A Tale of Two Tide Flats

Patterns and Rates of Landscape Change in Salt Marshes in the Lake Clark and Katmai National Parks and Preserves Compared to the Yukon-Kuskokwim Delta

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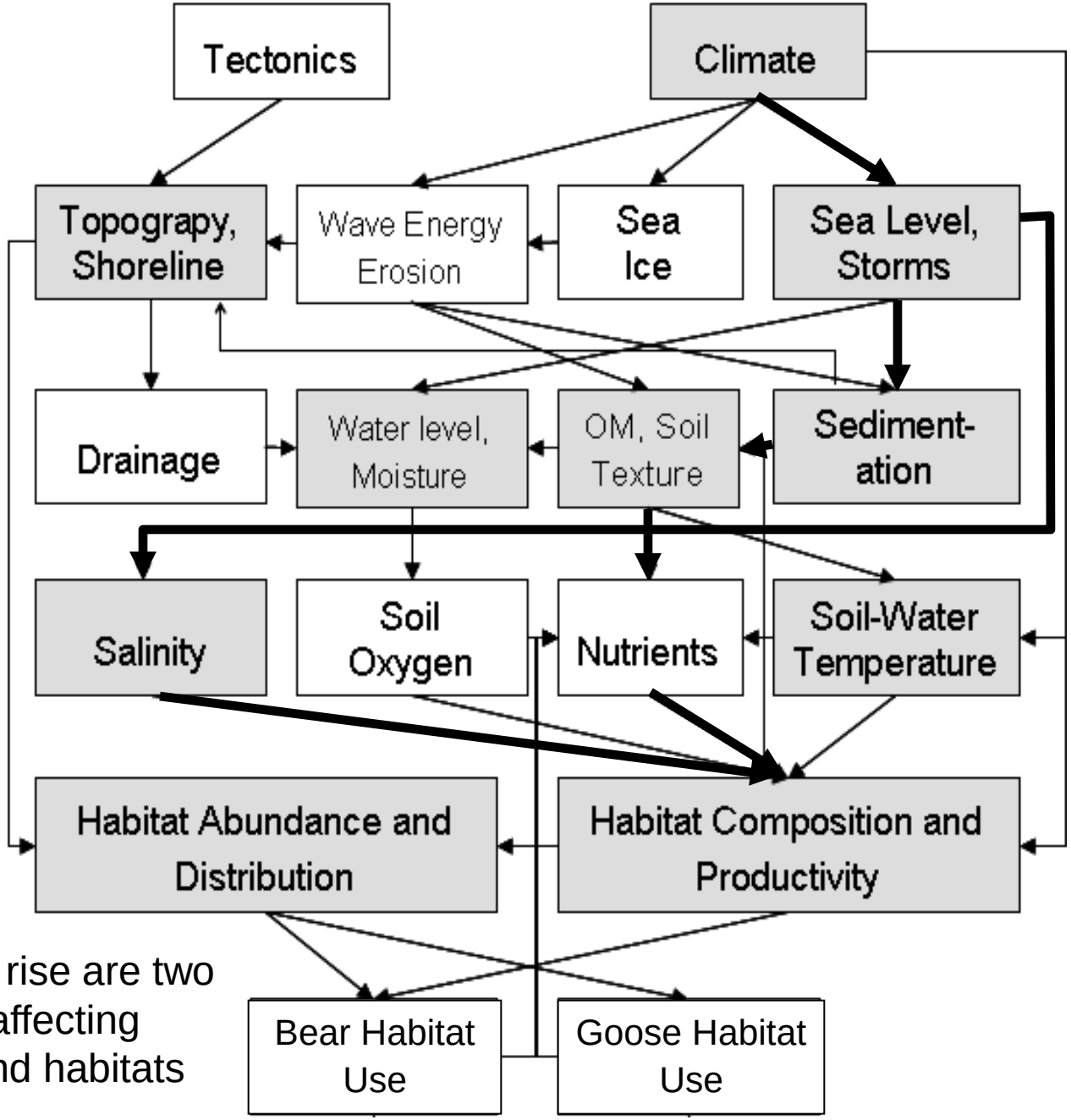
With support from NPS, USFWS, and USGS

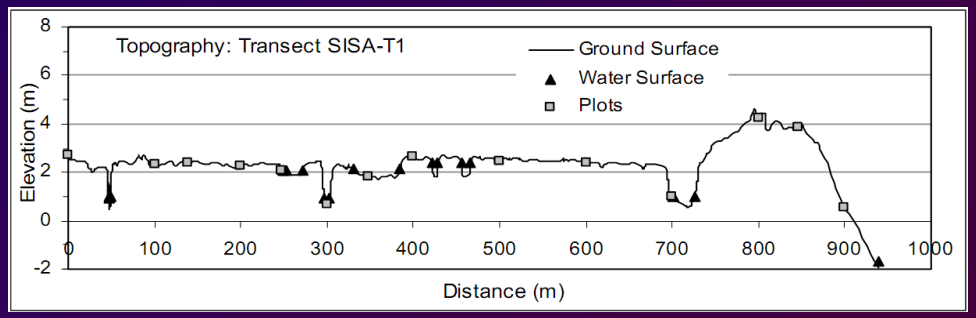
PROCESS MODEL



Storms and sea-level rise are two dominant processes affecting sediments, salinity, and habitats

Monitoring Approach

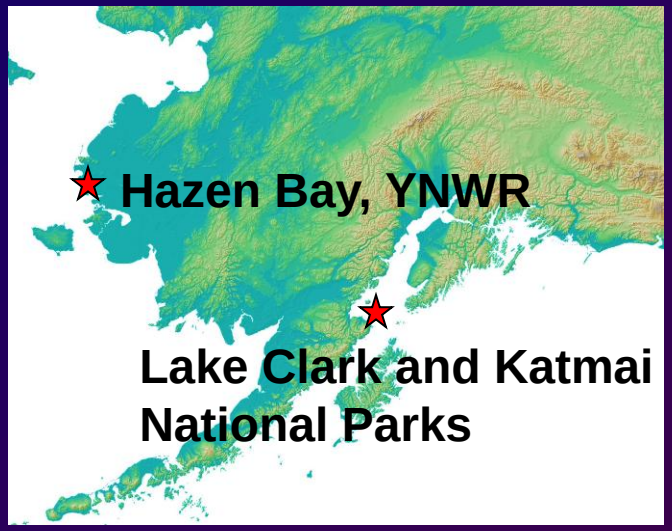
Monitoring Design:
Gradient-oriented sampling
Nested sampling approach
Intensive ground measurements
Remote sensing techniques.

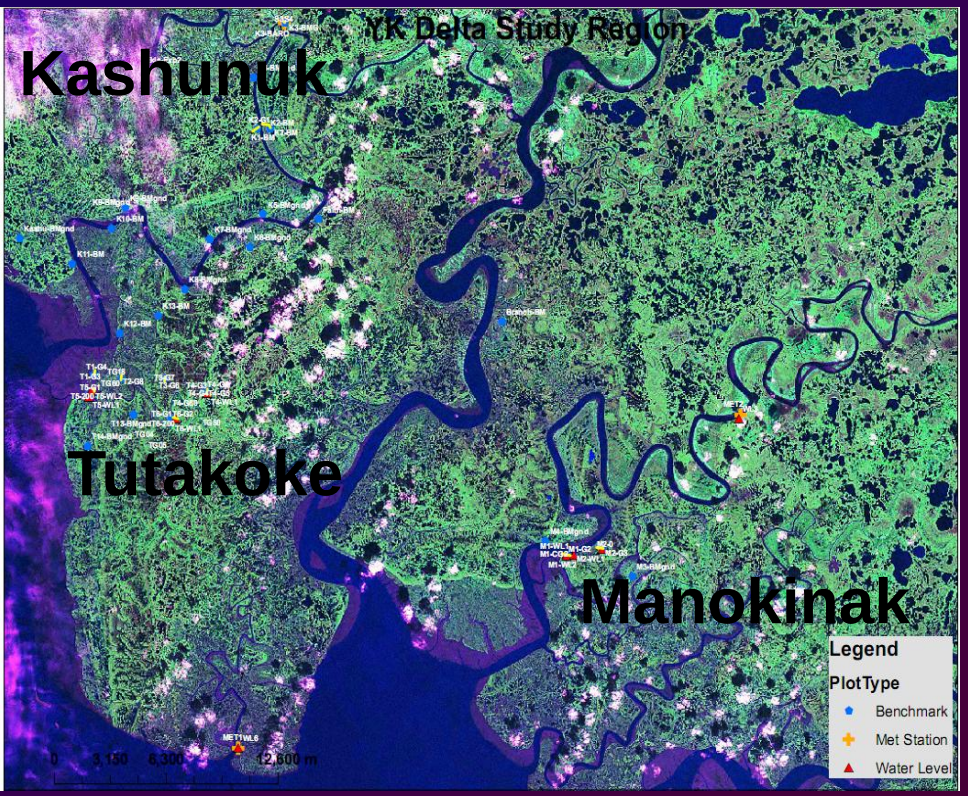


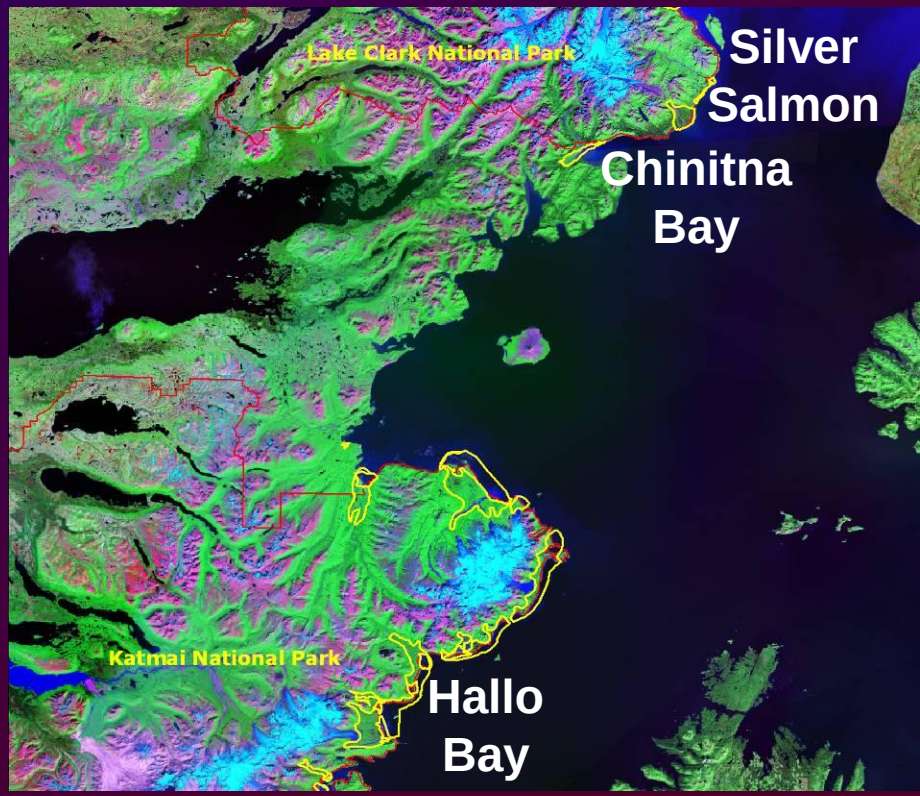
Field Sampling:
Topographic surveys
Vegetation cover
Sediment accumulation
Soil pH and salinity
Water levels
Soil temperatures

Remote sensing:
High-resolution airphotos/satellite images
Point-sampling technique
Photo-interpret vegetation/geomorphology
Changes related to processes

Study Areas


Hazen Bay, YNWR
Lake Clark and Katmai National Parks


YK Delta Study Region
Kashunuk
Tutakoke
Manokinak
Legend
PlotType
Benchmark
Met Station
Water Level

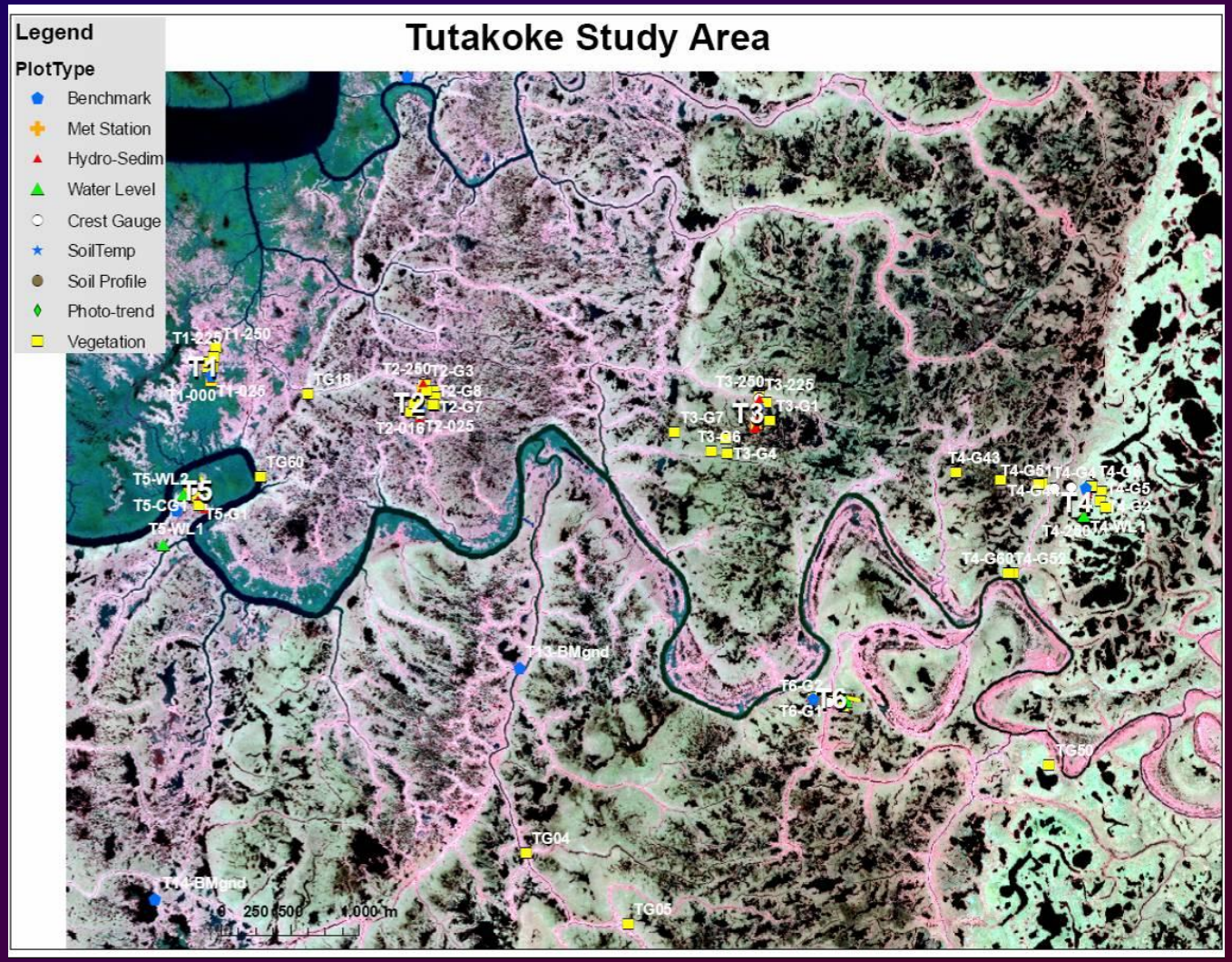

Lake Clark National Park
Silver Salmon
Chinitna Bay
Katmai National Park
Hallo Bay

Field Sampling Design with SWAN Parks

- Three study sreas
- 4 Systematic gradient-oriented transects/ area
- 6-12 plots/ transect (systematic and targeted)

Field Sampling Design in YK Delta

- Three Study Areas
- 2-6 Gradient Oriented Transects / Area
- 3-8 plots/ Transect

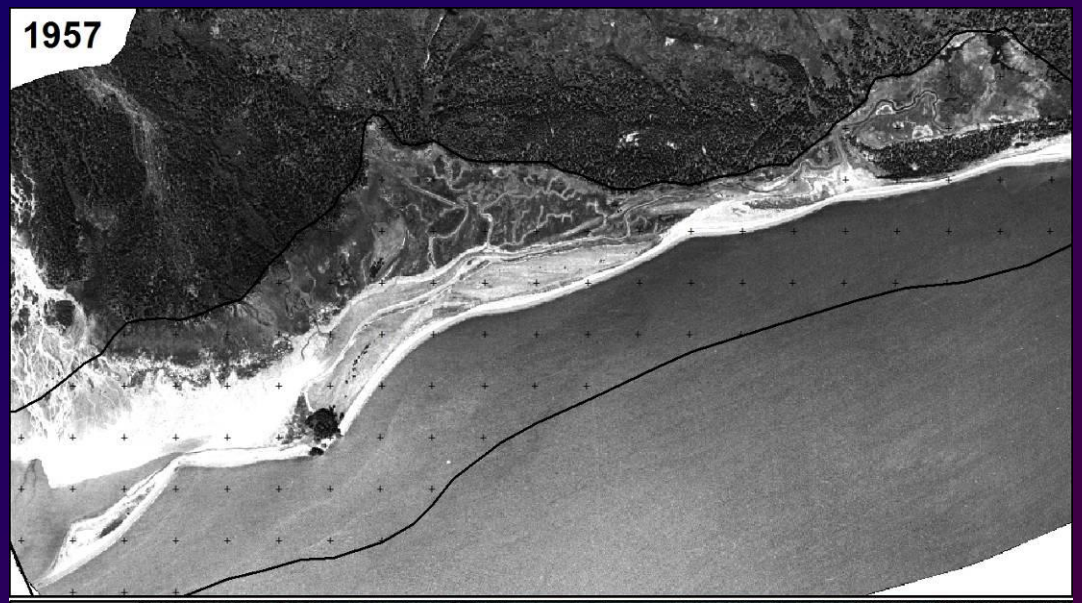


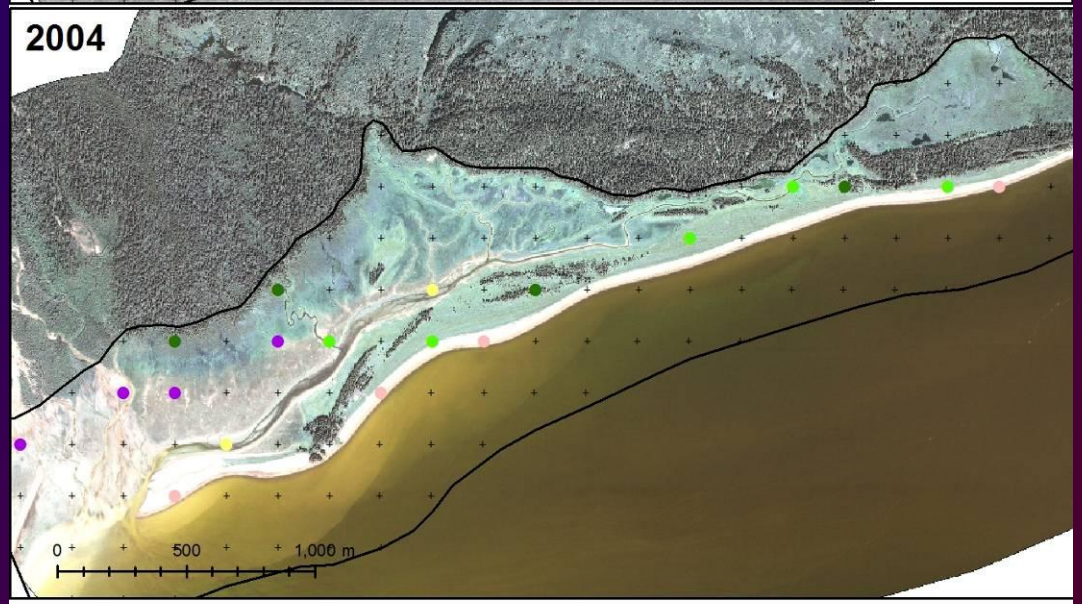
Remote Sensing Techniques for Detecting Change

Across Broader Area and Longer Time Period

- Spectral change between satellite images
- Compare classified satellite images
- NDVI change among satellite images
- Photo-interpreted mapping of vegetation and/or geomorphology polygons
- Photo-interpreted point sampling of vegetation and/or geomorphology
  - (extends record back to 1950s, less intensive than mapping, less sensitive to mis-registration, incorporates both veg and geomorph, dependent on experience of photo-interpreter

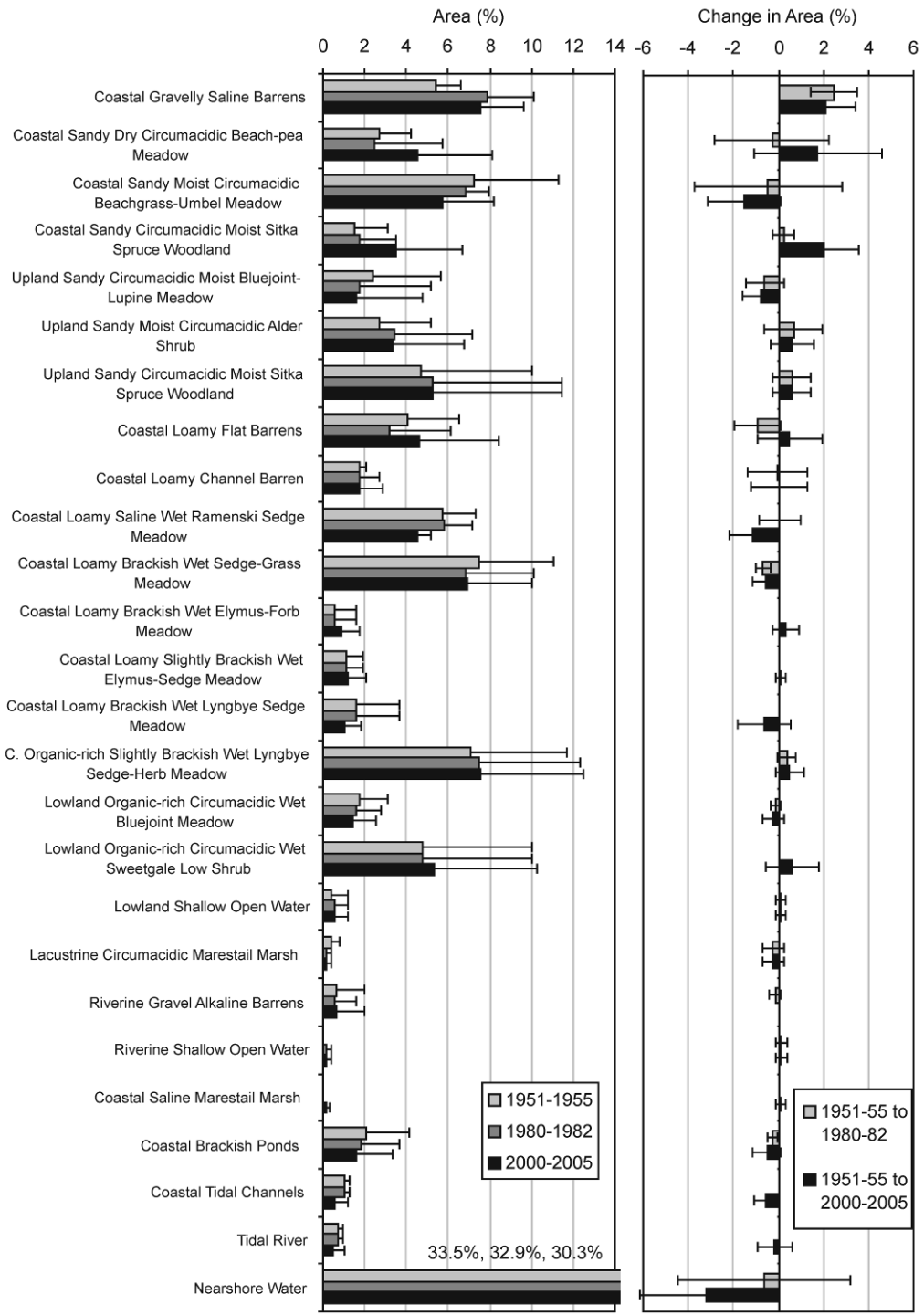
200-m systematic grid





Landscape Changes 1957-2004

none	channel erosion and deposition	sedimentation and succession
shoreline erosion	channel deposition	shoreline deposition-success.
shoreline erosion-deposition	sedimentation	early succession
shoreline deposition	beaver dam	late succession
channel erosion	paludification	



SWAN Ecosystem Change

Coastal Gravelly Barrens

Coastal Beachgrass-Umbel Meadow

Coastal Sitka Spruce Woodland

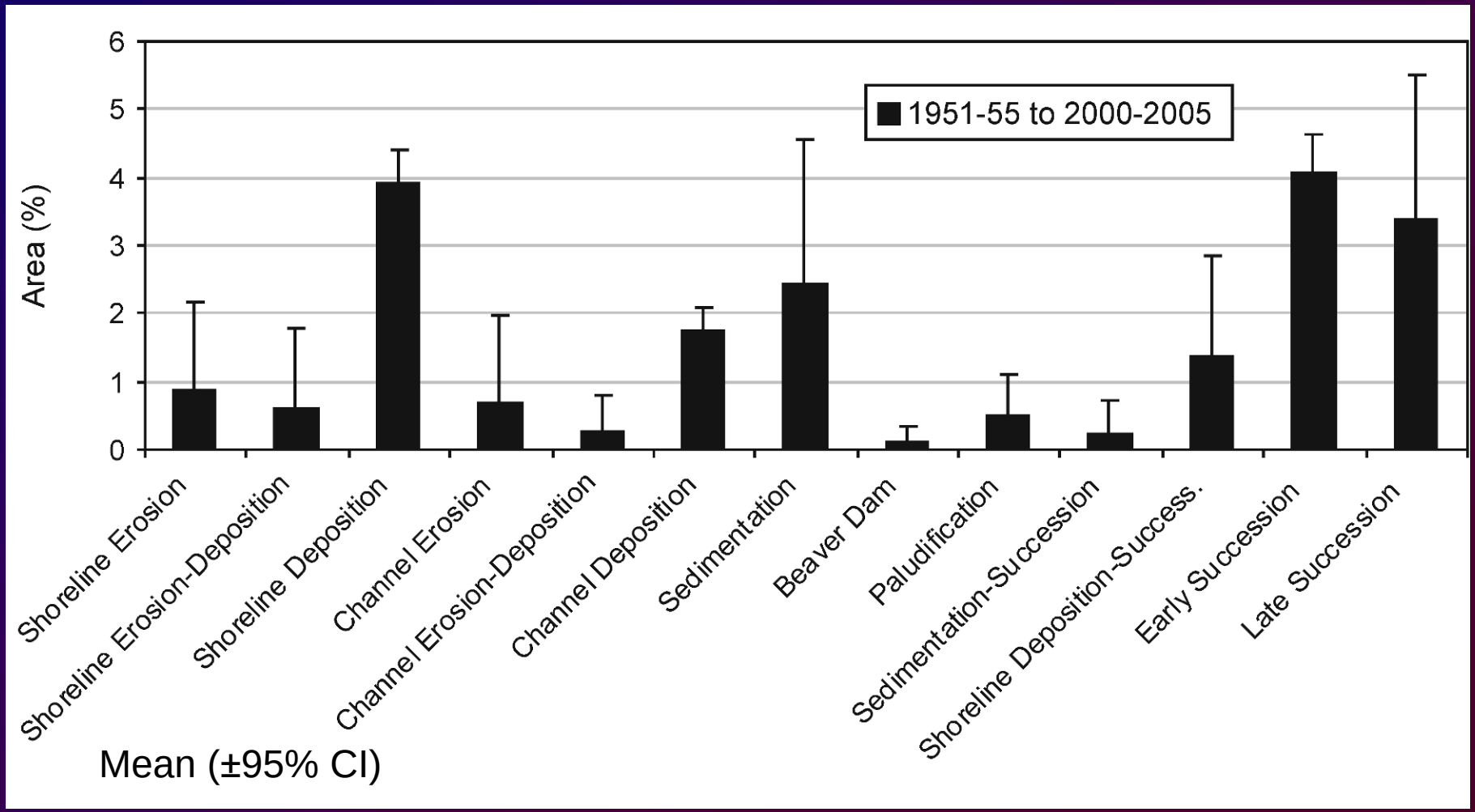
Coastal Wet Ramenskii Meadow

Coastal Brackish Ponds

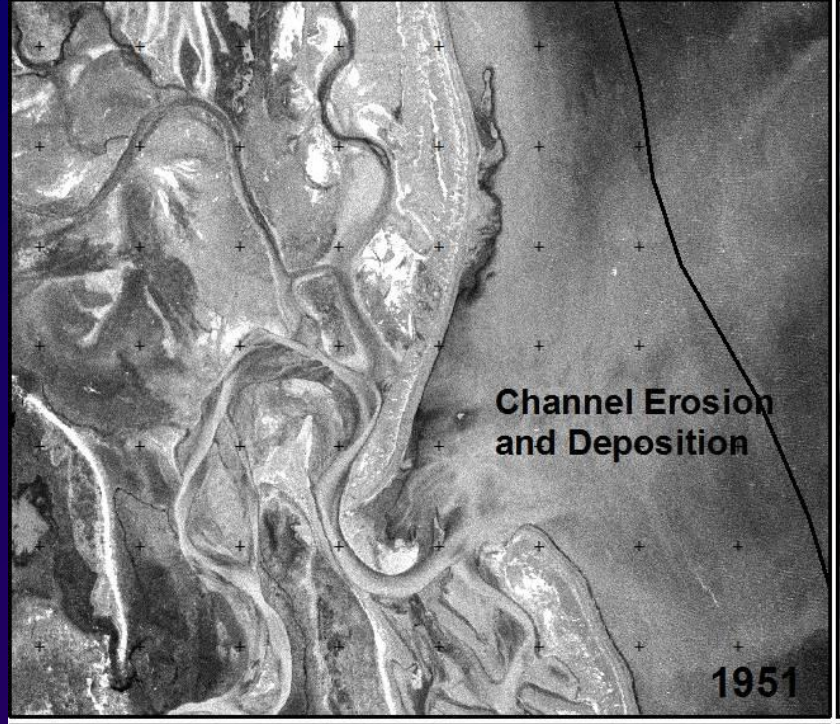
Mean cover across 3 study areas
(+/- 95% CI)

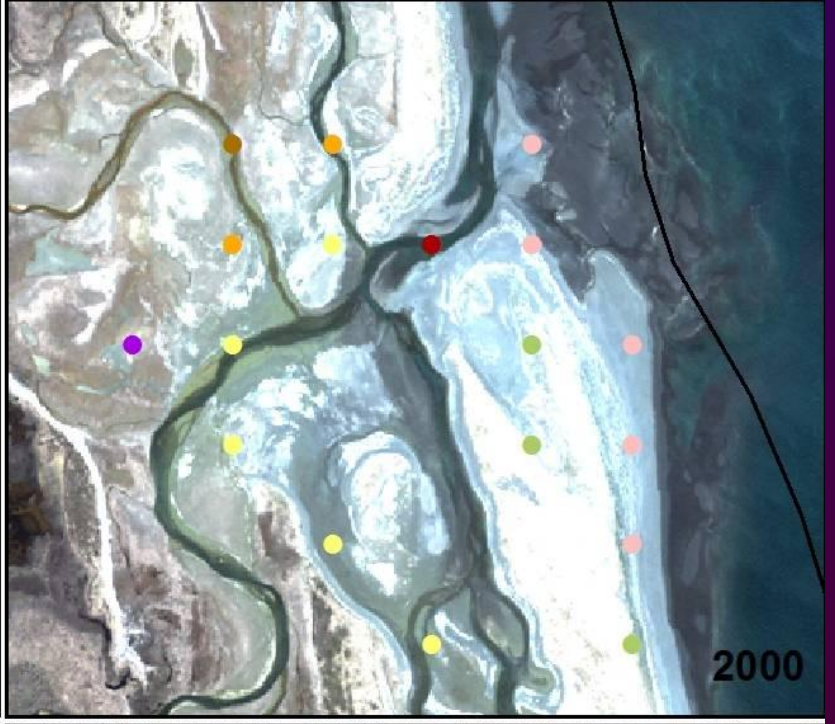
Change Related to Process

Change from one ecosystem type to another is related to a process:
Vegetated ecosystem to Nearshore water is caused by Shoreline erosion
Change from coastal beach meadow to coastal spruce forest is due to succession

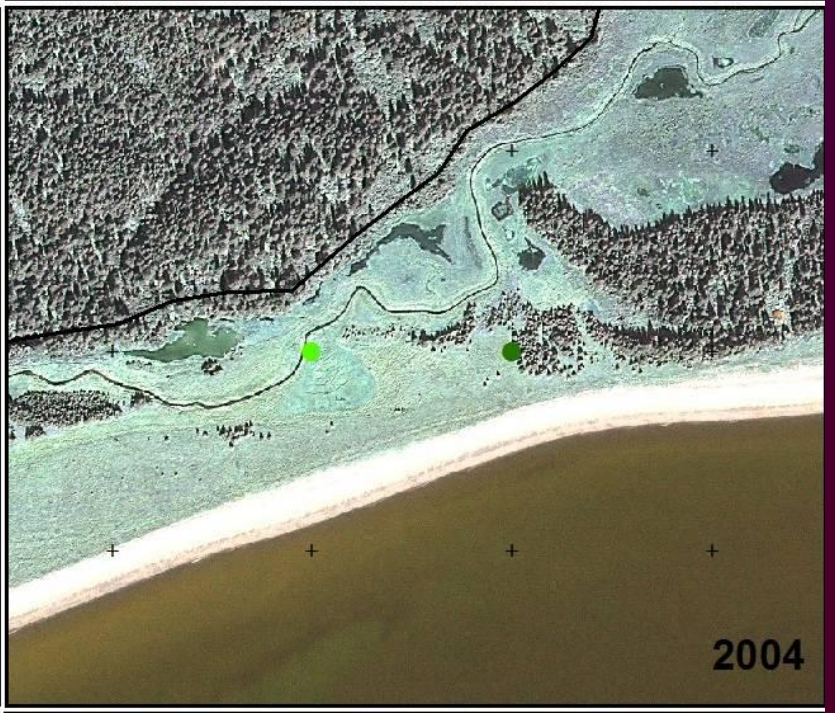


The cumulative change between 1951–1955 and 2007–2008 was 20.5 %


Channel Erosion
and Deposition
1951

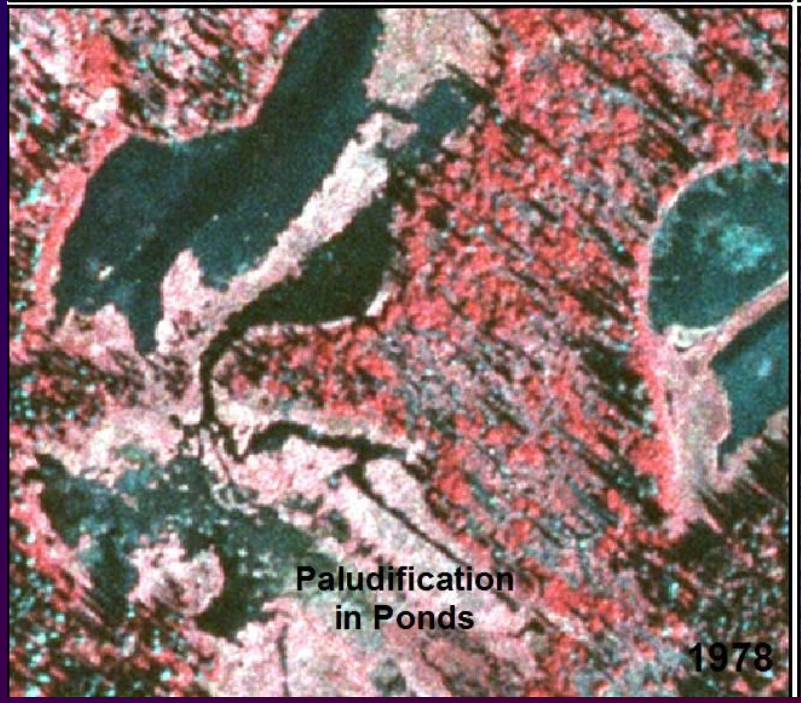

2000


Beach Ridge Overwash
and Shoreline Deposition
1957


2004

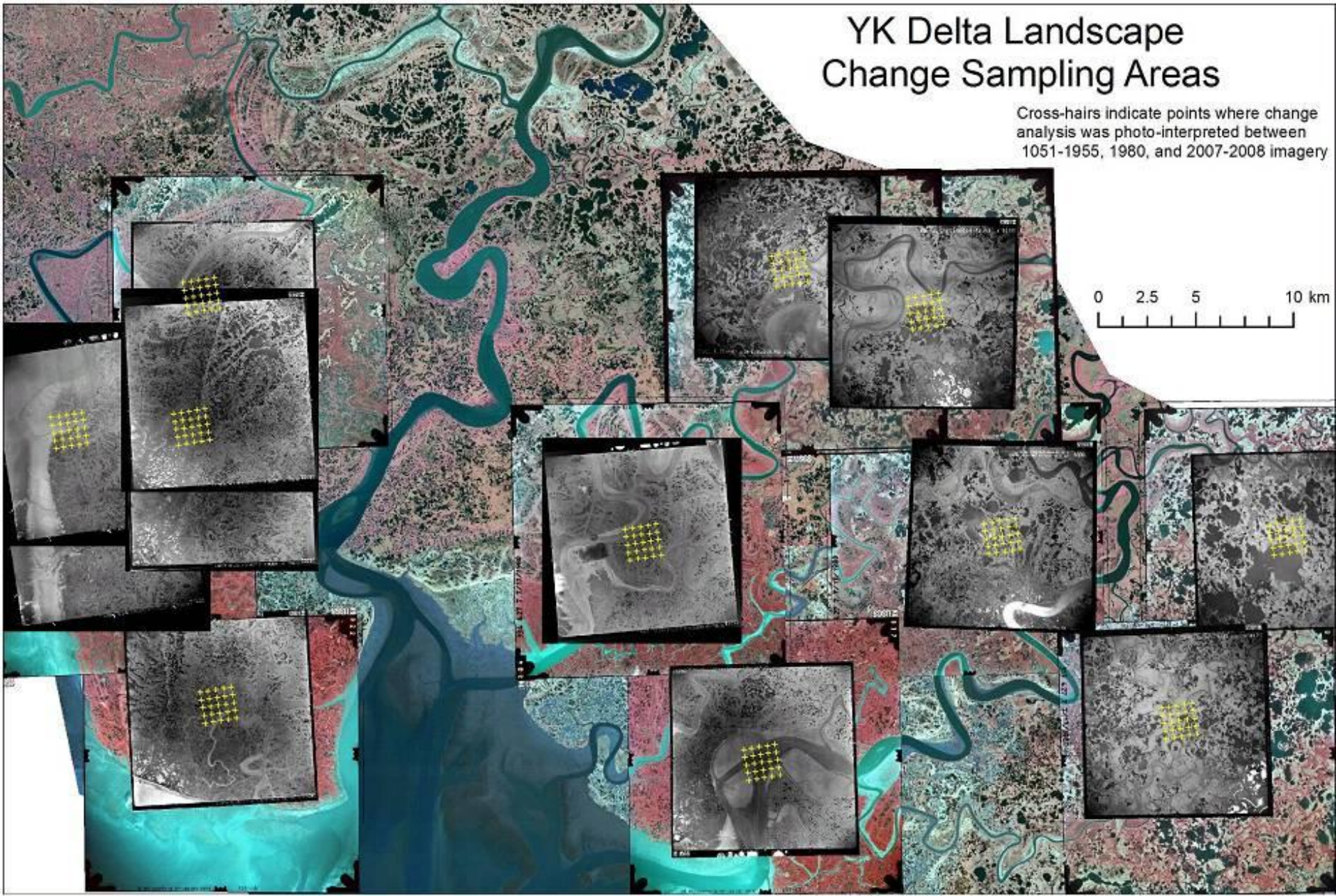

Early Succession
on Tidal Flats
1951

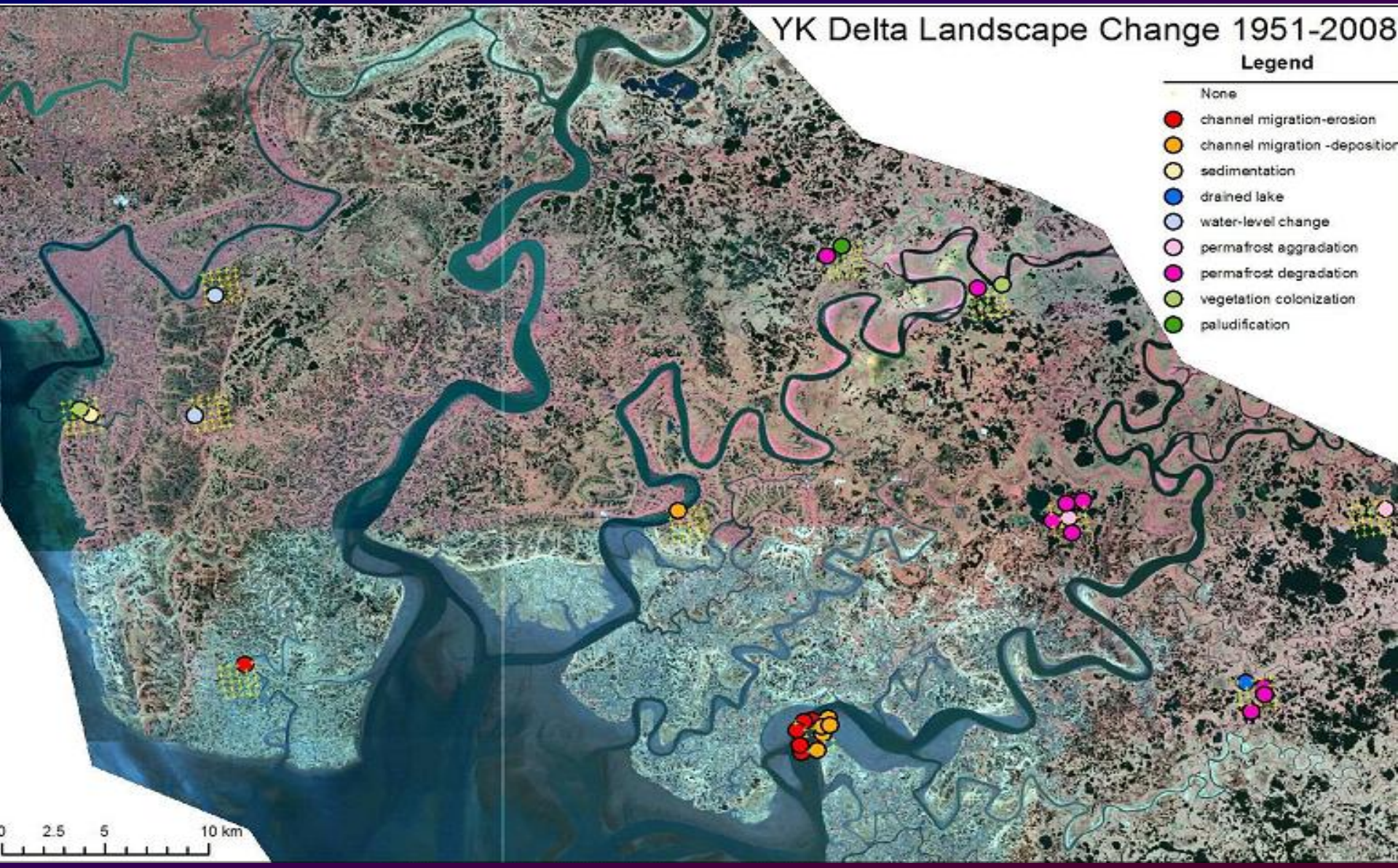

2000


Paludification
in Ponds
1978

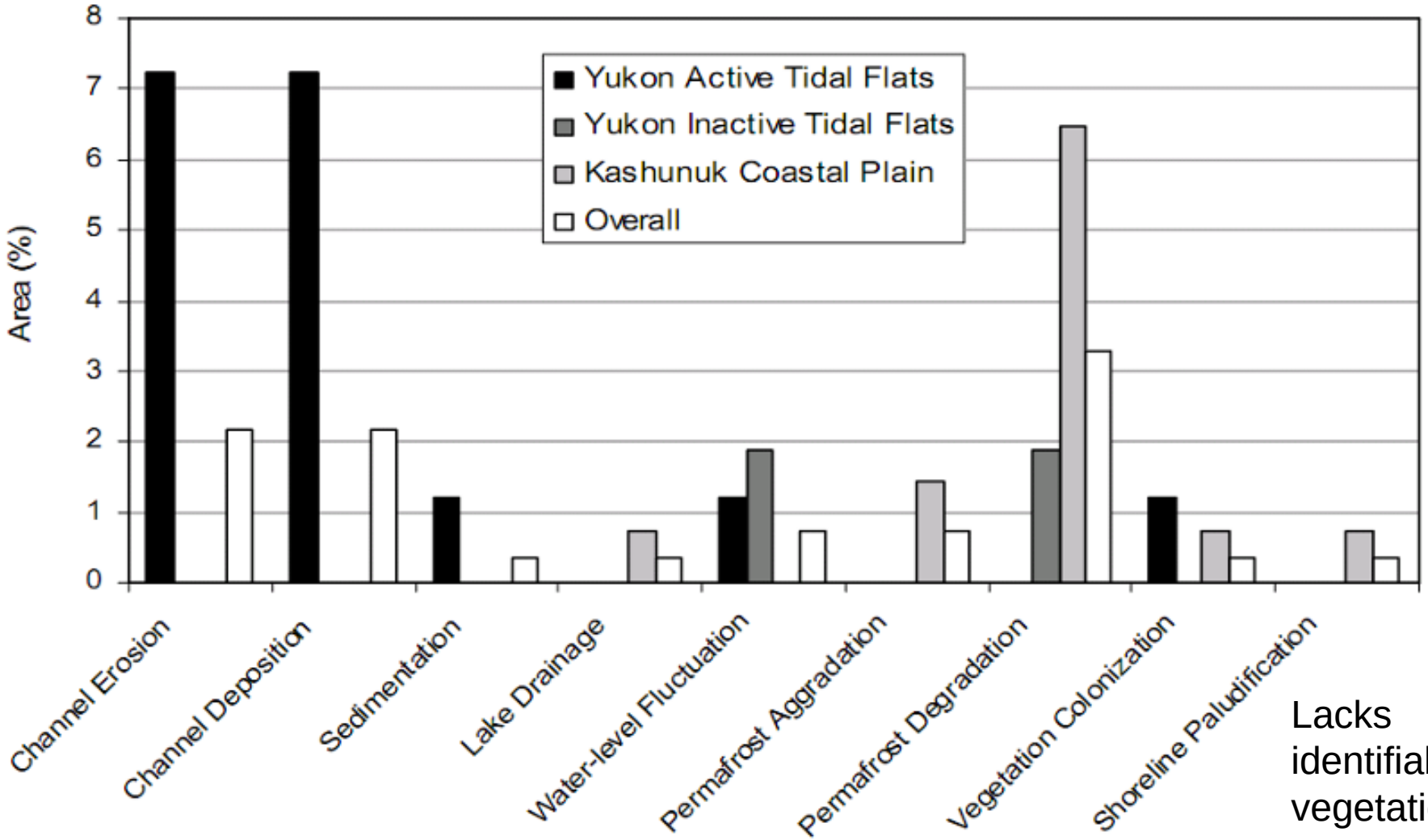

2005

YK Delta Changes Last 50 Years




YK Delta Landscape Change 1951-2008
Legend
None
channel migration-erosion
channel migration -deposition
sedimentation
drained lake
water-level change
permafrost aggradation
permafrost degradation
vegetation colonization
paludification
0
2.5
5
10 km

Extent of Change 1950s -2007



Lacks identifiable vegetation succession

The cumulative change between 1948–1955 and 2007–2008 was 13.5 % ± 4.5%

Salt-Killed Meadows from 2005 Storm

Thermokarst Moat

Conclusion

- Airphoto interpretation extends change detection back ~50 years
- Analysis can detect large structural changes but not subtle shifts in vegetation composition
- For SWAN cumulative change was 20.5%
- For YK Delta cumulative change was 13.5 %
- Change was highly patchy related to site specific disturbance processes.
- Patchiness is a problem for field monitoring: it takes a lot of plots to capture effects of disturbance.