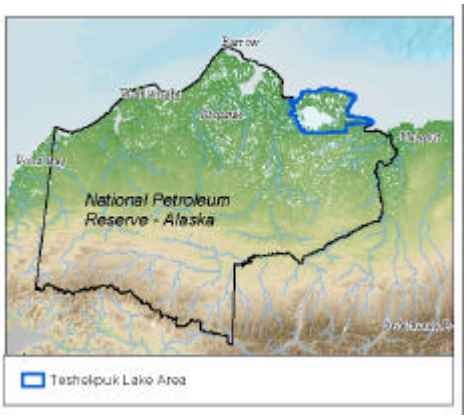
Alaska-Yukon Arctic Ecoregional Assessment
Update #11: Application of Ecoregional Data: Teshekpuk Lake Case Study

Introduction

In 2001, The Nature Conservancy began a comprehensive ecological assessment of the Alaska-Yukon Arctic ecoregion with the goal of identifying the lands and waters important for sustaining the ecoregion's biodiversity. In the first part of the assessment, we collected and catalogued information about conservation targets—the species, natural communities and ecological systems representative of the biodiversity of the ecoregion. Extensive biological data on these targets were compiled in a spatial database for use in mapping and analysis. We also developed several analytical tools, including predictive ecosystem models, a relative biodiversity index and a decision support tool. A full project description and the products of the assessment to date are available online at nature.org/alaska.

The Conservancy is now in the second phase of the assessment—working with partners and stakeholders to use the ecoregional data in the development of a conservation blueprint for the ecoregion. The blueprint will be a shared vision of key habitats in the region with strategies to conserve these habitats and the species that rely on them. As a first case study in the application of the assessment tools and data, the Conservancy has examined the relative biodiversity significance of Teshekpuk Lake. The Teshekpuk Lake area is in the northeast section of NPR-A[1] and is currently the focus of a significant land management decision. Teshekpuk Lake has long been recognized as important habitat for caribou, shorebirds, black brant, spectacled eider, and other waterfowl. In particular, Teshekpuk Lake provides critical molting and nesting habitat for a number of these waterfowl and provides important habitats for the Teshekpuk Lake caribou herd.

Figure 1. Location of Teshekpuk Lake



This update applies ecoregional data to describe the biodiversity of Teshekpuk Lake relative to the ecoregion and the Beaufort Coastal Plain and discusses the species and ecological systems that are disproportionately represented at Teshekpuk Lake.

[1] NPR-A is the National Petroleum Reserve – Alaska, a 23 million acre area which is managed by the Bureau of Land Management.

Teshekpuk Lake Case Study

The Alaska-Yukon Arctic ecoregion covers an area approximately 117,000 square miles in size. In order to compare biodiversity across the ecoregion, only data that were comprehensive to the ecoregion were used in the assessment. Thus, the data used in the assessment are at a coarse scale.

The applicability of coarse-scale data decreases as the size of the area being analyzed decreases. For this reason, we have restricted this study to questions about the relative biological importance of the sizeable Teshekpuk Lake area, which covers approximately 858,000 acres[2]. With the available ecoregional data we can identify species that are disproportionately represented in the area and quantify indices such as the relative biodiversity index, but we cannot locate specific places within Teshekpuk Lake that must be protected to conserve biodiversity.

We examined ecoregional data for the Teshekpuk Lake area to answer the following questions:

1. How does the biodiversity around Teshekpuk Lake compare to the biodiversity in the rest of the ecoregion?
2. How does the biodiversity around Teshekpuk Lake compare to the biodiversity in one subregion of the ecoregion – the Beaufort Coastal Plain?
3. Which species and ecological systems are most represented (that is, occur in disproportionately high concentrations) at Teshekpuk Lake?

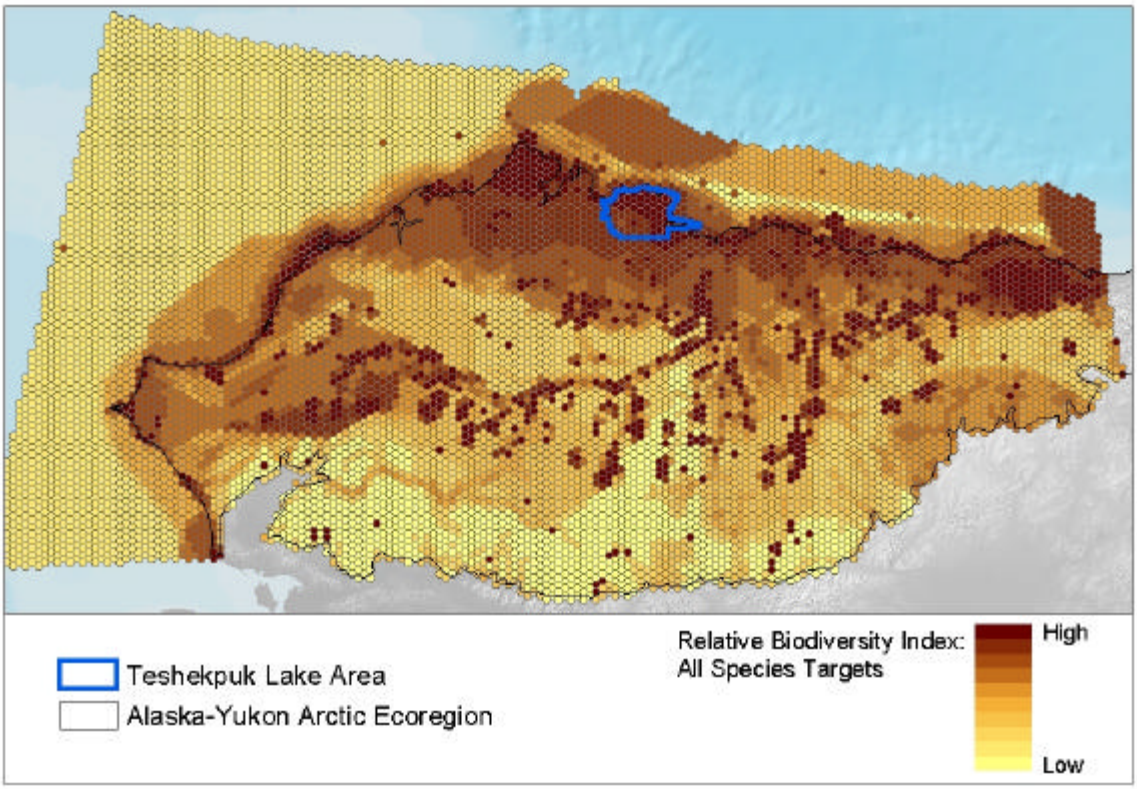
1. Biodiversity of Teshekpuk Lake Relative to the Ecoregion

Figure 2 illustrates the biological importance of the Teshekpuk Lake area relative to the rest of the ecoregion. The map is based on a relative biodiversity index (RBI) for the 85 primary conservation target species in the assessment.[3] Higher RBI scores (darker colors) indicate areas where there is either a greater *diversity* of species or a greater *concentration* of an individual species. In other words, a darker-shaded planning unit contains many different species, or it contributes relatively more to the total extent of one or more species' distributions.

As is evident from the map in Figure 2, the Teshekpuk Lake area (outlined in blue) has a high RBI score. Of 82 Teshekpuk Lake area planning units (each comprised of 5,000 ha), 99% score above the 80th percentile in the RBI for the entire ecoregion, and two-thirds score in the top 10th percentile of the relative biodiversity index. Compared to the rest of the ecoregion, the Teshekpuk Lake area has a high relative biodiversity index score.

[2] In our analysis, the Teshekpuk Lake area is defined using the boundaries of the existing Teshekpuk Lake Surface Protection Area, which covers 857,862 acres.
[3] See Update #5, *Conservation Targets*, for more details about which species are included.

Figure 2. Relative biodiversity index across ecoregion



2. Biodiversity of Teshekpuk Lake Relative to the Beaufort Coastal Plain

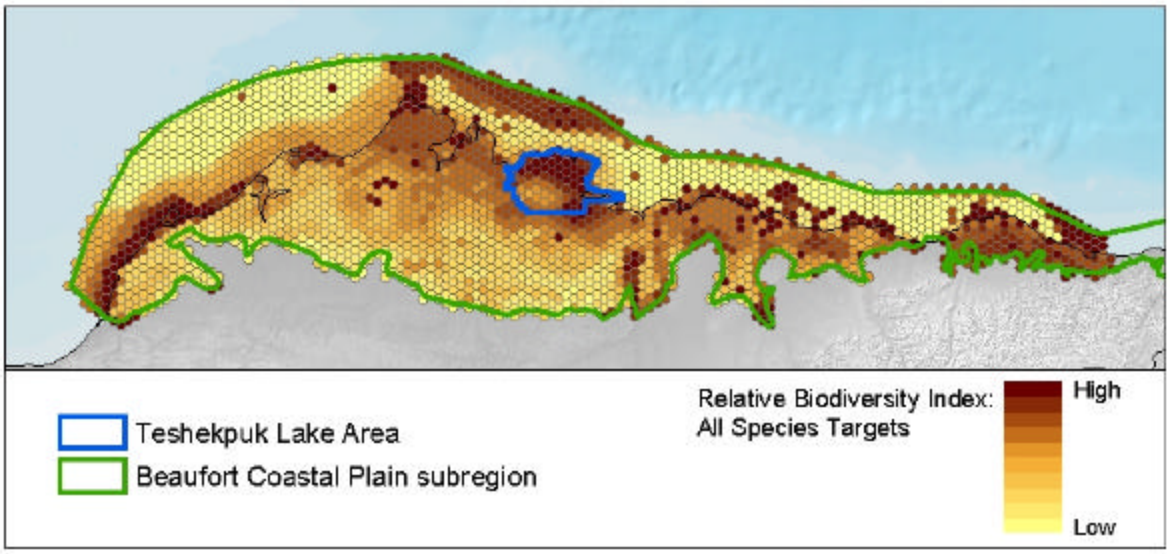
The Beaufort Coastal Plain is one of three major physiographic regions in the Alaska-Yukon Arctic ecoregion, and Teshekpuk Lake is located here. As shown by the darker shading in Figure 2 above, the Beaufort Coastal Plain has a high RBI relative to the rest of the ecoregion, suggesting that many species rely entirely or in part on the Beaufort Coastal Plain during their lifecycles.

But how biodiverse is Teshekpuk Lake relative to other areas in the Beaufort Coastal Plain? This answer to this question is illustrated in Figure 3, which depicts the gradient of biodiversity values across the Beaufort Coastal Plain. At this finer level of detail, a greater variation in biological importance across the Beaufort Coastal Plain can be distinguished.

Overall, 72% of the Teshekpuk Lake area rates above the 70th percentile of RBI for the Beaufort Coastal Plain, and over one-third of the area is in the top tenth percentile. Because the Coastal Plain already has a higher RBI than the rest of the ecoregion, the 72% figure demonstrates the very high biodiversity value of Teshekpuk Lake within the Beaufort Coastal Plain as well as the ecoregion as a whole.

Within the Teshekpuk Lake area itself, patterns of relative biodiversity are also noticeable. The northern and eastern portions of the Teshekpuk Lake area have very high relative biodiversity indices, and areas immediately southeast of the lake also have high values, although lower than in the north and east.

Figure 3. Relative biodiversity index across Beaufort Coastal Plain



3. Biological Importance of Teshekpuk Lake Area

Results of the two preceding analyses reveal that Teshekpuk Lake contains high biodiversity, relative to both the ecoregion and the Beaufort Coastal Plain. By examining the underlying ecoregional data, it is possible to determine the makeup of the biodiversity of the Teshekpuk Lake area and calculate the relative importance of the Teshekpuk Lake area to the long-term viability of various species and ecological systems.

Of the 85 primary species targets included in the ecoregional assessment, 10 are heavily represented in the Teshekpuk Lake area[4]. Of these, three species targets (separated into five life-stage targets)–Teshekpuk Lake caribou, black brant, and geese–are very heavily represented; over 50% of their total distribution in the ecoregion occurs in the Teshekpuk Lake area. Yellow highlights in Table 1 indicate the five life-stage targets that are disproportionately represented in the Teshekpuk Lake area relative to their distribution across the rest of the ecoregion.

[4] The ten target species are partitioned into 18 life-stage targets; see Table 1.

Table 1. Representation of species targets at the Teshekpuk Lake area

Target Species	Life Stage Target	Percentage of Ecoregional Distribution in the Teshekpuk Lake Area
geese (black brant; Canada, white-fronted, and snow geese)	*molting concentrations*	100%
	nesting concentrations	20%
Teshekpuk Lake caribou	*mosquito relief area*	100%
	calving area	53%
	oestrid fly relief area	48%
	summer area	17%
	wintering area	3%
black brant	*nesting colonies*	46%
	breeding density	7%
Sabine's gull	*colonies*	45%
	breeding density	6%
ducks	*molting concentrations*	43%
	nesting concentrations	12%
spectacled eider	*breeding density*	8%
yellow billed loon	*breeding density*	4%
shorebirds	*breeding density*	5%
white fronted goose	*breeding density*	6%
long-tailed duck	*breeding density*	4%
***Total** = 10*	***Total** = 18*	

The data presented in the table above suggest that the Teshekpuk Lake area is of great significance to the sustainability of several species. Likewise, the Teshekpuk Lake area contributes significantly to the ecoregional distribution of several terrestrial ecosystems. Of thirty-six terrestrial ecosystem classes described in the Alaska-Yukon Arctic ecoregional assessment, four are particularly heavily represented in the Teshekpuk Lake area[5]. Coastal wet sedge tundra, lowland lake, coastal barrens, and coastal grass and dwarf shrub tundra each have over 10% of their ecoregional distribution in the Teshekpuk Lake area (see Table 2). Coastal barrens, in particular, comprise only 0.8% of the Coastal Plain, and 0.2% of the ecoregion overall, making this ecosystem type naturally rare in the ecoregion[6]. That over 20% of this rare ecosystem type is represented at Teshekpuk Lake is notable and suggests that the Teshekpuk Lake area may be an important area for conservation of this ecosystem type and its constituent species.

[5] See *Update #2: Predictive Terrestrial Ecosystem Model* for more information on terrestrial ecosystems.
[6] See *Update #2: Predictive Terrestrial Ecosystem Model* for more information on terrestrial ecosystems.

Table 2. Representation of Target Systems

Target Systems	Percentage of Ecoregional Distribution in the Teshekpuk Lake Area
coastal barrens	22%
coastal grass and dwarf shrub	19%
coastal wet sedge tundra	18%
lowland lake	12%
lowland wet sedge tundra	4%
riverine wet sedge tundra	1%
***Total** = 6 terrestrial systems*	

The four ecosystems highlighted in yellow in Table 2 are also greatly underrepresented in the conservation network in the ecoregion; only 4% or less of each system's ecoregional distribution in the Coastal Plain is located on lands managed for conservation.[7]

Limitations of Analyses Regarding Teshekpuk Lake

This study of the relative biodiversity of Teshekpuk Lake must be viewed in light of the limitations of the spatial data available. The analyses discussed in this update drew from datasets developed for the ecoregional assessment; therefore, this study is based only on data that is comprehensive to the entire Alaska-Yukon Arctic ecoregion. The data is typically at a coarse scale. In general, lack of spatial data may omit identification of some areas with greater biological importance. Of the three target species with the greatest representation in the Teshekpuk Lake area, for two—black brant and geese—the spatial data is incomplete for the ecoregion and may require updating.[8] For black brant, scientists have identified two important molting locations and have observed that up to 30% of all black brant molt north and east of Teshekpuk Lake (Derksen et al 1982). However, spatial data for brant molting only exists for Teshekpuk Lake with the brant grouped with other geese. Unlike the spatial data for brant and other geese, however, the data for the Teshekpuk Lake caribou herd provides a more complete picture of habitat use by the herd in most seasons and at a finer scale.

The applicability of coarse-scale data decreases as the size of the area being analyzed decreases. For this reason, we have restricted this study to questions about the relative biological importance of the Teshekpuk Lake area. With the available data we can identify species that are disproportionately represented in the area and quantify indices such as the RBI. We can therefore prioritize areas for biodiversity significance, but we must then use conservation area planning, which is at a finer scale, to identify specific strategies and places for conservation within areas such as Teshekpuk Lake.

[7] See *Update #3: Gap Analysis of Terrestrial Ecosystems* for more on the classification of lands managed for conservation and the conservation status of terrestrial ecosystems in the Alaska-Yukon Arctic ecoregion.
[8] See *Update #8: Assessment Limitations and Data Gaps* for more information about spatial data gaps for the species targets highlighted in this analysis.

Contacts

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Previous Updates on the Alaska-Yukon Arctic Ecoregional Assessment

Update #1: Project Description
Update #2: Predictive Terrestrial Ecosystem Model
Update #3: Gap Analysis of Terrestrial Ecosystems
Update #4: Freshwater Ecosystem Model
Update #5: Conservation Targets
Update #6: Coastal Ecosystem Model
Update #7: Environmental Change Model
Update #8: Assessment Limitations and Data Gaps
Update #9: Cost Suitability Index
Update #10: Decision Support Tool
To obtain these updates, visit www.nature.org/alaska.

The Nature Conservancy

The Nature Conservancy is an international non-profit conservation organization that seeks to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. Ecoregional assessments employ a science-based approach to evaluate the biodiversity significance of landscapes. For the Alaska-Yukon Arctic, our goal is to gather sufficient information to identify areas of biological significance, evaluate current and potential stresses to biodiversity, and develop appropriate and constructive conservation strategies to ameliorate threats in special areas.