



Climate Change and the Chugach and Tongass National Forests

A summary of recent scientific findings relevant to managing Alaska's forest lands to minimize harmful impacts

THE HEAT IS ON for managers of Alaska's national forests. Climate change is altering the forests and will inevitably cause more dramatic changes as trees, other vegetation and wildlife continue to respond to altered temperatures and moisture, and shifting patterns of precipitation, fire, insects and disease outbreaks. Forest managers who are updating the management plans for these forests face the task of developing strategies to reduce adverse effects of climate change on forest wildlife and habitat. To be effective, these strategies and all management actions must apply the latest scientific information.



Toward that end, Defenders of Wildlife reviewed 11 recent reports on climate science, impacts and vulnerability of terrestrial, freshwater and marine wildlife and habitats. We compiled the key findings (summarized below) for U.S. Forest Service leaders and staff and members of the public interested in helping vulnerable species and landscapes survive the changes ahead.

KEY FINDINGS

Climate Changes

- Temperatures in southeastern and south-central Alaska have risen by an average of 3 F to 4 F from the middle of the 20th century to the early 21st century, with winter temperatures showing the largest increase.^{1, 2, 3, 7, 10, 11}
- While the scenarios and time frames may differ somewhat, the consensus is that the region will see increases of about 2 F over the next few decades, 3 F to 4 F in the second half of this century, and 4 F to 7 F by late century.^{1, 2, 3, 7, 10, 11}

Snow and Ice

- A likely reduction in the proportion of precipitation falling as snow, combined with conditions favorable for more rapid melting, will reduce snowpack, leading to stream flow increases in spring and decreases in summer and fall.^{3, 4, 6, 10}
- Most of the glaciers in the region are experiencing accelerated melting, with the most pronounced effects at low elevations. The resultant changes in flow and sediment output have multiple implications for river and coastal ecosystems.^{1, 2, 3, 4, 10, 11}



SOCKEYE SALMON, CHUGACH NATIONAL FOREST/USDA

Freshwater Habitats

- Lakes, ponds and wetlands are susceptible to drying out, with many of these habitats already showing decreases in area.^{2, 3, 10}
- Rivers and streams are expected to see alterations in stream flow amount and timing, temperature and nutrient content due to changing precipitation and melting patterns, with effects on benthic, aquatic plant and fish communities.^{10, 11}

Coastal and Marine Habitats

- Projections of sea-level rise, which would have consequences for coastal ecosystems important to shellfish and migratory birds, vary widely among reports and even for specific locations due to the complexities of local uplift from glacial melting and seismic activity.^{1, 3, 4, 9, 11}
- Figures vary slightly, but there is general agreement that the oceans have become about 30 percent more acidic and that the consequences of continued acidification for marine food webs would be severe.^{2, 3, 11}
- The dynamics of ocean temperature, changes in upwelling patterns, nutrient circulation and oxygen concentration are poorly understood, but a warming climate could affect ocean productivity by altering these processes and, in turn, impact marine wildlife.^{3, 11}

Terrestrial Habitats

- Key projected terrestrial impacts include decreases in soil moisture,^{2, 3, 7} a longer growing season,⁷ increased frequency and size

of forest fires,^{2,7} continued worsening of outbreaks of spruce beetles and other forest pests,⁷ and establishment of invasive plants.^{5, 7, 10} Multiple biome shifts are underway or expected, including species range shifts,^{3, 7} declines in key tree species,^{5, 7} and shrinking of alpine habitats due to encroachment of shrubs and trees.⁷

Wildlife

- Potential impacts to trout and salmon species include changes in life cycle timing, reduced food availability, loss of thermal refuge, and degradation of spawning habitat.^{2, 8, 10, 11}
- Birds associated with tundra (white-tailed ptarmigan) and glaciers (Kittlitz's murrelet) may be most at risk from climate change, but shorebirds, waterfowl, seabirds and forest birds may also experience changes to habitat quality and food availability.^{2, 7, 11}
- The response of the area's mammals to climate change does not show clear trends, with some species benefiting and others declining.^{2, 7}

BY ACCOUNTING FOR these observed and projected climate change impacts in crafting new management strategies for the Chugach and Tongass national forests, the Forest Service can help ensure that these two special places remain resilient forests with quality habitat for wildlife.



ALEXANDER ARCHIPELAGO WOLF, TONGASS NATIONAL FOREST/©SAM CATRON

REPORTS CITED

Statewide climate change impacts

1. Markon, C.J., S.F. Trainor, and F.S. Chapin III (eds.) 2012. *The United States National Climate Assessment—Alaska Technical Regional Report*. U.S. Geological Survey Circular 1379. 148 pp. <http://pubs.usgs.gov/circ/1379/pdf/circ1379.pdf>
2. Chapin, F.S., III, S.F. Trainor, P. Cochran, H. Huntington, C. Markon, M. McCammon, A.D. McGuire and M. Serreze. 2014. pp. 514-536 IN J.M. Melillo, T.C. Richmond, and G. Yohe, eds. *The Third National Climate Assessment*. U.S. Global Change Research Program. doi:10.7930/J00Z7150. <http://nca2014.globalchange.gov/report/regions/alaska>
7. Tillmann, P. and P. Glick. 2013 (December). *Climate Change Effects and Adaptation Approaches for Terrestrial Ecosystems, Habitats and Species: A Compilation of the Scientific Literature for the North Pacific Landscape Conservation Cooperative Region*. Funded by the North Pacific LCC. 417 pp. https://nplcc.blob.core.windows.net/media/Default/2012_Documents/Identifying_Synthesizing_Climate/Final_Report_Climate_Change_and_NPLCC_Terrestrial_Systems_NWF.pdf

Impacts to terrestrial systems (listed chronologically)

3. Haufler, J.B., C.A. Mehl, and S. Yeats. 2010. *Climate Change: Anticipated Effects on Ecosystem Services and Potential Actions by the Alaska Region, U.S. Forest Service*. Ecosystem Management Research Institute, Seeley Lake, Montana, USA. 53 pp. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsb-dev2_038171.pdf
4. Wolken, J. M., et al. [21 additional authors]. 2011. Evidence and implications of recent and projected climate change in Alaska's forest ecosystems. *Ecosphere* 2(11):1-35 (Article 124). http://www.lter.uaf.edu/pdf/1548_Wolken_Hollingsworth_2011.pdf
5. Vose, J. M., D.L. Peterson, and T. Patel-Weyand (eds.) 2012. Effects of Climatic Variability and Change on Forest Ecosystems: a Comprehensive Science Synthesis for the U.S. forest Sector. Gen. Tech. Rep. PNW-GTR-870. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 265 pp. http://www.usda.gov/oce/climate_change/effects_2012/FS_Climate1114%20opt.pdf
6. MacArthur, J., P. Mote, J. Ideker, M. Figliozzi, and M. Lee. 2012 (January). *Climate Change Impact Assessment for Surface Transportation in the Pacific Northwest and Alaska*. Region X Northwest Transportation Consortium. OTREC-RR-12-01. 272 pp. http://ppms.otrec.us/media/project_files/OTREC-RR-12-01_Final.pdf
8. Bryant, M.D. 2009. Global climate change and potential effects on Pacific salmonids in freshwater ecosystems of southeast Alaska. *Climatic Change* 95:169-193. [DOI 10.1007/s10584-008-9530-x] http://www.srs.fs.fed.us/pubs/ja/ja_bryant005.pdf
9. Glick, P., J. Clough, and B. Nunley. 2010. *Assessing the Vulnerability of Alaska's Coastal Habitats to Accelerating Sea-level Rise Using the SLAMM Model: A Case Study for Cook Inlet*. National Wildlife Federation. 17 pp. <http://www.fws.gov/slammm/alaska%20slamm%20summary%20report-1.ashx.pdf>
10. Tillmann, P. and D. Siemann. 2011 (December). *Climate Change Effects and Adaptation Approaches in Freshwater Aquatic and Riparian Ecosystems of the North Pacific Landscape Conservation Cooperative Region: A Compilation of Scientific Literature. Final Report*. National Wildlife Federation – Pacific Region, Seattle, WA. 268 pp. https://nplcc.blob.core.windows.net/media/Default/2011_Documents/Moving_from_impacts/NPLCC_Freshwater_Climate_Effects_Final.pdf
11. Tillmann, P. and D. Siemann. 2011 (December). *Climate Change Effects and Adaptation Approaches in Marine and Coastal Ecosystems of the North Pacific Landscape Conservation Cooperative Region: A Compilation of Scientific Literature*. Funded by the U.S. Fish and Wildlife Service Region 1 Science Applications Program. 264 pp. https://nplcc.blob.core.windows.net/media/Default/2011_Documents/Moving_from_impacts/NPLCC_Marine_Climate_Effects_Final.pdf



About Defenders of Wildlife

Defenders of Wildlife is a national, nonprofit membership organization dedicated to the protection of all native wild animals and plants in their natural communities. America's national forests are strongholds for much of our native flora and fauna, including one in three threatened and endangered species and more than 3,500 other imperiled species. Through our Forests for Wildlife Initiative, Defenders is working to ensure that at-risk and climate-change vulnerable wildlife and habitat persist on national forest lands as required under new national forest regulations. We are participating in the development of precedent-setting conservation plans on the Tongass and Chugach national forests and other "early adopters" of the new regulations.

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