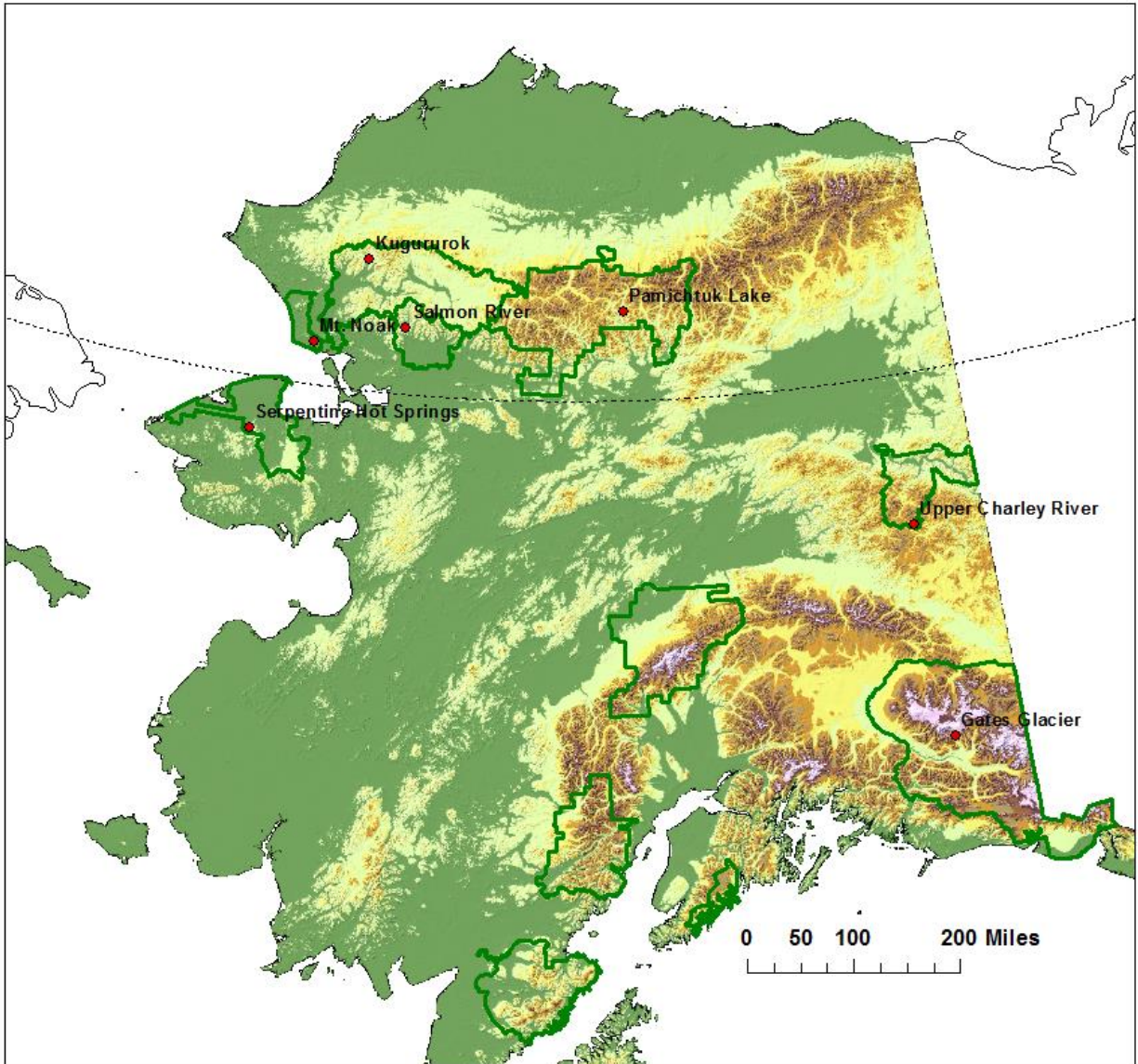


Time-Lapse Videos of Seasonal Changes in the National Parks of northern and central Alaska

Dave Swanson, Ecologist,
Arctic Inventory and Monitoring Network, Fairbanks, Alaska
david_k_swanson@nps.gov
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The National Park Service has remote automated cameras operating year-round in 7 National Park units in northern and central Alaska. These cameras are mounted on tripods with climate and weather monitoring instruments, and they are programmed to take 5 photos per day at one-hour intervals centered at noon. NPS scientists use these photographs to track seasonal changes as a part of the vital sign monitoring program (the Terrestrial Landscape Patterns and Dynamics vital sign, <https://irma.nps.gov/DataStore/Reference/Profile/2211095>). We have created a series of time-lapse videos from these photos by joining the individual photos together into a video file that runs through the photos at a rate of 8 frames per second; thus each day takes 0.625 seconds. The view is sometimes obscured by fog or snow covering the camera lens in the winter.

Gates Glacier

Wrangell-St. Elias National Park and Preserve

Latitude 61.6057°, Longitude -143.0150°, Elevation 4364 ft (1330 m)

The camera looks northeast across herbaceous tundra toward Gates Glacier. White, purple, and yellow wildflowers bloom through the summer. First the white *Dryas* blooms in the foreground, then the purple lupines come up among them, followed by the big white cow-parsnip on the slope behind. In late summer the pink fireweed blooms on the slope too, and then the cow-parsnip leaves turn yellow. The snow pack is deep here. September snows typically melt off, but usually in October the snow stays for the winter. Melt occurs mainly in May. Dahl's sheep or mountain goat tracks are occasionally visible in the snow.

2013 (ggl13.mp4). We started this camera in late June, and the battery ran out in late November.

2014 (ggl14.mp4). We restarted the camera with our visit in early July.

2015 (ggl15.mp4). The camera functioned properly all year.

2016 (ggl16.mp4). An avalanche passed downslope from the upper left-hand corner of the frame on March 29th.

2017 (ggl17.mp4). The camera functioned properly all year.

2018 (ggl18.mp4). The camera functioned properly all year.

2019 (ggl19.mp4). A big slab avalanche is visible on 21 March. Most of the slope in the mid-ground slid. The step-like lines on the slope are the fracture lines where the slab broke loose, and the surface downhill from the fracture lines (which the avalanche slid across) is quite smooth. Note that farthest visible part of the avalanche slid on a shallower layer and there are actually two fracture lines. The upper fracture released a thin slab, then further downslope a second fracture went deeper and allowed sliding of the full thickness of the slab. The lower shear surface was close to the ground surface, so the snow melted off quickly in April when temperatures went above freezing. Tracks show a fox happened by around Oct 22. An shallow early-season avalanche is visible on 25 Oct, and sliding and cracking in the vicinity continued in the following week. Another big slab avalanche affecting the whole snowpack down to the ground is visible on Dec 6. Tracks on Dec 13 and 19 are probably mountain goats.

2020 (ggl20.mp4). When the lens and weather finally cleared on 17 Apr, the fracture line of an avalanche is visible on the left midground. Tracks on May 27 look like a bear. Mountain goats foraging on the avalanche-prone slope on Dec 28 and 29th.

2021 (ggl21.mp4). In early January you can see abundant tracks from goats foraging on the mid-ground slopes. Starting on April 6 the fracture line of a slab avalanche is visible on the mid-ground slope with its flank paralleling the horizon on the slope. The bed surface (glide surface) is very smooth, but it included most of the snowpack and thus this area melted out very early, in late April. Photos are missing between September 21 and November 9. A goat trail in the snow is visible again on 20 November.

Kugururok

Noatak National Preserve

Latitude 68.3333°, Longitude -161.3759°, Elevation 1020 ft (311 m)

The camera looks east across low shrub tundra dominated by birch. Willow shrubs and balsam poplar trees occur in the riparian area along the Kugururok River at the foot of the slope in the background. The shrubs green-up in June. Fall colors start to show in mid-August, when shrub birch turns red and willows and poplars turn yellow. Leaves are mostly gone by early September. The snow cover is usually established for the winter in October and melts in May.

2015 (kug15.mp4). Photos started on June 5.

2016 (kug16.mp4). The camera functioned properly all year.

2017 (kug17.mp4). The camera functioned properly all year.

2018 (kug18.mp4). The camera functioned properly all year except July 19-20. Three bears appear on August 6th and 4 wolves on November 1st.

2019 (kug19.mp4). The camera functioned properly all year. Look for a common raven on Nov 29.

2020 (kug20.mp4). The camera functioned properly all year. See the full moon on December 29. The camera faces generally north, and the full moon is visible above the horizon because its path mimics the midsummer sun's path – which stays above the horizon here above the arctic circle.

2021 (kug21.mp4). The camera functioned properly all year.

Mt. Noak

Cape Krusenstern National Monument

Latitude 67.1414°, Longitude -162.9945°, Elevation 840 ft (256 m)

The camera looks north across Dryas dwarf-shrub tundra. Pink louseworts and white Dryas bloom in June. By the first week in August, a few low shrubs are already turning red, and the grass is brown by September. The winter snow cover is usually established in October, but November thaws can melt through the thin snow of this windswept location. On clear days in late December you can see the noon-day pink twilight colors that come with a location just above the Arctic Circle. The snow usually melts in May.

2013 (mno13.mp4). We started our camera in late June, 2013 and the camera was tilted (probably by a musk-ox) in July 2013. The camera ran into November when it stopped working for the rest of the 2013-14 winter.

2014 (mno14.mp4). We straightened the camera back up and restarted it during our annual maintenance visit in July 2014.

2015 (mno15.mp4). The camera got bumped again (by another musk-ox?) in May 2015. We re-positioned it during our early June visit when green-up was just starting.

2016 (mno16.mp4). A long-tailed jaeger was caught flying on-camera on June 17, and a musk-ox shows up on July 1.

2017 (mno17.mp4). In mid-March wildlife damage again (probably another musk-ox) caused the camera to stop working. We didn't have all the necessary parts to get it working again on our visit in the summer of 2017, so pictures are missing until after our summer visit of 2018.

2018 (mno18.mp4). Pictures resume in late July with our annual maintenance visit. In the lowest light months of November, December the first photo each day is obscured by a pattern.

2019 (mno19.mp4). The camera functioned normally all year except for the patterning on the first photo each day in January. Look for muskoxen fairly close on May 8, and farther away on May 9, 14, and 17. On August 9 a grizzly bear with 2 cubs was barely visible in the distance, and there were caribou on Nov 15 and 19.

2020 (mno20.mp4). The camera functioned normally all year except for the patterning on the first photo each day in the low-light months. The lens was obscured by frost or snow for much of Oct-Dec. Look for muskoxen snoozing near the camera on September 5.

2021 (mno21.mp4). The camera functioned normally all year except for the patterning on the first photo each day in the low-light months. The lens was obscured by frost or snow for the 2nd half of December.

Pamichtuk

Gates of the Arctic National Park and Preserve

Latitude 67.7664°, Longitude -152.1643°, Elevation 3343 ft (1019 m)

The camera looks north across Dryas dwarf-shrub tundra. White dryas and pink lousewort flowers appear in late May and June in the foreground. The fluffy white seed heads of dryas appear in July. Fall colors come in August. Dustings of snow in August are not unusual, but the permanent winter cover usually comes in September or early October. The snow never gets very deep on this windswept hilltop. Snowmelt is usually in early May, but new dustings of snow can still occur in June.

2013 (pam13.mp4). This video begins late May, 2013 and runs until the camera quit working in November 2013. The fence post and electric fence strands on this video are our attempt to discourage grizzly bears from damaging the instruments.

2014 (pam14.mp4). We restarted the camera during our annual maintenance visit in June, 2014 and it worked all through the winter of 2014-15.

2015 (pam15.mp4). The camera functioned properly all year.

2016 (pam16.mp4). The camera functioned properly all year.

2017 (pam17.mp4). The camera functioned properly all year.

2018 (pam18.mp4). The camera functioned properly all year. An unidentified bird crossed the frame on 11 August.

2019 (pam19.mp4). The camera functioned properly all year, except for some missing days in late December.

2020 (pam20.mp4). The camera functioned properly all year, except for some missing days in early January. Note the summer snowstorm on June 30.

2021 (pam21.mp4). The camera functioned properly all year. The winter snowpack melted early (in April) and snow cover was intermittent through May and early June. Caribou are visible December 13.

Salmon River

Kobuk Valley National Park

Latitude 67.4599°, Longitude -159.8412°, Elevation 1250 ft (381 m)

The camera looks north at a tall shrub thicket with a low-shrub tundra hilltop in the background. The tall shrubs visible in the middle of the view are mostly alders (the ones that stay green late in the fall) and a few willows (the ones that turn yellow). By early September the low vegetation turns brown and the willow shrubs yellow. The hill in the background turns red thanks to birch (*Betula nana*) and blueberry (*Vaccinium uliginosum*) shrubs. The station is near the boundary between an area where snow is wind-scoured (left foreground) and snow drift (mid-ground and right). Snow levels can decline due to wind scour without any melt. Wind scoured areas can melt out as early as mid-April, but drifts usually last into June. The snow cover usually returns for the winter in late September or October.

2013 (srw13.mp4). We started this camera in July and it ran through November, 2013 and then quit working. Our camera caught a harrier flying through the frame on October 19.

2014 (srw14.mp4). The station was hit by a bear in April of 2014, so we installed an electric fence and restarted the camera (with a slightly different view) in late July, 2014. A bear was seen walking by our

camera on 22 September 2014. Deep snow fell in late October and tracks on October 29 show a bear was still wandering the area at that time.

2015 (srw15.mp4). Mysterious tracks on October 4 look like a bear got inside the fence without destroying it completely.

2016 (srw16.mp4). On May 13 a bear knocked over the fence but left the camera intact. We repaired the fence on July 27 (see us and our helicopter in the video).

2017 (srw17.mp4). The camera functioned properly all year.

2018 (srw18.mp4). The camera functioned properly all year.

2019 (srw19.mp4). A bear (probably) bumped the temperature/humidity sensor on 21 May so the shield block part of the camera view until it was fixed on 12 June. Bears caught by the camera on 15 Aug and 7 Oct. A moose left some tracks on 16 Oct and voles on 21 Oct. On 14 Dec a marten (?) left tracks.

2020 (srw20.mp4). A bear damaged the station on 23 May, so pictures are missing until our visit on Aug 4. Tracks show that on 16 Dec a caribou stepped in front of the camera without tangling itself in the electric fence wires, which were already laying down at that time.

2021 (srw21.mp4). A moose walked by on May 12. On June 9 the camera was tipped, probably by a bear. NPS staff straightened up the camera and fixed the electric fence on July 14. Lots more moose tracks in the vicinity in October also, and the fence was damaged again.

Serpentine Hot Springs

Bering Land Bridge National Preserve

Latitude 65.8526°, Longitude -164.7087°, Elevation 470 ft (143 m)

The camera looks north at birch shrub-lichen tundra with Hot Springs Creek in the background. The low shrubs in the foreground that turn red in late August and September are birch (*Betula nana*), while the white areas in between them are lichens, and the shrubs that turn yellow along the creek in the background are willows. Snow cover is usually present from October through May, but winter thaws can remove snow from windblown areas where it is thin.

2013 (srt13.mp4). We started this camera in late summer of 2013 and it operated intermittently through the winter of 2013-14. The camera battery was dead for most of November and all of December.

2014 (srt14.mp4). Our first images from late January showed a discontinuous snowpack, very unusual for this location in mid-winter. Persistent, continuous snow didn't arrive until early March, and most of the snow melted off in late April. Some caribou are seen grazing on lichens in the foggy photos from December 11.

2015 (srt15.mp4). Caribou were in the area throughout February, March, and April, with especially good views on Feb. 7 and April 12. Tracks show they came very close to the camera on March 5, but our hourly camera shot missed it. Caribou feeding craters in the snow are visible in February also.

2016 (srt16.mp4). Some caribou are visible in late February, and when the frost melted off our lens in mid-March the snow in the camera view was completely trampled by caribou. Our instrument tripod blew over on October 29th and we got no more photos from 2016.

2017 (srt17.mp4). We set our camera up again during our annual field visit on August 11th.

2018 (srt18.mp4). The camera stopped taking photos on June 5th. We started it up again during our annual field visit on July 25th, and it took some good test photos, but then after we left started taking pictures with a yellow tint. This continued through the winter until it stopped working again on July 13th, 2019. We replaced the camera on August 1st, 2019.

2019 (srt19.mp4). The camera quit working on July 4.

2020 (srt20.mp4). Due to covid19-related travel restrictions, we didn't revisit the site and get the camera working again, so photos are missing from this year.

2021 (srt21.mp4). The camera was restarted on 4 June. The color balance was too yellow but relative changes are visible for the rest of the year.

Upper Charley River

Yukon-Charley Rivers National Preserve

Latitude 64.5169°, Longitude -143.2023°, Elevation 3640 ft (1109 m)

The camera looks north at birch shrubs. These shrubs start to turn orange in late August and drop their leaves by mid-September. The shrubs on the right with white flowers in late June or early July is Labrador tea (*Ledum decumbens*). Snow is usually present from October through May, but dustings of snow can happen in June and August.

2013 (uch13.mp4). Our photos start in late July. Batteries ran out in mid-November.

2014 (uch14.mp4). We restarted the camera in late May.

2015 (uch15.mp4). The camera quit working from Jan 26 until our visit on August 7.

2016 (uch16.mp4). A caribou was seen exiting the frame to the right on May 8 and another is looking our way from the far right side again on September 16. On August 17 our electric fence got torn loose and later scattered across the shrubs in the foreground.

2017 (uch17.mp4). We repaired the fence during our visit on June 14. Animals ran through the fence again in early August.

2018 (uch18.mp4). Camera functioned properly all year.

2019 (uch19.mp4). Lens was obscured by snow all of January and December.

2020 (uch20.mp4). Lens was obscured by snow most of Jan, Feb, Nov, Dec.

2021 (uch21.mp4). Lens was obscured by snow most of January and December. In June a maintenance crew cut down the several small spruce in the camera view.