



## **Natural resource value and vulnerabilities at a proposed development site in Dyea, Klondike Gold Rush National Historical Park**

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Footpath from NPS campground to Chilkoot Trail trailhead in Dyea, spring of 2020.

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## Executive Summary

This report describes the natural resource value and vulnerabilities of a tract of land at Klondike Gold Rush National Historical Park (KLGO) located in Dyea, Skagway Borough, Alaska. Natural resource values encompass ecological condition and functions, including related human environment values. These qualities were assessed using on-site biological information acquired in 2020, information from multi-year park monitoring programs, investigative studies done in the park or the region, and descriptive studies from similar habitats. Environmental and human forces acting upon the tract were examined to evaluate vulnerabilities.

The affected area was determined to have high natural resource value due to the presence of sensitive species of conservation concern, combined with high biodiversity and productivity linked to habitat-level characteristics not found elsewhere in the lower Taiya River valley. In addition, the affected area has high human environment values for harvest, education, and experience coupled with easy accessibility to park visitors at two opposite ends and through an interior footpath. The combination of high biological resource value and readily accessible high human environment value provides an opportunity for visitor experience and education not available elsewhere within KLGO or the larger borough of Skagway.

No federal Threatened or Endangered species were found in the affected area.

Natural resource values include sensitive species of state, regional or local rarity or other conservation concern found in the affected area. These include a toad, 29 birds, 5 bats, 1 mushroom and 6 vascular plants (taxonomic identification confirmation required for 2 plants). Of particular concern are the Boreal toad and Chestnut-backed Chickadee songbird which are found only in limited ranges in western US and Canada and have declining or vulnerable populations. Four plants rare at state or regional levels and found at only one spot within the affected area should also be considered at the species level. Other sensitive species have more widespread continental occurrence but are rare or have declining or uncertain populations in the state or region.

All sensitive species in the affected area depend upon the high biodiversity and productivity of less sensitive animals and plants that provide crucial reproduction, growth, and refuge features at the habitat level. These biota are present because of complex vegetative landcover structure and the close proximity of sub-habitats such as shallow, warm freshwater wetlands adjacent to moist uplands with abundant ground cover and woody debris. The configuration of landcover, sub-habitats and species diversity in the affected area is not found elsewhere in the lower Taiya River valley.

Vulnerabilities include short term negative impacts to sensitive organisms, and long term negative impacts at the habitat level. Short term impacts include changes that immediately increase mortality, decrease reproduction, or destroy habitat. These impacts apply to Boreal toads associated with wetland DY03 and 4 rare plants each found in only one patch within the site. Long term impacts include changes that may occur over longer time frames, such as habitat degradation or outside changes that make habitat within the site more locally significant.

After shielding particular sensitive species from short term impacts, **all biological and human experience values are best protected by considering impacts at the habitat level.**

The lower Taiya River has settled into an active main stem channel and is unlikely to produce new freshwater wetlands at past rates. As existing marginal wetlands transform to uplands, the habitat around wetland DY03 will become more important as a biodiversity site for sensitive toads, birds, mammals and plants dependent upon wetlands in the Dyea area.

The affected area supports interior-preference forest species, especially breeding birds, that are negatively influenced by edge effects. However, no part of the interior is far enough away from edges to be completely unimpacted by edge-related effects. Changes that add to edge effects, reduce interior size, or increase habitat fragmentation will likely degrade interior habitat and could displace interior-preference species.

High traffic edges show signs of invasive exotic plant intrusion, while intact native plant communities in the interior show signs of recovering from and resisting invasive plants. Creation of new interior edges or habitat fragmentation may deteriorate native plant communities and promote invasive plant expansion.



## Introduction and Purpose

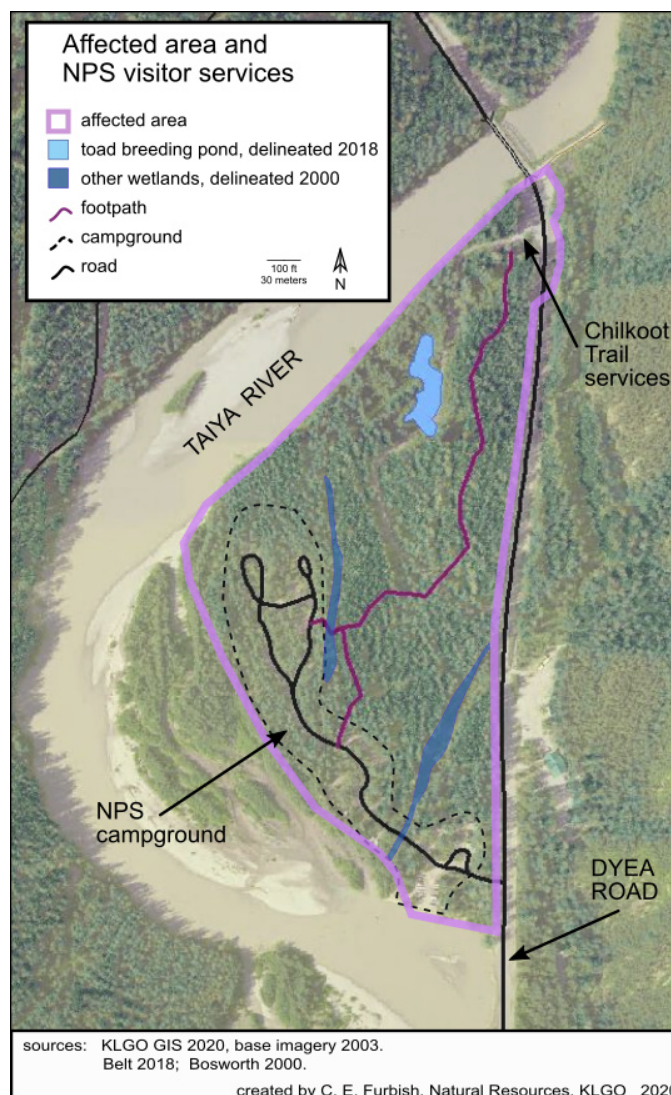
The affected area in Klondike Gold Rush National Historical Park (KLGO) includes trailhead parking and facilities for the historic Chilkoot Trail near the Taiya River bridge, a nearby National Park Service (NPS) campground including an overnight parking area for permitted Chilkoot Trail hikers at the campground entrance, and a footpath connecting the campground to the bridge area. (Map 1) The area of overnight parking at the campground entrance had been reduced due to river erosion since the mid-1990s, and in 2014 it was thought to be threatened by future erosion. Parking near the bridge has been informal, has increased with increasing tourism, and was recognized as needing improved management (KLGO 2014).

In June 2018, a preliminary assessment of proposed development at the northern end of the affected area was performed over 2 days by the Natural Resource Program Manager (Belt 2018). The assessment included wetlands delineation, descriptions of toad breeding pond DY03 and 2 nearby wetlands identified as important for toad reproduction, a brief search of nearby uplands for additional wetland signs and notable plants, a brief bird survey, a note on the nearest Bald Eagle nest, and a note on floodplain issues.

An orchid (*Corallorhiza trifida*) identified as having limited distribution in KLGO was found within the area of proposed development. An invasive exotic plant (*Ranunculus acris*) was noted near the established vault toilet. The assessment pointed out high native plant diversity and large variety of nesting migratory birds in the proposed area, and the potential for impacts upon Boreal toads in uplands near an important breeding pond.

In 2019, the acting Natural Resource Program Manager identified deficiencies in information about natural resource status and vulnerabilities in the affected area (Hake 2019). KLGO executed an interdisciplinary review of the environmental screening form within the National Park Service's Planning, Environment and Public Comment database (PEPC-77815) that demonstrated the need for more thorough natural resource information and assessment. In response, the acting Natural Resource Program Manager developed a workplan for collection of on-site biological information during spring and summer of 2020 (KLGO 2020b).

This report assesses the natural resource value and condition status of the affected area using ecological information generated in 2020, combined with information from multi-year park monitoring programs, investigative studies done in the area, and descriptive studies in similar habitats.



Map 1. Affected area and NPS visitor services (KLGO 2020a)

## Site Description

The affected area is a small, approximately 37 acre forest stand dominated by cottonwood trees (*Populus trichocarpa*) that partially close the high canopy while letting sunlight through to lower levels. Young spruce trees (*Picea sitchensis*) are mixed among the cottonwoods in scattered patches. Some areas of large, mature spruce trees are found along the eastern edge and in occasional discrete "spruce islands" that fully close off the canopy. Where sunlight penetrates the high canopy, shrubs and small trees create understory layers. At ground level, sparse to complete groundcover layers develop.

Soils are composed of river sediment deposits formed into a series of relatively level upland terraces that are crisscrossed by swales and ridges from previous stream channels or overflow events. A very gradual overall slope starts from highest at the northern point near the Taiya River bridge to lowest in the southwest corner formed by the Taiya River meander. In addition, human activities such as vehicle tracks and gravel mining have added to variations in ground topography. Wetlands formed where frequent overflow events occurred or where groundwater reached the substrate surface at least seasonally.

The variety of forest and ground properties in the affected area has created substantial variation in vertical and horizontal structure. Dead trees, standing snags and downed trunks, are scattered all through the site. Live shrubs or small trees may lean over to grow horizontally near the ground surface in wetter areas. Plant communities form mosaics of small patches with mixtures of micro-habitats. The resulting assortment of physical structure and plant communities fosters greater diversity of plant and animal species. In addition, the area shows higher biomass productivity - the overall bulk and frequency of turnover of organisms - than found in nearby closed-canopy forests.

## Plant Succession

Natural changes over time, absent large magnitude disturbances, will gradually shift landcover at the affected area out of its present high-diversity and high-productivity stage to less diverse, less productive natural configurations over the time period of about 50 to 80 years.

The current composition of landcover at the affected area is one stage in a continuum of changes to plant communities and structure known to occur over time within defined biogeographic regions. The process, called plant succession, follows a predictable pattern of dominant plant species being replaced after conditions change to favor a new set of dominant plants. The typical first substrate for land plant colonization in the lower Taiya River valley bottomlands is sediment deposits no longer exposed to frequent, scouring flooding or tidal inundation.

In very general terms, emergent wetland plants are often the first to establish, followed closely by wet meadows or low shrub communities as glacial rebound lifts the terrain above average groundwater levels. Taller shrub communities, woodlands and open forest typically follow. Mixed closed woodlands and spruce forests may then develop, with spruce-hemlock or hemlock dominated forests considered the climax plant community that is expected to develop if physical or biological disturbances do not alter the progression.

An intense large disturbance can re-set an area to an earlier successional stage. Natural examples of such large disturbances include the most extreme river floods, fires, or earthquakes. Human examples include landscape altering activities such as a gold rush stampede, agriculture, or logging. At any stage, certain combinations of smaller physical or biological disturbances may hold a plant community at a successional stage longer than would be expected. An example is the presence of a "keystone species", such as the beaver, that has a strong impact upon the physical environment and other organisms living there.

## Taiya River Hydrology and Geomorphology

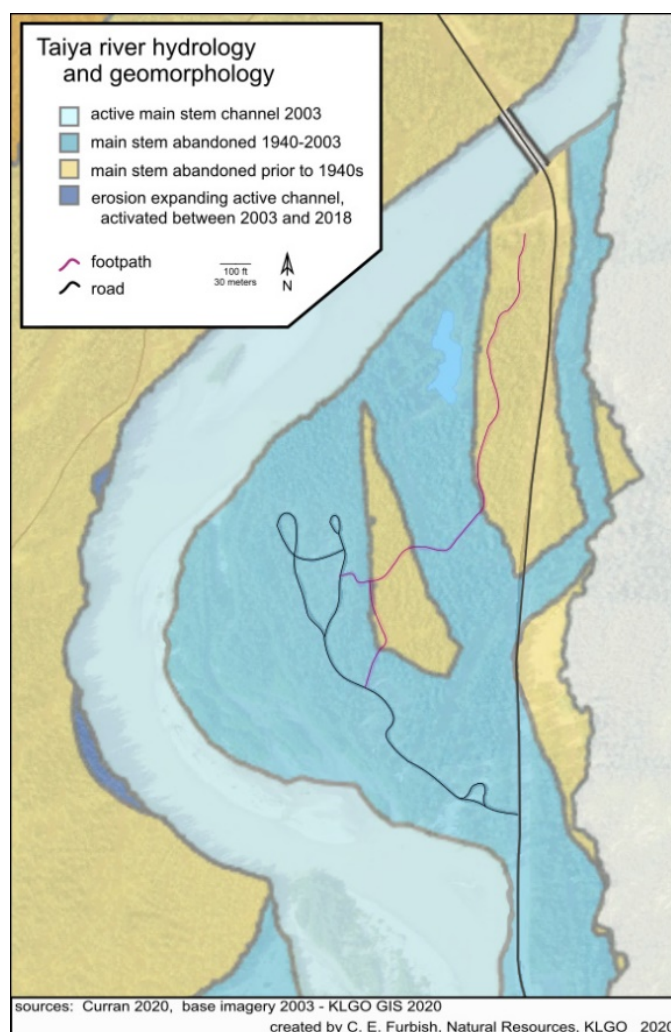
The Taiya River is the primary natural force driving landform and all related physical and biological conformations in the Dyea valley bottomlands positioned between steep, rocky hillsides.

A thorough investigation of lower Taiya River hydrology and geomorphology by J. H. Curran, published in 2020, included assessment of potential impacts to KLGO resources and infrastructure (Curran 2020). Results and conclusions of the investigation as they apply to the vicinity of the affected area provide the most current and pertinent evaluation of the river's influence on landforms and how they are likely to change in future decades. The Curran report is the reference for this section unless otherwise indicated.

The lower Taiya River is fed by hillside rain or snowmelt runoff and seasonal glacial meltwater with high sediment loads. Rivers with high glacial influence typically form braided channels with rapid channel movement within their floodplains. During the first half of the 20th century, the lower Taiya River experienced a gradual shift from braided channel behavior to a single flow path. During the last half of the 1900s, the main stem channel remained consolidated and stabilized. Side channels gradually changed from experiencing seasonal or occasional overflow activity to rare overflow from exceptional flood events.

Currently, the active main stem channel forms an unusually large meander curve that defines the affected area. (Map 2) The meander configuration is due to the river forces described above with added influences of mid-1900s bank stabilization at the Taiya River bridge abutment and the adjacent dike connecting to the start of the modern Chilkoot Trail northeast of the bridge (AKDOT&PF 2010). From the early 2000s, boulder rip-rap protection has been placed along Dyea Road south of the campground entrance to protect the road from erosion (KLGO 2000).

The active main stem channel is the relatively stable area within which the river is expected to move and rework sediments under conditions that have developed over the past century; conditions which included floods such as the rainstorm flood of 1967 and the West Creek glacial outburst flood of 2002. The active main stem channel widens downstream from the Taiya River bridge and opens broadly to the south of the affected area. The southwest arc of the large meander is a more dynamic exception to the expected stability of the active main stem channel, with anticipated increased southwest bank erosion and accretion or erosion on the northeast bank, until the meander curvature is reduced.



Map 2. Taiya river hydrology and geomorphology  
(KLGO 2020a)



Shoreline and main channel changes between the early 1990s and 2020 along the south side of the affected area illustrate river movement within the active main stem channel and at the more dynamic meander arc. (Map 3)

At the southeast corner of the affected area, the main river channel shifted back and forth within the active main stem channel over the past 3 decades. The main channel moved from south, to north, then back to the south shore, with substantial associated erosion and shoaling changes occurring within the active main stem channel.

The southwest meander arc experienced minor erosion on the southwest bank and variable accretion on the northeast bank during the 2 decades of 1990s and 2000s. During this time the main river channel stayed along the southwest shore. In the last half of the 2010s, the southwest shore experienced pulses of rapid erosion that pushed the active main stem channel to the south.

These trends are expected to continue in future decades and may further include substantial erosion within the broad active main stem channel to the south of the affected area. At any time, though, a 500-year or 1,000-year extreme event may occur.

#### Taiya River - Wetlands

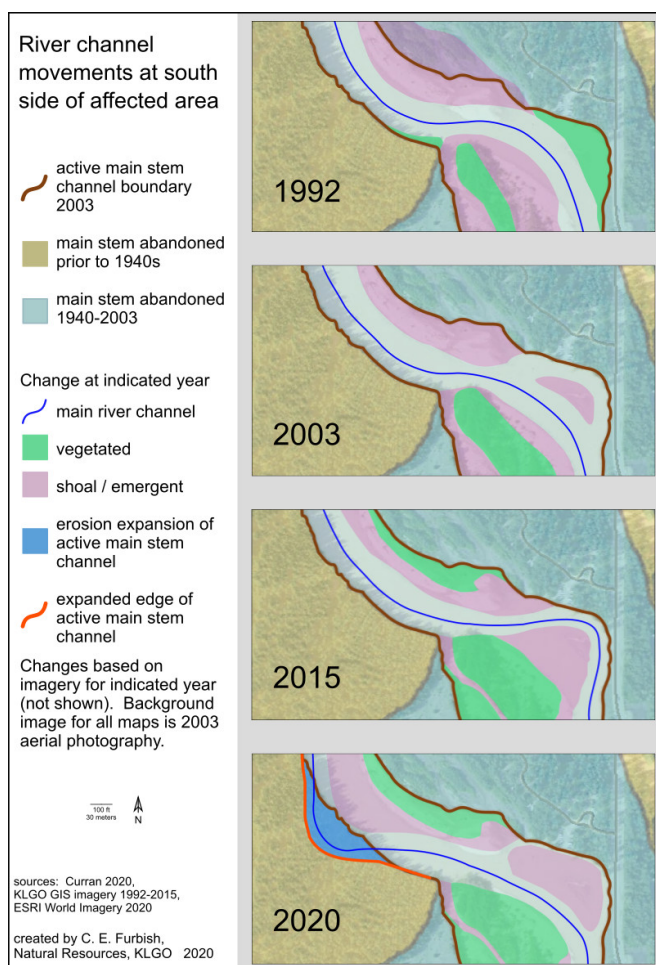
All but one existing wetland<sup>1</sup> in the Dyea valley bottomlands were generated through river processes such as abandoned river channels. The present stabilization of the river within the active main stem channel will interrupt formation of new wetlands through river processes. Meanwhile, glacial rebound in the Skagway area will likely continue at roughly 15mm (0.6") per year, raising landforms above sea level as long as sea level rise remains less than the rebound rate. The rate of global sea level rise was about 1.5mm (0.06") per year throughout most of the 20th century, but the rate has been accelerating since the early 1990s and was about 3.5mm (0.14") per year between 2015-2018. (Weeman & Lynch 2018, Lindsey 2021)

As glacial rebound lifts existing Dyea wetlands higher above the water table, drying will contribute to their transformation out of wetland character. Without new wetlands forming to provide alternate wetland habitat, existing wetlands are likely to become more individually important habitat in future decades as long as the Taiya River remains regulated within the active main stem channel.

#### Taiya River - other Hydro-geomorphic Influences

The affected area is also impacted by apparent river channel incision to the south of the Taiya River bridge. Data from the USGS stream gauge near the bridge show deepening of the main river channel adjacent to the affected area shoreline. The change is likely due to a combination of channel bed excavation and glacial rebound lifting, with the net result of a deeper cut from the level of the river berm surface to the channel bed.

Finally, woody debris jams can be effective for catching and anchoring sediment in many areas within the active main stem channel. However, wood jams will often be washed out at high erosion sites such as the southwestern bank of the large meander arc.



Map 3. River channel movements - affected area south (KLGO 2020a)

<sup>1</sup> the wetland located northwest of Slide Cemetery is not clearly associated with a channel (Curran 2020 p.51)



## Boreal Toad

In the early 2000s, the Boreal toad was evaluated for biological and cultural significance at Klondike Gold Rush National Historical Park (KLGO). It was selected as an important regional biological indicator species and a Secondary Vital Sign organism for the NPS Southeast Alaska Network Inventory and Monitoring Program. In addition, the Boreal toad was identified as having cultural significance for the Skagway Traditional Council and Chilkat/Chilkoot Tlingit, and the Carcross/Tagish first nations. The Boreal toad is also a central character in the Tagish story of the inception of the historic Klondike Gold Rush, having led Skookum Jim to the famed Bonanza gold-seam (McClellan 1963, Chambert et al. 2019).

KLGO initiated a Boreal toad monitoring program in 2004. A wetland in the north part of the affected area (DY03) was identified as a core toad breeding pond, and has been routinely checked for toad activity and status. This section is based on the monitoring program and data collected at DY03 during summer, 2020.

### Toad - Designations of Conservation Concern

The name "Boreal toad" can be an alternative common name for the Western toad (*Anaxyrus boreas*), or it may refer to the northern subspecies of the Western toad (*Anaxyrus boreas boreas*) recognized by some taxonomists.

Neither the Boreal toad species nor the subspecies are a federal Threatened or Endangered animal.

Boreal toads have limited distribution and only occur in the western mountains and temperate coastal areas of western US and Canada. The International Union on Conservation of Nature and Natural Resources (IUCN) and NatureServe, a consortium of nearly 100 organizations and over 1,000 scientists, list the overall toad population in 2020 as declining due to human-caused habitat destruction/degradation and disease impacts, primarily chytrid fungus disease (IUCN 2020; NatureServe 2020).

In 2018, the Alaska Center for Conservation Science (ACCS) and the Alaska Natural Heritage Program (AKNHP) determined Boreal toad populations in Alaska to be vulnerable due to "unknown status and either high biological vulnerability or high action need" (Drohini 2018). As of 2020, NatureServe assessed the status of Boreal toads in Alaska as S3/S4, "vulnerable / apparently secure but with cause for long-term concern" (NatureServe 2020).

Residents of southeast Alaska coastal towns have noted toad populations declining since the 1970s. Habitat destruction or degradation and chytrid fungal disease are the most likely stressors contributing to regional decline. Large decreases in abundance and distribution of Boreal toads have been documented in Skagway (Surdyk & Evans 2016).

### Toad - Life Cycle

Boreal toads are relatively long-lived with typical life spans of 9-10 years. Female toads are more important demographically than males since they are a limiting determinant for reproductive output. Females mature at 6 years, then breed every 2-3 years, for a total of about 3 times during their life span.

Eggs and tadpoles develop in fresh or brackish wetlands. Very young toads leaving the water may bunch together but eventually disperse into nearby upland areas near their nursery wetlands. Juveniles and adults spend late spring, summer and early fall feeding in moist uplands, usually relatively close to aquatic sites. Juvenile and adult toads, typically in groups, overwinter by hibernating in burrows for up to 7 months.

Immature toads experience high mortality due to predation. They are also susceptible to extreme swings in water levels at the breeding wetland (flooding or desiccation) such that an entire year's reproductive potential can be lost to these events.

## Toad - Habitat Requirements

Boreal toads migrate between aquatic breeding and terrestrial nonbreeding habitats (ADF&G 2020a). Southern populations of Boreal toads in the Rocky Mountains are primarily found at high elevations, whereas Boreal toads in Alaska are typically found closer to sea level (Chambert et al. 2019). These toads are highly adaptable to change within occurrence sites or occasional catastrophic events such as floods if key habitat requirements are met: shallow, still, aquatic breeding sites; upland maturation and feeding sites; and winter hibernation sites with existing sub-surface openings or substrate soft enough for toads to dig burrows below the frostline, often near streams where the frostline is shallow (AKNHP 2006).

## Toad - KLGO Data

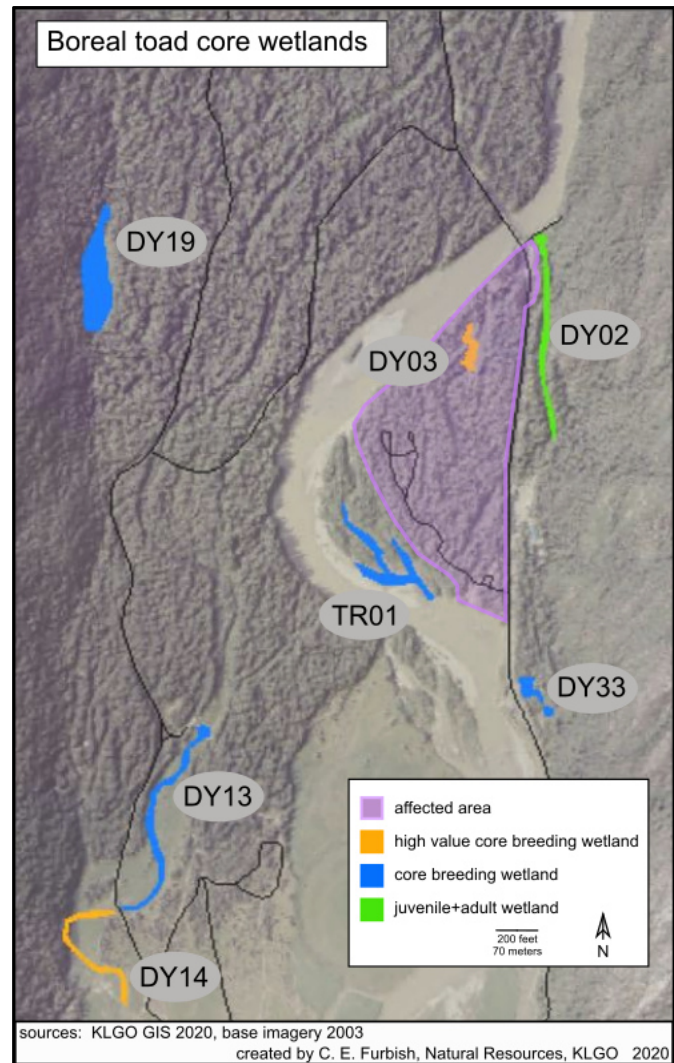
The KLGO Boreal toad monitoring program began in 2004. Eight core breeding wetlands were identified in the Dyea area, 6 of them in the river delta bottomlands between West Creek and the fjord. DY03 and DY14 are the 2 most consistent, productive, and successful toad breeding wetlands in the Dyea delta (Table A). DY03 is on land owned and managed by the NPS, whereas DY14 is on property owned and managed by the Municipality of Skagway Borough (MoS).

In 2012-13, eight adult males and 1 adult female were radio-tracked to determine their terrestrial movement patterns from mid-July to late-September. The majority of radio-tracked males stayed within 100 meters of the breeding wetland (TR01 or DY03) where they were initially captured, although one moved 277 meters from the pond. The female was tracked in August only of 2013 and stayed close to TR01 during that time.

Studies in British Columbia indicate females typically travel 4-10 times the distance of males before hibernating (Welfelt 2012). In Alaska, adult toads have been recorded 400 to 1,600 meters from breeding ponds outside the breeding season. (ADF&G 2020a).

Wetland DY02 is located to the east of Dyea Road across from the north part of the affected area. Sign of breeding activity has not been found at DY02, but it appears to be an important juvenile maturation site. Monitoring program records include notes that site visits were sometimes limited due to high numbers of juveniles and the fear of crushing them underfoot (Surdyk & Evans 2016).

In both 2012 and 2013, a radio-tracked toad moved from breeding pond DY03, across the Dyea Road, to the south part of DY02 - place that has since become the site of private residential development. Other radio-tracked toads were followed to probable hibernation sites near the river or under logs (Welfelt 2012, Welfelt 2013).



Map 4. Boreal toad core wetlands  
(KLGO 2020a)

Table A. Boreal toad reproductive importance rank of core wetlands in Dyea delta, 2004 to 2016.

core breeding wetland in Dyea delta area							
name	location	rank #	rank category	breeding consistency	breeding productivity	breeding success	note
TR01	south of campground	3	medium	high (11 out of 11 years)	presumed high	low often subject to flood or desiccation	pedestrian and dog disturbance
DY03*	south of Taiya River bridge, west of road	2	high	high (10 out of 12 years, plus prior to 2004)	presumed high	presumed high, usually stays wet during tadpole period	
DY13	north of Nelson slough bridge	4	low	low (3 out of 12 years)	presumed low	presumed medium, sometimes dries up	may be more important as maturation + adult habitat
DY14*	south of Nelson slough bridge	1	high	high (12 out of 12 years)	very high	high does not dry out - brackish	
DY19	north of slide cemetery	5	low	low (2 out of 12 years)	low	low	may be maturation site
DY33	east of raft pull out	6	low	low (3 out of 12 years)	low	low	staging area, high vehicle disturbance
important maturation / non-breeding wetland near DY03							
DY02	south of Taiya River bridge, east of road	no breeding activity (eggs or tadpoles) observed		appears to be an important area for juveniles and/or adults in some years		site visits were sometimes limited due to high numbers of juveniles and the fear of crushing them underfoot	
source: Surdyk & Evans 2016							
* Final reports are not available for 2017-2020, and 2019 data are unanalyzed. However, toads were recorded at both DY03 and DY14 in 2017, 2018 and 2019. In 2020, only TR01 and Dy03 were checked, toads were recorded at both. (Larsen 2020)							

### Toad - Vulnerabilities

Boreal toads are seen from sea level to higher elevations in the Municipality of Skagway Borough (MoS) but are primarily found in lower elevation river delta wetlands. Until the past 3-4 decades, toads were much more abundant and more broadly distributed in MoS. Oral histories describe Skagway and Taiya River delta ponds in the early to mid-1900s that were colored black in the spring with toad egg masses and tadpoles (Surdyk & Evans 2016).

Wetlands with still, warm, fresh or brackish water surrounded by moist uplands are an optimal habitat for Boreal toads. The lower 2.5 miles of the Taiya River delta, from sea level to about West Creek, contains a number of these wetlands. The lower 2.5 miles of the Skagway River delta has mainly been converted into commercial and residential developments. Toads have largely been displaced from the lower Skagway River delta, although occasional sightings of adults still occur.

While Boreal toads can be expected at higher elevations, in recent years the Dyea wetlands have become the best place to see toads and are likely the most important breeding sites in MoS.

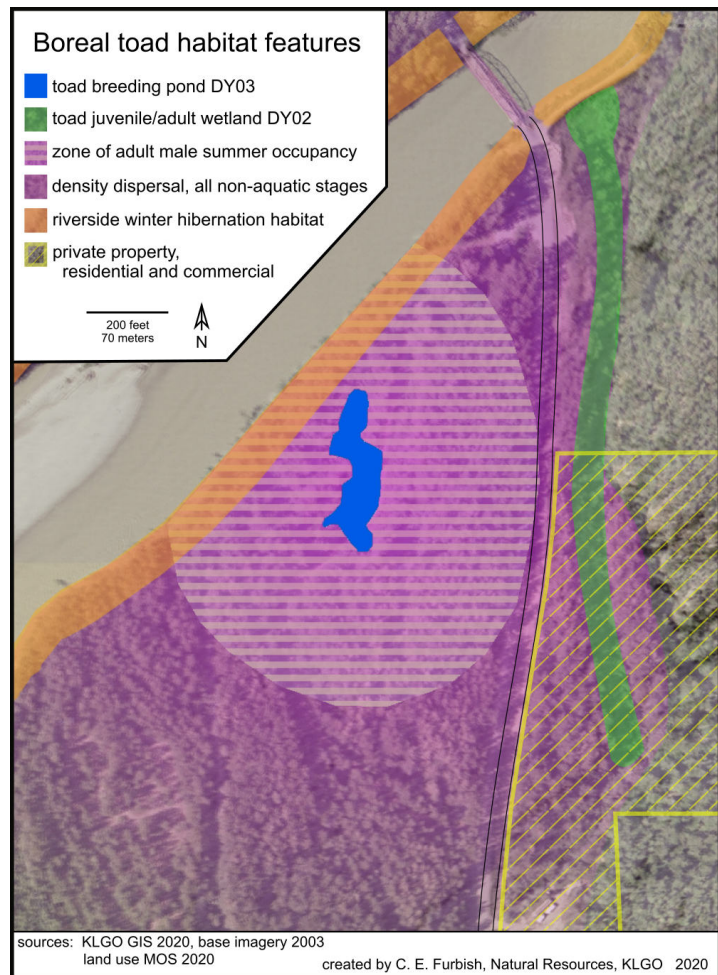
Tourism numbers for MoS have trended upward for decades (Municipality of Skagway 2020), except during the COVID-19 year of 2020 as of this writing, and may also be depressed during 2021. Higher numbers of visitors and vehicles in Dyea mean higher probability of trampling or crushing by vehicles, spreading chytrid disease, and other disturbance-related mortality for toads. However, it is habitat degradation and destruction that is the primary threat to toad populations.

Dyea land developments within and around NPS property can degrade or remove toad habitat. An example is the placement of fill for parking at DY33 in 2015 (Surdyk & Evans 2016). Another example is the creation of private residential building lots over the southern half of DY02, a place known from radio-tracking to be part of the dispersal pattern from breeding pond DY03 (Map 5). Community planning for Dyea includes further development of private residential lots (Municipality of Skagway 2020).

Taiya River hydrologic changes will likely depress the formation of new wetlands within the Dyea bottomlands. Existing wetlands will continue to slowly dry due to glacial rebound and reduced river overflow and will eventually lose wetland character.

As these trends progress over the next decades, toads will have fewer options for reproductive habitat, making existing wetlands more individually important for maintaining Boreal toad populations. In addition, crucial upland habitat for maturation, feeding and hibernation is susceptible to degradation or destruction as development pressure increases in Dyea.

Breeding pond DY03 is an established important toad area as one of the 2 high value breeding sites in the area. It is the only known high value breeding wetland on land owned and managed by KLGO. The DY03 wetland and associated upland habitat are likely to become more acutely important to maintain toad populations as Dyea wetland areas overall are affected by projected river hydro-geomorphic changes.



Map 5. Boreal toad habitat features  
(KLGO 2020a)



## Birds

About 200 species of birds have been recorded in Klondike Gold Rush National Historical Park (KLGO) and the Municipality of Skagway Borough (MoS) (Skagway Bird Club 2020). The birds are a mix of residents and migrators, waterbirds and landbirds, carnivorous predators and insect-berry-nut eaters. A survey of bird use in the affected area was completed in summer 2020 (Furbish 2020) and is the reference for this section unless otherwise indicated.

### Birds - Designations of Conservation Concern

No federal Threatened or Endangered birds were found in the affected area.

Forty-six (46) bird species used the affected area between late-April and the end of July 2020. A total of 29 birds had some level of conservation concern from the state of Alaska or bird conservation organizations. Fourteen (14) were listed as having declining populations statewide, and 4 were listed as vulnerable in southeast Alaska.

One species, the Chestnut-backed Chickadee (*Poecile rufescens*), was ranked as "under threat" due to restricted range and high population decline by Partners in Flight, a coalition of 150 government agencies and non-government organizations (Rosenberg et al. 2020).

Chestnut-backed Chickadees are only found near the coasts and in limited mountain areas of the western United States, British Columbia, and southeast & southcentral Alaska. The species is estimated to have experienced ~50% population loss over the last 44 years (1970-2014). If present trends continue, these chickadees are estimated to lose 50% of their current population over the next 46 years (Rosenberg et al. 2020).

### Birds - Life Cycles

Both resident and migrant birds used the affected area for breeding. Breeding sites are crucial for healthy bird populations of both types. For resident and partially resident birds, overwintering habitat is also important.

The breeding birds found in the affected area were primarily songbirds, but also included woodpeckers and grouse. In late-April and early-May, the breeding birds establish territories and lay eggs in nests, cavities, or ground hollows. After incubation, chicks are fed by one or both parents until they fledge (acquire some flying ability and leave the nest) in early summer. Most fledglings continue to receive high parental support for several weeks or more. Migrants may leave the area as early as mid-summer, while residents may move to different nearby habitats.

### Birds - Habitat Requirements

Breeding birds in the affected area included ground nesters, tree cavity excavators or users, and tree nest builders (Table B). Most breeding songbirds had small nesting territories such that many were unlikely to leave the affected area at all during the time between initiating nest-building and fledging young. Eleven (11) breeding birds were also birds of conservation concern due to declining or vulnerable populations.

Some breeding birds were habitat generalists that used both interior woodland habitat and woodland-edge habitat. Others were edge specialists, preferring to be near the places without trees. Still others were interior specialists, usually found inside woodlands or forests farther away from edges. Out of the 28 breeding birds found in the affected area, 11 were interior specialists that would normally be expected to nest in the interior of larger forest stands, and 5 were interior-favoring species that usually spend most of their time in interior habitat.

In addition to general nesting site requirements and interior vs. edge habitat, some breeding birds found in the affected area have affinities for particular habitat features. The affected area provides a wide variety of such features. Seven (7) species were found that need or prefer cavities in trees to nest, and the site has abundant standing dead trees used for cavity nesting and for drumming - the sound woodpeckers make by rapidly striking hollow tree trunks. Five (5) species were found that prefer to nest in conifer trees, and the site has scattered spruce islands within a predominantly open cottonwood forest. Six (6) ground nesting species that need dense cover at ground level were found, and the site has thick forb patches and tangles of downed live and dead shrubs. Twelve (12) species that prefer to be near water or wetlands were found, and the site has a river edge, small ponds, and wet swales.

Table B. Characteristics of breeding birds found in the affected area, 2020.

Common name <i>scientific name</i>	migrant	edge use	interior use	attracted to water	uses tree cavities	nests in conifers	nests on ground	conservation concern
American Dipper <i>Cinclus mexicanus</i>	no	high	minimal	exclusive				
American Redstart <i>Setophaga ruticilla</i>	yes	avoids	<i>prefers</i>	yes				declining population
American Robin <i>Turdus migratorius</i>	yes	uses	some					
Black-capped Chickadee <i>Poecile atricapillus</i>	no	uses	<i>prefers</i>		X			
Brown Creeper <i>Certhia americana</i>	mixed	some	<i>prefers</i>					vulnerable population
Chestnut-backed Chickadee <i>Poecile rufescens</i>	no	uses	<i>prefers</i>	along streams	X			declining population under threat
Dark-eyed Junco <i>Junco hyemalis</i>	mix	prefers	uses				X	
Downy Woodpecker <i>Dryobates pubescens</i>	no	<i>some</i>	<i>uses</i>		X			
Golden-crowned Kinglet <i>Regulus satrapa</i>	mixed	some	<i>prefers</i>			X		declining population
Hammond's Flycatcher <i>Empidonax hammondi</i>	yes	avoids	<i>prefers</i>			X		
Hairy Woodpecker <i>Dryobates villosus</i>	no	<i>some</i>	<i>uses</i>		X			vulnerable population
Hermit Thrush <i>Catharus guttatus</i>	yes	uses	uses	ponds			X	
Northern Waterthrush <i>Parkesia noveboracensis</i>	yes	<i>some</i>	<i>uses</i>	swamps wetlands			X	
Orange-crowned Warbler <i>Leiothlypis celata</i>	yes	prefers	uses	riparian			X	declining population
Pacific-slope Flycatcher <i>Empidonax difficilis</i>	yes	uses	<i>prefers</i>	yes	X			declining population
Red-breasted Nuthatch <i>Sitta canadensis</i>	mixed	some	<i>prefers</i>		X			
Red-breasted Sapsucker <i>Sphyrapicus ruber</i>	mixed	uses	uses	riparian	X			
Ruby-crowned Kinglet <i>Regulus calendula</i>	yes	<i>some</i>	<i>uses</i>					
Sooty Grouse <i>Dendragapus fuliginosus</i>	no	prefers	some				X	declining population
Steller's Jay <i>Cyanocitta stelleri</i>	no	uses	uses			X		

Common name <i>scientific name</i>	migrant	edge use	interior use	attracted to water	uses tree cavities	nests in conifers	nests on ground	conservation concern
Swainson's Thrush <i>Catharus ustulatus</i>	yes	some	<i>prefers</i>	streams				declining population
Townsend's Warbler <i>Setophaga townsendi</i>	yes	avoids	<i>prefers</i>					
Varied Thrush <i>Ixoreus naevius</i>	mixed	avoids	<i>prefers</i>			X		
Warbling Vireo <i>Vireo gilvus</i>	yes	uses	uses	ponds marshes				
Western Tanager <i>Piranga ludoviciana</i>	yes	uses	uses	wetlands				
Wilson's Warbler <i>Cardellina pusilla</i>	yes	prefers	avoids	streams			X	declining population
Yellow Warbler <i>Setophaga petechia</i>	yes	prefers	avoids	streams, wetlands				declining population
Yellow-rumped Warbler <i>Setophaga coronata</i>	yes	some	<i>uses</i>			X		
source: Furbish 2020								

Keystone species are organisms that cause changes within their environment that have a strong effect upon the physical structure and/or other biota in that environment. Red-breasted Sapsuckers (*Sphyrapicus ruber*) are a double keystone species thriving in the affected area, they exhibit two keystone behaviors. These sapsuckers excavate new nesting tree cavities every year, which are used later by other cavity nesting birds, bats and squirrels. They also create sap-producing holes in tree trunks that are an important food source for other animals. Their impacts on trees generate a high proportion of snags and down trees with cavities, helping to maintain the open-canopy structure of the woodland and providing shelter to other animals.

Special note: American Dippers (*Cinclus mexicanus*), charismatic, semi-aquatic songbirds, were probably nesting under the Taiya River bridge. A very young fledgling, barely able to fly, was seen being protected and fed by adults at the river's edge near the bridge.

Overall, bird habitat characteristics of the affected area are a diverse mosaic of physical and biological structure, providing favorable breeding sites to a wide variety of bird species that have a range of different habitat requirements.

## Birds - Vulnerabilities

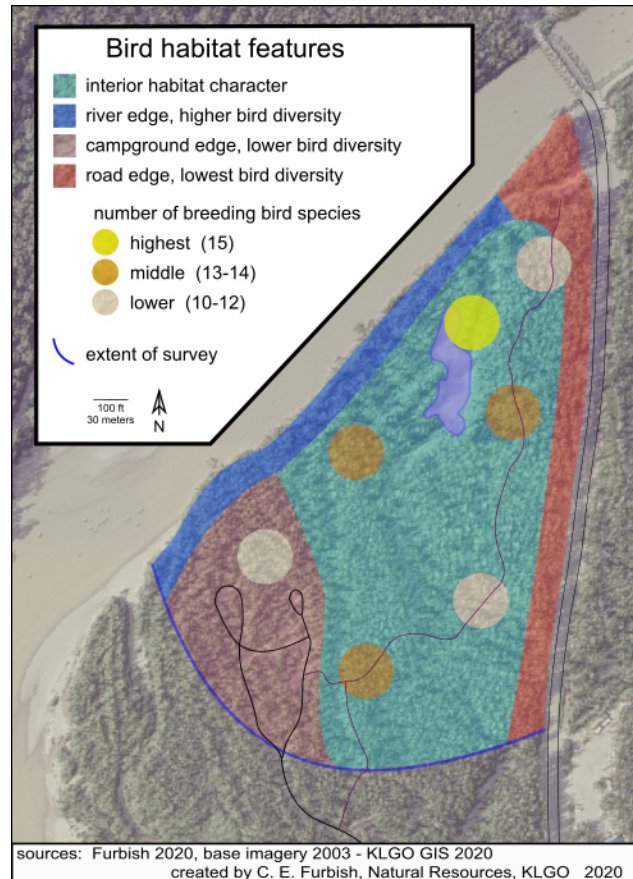
The high bird diversity in the affected area is linked to high variety of vegetative structure and features that meet habitat requirements of diverse bird species, especially breeding birds. These qualities signal the importance of including site-wide habitat character to evaluate potential impacts to birds in the affected area.

The affected area supports interior-preference species that are sensitive to edge effects. One half (16 out of 28 species) of breeding bird diversity within the site is due to nesting birds that are strongly or regularly linked to interior habitat.

However, there are indications that interior habitat within the site is marginal and vulnerable to alterations that could degrade interior character. Some edge-preference species were also nesting in the interior of the affected area, suggesting that the interior habitat has mixed characteristics. No part of the interior is far enough away from edges to be completely uninfluenced by edge-related effects.

The small overall size of the area makes it susceptible to changes to the interior area to perimeter edge ratio that could increase edge effects and diminish interior characteristics. Interior character is similarly susceptible to degradation from internal habitat fragmentation. Features that bisect the interior have the potential to become functional edges and create habitat fragmentation effects for some species, especially the interior-preference breeding birds.

Increased pedestrian, pet, and vehicle traffic can cause indirect effects, such as increased presence of predators attracted to human food.



Map 6. Bird habitat features  
(KLGO 2020a)



## Bats

Five species of bat have been documented in Klondike Gold Rush National Historical Park (KLGO), the highest verified bat species abundance in all of the Alaska Parks (Burger 2020). Three of these species represented northern range extensions in Alaska (Olson & Fiely 2014). Preliminary bat inventory work began in the Municipality of Skagway Borough (MoS) in the early 2010s. A KLGO sponsored survey was performed in 2013-2014 (Olson & Fiely 2014). Additional acoustic monitoring at specific locations in Dyea occurred intermittently through 2019 (Burger 2020). Acoustic data were collected within the affected area in 2020.

### Bats - Designations of Conservation Concerns

No federal Threatened or Endangered bats were found in the affected area.

#### Little brown bat (*Myotis lucifugus*)

is found across North America, but was assessed at the global level as Endangered by the IUCN (International Union on Conservation of Nature and Natural Resources) due to rapidly decreasing populations and white-nose syndrome disease (IUCN 2020). It was also ranked as vulnerable at the global, national and state levels by NatureServe (consortium of nearly 100 organizations and over 1,000 scientists) (NatureServe 2020).

#### Keen's myotis (*Myotis keenii*)

has a restricted range in coastal Washington state, British Columbia and southeast Alaska. In 2019, a taxonomic assessment concluded that *M. keenii* should be folded into the species Long-eared Bat (*Myotis evotis*) (Lausen et al. 2019) which occurs in the western US, southwestern Canada, and Baja California (IUCN 2020).

Only NatureServe had changed their taxonomic information as of this writing. The National Park Service, Alaska state agencies, IUCN, and Bat Conservation International still reference *M. keenii* (National Park Service 2020, ADF&G 2020b, IUCN 2020, Bat Conservation International 2020) therefore Keen's myotis is used in this document. NatureServe lists *M. evotis* as vulnerable at the state level (NatureServe 2020).

#### Long-legged myotis (*Myotis volans*)

has a broad range in western North America but was ranked as vulnerable at the state level by NatureServe (2020).

#### California myotis (*Myotis californicus*)

is found primarily in Mexico and western US, with smaller areas of southwest Canada and southeast Alaska. NatureServe lists it as "apparently stable but some cause for long-term concern" for the state of Alaska (NatureServe 2020).

#### Silver-haired bat (*Lasionycteris noctivagans*)

is found across most continental US states, south Canada and southcentral & southeast Alaska. It was ranked as vulnerable at the global and national levels by NatureServe, and as "apparently stable but some cause for long-term concern" at the state level (NatureServe 2020).

The state of Alaska considers all five species to be vulnerable due to "unknown status and either high biological vulnerability or high action need" (Droghini 2017).

Table C. Bat species, distribution and conservation status.

common name	scientific name	distribution	IUCN global assessment	NatureServe rank			Alaska state rank
Little brown bat	<i>Myotis lucifugus</i>	North America	Endangered population decreasing, white-nose syndrome	G3	N3	S3	vulnerable
Keen's myotis or Long-eared bat	<i>Myotis keenii</i> or <i>Myotis evotis</i>	Washington, British Columbia and southeast Alaska	stable population	G5	N4/N5	S3/S4	vulnerable
Long-legged myotis	<i>Myotis volans</i>	US & Canada western plains and mountains	stable population	G4/G5	N5	S3/S4	vulnerable
California myotis	<i>Myotis californicus</i>	Mexico& western US, southwestern Canada and southeast Alaska	stable population	G5	N5	S4	vulnerable
Silver-haired bat	<i>Lasionycteris noctivagans</i>	US-48, southern Canada, south central and southeast Alaska	stable population	G3	N3/N4	S4	vulnerable
NatureServe rank				Alaska state rank			
G = global N = national S = state				3 = vulnerable, rare, or low numbers 4 = Apparently secure, uncommon, or some cause for long-term concern 5 = Secure, common, widespread  vulnerable (orange) = unknown status and either high biological vulnerability or high action need			
sources: IUCN 2020, NatureServe 2020, ACCS 2017							

### Bats - Life Cycles

The bats found in the KLGO area have life spans from about 8 years up to 20-30 years in the wild.

All bats found at KLGO are mostly solitary as adults, except for small maternity groups in the summer. Mating occurs in the fall, but fertilization occurs in the spring. Females start reproducing at 1-2 years, and often have young every year if food is abundant. Usually a single pup is born per year, except the Silver-haired bat that often has twins.

Silver-haired bats exclusively eat flying insects. Long-legged and California myotis bats eat primarily moths and butterflies respectively, with some non-aerial prey. Little brown bats and Keen's myotis hunt aerial insects, but also forage ground or tree surfaces for prey. Little brown bats can have a diet up to 50% non-aerial insects & spiders gleaned from the surfaces of trees and snags.

Winter hibernation consists of periods of dormancy with episodes of activity during warm spells. Little brown bats may concentrate more on surface foraging for spiders and non-flying insects during winter active periods.

### Bats - Habitat Requirements

All bat species found at KLGO are generally known to prefer coastal forests in southeast Alaska, often in riparian areas or near open water. Landcover type can be old-growth forest, mixed conifer-broadleaf forests, and/or second-growth forests. Little brown bats and Keen's myotis can also be found in urban areas, which includes rural towns or remote human dwellings and other structures.

Summer roosts are often large trees or snags, under bark, in crevices or old cavities. Little brown bats and Keen's myotis may also use buildings as roosts, and to a lesser extent, California myotis may use a building in a rural area.

Winter hibernation sites are less well described. Little brown bats are known to use scree fields, tree root wads and stumps, and buildings. Little data is available for winter refuge sites for southeast Alaska populations, and less for KLGO populations.

#### Bats - KLGO data

Bat monitoring and surveys in KLGO and MoS from the 2010s documented the widespread Little brown bats and four additional species: Keen's myotis, Long-legged myotis, California myotis and Silver-haired myotis. In the town proper of Skagway, only Little brown bats and Keen's Myotis were found, whereas the other species were detected as distance from the denser urban development increased (BatAMP 2012, Olson & Fiely 2014, Burger 2020).

Data from 2013-14 surveys provided some additional specific information on Keen's myotis behavior at KLGO (Olson & Fiely 2014). Males in summer months appeared to prefer forest edge habitat for foraging. Their day roosts, the places where they rest or sleep during the day, were standing snags, primarily in dead hemlock trees.

In 2020, bat acoustic monitoring equipment was deployed in the affected area at toad pond DY03 from 24 June to 2 September (Larsen 2020). When compared to similar data from 2020 and 2013-14 at Nelson Slough, there was more total bat activity at the DY03 site. Three species were recorded: Little brown bat, Keen's myotis, and Silver-haired bat (Burger 2020).

The 2020 data also showed a general rise in activity in the affected area towards the end of the summer. When combined with species information, this indicated more bats were using the area later in the season, as opposed to a few bats simply being more active. The same pattern was consistently seen in the Nelson Slough data, suggesting that some interior or higher-elevation bats move into the area with the change in season and may spend winter months in the area (Burger 2020).

#### Bats - Vulnerabilities

Little brown bats are designated highly threatened by many organizations primarily due to White-nose Syndrome (WNS) disease. WNS has decimated many large Little brown bat colonies in North America, often with 90% mortality. Bat biologists point out that the Alaska bats of this species tend to be more solitary with smaller maternity colonies, however they are also more solitary in Washington and California where some WNS disease has been detected (Burger 2020).

Preliminary, limited information about Keen's myotis bat is available for KLGO. The 2020 data show that it is active in the affected area in the summer. There may also be some summer roosting in the affected area, which has abundant mature trees and snags, but no large hemlocks that the bats seemed to prefer in the 2013-14 KLGO surveys. The affected area also has many live trees and snags with abandoned cavities, which may be used for bat roosts.

Only minimal presence/absence information is available for Long-legged myotis, California myotis and Silver-haired bats at KLGO. The limited data indicate these species are not using the developed Skagway River delta but are found outside that area.

Although KLGO data indicate bats are moving into the lowlands in late summer, there are no data on winter bat roosting sites in Dyea.

The affected area shows overall high bat activity of at least 3 species, with indications of foraging, possible summer roosting, and possible winter hibernation functions. The affected area is supplying some level of favorable bat habitat in its current condition, and high bat activity at the site may indicate high value foraging habitat.

## Other Mammals

A variety of mammals are found at Klondike Gold Rush National Historical Park (KLGO). Well developed understory and groundcover vegetation in the affected area provide homes with plentiful food and shelter for small mammals. Larger mammals are also attracted to food and shelter at the site, but have home ranges of greater size than the affected area. Small mammal data and large mammal observations and signs were collected at the affected site during the summer of 2020.

### Other Mammals - Designations of Conservation Concern

No federal Threatened or Endangered species of small or large mammals were found in the affected area.

There is limited information on the distribution and abundance of small mammals in KLGO or the Municipality of Skagway Borough (MoS). The voles, deer mouse, shrews, and squirrel found in the affected area were listed as "not sensitive" for KLGO in the NPSpecies database of park biota (IRMA 2020). The same animals were ranked as "not vulnerable" or "vulnerable due to lack of data" but with suspected large, abundant, or increasing populations by the state of Alaska (AK Natural Heritage Program 2020). NatureServe, a consortium of nearly 100 organizations and over 1,000 scientists, ranked the same animals as "secure" or "apparently secure" for the state of Alaska (NatureServe 2020).

With one exception, all large mammals observed using the affected area, or likely to use the affected area but not recorded, were also listed in NPSpecies for KLGO as "not sensitive" (IRMA 2020). The exception was Mule deer, which has only recently become established in the area and is not listed in NPSpecies-KLGO. The state of Alaska does not include large mammals in their species ranking system. All of the large mammals were ranked by NatureServe as "secure" or "apparently secure" for the state of Alaska (NatureServe 2020).

### Other mammals - KLGO Data

A capture-release trapline for small mammals was deployed in the northern part of the affected area from June to August 2020. A remote recording game camera was deployed in the same area during the summer of 2020. In addition, opportunistic sightings of larger mammal individuals or signs (tracks, scat, etc.) were recorded throughout the season (Larsen 2020).

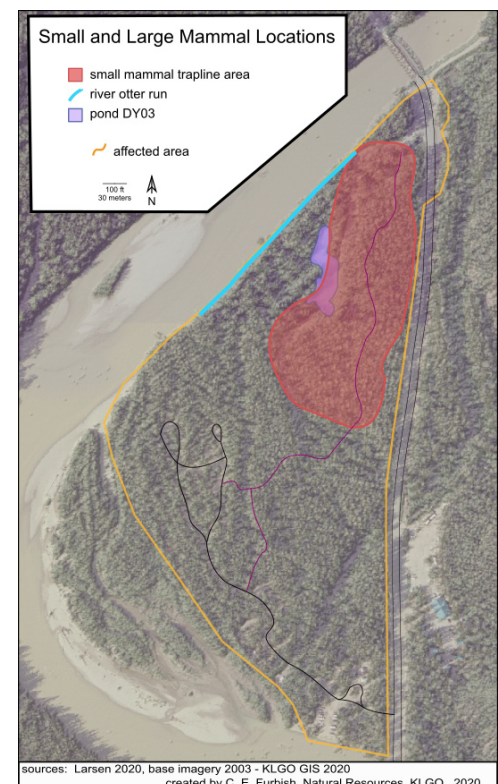
The 2020 trapline overall capture success was 8-37% across trapping sessions of 3-5 days, every other week. Capture rates of 20 - 30+% occurred in over half of trapping sessions in both July and August, which may indicate a high activity level (Flamme 2020). The most frequently caught species was the Northern red-backed vole.

### Small Mammals - Life Cycles

**Northern red-backed vole (*Myodes rutilus*)**  
is a small, primarily herbivorous rodent with a high reproduction rate of up to 5 litters a season and a life span of 1-2 years. These voles form a major part of the prey base for almost all carnivorous mammals and birds in the areas where they occur (Krebs et al. 2001).

**Long-tailed voles (*Microtus longicaudus*)**  
is a small, primarily herbivorous rodent that usually has a life span of 1-2 years. They average 2 litters per year, and population density fluctuates year to year. These voles generally avoid areas with high densities of other voles. They are eaten by larger mammals and birds.

**Deer mouse species (*Peromyscus* spp.)**  
the trapline deer mice were not identified to species, but NPSpecies lists only *Peromyscus keeni* as



Map 7. Small and large mammal locations (KLGO 2020a)



occurring in KLGO. *P. keeni* is an omnivore, but primarily feeds on seeds. They have 2-3 litters per year, and a life span of 1-2 years. They are preyed upon by larger mammals and birds.

#### Shrew species (*Sorex* spp.)

the trapline shrews were not identified to species, but NPSpecies lists 3 shrews found in KLGO. All are mostly carnivorous but can also include nuts and fruits in their diet. They have 1-4 litters per year, and life spans of 1-2 years. All have very high metabolic rates. They are eaten by larger mammals and birds.

#### American red squirrel (*Tamiasciurus hudsonicus*)

are primarily seed-eaters, but can be significant predators of bird eggs and chicks, and the pups of bats and small mammals. They typically produce 1 litter per year and have life spans of 5-10 years. They are preyed upon by larger mammals and birds.

### Small Mammals - Habitat Requirements

All rodents found in 2020 are strongly dependent upon adequate dense cover at ground level. Northern red-backed voles prefer shrub thickets but are also commonly found in forests and tundra. Long-tailed voles occupy habitats from rocky slopes and clear cuts to old growth forests that include rock or vegetation cover. Deermouse habitat is highly variable, from beaches to old growth forest, and includes human structures.

The shrews likely to be found in the affected area are attracted to moist areas with good ground cover, ranging from meadows to shrub thickets to woodlands and forests, as long as ground vegetation or litter is abundant.

Red squirrels highly adaptable and seemingly ubiquitous. They are abundant in forests or woodlands, and are comfortable in human settlements. Squirrels use both trees and ground for harvesting, hunting and shelter. They also seek thick humus at ground level for making middens of cached food for winter.

### Large Mammals - Life Cycles and Habitat Requirements

The large mammals observed or likely to use the affected area all have home range territories greater in size than the affected area. Therefore, they are only listed here with brief food or shelter information.

#### Black and/or Brown bear (*Ursus americanus* and *U. arctos*)

was recorded once by the game camera. Signs of bears included concentrated shoots of berry-producing plants from the previous year's droppings found along old trails and game paths, abundant fresh scat throughout the site, and churned soil from groundcone (*Boschniakia rossica*) harvest.

#### Red fox (*Vulpes vulpes*)

was recorded once by the game camera. A fox was seen almost every time an investigator visited the site. Nearby residents observed a fox visiting their property and moving into the affected area daily. A report was submitted of a fox leaving the area with 2 squirrels in its mouth.

#### Mule deer (*Odocoileus hemionus*)

was recorded 3 times by the game camera, and one was photographed by an investigator in early May. Extensive browse sign was noted throughout the site and throughout the season, primarily on watermelon berry (*Streptopus amplexifolius*) and fireweed (*Chamerion angustifolium*).

#### River otter (*Lontra canadensis*)

was observed at the top of the river berm in May. An otter run was noted along the river where human presence is normally low. An otter run is a pathway worn into vegetation along a shore by frequent passage of otters, with slides for quick, easy access between water and upland. Fresh otter scat was recorded along the run throughout the season.

#### Other large mammals likely to use the affected area:

canids: Coyote (*Canis latrans*), and less frequently Gray Wolf (*Canis lupus*)

felines: less frequently Lynx (*Lynx canadensis*)

hares: less frequently Snowshoe Hare (*Lepus americanus*)

weasels: Marten (*Martes americana*), American mink (*Neovison vison*), Ermine (*Mustela erminea*)

## Other Mammals - Vulnerabilities

The ground-based small mammals (voles, deermice, shrews) require thick protective structure at ground level, such as thickets, exposed roots, rocky crevices, down trees, thatch, duff, or moss beds. Most have a preference for moist areas and are attracted to high productivity of seeds, berries and insects. Red squirrels are attracted to high plant productivity, particularly within woodlands and forests. These conditions are found throughout the affected area.

A relatively small reduction in the size of the overall habitat would probably cause minor impacts to small mammal populations. Removal or degradation of substantial habitat could decrease small mammal productivity. Small mammals may be more directly affected by increased presence of humans and dogs. Human food scraps could attract small mammals, but may also draw in more predators that may eat them. Dogs might disturb or prey upon small mammals.

Large mammals are attracted to high biological productivity in the affected area. Mule deer and bears find abundant forage. Bears, foxes, and other carnivores find abundant small mammals. All larger mammals have home ranges greater than the size of the affected area.

The river otter is a semi-aquatic large mammal that does most of its hunting in the water. It uses the affected area primarily for resting or travel at the otter run on the river's edge.

All larger mammals are popular for viewing by park visitors. However, some may be displaced by human & vehicle traffic, while others risk becoming habituated to human presence or human-related food. The presence of habituated animals inevitably leads to killing of animals that become pests or dangerous to people.

Keeping corridors of low human activity open to animals may help prevent larger mammals from being displaced by human traffic. More opportunities for visitors to view animals should result if humans and animals can move with enough separation from each other for animals to feel safe using the area.

## Flora

Plant diversity at Klondike Gold Rush National Historical Park (KLGO) is unusual within the southeast Alaska region due to the presence of both coastal temperate rainforest species and continental boreal interior species. Plants are the primary producers of biomass, the basis of food for other organisms, and supply shelter for animals. Plants are valuable to humans for harvest, education, cultural or aesthetic appreciation, and natural services such as soil stabilization and water filtration.

A systematic and targeted survey for rare or sensitive vascular plants in the affected area was performed in the summer of 2020. In addition, plants with selected human values were noted; and an informal, brief appraisal of exotic plant distribution in the affected area was included. Nonvascular plants (mosses, liverworts) were only briefly noted in the 2020 survey due to field identification limited to the more common organisms. Information presented here is based on field notes from the 2020 survey unless otherwise indicated (KLGO 2020a).

### Flora - Designations of Conservation Concern

No federal Threatened or Endangered plants were found in the affected area.

Six plants with state, regional or local rarity were found in the affected area in 2020 (Map 9). All field identifications were supported by macrophotography with at least one level of review by regional or state botanists. Final verification through specimen evaluation is recommended for all, and necessary for the sedge and watercress species.

Rarity was assessed through several sources and is presented by species below and in Table C. NPSpecies, the National Park Service biological database, was queried for KLGO plant status (IRMA 2020). The Alaska Rare Vascular Plant Database was checked for state species assessments (AK Rare Plant Data Portal 2020). NatureServe, a consortium of nearly 100 organizations and over 1,000 scientists, was accessed for their ranks of organisms based on rarity and vulnerability (NatureServe 2020). Regional botanists Judy Hall Jacobson and Marlin Bowles provided expert perspective on Lynn Canal and southeast Alaska plant status (Jacobson 2020, Bowles 2020).

Two orchids were sparsely distributed throughout the affected area except an orchid-free area in the extreme northwest corner. In addition, several distinct higher density patches of orchids probably act as seed source locations (Map 9).

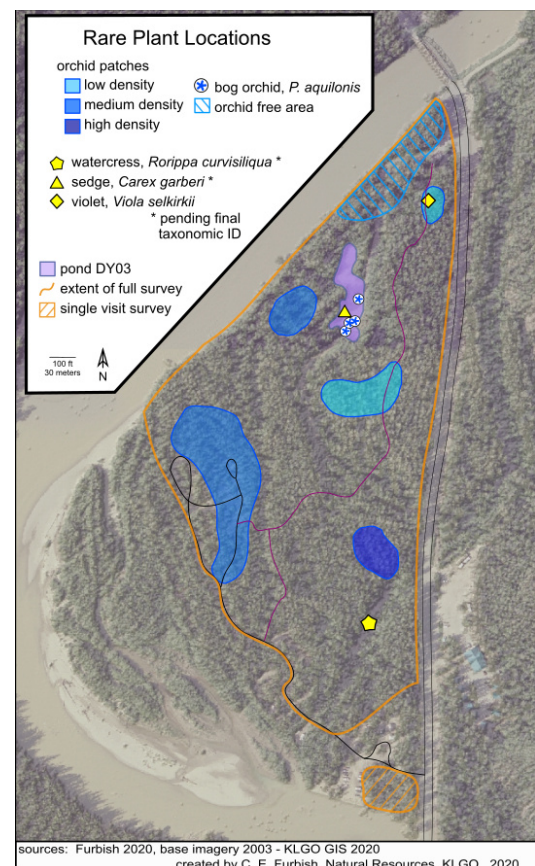
Early coralroot (*Corallorhiza trifida*) was sparsely distributed and occurred in patches. It was listed as "rare" in NPSpecies-KLGO, and has few records elsewhere in southeast Alaska.

Blunt-leafed rein orchid (*Platanthera obtusata*) was common in the affected area and occurred in patches. It may be rare in southeast Alaska, and is currently being reviewed by regional botanists.

Three plants associated with wetlands - an orchid, a sedge and a watercress - were each found in only one location.

Green-flowered bog orchid (*Platanthera aquilonis*) was found only at toad pond DY03. It was listed as "uncommon" in NPSpecies-KLGO, and has few records elsewhere in southeast Alaska.

Elk sedge (*Carex garberi*) was found only at toad pond DY03. It was listed as "rare" in NPSpecies-KLGO, and is included in Alaska Rare plants. NatureServe ranked it "imperiled" in Alaska. Final taxonomic identification is necessary for this species.



Map 9. Rare plant locations  
(KLGO 2020a)

Curvepod yellowcress (*Rorippa curvisiliqua*)

was found only at the pond behind the campground ranger station. It is included in the Alaska Rare Plant Portal. NatureServe ranked it as "critically imperiled" in Alaska. Final taxonomic identification is necessary for this species.

A violet was found at only one location next to the footpath in the north end of the affected area.

Great-spurred violet (*Viola selkirkii*) is regionally unusual. NatureServe ranked it as "vulnerable" in Alaska.

Table D. Vascular plants with state, regional or local rarity.

common name	scientific name	family	at site 2020	NPSpecies KLGO	other sources	NatureServe state rank
Early coralroot	<i>Corallorhiza trifida</i>	orchid	scattered, not abundant	rare	few records in SE AK, usually found with <i>Platanthera obtusata</i> (Jacobson, Bowles)	SNR state not ranked
Blunt-leafed rein orchid	<i>Platanthera obtusata</i>	orchid	common		may be rare in SE AK (Jacobson, Bowles)	SNR state not ranked
Green-flowered bog orchid	<i>Platanthera aquilonis</i>	orchid	found only at toad pond DY03	uncommon	thought likely to occur in SE AK, records scarce (Jacobson, Bowles)	SNR state not ranked
Elk sedge	<i>Carex garberi</i> *	sedge	found only at toad pond DY03	rare	initial taxonomy consultation with AK Natural Heritage Program	S2 imperiled
Curvepod yellowcress	<i>Rorippa curvisiliqua</i> *	mustard	found only at pond behind ranger station		Alaska rare plant list (ARPDP)	S1S2 critically imperiled
Great-spurred violet	<i>Viola selkirkii</i>	violet	found only adjacent to foot trail, north end		regionally unusual (Jacobson, ARPDP)	S3S4 vulnerable
* taxonomic verification required			sources: ARPDP 2020, Bowles 2020, IRMA 2020, Jacobson 2020, NatureServe 2020			

## Flora - Life Cycle and Habitat Requirements

Orchids have unusual growth forms and life cycles. They are dependent upon strong fungal associations to survive. Seed production more closely resembles that of mushrooms, with extremely tiny seeds the size of spores produced in massive quantities. Seed dispersal is achieved through wind, water movement or animal movement. The orchids found in the affected area are soil based, prefer moist areas, and may grow for several years entirely underground without showing above-ground signs of existence (Bowles & Armstrong 2019).

Elk sedge and Curvepod yellowcress are found in or near wetlands. Once established, Elk sedge can spread through rhizomes or by seed. The yellowcress is an annual that only spreads by seed. Both likely establish in new wetlands through migrating birds (Tande & Lipkin 2003, AK Rare Plant Data Portal 2020).

Great-spurred violet is a perennial, spreading by rhizomes once established. Seeds disperse a short distance by ejection from mature seed capsules, and are spread further by ants. This violet prefers moist shady habitat and is sometimes found on rotting wood (Botanikim 2020, Ohkawara-Higashi 1994).



## Flora - Human Environment Values

Park visitors and residents of the local community place additional values on plants, individually or as communities. Harvest of plants occurs wherever people occur. Where harvest is restricted, those interested in harvestable plants or natural history appreciate the educational opportunity of learning how to find and identify plants. Some people cherish the aesthetic beauty of individual plants, especially wildflowers. On a larger scale, nature walks through forest stands provide sensory opportunities valued by people for restorative, connectiveness, and solitude experiences.

Over the years, plants were used by people living in or passing through Dyea for food, medicine, clothing, crafts, fuel, and building materials. Field trips on how to find and identify desirable plants in locations where harvest is restricted are a low impact method to educate those interested in learning about plant harvest. KLGO visitor surveys (Park Studies Laboratory 2013, Vande Kamp & Seekamp 2005) and MoS community planning (Municipality of Skagway 2014) found that people value Dyea as an escape from noise and crowds and a location to experience the sights and sounds of nature.

Human values also include environmental services deemed beneficial. These include functions such as stabilization of soils, filtration of water, protection from environmental extremes, and providing habitat for preferred animals and plants.

## Flora - Harvest

Harvest is the most direct and immediate use of plants. Tlingit heritage knowledge of plants and their uses for food, medicine, and cultural art (AK Native People 2015, Newton & Moss 2009, Skagway Traditional Council 2004, Garibaldi 1999) is rooted in millennia of experience living in southeast Alaska (Emmons et al. 1991). European-heritage historic and modern harvesters have gathered plants for traditional and commercial uses (Pojar & MacKinnon 1994). Both groups include individuals evolving new uses for harvestable plant materials, and groups reviving past knowledge of practical and cultural uses.

Within the affected area, KLGO allows non-commercial harvest of berries. The affected area has an unusually high variety and productivity of edible berries and berry-like fruits. These include at least 4 types of currants, high-bush cranberry, nagoon berry, watermelon berry, bunchberry, dwarf bramble, soapberry, and rose hips (see Table D for scientific names).

High-bush cranberry is widespread within the site, and also occurs in a number of high-density patches within a short walk, making this location the best site for easy harvest of one of the most valued wild berries for food and wine making. High-bush cranberry is also heavily used by breeding birds and other animals such as bears putting on winter fat. Despite these combined harvests by animals and people, the high level of productivity in the affected area resulted in plentiful berries left on the stem overwinter in 2020.

The high diversity of plants and easy access at the affected area make it an outstanding site for educational nature walks to learn about plants, their uses and human history.

Table E. Selected native plants with harvest or other human values.

Note: only berry harvest for personal use is allowed, all other harvest values convert to educational in the affected area. List is selection of examples, not comprehensive.

WARNING: this table is not for use as a harvest guide - plant identification and toxicity concerns should be determined from detailed descriptive sources or through expert consultation.

Plant scientific name	common name	uses
<i>Alnus spp.</i>	alders	food, medicine, crafts, fuel
<i>Aruncus dioicus</i>	goat's beard	medicine, aesthetic
<i>Athyrium filix-femina</i>	lady fiddlehead	food, aesthetic
<i>Cornus canadensis</i>	bunchberry	food, aesthetic
<i>Cornus stolonifera</i>	red-osier dogwood	medicine, crafts
<i>Fragaria virginiana</i>	dwarf bramble	food, medicine
<i>Fritillaria camschatcensis</i>	chocolate lily	food, medicine, aesthetic
<i>Maianthemum dilatatum</i>	heartleaf	medicine, aesthetic
<i>Moneses uniflora</i>	single delight	medicine, aesthetic
<i>Oplopanax horridus</i>	devil's club	medicine, aesthetic
<i>Picea sitchensis</i>	Sitka spruce	food, medicine, crafts, fuel, building material
<i>Populus trichocarpa</i>	black cottonwood	food, medicine, crafts, building material
<i>Ribes spp.</i>	currants	food
<i>Rosa nutkana</i>	wild rose	food, medicine, crafts, aesthetic
<i>Rubus arcticus</i>	nagoon berry	food
<i>Salix spp.</i>	willow	medicine
<i>Shepherdia canadensis</i>	soapberry	food, medicine
<i>Streptopus amplexifolius</i>	watermelon berry	food, medicine
<i>Viburnum edule</i>	high-bush cranberry	food, medicine
<i>Viola spp.</i>	violets	food, aesthetic
sources: AK Native People 2015, IRMA 2020, Jacobson 2020, NatureServe 2020, Skagway Traditional Council 2004, Hall 1995		

## Flora - Exotic Plants

Exotic plants are non-native species that become established in an area through modern human activities. Invasive exotic plants have the potential to alter native plant community composition. Highly invasive exotic plants can cause large scale change in plant communities and displace native plants and animals.

A casual assessment of exotic species abundance was made during the spring and summer of 2020. An informal evaluation of invasive distribution and density was made in early-June using two easily noticed invasive exotic plants: common dandelion (*Taraxacum officinale*) and tall buttercup (*Ranunculus acris*).

The highest numbers of exotic species were seen along the road shoulder. Common dandelion and tall buttercup were seen in roads and parking areas and at current or former vehicle or pedestrian routes. These plants were spreading into nearby woodlands at the campground, road edge, and bridge parking area. Very little spread was seen along the footpath. Tall buttercup along the former ATV track showed signs of being shaded out by recovering native vegetation. (Map 10)

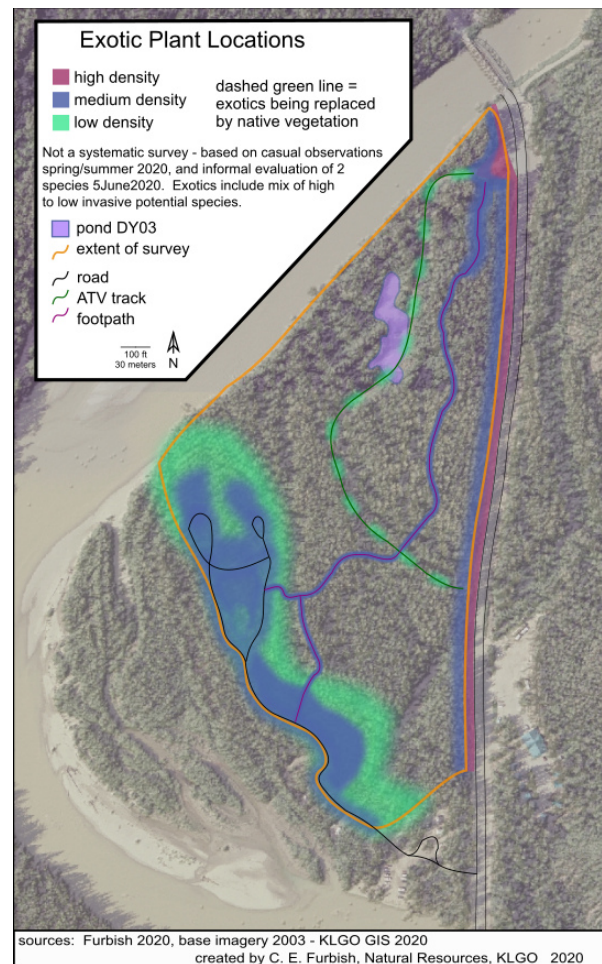
## Flora - Vulnerabilities

Changes that reduce the diversity of sub-habitats will reduce the diversity of flora within the site. In addition, sensitive plants in the affected area have strong associations with particular sub-habitats found within the site. Plants of harvest or other human values are also associated with the variety of plant communities.

Wetland areas are the only locations of several sensitive rare plants, and contribute to overall plant diversity. Wetlands are expected to become more individually important in the Dyea area as Taiya River changes make creation of new freshwater wetlands less likely in the future.

Intact interior native plant communities in the affected area show signs of recovery from and resistance to past levels of exposure to invasive exotic plants, whereas areas near human traffic edges show signs of recent intrusion by invasive exotic plants. Invasive exotic plants thrive at mowed road edges and high traffic parking areas, which become source locations for nearby spread. As vehicle traffic and human disturbance increases, the pressure of invasive plant spread also increases.

The ability of an area to resist invasive exotic plants is strongly contingent on the health and integrity of native plant communities. It is also linked to the intensity of initial colonization, the level of continued disturbance, and the source density of invasive seeds or other plant dispersal tissues such as stem or root fragments that can grow into new plants. The small size of the affected area makes it susceptible to changes that increase edge effects or cause interior habitat fragmentation that could increase edge effects and degrade interior characteristics.



Map 10. Exotic plant locations  
(KLGO 2020a)

## Fungi

Fungi are a fundamental ecological binding component, essential for plant and soil health. At Klondike Gold Rush National Historical Park (KLGO) the diversity of fungi likely high through association with plant diversity and physical diversity of climate and terrain. Fungi easily escape detection and are often only noticed when reproductive organs such as mushrooms are present. Many form intricate relationships with plant roots that are vital for healthy plants and thriving plant communities. Fungi perform an essential ecological function as a major decomposer of dead plant material.

Lichens are symbiotic organisms composed of 1 or more fungi and 1 or more algae. They are pioneer colonizers of newly exposed rock, soil and almost all other organic and nonorganic substrates. Most are very long-lived and many tolerate environmental extremes.

Informal observations were recorded for fungi in the affected area in 2020. An inventory of lichens at KLGO was published in 2010.

### Fungi - Designations of Conservation Concern

No federal Threatened or Endangered lichens could occur in the affected area - only 2 lichen species are listed nationwide, they occur in the continental southeast. There are no federal Threatened or Endangered listings of any fungi (ECOS 2020).

The taxonomy of both groups is changeable and expanding. Distribution ranges are incompletely described, particularly in the circumpolar regions.

KLGO was established as an astonishing lichen diversity hot spot in 2010 (Spribille et al. 2010), however conservation concern based upon those results cannot readily be placed within spatial hierarchies normally used for more widely documented plants and animals.

Fungi species and distributions are still being described in Alaska. Mycologists and citizen scientists document information on forum platforms which provide a preliminary level of state rarity assessment. One fungus seen in the affected area is listed as rare on global and national fungi portals such as Mushroom Observer (Wilson et al. 2020). It was found growing on dead wood at the edge of a wetland, *Gloiodon strigosus* [no common name] is a polypore-like toothed fungus with ornamental spores. This fungus was not listed in mycology forums for Alaska and may represent a new species for the state (Jacobson 2020).

### Fungi - KLGO Data

A 2010 lichen inventory for KLGO reported extraordinary diversity of lichens, including the largest number of species reported for any US National Park unit of any size (Spribille et al. 2010). The inventory described 1 genus and 5 species new to science, 34 taxa new or confirmed for North America, and a total of 196 taxa new for Alaska.

A casual, non-systematic survey for easily detected fruiting bodies (sporophores) or other signs of fungi was made in the affected area from mid-May to mid-September 2020. Field identification of lichens other than the most common species was beyond the capabilities of the survey, therefore they were not included. Identification of fungal fruiting bodies was provided by regional expert Judy Hall Jacobson of Haines (Jacobson 2020).

Information presented here is based on field notes from the 2020 survey (KLGO 2020a).

### Fungi - Human Environment Values

Similar to plants, fungi have a history of traditional harvest for food, medicine, and crafts. As fascinating and little-known organisms - more closely related to animals than plants - fungi provide many opportunities for natural history and human environment education.

Harvest is the most direct and immediate use of wild fungi. Historical and modern harvest has undoubtedly occurred whenever people occupied Dyea but is much less documented than for plants. Local harvesters, much like avid fisher folk, are reluctant to share the locations of their prime harvest spots.

Table E presents information on some of the fungi found within the affected area in 2020. The habitat is favorable for other choice edible fungi that are not included in the list, and the site is known to be a good location among local mushroom harvesters.

Table F. Selected fungi with harvest or other human values.

Note: only harvest for personal use is allowed.

WARNING: this table is not for use as a harvest guide - fungi identification and toxicity concerns should be determined from detailed descriptive sources or through expert consultation.

Fungus scientific name	common name	use
<i>Artomyces pyxidatus</i>	crown-tipped coral	edible
<i>Boletus edulis</i>	king bolete	edible - choice
<i>Hypomyces chrysospermus</i>	golden hypomyces	edible
<i>Ceratiomyxa fruticulose</i>	green elfcap	aesthetic, educational
<i>Chlorociboria aeruginascens</i>	- no common name -	crafts
<i>Crucibulum crucibuliforme</i>	white egg bird's nest	aesthetic, educational
<i>Dacrymyces chrysospermus</i>	orange jelly	edible
<i>Ganoderma applanatum</i>	artist's conk	crafts, medicinal, edible
<i>Laccaria laccata</i>	the deceiver	edible
<i>Leucopaxillus giganteus</i>	giant funnel	edible
<i>Lycogala epidendrum</i>	wolf's milk slime	aesthetic, educational
<i>Lycoperdon marginatum</i>	puffball	edible - choice
<i>Leccinum insigne</i>	aspen scaber stalk	edible
<i>Psathyrella spadicea</i>	- no common name -	edible
<i>Resupinatus striatulus</i>	- no common name -	aesthetic, educational
<i>Royoporus badius</i>	black-footed polypore	medicinal
<i>Russula spp</i>	- various -	edible
<i>Sistotrema confluens</i>	- no common name -	edible
sources: Jacobson 2020, Jacobson 2015		

### Fungi - Vulnerabilities

Through their strong linkage with plant roots, fungal diversity is linked to the diversity of plant communities and sub-habitats within the affected area. Wetland areas are areas of higher fungal diversity. *Gloiodon strigosus*, the fungus that may represent a new species for the state of Alaska, was found near the edge of a wetland.

As with plants, protection of intact native communities and important sub-habitats such as wetlands will benefit fungal diversity and the harvest and educational opportunities for people.



## Landcover - Habitat

The identification of sensitive organisms and characteristics such as biodiversity and productivity at the affected area is insufficient to fully evaluate the relative value of that site within the full extent of Klondike Gold Rush National Historical Park (KLGO) and the Municipality of Skagway Borough (MoS). Landcover mapping based on terrain and dominant plant associations provides a tool for quickly making a first step comparative assessment among ecological units. More detailed site-specific data can then be used to achieve more thorough comparisons within the limitations of available information.

Landcover classes were described and mapped in the lower Taiya River valley in 2015 as part of a larger park-wide mapping project (Flagstad & Boucher 2015). However, mapping within that effort stopped at the KLGO administrative boundary.

A bit over half (20 out of 37 acres) of the affected area is land owned and managed by KLGO that is outside of the park's legislative boundary, and therefore was not included in the landcover mapping project. To allow appraisal of the site in relation to the larger lower Taiya River area, landcover was mapped for the entire affected area in 2020 according to the 2015 landcover descriptions. Colors given within parentheses below match landcover class colors in Map 11.

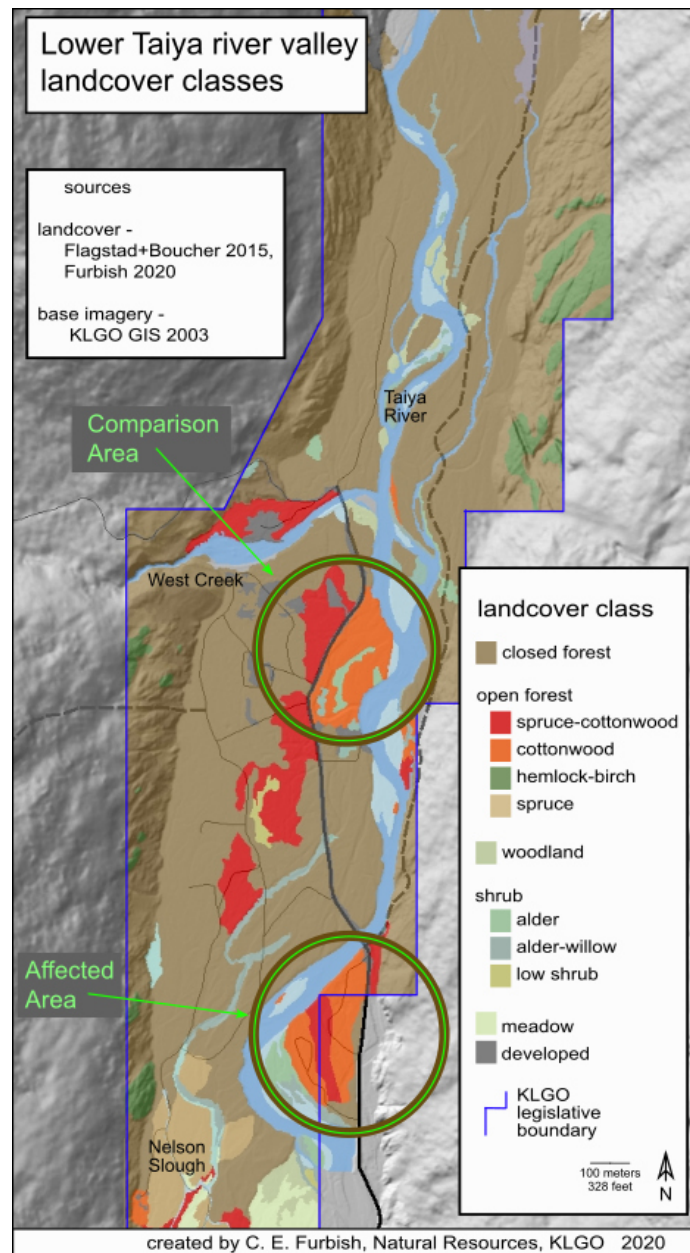
The affected area contains 2 large stands of "Black Cottonwood Open Forest" (orange). Smaller stands of "Sitka Spruce - Black Cottonwood Open Forest" (red) intertwine between them in the middle and at the northwest edge. Open forest is characterized by 25% to 59% canopy cover.

The affected area also contains smaller areas of "Sitka Spruce Closed Forest" (brown) along part of the Dyea Road and around the campground entrance in the southeast corner. Closed forest has 60% to 100% canopy cover, creating substantially more shade at ground level than open forest.

Similar landcover areas were sought in the lower Taiya River valley delta. No significant cottonwood or spruce-cottonwood stands occur to the south of Map 11 where tidal influences affect streams and the river. Some open forest stands occur along the Taiya River about 1.5 miles north of West Creek, to the north of Map 11. Those stands occur where elevation, terrain and accessibility attributes are substantially different than at the affected area.

Most forested areas shown in Map 11 are closed forest of various types (brown). Several stands of spruce-cottonwood open forest (red) and one stand of cottonwood open forest (orange) occur in north Dyea near West Creek.

There are no other areas with both types of open forest intertwined, but one comparison area contains adjacent stands of each type (Map 11). The affected area and the comparison area are roughly the same size. Both are impacted by similar lengths of Dyea Road, although the affected area receives much more



Map 11. Lower Taiya river valley landcover classes (KLGO 2020a)

traffic. The Dyea Road borders the affected area, but crosses through and separates forest stands at the comparison area. About 1/2 of the spruce-cottonwood stand in the comparison area is in private residential ownership. However, the comparison area is the most similar land space to the affected area, therefore it was used to estimate the likelihood that another location in Dyea may provide similar ecological characteristics and human environment experiences to the affected area.

#### Landcover-Habitat - Ecological Comparison

Much of the biodiversity and productivity at the affected site is linked to the variety of structure and multiplicity of sub-habitats in one area. Open cottonwood forest alone does not include conifer habitat created from patches of immature spruce and scattered mature spruce islands. Open forest without wetlands does not include physical subhabitat conditions of wetlands. Interior habitat characteristics are strongly linked to area size, edge effects and level of habitat fragmentation. These characteristics work together at the affected area to promote the diversity and productivity of plants and animals found at the site.

The comparison area is less likely to provide sub-habitat variety due to the side-by-side alignment of the cottonwood stand and the spruce-cottonwood stand, and their distinct separation by the Dyea Road corridor. The comparison area contains 1 small wetland along its south border, whereas the affected area contains 2 larger and 1 smaller wetlands dispersed within the site (Map 1).

The spruce-cottonwood stand in the comparison area is separated from the cottonwood stand by the Dyea Road, and is fragmented by residential development on private property, thus unlikely to have interior habitat character. There may be some development of interior habitat character in the cottonwood stand on the east side of the comparison area, but it is less likely due to the much smaller size of the cottonwood stand compared to the affected area.

The Boreal toad aquatic and upland habitat at wetland DY03 within the affected area is established as a high value breeding area. It is one of only 2 highly consistently successful toad breeding sites in the lower Taiya River valley delta, and the only one on land owned and managed by the NPS. The small wetland in the comparison area was evaluated for toad activity when the KLGO Boreal toad monitoring program was established in 2004. No evidence of toad activity was found at that time nor on subsequent visits (Surdyk & Evans 2016). However, nearby residents have twice reported seeing toads in the area south of the cottonwood stand in the late 2010s (McDermott 2020, Greenleaf 2021), suggesting at least some local migration or dispersal activity and pointing to a need for further monitoring to record toad breeding should it occur.

Breeding bird high diversity in the affected area was documented through the 2020 bird survey. Similar information is not available for the comparison area. However, Skagway Bird Club members have described the affected area as a good birding site, whereas the comparison area has not been noted as a place of high songbird activity (Skagway Bird Club 2020). Much of the bird diversity at the affected site was associated with mixed broadleaf & conifer woods, wetlands, and interior habitat features, which are not strong elements of the comparison area.

Bats were shown to have a high activity level at the affected area in 2020. The other area in Dyea with high bat activity, but not as high as the affected area, was the Nelson slough, located across the Taiya River from the affected area on the west side of the river delta. Bat monitoring in both areas was associated with open wetlands. Bats have been reported by tenants at the NPS residence adjacent to the south side of the comparison area (Greenleaf 2021). While bats would be expected to use the comparison area habitat, the one small wetland in the comparison area has less open area due to higher density of shrubs and trees, which likely indicates less activity than at the affected area.

High activity level of small mammals and evidence of use by larger mammals was found in the affected area in 2020. No analogous information is available at the comparison area, presumably similar mammal activity is likely.

Sensitive rare plants found in the affected area in 2020 were partially associated with the larger wetlands. The comparison area may also have sensitive plants, but it is less likely to contain rare plants associated with wetlands due to the small size and less open character of the one comparison area wetland. Fungal diversity is strongly linked to plant diversity and wetland habitat, and probably mimics the condition with plant diversity.

## Landcover-Habitat - Human Environment Comparison

The affected area is owned and managed by KLGO and subject to park harvest rules, whereas the comparison area includes private property. About 1/2 of the spruce-cottonwood stand in the comparison area is residential. High productivity of harvestable plants, especially high-bush cranberry was found in the affected area. The abundance of harvestable plants in the comparison area is undescribed but could feasibly have similar high-bush cranberry patches, although it is less likely to have the same diversity of harvestable berry plants because there is less abundance of patchy, diverse subhabitats at the comparison area. Similarly, mushroom harvest opportunities may or may not be similar at both areas, but are less likely to be as diverse in the comparison area because fungal diversity is linked to plant diversity.

An important factor to harvesters is the easy accessibility at the affected area, with parking and services at two ends and a footpath connecting them. The comparison area does not provide parking, visitor services, or established footpaths. There is an informal parking site at the north end of the comparison area, on non-NPS land identified for future development (Municipality of Skagway 2020).

Accessibility is also an important factor for other activities such as bird watching, wildflower appreciation, nature walks, and educational opportunities, both individual and guided. The affected area has a combination of habitat at a high diversity and productivity successional stage and easy, comfortable access for people that is not found elsewhere in the lower Taiya River valley, within Klondike Gold Rush National Historical Park, or in the Municipality of Skagway Borough.

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