



Sector 2: Health and Culture

All of the impacts included in the Health and Culture sector are described below and organized according to subsector. This sector focuses on the human health, cultural, recreational, and quality of life impacts of climate change on Alaskans.

DISEASES

1. **New and expanded diseases due to warmer temperatures:** Current impacts – new warmer temperature diseases, such as *Vibrio parahaemolyticus* and gastroenteritis in Prince William Sound oysters; increase in existing diseases because of warmer temperatures, such as botulism (e.g., Shishmaref), paralytic shellfish poisoning, giardiasis; *Trichinella* from walrus; *Anisakiasis* from anadromous and marine fishes; geographic expansion of diseases in Alaska, such as *giardia* from expansion of beavers; increase in bacterial skin infections. *Future projections – greater number of and extent of diseases (e.g., Echinococcus multilocularis parasitic tape worm disease); continued expansion and exposure to pathogens and diseases; greater incidence of skin infections and similar conditions; emergence of new or existing vector-borne diseases as temperatures become warm enough to support ticks, different species of mosquitoes, etc. (e.g., West Nile virus, Lyme disease, tularemia); emergence of new viral diseases transmissible to humans from rodents due to expanding populations and latitudinal shifts in distribution (e.g., "roboviruses" in white footed deer mice and voles).*
2. **Increase in disease-based health problems accompanying collapse of sewage or land fill infrastructure:** (Note: the underlying infrastructure issues are addressed in the Public Infrastructure Sector analysis; this subsector in the Health and Culture Sector addresses the health impacts of such failures) Current impacts – some communities have lost their landfill sites due to shoreline erosion, thawing permafrost, storm surges, or flooding (e.g., Newtok). *Future projections – greater health problems associated with landfill and sewer infrastructure failures affecting more communities.*

AIR QUALITY

3. **Smoke and other respiratory irritants:** Current impacts – increase in forest fire and tundra fire smoke resulting in respiratory disease exacerbations; recent years have seen

record breaking forest fire seasons (e.g., over 11 million acres burned in 2004/2005, the first and third largest seasons) and record breaking tundra fires (e.g., in 2007), with resulting respiratory impacts (e.g., Fairbanks exceeded EPA air quality small particulate standards repeatedly in 2004 and 2005; high reading was 1,000 micrograms/cubic meter); forest fires releasing more mercury (up to 15 times more) in the air that was sequestered in the soil; increase in other respiratory disease exacerbations, such as new and more prevalent airborne allergens over a longer season. *Future projections – greater amount of smoke with more respiratory disease exacerbations; greater release of mercury; increase in other pollutants, such as ozone and dust from newly retreated glaciers.*

WATER QUALITY

4. **Water quality and availability issues:** Current impacts – decrease in quality of potable water from drought (e.g., Nanwalek and Mountain Point), saltwater intrusion, source depletion, permafrost aquifer loss (e.g., Kwigillingok), sea water surges overtopping and contaminating freshwater reservoirs (e.g., Numan Iqua 2004); less access to quality drinking water from modified waterways or reduced stream flow. *Future projections – greater water quality and availability problems for communities and individuals with potentially associated health impacts.*

CULTURE AND SUBSISTENCE LIFESTYLE

5. **Traditional knowledge, ways of knowing, and subsistence culture:** Current impacts – undercutting of traditional knowledge and ways of knowing due to substantial changes in weather, migratory patterns, plant species distribution, ice and snow conditions, and overall predictability; destabilizing effect on culture and elder structure; adverse impacts on subsistence ways of life due to more difficult and dangerous travel conditions, less available prey, more diseases, loss of ice cellars, changed migratory patterns, etc.; increased migration from villages to hubs or urban settings with impacts on culture; potentially adverse impacts on youth who experience fewer opportunities to learn the subsistence ways of life due to reductions in traditional subsistence activities. *Future projections – greater undercutting of traditional knowledge and ways of life resulting in greater destabilization of culture and traditions; greater impacts on subsistence ways of life and increased urban migration.*
6. **Archeology and history:** Current impacts – loss of irreplaceable artifacts to coastal erosion, thawing permafrost, greater storms, river erosion (e.g., areas around Pt. Hope, Kaktovik, Barrow). *Future projections – continued losses.*
23. **Cemetery impacts:** Current impacts – cemeteries have been damaged from coastal and river shore erosion and thawing permafrost (e.g., Nanwalek, Barrow, Noatak,

Tuntutuliak). *Future projections – greater loss of cemeteries and potential need to relocate (e.g., Koyukuk), especially with significant sea level rise.*

24. **Ice cellar warming:** Current impacts – ice cellars are warming and thawing, impacting subsistence storage capabilities (e.g., areas around Kaktovik, Barrow). *Future projections – increased warming and loss of storage capability.*

7. **Diminishment or change of subsistence diet:** Current impacts – decreased quantity of subsistence foods (e.g., waterfowl, fish, marine mammals, sea vegetables, plant medicines, berries); health problems associated with diminished quantity of subsistence foods and shift to more unhealthy and/or less nutrient rich foods (e.g., obesity, diabetes, cancer, and cardiovascular diseases); avoidance of subsistence foods because of increased disease risk for humans (e.g., paralytic shellfish poisoning, *Trichinella*, *Anisakis*, *Diphyllobothrium*); subsistence foods more difficult to get because of changed migration patterns, population declines, and more risky, difficult, lengthy, costly, and/or dangerous transportation (e.g., to harvest walruses, ice seals, or caribou); changes in availability and sustainability of large mammal populations (e.g., caribou, moose, wild sheep) due to impacts from emergence of pathogens and parasitic diseases (e.g., lung, muscle, and gastrointestinal nematodes; changing distributions for arthropod vectors); altered availability of fish resources linked to disease and mortality (e.g., *Ichthyophonus*); difficulty in preparing and drying subsistence foods in wetter and hotter climates. *Future projections – greater diminishment of subsistence and locally harvested foods; increased health problems associated with loss of subsistence diet and substitution of Western diet; greater difficulty getting subsistence foods and greater concern about diseases; increased dependence on fewer varieties of subsistence foods in some areas; increased new healthy subsistence opportunities in some locations, such as salmon in northern Alaska (Note: pathogens and diseases can have a direct influence on sustainability of resources in marine, aquatic, and terrestrial food chains that are the foundation of subsistence culture; the effects of these diseases on wildlife populations is addressed in the Natural Systems and Associated Economies sector).*

HEAT STRESS

8. **Greater heat stress in summer:** Current impacts – greater heat stress, especially in the absence of air conditioning or with physical exertion; on average, Alaska summer temperatures have increased by more than 2.3 degrees Fahrenheit in the last 50 years; in some locations like Talkeetna, the increase has been 3.4 degrees Fahrenheit. *Future projections – greater heat stress, resulting in increased heat emergencies.*

COLD STRESS

9. **Reduced cold stress in winter:** Current impacts – reduced cold stress; Alaska winter temperatures have increased on average by more than 6.3 degrees Fahrenheit in the last 50 years. *Future projections – further reduction in cold stress; likely reduction in the spread of some infectious diseases.*
10. **Cold emergencies:** *Future projections – reduction in cold-based emergencies due to winter warming; some potential increase in cold-based emergencies due to fuel storage or delivery problems (Note: delivery problems are also addressed in the Public Infrastructure sector).*

INJURIES

11. **Ice- and storm-related injuries and death:** Current impacts – climate change is resulting in thinner shorefast ice, sea ice, and river ice, with higher consequent possibility of injury and death (e.g., Shishmaref death); increased possibility of injury and death from separated ice (e.g., North Slope); increased possibility of injury and death from exposure to more intense or more frequent storms (e.g., whaling boat capsized near Gambell due to unusually rough seas, killing four people); greater injuries from increased icy road conditions throughout much of the state. *Future projections – increased injuries and deaths from thin ice, storms, and icy roads.*
12. **Injuries from wildfires:** *Future projections – potential increased injuries and death to home and cabin residents and firefighters from increased wildfire frequency and/or intensity.*
13. **Insect and other bites and stings:** Current impacts – increase in yellow jacket attacks (two deaths in Alaska in 2006) and spider bites. *Future projections – further increase in number and variety of insect attacks and injuries.*

TOXIC EXPOSURE

14. **Toxic exposure:** Current impacts – new toxic chemical exposures as landfills with barrels containing toxic chemicals thaw; increased rate of toxic transport. *Future projections – increased release of toxins with warmer temperatures; potential exposure to pesticides that may be introduced to control new pests such as mosquitoes carrying West Nile virus.*

MENTAL HEALTH

15. **Psychological impacts:** Current impacts – at numerous gatherings, people throughout the state, but especially rural Alaskans, express concern and depression about present changes and projected future changes to Alaska's climate and the resulting impacts on

culture, subsistence, traditional knowledge and ways of knowing, fish and wildlife, individual infrastructure loss, community relocation and dislocation, changed winter recreational activities, impacts on future generations, impacts on the Alaskan way of life, etc. *Future projections – continued impacts on mental health, community wellness, family integrity, and potential increase in alcoholism, drug use, and other destructive coping behaviors.*

HEALTH CARE AND EMERGENCY RESPONSE SYSTEMS

16. **Clinic size and location issues:** Current impacts – clinics in compromised locations in limbo prior to relocation; some are inadequately sized to meet current needs (e.g., Shishmaref). *Future projections – potential similar or increased problems for clinics.*
17. **Extreme events:** *Future projections – likely greater demands on health care systems and emergency response systems, especially during major events such as flooding, fires, heat waves, and storms; possible infrastructure failures; possible introduction of new diseases; and clinical issues resulting from community and individual response to adverse socio-cultural and/or economic impacts.*

WINTER SPORTS AND RECREATION

18. **Skiing impacts:** Current impacts – reduced cross-country skiing opportunities (especially in large population areas like Anchorage and the Kenai Peninsula), affecting high school seasons, quality of life, and exercise opportunities; reduced downhill skiing season length, but potentially greater precipitation (e.g., Eaglecrest), affecting quality of life and exercise opportunities. *Future projections – further reduction in cross-country skiing opportunities, especially in urban areas; further reduction in downhill skiing opportunities; increased avalanche danger and other hazardous conditions. Note: effects on recreation economy and tourism are addressed in the Other Economic Activities sector.*
19. **Dog team and snow machine activities:** Current impacts – adverse impacts on dog sled racing, including cancellation of Fur Rendezvous races (3 times in the last 9 years), changing start of Iditarod, more dangerous conditions for dog sled races (e.g., 2008 Kusko 300); reduced snowmachine opportunities, affecting quality of life and recreation; also affecting major events like the Iron Dog Race (dubbed the “Wet Dog Race” in 2006). *Future projections – likely further reduction of dog team and snow machine opportunities; increased avalanche danger and other hazardous conditions.*

SUMMER SPORTS AND RECREATION

20. **Summer recreation impacts:** Current impacts – longer summer sports and recreation season; increased open water for water sports; more hiking opportunities; possible disruption in summer sports and recreation from summer smoke from large wildland fires (e.g., Fairbanks transported football teams to Anchorage for practice because of smoke); changed wildlife viewing opportunities. *Future projections – even longer summer sports and recreation season; potentially greater disruption from smoke over a longer period.*

GARDENING

21. **Impacts on gardens:** Current impacts – longer growing seasons; new crops possible (e.g., Alaska’s hardiness ratings have changed in some areas); new areas available for gardening; increased number of existing garden pests and new garden pests such as European black slug and aphids. *Future projections – greater expansion of garden crops, greater increase in garden pests.*

ENERGY DEMAND

22. **Individual energy use:** Current impacts – decreased winter heating demands in warmer weather; reduced fuel consumption; increased summer energy demands for cooling. *Future projections – further reduction in winter fuel needs for heating, but increased summer demands for cooling and air conditioning.*
23. **Emergency unmet fuel demands:** Current impacts – emergencies where fuel cannot be delivered to bulk storage because of low river water or shoreline problems (e.g., Newtok). *Future projections – possible increase in fuel emergencies.*