Plant Associations, Vegetation Succession, and Earth Cover Classes

Aniakchak National Monument and Preserve

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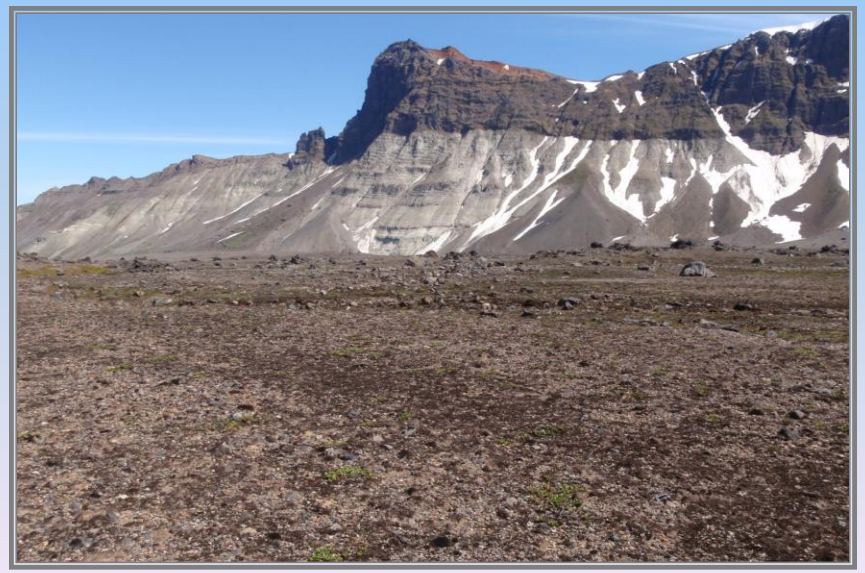


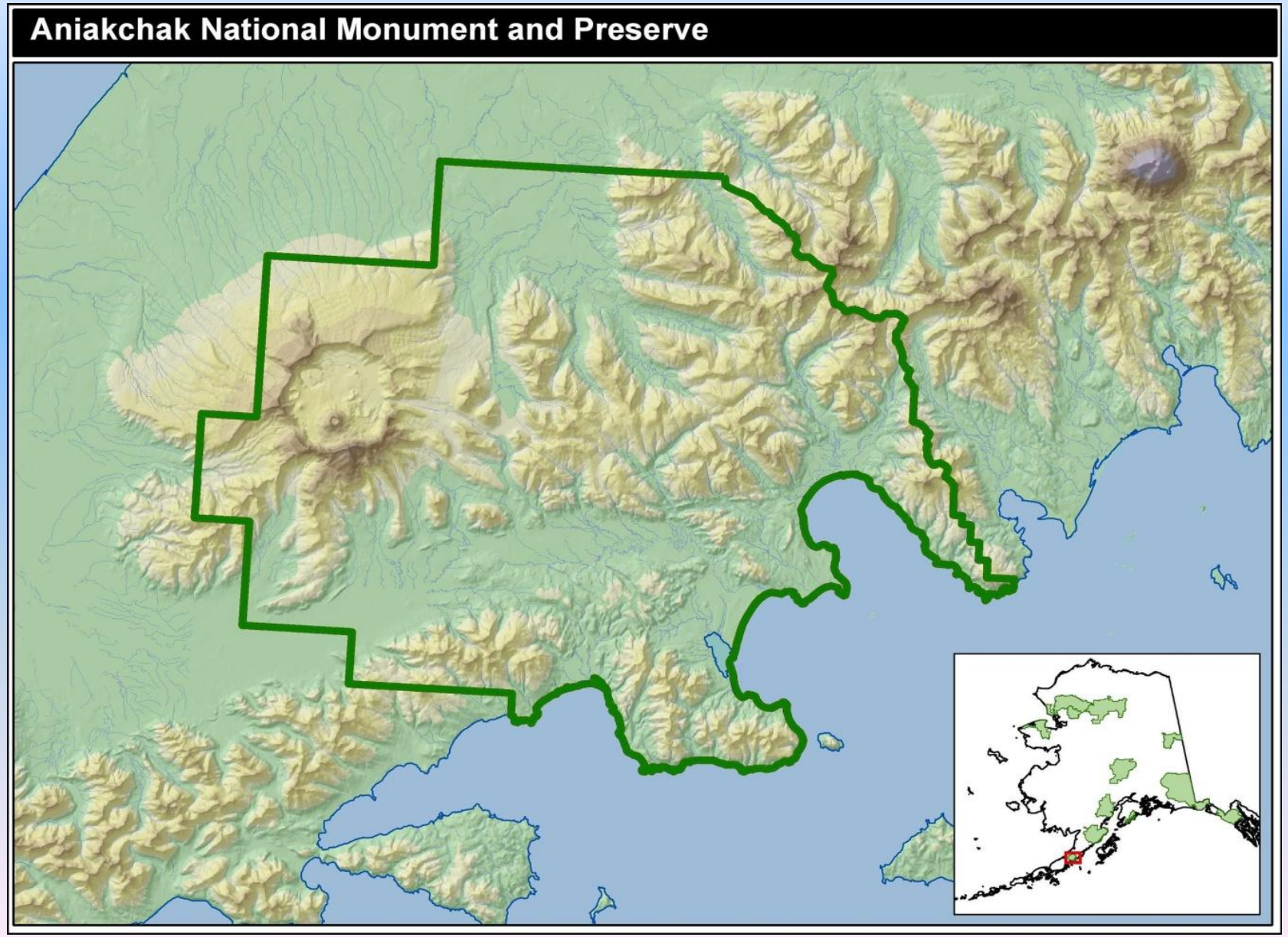
Acknowledgments

- National Park Service-Alaska Region Inventory Program
- Katmai National Park staff for logistical support
- Lindsey Flagstad, Cassandra Wright, Dan Bogan (Alaska Natural Heritage Program, UAA)
- Susan Ives (Oasis Environmental)
- Parker Martyn, Beth Koltun and Chuck Lindsey (National Park Service)
- Mike Duffy, Brian Heitz (Alaska Natural Heritage Program, UAA) and Ann DeBolt for species determinations.

Acknowledgments

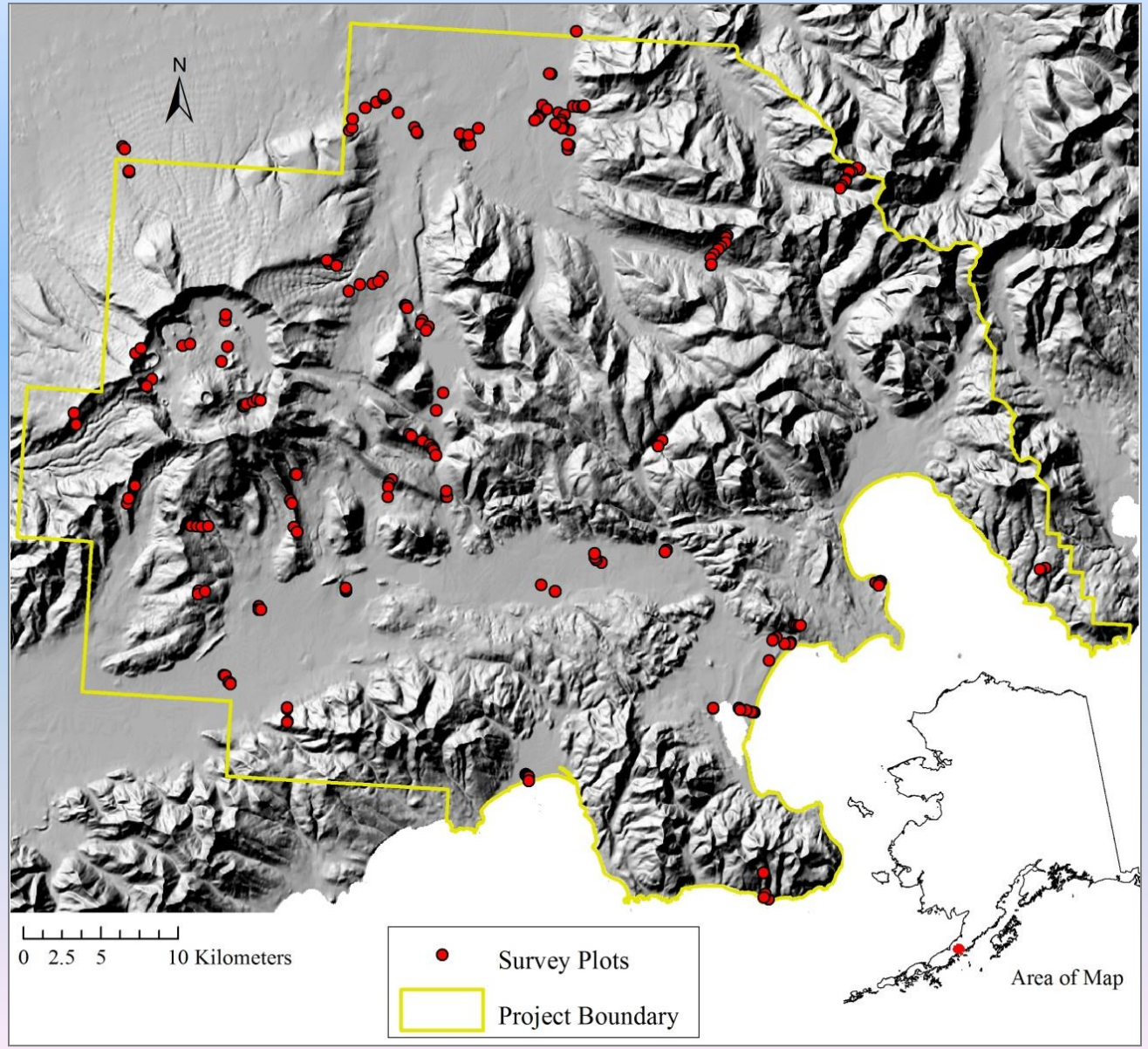
- Michael Shephard (National Park Service) for field direction

Figure 1. Location and topography of Aniakchak Monument and Preserve.



Collect plot data for plant association classification

Field plot locations within Aniakchak National Monument and Preserve.



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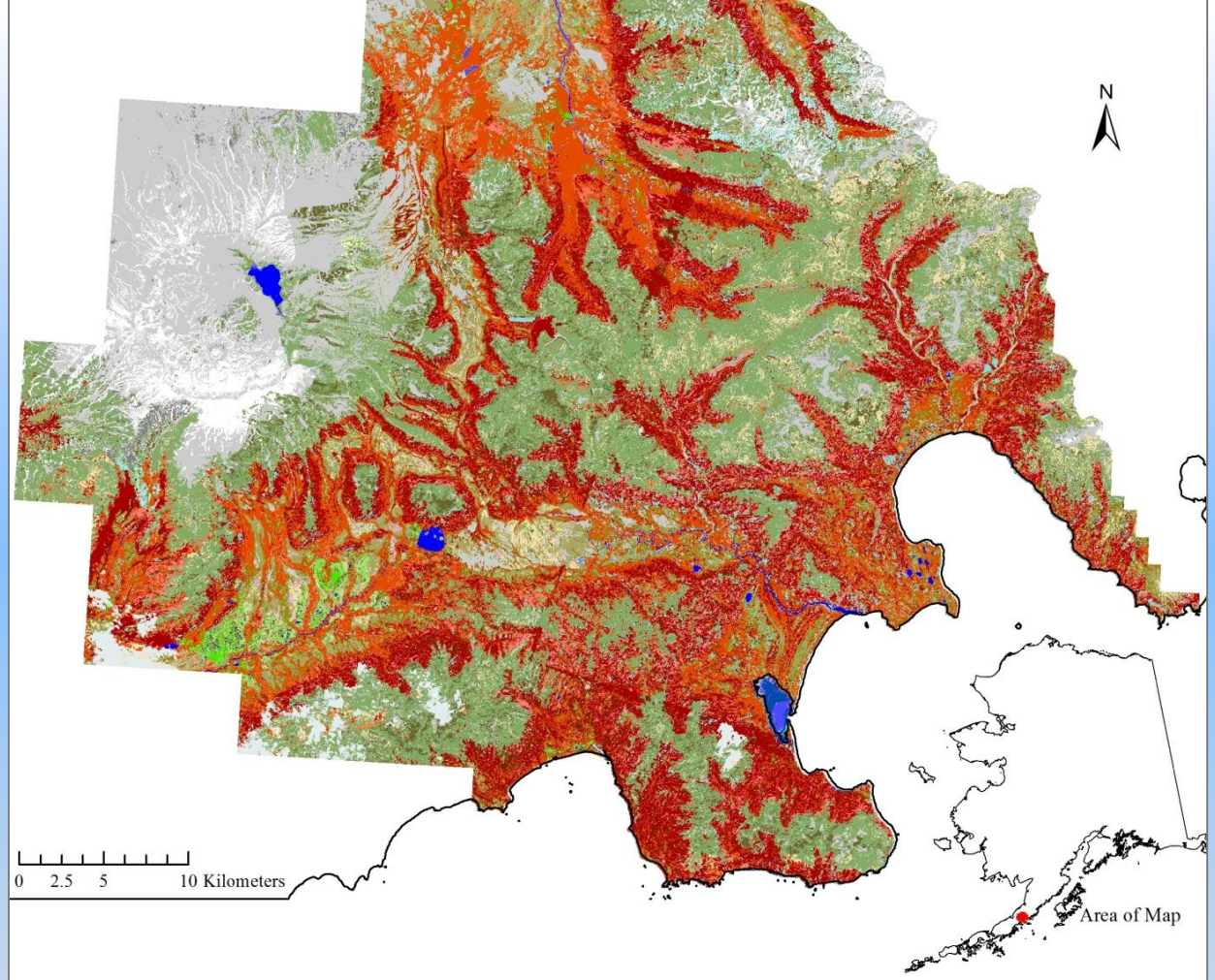
Empetrum nigrum/*Racomitrium* spp. Plant Association (Crowberry/Racomitrium Moss)

Plots sampled: 3
Rank: G3G4; S3S4
Other studies: a similar association, *Empetrum nigrum*/*Racomitrium canescens*, was listed in the Aniakchak caldera by Bosworth (1987); however plot data were recorded.

Distribution: Common plant association on volcanic deposits throughout the study area.
Patch size: Small
Elevation: 123 to 210 meters
Slope: 0 to 2°
Landform: Pumice plains, ancient floodplain terraces
Hydrology: Mesic
Profile consists of a very shallow organic (1 to 6 cm thick, pH 5.4 to 6.0) over material composed of is volcanic pumice. shallow A horizon is present on sites well-developed moss and dwarf shrub
Earth cover class: Dwarf Shrub–Other
stage: Early- to mid-seral

Vegetation: This plant association often occurs as a successional stage as vegetation establishes on volcanic pumice plains. *Racomitrium lanuginosum* is the dominant ground and *Empetrum nigrum* is the dominant shrub. Other common species include *Vaccinium uliginosum*, *Salix arctica*, and *rossii*. Patches of exposed pumice are common on early-seral sites.

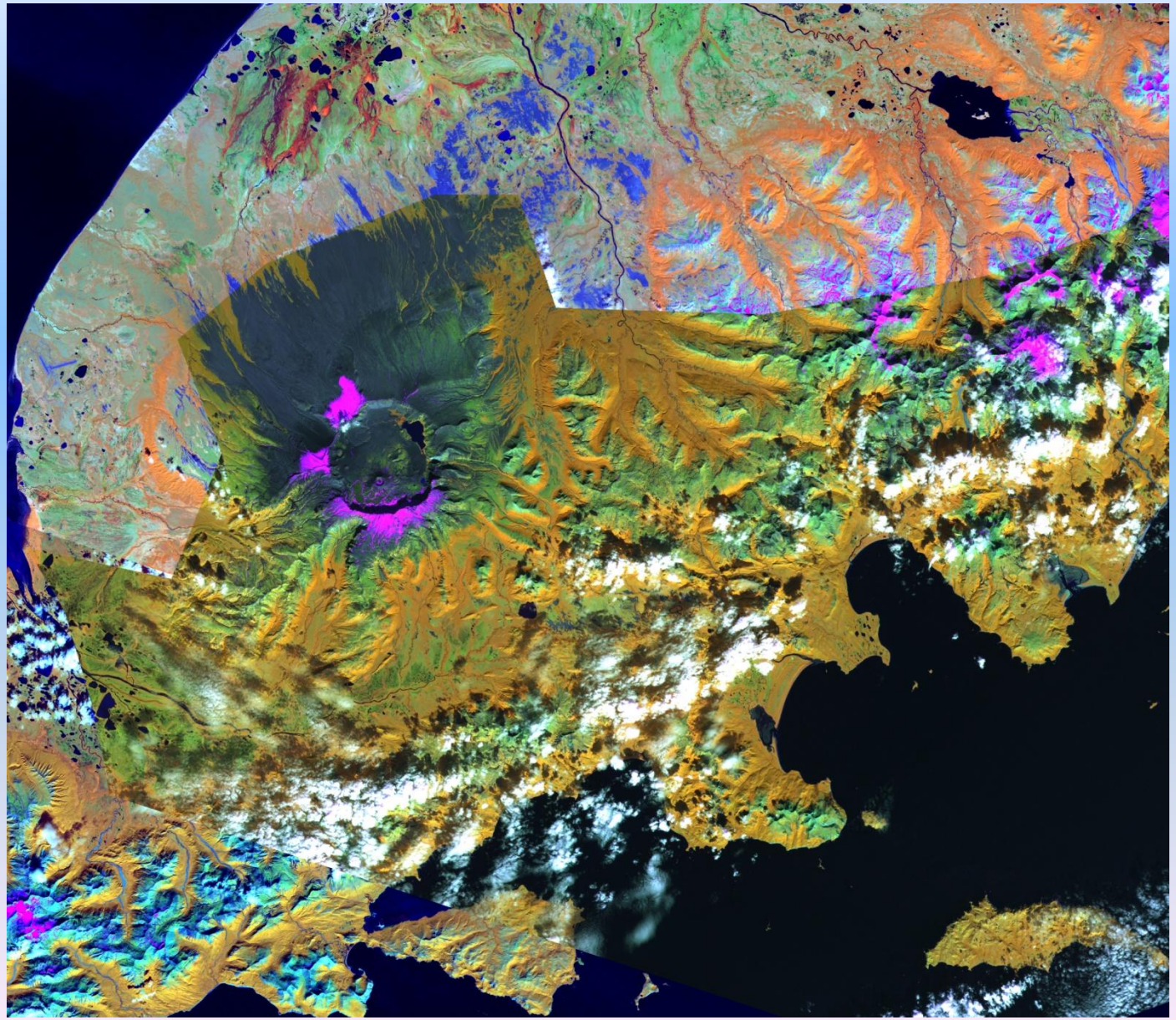
Species	Constancy	Canopy cover (%) Average	Canopy cover (%) Range	Height range (m)
Shrub				
Salix glauca	33	1	-	0.4
Empetrum nigrum	100	20	15 - 25	-
Salix arctica	100	3	2 - 5	-
Vaccinium uliginosum	100	2	1 - 3	0.1
Herbaceous				
Geum rossii	67	1	< 1 - 3	-
Lupinus nootkatensis	33	2	-	-
Graminoid				
Calamagrostis canadensis	33	0	-	-
Carex macrochaeta	33	0	-	-
Carex microchaeta	33	0	-	-
Deschampsia cespitosa	33	0	-	-
Festuca brachyphylla	33	0	-	-
Festuca rubra	67	0	-	-
Leymus mollis	67	1	-	-
Trisetum spicatum	33	0	-	-
Non-vascular				
Racomitrium	67	43	60 - 70	-
Racomitrium lanuginosum	33	20	-	-
Cladina rangiferina	33	1	-	-
Cladonia uncialis	67	1	1 - 2	-
Sphaerophorus globosus	67	0	< 1 - 1	-
Stereocaulon vesuvianum	33	2	-	-



Earth Cover Class Names

- Closed Poplar
- Tall Shrub - Willow
- Tall Shrub - Alder
- Tall Shrub - Alder/Willow
- Tall Shrub - Other
- Low Shrub - Willow
- Low Shrub - Alder
- Low Shrub - Alder/Willow
- Low Shrub - Other
- Dwarf Shrub - Lush
- Dwarf Shrub - Other
- Dwarf Shrub - Lichen
- Mesic/Dry Sedge Meadow
- Mesic/Dry Grass Meadow
- Mesic/Dry Graminoid
- Mesic/Dry Forb
- Wet Graminoid
- Wet Forb
- Wet Sedge
- Bryoid Moss/Dwarf Shrub - Lichen
- Sparse Vegetation
- Crypto-Biotic Soil
- Floating Algea
- Non-Vegetated Soil
- Rock/Gravel
- Turbid/Shallow Water
- Clear Water
- Snow/Ice
- Ocean Water

Succession on volcanic deposits



- 3,400 BP (magma reservoir/stratocone)
- 20 small ash producing eruptions (1931)
- 900 BP lake drained

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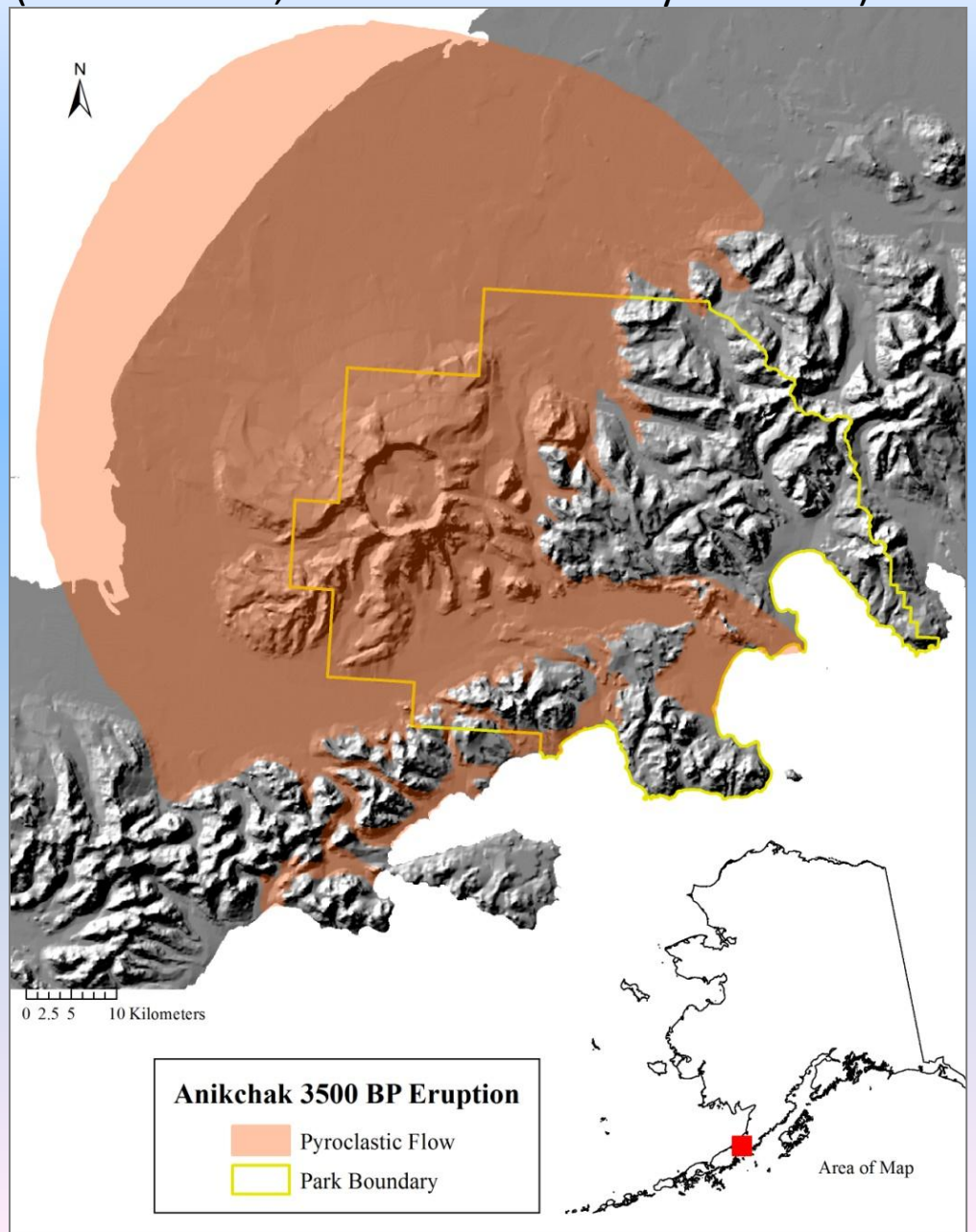
Katmai ash deposits (2 m deep ash)

Katmai-Valley of Ten Thousand Smokes

Pyroclastic flow

Image from http://tmp.kiwix.org:4201/A/Pyroclastic_flow.html

Pyroclastic flow deposits from the eruption 3,400 years B P
(Matson 2003, VanderHoek and Myron 2004)



Succession on pyroclastic flow deposits

- Side slopes
- Flat pumice plain surfaces
- (also Dunes (<3 m tall) and vegetated wetlands)

Pyroclastic flow side slopes

Table 7. Soil and soil surface characteristics on the side slope seral sequence. We arranged the associations in a chronosequence from young to old.

Seral stage	Mean									
	pH		Horizon thickness (cm)		% of soil surface					
Landcover class (dominant genera)	10 cm	20 cm*	O	A + B	Bio-crust	Moss/ lichen	Mineral soil	Slope degrees	Elevation m	# plots
Early-seral										
Bareground or sparse vegetation (<25%)	6.2	6.9	0	0	2	14	84	16	652	7
Mid-seral										
Biological crust	5.2	6.0	1	0	70	9	21	12	481	2
Dwarf shrub (<0.1 m) (*Salix-Vaccinium*)	5.5	6.0	2	0	18	39	30	15	460	5
Moss (*Racomitrium*)	4.7	5.9	3	0	5	85	0	15	444	1
Late-seral										
Biological crust	5.4	6.4	1	9	54	20	27	6	531	6
Dwarf shrub (<0.1 m) (*Empetrum-Vaccinium*)	5.5	6.1	4	12	3	23	5	14	348	13
Mesic herbaceous (*Calamagrostis-Heracleum*)	5.5	6.0	6	22	0	27	3	18	323	7
Tall or low shrub (>0.1 m) (*Salix-Alnus*)	5.2	5.8	6	15	0	9	2	19	204	7

* pH in 20 cm horizon

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Side slope succession

Photographs of the early-seral side slope associations *Saxifraga* spp./Rock (on left) and *Silene acaulis–Geum Rossii*.

Table 8. Species that dominate or co-dominate Aniakchak biological crusts.

Dominant or co-dominant species	Lifeform	Dominant or co-dominant species	Lifeform
Scytonema sp.	cyanobacteria	*Calypogeia* sp.	leafy liverwort
Anthelia juratzkana	liverwort	*Cetraria ericetorum*	lichen
Cephaloziella sp.	liverwort	*Stereocaulon* sp.	lichen
Gymnomitrion corallioides	liverwort	*Synthrichia* sp.	moss
Nardia breidleri	liverwort	*Grimmia* sp.	moss
Scapania undulata	liverwort	*Syntrichia* sp.	moss

Salix arctica–Salix reticulata Plant Association
(Arctic Willow–Net-leaf Willow)

Mesic herbaceous

Flat pumice plain

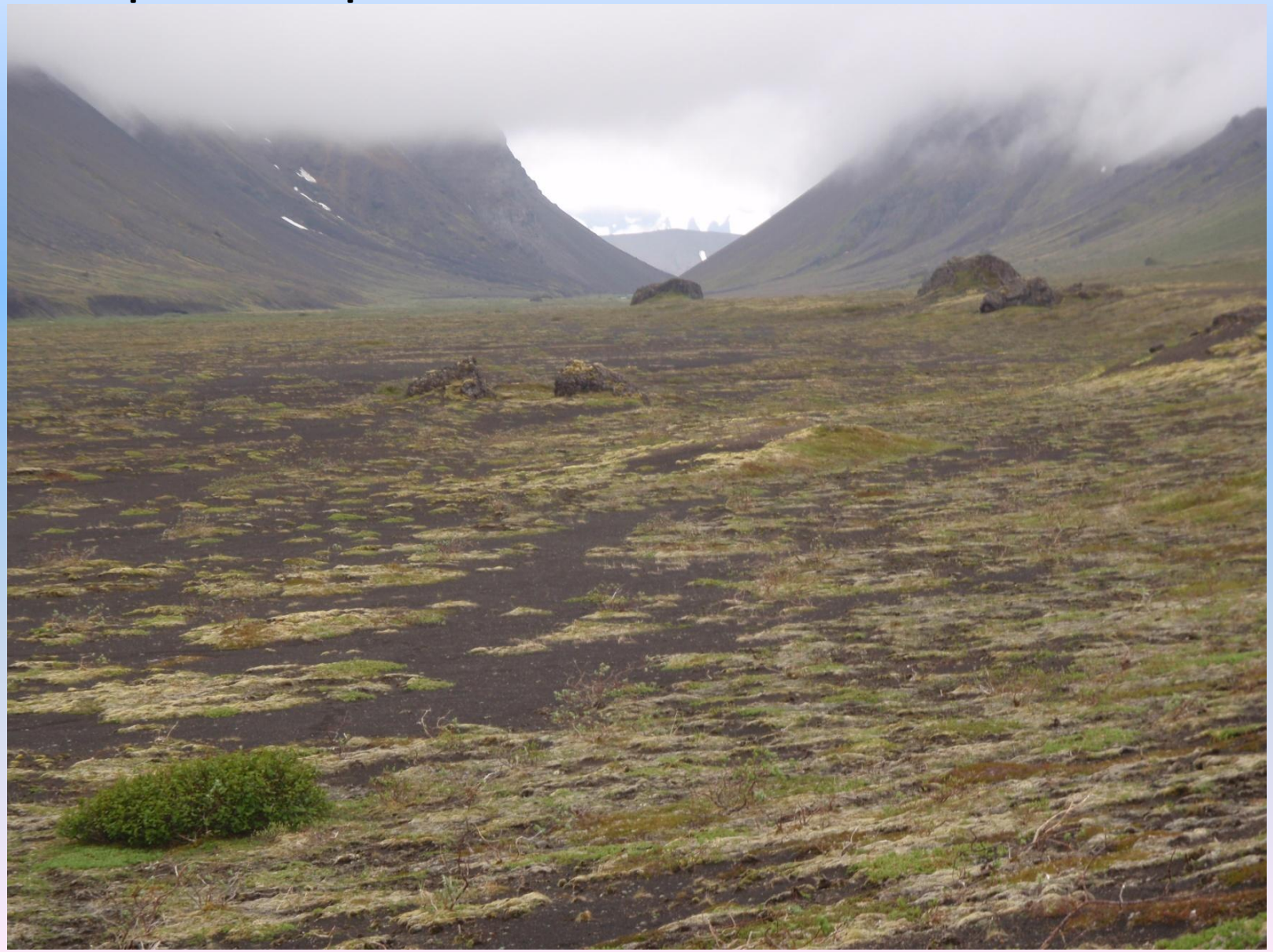

Table 10. Soil and soil surface characteristics on the pumice plain seral sequence. We arranged the associations in a chronosequence from young to old.

Seral stage	Mean									
	pH		Horizon thickness (cm)		% of soil surface					
Landcover class (dominant genera)	10 cm	20 cm*	O	A + B	Bio-crust	Moss/ lichen	Mineral soil	Slope degrees	Elevation m	# plots
Early-seral: species invade bare pumice plain										
Racomitrium spp. invade mineral soil										**
Sparse vegetation (10-25%) (*Artemisia-Rumex*)	6.5	5.6	1	0	2	3	87	1	143	8
Mid-seral: hummock-bareground mosaic										
Dwarf shrub (<0.1 m) (*Empetrum/Racomitrium*)	6.2	6.8	2	0	0	34	46	1	164	4
Tall shrub (>1.5 m) (*Alnus*)	5.4	6.7	1	0	0	50	15	1	209	1
Late-seral: small hummock										
Dwarf shrub (<0.1 m) (*Empetrum*)	5.2	6.0	4	11	1	10	2	1	97	9
Low shrub (0.1-1.5 m) (*Salix*)	5.8	6.2	4	28	0	20	3	2	201	3
Tall shrub (>1.5 m) (*Alnus*)	6	6.5	2	11	0	8	5	1	147	3
Late-seral: tall hummock										
Dwarf shrub (<0.1 m) (*Empetrum*)	--	--	3	50	0	5	5	0	20	2
Eroding hummock-mineral soil mosaic										
Dwarf shrub (<0.1 m) (*Empetrum-Vaccinium*)	5.7	6.9	3	18	0	5	33	2	119	3

* pH in 20 cm horizon

** Numerous observations of *Racomitrium* spp. invading bareground

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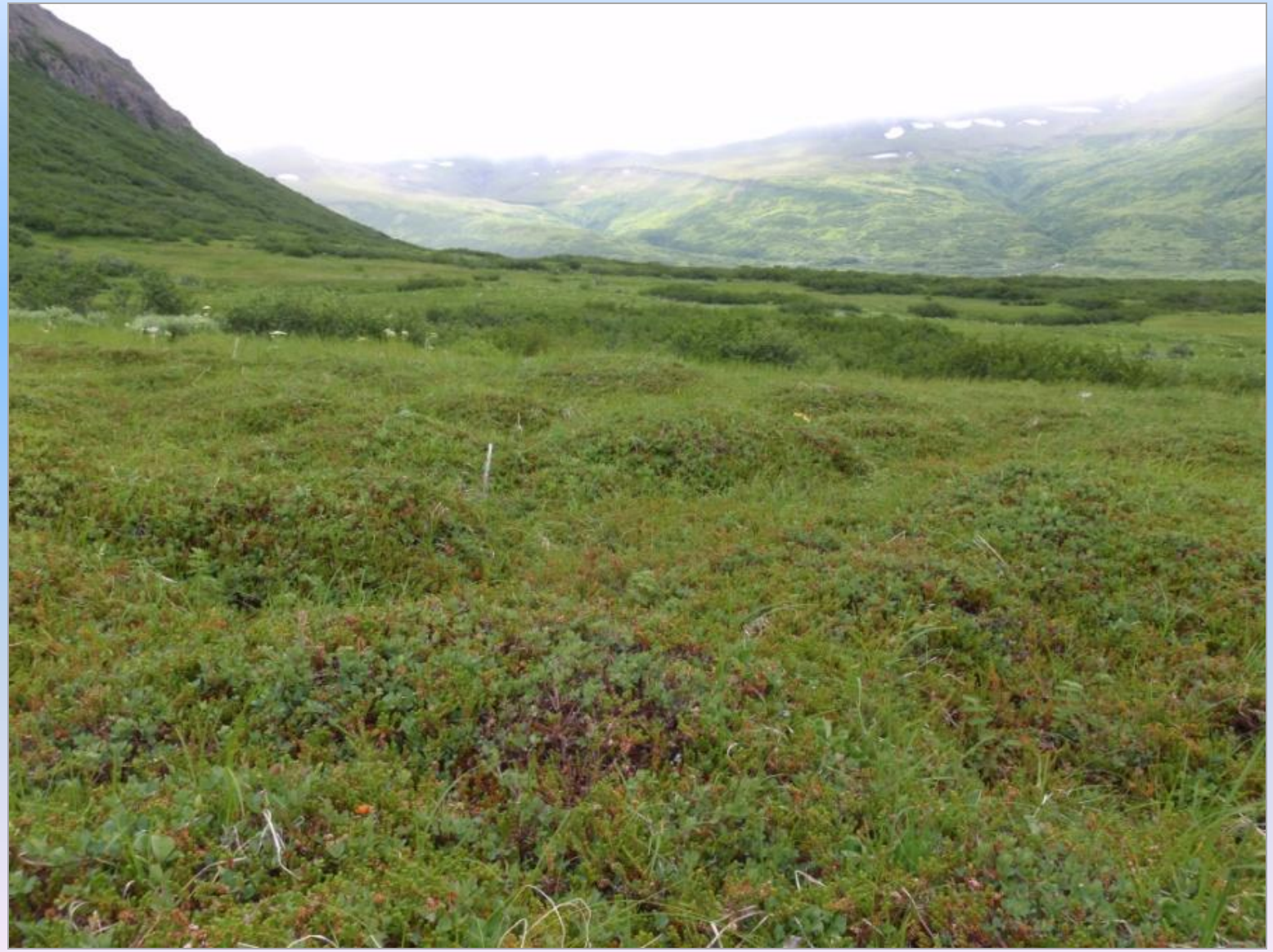
Mound growth
-Capture wind blown sediment
-Organic matter buildup

Late seral pumice plain



Eroding hummock mineral soil mosaic

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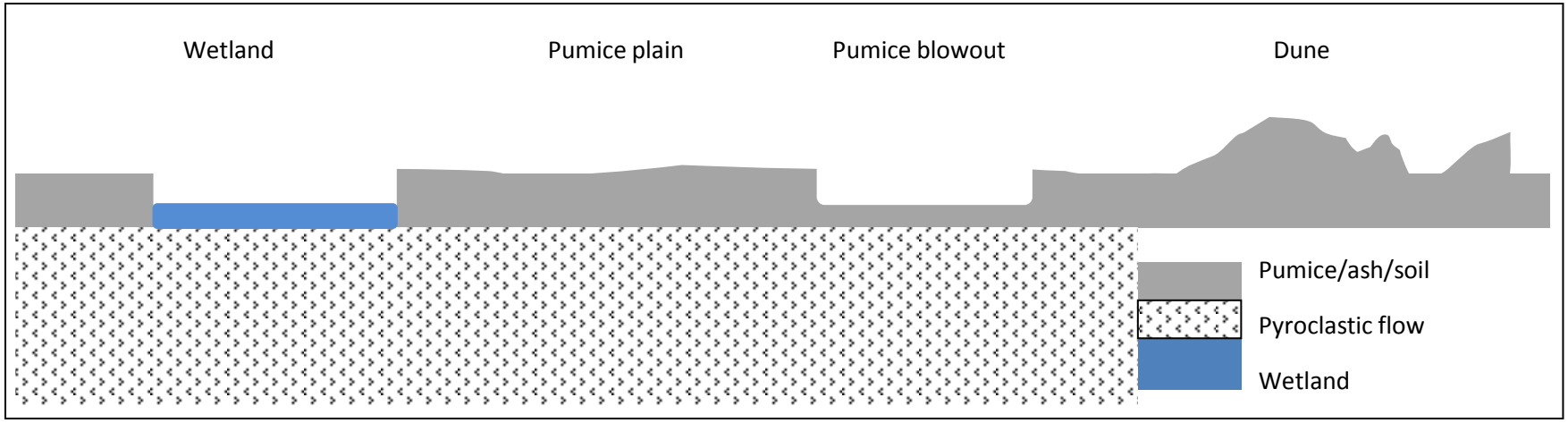
Pumice plain blowout

Pumice Plain Vegetation-Soil Chronosequence



- Thin mantle of soil (1 m thick) over pyroclastic rock (pumice)
- Sediment removed
- Pedogenic processes create more sediment (plus loess and ash fall)

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Anthelia juratzkana–Gymnomitrion corallioides **Plant Association**
(Liverwort Biological Soil Crust)

Pohlia wahlenbergii–Philonotis Fontana **Plant Association**
(Wahlenberg's Pohlia Moss–Philonotis Moss)

***Stereocaulon vesuvianum–Racomitrium lanuginosum* Plant Association**
(Snow Lichen–Racomitrium Moss)