

Cumulative Effects, Adaptive Management, and North Slope Oil & Gas



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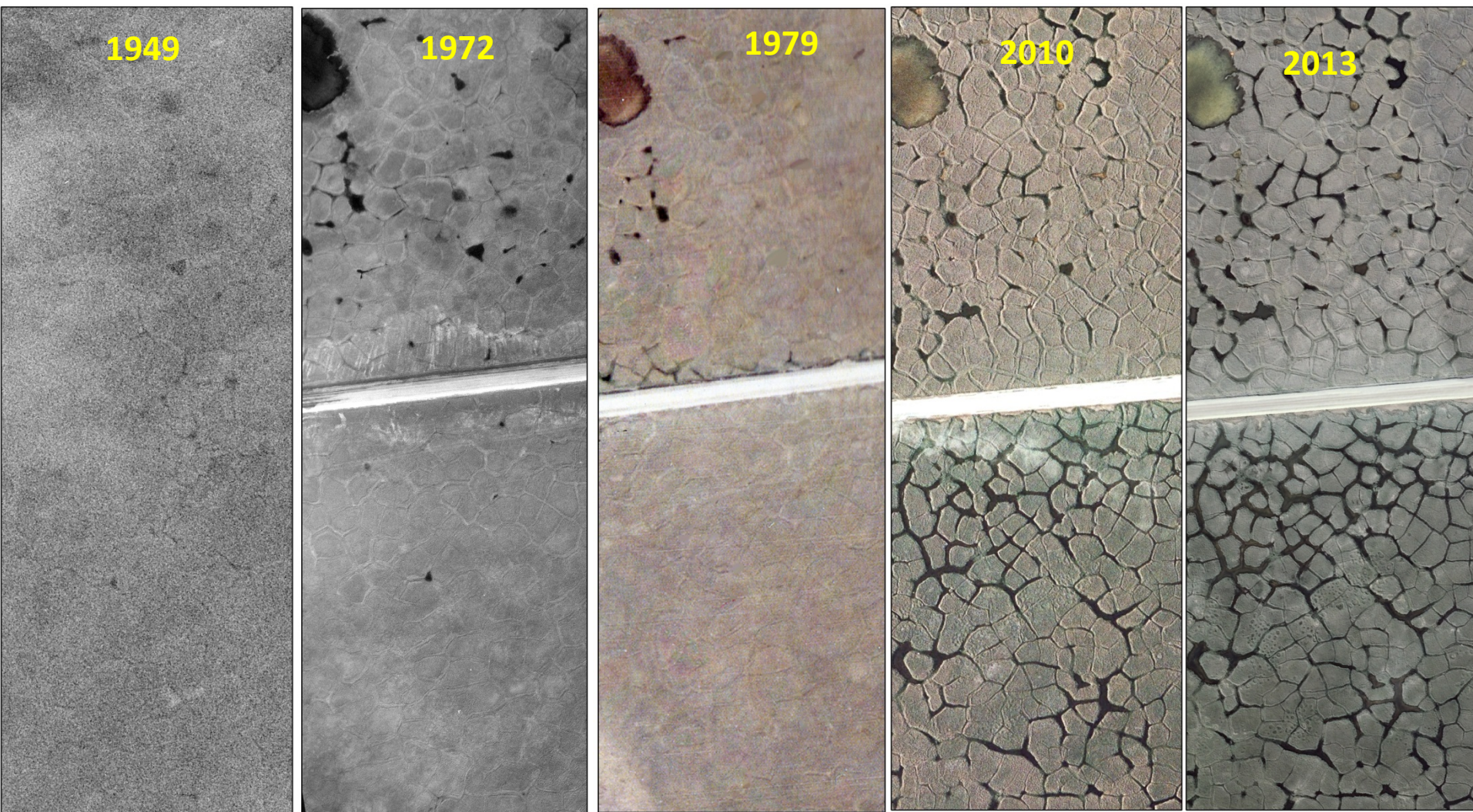
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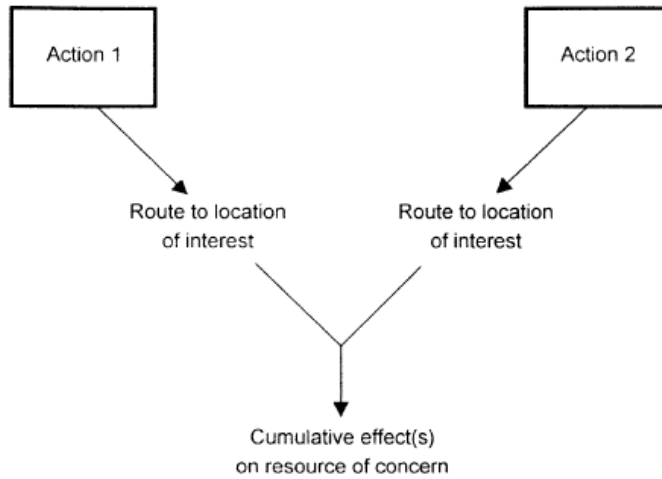
- Cumulative effects “The incremental impact of action when added to other past, present, and reasonably foreseeable future actions.... result from individual minor but collectively significant . . .” (NEPA 1978)
 - Multiple drivers
 - Multiple jurisdictions
 - non linearity of system behavior / complexity
 - Land cover + land use change

- How are they perceived?
- How are they best measured?
- How are they best managed?

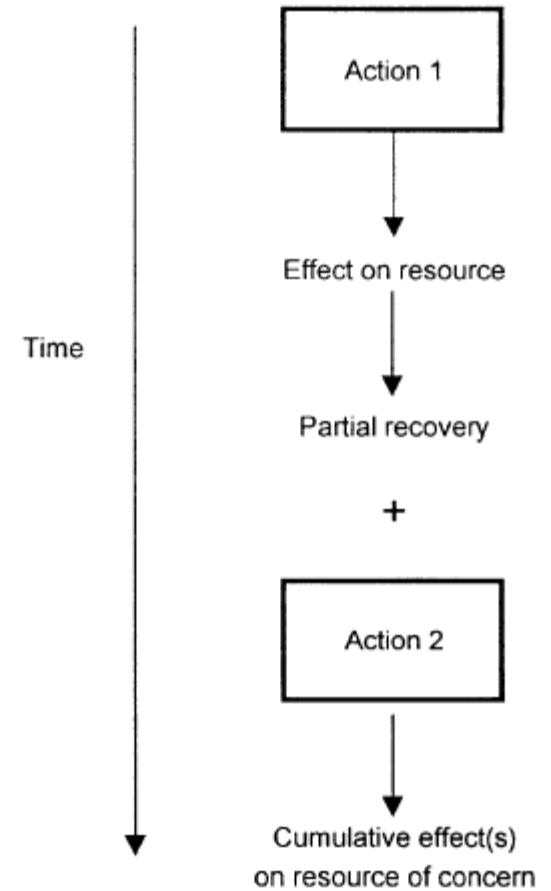


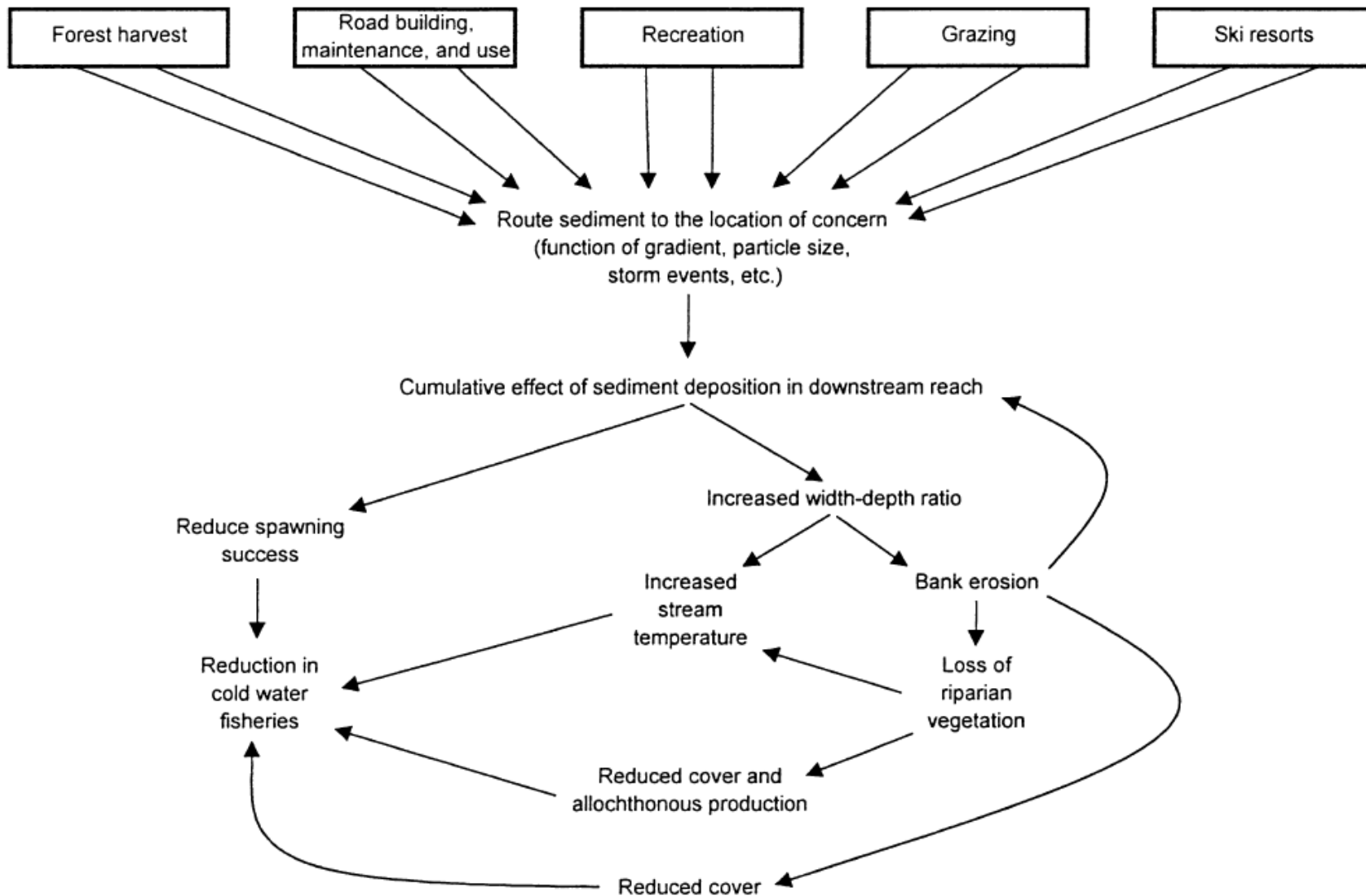
**Prudhoe Bay -
Raynolds et al 2013**

a) Cumulative effect in space



b) Cumulative effect in time





McDonald 2000)

methods

- Conceptual Models
- Modified interaction matrices
- Networks
- Simulation modeling
- Adaptive management

EFFECTS ON SOCIOCULTURAL SYSTEMS

Alternative A (No-action Alternative)	Alternative B-1	Alternative B-2 (Preferred Alternative)	Alternative C	Alternative D
<p>Cumulative Effects: Impacts to the sociocultural systems of the Iñupiat of the North Slope have occurred since the first direct interactions with non-Natives in the first quarter of the 19th century. Since that time, the Iñupiat have adapted to new technologies, new external pressures, and regulatory actions. By the mid-20th century, Iñupiat settlement patterns had changed significantly. The population became centralized into a few communities, when they previously had been spread in small family-based units across the North Slope. The cumulative effects of oil and gas development on sociocultural patterns over the last 50 years are hard to establish with quantitative precision given the lack of baseline data. Nonetheless, there is evidence that North Slope sociocultural systems have been subject to ongoing, additive, and synergistic cumulative impacts. Stresses on North Slope sociocultural systems include residents' inability to access traditional use areas, threats to resources/life ways and to spiritual connection with the land, having to deal with multiple environmental impact assessments and other development processes, and being ignored or discounted by agency representatives. Long-term stresses would result in greater impacts to sociocultural systems. The possibility of a major oil spill in the marine environment and its effects on bowhead whales, other marine mammals, and fish is residents' greatest concern—now increased significantly by the greater likelihood of offshore oil and gas activity in both the Chukchi and Beaufort seas. These and other stresses accumulate because they interact and are repeated with each new lease sale, EIS, development proposal, and facility expansion. These effects would be greatest under Alternative D because the entire NPR-A would be available for oil and gas leasing and development. However, the amount of wealth, including income from royalties, taxes, and jobs, generated by oil and gas activity and available to residents of the North Slope would be anticipated to be greater under this alternative than the other alternatives. The effects on wealth and on subsistence resources would be least under Alternatives B-1 and B-2, while the effects on wealth under the no-action alternative and Alternative C would be similar, but Alternative A (no action) would have greater impacts on subsistence use areas.</p>				

EFFECTS ON ENVIRONMENTAL JUSTICE

Alternative A (No-action Alternative)	Alternative B-1	Alternative B-2 (Preferred Alternative)	Alternative C	Alternative D
<p>Cumulative Effects: Euro-American presence, commercial whaling, military activities and other non-oil and gas development and oil and gas exploration and development have had cumulative impacts to Iñupiat culture and to fish and wildlife used for subsistence. Euro-American presence has impacted the Iñupiat through disease and a variety of socioeconomic and psychological problems that are commonly associated with colonization. Commercial whaling nearly decimated whale stocks in the Chukchi and Beaufort seas; bowhead whale populations, though recovering, remain below their levels in the 1800s. Non-oil and gas development associated with military, residential, and commercial development have directly impacted several thousand acres of fish and wildlife habitat and has also indirectly affected habitat and animal behavior; these impacts have accumulated and persist today. Oil and gas exploration and development conducted by the federal government and industry have directly impacted the habitat use and behavior of subsistence species, and these impacts persist today. These effects have disrupted subsistence uses, and may, in part, account for some of the social problems seen in the villages today. Climate change can be understood as an environmental justice issue and the Iñupiat of the North Slope are disproportionately impacted by it both by the fact that climate changes effects are more pronounced in the western Arctic and by the fact that Iñupiat subsistence activities are particularly dependent on ice, wind, and permafrost conditions. Under the cumulative case, proposals for offshore oil and gas development in the Chukchi and Beaufort seas cause the greatest concern, while the potential impacts of increasing onshore development made possible by pipelines to transport offshore product may also be important. Iñupiat users would be less likely to utilize for subsistence an area from 5 miles to 25 miles around permanent facilities and any possible environmental justice issues associated with the alternatives will be largely determined by the location of future development and by the economic benefits it brings. Alternative B-1 would protect the greatest amount of land that is important to Iñupiat for both cultural and subsistence reasons, while Alternative B-2 would protect more key subsistence areas than alternatives A, C, or D but would not preclude development in many high potential areas. Effects to subsistence comprise direct effects to the Iñupiat, a recognized minority population and the primary subsistence harvesters on the North Slope. Impacts to human health and well-being, social systems, and cultural values of the Iñupiat cumulatively lead to disproportionate effects on this minority population.</p>				

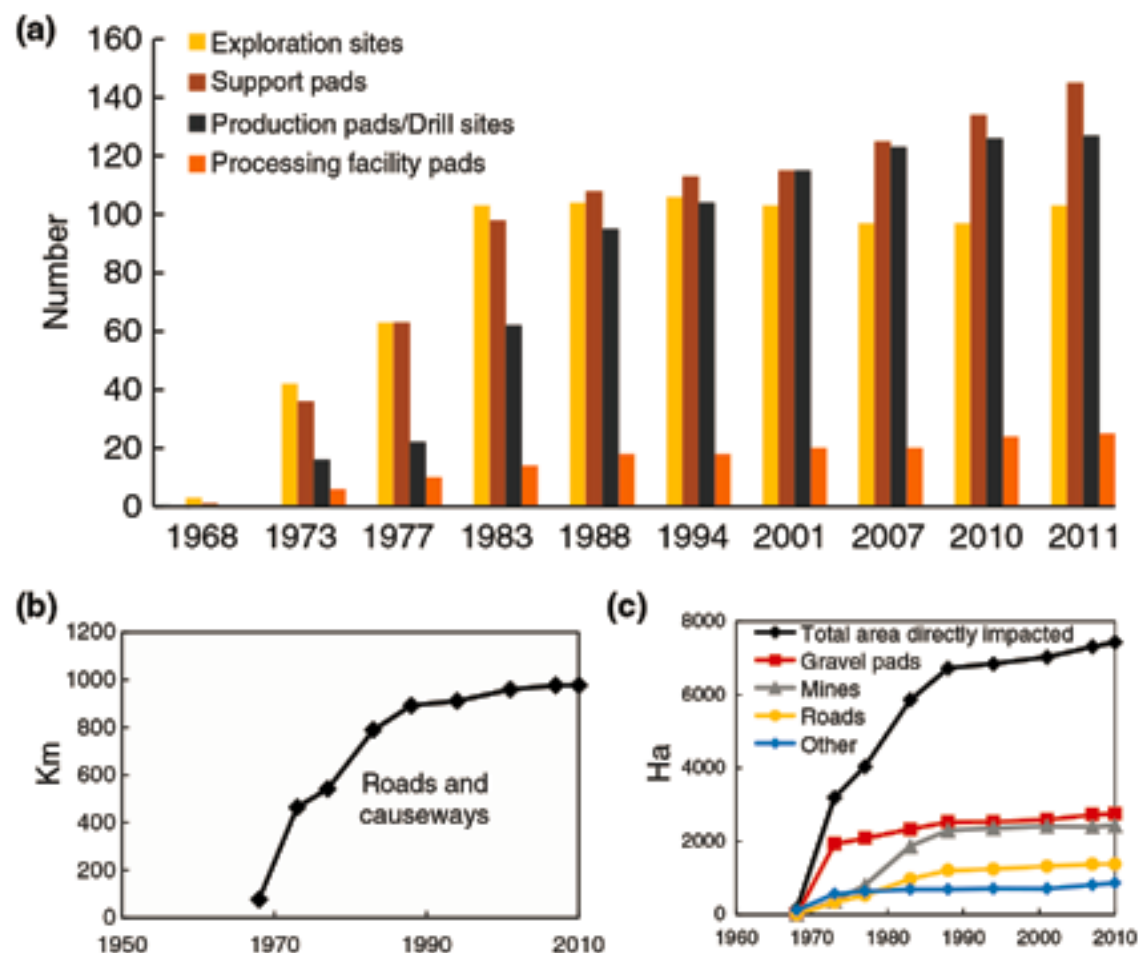
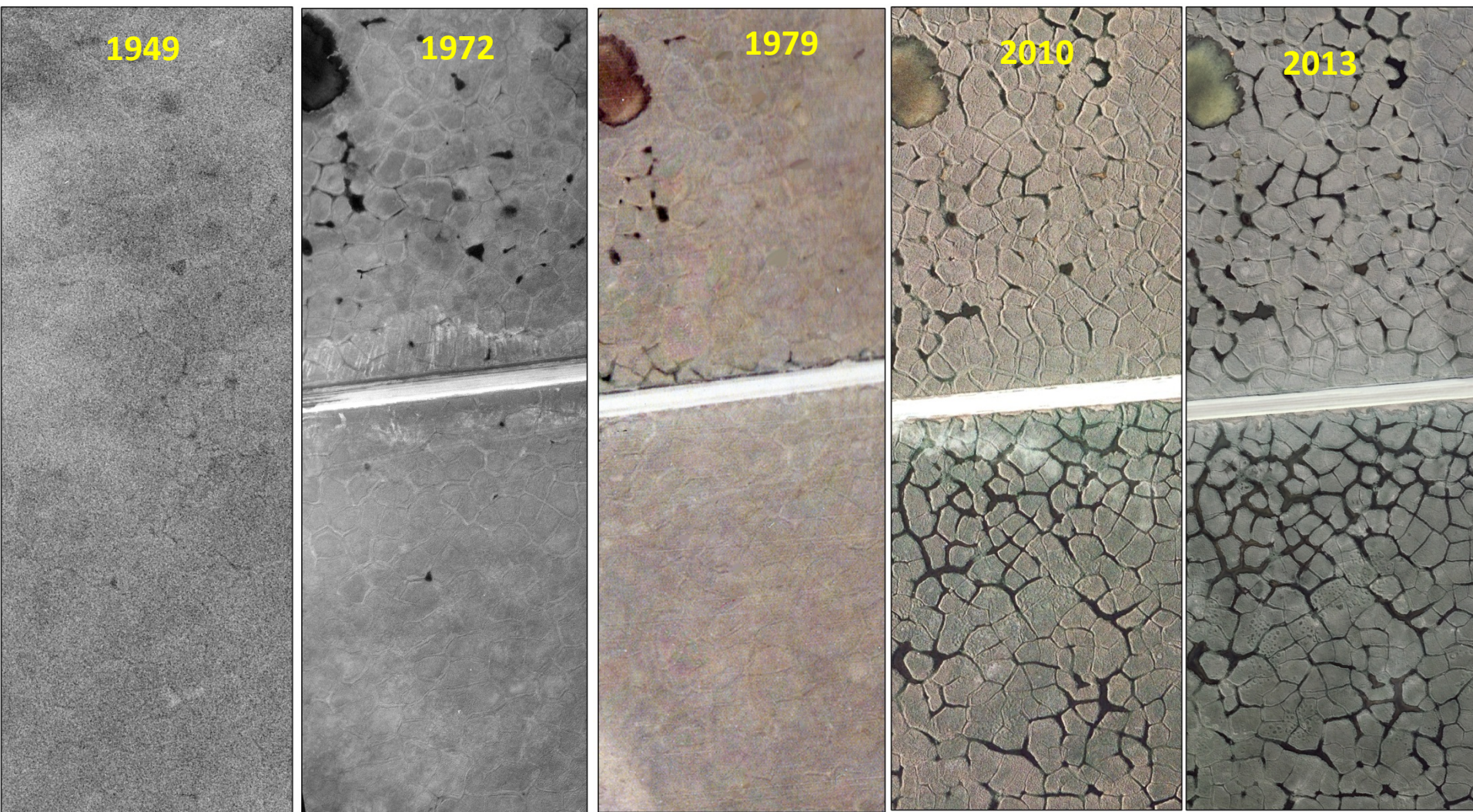
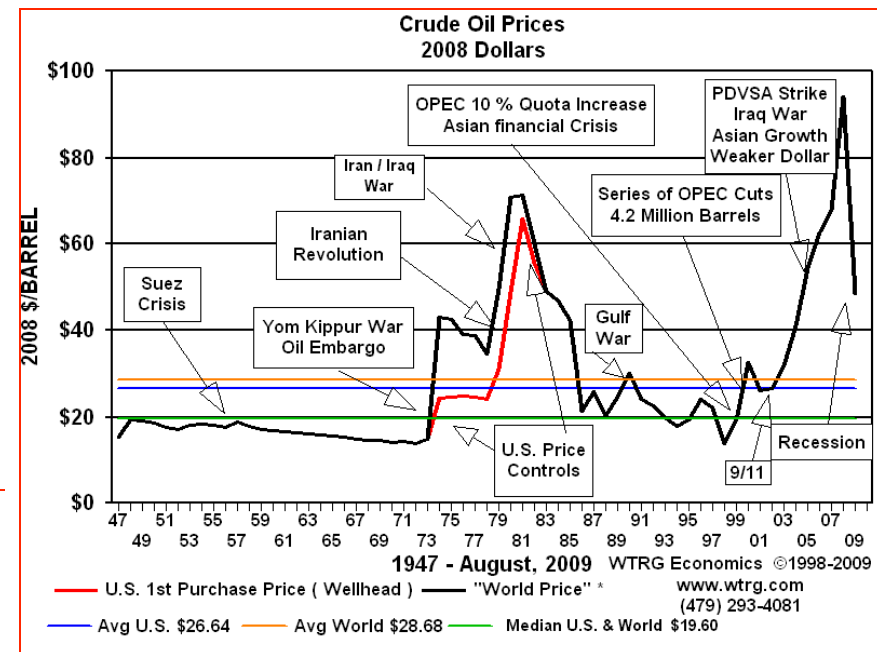
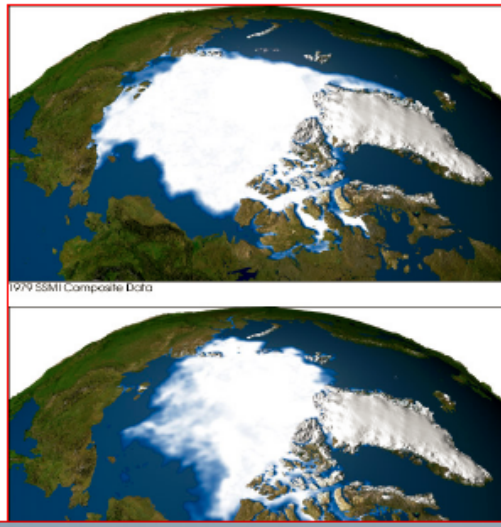


Fig. 4 History of infrastructure on the North Slope oilfields 1968–2011 (excluding the Dalton Highway and Trans-Alaska Pipeline System). (a) Number of infrastructure items, (b) total length of roads (km), (c) directly impacted area (ha). Data courtesy of Aerometric, Inc. and BP Exploration (Alaska), Inc.



**Prudhoe Bay -
Raynolds et al 2013**

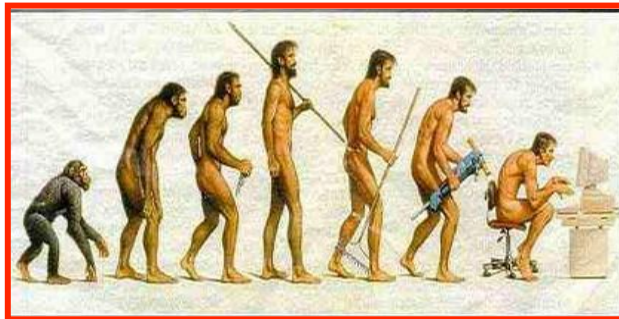
Rapid change is presenting challenges . . .

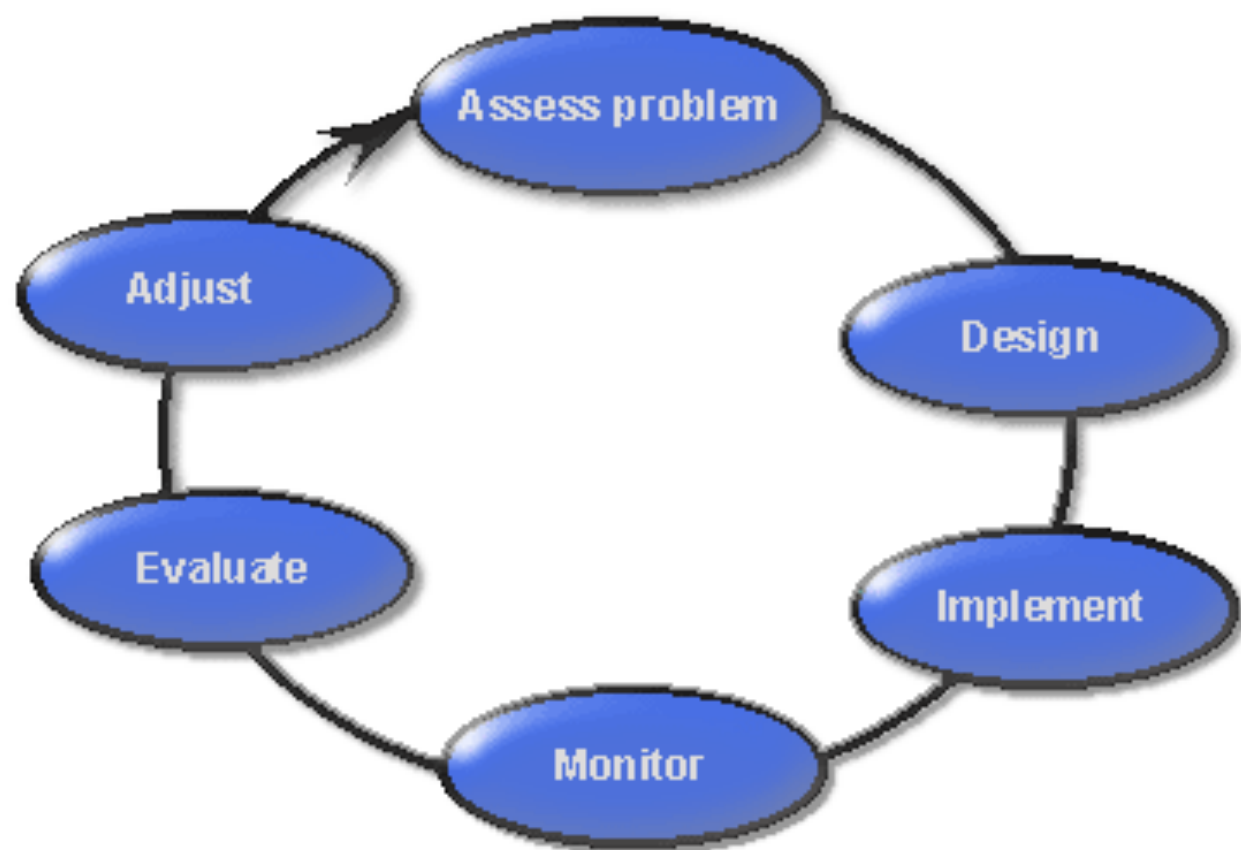


Sources: http://www.wtrg.com/oil_graphs/oilprice1947.gif

Human dimensions of land cover land use change

- Social-Ecological System
- Adaptation, mitigation, & transformation
- Adaptive Capacity/adaptability- Capacity of human actors to **respond** to, create, and shape change in the state of the system
- Adaptive Management: A strategy for limiting and anticipating surprise, and **learning** from them in a positive manner...



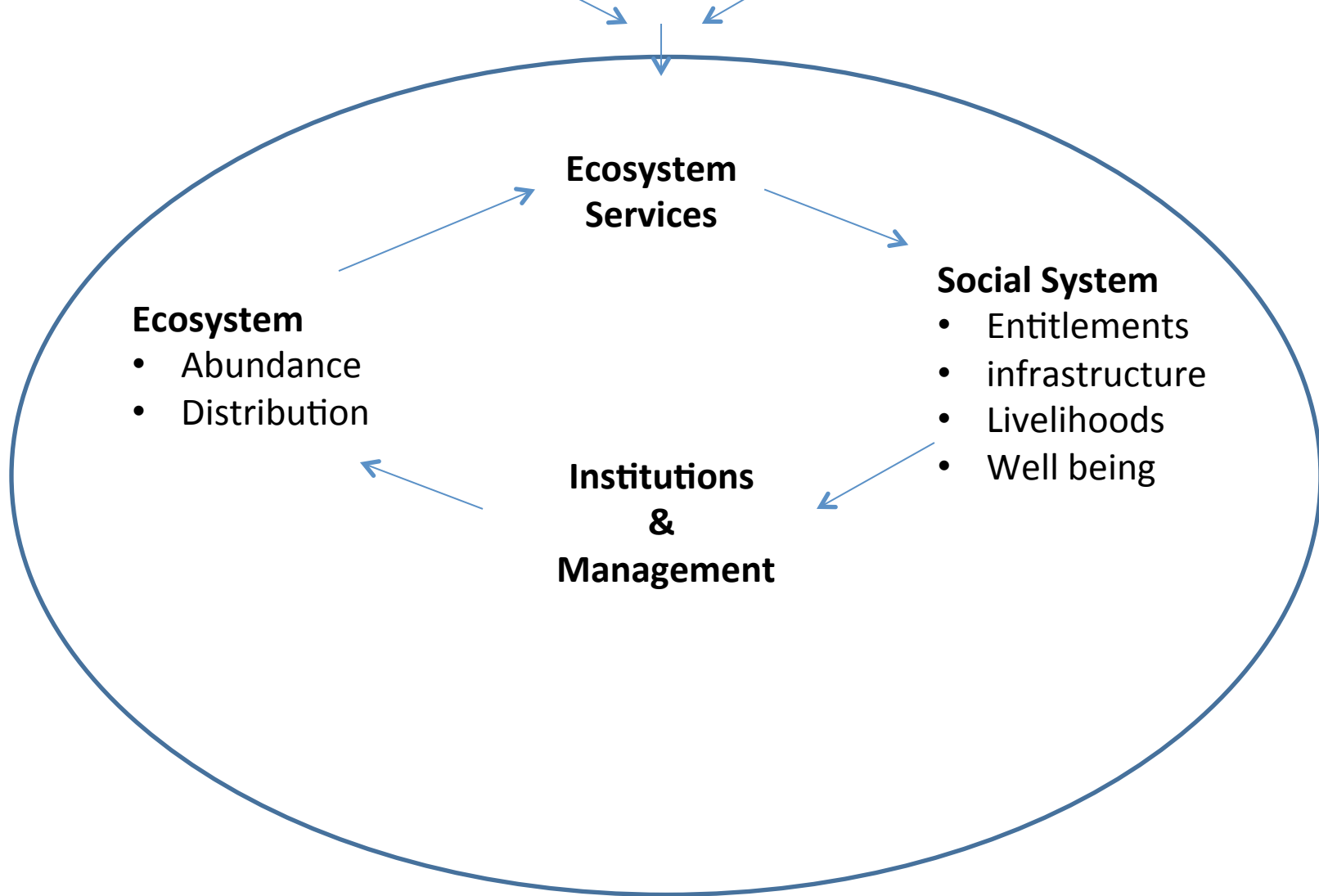


Research Activities

- Local knowledge studies with communities
- Review of assessments and records of decision
- Interviews with agency, industry, and indigenous leaders / managers

Land Use Δ

Climate Δ



Nuiqsut



Last 12 Months Overlapping Use Areas

High
466 use areas
reported by
33 respondents
Low

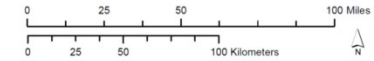
Most Recent Harvest Locations

261 harvest locations
reported by
33 respondents

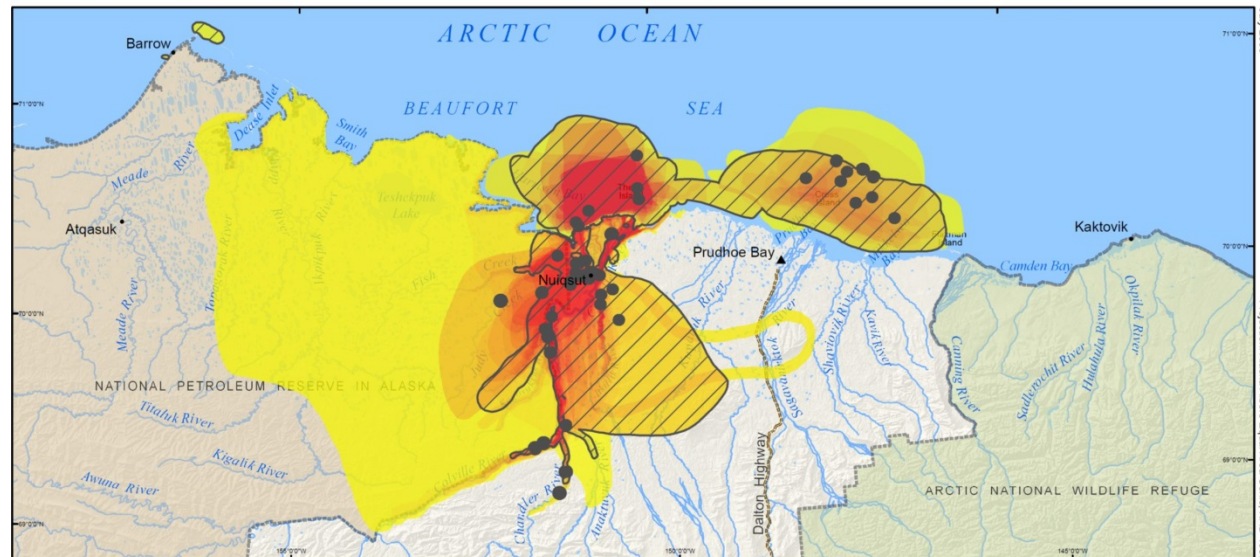
Arctic National Wildlife
Refuge
National Petroleum
Reserve in Alaska

Other areas may have been used for resource harvesting.

Some areas shown on this map may have been used while respondents visited or lived in other communities



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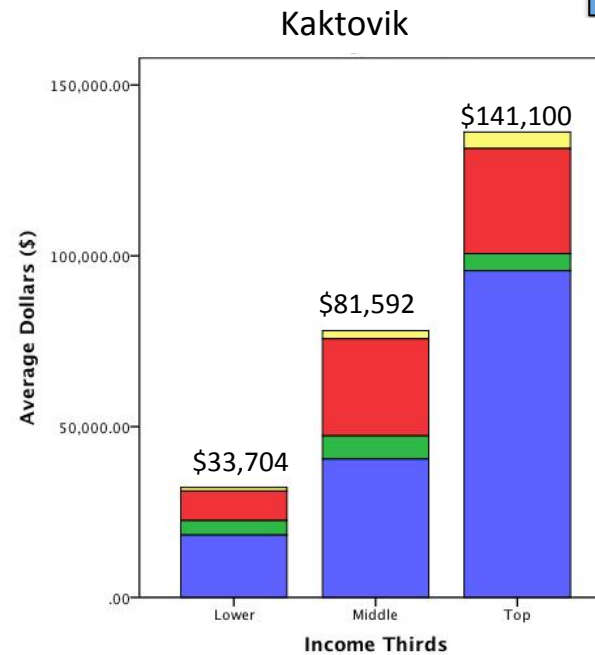
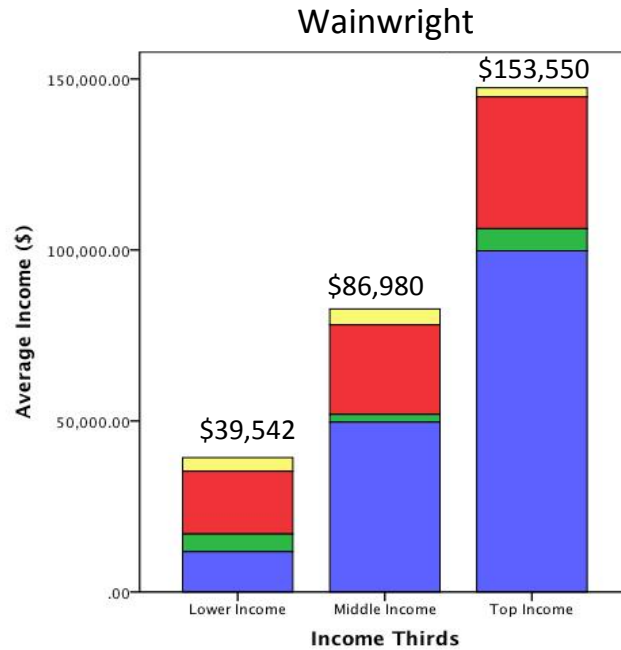


July 2009

Projection: Alaska Albers Equal Area Conc. NAD 1983

Types of Income and their returns

- Public Assistance
- Dividends
- Elders' Income
- Job Income



	Wainwright	Kaktovik
Per Capita Job Income	\$ 24,130	\$ 26,831
Per Capita Income	\$ 41,485	\$ 40,613
Employment months per adult	8.2	8.2
No. jobs/household	1.8	2.3

Jobs and
Income Data

Local-level implications

- Displacement from traditional use areas
- Changes in ecosystem services
 - Direct – caribou migration
 - Indirect (noise and pollution)
- Larger infusion of \$ to village
- Greater inner-community conflicts
- Increased wealth disparity
- Stressed capacity to engage and shape decisions

Examples of Hunter Observations of Landscape Change (completed with Alaska EPSCoR Northern Test Case)



Changing water levels



Lake draining



River bank erosion

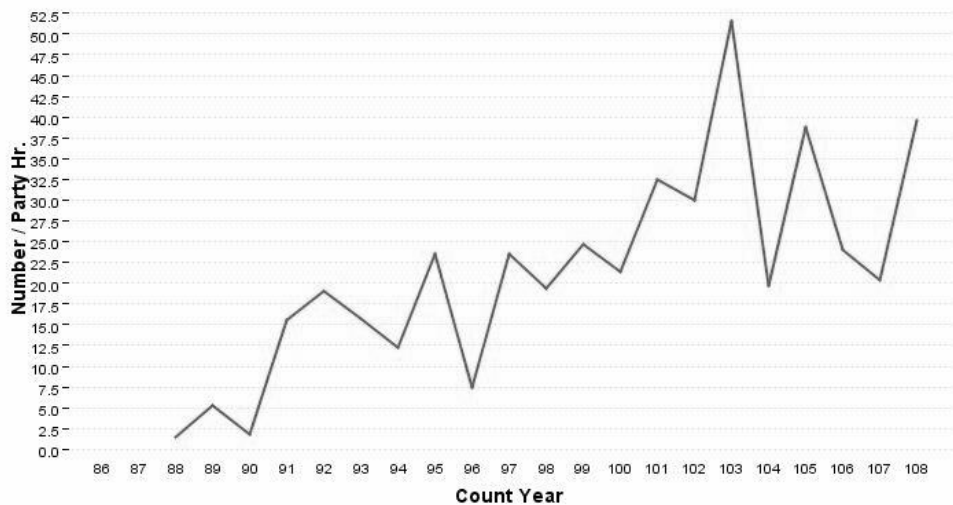
Hunters in Nuiqsut given GPS units cameras – documenting their observations of landscape change. Follow up interviews conducted for explanations and for participatory mapping.

- **Limitations realizing Adaptive Management:**
 - limited staff size,
 - high turnover of agency personnel,
 - limitations in handling the high number of applications (i.e. for permits) received,
 - a lack of standardized policies and guidelines for addressing applications,
 - limited engagement with a greater community such as university researchers and regional assessment teams,
 - inadequate GIS capacity

AK-DNR/ Northern Regions study (2006)

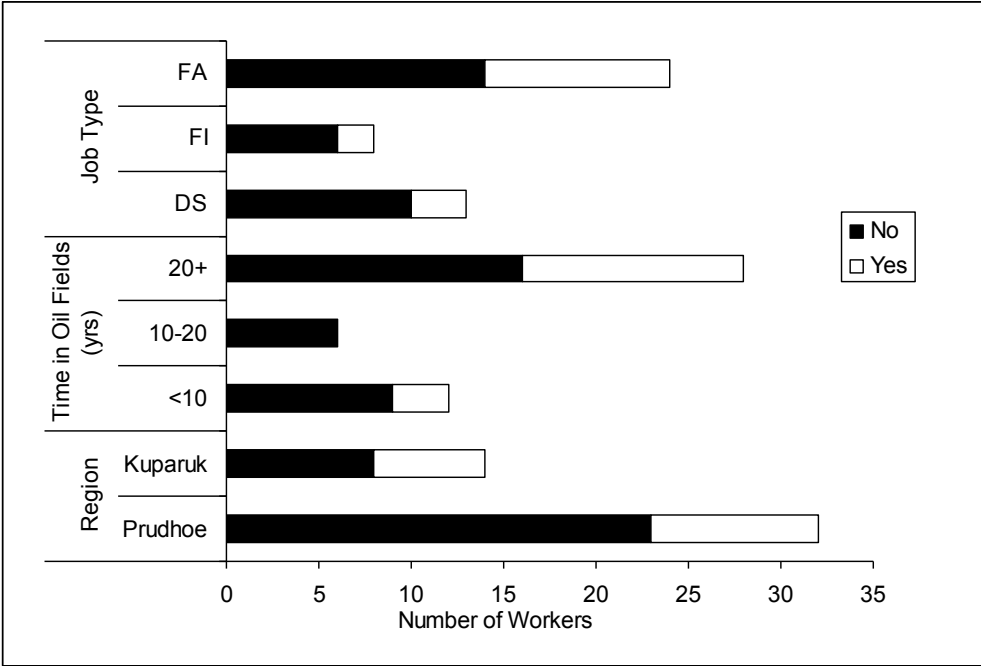
Local Knowledge of Oil Field Workers

Common Raven, Prudhoe Bay, From Count 86 to 108



S. Backenstoe (2005)

Eggs seen with raven nests?



Industry Perspective on “Adaptive Management”

- 10 middle management participants
- Cumulative effects?
- Managing aging infrastructure
- Disconnect between data and regulations
- Wicked problems
- Cases

Evolution of practice

- Netting waste pits
- Strobes to deter bird strikes
- Waste management (dumping to injection)
- Pipeline heights
- Polar Bear Hazing (USFW)
- Tundra rehabilitation
- Reuse of gravel
- Spill response
- Sedimentation near causeways
- Compliance matrix for regulations

Comparative Studies?

	North Slope Alaska	Yamal
Changes in ecosystem services for indigenous people		
Cumulative effects Perceptions of Δ Formal Assessments Indicators		
Management (practice) Agencies Industry Indigenous orgs & local communities		