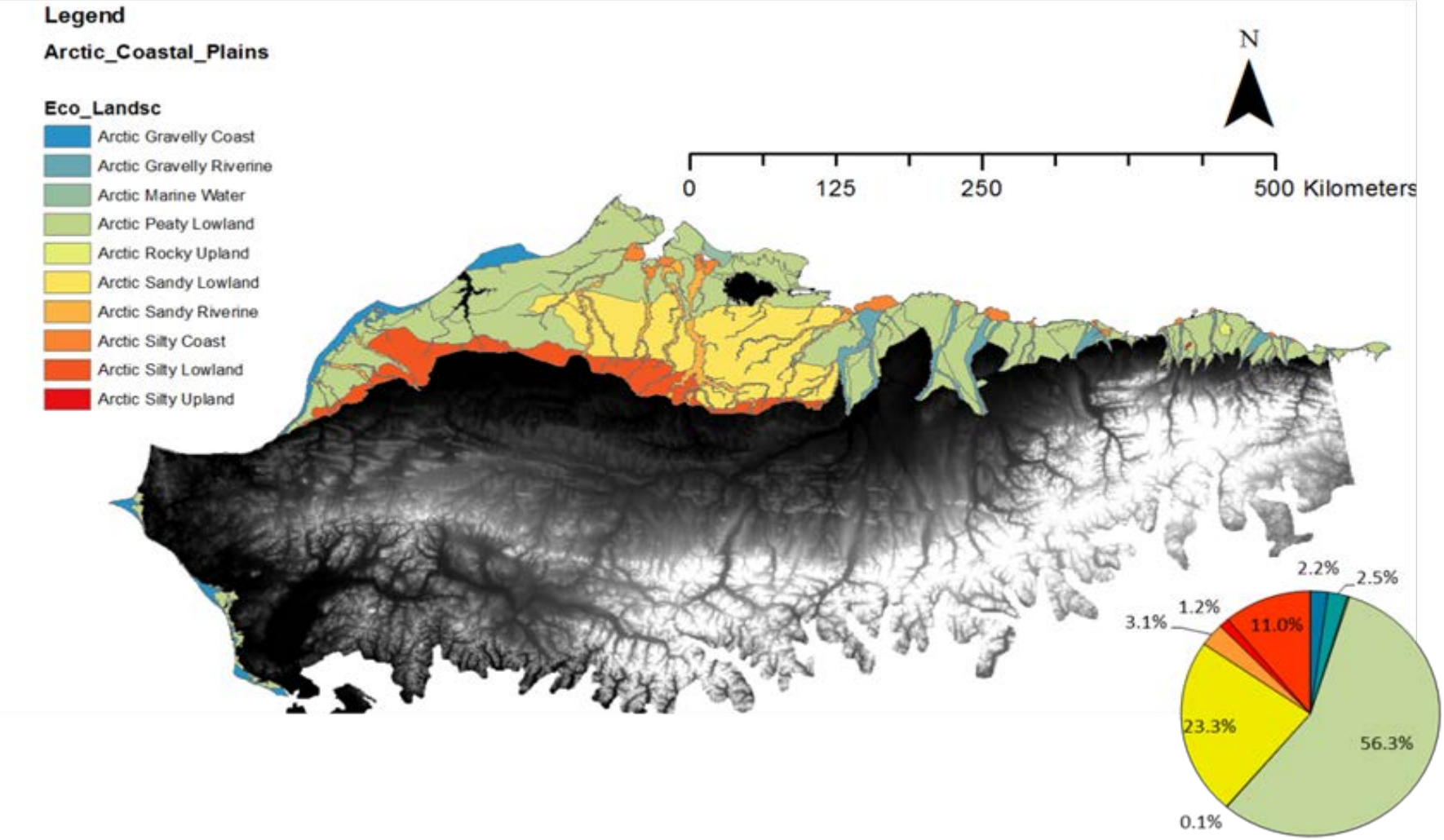
Thermokarst and Waterbirds: What's the Connection?

Philip Martin
Arctic LCC, Sept 2015

Beaufort (Arctic) Coastal Plain



Shorebirds – 5.9 million
16 species
Photo Credit: Ted Swem

Waterfowl – 980,000
14 Species

Photo Credit: Ted Swem

Gulls, Terns, Jaegers – 263,000
5 Species

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Loons – 39,000
4 Species
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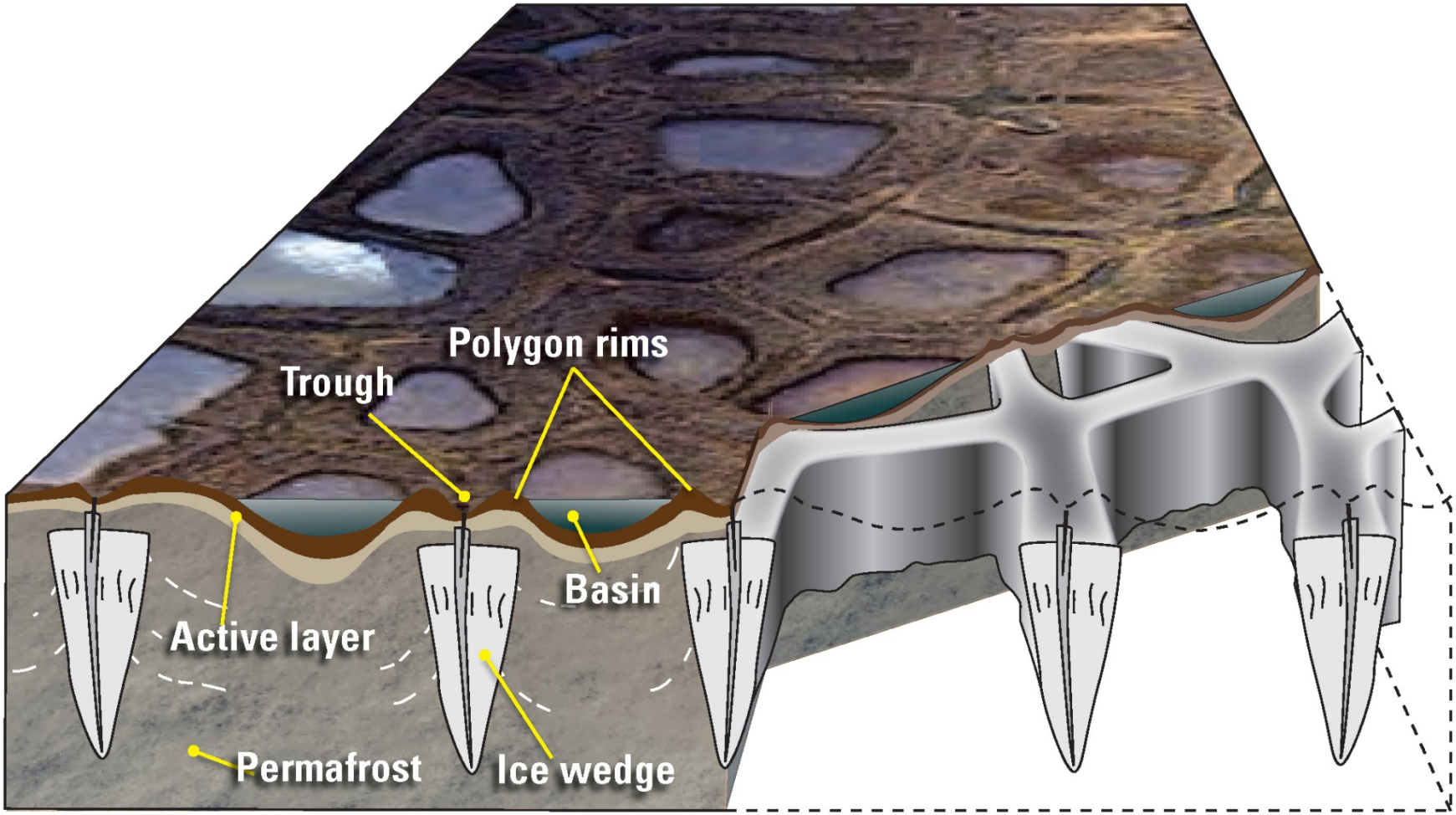
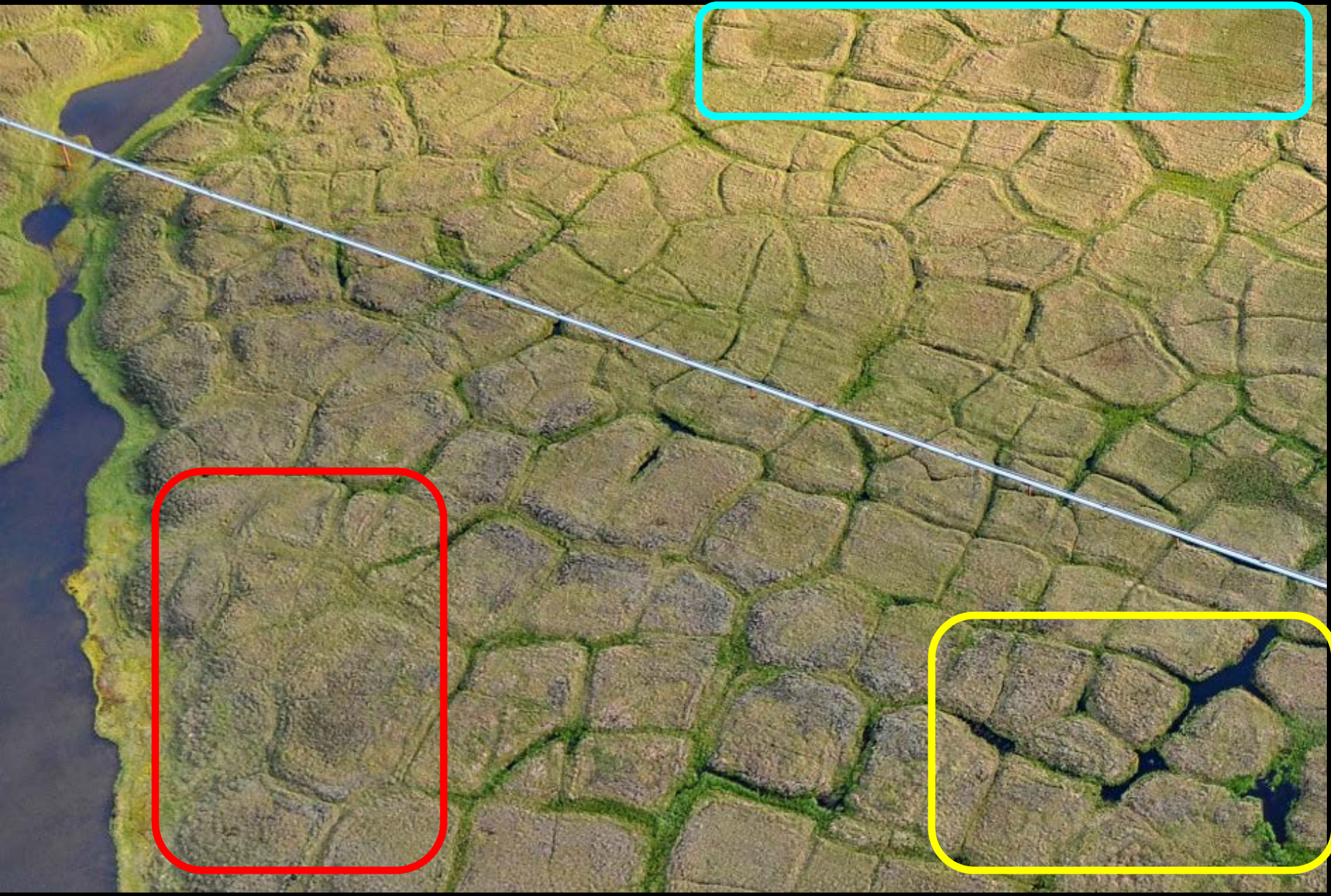
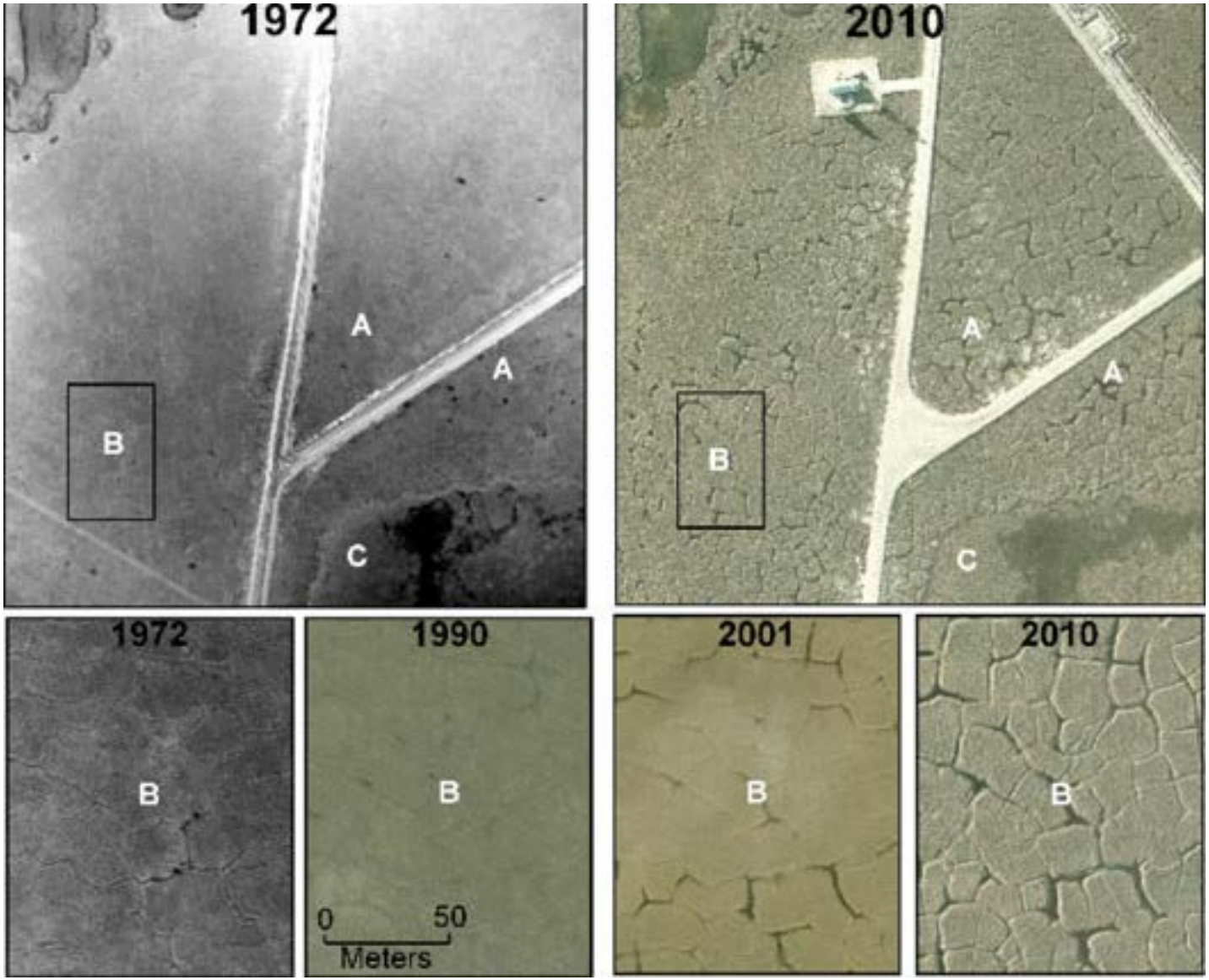
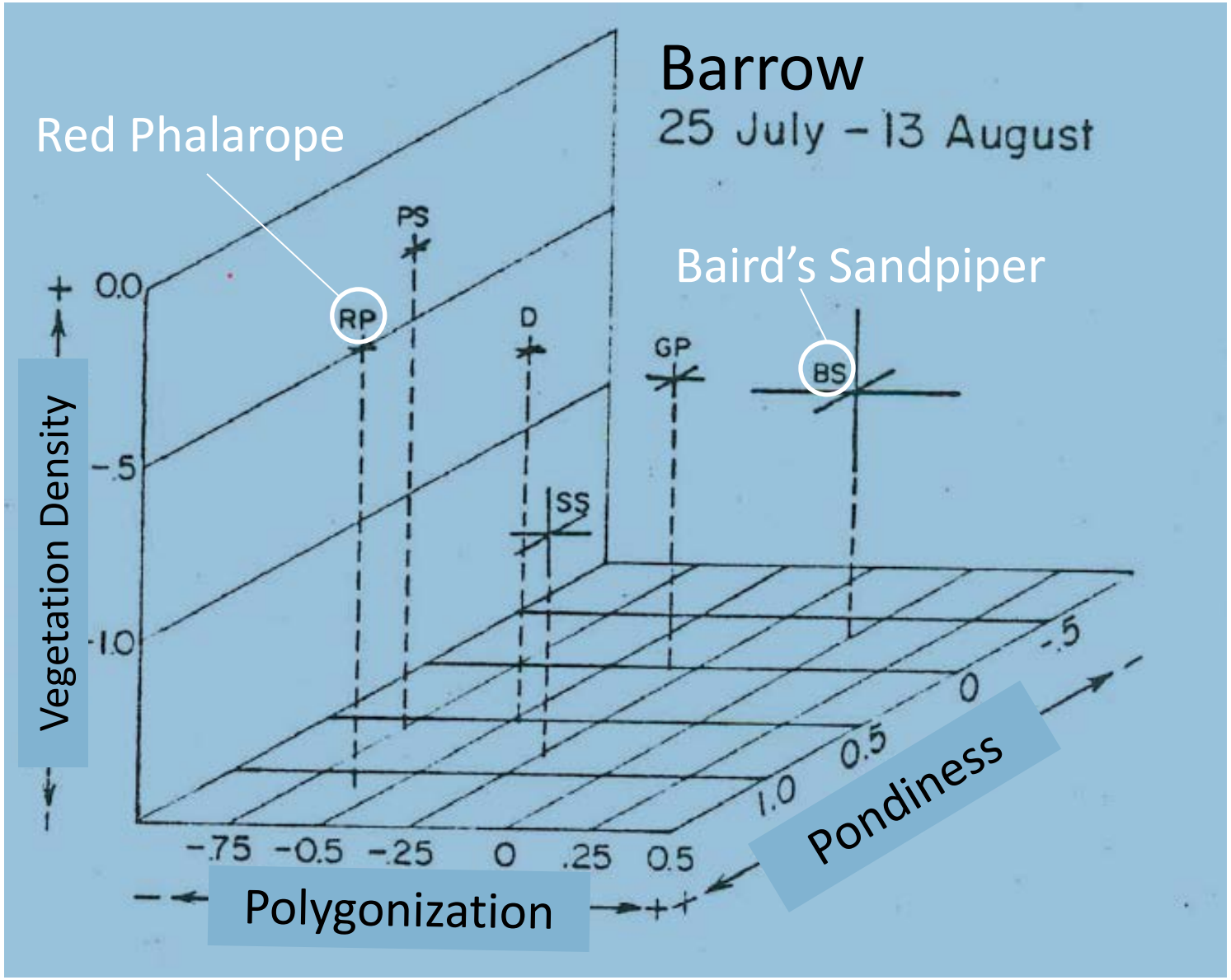


US Fish and Wildlife Service figure





Raynolds et al. 2014. cumulative geoecological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska.



Myers, J.P. and F.A. Pitelka. 1980. Effect of habitat conditions on spatial parameters of shorebird populations. Report to DOE for 1975-1979.

Habitat	Gr. White-fronted Goose	King Eider	Long-tailed Duck	Semipalmated Sandpiper	Pectoral Sandpiper	Dunlin	Stilt Sandpiper	Red-necked Phalarope	Red Phaarope	Lapland Longspur
High-Centered Polygons	+	---	--		---		+++	---		+++
Moist-smooth		---			---		--	---		+++
Moist, Wet, LCP & Strangmoor		--	++	++	---	+++		---		+++
Wet, tundra low LCP							-	----	--	+++
Wet-strangmoor	-	---	+++	+++		+				+++
Wet-nonpatterned			---	---	+++					---
Aquatic-Strangmoor		+++			+++	++		+++		---
Pond/lake		+++	--	--	---	---				---
Ponds with Emergents		+++	---	---		---		+++		---
Impoundments	-	-	-	--		-		+++		---

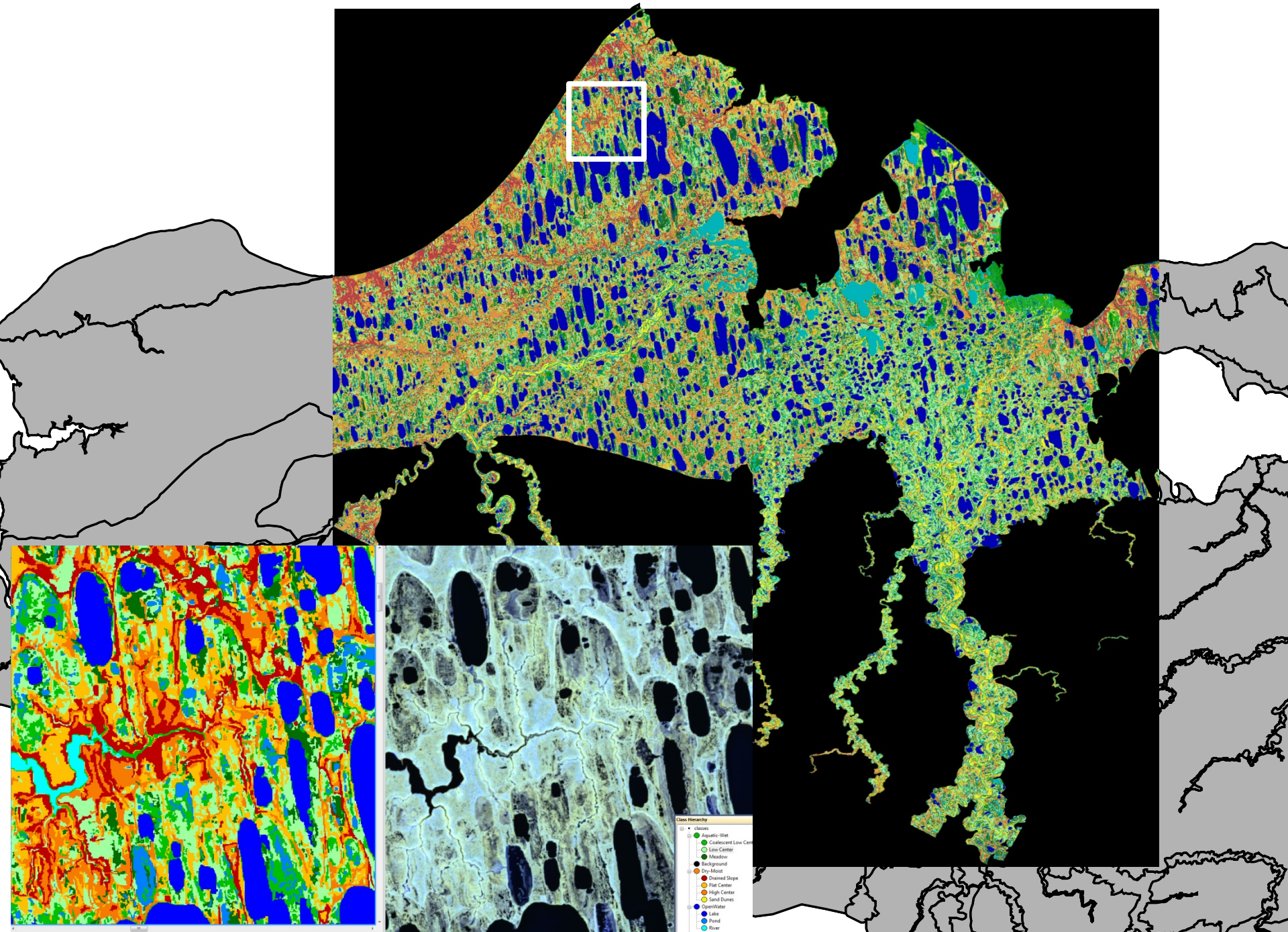
+ (-) = p<0.05; ++ (--) = p<0.01; +++ (---) = p < 0.001

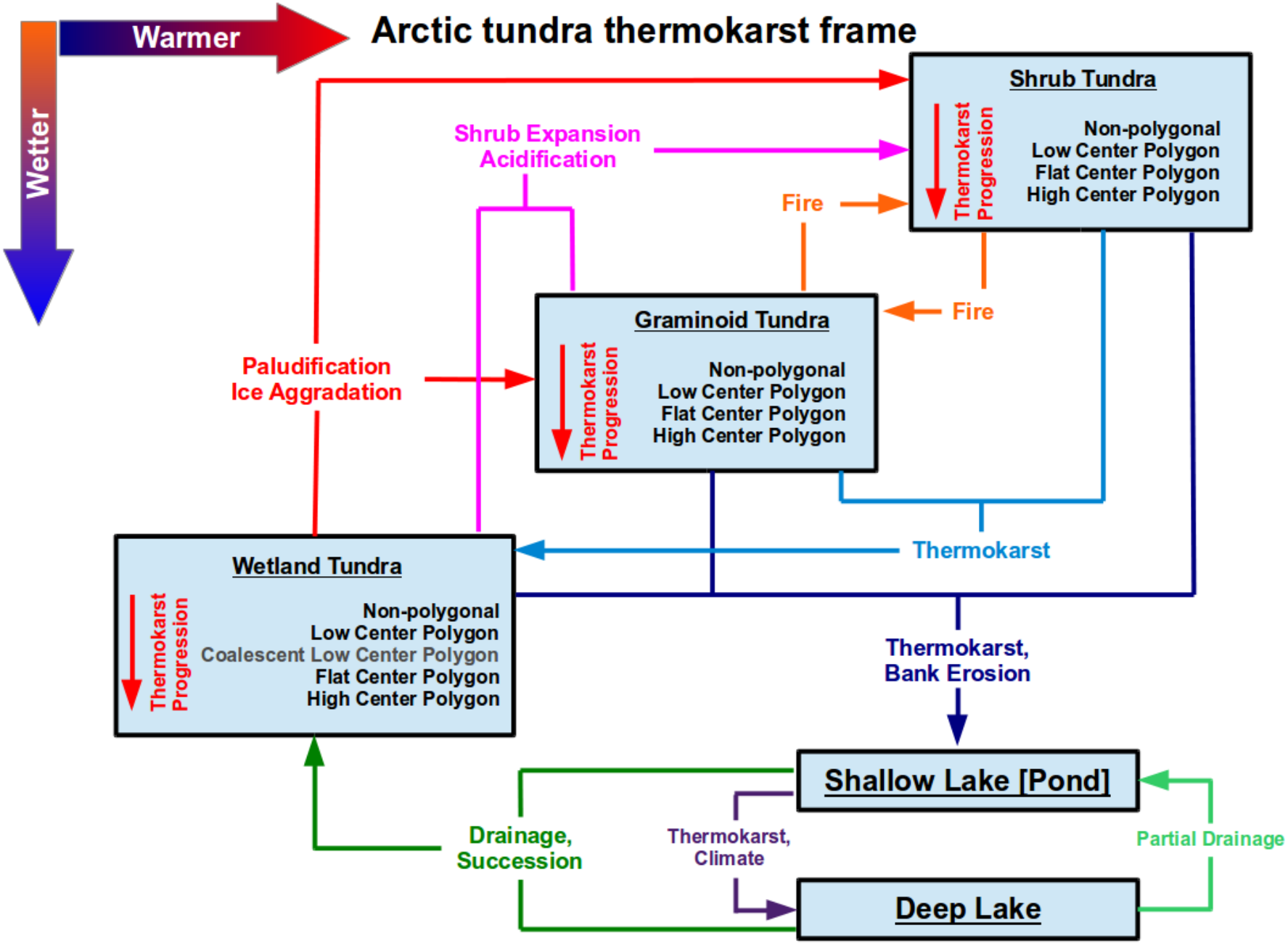
Troy, D.M. 1988. Bird use of the Prudhoe Bay oil field during the 1986 nesting season. LGL Alaska Ecological Research Associates, for AOGA, Anchorage, AK.

In summary…

- **Ice-wedge degradation is observably reshaping surface microtopography and hydrology**
- **A net shift from wet to moist tundra would be detrimental to many water bird species, favorable to others**

How Quickly Will The Landscape Change, And Over What Area?


Class Hierarchy
classes
Aquatic-Wet
Coalescent Low Cente
Low Center
Meadow
Background
Dry-Moist
Drained Slope
Flat Center
High Center
Sand Dunes
OpenWater
Lake
Pond
River


Warmer
Wetter
Arctic tundra thermokarst frame
Shrub Tundra
Thermokarst Progression
Non-polygonal
Low Center Polygon
Flat Center Polygon
High Center Polygon
Shrub Expansion
Acidification
Fire
Fire
Graminoid Tundra
Thermokarst Progression
Non-polygonal
Low Center Polygon
Flat Center Polygon
High Center Polygon
Paludification
Ice Aggradation
Thermokarst
Wetland Tundra
Thermokarst Progression
Non-polygonal
Low Center Polygon
Coalescent Low Center Polygon
Flat Center Polygon
High Center Polygon
Thermokarst,
Bank Erosion
Shallow Lake [Pond]
Drainage,
Succession
Thermokarst,
Climate
Partial Drainage
Deep Lake

Project Outlook

- Draft Landforms Map – Dec 2015
- Accuracy Assessment, Map Revisions -- Feb 2016
- Model testing, Barrow Peninsula – May 2016
- Arctic Coastal Plain Simulation to 2100 – Aug 2016
- Final Report – Sep 2016