Appendix C: Tables

Table 1. Mean fire-return intervals for Alaskan tundra ecosystems during the late Holocene

Location	Plant community	Mean (range) fire-return interval (years)	Methods	Reference
North Slope	tussock-shrub tundra	>5,000 years	charcoal deposits in sediments of 2 lakes spanning to 5,000 years BP	Jandt and others (2008) [36]
Noatak National Preserve, entire 31-mile (50 km) transect	tussock-shrub tundra; birch ericaceous shrub tundra; and willow-shrub tundra with white spruce	260 (30-840)*	pollen grains and charcoal deposits in lake sediments from 4 lakes spanning 50 km along an east-west transect; records spanned from 6,000 years BP to 2007	Higuera and others (2011) [29]
Noatak National Preserve, eastern portion of transect (Poktovik and Little Isac lakes)		142 (115-174)*	pollen grains and charcoal deposits in lake sediments from 4 lakes spanning 50 km along an east-west transect; records spanned from 2,500 years BP to 2007	Higuera and others (2011) [32]
Noatak National Preserve, western portion of transect (Raven and Uchugrak lakes)		263 (175-374)*		
Seward Peninsula	sedge tussock tundra	240	pollen grains and charcoal deposits in lake sediments	Jennifer Allen personal communication cited in LANDFIRE Biophysical Settings (2009) [44]
Beaufort Coastal Plain		>1,000	pollen grains and charcoal deposits in lake sediments	
Throughout Alaska		50-300	expert opinion	FRCC Experts Workshop 2004 personal communication cited in LANDFIRE Biophysical Settings (2009) [44]
	tundra	35-200	expert opinion	Duchesne and Hawkes (2000) [19]

*The fire-event return interval was calculated for a 0.6 mile (1km) area around each lake. The term "fire event" was used to acknowledge that some peaks in charcoal deposits may include more than 1 fire. Chronologies had a minimum detectable mean fire-event return interval of 30 years and a minimum mean fire-event return interval of about 75–125 years.

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Table 2. Natural fire-rotation interval estimates for tundra ecosystems using fire records from the 1900s and 2000s

Location	Plant community	Fire rotation interval (years)	Area of interest	Methods	Citation
Alaska					
Arctic Coastal Tundra physiographic section	all community types	>10,000	17.557 million acres	records of lightning-caused fires from 1957 to 1979	Gabriel and Tande (1983) [24]
Arctic Foothills Tundra physiographic section		>10,000	28.362 million acres		
Noatak Lowlands physiographic section		480	4.321 million acres		
Kobuk-Selawik Lowland physiographic section		3,245	6.752 million acres		
Seward Peninsula physiographic section		260	13.505 million acres		
Bering Platform physiographic section		no data	6.752 million acres		
Ahklun Mountains physiographic section		>10,000	9.454 million acres		
Aleutian Range physiographic section		>10,000	3.240 million acres		
Seward Peninsula ecoregion		340	entire ecoregion	all fire records from the large fire database from 1950 to 1999	Kasischke and others (2002) [43]
Nulato Hills ecoregion		356	entire ecoregion		
Kobuk Ridges and Valleys ecoregion		215	entire ecoregion		
Northwestern Alaska, including parts of 8 ecoregions	tundra	630	96.330 million acres	all fire records from 1950 to 2007	Jones and others (2009) [41]
Noatak River Watershed*		988	33,670 km²	all fire records from 1956 to1983 and satellite imagery from 1972 to 1981	Racine and others (1985) [59]
Tundra <600 m elevation, above which alpine tundra occurred		611			
Tundra <300 m elevation, where most arctic tundra occurred		221			
Canada					
Northern Quebec	southern boreal forest-shrub tundra ecotone**	180	17,820 km²	fire scars on black spruce; origin of dwarf birch stem sections; and fire scars at the root collar of shrubs; fire records from 1920-1984	Payette and others (1989) [55]
	northern boreal forest-shrub tundra ecotone***	1,460	20,520 km²		
	shrub tundra****	9,320	9,990 km²	origin of dwarf birch stem sections and fire scars at the root collar of shrubs; fire records from 1930-1984	
Northern Canada from the Hudson Bay to the Yukon border	forest-tundra ecotone	2,941*****	260,000 km²	1,312 aerial photos taken from 1950 to 1980	Timoney and Wein (1991) [75]
Nunavut	tundra	>4,000	143,000 km²	if the exceptional 1973 fire season were repeated randomly once every 10 years, the entire study area would be burned in 4,000 years	Shilts (1975) [66]

*The Noatak River Watershed is mostly tundra except for white spruce forest along the lower drainage of the river and its tributaries, and small bands of balsam poplar (*Populus balsamifera*) forest near the river throughout the watershed. Below 2,000 feet (600 m) tussock tundra and low shrubland tundra are dominant, with various forms of alpine tundra above this elevation.

**Forests were "extensive" with scattered lichen-heath-dwarf birch tundra communities.

***Small areas of forest and krummholz with extensive lichen-heath and shrub tundra communities.

****Mesic and dry tundra communities dominated by lichens, bryophytes, and shrubs.

*****Estimated from the mean percentage cover of burned area and an assumed regeneration time of 50 years.

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Table 3. Records of tundra communities that burned 2 or more times at very short fire-return intervals during the late 1900s and early 2000s

Location	Plant community	Fire-return interval (years)	Fire record details	Reference
Arctic Alaska				
Noatak River Watershed	tussock and shrub-tussock tundra	6-9	2 areas burned twice during the period from 1956 to 1983	Racine and others (1985) [59]
Central Seward Peninsula	tundra	5-19	1 location burned 4 times in 58 years; 11 other locations burned more than once during this period, but the return interval was not reported	Joly and others (2009) [40]
Interior Alaska				
Near Fairwell in the Kuskokwim Lowland physiographic province	sedge (Cyperaceae) tussock tundra	14	2 areas burned in 1963 and again by the Bear Creek Fire in 1977	Hanson (1979) [27]

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Table 4. Mean fire-return intervals for tundra ecosystems during the late Pleistocene and early to mid-Holocene

Location	Plant community	Mean or range of fire-return interval (years)	Methods	Reference
Alaska				
Kenai Lowlands	shrub-herb tundra during late Pleistocene and early Holocene (13,000 years BP)	138	pollen, plant macrofossils, and sedimentary charcoal from 3 lakes	Anderson and others (2006) [3]
South-central Brooks Range	bog birch (*Betula glandulosa*) and/or dwarf birch (*B. nana*) shrub tundra during the late Pleistocene and early Holocene (13,300-10,300 years BP)	137-150	fossil pollen and stomata and sedimentary charcoal from 4 lakes	Higuera and others (2009) [31]
	forest-tundra during the mid-Holocene (8,500-5,500 years BP)	131-238		

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Table 5. Fire severity in 3 plant communities in a low arctic tundra ecosystem on Nimrod Hill recorded after the 1977 Imuruk Lake Fire on the Seward Peninsula [58]

Community type	Site characteristics	Severity category*	Description
Sheathed cottonsedge tussock-dwarf shrub tundra**	poorly drained footslopes	light to moderate	Fire reduced plant cover substantially compared to prefire levels, but many small patches of unburned or scorched vegetation were common, and <20% of the organic layer was consumed, indicating the fire was low to moderate severity. Most postfire regeneration was by sprouting of sheathed cottonsedge.
Birch and ericaceous dwarf shrub tundra***	moderately well-drained slopes	moderate to severe	100% of the aboveground vegetation burned and about 50% of the organic mat burned. All postfire regeneration appeared to be by seed from species of minor importance in the prefire community rather than from sprouting of species abundant before fire.
Leafy tussock sedge-white cottongrass (Eriophorum scheuchzeri)-shrub tundra****	very poorly drained, level crest of Nimrod Hill	moderate	Burning was patchy and of mixed severity. About 2 to 6 inches (5-15 cm) of the soil organic layer was removed where prefire organic layers ranged from 8 to 14 inches (20-35 cm) deep. Pockets of dwarf shrubs between sphagnum moss hummocks burned severely. Sphagnum moss mats generally remained unburned but were scorched and dead. Most postfire regeneration was by sprouting of species present before fire.

*Author used the fire severity rating system developed by Viereck and others [81].

**Dwarf shrubs included northern Labrador tea (*Ledum palustre*), dwarf birch (*Betula nana*), cloudberry (*Rubus chamaemorus*), mountain cranberry (*Vaccinium vitis-idaea*), bog blueberry (*V. uliginosum*), and black crowberry (*Empetrum nigrum*); mosses included *Sphagnum* spp., *Dicranum elongatum* , *Hypnum pratense* , and *Aulacomnium palustre* ; and lichens included *Cetraria islandica* , *Cladonia gracilis* , *Cladina rangiferina* , *Flavocetraria cucullata* , and *Peltigera aphthosa* .

***This community is composed of the same dwarf shrub species as found in the sheathed cottonsedge tussock-dwarf shrub community, with the exception of cloudberry. Bigelow sedge replaces sheathed cottonsedge, and lichens are more important than mosses.

****Shrubs include cloudberry, dwarf birch, northern Labrador tea, and mountain cranberry. Sphagnum moss is more important here than in the other communities [58].

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Table 6. Mean vascular plant, moss, and lichen cover (%) in 4 burn severity classes in sheathed cottonsedge (*Eriophorum vaginatum*) tussock tundra after the 1977 Kokolik River Fire on the North Slope, Alaska [37]

Burn severity*	Vegetation category	Immediately after fire	Postfire year 1	Postfire year 2	Postfire year 3	Postfire year 4	Postfire year 5
Unburned control	vascular plants	80	80	80	73	70	---**
	mosses and lichens	50	40	50	67	60	---
Lightly burned***	vascular plants	40	65	70	77	74	79
	mosses and lichens	80	50	55	92	90	89
Moderately burned***	vascular plants	30	40	50	58	51	70
	mosses and lichens	trace	20	20	52	61	70
Severely burned****	vascular plants	<10	10	30	33	33	39
	mosses and lichens	0	20	20	51	60	52

*Burn severity based upon the amount of aboveground vegetation removed by fire. Soil organic matter consumption was not measured [37].
**No data.
***Light and moderate severity burned tussock tundra was "irregularly distributed" in swales and other areas of low relief.
****All areas of raised relief were severely burned either due to greater fuel availability or to better drainage of higher terrain [25].

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Table 7. Fire sizes in tundra communities

Location	Plant community	Observations	Notes
Alaska			
North Slope	moist acidic tussock tundra*	250,000 acres	1 fire in 5,000 years [40]
Noatak River Watershed	tundra	mean: 3,237 acres (range: 1-113,200 acres)	fires occurring from 1956 to 1983 [59]
	arctic tundra	47% of fires were <25 acres (10 ha)	
		16% of fires were 25 to 250 acres (10-100 ha)	
		19% were 250 to 2,500 acres (100-1,000 ha)	
		14% were 2,500 to 25,000 acres (1,000-10,000 ha)	
		4% were >25,000 acres each	
Interior Alaska	open tundra/grass-shrub	most fires were <100 acres (40 ha) and "few" exceeded 1,000 acres (400 ha)	lightning-caused fires occurring from 1956 to 2000 [17]
Canada			
Inuvik, Northwest Territories, east of the Mackenzie River Delta	tundra	all fires <86 acres (35 ha) and "most" <10 acres (4 ha)	fires occurring from 1969 to 1975 [88]
Northern Quebec	shrub tundra	74% of fires were <120 acres (50 ha) and 1% was >2,500 (1,000 ha)	fires occurring from 1930 to 1984 [55]

*Moist acidic tundra characterized by sheathed cottonsedge (*Eriophorum vaginatum*) and Bigelow sedge (*Carex bigelowii*) with >25% cover of dwarf shrubs especially northern Labrador tea (*Ledum palustre*), dwarf birch (*Betula nana*), and mountain cranberry (*Vaccinium vitis-idaea*). Diamondleaf willow (*Salix pulchra*) was the predominant low shrub present, but alders (*Alnus* spp.) also burned along the rivers.