Alaska Longline FISHERMEN'S ASSOCIATION

P.O. Box 1229
Sitka, AK 99835
Alaska Longline Fishermen's Association

Erin Mathews—Tongass Plan Revision Coordinator
Tongass National Forest Supervisor's Office
648 Mission Street, Suite 110,
Ketchikan, AK 99901-6591,
Submitted electronically at: US Forest Service NEPA Projects Home

Attn: Draft Assessment

Dear Ms. Mathews:

I submit the following scoping comments on behalf of the Alaska Longline Fishermen's Association (ALFA) regarding the Tongass National Forest Land Management Plan Revision resource assessments. ALFA represents numerous Southeast Alaska residents who participate in, or otherwise support and benefit from the commercial fishing economy.[1] Many of ALFA's members are Southeast Alaska residents who participate in regional salmon fisheries and rely on forest resources for recreation, food, health, scenery and other resource values. ALFA advocates for salmon conservation, supports science-based fisheries management and works to safeguard the health of the marine and freshwater environments that support salmon and other marine life. ALFA markets wild, sustainably caught Alaska seafood under the Alaskans Own label throughout Alaska and the U.S. to fund its Seafood Donation Program and Fishery Conservation Network. Alaskans Own is a leader in the sustainable seafood movement and has helped address food insecurity issues in Alaska and the Northwest.

Introduction

There are several assessments that discuss Southeast Alaska's salmon but no single assessment that covers the species ecology, economy, habitats and factors that limit population productivity. Given the important of this resource, ALFA submits that it would be useful to discuss salmon in one assessment. Southeast Alaska's most important economic drivers include productive commercial, sport and subsistence salmon fisheries. Salmon also feed multiple mammal and avian species and are ecosystem engineers, bringing energy and nutrients to freshwater and riparian ecosystems.[2] The large

[1] ALFA also has members throughout Alaska and the United States.

[2] Griffiths, J.R., Schindler, D.E., Armstrong, J.B., Scheurell, M.D., Whited, D.C., Clark, R.A., Hilborn, R., Hold, C.A., Lindley, S.T., Stanford, J.A. & E.C. Volk. 2014. Performance of salmon fishery portfolios across western North America. *Journal of Applied Ecology, 51*(6):1554-1563.

transboundary mainland rivers, the Alexander Archipelago Island ecosystems, and the northern outer coast from Cape Spencer to Cape Suckling are the three distinct areas that produce salmon. The range of habitats and differences in run timing normally buffers against variability in marine and freshwater conditions.[3] These comments provide additional information for inclusion in the assessment in support of future decisionmaking about the need to revise the Forest Plan.

Because salmon are so critical to Southeast Alaska communities, preserving the salmon portfolio is of utmost importance as the Forest Service moves forward with the Forest Plan revision. Section I. of this comment letter describes Southeast Alaska's salmon economy. The socio-economic assessment could more fully capture the diverse regional fisheries and how critical they are to each Southeast Alaska community. Section II. discusses the impacts of logging on salmon and emphasizes our longstanding concerns about the need for bigger buffers for riparian areas and identifies barrier culverts as one of the most significant threats to the region's salmon portfolio. Section III. discusses regional salmon productivity trends and both realized and projected climate change impacts for the region's salmon. While many runs are resilient, recent low fluctuations for several species of forest fish are a concern and heighten the need to maintain intact habitat for client resilience.

The ensuing sections respond to other resources discussed in the assessments. Section IV. explains that many Southeast Alaska fishermen are also hunters, and the assessment process would benefit from additional discussion of Sitka black-tailed deer habitat needs and population trends. Section V. shows that conserving high biodiversity forests – both abundant large old-growth trees and trees that can soon reach large diameters – for their value as carbon reservoirs is by far one of the most cost-effective options for climate mitigation in part because of the high value of intact forests for the other ecosystem services they provide - biodiversity; scenic beauty; recreation; human health; fisheries; indigenous cultural and traditional values; and enhanced resilience in a changing climate. Section VI. responds to the Designated Areas Assessment's discussion of estuaries and explains that those high value ecosystems are also carbon sinks and provide habitat features that are essential for salmon and virtually every marine fish species found in the region. The carbon storage capacity of Alaska's naturally functioning coastal forest and estuarine ecosystems is globally significant because of their capacity to offset anthropogenic greenhouse gas emissions.[4] Concluding sections discuss the cumulative impacts of industrial logging and the need for intact forests to provide for climate resilience.

Most of the information provided herein is also available in the Alaska Sustainable Fisheries Trust's annual SeaBank reports, which are available here: About SeaBank — Alaska Sustainable Fisheries Trust. We also are attaching our Petition for a Salmon Conservation Rulemaking that we submitted to the U.S. Secretary of Agriculture in 2020 which requested significant Forest Plan changes related to management of Tongass salmon habitat. That document has additional discussion and reference materials relevant to the assessment process.

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[3] Bryant, M.D. 2009. Global climate change and potential effects on Pacific salmonids in freshwater ecosystems of Alaska. *Climate Change,* 95, p.169-193.

[4] Vynne, C., Dovichin, E., Fresco, N., Dawson, N., Joshi, A., Law, B.E., Lertzman, K., Rupp, S., Schmiegelow, F. & Trammell, E.J. 2021. The importance of Alaska for climate stabilization, resilience, and biodiversity conservation. *Frontiers in Forests and Global Change*, *4*, p.121; DellaSala, D.A., Gorelik, S.R. & Walker, W.S. 2022. The Tongass National Forest, Southeast Alaska, USA: A Natural Climate Solution of Global Significance. *Land*, *11*(5), p.717.

I. A more thorough discussion of Southeast Alaska's salmon economy would improve the Socio-economic assessment

Both the socio-economic and non-commercial harvest assessments discuss the significant contribution that fisheries make to Southeast Alaska's socio-economic well-being. The assessments note the significant contribution that "forest fish" – salmon – make to regional fisheries since three-fourths of the harvested salmon spawn and rear in forested watersheds.[5] The Socioeconomic Assessment provides seafood processing employment data and income figures from one regional economic report but omits the large number of commercial fishing vessel businesses from the discussion.[6] The non-commercial harvest assessment provides some research and data about commercial salmon fishery values from 2007-2016.[7] Agency decisionmakers would benefit from a more current and comprehensive assessment of Southeast Alaska's coastal community fishery economy.

The non-commercial harvest assessment describes the economic, ecological and cultural value of salmon to the economy, ecology and culture to Southeast Alaska as "immeasurable."[8] It recognizes that the Tongass National Forest provides critical spawning and rearing habitat, and that changes in the abundance and stability of salmon populations affect community well-being.[9] Because of this significance, assessment notes that maintenance of salmon streams and populations are identified as a major concern and focus by public, tribal representatives, and agencies. [10]

The following discussion describes the current economic profile of Southeast Alaska's salmon economy. This information is also available in a recent National Marine Fisheries Service Environmental Impact Statement and the Alaska Sustainable Fisheries Trust's SeaBank reports. Recent runs and earnings from salmon fisheries have varied considerably. The Gulf of Alaska marine heat waves occurring in 2014-2016 and 2018-2019 had a significant impact on regional salmon fisheries. 2020 was a year of poor salmon returns all over Southeast Alaska. However, Southeast Alaska has a diverse salmon portfolio, and the recent recovery of multiple runs has helped to boost harvests and fishery values since then. Key points are as follows:

(1) Southeast Alaska is one the most important fishing regions in the United States and the viability of its fisheries depend on salmon;
(2) Alaska Natives have fished for salmon for ~10,000 years and continue to do so today;
(3) The Southeast Alaska salmon economy remains vital to local communities and the broader Pacific Northwest and its portfolio of salmon resources remains resilient in a changing environment; and,
(4) Multiple studies indicate that in general, each dollar in a commercial fishermen's earnings can generate $4 in additional economic impacts in local communities, or in some cases, throughout a broader multi-regional economy.

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[5] Doyon, T. 2024. Socioeconomic Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024; Noesser, E., R. Cross & G. Risdahl. 2024.

[6] *Id.; see* Tables 10 & 11 (estimating current seafood processing jobs number and income).

[7] Noesser, E., R. Cross & G. Risdahl. 2024.

[8] *Id.*

[9] *Id.*

[10] *Id.*

Southeast Alaska: a small boat commercial fishing region of national significance

Southeast Alaska is one of the most important fishing regions in Alaska, with more full-time fishery workers than any region other than the Bering Sea.[11] Juneau, Ketchikan, Petersburg and Sitka are consistently among the top 40 fishing ports in the U.S. based on landing volume and value.[12] In any given year, Craig, Haines, Wrangell and Yakutat may also be among the top 100 fishing ports by value.[13] Resident earnings are high-level: Petersburg (3rd, $49 million), Sitka (4th, $41 million), Juneau (8th, $20 million) and Ketchikan (10th, $16 million) are four of the top 10 fishing communities in Alaska.[14]
The top competitive strength is the high quality of Southeast Alaska seafood products, which include most of the Alaska harvest of high-value Chinook and coho salmon, Dungeness crab, spot shrimp, geoducks and sea cucumbers.[15] Small-boat fishermen harvest these species with sustainable fishing gear types in small amounts or even one at a time and promptly process and chill them for rapid delivery to a local processor or freeze them at sea.[16] Southeast Alaska's cold, pristine waters and diverse food web also contribute to the superior quality of its seafood. [17] Over the past decade (2013-2022), the region's average inflation-adjusted, ex-vessel value (the amount paid to fishermen) was $308 million.[18] A changing ocean environment, lower salmon harvests and the COVID-19 pandemic reduced fishery values in 2018 through 2020.[19] The 2021 and 2022 seasons were considerably better, with stronger salmon catches, combined with higher halibut prices and high Dungeness crab harvests. This increased fishermen's earnings to $301.8 million – the most valuable catch since 2017.[20] The $892 million wholesale value generated by regional processors in 2022 was the highest on record.[21]
Resident participation in Southeast Alaska fisheries is high. Residents own 2,655 fishing vessels – one-third of Alaska's fishing fleet and more than any other region in the state.[22] Most fishing vessel owners participate in multiple fisheries. The number of resident commercial fishermen (vessel owners and

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[11] McKinley Research Group. 2022. The economic value of Alaska's seafood industry. January 2022. *Available at*: https://mckinleyresearch.com/project/economic-value-of-alaskas-seafood-industry-2022/.

[12] United Fishermen of Alaska. 2021. 2020 commercial fishing and seafood processing facts. *Available at:* http://www.ucida.org/wp-content/uploads/2021/01/2020-UFA-Fish-Facts.pdf; United Fishermen of Alaska. 2023. 2022 commercial fishing and seafood processing facts. *Available at:* https://www.ufafish.org/fishing-facts/.

[13] *Id.*

[14] McKinley Research Group. 2022.

[15] Rain Coast Data. Southeast Alaska by the numbers 2023. Prepared for: Southeast Conference. *Available at:* https://www.seconference.org/wp-content/uploads/2023/09/SE-by-the-numbers-2023-Final.pdf.

[16] Alaskans Own. *Available at*: https://alaskansown.com/pages/seafood-species; Seafood Producers Cooperative. *Available at*: https://alaskagoldbrand.com/.

[17] *Id.*

[18] Rain Coast Data. Southeast Alaska by the numbers 2021. Prepared for: Southeast Conference. *Available at*: https://www.seconference.org/wp-content/uploads/2021/09/SE-by-the-numbers-2021-final.pdf?399dc1&399dc1.

[19] *Id.*

[20] Rain Coast Data. Southeast Alaska by the numbers 2023.

[21] *Id.*

[22] McKinley Research Group. 2022.

crew) peaked at 5,000 in 2014 and has since declined to roughly 4,400.[23] Another 1,000 fishermen from out of state also work in Southeast Alaska fisheries.[24]

Fishermen's harvests support 41 shore-based processing facilities and 2,900 full-time- equivalent processing jobs.[25] From 2014 to 2019, annual wholesale values ranged between $400 million and $600 million.[26] Fisheries also support 1,100 government and hatchery management jobs and significant employment in the transportation, marine and academic sectors.[27] Economists estimate that direct and indirect economic output from Southeast Alaska seafood, including multiplier impacts, exceeds $800 million annually and accounts for 15 percent of regional employment.[28]

For local and state governments, commercial fisheries directly contribute substantial revenue through landing taxes and fisheries business taxes.[29] Processors' business tax revenues go into Alaska's general fund, and the legislature then appropriates up to 50 percent of the revenue back into communities where processing occurred.[30] Also, one-half of the landing tax is returned to municipalities based on landing location.[31]

Fisheries are critical to nearly all of Southeast Alaska's 33 communities. Many of the more remote communities, such as Edna Bay, Meyers Chuck, Point Baker, Port Protection, Port Alexander and Pelican, are historical fishing villages that rely almost exclusively on commercial fishing, with some of these communities recently developing economic activity from sport fishing lodges.[32] Prince of Wales Island has 202 active fishing permit holders and 438 crew – roughly eight percent of the borough population – who earn $20.4 million in ex-vessel revenue.[33]

The Alaska Native villages of Hoonah, Klawock, Metlakatla and Yakutat also heavily rely on commercial fishing.[34] Eight percent of the Hoonah/Angoon Borough population is active in commercial fishing.[35] Residents own 156 boats and 234 permits, earning $5.3 million and generating jobs for a mostly local seafood processing work force.[36] Yakutat is among the top 70 ports in the U.S. based on the value of commercial seafood landings.[37] Twenty percent of its population is active in commercial fishing.[38]

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[23] McDowell Group. 2020. The economic value of Alaska's seafood industry. Prepared for: Alaska Seafood Marketing Institute. *Available at*: https://www.alaskaseafood.org/wp-content/uploads/McDowell-Group_ASMI-Economic-Impacts-Report-JAN-2020.pdf.

[24] *Id.*

[25] McKinley Research Group. 2022.

[26] *Id.*

[27] McDowell Group. 2020.

[28] *Id.*

[29] *Id.*

[30] United Fishermen of Alaska. 2021. Alaska Seafood Industry Taxes and Fees. Juneau, AK. Available at: https://www.ufafish.org/wp-content/uploads/2015/02/4a-Alaska-Seafood-Industry-Taxes-Fees-021115-v1s.pdf.

[31] *Id.*

[32] 2016 TLMP FEIS.

[33] United Fishermen of Alaska. 2023.

[34] 2016 TLMP FEIS.

[35] United Fishermen of Alaska. 2023.

[36] *Id.*

[37] *Id.*

[38] *Id.*

In the region's three largest communities – Juneau, Ketchikan and Sitka – commercial fishing is a primary private sector small business generator and employer. These communities have over 2,000 permit holders and crew – and 1,475 fishing boats.[39] They have 17 processors which collectively employ nearly 2,700 workers earning over $50 million in wages.[40] Sitka is Southeast Alaska's top seafood port and ranks 16th in the U.S. by seafood volume and value, producing 73.4 million pounds of seafood worth $53.5 million in 2021.[41] Roughly 10 percent of Sitka residents are active commercial fishermen.[42]

The "mid-sized" Southeast Alaska communities of Haines, Petersburg and Wrangell are heavily dependent on SeaBank fishery resources. In 2021, Petersburg was the 21st ranked port by seafood volume and 33rd by value in the U.S. It landed 44.3 million pounds of seafood worth $38.3 million.[43] Petersburg's active resident permit holders earned $66.5 million from local, Gulf of Alaska and Bristol Bay fisheries in 2021, the third-highest fishing earnings among Alaska communities and highest in Southeast Alaska. Nearly one-quarter of Petersburg residents are active fishermen.[44] Wrangell and Haines both rank among the nation's top 100 fishing ports in some years.[45] The gillnet fishery – mostly in Lynn Canal – is the most important fishery for the Haines fleet.[46] In these three communities, over 1,000 individual resident fishermen, including crew, rely on a fleet of roughly 700 vessels. The fleet generated roughly $98 million in fishing income in 2021.[47] Seafood landed in these communities supported nearly 900 processing jobs, and created over $14 million in wages.[48]

In 2021, economists from the University of Alaska's Institute of Social and Economic Research produced an Alaska-specific economic analysis of fishery economic outputs.[49] The analysis revealed that Alaska resident seafood harvests, as well as harvests by non-resident fishers who function as locals during the extended season, significantly benefit local economies through local expenditures on fuel, groceries, vessel repair, and maintenance sectors and gear suppliers. This boosts the local economies, with indirect employment and wage income that circulates.[50] These fishery economic multiplier effects on local economies are indispensable to a diverse range of businesses. Each dollar in resident fishery earnings generates $1.54 in total community revenue and over seven jobs per $1 million dollars in fishery earnings.[51] In other words, local earnings of over $231 million in 2022 generated $356 million in income within Southeast communities and 2,100 jobs.

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[39] *Id.*

[40] *Id.*

[41] *Id.*

[42] *Id.*

[43] *Id.*

[44] *Id.*

[45] United Fishermen of Alaska. 2021.

[46] United Fishermen of Alaska. 2023.

[47] *Id.*

[48] *Id.*

[49] Watson, B., M.N. Reimer, M. Guettabi & A. Haynie. 2021. Commercial Fishing and Local Economies. Institute of Social and Economic Research, University of Alaska Anchorage.

[50] *Id.*

[51] *Id.*

Table II.1: 2022 all fishery landings by southeast Alaska residents

Borough	Active Permits	Pounds	Ex-vessel value
Haines	80	6,295,000	$9,470,000
Hoonah	87	2,401,000	$5,138,000
Juneau	308	13,157,000	$25,047,000
Ketchikan	278	23,625,000	$24,664,000
Petersburg	604	44,561,000	$67,797,000
Prince of Wales	288	16,457,000	$19,453,000
Sitka	639	39,737,000	$60,874,000
Skagway	6	193,000	$317,000
Wrangell	204	10,006,000	$12,597,000
Yakutat	123	1,786,000	$6,090,000
All Alaska	2,617	158,218,000	$231,447,000

Southeast Alaska Salmon Economy and Culture

As explained in the following discussion, for all of the above communities, the salmon fisheries are the most important in terms of value and volume. ALFA's members come from Alaska's diverse fishing cultures. Southeast Alaska is the historical territory of Haida and Tlingit people, who lived in villages throughout the islands and mainland areas in Southeast Alaska and northern British Columbia.[52] Salmon (x̱aat in Tlingit) have been a major driver of the Southeast Alaska culture, economy and governance for thousands of years.[53] Tlingit and Haida societies historically consisted of multiple geographic units (known in Tlingit as kwáans) governed by independent clans which owned and managed lands and resources, particularly salmon streams.[54] Each clan monitored salmon streams, measuring escapements and developing abundance thresholds that informed the timing, location, and volume of harvest.[55] Clans introduced salmon to previously unoccupied streams and developed late-fall chum runs.[56] They also maintained productive stream habitats by removing blockages, such as landslides, fallen trees and beaver dams, managed predators, and enhanced salmon spawning beds.[57]

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[52] Schurr, T.G., Dulik, M.C., Owings, A.C., Zhadanov, S.I., Gaieski, J.B., Vilar, M.G., Ramos, J., Moss, M.B., Natkong, F. and Genographic Consortium, 2012. Clan, language, and migration history has shaped genetic diversity in Haida and Tlingit populations from Southeast Alaska. *American journal of physical anthropology*, *148*(3), pp.422-435; Langdon, S.J., 2015. Foregone harvests and neoliberal policies: Creating opportunities for rural, small-scale, community-based fisheries in southern Alaskan coastal villages. *Marine Policy*, *61*, pp.347-355.

[53] Langdon, S., 2006. *Traditional knowledge and harvesting of salmon by Huna and Hinyaa Tlingit*. Anchorage: US Fish and Wildlife Service, Office of Subsistence Management.

[54] Langdon, S.J., 2015; Carothers, C., Black, J., Langdon, S.J., Donkersloot, R., Ringer, D., Coleman, J., Gavenus, E.R., Justin, W., Williams, M., Christiansen, F. and Samuelson, J., 2021. Indigenous peoples and salmon stewardship: a critical relationship. *Ecology and Society, 26*(1).

[55] *Id.*

[56] Carothers, C., et al. 2021; Langdon, S.J. 2015.

[57] *Id.*

This management system sustained Southeast Alaska's large salmon runs for thousands of years. [58] After the arrival of Euroamericans, Tlingit and Haida fishermen combined participation in emerging Southeast Alaska commercial fisheries with traditional subsistence fisheries to meet their nutritional, economic, and cultural needs.[59]

Many Southeast Alaskans continue to use historical fishing locations for personal- and community-use food fisheries.[60] In many communities, including Angoon, Hydaburg, Hoonah, Kake and Yakutat, roughly one in every 10 residents participated in personal-use food fisheries.[61] Recent annual average harvests were 57,000 salmon. [62] Sockeye has long been the most sought after species, comprising over 80 percent of the catch.[63] Personal-use harvesters use 140 of Southeast Alaska's more than 200 sockeye salmon-producing systems.[64] In 2016, over 2,000 Southeast Alaska fishermen harvested salmon for personal and community food using subsistence permits issued by the Alaska Department of Fish and Game.[65] Roughly 1,000 Haines and Sitka residents had the highest harvests, with 1,000 fishermen catching over 20,000 sockeye.[66]

Southeast Alaska salmon runs, sustained by centuries of tribal management, today support one in 10 jobs in Southeast Alaska, where commercial, sport and subsistence salmon fisheries can produce $1 billion in economic outputs during a strong season.[67] It is the region's most abundant and valuable harvested seafood species and comprises between 60 and 70 percent of the total seafood productivity in any year.[68] There are five commercial salmon fisheries in the region: purse seine, drift gillnet, set gillnet, hand troll and power troll.[69] They harvest all five Pacific salmon species. Since 1975, pink salmon have generated one-third of the harvest value; chum salmon and coho salmon have each generated over 20 percent; and Chinook and sockeye salmon each 13 percent.[70]

From 2011 to 2020, Southeast Alaska salmon fishermen produced an average annual harvest of 47.5 million salmon worth $127.6 million in ex-vessel value.[71] In 2013, a record year for salmon catches by all gear types, decadal-peak harvests reached 95 million pinks, 12.3 million chum and 4 million

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[58] *Id.*

[59] *Id.*

[60] Fall, J. A., Turek, M. & Naves, L. 2009, *supra* n. 113.

[61] Fall, J. A., Godduhn, A,, Halas, G., Hutchinson-Scarbrough, L., Jones, B., McDavid, B., Mikow, E., Sill, L.A., Wita, A. & Lemons, T. 2019. Alaska Subsistence and Personal Use Salmon Fisheries 2016 Annual Report. Alaska Department of Fish and Game Division of Subsistence Technical Paper No. 446, Anchorage, AK.

[62] *Id.*

[63] Fall, J. A., Turek, M. & Naves, L. 2009. Overview of amounts reasonably necessary for subsistence uses of salmon in Southeast Alaska. Division of Subsistence Special Publication No. BOF 2009-03, Anchorage, AK.

[64] *Id.*

[65] Fall, J. A., et al. 2019.

[66] *Id.*

[67] U.S. Forest Service. 2017. Tongass Salmon Fact Sheet. Alaska Region, R10-PR-40.

[68] McKinley Group. 2022; McDowell Group. 2020.

[69] Stern, C., Robbins, B. & Strong, D. 2021. CFEC Permit holdings and estimates of gross earnings in the Yakutat and Southeast Alaska commercial salmon fisheries, 1975-2020. CFEC Report Number 21-4N, December 2021 (Revised January 2022). Juneau, AK.

[70] *Id.*

[71] Conrad, S. & Thynes, T. 2022. Overview of the 2021 Southeast Alaska and Yakutat commercial, personal use, and subsistence salmon fisheries. Alaska Department of Fish and Game, Fishery Management Report No. 22-05, Anchorage, AK.

coho.[72] The catch of 112 million fish was a regional record and worth $228 million in ex-vessel value.[73] Since 2019, runs and earnings from salmon fisheries have varied considerably, driven in large part by pink salmon run sizes and chum salmon prices.[74]

Over half of Southeast Alaska communities have active fish processors that rely heavily on salmon, which comprise roughly 70 percent of regional seafood production value.[75] The first wholesale value of salmon in 2022 was $602.8 million.[76] Many smaller communities depend on salmon processing with little opportunity to shift to another industry.[77]

The year 2020 yielded poor salmon returns all over Southeast Alaska but salmon harvests rebounded in 2021. The 2021 pink salmon harvest of 48.5 million fish was six times as high as the 2020 catch and aligned with the average odd-year harvest of 49 million fish during the 2010s.[78] While the 2022 catch volume was lower due to a smaller number of pinks, high chum prices boosted the harvest value to the highest since 2017.[79] The 2023 catch of 65.7 million salmon was the highest since 2013 and the sixth-largest harvest of the 21st century.[80]

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[72] *Id.*

[73] *Id.*

[74] *Id.*

[75] NMFS. 2024. Draft Environmental Impact Statement (DEIS) for the Issuance of an Incidental Take Statement under the Endangered Species Act (ESA) for Salmon Fisheries in Southeast Alaska Subject to the Pacific Salmon Treaty and Funding to the State of Alaska to Implement the 2019 Pacific Salmon Treaty Agreement. Juneau, AK 99802. January 2024.

[76] *Id.* at 213.

[77] *Id.* at 214-215.

[78] Brenner, R.E., Donnellan, S.J. & Munro, A. eds. 2022. Run forecasts and harvest projections for 2022 Alaska fisheries and review of the 2021 season. Alaska Department of Fish and Game, Special Publication No. 22-11, Anchorage, AK.

[79] Alaska Department of Fish and Game. 2022 Salmon Harvest Summary press release. November 11, 2022. *Available at*: https://www.adfg.alaska.gov/index.cfm?adfg=pressreleases.pr&release=2022_11_10#:~:text=The%202022%20commercial%20salmon%20fishery,harvest%20of%20233.8%20million%20fish.

[80] Conrad, S. & Thynes, T. 2022.

TABLE II.2: SOUTHEAST ALASKA SALMON HARVESTS AND VALUE (MILLIONS OF DOLLARS) 2020-2023[81]

	Chinook	Sockeye	Coho	Pink	Chum	Total
Avg. Catch 2011-2020	271,468	1,074,723	2,393,262	33,811,239	10,008,115	47,532,032
Avg. Value 2017-2019	$13.2	$7.9	$17.6	$25.3	$64.7	$132.0
Avg. Price/lb 2017-2019	$6.76	$1.94	$1.67	40.33	$0.74	---
2020 Catch	200,277	373,458	1,102,285	7,969,459	4,656,485	14,301,964
Value	$13.5	$2.6	$12.2	$6.2	$15.7	$50.1
Price/lb.	$5.65	$1.29	$1.74	$0.22	$0.45	---
2021 Catch	216,338	1,117,597	1,505,569	48,212,277	6,988,703	58,040,484
Value	$15.2	$11.4	$17.9	$48.1	$39.6	$132.3
Price/lb.	$6.17	$1.80	$2.11	$0.36	$0.84	---
2022 Catch	257,103	1,161,359	1,240,499	17,557,187	9,382,534	29,598,682
Value	$16.2	$13.2	$13.0	$22.5	$79.2	$144.0
Price/lb.	$5.54	$1.98	$1.84	$0.34	$1.18	---
2023 Catch	184,083	882,188	1,519,610	47,645,891	15,508,87	65,737,799
Value	$12.7	$5.5	$11.8	$33.9	$53.2	$117.1
Price/lb.	$6.31	$1.09	$1.40	$0.23	$0.53	--

Local vessel owners predominate in Southeast Alaska's salmon fisheries. In 2022, over 80 percent of nearly 1,000 active vessels in the troll and gillnet fisheries were operated by Alaska residents.[82] They also harvested over 80 percent of the 40-million-pound catch from the two fisheries, earning $55 million – 85 percent of the value from the two fisheries.[83] Alaskans owned over one-half of the 195 active seine permits and generated one-half the fishery volume and value in 2022.[84]

Southeast Alaska salmon fisheries benefit the larger North American economy.[85] In particular, Washington State supplies many Alaska businesses and distributes salmon caught in Southeast Alaska.[86] Residents of Washington State are the most significant fishery participants from outside Alaska,

[81] Stern, C., Robbins, B. & Strong, D. 2021. Alaska Department of Fish and Game harvest values summaries. *Available at:* 2021 Preliminary Alaska Commercial Harvest and Exvessel Values; 2022 Preliminary Alaska Commercial Harvest and Exvessel Values; https://www.adfg.alaska.gov/static/fishing/pdfs/commercial/2023_preliminary_salmon_summary_table.pdf.

[82] Alaska Commercial Fisheries Entry Commission. 2023. Southeast Alaska Salmon Permit & Fishing Activity by Year, State, Census Area, or City, 2022. *Available at:* https://www.cfec.state.ak.us/fishery_statistics/earnings.htm.

[83] *Id.*

[84] *Id.*

[85] NMFS. 2024. Draft Environmental Impact Statement (DEIS) for the Issuance of an Incidental Take Statement under the Endangered Species Act (ESA) for Salmon Fisheries in Southeast Alaska Subject to the Pacific Salmon Treaty and Funding to the State of Alaska to Implement the 2019 Pacific Salmon Treaty Agreement. Juneau, AK 99802. January 2024.

[86] *Id.* at 217.

particularly the seine fishery.[87] Roughly a third of commercial salmon fishing jobs and processing workers are from outside of Alaska, mainly from Washington State.[88]

Troll, Seine and Gillnet Salmon Fisheries

The troll fleet is diverse, including hand trollers (who use hand-powered downriggers or fishing rods), power trollers who sell iced fish to shore-based processing plants and tenders, and catcher-processors (freezer boats which harvest fish and freeze them at sea).[89] The troll fleet operates in every Southeast Alaska community and comprise the region's largest and most widely distributed fishing fleet.[90] They are an economic pillar in rural fishing communities where residents rely on trolling as the primary or only income source and in larger communities with more diverse economies such as Sitka, where there is a large troll fleet of 184 active fishermen who harvested 5.6 million pounds of salmon worth $12.6 million in 2022.[91]

Trollers harvest mostly Chinook and coho salmon – roughly two-thirds of the regional harvest of both species.[92] Since 1975, coho and Chinook salmon have comprised 51.4 percent and 43 percent of troll harvest value, respectively.[93] In recent years, trollers have devoted significant effort to harvesting chum, averaging 450,000 per year during the 2010s.[94] The outer coast areas offshore of Sitka and Craig typically comprise roughly two-thirds of the troll fishery value each year.[95] Sitka has the largest troll fleet, with 184 active permit holders harvesting 5.6 million pounds of salmon worth $12.6 million in 2022.[96]

Troll Chinook harvests since the early 2010s have been much lower than in the past. The main reasons are declines in Alaska stocks and new restrictions under the Pacific Salmon Treaty limiting harvests of stocks from the Pacific Northwest which transit Southeast Alaska waters.[97] Alaska Department of Fish and Game regulations intended to protect Southeast Alaska transboundary river stocks have limited both the areas and the seasons for spring and winter troll fisheries, reducing harvests and effort.[98]

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[87] Alaska Commercial Fisheries Entry Commission. 2023. Southeast Alaska Salmon Permit & Fishing Activity by Year, State, Census Area, or City, 2022. *Available at:* https://www.cfec.state.ak.us/fishery_statistics/earnings.htm

[88] NMFS. 2024.

[89] Hagerman, G., Vaughn, M. & Priest, J. 2021. Annual management report for the 2020 Southeast Alaska/Yakutat salmon troll fisheries. Alaska Department of Fish and Game Management Report No. 21-17, Anchorage, AK.

[90] NMFS. 2024.

[91] *Id.* at 201-02*;* Alaska Commercial Fisheries Entry Commission. 2023. Southeast Alaska Salmon Permit & Fishing Activity by Year, State, Census Area, or City, 2022. *Available at:* https://www.cfec.state.ak.us/fishery_statistics/earnings.htm

[92] *Id.*

[93] Stern, C., Robbins, B. & Strong, D. 2021.

[94] Hagerman, G., Vaughn, M. & Priest, J. 2021.

[95] Alaska Commercial Fisheries Entry Commission. 2023. Southeast Alaska Salmon Permit & Fishing Activity by Year, State, Census Area, or City, 2022. *Available at:* https://www.cfec.state.ak.us/fishery_statistics/earnings.htm.

[96] *Id.*

[97] Hagerman, G., Vaughn, M. & Priest, J. 2021.

[98] *Id.*

Most troll-caught coho originate in Southeast Alaska watersheds.[99] The long term (1989-2019) troll coho harvest average is 1.7 million fish.[100] The 1990s had high harvests, averaging 3.2 million coho, and included a record of 5.5 million fish in 1994.[101] The highest recent harvest was 2.1 million in 2017, but trollers harvested less than 1 million coho per year from 2018-2020, with a 750,000-fish catch in 2020 being the lowest since 1988.[102] Power trollers now account for nearly all of the troll harvest.[103] Roughly 85 percent of these vessels are local to Southeast Alaska.[104] Between 2011 and 2020 an average of 715 power trollers fished each year.[105]

TABLE II.3: SOUTHEAST ALASKA POWER TROLL ECONOMY[106]

Year	Million pounds	Ex-Vessel Value	Active Permits	Local Value	Local Active Permits
2011-2020	16.2	$33.3	715	$28.5	599
2020	7.9	$23.4	629	$20.5	537
2021	11.7	$30.6	629	$26.6	529
2022	15.4	$34.2	609	$26.3	511

The troll fishery is essential for Southeast Alaska Tlingit and Haidas, who have fished for salmon for thousands of years, and continue to do so.[107] They trolled for Chinook salmon long before contact with Europeans.[108] Many now depend on it for their livelihood and have for multiple generations.[109] Tribal members comprise nearly a third of the troll fleet and also hold roughly twenty percent of the region's purse seine and drift gillnet permits.[110] These fishermen provide food, employment, and income for many people and support traditional communities that also depend on fishing revenues to support schools and maintain basic infrastructure.[111]

Purse seine fisheries, typically conducted by 50- to 58-foot vessels, occur throughout Southeast Alaska south of Cape Spencer.[112] Seiners mostly harvest pink and chum salmon, and catch over 70 percent of the total Southeast Alaska salmon fishery volume each year.[113] In general, fishing districts near Ketchikan and Prince of Wales Island garner one-half to two-thirds of the fishery value each

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[99] *Id.*

[100] *Id.*

[101] *Id.*

[102] *Id.*

[103] *Id.*

[104] Stern, C., Robbins, B. & Strong, D. 201.

[105] Conrad, S. & Thynes, T. 2022.

[106] *Id.,* Stern, C., Robbins, B. & Strong, D. 2021; Alaska Commercial Fisheries Entry Commission. 2023.

[107] NMFS. 2024. Draft Environmental Impact Statement (DEIS) for the Issuance of an Incidental Take Statement under the Endangered Species Act (ESA) for Salmon Fisheries in Southeast Alaska Subject to the Pacific Salmon Treaty and Funding to the State of Alaska to Implement the 2019 Pacific Salmon Treaty Agreement. Juneau, AK 99802. January 2024.

[108] *Id.*

[109] *Id.*

[110] *Id.* at 210.

[111] *Id.* at 209-210.

[112] Langdon, S.J. 2015.

[113] Thynes, T., Bednarski, J.A., Conrad, S.K., Dupuis, A.W., Harris, D.K., Meredith, B.L., Piston, A.W., Salomone, P.G. & Zeiser, N.L. 2021. Annual management report of the 2020 Southeast Alaska commercial purse seine and drift gillnet fisheries. Alaska Department of Fish and Game, Fishery Management Report No. 21-30, Anchorage, AK.

year.[114] Petersburg has the highest level of engagement in the seine fishery, with 40 or more permit holders fishing each year.[115] In 2021, Petersburg seiners caught over 30 million pounds of salmon worth $17.0 million – twice as much as any other Southeast Alaska community.[116] Most of the non-Alaska permit holders are from Washington State, who account for over one-third of the effort, catch volume and value.[117]

From 1975 to 2020, the purse seine fishery's harvest value was roughly 61 percent from pinks and 24 percent from chums.[118] Due in large part to declining pink salmon runs, the 2020 seine fishery value was the lowest since 1975.[119] Pink runs rebounded in 2021, with seiners catching 44.5 million pinks out of the total 48.5-million-fish harvest.[120] In 2023, 204 seiners fished,[121] and harvests were exceptional in areas near Ketchikan and Craig, where seiners caught 29.5 million pinks and 3 million chum.[122]

TABLE II.4: SOUTHEAST ALASKA SEINE ECONOMY[123]

	Million pounds	Ex-Vessel Value	Active Permits	Local Value	Local Active Permits
2011-2020	144.2	$73.5	252	$42.0	132
2020	39.2	$18.3	201	$9.5	119
2021	146.0	$88.1	208	$48.1	120
2022	85.0	$69.5	195	$38.6	112

Among gillnetters, Southeast Alaskans own 330 of the active vessels and permits – over three-fourths of the fleet.[124] Most of the vessels are between 32 and 40 feet in length.[125] Gillnetters harvest a mix of all five salmon species and averaged nearly 5 million fish per year during the 2010s.[126] Since 1975, sockeye salmon and chum salmon have comprised 32.7 percent and 41.7 percent of the gillnet fishery harvest value, respectively.[127] Chum salmon have become increasingly important in recent years, comprising two-thirds of the gillnet fishery value in 2021.[128]

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[114] *Id.*

[115] Alaska Commercial Fisheries Entry Commission. 2023.

[116] *Id.*

[117] *Id.*

[118] Stern, C., Robbins, B. & Strong, D. 2021.

[119] *Id.*

[120] Brenner, R.E., Donnellan, S.J. & Munro, A. 2022; Alaska Department of Fish and Game. 2023. Southeast Alaska Purse Seine Fishery Announcement August 30, 2023.

[121] Alaska Department of Fish and Game. 2023. Southeast Alaska Purse Seine Fishery Announcement August 30, 2023.

[122] *Id.*

[123] Conrad, S. & Thynes, T. 2022Stern, C., Robbins, B. & Strong, D. 2021; Alaska Commercial Fisheries Entry Commission. 2023.

[124] *Id.*

[125] Stern, C., Robbins, B. & Strong, D. 2021.

[126] Thynes, T., et al. 2021.

[127] Stern, C., Robbins, B. & Strong, D. 2021.

[128] Thynes, T., Bednarski, J.A., Conrad, S.K., Dupuis, A.W., Harris, D.K., Meredith, B.L., Piston, A.W., Salomone, P.G. & Zeiser, N.L. 2022. Annual management report of the 2021 Southeast Alaska commercial purse seine and drift gillnet fisheries. Alaska Department of Fish and Game, Fishery Management Report No. 22-25, Anchorage, AK.

There are five drift gillnet fishing areas: Tree Point south of Ketchikan near the British Columbia border; the north Prince of Wales Island in Sumner Strait and Clarence Strait; the Stikine River gillnet fishery near Petersburg and Wrangell; the Taku River/Port Snettisham gillnet fishery south of Juneau; and the Lynn Canal gillnet fishery near Haines.[129] This fishery's most productive areas over the past decade are Lynn Canal and Taku River/Port Snettisham, particularly for sockeye and chum and often comprise over one-half the yearly gillnet fishery value.[130] In 2023 the two areas produced 76 percent of the gillnet sockeye harvest and 65 percent of the chum.[131] The Sumner Strait fishery produces the most diverse mix of sockeye, coho, pinks and chum.[132]

TABLE II.5: SEABANK GILLNET HARVESTS BY AREA[133]

Area	Avg. Sockeye Harvest 2011-2020	Sockeye Harvest 2023	Avg. Coho Harvest 2011-2020	Coho Harvest 2023	Avg. Chum Harvest 2011-2020	Chum Harvest 2023
Tree Point	41,265	23,299	59,160	22,210	432,520	418,380
Sumner	63,312	42,300	118,590	42,300	149,300	179,200
Stikine	23,630	5,900	21,990	20,900	135,320	105,300
Taku	127,720	79,700	30,820	20,500	493,630	622,600
Lynn Canal	137,880	160,000	37,780	25,600	1,137,710	1,391,200

There is also a Yakutat setnet fishery targeting sockeye and coho salmon, mostly bound for the Situk River, which comprises nearly all of the fishery's value.[134] Between 90 and 120 permit holders fish each year, and roughly 70 percent of the permit holders live in Southeast Alaska.[135]

During the 2010s, Alaska typically issued 474 drift gillnet permits each year and 80 to 90 percent of the permit holders actively fished.[136] Most communities have a significant gillnet fleet. The largest active gillnet fleets are from Juneau and Yakutat, with over 60 active permit holders.[137] There also are roughly 50 active gillnetters operating out of Haines, Petersburg and Wrangell.[138]

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[129] Thynes, T., et al. 2021.

[130] *Id.*; Brees, J. & Crittenden, W. 2023. Section 1-B Drift Gillnet Post Season Review. *Available at:* https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/southeast/meetings/gillnet/2023_d15_gillnet_review.pdf.

[131] Thynes, T., et al. 2022.

[132] *Id.*

[133] Thynes, T., et al. 2022; Brees, J. & Crittenden, W. 2023, *supra* n. 184; Salomone, P. 2023. Districts 6 and 8 Drift Gillnet Fisheries 2023 Postseason Report. *Available at:* https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/southeast/meetings/gillnet/2023_d6and8_gillnet_review.pdf; Vinzant, R. 2023. District 11 Drift Gillnet Fishery Taku Inlet, Stephens Passage and Port Snettisham 2023 Management Summary. *Available at:* https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/southeast/meetings/gillnet/2023_d15_gillnet_review.pdf; Zeiser, N. 2023. District 15 (Lynn Canal) Drift Gillnet Fishery 2023 Postseason Summary. *Available at:* https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/southeast/meetings/gillnet/2023_d11_gillnet_review.pdf.

[134] Hoffman, R.A. & Christian, H.L. 2021. Annual Management Report for the 2020 Yakutat commercial set gillnet salmon fisheries. Alaska Department of Fish and Game, Fishery Management Report No. 21-09, Anchorage, AK.

[135] Stern, C., Robbins, B. & Strong, D. 2021.

[136] Stern, C., Robbins, B. & Strong, D. 2021.

[137] Alaska Commercial Fisheries Entry Commission. 2023.

[138] *Id.*

TABLE II.6: SEABANK GILLNET HARVESTS AND VALUE (INCLUDES YAKUTAT)[139]

	Million Pounds	Ex-Vessel Value	Active Permits	Local Value	Local Active Permits
2011-2020	37.4	$29.4	532	$24.5	413
2020	13.5	$9.0	460	$7.1	367
2021	17.1	$20.4	465	$16.2	359
2022	25.0	$30.2	375	$25.4	312

II. Double Jeopardy: Industrial Scale Logging and Climate Change risks for salmon

Federal land management that allows for industrial scale logging has reduced the value of the salmon economy (discussed in the preceding section) from what it could be. Forest Plan Standards direct the agency to maintain habitats for fish, prevent adverse effects to rearing and spawning habitat and maintain features that regulate stream temperatures.[140] The assessments recognize that riparian forests are essential for water quality and key habitat features such as temperature regulation, but fail to fully recognize the extent to which these standards are not being met.[141] ALFA submits that current Forest Plan provisions are not adequate to protect salmon habitat in light of the cumulative impacts of climate change and industrial logging. For example, the existing Forest Plan applies only a 100-foot no-cut buffer only along Class I streams known to support salmon and Class II streams that flow directly into a Class I stream.[142] Other stream buffers are discretionary.[143] Southeast Alaska's salmon have opportunities for resilience to climate change but will need more protective riparian buffers. ALFA submits that the assessments should more fully detail land management risks to salmon so that larger buffers, such as the 300-foot buffers for salmon streams and 150 foot buffers for headwaters streams used on federal lands elsewhere in the Pacific Northwest, are considered during the revision process.[144]

The Forest Service built most of the roads to benefit the timber industry, frequently in fish habitat.[145] The timber industry never restored damaged areas, and the Forest Service has allowed timber companies to externalize these costs by forcing taxpayers to fund the habitat mitigation program, and Southeast Alaska commercial, sport and food fishermen to absorb lower harvests when funding has been insufficient to mitigate logging-caused habitat harms. Prince of Wales Island – the

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[139] Stern, C, Robbins, B. & Strong, D. 2021.

[140] FISH2 IV.A., E., F. & G.

[141] Turner, R. Cross & A. Mallott. 2024. Draft Terrestrial Ecosystems Resource Assessment.

[142] Noesser, E., R. Cross & G. Risdahl. 2024.

[143] Forest Plan Standard RIP2 II.E; Noesser, E., R. Cross & G. Risdahl. 2024.

[144] *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.

[145] Engelmann, D. 2024. Draft Forest Management and Timber Assessment.

region's most important salmon producing ecosystem - has a higher road density than anywhere else on the Tongass.[146] The assessment recognizes that roads are major sources of sediment inputs into streams and are initiation points for landslides that deposit in a valley floor stream. [147]

In many cases, the agency can no longer afford to mitigate habitat harms from outdated infrastructure, despite intentions to maintain infrastructure in ways that respond to ecological, economic and social concerns. [148] The assessments recognize that barrier culverts or other road crossings impede fish passage by blocking or degrading their upstream or downstream movements.[149] It has long been known that the most efficient use of limited agency restoration resources is culvert replacements.[150] Although the Forest Plan directs the agency to protect watersheds from road effects and the Forest Service has done some replacements, failed culverts are prevalent throughout the road system.[151]

The assessments indicate that there are roughly 5,000 miles of forest roads with roughly 14,000 stream crossings in fish habitat. [152] The Forest Service has surveyed 3,800 of these crossings in fish habitat and found that nearly a third of them partially or fully obstruct fish passage because of debris, failed culverts or other problems. [153] Over the past quarter century, the Forest Service has addressed a fraction of these fish passage barriers. [154] Most of the work occurred between 1998 and 2006 when the Forest Service had a specific program and fixed roughly 50 sites per year before cancelling the program due to funding reductions. [155] Mitigation work since slowed even more, with an overall repair rate of 41 fish passage barriers per year since 1998 that has dropped to 25 stream crossings per year since 2017.[156] There are currently 1,200 barrier culverts on the Tongass.[157] Funding is currently inadequate and decreasing while repair costs are on the rise.[158]

This situation is unacceptable, particularly since the existing Forest Plan continues to authorize logging, adding to the deferred maintenance backlog. At one time, the Pacific Northwest supported the largest salmon runs and fisheries in the world.[159] But habitat loss has been a major factor in the decline

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[146] Noesser, E., R. Cross & G. Risdahl. 2024.

[147] *Id.*

[148] Engelmann, D. 2024. Draft Forest Management and Timber Assessment; Escamilla, D. 2024. Draft Infrastructure Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

[149] Noesser, E., R. Cross & G. Risdahl. 2024; Chestnut, T. 2024. Draft Aquatics Resource Assessment.

[150] Reeves, G.H. et al. 2018.

[151] Noesser, E., R. Cross & G. Risdahl. 2024.

[152] *Id.;* Bousfield, G. 2024. Draft Watershed Condition and Water Resource Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

[153] *Id.*

[154] Noesser, E., R. Cross & G. Risdahl. 2024.

[155] USDA Forest Service. 2008. Tongass Land and Resource Management Plan Final Environmental Impact Statement. Alaska Region. R10-MB-603c.

[156] Bousfield, G. 2024. Draft Watershed Condition and Water Resource Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

157 Chestnut, T. 2024. Draft Aquatics Resource Assessment.

158 Escamilla, D. 2024. Draft Infrastructure Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

[159] 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.

of Pacific salmon populations at the southern end of their range.[160] 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.[161] Salmon that remain in heavily-logged watersheds for extended portions of their lifecycle are vulnerable to significant losses in productivity.[162] Habitat destruction has necessitated billions of dollars of expenditures in the Pacific Northwest on hatcheries and restoration actions to maintain salmon and salmon fisheries.[163] Intact, functioning forested ecosystems previously provided ecosystem services needed for fish, such as clean water, at no cost.

Southeast Alaska remains one of the largest remaining productive salmon systems in the world, in large part because there are still hundreds of pristine watersheds.[164] The Tongass National Forest is still by far the leading producer of wild salmon of any national forest.[165] Although these salmon still support viable fisheries, Forest Service researchers acknowledge that the same threats responsible for reducing salmon populations in the Pacific Northwest are present in the Tongass.[166] During the initial phase of industrial logging in the Pacific Northwest, impacts targeted the most productive watersheds because the most valuable timber grew in riparian zones.[167] Until the 1970s, no riparian buffers were required along anadromous streams, and riparian forest loss continued afterward because of prevalent selective cutting within the buffers or clearcutting upslope of buffer boundaries.[168] The loss of habitat 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.[169] It is likely that the most heavily impacted watersheds have been producing fewer salmon,[170] but the extent of lost population productivity remains unknown.[171]

Scientists identify logging and timber roads, along with climate change, as the greatest risks to salmon habitat.[172] The changing productivity of the marine environment increases the importance of freshwater habitat.[173] A major concern is the "double jeopardy" – that high levels of habitat degradation caused by logging and timber roads will coincide with periods of low marine productivity, which climate

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[160] 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.

[161] Johnson, A.C. et al. 2019.

[162] Wilson, K.L., Bailey, C.J., Davies, T.D., & Moore, J.W. 2022. Marine and freshwater regime changes impact a community of migratory Pacific salmonids in decline. *Global Change Biology*, *28*(1), pp.72-85.

[163] *Id.*

[164] 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).

[165] Johnson, A.C. et al. 2019.

[166] *Id.;* Everest, F. H. & Reeves, G.H. 2006; USDA Forest Service. 1995.

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

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

[169] *Id.*

[170] *Id.*

[171] *Id.*

[172] Bryant, M.D. 2009. Global climate change and potential effects on Pacific salmonids in freshwater ecosystems of Alaska. *Climatic Change, 95*(1-2), pp.159-193.

[173] USDA Forest Service. 1995.

change is making more frequent and severe.[174] Although intensively- logged watersheds have some value for fish during times of high marine productivity,[175] during times when low marine productivity and freshwater habitat degradation coincide, there may be long-term harm to salmon populations.[176]

Avoiding further impacts from logging and timber roads will be important to maintaining a salmon population portfolio in a changing climate. More severe climatic events such as atmospheric rivers, summer droughts and winter snow droughts, and elevated stream temperatures are long-term hazards to salmon productivity.[177] Logging alone can cause stream temperature threshold exceedances which will more frequently rise to lethal levels in a warming climate.[178] Riparian vegetation is critical for temperature regulation during summer solar radiation peaks. [179] The shade is particularly important for small forested streams where riparian vegetation is dense and maintains relatively cool and stable water temperatures.[180] Logging can increase temperatures in these streams by as much as 18° F. [181]

The increasing frequency of landslides, a result of climate change, further threatens fish habitat.[182] Landslides cause egg and embryo mortality by scouring spawning habitat and depositing sediments along downstream stretches.[183] The scouring and deposition can depress spawning success and impair winter survival for some salmon species such as coho that rear in-stream, with potential long-term population harm.[184] Logging and roads intensify these risks by reducing the watershed regulating service of natural forests that mitigates severe weather events.[185]

Even without considering climate change, clearcutting and timber road construction in salmon habitat reduces productivity in numerous ways. This is widely recognized as a principal cause of declining salmon runs in the Pacific Northwest.[186] 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. This is because timber roads and clearcutting commonly increase sedimentation, degrade water quality, fragment habitat and increase high-temperature events.[187]

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[174] *Id.*

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

[176] *Id.*

[177] Bryant, M.D. 2009.

[178] Owen, B. 2022. "Logging in watersheds among stressors for declining Pacific salmon population, experts say." *The Globe and Mail* (January 3, 2022). *Available at:* https://www.theglobeandmail.com/canada/british-columbia/article-logging-in-watersheds-among-stressors-for-declining-pacific-salmon/; Frissell, C.A. 2019.

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

[180] *Id*.

[181] *Id*.

[182] Owen, B. 2022.

[183] Bryant, M.D. 2009.

[184] *Id.*

[185] *Id.*

[186] Owen, B. 2022, *supra* n. 201; USDA Forest Service. 1995; Frissell, C.A. 2019.

[187] USDA. 2001; 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.

Roads are a primary cause of accelerated, chronic sediment production that degrades salmon spawning and rearing habitat.[188] It is nearly impossible to mitigate this impact.[189] Large volumes of sediment from road surfaces, ditches and cut and fill surfaces traverse streamside riparian zones and enter streams from multiple locations within a watershed.[190] Tongass National Forest timber sales environmental impact statements identify sedimentation as a chronic impact on fish habitat on islands throughout Southeast Alaska that are heavily impacted by clearcutting and high road densities. Intact riparian vegetation can capture and store some sediment, but once an area is disturbed by roads or logging, most of the sediment passes through to stream channels. [191] In river valleys, roads often run parallel to salmon streams, replacing riparian forests and permanently altering ecosystem productivity.[192]

These and other adverse impacts to salmon are likely even when measures are in place to mitigate habitat harms.[193] Significant habitat degradation occurs even with forested buffers on known anadromous streams.[194] But many anadromous streams remain uncatalogued. In Southeast Alaska the buffers are narrow and tend to blow down, losing their effectiveness over time.[195] Buffer requirements are minimal for most landowners and most stream sizes.[196] Even where buffers remain intact, they provide little protection against landslides caused by upslope logging or against road-caused sediment delivery.[197] Because no buffers are required along smaller, non-anadromous headwaters streams, logging adjacent to these steep stream segments is a big source of sediment, which degrades water quality far downstream.[198] Because logging and road construction cause high stream temperatures in various ways, buffers alone do not prevent temperature increases. Some studies found stream temperatures to be up to 7 to 11° F warmer in logged areas.[199] These warmer temperatures alter fish behavior and the timing

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188 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.

189 Frissell, C.A. 2019.

190 Everest, F. H. & Reeves, G.H. 2006.

191 *Id.*

192 *Id.*

193 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.

194 USDA Forest Service. 1995.

195 *Id.*; Frissell, C.A. 2019.

196 Everest, F. H. & Reeves, G.H. 2006.

197 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.

198 *Id.*

199 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.

of lifecycle events and can cause population declines or even collapses.[200]

Because of these impacts, preventing further development in salmon habitats is the most cost-effective way to improve ecosystem productivity for salmon.[201] The second most effective measure is to remove failed ("barrier" or "red") culverts.[202] When less habitat is accessible to salmon for spawning, rearing and other lifecycle needs, there can be a significant loss of population productivity, to the point of local extirpations.[203]

The Forest Service currently is not allocating the funds necessary to maintain or decommission roads on the Tongass, and instead plans for adverse effects to fish and water quality to continue and worsen as older roads and stream crossings deteriorate.[204] Culverts are the most common method used by road builders to cross streams.[205] They cost less than bridges but it is difficult to maintain fish passage with culverts because stream and debris flows change constantly, so they eventually impede fish passage or become complete barriers to fish movements.[206] Culverts can also become barriers by creating high-velocity stream flows.[207] Floods magnify this impact.[208] Overflow that bypasses barrier culverts also increases sedimentation and stream temperatures.[209]

The risks to salmon populations go far beyond the obvious problem of spawning habitat being degraded or lost. Salmon require habitat connectivity.[210] In addition to the marine lifecycle migrations of salmon, juvenile salmon will move within a watershed to rearing or overwintering habitat or explore other habitats in pursuit of food.[211] They also move to seek refuge from adverse environmental conditions such as floods or debris flows from landslides.[212] 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.[213] Barrier culverts (often throughout a watershed) block those movements, cumulatively reducing population productivity by impairing foraging

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[200] Frissell, C.A. 2019.

[201] 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.

[202] *Id.*

[203] 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.

[204] 2020 Alaska Roadless Rulemaking FEIS.

[205] Clark, C. et al. 2020.

[206] *Id.,* Price, D.M. et al. 2010.

[207] 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.

[208] Price, D.M. et al. 2010.

[209] USDA Forest Service. 2001; Clark, C. et al. 2020.

[210] Clark, C. et al. 2020.

[211] Davis, J.C. & Davis, G.A. 2011.

[212] *Id.;* Price, D.M. et al. 2010.

[213] Riley, C. 2003.

opportunities that slow growth and development and by blocking access to refugia.[214]

Barrier culverts and other stream crossings that impair fish habitat are prevalent throughout Southeast Alaska. The cumulative impacts of road networks and multiple stream crossings commonly cause or threaten major adverse effects to fish habitat.[215] 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.[216] Permanent roads crossed salmon streams more than 920 times and smaller streams more than 1,700 times.[217] Only one-third of the stream crossings provided adult and juvenile fish passage.[218]

Another 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.[219] Many were obvious barriers, verified by the relative absence of upstream salmon – altogether, there were seven times as many juvenile salmon downstream from the barrier culverts as there were upstream.[220]

The loss and degradation of anadromous fish habitat is not an abstract matter – it is a gross, region-wide loss of vital ecosystem services that support salmon fisheries. Canadian researchers developed methods to estimate the loss of salmon-related economic values caused by logging and associated road construction. A conservative estimate is that each salmon spawning-stream-mile is worth $10,000 per year. This means that barrier culverts in the Tongass National Forest alone (not counting non-federal forests in the region) cost commercial fishermen $2.7 million annually.[221]

Removing barrier culverts is a primary means of restoring salmon populations.[222] 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.[223] Scientists recommend land managers of forested areas to focus on projects like barrier culvert removals that, especially with climate change in mind, improve low-flow passage and moderate stream temperatures.[224] A 2019 study found a tripling of coho smolt abundance shortly after culvert replacement, and that results of other stream restoration measures were modest or undetectable.[225]

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[214] *Id.;* Clark, C. et al. 2020; Price, D.M. et al. 2010.

[215] USDA Forest Service. 2001.

[216] Flanders, L.S. & Cariello, J. 2000. Tongass Road Condition Report. ADF&G Habitat Restoration Division Tech. Rpt. No. 00-7. June 2000.

[217] *Id.*

[218] *Id.*

[219] Riley, C., 2003.

[220] *Id.*

[221] Foley, N. et al. 2012. A review of bioeconomic modelling of habitat-fisheries interactions. *International Journal of Ecology, 2012*; Knowler, D. et al. 2001. Valuing the quality of freshwater salmon habitat – a pilot project. Simon Fraser University. Burnaby, B.C. January 2001; Knowler, D.J., MacGregor, B.W., Bradford, M.J., & Peterman, R.M. 2003. Valuing freshwater salmon habitat on the west coast of Canada. *Journal of Environmental Management, 69*, pp.261-273

[222] Clark, C. et al. 2020; Price, D.M. et al. 2010.

[223] Clark, C. et al. 2020.

[224] 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.

[225] 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.

Increased logging by non-federal landowners on Prince of Wales Island is a significant immediate risk to salmon.[226] Prince of Wales Island is the most important island ecosystem in Southeast Alaska for commercial fish production, on the basis of sockeye habitat, numbers of stream-miles for coho and pink salmon and the number of Alaska Department of Fish and Game "Primary Salmon Producer" watersheds.[227] The island's watersheds have been one of the most important parts of Southeast Alaska's salmon system and primary producers of wild salmon stocks that support sport, subsistence, seine, gillnet and troll fisheries.[228]

Another significant concern is that Forest Service second-growth timber targets will negatively affect southern Southeast Alaska watersheds that are currently in recovery from past clearcutting. Forested aquatic ecosystems take decades to recover after logging.[229] The Forest Service's second-growth logging program would once again degrade previously-logged watersheds, committing them to a succession of short timber rotation cycles. Scientists explain that "[f]ew refuges remain in a watershed that fish can use during such widespread, intense, and recurrent disturbances."[230] Frequent cutting on a landscape scale prevents reestablishment of aquatic system stability provided by maturing forests.[231]

III. Status of Southeast Alaska salmon populations

Two assessments describe the status of Southeast Alaska salmon and their habitats. The Non-Commercial Harvest Draft Resource Assessment identifies most salmon populations as stable and healthy, but acknowledges that stock productivity fluctuates across the region and from year to year.[232] The assessments suggest that past logging and timber road construction has damaged some fish habitat in some areas in the past and in some areas, but assert that overall these impacts are small and isolated.[233] According to the watershed condition assessment, current declines in habitat conditions are associated with land exchanges and mining.[234] While ALFA agrees that there are many healthy salmon populations due to the amount of intact habitat, past and ongoing logging and road impacts are likely reducing salmon population productivity to a much higher degree than acknowledged. Climate change also presents significant risks to salmon. The assessments would benefit from a more thorough analysis of salmon population trends and factors that affect their productivity.

Most regional watersheds produce multiple salmon species. Each salmon species has a unique life history and habitat needs, and is vulnerable to species-specific threats. [235] Pink and chum rear in the marine environment while coho, chinook and sockeye rear in lakes or rivers.[236] Pink and chum salmon

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[226] Resneck, J. et al. 2022.

[227] 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.

[228] *Id.*; Albert, D. & Schoen, J. 2007.

[229] *Id.*; USDA Forest Service. 1995.

[230] *Id.*

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

[232] Noesser, E., R. Cross & G. Risdahl. 2024. Subsistence and Non-Commercial Harvest Draft Resource Assessment.

[233] *Id.*

[234] Bousfield, G. 2024. Draft Watershed Condition and Water Resource Assessment.

[235] Noesser, E., R. Cross & G. Risdahl. 2024.

[236] 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.

spawn first, beginning in early July.[237] Adult coho return to the outer coast during the summer and spawn throughout the fall.[238] Sockeye and Chinook return to spawn in late spring/early summer.[239]

The region's major mainland rivers – the Alsek, Chilkat, Stikine, Taku and Unuk – produce all five salmon species and run sizes (escapement and harvests) can exceed over one million fish per year.[240] Some of the most economically-valuable salmon species – coho and sockeye salmon – comprise the largest numbers of fish spawning in these rivers.[241] The two most prevalent species spawning in Tongass National Forest island ecosystems are coho and pink salmon.[242] Overall, the Tongass National Forest is the breeding source of 95% or more of Southeast Alaska's pink salmon harvest and roughly two-thirds of the coho harvest.[243]

The most common metric used for the health of salmon stocks is escapement, or the number of salmon that survive and return to freshwater to spawn.[244] Fishery performance is a measure of salmon abundance. [245] Escapement goals, which reflect the number of spawning salmon needed to provide a salmon population that can support a sustainable fishery.[246] None of the assessments fully captured current resource fluctuations – many of which support the hypothesis that industrial logging – whether past or present, may be contributing to lower productivity. The following discussions covers the three "forest fish" species most vulnerable to logging due to their prevalence on southern Southeast Alaska island ecosystems where timber industry impacts have been highest.

Pink salmon are the most abundant of the five salmon species and the smallest in size.[247] Nearly all the pink salmon in Southeast Alaska are wild. There are over 6,000 pink salmon populations that utilize the lower reaches of over 3,000 streams for spawning.[248] Prince of Wales Island has the most pink salmon spawning habitat in the region.[249]

Because pink salmon have a fixed, 2-year life cycle they also comprise reproductively isolated and distinct odd- and even-year runs.[250] Even-year cycles of pink salmon runs have historically been much lower than odd years, and odd-year productivity is spread more uniformly across the region.[251]

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[237] *Id.*

[238] *Id.*

[239] *Id.*

[240] Forbes, S. 2019. District 11 Drift Gillnet Fishery: Taku Inlet, Stephens Passage and Port Snettisham, 2019 Management Summary; Kowalske, T. 2019. 2019 District 6 and 8 Gillnet Fishery Postseason Report; Zeiser, N. 2019. 2019 Lynn Canal (District 15) commercial drift gillnet fishing season summary.

[241] McDowell Group. 2016. Southeast Alaska Transboundary Watersheds Economic Impact Analysis. *Available at*: https://static1.squarespace.com/static/630575024bbe7028e1b70ba8/t/6363fd74bbd34a233a0291ba/1667497336155/final_southeast_alaska_transboundary_watershed_economic_impacts_-_executive_summary_10_10.pdf.

[242] Johnson, A.C. et al. 2019.

[243] *Id.*

[244] Noesser, E., R. Cross & G. Risdahl. 2024.

[245] *Id.*

[246] *Id.*

[247] Halupka, K.C. 2000.

[248] *Id.*

[249] Albert, D. & Schoen, J. 2007.

[250] Halupka, K.C. 2000.

[251] Thynes, T. et al. 2021.

Northern and southern Southeast Alaska pink salmon populations have distinctly different life histories, using different migratory pathways, and do not intermingle.[252] For the even-year runs, the southern Southeast area provides most of the region's pink salmon harvest – in some years as much as 90 percent of the harvest, with regulatory districts near Prince of Wales Island and Ketchikan being top producers.[253]

Pink salmon marine survival estimates are based on a long time-series of data from Auke Creek near Juneau.[254] On average just over 11 percent survive to return, but this can range from just over one percent to nearly 50 percent.[255] Factors that influence marine survival include migration timing, fishery effort and timing, predation, growth rates, genetic variation and stream conditions.[256] Significant warming trends in Auke Creek are causing earlier out-migrations with juveniles entering the marine environment earlier and adults returning earlier to spawn.[257]

Pink salmon returns declined significantly throughout the region during the late 2010s. The 2016 return of 18 million fish (which was a federally-declared fishery disaster) parented a 2018 run in which only 8 million fish were harvested – the lowest since 1976.[258] The poor 2018 parent year and the resulting near record-low juvenile pink salmon abundance estimates in 2019 led to another poor return in 2020, with another harvest of only 8 million fish.[259] Drought conditions and marine heat waves are likely causes of the population decline.[260] The 2019 pink harvest of 21.1 million fish was the lowest odd-year harvest in over three decades.[261] Northern Southeast Alaska runs declined the most from 2016 to 2020, with escapements falling well below targets for most surveyed stocks.[262]

Pink salmon runs have since rebounded, implying better freshwater and early marine survival.[263] The 2021 regionwide harvest of 48.5 million pink salmon, from 2019 juveniles, vastly exceeded recent harvests.[264] The 2023 harvest was nearly 48 million fish and well over the preseason forecast of 19 million pinks.[265] There may have been exceptional marine conditions for pink salmon in 2023. [266] Runs

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[252] Halupka, K.C. 2000.

[253] Thynes, T. et al. 2021.

[254] Vulstek, S.C. & Russell, J.R. 2021. Marine survival index for pink salmon from Auke Creek, Southeast Alaska. In: Ferriss, B.E. & Zador, S. 2021. Ecosystem Status Report 2021: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, Anchorage, AK.

[255] *Id.*

[256] *Id.*

[257] *Id.*

[258] *Available at*: http://media.fisheries.noaa.gov/national/funding-and-financial-service/fishery-disaster-determinations; *available at*: https://www.adfg.alaska.gov/static/fishing/pdfs/commercial/2018_preliminary_salmon_summary_table.pdf.

[259] Bauman, M. "SE Alaska pink salmon forecast in weak range." *The Cordova Times*, December 3, 2019. *Available at*: https://www.thecordovatimes.com/2019/12/03/se-alaska-pink-salmon-forecast-in-weak-range/; *available at*: https://www.adfg.alaska.gov/static/fishing/pdfs/commercial/2020_preliminary_salmon_summary_table.pdf.

[260] *Id.*

[261] *Available at:* https://www.adfg.alaska.gov/static/fishing/pdfs/commercial/2019_preliminary_salmon_summary_table.pdf.

[262] Thynes, T. et al. 2021.

[263] Alaska Department of Fish and Game. 2020. NOAA Fisheries-Alaska Department of Fish and Game Southeast Alaska pink salmon harvest forecast. Advisory Announcement, November 18, 2020.

[264] Brenner, R. E., Donnellan, S.J. & Munro, A.R., eds. 2022. Run forecasts and harvest projections for 2022 Alaska salmon fisheries and review of the 2021 season. Alaska Department of Fish and Game, Special Publication No. 22-11, Anchorage, AK.

[265] Alaska Department of Fish and Game. 2023. 2024 NOAA Fisheries-Alaska Department of Fish and Game pink salmon forecast. November 17, 2023.

[266] *Id.*

were large throughout the species range, including Washington State, British Columbia and Russia with record returns in some areas. [267] Southeast Alaska returns were the third- highest escapement since 1960, meeting goals throughout the region.[268] Even-year harvests are also improving.[269] The 18.3-million-harvest in 2022 was the largest even-year harvest since 2014.[270] However, there were poor escapements in northern Southeast Alaska in 2022 and juvenile pink salmon sampled in 2023 were below average in physical condition, indicating continuing concern for recovery of these runs.[271]

Coho salmon

The assessments acknowledge that coho most frequently encounter habitat stressors from logging.[272] Coho spawn and rear in a variety of freshwater ecosystems for at least a year before migrating to the marine environment.[273] The availability of rearing habitat in small streams, ponds, lakes and off-channel areas is a key factor in the viability of coho populations and they are highly vulnerable to changes in freshwater habitat.[274] After rearing, coho typically spend 16 months in the marine environment before returning to Southeast Alaska's outer coast during the summer and entering streams to spawn in the fall.[275] Like many Alaska salmon species, coho sizes are diminishing and they are shortening their marine life cycle and spawning at younger ages.[276]

Southeast Alaska's cohos emanate from 4,000 streams, large transboundary mainland rivers and 13 hatcheries. [277] Mainland rivers provide over 3,000 miles of coho freshwater habitat.[278] Most of the 2,300 stocks are small populations of less than 1,000 spawners that utilize small to medium stream systems; they support 60 percent of the annual return.[279] The region's most abundant stocks are from larger mainland systems such as the Chilkat, Stikine and Taku Rivers and the Tsiu-Tsivat system, which provide over 3,000 miles of coho freshwater habitat.[280] North Prince of Wales Island has 1,904 stream-miles of coho habitat, making it the most important island ecosystem for cohos, followed by eastern Chichagof Island and Mitkof and Kupreanof Islands.[281]

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[267] *Id.*

[268] Alaska Department of Fish and Game. 2023. Escapement Summary.

[269] *Id.*

[270] *Id.*

[271] *Id.*

[272] Noesser, E., R. Cross & G. Risdahl. 2024.

[273] Halupka, K. 2000.

[274] *Id.*

[275] *Id.*

[276] Oke, K.B. et al. 2020. Recent declines in salmon body size impact ecosystems and fisheries. Nature Communications (2020) 11:4155

[277] Heinl, S.C. et al. 2021; Priest, J.T., Heinl, S.C. & Shaul, LD. 2021. Coho Salmon Stock Status in Southeast Alaska: A Review of Trends in Productivity, Harvest, and Abundance through 2019. Pacific Salmon Comm. Tech. Rep. No. 45: 67 p.

[278] Albert, D. & Schoen, J. 2007.

[279] Halupka, K. 2000; Hagerman, G., Vaughn, M. & Priest, J. 2021. Annual management report for the 2020 Southeast Alaska/Yakutat salmon troll fisheries. Alaska Department of Fish and Game, Fishery Management Report NO. 21-17, Anchorage, AK.

[280] Hagerman, G. et al. 2021; Albert, D. & Schoen, J. 2007.

[281] Albert, D. & Schoen, J. 2007.

Harvests have been lower in recent years, suggesting lower abundance. From 2011 to 2020 commercial fishermen harvested an annual average of 2.4 million cohos, but over the last four years (2020-2023) annual harvests averaged 1.4 million cohos.[282] 2020 returns were the poorest – four of the eight Southeast Alaska indicator coho salmon systems failed to meet escapement goals – the first time more than three systems failed.[283] Other stocks were at the lower end of escapement goal ranges.[284] Escapements improved in 2022 and 2023, with nearly all surveyed stocks meeting or exceeding goals.[285]

Alaska salmon fishery researchers have collected data on marine survival of Auke Creek coho since 1980.[286] Survival rates vary from five percent to nearly 50 percent, with an average survival rate of ~22 percent.[287] Key factors include migration timing, juvenile growth rates and marine environmental productivity – both in nearshore areas and in the ocean.[288] The 2020 marine survival rate of just over eight percent was the fourth-lowest on record, compounding an overall survival rate of under 10 percent over the last five years.[289]

Sockeye salmon

Sockeye salmon can utilize various freshwater habitat but most of Southeast Alaska's roughly 200 stocks spawn in systems that include lakes.[290] Juveniles typically spend one year rearing in lakes.[291] Juveniles typically leave freshwater systems in the late spring and spend two to three years in the marine environment before returning to spawn.[292]

The largest systems are on the mainland – the Alsek and Situk Rivers near Yakutat, the Chilkat River and Chilkoot Lake near Haines and the Taku and Stikine Rivers near Juneau and Wrangell,

[282] Conrad, S. & Thynes, T 2021;
https://www.adfg.alaska.gov/static/fishing/pdfs/commercial/2019_preliminary_salmon_summary_table.pdf,
https://www.adfg.alaska.gov/static/fishing/pdfs/commercial/2020_preliminary_salmon_summary_table.pdf,
https://www.adfg.alaska.gov/Static/fishing/pdfs/commercial/2021_preliminary_salmon_summary_table.pdf.

[283] https://www.adfg.alaska.gov/static/fishing/pdfs/commercial/2020_preliminary_salmon_summary_table.pdf;
https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/Southeast/meetings/120720_escapement_presentation.pdf.

[284] https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/Southeast/meetings/120720_escapement_presentation.pdf.

[285] Alaska Department of Fish and Game. 2023. 2023 Southeast Alaska escapements. *Available at:*
https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/Southeast/meetings/2023_Southeast_salmon_escapements.pdf

[286] Vulstek, S.C., Russell, J.R. & Yasumiishi, E.M. 2021. Marine survival index for coho salmon from Auke Creek, Southeast Alaska. In: Ferriss, B.E. & Zador, S. 2021. Ecosystem Status Report 2021: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, 1007 West Third Suite 400, Anchorage, AK.

[287] *Id.*

[288] *Id.*

[289] *Id.*

[290] Halupka, K.C. 2000.

[291] *Id.*

[292] *Id.*

respectively.[293] Prince of Wales Island provides the most sockeye habitat of any island ecosystem.[294] These larger systems support major drift gillnet fisheries and significant subsistence harvests.[295]

The Draft Subsistence Report cites sockeye as example of a healthy population because 9 of the 12 Sockeye Salmon stocks with escapement goals met or exceeded those goals in 2023. [296] In 2023, over 80 percent of the gillnet harvest came from Lynn Canal and Taku River systems and there were below average harvests in all southern systems.[297] This is not a new trend - since 2018 southern Southeast Alaska sockeye production has been mostly poor. [298] In contrast, most northern sockeye systems were productive.[299] One major difference between southern and northern sockeye productivity is that southern stocks spawn in areas like Prince of Wales Island where past and ongoing logging has occurred with much greater intensity.

One southern sockeye stock is an ADF&G designated stock of concern: McDonald Lake.[300] McDonald Lake, on the mainland roughly 40 miles north of Ketchikan, is one of the largest sockeye salmon systems in southern Southeast Alaska.[301] Average escapements exceeded 100,000 fish during the 1990s.[302] McDonald Lake sockeye supported the largest personal-use fishery in southern Southeast Alaska, with maximum harvests exceeding 10,000 fish.[303] The stock failed to meet its minimum

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[293] Thynes, T., Bednarski, J.A., Conrad, S.K., Dupuis, A.W., Harris, D.K., Meredith, B.L., Piston, A.W., Salomone, P.G. & Zeiser, N.L. 2021. Annual management report of the 2020 Southeast Alaska commercial purse seine and drift gillnet fisheries. Alaska Department of Fish and Game, Fishery Management Report No. 21-30, Anchorage, AK; Heinl, S.C. et al. 2021; Bednarski, J.A., Conrad, S.K., Dupuis, A.W., Harris, D.K., Meredith, B.L., Piston, A.W., Salomone, P.G. & Zeiser, N.L. 2022. Annual management report of the 2021 Southeast Alaska commercial purse seine and drift gillnet fisheries. Alaska Department of Fish and Game, Fishery Management Report No. 22-25.

[294] Albert, D. & Schoen, J. 2007. A conservation assessment for the coastal forests and mountains ecoregion of Southeast Alaska and the Tongass National Forest. In: Southeast Alaska Conservation Assessment, Ch. 2.

[295] Heinl, S.C. et al. 2021.

[296] Noesser, E., R. Cross & G. Risdahl. 2024.

[297] Vinzant, R. 2023. District 11 Drift Gillnet Fishery Taku Inlet, Stephens Passage and Port Snettisham 2023 Management Summary. *Available at:*

https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/Southeast/meetings/gillnet/2023_d15_gillnet_review.pdf; Zeiser, N. 2023. District 15 (Lynn Canal) Drift Gillnet Fishery 2023 Postseason Summary. *Available at:*

https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/Southeast/meetings/gillnet/2023_d11_gillnet_review.pdf; Brees, J. & W. Crittenden. 2023. Section 1-B Drift Gillnet Post Season Review. *Available at:* https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/Southeast/meetings/gillnet/2023_d15_gillnet_review.pdf; Salomone, P. 2023. Districts 6 and 8 Drift Gillnet Fisheries 2023 Postseason Report. *Available at:*

https://www.adfg.alaska.gov/static/fishing/PDFs/commercial/Southeast/meetings/gillnet/2023_d6and8_gillnet_review.pdf.

[298] Heinl, S.C., Jones III, E.L., Piston, A.W., Richards, P.J., Priest, J.T., Bednarski, J.A., Elliot, B.W., Miller, S.E., Brenner, R.E. & Nichols, J.V. 2021. Review of salmon escapement goals in Southeast Alaska. 2020. Alaska Department of Fish and Game, Fishery Manuscript Series No. 21-03, Anchorage, AK; Thynes, T. et al. 2021.

[299] Thynes, T. et al. 2021; Vinzant, R. 2023; Zeiser, N. 2023; Alaska Department of Fish and Game. 2023.

[300] Walker, S., Thynes, T., Gray, D., Reppert, K.S., Piston, A.W. & Heinl, S.C. 2018. McDonald Lake sockeye salmon stock status and action plan 2018. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 1J18-03.

[301] Walker, S. et al. 2018.

[302] *Id.*

[303] *Id.*

escapement goal of 55,000 sockeye salmon numerous times over the last two decades.[304] In 2023, the stock met its escapement goal for the first time since 2015.[305]

Salmon in double jeopardy: marine and freshwater environments

The warming and more volatile climate will change the environment in many ways that are harmful for salmon.[306] Alaska salmon benefit from largely intact freshwater ecosystems and habitat and population diversity that enable resiliency to natural and anthropogenic stressors.[307] However, climate change is accelerating habitat change more rapidly than any change they have adapted to in the past.[308] The recurring marine heatwaves 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.[309]

Salmon use a combination of freshwater, estuarine and marine habitats at different stages of their life cycle, exposing them to multiple climate-change threats.[310] Climate-change stressors include lower summer stream flows, higher winter stream flows and warmer water in both the marine and freshwater environment.[311] Water temperature is a major driver of salmon system productivity, influencing spawn timing, incubation, growth, distribution and abundance.[312] Each salmon stock is adapted to local conditions in a watershed, including temperature and stream flow patterns.[313] Climate change is altering those conditions through more extreme fall and winter storms, drought and warming stream temperatures.[314] These events, even if short in duration, can impact multiple life stages, increasing mortality for adults and eggs and lowering survival rates for rearing juveniles.[315]

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304 *Id.*

305 Alaska Department of Fish and Game. 2023. Escapement Summary

306 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.

307 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.

308 *Id.*

309 *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.

310 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.

311 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; Pitman, K.J. et al. 2021, *supra* n. 140.

312 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).

313 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.

314 Bellmore, J.R., Sergeant, C.J., Bellmore, R.A., Falke, J.A. & Fellman, J.B. 2022. 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.

315 *Id.*; Jones, L.A. et al. 2020.

Increased air temperatures and lower contributions of cooler water from glacial melt and snowmelt will make watersheds warmer over time.[316] Stream warming, summer droughts and changes in summer stream flow can reduce habitat suitability for spawning and survival.[317] Alaska's water quality standards for temperature are 59° F for migration routes and rearing areas, and 56° F for spawning areas and egg and fry incubation.[318] Stream temperatures in 2019 for many parts of Alaska far exceeded the 59° F threshold for migrating and rearing fish and the 56° F threshold for spawning fish, in some cases reaching 80° F.[319] A recent study confirmed that temperatures above 68° F are a lethal threshold for salmon.[320] In Staney Creek, a heavily-logged watershed near Klawock on Prince of Wales Island, summer stream temperatures exceeded lethal levels for three years between 2017 and 2019.[321] Even the glacially-fed Situk River near Yakutat exceeded temperature thresholds in 2019.[322]

There is some variability in how Southeast Alaska's salmon systems will respond to warming because of differences in elevation, terrain, lake coverage and the proportion of stream-flow-derived rainfall run-off or snowmelt.[323] Scientists studying regional streams and other Alaska watersheds are identifying characteristics that may help predict stream susceptibility .[324] Snow- and glacier-fed watersheds are less vulnerable to rising air temperatures and floods, and will be the most resilient.[325] Many of these systems occur in higher-than-average elevations with a higher proportion of snow and reduced flood risks.[326] Meltwaters maintain higher, cooler and more stable summer stream conditions, enabling upstream migrations in years when warm, drought conditions impede salmon spawning in rain-fed streams. [327] These cooler watersheds, though historically thought to be less productive, will be important future climate refugia.[328] Some have been too cool to reach high salmon productivity levels in the past buy may support more salmon as they warm.[329]

Roughly one-third of regional watersheds rely on rain and already have higher water temperatures, making them more prone to drought than snow- and glacier-fed systems.[330] Projected decreases in summer rain and snow droughts in winter may lower summer stream flows and increase

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[316] Bellmore, J.R. et al. 2022.

[317] 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.

[318] 18 AAC § 70.20(b)(10).

[319] Mauger, S. 2019. Wild salmon in a warming world. Powerpoint, 12th Annual Mat-Su Salmon Science and Conservation Symposium, November 13-14, 2019, Palmer, AK.

[320] *Id.* Jones, L.A. et al. 2020,.

[321] Alaska Coastal Rainforest Center. *Available at:* https://acrc.alaska.edu/projects/stream-dynamics/stream-temp-network.html.

[322] *Id.*

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

[324] *Id.*; Sergeant, C.J. et al. 2017.

[325] Bellmore, J.R. et al. 2022; Shanley, C.S. & Albert, D.M. 2014.

[326] Bellmore, J.R. et al. 2022; Winfree, M.M. et al. 2018.

[327] Bellmore, J.R. et al. 2022.

[328] Bellmore, J.R. et al. 2022.

[329] Pitman, K.J. et al. 2020,; Lader, R. et al. 2022.

[330] Bellmore, J.R. et al. 2022.

stream temperatures.[331] Rain-fed, low-elevation watersheds with higher lake coverage will be most vulnerable to higher summer air temperatures.[332] Warmer summer stream temperatures are likely because lakes have the most exposure to solar radiation and temperature.[333] Salmon in these systems will face impacts from both warmer summers (accompanied by drought conditions) and projected wetter winters with higher flooding risks.[334]

Warmer summertime waters are a significant stressor for salmon migrating upstream to spawn.[335] In many cases higher stream temperatures – or worse, streambed drying – can block migratory corridors and access to spawning habitat.[336] 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.[337] There was one significant mortality event that occurred when salmon moved into a slough that later dried up.[338] Southeast Alaska has a long history of pre-spawning mortality events in smaller watersheds, usually caused by low flows, warm temperatures and a high density of pink or chum salmon returning in the summer.[339] Often these events correlated with historical periods of drought.[340] Smaller watersheds and small streams utilized by salmon are prevalent in the region and are most vulnerable to pre-spawning die-offs.[341] These events may become more frequent and widespread as the climate continues to warm.[342]

Some scientists suspect that extreme precipitation or flooding events in fall and winter may be more impactful than rising summer stream temperatures.[343] Fall and winter storms are likely to occur more often, especially fall atmospheric rivers that impact freshwater habitat quality and quantity. [344] These intensifying precipitation events will occur when salmon eggs are incubating.[345] 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.[346] The impacts of these floods can be even worse when heavy rains fall on top of existing snowpack.[347]

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[331] Sergeant, C.J. et al. 2017.

[332] Winfree, M.M. et al. 2018, Bellmore, J.R. et al. 2022.

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

[334] Bellmore, J.R. et al. 2022.

[335] Littell, J.S. et al. 2020.

[336] *Id.*; Jones, L.A. et al. 2020; Bellmore, J.R et al. 2022.

[337] Hoell, A., Thoman, R., McFarland, H.R. & Parker, B. 2022. Southeast Alaska drought [report]. International Arctic Research Center, University of Alaska, Fairbanks, Fairbanks, AK.

[338] *Id.*; Bellmore, J.R. et al. 2022.

[339] 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.

[340] Bellmore, J.R. et al. 2022.

[341] Halupka, K.C. 2000.

[342] Bryant, M.D. 2009. Global climate change and potential effects on Pacific salmonids in freshwater ecosystems of Alaska. *Climate Change,* 95, pp.169-193.

[343] *Id.* Bellmore, J.R. et al. 2022.

[344] *Id.*

[345] Bryant, M.D. 2009; Shanley, C.S. & Albert, D.M. 2014. Climate change sensitivity index for Pacific salmon habitat in Southeast Alaska. *PloS ONE*, *9*(8), p.e104799; 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.

[346] *Id.*

[347] Bellmore, J.R. et al. 2022.

An increased occurrence of high stream flows and floods in wintertime, especially during storms, is likely to result in more frequent streambed scouring, at a time when salmon eggs are in the gravel. [348] Stream bed scouring reduces egg-to-fry survival and increases fine sediment levels.[349] A related risk from these weather conditions is salmon egg mortality from landslide scour.[350] Recent research from southcentral Alaska concluded that extreme precipitation events during fall spawning and early winter incubation periods had an even greater negative impact on salmon productivity across multiple populations than summer stream warming.[351] Loss of coho spawning habitat may be significant in steeper stream reaches because confining banks or terrain make it susceptible to streambed scour during high flows.[352] The anticipated increase in high- flow events may eliminate as much as 10 percent of coho spawning habitat over the next two decades.[353]

The loss of a buffering effect of snowpack on maximum stream temperatures is a significant factor in life cycle timing as well.[354] When less winter precipitation falls as snow, streams will be warmer at multiple stages of the salmon life cycle.[355] Spring stream flows will be lower in spring and occur at different times, changing migration timing for both juveniles moving downstream and adults returning upstream.[356] Warmer winter stream temperatures are also altering the timing of life cycle events by accelerating egg incubation rates and emergence timing.[357]

These changes can cause mismatches in migration even under optimal habitat conditions. In Auke Creek near Juneau, a low-elevation watershed, the long-term rise in water temperatures during incubation has caused pink salmon fry to enter the marine environment earlier.[358] The earlier fry migration in turn caused earlier returns by adult spawners.[359] Auke Creek could become unsuitable habitat for pink salmon in the long-term because this early return, when occurring during high summer stream temperatures will increase pre-spawning mortality.[360] This same dynamic is occurring in Bristol Bay, where sockeye are leaving warmer freshwater lakes earlier.[361] This earlier migration is also increasing the proportion of sockeye that spend one year instead of two in freshwater.[362]
Changing migration patterns are a significant factor in declining salmon body sizes because fish are returning to reproduce at a younger age than in the past.[363] Most of the body size declines are recent –

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[348] *Id.*; Littell, J.S. et al. 2020.

[349] *Id.*

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

[351] Jones, L.A. et al. 2020.

[352] Sloat, M.R. et al. 2017.

[353] *Id.*

[354] Littell, J.S. et al. 2020, *supra* n. 20.

[355] *Id.*

[356] *Id.*

[357] 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.

[358] *Id.*

[359] *Id.*

[360] *Id.*

[361] Cline, T.J. et al. 2019.

[362] *Id.*

[363] Lewis, B., Grant, W.S., Brenner, R.E. & Hamazaki, T. 2015. Changes in size and age of chinook salmon returning to Alaska. *PLoS ONE* 10(6): e0130184; Oke, K.B., Cunningham, C.J., Westley, P.A.H., Baskett, M.L., Carlson, S.M., Clark, J., Hendry, A.P.,

sockeye, chum and coho all showed abrupt declines in body size starting in 2000 and intensifying after 2010.[364]

IV. The Assessments should provide additional discussion about industrial scale logging impacts to deer

Many Tongass wildlife populations require an interconnected old-growth forest ecosystem.[365] But industrial-scale logging has disproportionately impacted the most productive and contiguous old-growth forests, forcing many wildlife populations to instead persist with less resilience in isolated old-growth patches scattered within broader landscapes consisting of unproductive second-growth forests.[366] The current landscape of expansive clearcuts and old-growth forest that is less abundant and diverse can no longer reliably support high levels of old-growth-dependent wildlife over future decades.[367] Biologists fear that isolated, old-growth-dependent wildlife populations may face irreversible consequences as habitat loss and fragmentation and associated decreases in connectivity between patches of suitable habitat isolate populations, increasing risks of inbreeding, local extirpations or extinctions.[368]

Southeast Alaska has retained most of its historical large mammal (megafauna) populations whose abundance is important for healthy ecosystem function, as well as for providing other benefits to local communities and visitors.[369] Most of world's remaining intact megafauna populations live in intact landscapes.[370] Sitka black-tailed deer are the region's primary herbivore and an important species because of their well-studied need for large home ranges, dependence on old-growth forests and multiple habitats, and as a critical source of protein for game and subsistence hunters – and black bears and wolves.[371] They are a subspecies of mule deer adapted to wet coastal rainforests in Southeast Alaska and north coastal British Columbia.[372] They are present on nearly every island in the Alexander Archipelago.[373] Deep snow keeps the number of deer on the mainland lower than on adjacent islands that generally accumulate lower snowpack.[374]

Karatayev, V.A., Kendall, N.W., Kibele, J. & Kindsvater, H.K. 2020. Recent declines in salmon body size impact ecosystems and fisheries. *Nature Communications*, *11*(1), p.4155.

[364] Oke, K.B. et al. 2020.

[365] Smith, W.P., & Flaherty, E.A., 2023. Wildlife studies on the Tongass National Forest challenge essential assumptions of its wildlife conservation strategy. *The Journal of Wildlife Management*, p.e22450.

[366] *Id.*

[367] *Id.*

[368] *Id.*

[369] Vynne, C., Gosling, J., Maney, C., Dinerstein, E., Lee, A.T., Burgess, N.D., Fernández, N., Fernando, S., Jhala, H., Jhala, Y., & Noss, R.F. 2022. An ecoregion-based approach to restoring the world's intact large mammal assemblages. *Ecography*, *2022*(4).

[370] *Id.*

[371] Schoen, J. & Kirchhoff, M. 2016. Sitka black-tailed deer. In: Smith, M.A. ed. 2016. *Ecological Atlas of Southeast Alaska*. Audubon Alaska, Anchorage, AK; Gilbert, S.L., Hundertmark, K.J., Person, D.K., Lindberg, M.S. & Boyce, M.S. 2017. Behavioral plasticity in a variable environment: snow depth and habitat interactions drive deer movement in winter. *Journal of Mammalogy*, *98*(1), pp.246-259.

[372] Hayward, G. H., Colt, S., McTeague, M.L. and Hollingsworth, T.N., eds. 2017**.** Climate change vulnerability assessment for the Chugach National Forest and the Kenai Peninsula. Gen. Tech. Rep. PNW-GTR-950. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 340 p.

[373] *Id.*; Schoen, J. & Kirchhoff, M. 2016.

[374] Hayward, G. H. et al. eds. 2017.

The current Forest Plan designates large portions of the region's old-growth forest for timber production or in other land use designations that allow for logging and timber road construction.[375] Past logging, concentrated on Southeast Alaska's southernmost islands, disproportionately removed the largest old-growth trees.[376] Industrial-scale logging, past and present, has changed ecological conditions for deer. Deer are the most heavily hunted large mammal in Southeast Alaska and are highly valued for food.[377]

Most ALFA members reside in Southeast Alaska communities which, as acknowledged in the Socioeconomic Assessment, rely on hunting, fishing, and gathering to provide food and offset the high cost of living in the region.[378] In particular, Sitka black-tailed deer are among the most important food sources for our members and have nutritional, cultural and recreational value for residents of communities throughout the region.[379] Average annual harvests once exceeded 12,000 deer and provide nearly one-quarter of the region's subsistence food harvests.[380] A typical rural resident may consume 40 pounds of venison each year.[381]

Figure 6 in the Subsistence and Non-Commercial Harvest Draft Resource Assessment illustrates deer harvest trends by Game Management Unit. Currently, Game Management Unit 4 provides over half the region's deer harvest (over 4,000 deer) while Game Management Units 1, 2 and provide less than half the harvest, and show a significant diminishing trend for Game Management Unit 2, with harvests dropping by more than half over the past decade.[382] The Draft Assessment suggests that the declining harvests may not necessarily reflect declining populations but acknowledges that intensive clearcutting on Prince of Wales Island "is an often-cited factor responsible for reduced deer numbers observed by residents over the past decades."[383] Deer populations and harvests are also low and trending downward in Game Management Units 1 and 3. There has been substantial highgrading of old-growth forests in these areas as well – timber companies disproportionately removed the very largest and most ecologically important old-growth stands. ALFA requests that the final assessments provide additional discussion about logging impacts to deer, particularly the concept of "succession debt."

Severe winter weather is a primary cause of deer mortality, causing malnutrition, disease and higher predation and thus drives fluctuations in abundance.[384] Deer depend on old-growth forests that

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[375] Turner, R. Cross & A. Mallott. 2024. Draft Terrestrial Ecosystems Resource Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

[376] *Id.*

[377] Southeast Alaska Subsistence Regional Advisory Council. 2017. Meeting materials October 31 – November 2, 2017; Bethune, S. 2015. Unit 2 deer. Chapter 4, pages 4-1 through 4-15 [In] P. Harper and L.A. McCarthy, editors. Deer management report of survey and inventory activities 1 July 2012-30 June 2014. Alaska Department of Fish and Game. Species Management Report ADF&G/DWC/SMR-2015-3, Juneau, AK.

[378] Doyon, T. 2024. Socioeconomic Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

[379] Brinkman, T.J., Chapin, T., Kofinas, G. & Person, D.K. 2009. Linking hunter knowledge with forest change to understand changing deer harvest opportunities in intensively logged landscapes. *Ecology and Society 14*(1):36.

[380] Schoen, J. & Kirchhoff, M. 2016*;* Farmer, C.J., Person, D.K. & Bowyer, R.T. 2006. Risk factors and mortality of black-tailed deer in a managed forest landscape. *The Journal of Wildlife Management*, *70*(5), pp.1403-1415.

[381] Alaska Division of Forestry. 2020. 2020 Alaska forest action plan.

[382] Noesser, E., R. Cross & G. Risdahl. 2024. Subsistence and Non-Commercial Harvest Draft Resource Assessment.

[383] *Id.*

[384] Person, D.K. & Brinkman, T.J. 2013. Succession debt and roads: Short-and long-term effects of timber harvest on a large mammal predator prey community in Southeast Alaska. Pages 143-167 [In] Orians, G.H. & Schoen, J.W., eds. *North Pacific Temperate Rainforests: Ecology & Conservation*, Audubon Alaska, Anchorage, AK; Gilbert, S.L. et al. 2020, *supra* n. 590.

have overwinter forage and intercept snowfall, making food available during periods of deep snow.[385] During severe snowfall, deer gather in low elevation old-growth forests or on beaches.[386] Deer densities on winter ranges can exceed 60 deer per square mile.[387] Because of this ecological function, large blocks of intact, low-elevation, old-growth forest are essential to maintaining healthy populations.[388]

Industrial-scale logging reduces the ability of deer to withstand severe winters.[389] Young clearcuts provide abundant forage during snow-free periods, but within several decades the newly growing forests shade out understory plants used by foraging deer.[390] This creates large areas of unsuitable, sterile habitat causing long-term decline in a deer population's density.[391] Declines are periodically caused by a winter of severe weather or several in succession, particularly in central Southeast Alaska.[392] These losses are intensified when logging has reduced winter habitat capability or has disrupted predator-prey dynamics giving wolves and bears a heightened advantage.[393] Population recovery has been slower than anticipated in that central area – taking several decades, likely because of the predators' advantage.[394]

Industrial-scale, old-growth logging sets off a succession of harmful habitat changes that worsen for decades. The new, second-growth forest area changes character decade by decade while regrowing.[395] Roughly 25 years after clearcutting, a "stem exclusion" stage of forest succession begins when the forest canopy closes, creating unsuitable habitat for many old-growth-associated wildlife species, including deer.[396] Low forage conditions last 100 to 150 years, a prolonged debt that can be repaid only by nature's work in returning to an old-growth condition (if given the chance) through successional changes in the growing forest's structure.[397] Deer populations likely will decline because of the poor quality of forage in the extensive amount of second-growth forest, a debt in natural capital incurred by logging as far back as a half century or more ago.[398]

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[385] Bethune, S. 2015. Unit 2 deer. Chapter 4, pages 4-1 through 4-15 in P. Harper & L.A. McCarthy, eds. Deer management report of survey and inventory activities 1 July 2012-30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-3, Juneau, AK.

[386] Hayward, G. H. et al. eds. 2017.

[387] Hanley, T.A. 1984. Relationships between Sitka black-tailed deer and their habitat (Vol. 168). US Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.

[388] *Id.*; Person, D.K. & Brinkman, T.J. 2013.

[389] Gilbert, S.L. et al. 2017.

[390] Lowell, R.E. 2015. Unit 3 deer. Chapter 5, pages 5-1 through 5-16 in P. Harper & L.A. McCarthy, editors. Deer management report of survey and inventory activities 1 July 2012-30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-3.

[391] Brinkman, T.J. et al. 2009.

[392] *Id.*

[393] Lowell, R.E. 2015, *supra* n. 616.

[394] *Id.*

[395] Farmer, C.J., Person, D.K., & Bowyer, R.T. 2006. Risk factors and mortality of black-tailed deer in a managed forest landscape. *The Journal of Wildlife Management*, *70*(5), pp.1403-1415; Schoen, J. and Kirchhoff, M. 2007. Sitka black-tailed deer. Ch. 6.1 in: J.W. Schoen & E. Dovichin, eds. The coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest: a conservation assessment and resource synthesis; Lowell, R.E. 2015. Unit 3 deer.

[396] *See, e.g.* Bethune, S. 201.

[397] Person, D.K. & Brinkman, T.J. 2013. Succession debt and roads: Short-and long-term effects of timber harvest on a large mammal predator prey community in Southeast Alaska. Pages 143-167 [In] G.H. Orians & J.W. Schoen, eds. *North Pacific Temperate Rainforests: Ecology & Conservation*. Audubon Alaska, Anchorage, AK.

[398] *Id.*

Losses in habitat quality and quantity caused by clearcut logging, combined with severe winter weather and predation by wolves and bears, are the main threats to Sitka black-tailed deer.[399] The disproportionate logging of low-elevation, productive old-growth forest – essential winter habitat for deer – worsens the impacts of severe winters, particularly in areas where deer are prey for wolves or bears.[400] In areas with substantial wolf or bear predation, a sharp decline from one or more severe winters can cause a "predator pit," from which it can take many decades for a deer population to recover.[401]

Climate change effects on deer and deer habitat are unknown.[402] Warmer winters will not necessarily diminish the importance of winter habitat. Risks of severe snowfall associated with expected increases in precipitation and extreme storms may exacerbate risks to deer as a warming climate makes weather more chaotic.[403] Sitka black-tailed deer populations likely will decline regardless of winter weather.[404] The quantity and quality of habitat and forage in second-growth forests is lower than in old-growth forests.[405] Vulnerability to predators and hunters is higher because of road access and loss of protective shelter previously offered by old-growth forests.[406]

Long-term deer carrying capacity in some portions of Baranof and Chichagof Islands is reduced because of past clearcutting.[407] Admiralty, Baranof and Chichagof Islands have large, protected wilderness areas and less predation (there are no wolves or black bears) so that deer have been able to recover from population declines caused by recent severe winters.[408] The three islands now produce over one-third of the statewide deer harvest.[409]

Impacts to deer are worse in the southern portions of the Alexander Archipelago.[410] A severe deer population decline has occurred on central Tongass islands, where most of the logging occurred on low-elevation, south-facing slopes favored by deer.[411] One-half of all the large-tree, old-growth forest from Kupreanof and Mitkof Islands and nearly one-quarter of the prime winter deer habitat is gone.[412] Deer numbers are extremely low on Kuiu, Kupreanof and Mitkof Islands and have been since a series of harsh

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[399] Farmer, C.J., Person, D.K., & Bowyer, R.T. 2006.

[400] *Id.;* Brinkman, T.J., Chapin, T., Kofinas, G., & Person, D.K. 2009. Linking hunter knowledge with forest change to understand changing deer harvest opportunities in intensively logged landscapes. *Ecology and Society* 14(1):36; Person, D.K. et al. 1996. The Alexander Archipelago Wolf: A conservation assessment. Gen. Tech. Rpt. PNW-GTR-384, November 1996. Pacific Northwest Research Station, U.S. Forest Service; Gilbert, S.L. et al. 2022, *supra* n. 39.

[401] Lowell, R.E. 2015.

[402] Bethune, S. 2015.

[403] Person, D.K. & Brinkman, T.J. 2013.

[404] *Id*; Farmer, C.J., Person, D.K., & Bowyer, R.T. 2006.

[405] *Id.;* Gilbert, S.L. et al. 2022.

[406] *Id.*

[407] Bethune, S. 2020. Sitka black-tailed deer management report and plan. Game Management Unit 4: Report period 1 July 2011-30 June 2016, and plan period 1 July 2016-30 June 2021. Alaska Department of Fish and Game, Species Management Report and Plan ADF&G.DWC.SMR&P-2020-5, Juneau, AK.

[408] *Id.*

[409] *Id.*

[410] Gilbert, S.L. et al. 2022.

[411] Lowell, R.E. 2015; Albert, D. & Schoen, J. 2007.

[412] *Id.*

winters in the 1970s.[413] Record-setting snowfalls in the winters of 2006-2007 and 2007-2008 resulted in further declines.[414] Other central Southeast Alaska islands such as Etolin and Zarembo (near Wrangell) have lost over 20 percent of their historical deer habitat capability due to logging.[415] The extensive habitat loss forced deer to concentrate in smaller old-growth stands during deep snow winters with less forage and more exposure to predation by wolves.[416] Extensive clearcutting of Revilla and Gravina Islands and the Cleveland Peninsula has similarly reduced deer habitat in the Ketchikan area.[417] These changes have reduced hunting opportunities.[418]

Biologists expect the Prince of Wales Island deer population to decline because of habitat loss caused by logging. [419] The substantial and disproportionate 40 percent loss of large-tree forest to logging on northern Prince of Wales Island contributes to the loss of one-half of the winter deer habitat to date.[420] Recent federal timber sales targeted most of the last remaining stands of high-quality winter deer habitat and deer travel corridors in the north and central parts of the island.[421]

The decline in deer carrying capacity has long-term consequences in terms of reductions in deer hunting opportunity and inability to meet hunter demand and subsistence needs.[422] Prince of Wales Island once produced nearly one-quarter of the statewide deer harvest and is the second most important provider of deer in the region.[423] The island's deer support a substantial and increasing hunting effort – Prince of Wales Island residents, hunters from other Southeast Alaska communities and non-resident hunters harvest as many as 3,600 deer each year. [424] The increased hunting pressure concerns subsistence hunters who are having increasing difficulty harvesting deer on the island.[425] The Alaska Department of Fish and Game has concerns about the cumulative adverse effects of past, ongoing and future industrial-scale clearcutting on future deer dividends:

> We should better inform the public regarding the effects of logging on deer populations, so they are aware of trade-offs between timber harvest and wildlife. We anticipate that logging related reductions in important winter habitat will reduce deer carrying capacity for

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[413] Schoen, J. & Kirchhoff, M. 2007; Lowell, R.E. 2015; ADFG. 2018. Annual report to the Alaska Board of Game on Intensive Management for Sitka black-tailed deer with wolf predation control in Portions of Unit 3, Prepared by the Division of Wildlife Conservation, February 2018.

[414] Lowell, R.E. 2021. Deer management report and plan. Game Management Unit 3: Report period 1 July 2011-30 June 2016 and plan period 1 July 2016-30 June 2021. Alaska Department of Fish and Game. Species Management Report and Plan ADF&G/DWC/SMR&P-2021-19, Juneau, AK.

[415] Albert, D. & Schoen, J. 2007.

[416] Lowell, R.E. 2021.

[417] Dorendorf, R. 2020.

[418] Lowell, R.E. 2021.

[419] Hasbrouck, T.R. 2020.

[420] Albert, D. & Schoen, J. 2007; Brinkman, T.J. et al. 2009; Bethune, S. 2015.

[421] Hasbrouck, T.R. 2020a.

[422] Schoen, J. & Kirchhoff, M. 2007; Brinkman, T.J. et al. 2009.

[423] Person, D.K. & T.J. Brinkman. 2013.

[424] Brinkman, T.J. et al. 2009; Bethune, S. 2015.

[425] Hasbrouck, T.R. 2020a; Southeast Alaska Subsistence Regional Advisory Council. 2017. Meeting materials October 31 – November 2, 2017; Bethune, S. 2015.

decades to come. The long-term consequences of habitat loss include loss of hunting opportunity and the inability to provide for subsistence needs of rural residents.[426]

V. Protect Forests for Carbon Sequestration

The draft carbon stocks assessment recognizes that Tongass carbon stocks are of national significance.[427] There was a net increase in forested area between 2005 and 2023, increasing both the overall carbon stocks and the carbon density per acre.[428] The assessment acknowledges that carbon stocks would have been higher under a no-logging scenario.[429] A final assessment would benefit from a more thorough discussion of how logging reduces the carbon sequestration potential of the Tongass, including a discussion of losses through soil disturbance.

Land use change, including logging and other causes of forest loss, accounts for nearly one-quarter of anthropogenic greenhouse gas emissions.[430] Industrial logging is one of the major drivers of global forest and biodiversity loss and undermines one of the most cost-effective climate change mitigation strategies – the conservation of green carbon.[431] Globally, forest loss and degradation cause more climate-harming emissions than the entire transportation network.[432]

Protecting forests is one of the most cost-effective ways to mitigate climate change; that is, reduce CO_2 emissions.[433] Terrestrial ecosystems, primarily forests, have been removing almost one-third of CO_2 emissions caused by human activities for six decades.[434] Some of the stored carbon returns to the atmosphere through soil respiration, fires and decomposition. [435] Forests store accumulated carbon in five different pools: aboveground biomass (leaves, trunks, limbs and brush), below ground biomass

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[426] Bethune, S. 2015.

[427] Ontl, T. & S. Rebain. 2024. Draft Carbon Stocks Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

[428] Ontl, T. & S. Rebain. 2024. Draft Carbon Stocks Assessment.

[429] Ontl, T. & S. Rebain. 2024. Draft Carbon Stocks Assessment.

[430] Arneth, A., Denton, F., Agus, F., Elbehri, A., Erb, K., Osman Elasha, B., Rahimi, M., Rounsevell, M., Spence, A., & Valentini, R. 2019: Framing and Context. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [Shukla, P.R., Skea, J., Calvo Buendia, E., Masson-Delmotte, V., Pörtner, H.-O., Roberts, D.C., Zhai, P., Slade, R., Connors, S., van Diemen, R., Ferrat, M., Haughey, E., Luz, S. Neogi, S., Pathak, M., Petzold, J., Portugal Pereira, J. Vyas, P., Huntley, E., Kissick, K., Belkacemi, M., Malley, J. (eds.)]. In press.

[431] Griscom, B.W., Adams, J., Ellis, P.W., Houghton, R.A., Lomax, G., Miteva, D.A., Schlesinger, W.H., Shoch, D., Siikamäki, J.V., Smith, P. & Woodbury, P. 2017. Natural climate solutions. *Proceedings of the National Academy of Sciences*, *114*(44), pp.11645-11650.

[432] Houghton, R.A. & A.A. Nassikas. 2018. Negative emissions from stopping deforestation and forest degradation, globally. *Glob. Change Biol. 24*: 350-359.

[433] Vynne, C. et al. 2021.

[434] *Id.;* 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*(6), p.e2023AV000965.

[435] Hoover, K. & Riddle, A.A. 2020. Forest Carbon Primer. Congressional Research Service Report R46312 prepared for members and committees of Congress. Updated May 2020. *Available at*: https://crsreports.congress.gov.

(roots), deadwood, detritus (fallen leaves, stems) and soils.[436] In general, forests store over 50 percent of the carbon in soils and over 25 percent in aboveground biomass.[437]

U.S. forests are a net carbon sink and currently offset between 11 and 13 percent of the greenhouse gas emissions released from the U.S. into the atmosphere.[438] Existing older and maturing second growth forests in the U.S. – most of them publicly-owned – could sequester 120 gigatons of carbon by 2100, offsetting over a decade's worth of global CO_2 emissions.[439] Whether a forest is a sink or a source depends on the degree of disturbances such as logging or wildfires.[440]

While most northern hemisphere forests have been carbon sinks in recent decades, wildfires are becoming an increasing source of emissions.[441] For example, wildfires, combined with other disturbances such as logging and insect infestations have transformed British Columbia's interior forests into carbon sources.[442] Southeast Alaska forests are more likely to remain a carbon sink if conserved than other U.S. forests, which will become drier and experience larger maximum temperatures over the next century, increasing wildfire vulnerability.[443] Thus, while climate change is likely to increase the frequency and severity of disturbances (wind, landslides, fire) to regional forests, the cooler wetter conditions will make them relatively stable compared to other U.S. forests.[444]

Cutting down old-growth forests releases one-half of the forest carbon as CO_2 into the atmosphere and losses can continue for years as logs and snags left after harvest decompose.[445] It takes centuries for regrowing trees to compensate for these losses.[446] Logging is the primary cause of CO_2 emissions from U.S. forests, releasing over 700 million tons of CO_2 into the atmosphere – equivalent to burning more than 3.7 billion pounds of coal.[447] Because of the sequestration capacity of forests and the impacts of logging, reducing emissions from forest degradation is as urgent as halting fossil fuel use.[448]

Southeast Alaska's forest is one of just four remaining relatively intact temperate rainforests in

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436 *Id.;* McNicol, G., Bulmer, C., D'Amore, D., Sanborn, P., Saunders, S., Giesbrecht, I., Arriola, S.G., Bidlack, A., Butman, D. & Buma, B., 2019. Large, climate-sensitive soil carbon stocks mapped with pedology-informed machine learning in the North Pacific coastal temperate rainforest. *Environmental Research Letters*, 14(1), p.014004.

437 Hoover, K. & Riddle, A.A. 2020.

438 *Id.*; Moomaw, W.R., Masino, S.A. & Faison, E.K. 2019. Intact forests in the United States: Proforestation mitigates climate change and serves the greatest good. *Frontiers in Forests and Global Change*, *2*, p.27; Domke, G. M., Walters, B.F., Giebink, C.L., Greenfield, E.J., Smith, J.E., Nichols, M.C., Knott, J.A., Ogle, S.M., Coulston, J.W. & Steller, J. 2023. Greenhouse gas emissions and removals from forest land, woodlands, urban trees, and harvested wood products in the United States, 1990-2021. Resour. Bull. WO-101. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office. 10 p.

439 Moomaw, W.R., Masino, S.A. & Faison, E.K. 2019.

440 *Id.*

441 Giles-Hansen, K. & Wei, X. 2022. Cumulative disturbance converts regional forests into a substantial carbon source. *Environmental Research Letters*, *17*(4), p.044049; Domke, G. M. et al. 2023, *supra* n. 54.

442 Giles-Hansen, K. & Wei, X. 2022.

443 Law, B.E. et al. 2023.

444 *Id.*

445 Hudiburg, T.H. 2019. Meeting GHG reduction targets requires accounting for all forest sector emissions. Environ. Res. Lett. 14 095005; Barrett, T.M. 2014. Storage and flux of carbon in live trees, snags and logs in the Chugach and Tongass National Forests. USDA Forest Service, Pacific Northwest Research Station. Gen. Tech. Rpt. PNW-GTR-889. Portland, OR. January 2014.

446 Moomaw, W.R., Law, B.E., & Goetz, S.J. 2020. Focus on the role of forests and soils in meeting climate change meeting goals: summary. *Environ. Res. Lett.*, 15, 054009.

447 *Id.*; Moomaw, W.R. et al. 2019.

448 Artaxo, P. et al. 2018. Scientists Statement: Five Reasons the earth's climate depends on forests. *Available at:* https://www.climateandlandusealliance.org/scientists-statement/.

the world, making it globally-significant and irreplaceable for their carbon stores and biodiversity.[449] The Tongass National Forest is essential to climate change mitigation both because of its size and its large remaining area of intact forest – even after substantial forest loss caused by extensive industrial logging during the latter half of the 20th century.[450] The Tongass holds more biomass per acre than any other rainforest in the world and stores more carbon than any other national forest in the United States.[451] Its carbon stores amount to 20 percent of total carbon for the entire national forest system and are irreplaceable as a carbon sink.[452] Total live and dead tree carbon storage capacity is roughly twice as high as other U.S. forests.[453] Live trees in the old-growth remove 2,800 pounds of atmospheric CO_2 per acre per year.[454] The aboveground biomass (live trees, snags and logs) alone amounts to an estimated 650 million tons of carbon, equivalent to 2.4 billion tons of CO_2.[455] Adding in the carbon stored in soils, the Tongass National Forest stores a total of 2.7 billion metric tons of carbon.[456]

Old-growth forests are a primary driver of the carbon storage capacity, continuing to accrue biomass and carbon at high rates.[457] Trees accumulate carbon continuously so that the largest, oldest trees and oldest forests store a disproportionate amount of carbon over time.[458] The largest one percent of old-growth trees may store between 40 and 50 percent of the forest stand level above ground carbon.[459] At the stand level, old-growth forests store 35 to 70 percent more carbon, including in the soils, compared to logged stands.[460]

The carbon sequestration potential is less than optimal because ongoing logging of old-growth

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[449] DellaSala, D.A., Moola, F., Alaback, P., Paquet, P.C., Schoen, J.W. & Noss, R.F. 2011. Temperate and boreal rainforests of the Pacific Coast of North America. In *Temperate and boreal rainforests of the world: ecology and conservation* (pp. 42-81). Island Press, Washington, DC.

[450] Law, B. E. et al. 2023, *supra* n. 50.

[451] U.S. Dept. of Agriculture. Special Areas, Roadless Area Conservation; National Forest System Lands in Alaska. Final Rule. [88 Fed. Reg. 5255.] Friday, January 27, 2023.

[452] DellaSala, D.A. et al. 2022, *supra* n. 9; Buma, B. & Thompson, T. 2019. Long-term exposure to more frequent disturbances increases baseline carbon in some ecosystems: Mapping and quantifying the disturbance frequency-ecosystem C relationship. *PLoS One*, *14*(2), p.e0212526.

[453] Zhou, X., Schroder, S.A., McGuire, A.D. & Zhu, Z. Forest inventory-based analysis and projections of forest carbon stocks and changes in Alaska Coastal Forest. Ch. 5 in: Zhu, Zhiliang & McGuire, eds. 2016. Baseline and projected future carbon storage and greenhouse-gas fluxes in ecosystems of Alaska: U.S. Geological Survey Professional Paper 1826, 196 p.; U.S. Dept. of Agriculture. Special Areas, Roadless Area Conservation; National Forest System Lands in Alaska. Notice of proposed rulemaking, request for comment. 86 Fed. Reg. at 66,498, 66,499 (Tuesday, November 23, 2021).

[454] Barrett, T.M. 2014.

[455] *Id.*

[456] DellaSala, D.A. et al. 2022.

[457] Buma, B. & Barrett, T.M. 2015. Spatial and topographic trends in forest expansion and biomass change, from regional to local scales. *Global change biology*, *21*(9), pp.3445-3454.

[458] Moomaw, W.R. et al. 2020; U.S. Forest Service. 2020. Forestry as a Natural Climate Solution: The positive outcomes of negative carbon emissions. Science Findings 225/March 2020. Pacific Northwest Research Station, Portland, OR; Stephenson, N.L., Das, A.J., Condit, R., Russo, S.E., Baker, P.J., Beckman, N.G., Coomes, D.A., Lines, E.R., Morris, W.K., Rüger, N. and Alvarez, E. 2014. Rate of tree carbon accumulation increases continuously with tree size. *Nature*, *507*(7490), pp.90-93.

[459] Lutz, J.A., Furniss, T.J., Johnson, D.J., Davies, S.J., Allen, D., Alonso, A., Anderson-Teixeira, K.J., Andrade, A., Baltzer, J., Becker, K.M. & Blomdahl, E.M. 2018. Global importance of large-diameter trees. *Global Ecology and Biogeography*, *27*(7), pp.849-864; Moomaw, W.R. et al. 2020, *supra* n. 62; DellaSala, D.A., Mackey, B., Norman, P., Campbell, C., Comer, P.J., Kormos, C.F., Keith, H. & Rogers, B. 2022. Mature and old-growth forests contribute to large-scale conservation targets in the conterminous United States. *Frontiers in Forests and Global Change*, *5*, p.979528.

[460] DellaSala, D.A. et al. 2022.

and maturing forests undercuts sequestration by returning stored carbon to the atmosphere.[461] The Tongass National Forest is the only national forest subjected to substantial amounts old-growth logging in recent decades.[462] Logging has offset sequestration gains by aboveground biomass because of the substantial amount of CO_2 lost to the atmosphere.[463] Researchers estimate that logging in the Tongass National Forest from 1909 through 2021 caused over 69 million metric tons of CO_2 emissions.[464] The social cost of this carbon loss could exceed five billion dollars using the recent U.S. estimated social cost at the recommended discount rate of $76 per ton.[465] Recent research indicates the social cost of carbon emissions may be much higher, with median costs exceeding $400 per ton.[466]

Past logging has created roughly 450,000 acres of previously clearcut forests on federal land in Southeast Alaska that are now regenerating (not counting a nearly equal amount on non-federal lands).[467] The Forest Service plans to clearcut significant portions of these recovering forests.[468] Many of these forests are "middle-aged," between 50 and 100 years old.[469] These forests sequester carbon quickly and are "carbon hotspots."[470] There is also a significant number of stands that are 30 to 50 years old and approaching ages where they could similarly increase live tree carbon storage.[471]

There is wide recognition that preserving these forests would increase sequestration rates, by avoiding the simultaneous CO_2 emissions caused by logging and the consequent loss of future carbon storage capacity.[472] Proforestation (allowing forests to continue to grow) is the most rapid means to accumulate additional carbon in forests and out of the atmosphere.[473] Emphasis on proforestation is increasing, as a cost-effective strategy for mitigating climate change.[474] Proforestation allows maturing trees that are already rapidly sequestering carbon to fully mature into natural forests of diverse species,

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[461] Law, B.E., Hudiburg, T.W., Berner, L.T., Kent, J.J., Buotte, P.C. and Harmon, M.E. 2018. Land use strategies to mitigate climate change in carbon dense temperate forests. *Proceedings of the National Academy of Sciences*, *115*(14), pp.3663-3668; Dellasalla, D. et al. 2011, *supra* n. 65; Moomaw, W., Pimm, S., Lovejoy, T., Dinerstein, E. & Dellasalla, D.A. 2021. U.S. forests hold climate keys (11/15/2021). *Available at*: https://thehill.com/opinion/energy-environment/581612-us-forests-hold-climate-keys/.

[462] Barrett, T.M. 2014.

[463] *Id*.

[464] DellaSala, D.A., Gorelik, S.R. & Walker, W.S. 2022.

[465] Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990 Interagency Working Group on Social Cost of Greenhouse Gases, United States Government. Available at: https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

[466] Ricke, K., Drouet, L., Caldeira, K. et al. 2018. Country-level social cost of carbon. Nature Clim Change, (8)p.895–900.

[467] USDA Forest Service. 2016. Tongass National Forest Land and Resource Management Plan Final Environmental Impact Statement (hereinafter 2016 TLMP FEIS).

[468] USDA Forest Service. 2016. Tongass National Forest Land and Resource Management Plan, Forest Plan. R10-MB-769j. USDA Forest Service, Alaska Region, Juneau, AK, (hereinafter 2016 Tongass Forest Plan). Available at:

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd977797.pdf.

[469] USDA Forest Service. 2020. Forestry as a Natural Climate Solution: The positive outcomes of negative carbon emissions. Science Findings 225/March 2020. Pacific Northwest Research Station, Portland, OR.

[470] Id.

[471] Barrett, T.M. 2014.

[472] Id. Hoover, K. & Riddle, A.A. 2020; U.S. Forest Service. 2020. Forestry as a Natural Climate Solution: The positive outcomes of negative carbon emissions. Pacific Northwest Research Station Science Findings 225/March 2020; Moomaw, W.R. et al. 2020.

[473] Vynne, C. et al. 2021.

[474] Moomaw, W.R. et al. 2019.

maximizing their potential as carbon sinks.[475] Allowing maturing forests to grow would generate rapid, additional carbon sequestration and significantly help in offsetting CO_2 emissions in the U.S.[476]

The amount of future logging will determine the extent to which the Tongass National Forest and state- and privately-owned forests in the region will continue to sequester carbon – or become a potentially large source of emissions.[477] The key to increasing the amount of accumulated forest carbon is to implement policies that maintain existing intact forests and allow maturing forests to grow.[478] Under a no-logging scenario, forest carbon stocks would increase by 27 percent – from just over one billion metric tons to 1.3 billion metric tons by the end of the 21st century.[479]

VI. Comments on Designated Areas

Southeast Alaska's Estuaries are exceptionally high value habitats

The Draft Designated Areas Assessment notes that the changing climate can threaten unique values of areas where it is important to maintain ecosystem integrity.[480] Alaska Region staff are considering designating some areas as "Key Coastal Wetlands" because of their importance to fish and wildlife populations.[481] Potential designated areas include the Yakutat Forelands and the Lower Stikine, both of which are biodiversity "hot spot" stopover habitat for hundreds of thousands of migratory birds.[482] As explained in the following discussion, excerpted from the Alaska Sustainable Fisheries Trust's 2024 SeaBank Report, ALFA supports further consideration of protections for estuarine habitat.

Natural resource economists identify estuaries as the highest-valued ecosystems – providing $15,000 per acre in ecosystem services each year ($5.3 billion).[483] This value is second only to coral reef ecosystems, and higher than all terrestrial ecosystems combined.[484] This disproportionate ecological importance is because terrestrial, freshwater and marine ecosystems in these areas connect and provide numerous services.[485]

Southeast Alaska's estuaries are globally significant because of their high productivity. There are 12,000 estuaries in Southeast Alaska occupying 350,000 acres.[486] Nearly 3,000 of the estuaries are

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475 Id.; Moomaw, W.R. et al. 2020.

476 Id.

477 DellaSala, D.A., Gorelik, S.R. & Walker, W.S. 2022.

478 Zhou, X. et al. 2016.

479 *Id.*; Law, B.E. et al. 2023, *supra* n. 50.

480 Matthews, E. 2024. Draft Designated Areas Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

481 *Id.*

482 *Id.*

483 De Groot, R., Brander, L., Van Der Ploeg, S., Costanza, R., Bernard, F., Braat, L., Christie, M., Crossman, N., Ghermandi, A., Hein, L. & Hussain, S. 2012. Global estimates of the value of ecosystems and their services in monetary units. *Ecosystem Services*, *1*(1), pp. 50-61.

484 DeGroot, R., et al. 2012.

485 Carstensen, R. 2007. Coastal habitats of Southeast Alaska. In: J. Schoen & E. Dovichin (eds), *Coastal Forests and Mountains Ecoregions of Southeastern Alaska and the Tongass National Forest: A Conservation Assessment and Resource Synthesis*. Ch. 5.3. Audubon Alaska and The Nature Conservancy. Anchorage, AK.

486 Baker, L., Koski, K., Albert, D. & Cohen, N. 2011. A conservation action plan for estuarine ecosystems of Southeastern Alaska. September 2009, updated January 2011. The Nature Conservancy.

roughly 250 acres in size.[487] The largest estuaries are on the mainland, including the 21,000-acre Stikine River Delta.[488] The Yakutat Forelands area includes the 13,859-acre Dangerous River estuary and the 6,811-acre Dry Bay estuary.[489] Two of the region's other five largest estuaries are on Kupreanof Island at Duncan Canal (9,446 acres) and Rocky Pass (5,823 acres).[490] Those estuaries drain freshwater systems that are much smaller than transboundary rivers. [491] The Chilkat River and Gustavus and Taku estuaries are all larger than 4,000 acres. [492]

Estuaries provide important resource values for nearly all Southeast Alaska's fish and wildlife assets.[493] This includes spawning and nursery areas for diverse species of finfish, forage fish, shellfish and other invertebrates.[494] For migratory birds, sea birds, marine mammals and terrestrial mammals, estuaries provide areas for breeding, refuge and forage.[495] They also support ocean health and water quality, as buffers between ocean and land that filter sediment and pollutants from freshwater before they enter the ocean.[496]

Estuaries provide protection, nutrient exchanges and abundant food sources for fish and shellfish, including numerous forage fish such as herring, eulachon, Pacific sand lance and capelin that support other species.[497] Three-fourths of all fish caught in Alaska utilize estuaries and estuarine vegetation during some part of the life history, including major groundfish species such as halibut, sablefish, pacific cod and rockfish.[498] Juvenile sablefish occur only in a few estuaries, heightening the value of those locations.[499]

Salmon fishery production often corresponds to productive estuaries.[500] Estuaries are transitional habitats between the marine and freshwater environments for salmon. Critically, salmon pass through estuaries twice, during outmigration as smolts (rearing there extensively as juveniles) and when returning to spawn.[501] Multiple studies of juvenile salmon show that their initial growth and survival depend on the capacity of these systems to produce forage and protection from predators.[502]

Estuarine vegetation such as salt marsh grasses, seagrass meadows and kelp forests provide critical ecological functions for numerous SeaBank assets. These species are ecosystem engineers that

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487 *Id.*
488 Carstensen, R. 2007.
489 *Id.*
490 *Id.*
491 *Id.*
492 *Id.*
493 *Id.*
494 Beck, M., et al., 2001. The Identification, Conservation and Management of Estuarine and Marine Nurseries for Fish and Invertebrates. *Bioscience, 51(*633-641); Baker, L., et al. 2011, *supra* n. 63.
495 Baker, L., et al. 2011.
496 *Id.*
497 Johnson, S.W., Murphy, M.L., Csepp, D.J., Harris, P.M. & Thedinga, J.F. 2003. A survey of fish assemblages in eelgrass and kelp habitats of Southeastern Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS.AFSC-139, 39 p.
498 Baker, L., et al. 2011.
499 *Id.*
500 Kennedy, L.A., Juanes, F. & El-Sabaawi, R. 2018. Eelgrass as valuable nearshore foraging habitat for juvenile Pacific salmon in the early marine period. *Marine and Coastal Fisheries*: *Dynamics, Management and Ecosystem Science, 10(*190-203).
501 *Id.;* Cak, A.D., Chaloner, D. T. & Lamberti, G.A. 2008. Effects of spawning salmon on dissolved nutrients and epilithon in coupled stream-estuary systems of Southeastern Alaska. *Aquat. Sci, 70*(169-178).
502 *Id.*

form habitats that are essential to biodiversity and marine productivity.[503] Seagrasses such as eelgrass are flowering plants that form underwater meadows along coastal shorelines and provide some of the most biodiverse and productive coastal habitats.[504] They grow below salt marshes in wave-sheltered shallow marine habitats such as the lower intertidal and nearshore subtidal portions of estuaries.[505]

Seagrass meadows, one of the planet's most productive ecosystems, provide critical services for coastal communities, economies and lifestyles.[506] The multiple ecosystem services they provide include food sources, coastal protection and erosion control, water purification, maintenance of fisheries and carbon sequestration. [507] They also support important forms of tourism, recreation, education and research.[508]

Eelgrass is the most widespread seagrass species in the northern hemisphere and most common seagrass along the North American Pacific Coast.[509] Most of Southeast Alaska's eelgrass meadows grow in soft sand and mud substrates in protected bays and inlets that have freshwater influence.[510] Peak growth occurs in the late spring.[511] The 3,500 shoreline miles of continuous or patchy eelgrass meadows in Southeast Alaska likely exceed that of the combined shorelines in Oregon and Washington.[512] The outer coast also contains surfgrass meadows which have higher wave tolerances.[513]

Eelgrass is one of the most important habitats of Southeast Alaska's estuarine ecosystems. Dozens of marine finfish, commercially-utilized invertebrates such as crab and shellfish and numerous other invertebrates occupy eelgrass habitats.[514] Southeast Alaska eelgrass meadows are the top estuarine habitat for species diversity (relative to kelp and salt marshes).[515] In areas where eelgrass is less common, such as the mainland and adjacent inside waters, the beds that are present may be disproportionately important for local fish populations.[516]

Eelgrass is a productive habitat that supports a high abundance and diversity of Southeast Alaska's marine species, including dozens of forage fish and commercially important species.[517] Juvenile

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[503] Rogers-Bennett, L. and Catton, C.A. 2019. Marine heat wave and multiple stressors tip bull kelp forest to sea urchin barrens. *Scientific Reports*, *9*(1), p.15050.

[504] Prentice, C., Poppe, K.L., Lutz, M., Murray, E., Stephens, T.A., Spooner, A., et al. 2020. A synthesis of blue carbon stocks, sources, and the accumulation rates in eelgrass (Zostera marina) meadows in the Northeast Pacific. *Global Biogeochemical Cycles*, 34, e2019GB006345.

[505] Johnson, S.W., et al. 2003.

[506] Dewsbury, B.M., Bhat, M. & Fourqurean, J.W. 2016. A review of seagrass economic valuations: Gaps and progress in valuation approaches. *Ecosystem Services, 18* (68-77); Baker, L., et al. 2011; Barbier, E.B., Hacker, S.D., Kennedy, C., Koch, E. W., Stier, A.C. & Silliman, B.R. 2011. The value of estuarine and coastal ecosystem services. *Ecological Monographs, 81*(2), pp. 169-193; Johnson, A.C., Noel, J., Gregovich, D.P., Kruger, L.E. & Buma, B. 2019. Impacts of submerging and emerging shorelines on various biota and indigenous Alaskan harvesting patterns. *Journal of Coastal Research*, *35*(4), p.765-775.

[507] Barbier, E.B., et al. 2011.

[508] *Id.*

[509] Harris, P.M., Neff, A.D., Johnson, S.W. & Thedinga, J.F. 2008. Eelgrass Habitat and Faunal Assemblages in the City and Borough of Juneau, Alaska NOAA Tech. Memo NMFS-AFSC-182, 46 p.

[510] Johnson, S.W., et al. 2003.

[511] Murphy, M.L., Johnson, S.W. & Csepp, D.J. 2000. A comparison of fish assemblages in eelgrass and adjacent subtidal habitats near Craig, Alaska. *Alaska Fishery Research Bulletin*, 7.

[512] Coastal & Ocean Resources Inc. & Archipelago Marine Research Ltd. 2011; Johnson, A.C., et al. 2019.

[513] Coastal & Ocean Resources Inc. & Archipelago Marine Research Ltd. 2011.

[514] Johnson, S.W., et al. 2003; Murphy, M.L., et al. 2000; Baker, L., et al. 2011.

[515] Johnson, S.W., et al. 2003.

[516] Harris, P.M., Neff, A.D., Johnson, S.W. & Thedinga, J.F. 2008.

[517] Johnson, S.W., et al. 2003.

fish are dominant in surveys of Southeast Alaska's eelgrass meadows in different parts of the region, showing their importance as nursery areas that provide food and predator protection.[518]

In particular, surveys have found large numbers of juvenile pink, chum and Chinook salmon in estuarine eelgrass meadows where they grow and transition to the marine environment.[519] They occupy eelgrass meadows extensively during May and June, and feed on a rich invertebrate community that can comprise up to 80 percent of the juvenile chum salmon diet.[520] Juvenile salmon grow rapidly during this life cycle phase, which is critical because larger fish are more likely to survive early marine residence.[521] Studies have shown that large-scale eelgrass loss in many estuaries can decrease invertebrate densities, reduce salmon survival rates and drastically diminish salmon returns. [522]

Eelgrass supports other marine species such as juvenile shellfish. There is a rich invertebrate community of mussels, shrimps and crabs. Dungeness crab and spot shrimp are the most common invertebrates in some areas and use the meadows as nursery habitat. Pacific herring use eelgrass as a spawning substrate.[523]

Eelgrass is susceptible to coastal development and environmental changes both in nearshore waters and on adjacent uplands. Direct disturbances such as dredging and marine construction or scouring from motorized boat propellers and excess sediment or other pollution from mining, agriculture and other industrial activity are a major cause of seagrass declines.[524] Excessive runoff from timber roads and deposition of logging waste has been known to destroy eelgrass habitats.[525]

Salt marshes are a diverse grassland plant community that occupies the upper intertidal zone at the border of an estuary.[526] The marshes utilize wave-protected shorelines and grow behind barrier island systems and in bays and estuaries.[527] In Southeast Alaska they are common at river deltas and the heads of inlets.[528] There are nearly 34,000 acres of salt marshes in Southeast Alaska, making them the most common shoreline plant community.[529] Salt marshes occur continuously or in patches along at least 8,000 miles of the Southeast Alaska shoreline.[530]

Ecosystem services provided by salt marshes include coastal protection from waves and storm surges because they attenuate waves by as much as 40 percent, controlling erosion, flood defense and protecting coastal areas.[531] Salt marshes have significant habitat values for economically and ecologically important fish species, including protection from larger fish predators and plant material

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[518] Harris, P.M., et al. 2008; Johnson, S.W., et al. 2003.
[519] *Id.*
[520] *Id.*
[521] Kennedy, L.A., et al. 2018.
[522] *Id.*
[523] Harris, P.M., et al. 2008.
[524] Dewsbury, B.M., et al. 2016.
[525] Baker, L., et al. 2011; Harris, P.M., et al. 2008.
[526] Carstensen, R. 2007; Coastal & Ocean Resources Inc. & Archipelago Marine Research Ltd. 2011.
[527] Barbier, E.B., et al. 2011.
[528] Carstensen, R. 2007.
[529] Albert, D. and Schoen, J. 2007. *A Conservation Assessment and Resource Synthesis for the Coastal Forests and Mountains Ecoregion of Southeast Alaska and the Tongass National Forest: A Conservation Assessment and Resource Synthesis*. The Nature Conservancy and Audubon Alaska. Anchorage, AK.
[530] Coastal & Ocean Resources Inc. & Archipelago Marine Research Ltd. 2011.
[531] Barbier, E.B., et al. 2011.

for forage.[532] They also take on excess nutrients from rivers and terrestrial runoff, purifying and improving water quality entering the estuary and benefitting adjacent ecosystems such as seagrass meadows.[533]

Estuarine and coastal ecosystems are heavily used and threatened on a global and regional scale.[534] There is rapid global loss of coastal wetlands, including one-half of the salt marshes and nearly one-third of the seagrasses.[535] Global loss of seagrasses continues at a rate of 5 to 7 percent annually.[536]

Changes in sea level are a main threat to seagrasses.[537] In northern Southeast Alaska, the rate of sea level fall (i.e., northern Southeast Alaska is rising from the sea) is outpacing sea level rise. "Postglacial isostatic rebound" occurs when land rebounds after glaciers and icefields melt and retreat. The rates of uplift are as high as 1.2 inches annually in some portions of the region, with Yakutat experiencing the greatest uplift rates in the world.[538]

The expected sea level lowering of between 2 to 8 feet throughout much of the region is likely to be a major cause of a projected 30 percent decrease in estuary shoreline lengths over the next century.[539] The greatest projected change in shoreline lengths will occur in low-slope gradient shorelines within protected bays and estuaries – particularly those dominated by eelgrass.[540] Researchers project a cumulative eelgrass loss of 14 percent over the next century with the greatest loss – roughly one-third – around Kake.[541] Some of the southern portions of the region may receive increases in shore eelgrass length in Kasaan and Klawock.[542]

This land emergence has significant consequences for protected-bay coastlines.[543] Naturalists project a rapid loss of coastal marshes, which will transition to meadows.[544] The "uplift meadows" will replace salt-tolerant grasses in the salt marsh zone and the areas will eventually transition to spruce forests.[545] Uplift meadows are emerging near Gustavus, the Chilkat estuary and in Port Frederick near Hoonah.[546] The largest uplift meadows are emerging in estuaries in the vicinity of Icy Strait and Lynn Canal.[547]

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[532] *Id.*
[533] *Id.*
[534] Beck, M., et al. 2001. The Identification, Conservation and Management of Estuarine and Marine Nurseries for Fish and Invertebrates. *Bioscience,* 51(8), 633; Emmett, R., et al. 2012. Geographic Signatures of North American West Coast Estuaries. *Estuaries, 23*(6), pp. 765-792.
[535] Barbier, E.B., et al. 2011..
[536] Röhr, M.E. 2019. Environmental drivers influencing the carbon sink capacity of eelgrass (*Zostera marina)*. Åbo Akademi University, Turku, Finland; Nordlund, L. M., Jackson, E.L., Nakaoka, M, Samper-Villarreal, J., Beca-Carretero, P., Creed, J.C., 2018. Seagrass ecosystem services – What's next? *Marine Pollution Bulletin, 134*, pp. 145-151.
[537] Macreadie, P.I., Anton, A., Raven, J.A., Beaumont, N., Connolly, R.M., Friess, D.A., Kelleway, J.J., Kennedy, H., Kuwae, T., Lavery, P.S. & Lovelock, C.E. 2019. The future of Blue Carbon science. *Nature Communications*, *10*(1).
[538] Johnson, A.C., et al. 2019.
[539] *Id.*
[540] *Id.*
[541] *Id.*
[542] *Id.*
[543] *Id.*
[544] Carstensen, R. 2007.
[545] *Id.*
[546] *Id.*
[547] *Id.*

The numerous ecosystem services provided by tidewater vegetated ecosystems include significant CO_2 uptake and long-term carbon storage.[548] *Blue carbon* is the organic carbon sequestered and stored by or released from coastal tidewater wetlands and estuaries – most of it stored in sediments.[549] Blue carbon ecosystems like salt marshes and sea grasses cover two-tenths of a percent of the ocean floor but account for one-third of oceanic carbon uptake.[550] The living plant biomass sequesters carbon only for short periods of time, but once captured in coastal soils the carbon can remain place for millennia and build up into large carbon stocks.[551]

Coastal wetlands, like forests, become sources of CO_2 emissions when degraded by industrial development or other causes.[552] Seagrasses and salt marshes store most of the blue carbon in sediments so that conversion or degradation of these ecosystems causes the release of blue carbon accumulated over centuries or even millennia to the atmosphere.[553] While there is significant global loss of salt marshes and seagrass estuaries each year, most of these ecosystems in Alaska remain intact.[554]

Salt marshes comprise one to two percent of the annual carbon sinks in the U.S.[555] They are most valuable for climate mitigation in areas of large coastal expanse.[556] Salt marsh sediments accrue 95 percent of the stored carbon.[557] Scientists studying salt marshes in British Columbia found that salt marshes in that area are sequestering carbon at high rates of roughly one metric ton per 2.5 acres per year.[558] Assuming similar sequestration and storage capacity, Southeast Alaska's 42,500 acres of salt

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[548] Dewsbury, B.M., Bhat, M. & Fourqurean, J.W. 2016. A review of seagrass economic valuations: Gaps and progress in valuation approaches. *Ecosystem Services* 18 (2016) 68-77; Fourqurean, J.W., Duarte, C.M., Kennedy, H., Marbà, N., Holmer, M., Mateo, M.A., Apostolaki, E.T., Kendrick, G.A., Krause-Jensen, D., McGlathery, K.J. & Serrano, O. 2012. Seagrass ecosystems as a globally significant carbon stock. *Nature geoscience*, 5(7), pp.505-509.

[549] Prentice, C., Poppe, K.L., Lutz, M., Murray, E, Stephens., T.A. & Spooner, A. et al. 2020. A synthesis of blue carbon stocks, sources, and the accumulation rates in eelgrass (Zostera marina) meadows in the Northeast Pacific. *Global Biogeochemical Cycles*, 34, e2019GB006345; Macreadie, P.I., Anton, A., Raven, J.A., Beaumont, N., Connolly, R.M., Friess, D.A., Kelleway, J.J., Kennedy, H., Kuwae, T., Lavery, P.S. & Lovelock, C.E. 2019. The future of Blue Carbon science. *Nature communications*, 10(1), pp.1-13; Vynne, C. et al. 2021, *supra* n. 9. Vynne, C., Dovichin, E., Fresco, N., Dawson, N., Joshi, A., Law, B.E., Lertzman, K., Rupp, S., Schmiegelow, F. & Trammell, E.J. 2021. The importance of Alaska for climate stabilization, resilience, and biodiversity conservation. *Frontiers in Forests and Global Change*, *4*, p.121

[550] Röhr, M.E., Holmer, M., Baum, J.K., Björk, M., Boyer, K., Chin, D., Chalifour, L., Cimon, S., Cusson, M., Dahl, M. & Deyanova, D. 2018. Blue carbon storage capacity of temperate eelgrass (Zostera marina) meadows. *Global Biogeochemical Cycles*, *32*(10), pp.1457-1475.

[551] Fourqurean, J.W. et al. 2012.

[552] Dewsbury, B.M. et al. 2016.

[553] Pendleton L. et al. 2012. Estimating Global "Blue Carbon" Emissions from Conversion and Degradation of Vegetated Coastal Ecosystems. *PLoS One*, 7(9): e43542; Prentice, C. et al. 2020.

[554] Vynne, C. et al. 2021.

[555] Hutto, S.H., Brown, M., & Francis, E. 2021. Blue carbon in marine protected areas: Part 1; a guide to understanding and increasing protection of blue carbon. National Marine Sanctuaries Conservation Science Series ONMS-21-07. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries. Silver Spring, MD.

[556] Friess, D.A., Yando, E.S., Alemu, J.B., Wong, L.W., Soto, S.D. & Bhatia, N. 2020. Ecosystem services and disservices of mangrove forests and salt marshes. *Oceanography and Marine Biology*, *58*, pp.107-142.

[557] Alongi, D.M. 2020. Carbon balance in salt marsh and mangrove ecosystems: A global synthesis. *Journal of Marine Science and Engineering*, *8*(10), p.767.

[558] Chastain, S.G., Kohfeld, K.E., Pellatt, M.G., Olid, C. & Gailis, M. 2021. Quantification of Blue Carbon in Salt Marshes of the Pacific Coast of Canada. *Biogeosciences Discussions*, pp.1-41; Gailis, M., Kohfeld, K.E., Pellatt, M.G. & Carlson, D. 2021. Quantifying blue carbon for the largest salt marsh in southern British Columbia: implications for regional coastal management. *Coastal Engineering Journal*, *63*(3), pp.275-309.

marshes may sequester enough CO_2 to offset emissions from 85,000 vehicles per year, in storing an additional 1.4 to 2.1 million metric tons of carbon.[559]

Seagrasses use CO_2 dissolved in seawater to grow, and once the plant completes its life cycle, carbon accumulates in the sediment.[560] Alaska has some of the largest eelgrass beds in the world.[561] Seagrass carbon burial rates are highly variable, making it difficult to use extrapolated rates from other areas. [562] Recent research suggests that meadow size, particularly the presence of large and continuous meadows, may elevate carbon sequestration capacity.[563] Some of the most highest sequestration rates occurred in meadows in Scandinavia that were similar to Southeast Alaska in latitude and ocean exposure.[564]

In a recent study of eelgrass meadows from Oregon to Prince of Wales Island in Southeast Alaska, sampled sites showed similarities to other studied eelgrass systems in the north Pacific and north Atlantic oceans.[565] Some of the Southeast Alaska sites studied had high organic carbon content values that were close to the global average for all types of seagrass meadows while others had low values.[566] In general Prince of Wales Island sites had higher organic carbon content than Pacific Northwest eelgrass meadows.[567]

Roadless Rule

The Designated Areas Assessment explains that the purpose of the 2001 Roadless Area Conservation Rule (Roadless Rule) is to provide lasting protection for inventoried roadless areas (IRAs) within the National Forest System (NFS).[568] It recognizes that protection of these roadless characteristics on the Tongass National Forest is of local and national importance. [569]

ALFA submits that the assessments could review and describe widespread public support for protecting intact forested areas on the Tongass from logging and timber road construction. There are nearly 2 million acres of Tongass inventoried roadless areas allocated to development land use designations in the current forest plan.[570] These areas provide large, relatively undisturbed blocks of important habitat for a variety of species. [571]

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[559] *Available at*: https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references.

[560] Rohr, M.E. et al. 2018.

[561] Vynne, C. et al. 2021.

[562] Poppe, K.L. & Rybczyk, J.M. 2018. Carbon sequestration in a Pacific Northwest Eelgrass (Zostera marina) meadow. *Northwest Science*, Vol. 92, No. 2.; Postlethwaite V.R., McGowan A.E., Kohfeld, K.E., Robinson C.L.K., Pellatt M.G. 2018. Low blue carbon storage in eelgrass (*Zostera marina*) meadows on the Pacific Coast of Canada. *PLoS One*, 13(6): e0198348.

[563] Röhr, M.E. et al. 2018.

[564] *Id.*

[565] Prentice, C. et al. 2020.

[566] *Id.*

[567] *Id.*

[568] Matthews, E. 2024. Draft Designated Areas Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

[569] *Id.*

[570] *Id.*

[571] *Id.*

For example, the Roadless Rule is critical to maintaining the provisioning and cultural ecosystem services provided by SeaBank deer. The Rule protects substantial proportions of remaining winter deer habitat in heavily logged areas – on North Prince of Wales Island, large roadless areas protect over one-half of the remaining winter deer habitat.[572] Large roadless areas also protect over 60 percent of the remaining winter deer habitat on other islands with high levels of past logging, such as Gravina, Kuiu, Kupreanof, Mitkof and Revillagigedo.[573]

In 2023, the USDA reinstated Roadless Rule protections of Tongass National Forest roadless areas, reversing a 2020 rule exempting the Tongass.[574]. After conducting a regulatory process, the agency removed all 9.4 million acres from Roadless Rule protections in October 2020.[575] That 2020 decision to exempt the Tongass was unpopular. Over 96 percent of the over 15,000 individual commenters opposed exempting the Tongass, and only 1 percent of the commenters supported the exemption.[576] When the agency then initiated a widely supported regulatory process to reinstate Roadless Rule protections, it received over 9,000 unique individual comments and over 100,000 form comment letters mostly supporting reapplying the Roadless Rule.[577] Another 130,000 individuals signed a total of 14 petitions requesting reinstatement. [578] Nineteen tribes in Southeast Alaska also requested restoring Roadless Rule protections to their ancestral lands.[579]

[572] Albert, D.M. 2019. Conservation Significance of Large Inventoried Roadless Areas on the Tongass National Forest. Defenders of Wildlife. Washington, DC. *Available at*: https://defenders.org/sites/default/files/2020-02/2019_12_14_albert_conservation_significance_of_tongass_roadless_areas.pdf.

[573] *Id.*

[574] USDA Forest Service. 2023. Special Areas, Roadless Area Conservation; National Forest System Lands in Alaska. Final Rule. 88 Fed. Reg. 5253, 5255. Friday, January 27, 2023.

[575] 86 Fed. Reg. at 66498.

[576] Southeast Alaska Conservation Council. 2020. FOIA: 96% of Americans Support Keeping National Roadless Rule on the Tongass Despite Attempted Rollback. *Available at:* https://www.seacc.org/americans-want-to-keep-roadless-rule/.

[577] 88 Fed. Reg. at 5253.

[578] *Id.*

[579] *Id.*

VII. *The cumulative impacts of past logging concentrated on high-grading old-growth trees from island ecosystems*

The assessments notes that there have been changes in landownership in Southeast Alaska, including the conveyance of 240,000 acres to other entities.[580] Several assessments have characterized timber removals over past several decades as small and compared the acreage removed overall as a modest percentage of the overall Forest. It is important to recognize that these ongoing removals occur in a landscape where past industrial logging has removed the largest tree old-growth forests that had the highest value for fish and wildlife. Between 1954 and 2004 industrial-scale logging on a mix of land ownerships – federal, State of Alaska and private – removed much of the large, contiguous old- growth forest, leaving fragmented forest habitats and degraded watersheds on a landscape scale.[581] Timber companies targeted the largest old-growth trees, removing roughly two-thirds of the highest volume forest by 2004 with disproportionate impacts on the most productive fish and wildlife habitat, and created a network of about 5,000 miles of logging roads to enable that extraction.[582]

The most intensive clearcutting of larger-tree, old-growth forests occurred in federal and non-federal forestlands on several major islands: Etolin, Kuiu, Kupreanof, Mitkof, Wrangell and Zarembo Islands in central Southeast Alaska and Prince of Wales and Revillagigedo Islands in southern Southeast Alaska.[583] These areas suffered habitat loss at a much greater rate than other portions of Southeast Alaska.[584] Prince of Wales Island is by far hardest hit: as of 2018, timber companies had already logged 380,950 acres on the island, including 80,445 acres over the last 30 years, with thousands of acres of non-federal old-growth at risk in the near future.[585] Federal and non-federal logging combined, the island has the highest density of clearcuts in Southeast Alaska.[586]

The assessments should provide a more detailed description of recent logging patterns – which are currently occurring in these same areas, further fragmenting fish and wildlife habitat. Although there has been less old-growth logging on Forest Service lands in recent years, annual forest loss has ranged from 3,000 to 5,000 acres over the past decade, and continues to increase.[587] Nearly half that logging occurs on formerly public lands transferred from the Forest Service to state or private entities through Congressionally approved land exchanges.[588] The Alaska Division of Forestry, the Alaska Mental

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[580] Engelmann, D. 2024. Draft Forest Management and Timber Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024; Noesser, E. 2024. Lands: Status, Ownership and Uses. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024. Stating nothing about the other uses.

[581] Albert, D.M. & Schoen, J.W. 2013. Use of historical logging patterns to identify disproportionately logged ecosystems within temperate rainforests of southeastern Alaska. *Conservation Biology*, *27*(4), pp.774-784.

[582] *Id.*

[583] *Id.*

[584] *Id.*

[585] USDA Forest Service. 2018. Prince of Wales Landscape Level Analysis Environmental Impact Statement. R10-MB-833e. U.S. Forest Service, Alaska Region. October 2018.

[586] Hasbrouck, T.R. 2020. Sitka black-tailed deer management report and plan. Game Management Unit 2: Report period 1 July 2011-30 June 2016, and plan period 1 July 2016-30 June 2021. Alaska Department of Fish and Game, Species Management Report and Plan ADF&G.DWC.SMR&P-2020-30, Juneau, AK.

[587] Resneck, J., Stone, E., Boyda, E., & Aldern, C. 2022. “Road to Ruin: The Roadless Rule is supposed to protect wild places. What went wrong in the Tongass National Forest?” *Grist*. March 29, 2022.

[588] *Id.*

Health Trust, the University of Alaska and corporate landowners have been responsible for most of the logging in the region in the 21st century.[589]

The Alaska Division of Forestry plans to offer nearly 62 million board feet of mostly old-growth timber from 3,000 acres of state-owned lands over the next five years.[590] Two-thirds of the timber would come from Prince of Wales Island and nearby smaller islands.[591] Over 100 Southeast Alaskans and visitors, particularly Prince of Wales Island residents, requested that the Alaska's Division of Forestry cease plans for intensive old-growth logging, mostly on Prince of Wales Island.[592] The biggest concern is loss of old-growth forests that have high values for local and visitor recreation.[593]

Other proposed Alaska Division of Forestry timber sales would add to an already massive expanse of recently clearcut forest near Edna Bay on Kosciusko Island.[594] During the 1960s, timber companies removed over one-third of the original productive old-growth on Kosciusko Island, creating some of the oldest second-growth forests in Southeast Alaska.[595] Federal, University of Alaska, State of Alaska and private corporate landowners recently clearcut both the recovering forest and much of the remaining old-growth, instead of allowing recovery of the forest and its habitat values.[596] That remaining old-growth forest had previously provided deer winter range, supported bear denning habitat and sheltered the community of Edna Bay, its harbor facilities and mariners from severe windstorms.[597]

The Division of Forestry also plans four large timber sales that *each* would offer between 3 and 6 million board feet of timber, to be taken from community recreation and subsistence use areas near Petersburg, Wrangell and Ketchikan.[598] Past logging on these islands was extensive, with substantial losses of large-tree, old-growth forests and losses of nearly one-third or more of key habitats for old-growth dependent wildlife species.[599]

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[589] 2016 TLMP FEIS Vol. II, Appx. C; USDA Forest Service. 2018.

[590] Alaska Division of Forestry. 2023. 2023-2027 Five Year Schedule Timber Sales (FYSTS).

[591] *Id.*

[592] Alaska Division of Forestry. 2023. *Available at:* https://aws.state.ak.us/OnlinePublicNotices/Notices/Attachment.aspx?id=141987.

[593] *Id.*

[594] Alaska Division of Forestry. 2023; USDA Forest Service, Alaska Region. 2016. Kosciusko Vegetation Management and Watershed Improvement Project, Environmental Assessment, Final Decision Notice, and Finding of No Significant Impact. R10-MB-762(c). Thorne Bay, AK: September 2016.

[595] *Id.*

[596] *Id.*

[597] Alaska Department of Fish and Game Division of Wildlife Conservation, Southeast Region. 2015. Letter re: Edna Bay Parlay Timber Sale.

[598] Alaska Division of Forestry. 2023.

[599] Lowell, R.E. 2015. Unit 3 deer. In: Harper, P. and McCarthy, L.A. eds., 2015. Deer Management Report of Survey-inventory Activities, 1 July 2012-30 June 2014. Alaska Department of Fish and Game, Division of Wildlife Conservation; Dorendorf, R. 2020. Deer management report and plan. Game Management Unit 1A: Report period 1 July 2011-30 June 2016, and plan period 1 July 2016-30 June 2021. Alaska Department of Fish and Game, Species Management Report and Plan ADF&G/DWC/SMR&P-2020-24. Juneau; Reeck, J. 2014. Wildlife and Subsistence Report. Prepared for: Ketchikan/Misty Fiords Ranger District, Tongass National Forest; Albert, D. & Schoen, J. 2007. A conservation assessment for the coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest. In: J.W. Schoen & E. Dovichin, eds. The coastal forests and mountains ecoregion of southeastern Alaska and the Tongass National Forest: a conservation assessment and resource synthesis. *Available at*: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/alaska/seak/era/cfm/Documents/PDFs/4.17_Kupreanof-Mitkof.pdf and http://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/alaska/seak/era/cfm/Documents/PDFs/4.18_Wrangell_Zarembo_Etolin.pdf.

Thus, although the Forest Service has been unable to attain planned logging levels in recent years, annual forest loss continues, ranging from 3,000 to 5,000 acres per year over the past decade.[600] Alaska's Division of Forestry and other state entities and corporate landowners removed large amounts of old-growth forest during the 20th century – over 400,000 acres - and have been responsible for most of the logging in the 21st century.[601] Nearly half that logging occurs on formerly public lands transferred from the Forest Service to state or private entities through Congressionally approved land exchanges.[602]

VII. Forests are invaluable for climate resilience

The Climate Change Assessment describes projected changes for Southeast Alaska, with both temperature and precipitation expected to increase as the century progresses.[603] Other projected changes include accelerated loss of glacial ice, sea level changes (both up and down), yellow cedar decline, and increases in insect outbreaks.[604]

ALFA requests that the final climate assessment include a discussion of forest regulating ecosystem services. The forest's *provisioning services,* supply the easily recognizable economic values of scenery, recreation opportunities and habitat for fish and wildlife. In contrast, the economic value of the forest's *regulating ecosystem services* is much less noticed, with the exception of considerable attention on carbon sequestration. These increasingly important services of intact forested habitat and roadless watersheds include maintaining air quality, water quality and regulating temperatures of the terrestrial and aquatic environments.[605] The economic value of these contributions by forests are increasingly important, particularly regulating services that reduce risks caused by severe weather events.[606] Old-growth forests in particular are a natural buffer against extreme climate conditions.[607]

Intact forested ecosystems will increase in value in a warming climate because of their higher resilience to climate change, buffering effect against disturbance events, and increasing global rarity. Studies of the Pacific Northwest's old-growth forests have found that maximum air temperatures in old-growth stands (compared to logged areas) were as much as 2.5° C lower in spring and summer.[608] Intact

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[600] Resneck, J., Stone, E., Boyda, E. & Aldern, C. 2022. Road to Ruin: The Roadless Rule is supposed to protect wild places. What went wrong in the Tongass National Forest? Grist. March 29, 2022; Available at: https://grist.org/project/accountability/tongass-national-forest-roadless-rule-loophole/.

[601] 2016 TLMP FEIS.

[602] Resneck, J., Stone, E., Boyda, E. & Aldern, C. 2022.

[603] Wiles, S. & K. Warren. 2024. Draft Drivers, Stressors and Climate Change Assessment. Tongass National Forest Plan Revision. Forest Service, Alaska Region. December 2024.

[604] Wiles, S. & K. Warren. 2024. Draft Drivers, Stressors and Climate Change Assessment

[605] Costanza, R., de Groot, R. Braat, L., Kubiszewski, I., Fioramonti, L. Sutton, P., Farber, S., & Grasso, M. 2017. Twenty years of ecosystem services: How far have we come and how far do we still need to go? *Ecosystem Services, 28*(2017), pp.1-16; Alaska Division of Forestry. 2020. 2020 Alaska forest action plan. *Available at:* https://forestry.alaska.gov/2020ForestActionPlan.htm.

[606] Costanza, R. et al. 2017.

[607] DellaSala, D.A., Mackey, B., Norman, P., Campbell, C., Comer, P.J., Kormos, C.F., Keith, H., & and Rogers, B. 2022. Mature and old-growth forests contribute to large-scale conservation targets in the conterminous United States. *Frontiers in Forests and Global Change*, *5*.

[608] Frey, S.J., Hadley, A.S., Johnson, S.L., Schulze, M., Jones, J.A. & Betts, M.G. 2016. Spatial models reveal the microclimatic buffering capacity of old-growth forests. *Science advances*, *2*(4), p.e1501392.

forests protect against extreme weather impacts by reducing flood and landslide risks.[609] Forests also regulate and purify water and the air, and as "natural air conditioners" act as a climate buffer that stabilizes microclimates and can mitigate the damage of heatwaves to aquatic life.

Regulating services provided by naturally-functioning forest ecosystems reduce risks from severe weather and include flood control, wind protection, water regulation and purification, air quality maintenance and air temperature regulation.[610] For example, forested ecosystems moderate water flows into streams during peak storm events and mitigate the effects of heatwaves on stream warming.[611] Industrial-scale logging and timber road construction reduce the functional and economic values of these regulating ecosystem services, and worse, exacerbate damage caused by severe weather events.[612] Logging increases landslide risks by altering underground and surface hydrology and by reducing the anchoring and reinforcing effect of tree roots that is critical to maintaining soil stability in high risk areas.[613] Intense rainfall on saturated soils – particularly during fall and winter multi-day storms – is the primary cause of landslides in Southeast Alaska.[614] Landslides during heavy precipitation events are most common in large clearcuts.[615] Southeast Alaska-specific studies show that logging makes landslides in logged areas typically three to five times more frequent than in unlogged areas.[616] Similar studies in British Columbia's Haida Gwaii archipelago and other areas in western North America have identified even higher landslide occurrence rates after logging and logging road construction.[617]

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[609] Miura, S., Amacher, M., Hofer, T., San-Miguel-Ayanz, J., Ernawati & R. Thackway. 2015. Protective functions and ecosystem services of global forests in the past quarter-century. In: Forest Ecology and Management; Costanza, R., De Groot, R., Braat, L., Kubiszewski, I., Fioramonti, L., Sutton, P., Farber, S. and Grasso, M. 2017. Twenty years of ecosystem services: how far have we come and how far do we still need to go?. *Ecosystem services*, *28*, pp.1-16; Sutton, P.C., Anderson, S.J., Costanza, R. & Kubiszewski, I. 2016. The ecological economics of land degradation: Impacts on ecosystem service values. *Ecological Economics*, *129*, pp.182-192; Brandt, P., Abson, D.J., DellaSala, D.A., Feller, R. & von Wehrden, H. 2014. Multifunctionality and biodiversity: Ecosystem services in temperate rainforests of the Pacific Northwest, USA. *Biological Conservation*, *169*, pp.362-371.

[610] Costanza, R. et al. 2017, *supra* n. 302.

[611] Farberm, S.C., Costanza, R., & Wilson, M.A. 2002. Economic and ecological concepts for valuing ecosystem services. *Ecological Economics, 41* (2002), pp.375-392.

[612] Sutton, P.C., Anderson, S.J., Costanza, R., & Kubiszewski, I. 2016. The ecological economics of land degradation: Impacts on ecosystem service values. *Ecological Economics, 129* (2016), pp.182-192.

[613] Swanston, D.N. 2006. Assessment of landslide risk to the urban corridor along Mitkof Highway from planned logging of Mental Health Trust Lands. Unpublished. 19 pp.; Swanston, D.N. 1989. A preliminary analysis of landslide response to timber management in Southeast Alaska: an extended abstract. In A Conference on the Stewardship of Soil, Air, and Water Resources. USDA Forest Service, Alaska Region.

[614] *Id*. Bryant, M.D. 2009, *supra* n. 195.

[615] Bishop, D.N. & Stevens, M.E. 1964. Landslides in logged areas in southeast Alaska. Northern Forest Exp. Sta. USDA FS Res. Pap. NOR-1, 18 p., illus.

[616] Swanston, D. N. & Marion, D.A. 1991. Landslide response to timber harvest in southeast Alaska. Proceedings of the Fifth Federal Interagency Sedimentation Conference, Vol. 2, Las Vegas, Nevada, March 18-21, 1991: Subcommittee on Sedimentation of the Interagency Advisory Committee on Water Data, p. 10-49-10-56; Landwehr, D.J. 1999. The Inventory and Analysis of Landslides associated with 89-94 KPC LTS Units and Roads on the Thorne Bay Ranger District. Ketchikan Area Watershed Group, February 1999. Final unpublished monitoring report.

[617] Chatwin, S. 2005. Managing landslide risk from forest practices in British Columbia. British Columbia For. Prac. Board Spec. Investig. Rep. 14, BC For. Prac. Board, Victoria, BC.; Alaska Department of Natural Resources. 2011. Forest Resources and Practices Act landslide bibliography. Forest Resources & Practices Act Landslide Science & Technical Committee. Ed. Freeman, M.W.

Conclusion

Thank you for the opportunity to review and comment on the draft assessments. ALFA requests that you include the information in these comments in the final assessment to inform decision making about the need to revise the current Forest Plan.

Sincerely,

Linda Behnken
Executive Director, ALFA