

From ice to alder: characterizing a half-century of vegetation change in Kenai Fjords National Park



Tina Boucher
Alaska Natural Heritage Program

Chuck Lindsay & Amy Miller
National Park Service – Southwest Alaska Network

‘a submerged coast and mountain range’

A dynamic landscape leads to habitat heterogeneity and greater biological diversity



Widespread glacial retreat is changing the landscape

Approaches to measuring vegetation change

- I. Long-term changes across the landscape (1950-2005)
 - Air photo interpretation (1950s, 1980s, 2005)
 - Analyze for % change in dominant cover types

- II. Short-term changes in community composition (1993-2008)
 - Field measurements on established vegetation plots
 - Analyze for % change in species composition

I. Landscape-level changes estimated from historic air photos (1950-2005)

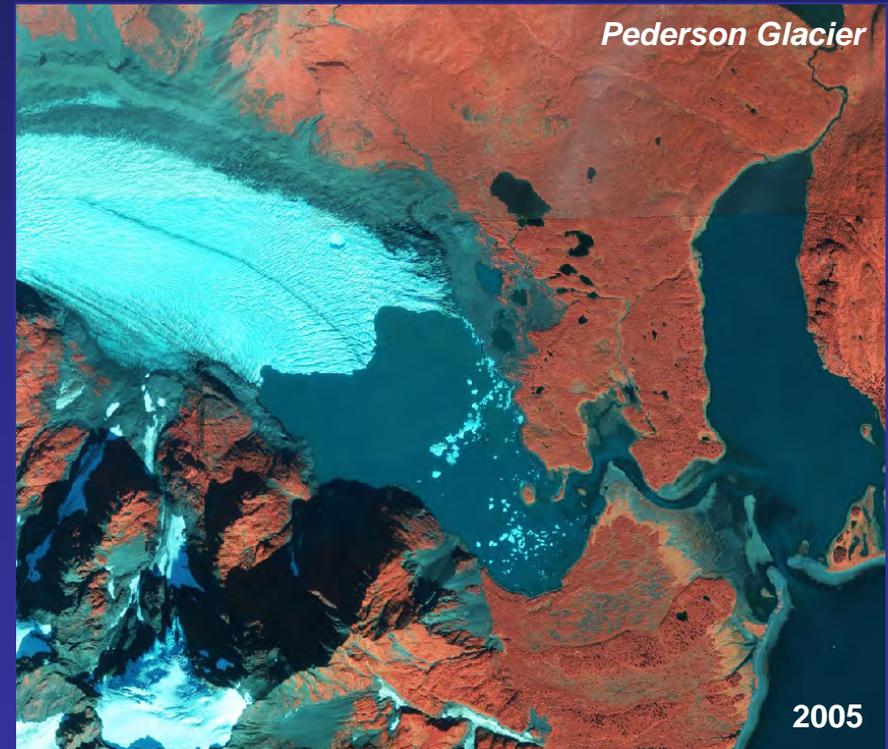
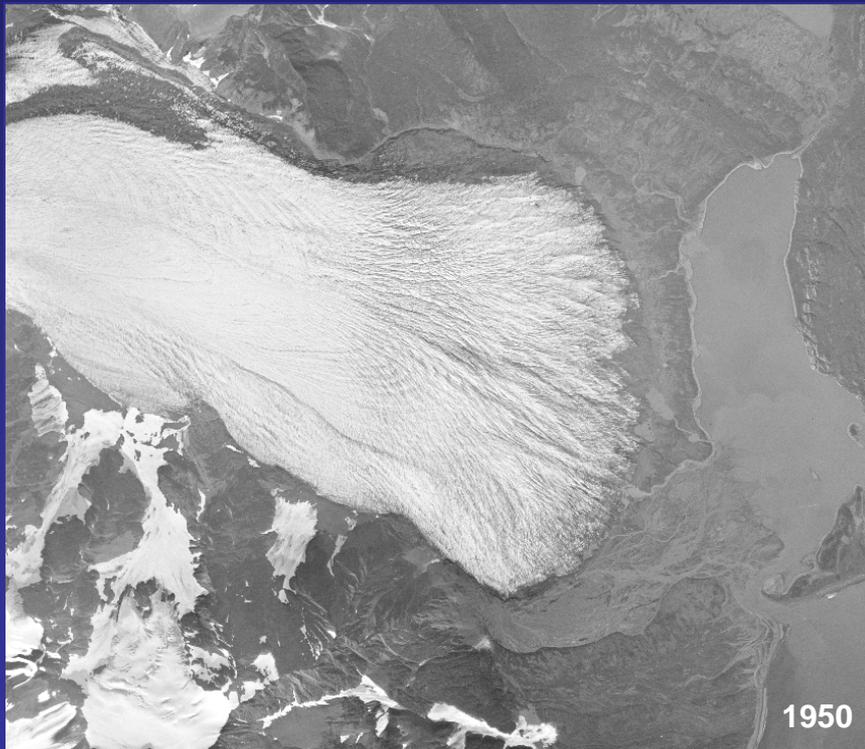
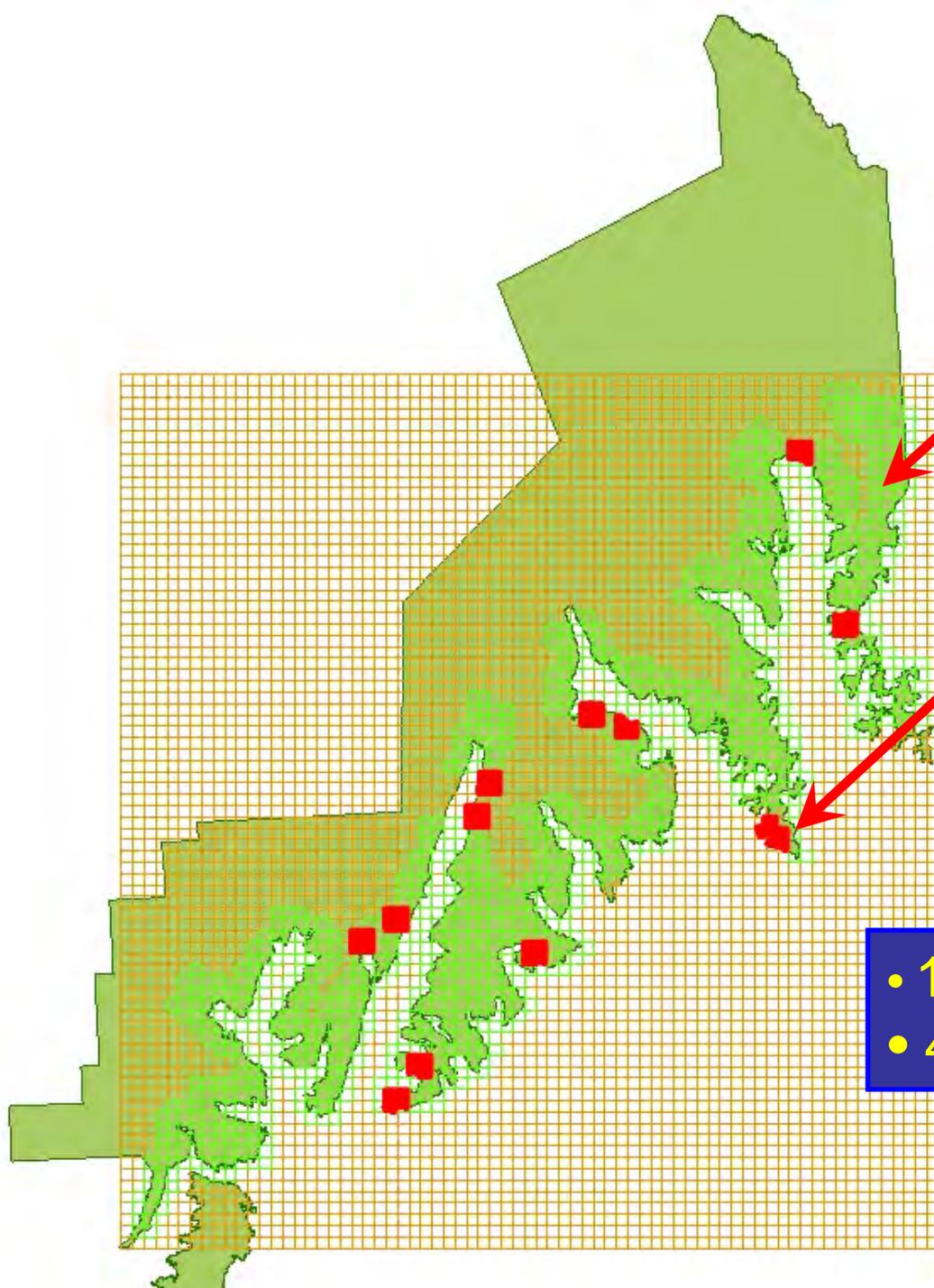


Photo interpretation



4 time slices

4 km² blocks

- 1 km grid applied to park
- 4 km² blocks interpreted

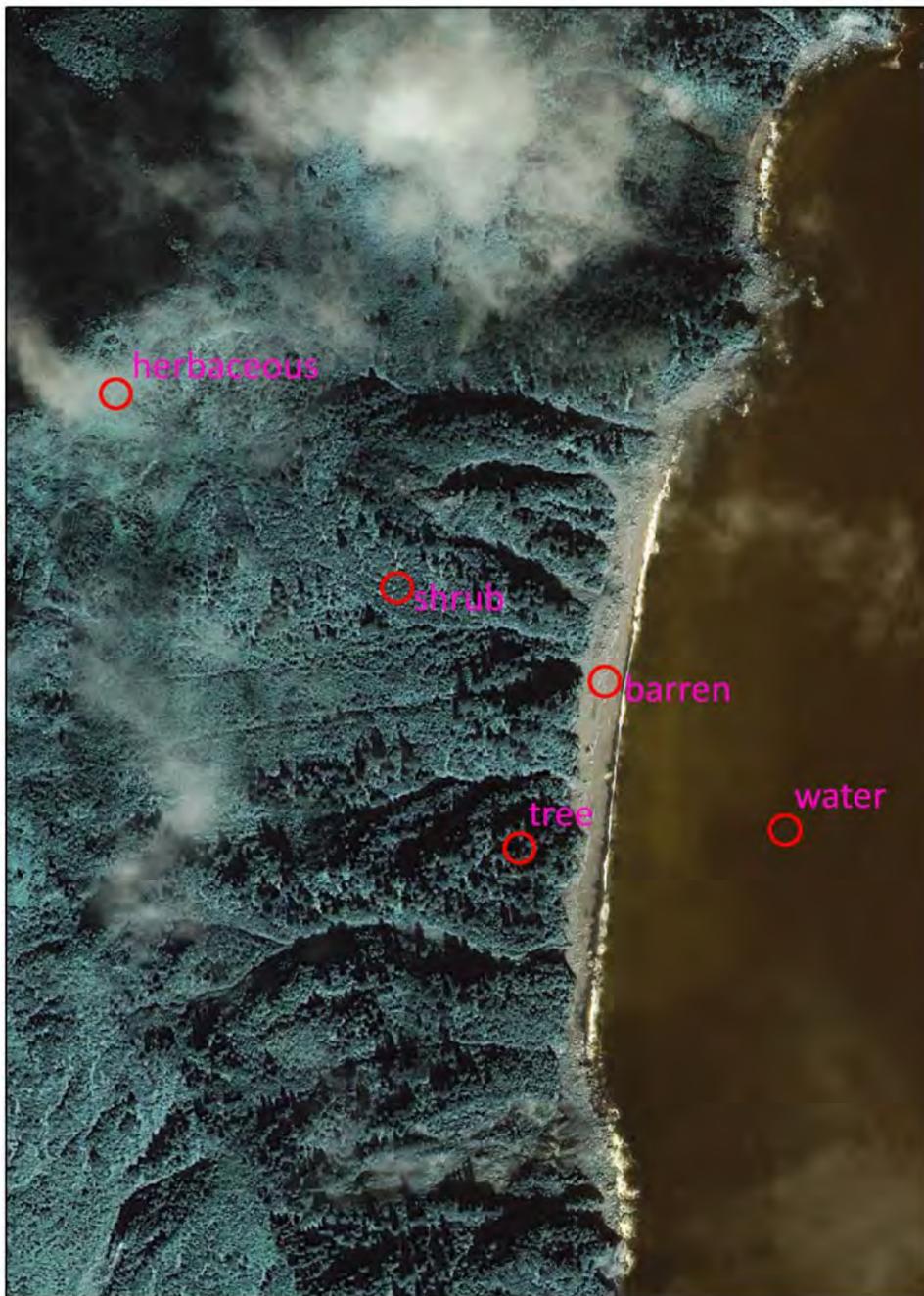


Photo Interpretation

Base image = IKONOS (2005)

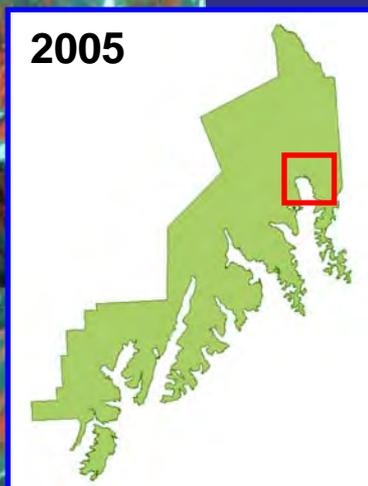
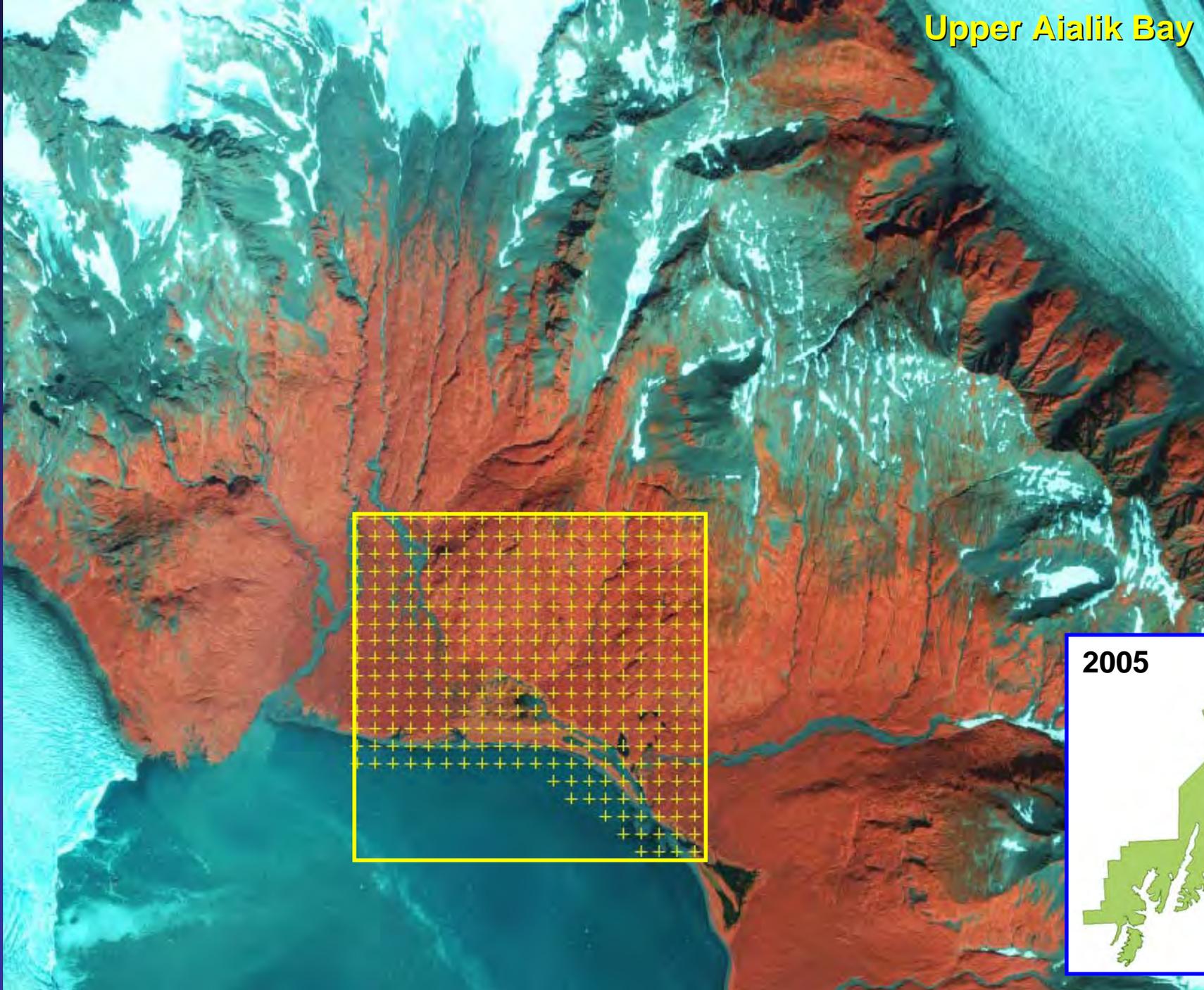
Scale: 1:3,000 (1 cm = 30 m)

Horizontal accuracy < 30 m

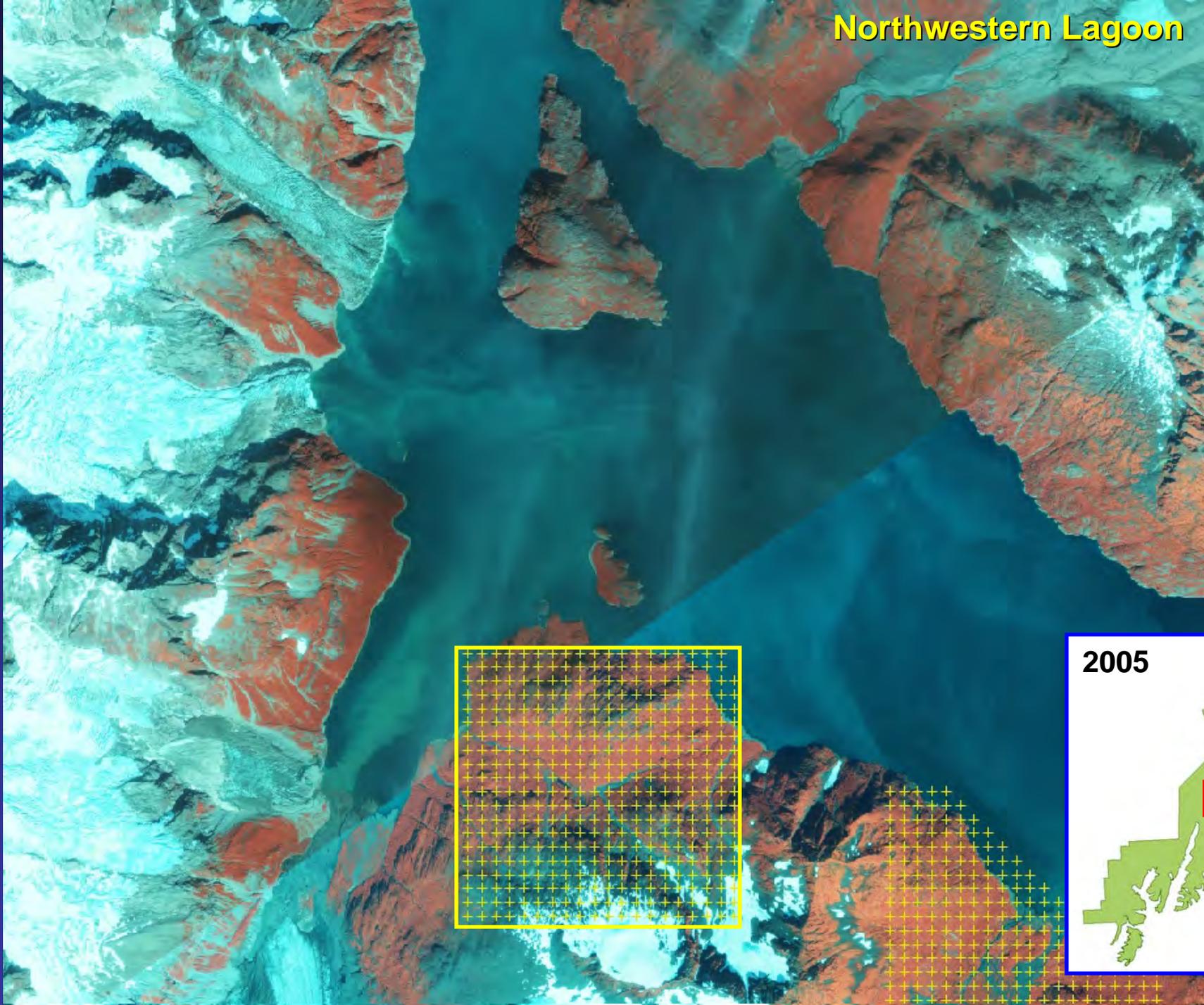
Classes:

- Ice
- Water
- Bare rock
- Herb
- Shrub
- Tree

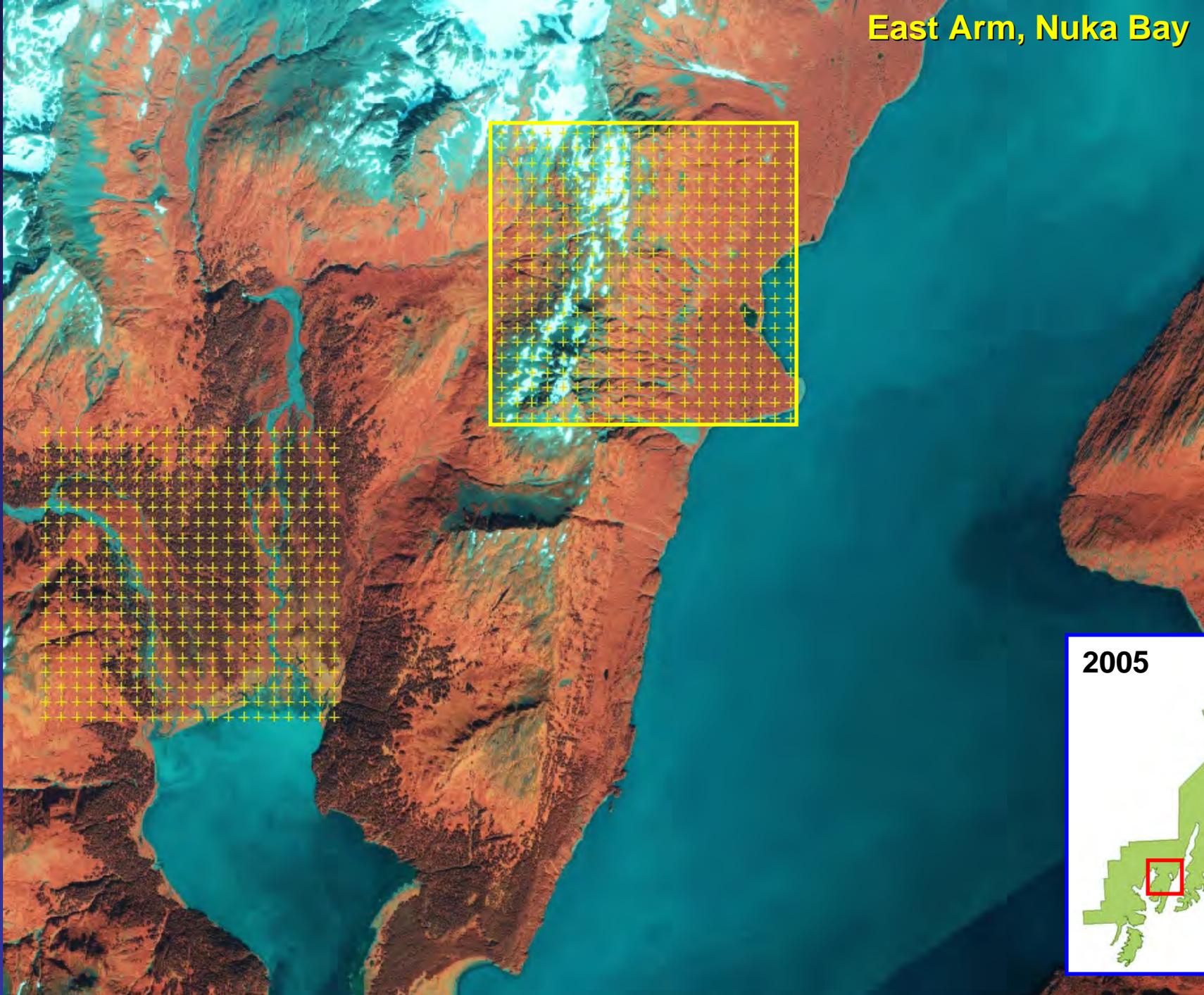
Upper Aialik Bay

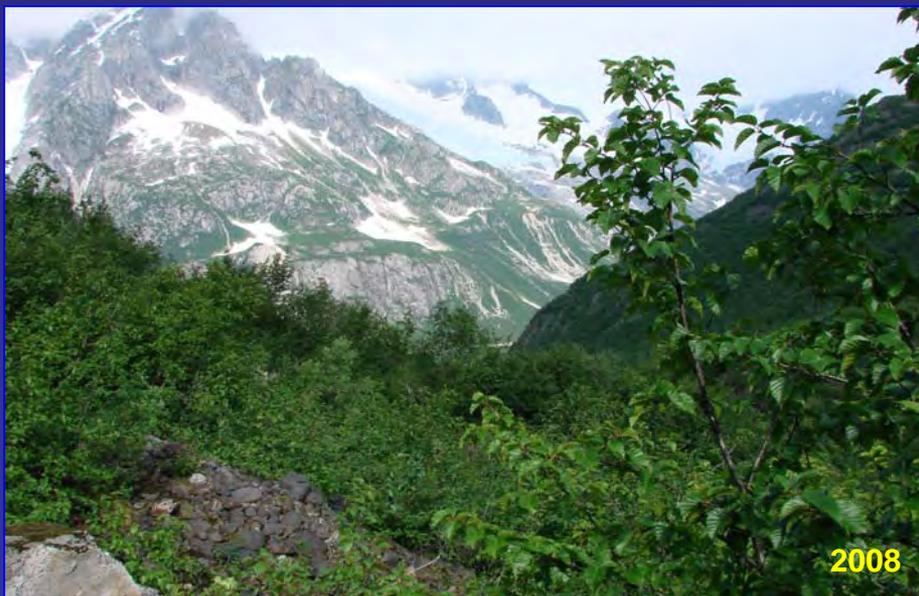
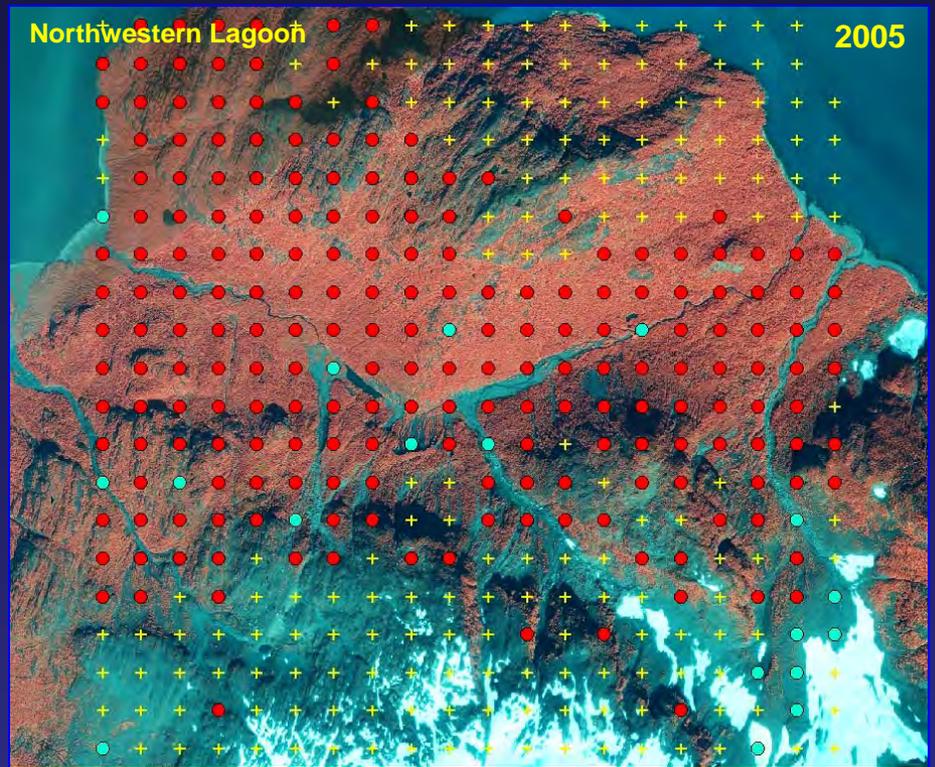
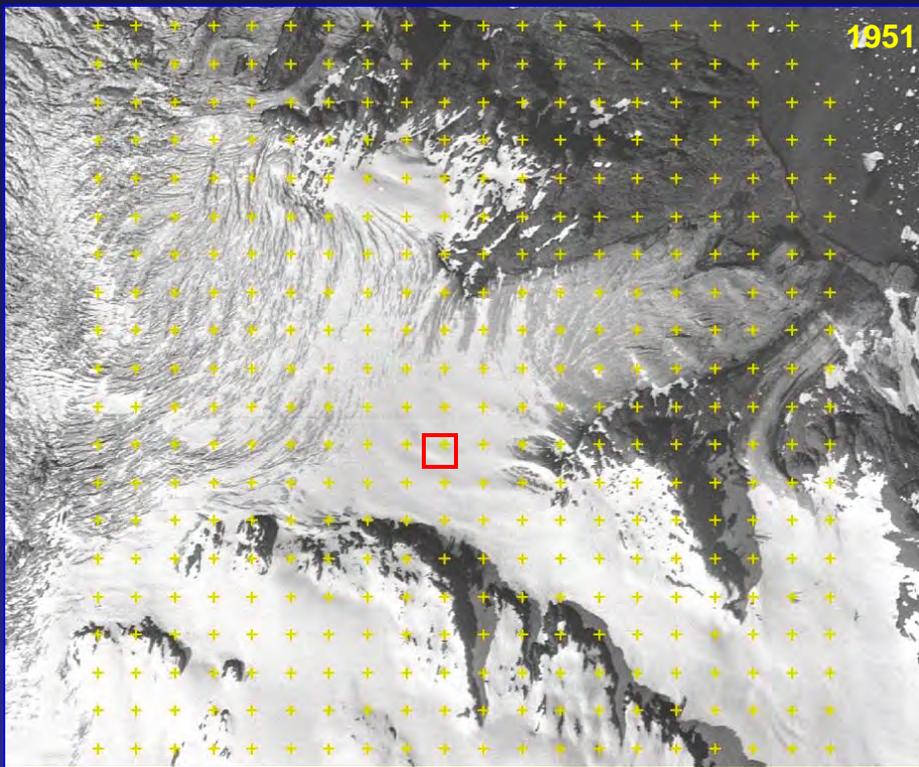


Northwestern Lagoon



East Arm, Nuka Bay





- conversion to bare ground
- conversion to shrub



Landscape-level changes in cover (1950-2005)

<i>Direction of change</i>	% Change			
	Upper Aialik	Lower Aialik	Northwest	East Arm
Barren >> shrub	4%	2%	8%	14%
Shrub >> barren	2%	<1%	0%	<1%
Shrub >> tree	0%	3%	0%	<1%
Ice >> barren	0%	0%	4%	0%
Ice >> shrub	0%	0%	39%	0%
Shrub (no change)	66%	40%	9%	20%
Barren (no change)	1%	<1%	1%	15%
Ice (no change)	0%	0%	0%	0%



- Older areas of landscape appear unchanged
- Younger sites show shrub expansion near margins
- Channel migration, landslides, subsidence also apparent

II. Community-level changes estimated from pre-established field plots (1993-2008)





Upper Aialik Bay

Field measurements

Step 1:

Pinpricks on air photos (1993) converted to point locations in a GIS (2008) with IKONOS base layer.

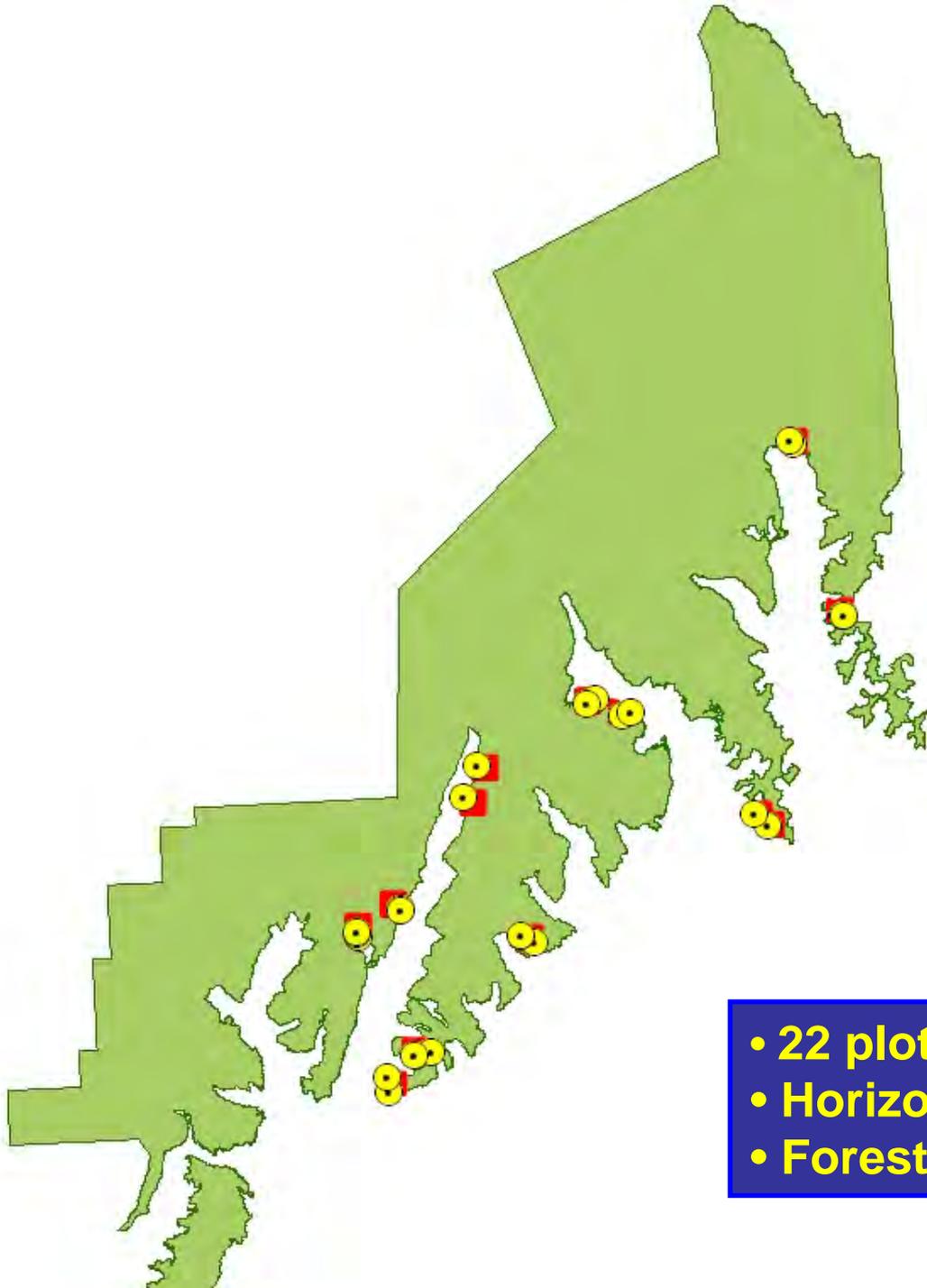
Step 2:

Point locations reviewed using plot data & field photos.

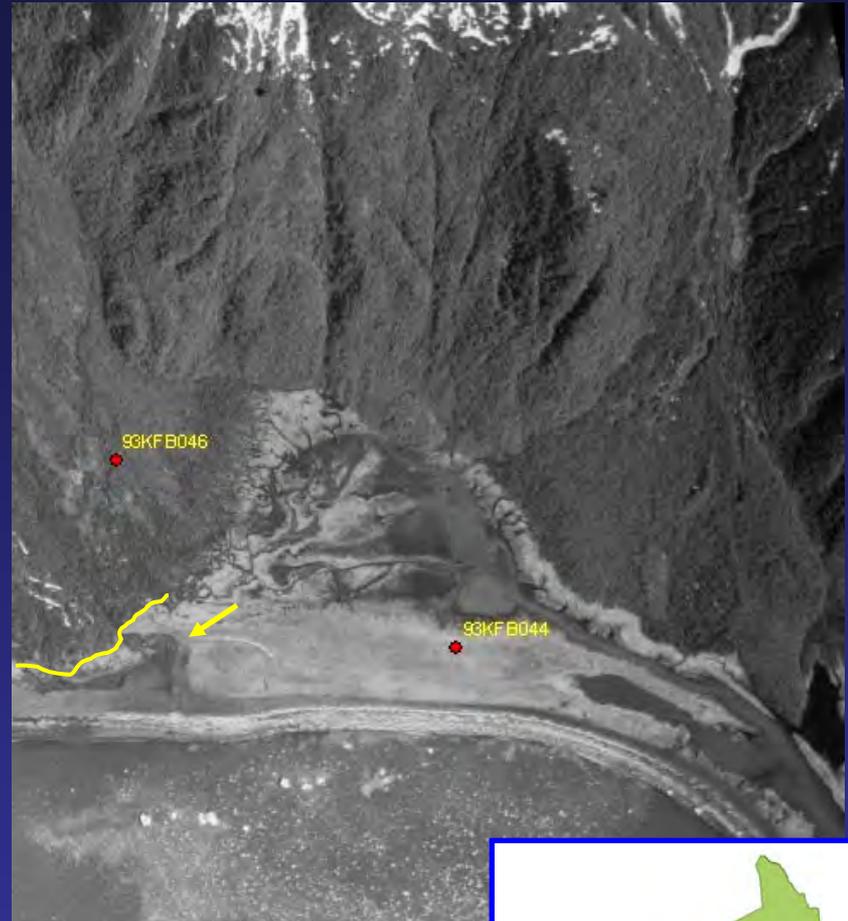
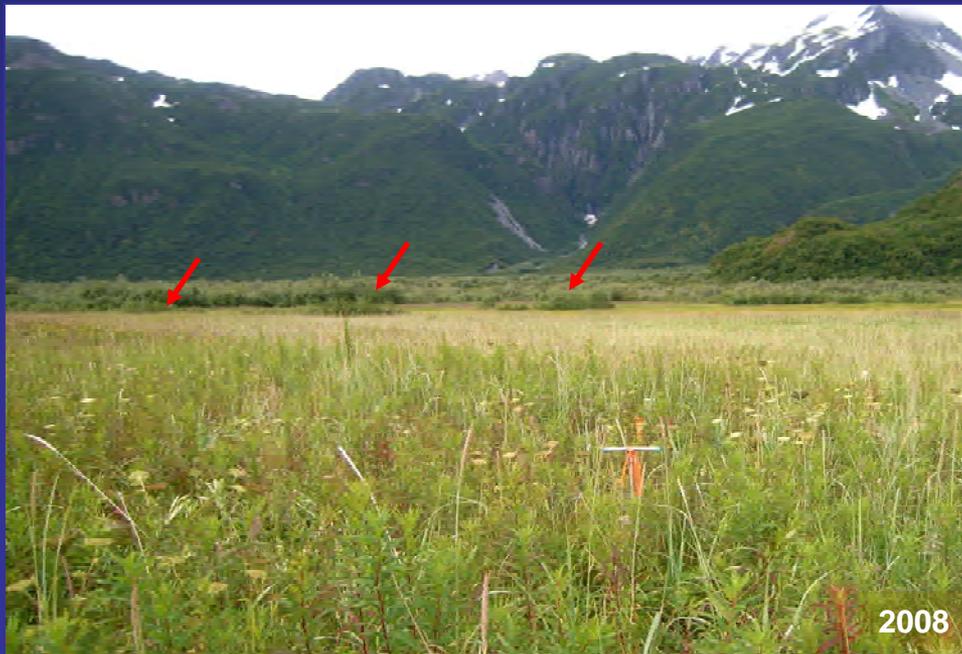
Step 3:

Sites prioritized based on data quality & vegetation class.

Field measurements



- 22 plots relocated & re-measured
- Horizontal accuracy <math>< 5\text{ m}</math> - >50 m
- Forested and non-forested sites



Upper Aialik Bay – KFB044





Thunder Bay – KFB079



1993



2008



Thunder Bay – KFC079



Lower Aialik Bay – KFC048



1993

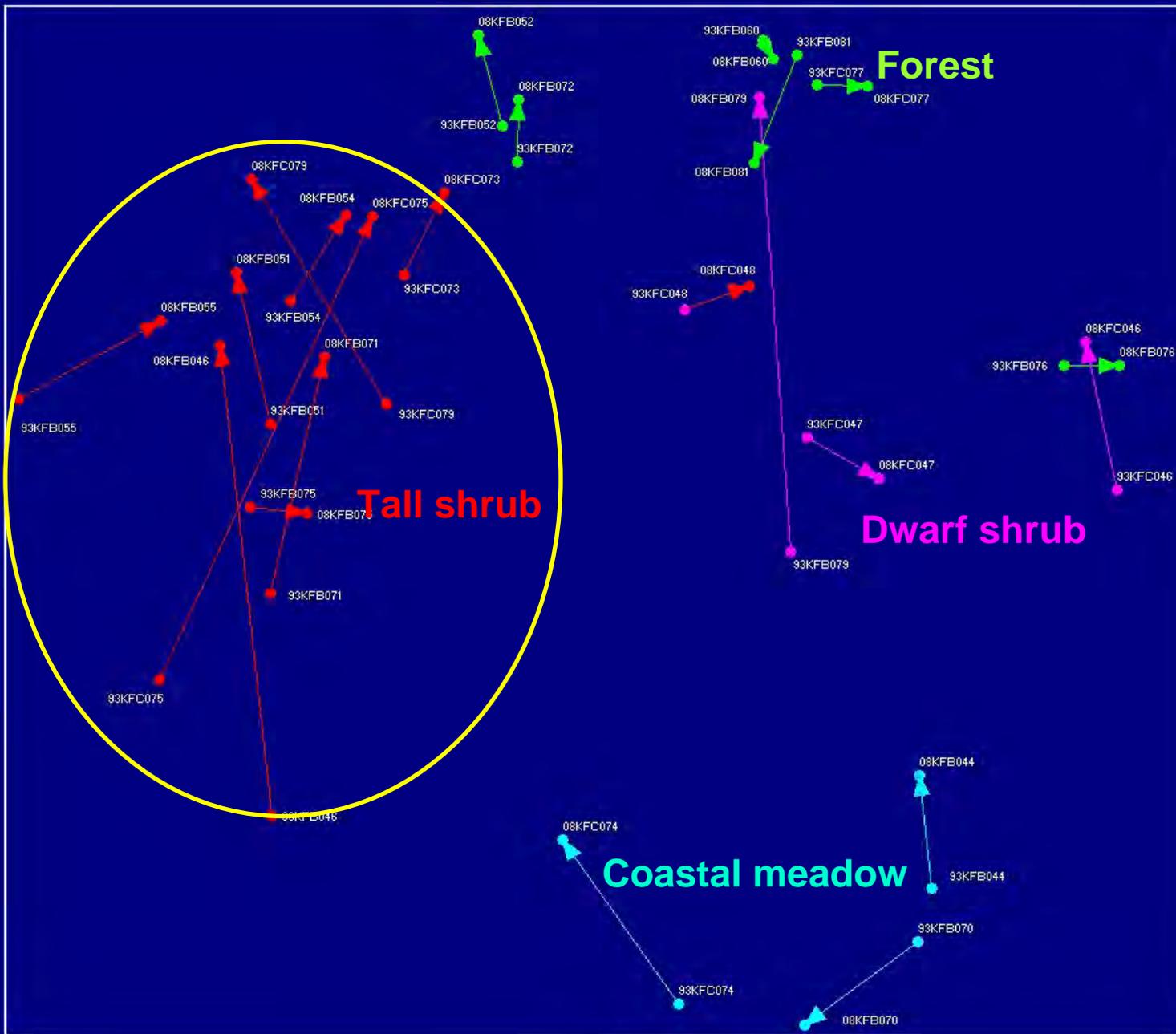


2008



Granite Passage - KFB060

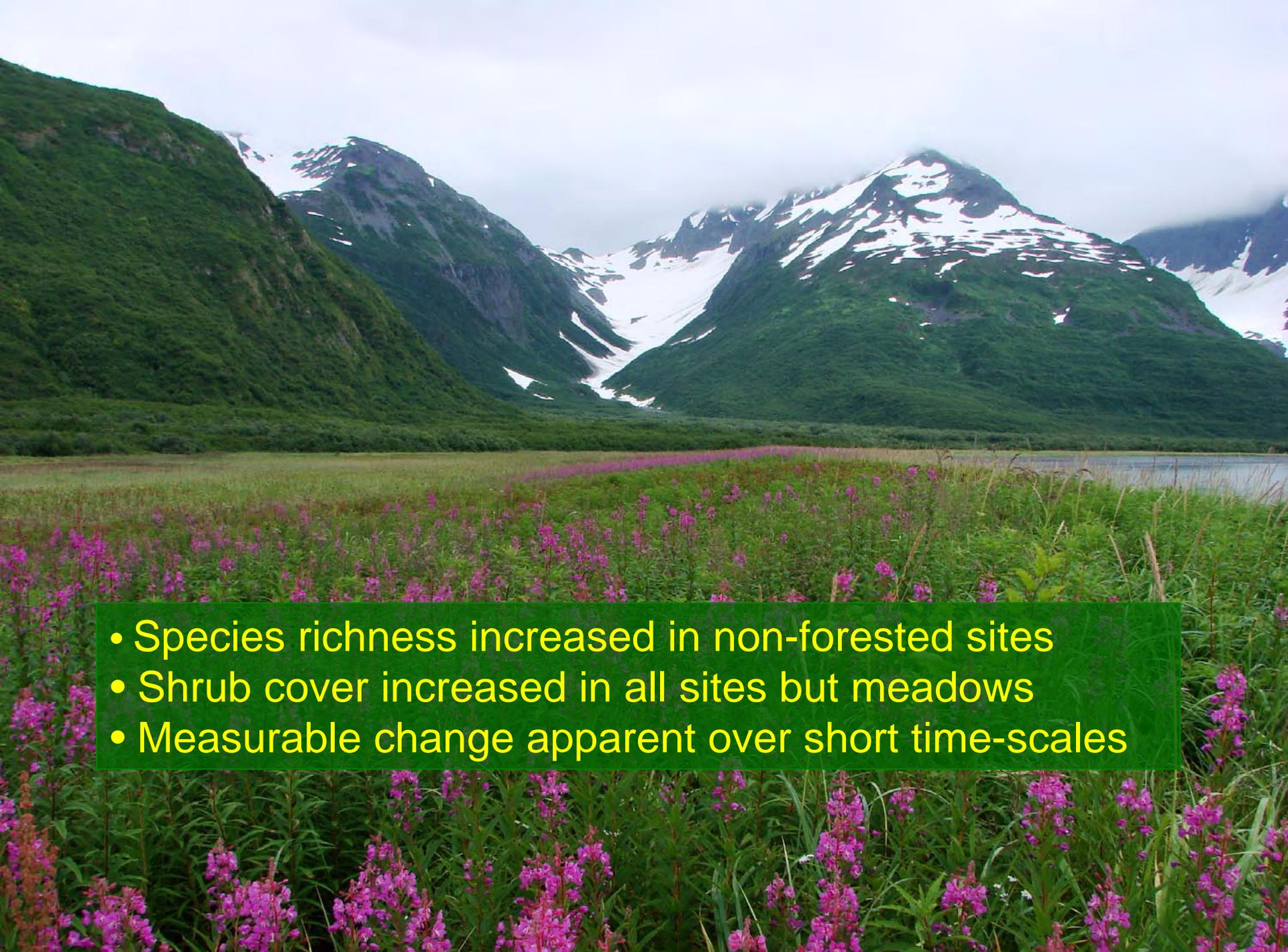
'Successional gradient'



'Soil moisture gradient'

Community-level changes in cover (1993-2008)

	<i>% Change</i>			
	Coastal meadow (n = 3)	Shrub (n = 10)	Dwarf shrub (n = 3)	Forest (n=6)
Species richness	57%	54%	57%	3%
Shrub cover	N/A	5%	7%	16%
Graminoid cover	-21%	-43%	-30%	-44%
Forb cover	583%	5%	113%	27%

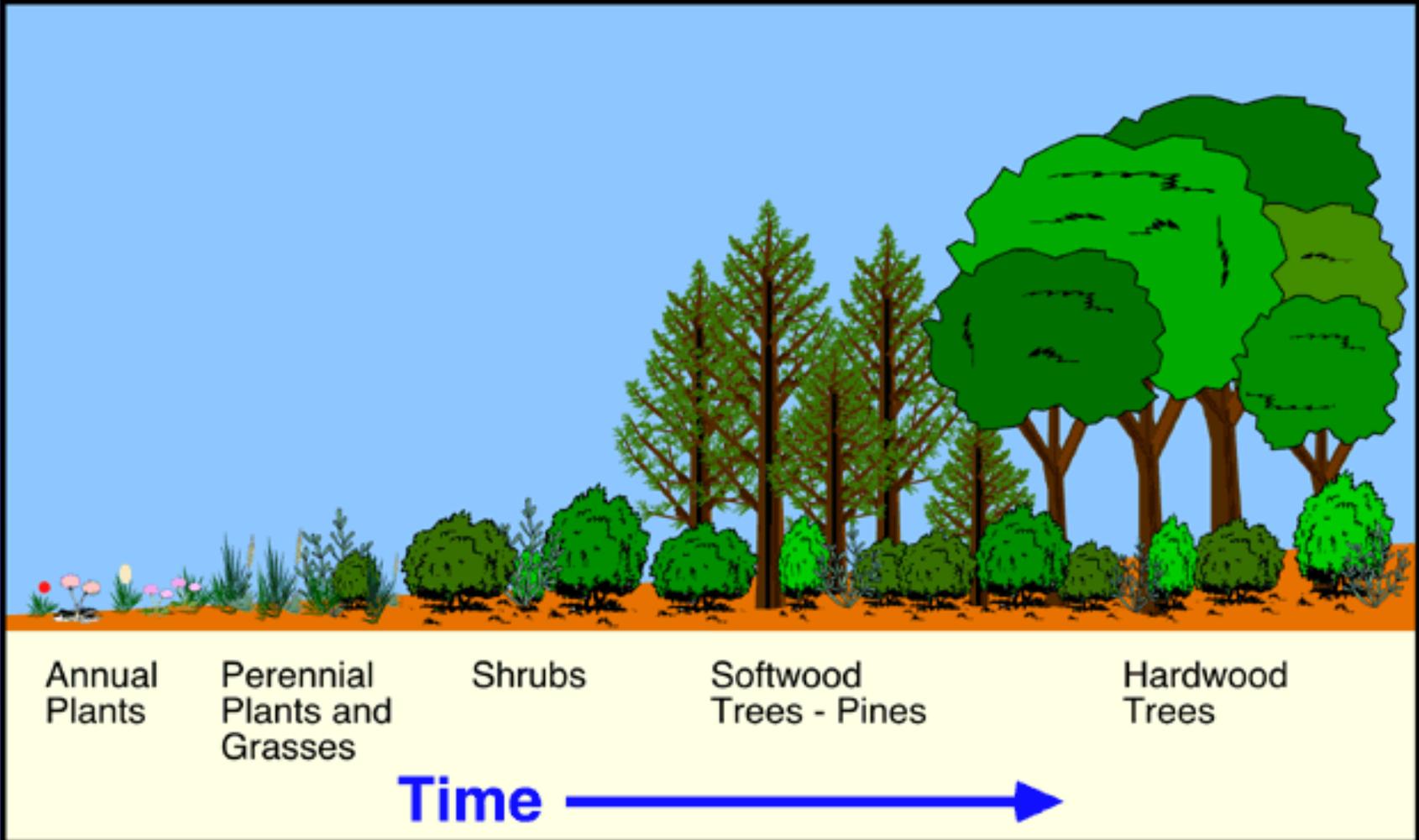


- Species richness increased in non-forested sites
- Shrub cover increased in all sites but meadows
- Measurable change apparent over short time-scales

Preliminary Results

- Air photos (1950-2005) showed landscape-level changes in cover, particularly at younger sites, but not more subtle changes in species composition
- Field measurements (1993-2008) suggested broad-scale increases in shrub cover and species richness

Succession vs. climate effects



THANKS:

Andy Robertson, St. Mary's
University

Rob DeVelice, U.S. Forest
Service, Chugach N.F.

Bill Thompson, Southwest
Alaska Network

Christina Kriedeman

Meg Hahr

Shelley Hall

Kenai Fjords National Park

Keith Boggs, Alaska Natural
Heritage Program

