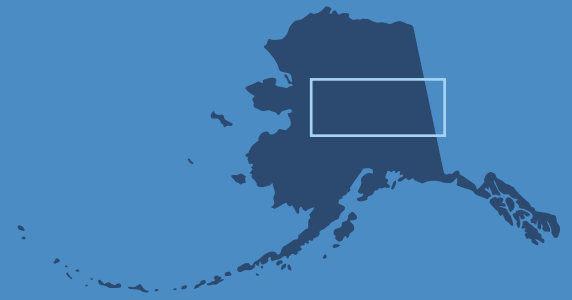


Interior Winter Rain



Overview

Winter rain has impacted Interior Alaska for the last century by creating thick, hazardous ice on roads and sidewalks that persist until spring. Increased car accidents are reported starting from the day of the event until the end of March or April when ice melts. The ice and heavy snow also cause power outages, school cancellations, business closures, and wildlife die-offs. Ambulances also have problems traveling on ice, slowing emergency response. Such events have become more intense and frequent in the past few decades and climate model simulations project the hazard to worsen, posing true concerns for transportation, safety, and subsistence in Interior Alaska.



Interior Alaska: A unique environment



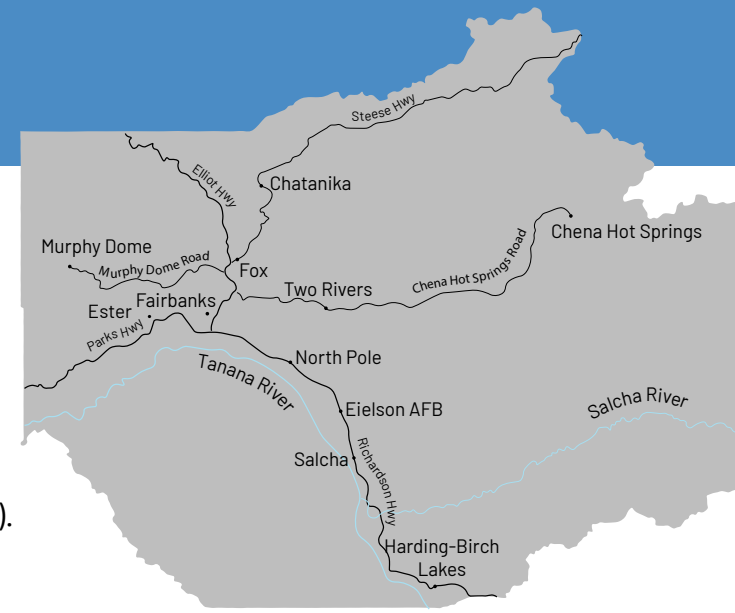
Winter rain is caused by a warm, above-freezing air mass above a cold, below-freezing air mass: the **rain falls as liquid** and **freezes instantly** on the ground and other surfaces. Therefore, even at below-freezing ground temperatures, winter rain is a risk. The rain also creates heavy snow which leads to **collapsed power lines** and **branches**. Wet snow is also difficult to plow, often leading to a solid **barrier** of **ice** on roads. In Interior Alaska, winter temperatures above freezing are rare, meaning the **ice persists all winter until spring breakup**. This differs from freezing rain events in other parts of the United States like New England, where temperatures fluctuate often, creating melt-freeze cycles that mitigate ice build-up.

Winter rain formation

Snow falls when an entire column of air is below freezing (left), while **freezing (winter) rain** falls when warm air overlies cold air (right), causing rain to freeze instantly on contact with the ground and other below freezing surfaces.



Winter rain through history



1920	February 20, 1920: 0.16 inches precipitation*, 0.5 inches snow; heavy snowfall slowed down recreational dog teams and backcountry travelers, slippery boardwalks in downtown, northern mail was delayed
1929	January 19-20, 1929: 1.24 inches precipitation, 6 inches of wet heavy snow closed roads; Ester and Chatanika roads and Richardson highway impassable, all roads out of Fairbanks blocked for 48 hours, mail delays in Nenana
1935	November 1-4, 1935: 0.82 inches rain for 33 hours; airport service suspended; Chena River opened up and ice shifted November 20, 1935: 0.14 inches rain, 65 degree weather swing in 48 hours (-30°F to +35°F); ice on runway damaged landing plane
1937	January 20, 1937: 0.99 inches rain, 15.5 inches snow in 12 hours, wettest winter month in Fairbanks, temperatures reached 36°F; ice and snow covered roads, taxi companies closed, mail delays between Healy and Fairbanks due to icy railroads
1963	January 19-20, 1963: 0.52 inches precipitation which was mostly rain; travel advisories on Richardson, Elliot, and Steese highways and downtown Fairbanks; meat stored outdoors spoiled due to warmth
1967	March 4, 1967: 0.26 inches precipitation, 0.9 inches snow, high of 37 °F; slick roads November 21, 1967: 0.10 inches precipitation; icy roads, multiple accidents December 29-30, 1967: 0.45 inches precipitation, 0.5 inches snow; fog decreased visibility, slick roads, 6 accidents
1979	November 6-11, 1979: 0.36 inches rain, high temperature 34°F; numerous accidents, late school buses
1993	November 9, 1993: 0.16 inches precipitation; 15-20 accidents, travel advisory on Chena Hot Springs Road
2002	November 26, 2002: 0.04 inches rain and 44°F; FNSB schools closed and sporting events postponed February 8-10, 2003: 0.29 inches rain, temperature reached 40°F; numerous accidents including public bus, injuries from falling; FNSB schools closed for 2 days
2003	November 2-8, 2003: 0.44 inches precipitation; slick roads; FNSB schools closed Nov. 2, Daily News-Miner delivery halted
2006	February 19, 2006: 0.06 inches rain followed by high wind created slick ice; several accidents on Steese and Richardson highways, travel advisory on Dalton Highway
2010	November 22-24, 2010: major, high impact event the week of Thanksgiving (see event spotlight)
2013	January 14, 2013: 0.15 inches rain followed by 57 degree temperature drop; travel advisories on Parks Highway, travel discouraged along Richardson, Elliot and Alaska highways, State Troopers responded to 50 vehicles in distress, buses suspended; FNSB schools closed November 14-15, 2013: 0.73 inches alternating freezing rain and snow, and high wind gusts up to 70 mph; travel discouraged on Parks Highway, Elliot, and Dalton highways, parts of Steese Highway closed, flights canceled; FNSB schools closed for 2 days; 14,000 customers without power, at least 3,000 for over 36 hours. In response, grocery stores emptied fridges and 25 people took refuge in high school warming centers
2014	January 23-24, 2014: 0.08 inches rain; 52 collisions and vehicles in ditches in Fairbanks reported to State Troopers, 15 reports of distressed vehicles in Tok; FNSB schools closed, UAF classes canceled
2015	February 21-22, 2015: 0.23 inches rain; roads hazardous; FNSB schools and UAF closed
2018	January 16, 2018: 0.05 inches rain; slick roads, 23 car pileup on the Johansen expressway in Fairbanks
2021	December 26-27, 2021: historic, high impact event (see event spotlight)
2025	January 24, 2025: 0.23 inches rain; hazardous road conditions, State Troopers responded to over 50 collisions and vehicles in ditches; avalanche closed Parks Highway and trapped one car; 700 power outages

Event Spotlight: November 22-24, 2010

On the week of Thanksgiving in 2010, **0.94 inches of rain** fell in Fairbanks. This was the **largest November winter rainfall** ever recorded in Fairbanks. Temperatures reached a high of 37 °F and remained **above freezing for 49 consecutive hours** (longest period of time with above freezing temperatures ever recorded in November). One inch of ice accumulated on the roads making travel nearly impossible from Nov. 21-Nov. 25, including on Thanksgiving Day. There was a travel advisory on the Parks Highway between Nenana and Fairbanks and travel was not recommended on the Steese and Richardson highways. There were many car accidents on Nov. 21 from the initial ice build up including a 5 car pileup. Many people drove off the road but no serious injuries occurred. Due to lingering ice, vehicle accidents continued into late winter and spring including one fatal accident in March. There were sporadic power outages due to wet snow accumulation on Nov. 22 and Nov. 23. FNSB buses, schools, University classes, government offices, and Tanana Chiefs Conference clinics were closed. The airport remained open. Big Ray's stayed open for people to buy ice cleats and grocery stores were open with limited staff due to icy roads.

Event Spotlight: December 26-27, 2021

9 inches of snow fell on Dec. 25, 2021, followed by 1 to 1.5 inches of rain on Dec. 26, followed again 8 inches of snow on Dec. 28. Dec. 26 was the most liquid to fall in a winter calendar day in Fairbanks. The temperature dropped from near freezing to -20°F on Dec. 29, creating massive ice sheets on roads. There were travel advisories everywhere, especially north of Fairbanks due to ice, wind, and drifting snow. The Parks Highway was closed from Denali to Nenana, parts of Steese Highway were closed, Elliot Highway was closed at the junction with Dalton Highway, and the Richardson and Alaska highways were open but travel was discouraged. There was an avalanche on Parks Highway near Healy due to heavy snow. State Troopers responded to 54 vehicle collisions and vehicles in distress from Dec. 26-Dec. 27 in Fairbanks alone. Hazardous conditions and injuries continued into February and March, including one fatal accident in March on the Richardson Highway. During this event, The Alaska Department of Transportation spent **\$4.8 million** on road treatment, staff overtime, and private contract support (upcoming ACCAP Policy Brief). Over **20,000** customers lost power in Fairbanks, North Pole, and Healy due to heavy snow, many for 48 hours and some for longer in isolated areas. The roof collapsed at the Delta Junction grocery store, the Ester Volunteer Fire Department, and Spenard's in downtown Fairbanks. Fairbanks, Delta Junction, and Nenana courts closed with non-emergency hearings rescheduled; Fairbanks library and city hall were also closed. On March 24, 2022, President Biden issued a federal disaster declaration and FEMA later approved **\$1.9 million** in public assistance to repair infrastructure damage from heavy snow and ice.



Icy roads during the December 2021 event. Photo credits: Jeff Chaucer, Fairbanks Daily News-Miner

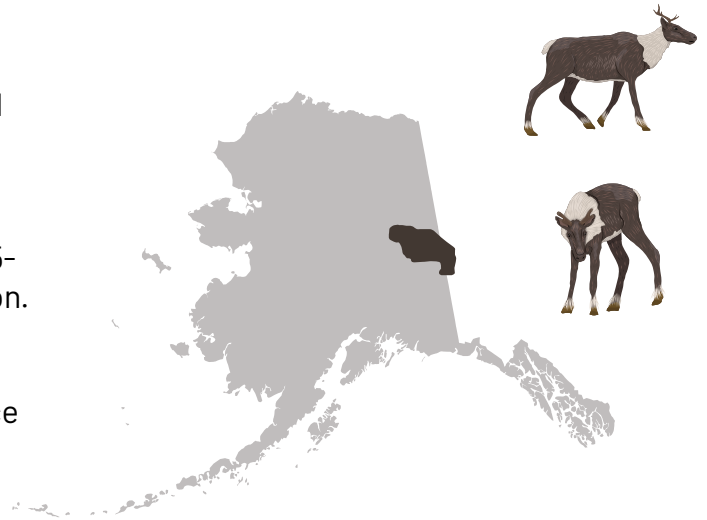
Note: some small events have been excluded for clarity and brevity.

*Precipitation refers to the sum of liquid rain and melted snow

Impacts on wildlife & climate trends

Fortymile Caribou Herd

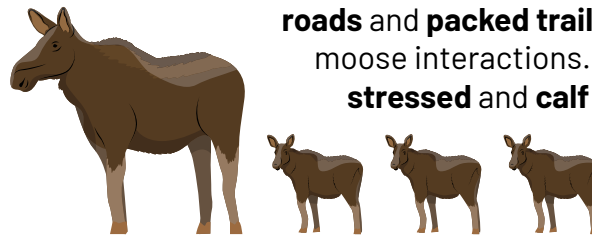
Lichen, a low-lying, crusty plant, is an important winter food for **caribou**. Winter rain events can create a crust on top of snow making it difficult to access snow covered forage like lichen. Caribou die-offs in the Northwest Arctic Borough (2007) and the northern islands off of Nunavut, Canada (1995-1998) have been tied to winter rain and subsequent starvation. The **Fortymile Caribou Herd** in Interior Alaska and Western Canada's reliance on snow covered forage in winter makes them **vulnerable** to future winter rain events that may reduce food access within their already limited range.



Fortymile caribou herd range in Interior Alaska and Western Yukon Territory. Adapted from US Fish and Wildlife Service.

Did you know?

Following the December 2021 winter rain event, Alaska Department of Fish and Game estimated a 40% decline in some moose populations.

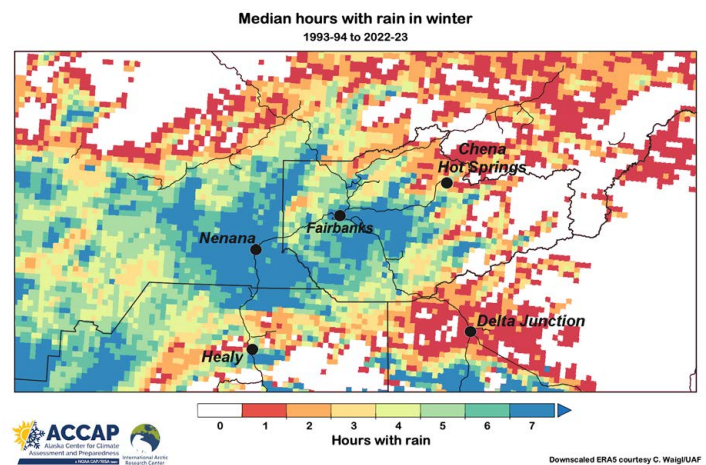


Moose

Moose expend **more energy** traveling when there are **ice layers** on top of or within the snowpack. During the December 2021 event, moose were **more likely** to travel on **treated roads** and **packed trails**, increasing human-moose interactions. They were also **more stressed** and **calf mortality increased**.

Spatial climate trends

The figure on the right shows the typical annual hours of winter rain from **1993** to **2023**. During this time, central Interior Alaska averaged between **zero and seven hours of winter rain per year**. **Fairbanks** and **Nenana** emerged as winter rain **hotspots** while Chena Hot Springs, Healy, and Delta Junction saw **much less frequent rain**. The **frequency** of winter rain in **all areas** will **increase** in the coming decades.



Explore other extreme events at uaf-accap.org/projects/extreme-events-library

Sources: Alaska Department of Fish and Game, Alaska Department of Transportation, Arctic Focus, Ehlers et al. 2024 A taste of space: Remote animal observations and discrete-choice models provide new insights into foraging and density dynamics for a large subarctic herbivore, Fairbanks Daily News-Miner, Fox, L. (n.d.). New insights into Fortymile caribou herd a source of both hope and controversy. Golden Valley Electric Association, Miller and Gunn 2003 Catastrophic Die-Off of Peary Caribou on the Western Queen Elizabeth Islands, Canadian High Arctic, National Weather Service, NOAA Storm Data Reports, US Fish and Wildlife Service

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