Monitoring and Management in the Peace-Athabasca Delta

Outline

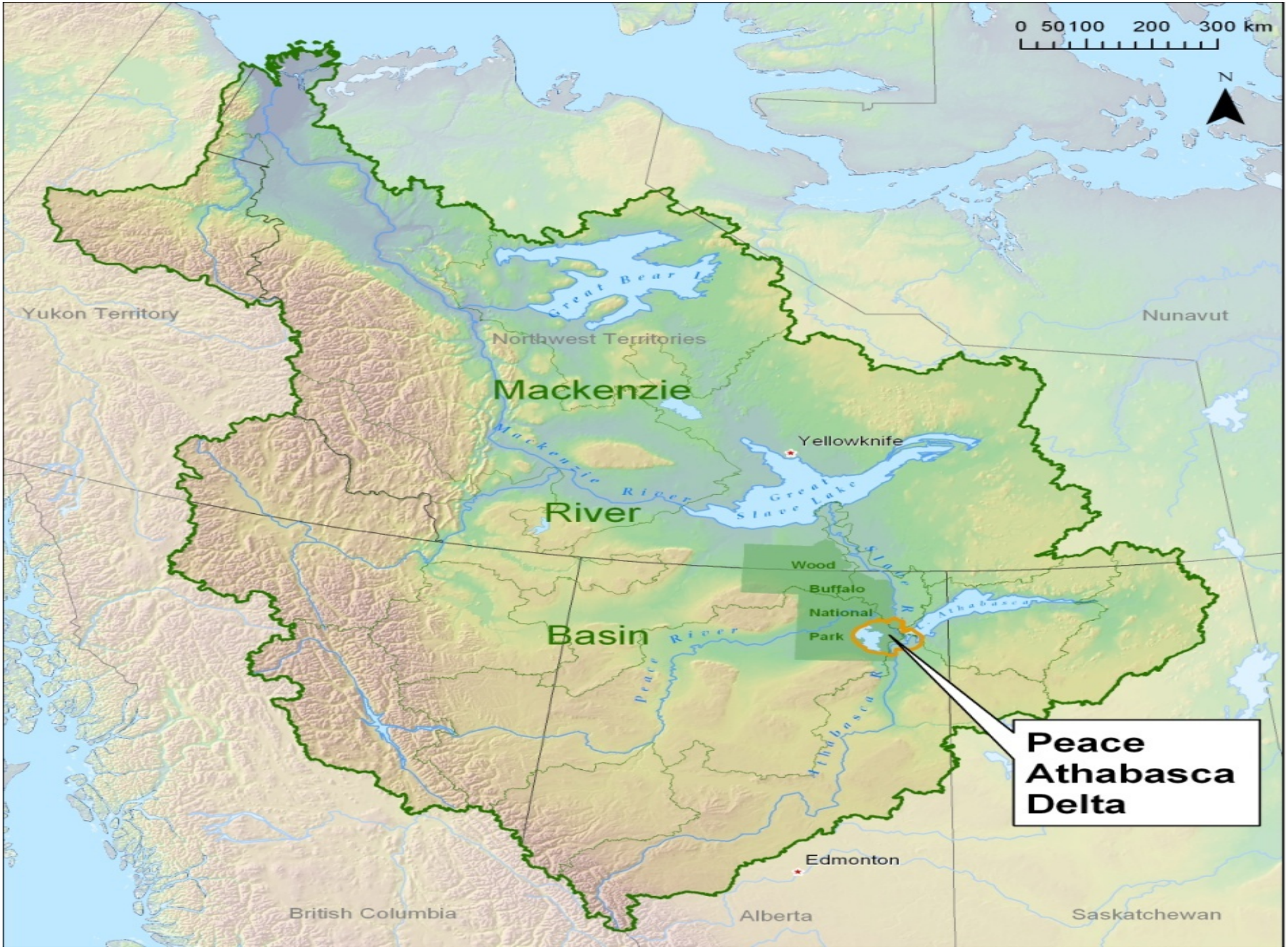
- What makes the Peace-Athabasca Delta unique
- Threats to water quality and quantity
- Monitoring efforts: PADEMP, CBM, ECCC, PARKS, TEK, external research, etc.
- Management strategies: current and future

Wood Buffalo National Park

PATRIMONIO MUNDIAL • WORLD HERITAGE • PATRIMOINE MONDIAL

Peace-Athabasca Delta

Ramsar Wetland of International Importance
(May 24, 1982)


0 50 100 200 300 km
N
Yukon Territory
Northwest Territories
Nunavut
Great Bear L.
Mackenzie
River
Basin
Mackenzie River
Yellowknife
Great Slave Lake
Wood
Buffalo
National
Park
Peace River
Athabasca R.
Lower
Peace
Athabasca
Delta
Edmonton
British Columbia
Alberta
Saskatchewan


Peace
Athabasca
Delta
Mackenzie R.
Great Slave Lake
Yukon Territory
Slave R.
Basin
Slave R.
Athabasca
Fond du Lac R.
Saskatchewan
Birch R.
Lake Athabasca Basin
Peace River Basin
W.A.C.
Bennett
N
0
100
200
400 Km

“The Peace-Athabasca Delta is a clear example where cumulative effects have generated ecological change on a landscape scale”

Mackenzie River Basin Board

Issues Update, 2012

Joint Canada - Alberta OS Monitoring Plan

Peace River WPAC

Slave River and Delta Partnership

University of Waterloo

WBNP Ecological Integrity Monitoring

Alberta Biodiversity Monitoring Institute

USGS

ECCC

Lower Athabasca R. Water Management Framework

MCFN / ACFN CBM Program

Gov't of Alberta

Stanford University

Lower Athabasca Regional Plan

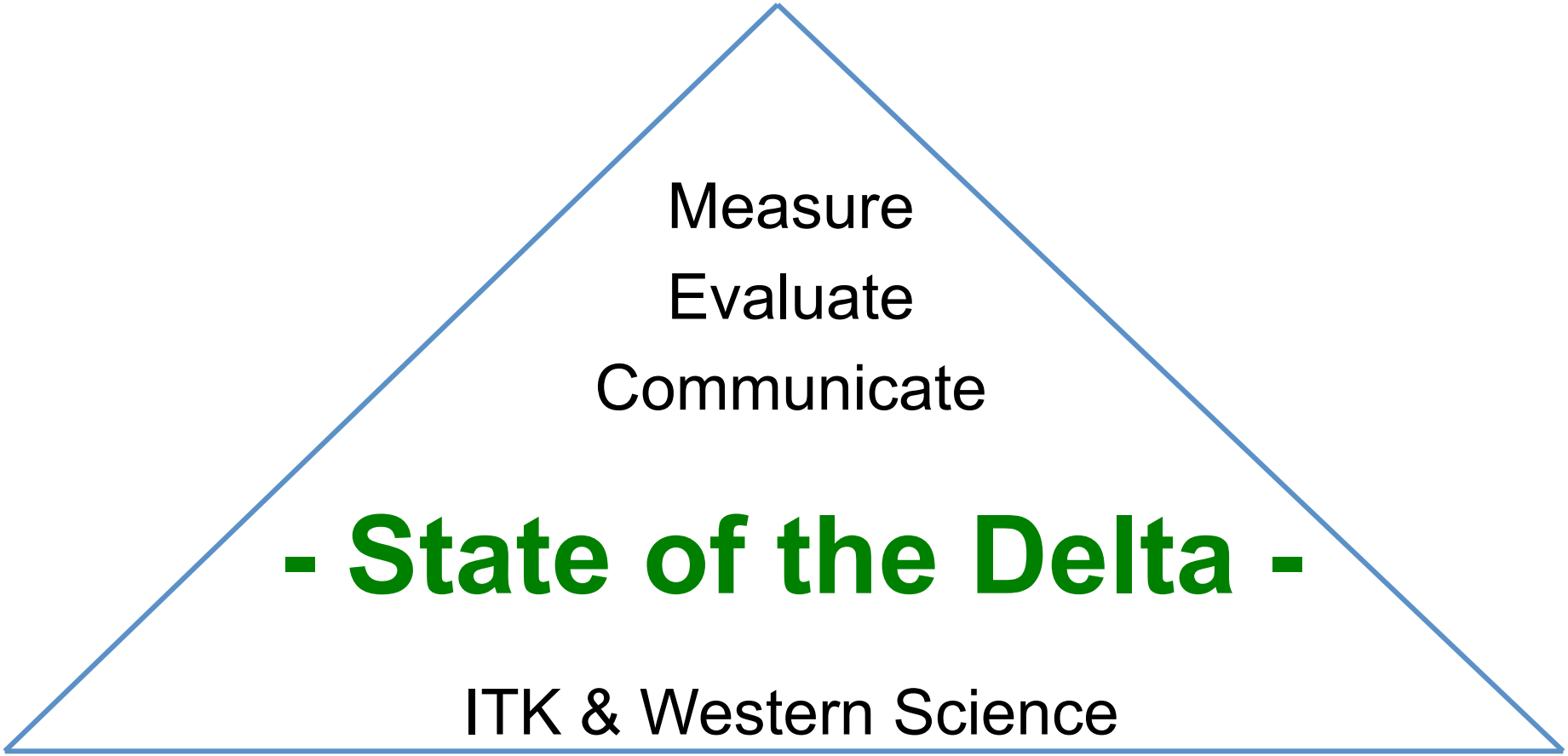
NASA SWOT Mission

Athabasca River WPAC


Wetland Health
Contaminants in birds and amphibians
Contaminants in Harvested Wildlife
"First Nation drops out of 'frustrating' oil-sands monitoring talks"
Globe and Mail – October, 2014
Water Quality
Air Quality
Fish Health

Who is PADEMP?

PADEMP Mandate



PEACE-ATHABASCA DELTA ECOLOGICAL MONITORING PROGRAM

Peace-Athabasca Delta Ecological Monitoring Program (PADEMP)

PEACE-ATHABASCA DELTA: AN ECOSYSTEM AT RISK

"The Peace-Athabasca Delta is a clear example where cumulative effects

Ramsar

LOCATE US

What's New

SEARCH PADEMP

WBNP Ecological Integrity Monitoring

3 indicator ecosystems, with 5 measures each

Forest	Freshwater	Wetland
Landscape change	River water quality	Water extent in the PAD
Wolves relative abundance	River discharge	Waterbird and amphibian status
Bird community	Ice phenology	Muskrat abundance
Snowshoe hare	Freshwater macroinvertebrates	Bison productivity & abundance
Plant productivity and growing season change	Contaminants in colonial waterbird eggs	Vegetation change in the PAD

The Mighty Muskrat – An Ecological and Cultural Keystone Species

- **How is muskrat abundance changing over time?**
- **How is muskrat habitat changing over time (water levels, vegetation)?**
- **Are contaminants affecting muskrat / habitat?**
- **Are muskrat safe to eat?**

Muskrat Monitoring

Understanding the decline of muskrat in the PAD

Muskrat abundance is a good indicator of delta ecosystem health. Muskrats play a key cultural and ecological role in the delta, are common in wetlands, and are sensitive to changing water levels. Traditional Knowledge Holders say many basins are now empty of muskrats.

In 2012, community members and Knowledge Holders from Fort Chipewyan identified important questions they have been working with PADEMP to answer:

- How is the relative abundance of muskrat changing over time?
- Is there a difference in muskrat abundance between basins receiving water from the Athabasca River and those that do not?
- How long does it take muskrats to re-establish after average to above-average snowfall years, or after floods?
- Is there a difference in water quality between productive and unproductive basins?

David Campbell, left, Archie Antoine and Ross Campbell pose with a huge rat house in the delta.

How are we doing it?

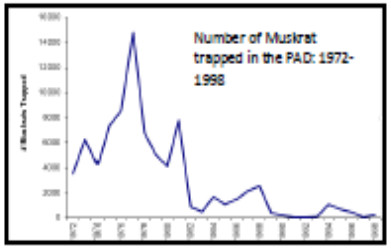
Ground Survey:

Trappers and land-users began by identifying basins where muskrat used to be abundant, and where trappers used to find muskrat. Field crews go out by snowmobile to count active muskrat houses and pushups at the same basins twice every year: in early winter and late winter. This gives us an idea of how many muskrats there are and how many are able to survive the winter. While we're at the basins, we measure snow depth, ice thickness, water depth, and vegetation composition of houses and pushups.

Aerial Survey:

Every year, Parks Canada and community observers fly over the same set of muskrat basins. They count muskrat houses and pushups from air in late winter to estimate changes in muskrat abundance over time.

Findings so far...



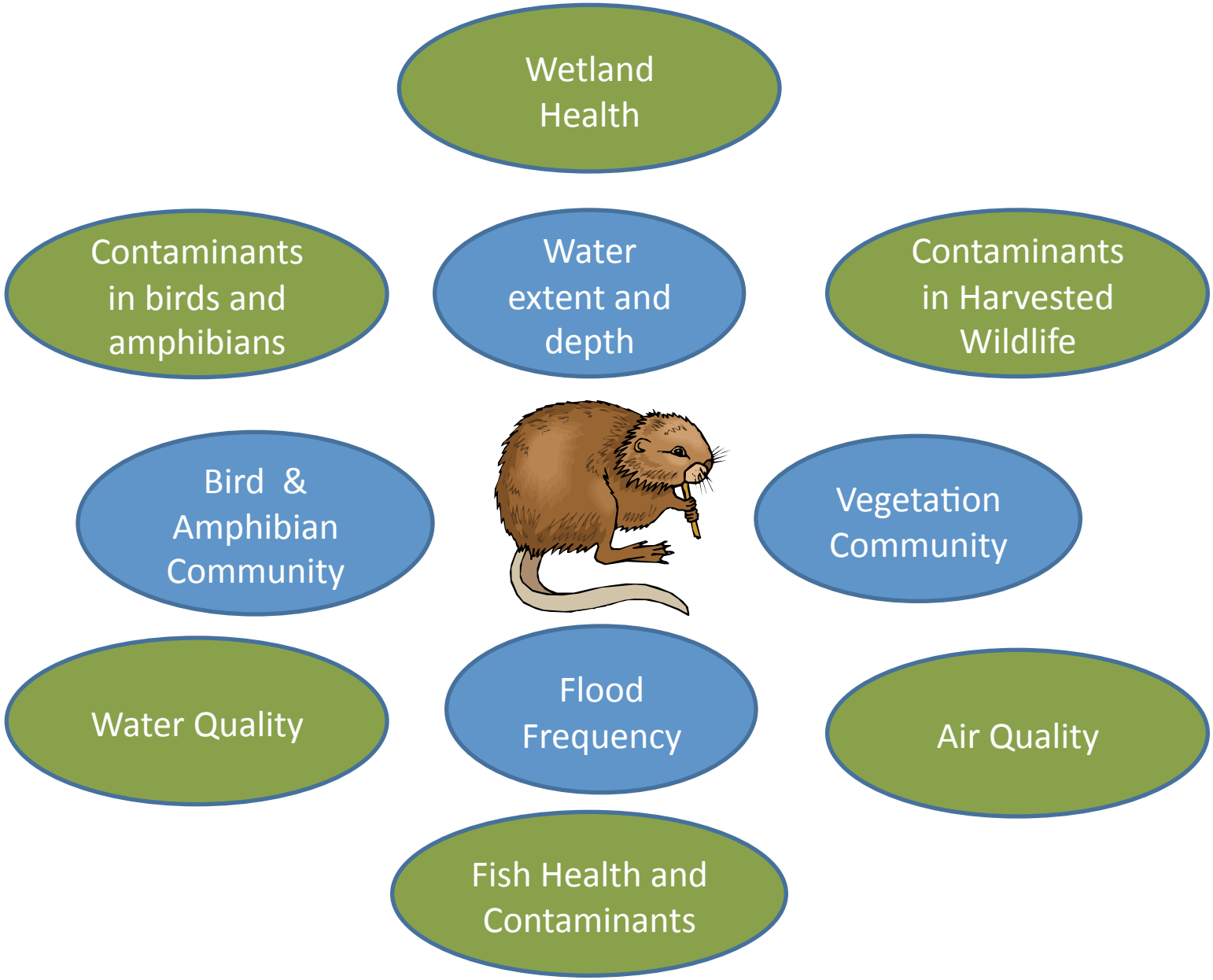
In January 2014 we observed muskrat activity in four areas. Muskrat numbers were higher than in 2013, as were water and ice levels. Basins with muskrat had slightly more water and ice than basins without muskrat. This shows that water levels are an important factor in determining which basins can support muskrat in the PAD.

What's next?

1) Our muskrat study is in its third year, but we know from talking to elders that muskrat numbers used to be much, much higher in the delta. Is it possible to translate this knowledge into a traditional baseline for muskrat numbers in the PAD?

2) In 2014, water levels were higher in the PAD than they have been since the floods of 1997. Some basins that have been dry for decades received flood water. Will numbers of muskrat increase after the 2014 flood?

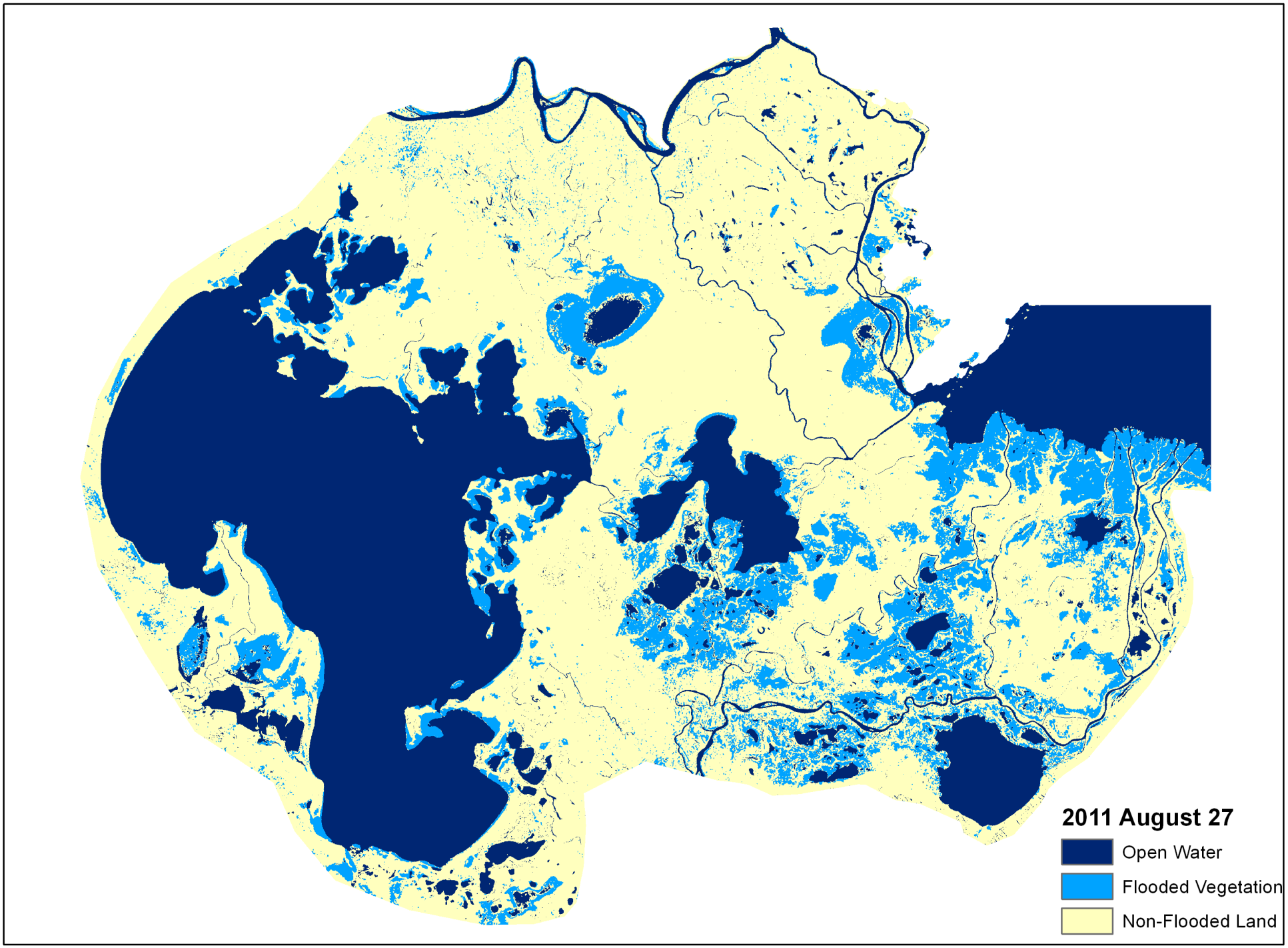
3) Involving youth in the muskrat study would help connect youth and elders on the land. In 2014/2015, we hope to have one youth from the community join each ground survey team.


Wetland Health
Contaminants in birds and amphibians
Water extent and depth
Contaminants in Harvested Wildlife
Bird & Amphibian Community
Vegetation Community
Water Quality
Flood Frequency
Air Quality
Fish Health and Contaminants

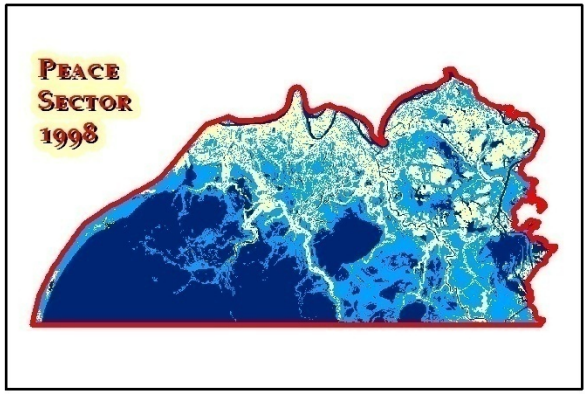
The delta is a flood dependent ecosystem.

Regular flooding from the **Peace and Athabasca Rivers** is required to maintain productive wetland habitat.

When floods are less frequent, wetlands in the delta start to disappear.

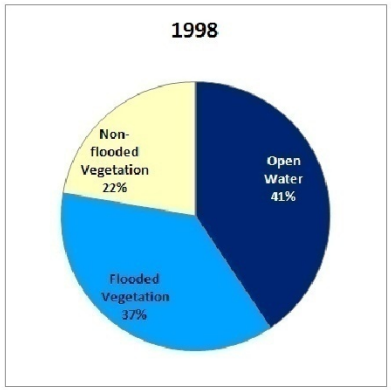

2011 August 27
Open Water
Flooded Vegetation
Non-Flooded Land

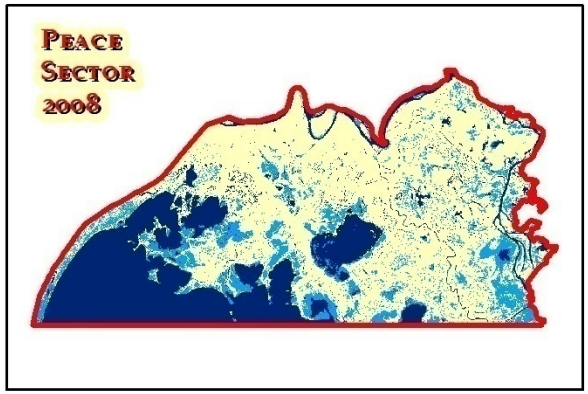
Peace Sector Flood Images



1998

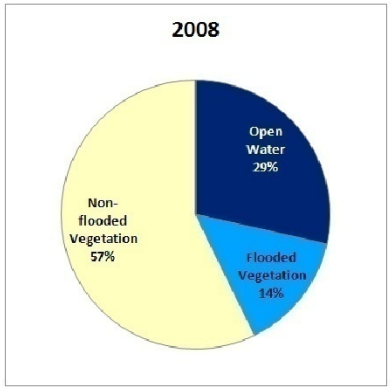
Open Water	41%
Flooded Vegetation	37%
Non-flooded Vegetation	22%

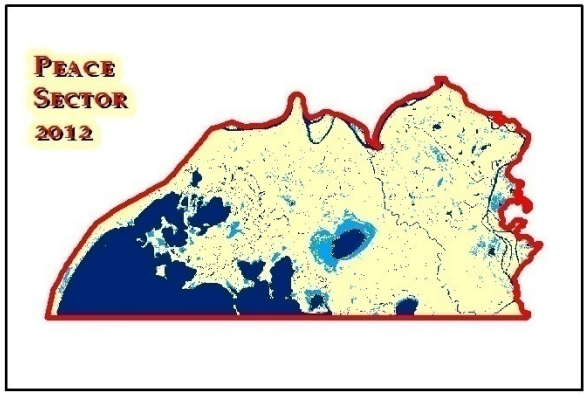




2008

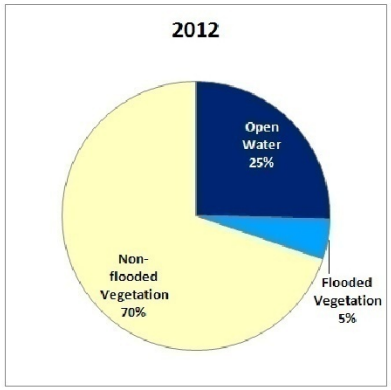
Open Water	29%
Flooded Vegetation	14%
Non-flooded Vegetation	57%



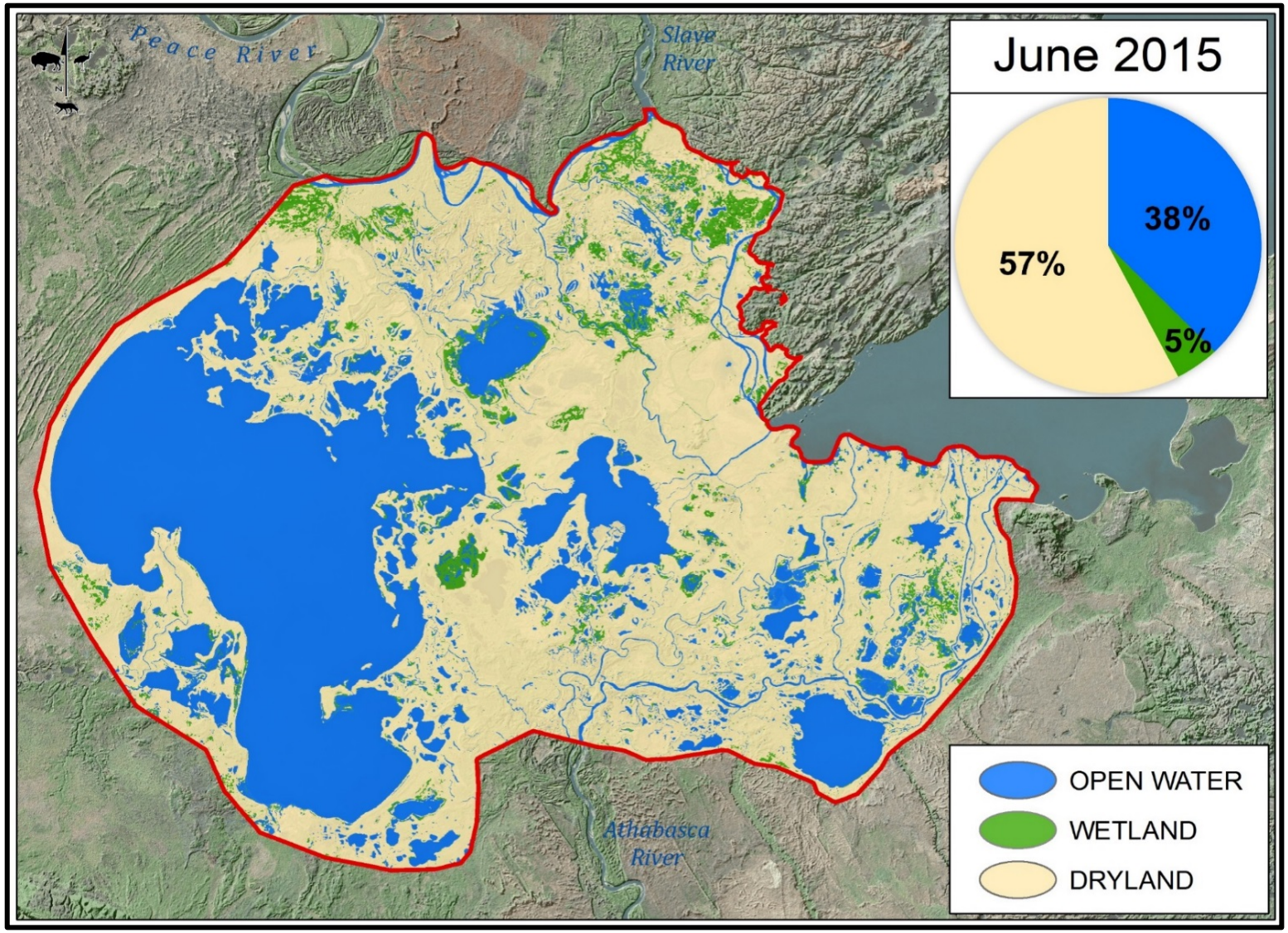


2012

Open Water	25%
Flooded Vegetation	5%
Non-flooded Vegetation	70%

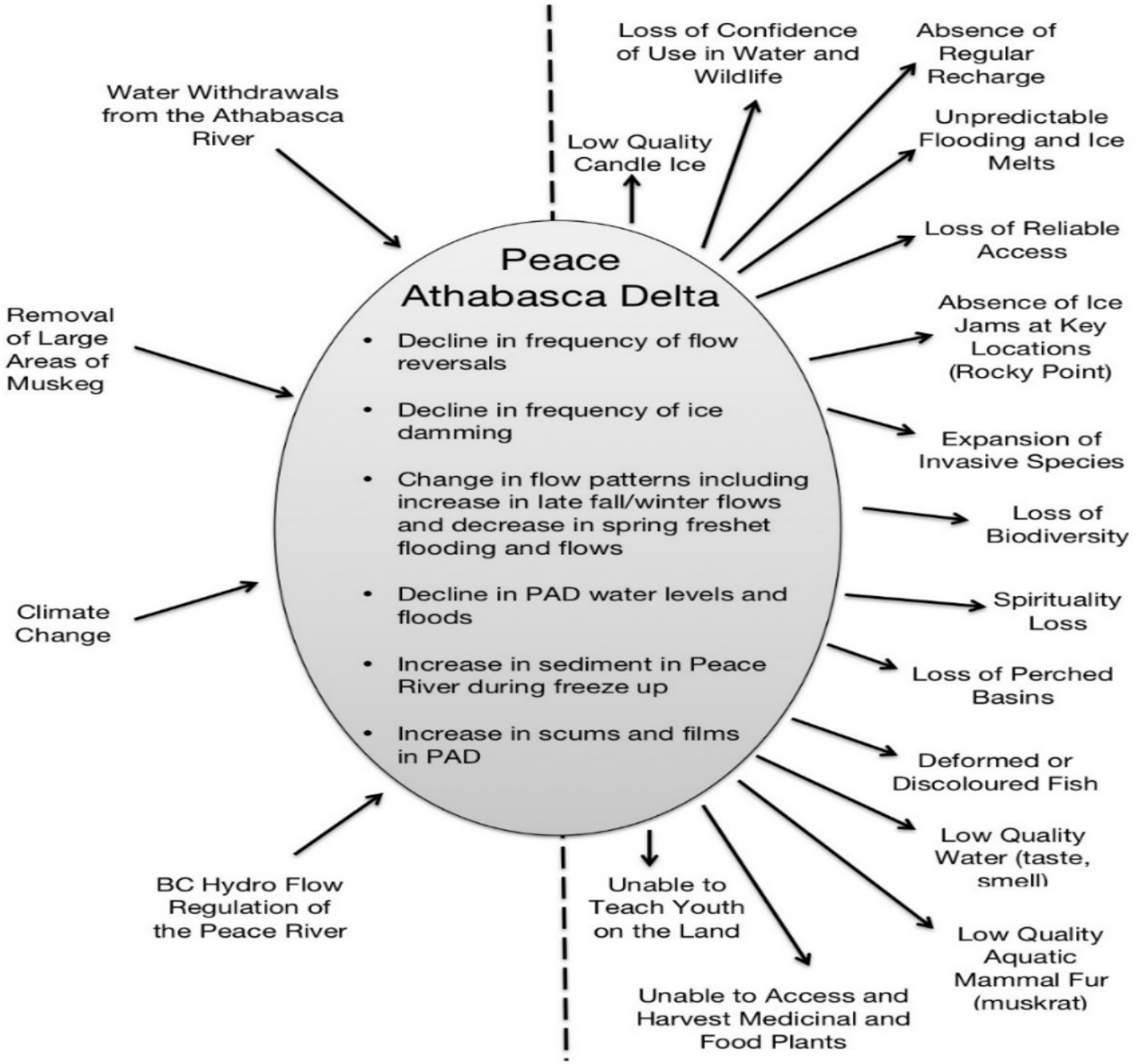


Open Water Flooded Vegetation Non-Flooded Land


Peace River
Slave River
Athabasca River
June 2015
38%
57%
5%
OPEN WATER
WETLAND
DRYLAND

Trends in abundance of waterfowl in the PAD in relation to number of years since flood

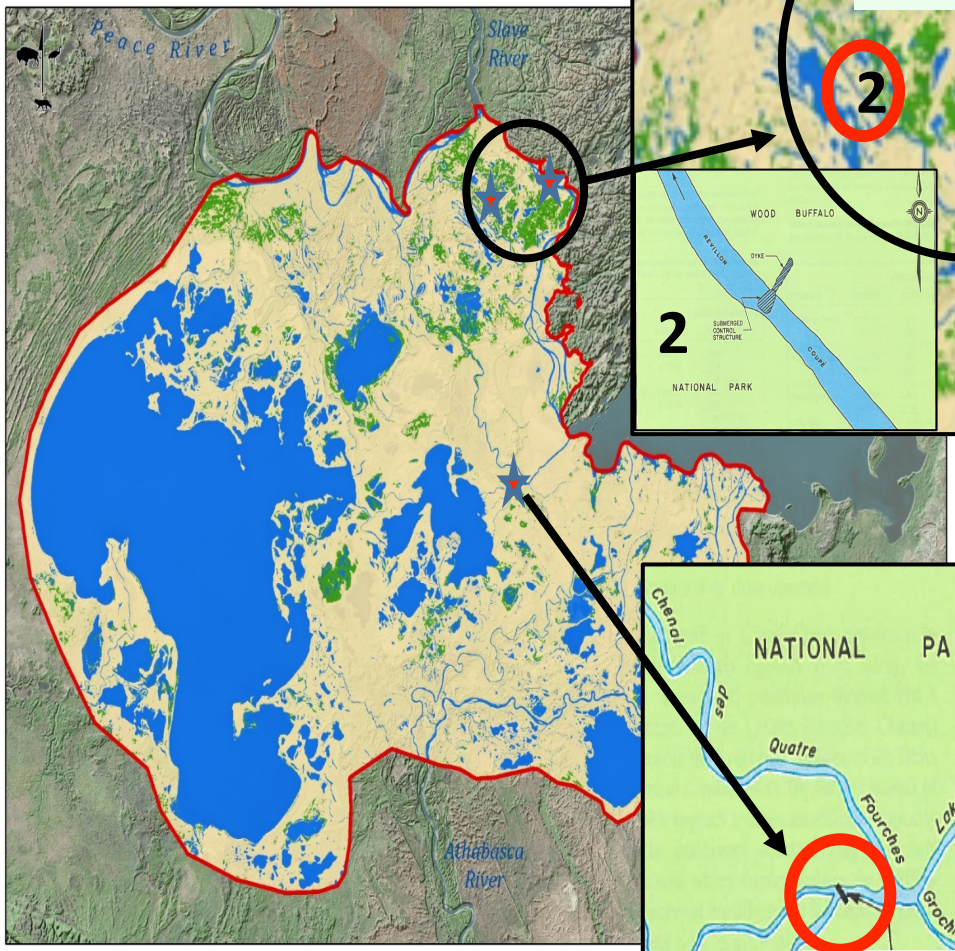
Group	Species	Years since last flood event				Years since 1956			
		Effect	Std.err	z	p	Effect	Std.err	z	p
Overwater nesting species	Canvasback	-0.047	0.015	3.22	***0.001***	0.011	0.005	2.20	***0.028***
	Redhead	-0.004	0.015	0.24	0.811	-0.021	0.005	3.96	***0.000***
	Ring-necked duck	-0.029	0.019	1.57	0.118	0.021	0.007	3.17	***0.002***
	Ruddy duck	-0.011	0.019	0.59	0.553	0.006	0.007	0.87	0.384
Ground nesting species	Mallard	-0.025	0.015	1.74	**0.082**	-0.009	0.005	1.81	***0.070***
	Gadwall	-0.007	0.020	0.38	0.705	0.027	0.007	3.90	***0.000***
	American wigeon	-0.028	0.013	2.07	***0.039***	-0.012	0.005	2.55	***0.011***
	Green-winged teal	0.001	0.016	0.050	0.960	0.006	0.006	1.13	0.257
	Blue-winged teal	0.010	0.019	0.565	0.572	-0.012	0.007	1.76	***0.079***
	Northern shoveler	-0.010	0.014	0.696	0.486	0.003	0.005	0.64	0.520
	Northern pintail	0.002	0.023	0.092	0.927	-0.021	0.008	2.60	***0.009***
	Generic scaup	-0.032	0.016	2.04	***0.041***	-0.013	0.005	2.42	***0.016***
Cavity nesting species	Mergansers	-0.015	0.024	0.63	0.529	0.009	0.008	1.08	0.280
	Generic goldeneye	-0.039	0.022	1.79	***0.073***	-0.008	0.008	1.02	0.308
	Bufflehead	-0.037	0.013	2.93	***0.003***	0.005	0.004	1.07	0.285
Other species	Canada goose	0.077	0.031	2.48	***0.013***	0.018	0.011	1.62	0.105
	American coot	0.014	0.034	0.42	0.675	-0.009	0.012	0.78	0.438
Note: value of p<0.1 is indicated in **bold** and *italic*									

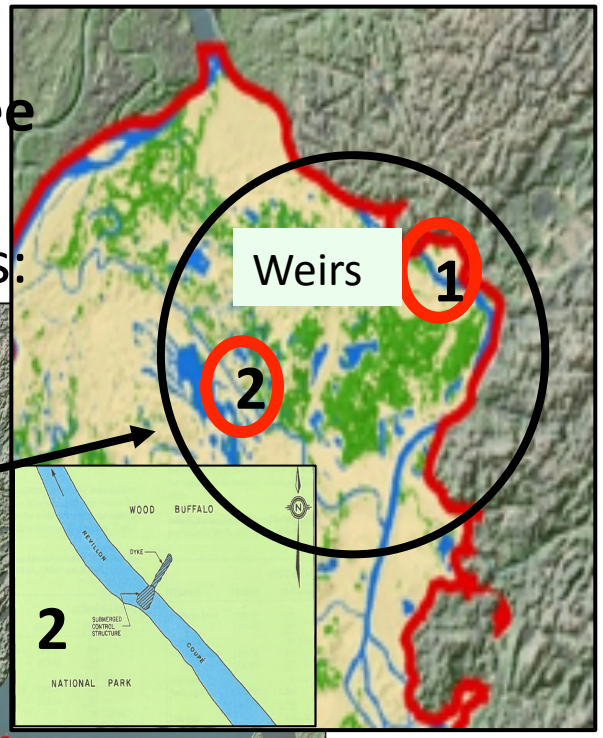

Water Withdrawals from the Athabasca River
Removal of Large Areas of Muskeg
Climate Change
BC Hydro Flow Regulation of the Peace River
Peace Athabasca Delta
• Decline in frequency of flow reversals
• Decline in frequency of ice damming
• Change in flow patterns including increase in late fall/winter flows and decrease in spring freshet flooding and flows
• Decline in PAD water levels and floods
• Increase in sediment in Peace River during freeze up
• Increase in scums and films in PAD
Low Quality Candle Ice
Loss of Confidence of Use in Water and Wildlife
Absence of Regular Recharge
Unpredictable Flooding and Ice Melts
Loss of Reliable Access
Absence of Ice Jams at Key Locations (Rocky Point)
Expansion of Invasive Species
Loss of Biodiversity
Spirituality Loss
Loss of Perched Basins
Deformed or Discoloured Fish
Low Quality Water (taste, smell)
Low Quality Aquatic Mammal Fur (muskrat)
Unable to Access and Harvest Medicinal and Food Plants
Unable to Teach Youth on the Land


Slave River
Wood Buffalo
National Park
SLAVE RIVER AT FITZGERALD, ALBERTA
PEACE RIVER AT PEACE POINT, ALBERTA
Peace River
Lake Athabasca
Lake Claire
ATHABASCA RIVER AT 27 BASELINE
Athabasca River
Mackenzie River
Yellowknife

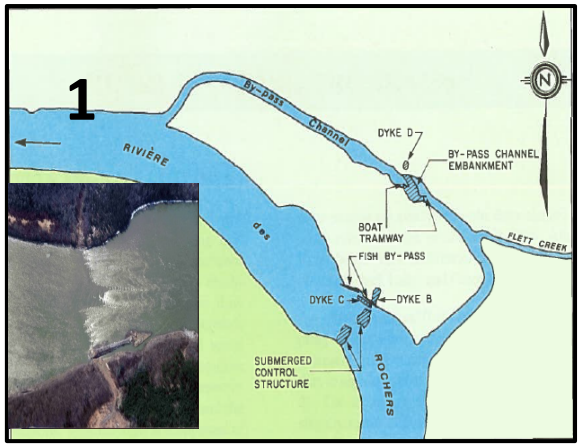
PAD Project Group / PAD Implementation Committee (1971-1976)

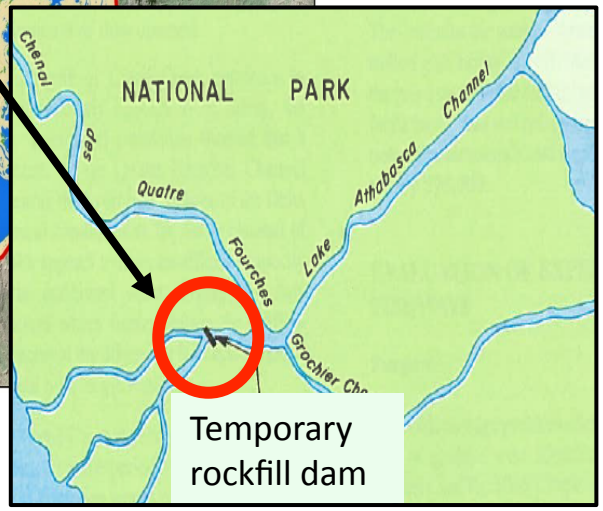
- Outflow control structures:





Submerged outflow weirs installed: 1. Riviere des Rocher (1975)
2. Revillion Coupe (1976)





Quatre Fourches River Dam (temporary)
- Installed 1971
- Removed 1975

PAD Project Group / PAD Implementation Committee (Canada, Alberta, Saskatchewan), 1971-1976:

Outflow control structures:

- Temporary Quatre Fourches dam installed (fall 1971, $200 K) to immediately raise water levels, while studies were undertaken to find more permanent, environmentally acceptable solutions (dam only affects 60% of delta, reduces flushing action and blocks fish migration). Dam damaged in 1974 flood and removed in 1975 following completion of Roche weir.
- Following assessment of options, Rocher weir (with fish bypass channel and boat tramway) installed in 1975 to delay the rate of outflow and raise water levels ($2.0 M); Coupe weir installed 1976 as studies predicted high velocities and erosion on that channel.
- Weirs have nearly restored natural summer peak levels, but the amplitude of water levels is less than under the natural regime. The weirs do not influence the perched basins flooded by the PR.

Bennett Dam Releases / Spills

- Spring 1996: when an ice-jam formed on the delta reach of the Peace River, Alberta requested that BC Hydro release additional water to augment the flood. Releases were increased by 500 cms for about a week. Subsequent analysis by EC concluded that the augmented release increased flood elevations by 20 cm.
- Summer 1996: a structural fault (sinkhole) was detected in the dam and an emergency spill was ordered to draw down the reservoir by 3 metres while repairs took place. The spill volume was about 5000 cms for 7 weeks; subsequent analysis by EC concluded that the spill resulted in approximately natural, pre-regulation flows on the Peace River.

Adaptive Management
Cooperative Management