Identifying a Portfolio of Areas of Biological Significance

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Abstract

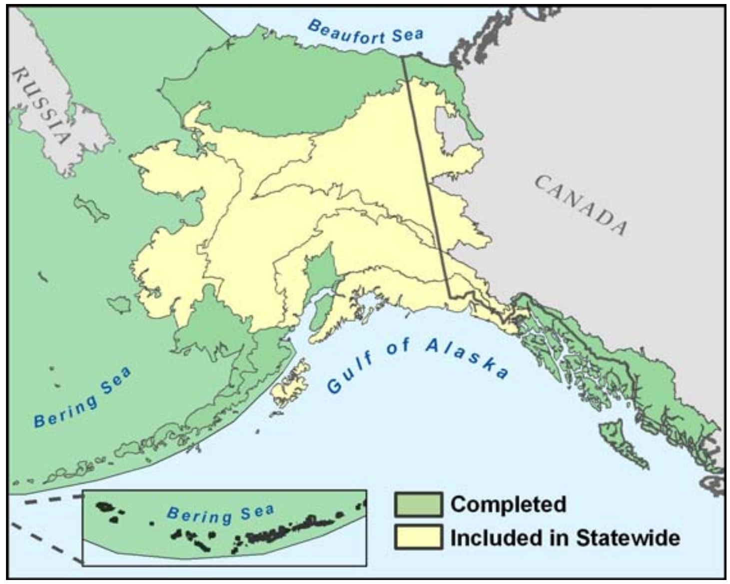
The Nature Conservancy in Alaska has completed ecoregional assessments for six of the eleven ecoregional planning units in the state. Each of these assessments produced a map indicating areas of biological significance. Referred to as portfolios, these maps represent areas that, if managed for biodiversity, will likely conserve the native species and ecological communities of those ecoregions. The portfolio is a conservation blueprint – a vision for conservation success – to guide public land managers, conservation organizations, private landowners, and others in conserving natural diversity within the ecoregion. This paper describes how we completed the portfolio for the remaining five ecoregional planning units and thus completed a conservation blueprint for Alaska. To design a statewide portfolio of areas of biological significance, we first identified species and ecological systems that represent the biodiversity of Alaska and are of conservation concern. The target list included 14 birds and one bird group, 6 fish, 7 mammals and one mammal group, and 19 vegetation classes. We defined conservation goals for these species and ecosystems, which have a quantitative and spatial component, as the basis for delineating areas of biological signification. In addition to conservation goals, we used areas previously identified for their ecological importance to locate potential portfolio sites.

The statewide portfolio comprises 82.3 million ha and includes 219 areas of biological significance. This terrestrial portion of the portfolio contains 55.7% of the state. One hundred fifty-two (69%) areas of biological significance also have a marine component. The final portfolio meets 21 of 22 breeding conservation goals for species targets and all 13 non-breeding goals and includes a minimum of 30% of all 9 featured habitats and 18 of 19 terrestrial ecosystems. Human activities have had little impact on most portfolio sites, with 127 sites (58.0%) showing less than 10% of moderate to critical levels of cumulative impact. Nearly half (45.5%) of the portfolio is currently managed to conserve biodiversity. Based on our experience with other Alaska ecoregions, this rapid approach to delineating a portfolio achieves our goal to identify the places that are important for the conservation of biodiversity in the state. The advantages of the method outlined in this paper are that it is simple, rapid, and uses tools and techniques appropriate for the scale of the project and the project objective. Most importantly, we are able to identify functional conservation sites quickly and use this as a foundation to formulate conservation strategies for Alaska.

Introduction

The Nature Conservancy in Alaska has completed ecoregional assessments for six of the eleven ecoregional planning units in the state (Figure 1). Each of these assessments produced a map indicating areas of biological significance. Referred to as portfolios, these maps represent areas that, if managed for biodiversity, will likely conserve the native species and ecological communities of those ecoregions. The portfolio is a conservation blueprint – a vision for conservation success – to guide public land managers, conservation organizations, private landowners, and others in conserving natural diversity within the ecoregion. This paper describes how we completed the portfolio for the remaining five ecoregional planning units and thus completed a conservation blueprint for Alaska.

Figure 1. Status of Assessments of Ecoregional Planning Units in Alaska in 2004



With each ecoregional assessment requiring a great deal of resources, efficiencies were needed to complete the portfolio for Alaska. This statewide assessment was coarse in comparison to the earlier ecoregional assessments in that it was based on a smaller subset of Alaska's biodiversity (plants, animals, and ecosystems) yet followed well-established methods of conservation area design.

Scientists have developed similar principles for designing networks of conservation areas that maintain regional biodiversity and ecological integrity (Noss and Cooperrider 1994; Groves et al. 2000; Groves et al. 2002; Margules and Pressey 2000; TNC 2003). Conservation biology thought and research on reserve size, fragmentation, and connectivity have contributed to these concepts. Groves (2003) synthesized the various ideas on conservation area design into three principles:

- ***Representation*** or representativeness of each vegetative community or ecosystem across the environmental gradients in which they occur in a conservation area network;
- ***Persistence*** of conservation targets (i.e. species and ecosystems of conservation interest) through a conservation area network that can maintain viability and ecological integrity;
- ***Efficiency*** in a network that achieves regional goals for biodiversity conservation in the least total area and/or the least number of conservation areas.

The Nature Conservancy also considers ***Irreplaceability, Integration, and Functionality*** when designing conservation areas (Groves et al. 2000). Areas with irreplaceable occurrences of conservation targets, or those that have no substitutes, should be included in the portfolio even if no other targets occur there. Yet we give priority to areas that integrate multiple types of coarse-scale ecosystems (e.g., terrestrial, aquatic and coastal) or areas that have targets at multiple spatial scales and levels of biological organization (Poiani et al. 2000). Functionality refers to the ability of a conservation area to maintain healthy, viable conservation targets[1] over the

[1] Viability refers to the ability of populations of species and occurrences of ecological communities and systems to persist over a specified time period. In essence, viability assessment represents a risk analysis for making an investment decision (Groves et al. 2000). Due to Alaska's lack of habitat fragmentation and limited development, we assume most current populations and occurrences of species and systems to be 'viable.' We avoid areas with a higher level of development, fragmentation, or other human pressure in conservation area design, unless the conservation targets in such areas do not occur anywhere else.

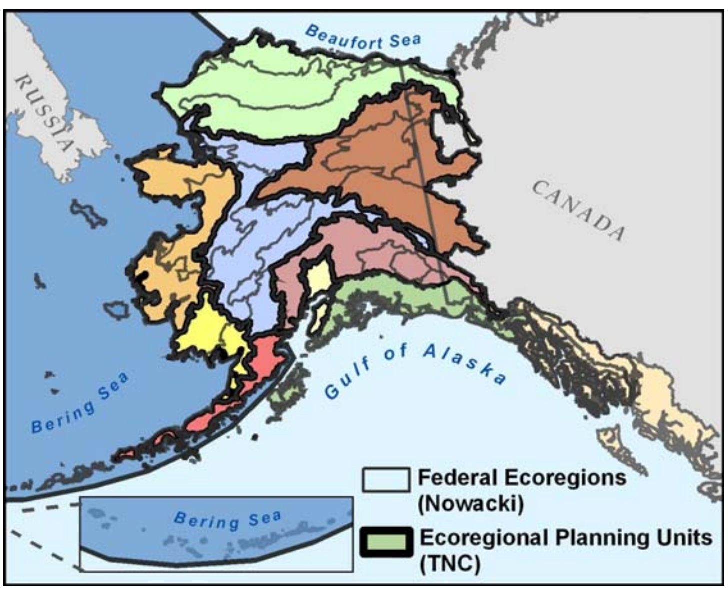
long term (100+ years), including the ability to respond to natural or human-caused environmental change (Poiani et al. 2000). Areas should be functional or readily restorable to a functional condition to ensure persistence of conservation targets. Functional conservation networks incorporate buffers of critical areas and connectors between these critical areas.

Methods

Study Area

Alaska's 365 million acres span roughly 21 degrees of latitude and 43 degrees of longitude, with 70,800 km of coastline (ADNR 2006), more than the rest of the U.S. combined. The position of Alaska between the cold Arctic Ocean and warmer North Pacific Ocean, widespread coastline and islands, high mountain ranges and ice fields, and the large size of the state contribute to overall biological diversity. Elevations range from sea level to the highest mountain in North America, Denali, at 20,320 feet (6194 meters). Topography, climate, wildlife, vegetation, and human communities within this expanse are diverse and the range of variations is dramatic. This variety of geographical extent is reflected in a great diversity of precipitation, temperature, and vegetation in the state, from the temperate rainforest in the southeast panhandle to the arid tundra of the Arctic coastal plain. Variation in number of frost-free days is great, ranging from more than 200 days in portions of southeastern Alaska and the Aleutian Islands to 40 days in the Arctic. Precipitation ranges from roughly 10 inches in the Arctic to around 200 inches in parts of southeastern Alaska. Less than 1 percent of the landscape has been altered by agricultural, industrial, or urban development (Schoen and West 1994), so large-scale ecological processes continue with little human interference. For example, over 6 million acres of taiga burned in the summer of 2004 (NIFC 2004), and caribou migrate hundreds if not thousands of miles annually.

Figure 2. Ecoregions (Nowacki et al. 2001) and TNC's Ecoregional Planning Units



The rich mosaic of landscapes and wildlife in the state can be characterized by its ecoregions. Ecoregions can be defined as large areas of land and waters that contain groups of vegetation communities that share species and ecological dynamics, environmental conditions, and interactions that are critical for long-term species persistence. Within an ecoregion, similar biotic and abiotic conditions exist, defining the structure and function of the land, species, communities and ecological processes within that area. Nowacki et al. (2001) delineated 32 terrestrial ecoregions in Alaska; these ecoregions are either wholly in Alaska or extend from Alaska into western Canada or the Russian portion of the Bering Sea (Figure 2). [2] The Nature Conservancy aggregated the ecoregions into 11 ecoregional planning units (EPUs) to facilitate planning (Figures 1 & 2).

Designing a Portfolio for Alaska

To design a portfolio of areas of biological significance in Alaska, we first identified conservation targets for the state (Figure 3). Conservation targets are the plant and animal species and ecological systems selected to represent biodiversity in an ecoregional assessment. We defined conservation goals, which have a quantitative

[2] See *Ecoregions of Alaska* on the Statewide Blueprint CD for a map and description of these ecoregions.

and spatial component, as the basis for delineating areas of biological significance in the five ecoregional planning units. After drafting a portfolio that met conservation goals for species targets in the five EPUs, we mapped areas previously identified by agencies and conservation organizations for their ecological importance to locate other potential portfolio sites. We refined the draft portfolio to achieve integration, irreplaceability, and functionality, and to ensure sufficient representation of ecological systems. The portfolios for the six EPUs were included in the assessment of ecosystem representation.

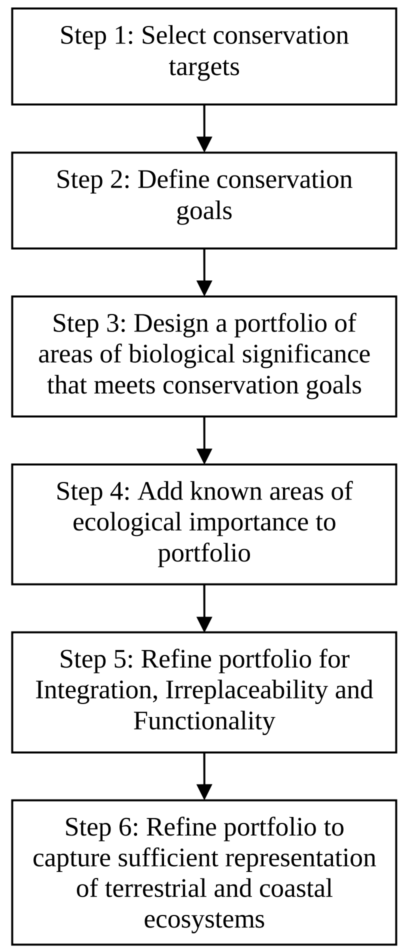
We designed the portfolio based primarily on a terrestrial assessment of Alaska's biodiversity. Some nearshore marine and coastal areas were captured due to the inclusion of coastal habitats and marine species that use the coastline. Freshwater areas were included as indicated by available data for salmonid fish species. Even though the ecoregions and EPUs include portions of Canada, the portfolio design did not include Canada.

Conservation Targets

The Nature Conservancy uses a coarse filter – fine filter approach to selecting conservation targets (Groves et al. 2000). The coarse filter is a broad-level conservation strategy whereby ecological systems are used as surrogates to represent habitats, constituent species, and ecological processes, without having to account for each element individually. Conservation of a representation of each coarse-filter target (terrestrial, aquatic, and marine ecosystems and communities) assumes that the biodiversity inhabiting each system will also be protected. The fine filter complements the coarse filter by assessing certain elements of biodiversity that require special attention. Some species may not be captured in conservation of the coarse filter, due to rarity, limited distribution, vulnerability, or large spatial requirements. Yet including the coarse filter ensures that unknown and poorly studied species and communities are incorporated (Higgins et al. 2004).

The vast number of plant and animal species comprising Alaska's biological diversity makes it impractical to assess and plan for each individual species. The first step, therefore, was to select a subset that efficiently represents the biological diversity of the state. To complement this subset, all coarse-scale ecosystems representative of the state were also selected as targets. The coarse filter-fine filter approach is designed to strike a balance between manageability of information about biodiversity and insurance that all major habitat types (i.e. ecological systems) are considered in the analysis (Groves et al. 2000). For this statewide assessment, we selected fine filter and coarse filter targets based on three classes of biodiversity surrogacy (Noss 2004):

Figure 3. Steps to designing a portfolio for Alaska



1. ***Special Elements***
   - static (i.e. plants) and/or rare species
   - species that show a high fidelity to a particular place and/or have a restricted local range during some seasons or life stages
   - species in greatest need of conservation, such as threatened and endangered species and those in demonstrable decline

- species concentration areas that are unique, irreplaceable, or critical to the conservation of a certain species or suite of species (e.g. migratory bird stopovers)
- Alaska endemics (no subspecies included)

2. ***Focal Species***
   - species that act as connectors (e.g. migratory species)
   - species that require large areas (i.e. wide-ranging)
   - keystone species (i.e. a species whose impact on its ecosystem is larger than would be expected from its abundance)
3. ***Representation***
   - Featured habitats (i.e. broadly-defined habitats that either support high biodiversity or are of conservation concern due to demonstrated decline in extent, vulnerability to anthropogenic forces, or high probability of conversion)
   - Terrestrial ecosystems

We drafted a potential target list based on previous ecoregional assessments, species listed through the Endangered Species Act, and expert opinion. We attempted to list species that use a broad range of habitat types and thus require different places during their lifecycle. Biologists from state and federal agencies in Alaska and the University of Alaska reviewed the list and available spatial data. The potential target list included species that use terrestrial, freshwater, and coastal habitats. Marine species that do not utilize some portion of the coastline during their life cycle were not included. We used anadromous rivers as a surrogate for aquatic ecosystems.

Due to limited time and resources, we needed to make careful choices about the species that we chose as surrogates for biodiversity in this statewide assessment. To help narrow down the potential target list, we employed three criteria suggested by Noss (2004):

1. ***Validity*****:** The target must be an element of legitimate conservation interest in its own right or have a well-documented or reasonable relation to such elements. We relied upon published literature and expert opinion to categorize species as 'definite,' 'moderate,' or 'not valid' conservation interest.
2. ***Complementarity and Comprehensiveness*****:** The suite of targets selected should be complementary rather than redundant. Some redundancy is desirable to compensate for data gaps, but the overall suite of targets should be complementary and span as broad a spectrum of biodiversity as possible. Some species and habitats can also be viewed as surrogates for species which have not been studied or mapped.
3. ***Data Availability and Uniformity:*** For each target, there must be easily obtainable, consistent spatial data for its distribution and habitat use throughout the state. Without such data, we cannot incorporate a target into a spatial analysis. We placed the quality of the data into four categories based on spatial extent and specifity:

   - 'comprehensive' if extent complete to the target's distribution in Alaska and specific to general types of habitat used (e.g. tundra vs. forest)
   - 'partial' if extent did not cover all of target's distribution
   - 'incomplete' if extent so limited to make data not useful
   - 'range' if data complete to target's distribution but lacking specificity to general habitat types used (e.g. south of the 65 degrees latitude)

The final list of fine filter targets included 14 birds and one bird group, 6 fish, 7 mammals and one mammal group (Table 1). In all, 19 special elements, 8 focal species or species groups, and 9 featured habitats were chosen as targets (Appendix 1). Two species – caribou and Pacific walrus – were chosen both as special elements and focal species. The species aggregation of waterfowl as a focal species included some of the birds chosen as special elements.

Table 1. Fine Filter Conservation Targets

BIRDS	MAMMALS
Black brant	Brown bear
Black guillemot	Caribou
Black oystercatcher	Ice seal
Black-legged kittiwake	Moose
Bristle-thighed curlew	Northern fur seal
Buff-breasted sandpiper	Pacific walrus
Kittlitz's murrelet	Polar bear
Marbled godwit	Steller sea lion
McKay's bunting	
Red-legged kittiwake	FEATURED HABITATS
Spectacled eider	Big tree old growth forests in SE Alaska
Steller's eider	Coastal lagoons and barrier islands
Waterfowl (ducks & geese)	Coastal plain wetlands
Whiskered auklet	Eelgrass beds
Yellow-billed loon	Interior wetland complexes
	Karst topography
FISH	Kelp beds
Pacific herring	Sand dunes
Salmon (5 Pacific species)	Tidal glaciers

For the coarse filter, we employed the Advanced Very High Resolution Radiometer (AVHRR) landcover map for Alaska (Fleming 1997) for a vegetation map for the state. AVHRR covers the area from latitude 51 to 71 degrees north and longitude 131 to 179 degrees west, excluding the central and western Aleutian Chain. We used 19 vegetation classes for our assessment, excluding classes for adjacent countries, water, and fires (Table 2).

Table 2. Coarse Filter Conservation Targets

Vegetation Classes from AVHRR (Fleming 1997)
Alpine Tundra & Barrens
Closed Broadleaf & Closed Mixed Forest
Closed Mixed Forest
Closed Spruce & Hemlock Forest
Closed Spruce Forest
Dwarf Shrub Tundra
Glaciers & Snow
Low & Dwarf Shrub
Low Shrub/Lichen Tundra
Moist Herbaceous/Shrub Tundra
Open & Closed Spruce Forest
Open Spruce & Closed Mixed Forest Mosaic
Open Spruce Forest/Shrub/Bog Mosaic
Spruce & Broadleaf Forest
Spruce Woodland/Shrub
Tall & Low Shrub
Tall Shrub
Tussock Sedge/Dwarf Shrub Tundra
Wet Sedge Tundra

Conservation Goals for Targets

Goals provide the quantitative basis for identifying areas of biological significance and for evaluating the effectiveness of conservation action. Conservation goals are measureable both quantitatively and spatially. The quantitative component defines the number of occurrences of each target necessary to adequately conserve the target. The spatial component describes how target occurrences should be distributed across the landscape. As a general rule, multiple examples of each target, stratified across the target's geographic range, are necessary to represent the variability of the target and its environment, and to provide some level of replication to ensure persistence in the face of environmental stochasticity. To capture this variability within the EPUs, we used the ecoregions developed by Nowacki et al. (2001) (Figure 2).

For example, a conservation goal of five occurrences in an EPU may be further refined to require that at least one occurrence be located in each ecoregion within the EPU. The science involved in setting conservation goals is still young, and appropriate guidelines for answering the inherent question “How much is enough?” are sparse, particularly in largely intact systems such as occur in Alaska. A number of factors, including life history, key ecological processes and genetic or environmental variability of a target, contribute to the goal-setting process for each target. Ideally, conservation goals should be based on minimum population viability theory and a thorough understanding of the population biology of targeted species. Unfortunately, current, complete and specific data were not available for most of the targets in this assessment.

Using a variable goal setting approach developed for the Alaska-Yukon Arctic ecoregional assessment (TNC 2006), we assigned goals to species targets based on two criteria: the target selection criteria and whether or not the species’ reproduction was identified as a critical life stage (e.g., nesting, breeding, calving, etc.) (Appendix 2). We assigned a score between 1 and 4 to each species target based on its selection criteria; if more than one criterion was listed, we assigned the highest ranked criterion (Table 3). Targets that were identified because a reproductive life-stage occurred in Alaska were assigned a score of 4. Some targets did not receive scores for reproduction, but all targets received a score for selection criteria.

Table 3. Species Target Ranking Scores

Target reproduction attribute	Score	Target selection criteria	Score
nesting	4	threatened or endangered	4
breeding	4	documented declining	3
rearing	4	limited distribution/high fidelity	2
spawning	4	vulnerable	2
breeding colonies	4	endemic	2
post-breeding	4	large area needs	1
calving	4	connectors	1
		keystone species	1

Table 4. Species Target Conservation Scores & Goals

Combined score = reproduction + selection	Conservation goal (%)
1	30
2	30
3	30
4	40
5	50
6	60
7	70
8	80

To reach an overall goal for each species target, we combined a target’s selection criteria score and a target’s reproduction attribute score, if applicable (Table 4). Combined scores ranged from 1 to 8. These values were transformed into percentages to represent goals, according to a crosswalk. The minimum goal given any species target was 30%. Goals for targets ranged from a low of 30% (for a species selected as an umbrella species, with no reproduction attribute, for example), to a high of 80% (for an imperiled species in its breeding range, for example) (Appendix 2).

Our analysis, like many before (Duffy et al. 1999; Engelking 1994), used vegetation as a surrogate for terrestrial biodiversity in the representation assessment. The question of how much constitutes sufficient representation has been approached in different ways, from not determining a threshold (DeVelice et al. 1988), to setting one minimum for a large region (CAFF 1994), to quantifying relationships between number of species and land area (Dobson 1996; MacArthur and Wilson 1967). In lieu of a widely accepted theory that suggests how much area is enough, we chose a 30% minimum benchmark because it is in accord with the majority of conservation plans published in the literature. Our more cautious approach in Alaska follows recommendations for large reserves (Poiani et al. 2000; Groves et al. 2002) and is based on the large habitat needs of wide-ranging and migratory mammals like brown bears and caribou, the homogeneity of the landscape, and ecological processes that still occur across large areas of Alaska without human interference.

We also used 30% as a benchmark for most of the featured habitats selected as targets. The exception was Sand Dunes. These habitats are few in Alaska and the available data only identified a portion of sand dunes in the state, so we set the goal at all mapped occurrences.

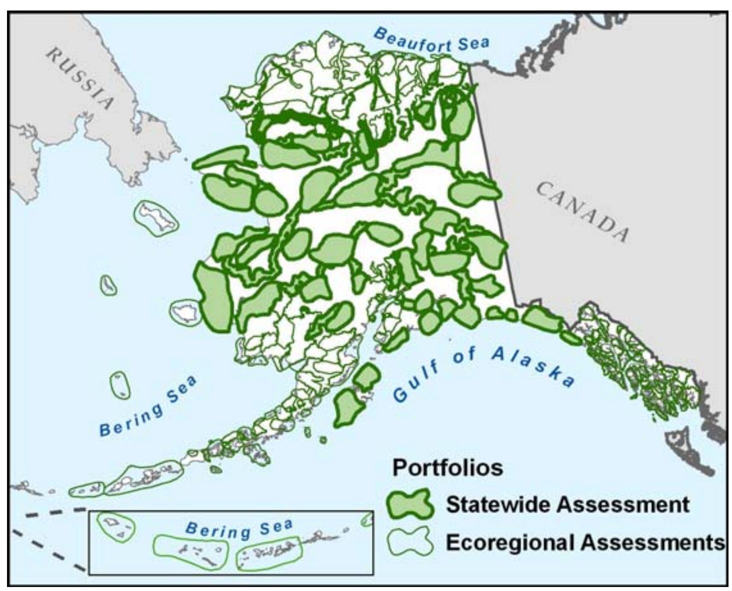
Portfolio Delineation

To examine the spatial requirements of special elements, focal species, and featured habitats, we developed portfolios for each of these target classes. We considered salmonids separately from the other focal species due to the linear nature of their habitat. Anadromous systems can provide connectivity between areas of biological significance. We prioritized anadromous streams by the number of salmonid species present to maximize diversity, the presence of king salmon for their relative rarity in the state, and the presence of sockeye salmon for their use of headwater lakes to spawn. Selected anadromous systems were buffered 10 kilometers to delineate the area of biological significance.

Using the conservation goals for targets and the principles of integration, irreplaceability, and efficiency (Groves et al. 2000), we delineated polygons around groups of target occurrences. To capture targets across the environmental gradient of Alaska, we used the 32 ecoregions (Nowacki et al. 2001) to stratify the EPUs. We selected areas to capture target needs in each of these ecoregions as well as within the EPUs and across the state.

Up to this point, we focused portfolio delineation on the five ecoregional planning units that had not been considered in previous assessments. The portfolios from the other six ecoregional planning units were then added to identify places of overlap or potential gaps in the earlier portfolio development (Figure 5).

Figure 5. Portfolios from previous ecoregional assessments and portfolio developed in statewide assessment.



Known Areas of Ecological Importance

Just as we referred to published reports and experts about target selection, we also sought out previous studies about the important natural places in Alaska. Government agencies and conservation groups have studied Alaska and northwestern Canada to identify representative examples of ecosystems and communities, to protect vulnerable species and plant communities, or to call attention to unique landscape features[3] (Table 5). Many of these studies occurred in the 1970s and 1980s before the advent of geographical information systems (GIS) so we digitized maps associated with the older reports.

We used these studies to both direct us to important places within Alaska's ecoregions and to further inform us about the places we were identifying as areas of biological significance. Because most of these past efforts included fieldwork, concentration on specific species groups, and/or more time and resources than available to our team, they had the potential to suggest portfolio sites that were not indicated by target data. These areas included

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[3] See *Known Areas of Ecological Importance* for more about each study that we identified and used. Maps of most studies are included on the Statewide Blueprint CD.

some unique habitats that we were not able to map in any other way (e.g. hot springs). We also used these studies to choose between similar potential portfolio sites.

Table 5. Previous studies about important places in Alaska.

Studies	Agency/organization
Potential national natural landmarks	National Park Service
Proposed ecological reserves	USDA Forest Service
Research natural areas	USDA Forest Service, Bureau of Land Management
Coastal areas meriting special attention	State of Alaska
Most environmentally sensitive areas	State of Alaska
Important bird areas	Audubon Society
Western hemisphere shorebird reserve network	WHSRN
Biological place prioritization	TNC & Alaska Natural Heritage Program
Prince William Sound hotspots	National Wildlife Federation

Portfolio Refinement

We combined the portfolios for the three target classes and salmonids and the locations of known areas of ecological importance to delineate a draft statewide portfolio. We used the three guidelines of Integration, Irreplaceability, and Functionality, as well as the conservation goals, to guide our decisions on how best to combine adjacent or overlapping sites. Meeting conservation goals ensured that irreplaceable places for sensitive species in Alaska would be included in the portfolio. Where we over-met conservation goals, we selected sites or combined adjacent sites that captured multiple targets. We incorporated major anadromous stream systems as connectors between areas of biological significance.
We assessed the draft statewide portfolio for representation of terrestrial ecosystems by ecoregion, EPU, and across the state. Where ecosystem representation fell below the 30% benchmark at any of the three spatial scales, we augmented portfolio sites to capture more of the under-represented ecosystem(s).

Lastly, we asked an expert on the natural landscapes of Alaska who authored several of the U.S. and state government studies to review the portfolio for any gaps.

Assessment of Human Activities in the Portfolio

To quantify the pattern and the amount of potential impact caused by human activities in Alaska, we developed a spatially explicit model that quantifies the relative amount and pattern of human activity in each ecoregion in Alaska.[4] We focused on four human activities across the state: human access, mining, logging, and energy extraction. We analyzed the human activity level in the portfolio, specifically looking at how much of each site was affected by moderate to critical levels of potential impact.

Assessment of Conservation Status of the Portfolio

We mapped the distribution of land management across Alaska and looked at different land management types in Alaska. Using the framework of the USGS Gap Analysis Program, we developed conservation management status categories appropriate to the level of development and human use in the state.[5] We analyzed the portfolio to quantify the existing level of protection in each site.

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[4] See *An Assessment of Cumulative Human Activities in Alaska* for more about the methods of developing that dataset. Maps of the human activities and analyses are included on the Statewide Blueprint CD.
[5] See *Assessing Protection of Alaska's Terrestrial Biodiversity* for more about conservation management status and the dataset we developed. Maps of land management, ownership, and conservation management status are included on the Statewide Blueprint CD.

Results

Portfolio for Alaska

The total portfolio for the state of Alaska comprises 82.3 million ha and includes 219 areas of biological significance (Appendix 3, Figure 6). This terrestrial portion of the portfolio contains 55.7% of the state. One hundred fifty-two areas of biological significance (69%) also have a marine component based on the habitat needs of coastal conservation targets. To capture the habitat and migration needs of salmon, major river systems such as the Yukon, Tanana, and Copper Rivers were included in the portfolio.

The portfolio contains land and waters in all 32 ecoregions and 11 EPUs, though with a wide variation in the amount of lands included. Within ecoregions, sites occupy a minimum of 11% of the North Ogilvie Mountains to a maximum of 99.6% of the terrestrial areas of the Bering Sea Islands. The range of lands included is also great in EPUs, with a minimum of 28.9% inclusion in Yukon Plateau and Flats and a maximum of 85.8% in the Bering Sea and Aleutians.

Conservation Goals

The final portfolio meets 20 of 22 reproduction conservation goals for species targets and all 13 non- reproduction goals (Table 6). Reproduction goals were not met for Kittlitz's murrelet and yellow-billed loon. The reproduction goal was 70% for both of these species. Only 50% of documented Kittlitz's murrelet sites were included in the portfolio. Spatial data for yellow-billed loons was limited to breeding range and approximately 50% of the range was included in the portfolio. With the exceptions noted, species goals were met in ecoregions and EPUs.

The final portfolio includes a minimum of 30% of all featured habitats, with final representation well-exceeding that threshold for Big Tree Old Growth Forests, Coastal Lagoons & Barrier Islands, Coastal Plain Wetlands, Eelgrass Beds, and Kelp Beds. Only 5 of 8 Sand Dune occurrences were captured in the portfolio, falling short of the goal of 100%. Except for Sand Dunes, goals for featured habitats were met in ecoregions and EPUs.

Overall, the portfolio over-represents vegetation classes in the state. Of the 19 terrestrial ecosystems, only Glaciers & Snow were under-represented across the state, with just 22.6% captured in the portfolio. For the other 18 classes, representation ranged from a minimum of 45.3% for Spruce & Broadleaf Forest to a maximum of 83.5% for Wet Sedge Tundra.

Table 6. Achievement of Reproduction and Non-reproduction Goals for Conservation Targets

Target Group	Number of Breeding Goals	Number of Breeding Goals Met	Number of Non-breeding Goals	Number of Non-breeding Goals Met
Birds	15	13	5	5
Fish	2	2	2	2
Mammals	5	5	6	6
Featured Habitats	NA	NA	9	8
Terrestrial Ecosystems	NA	NA	19	18

Within EPUs, 6 vegetation classes are under-represented in 6 ecoregions. Glaciers & Snow are most often under-represented (4 EPUs). In the Gulf of Alaska Mountains and Fjordlands, 4 vegetation classes (Open & Closed Spruce Forest, Tall & Low Shrub, Glaciers & Snow, and Closed Broadleaf & Closed Mixed Forest) are under-represented, but with the exception of Glaciers & Snow, 3 of these classes could be considered to be peripheral[6] in that EPU.

The portfolio meets goals for most vegetation classes in most ecoregions. Ten vegetation classes are under-represented in 14 ecoregions. Again, some of these vegetation classes could be considered peripheral in those ecoregions, and Glaciers & Snow is the only under-represented class in 4 of those ecoregions. Multiple vegetation classes are under-represented in the Chugach-St. Elias Mountains, Kuskokwim Hills, Lime Hills, and North Ogilvie Mountains ecoregions.

Human Activities in the Portfolio

Human activities have had little impact on most portfolio sites, with 127 sites (58.0%) showing less than 10% of moderate to critical levels of cumulative impact. Only 36 sites (16.4%) have greater than 20% of moderate to critical levels of cumulative impact. The highest levels of impact occurred at the Kenai River and Kenai/Kasilof Wetlands sites, with 88.4% and 77.1% of these sites respectively with moderate to critical levels of cumulative impact from the four human activities.

Conservation Status of the Portfolio

Nearly half (45.5%) of the portfolio is currently managed to conserve biodiversity (Table 7, CMS 1 & 2). More than a quarter (27.5%) is managed primarily for human use and development. Private parties own 16.3% of the portfolio, with the largest group being regional Native corporations (13.3%).

Table 7. Conservation Management Status of the Portfolio

Conservation Management Status (CMS)	Percent of Portfolio by Area (%)
1	38.8%
2	6.7%
3	10.7%
4	27.5%
Private	16.3%
	100.0%

[6] We defined an ecosystem to be 'peripheral' in any unified ecoregion where its total area was less than 200 km^2. For the least abundant vegetation class, Closed Spruce Forest, this cutoff equaled 2.4% of its total extent in the state. For the most abundant vegetation class, Open Spruce Forest/Shrub/Bog Mosaic, this cutoff equaled less than 1% of its total extent.

Figure 6. Portfolio of Areas of Biological Significance in Alaska

Discussion

Alaska's unfragmented landscape and wide-ranging species lead us to design large portfolio sites that meet the guidelines of conservation area design. These sites are ***functional***, allowing natural processes like migration and fire to occur without restriction. Large sites ensure that these critical ecological processes can continue. Many of the species targets (e.g. caribou, brown bear, salmon) have large home-range sizes. Home range refers to that area traversed by an individual in its normal activities of food-gathering, mating and caring for young. Other species in the state are migratory and require a network of areas for various life stages (e.g., migratory shorebirds). Larger areas have several advantages. Large areas are likely to contain a greater number of species than small areas, as well as larger populations of the species present (Meffe and Carroll 1997). Large areas are more likely than small areas both to maintain genetic diversity through disturbance events and environmental stochasticities and to minimize edge effects (Primack 2000). Large areas also are more likely to contain heterogenous habitat patches.

We have designed a portfolio that captures the ***irreplaceable*** places for sensitive species in Alaska. The portfolio contains 85% of the rookeries of the endangered Steller sea lion, 100% of the breeding area of the endangered Steller's eider, 100% of the nesting colonies of declining red-legged kittiwake, and 100% of the breeding area of the endemic McKay's bunting. The portfolio sites that capture those critical habitats also include important habitat for other Alaska species, thus integrating the diverse needs of multiple species.

Integration of terrestrial and anadromous species has also led to large portfolio sites that encompass entire watersheds or anadromous river systems. Connectivity among isolated patches is important for the interchange of individuals among populations and may increase local and regional persistence of populations (Fahrig and Merriam 1994, Sjogren 1991 in Rosenberg et al. 1997). In the portfolio, the large areas of biological significance offer connectivity among terrestrial areas. Salmon and their river systems are natural connectors as salmon play a crucial role in transferring nutrients from the marine environments to the freshwater systems. Effectively utilizing salmon as targets entails protection of entire river systems through which they pass in their lifetimes, from spawning grounds at headwaters to juvenile rearing in estuaries.

In The Nature Conservancy's coarse filter-fine filter approach to conservation area design, typically the coarse filter (i.e. ecosystems) is used as the first step in choosing portfolio sites, with an emphasis on including protected areas. In Alaska, we've found that the fine filter (i.e. species and communities) is a better driver for portfolio design for several reasons. First, Alaska remains a largely intact landscape, but biodiversity is not evenly distributed. We must focus conservation on the parts of the landscape that we know contain high species diversity. A fine-filter approach allows us to do that, whereas a coarse-filter approach in this setting tends to generate random, interchangeable portfolios that may or may not capture areas of high biodiversity. Second, these intact landscapes are inhabited by wide-ranging and migratory species that require vast areas be incorporated into the portfolio. Third, the land cover data available at the EPU and statewide levels does not provide/ sufficient detail to inform decisions about selecting important areas. The best statewide dataset is a 1-km resolution raster with only 19 vegetation classes total. Using this dataset to drive site selection would not produce focused results.

Even with the fine filter emphasis, goals for some targets were not met in the portfolio. Previous studies about conservation in Alaska have shown that existing federal and state conservation units (e.g. park and refuge lands) sufficiently represent the diversity of most ecosystems across the state (e.g. Duffy et al. 2000). Any ecosystems that are under-represented in the statewide portfolio might be adequately represented if all government conservation units were included in the portfolio. Our recent assessment of the protection of Alaska's biodiversity indicates that public lands alone do not ensure long-term survival of ecosystems. [7] Where the portfolio did not achieve goals for fine filter targets, we chose not to revise the portfolio because data was

[7] See *Assessing Protection of Alaska's Terrestrial Biodiversity* on the Statewide Blueprint CD for more about conservation management status and existing protection of ecosystems in Alaska.

incomplete for those targets and the possibility existed that the portfolio would prove to meet goals with better data.

Reliance on the fine filter, while over meeting goals for the coarse filter, suggests that conservation planning in intact landscapes such as Alaska should be driven by species needs. If this is the case, development of fine scale vegetation datasets may not be necessary. Relying upon coarser level data, such as AVHRR, could reduce the cost of conservation planning and increase the speed with which a plan can be completed.

Based on our experience with other Alaska ecoregions, this rapid approach to delineating a portfolio achieves our goal to identify the places that are important for the conservation of biodiversity in the state. The advantages of the method outlined in this paper are that it is simple, rapid, and uses tools and techniques appropriate for the scale of the project and the project objective. The project is based on data for a group of targets that represent a variety of habitat usage, both in type and extent, throughout the state.

Most importantly, we are able to identify functional sites quickly and use this as a foundation to formulate conservation strategies for Alaska. As a next step, we can use the biological data we've gathered, our Human Activities assessment, and conservation management status to help us prioritize where we focus our conservation strategies.[8] This conservation blueprint can also aid agencies and other conservation organizations in setting their own priorities in the context of the entire range of Alaska's biodiversity.

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[8] See *Prioritizing the Portfolio* on the Statewide Blueprint CD for one approach to determining conservation priorities in Alaska.

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Appendix 1. Conservation Targets Used in Portfolio Assembly

Targets Used in Portfolio Assembly

Target	Habitat	Critical Life Stage	Why Chosen	Validity[9]	Complementarity[10]	Data Quality[11]
Special Elements						
BIRDS						
Black brant	Large lakes	Breeding, molting	Demonstrated decline	definite	complements	comprehensive
Black oystercatcher	Coastal rocky intertidal zone	Breeding	Majority (65%) population in Alaska	definite	complements	partial
Bristle-thighed curlew	Tundra meadows hilly	Nesting	High fidelity to place	definite	complements at Seward	comprehensive
Buff-breasted sandpiper	Coastal dry tundra near wetlands in Arctic	Nesting/breeding, migration	Demonstrated decline	definite	complements	partial
McKay's bunting	Coastal tundra lowlands	Breeding, wintering	Endemic	definite	complements	comprehensive
Red-legged kittiwake	Coastal cliffs	Nesting	High fidelity to place; demonstrated decline	definite	redundant w/ BLKI but limited distribuition	comprehensive
Spectacled eider	Coastal lagoons and bays	breeding, wintering	Threatened	definite	complements	comprehensive
Steller's eider	Coastal lagoons and bays	breeding, wintering, molting	Threatened	definite	some redundancy?	comprehensive
Black guillemot	Coastal beaches	Nesting, breeding	High fidelity to place	moderate	complements other colonial seabird	comprehensive
Black-legged kittiwake	Coastal cliffs	Nesting	High fidelity to place	moderate	redundant w/ RLKI & TOMU but large colonies separate	comprehensive
Kittlitz s murrelet	Tidal glaciers, fjords	Nesting	Demonstrated decline; candidate ESA; maj pop in AK	moderate	complements	incomplete

[1] Is the target of legitimate conservation interest? We categorized species as 'definite,' 'moderate,' or 'not valid' conservation interest.
[2] Does the target's habitat needs complement those of other targets?
[3] Is there easily obtainable, consistent spatial data for the target's distribution and habitat use throughout the state? We categorized data as 'comprehensive,' 'partial,' 'incomplete,' or 'range.' See main text for more explanation.

Target	Habitat	Critical Life Stage	Why Chosen	Validity	Complementarity	Data Quality
Marbled godwit	Tundra meadows	Breeding	High fidelity to breeding grounds	moderate	some redundancy w/ caribou calving	comprehensive
Whiskered auklet	Talus slopes, boulder beaches, lava flows	Breeding, nesting	High fidelity to place; Rare	moderate	complements other colonists	comprehensive
Yellow-billed loon	Large clear-water lakes	Breeding, wintering	Demonstrated decline	moderate	complements N Slope breeders	partial, range
FISH						
Pacific herring	Coastal bays, intertidal & subtidal w/ vegetated	Spawning	High fidelity to place	definite	Surrogate for kelp	incomplete
MAMMALS						
Caribou	Tundra	Calving concentration areas, insect relief areas	high fidelity	definite	complements, surrogate for small tundra species	comprehensive (calving); incomplete (insect)
Northern Fur Seal	Coastal - sand & low angle rocky beaches	Rookeries	Demonstrated decline; high fidelity	definite	complements other marine mammals	comprehensive
Pacific Walrus	Coastal - sloping, protected beach w/ low tide flx	Male haulouts	High fidelity to place; endemic	definite	complements other marine mammals	partial
Steller sea lion	Coastal - rocky with immediate water access	Rookeries, haulouts	Endangered & Threatened; high fidelity	definite	complements if no harbor seal	comprehensive
FOCAL SPECIES						
BIRD						
Waterfowl (ducks and geese)	Coastal and interior wetlands, riparian areas	Breeding, nesting, migration, molting, wintering?	connectors (migratory)	moderate	may complement some lifestage info of individual species	partial
FISH						
Salmon	Freshwater streams	Spawning, rearing	connectors (migratory); keystone	definite	surrogate for aquatic, riparian, bears, beavers	partial
MAMMAL						
Caribou	Tundra	Calving concentration areas, insect relief areas	connectors (migratory); keystone in Arctic	definite	complements, surrogate for small tundra species	comprehensive (calving); incomplete (insect)

Target	Habitat	Critical Life Stage	Why Chosen	Validity	Complementarity	Data Quality
Pacific Walrus	Coastal - sloping, protected beach w/ low tide flx	Male haulouts	connectors (migratory)	definite	complements other marine mammals	partial
Brown bear	Riparian, tundra	Spring concentration areas, food concentration	large area (wide-ranging)	moderate	complements	partial
Ice seals	Ice edge	Haulouts	connectors (migratory)	moderate	complements other marine mammals	partial
Moose	Boreal forests, riparian areas	Calving, wintering	keystone	moderate	complements	partial but could be complete
Polar Bear	Coastal tundra and ice edge	Denning	large area (wide-ranging)	moderate	complements	comprehensive
FEATURED HABITATS						
Big tree old growth forests in SE Alaska		karst, alluvial, and upland locations; high biodiversity and perenially threatened due to economic value		definite	surrogate for OG species (marbled murrelet)	comprehensive
Coastal lagoons and barrier islands				definite	redundant w/ some migratory birds	partial
Coastal plain wetlands		coastal wetlands in Y-K Delta important for staging of shorebirds (curlews, godwits, WESA) and North Slope for shorebird nesting		definite	complements bird data	range
Eelgrass beds		as far north as Safety Lagoon near Nome; small patches		definite	some overlap w/ coastal lagoons	partial
Karst topography		expert nominated;		definite	complements	comprehensive
Kelp beds		expert nominated; nurseries, sea otter refuge		definite	surrogate for nearshore marine species	incomplete
Sand dunes		expert nominated; e.g. Kobuk, Nogahara, Pic, east of Prudhoe, NPRA; small active patches (not large interior dunes)		definite	complements	partial
Interior wetland complexes		73% of state could be considered wetlands for waterfowl, but muskeg useless (Rothe);		moderate	surrogate for landbirds, solitary sandpipers, scaup	range
Tidal glaciers		expert nominated; tremendous change & unique environment; rare statewide but abundant SE		moderate	surrogate for kittlitz's murrelet, harbor seals	comprehensive

Appendix 2. Conservation Goals for Targets Used in Portfolio Assembly

Target	Critical Life Stage	Why Chosen	Score for Selection Criteria	Score for Reproduction Attribute	Combined Score	Conservation Goal for Reproduction	Conservation Goal for Non-Reproduction
BIRDS							
Black brant	Breeding, molting	Demonstrated decline	3	4	7	70%	30%
Black oystercatcher	Breeding	Majority (65%) population in Alaska	2	4	6	60%	NA
Bristle-thighed curlew	Nesting/breeding	High fidelity to place	2	4	6	60%	NA
Buff-breasted sandpiper	Nesting/breeding, migration	Demonstrated decline	3	4	7	70%	30%
McKay s bunting	Breeding, wintering	Endemic	2	4	6	60%	30%
Red-legged kittiwake	Nesting	High fidelity to place; demonstrated decline	3	4	7	70%	NA
Spectacled eider	Breeding	Threatened	4	4	8	80%	NA
Steller s eider	Breeding, wintering, molting	Threatened	4	4	8	80%	40%
Black guillemot	Nesting, breeding	High fidelity to place	2	4	6	60%	NA
Black-legged kittiwake	Nesting	High fidelity to place	2	4	6	60%	NA
Kittlitz s murrelet	Nesting	Demonstrated decline; candidate ESA; maj pop in AK	3	4	7	70%	NA
Marbled godwit	Breeding	High fidelity to breeding grounds	2	4	6	60%	NA
Whiskered auklet	Breeding, nesting	High fidelity to place; Rare	3	4	7	70%	NA
Yellow-billed loon	Breeding	Demonstrated decline	3	4	7	70%	NA
Waterfowl (ducks and geese)	Breeding, nesting, migration, molting, wintering	Connectors (migratory)	1	4	5	50%	30%
FISH							
Pacific herring	Spawning	High fidelity to place	2	4	6	60%	30%
Salmon	Spawning, rearing	Connectors (migratory); keystone	1	4	5	50%	30%

Target	Critical Life Stage	Why Chosen	Score for Selection Criteria	Score for Reproduction Attribute	Combined Score	Conservation Goal for Reproduction	Conservation Goal for Non-Reproduction
MAMMALS							
Caribou	Calving concentration areas, insect relief areas	High fidelity	2	4	6	60%	30%
Northern Fur Seal	Rookeries	Demonstrated decline; high fidelity	3	4	7	70%	NA
Pacific Walrus	Male haulouts	High fidelity to place; endemic	2	0	2	NA	30%
Steller sea lion	Rookeries, haulouts	Endangered & Threatened; high fidelity	4	4	8	80%	40%
Brown bear	Spring concentration areas, food concentration	Large area (wide-ranging)	1	0	1	NA	30%
Ice seals	Haulouts	Connectors (migratory)	1	0	1	NA	30%
Moose	Calving, wintering	Keystone	1	4	5	50%	30%
Polar Bear	Denning	Large area (wide-ranging)	1	4	5	50%	NA
FEATURED HABITATS							
Big tree old growth forests in SE Alaska						NA	30%
Coastal lagoons and barrier islands						NA	30%
Coastal plain wetlands						NA	30%
Eelgrass beds						NA	30%
Karst topography						NA	30%
Kelp beds						NA	30%
Sand dunes						NA	100%
Interior wetland complexes						NA	30%
Tidal glaciers						NA	30%

Appendix 3. Portfolio of Areas of Biological Significance for Alaska

Area of Biological Significance	EPU Assessment	Area (hectares)	Area (acres)
Amak Island	Alaska Peninsula/Bristol Bay Basin	14,278	5,778
Aniak River	Alaska Peninsula/Bristol Bay Basin	509,312	206,116
Bechevin Bay and False Pass	Alaska Peninsula/Bristol Bay Basin	95,795	38,768
Belkofski	Alaska Peninsula/Bristol Bay Basin	127,352	51,539
Cape Seniavan	Alaska Peninsula/Bristol Bay Basin	62,228	25,183
Caribou River	Alaska Peninsula/Bristol Bay Basin	173,278	70,125
Chignik	Alaska Peninsula/Bristol Bay Basin	398,339	161,206
Chirikof Island	Alaska Peninsula/Bristol Bay Basin	45,966	18,602
Cinder River Flats	Alaska Peninsula/Bristol Bay Basin	232,483	94,085
Egegik-Becharof	Alaska Peninsula/Bristol Bay Basin	561,246	227,133
Goodnews Coast	Alaska Peninsula/Bristol Bay Basin	387,711	156,904
Goodnews River	Alaska Peninsula/Bristol Bay Basin	288,796	116,874
Izembek-Morzhovoi-Cold Bay	Alaska Peninsula/Bristol Bay Basin	359,355	145,429
Kamishak	Alaska Peninsula/Bristol Bay Basin	790,968	320,100
Katmai Coast	Alaska Peninsula/Bristol Bay Basin	512,836	207,542
Kvichak and Alagnak	Alaska Peninsula/Bristol Bay Basin	683,897	276,769
Lake Iliamna	Alaska Peninsula/Bristol Bay Basin	783,838	317,215
Mother Goose Lake	Alaska Peninsula/Bristol Bay Basin	53,511	21,656
Naknek Lake Drainage	Alaska Peninsula/Bristol Bay Basin	509,437	206,166
Nushagak	Alaska Peninsula/Bristol Bay Basin	1,819,075	736,170
Nushagak Peninsula	Alaska Peninsula/Bristol Bay Basin	130,660	52,877
Pavlof Bay	Alaska Peninsula/Bristol Bay Basin	245,101	99,191
Port Heiden	Alaska Peninsula/Bristol Bay Basin	284,451	115,116
Port Moller	Alaska Peninsula/Bristol Bay Basin	245,992	99,551
Puale Bay	Alaska Peninsula/Bristol Bay Basin	65,764	26,614
Sanak Islands	Alaska Peninsula/Bristol Bay Basin	98,752	39,964
Sandy and Bear Rivers	Alaska Peninsula/Bristol Bay Basin	139,765	56,562
Sapsuk	Alaska Peninsula/Bristol Bay Basin	42,141	17,054
Seal Islands	Alaska Peninsula/Bristol Bay Basin	103,977	42,079
Semidi Islands	Alaska Peninsula/Bristol Bay Basin	66,956	27,097
Shumagin Islands	Alaska Peninsula/Bristol Bay Basin	600,640	243,076
Togiak Islands	Alaska Peninsula/Bristol Bay Basin	230,156	93,143
Togiak River	Alaska Peninsula/Bristol Bay Basin	356,148	144,131
Ugashik	Alaska Peninsula/Bristol Bay Basin	276,869	112,047
Urilia Bay	Alaska Peninsula/Bristol Bay Basin	83,713	33,878
Wide Bay	Alaska Peninsula/Bristol Bay Basin	143,657	58,137
Wood-Tikchiks	Alaska Peninsula/Bristol Bay Basin	778,113	314,898
Yantarni	Alaska Peninsula/Bristol Bay Basin	96,955	39,237
Alatna River	Alaska-Yukon Arctic	169,944	68,775
Amatusak Hills	Alaska-Yukon Arctic	321,977	130,302
Anaktuvuk	Alaska-Yukon Arctic	78,016	31,573
Anaktuvuk River	Alaska-Yukon Arctic	94,535	38,258
Arrigetch	Alaska-Yukon Arctic	319,848	129,441
Barter Island	Alaska-Yukon Arctic	94,120	38,090
Boulder Patch Communities	Alaska-Yukon Arctic	132,093	53,457
Boulder Patch Communities	Alaska-Yukon Arctic	10,260	4,152
Boulder Patch Communities	Alaska-Yukon Arctic	12,034	4,870
Boulder Patch Communities	Alaska-Yukon Arctic	12,172	4,926

Area of Biological Significance	EPU Assessment	Area (hectares)	Area (acres)
Boulder Patch Communities	Alaska-Yukon Arctic	17,222	6,970
Canning River	Alaska-Yukon Arctic	292,290	118,288
Chandlar Mountains	Alaska-Yukon Arctic	199,905	80,901
Chandlar River (middle fork)	Alaska-Yukon Arctic	102,221	41,368
Chandlar River (north fork)	Alaska-Yukon Arctic	80,580	32,610
Colville River	Alaska-Yukon Arctic	760,978	307,964
Eastern Coastal Plain	Alaska-Yukon Arctic	1,282,588	519,056
Hulahula River	Alaska-Yukon Arctic	180,049	72,865
Ikpikpuk River	Alaska-Yukon Arctic	256,838	103,941
Ikpikpuk-Topagoruk Lowlands	Alaska-Yukon Arctic	205,664	83,231
Ikpikpuk-Topagoruk Uplands	Alaska-Yukon Arctic	88,656	35,878
Itkillik Glaciated Foothills	Alaska-Yukon Arctic	464,604	188,023
Itkillik River	Alaska-Yukon Arctic	141,010	57,066
Ivishak-Echooka Foothills	Alaska-Yukon Arctic	220,787	89,351
John River	Alaska-Yukon Arctic	146,374	59,237
Kalikpuk-Inico-Judy Lowlands	Alaska-Yukon Arctic	196,376	79,472
Karupa Uplands	Alaska-Yukon Arctic	160,131	64,804
Kaseguluk Lagoon	Alaska-Yukon Arctic	780,618	315,912
Killik River	Alaska-Yukon Arctic	110,812	44,845
Kongakut River	Alaska-Yukon Arctic	117,491	47,548
Koyukuk River	Alaska-Yukon Arctic	73,216	29,630
Krusenstern Coast	Alaska-Yukon Arctic	155,203	62,810
Krusenstern-Noatak Coast	Alaska-Yukon Arctic	55,144	22,317
Kukpowruk River	Alaska-Yukon Arctic	100,374	40,621
Kuparuk River Lowlands	Alaska-Yukon Arctic	510,948	206,778
Lisburne Peninsula	Alaska-Yukon Arctic	398,380	161,222
Mancha Creek	Alaska-Yukon Arctic	102,187	41,354
Nigu-Etivluk Rivers	Alaska-Yukon Arctic	110,330	44,650
Nigu-Ipnavik Rivers	Alaska-Yukon Arctic	440,927	178,441
Noatak River	Alaska-Yukon Arctic	408,684	165,392
North Fork Koyukuk River	Alaska-Yukon Arctic	555,991	225,007
Peard Bay	Alaska-Yukon Arctic	767,972	310,794
Point Barrow / Dease Inlet	Alaska-Yukon Arctic	1,152,422	466,379
Prudhoe Nearshore	Alaska-Yukon Arctic	291,714	118,055
Sagavanirktok River	Alaska-Yukon Arctic	278,582	112,741
Schwatka Mounatins	Alaska-Yukon Arctic	279,254	113,013
Shaviovik River Lowlands	Alaska-Yukon Arctic	343,175	138,881
Sheenjek Headwaters	Alaska-Yukon Arctic	366,623	148,370
Sheenjek River	Alaska-Yukon Arctic	223,169	90,315
Teshekpuk Lake	Alaska-Yukon Arctic	476,571	192,866
Utokok Uplands	Alaska-Yukon Arctic	2,055,527	831,860
Utukok River	Alaska-Yukon Arctic	146,658	59,352
Utukok River Lowlands	Alaska-Yukon Arctic	128,265	51,908
Western DeLong Mountains	Alaska-Yukon Arctic	472,145	191,074
Wind Mountains	Alaska-Yukon Arctic	197,933	80,102
Wind-Chandalar Rivers	Alaska-Yukon Arctic	188,507	76,288
Wulik River	Alaska-Yukon Arctic	150,551	60,927
Andreanof Islands	Bering Sea and Aleutian Islands	2,749,512	1,112,712
Fox Islands	Bering Sea and Aleutian Islands	2,612,805	1,057,388
Islands of Four Mountains	Bering Sea and Aleutian Islands	688,215	278,517

Area of Biological Significance	EPU Assessment	Area (hectares)	Area (acres)
Near Islands	Bering Sea and Aleutian Islands	1,351,455	546,926
Nunivak Island	Bering Sea and Aleutian Islands	1,225,354	495,894
Pribilof Islands	Bering Sea and Aleutian Islands	681,429	275,771
Rat Islands	Bering Sea and Aleutian Islands	3,057,809	1,237,478
St Lawrence Island	Bering Sea and Aleutian Islands	1,769,676	716,178
St Matthew Island	Bering Sea and Aleutian Islands	392,291	158,758
Admiralty Island - North	Coastal Forests and Mountains	121,107	49,011
Admiralty Island - South	Coastal Forests and Mountains	246,126	99,606
Baranof Island - South	Coastal Forests and Mountains	154,444	62,503
Berners Bay	Coastal Forests and Mountains	104,353	42,231
Bradfield Canal	Coastal Forests and Mountains	157,969	63,929
Chichagof Portage	Coastal Forests and Mountains	60,035	24,296
Chilkat Mountains	Coastal Forests and Mountains	80,240	32,473
Chilkat River	Coastal Forests and Mountains	274,891	111,247
Chuck River / Endicott Arm	Coastal Forests and Mountains	175,180	70,894
Cleveland Peninsula	Coastal Forests and Mountains	130,057	52,633
Coronation Island	Coastal Forests and Mountains	29,947	12,119
Dall Island Group	Coastal Forests and Mountains	154,175	62,394
Duke Islands	Coastal Forests and Mountains	59,988	24,277
Duncan Canal / Ptsburg Cr.	Coastal Forests and Mountains	127,702	51,680
Dundas Bay	Coastal Forests and Mountains	62,808	25,418
Etolin Island	Coastal Forests and Mountains	97,020	39,264
Forrester Islands	Coastal Forests and Mountains	6,137	2,484
Gravina Island	Coastal Forests and Mountains	23,506	9,513
Gustavus Forelands	Coastal Forests and Mountains	105,927	42,868
Hazy Islands	Coastal Forests and Mountains	1,083	438
Hoonah Sound	Coastal Forests and Mountains	132,883	53,777
Icy Strait	Coastal Forests and Mountains	7,322	2,963
Icy Strait	Coastal Forests and Mountains	89,387	36,174
Icy Strait	Coastal Forests and Mountains	7,211	2,918
Karta River / Honker Divide	Coastal Forests and Mountains	115,790	46,859
Kelp Bay	Coastal Forests and Mountains	34,954	14,146
Kuiu Island	Coastal Forests and Mountains	252,008	101,986
Misty Fjords	Coastal Forests and Mountains	471,815	190,941
Moira Sound	Coastal Forests and Mountains	44,272	17,917
Naha River / Leask Lakes	Coastal Forests and Mountains	85,910	34,767
North POW - Karst	Coastal Forests and Mountains	80,761	32,684
Nutkwa Lagoon	Coastal Forests and Mountains	75,977	30,748
Outside Islands	Coastal Forests and Mountains	92,021	37,241
Porth Houghton / Farragut Bay	Coastal Forests and Mountains	112,308	45,451
Prince of Wales - South	Coastal Forests and Mountains	21,024	8,508
Rocky Pass	Coastal Forests and Mountains	119,925	48,533
Sea Otter Sound	Coastal Forests and Mountains	192,989	78,102
Sitka Sound	Coastal Forests and Mountains	227,101	91,907
Skowl Arm	Coastal Forests and Mountains	24,867	10,064
Stikine River	Coastal Forests and Mountains	100,141	40,526
Taku River	Coastal Forests and Mountains	49,612	20,078
Tenakee Inlet	Coastal Forests and Mountains	91,019	36,835
Unuk / Chickamin Rivers	Coastal Forests and Mountains	284,942	115,314
Whiting River	Coastal Forests and Mountains	89,919	36,390

Area of Biological Significance	EPU Assessment	Area (hectares)	Area (acres)
Yakobi - West Chichagof	Coastal Forests and Mountains	126,076	51,022
Anchor River	Cook Inlet Basin	7,795	3,154
Anchorage	Cook Inlet Basin	20,212	8,180
Chuitna River	Cook Inlet Basin	40,946	16,570
Kachemak Bay	Cook Inlet Basin	273,445	110,662
Kalgin Island	Cook Inlet Basin	22,520	9,114
Kenai River	Cook Inlet Basin	42,575	17,230
Kenai/Kasilof Wetlands	Cook Inlet Basin	12,608	5,102
Knik Arm	Cook Inlet Basin	69,786	28,242
Lake Creek	Cook Inlet Basin	84,926	34,369
Northern Kenai	Cook Inlet Basin	357,534	144,692
Redoubt/Trading Bay	Cook Inlet Basin	280,111	113,359
Susitna Flats	Cook Inlet Basin	275,646	111,552
Tustamena Bench	Cook Inlet Basin	312,914	126,635
Upper Susitna Basin	Cook Inlet Basin	615,953	249,273
Afognak	Statewide	731,073	295,861
Chitina River	Statewide	705,682	285,586
Copper River	Statewide	1,011,336	409,282
Copper River Basin	Statewide	1,283,349	519,364
Copper River Delta	Statewide	859,690	347,912
Davidson Mountains	Statewide	1,659,103	671,430
Fairweather	Statewide	256,112	103,647
Icy Bay	Statewide	174,432	70,591
Imuruk Lake	Statewide	681,550	275,819
Innoko	Statewide	1,056,591	427,597
John River	Statewide	57,352	23,210
John River Valley	Statewide	837,247	338,829
Kenai Fjords	Statewide	433,621	175,484
Kobuk River	Statewide	506,333	204,910
Koyuk River	Statewide	158,777	64,256
Koyukuk River	Statewide	821,783	332,571
Koyukuk-Yukon	Statewide	1,824,617	738,412
Kuskokwim Confluence	Statewide	1,799,437	728,222
Kuskokwim Delta	Statewide	1,779,019	719,959
Kuskokwim River	Statewide	1,102,641	446,233
Lake Clark	Statewide	800,043	323,773
Lake Minchumina - McKinley River	Statewide	946,488	383,038
Lower Noatak	Statewide	476,859	192,982
Minto Flats	Statewide	305,570	123,662
Montague	Statewide	647,186	261,913
Mulchatna River	Statewide	526,100	212,910
Noatak River	Statewide	587,564	237,784
Northern Seward Peninsula	Statewide	1,162,505	470,460
Northwest Prince William Sound	Statewide	487,687	197,364
Norton Bay	Statewide	1,192,751	482,700
Nulato Hills	Statewide	855,309	346,139
Nushagak River	Statewide	47,228	19,113
Porcupine River	Statewide	89,318	36,146
Portage Valley	Statewide	182,901	74,019
Selawik	Statewide	1,893,489	766,284

Area of Biological Significance	EPU Assessment	Area (hectares)	Area (acres)
South Kodiak Islands	Statewide	1,174,470	475,301
South Schwatka Mountains	Statewide	934,500	378,187
Southeast Prince William Sound	Statewide	434,769	175,948
Southern Seward Peninsula	Statewide	2,147,631	869,134
Stony River	Statewide	938,689	379,882
Susitna River	Statewide	420,228	170,064
Talkeetna - Kashwitna	Statewide	878,876	355,676
Talkeetna Mountains	Statewide	906,958	367,041
Tanana River	Statewide	1,265,771	512,251
Tanana Valley	Statewide	1,122,983	454,465
Teocalli Mountains	Statewide	373,022	150,960
Tetlin	Statewide	1,481,968	599,744
Western Philip Smith Mountains	Statewide	545,782	220,875
White Mountains	Statewide	1,509,856	611,031
Yakataga	Statewide	242,145	97,995
Yakutat Forelands	Statewide	1,034,672	418,726
Yukon Delta	Statewide	1,254,311	507,613
Yukon Flats	Statewide	1,926,866	779,792
Yukon River	Statewide	3,309,596	1,339,375
Yukon-Kuskokwim Wetlands and Lakes	Statewide	3,130,925	1,267,068
Yukon-Tanana	Statewide	1,711,161	692,497