ECOLOGICAL ATLAS OF SOUTHEAST ALASKA

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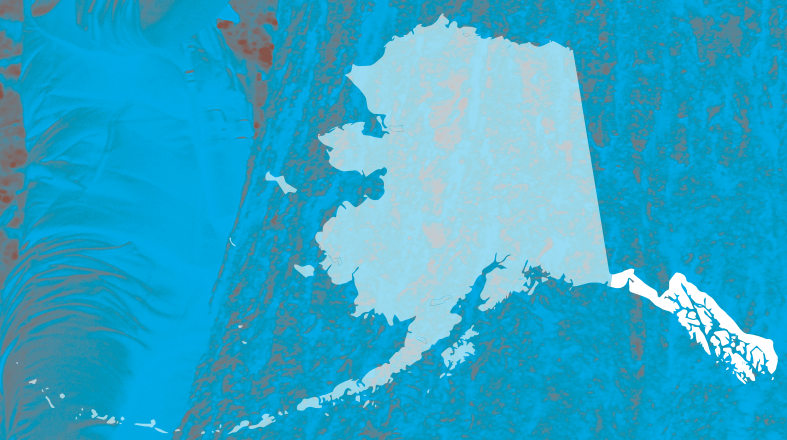
Ecological Atlas of Southeast Alaska



Melanie A. Smith,
editor
2016

Cover photo by Dave Shaw, this page by Nick Jans

Contents

COMMONLY USED ACRONYMS

ABC – Admiralty, Baranof, Chichagof
ADFG – Alaska Department of Fish and Game
ANCSA – Alaska Native Claims Settlement Act
ANILCA – Alaska National Interest Lands Conservation Act
GMU – Game Management Unit
IBA – Important Bird Area
LUD – Land Use Designation
NWI – National Wetlands Inventory
POG – Productive old growth
POW – Prince of Wales
SNAP – Scenarios Network for Alaska and Arctic Planning
TLMP – Tongass Land Management Plan
TNC – The Nature Conservancy
TU – Trout Unlimited
USFS – United States Forest Service
USFWS – United States Fish and Wildlife Service
VCU – Value Comparison Unit

A list of atlas maps and page numbers is included in Table 1-1 on page 4.

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INTRODUCTION

Welcome to Southeast Alaska. This Ecological Atlas will take you on a scientific journey along the rugged coastline, through the towering temperate rainforests, up the steep mountainsides, and onto the icefields of Alaska's panhandle. Along the way you'll learn about regional climate, old-growth ecosystems, fishes, endemic mammals and birds, economic development, and more. Like Audubon Alaska itself, the atlas is rooted in science and communicated through maps and writing. Blended in are bits of natural and human history, and perspectives on conservation issues to consider as we learn from the past and look to the future. From your office desk or with a cup of tea in a big comfortable chair, we hope you'll immerse yourself in the maps, photos, and descriptions, and learn something new about this place whether you aspire to visit or have been rooted here for generations.

Audubon Alaska has worked on conservation issues in Southeast Alaska for most of our 40-year history. Our mission is to conserve the spectacular natural ecosystems of Alaska, focusing on birds, other wildlife, and their habitats, for the benefit and enjoyment of current and future generations. Even though Audubon is known for our focus on conservation of birds, in Southeast Alaska our work has taken a whole-ecosystem approach, which is reflected in this Ecological Atlas. We use science to identify conservation priorities and support conservation actions and policies, with an emphasis on public lands and waters. This "data to design" approach gives us a solid foundation in ecological principles and spatial patterns that allow us to identify priority species, places, and threats. We work with science researchers, land managers, local stakeholders, and decision-makers to envision a healthy future for this incredible place better known as the Tongass National Forest. This all begins with an understanding of the ecology, the human history, and current human use aspects of this special landscape—which is why we developed this atlas. It is a multi-purpose information resource that we anticipate will both answer and inspire many types of questions and conversations about Southeast Alaska.

PREVIOUS RELATED EFFORTS

A decade ago, Audubon and The Nature Conservancy (TNC) partnered on *A Conservation Assessment and Resource Synthesis for the Coastal Forests & Mountains Ecoregion in Southeastern Alaska and the Tongass National Forest* (Conservation Assessment; Schoen and Dovichin 2007). That multi-year project collected, analyzed, and synthesized extensive biological data, resulting in a comprehensive Conservation Area Design for Southeast Alaska. Edited by John Schoen (now retired from Audubon Alaska) and Erin Dovichin (then of TNC), the Conservation Assessment was a major contribution to science and conservation planning in Southeast Alaska. John Schoen and David Albert (TNC) led the effort, designing and carrying out the project. David Albert collected the GIS data needed for the effort, conducted analyses, and mapped the information. Data were mapped across jurisdictions, providing a holistic look at Southeast Alaska. Together with a team of invited experts, they developed spatial models for species and ecosystem components that are key to the functioning of the Tongass. Many experts were involved in the development of the document and writing of the chapters, including university researchers, agency scientists, and local ecologists. The Conservation Assessment addressed various aspects of the Southeast Alaska coastal rainforest ecosystem in depth and continues to be an excellent interdisciplinary resource for the region. It is available online at http://bit.ly/2aNbva2.

The Conservation Assessment resulted in a greater acknowledgment of the globally rare opportunity to preserve a coastal temperate rainforest ecosystem such as the Tongass. Together with the old-growth coastal forests in British Columbia, the region makes up the largest such ecosystem remaining in the world. After publication of the Conservation Assessment, Audubon led an effort to expand scientific awareness of the North Pacific temperate rainforest ecosystem. In 2008, John Schoen and David Albert organized a cruise with eight leading science and policy experts to conduct a field-based peer review of the Conservation Area Design. The cruise led to an endorsement by the group of the approach taken and principles developed around watershed-scale conservation.

Next, that same group of scientists organized a science conference in Juneau, held in 2009, sponsored by Audubon Alaska and TNC. The focus was "to discuss opportunities for incorporating fundamental concepts of conservation biology into management strategies for conserving the biodiversity and ecological integrity of the Tongass National Forest" (Orians and Schoen 2013). The invited speakers each wrote a paper relating their area of expertise to this charge. The conference included papers on forestry, wildlife biology, national forest policy, endemism, natural disturbance, indigenous and commercial use of natural resources, road ecology, watershed-scale conservation, timber harvest methods, riparian ecology, and climate change. During the conference the group laid plans to develop a book based on the work presented there. In 2013, the University of Washington Press published *North Pacific Temperate Rainforests: Ecology and Conservation*, edited by Gordon Orians and John Schoen.

John Schoen

Upper Tenakee Inlet.

John Schoen

Yakutat Bay.

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Nick Jans

Totem pole in Kasaan, Prince of Wales Island.

THE 2016 *ECOLOGICAL ATLAS OF SOUTHEAST ALASKA*

Around the time of publication of *North Pacific Temperate Rainforests*, Audubon Alaska began the project of developing the *Ecological Atlas of Southeast Alaska*. At Audubon, maps are a central part of our conservation work. They are the way that we bring together data and ecological concepts to understand a landscape more deeply, to see patterns, to anticipate threats, and to make science-based recommendations. In creating this atlas we are sharing that information with you.

Publishing an atlas most immediately requires spatial data to represent the various ecosystem components on maps. We began by updating and revising many of the great maps and ecological summaries that were published in the 2007 Conservation Assessment. While many datasets were created by Audubon Alaska and our collaborators at TNC, many other primary datasets were provided by outside organizations. We talked with researchers working across Southeast Alaska to locate the latest and best datasets; gathered scientific papers and reports; synthesized data; and conducted spatial analyses. Foremost data contributors include the Scenarios Network for Alaska and Arctic Planning (SNAP), the AdaptWest Project, the US Forest Service, Alaska Department of Fish and Game, and the US Fish and Wildlife Service.

The 56 maps in the atlas bring together many types of spatial data into a common format and geographic extent. Each written summary describes the ecology and natural history of the topic, followed by a Conservation Issues summary. Next, the Mapping Methods section describes the sources of data, how the data were processed, analysis methods, and/or information that is helpful for interpreting the map. A Map Data Sources section provides short-form citations for the data used, which are referenced at the end of each chapter. Each map includes an abstract that relays interesting facts and the relevance of the topic or species to the ecology of Southeast Alaska. Maps also cite the sources of the data presented.

In the *Ecological Atlas of Southeast Alaska*, we present new maps on topics such as climate change, marine bird colonies, mammal species richness, transportation and energy infrastructure, fishing, and mining. These are in addition to the many maps depicting physical geography, hydrology, vegetation, bird and mammal distribution, land ownership, timber, and so on, making this an inclusive resource for Southeast Alaska.

ACKNOWLEDGMENTS

The Ecological Atlas was made possible by the efforts of many. Contributions came in the form of data, analysis, cartography, scientific expertise, writing, editing, expert review, graphic design, and photography. The Conservation Assessment was a foundation for this work. Many datasets developed a decade ago for that effort continue to be the best available. Many of the ecological summaries written for the Conservation Assessment reappear under this cover; the original authors agreed to let us revise and update their written species accounts and ecological summaries. Importantly, we also reduced the length of those summaries, or rearranged them into new ones. The 2007 Conservation Assessment addresses issues in greater length than the Ecological Atlas; for a more in-depth description of species and habitats, refer to that previous work.

Information in the Ecological Atlas is presented in eight chapters. Table 1-1 is an overview of the chapters, maps, and written summaries included. In addition, to clarify the relationship of the 2007 Conservation Assessment to this work, the table notes the origin of the spatial data and writing. In all cases the data and writing were revised for this volume.

There are many moving parts to produce a publication such as this. Many Audubon Alaska staff and board members, partner organizations, and science colleagues have contributed. Below is a summary of the lead contributors in several important categories.

- Concepting: Nils Warnock, Melanie Smith, Nathan Walker, Beth Peluso
- Cartography: Melanie Smith, Nathan Walker, Lauren Tierney
- Data compilation and analysis: Nathan Walker, Melanie Smith, David Albert, Lauren Tierney, Benjamin Sullender
- Writing: Melanie Smith, John Schoen, Bob Armstrong, David Albert, Marge Osborn, Beth Peluso, Lauren Tierney, Matt Kirchhoff, Susan Culliney, Nils Warnock, Nathan Walker, Gordon Orians, and many others (see individual summaries)
- Science Advising: John Schoen, Matt Kirchhoff, Nils Warnock, and Gordon Orians
- Review and Content Editing: Melanie Smith, John Schoen, Susan Culliney, Nathan Walker, Beth Peluso, Nils Warnock, Matt Kirchhoff, Mark Kaelke, Mark Hieronymus, Francis Biles, Gwen Baluss, Buck Lindekugel, Bob Armstrong, Gordon Orians, Guy Archibald, Andrew Thoms, Winston Smith, Sarah Venator, Iain Stenhouse, Ed Jones, Roger Harding
- Copyediting and References: Melanie Smith, Susan Culliney, Jill Dery, Beth Peluso
- Images and Graphics: John Schoen, Bob Armstrong, Nick Jans, Milo Burcham, Melanie Smith, Erika Knight, Beth Peluso, and others
- Print Layout and Design: Eric Cline
- Funding: True North Foundation, Moore Foundation, Turner Foundation, individual donors to Audubon Alaska, and the efforts of development staff of Audubon Alaska including Nils Warnock and Michelle LeBeau. Esri generously donated ArcGIS software.

From birds and wildlife to climate and resource use, this atlas maps out the intricacies of the exceptional landscape of Southeast Alaska. We hope this compilation of a wide array of information will prove to be an invaluable resource for many uses, and that you'll enjoy your journey through the *Ecological Atlas of Southeast Alaska*.

Melanie Smith
Director of Conservation Science

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TABLE 1-1 Maps and summaries included in the Ecological Atlas, with information on the foundation of the spatial data and scientific writing.

Map #	Page #	Map Name	Written Summary	Data [1]	Writing [1]
Chapter 1: Introduction					
1.1	5	Regional Overview	Introduction	EA	EA
Chapter 2: Physical Setting					
2.1	9	Topography	Topography	EA	EA
2.2	10	Landform	Topography	CFM	EA
2.3	13	Geologic Setting: Glaciers & Karst	Geologic Setting: Glaciers & Karst	EA	EA
2.4	16	Air Temperature: Recent, 1980–2009	Air Temperature	EA	EA
2.5	17	Air Temperature: Projected Change, 2010–2049	Air Temperature	EA	EA
2.6	20	Precipitation: Recent, 1980–2009	Precipitation	EA	EA
2.7	21	Precipitation: Projected Change, 2010–2049	Precipitation	EA	EA
2.8	25	Snow Depth: Recent, 1981–2010	Snow	EA	EA
2.9	26	Snow-Day Fraction: Projected Change, 2010–2049	Snow	EA	EA
2.10	29	Watersheds & Value Comparison Units (VCUs)	Watersheds & Value Comparison Units (VCUs)	CFM, EA	CFM
Chapter 3: Biological Setting					
3.1	38	Biogeographic Provinces	Biogeographic Provinces	CFM	EA, CFM
3.2	40	Wetlands	Wetlands	EA	EA
3.3	43	Salt Marsh Estuaries	Estuaries	EA, CFM	CFM, EA
3.4	49	Land Cover	Land Cover & Forest Vegetation	EA	EA
3.5	50	Forest Vegetation	Land Cover & Forest Vegetation	EA	EA
3.6	55	Productive Old-growth Forest	Old-growth & Second-growth Forest	CFM, EA	CFM, EA
3.7	56	Second-growth Forest	Old-growth & Second-growth Forest	CFM, EA	CFM, EA
3.8	58	Core Areas of High Biological Value: Watershed Scale	Core Areas of High Biological Value	CFM	CFM
3.9	59	Core Areas of High Biological Value: Sub-Watershed Scale	Core Areas of High Biological Value	CFM	CFM
3.10	63	Index of Cumulative Ecological Risk	Index of Cumulative Ecological Risk	CFM	CFM
Chapter 4: Anadromous Fish					
4.1	71	Anadromous Fish Species Richness	Anadromous Fish Habitat	EA, CFM	CFM, EA
4.2	72	Pacific Salmon Hydroclimatic Sensitivity Index	Anadromous Fish Habitat	EA	CFM, EA
4.3	75	King (Chinook) Salmon	King (Chinook) Salmon	EA, CFM	CFM
4.4	78	Red (Sockeye) Salmon	Red (Sockeye) Salmon	EA, CFM	CFM
4.5	81	Silver (Coho) Salmon	Silver (Coho) Salmon	EA, CFM	CFM
4.6	84	Pink (Humpy) Salmon	Pink (Humpy) Salmon	EA, CFM	CFM
4.7	87	Chum (Dog) Salmon	Chum (Dog) Salmon	EA, CFM	CFM
4.8	90	Steelhead Trout	Steelhead Trout	EA, CFM	EA
4.9	94	Dolly Varden	Dolly Varden	EA	CFM
4.10	98	Coastal Cutthroat Trout	Coastal Cutthroat Trout	EA	CFM
4.11	102	Eulachon (Hooligan)	Eulachon (Hooligan)	EA	CFM
Chapter 5: Birds					
5.1	113	Breeding Bird Species Richness	Bird Species Richness	EA	EA, CFM
5.2	116	Important Bird Areas (IBAs)	Important Bird Areas (IBAs)	EA	EA
5.3	119	Marine Bird Colonies	Marine Bird Colonies	EA	EA
5.4	122	Marbled Murrelet	Marbled Murrelet	CFM, EA	EA
5.5	125	Kittlitz's Murrelet	Kittlitz's Murrelet	EA	EA
5.6	128	Shorebirds	Shorebirds	EA	EA
5.7	131	Prince of Wales Spruce Grouse	Prince of Wales Spruce Grouse	EA	EA
5.8	134	Queen Charlotte Goshawk	Queen Charlotte Goshawk	EA	CFM, EA
5.9	137	Bald Eagle	Bald Eagle	EA	CFM
Chapter 6: Mammals					
6.1	146	Mammal Species Richness	Mammal Species Richness	EA, CFM	EA
6.2	149	Northern Flying Squirrel	Northern Flying Squirrel	EA	CFM
6.3	154	Sitka Black-tailed Deer	Sitka Black-tailed Deer	CFM	CFM
6.4	159	Alexander Archipelago Wolf	Alexander Archipelago Wolf	EA	EA, CFM
6.5	167	Brown and Black Bear	Brown Bear, Black Bear	CFM, EA	CFM
Chapter 7: Human Uses					
7.1	179	Land Ownership	Land Ownership	EA	EA
7.2	186	Transportation and Energy Infrastructure	Transportation and Energy Infrastructure	EA	EA
7.3	190	Community Subsistence Use	Community Subsistence Use	CFM, EA	CFM
7.4	194	Timber	Timber	EA	EA
7.5	200	Metals Mining	Metals Mining	EA	EA, CFM
7.6	205	Commercial Fishing	Sport and Commercial Fishing	EA	EA
7.7	209	Land Use Designations	Land Use Designations	EA	EA
7.8	210	Legislatively Protected Areas	Land Use Designations	EA	EA
7.9	213	A Conservation Area Design for Southeast Alaska	A Conservation Area Design for Southeast Alaska	CFM	CFM
7.10	216	Tongass 77 Watersheds	Tongass 77 Watersheds	EA	EA
Chapter 8: Conservation Summary					

[1]EA = *Ecological Atlas of Southeast Alaska*, CFM = *A Conservation Assessment for the Coastal Forests and Mountains Ecoregion*.

Audubon ALASKA

Regional Overview

Located between 55 and 60° N latitude, Southeast Alaska extends approximately 500 miles northwest from the Canadian Border to Yakutat Bay and is about 120 miles in width. The lands of Southeast Alaska cover about 23 million acres (similar in size to the State of Maine), of which about 17 million acres are within the Tongass National Forest. The region is dominated by the Alexander Archipelago, which is made up of over 5,000 islands. The shoreline is more than 18,000 miles long, which makes up about 20% of the coastline of the entire United States.

Yakutat
Haines Hwy
Klondike Hwy
Teslin
Tagish Lake
Skagway
Klukwan
Chilkat R.
Haines
Atlin Lake
Mt. Fairweather (15,325 ft, 4671 m)
Fairweather Mountains
Glacier Bay
Icy Strait
Lynn Canal
Gustavus
Tatsa River
Elfin Cove
Juneau
Hoonah
Pelican
CHICHAGOF ISLAND
Whitins River
Tenakee Springs
Chatham Strait
Stephens Passage
CANADA
UNITED STATES
Coast Mountains
ADMIRALTY ISLAND
Angoon
Sitka
BARANOF ISLAND
Frederick Sound
Kake
KUIU ISLAND
Kupreanof
KUPREANOF ISLAND
Petersburg
Stikine River
Iskut River
Cassiar Mountains
Point Baker
Wrangell
Port Alexander
Port Protection
Summer Strait
ZAREMBO ISLAND
WRANGELL ISLAND
ETOLIN ISLAND
Whale Pass
Coffman Cove
Edna Bay
PRINCE OF WALES ISLAND
Clarence Strait
Thorne Bay
Meyers Chuck
Hyder
Klawock
Kasaan
REVILLAGIGEDO ISLAND
Craig
Hollis
Ketchikan
Saxman
Hydaburg
Metlakatla
Pacific Ocean
UNITED STATES
CANADA
Dixon Entrance
Prince Rupert

Satellite Imagery[1]

1. Esri (2015), based on: USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen and the GIS User Community.

N

0 50 miles
0 50 km

Map 1.1: Regional Overview