Statement of Work

Landscape Conservation Design Spatial Analyst:

Post-Doctoral Position (2-year commitment), shared between USFWS NWRS and OSA

Title: Connectivity for Landscape Conservation Design and Adaptation Planning

Project Summary:

In the Northwest Boreal and Western Alaska region, climate is changing twice as fast as the global average. This is coupled with an increase in global demand for the region's natural resources. Yet this region presently has less urbanization and development and therefore, fewer barriers to implementing a strategic landscape design for conservation (Chapin et al. 2004). Landscape conservation design in Alaska is an opportunity for the U.S. Fish and Wildlife Service's, National Wildlife Refuge System (NWRS) to work collaboratively with partners to develop and implement a landscape approach that ensures our priority resources will have the capacity to cope with and respond to future change.

Plants and animals are already shifting their distributions in response to changes in climate (Parmesan and Yohe 2003). As the climate continues to change, redistribution will likely lead to ecological communities that look very different than what currently occurs (Staudinger et al. 2012, Veloz et al. 2012, Hobbs et al. 2013). Natural resource planners need to maintain and enhance landscape connectivity in order to facilitate these shifts (Mawdsley et al. 2009). The number one recommendation for managing biodiversity in the face of climate change is to ensure that species can move across the landscape (Heller and Zavaleta 2009). Once a landscape becomes fragmented, it is extremely difficult and expensive to restore connectivity. There is a unique opportunity in the Northwest Boreal and Western Alaska Landscape Conservation Cooperatives (NWB LCC and WA LCC) to use landscape conservation design to proactively develop linkages that ensure long-term connectivity.

Figure 1. The boundaries of the Northwest Boreal and Western Alaska LCC partnerships. National Wildlife Refuge boundaries are included in Figure 2.

The NWB and WA LCCs are diverse partnerships spanning over 423 million acres of boreal ecosystems in Alaska, Yukon, southeast Northwest Territories and northern British Columbia (Figure 1). Although partner

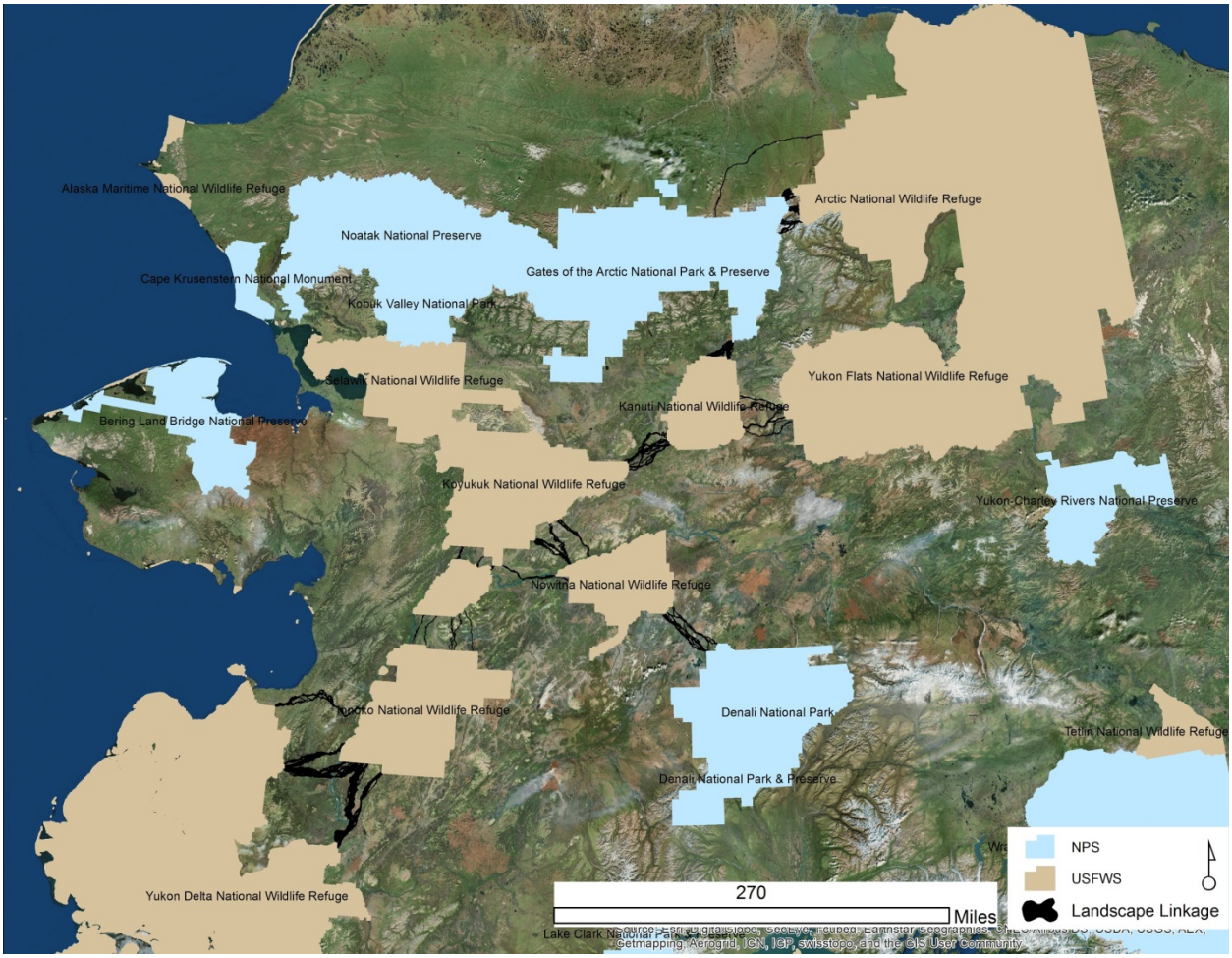

Figure 2. National Wildlife Refuge System and National Park Service lands are the conservation estate in Alaska. A NWB LCC project used geodiversity to model landscape linkage between these key lands in the conservation estate.

organizations have different missions and mandates, they all recognize and prioritize the opportunity to use landscape conservation design to be proactive in assuring the landscape will support long-term, healthy, resilient ecosystems, and the species that depend on them.

To demonstrate the effectiveness of landscape conservation design in this region, the NWB LCC has chosen a pilot region to begin designing landscape linkages among federal lands in Alaska (Figure 2). Continuing to understand ecological connectivity within and among the conservation estate will be key to designing landscapes that are resilient to future change. Vulnerability assessments include three components: exposure, sensitivity and adaptive capacity. Connectivity is integral to reducing vulnerability because maintaining a connected landscape increases the adaptive capacity of the people, ecosystems and species across the region.

Additionally, management actions can be connected through voluntary cooperation to strategically coordinate adaptation approaches (Magness et al. 2011). The components of

vulnerability vary geographically. For example, some places are warming faster and therefore have higher exposure. This geographic context can help managers decide which adaptation strategies are best suited to their particular refuge and how their refuge can play a role in the larger National Wildlife Refuge System (Figure 3). The first step is to use the best-available data to stratify and map landscape vulnerability to climate and land-use change.

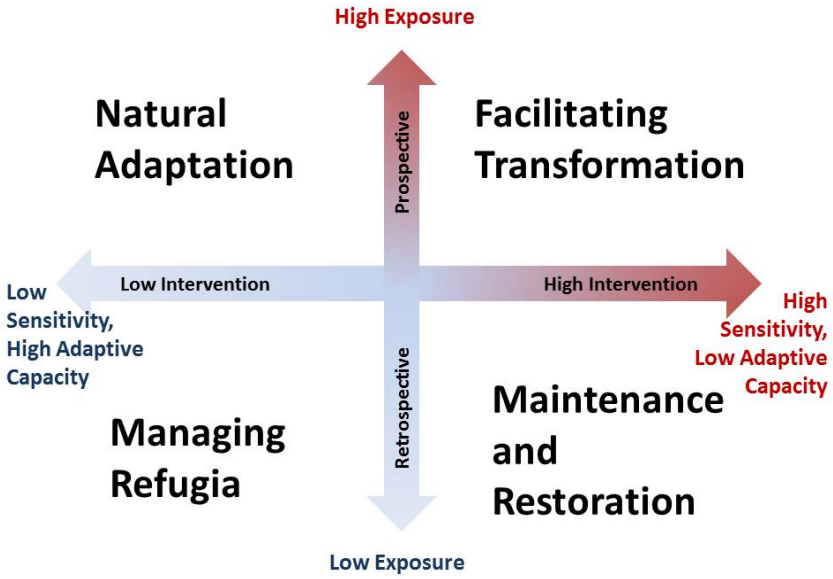

Figure 3. Figure adapted from Magness et al. 2011. Metrics of exposure, sensitivity, and adaptive capacity vary spatially. Therefore different lands can be categorized across the range of exposure, sensitivity, and adaptive capacity metrics and these conditions can inform choices about adaptation approaches. Management actions for adaptation can restore to historical conditions (retrospective) or shape future conditions (prospective) and vary in the level of management intervention. Natural adaptation approaches are low intervention and allow ecosystems to move toward future conditions. Managing refugia are approaches that maintain historical condition in systems where climate change and other rates of change are slow. Actions to facilitate transformation may be best in situations with high rates of change and when intervention is possible. Maintenance and restoration approaches may work when rates of change are slow, but other management interventions are necessary.

Desired Post-Doctoral Researcher skill set:
Landscape ecology focus, proficient in R, ArcGIS, vulnerability assessments including adaptive capacity, spatial analysis including species-distribution, and climate envelope modeling.

Goals and Objectives:

Goal 1: Enhance and expand NWB LCC efforts to identify current and future terrestrial and aquatic connectivity among and within NWRs and other protected areas.
The deliverable will be a landscape connectivity design.

Objective 1: Continue to build a menu of connectivity options using various methods among and within NWRs and parks in Alaska with consideration of current and potential future land use. Methods can include:

- Species based approaches - potential corridors or geophysical settings could be linked to species, at least conceptually, to prioritize which connectivity areas may benefit greater numbers of species (e.g., species-

distribution modeling approaches, comparing overlap with geodiversty or other approaches below).

- Geodiversity (topography) based - continue to build on effort to connect parks and refuges with models. Compare alternative outputs with private, state and other lands excluded.
    - Include riparian areas, including anadromous streams and ensuring connectivity from spawning areas to oceans
- Habitat/ecological communities - Map priority habitats both on and off Refuges, currently and where projected in the future.
- Climate based (Alaska and Northwest Canada) - Overlay climate and geodiversity maps to look for areas expected to change slowly and rapidly across the landscapes.

- **Goal 2: Interdisciplinary spatial vulnerability assessment.** Use connectivity models, climate change projections, and other available data to assess the exposure, sensitivity and adaptive capacity indicating landscape vulnerability in the NWB and WA LCCs. The de*liverables will be landscape vulnerability maps, a geodatabase and synthesis report.*
    - **Objective 1:** Stratify the landscape based on projected rates of change.
    - **Objective 2:** Work with managers to use the vulnerability assessment outputs to identify decision space and contexts for managing land units across a continuum of vulnerability.

- **Goal 3: Iterative knowledge co-production with FWS decision makers**.
  Deliverables will include quarterly meetings to guide efforts to ensure usability, regular communications with LCC Steering Committees and Refuge staff; online and publically-available geodatabases, websites, etc.
    - **Objective 1:** Work with NWRS staff and the NWB and WA LCCs to help identify and provide data necessary to inform landscape conservation design in the Northwest Boreal geography and the Yukon Kuskokwim Delta section of the Western Alaska geography.
        - Build geo-data library for staff use;
        - Archive and distribute any geo-data produced;
        - Interface to work with or modify scenarios that are generated.
    - **Objective 2:** Interact regularly with NWB LCC, Western Alaska LCC and NWRS staff to identify priorities and adapt as needed.

- **Objective 3:** Work with staff to generate best practices/lessons learned to be applicable to subsequent landscape conservation design processes that will help inform Refuges Comprehensive Conservation Plans, land acquisitions, etc.

Performance Tasks and Timeline: project activities and deliverables	**Anticipated Completion Date**
Regular communication with NWB and WA LCCs coordinators, and NWRS staff to identify and update workflow and priorities	Quarterly and as needed
Regular communication with NWB and WA LCC Steering Committees and NWRS staff	Quarterly and as needed
Written progress report and presentation to USFWS leadership	September 30, 2017; September 30, 2018
Online and publically-available geodatabases, project websites	September 30, 2018
Landscape vulnerability maps, geodatabase and synthesis report	September 30, 2018
Landscape connectivity design	September 30, 2018

Budget:

Salary and benefits (including indirect costs)	$82,150.00 per year ($164,300.00 total)
Travel, supplies and misc.	$5,000.00 per year ($10,000 total)
Total for two years	**$174,300.00**

Budget Justification: Landscape conservation design is a planning process endorsed by DOI and institutionalized by the USFWS as a way of working collaboratively towards identifying and achieving conservation goals at multiple-scales, starting with large landscapes. Great progress initiating landscape conservation design has been made by the Northwest Boreal LCC, but with

limited resources and capacity, continued progress will be slow and expansion into new areas nearly impossible. To expedite progress and inform planning efforts now, including two Comprehensive Conservation Plans (CCPs) for Yukon Flats and Yukon Delta National Wildlife Refuges, geospatial and modeling capacity at the Ph.D. level is critical. By funding this postdoctoral position, we seek to bring both broad intellectual capacity in the area of landscape ecology and technical spatial modeling abilities. The funds will cover salary and benefits (including overhead), as well as, travel and supplies for the successful candidate.

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