FEDERAL AID ANNUAL RESEARCH PERFORMANCE REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

Alaska Department of Fish and Game
Wildlife Restoration Grant

GRANT NUMBER: AKW-20 **SEGMENT NUMBER:** 5

PROJECT NUMBER: 34.0

PROJECT TITLE: Forest management and wildlife-habitat relationships in Interior Alaska

PROJECT DURATION: 1 July 2014–30 June 2018 (extended to FY 2018)

REPORT DUE DATE: 1 September 2018

PARTNER: None

PRINCIPAL INVESTIGATORS: Thomas F. Paragi, Julie C. Hagelin, and Scott M. Brainerd

COOPERATORS: James D. Durst (ADF&G-Division of Habitat), Martha Freeman (Alaska Department of Natural Resources-Division of Forestry)

WORK LOCATION: Region III, Fairbanks

I. SUMMARY OF WORK COMPLETED THIS SEGMENT ON JOBS IDENTIFIED IN ANNUAL WORK PLAN

OBJECTIVE 1: Conduct a literature review that summarizes existing information about boreal wildlife and habitat that is applicable to forest management in Interior Alaska.

JOB/ACTIVITY 1A: Conduct literature review.

Literature compilation is completed but synthesis of information is continuing. Hagelin's contributions for non-game species were supported under State Wildlife Grants T-32 and 32-1, Project# 11. We requested an extension to FY 2018 for completion of writing.

OBJECTIVE 2: Design a framework for monitoring and adaptively managing forests and wildlife in the Tanana Valley, Alaska.

JOB/ACTIVITY 2A: Identify habitat gradients that may describe the relationship between wildlife species richness metrics and forest structure or composition within timber harvest areas of the Tanana Valley.

Defining gradients in landscape structure based on a patch-mosaic model can inform judgement of habitat suitability and selection of monitoring sites for forest-wildlife interactions. Using funding to Hagelin from State Wildlife Grant T-32-1 Project #11, we contracted with a University of Alaska-Fairbanks faculty member (Dr. Falk Huettmann)

to produce a few simple landscape indices based on the stand-level inventory of forest type classes (species, tree size class, canopy closure) from the Tanana Valley using FRAGSTATS (McGarigal and Marks 1995). The inventory polygons were resampled to 50 m raster cells for calculating indices of landscape structure (e.g., density of type class edges, distance of nearest type of same class). Distributions of index classes were compared among state forest areas to discern magnitude of differences and examine possible cause of differences (e.g., fire history, timber harvest). Separate moving-window calculations based on values in adjacent cells produced smoothed rasters to discern spatial gradients for indices. Overlay on polygon boundaries illustrate how landscape indices complement stand-level type data at the operational scale of forest management activities.

JOB/ACTIVITY 2 B: Design a pilot study aimed at describing patterns in wildlife conditions (e.g., songbird diversity) or effects (e.g., herbivory on trees) at extremes of habitat gradients to discern the range of existing conditions or effects correlated to habitat patterns in managed forests.

Based on a FY16 biometric evaluation our proposed pilot study, we would need 2 field seasons to detect differences in songbird occupancy. We did not have the funding to conduct 2 field seasons of a pilot study so terminated this job. We will describe the sampling implications for study design in the final report.

II. SIGNIFICANT DEVIATIONS AND/OR ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD

Paragi participated in a teleconference to the Alaska Board of Forestry when the reforestation standards were reviewed, including wildlife habitat recommendations developed during the prior two years of participation by Paragi and Hagelin in a scientific and technical committee and an implementation group. The standards were adopted by the Board and were approved by the Legislature, and the habitat recommendations will be incorporated into training materials for staff and operators that implement timber sales.

Hagelin and Paragi were invited to contribute to a paper on boreal bird habitat for a special issue in the journal *Avian Conservation and Ecology*. The paper has Alaskan and Canadian authors and focuses on state/provincial and federal government roles in bird habitat management and conservation. Aside from general information we contributed a case study paragraph that mentioned recommendations for habitat conservation and research needs from our recent involvement in the reforestation practices review for the Alaska Board of Forestry and the intent of the literature review from project 34.0.

Paragi, Hagelin, and Brainerd gave a poster “Incorporating forest-wildlife interactions into reforestation guidelines for boreal Alaska” at the April 2017 meeting of the Alaska Chapter of The Wildlife Society in Fairbanks (see Appendix 1).

III. PUBLICATIONS

None this period.

Literature cited:

McGarigal, K., and B.J. Marks. 1995. FRAGSTATS: spatial pattern analysis program for quantifying landscape structure. Gen. Tech. Rep. PNW-GTR-351. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 122 p.

IV. RECOMMENDATIONS FOR THIS PROJECT

In the final year, we will complete the bibliography and EndNote database, with further annotation limited to selected citations as time permits. Synthesis of the literature will occur to describe forest-wildlife interactions and wildlife response to forest practices germane to Interior Alaska.

We will use the synthesis plus patterns we identified in existing spatial data on forest vegetation and disturbance patterns from fire and logging to recommend a framework for monitoring and adaptively managing forests and wildlife in areas where trees are commercially harvested in the Tanana Valley. Hagelin's future contributions to this project will be funded under State Wildlife Grant T-32-1, Project# 11.0.

PREPARED BY: Thomas F. Paragi

DATE: 12 July 2017

Appendix 1. Government roles in protecting bird habitats (boreal forest)

Steven M. Matsuoka[1], Julie C. Hagelin[2], and Amanda L. Sesser[3,4], Thomas F. Paragi[5]

[1]U. S. Geological Survey, Alaska Science Center
[2]Alaska Department of Fish and Game, Threatened, Endangered, and Diversity Program
[3]U.S. Fish and Wildlife Service, Northwest Boreal Landscape Conservation Cooperative
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Alaska

Federal and state governments play a variety of essential roles in conserving and managing a vast landscape of habitats for birds in the boreal region of Alaska (Fig. 1 and 2). The Alaska boreal contains expanses of largely remote and intact ecosystems, a unique diversity of birds collectively migrating across most of the world's flyways, and few species listed as threatened or endangered (ADFG 2015, Handel and Stenhouse 2017). The potential for change in Alaska's boreal region is notable, given it contains some of the world's largest untapped deposits of metals and coal, is home to 75% of the state's growing human populations (Handel and Stenhouse 2017), and is already undergoing widespread ecosystem alterations from climate-driven increases in the extent and intensity of permafrost thaw, wetland drying, and forest fires and insect outbreaks (Chapin et al. 2006, Wolken et al. 2011).

Managing public lands

The most prominent role governments play in protecting bird habitats in Alaska is managing the 88% of the state held in public lands (approximately 64% federal, 24% state; Hull and Leask 2000, ADNR 2007, Vincent et al. 2017), which divides into roughly equal amounts of land managed as protected areas versus for multiple-use (Hull and Leask 2000). Approximately 40% of Alaska's boreal region is managed as protected areas (CEC 2010), including some of the largest conservation units and wilderness areas on the continent (Fig. 2). Most of boreal Alaska conservation lands were legislatively established as National Parks and Preserves, National Wildlife Refuges, and Alaska State Game Refuges and Parks with a primary purpose among others to protect or conserve wildlife populations and habitats and natural landscapes from other non-compatible land uses (Alaska National Interest Lands Conservation Act, Alaska Statutes [AS] 16.20, National Park Organic Act, National Wildlife Refuge Administration Act). Birds are therefore afforded a high level of protection by Alaska's extensive network of conservation lands, which is the largest for any state or province in North America (CARTS 2015, National Gap Analysis Program 2016).

The other roughly half of public lands in boreal Alaska are managed by the Alaska Department of Natural Resources (DNR) or Bureau of Land Management (BLM) for a balance of multiple uses, such as ecosystem protection, recreation, economic development (often through resource extraction), and settlement (Hull and Leask 2000). These multiple-use lands are extensive, remain largely undeveloped, and dominate the matrix of lands between protected areas (Fig. 2, Hull and Leask 2000:13–14). Thus, government decisions on how these lands will be used may largely determine regional levels of habitat connectivity for birds and other biota in the future (see *Case study: Northwest Boreal Landscape Conservation Cooperative*). Multiple-use lands

are administered through area or resource management plans (AS 38.04.065, Federal Land Policy and Management Act) that can classify areas for particular purposes such as Wildlife Habitat Lands (DNR designation) and Areas of Critical Environmental Concern or Riparian Conservation Areas (BLM designations) where the conservation of fish and wildlife habitats may be prioritized over other non-compatible uses. For example, the BLM recently prioritized protection of riparian areas and subsistence and sensitive species over mineral leasing on 895,000 ha of multiple-use lands in eastern interior Alaska (Draanjik and Fortymile Planning Areas). The sensitive species included (among others) Trumpeter Swan, Bald Eagle, and declining Short-eared Owl, Olive-sided Flycatcher, Blackpoll Warbler, and Rusty Blackbird (80 Federal Register 52; BLM 2016a, b).

The information required to designate these special habitat areas on multiple-use lands is often lacking for boreal birds, particularly sensitive or declining species (ADFG 2015). It should therefore be a priority to identify key habitats and concentration areas for these birds more broadly across boreal Alaska (Audubon Alaska 2016), which could then be (1) nominated as new Wildlife Habitat Lands and Areas of Critical Environmental Concern when multiple-use management plans are developed or revised on ~20 year cycles, or (2) given special consideration when tailoring best management practices to minimize adverse impacts of land use practices on birds.

Land use impacts on bird habitats

Most major land use projects in Alaska, including all federal activities and funded projects (National Environmental Policy Act), require a review of their significant environmental impacts and alternatives before they can be permitted to proceed. This can bring into play a variety of agency regulations to avoid, minimize, or compensate for the adverse environmental impacts of projects, some of which apply directly to birds. The U. S. Fish and Wildlife Service (USFWS) administers the Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act, and the Endangered Species Act (ESA). The former two acts protect birds and their nests and eggs from injury, mortality, or harassment (take) from human activities and in doing so may indirectly protect bird habitats. For example, USFWS recommends that developers maintain ≥200 m buffers between their activities and Bald Eagle nests (50 Code of Federal Regulations [CFR] Parts 13 and 22, USFWS 2007), which has protected substantial amounts of forested habitats for eagles across Alaska (Hodges 2011). The ESA protects critical habitats for threatened and endangered species. At this time, only marine mammals have designated critical habitats on the border of the Alaska boreal region (USFWS and NMFS 2014), although habitats necessary for other priority or declining boreal birds are often recommended for protection from land development during project reviews to prevent future listings.

Among other laws protecting fish and wildlife habitats, the most important to the region's birds to date have been those protecting wetlands. This is because wetlands are ubiquitous, covering 43% of boreal Alaska (Hall et al. 1994) and are obligate breeding habitats for several declining boreal bird species (Greenberg et al. 2011, ADFG 2015, Handel and Stenhouse 2017). Wetlands are also often essential habitats for salmon and other fishes with subsistence, commercial, or sport fisheries and thus include broad conservation constituencies and effective protective regulations (AS 16.05.871 et seq., ADFG et al. 2002, Smith and Speed 2013). Most prominently, wetlands have among the strongest habitat protections through section 404 of the Clean Water

Act. This authorizes the U.S. Army Corp of Engineers (USACE) and Environmental Protection Agency to regulate fill placed in wetlands, and importantly require compensatory mitigation when appropriate and practicable for unavoidable wetlands impacts that are permitted to occur. There are no equivalent protections for upland bird habitats in the U.S. (Angelo and Cotter 2005).

Wetland mitigation is often administered through mitigation banks or in-lieu fee programs (33 CFR 325 and 332, 40 CFR 230) that pool mitigation funds to enhance, restore, or preserve wetlands. The Alaska Department of Transportation and Public Facilities alone contributed over $8 million to these programs between 2009 and 2015 (Brehmer 2015). USACE has partnered with the Conservation Fund, Great Land Trust, and other non-governmental organizations to use mitigation funds to preserve nearly 19,000 ha of wetlands and adjacent upland habitats across Alaska since 2005 (B. Meikeljohn and D. Mitchell, pers. comm.) as part of conservation easements, municipal greenbelts, or additions to existing protected areas (Buxton 2011, McBride 2014, PBHJV 2015). Mitigation funds are often a nexus for attracting other private donations and grants from state, federal, industry, or non-governmental groups—a formula that will likely be increasingly used to protect bird habitats in Alaska as land use expands. As only 36% of the state's wetlands are mapped in detail, characterizing wetlands across the boreal region will be important for developing a more effective wetland conservation strategy in Alaska (ADEC 2015).

The Alaska Forest Resources and Practices Act (FRPA, AS 41.17) provides standards for commercial timber operations on state, private, trust and municipal lands, which make up 42% of boreal Alaska (Fig. 2). FRPA was established to provide for a strong timber and commercial fishing industry by protecting riparian habitats and water quality for fish while promoting reforestation after timber harvest. Specific guidance under FRPA for terrestrial wildlife habitat is limited on much of Alaska's public lands and voluntary on private lands, because wildlife issues are typically addressed through land use planning. However, a recent inter-agency collaboration aims to improve land use practices in a manner beneficial for both wildlife and reforestation.

Case Study: Alaska Department of Fish and Game collaboration with Department of Natural Resources

Alaska Department of Fish and Game (ADFG) recently partnered with Alaska Department of Natural Resources (DNR) to review FRPA practices that can best sustain wildlife habitat and facilitate reforestation within harvest areas. ADFG recommendations emphasized how both wildlife biodiversity and forestry objectives can be simultaneously addressed through retention of late-seral forest habitat (Paragi et al. 2015, 2016). For example, retaining late-seral features in harvest areas, such as cavity trees, provides habitat for avian predators that feed on small mammals and insects known to damage seedlings and trees (Fayt et al. 2005, Mooney et al. 2010, Mäntylä et al. 2011). ADFG guidance has been was reviewed by the Alaska Board of Forestry and endorsed by a DNR Implementation Committee. The guidance will be put into practice through land use planning and training documents for agency staff and operators. ADFG is currently reviewing landscape-scale harvest practices as a potential means of mimicking natural fire disturbance (Hunter 1993, Delong and Tanner 1996). Larger cut blocks that retain late-seral habitat could meet both wildlife population and reforestation objectives in

boreal forest, provided they are first proven effective in an adaptive management framework (Walters and Holling 1990, Fisher 2002).

Conservation funding, science, and planning

Government agencies in Alaska have myriad other roles in avian and fish and wildlife conservation, often through multi-agency collaborations that contribute significantly to the protection of avian habitats both in boreal Alaska and in the many places boreal birds migrate to across the Americas. Federal funding is central in this work, including grants to the state, Alaska Native groups, and other partners. For example, the USFWS allocated $1.1 billion to state wildlife agencies across the U. S. in 2016 to support fish and wildlife conservation, including over $50 million to the Alaska Department of Fish and Game to fund over 200 fish and wildlife research and management projects across Alaska, many of which benefit birds (ADFG 2015). Competitive grants from USFWS through the North American Wetlands Conservation Act and Neotropical Migratory Bird Conservation Act have provided more than $2 billion since 1990 towards bird conservation projects by partners throughout international flyways (NAWCC 2016, USFWS 2016). The Blue Ribbon Panel on Sustaining America's Diverse Fish and Wildlife (2016) concluded that an additional $1.3 billion in annual federal funding is needed to fully implement existing State Wildlife Action Plans across the U.S., including Alaska (ADFG 2015). The panel also concluded that the required funds could come from existing revenues from energy and mineral resource developments on federal lands and waters.

Government programs also conduct a variety of avian studies that help prioritize habitat conservation for birds in boreal Alaska. Some of the larger programs include the ADFG Waterfowl Research and Management Program and the Threatened, Endangered, and Diversity Program (ADFG 2015), the National Park Service Biological Resources Division and Inventory and Monitoring Division (MacCluskie and Oakley 2005, Hilderbrand et al. 2013), the USFWS Divisions of Migratory Bird Management and National Wildlife Refuges (Woodward and Beever 2011), and USGS Alaska Science Center (Holland-Bartels 2007). These government programs and others often partner together on studies such as avian inventory and monitoring (Smith 1995, Handel et al. 2009, Mizel et al. 2016, Sauer et al. 2017), resource requirements and limiting factors (Corcoran et al. 2007, Edmonds et al. 2010, Lewis et al. 2015), responses to disturbance (Matsuoka et al. 2001, Lewis et al. 2016a, b, Stralberg et al. 2017), and migratory connectivity (McIntyre et al. 2008, Petersen and Savard 2015, Johnson et al. 2012, 2017). Studies of migratory connectivity are increasingly important for the many declining boreal species whose populations are often most constrained by land use in temperate or tropical portions of their non-breeding migratory ranges (Greenberg and Matsuoka 2010, Booms et al. 2014).

Finally, there are several voluntary multi-agency partnerships at regional, statewide, or international scales that greatly benefit habitat conservation for boreal birds in Alaska. This includes bird conservation initiatives such as Partners in Flight (Handel and Stenhouse 2017, Rosenberg et al. 2016) and the North American Waterfowl Management Plan (NAWMP Committee 2012), land and science conservation programs such as the Northwest Boreal LCC (Northwest Boreal Landscape Conservation Cooperative 2015), and the Alaska Climate Change Executive Roundtable, a forum among agency executives for sharing information and facilitating cooperation on adaptation to climate change.

Case study: The Northwest Boreal Landscape Conservation Cooperative

Collaborative conservation that takes a holistic view of ecosystems and society across large landscapes is emerging as a 21st century model (Chapin et al. 2010, Bartuszevige et al. 2016). It requires the conservation community to work outside of jurisdictions, years of relationship building (McKinney and Johnson 2009), and often a bridging entity to bring together traditional and non-traditional partners (Jacobson and Robertson 2012). Landscape Conservation Cooperatives (LCCs) are a network of 22 bridging entities across North America and the Pacific and Caribbean Islands to support collaborative conservation at large scales (LCC 2014). The Northwest Boreal (NWB) LCC facilitates landscape-scale conservation among more than 30 partners, including federal, state, provincial, and territorial agencies; nongovernmental organizations; Tribes and First Nations; and research institutes. Spanning boreal Alaska, Yukon, northern British Columbia and westernmost Northwest Territories (Fig. 1), the NWB LCC region includes a diversity of boreal forests, alpine environments, and wetlands and rivers over an altitudinal range from sea level to the highest point in North America (Northwest Boreal Landscape Conservation Cooperative 2015). The NWB LCC partnership is committed to being *proactive* to change—identifying what changes may occur and acting now—rather than reacting to changes after they have occurred. Two NWB LCC projects focused on the network of protected areas across the region have shown early success towards collaborative and proactive conservation.

Connecting protected areas in Alaska

Maintaining landscape connectivity is often a top recommendation for climate adaptation planning (Heller and Zavaletta 2009). In the boreal, we have an opportunity to plan for connectivity now while we still have intact systems, rather than the expensive alternative of restorative connectivity (Schmiegelow et al. 2014). Magness and Sesser (in review) used a land facets approach (Brost and Beier 2012) to identify geophysical features that provide potential connections for species distribution shift among federal protected areas in Alaska, such as linkages among low-elevation waterfowl breeding sites important for declining bird populations and fish and wildlife passage. Geophysical features provide a robust method for climate change planning because they do not change with climate, unlike the more common approach using current vegetation types to model landscape linkages. Land managers at the Bureau of Land Management and the U.S. Fish and Wildlife Service are now considering the results from these analyses to manage for connectivity among agency lands and thereby safeguard the adaptive capacity of Alaska's vast conservation estate. These models could be modified in the future by including or excluding land owners depending on management objectives.

Supporting adaptive management in the face of climate change

The NWB LCC is collaborating with the Boreal Ecosystems Analysis for Conservation Networks Team (Schmiegelow et al. 2014) to develop an adaptive management framework to help land and resource management agencies across this boreal region conserve large-scale ecological processes, maintain habitats for important taxa, and measure the effects of active management activities. Land managers need to disentangle climate-change impacts from the impacts of active management. Therefore, ecological benchmarks are identified by this study to secure large-scale ecological processes and serve as reference points for monitoring on intact versus actively management landscapes. Current reserves as well as areas outside protected areas are evaluated and ecological benchmarks identified and prioritized based on their size and intactness, hydrologic connectivity, and how they contribute to regional targets for ecological

representation and coverage of focal species habitats. The latter include late-seral forest birds, waterfowl, and mammals and salmon important for subsistence (Suarez-Esteban and Lisgo 2016). This framework therefore seeks to balance biodiversity conservation and sustainable resource use to help multiple stakeholders achieve their goals.

By incorporating principles of landscape and wildlife ecology with the reality of land and resource management, the NWB LCC is beginning to demonstrate the effectiveness of proactive conservation. More information can be found at nwblcc.org.

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Figure 1. The northwest boreal forest region of North America makes up the geographic area of the Northwest Boreal Landscape Conservation Cooperative (NWB LCC). The LCC includes the boreal forests of Alaska, Yukon, northern British Columbia, and western Northwest Territories, and the mountains of Alaska and the western Canada.

Figure 2. Land ownership in Alaska within the Northwest Interior Forest Bird Conservation Region (BCR4, U.S. NABCI 2000). Bureau of Land Management (BLM) lands in this region include those selected by Alaska Native corporations (1.3% of region) and the State of Alaska (4.6%) that are not presently conveyed, thus still managed as BLM land. Other private lands are small parcels that total <1% of BCR4 in Alaska.

Fig. 1

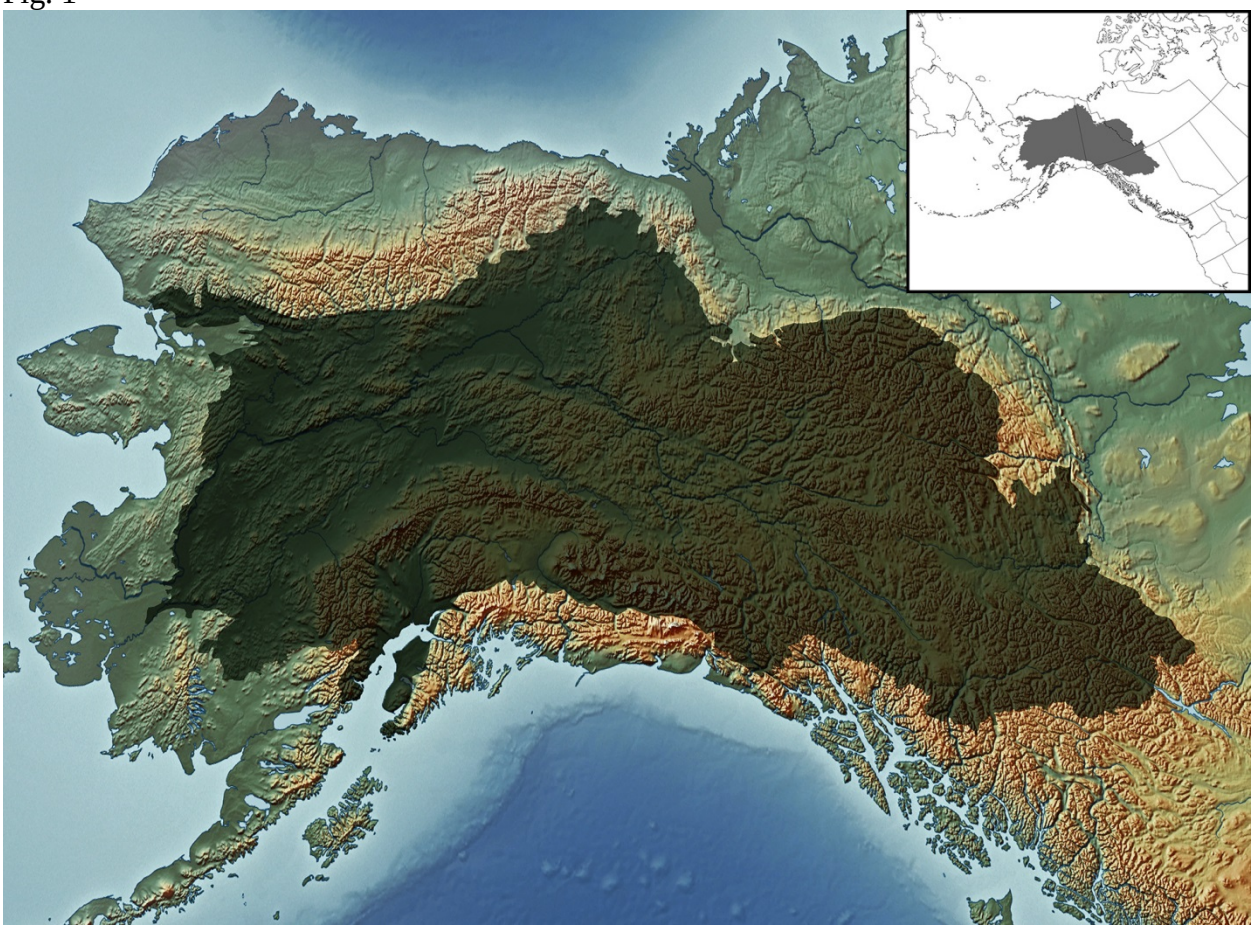
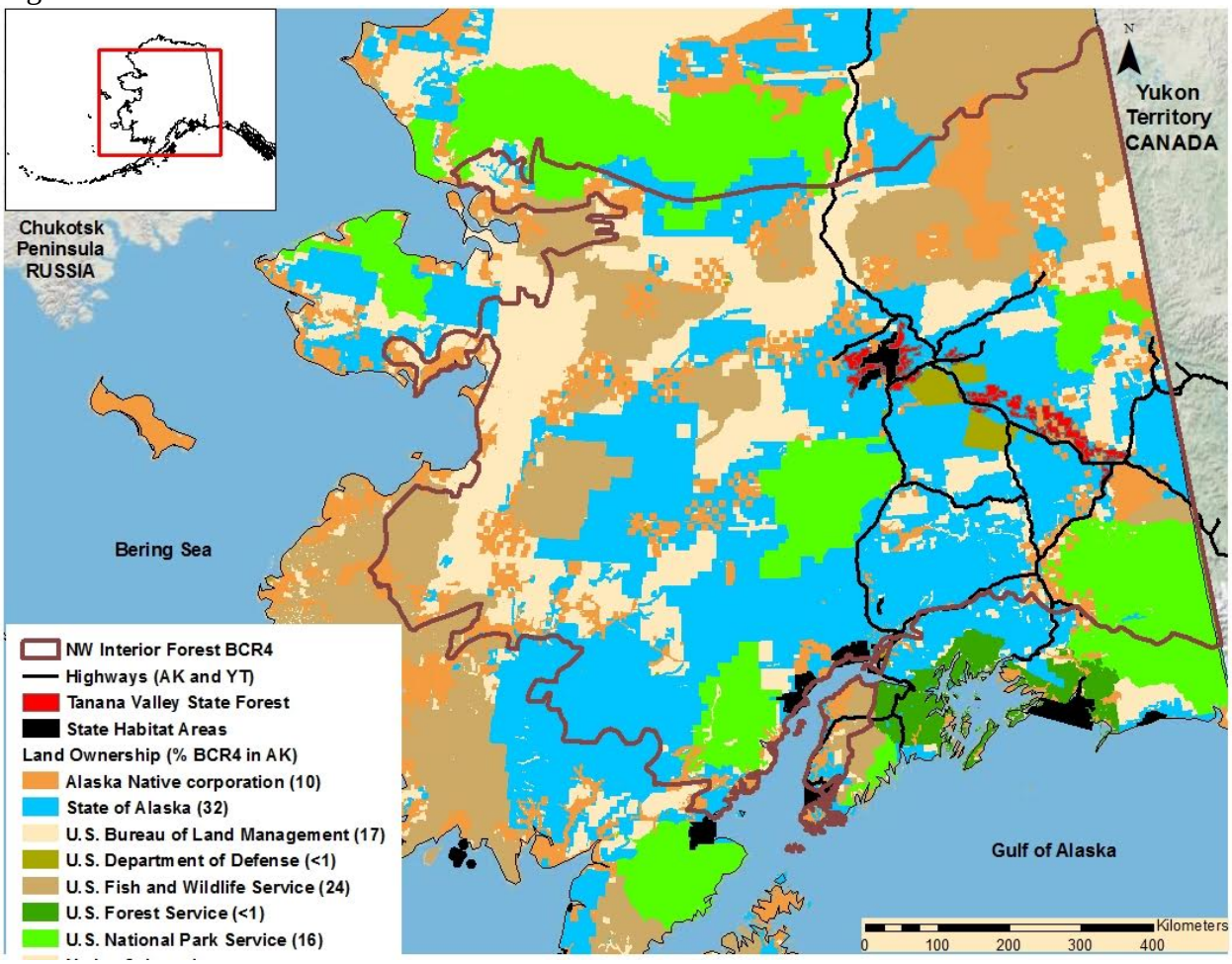


Fig. 2


N
Yukon Territory CANADA
Chukotsk Peninsula RUSSIA
Bering Sea
Gulf of Alaska
NW Interior Forest BCR4
Highways (AK and YT)
Tanana Valley State Forest
State Habitat Areas
Land Ownership (% BCR4 in AK)
Alaska Native corporation (10)
State of Alaska (32)
U.S. Bureau of Land Management (17)
U.S. Department of Defense (<1)
U.S. Fish and Wildlife Service (24)
U.S. Forest Service (<1)
U.S. National Park Service (16)
Kilometers
0 100 200 300 400