
**Social, Economic and Cultural Consequences to
NWAAC Communities from Climate Change.**

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Webinar #3 – April 13, 2011

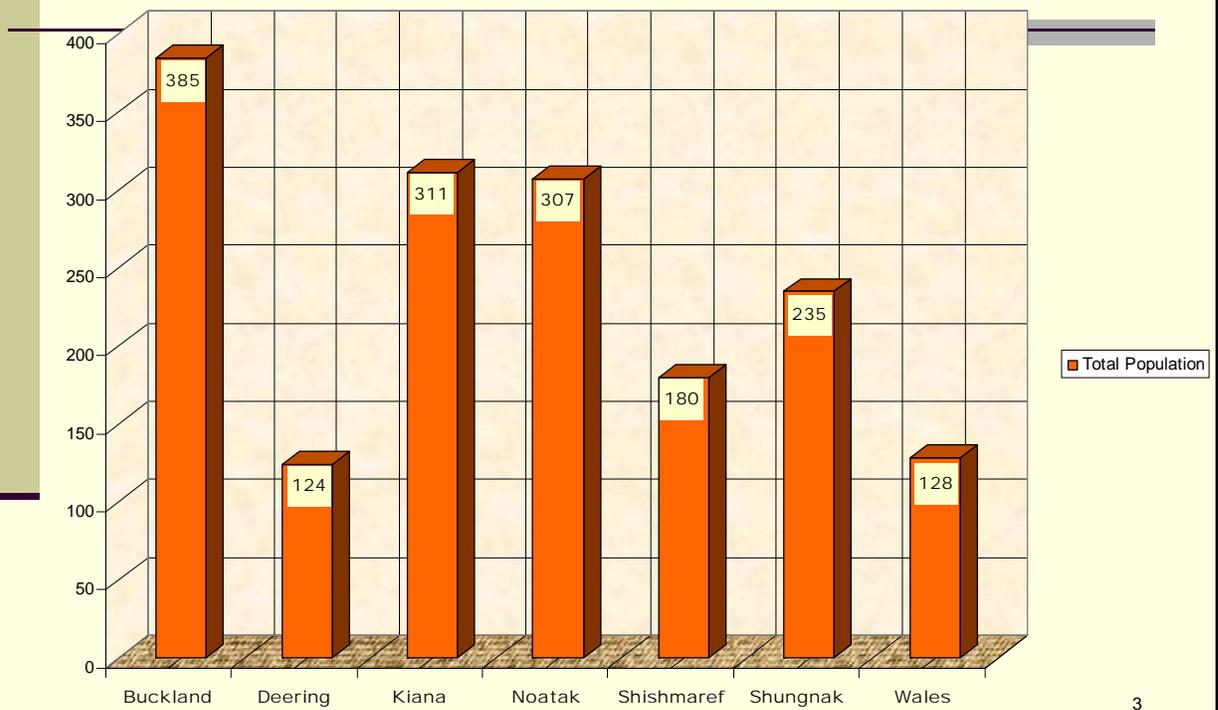
1

Northwest Alaska



Population Size Select Northwest Alaska Communities.

Total Population: Select Northwest Arctic Communities



3

Select Northwest Alaska Communities: Income & Harvest Levels

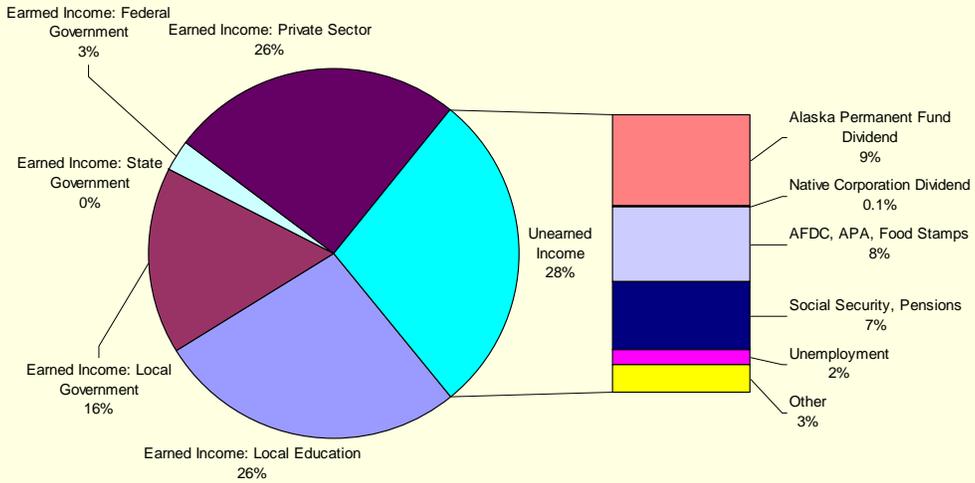
Community	*Per Capita Personal Income (2006 - Constant \$'s)	Percent Wage	Per Capita Harvest (lbs)
Kiana (2006)	15,203	67%	345
Wales (1993)	13,689	73%	744
Deering (1994)	13,423	70%	672
Buckland (2003)	11,513	74%	554
Shishmaref (1995)	11,137	47%	792
Shungnak (2002)	10,926	47%	611
Noatak (1994)	7,644	59%	461
	*Anchorage = \$40,187 (2006)		

The Community of Wales Alaska 1994



5

Wales: Source of Community Income



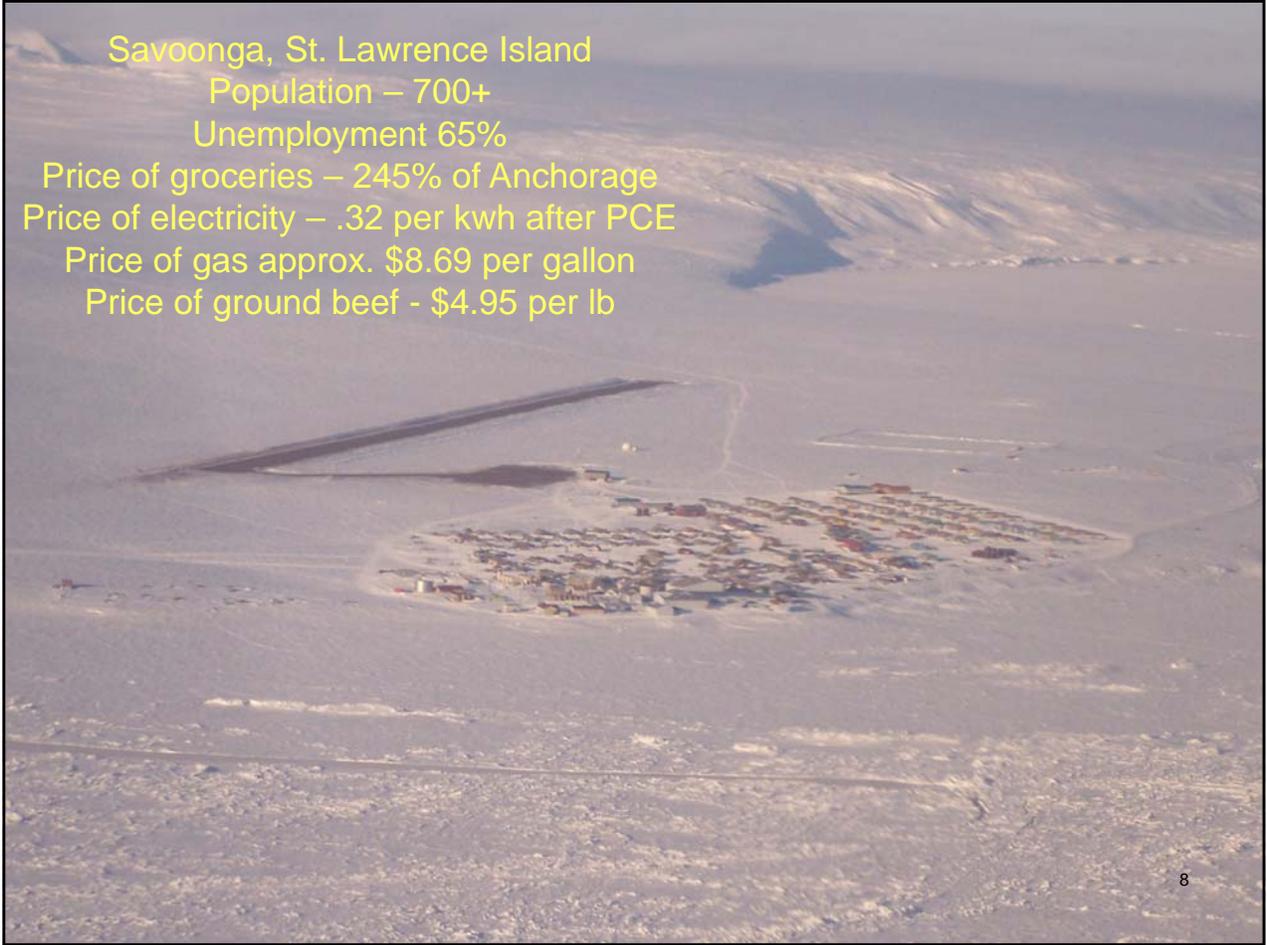
POVERTY STATISTICS FOR REMOTE RURAL ALASKA:
PERCENT OF POPULATION
BELOW THE POVERTY THRESHOLD: 2000

	TOTAL	ALASKA NATIVE*	NON- NATIVE
Remote Rural	19.4%	22.5%	5.4%
Regional Centers	10.1%	13.6%	3.7%
Smaller Places	23.6%	25.4%	8.1%
Anchorage	7.3%	15.7%	6.4%

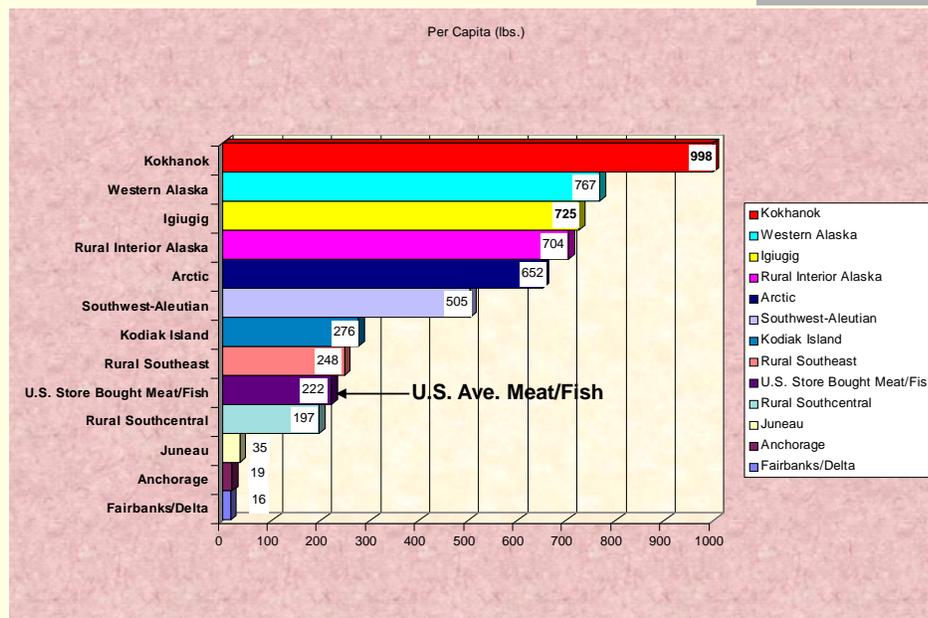
Source: U.S. Census of Population

*Alaska Native alone or in combination with another ethnicity.

Savoonga, St. Lawrence Island
Population – 700+
Unemployment 65%
Price of groceries – 245% of Anchorage
Price of electricity – .32 per kwh after PCE
Price of gas approx. \$8.69 per gallon
Price of ground beef - \$4.95 per lb

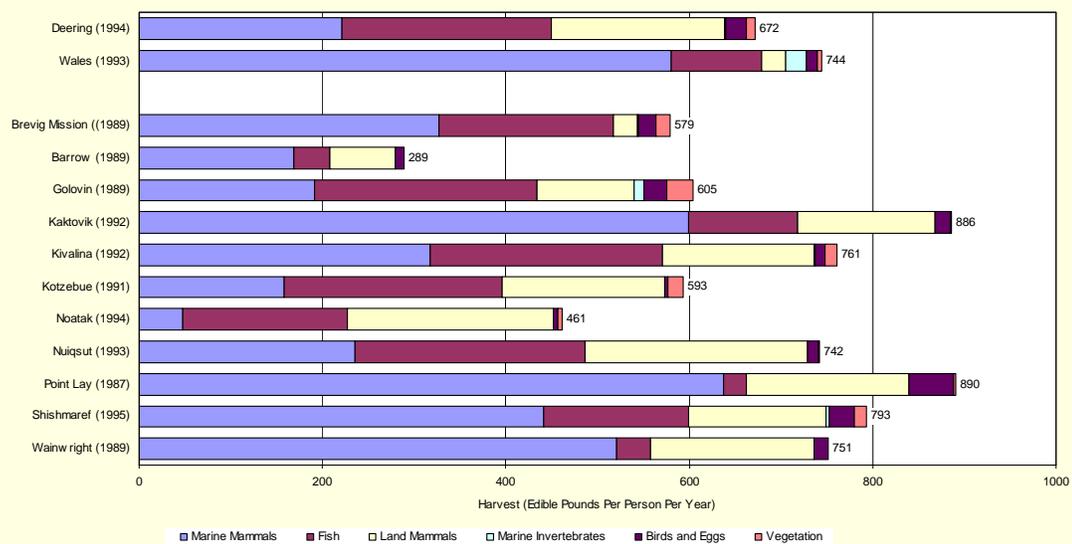


Per Capita Consumption of Wildlife Resources in lbs.



10

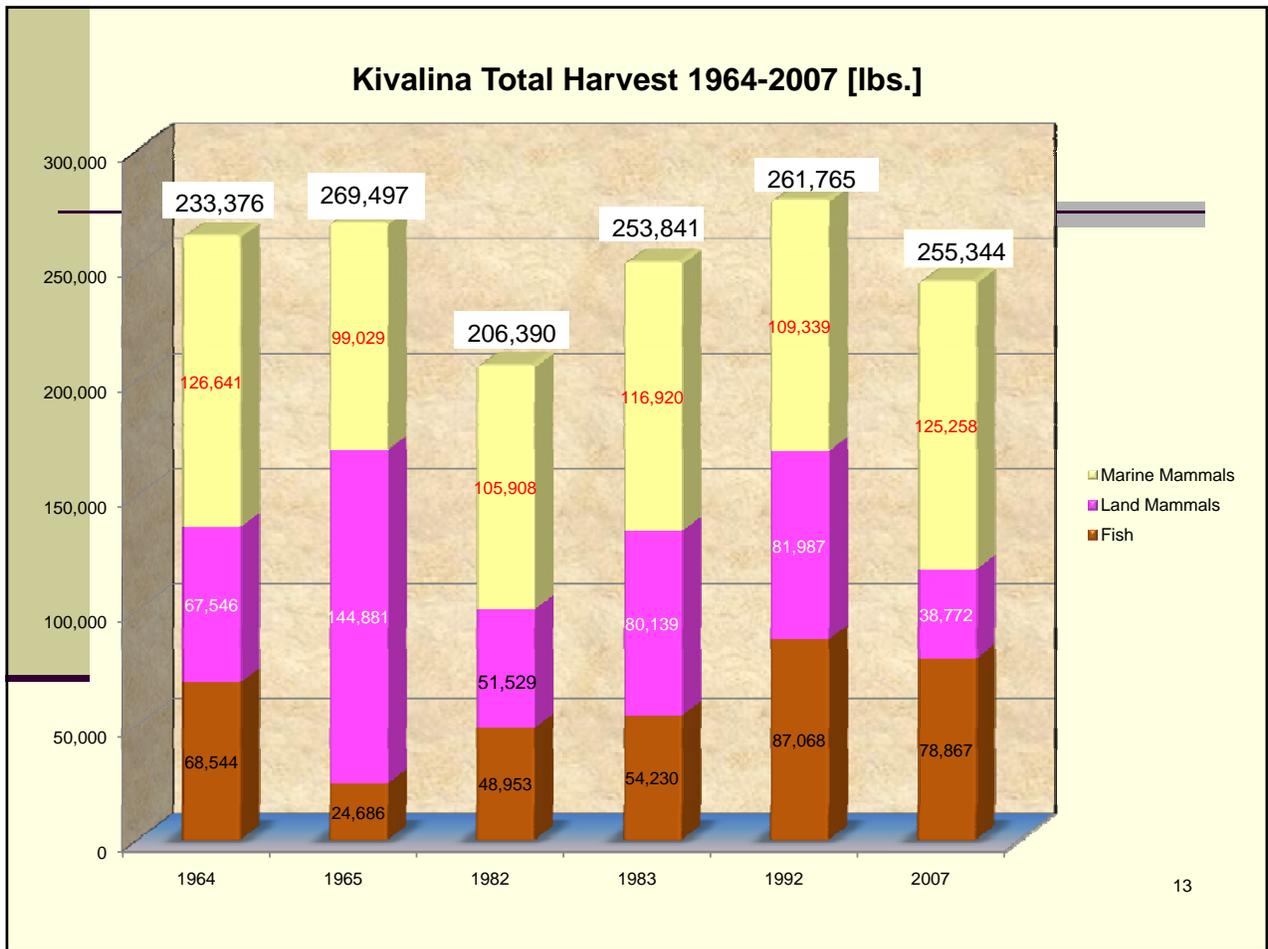
Estimated Harvests of 13 northwest Alaska communities by Resource Category



Magdanz et al, 2002, "Working Together – The Production and Distribution of Wild Food in Wales & Deering, Alaska. 11 ADF&G Technical Paper #259.



Kivalina

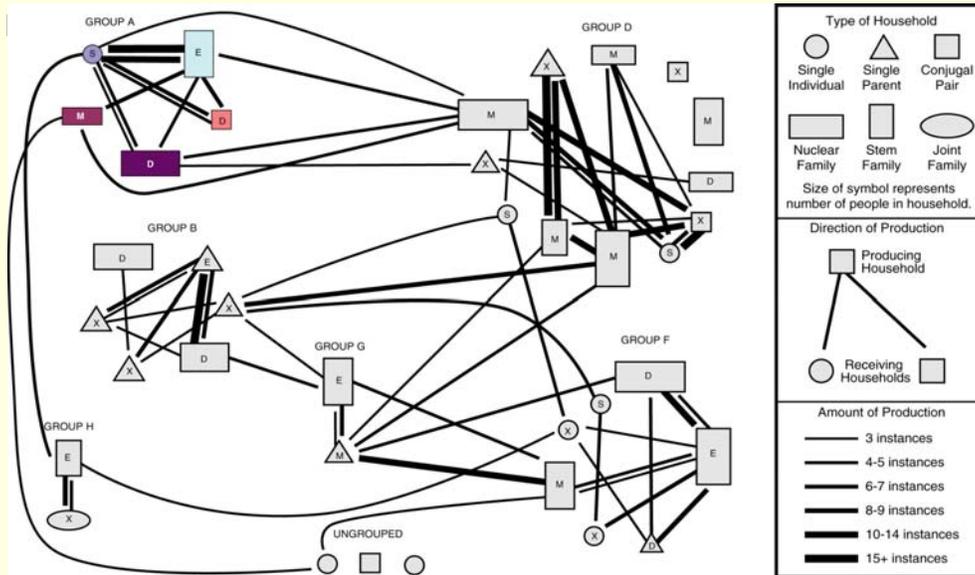


Community of Deering Alaska



14

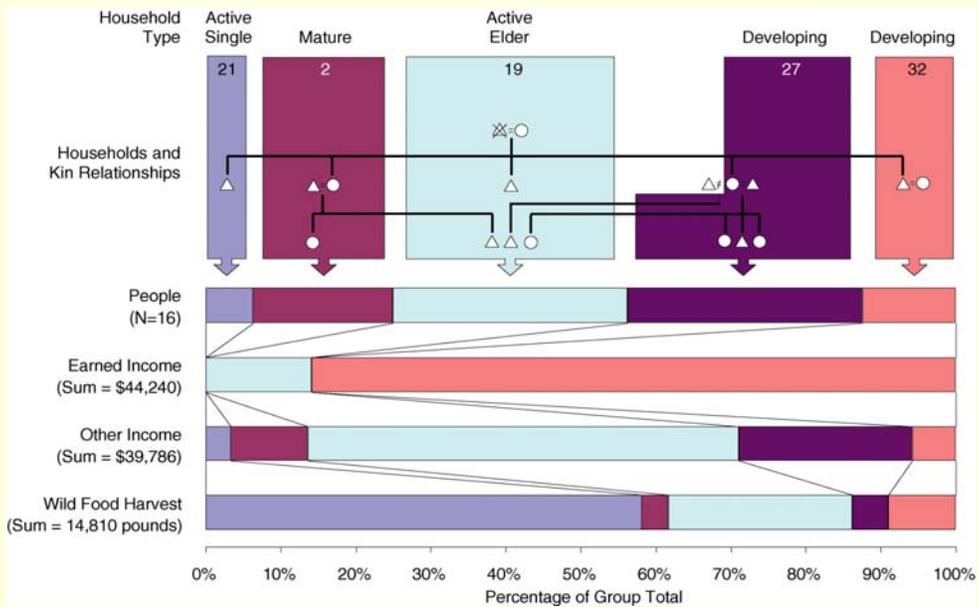
Wild Food Distribution Networks, Deering



Magdanz et al, 2002, "Working Together – The Production and Distribution of Wild Food in Wales & Deering, Alaska. ADF&G Technical Paper #259.

15

One Network's Kin Relationships Genealogy, People, Income, and Harvests, *Deering A*



Magdanz et al, 2002, "Working Together – The Production and Distribution of Wild Food in Wales & Deering, Alaska. ADF&G Technical Paper #259.

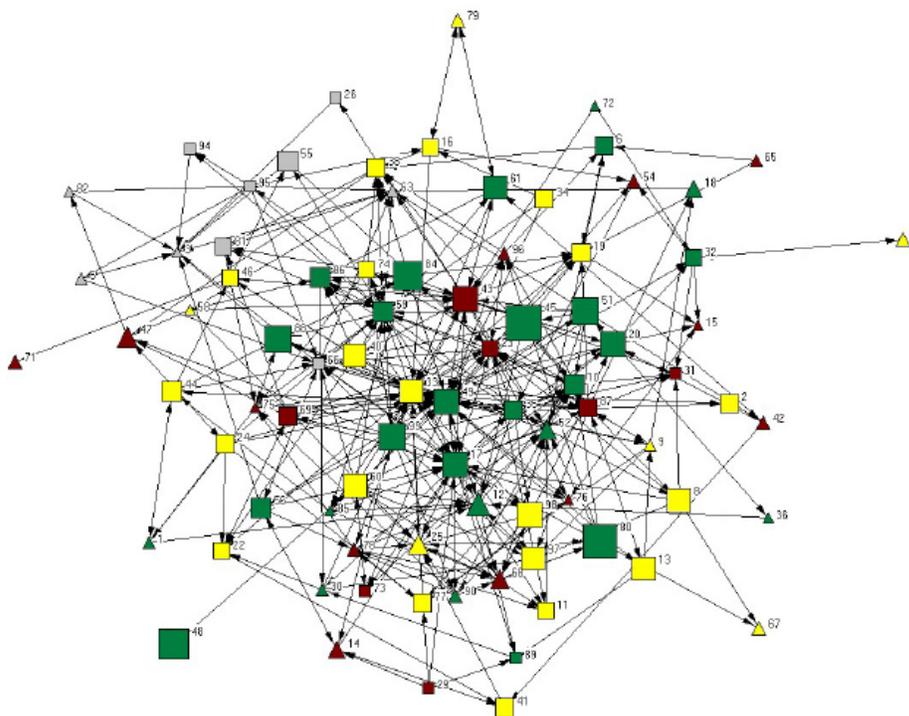
Wales Family by a Food Cache 1916



17

Buckland Social Networks Based on Distribution of Subsistence Resources

(Courtesy of James Magdanz)



BUCKLAND SOCIAL NETWORK

This diagram describes cooperation among 83 of 88 households in Buckland, Alaska, during 2003. Each symbol represents one household. In a survey of households, each household was asked:

"Who harvested, processed, and distributed the fish, meat, berries and greens your household used this year?"

"Who paid for the groceries, gasolines, and other supplies your household used this year?"

"Who owns the equipment your household used for subsistence this year?"

"For your household, who decided when, where, and how to hunt, fish or gather this year?"

Each line represents the answers to those questions. If someone outside the surveyed household provided wild food, other supplies, equipment, or decisions for the surveyed household, a line connects the two households. The line begins at the source household and ends at the consuming household. The arrowhead points at the consuming household. The more kinds of support one household received from another, the wider the line.

The size of household symbols represents the number of people in each household. The color and shape of the symbols represent household heads' age and household structures.

■ Elder Households (heads 60 years old or older)

■ Mature Households (heads 40-59 years old)

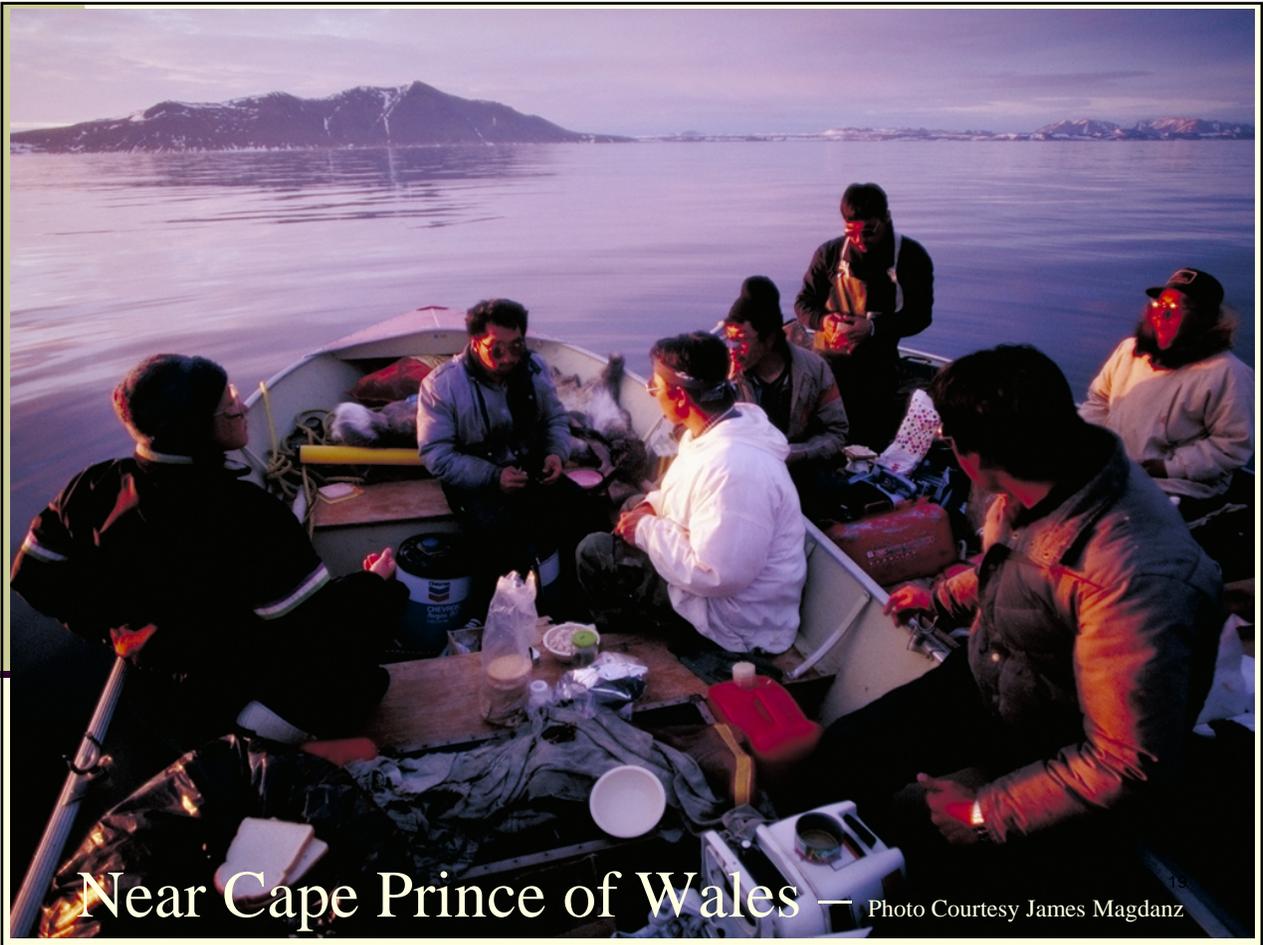
■ Developing Households (heads 39 years old or younger)

■ Teacher Households

□ Households Headed by a Couple

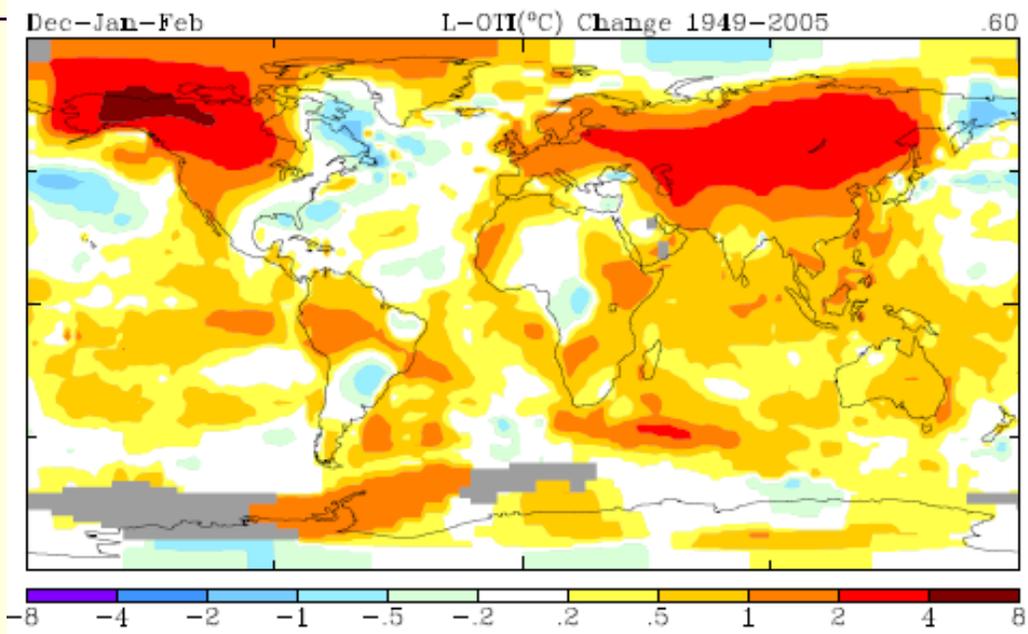
△ Households Headed by a Single Person

18



Near Cape Prince of Wales — Photo Courtesy James Magdanz

Alaska's Changing Climate



Climate Change

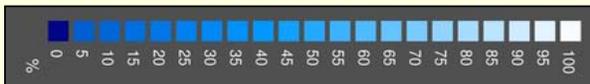
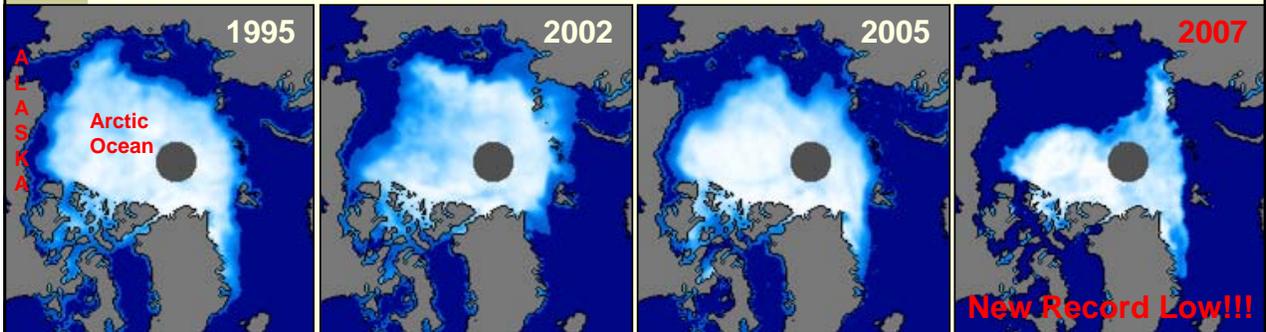
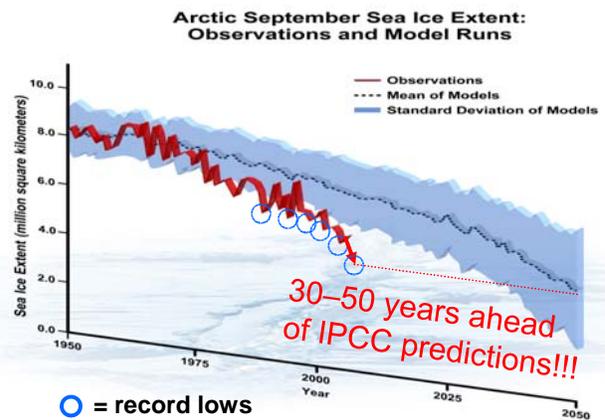
Temperature:

- Last 60 years - Alaska & Western Canada mean winter surface temperature has increased 3-4 °C.
- Triple the change experienced at equator
- Increase in precipitation of about 30% between 1968-1990.

Trends in Arctic Summer Sea Ice Extent: 1900 12 million km² to 4.7 million km² in 2008 - 60% decrease - most of loss last decade.

Causes:

- Warmer Temperatures
- Changes in Wind Direction
- Consistent with increasing Green House Gases



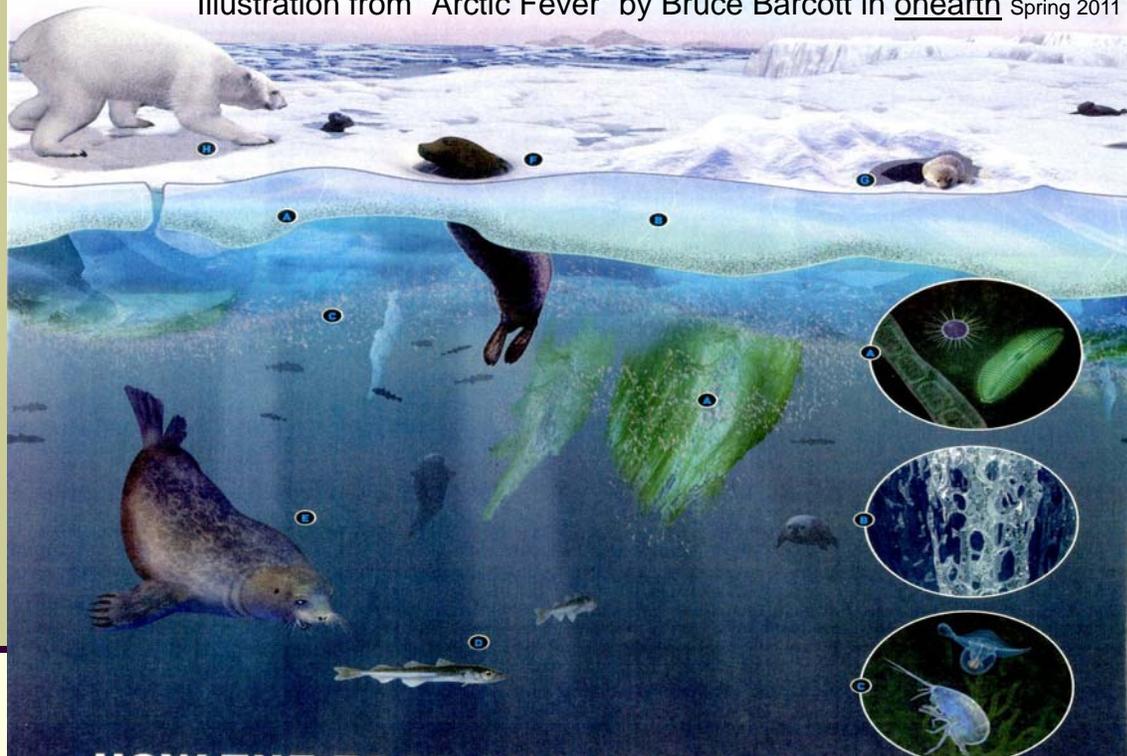
Adapted from Stroeve et al. 2008 & <http://NSIDC.ORG>

1. Impacts of Decreasing Sea Ice:

- Sea ice reflects sun's energy, more open water absorbs energy and gives this energy to increasing the impact of storm surges.
- Less ice perimeter less food as ice margin is a particularly rich environment for nutrient mixture in water column.
- Sea Ice serves as habitat for specific phytoplankton ecosystem.

23

Illustration from "Arctic Fever" by Bruce Barcott in onearth Spring 2011



HOW THE FOOD CHAIN WORKS

SEA ICE provides habitat for a diverse community of **ICE ALGAE**, like these diatoms and flagellates (A). The **BRINE CHANNELS** (B) in which the algae make their home are networks of tiny capillaries formed as dense, salty water makes its way through small spaces between the ice crystals. The algae support a variety of **ZOOPLANKTON** (C), including crustaceans called amphipods (foreground), which graze on the bottom of the ice, and open-water sea butterflies (rear), which thrive on the algal blooms that form when the

ice melts in spring, sometimes growing into long, hanging strands. **ARCTIC COD** (F) feed on the zooplankton, and the **RINGED SEAL** (I) feeds in turn on both the cod and the zooplankton, especially copepods and nematodes. Ringed seals maintain holes in the ice (J), to which they return several times a day to breathe, and build small dens on the ice (G), which provide safety and warmth to their newborn pups. The apex predator in the Arctic food web, the **POLAR BEAR** (H), relies almost exclusively on ringed, bearded, and spotted seals for food.

24

2. Impacts of Decreasing Sea Ice:

- Sea ice provides habitat for walrus and seals.
- Retreating sea ice conveyor belt carries walrus over their food sources.
 - One billion m³ re-suspension of sediment
- Walrus population on decline.
- Ring seals depend on stable ice for successful nursing.
 - Three year decline in ring seal productivity



3. Impacts of Decreasing Sea Ice:

- Polar bears prey on seals.
 - Cubs of year (COY) survival rate declined from 65% to 44%.
 - Male bears decreasing cranial size & mean weight.
 - Projection 30% decrease in bear population by 2050
- Inuit hunters harvest seals, walrus & bears.



28

Whaling Captains' Survey: Impacts of Climate Change on Whaling & Marine Mammal Hunting.

- Whales arrive earlier
- Leads are wider
- Whales are further out
- First year shore ice is brittle difficult to find haul outs to process whales
- New base camp locations must be found because of changing ice conditions.
- More dangerous more open water & rougher
- More boats are needed for safety reasons
- Bigger more expensive motors are needed.
- More fuel is needed in a time of rising fuel prices

Impacts from Melting Permafrost

- Impacts of infrastructure such as:
 - Buildings
 - Roads
- Loss of closed-basin lakes.
 - Migratory bird habitat
- Makes coastal soils more susceptible to erosion from storm surges.

Shishmaref: reduced sea ice allows higher storm surges to reach shore and thawing permafrost makes the shoreline more vulnerable to erosion



31

Storm Surges & Climate Change Impacts on Community Infrastructure

- Recent GAO report found 90% of states 213 predominantly Native villages, historically situated along rivers and coasts, are affected regularly by floods or erosion.
- Global Warming has exacerbated the problems according to the report:
 - Melting permafrost more prone to erosion
 - Barrier sea ice coming later in the year leaving villages, such as Shishmaref, vulnerable to fall storms (and storms are more violent).
 - Flooding from rising sea levels.

32

Shishmaref Relocation Costs.

- Four Alternatives (\$650k- \$1million/hh):
 - Move to mainland - \$179 million
 - \$20 million move 150 homes
 - \$26 million to move or build school, clinic, city hall
 - \$25 million for new airport
 - \$23 million for roads
 - \$25 million for water treatment & sewage
 - Move everyone to Nome - \$93 million
 - Move everyone to Kotzebue - \$141 million
 - Stay put on Sarichef “Island” & fight erosion \$109 million.

33

Acidification of Ocean Waters Over Time

Reviewing the Impact of Increased Atmospheric CO₂ on Oceanic pH and the Marine Ecosystem

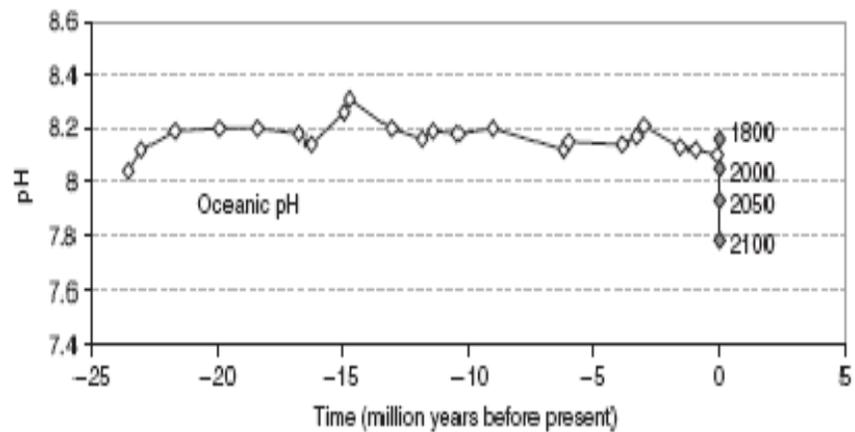
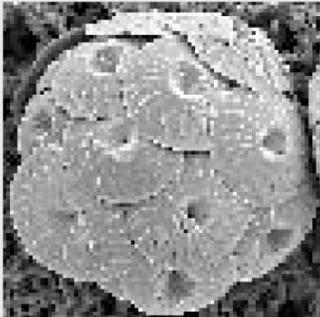


Figure 8.2 Past (white diamonds, data from Pearson and Palmer, 2000) and contemporary variability of marine pH (grey diamonds with dates). Future predictions are model derived values based on IPCC mean scenarios.

34

How do phytoplankton react to increased in CO₂ ?

Current Levels
of CO₂



Scanning electron
microscopy of calcifying
phytoplankton for:

Current CO₂ of 280 to 380 ppm

Projections of CO₂ of 580 to 720 ppm

Calcidiscus Leptoporus

Projected
Levels of CO₂

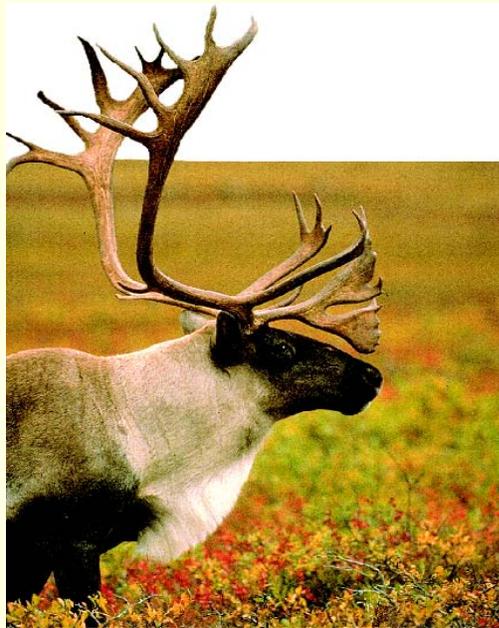


World Bank
recently projected
750 ppm for CO₂³⁵
levels by 2100

Changing Habitat – Terrestrial:

- Boreal forests expanding north at rate of 100km for ever increase of 1°C.
- 100 years Seward Peninsula change from tundra ecosystem to white spruce deciduous forest.
- Forests:
 - 20% increase in growing-degree days
 - Increased pest outbreaks
 - 200% increase in total burn area per decade!
- Caribou populations extremely complicated.

Western Arctic Caribou Herd



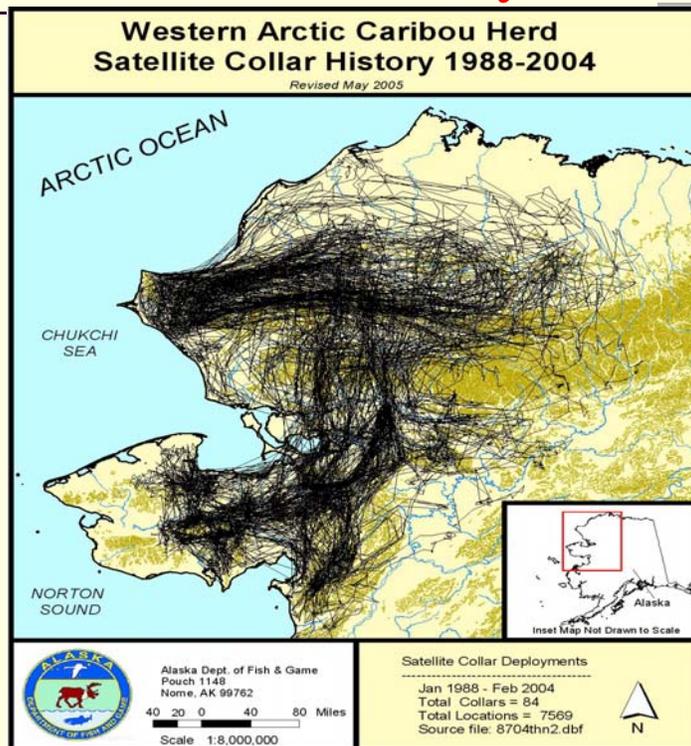
37

July 2003: Portion of WACH - South of Point
Lay as Herd Heads East into Brooks Range.



38

Western Arctic Caribou Herd Satellite Collar History 1988-2004



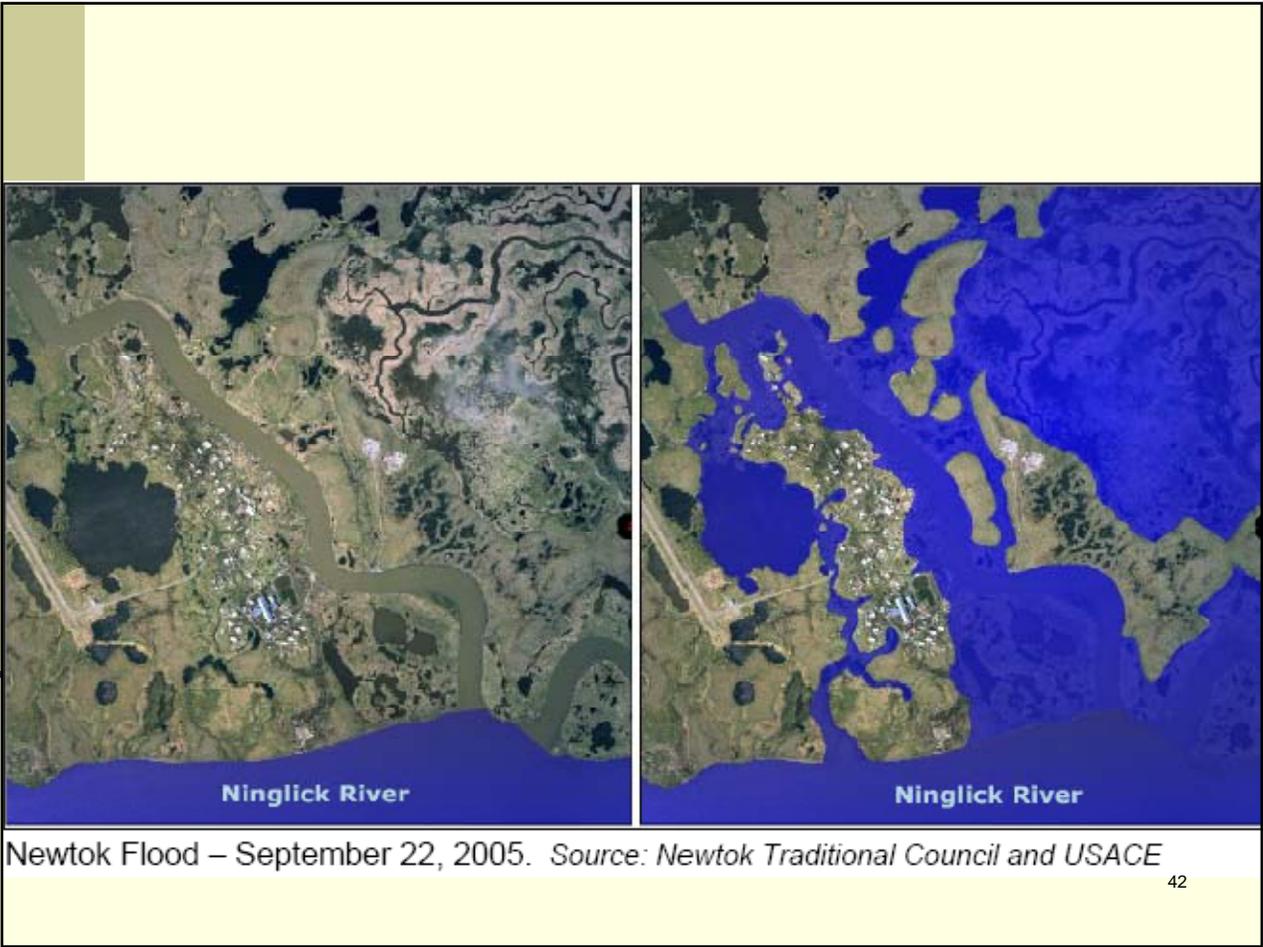
39

Newtok – An Early Casualty



40





Newtok Flood – September 22, 2005. Source: *Newtok Traditional Council and USACE*

Participants in Newtok Planning Group

Native Village of Newtok

- Newtok Traditional Council (NTC)
- Newtok Native Corporation (NNC)

State

- Alaska Department of Commerce, Community, and Economic Development (DCCED), Division of Community & Regional Affairs
- Alaska Department of Environmental Conservation/Village Safe Water Program (VSW)
- Alaska Department of Transportation and Public Facilities (DOT/PF)
- Alaska Department of Military and Veterans Affairs/Division of Homeland Security and Emergency Management (DHS&EM)
- Alaska Department of Education and Early Development (DEED)
- Alaska Department of Health and Social Services (DHSS)
- Alaska Industrial Development and Export Authority (AIDEA)/Alaska Energy Authority (AEA)
- Alaska Governor's Office

Federal

- U.S. Army Corps of Engineers (USACE), Alaska District
- U.S. Department of Commerce, Economic Development Administration (EDA)
- U.S. Department of Agriculture, Rural Development
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)
- U.S. Department of Housing and Urban Development (HUD)
- U.S. Department of the Interior, Bureau of Indian Affairs (BIA)
- U.S. Department of Transportation, Federal Aviation Administration (FAA).
- U.S. Environmental Protection Agency (EPA)
- Denali Commission
- Senator Lisa Murkowski's Office

Regional Organizations

- Association of Village Council Presidents (AVCP), Housing Improvement Program (HIP)
- Coastal Villages Region Fund (CVRF)
- Lower Kuskokwim School District (LKSD)
- Rural Alaska Community Action Program (RurAL CAP)
- Yukon-Kuskokwim Health Corporation

43

Cape Espenberg in Northwest Alaska The Sun Sets on a Changing Landscape

