

Scenarios for Energy and Resource Development on the North Slope and Adjacent Seas

Research and Monitoring
Prioritization for the NSSI

Community Environmental Health & Food Security

Summary

As interest in oil and gas development and resource extraction increases, communities may face positive and negative effects on health and food security. Exposure to contaminants, pollution, or hazardous conditions can affect community health through impacts on water and air quality, land use sites, and food sources. Presence of infrastructure, exploration activities, and exposure to contaminants can affect animal behavior, subsistence species populations and potentially conflict with harvest activities. Permitted resource extraction activities take into consideration potential impacts to community health and possible disruptions to subsistence activities. Resource development may also provide positive effects on community health (e.g. improvements in health services).

Chronic exposure to contaminants, changes in diet and environmental changes that affect access to subsistence resources can act as drivers affecting regulations, costs for mitigating pollution, and community perceptions of resource development in the region.

Overview

Factors affecting community health and mortality may change over time and several factors (e.g. diet, climate change) may interact to cause changes in disease, mortality and injury rates. Strong relationships between Alaska Native communities and the environment are bound in culture. Negative impacts to the environment could have direct and indirect impacts on health and food security, particularly as they relate to the use of subsistence resources.

Air quality

Most emissions in the North Slope come from stationary point sources such as industrial processes and energy generation activities (1). Road vehicles and aircraft, burning waste, and venting vapors (e.g. solvents and gasoline) contribute as non-point sources of emissions. Pollution from road dust and quarry operations in gravel pits are man-made sources of dust that can be difficult to suppress in villages. Values of dust above the National Ambient Air Quality Standard ($150 \mu\text{g}/\text{m}^3$) have been recorded in the Northwest Arctic Borough (3).

Natural sources of air pollution include forest fires, volcanic eruptions and wind-blown dust. Particulate matter (including dust and ash), gases (e.g. carbon monoxide, nitrous oxides, sulfur dioxide) and aerosols (e.g. mists/ fumes) affect air quality and can contribute to respiratory health problems, such as asthma. Elderly adults, children and those with heart or lung problems are at greater risk of negative effects from air pollution.

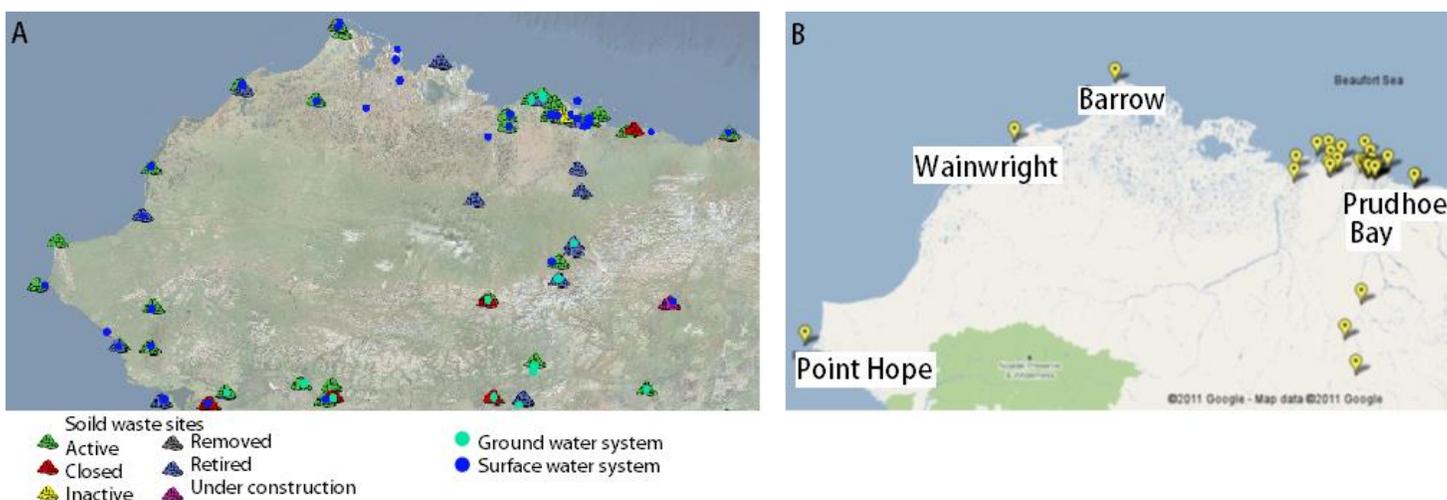


Figure 1. (A) Locations of drinking water protection areas and solid waste sites on the North Slope (Source: Alaska Department of Environmental Conservation), and (B) major permitted emission point sources in the North Slope Borough (1)

Water quality

Access to adequate clean water plays an important role in prevention of disease transmission and maintenance of health. Over 80% of housing units on the North Slope have water and sewer service. There are few cases of water-related health problems or water borne-disease issues on the North Slope. In Alaskan communities without in-home piped water studies show elevated rates of lower respiratory infections, skin, and sometimes gastrointestinal infections. These infections are often associated with hygiene behaviors and water availability.

Human-caused sources of water pollution may come from atmospheric deposits or from direct discharge of waste or pollutants. Water pollution may be transported through hydrological pathways from distant sources or on drifting sea ice. Pollutants may include hydrocarbons, metals (eg. lead, mercury), nutrients or sediment loads, or organic waste. Persistent organic pollutants (POPs) may also accumulate in the tissues of contaminated animals and may affect humans using these animals for food. High exposure levels may include health impacts to the central nervous system, child and fetal development problems, seizures or death. It is likely that exposure to many contaminants is primarily through food consumption.

On the North Slope sediment loads are highest during the spring run-off. Elevated levels of trace metals have been found in Prudhoe Bay and the Chukchi Sea but at levels lower than the USEPA criteria for marine life protection (4). Hydrocarbon concentrations in the Beaufort Sea are also below detrimental levels and are unlikely to be from anthropogenic sources.

Terrestrial contamination

Dump sites, waste storage sites and spills or leaks can contribute to contamination on land. Kaktovik and Nuiqsut contain the highest number of active contaminated sites in the North Slope (7). Outside the North Slope Borough, dust from road traffic around mining sites may be responsible for elevated zinc and lead concentrations on vegetation and in soils (5).

Contaminated sites on land may also threaten water quality for surface and groundwater sources of water.

Food security

Food security refers to reliable access to affordable, nutritious, and culturally appropriate sources of food.

Access to subsistence resources

Changes in climate, the environment (e.g. sea ice, thermokarst), human activities (e.g. noise, waste discharge) and the presence of built infrastructure have the potential to affect the habitat, population size and movements of subsistence species. For example, marine mammals are sensitive to noise disturbance and caribou may alter their behavior in the presence of roads or pipelines. Subsistence use areas vary by community and each community may face different challenges for accessing subsistence resources (e.g. safety for hunters on sea ice, changes in caribou migration patterns). Subsistence camps used for generations may be lost through erosion of lake and coastal shorelines or river banks. This also affects access to food.

Contaminated food

High contaminant levels of PCBs, DDT or hydrocarbons have not been detected from monitoring studies of fish in the North Slope. Elevated methyl mercury levels have been found in villages south of the study area and higher contaminant levels in marine mammals have also been detected. Nursing mothers may need to be aware of potentially contaminated caribou meat from animals consuming lichens. Although disease outbreaks occasionally affect marine mammals and birds there are no known major effects on community health through consumption of contaminated subsistence food (4). Perceptions of the safety of subsistence foods may also influence the use of subsistence foods.

Food storage

Residents of some communities use below-ground food storage cellars dug into permafrost. Thawing of permafrost may impact their ability to keep food safely stored for extended periods.

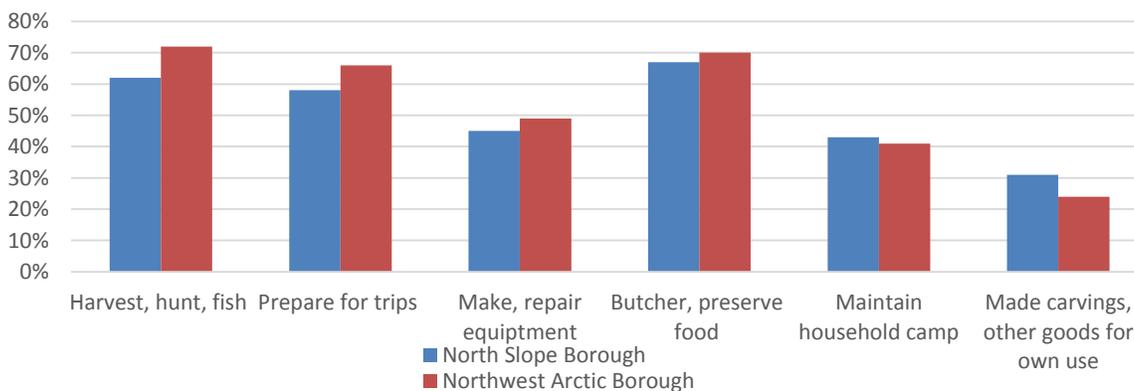


Figure 2. Household adults participating in subsistence activities. Source: Survey of Arctic Living Conditions (6)

Uncertainties

Non-subsistence food sources

Changes in the dietary amount of processed food and other store-bought food can affect community health by altering diets. Income and access to commercial food also plays a role in food security. The low incidence of cardiovascular mortality in the North Slope has been attributed to the use of subsistence resources, while increasing rates of diabetes and obesity may be related to greater consumption of commercially available foods such as high-sugar content drinks. Higher incidences of tooth decay in rural communities have been associated with the affordable, sugary beverages, and the lack of consistent and affordable dental care (7).

In 2012 approximately 12.49 % of the North Slope population were participants of SNAP (nutrition assistance) (8). Changes in access to food or emergency food supplies also affect food security.

Trends

Trends in health problems on the North Slope show increasing rates of cancer. Lung cancer is most common, followed by colorectal, prostate and breast cancer on the North Slope. Increasing injury rates have also been reported as well as increasing rates of chronic lower respiratory disease on the North Slope. Changes in diet and smoking or chewing of tobacco products have been identified as possible causes of major health problems in the region, but few studies have provided a direct link between contaminant levels and human health.

Long term monitoring of food security and human health has not been consistently applied throughout the North Slope. As a result, it is difficult to project impacts of environmental contaminants on human health or trends in food security. The effects of contaminants from distant sources (e.g. airborne contaminants from Asia, radioactive contamination) can be difficult to track or regulate. The high incidences of health problems such as cancer and cardiovascular disease are difficult to ascribe to specific causes making it difficult to link changes in the environment to observed trends in health problems. The cumulative effects of different factors on health are also not well understood although Health Impact Assessments are a possible tool to identify the relationships between development and human health.

Factors affecting food security differ by village and it is highly uncertain how each community may be affected by potential events such as large-scale oil spills in the marine environment. The proportion of subsistence foods relative to commercial foods consumed may also change over time, changing the health risks of exposure to contaminated subsistence foods, or the potential health impacts from consuming more processed food (e.g. tooth decay, cardiovascular disease).

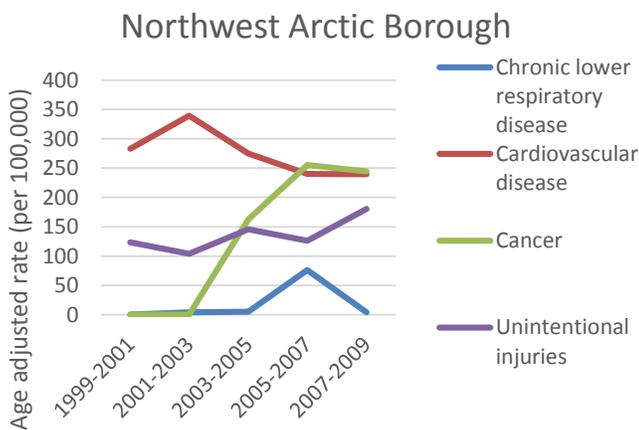


Figure 3. Cause of mortality from 1999-2009 in the Northwest Arctic Borough (2)

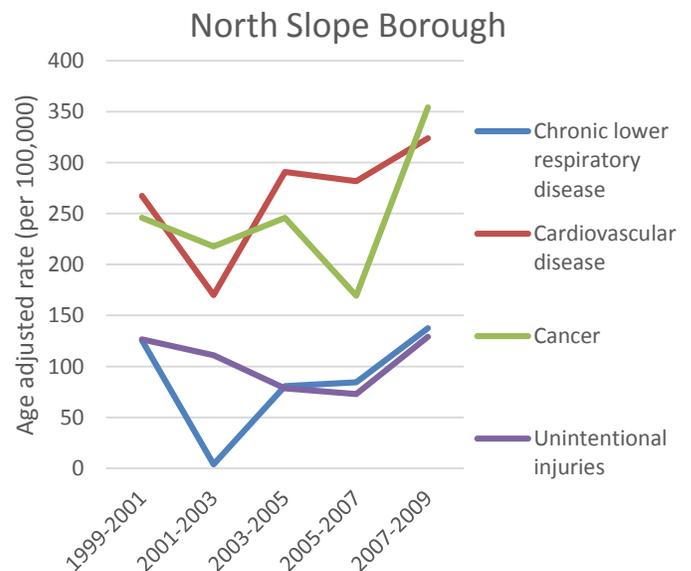


Figure 4. Cause of mortality from 1999-2009 in the North Slope Borough (2)

Driver interactions

Resource development

Industrial activities from oil and gas extraction and mining activities produce waste that subsequently needs to be disposed in permitted locations. State and Federal regulations limit the levels of pollutants and contaminants that may become chronic sources of exposure to communities. Regulations may require treatment of waste materials prior to disposal or plans for long-term containment of waste. Point sources of pollution can be monitored to track emissions and discharge levels that may affect communities in close proximity to contaminants. However increased vehicle transportation activity and wide-scale movement of airborne contaminants may also affect the health of communities not directly exposed to the source of pollution.

The presence of built infrastructure and occurrence of exploration activities (e.g. seismic exploration) have the potential to affect the behavior, habitat and health of subsistence species. Impacts to subsistence harvest activities have to be considered to avoid or minimize any disruptions. Other direct effects of resource extraction activities on food security may include contamination of subsistence food from waste discharge or accidental spills. Improvements in employment-based income may in turn affect the financial accessibility of either subsistence or store-bought food. Economic benefits from resource development may include improved access to health and sanitation services.

Although not currently considered a major impact on community health, increasing the number of workers from outside communities may also bring changes in culture.

Other driver interactions

Climate change is predicted to influence the safety, access and storage of subsistence food with potentially negative impacts on food security (9). As the region becomes more accessible for travel year-round, the influx of human and invasive species may expose communities to greater health risks or disruptions in subsistence harvest activities.

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