of which occurred on Saturdays and Sundays.
4. Most road use occurred in the early afternoon.
5. We observed minimal commercial use (similar to past years). However, observations at the winter visitor center during the implementation of a visitor survey suggest that commercial vehicles access the road nearly daily.
6. Moose were the only observed large animal species.
7. We observed no significant negative wildlife-vehicle interactions and no significant safety or law enforcement incidents were reported.
8. Parking at the Mountain Vista Rest Area increased in 2018. We observed an average of 6.2 parked vehicles compared to 4.5 and 5.0 average vehicles in 2017 and 2016, respectively.
9. The park expended nearly $51,000 for ERO 2018. This expenditure has increased each trial year and has been greater than estimated within the Environmental Assessment.

Introduction

Until 2014, the first significant autumn snowfall closed the park road to private vehicles at headquarters (mile 3.3) until around mid-March. In mid-March, one lane beyond mile 3.3 was machine-packed to allow administrative access to facilities and to manage aufeis accumulation while the second lane was unmaintained and opened for all forms of non-motorized traffic. By mid-March, both lanes were cleared for Spring Road Opening (SRO), opened to the Mountain Vista Rest Area (MV) or Savage River (mile 14.8) around April 1 and finally to Teklanika by mid-April.

In 2013, the National Park Service (NPS) approved the Preferred Alternative in the Winter Road Plowing Environmental Assessment (EA) to open the park road to MV at mile 12.8 by mid-February for a three- to five-year trial period (National Park Service, 2013)[1]. The action intends to expand winter park access by allowing visitors to drive an additional nine miles of the park road and to park at MV. The EA also allows for expanded Commercial use of these areas.

Expanding winter access necessarily entails expense, effort, and impact to park operations. Thus, during the Early Road Opening (ERO) trial period (2014-2018), park staff will monitor visitor use levels of the expanded opportunities, wildlife-vehicle interactions (including behavior), and local soundscapes. Staff will also estimate costs directly related to the ERO. This report summarizes the fifth and final year of ERO monitoring under the 2013 EA.

The following mitigation measures were included in the EA to address potential negative effects to wildlife caused by increased vehicle traffic:

- Park staff will monitor incidents of wildlife caught on the road between snow-berms and motor vehicles.
- A seasonal reduction in speed limit may be implemented if wildlife use the plowed road as a primary travel route.
- Resource staff will notify park management if wildlife-vehicle conflicts develop. Park management and resource staff will work together to determine if a road closure is needed.

[1] The finding of no significant impact (FONSI) can be found at the National Park Service's planning site at: https://parkplanning.nps.gov/document.cfm?parkID=9&projectID=39554&documentID=54352

Methods

The study area is the segment of the park road from the HQ gate (mile 3.3) to the parking area at Savage Cabin (the "mushers' parking lot" (MPL)) just west of MV (Figure 1). To maintain comparable datasets between years, the Road Ecology Program (REP) used a common monitoring period of 30 days. In 2018, the monitoring period was from Saturday, February 17, to Sunday, March 18. Plowing operations began approximately February 1. The road opened to the public on February 8. During the monitoring period, snow closed the road for three days: February 22-23 and March 14.

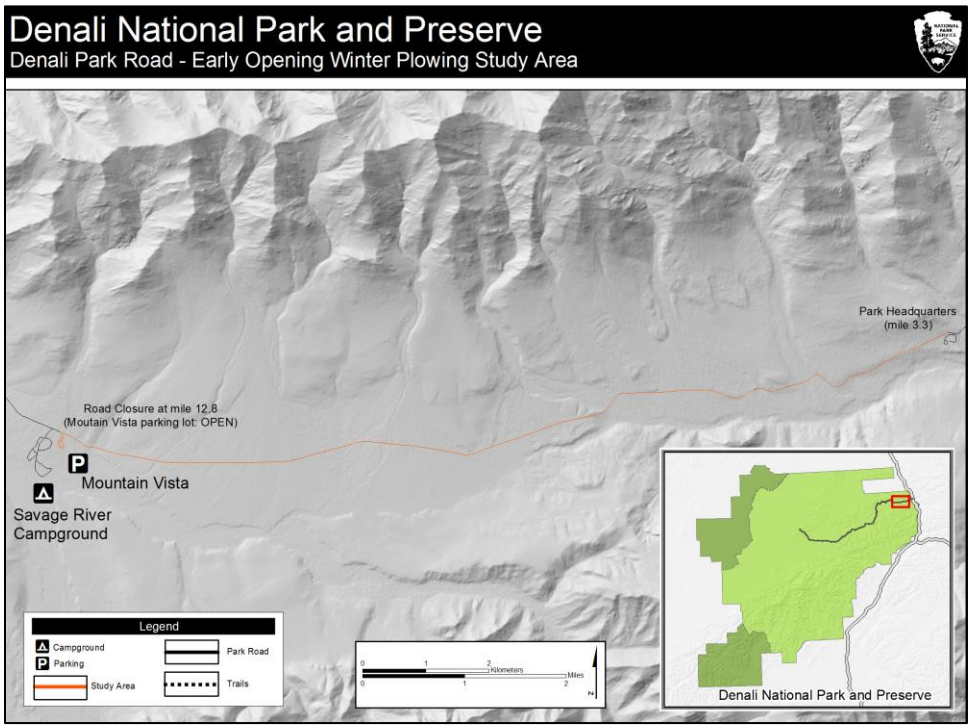

Figure 1. The Early Road Opening study area of the Denali Park Road, Denali National Park and Preserve, Denali Park, Alaska, USA. The study area is a 9.5-mile segment of road that begins at Park Headquarters and ends just west of the Mountain Vista parking area.

Weather

March and February temperature and snow accumulation data for DENA from 2014-2018 and from 1981-2010 (the latest climate period) were compiled by the NPS Central Alaska Network Inventory and Monitoring Program (Pam Sousanes, pers. comm.).

Park Visitation

Visitor Center Statistics

The Murie Science and Learning Center (MSLC, mile 1.4) functions as Denali's winter visitor center from mid-September to mid-May. MSLC staff has counted visitors since the Center opened in 2005. Counting methods have changed over time. Through 2014, staff counted the number of visitors entering the door regardless of whether they had entered earlier. Since 2015, staff counted each

visitor only once. Thus, counts that are more recent represent a more accurate estimate of unique winter visitors at the MSLC. NPS and MSLC staff was not counted if entering for work purposes.

Total Vehicle Traffic Estimates

From February 17 to March 18, REP staff deployed one Reconyx Hyperfire License Plate Camera (Reconyx, Holmen, WI) on a tree angled acutely toward the park road at mile 3.3 to collect data on vehicle traffic. The same set-up was used in 2017. This set-up differed from 2016, where the same model camera was angled obtusely along the park road from a traffic sign (since removed), and from 2014-2015, where a Reconyx Hyperfire Professional Covert Camera faced northwest from the aforementioned tree. For all years, the camera took three rapid-fire photos for each motion trigger. Results were ground-truthed in 2015 and 2016, not in 2017 and 2018.

We classified camera captures in Excel by 1) vehicle grouping and 2) direction of travel. Groupings were: wildlife**,** privately owned vehicle (POV), government-owned vehicle (GOV), heavy equipment (Equip), commercial vehicle (Commercial), indeterminate (Ind), or pedestrian (Ped), which included skiing, skijoring, snowshoeing, walking, dog walking, and biking. Direction of travel was either west (W), east (E), or indeterminate (Ind). If presence of a vehicle was inferred (e.g., from snow blown by tires or from shine made by lights) but exact identification was impossible, vehicle grouping was recorded as "indeterminate," direction of travel was indicated where possible, and "vehicle" was entered in the comments. Many eastbound vehicles must have failed to register due to the angle of the camera. However, their presence could reasonably be inferred by a telltale signature of blown snow. Such "ghost" captures occurred almost exclusively during daylight hours, i.e. periods of relatively high vehicle traffic. There is scant evidence to suggest that the camera was triggered merely by atmospheric conditions. In the infrequent case where a capture occurred without any classifiable visual indicator, "no capture" was indicated. Such events occurred more often later in the sampling period, presumably because the road remained relatively clear, leaving less snow to blow in the wake of a passing vehicle. The camera recorded temperature (Fahrenheit) for every capture.

All vehicles on the park road must travel west and east (dead-end road). Thus, we used the higher of the two figures as the basis for the vehicle count.

Mountain Vista Vehicle Counts

From February 18 to March 18, REP staff recorded number and type (POV, GOV, Equip, bus, van, or idling) of vehicles parked at MV. MV has striping for approximately 12 vehicles. We used a random number generator (RNG; www.random.org) to determine dates and times of observation periods. Vehicles were counted when staff first arrived (time=0), after 15 minutes, and after 30 minutes. Total MV counts included vehicles in the MPL but did not include the monitoring vehicle. We did not count vehicles observed driving through the parking lot without stopping.

Commercial Use and Interest

The DENA Concessions Management Specialist provided a list of the CUAs issued to companies for 2018. A 2018 commercial activity report will not be available before January 2019; the 2017 report, however, is available and described.

Wildlife

Wildlife Sightings and General Observations

REP staff used Apple iPads (Apple, Cupertino, CA) to gather data on wildlife sightings along the park road between HQ and MV. Wildlife sighting data included species, count, age (adult vs. young), sex, behavior, change in behavior, milepost, side of road, and distance from road. Target wildlife species included moose (*Alces alces*), caribou (*Rangifer tarandus*), wolf (*Canis lupus*), Dall sheep (*Ovis dalli*), and grizzly bear (*Ursus arctos*). We considered different species occurring in the same location at the same time as different events.

Because more than one observer may have gathered data on a given day and because we gathered data on both westbound and eastbound trips, wildlife sightings do not represent unique counts of individuals. The aim of the wildlife sightings data was to document visibility of wildlife from the park road and to describe wildlife behavior with respect to vehicle presence.

Fifteen-minute Wildlife Behavioral Observations

To assess potential impacts of vehicle traffic on wildlife, REP staff conducted 15-minute behavioral observations of target wildlife species within 500 meters of the park road. We used Bushnell rangefinders (Bushnell, Overland Park, KS) to determine distances. Wildlife beyond 500 meters of the park road was deemed too distant to be accurately described. (Presumably, too, vehicles are less likely to pause for and less likely to impact wildlife at that distance.) Behavioral observations collected by REP staff were based on protocols modified from Fortier and Tomkiewicz, 1995. By design, VRP staff did not collect 15-minute behavioral observations.

Fifteen-minute observation periods began once REP staff sighted one of the target species. Observers recorded initial behavior as well as behavior associated with the approaching monitoring vehicle. We documented all stimuli (e.g., vehicles passing, vehicles stopping, visitors exiting vehicles) and responses. For groups of animals, the behavior of the individual closest to the road was recorded. If this proved impossible (e.g., due to group bunching), observers recorded behavior of the group collectively. Behavioral observations lasted 15 minutes or until wildlife moved out of view.

Soundscape

We monitored the soundscape near mile 7.5 from 2012-2014 to create a sound amplification model in the study area (Betchkal, 2014). No soundscape data were collected from 2015-2018.

VRP Response

Alaska Region Communication Center (ARCC) provided data on VRP activity on the park road (law enforcement and visitor assistance).

Monetary and Non-monetary Costs

We estimated both monetary and non-monetary (i.e., opportunity) costs of ERO to the Resources, Maintenance, Interpretation, and VRP divisions. Monetary costs across divisions included wages, housing, materials, fuel, and equipment. Non-monetary costs are operations lost or foregone due to the requirements of ERO. Non-monetary costs can translate to further expenditure (i.e. a monetary cost) or savings to park operations.

Visitor Survey

Denali implemented a winter visitor survey that aimed to determine visitor's knowledge of the ERO prior to arriving in DENA, motivations for their visit, activities in which they planned to engage, and demography. This effort was a two-year study that has evolved the ERO monitoring into an interdisciplinary study on winter visitor use of DENA. Results of this survey will improve DENA's understanding of winter visitor demographics, needs, and expectations, which are imperative to providing high quality experiences. Though tightly related, the visitor survey is beyond the scope of resource monitoring for the ERO outlined in the EA. Thus, the report will be published to the Integrated Resource Management Applications (IRMA) website – a portal for all published NPS documents (www.irma.nps.gov) – separately and is in preparation.

Results

Weather

February and March 2018 were slightly warmer and much snowier than usual – good conditions for skiing and mushing (Table 1). February temperatures were just 0.3 C higher than the 1981-2010 average; March temperatures were 1.9 C higher than the 1981-2010 average. A total of 46.7 cm of snow fell in each of February and March, exceeding the 1981-2010 averages by 25.7 and 29.7 cm, respectively. 2018 was a very snowy year – 93.4 cm between February and March compared to the normal 38.6 cm.

Table 1. Summary of average temperatures and snow accumulation during Early Road Opening months from 2014 to 2018 at Denali National Park and Preserve, Denali Park, Alaska, USA.

	Temperature (C)		Snow Accumulation (cm)		
Month	**Average**	**Deviation from 1981-2010 Average**	**Total**	**Deviation from 1981-2010 Average Total**	**Daily Average Snow Depth**
February 2014	-17.4	-3.8	14.9	-6.4	38.6
February 2015	-12.3	+1.3	2.3	-19.1	30.2
February 2016	-6.7	+6.9	6.9	-14.5	60.0
February 2017	-11.9	+1.7	65.8	+44.5	40.4
February 2018	***-13.3***	***+0.3***	***46.7***	***+25.7***	***58.4***
February 1981-2010 Average	***-13.6***	***–***	***21.3***	***–***	***–***
March 2014	-9.3	+1.0	6.4	-10.9	39.6
March 2015	-8.3	+2.0	10.3	-6.4	31.1
March 2016	-6.4	+3.9	31.5	+14.2	62.6
March 2017	-18.2	-7.9	8.4	-8.9	55.1
March 2018	***-8.4***	***+1.9***	***46.7***	***+29.7***	***76.2***
March 1981-2010 Average	***-10.3***	***–***	***17.3***	***–***	***–***

Park Visitation

Visitor Center Statistics

February and March visitation at the MSLC has increased steadily and substantially since at least 2012. In 2018, the MSLC recorded 1,591 visitors in February and 3,616 visitors in March. Visitation in February 2018 was 17% higher than visitation in February 2017. Visitation in March 2018 was 16% higher than visitation in March 2017. February and March 2018 visitation increased 252% and 420%, respectively, from 2012.

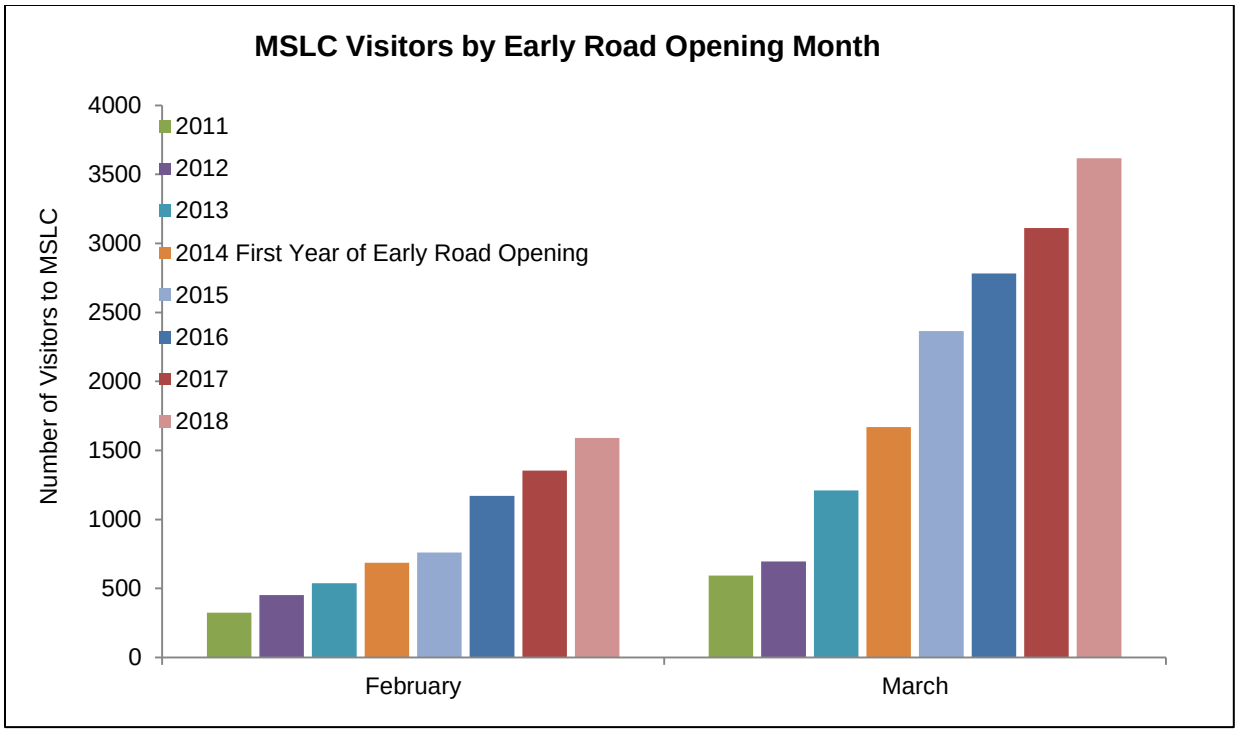

Figure 2. Number of visitors recorded at the Murie Science and Learning Center (MSLC) in Denali National Park and Preserve, Denali Park, Alaska, USA, during Early Road Opening months.

Total Vehicle Traffic Estimates

With the exception of February 22, February 23, and March 14, the park road was open at least part of the day every day for the 30-day monitoring period. During this time, the camera captured 1,033 total vehicles traveling west on the park road (Figure 3). As in years past, POVs represented the highest number of vehicles by far: 818 (79%). GOVs represented approximately 12% (*n*= 119); Equip, 5% (*n*= 49); Ind, 3% (*n*= 30); and Commercial, 2% (*n*= 17).

Camera data show that 2018 ERO traffic patterns resemble those of 2014-2017. POV use of the road peaked at 80 vehicles on Saturday, March 17. Peak time of day for POVs was in the 1400-hours block (Figure 4). For POVs, weekends were at least twice as busy as weekdays (Figure 5). Maximum pedestrian use occurred on Monday, March 12.

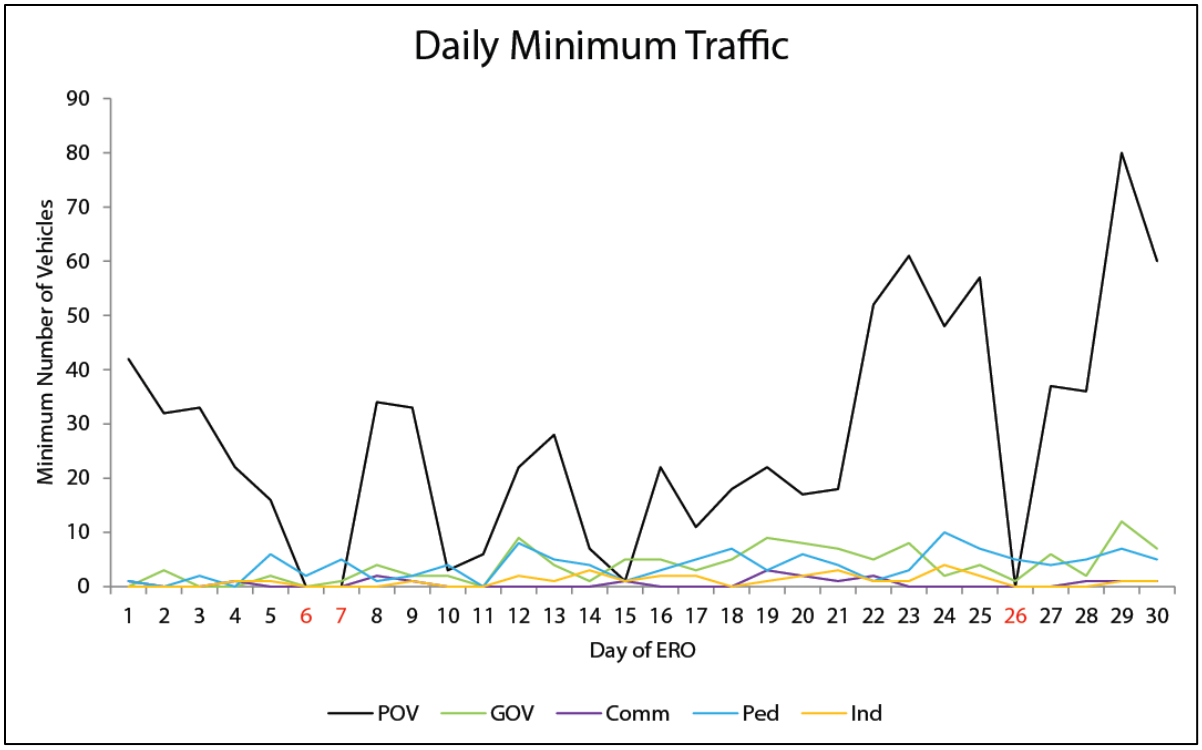

Figure 3. Road use by day of Early Road Opening as captured by a traffic camera on the Denali Park Road, Denali National Park and Preserve, Denali Park, Alaska, USA. Days marked red indicate road closures.

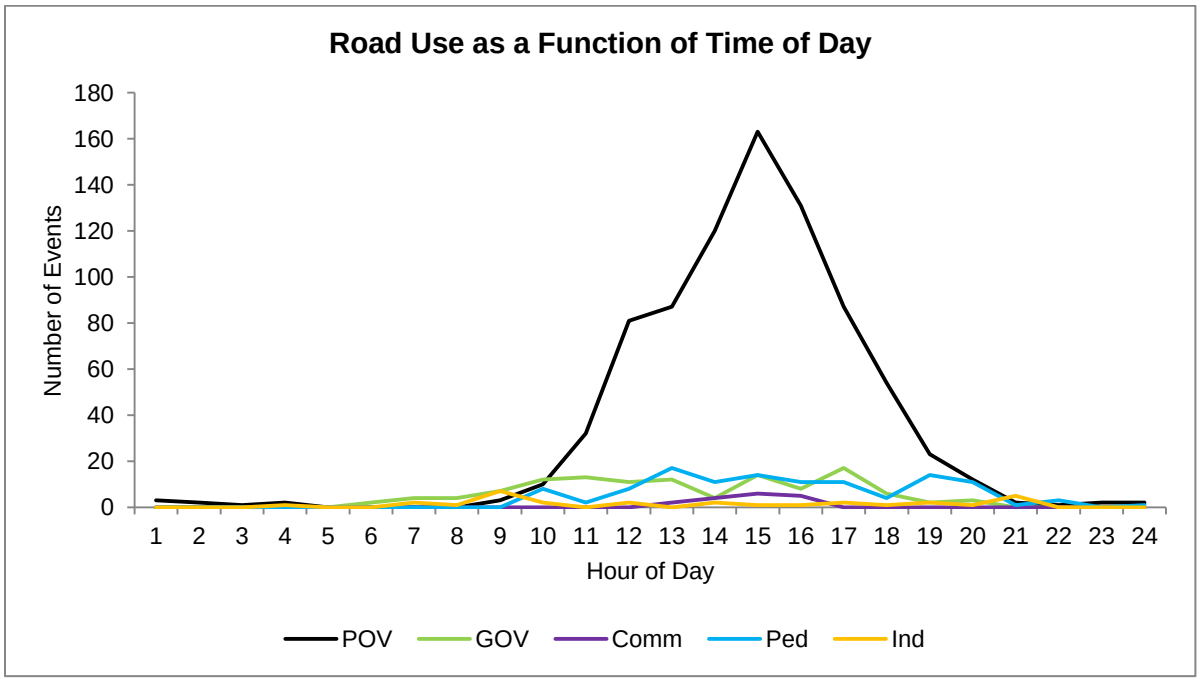

Figure 4. Road use by hour of day during Early Road Opening as captured by a traffic camera on the Denali Park Road, Denali National Park and Preserve, Denali Park, Alaska, USA. POVs used the road most during peak daylight hours. GOVs used the road earlier in the day than other vehicle groups.

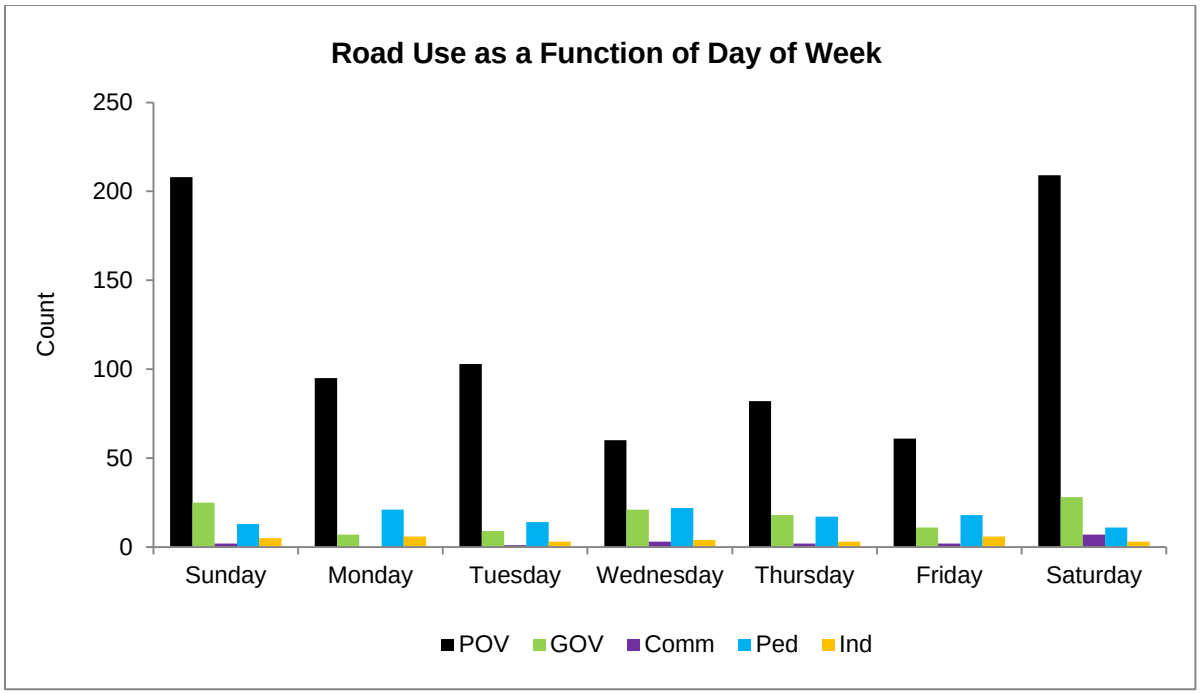

Figure 5. Road use by day of week during Early Road Opening as captured by a traffic camera on the Denali Park Road, Denali National Park and Preserve, Denali Park, Alaska, USA. POVs used the road at least twice as much on weekends as on weekdays.

MV Vehicle Counts

Park staff made 48 MV vehicle counts over 16 trips across nine days of ERO. We sampled every day of the week except Tuesday and Friday. The average number of vehicles observed was 6.2 ($\sigma = 5.3$). The maximum number of vehicles observed was 23 (Saturday, March 17): 18 POVs, one GOV, and four Equip.

Saturday and Sunday had the highest mean number of parked vehicles; Monday and Thursday had the lowest mean number of parked vehicles (Table 2). Two observations included one vehicle idling. We did not observe heavy equipment or buses at MV. POVs outnumbered all other vehicle types by a large margin.

Table 2. Mean (and standard deviation) and maximum vehicles at Mountain Vista by day of week during the Early Road Opening period on the Denali Park Road, Denali National Park and Preserve, Denali Park, Alaska, USA. Saturdays had by far the most traffic at Mountain Vista.

	POV		GOV		Total Vehicles		
Day of Week	**Mean (SD)**	**Max**	**Mean (SD)**	**Max**	**Mean (SD)**	**Max**	***n***
Sunday	4.9 (2.6)	9	0.9 (1.3)	3	6.2 (2.8)	11	20
Monday	4.1 (3.0)	9	0.0 (0.0)	0	4.1 (3.0)	9	8
Wednesday	4.5 (2.8)	9	0.0 (0.0)	0	4.5 (2.8)	9	8
Thursday	4.0 (4.6)	9	0.0 (0.0)	0	4.0 (4.6)	9	5
Saturday	7.2 (5.6)	18	0.4 (0.5)	1	8.6 (6.6)	23	27

Commercial Use and Interest

Reporting of winter tour operators to MV is asynchronous with this report – 2018 data will be available by January 2019. However, we report 2017 data.

Two authorized winter tour operator self-reported activity on the park road during ERO. Northern Alaska Tours took 52 clients to Mountain Vista during the first week of ERO. From March 3-18th, Alaska Skylar Travel took 262 clients on road-based vehicle tours to Mountain Vista.

Wildlife

Wildlife Sightings and General Observations

Of an estimated 47 roves during ERO (21 by REP staff, 26 by VRP rangers), we recorded 25 sightings of target species during road open conditions. Moose was the only target species observed. The maximum group size for moose was three. We analyzed wildlife sightings spatially and temporally. Most wildlife sightings occurred west of mile nine, where tree cover is less abundant (Figure 6). Wildlife sightings occurred uniformly temporally over the ERO period. POVs were observed at six of the 27 wildlife sightings (Figure 7).

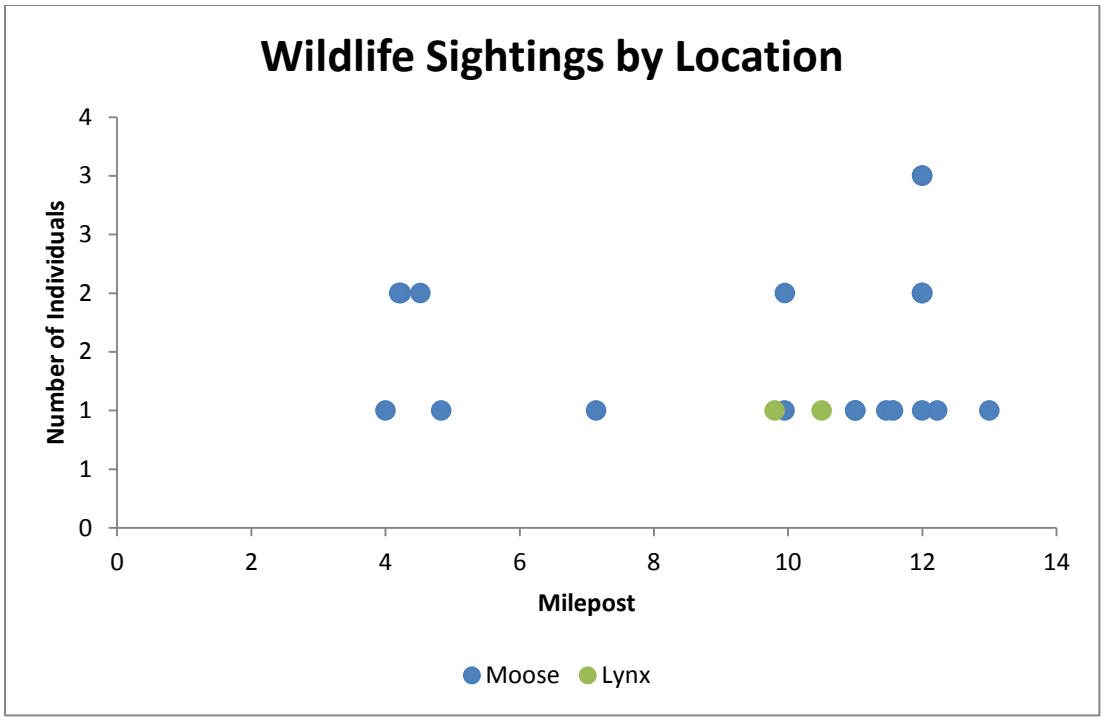

Figure 6. Wildlife sightings by location along the Denali Park Road during Early Road Opening 2018 (Denali National Park and Preserve, Denali Park, Alaska, USA). Most observations of wildlife occur furthest from the headquarters area. Moose are not herd ungulates and tend to be seen in smaller groups.

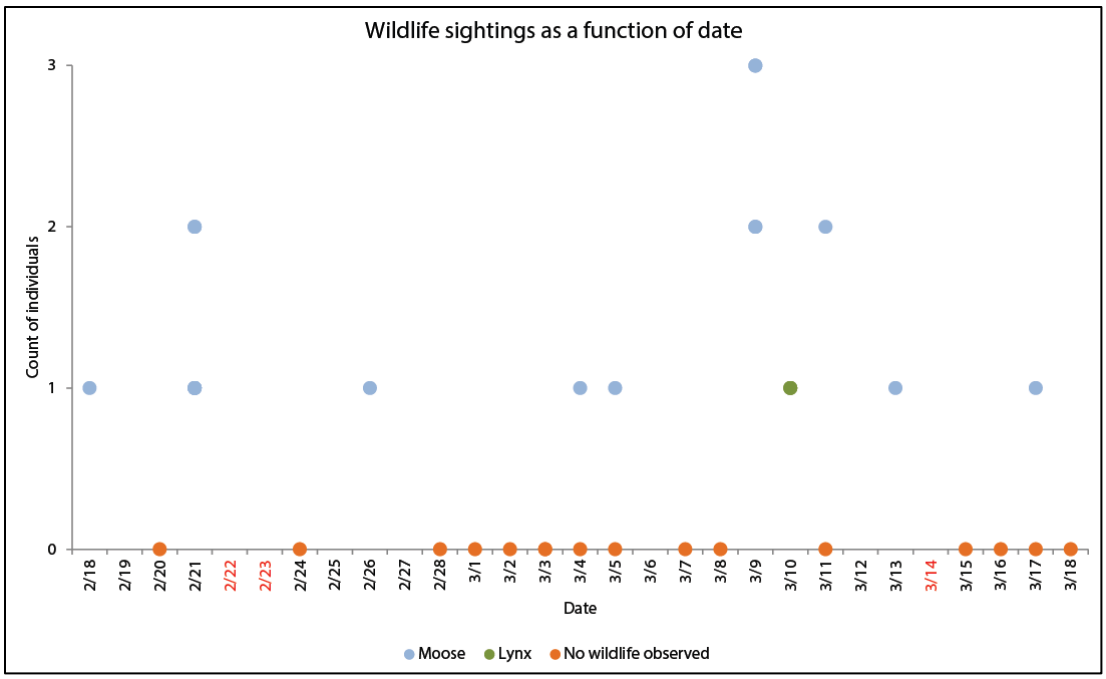

Figure 7. Wildlife sightings by date along the Denali Park Road during Early Road Opening 2018 (Denali National Park and Preserve, Denali Park, Alaska, USA). On some days, more than one observer conducted a rove. Red dates indicated full-day road closures.

Fifteen-minute Wildlife Behavioral Observations

We initiated 15-minute behavior observations on 11 moose encounters. Two moose initially trotted away as a response to vehicle presence. The nine others briefly glanced (6), did not respond (2), or stared at the observer's vehicle (1). All animals resumed their previous activity after their initial response, whether it was lying, feeding and travelling, or walking. No animals dispersed from the road due to the vehicle's presence. VRP made several moose behavior observations: nine instances with no observed effect and two instances of the animal moving or running away from the road.

Soundscape

Acoustical monitoring did not take place during 2018 ERO. However, the effects of noise on the soundscape in this area are well documented (Toubman et al., 2015, Betchkal 2014).

Visitor and Resource Protection

VRP rangers responded to the following 17 incidents on the park road during 2018 ERO:

- Six disabled vehicles
- Four road closures
- Three license plate and registration checks
- One suspicious activity report
- One accident (no injuries)
- One visitor assistance request – transport

Monetary Costs

Across divisions, estimated monetary costs of ERO in 2018 totaled $50,914 (Table 3). Resources costs comprised two pay periods (one month, or the duration of the monitoring period) for one staff member to monitor MV and two pay periods for training and reporting ($8,925). Maintenance costs, by far the largest, included equipment operator and laborer wages, material, and fuel ($39,448). Interpretation costs pertained exclusively to Kennels and described as non-monetary. VRP costs consisted of patrolling rangers' wages ($2,541).

Table 3. Estimated monetary costs of ERO for the Resources, Maintenance, Interpretation (Kennels), and VRP Divisions. Kennels reported costs better described as non-monetary costs.

Division	2014	2015	2016	2017	2018
Resources	$8,284	$10,648	$5,220	$2,806	$8,925
Maintenance	$13,155	$22,000	$26,020	$40,803	$39,448
Interpretation	$9,599	$1,745	$606	–	–
VRP	$1,868	$2,140	$2,912	$1,283	$2,541
Total	**$32,906**	**$36,533**	**$34,758**	**$44,892**	**$50,914**

Non-monetary Costs

Kennels (Interpretation) reported non-monetary costs in the form of lost opportunities and negative impacts to operations. Traditionally, Kennels has used the unplowed park road for training, travel, media, and outreach. Additionally, the unplowed park road offers the safest location for skijoring opportunities for the public and as a training method for young sled dogs. The alternate route for Kennels to access the Denali backcountry the unplowed park road has been the Spring Trail. In 2018, the Spring Trail remained usable well into April. However, typically the Spring Trail is less safe, less efficient, and less dependable. In future years, additional repairs and improvements to the spring trail may be necessary to increase safety and make the trail reliably useable earlier in the season. A second alternative is to drive the dogs to the MPL, which would allow for potential outreach opportunities.

Discussion

Wildlife-Vehicle Interactions

We did not encounter wildlife frequently and thus, made few protracted animal behavior observations in 2018, limiting our ability to describe consequences of vehicle presence on animal behavior. However, if we consider observations from 2014-2018, we observe a trend: wildlife are tolerant of vehicles within reason – fast-moving cars tend to initially push animals further from the road. These observations are true at current winter visitation volumes. How wildlife would respond to greater traffic volumes is untested and beyond our scope.

Visitation and Park Use during Early Road Opening

When the road is open, visitors use it – especially on weekend days. Vehicle use of the park road during ERO increased from 2017 to at least 1,033 vehicles. It is likely that the 10-day road closure in 2017 can explain some of this increase. Averaged over the number of open days, there were fewer vehicles on the road in 2018 (~36/day compared to ~45/day in 2017).

Nearly 80% of traffic was private use, a proportional increase of almost 20% from 2017. While there is a clear increase in POV use, the overall proportional increase is somewhat misleading and is an artifact of a combination of other factors including a decrease in the number of vehicle passes classified as indeterminate and a simultaneous decrease in the number of equipment observations. GOV use tends to be somewhat fixed.

We identified 17 commercial vehicles using the traffic cameras. This is a noticeable increase from previous years (18 total commercial vehicles were identified from 2014-2017). It is difficult to distinguish commercial vans from privately rented ten-passenger vans, a popular rental choice in Alaska. Commercial interest through the CUA program is increasing.

Traffic volume demonstrably peaks on weekends; however, our sample size is too small to determine statistical significance. Regardless of statistical significance, the increase is large and may affect park operations (e.g. staffing levels at the visitor center, law enforcement). Additionally, data suggest that the majority of visitors (56%) did not know the park road would be open when planning their trip (Keller & Clark, 2018, in review). As the public become more aware of the ERO, winter visitation and the number of park road travelers will likely continue to increase. Further, eight years of visitor statistics suggest that even if the ERO were to sunset, winter visitation is likely to increase. Of the visitors who did not know the road was open, 43% would have changed their trip plans if they had known (Keller & Clark, 2018, in review). Thus, visitor behavior (and therefore, expected services) may depend upon if ERO continues or sunsets.

Weather

February and March 2018 were slightly warmer and much snowier than normal. This contributed to good conditions for backcountry users well into spring. Even with significant snowfall, our data fail to show significant negative interactions between wildlife and vehicles related to high snowfall.

Weather likely affects the amount and kind of visitor use in the park. In colder weather, park visitors may prefer a driving tour rather than hiking or stopping. Warm winters may be more inviting to certain user groups and could drive an increase in use. Alternatively, dry winters are typically poor years for many wintertime activities such as skiing, snowshoeing, and mushing. This demographic may seek other locations for such activities.

Expense

Costs associated with ERO are higher than approximated ($25,203) by the EA, which did not consider any costs to the Resources and Interpretation divisions. It is difficult for park divisions to estimate cost of operations differences between if the road was plowed and open versus not plowed and closed. All costs provided in this report are only estimates. Non-monetary costs, especially those incurred by the Kennels operation, are also difficult to estimate, but are acknowledged.

Safety

No major incidents occurred during ERO in 2018 that required the assistance of VRP staff, though there were more minor incidents than in 2017 or 2016. Staff is exposed to more risk with increased winter operations and more work is generated for Alaska Region Communication Center.

Recommendations for Management

- Consider a hybrid-opening schedule as a compromise between increasing access and protecting wildlife and wilderness character. The majority of POV use falls on weekends (58%). Consider an opening schedule of Friday – Monday for vehicle traffic and closing it other days to allow for only foot and bicycle traffic.
- Improve communication regarding current road conditions to the public as it greatly affects expectations and visitor plans by putting its status on the front banner of the webpage and a new sign in the entrance area or at the MSLC.
- Collect and evaluate the comment cards from visitors regarding winter and shoulder season recreation (October-April).
- Complete a non-summer planning document that outlines the directions in which park management would like expansion or contraction of services because regardless of ERO, survey data and eight years of DENA data suggest visitation will continue to increase.

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