Alaska Longline
FISHERMEN'S ASSOCIATION
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Linda Behnken, Executive Director
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June 7, 2026

Re: Twin Mountain II Timber Sale Draft Environmental Impact Statement

Dear Tongass National Forest Supervisor Nelson:

The Alaska Longline Fishermen's Association (ALFA) is a Southeast Alaska-based commercial fishing organization that represents and advocates for community-based, small commercial fishing businesses. ALFA represents commercial fishing vessel owners, deckhands and business members from nearly every community in Southeast Alaska who participate in, or otherwise support and benefit from, the commercial fishing economy. ALFA's members participate in halibut and sablefish longline fisheries, the crab and shrimp pot fisheries, and in all Southeast Alaska commercial salmon fisheries – seine, gillnet and troll.

The proposed action for the Twin Mountain II Timber Sale would extract 26.8 million board feet of old-growth timber from 1,655 acres from the Staney and Red Bay areas.[1] The project would impact 38 watersheds, including multiple Primary Fish Producing watersheds – areas where ADF&G has recommended managing these areas in ways that reduce risks to salmon. This project instead would worsen conditions by increasing the amount of logged watershed area and increase road impacts, affecting water yield, peak flows, sedimentation, lower water quality.

The DEIS also includes a no action alternative and a third alternative that would extract 15.5 million board feet of timber. ALFA supports the no-action alternative and requests that you cease planning on this project. If you proceed with further analysis, as explained below, the discussion of impacts to fish in the DEIS fell well short of NEPA's requirement to take a "hard look" at project impacts.

The DEIS failed to consider climate change and cumulative impacts to fish

The DEIS barely mentions climate impacts on fish at all, except for a brief acknowledgment that climate models developed over a decade ago suggest warmer, wetter conditions in the future, with possible changes in stream flow patterns. The lack of updated climate research in the appended reference list was shocking, with just a few generalized documents that date back to

[1] U.S. Forest Service. 2026. Twin Mountain II Timber Sale Draft Environmental Impact Statement. Alaska Region, Tongass National Forest. R10-MB-872a. April 2026 (hereinafter DEIS).

2016 or even earlier. As a result, the discussion of impacts to salmon (and other forest resources) was inadequate.

Southeast Alaska's climate has become warmer, wetter and wilder since 2016

Each of the past ten years ranks individually as one of the ten warmest years on record since 1850, globally.[2] The last three years were the three warmest. 2024 holds the record, and exceeded the 20th century average temperature of 57°F by 2.3 °F.[3] 2025 was the third warmest.[4] Alaska overall has warmed twice as fast as the rest of United States, and has increasing numbers of record-high temperature days.[5] For the first time ever, in 2019 the state's average annual temperate exceeded freezing.[6] Rising temperature is but one climate change impact. Others include: changes in sea level; melting of glaciers; higher air, ocean and freshwater temperatures; changing amounts and seasonal patterns of precipitation; and changes in the abundance and distributions of plants and animals. Coastal ecosystems are particularly vulnerable to these climate change impacts.[7]

In the 20th century up until the late 1970s, Alaska's temperatures varied year-to-year without any particular trend, and then they began to climb.[8] The greatest increases in average annual temperature, of up to 6°F, occurred in northern and arctic portions of Alaska.[9] Southeast Alaska, too, has warmed notably over the past 50 years, by over 2° F in southern portions of the region such as Prince of Wales Island.[10] Southeast Alaska's average annual precipitation has also increased since the 1970s, by between 5 and 15 percent depending location.[11]

These changes are intensifying – six of Alaska's ten warmest years on record have occurred since 2010.12 The 2019 Alaska heat wave was globally significant, and it set record high temperatures in Southeast Alaska in both the spring and summer.13 Temperatures during the

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[2] NOAA National Centers for Environmental Information. 2026. Global Climate Report for Annual 2025. https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202513

[3] *Id.;* World Meteorological Organization. 2025. State of the Global Climate 2024. Geneva: World Meteorological Organization. WMO-No. 1368. ISBN 978-92-63-11368-5, . https://wmo.int/sites/default/files/2025-03/WMO-1368-2024_en.pdf.; NOAA National Centers for Environmental Information. 2026.

[4] *Id.;* Ripple, W.J., Wolf, C., Mann, M.E., Rockström, J., Gregg, J.W., Xu, C., Wunderling, N., Perkins-Kirkpatrick, S.E., Schaeffer, R., Broadgate, W.J. and Newsome, T.M., 2025. The 2025 state of the climate report: a planet on the brink.

[5] Markon, C., Gray, S., Berman, M., Eerkes-Medrano, L., Hennessy, T., Huntington, H., Littell, J., McCammon, M., Thoman, R. &. Trainor, S. 2018: Alaska. In: Impacts, risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., Avery, C.W., Easterling, D.R., Kunkel, K.E., Lewis, K.L.M, Maycock, T.K. & Stewart, B.C. (eds.)]. U.S. Global Change Research Program, Washington DC, USA, pp. 1185-1241.

[6] Lader, R., Bidlack, A., Walsh, J.E., Bhatt, U.S. & Bieniek, P.A. 2020. Dynamical downscaling for southeast Alaska: Historical climate and future projections. *Journal of Applied Meteorology and Climatology*, *59*(10), pp.1607-1623.

[7] Wyllie de Echeverria, V.R. & Thornton, T.F. 2019. Using traditional ecological knowledge to understand and adapt to climate and biodiversity change on the Pacific coast of North America. *Ambio*, *48*(12), pp.1447-1469.

[8] Thoman, R. & H.R. McFarland, eds. 2024. Alaska's Changing Environment 2.0 (2024). Alaska Center for Climate Assessment and Policy, International Arctic Research Center, University of Alaska Fairbanks. uaf.iarc.org/communicating-change.

[9] *Id.*

[10] *Id.*

[11] Hoell, A., Thoman, R., McFarland, H.R. & Parker, B. 2022. Southeast Alaska drought [report]. International Arctic Research Center, University of Alaska, Fairbanks, Fairbanks, AK. *Available at*: https://uaf-iarc.org/wp-content/uploads/2022/02/Southeast-Alaska-drought-FUTURE.pdf

[12] Thoman, R. & H.R. McFarland, eds. 2024.

[13] Available at: https://www.climate.gov/news-features/event-tracker/high-temperatures-smash-all-time-records-alaska-early-july-2019; Viechnicki, J. 2019. "High temperature record set in Southeast Alaska." *KFSK*, March 21, 2019;

2020s have been above average to well above average in most seasons, although the region experienced cooler than normal temperatures during most of 2025.[14] Alaska climate researchers project that by 2050, Southeast Alaska will become as much as 6° F warmer.[15] This rapid warming risks extreme ecological disruptions over the next several decades.[16]

Extreme weather events: drought and atmospheric rivers

Extreme weather events are the most immediate climate threats to Southeast Alaska communities and resources.[17] Climate change will increase the frequency and intensity of extreme weather such as record heat and longer dry periods, heavy precipitation events, marine heat waves and other anomalous weather conditions.[18] Atmospheric rivers (massive streams of water vapor in the lower atmosphere that can be 300 miles wide and hundreds of miles long) transport sub-tropical moisture from the Pacific Ocean to Southeast Alaska and are a primary cause of extreme precipitation events, and an increasing concern.[19] They trigger floods, landslides, and avalanches that threaten lives and livelihoods in Southeast Alaska.[20] Alaska's extreme weather events are increasingly more frequent and intense.[21] Since 2020 the State of Alaska has declared over 30 weather or climate related disasters – twice as many as occurred during the like period 2014-2019.[22] Nine of them occurred in Southeast Alaska between 2020 and 2024.[23]

The region is already one of the wettest areas in North America and is becoming even wetter.[24] Projected changes in precipitation patterns will occur irregularly rather than uniformly.[25] For the most part, increases will occur as fall and winter precipitation events that are

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Alaska Center for Climate Assessment & Policy. 2019. May-Oct. Alaska Climate Dispatch. Alaska Center for Climate Assessment & Policy. 2019. Nov. 2019-Apr. 2020. Alaska Climate Dispatch.

[14] Thoman, R. 2023. October 2023 Alaska Region Climate Outlook/Briefing. ACCAP/UAF, Oct. 20, 2023; Thoman, R. 2024. Alaska climate outlook briefing July 2024; Thoman, R. 2024. Alaska climate outlook briefing October 2024; Thoman, R. 2025. Alaska climate outlook briefing October 2025; Thoman, R. 2025. Alaska climate outlook briefing July 2025; Thoman, R. 2026. Alaska climate outlook briefing January 2026.

[15] Thoman, R. & H.R. McFarland, eds. 2024

[16] Law, B. E., Berner, L. T., Wolf, C., Ripple, W. J., Trammell, E. J. & Birdsey, R. A. 2023. Southern Alaska's forest landscape integrity, habitat, and carbon are critical for meeting climate and conservation goals. *AGU Advances*, 4, e2023AV000965.

[17] Thoman, R., Lader, R. & Littell, J. 2021. Are we living in the future? The climate extremes of recent and future Southeast Alaska droughts and floods. Alaska Center Climate Assessment and Policy, Powerpoint, Arctic Research Consortium of the United States, January 26, 2021.

[18] Markon, C.S. et al. 2018; Lader, R., Bhatt,, U.S., Walsh, J.E. & Bieniek, P.A. 2022. Projections of Hydroclimatic Extremes in Southeast Alaska under the RCP8.5 Scenario. Earth Interactions, 26(1), pp.180–194.

[19] Sharma, A.R. & Déry, S.J. 2020. Contribution of atmospheric rivers to annual, seasonal, and extreme precipitation across British Columbia and southeastern Alaska. *Journal of Geophysical Research: Atmospheres*, *125*(9), p.e2019JD031823; Ralph, F.M. & Dettinger, M.D. 2011. Storms, Floods, and the Science of Atmospheric Rivers. *Eos*, *9(32)*, pp.256-266.

[20] Nash, D., Rutz, J. J., & Jacobs, A. 2024. Atmospheric rivers in Southeast Alaska: Meteorological conditions associated with extreme precipitation. *Journal of Geophysical Research: Atmospheres*, *129*, e2023JD039294. https://doi.org/10.1029/ 2023JD039294

[21] Thoman, R. & H.R. McFarland, eds. 2024.

[22] *Id.*

[23] *Id.*

[24] Hoell, A. et al. 2022.

[25] Lader, R. et al. 2022.

more intense than in present experience.[26] Intermixed longer and more frequent dry periods should be expected (particularly during summers) as well as more short-term droughts (known as "flash droughts") during warm summers that may coincide with high temperatures.[27]

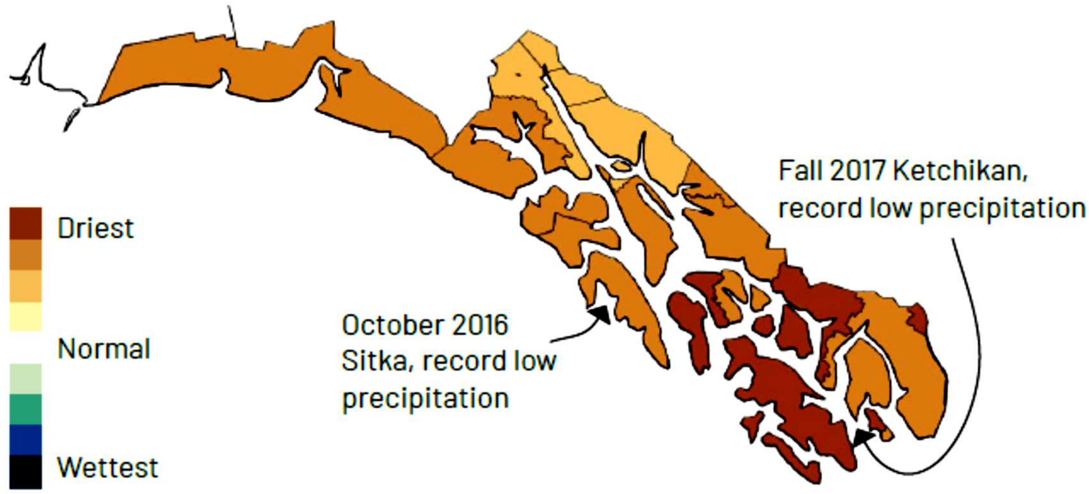

FIGURE 1: DROUGHT IN SOUTHEAST ALASKA BETWEEN 2016 AND 2019. GRAPHIC CREDIT: HOELL, A. ET AL. 2022. SOUTHEAST ALASKA DROUGHT [REPORT]. INTERNATIONAL ARCTIC RESEARCH CENTER, UNIVERSITY OF ALASKA FAIRBANKS.

Southeast Alaska had its most impactful extended drought *ever* from October 2016 to September 2019, including record-high temperatures and record-low rainfall.[28] Severe to extreme drought conditions developed on Prince of Wales Island.[29] The drought reached its extreme during the hot summer of 2019. [30] That year was the first "extreme drought" of record, and the full 2016-2019 drought was the most severe of record.[31] Record-low streamflow and high stream temperatures impacted salmon migrations.[32] Climate change scenarios make it likely that periods of summer drought will recur.[33] Warmer summers, by elevating evaporation, can worsen both drought severity and frequency.[34]

Conditions shifted dramatically between the summer of 2019 (when the drought ended) and the exceptionally wet period that began in the autumn of 2020, when most of the region's precipitation was two or three times normal.[35] Since then seasonal precipitation has generally been above average and at times record-setting, foreshadowing future climate trends.[36] During

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[26] *Id*.
[27] *Id*.
[28] Hoell, A. et al. 2022.
[29] *Id.*
[30] *Id.*
[31] Lader, R. 2024. Extreme Precipitation in Southeast Alaska: Visualizing Climate Modeling with a Storymap (Part 1). February 27, 2024.
[32] Hoell, A. et al. 2022.
[33] *Id.*
[34] *Id* Hoell, A. et al. 2022..; Lader, R. et al. 2022.
[35] Lader, R. et al. 2022.Darrow, M.M., Nelson, V.A., Grilliot, M., Wartman, J., Jacobs, A., Baichtal, J.F. & Buxton, C. 2022. Geomorphology and initiation mechanisms of the 2020 Haines, Alaska landslide. *Landslides*, *19*(9), pp.2177-2188.
[36] Darrell, J. 2024. "What 2023 Ketchikan weather could mean for the future, according to Alaska climate specialist." *KRBD*, January 5, 2024. Available at: https://www.krbd.org/2024/01/05/2023-was-sixth-wettest-year-in-ketchikan-alaska-climate-specialist-predicts-more-of-the-same/; Thoman, R. 2024. Alaska climate outlook briefing July 2024.

fall, atmospheric rivers contribute most of the regional precipitation, and nearly all of that comes in exceptionally heavy downpours.[37] Extreme atmospheric rivers carry larger amounts of water vapor.[38] Peak precipitation rates can range between four and seven inches in a day.[39] Landslides occur regularly in Southeast Alaska because of the region's steep topography and periodic heavy rains.[40] Because the frequency and intensity of atmospheric rivers and heavy rain events are increasing, landslides are becoming more common and dramatic.[41] Climate models project more and intenser atmospheric rivers in future falls and winters in Southeast Alaska.[42]

Warmer winters — and both snow droughts and snow deluges

Temperatures are rising more in winter than any other season, in Alaska.[43] Southeast Alaska's past winter temperatures averaged near or just below freezing.[44] The region's projected temperature increase for future winters may be the largest of any region in North America.[45] Some climate models project 30 to 40 more days per year without freezing temperatures here, for the 2031 to 2060 period.[46]

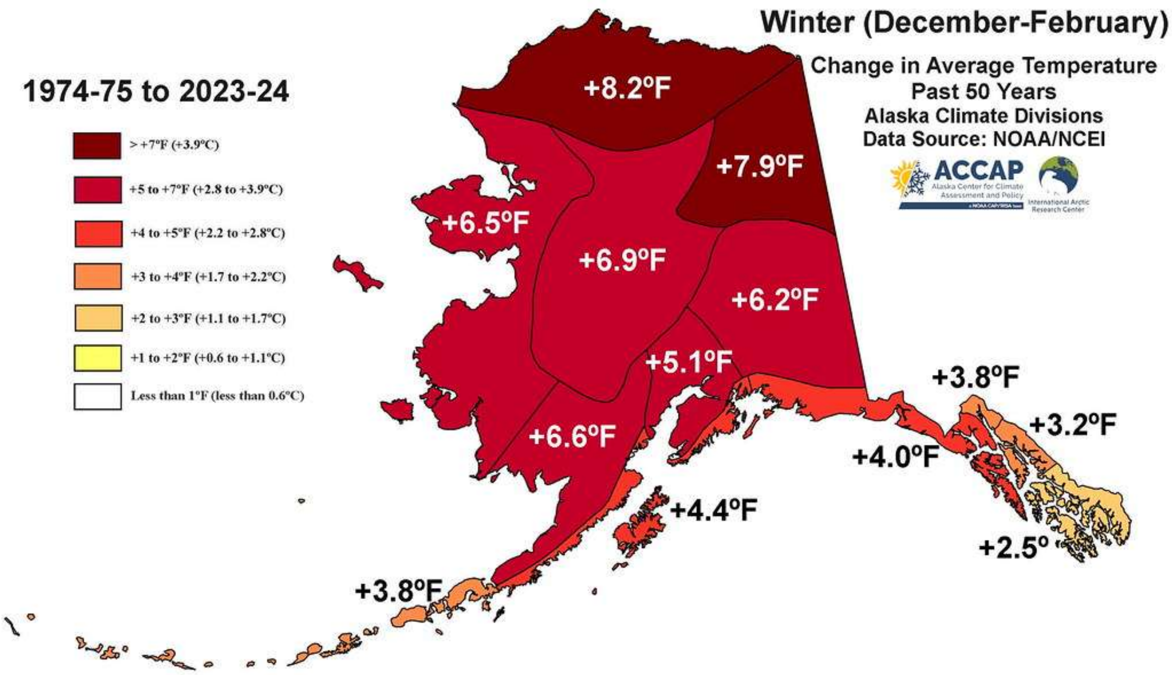

FIGURE 2: ALASKA CENTER FOR CLIMATE ASSESSMENT & POLICY, UNIVERSITY OF ALASKA FAIRBANKS, FUNDED BY THE NOAA CLIMATE PROGRAM OFFICE.

Warmer winters will strongly affect the amount of snowfall and accumulation of

[37] Sharma, A.R. & Déry, S.J., 2020.
[38] Nash, D., A. Jacobs & J. Rutz. 2024a. Powerpoint: Differentiating between impactful and non-impactful atmospheric river events in Southeast Alaska. Virtual Alaska Weather Symposia, August 1, 2024.
[39] Nash, D., Rutz, J. J., & Jacobs, A. 2024.
[40] *Id.*; Thoman, R. & H.R. McFarland, eds. 2024; Nash, D., Rutz, J. J., & Jacobs, A. 2024.
[41] Nash, D., Rutz, J. J., & Jacobs, A. 2024; Sobie, S.R. 2020. Future changes in precipitation caused landslide frequency in British Columbia. *Climatic Change*, *162*(2), pp.465-484.
[42] Sharma, A.R. & Déry, S.J. 2020.
[43] Walsh, J.E., Bienek, P.A., Brettschneider, B., Euskirchen, E.S., Lader, R. & Thoman, R.L. 2017. The exceptionally warm winter of 2015/16 in Alaska. *Journal of Climate, 30*(6), pp.2069-2088.
[44] Lader, R. et al. 2022.
[45] Shanley, C.S. & Albert, D.M. 2014. Climate change sensitivity index for Pacific salmon habitat in Southeast Alaska. *PloS ONE*, *9*(8), p.e104799.
[46] Lader, R. et al. 2020.

snowpack.[47] The snowpack has typically built throughout the winter, melting later in the year.[48] Climate warming is set to decrease the proportion of precipitation falling as snow, perhaps by as much as 25 percent over the next 30 to 40 years. [49] Lower and middle elevations will suffer high loss.[50] Only the highest elevations are likely to retain historical snowpack levels.[51]
Climate scientists characterize these deficits as "snow droughts."[52] As shown below, Southeast Alaska has had recent snow droughts. The winter of 2023/2024 started off with above average temperatures in December and remained warm through March 2024. It was abnormally dry, with very little snow.[53] The same pattern recurred during the following winter, with drier-than-normal conditions accompanied by above average temperatures.[54] As a result, the snowpack was very small south of Juneau.[55]

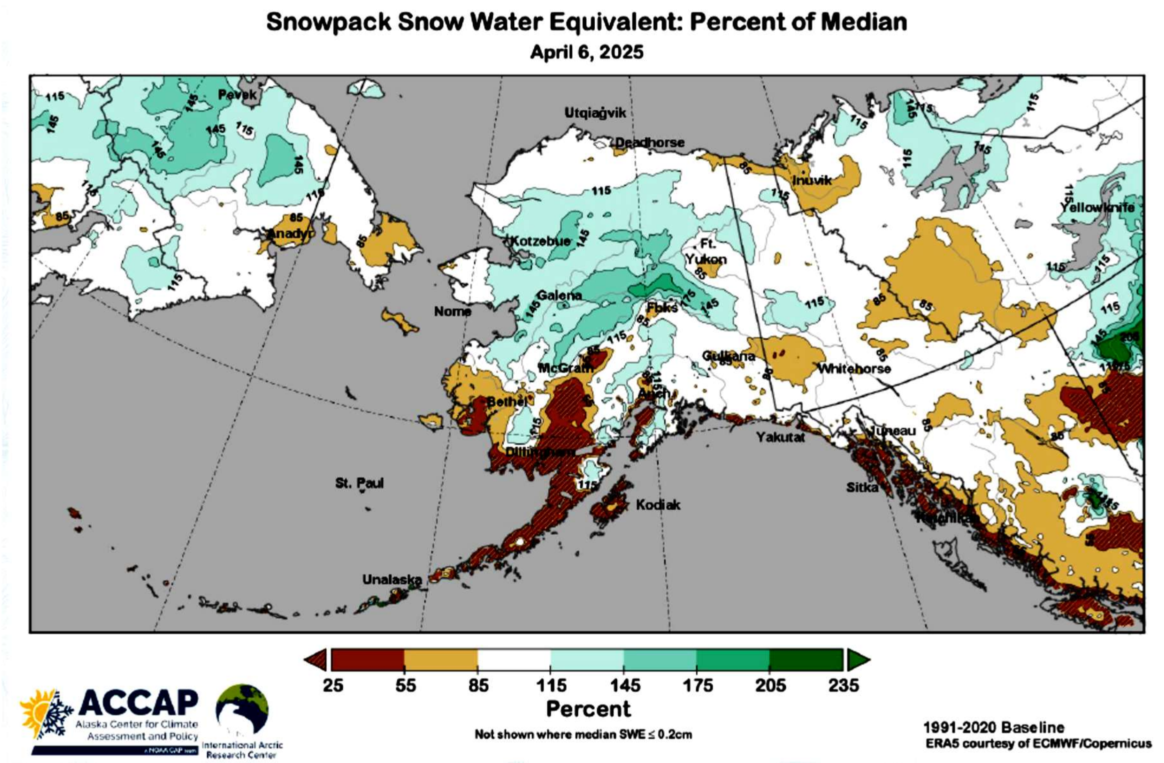

FIGURE 3: THOMAN, R. 2025. ALASKA CLIMATE OUTLOOK BRIEFING APRIL 2025. APRIL 19, 2025

[47] Littell, J.S., Reynolds, J.H., Bartz, K.K., McAfee, S.A., & Hayward, G. 2020. So goes the snow: Alaska snowpack changes in a warming climate. *Alaska Park Science*, 19(1), pp.62-75.
[48] *Id.*
[49] *Id.*; Lader, R. et a. al. 2022.
[50] Lader, R. et al. 2020; Littell, J.S. et al. 2020.
[51] Lader, R. et al. 2022.
[52] Littell, J.S. et al. 2020.
[53] Thoman, R. 2024. Alaska climate outlook briefing January 2024; Alaska climate outlook briefing April 2024. April 19, 2024.
[54] Thoman, R. 2025. Alaska climate outlook briefing April 2025. April 19, 2025.
[55] Thoman, R. 2025. February 2025 Alaska Climate Summary. Arctic and Alaska Climate Newsletter. March 3, 2025; Snowpack Update: February 2025. Arctic and Alaska Climate Newsletter. February 24, 2025; January 2025 Arctic and Alaska Climate Review. Arctic and Alaska Climate Newsletter. February 8, 2025; Alaska climate outlook briefing April 2025. April 19, 2025.

Warmer winter temperatures will shorten Alaska's snow season by roughly one month, due largely to a halving of the historical autumn snowfall and an earlier onset of season-end melting.[56] The snow season is already shorter than it was several decades ago.[57] Across most of Alaska, autumn snowfall is decreasing and it is raining instead.[58] The greater shift is occurring in the spring, with land becoming snow free earlier.[59] Climatologists call this melt the "spring snow-off." [60] The snow-off date varies from year to year, but one of the areas with the biggest change is in southern Southeast Alaska, where since 2019 the snow-off has begun nearly a week earlier.[61] Although snow seasons are now shorter in duration, with fewer snowfall events that, generally, are small to moderate, many areas may still store significant snowpacks as snow deluges happen more often.[62] Snow deluges occur when cooler conditions on land combine with an incoming atmospheric rivers to cause extreme snowfall.[63] In most of Alaska mid-winter snowfall is increasing.[64] As a coastal area, Southeast Alaska is susceptible to snow deluges because it is near the ocean, where today's warmer ocean temperatures evaporate more moisture than before.[65] Over the next few decades, snow deluges may become one of the more impactful and costly consequences of climate change.[66] The scale of future deluges in our high-latitude communities should be expected to exceed the largest snowfalls of the past.[67] Other hazards include rapid melts and increased mortality risks for some wildlife species.[68]

Salmon in double jeopardy: marine and freshwater environments

The warming and more volatile climate reviewed in the preceding discussion will change the environment in many ways that are harmful for salmon.[69] Alaska salmon benefit from largely intact freshwater ecosystems and habitat and population diversity that enable resiliency to natural and anthropogenic stressors.[70] However, climate change is accelerating habitat change more rapidly than any change they have adapted to in the past.[71] The recurring marine heatwaves

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[56] Lader, R. et al. 2020; Lader, R. et a. al. 2022.
[57] Thoman, R. & H.R. McFarland, eds. 2024.
[58] *Id.*
[59] *Id.*
[60] *Id.*
[61] *Id.*
[62] Walsh, J.E., Ballinger, T.J., Euskirchen, E.S., Hanna, E., Mård, J., Overland, J.E., Tangen, H. and Vihma, T., 2020. Extreme weather and climate events in northern areas: A review. *Earth-Science Reviews*, *209*, p.103324; Quante, L., Willner, S.N., Middelanis, R. and Levermann, A., 2021. Regions of intensification of extreme snowfall under future warming. *Scientific Reports*, *11*(1), p.16621
[63] Guan, N. P. Molotch, D. E. Waliser, E. J. Fetzer, P. J. Neiman. 2010. Extreme snowfall events linked to atmospheric rivers and surface air temperature via satellite measurements. *Geophys. Res. Lett.* 37, L20401.
[64] Thoman, R. & H.R. McFarland, eds. 2024.
[65] *Id.*; Lute, A.C., Abatzoglou, J.T. and Hegewisch, K.C., 2015. Projected changes in snowfall extremes and interannual variability of snowfall in the western United States. *Water Resources Research*, *51*(2), pp.960-972.
[66] Quante, L. et al. 2021.
[67] *Id.*
[68] *Id.*
[69] Lader, R. et al. 2022.
[70] Littell, J.S. et al. 2020.
[71] *Id*.

during the 2010s, for example, created unfavorable ocean conditions that contributed to the low abundance and poor marine survival of all salmon species in the Gulf of Alaska.[72]

Salmon use a combination of freshwater, estuarine and marine habitats at different stages of their life cycle, exposing them to multiple climate-change threats.[73] Increased air temperatures and lower contributions of cooler water from glacial melt and snowmelt will make watersheds warmer over time.[74] Water temperature is a major driver of salmon system productivity, influencing spawn timing, incubation, growth, distribution and abundance.[75] Each salmon stock is adapted to local conditions in a watershed, including temperature and stream flow patterns.[76]

Other climate change stressors include smaller snowpacks, altered spring run-off timing, lower summer stream flows accompanied by periods of drought, higher winter stream flows, and warmer ocean temperatures.[77] These conditions, even if short in duration, can impact multiple life stages, increasing mortality for adults and eggs and lowering survival rates for rearing juveniles.[78] The balance between snow and rain has already shifted, with snow comprising a smaller proportion of total precipation, creating warmer and lower spring and summer stream flows.[79] Projections for more fall and winter rainfall may trigger more major flood events.[80]

Scientists studying regional streams and other Alaska watersheds are identifying characteristics that may help predict stream susceptibility.[81] The magnitude of impacts will vary by location because of differences in elevation, terrain, lake coverage and the proportion of stream-flow-derived rainfall run-off or snowmelt.[82] Rain-fed, low elevation streams, for example, are most vulnerable to both summer warming and exacerbated winter flooding during projected wetter winters.[83] Roughly one-third of regional watersheds rely on rain and already have higher

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[72] *Available at:* https://www.fisheries.noaa.gov/national/funding-and-financial-services/fishery-disaster-determinations; State of Alaska. 2021. Letter re: State of Alaska Federal Fishery Disaster Requests.

[73] Cline, T.J., Ohlberger, J. & Schindler, D.E. 2019. Effects of warming climate and competition in the ocean for life-histories of Pacific salmon. *Nature Ecology & Evolution*, *3*(6), pp.935-942.

[74] Bellmore, J.R. et al. 2022b.

[75] Winfree, M.M, Hood, E., Stuefer, S.I., Schindler, D.E., Cline, T.J., Arp, C.D. & Pyare, S. 2018. Landcover and geomorphology influence streamwater temperature sensitivity in salmon bearing watersheds in Southeast Alaska. *Environ. Res. Lett.* 13 (2018).

[76] Crozier, L.G., McClure, M.M., Beechie, T., Bograd, S.J., Boughton, D.A., Carr, M., Cooney, T.D., Dunham, J.B., Greene, C.M., Haltuch, M.A. & Hazen, E.L., 2019. Climate vulnerability assessment for Pacific salmon and steelhead in the California Current Large Marine Ecosystem. *PloS ONE*, *14*(7), p.e0217711.

[77] Leppi, J.C., D.J. Rinella, R.R. Wilson & W.M. Loya. 2014. Linking climate change projections for an Alaskan watershed to future coho salmon production. Global Change Biology. 2014 Jun; 20(6):1808–1820. https://doi.org/10.1111/gcb.12492 PMID: 24323577; Bellmore, J.R., Sergeant, C.J., Bellmore, R.A., Falke, J.A. & Fellman, J.B. 2022b. Modeling coho salmon (Oncorhynchus kisutch) population response to streamflow and water temperature extremes. *Canadian Journal of Fisheries and Aquatic Sciences*, *80*(2), pp.243-260.

[78] *Id.*; Bellmore, J.R., et al. 2022b; Jones, L.A., Schoen, E.R., Shaftel, R., Cunningham, C.J., Mauger, S., Rinella, D.J. & St. Saviour, A. 2020. Watershed-scale climate influences productivity of Chinook salmon populations across southcentral Alaska. *Global change biology*, *26*(9), pp.4919-4936.

[79] Flitcroft, R. J. Munyon,S. Claeson, A. Johnson; M. Moore, E. Tucker, K. Prussian, S. Jacobson & H. Lombard. 2022. Forest legacies and climate realities: spatial and temporal variation in fish populations and habitat characteristics on the Tongass National Forest, Alaska. Gen. Tech. Rep. PNW-GTR-1009. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 77 p. https://doi.org/10.2737/PNW-GTR-1009; Chesnut, T. & E. Tucker. Aquatics Resource Assessment. Tongass National Forest Plan Revision. June 2025.

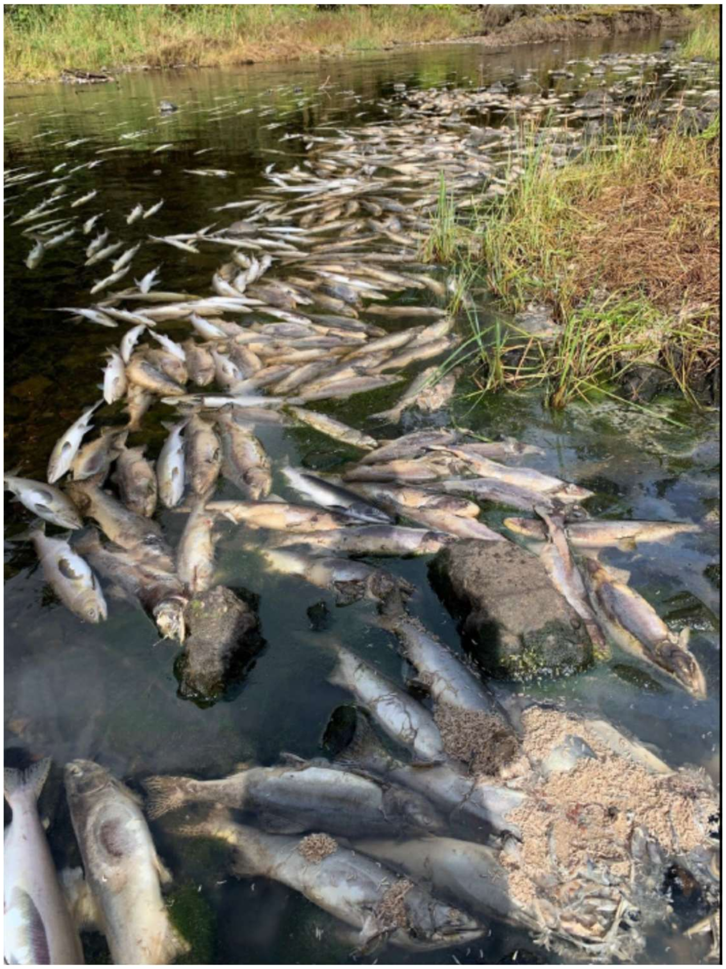
[80] Chesnut, T. & E. Tucker. 2025.

[81] *Id.*; Sergeant, C.J. et al. 2017. Winfree, M.M. et al. 2018,.

[82] Winfree, M.M. et al. 2018,.

[83] Leppi, J.C. et al. 2014. Winfree, M.M. et al. 2018; Bellmore, J.R. et al. 2022b.

water temperatures, making them more prone to drought than snow- and glacier-fed systems.[84] When these streams occur in watersheds with high proportions of lake coverage, downstream water temperatures will be even higher because of lakes have higher exposure to solar radiation and summer air temperatures.[85]



Stream warming, summer droughts and changes in summer stream flow can reduce habitat suitability for spawning and survival.[86] Warmer summertime waters are a significant stressor for salmon migrating upstream to spawn.[87] In many cases higher stream temperatures – or worse, streambed drying – can block migratory corridors and access to spawning habitat.[88] Southeast Alaska has a history of pre-spawning mortality events in smaller watersheds, usually caused by a combination of low flows, warm temperatures and a high density of pink or chum salmon returning in the summer.[89] Often these events correlated with historical periods of drought.[90] Smaller watersheds and small streams utilized by salmon are prevalent in the region and are most vulnerable to pre-spawning die-offs.[91] These events may become more frequent and widespread as the climate continues to warm.[92] Many watersheds in Alaska are remote, and in most cases die-offs are undetected.[93]

FIGURE 4: 2023 FISH KILL AT 108 CREEK, PRINCE OF WALES ISLAND. PISTON, A. W., AND T. M. FISH. 2024. PINK SALMON STOCK STATUS AND ESCAPEMENT GOALS IN SOUTHEAST ALASKA THROUGH 2023. ALASKA DEPARTMENT OF FISH AND GAME, SPECIAL PUBLICATION NO. 24-16, ANCHORAGE.

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[84] Bellmore, J.R. et al. 2022.
[85] Winfree, M.M. et al. 2018; Bellmore, J.R. et al. 2022b.
[86] Jones, L.A. et al. 2020; Sergeant, C.J., Bellmore, J.R., McConnell, C. & Moore, J.W. 2017. High salmon density and low discharge create periodic hypoxia in coastal rivers. *Ecosphere*, *8*(6), p.e01846.
[87] Littell, J.S. et al. 2020
[88] *Id.*; Jones, L.A. et al. 2020; Bellmore, J.R et al. 2022b.
[89] Halupka, K.C. 2000. Biological characteristics and population status of anadromous salmon in southeast Alaska (Vol. 468). US Department of Agriculture, Forest Service, Pacific Northwest Research Station.
[90] Bellmore, J.R. et al. 2022b.
[91] Halupka, K.C. 2000.
[92] Bryant, M.D. 2009. Global climate change and potential effects on Pacific salmonids in freshwater ecosystems of Alaska. *Climate Change,* 95, pp.169-193.
[93] Leppi, J.C. et al. 2014; Piston, A. W., and T. M. Fish. 2024. Pink salmon stock status and escapement goals in Southeast Alaska through 2023. Alaska Department of Fish and Game, Special Publication No. 24-16, Anchorage.

During the hot summer of 2019, warm water and low stream flows caused salmon to stay in deeper, cooler offshore waters and spawn later than usual.[94] There was at least one significant mortality event that occurred when salmon moved into a slough that later dried up.[95] In project area watershed Staney Creek summer stream temperatures exceeded lethal levels for three consecutive years from 2017 and 2019.[96] In 2023, large pink salmon runs entered streams during a late summer drought.[97] Streams were warm and dry, resulting in numerous small and several large prespawning mortality events.[98] One of the larger events occurred in project area watershed 108 Creek near Whale Pass which received just 0.15 inches of rain between August 19 and September 3 while large numbers of fish occupied nearby 108 Creek.[99] The event killed numerous pink salmon, as well as coho and Dolly Varden.[100]

Some scientists suspect that the increasing frequency of extreme precipitation or flooding events in fall and winter may be more impactful than rising summer stream temperatures.[101] Salmon may at times adapt to summer conditions by delaying migrations or seeking refugia, but it is much harder for them find refuge from floods.[102] Increased precipitation, and more precipitation falling as rain instead of snow is, by 2050, likely to cause a 17 percent increase in fall and winter flooding.[103] These events will occur when salmon eggs are incubating.[104] Stream bed scouring by floods destroys eggs and heightens fine sediment levels.[105] Flood intensity can be even higher when heavy rains fall on top of existing snowpack.[106] Landslides triggered by these storms also scour streams, causing additional salmon egg mortality.[107]

Coho are most vulnerable to changing aquatic conditions, particularly fall and winter flooding, because they rear for up to 2 years in the freshwater environment.[108] For them, freshwater conditions are equally as important to survival as the marine environment.[109] Scientists project significant coho spawning habitat loss, expecially in higher elevation streams which are most susceptible to streambed scour during high intensity precipitation events.[110] Flooding may reduce Southeast Alaska's coho spawning habitat by as much as ten percent over the next two decades.[111] Research modelling impacts to coho in southcentral Alaska generated similar

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94 Hoell, A. et al. 2022.
95 *Id.*; Bellmore, J.R. et al. 2022b.
96 Alaska Coastal Rainforest Center. *Available at:* https://acrc.alaska.edu/projects/stream-dynamics/stream-temp-network.html.
97 Piston, A. W., and T. M. Fish. 2024. Special Publication No. 24-16.
98 *Id.*
99 *Id.*
100 *Id.*
101 *Id.* Bellmore, J.R. et al. 2022; Jones, L.A. et al. 2020.
102 Leppi, J.C. et al. 2014.
103 Bryant, M.D. 2009; Sloat, M.R., Reeves, G.H. & Christiansen, K.R. 2017.
104 Bryant, M.D. 2009; Shanley, C.S. & Albert, D. 2014; Sloat, M.R., Reeves, G.H. & Christiansen, K.R. 2017. Stream network geomorphology mediates predicted vulnerability of anadromous fish habitat to hydrologic change in southeast Alaska. *Global Change Biology*, *23*(2), pp.604-620; Bellmore, J.R. et al. 2022b.
105 *Id.;* Leppi, J.C. et al. 2014.
106 Bellmore, J.R. et al. 2022b.
107 Lader, R. et al. 2022.
108 Leppi, J.C. et al. 2014.
109 *Id.*
110 Sloat, M.R. et al. 2017; Flitcroft, R. et al. 2022; Bellmore, J.R. et al. 2022b.
111 Sloat, M.R. et al. 2017

results.[112] Although winter flooding impacts would vary considerably within a watershed, in the most vulnerable streams egg-to-fry survival would be nearly impossible.[113]

There is some evidence showing that recent winter flooding has impacted coho survival in Southeast Alaska.[114] During the 2010s, researchers identified large reductions in coho fry abundance in monitored rain-fed streams after an intense storm event that occurred in January 2015.[115] The most dramatic drop was in Staney Creek on Prince of Wales Island, where the storm caused flood or near flood conditions.[116] There were also fewer resident fish such as trout, indicating that freshwater rather than marine conditions were responsible.[117]

In some watersheds, the loss of a buffering effect of snowpack on maximum stream temperatures is altering life cycle timing.[118] When less winter precipitation falls as snow, streams are warmer at multiple life cycle stages.[119] Warmer winter stream temperatures are accelerating egg incubation rates, leading to earlier fry emergence timing.[120] Juveniles are migrating to the ocean earlier in the spring in response to lower and earlier spring stream flows, causing adults returning upstream earlier than in the past.[121] Long-term warming of low-elevation watersheds has caused both early outmigrations and earlier returns by adult spawners.[122] Some of these systems could become unsuitable habitat for pink salmon in the long-term because early returns during periods of high summer stream temperatures could result in more frequent pre-spawning mortality events.[123]

Logging by itself threatens salmon and exacerbates climate change impacts

Other anthropogenic stressors such as logging and timber road construction will intensify climate change vulnerabilities by contributing to increased stream temperature, landslide risks and high and low extremes in stream flow.[124] One of the more significant concerns will be how the Twin Mountain II sale and other industrial logging projects will worsen climate change impacts on salmon as well as freshwater resident fish such as Dolly Varden and cutthroat trout and their habitats.[125] Timber companies first targeted easily accessible, highly productive floodplain and riparian forests that overlapped with highly productive salmon habitat, particularly for coho salmon.[126] The low-elevation streams, proximity to the ocean and large pools supported large salmon populations.[127] The first round of logging reduced stream habitat complexity, increased

[112] Leppi, J.C. et al. 2014.
[113] *Id.*
[114] Flitcroft, R. et al. 2022.
[115] *Id.*
[116] *Id.*
[117] *Id.*
[118] Littell, J.S. et al. 2020.
[119] *Id*.
[120] Steel, E.A., Tillotson, A., Larsen, D.A., Fullerton, A.H., Denton, K.P. & Beckman, B.R. 2012. Beyond the mean: the role of variability in predicting ecological effects of stream temperature on salmon. *Ecosphere*, *3*(11), pp.1-11.
[121] *Id*.
[122] *Id.*
[123] *Id.*
[124] Bryant, M.D. 2009.
[125] Flitcroft, R. et al. 2022.
[126] *Id.*
[127] *Id.*

fine sediment loads, reducing winter survival rates for coho and negatively impacted other aquatic species.[128]

The DEIS omitted any meaningful discussion about how climate change and planned timber extraction will impact salmon and reduce the future resilience of aquatic ecosystems and fisheries.[129] The agency's own researchers are skeptical that past experience and outcomes will inform future conditions on the Tongass and recognize that salmon and timber extraction are "competing interests."[130] Forests provide nutrients for rearing salmon and returning salmon respond in kind, replenishing forests with large numbers of marine nutrients after spawning.[131] Forests in turn supply large wood that add habitat complexity to the stream.[132] Both the loss of larger trees that provide some relief from high temperatures and the large number of impaired stream crossings, which worsen flood conditions, are major concerns.[133]

At one time, the Pacific Northwest supported the largest salmon runs and fisheries in the world.[134] But habitat loss drove the decline of Pacific salmon populations at the southern end of their range.[135] Degradations of freshwater spawning and rearing habitat by industrial logging and timber road construction, past and present, are significant contributors to these run failures and reduced salmon abundance and diversity.[136] Habitat destruction has necessitated billions of dollars of expenditures in the Pacific Northwest on hatcheries and restoration actions to maintain salmon and salmon fisheries.[137] Intact, functioning forested ecosystems previously provided ecosystem services needed for fish, such as clean water, at no cost.

Southeast Alaska assets include one of the largest remaining productive salmon systems in the world, in large part because of natural capital that includes hundreds of pristine watersheds of all sizes within this region, the planet's largest tract of undisturbed coastal temperate rainforest.[138] The physical and biological diversities of Southeast Alaska's salmon-producing watersheds are globally unique and rely on a large number of intact watersheds with high water quality and productive capacity.[139] The Tongass National Forest is still by far the leading producer of wild salmon of any national forest.[140]

Although regional watersheds still support viable fisheries, Forest Service researchers acknowledge that the same threats responsible for reducing salmon populations in the Pacific

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128 *Id.*
129 *Id.*
130 *Id.*
131 *Id.*
132 *Id.*
133 Flitcroft, R. et al. 2022; Chesnut, T. & E. Tucker. Aquatics Resource Assessment. Tongass National Forest Plan Revision. June 2025.
134 Johnson, A.C., Bellmore, J.R., Haught, S., & Medel, R. 2019. Quantifying the monetary value of Alaskan National Forests to commercial Pacific salmon fisheries. *North American Journal of Fisheries Management, 39*(6), pp.1119-1131.
135 Everest, F. H. & Reeves, G.H. 2006. Riparian and aquatic habitats of the Pacific Northwest and southeast Alaska: ecology, management history, and potential management strategies. Gen. Tech. Rep. PNW-GTR-692. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 130 p.
136 Johnson, A.C. et al. 2019.
137 *Id.*
138 USDA Forest Service. 1995. Report to Congress Anadromous Fish Habitat Assessment. Pacific Northwest Research Station, Alaska Region. R10-MB-279; Bryant, M.D. & Everest, F.H. 1998. Management and condition of watersheds in Southeast Alaska: the persistence of anadromous salmon. *Northwest Science*, *72*(4).
139 Bryant, M.D. 2019. Comment on the Alaska Roadless Rule; Frissell, C.A. 2019. Comments on Fisheries and Water Quality Issues in the US Forest Service Draft Environmental Impact Statement for the Alaska Roadless Rule.
140 Johnson, A.C. et al. 2019.

Northwest are present in the Tongass, too.[141] During the 20th century, timber companies targeted easily accessible, low elevation flood plain forests, removing the most valuable large old-growth trees in valley bottoms.[142] Those watersheds had high productivity for salmon because of "ideal fish habitat conditions:" plenty of pools, proximity to the marine environment and ample carrying capacity for large salmon populations.[143]

The existing road network and impacts from 20th century logging continue to degrade salmon habitat.[144] The habitat loss was – and still is – significant; by the end of the 20th century, industrial-scale logging had impacted nearly one-half of the stream-miles of salmon habitat, to varying degrees.[145] It is likely that the most heavily impacted watersheds have been producing fewer salmon, but the extent of lost population productivity remains unknown.[146] Forest managers analyzed impacts at the scale of large watersheds which diluted damage to salmon habitat by lumping logged systems together with areas that had intact streams.[147] Impacts are detectable at smaller scales, and many subwatersheds are not fully functional ecosystems.[148]

Double Jeopardy: climate change and logging threats

The Forest Service's 2018 Prince of Wales Landscape Level Analysis FEIS and project record identified a number of watersheds at risk, 447 red pipes blocking 90 miles of salmon habitat, and a need for a number of watershed treatments deemed necessary to mitigate losses to salmon production. There was substantial deferred maintenance and chronic sedimentation throughout the project area and ample evidence that landscape scale modifications, such as the island's system of logging roads, impair and reduce salmon production capacity. This project would increase risks to Prince of Wales Island's salmon production capacity by building road in fish habitat accompanied by intensive logging of old growth and second growth recovering forests – and do so at a time when multiple, cumulative environmental factors have put the island's salmon production capacity at risk. That DEIS, like the Twin Mountain II DEIS, did not address environmental uncertainties or risks to island fish populations in any meaningful way. It provided a single paragraph – "Effects of Forest Management Practices on Salmonid Fish Stocks" which speculated that forest management may affect salmon abundance. It mentioned that sediment may impact habitat productivity, and notes that the project may affect salmon species which rear in freshwater for longer periods of time more than species that rear in the marine environment.

This cursory treatment of impacts in the environmental analysis that violates NEPA and NFMA in numerous ways. The DEIS is flawed because: (1) there is an unmet need to describe the updated status of southeast Alaska's salmon populations, particularly on Prince of Wales Island

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[141] Everest, F. H. & Reeves, G.H. 2006; USDA Forest Service. 1995; Johnson, A.C. et al. 2019.

[142] Prussian, K. 2025. Salmon Resource Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region; Flitcroft, R., J. Munyon, S. Claeson, A. Johnson, M. Moore, E. Tucker, K. Prussian, S. Jacobsen and H. Lombard. 2022. Forest legacies and climate realities: spatial and temporal variation in fish populations and habitat characteristics on the Tongass National Forest, Alaska. Pacific Northwest Research Station General Technical Report PNW-GTR-1009. December 2022.

[143] *Id.*

[144] Chestnut , T. & E. Tucker. 2025. Aquatic Resource Assessment. Tongass National Forest Plan Revision Forest Service, Alaska Region.

[145] Everest, F. H. & Reeves, G.H. 2006.

[146] *Id.*

[147] Bousfield, G. 2025. Watershed Condition and Water Resource Assessment Tongass National Forest Plan Revision Forest Service, Alaska Region.

[148] *Id.*

where pink salmon harvests have been anomalously low a number of times since 2016;[149] (2) the DEIS needs to provide an appropriate degree of site-specific, watershed analysis for a timber project that may have significant and foreseeable direct, indirect and cumulative impacts on populations that are declining and vulnerable because of a variety of environmental conditions; (3) the DEIS relies on unfunded, speculative mitigation measures – particularly given the culvert crisis in the project area and across the island.

The marine environment's diminishing productivity due to climate change increases the importance of maintaining and restoring high productivity of freshwater habitat.[150] A major concern is "double jeopardy" – that high levels of habitat degradation caused by logging and timber roads will coincide with periods of low marine productivity, which climate change is making more frequent and severe.[151] Although intensively-logged watersheds have some value for fish during times of high marine productivity, during times when low marine productivity and freshwater habitat degradation coincide, there may be long-term harm to salmon populations.[152]

Timber sale planners often claim that risks to salmon habitat from logging projects are minimal or negligible — those are assumptions that 21st century salmon scientists say "may not be scientifically defensible."[153] Numerous case studies have assessed harms to salmon habitat and resulting reduced salmon abundance caused by logging and timber road construction.[154] Logging is a major disturbance that produces detectable, harmful changes in stream flow and temperature at various levels of logging intensity.[155] These flow and temperature changes are comparable in magnitude to ones projected from climate change later this century.[156]

Logging increases summer stream temperatures by removing trees that provide shade.[157] In general, summer stream temperatures are 3.6° F higher in logged watersheds but there is considerable variability.[158] Studies of western Washington and British Columbia watersheds found stream temperatures 4 to 6° F warmer in logged areas.[159] Logging-induced low stream flows in summer worsen the effects of sunlight and hot air on stream temperatures.[160] Continuous exposure to thermal stress can alter the timing of salmon lifecycle events, reducing survival and potentially suppressing the population.[161]

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[149] The DEIS creates the false impression that pink salmon runs are healthy, and, bizarrely, references productivy in Redoubt Bay near Sitka as a proxy for the health of sockeye populations. Sockeye populations in northern Southeast Alaska such as the Redoubt Lake stock are doing well and fishery performance data indicates that Prince of Wales and other southern Southeast Alaska are experiencing sustained seasons of lower productivity.

[150] USDA Forest Service. 1995.

[151] *Id.*

[152] Bryant, M.D. & Everest, F.H. 1998.

[153] Naman, S.M., Pitman, K.J., Cunningham, D.S., Potapova, A., Chartrand, S.M., Sloat, M.R., and Moore, J.W.. 2024. Forestry impacts on stream flows and temperatures: A quantitative synthesis of paired catchment studies across the Pacific salmon range. Ecological Solutions and Evidence, 5, e12328. https://doi.org/10.1002/2688-8319.12328.

[154] *Id.*

[155] *Id.*

[156] *Id.*

[157] Everest, F. H. & Reeves, G.H. 2006.

[158] Naman, S.M. et al. 2024.

[159] Pollock, M.M., Beechie, T.J., Liermann, M., & Bigley, R.E. 2009. Stream temperature relationships to forest harvest in Western Washington. JAWRA *Journal of the America Water Resources Association, 45*(1), pp.141-156; Macdonald, J.S., Scrivener, J.C., Patterson, D.A., & Dixon-Warren, A. 1998. Temperatures in aquatic habitats: the impacts of forest harvesting and the biological consequences to sockeye salmon incubation habitats in the interior of B.C. Forest-Fish Conference: Land Management Practices Affecting Aquatic Ecosystems. Proceedings of the Forest-Fish Conference, 1-4 May 1996, Calgary, Alberta.

[160] Naman, S.M. et al. 2024.

[161] *Id.;* Frissell, C.A. 2019.

Logging increases the frequency and severity of landslides and floods by damaging the soil moisture regulating service otherwise present in a natural forests. This often becomes evident during severe rain and wind events.[162] Logging typically causes increased peak streamflow, which contributes to egg mortality and lower habitat quality for juvenile salmon.[163] Across a wide range of Pacific salmon anadromous systems, watershed-specific flow increases ranged widely, from 8 to 125 percent. [164] Higher latitude areas like Southeast Alaska are more likely to experience the larger peak flow increases.[165] Landslides also cause egg and embryo mortality by scouring spawning habitat and depositing sediments downstream.[166] Scouring and deposition can diminishspawning success and, for some salmon species such as coho that rear in-stream, over-winter survival as well. [167] Harm to the population is potentially long-term.[168]

Timber road construction in salmon habitat also contributes to temperature and flow changes and reduces salmon productivity in numerous ways. In general, watersheds that are roadless or have a low road density are two to three times as likely to support more abundant and diverse salmon populations than watersheds with high road densities.[169] This is because timber roads commonly increase sedimentation, degrade water quality, fragment habitat and increase high-temperature events.[170] Roads are a primary cause of accelerated, chronic sediment production that degrades salmon spawning and rearing habitat.[171] It is nearly impossible to mitigate this impact.[172] Logging roads route runoff overland and send large volumes of sediment into streams atmultiple locations within a watershed.[173]

Roads that cross or are adjacent to streams are the largest source of sedimentation on the Tongass.[174] Sedimentation is a chronic habitat condition on Alexander Archipelago islands that have a history of intensive clearcutting and high road densities.[175] Intact riparian vegetation can

[162] Bryant, M.D. 2009.
[163] Naman, S.M. et al. 2024.
[164] *Id.*
[165] Bousfield, G. 2025.
[166] Bryant, M.D. 2009.
[167] *Id.*
[168] *Id.*
[169] 2000 Roadless Area FEIS.
[170] *Id.*; DellaSala, D.A., Karr, J.R., & Olson, D.M. 2011. Roadless areas and clean water. *Journal of Soil and Water Conservation, 66*(3): 78A-84A; Trombulak, S.C. & Frissell, C.A. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. *Conservation Biology, 14*(1), pp.18-30.
[171] Jones, J.A., Swanson, F.J., Wemple, B.C., & Snyder, K.U. 2000. Effects of roads on hydrology, geomorphology, and disturbance patches in stream networks. *Conservation Biology 14*(1), 76-85; Wemple, B.C., Swanson, F.J., & Jones, J.A. 2001. Forest roads and geomorphic process interactions, Cascade Range, Oregon. Earth surface processes and landforms. *The Journal of the British Geomorphological Research Group 26*(2), pp.191-204. Everest, F.H., Swanston, D.N., Shaw, C.G., Smith, W.P., Juln, K.R., & Allen, S.D. 1997. Evaluation of the use of scientific information in developing the 1997 Forest Plan for the Tongass National Forest. Gen. Tech. Rep. PNW-GTR-415. Portland, Or: US Department of Agriculture, Forest Service, Pacific Northwest Research Station. 69 p.; Trombulak, S.C. & Frissell, C.A. 2000; Everest, F. H. & Reeves, G.H. 2006.
[172] Frissell, C.A. 2019.
[173] Everest, F. H. & Reeves, G.H. 2006; Moore, M.J., R.L. Flitcroft, E. Tucker, K.M. Prussian & S.M. Claeson. 2024. Same streams in a different forest? Investigations of forest harvest legacies and future trajectories across 30 years of stream habitat monitoring on the Tongass National Forest, Alaska. PLoS ONE 19(7): e0301723. https://doi.org/10.1371/journal.pone.0301723
[174] Prussian, K. 2025.
[175] USDA Forest Service. 2018. Prince of Wales Landscape Level Analysis; USDA Forest Service. 2019. Central Tongass Project Draft Environmental Impact Statement. R10-MB-832a. Tongass National Forest, Petersburg Ranger District and Wrangell Ranger District. July 2019.

capture and store some sediment, but once an area is disturbed by roads or logging, most of the sediment passes through to stream channels.[176] In river valleys, roads replaced riparian forests where they parallel salmon streams.[177]

Adverse impacts to salmon are likely even when measures are in place, in an attempt to mitigate habitat harms.[178] Southeast Alaska fisheries scientists have long cautioned that wider riparian no-cut buffers, and buffers for tributary and headwaters streams, are necessary to ensure quality habitat for fish.[179] Regulations in place since the 1990s for federal lands in the Pacific Northwest require 300 foot buffers for salmon streams and 150 foot streamside buffers for headwaters streams.[180] In contrast, Tongass National Forest Plan buffers are just 100 feet wide and are placed only along known salmon streams and some resident fish streams.[181] The Alaska Forest Resources and Practices Act imposes similar buffers for state lands and 66 foot buffers on privately owned forests.[182] Other buffers on both state and federal lands are discretionary.[183]

Blowdown has been and remains a chronic problem so that buffers lose their effectiveness over time.[184] Logging increases windthrow risks, particularly in areas with cleared forests outside the buffer on both sides of a stream.[185] Even where buffers remain intact, they provide little protection against landslides caused by upslope logging or against road-caused sediment delivery.[186] Because on the Tongass no buffers are required along smaller, non-anadromous headwaters streams, logging adjacent to these steep stream segments is a big source of sediment, and this degrades water quality far downstream.[187] Because of these impacts, preventing further development in salmon habitats is the most cost-effective way to improve ecosystem productivity for salmon.[188]

Barrier culverts: blocking spawning and rearing habitat and worsening climate change impacts

[176] Everest, F. H. & Reeves, G.H. 2006.
[177] *Id*.
[178] Al-Chokhachy, R., Black, T.A., Thomas, C., Luce, C.H., Rieman, B., Cissel, R., & Kershner, J.L. 2016. Linkages between unpaved roads and streambed sediment: why context matters in directing road restoration. *Restoration Ecology 24*(5): 589-598.
[179] Everest, F. H. & Reeves, G.H. 2006; USDA Forest Service. 1995.
[180] *See* Reeves, G.H., D.H. Olson, S.M. Wondzell, P.A. Bisson, S. Gordon, S.A. Miller, J.W. Long & M.J. Furness. Chapter 7: The Aquatic Conservation Strategy of the Northwest Forest Plan—A Review of the Relevant Science After 23 Years. In: Spies, T.A., Stine, P.A., Gravenmier, R.A., Long, J.W. and Matthew, J., 2018. Volume 3—Synthesis of science to inform land management within the Northwest Forest Plan area. *Gen. Tech. Rep. PNW-GTR-966. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station: 625-1020. Vol 3.*, *966*, pp.625-1020.
[181] 2016 Forest Plan Standard RIP2 II.E.
[182] AS §§ 41.17.115-118.
[183] 2016 Forest Plan Standard RIP2 II.E.
[184] *Id.*; Frissell, C.A. 2019; Prussian, K. 2025. USDA Forest Service. 1995; Chestnut , T. & E. Tucker. 2025.
[185] Prussian, K. 2025.
[186] Frissell, C.A. 2019; Frissell, C.A. 2012. Sediment concerns in headwaters streams on state and private forests in the Pacific Northwest: a brief review of directly pertinent science. Memorandum prepared for Oregon Stream Protection Coalition, Portland, OR. 10 pp.
[187] *Id*.
[188] Walsh, J.C., Connors, K., Hertz, E., Kehoe, L., Martin, T.G., Connors, B., Bradford, M.J., Freshwater, C., Frid, A., Halverson, J., & Moore, J.W. 2020. Prioritizing conservation actions for Pacific salmon in Canada. *Journal of Applied Ecology*, *57*(9), pp.1688-1699.

The Forest Service plans to build roads for Viking Lumber that will cross streams 81 times.[189] The DEIS includes a Figure 20 displaying "Red Pipes on Haul Routes" which shows an alarming number of barrier culverts in project area watersheds that understates the actual chronic fish passage blockage problems found throughout the island.[190] The DEIS states that annual maintenance and replacement of red pipes would occur according to annual forest priorities and funding, omitting critical information about the agency's failure to address this problem.

Failed ("barrier" or "red") culverts that reduce the amount of habitat available for spawning, rearing and other lifecycle needs.[191] The roughly 5,000 miles of road on the Tongass National Forest cross streams 15,000 times.[192] 3,743 of the stream crossings occur in fish habitat.[193] Nearly a third of them – 1,170 - are "red crossings" that partially or completely block fish passage.[194] Most of these are a leftover legacy from the 20th century.[195] A review of five major salmon systems surveyed in heavily-logged portions of northeast Chichagof Island during the late 1990s found some degree of blockage by 35 of 38 culverts, resulting in *a loss of over one-third* of the high- and moderate-quality upstream salmon habitat.[196] Many were obvious barriers, shown by the relative absence of fish upstream – there were seven times as many juvenile salmon downstream from the barrier culverts as there were upstream.[197]

Culverts are the most common method used by road builders to cross streams.[198] They cost less than bridges but it is difficult to maintain fish passage through them because stream and debris flows change constantly. Many culverts eventually impede fish passage or become complete barriers, by plugging up or collapsing.[199] Another way they become barriers is by creating high-velocity stream flows.[200] Floods magnify this impact.[201] Overflow across roads (over impaired culverts) also increases sedimentation and stream temperatures.[202]

Risks to salmon populations go far beyond the obvious one of degradation or loss of spawning habitat. Salmon require habitat connectivity.[203] In addition to challenges to salmon in their marine lifecycle, juvenile salmon will move within a watershed to rearing or overwintering

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[189] DEIS Table 4.
[190] The project area has 120 red crossings which block 7.8 miles of Class I and 22.8 miles of Class II streams, including two watersheds that have 12 red crossings.
[191] *Id.*; Davis, J.C. & Davis, G.A., 2011. The influence of stream-crossing structures on the distribution of rearing juvenile Pacific salmon. *Journal of the North American Benthological Society*, *30*(4), pp.1117-1128; Clark, C., Roni, P., Keeton, J., & Pess, G. 2020. Evaluation of the removal of impassable barriers on anadromous salmon and steelhead in the Columbia River Basin. *Fisheries Management and Ecology, 27*(1), pp.102-110; Price, D.M., Quinn, T., & Barnard, R.J. 2010. Fish passage effectiveness of recently constructed road crossing culverts in the Puget Sound region of Washington State. *North American Journal of Fisheries Management*, *30*(5), pp.1110-1125.
[192] Prussian, K. 2025; Bousfield, G. 2025.
[193] Prussian, K. 2025.
[194] *Id*.
[195] *Id*.
[196] Riley, C., 2003.
[197] *Id.*
[198] Clark, C. et al. 2020.
[199] *Id.*; Price, D.M. et al. 2010.
[200] Davis, J.C. & Davis, G.A. 2011; Riley, C. 2003. Fish passage at selected culverts on the Hoonah Ranger District, Tongass National Forest. Proceedings of the International Conference on Ecology and Transportation. Editors: Irwin, C.L., Garrett, P. & McDermott K.P. Center for Transportation and the Environment, North Carolina State University. Raleigh, NC.
[201] Price, D.M. et al. 2010.
[202] 2000 Roadless Rule FEIS; Clark, C. et al. 2020.
[203] Clark, C. et al. 2020.

habitat or explore other habitats in pursuit of food.[204] They also move to seek refuge from adverse environmental conditions such as floods or debris flows from landslides.[205] Coho salmon in particular use all stream tributaries in all seasons, particularly in the fall when they move upstream in large numbers from main channels and during their outmigration in the spring.[206] Barrier culverts (often throughout a watershed) block those movements, cumulatively reducing population productivity by impairing foraging opportunities, which slows growth and development, and by blocking access to refugia.[207] Red culverts reduce resiliency to floods.[208]

Barrier culverts and other stream crossings that impair fish habitat are prevalent throughout Southeast Alaska. Roughly two decades ago the Alaska Department of Fish and Game surveyed 60 percent of the Forest Service's roads to assess fish passage problems in the region.[209] Only one-third of the stream crossings provided adult and juvenile fish passage.[210] The Forest Service made a dedicated effort to address some of these problems between 1998 and 2006, fixing roughly 50 sites per year, but cancelled the program due to funding reductions.[211] Although agency personnel have identified and prioritized fixing the most serious fish passage problems, efforts to repair harms to aquatic and habitats are diminishing.[212] Since 2017, the agency has repaired an average of only 25 stream crossings per year.[213] At this rate, conditions are deteriorating, as there are seventy more red stream crossings today than there were a decade ago.[214] Funding for maintaining or decommissioning roads on the Tongass is and has been inadequate, and the Forest Service anticipates that adverse effects to fish, water quality and ecosystem functioning will continue and worsen as older roads and stream crossings deteriorate.[215]

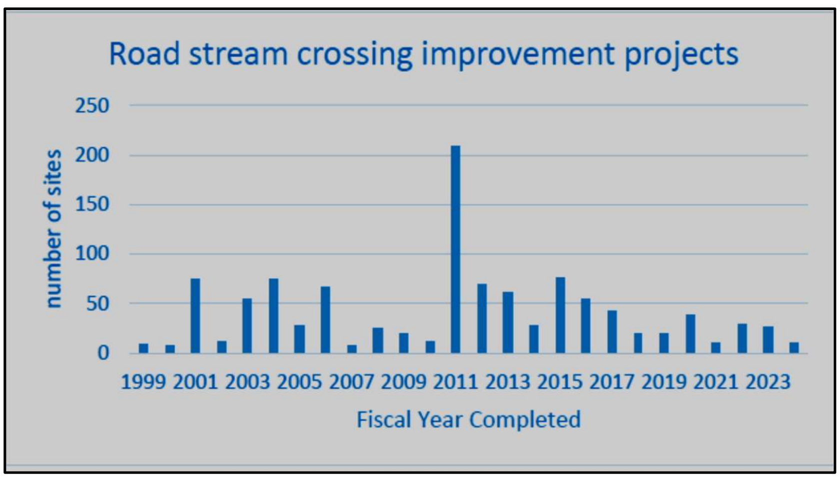

FIGURE 5: GRAPHIC CREDIT: BOUSFIELD, G. 2025. WATERSHED CONDITION AND WATER RESOURCE ASSESSMENT TONGASS NATIONAL FOREST PLAN REVISION FOREST SERVICE, ALASKA REGION.

204 Davis, J.C. & Davis, G.A. 2011.
205 *Id.;* Price, D.M. et al. 2010.
206 Riley, C. 2003.
207 *Id.;* Clark, C. et al. 2020; Price, D.M. et al. 2010.
208 Chestnut , T. & E. Tucker. 2025.
209 Flanders, L.S. & Cariello, J. 2000. Tongass Road Condition Report. ADF&G Habitat Restoration Division Tech. Rpt. No. 00-7. June 2000.
210 *Id.*
211 USDA Forest Service. 2008. Tongass Land and Resource Management Plan Final Environmental Impact Statement. Alaska Region. R10-MB-603c.
212 Bousfield, G. 2025.
213 *Id.* Bousfield, G. 2025.
214 Prussian, K. 2025; 2016 TLMP FEIS.
215 2020 Alaska Roadless Rulemaking FEIS; Prussian, K. 2025.

The problem is most significant on Prince of Wales Island, which historically has been the most important island ecosystem in Southeast Alaska for commercial fish production. That is on the basis of sockeye habitat, numbers of stream-miles for coho and pink salmon and the number of watersheds the Alaska Department of Fish and Game rates as a "Primary Salmon Producer."[216] In 2018, there were 447 red crossings on Prince of Wales Island and nearby Kosciusko, Tuxekan and Heceta Islands, and another 175 crossings with an unknown or marginal fish passage status — nearly half the total number of stream crossings in the area.[217] The agency has planned to address roughly ten of these red pipes per year since 2020, but increasing costs and lack of contractor capacity have resulted in a repair rate of roughly five per year.[218]

Removing barrier culverts is a primary means of restoring salmon populations.[219] It improves fish passage, immediately increases the amount of available habitat, increases juvenile fish abundance upstream from the barrier and has higher certainty of effectiveness than other restoration actions.[220] Scientists recommend that land managers of forested areas focus on projects like barrier culvert removals that, especially with climate change in mind, improve low-flow passage and moderate the stream temperatures.[221] A 2019 study found a tripling of coho smolt abundance shortly after culvert replacement, and that results of other stream restoration measures were comparatively modest or undetectable.[222] On Prince of Wales Island, Forest Service personnel have observed significant numbers of salmon upstream in the few areas where funding has allowed for culvert replacement.[223] The DEIS should disclose that the agency's backlog vastly exceeds repairs occurring over the past few years, and that there is no funding for future repairs because all agency resources are focused solely on producing timber sales for the agency's two large timber sale purchasers.

Conclusion

ALFA requests that you cease planning on this project. If you do proceed, the EIS requires substantial improvements with regard to impacts to salmon and other fish.

Linda Behnken
Executive Director

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[216] Flanders, L.S., Sherburne, J., Paul, T. Kirchhoff, M., Elliot, S., Brownlee, K., Schroeder, B., & Turek, M. 1998. Tongass Fish and Wildlife Resource Assessment 1998. Alaska Department of Fish and Game Technical Bulletin No. 98-4; Albert, D. & Schoen, J. 2007.
[217] USDA Forest Service. 2018. Prince of Wales Landscape Level Analysis Environmental Impact Statement.
[218] *See* Sanders, A. & D. Kuda. 2023 Red Pipe Improvements. Aquatic Organism Passage Presentation Spring 2023; Sanders, A. 2022. Red Pipe Improvements. Aquatic Organism Passage Presentation April 2022; Prince of Wales Landscape Level Analysis (POW LLA) Long-term Plan – Spring 2025. *Available at:* https://www.fs.usda.gov/r10/tongass/projects/prince-wales-landscape-level-analysis-project-pow-lla
[219] Clark, C. et al. 2020; Price, D.M. et al. 2010.
[220] Clark, C. et al. 2020.
[221] Beechie, T., Imaki, H., Greene, J., Wade, A., Wu, H., Pess, G., Roni, P., Kimball, J., Stanford, J., Kiffney, P., & Mantua, N. 2013. Restoring salmon habitat for a changing climate. *River Research and Applications*, *29*(8), pp.939-960.
[222] Anderson, J.H. et al. 2019. Coho salmon and habitat response to restoration in a small stream. *Transactions of the American Fisheries Society, 148.5* (2019), pp.1024-1038.
[223] Prince of Wales Landscape Level Analysis (POW LLA) Long-term Plan – Spring 2025.