Scenarios as a critical component of Cumulative Effects Analyses

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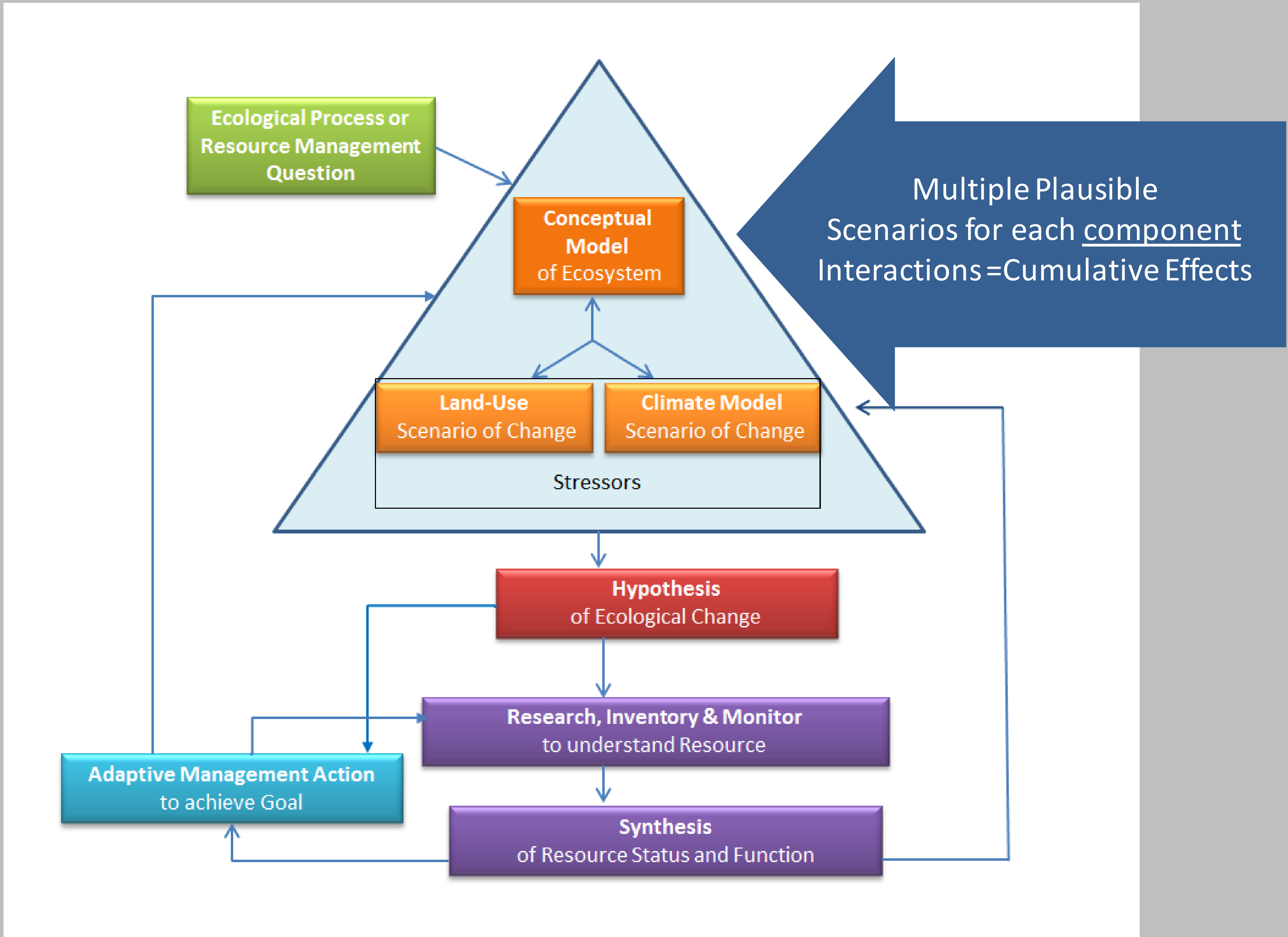
Ecological Process or Resource Management Question
Conceptual Model of Ecosystem
Multiple Plausible Scenarios for each component Interactions = Cumulative Effects
Land-Use Scenario of Change
Climate Model Scenario of Change
Stressors
Hypothesis of Ecological Change
Research, Inventory & Monitor to understand Resource
Adaptive Management Action to achieve Goal
Synthesis of Resource Status and Function

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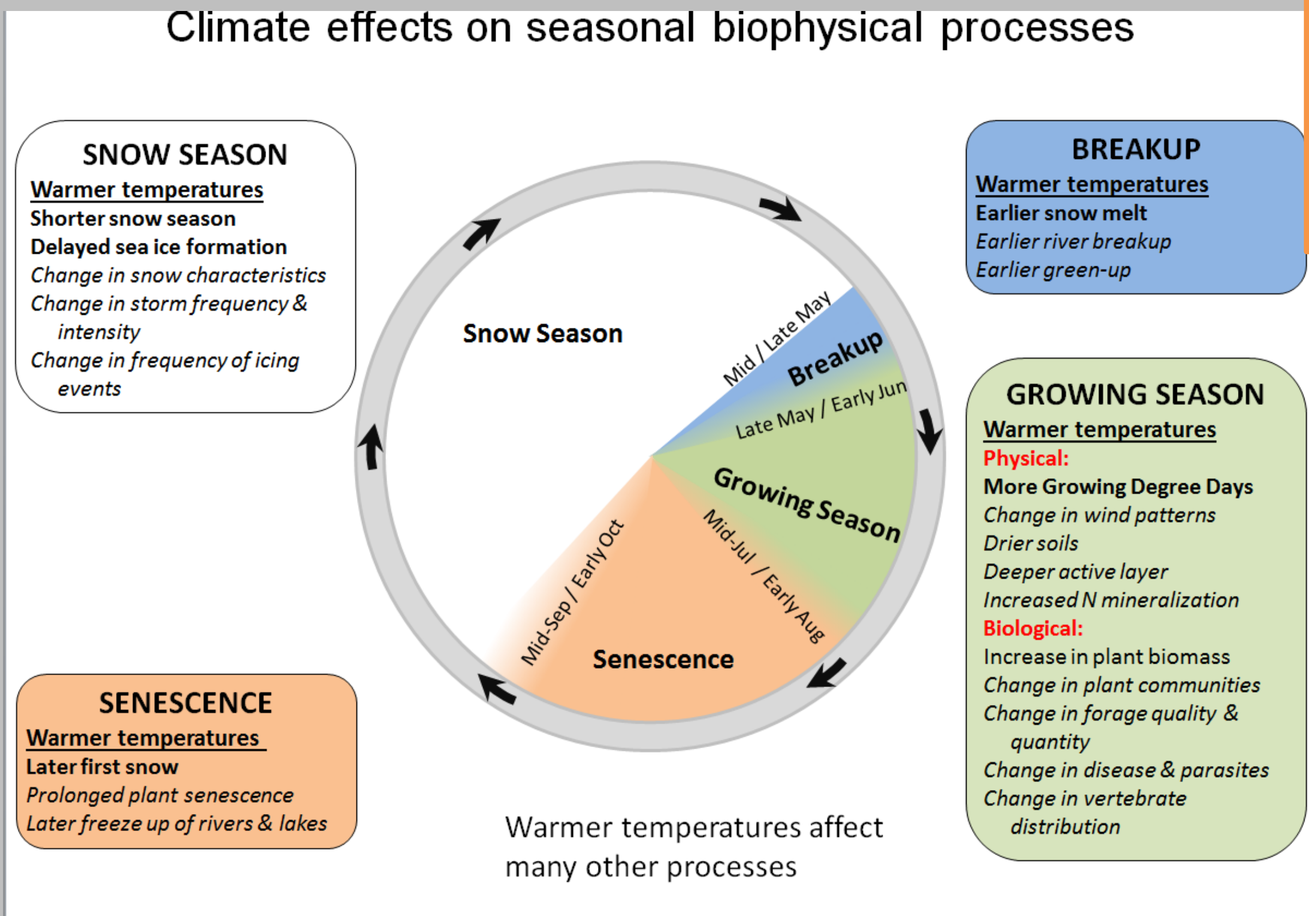
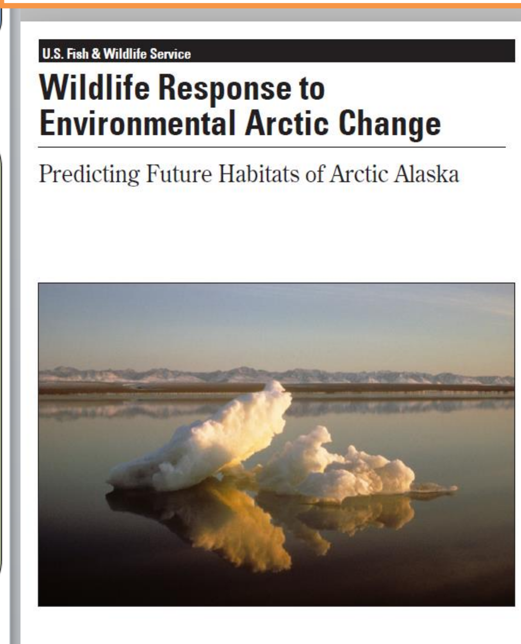
Advancing Science, Understanding Change.

Understanding future landuse and landform change in the Arctic



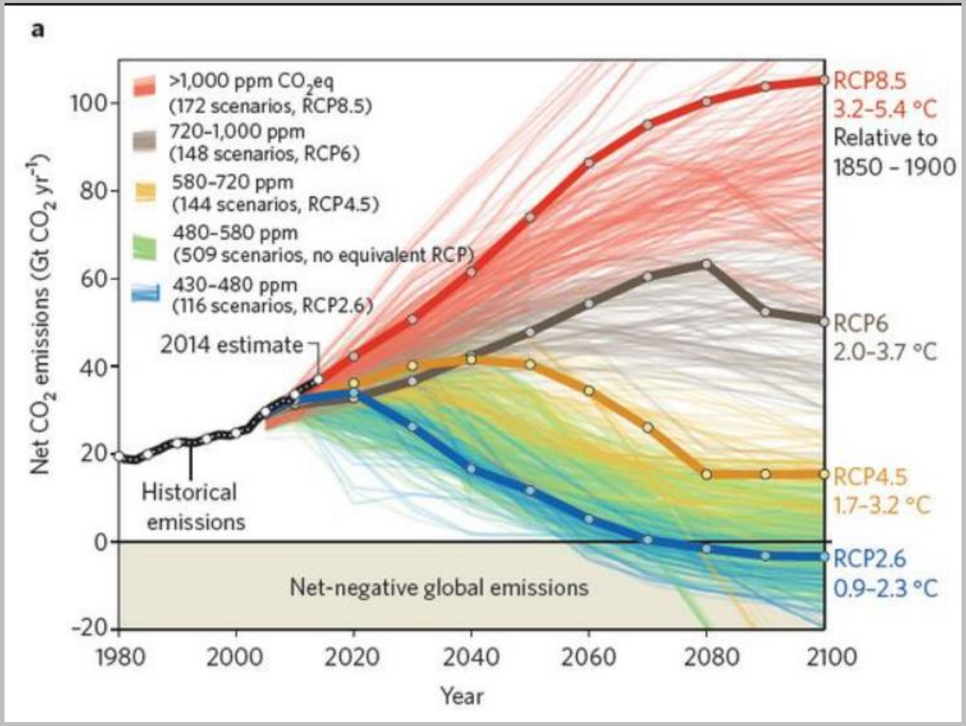
Factors driving land-form/cover change in a warming Arctic with altered precipitation, from USFWS WildREACH (2008)



SCENARIOS FOR OUR FUTURE CLIMATE

In IPCC's Fifth Assessment Report (AR5), four Representative Concentration Pathways (RCPs) describe scenarios for future emissions, concentrations, and land-use.

- Strong mitigation policies result in a low forcing level (RCP2.6);
- Two medium stabilization scenarios lead to intermediate outcomes: (RCP4.5, RCP6.0);
- RCP8.5 assumes a population to 12 billion, a low rate of technology development, slow GDP growth, a massive increase in world poverty, plus high energy use and emissions.



http://www.ipcc.ch

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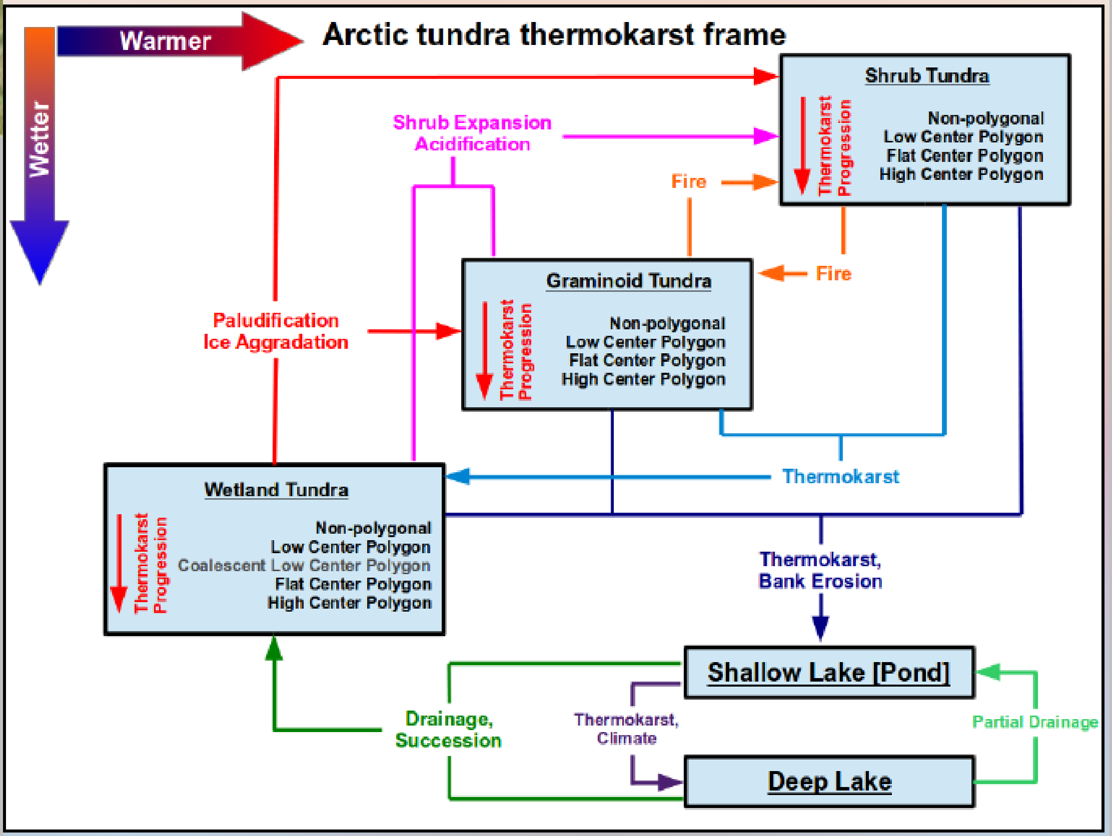
Alaska Thermokarst Model (ATM)

Bob Bolton et al. (UAF)



ATM is in development, will couple with the Integrated Ecosystem Model (IEM)

Models landform transition associated with increasing active layer for climate scenarios

Will be useful for understanding habitat change, landform stability

Understanding future land-use and landform change in the Arctic

Factors driving land-use change via energy and resource development, from the North Slope Science Initiative (NSSI) Scenarios Process (2016)

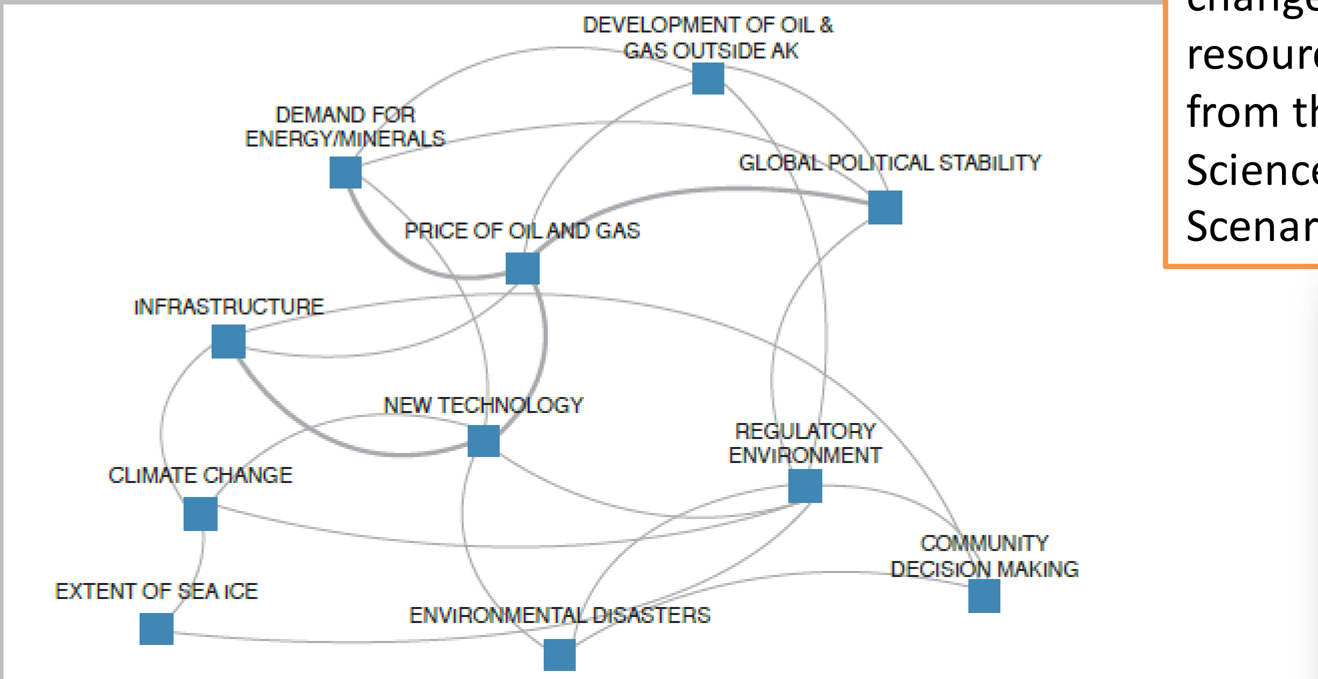
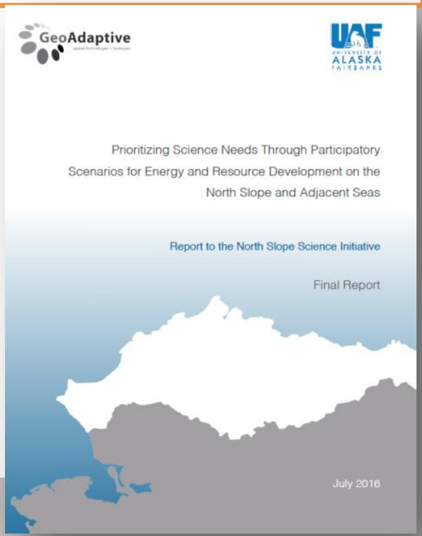


Figure 14. Summary of the key relationships amongst the top 10 drivers, including the "Community decision making" driver



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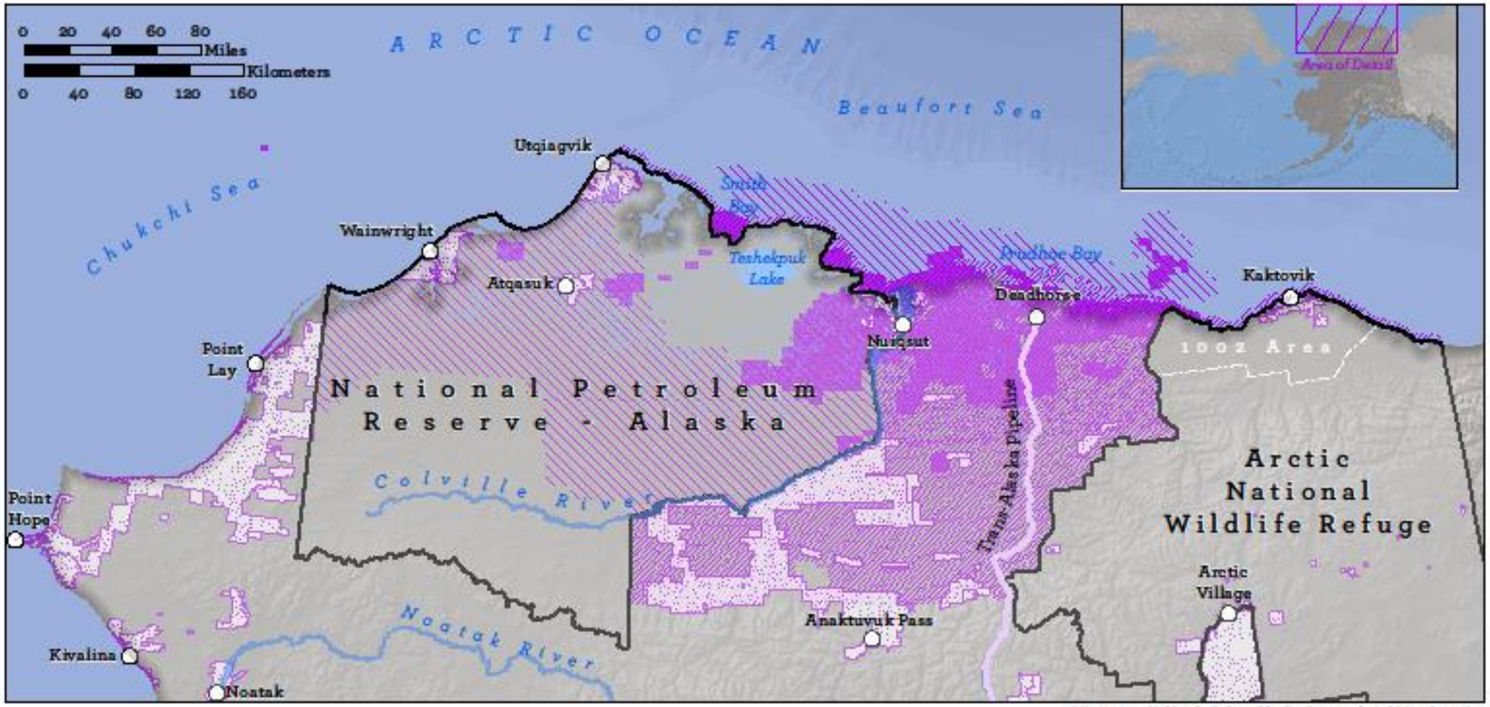
Oil & Gas Leasing on Alaska's North Slope



Map composed by Audubon Alaska. Last updated March 2, 2017.

- Sold Federal and State Leases
- Active State Lease Area
- Active Federal Lease Area
- Conveyed Native Lands
- Selected Native Lands

Approximate Extent

State Land (North Slope, North Slope Foothills, and Beaufort Sea Nearshore)[1]
- 3.5 million acres in existing leases
- 15 million acres in leasing area

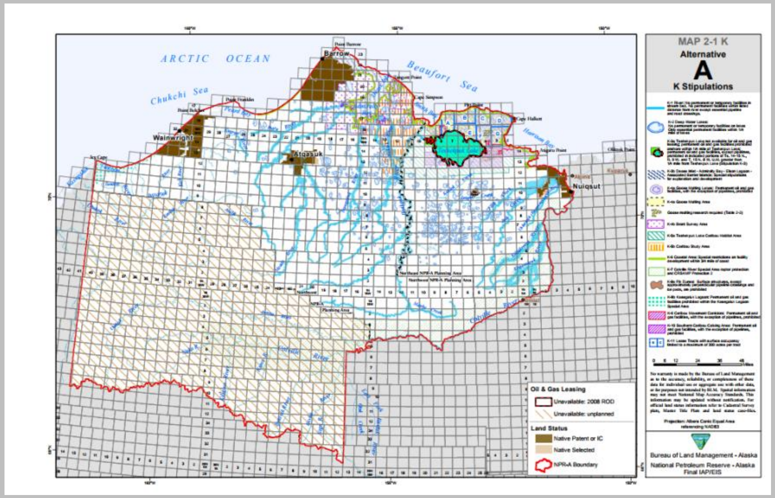
Arctic Ocean (Outer Continenal Shelf; BOEM)[2]
- 200,000 acres in existing leases
- 2.8 million acres in leasing area

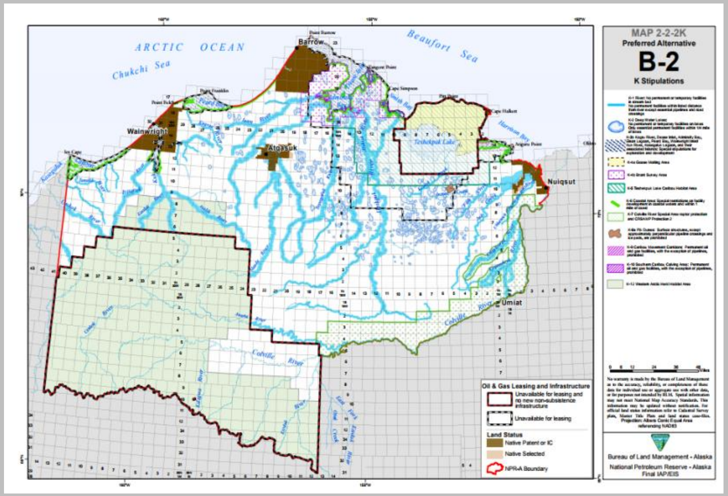
National Petroleum Reserve - Alaska (BLM)[3,4]
- 1.5 million acres in existing leases
- 12.3 million acres in leasing area
- 22.8 million acres total area

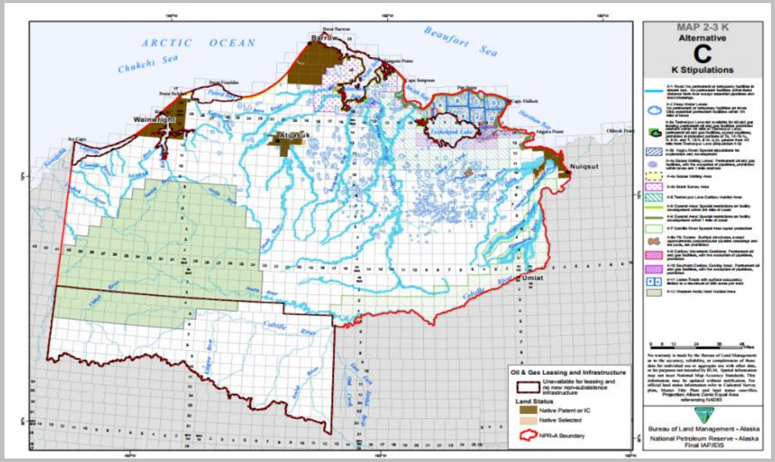
Audubon ALASKA

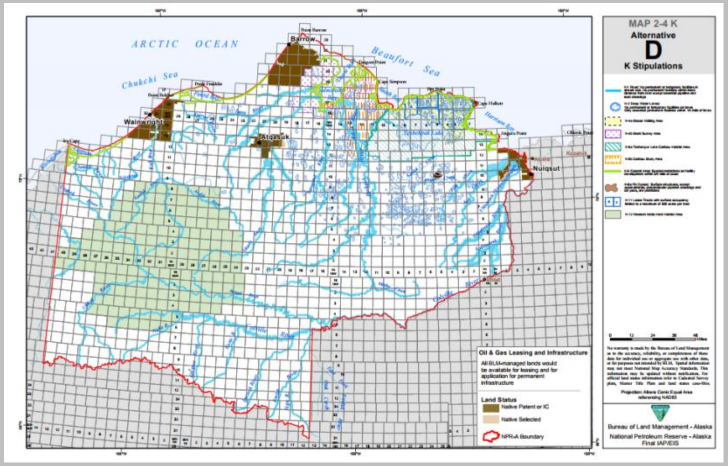
Sources:
1: Alaska Department of Natural Resources - Division of Oil and Gas. 2017. http://dog.dnr.alaska.gov/GIS/GISDataFiles.htm.
2: Bureau of Ocean Energy Management. 2016. https://www.boem.gov/Alaska-Cadastral-Data/#GIStable.
3: Bureau of Land Management. 2016. https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/regional-lease-sales/alaska.
4: Bureau of Land Management. 2013. NPR-A Final Integrated Activity Plan Record of Decision.

NPRA Management Alternatives (Scenarios) in 2013 Integrated Activity Plan/EIS









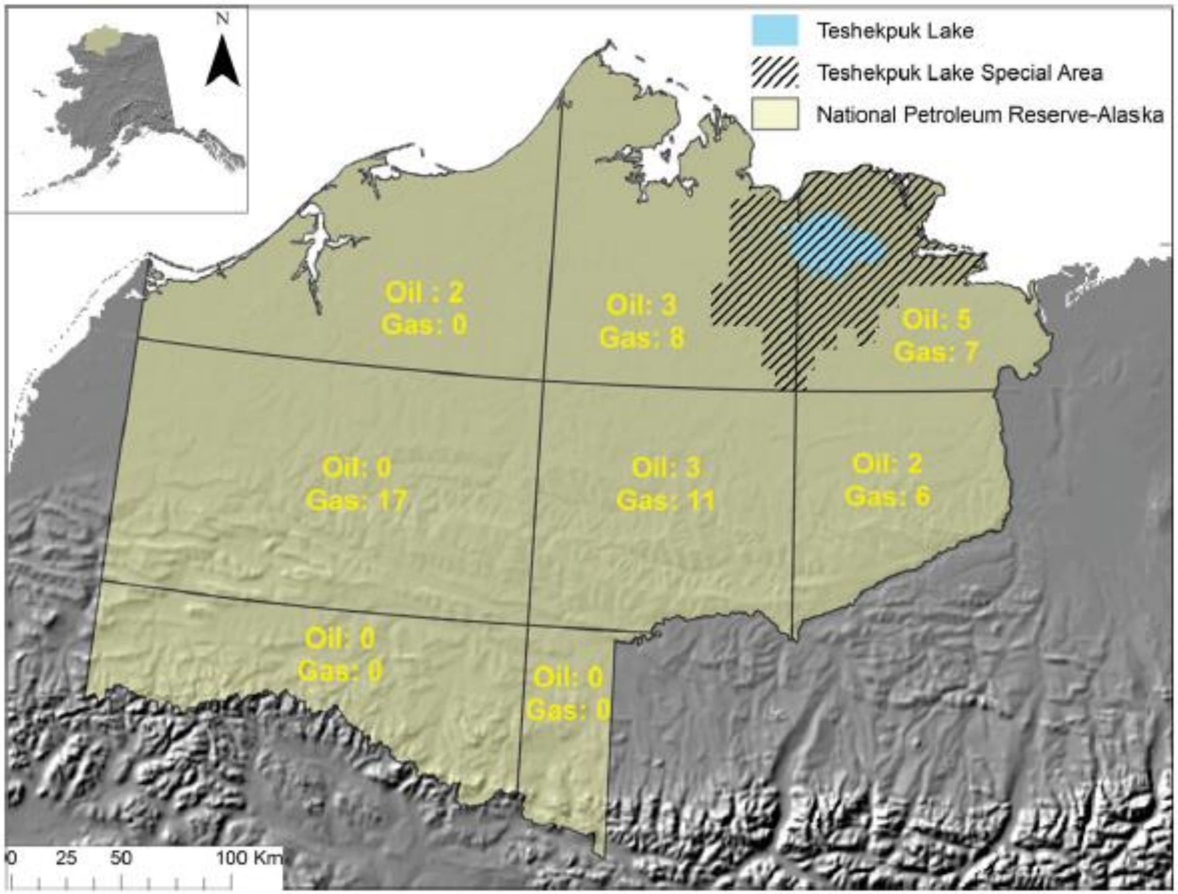


Figure 1 Location of the National Petroleum Reserve-Alaska (NPRA) within Alaska. Borders of Economic Zones within the NPRA are depicted and labeled with the number of oil and gas accumulations expected to be economically viable to develop if the entire reserve were open to development. The Teshekpuk Lake Special Area depicted with hash marks. Accumulation data are from Attanasi & Freeman (2011).

From Wilson et al. (2013) *Accounting for uncertainty in oil and gas development impacts to wildlife in Alaska,* Conservation Letters

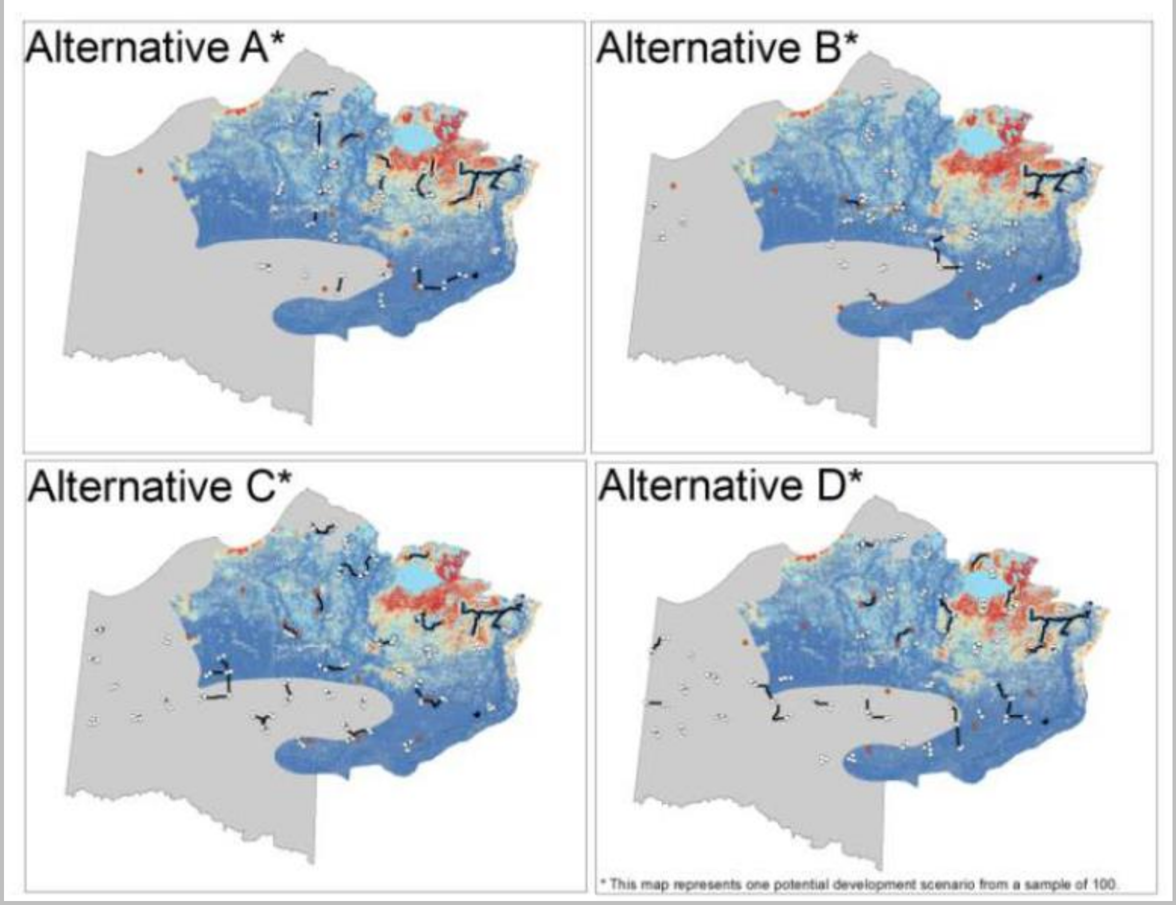
Effects of landuse change, ready for landform change

Development footprint assumptions defined in NPRA IAP/EIS

To account for uncertainty in location of oil, models were run 100 times

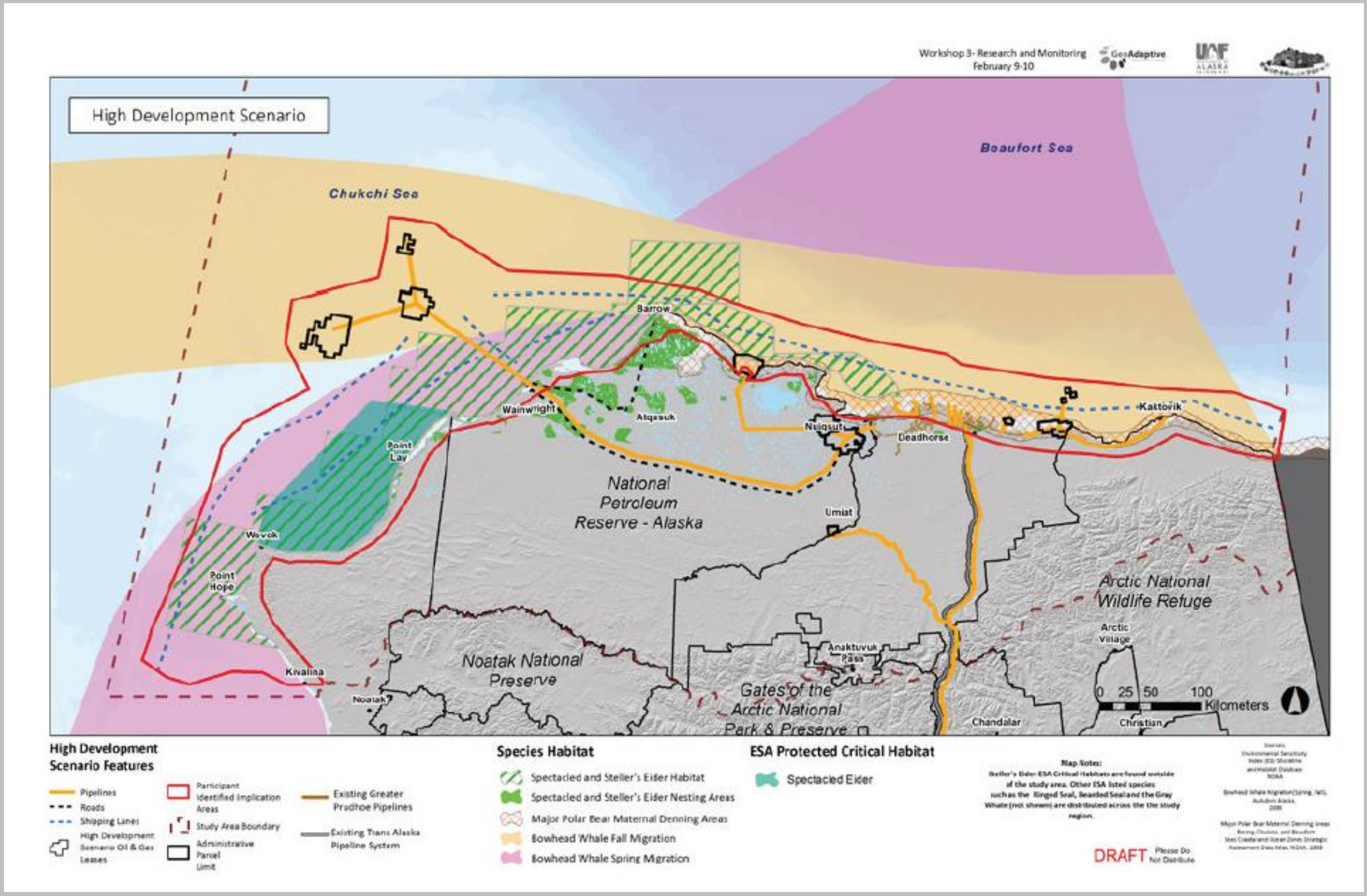
Footprint (black) overlaid on high value caribou calving habitat (red) and habitat was devalued based on proximity to infrastructure

Allowed for quantification of impacts of development on calving habitat



From Wilson et al. (2013) *Accounting for uncertainty in oil and gas development impacts to wildlife in Alaska,* Conservation Letters

NSSI Development Scenarios: Guiding Monitoring and Research



Example: A tool to explore scenarios of routes for a pipeline from the Chukchi Sea to Nuiqsut or Umiat

Quantify how route changes under different management scenarios:

- ‘costs’ of landscape features like waterbodies
- Economic, development potential and engineering considerations related to thermokarst
- Other scenarios (ASTAR)

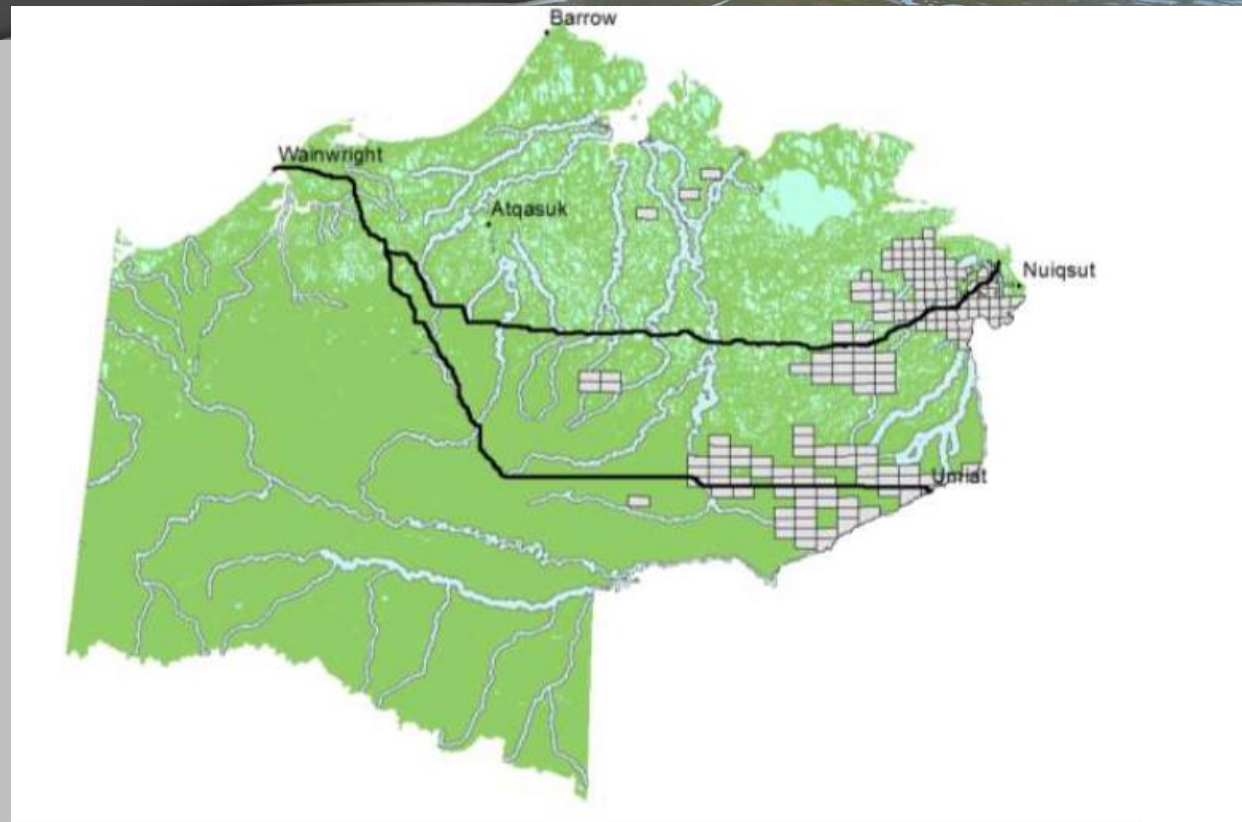


Figure 5. Two potential routes to transport oil from the Chukchi Sea from Wainwright to TAPS under Alternative B. Pipeline routes are restricted based on surface development restrictions outlined in the Draft Plan. Least-cost path analysis was used to estimate a pipeline route from Wainwright to CD-5 (top line), or Wainwright to Umiat (bottom line). The model allowed pipelines to go across water, but at a high cost (low permeability). Pipelines were allowed to go through areas such as river buffers (shown on the map in blue with black outline) that “generally” restrict surface development except when necessary. In these areas, the cost was increased to 50% of unrestricted lands.

From Loya and Wilson, comments to BLM on NPRA Draft EIS, 2012

Scenarios can be used to guide quantitative analyses of cumulative effects of ecosystem, cultural, economic and other values

Assumptions and drivers need to be updated as new information becomes available

Quantitatively evaluating scenarios produces science that stakeholders can typically agree on, begin a discussion about current and future values