



# Climate Change in **Pilot Point**, Alaska

Strategies for Community Health

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*Achieving wellness through awareness and adaptation*



# TABLE OF CONTENTS

Summary	1
Community	3
Findings	
Temperature – <i>the climate is warmer than in the past</i>	5
Precipitation – <i>the climate is wetter than in the past</i>	9
Storms – <i>parts of town are vulnerable to flooding</i>	13
Erosion – <i>erosion is causing damage to property and infrastructure</i>	15
Landscape – <i>the land and plants are changing</i>	17
Wildlife – <i>there are changes in animal and bird abundance, behavior and species</i>	19
Subsistence – <i>there have been harvest failures including caribou and berries</i>	21
Summary of Findings	25
Conclusion	27
Figures	
1. Map of Bristol Bay Native Association (BBNA) service area	2
2. Map view of Pilot Point region	4
3. Historical and Projected Average Monthly Temperature	6
4. Mean Annual Temperature Trend in King Salmon	7
5. Historical and Projected Average Monthly Precipitation	10
6. Projected Snow-days	11
7. Climate Change Health Assessment Summary of Findings	28
Appendices	
A. Participants and Project Collaborators	29
B. Web Resources	30
C. Resolution of Support – Native Village of Pilot Point	31
D. Glossary	32
References	33



# SUMMARY

**Climate change refers to change over time** due to natural variability or as a result of human activity (IPCC, 2008). Alaska communities are experiencing a wide range of impacts from climate change and residents seek adaptive strategies that encourage wellness and sustainability. This report documents climate change impacts and potential impacts as described by the local people and interpreted through the lens of public health. It is the sixth report in a series describing climate change across Alaska, and the first report to focus on the Bristol Bay Region.

In the Yupik and Aleut community of Pilot Point residents report changes to the weather, landscape, plants and wildlife. Extreme weather events are thought to be more common, the timing of seasons is more unpredictable, erosion to shorelines is occurring at a rapid rate, and consequentially, vulnerability to flooding is increasing. Identified health concerns include food security, damage to health-critical infrastructure, injury and behavioral health issues related to extreme and unusual weather conditions.

The process for these health assessments began with a climate change workshop in Dillingham in 2011 with tribal environmental managers from throughout the region. In 2012, baseline information on climate change vulnerabilities were compiled and weighted, and three communities representing coastal, river, and lake biomes were selected. Pilot Point was



*View from across Ugashik Bay at the Old Cannery and the school and rest of the community on the bluff above.*

*Photo by Mike Brubaker, 2012.*

*This Climate Change Health Assessment was performed based on requests from tribal health representatives and from local and regional leadership. Information about local climate, environment, and health conditions was gathered with the help of local and regional government, universities, industry, and state and federal agencies.*

identified as Priority Level 1, at highest risk from climate change due to a combination of economic factors and vulnerability to floods and erosion. Upon receiving a supporting resolution from the Pilot Point Tribal Council (Appendix C), a survey team was established consisting of Nikki Shanigan from Pilot Point Tribal Council, Sue Flensburg from the Bristol Bay Native Association (BBNA), Jennifer Skarada from the Bristol Bay Area Health Corporation (BBAHC), and Mike Brubaker from the Alaska Native Tribal Health Consortium (ANTHC).

Site visits by the survey team were made to Pilot Point in June and October 2012. This report was prepared by the ANTHC, Center for Climate and Health in partnership with BBNA, BBAHC, the Pilot Point Tribal Council, the City of Pilot Point, and a multiagency advisory team (ANTHC, BBNA, BBAHC, U.S. Fish & Wildlife Service, and UAF-SeaGrant). Funding was provided by the Western Alaska Landscape Conservation Cooperative, and the United States Environmental Protection Agency. In-kind contributions were provided by all of the project partners. Information sources for this report include observations of Pilot Point residents and the survey team, reports from government agencies, and scientific findings gathered from published sources.



Figure 1.  
Bristol Bay Native Association (BBNA) service area.

*This report includes observations, experience and knowledge shared by a wide range of local experts. Predictions and projections on future conditions such as climate, flooding, and erosion are based on available information and limited by the quality of current scientific data and the uncertainties inherent in models. Research and model development is ongoing in Alaska and new information will be available in the near future.*

# COMMUNITY

**Pilot Point is a small fishing community** located about 84 miles from King Salmon, 115 miles from Dillingham and 368 miles from Anchorage. It is located on the northern coast of the Alaska Peninsula, on the east shore of Ugashik Bay. The Alaska Peninsula Wildlife Refuge is accessible by boat up the Ugashik River. Since the 1980s the population has ranged from about 64 to 100 residents, mostly Alaska Native People of Alutiiq and Yup'ik Eskimo descent.

The site was probably a hunting, fishing and trapping camp in the early 1800s (Pilot Point Journal, 1979) and got its name from a salting plant established in 1889. At that time, it was called "Pilot Station," after river pilots that guided boats to the large cannery at Ugashik. The first school was built in 1909 and in 1918 the Alaska Packers Association built a three-line cannery. At the time there were 600 residents in Pilot Station. That same year the Spanish Flu devastated the community and only 60 people survived. Reindeer herding helped to repopulate the area and new families moved in. Russian Orthodox and Seventh Day Adventist churches were built and with a new post office in 1933, the name was changed to Pilot Point. Over time the beach under the dock filled in, closing the cannery in 1958. In 1982 Pilot Point was incorporated as a 2nd class city, and in 1979 joined the new Lake and Peninsula Borough. No roads lead to Pilot Point, although there are several miles of road throughout the community running north and south along the coast and east, inland into the highlands. Residents rely upon seasonal barge service and year-round air service for food, fuel, and other supplies. Commercial salmon fishing provides



*The local salmon fishing fleet, early 1900s.  
Photo Courtesy of Pilot Point Tribal Council.*

*Pilot Point was probably a hunting, fishing and trapping camp in the early 1800s and got its name from a salting plant established in 1889.*



Figure 2. Google view of Pilot Point and region.

the majority of income, but residents are also employed in construction, mining, tourism, guiding, health care, education, traditional crafts, and other business and government required to keep a rural community running. Subsistence is another important economy and a variety of fish, birds, plants and wildlife are harvested.

The community proper is situated on a high bluff that rises above Ugashik Bay. Rolling hills provide protection from persistent winds and several small lakes are frequented by ducks, geese, loons and other waterfowl. Situated around the town are churches, the post office, tribal and city offices, a health clinic, a school, a store, bulk fuel storage facility and other structures. Off the bluff, down along the water is the old cannery, and seasonal camps used by commercial salmon fishermen. Scattered throughout historic buildings are artifacts from fishing days, including rows of old double ended sailing boats. Homes are heated by fuel oil; water comes from individual wells and cisterns, and sewage is handled by individual septic systems. Electricity is provided by a diesel power plant and a 10kW capacity wind turbine. Fuel sales are provided by the City of Pilot Point.

*“We lose at least two feet of beach bank each year. When we have a big storm we lose more.”*

Victor Seybert



# TEMPERATURE

**Observed change:** increases in temperature, variability and extremes;  
**Community impacts:** travel disruptions, infrastructure damage, timing of seasons;  
**Health concerns:** supply shortages, accident and injury, mental stress;  
**Adaptations:** enhance systems for self-sufficiency and emergency preparedness

## The climate is warmer than in the past

Pilot Point is located in a transition area between coastal and continental climate zones on opposite sides of the Aleutian Range. The climate is characterized by long periods of cloudy, wet weather and strong winds that blow consistently from the north or southeast in winter and from the southeast in summer. Over the past half century, the area has become warmer with increasing frequency of extreme high temperatures.



*Snow machines were commonplace in Pilot Point in the 1970s.  
Photo courtesy of Native Village of Pilot Point.*

*“We used to have a lot of snow machines in Pilot Point. Now I don’t think there is a single snow machine in town.”*

Nikki Shanigan

Records from King Salmon’s weather station (80 miles North from Pilot Point) indicate that between 1949 and 2008, average annual temperatures increased by 3.8 degrees Fahrenheit (°F) with most warming occurring in winter (+8.1°F) and the least in the fall (+0.6°F)(Alaska Climate Research Center). Long term records show a gradual increase in average annual temperature since 1925. The record low temperature at Egegik Station (40 miles North from Pilot Point) occurred during February and was in the -50s°F. Record high temperatures were in the 80s°F and occurred during July. A review of trends in extreme events found an increase in the frequency of extreme maximum temperatures, and a decrease in frequency of extreme minimum temperature events, especially in the spring and winter (Stewart 2011).

Despite the long-term warming trend, temperatures south of the Brooks Range have been cooling for the past decade (Wendler et al. 2012). A regional climate cycle called the Pacific Decadal Oscillation (PDO) periodically affects the amount of warm air reaching Alaska from the North Pacific, and exerts the most influence on Western Alaska. Since 2000, King Salmon’s average annual temperature has dropped by a significant 2.9°F. The PDO typically has about a 20 to 30 year cycle, which means that much of Alaska could experience a period of colder average temperatures that could last for decades. The historical signature of the PDO

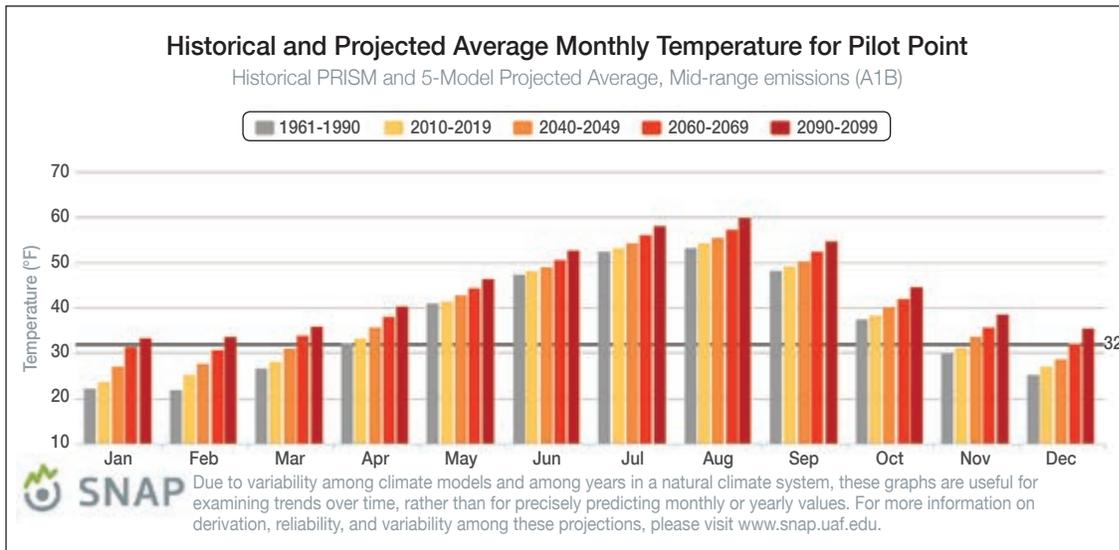


Figure 3. Historic & Projected Temperature, Pilot Point, Alaska. UAF, Scenario Network for Alaska Planning 2013.

*Long term records show a gradual increase in average annual temperature since 1925.*

can be seen in the King Salmon trend data (Figure 4), with cyclical cold (1950s-1970s) and warm (1920s – 1940s, and 1980s – 2000) periods.

**Recommendation:** The Bristol Bay area is currently in a cool period that could last for decades, the result of regional cycles rather than global climate change trends. However, just as global temperatures continue to rise, long-term records in Bristol Bay also show a gradual regional increase. This PDO cycle may provide some communities with a few decades of respite from some warming related impacts. Still, seasonal changes including variation in the timing of freeze-up, break-up and green-up are expected as are increases in the frequency and intensity of extreme weather. Pilot Point would benefit from systems that ensure energy, water, health care, and food security in times of natural disaster, extreme weather, transport interruption and shortages. Attention to climate projections is important for informed city engineering and design decisions. Key contacts: City and Tribal Government of Pilot Point, National Weather Service, Alaska Center for Climate Assessment and Policy.

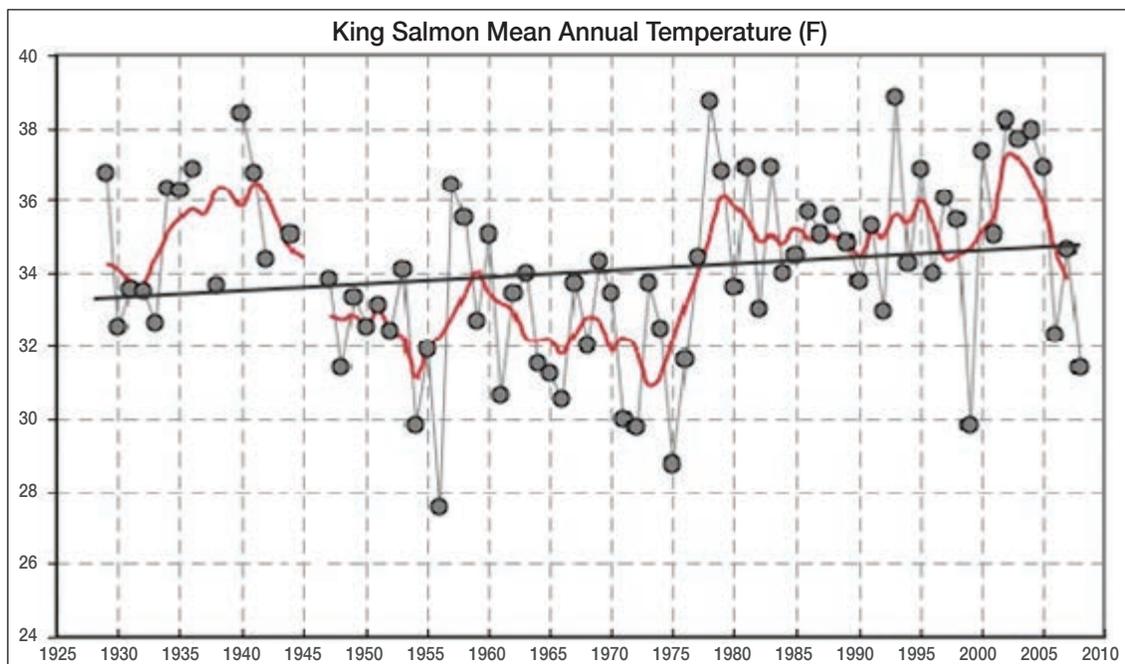


Figure 4. Mean Annual Temperature Trend in King Salmon. Alaska Climate Research Center, Geophysical Institute, UAF.

*“The nights were so cold this spring, that the swallows were dying. The kids were picking up the dead swallows.”*

Nikki Shanigan



*Snowfalls like this one from winter 2012 are now considered unusual events.  
Photo courtesy of Sue Evanoff.*

# PRECIPITATION

**Observed change:** extreme weather, increased precipitation, less snow;  
**Community impacts:** travel challenges and disruptions due to extremes and marginal weather;  
**Health concerns:** supply shortages, accident and injury, mental stress, depression;  
**Adaptations:** enhance systems for self-sufficiency and preparedness, encourage social activities

## The climate is wetter than in the past

Pilot Point residents report a general decline in snow accumulation over the last few decades, sometimes as a result of drought, but frequently due to warming and increases in winter rain and wind events. As reported in the Pilot Point Journal in 1979: “Though the villagers tell of large snowfalls in years past, there is not a great deal of snow in the winter now, when it does snow the wind blows it off, or rain comes and washes it away.” There can be considerable variability, and the winter of 2011 is an example, with both extreme cold and high snow accumulation. Precipitation is important for transportation, overland on snow or ice and by boat up river. Snow fall has typically averaged about 38 inches per year, but generally with little accumulation. Data from nearby King Salmon indicates that between 1971 and 2000 the mean monthly snow depth averaged 1 to 2 inches (Alaska Climate Research Center). Because of the low accumulation there has been a gradual decline in snow machine use and an increase in the use of ATVs. The snow day fraction (a measure of days of snow versus rain) was 30 to 40 in the 1990s. The projection for the future is for the winters to become rain rather than snow dominated with snow day fractions of 20-40 by the year 2040 (McAfee, 2013).



Spawned salmon in Pick Creek.  
Photo by Gordon Holtgrieve.

*“In low snow years, there is not enough spring flood to bring the salmon carcasses back into the system.”*

Dan Kingsley

Western Alaska is already among the most vulnerable areas of Alaska for “icing events” over the land or snow, typically experiencing over seven of these events per year, mostly in the spring (Wilson, 2012).

Low water level in the Ugashik River has in some years reduced navigability by boat, limiting seasonal access to subsistence harvest areas. Questions have been raised about the effects of low water on the nutrient cycle of the river due to changes in the availability of salmon carcasses in the system. Precipitation is also important for community water and Pilot Point residents rely on private wells. Precipitation averages about 19 inches per year, mostly in the late summer and early fall. The wettest month is September and the driest is February. Comparing average precipitation in the periods 1961 to 1990, and 2010 to 2012, amounts have increased in nine out of twelve months. Projections through 2040-2049 are for continued increases in every month except July (SNAP 2013). The frequency of extreme precipitation events is expected to increase. In 1963 the estimate was 3 inches for a 100-year/24-hour event (NOAA Technical Paper 47). The 2012 estimate is for 3.2 inches (NOAA Atlas 14).

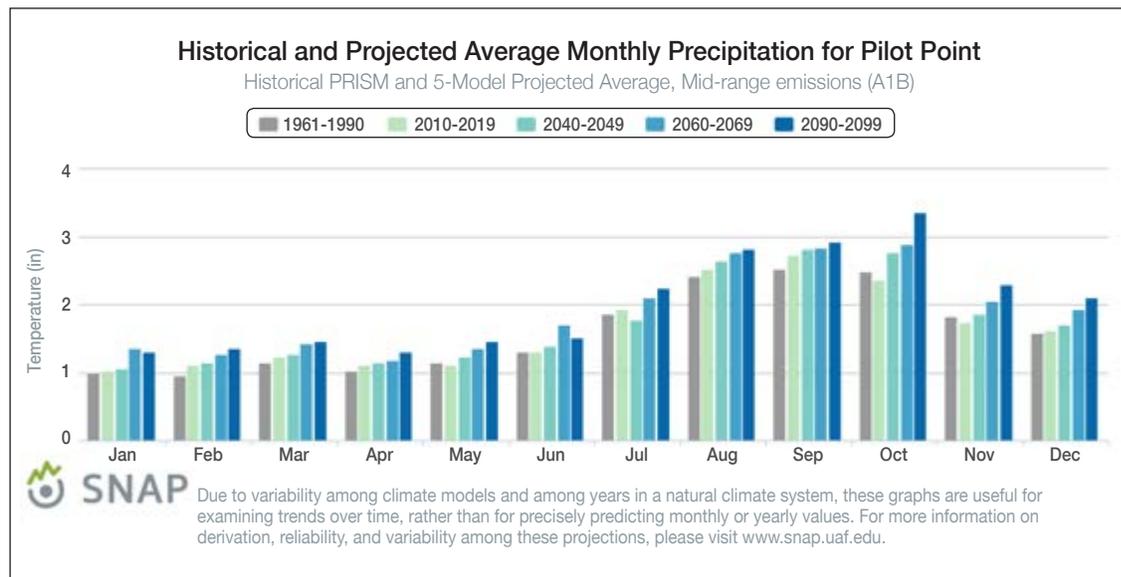
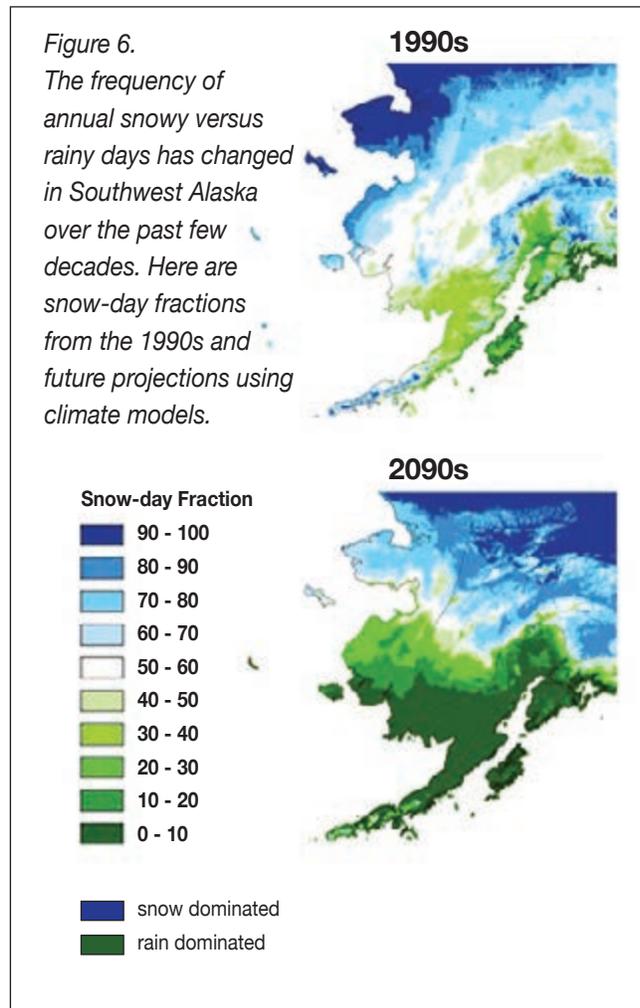


Figure 5. Projected Average Monthly Precipitation, Pilot Point, Alaska. UAF, Scenario Network for Alaska Planning 2013.

*“The dry fish used to come out perfect but now wet weather can spoil them. When we make smoked salmon we have to watch them very closely.”*

Sophie Abyo

**Recommendation:** Through the year 2019 precipitation is projected to increase during the summer and decrease in winter. Longer term projections are for increases in almost every month. Engineering design should take into consideration revised monthly and extreme event estimates. Changes in snow accumulation have implications for structural load design, community water supply, and transportation, as well as conditions for streams, vegetation, birds, fish and wildlife. Improved precipitation data requires daily measurements, which could be coordinated through partnerships with the National Weather Service. Key contacts: City and Tribal Government of Pilot Point, Alaska Center for Climate Assessment and Policy and the National Weather Service. Regional research on river change is occurring through the University of Washington (contact Daniel Shindler).



*Courtesy of the Alaska Climate Science Center.*

*Winters are projected to become increasingly rain rather than snow dominated.*



*Dry patches in the tundra.  
Mike Brubaker, 2012.*

*“The tundra where we pick berries  
is more brown and dry. Not bright  
green like it used to be.”*

Sophie Abyo

# STORMS

**Observed change:** more storms, extreme and poor weather and less winter shore ice;

**Community impacts:** damage to infrastructure, travel challenges and disruptions;

**Health concerns:** supply shortages, accident and injury, mental stress, depression;

**Adaptations:** engineer for extremes, phased relocation, encourage social activities

## The coastal areas are increasingly vulnerable to flooding.

Pilot Point, residents commented on how “unusually miserable” the weather has been in recent years, the intensity of storms and the stress caused by extreme weather and months of staying largely indoors. Climate change is generally associated with increases in the frequency and intensity of extreme weather. Of the 34 Bristol Bay extreme weather events since 2006, 24 occurred during the winter, nine in spring and five in the fall. These include coastal floods, blizzards, storm surges and high wind events (National Climate Data Center, Storm Events Database, Bristol Bay).

The coast around Pilot Point consists largely of low banks, less than six feet in height with sandy soils and beach grasses that are vulnerable to erosion. Fortunately, most of Pilot Point is located on high ground, a bluff a hundred feet above the high tide line of Ugashik Bay. But being a commercial fishing and subsistence community, infrastructure is necessary along the shore to provide access for fishing sites, launching boats, processing plants and utilities. Flooding may result from storm surge, high tides, tsunami or sea level rise. Vulnerable areas include the roads and trails extending north and south



*Computer generated storm surge and sea level risk scenario.  
Model by Moses Tcheripanoff*

*“The fall storms are much stronger than they used to be. These are late fall storms that occur with high tides and high wind before the ice forms.”*

Nikki Shanigan

from town as well as the bulkhead where commerce is carried out, private fish camps in “Southbeach”, and power lines along the shore. The old Alaska Packers Association Cannery, which is still used for storage, is also in the flood zone. Historical photographs from September 1930

document a high water event that resulted in the evacuation of this part of town. The school, teacher homes and cannery were flooded and residents had to be rescued by row boat. The area was again inundated as a result of high tides and storm surge, in about December 1995 (Pilot Point Tribal Council).



*Flood that resulted from storm surge and high tides in December 1995.*

*Photo courtesy Maggie Abyo.*

The Bristol Bay Lowlands were shaped by glaciation, alluvial deposition from rivers, and changes in sea level between glacial periods. With the onset of rapid climate change, sea level is again expected to play an important role in shaping the landscape of Bristol Bay, contributing to erosion and flood risk. Since 1870, global sea level has risen by about 8 inches (IPCC 2012) and is expected over the next century to rise at a much greater rate (Nicholls 2007). Global models project increases in sea between 0.6 – 1.9 feet (IPCC 2007), and these may be conservative. Sea level projections are not available for Western Alaska and efforts are underway to improve coastal maps as well as sea level measurements. Currently glacial melt is causing the land to rebound in some parts of Alaska and causing a relative drop in sea level in Southern Alaska. The effects in the Bristol Bay region are uncertain.

**Recommendation:** Understanding future projections is important so that appropriate shore protection, flood prevention and planning measure can be implemented. In the near term, a decadal period of cooling may help to harden the shore line during winter, temporarily slowing the rate of coastal erosion. Despite this, low coastal areas are already vulnerable to extreme weather, high water events, storm surge, and flooding, and residents should apply themselves in developing strategies that will harden their coastal infrastructure and when possible, perform phased relocation of infrastructure to less vulnerable areas. Key Contacts: City and Tribal Government of Pilot Point, Lake and Peninsula Borough, U.S. Army Corp of Engineers.

*“Last winter was bad for mental health.  
The weather was so bad it was very  
hard to get out of the house.”*

*Nikki Shanigan*

# EROSION

**Observed change:** less shore ice, storms and flooding are increasing erosion;  
**Community impacts:** damage to roads and associated utilities, bulkhead, and fish camps;  
**Health concerns:** damage or disruption to critical health infrastructure;  
**Adaptations:** shore hardening, engineer for extremes, phased relocation to high ground.

## Erosion is causing damage to property and infrastructure.

Storm activity is eroding the coastline in Pilot Point. For decades warm winters have delayed ice development, leaving the shoreline without a buffer against the energy and impact of winter storms. Pilot Point was identified in a statewide erosion assessment as one of 69 “monitor conditions communities” meaning significant impacts had occurred but were not likely to affect the viability of the community (USACE 2009).



*Evidence of erosion damage to the shoreline and Pilot Point bulkhead.  
Photo by Mike Brubaker, 2012.*

*“We are very concerned about the  
bulkhead and the road to Dago Creek.”*

Victor Seybert

Also lost to erosion is ¼ mile of the Dago Creek Road which connects the town with the bulkhead facility. A new road was constructed further inland, but sections of the current road and utility poles are within twenty feet of the eroding cut bank. The entire length of the road is also vulnerable to flooding. Without a change in winter weather conditions, erosion and storm damage will continue requiring periodic repairs and phased relocation.



*Flooding and erosion is causing damage to coastal roads.  
Photo courtesy of Sue Evanoff*

Private properties including subsistence and commercial fishing camps have also been lost to erosion. Many are currently vulnerable and some property owners have been actively engaged in efforts to reinforce the limited bank that still remains. Continued winter storm activity, diminishing ice conditions and increases in sea level all pose challenges for property owners in the coastal zone. The U.S. Army Corps of Engineers recommendation is to prepare for a five-foot sea level rise by 2100 (National Geographic, 2013).

Property owners should brace themselves for the inevitable loss of this area. The question is not if, but when and how quickly. Cold winters for a few decades may improve shore ice conditions but Alaska is in a long-term warming trend and inevitably the length of the erosion season will grow along with flood risk. With so little bank area remaining the vulnerability to storm surge will remain high, regardless of what happens to regional climate conditions.

**Recommendation:** Most of Pilot Point is located on high ground safe from the effects of erosion and flooding and a good emergency shelter at the school is above the recognized flood zone. Continued regular maintenance of the road and bulkhead will help to prevent catastrophic loss of infrastructure. Engineering studies to better understand coastal processes are recommended as well as monitoring of coastal change. When possible, perform phased relocation of infrastructure to less vulnerable areas to minimize impacts from flooding in low areas. Key Contacts: City and Tribal Government of Pilot Point, Lake and Peninsula Borough; for erosion - U.S. Army Corp of Engineers; for storm surge vulnerability see Robert Grumbine with NOAA.

*“Last year we had to build a new section of road, because the erosion was so bad from the fall storms.”*

Sue Evanoff

# LANDSCAPE

**Observed change:** rapid tree growth, new coastal wetlands, invasive plants;

**Community impacts:** new waterfowl habitat, loss of tundra to woodlands, loss of berry plant habitat;

**Health concerns:** food security, potential for new or increased pollen allergens, mental health;

**Adaptations:** monitor changes; inform clinics on emerging environmental concerns; manage invasive plants

## The land and plants are changing.

Ecosystems are areas that share similar climate, geographic conditions and communities of plants and animals. Pilot Point is part of the Bristol Bay Lowlands, a subset of a larger Bering Taiga ecosystem of Western Alaska. Shaped by glaciers, the lowlands have large terminal moraines and outwash plains. Balsam poplar stands are common along the rivers and the slopes support communities of dwarf birch and alder. Higher elevations are covered with shrub tundra and lichens, and the lowland wetlands support sedge-tussok and sedge-moss bogs, and willows along the small steams (Spencer et al. 2007). Walrus, seals and sea lions inhabit the coastal areas; rivers support productive salmon fisheries and habitat for moose and beaver. The wetlands are thick with waterfowl, and caribou, wolves, and bears can be found in the uplands.

Pilot Point residents describe changes to this ecosystem including increases in willow and alder shrubs and trees, and encroachment of grasses and shrubs into tundra areas. Also described are changes in timing of the seasons such as freeze-up, break-up and green-up. The spring of 2012 resulted in a die-off of swallows, possible due to lingering snow and ice conditions



*Cottonwood trees have been growing rapidly in recent years, perhaps influenced by warmer temperatures.*

*Photo by Mike Brubaker, 2013.*

**“The cottonwood is cropping up where they did not used to be. You can see them out at the dump road.”**

**Sue Evanoff**

(Nikki Shanigan, personal communication). Residents also describe changes to the landscape including coastal erosion that has resulted in the development of new wetland and waterfowl habitat near town at Swamp Lake. With the loss of shore bank, the bay water is spilling over the land at high tide filling low areas and creating a shallow lake and a creek that flows back into the bay. A positive outcome is habitat for waterfowl and convenient access for hunters.



*Storm activity and erosion of the shoreline are two mechanisms for changing the landscape in Pilot Point.  
Photo by Mike Brubaker, 2012.*

Computer models consider future “cliomes”; areas where temperature and precipitation reflect certain kinds of wildlife and vegetation. Bristol Bay’s current cliome “boreal forest with coastal influence and intermixed grass and tundra,” is expected to shift north and largely disappearing by 2090. It may be replaced by “prairie and grasslands,” a cliome that does not currently occur in Alaska, and is characteristic southeastern Alberta in Canada (Fresco et al. 2012). Watch species for the Pilot Point area includes plants that are vulnerable to encroachment and new and invasive species. Historically Alaska’s cold climate prevented non-native plants from becoming established. However, in recent years there has been an influx of invasives. Meadow hawkweed, Canada thistle, and spotted knapweed have localized populations in Alaska. Other species such as reed canary grass and white sweet clover are now widespread (Carlson et al. 2007). Invasive plants to watch for include orange hawkweed, yellow toadflax, and oxeye daisy which have taken hold along the road system in Dillingham and Aleknagik (BBNA). These plants can out-compete native plants and form their own exclusive islands, with negative impacts to the native biome.

**Recommendation:** Climate model findings suggest that this region will be ecologically stressed during a period of rapid change. This may mean higher susceptibility to diseases and pests and competition from other species. Local observers can assist in understanding and adapting, and invasive species management plans are recommended. Residents can help to protect the native plant species and prevent negative impacts by working with regional invasive plant experts to implement removal and control strategies. Key contacts: AACD, Alaska Department of Fish and Game, and UAF Cooperative Extension.

*“The high tide pushes all the water into swamp lake and has now formed a creek that drains the tidal slough.”*

Victor Seybert

# WILDLIFE

**Observed change:** increasing encounters with bears and wolves, new bird species;

**Community impacts:** increased caution with children and pets, concerns about invasive species;

**Health concerns:** food security, public safety, mental health (anxiety, fear);

**Adaptations:** monitor wildlife changes and events; assess wildlife change causes

## There are changes in abundance, behavior and species

Residents report increasing numbers of and changing behavior in wolves and bears. Wolves have been boldly approaching the town, which has raised concerns about the safety of people and of pets. Since 2000, there have been several notable events in Alaska when wolves have attacked humans. Concerns have been especially high since 2010 when a wolf pack attacked and killed a young school teacher in nearby Chignik Lake. According to Kimberlee Beckman DVM, attacks generally occur when animals are food conditioned, rabid or starving (Fairbanks Daily News Miner, 2012). The Chignik Lake wolves were killed, examined and found to be neither food stressed or rabid. Unusual wolf behavior has been reported in other areas of Bristol Bay and residents wonder whether changes in caribou or other prey species may be a source of stress. Climate change is thought to be altering the behavior and range of Arctic predator species. A five-year study is currently underway in thirteen communities in Nunavut, Canada looking at wolf, wolverine and bear behavior and the effects of climate change including human-wildlife interactions and the changing range of wildlife.

Along with climate and landscape change comes new plants birds, insects, fish and wildlife. An “invasive species” is defined as a species that is non-native to the ecosystem and whose introduction causes or is likely to cause harm to the economy, environment or human health. Non-native



*Scientists in Canada are studying the effects of climate change on predator behavior.*

*Photo by Stanley Watkins.*

*“We never used to see wolves.  
Now we see them in town.”*

Sophie Abyo

species become invasive in a new environment when the natural predators, diseases, or other biological mechanisms that kept the species in check within its former habitat are missing in its new environment. Lacking this biological balance, the invading species effectively changes the biodiversity. This can often cause millions of dollars in damage to local economies.

Of special concern in Bristol Bay is aquatic invasive species because they can impact salmon. Often invasive are spread by human activity and visitors to Bristol Bay come from all over the world. Likely sources for invasives include ballast water, organisms attached to ship hulls, heavy equipment, animal feed and straw, fill material, seed and fishing gear. One particular concern for anglers is “Whirling Disease”, which can damage nerves and spines of trout and other fish, and New Zealand mudsnails which compete for food with juvenile salmon. Other important aquatic watch species include Atlantic salmon, northern pike, and yellow perch (ADF&G 2002).



*Climate change effects on salmon are a concern to residents.*

There are also new bird species which have taken up residence in Pilot Point, including Northern Shrikes, American Kestrels and Golden Eagles. Residents are concerned about invasive birds and other wildlife in the community. Important invasive bird “watch species” include the European Starling and the Rock Dove.

**Recommendation:** A regional study of predator species should be considered, due to public concern and the number of interactions. Invasive management plans are advised and a Local Environmental Observer (LEO) in Pilot Point is available to monitor occurrences and invasives and to help coordinate technical assistance. Key contacts: City and Tribal Government of Pilot Point, ADF&G, Southwest Alaska Salmon Habitat Partnership, ANTHC, FWS.

*Of special concern in Bristol Bay  
is aquatic invasive species because  
they can impact salmon.*

# SUBSISTENCE

**Observed change:** decline in caribou harvest, variable berry harvest;

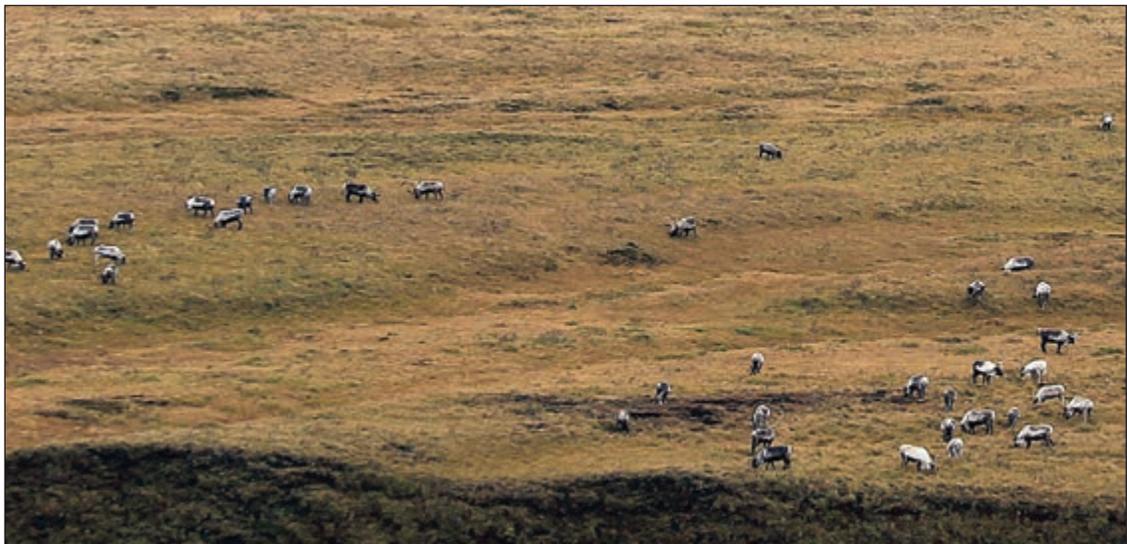
**Community impacts:** dietary change; increased dependence on moose, fish and waterfowl;

**Health concerns:** food security, mental health issues;

**Adaptations:** monitor subsistence events; perform comprehensive harvest survey; encourage healthy food alternatives

## There have been harvest failures including caribou and berries.

Commercial fishing and subsistence have historically been the basis of the economy and lifestyle in Pilot Point. Today however, residents face challenges in continuing these lifestyles because of the high cost of living and declining availability of subsistence resources. A harvest survey performed in 1973 identified a variety of wild foods in Pilot Point. The most important part of the diet for residents was for many years caribou, followed by salmon and then a wide range of birds (ptarmigan, geese, duck, swans, snipes, cranes) eggs, and berries. Indeed, the logo for the Pilot Point Tribal Council features a caribou. A comprehensive harvest survey in 1987 found conditions stable, with a consumable harvest of about 384 lbs per capita (Fall and Morris 1987).



*Caribou used to comprise the majority of the subsistence harvest.*

*“We used to be able to see thousands of caribou cross the river, now there are very few. We have not been able to hunt caribou for the past eight years.”*

Sophie Abyo

In the 1990s harvest conditions began to change and today there is less game than in the past; airplanes are sometimes needed to access available game. By 2000, there was no longer a viable caribou harvest in Pilot Point, and an iconic species that had accounted for 60% of total annual subsistence harvest, essentially disappeared from the diet. The cause is uncertain and likely influenced by a number of factors. One possible contributing factor is the effect of icing events on caribou forage areas. The highest frequency of icing events in Alaska occurs in the southwest, especially at low elevations adjacent to the coast. Some areas have experienced as many as seven events per winter (Wilson et al. 2012). These events have been implicated in die-off events of caribou in other areas of the circumpolar north.

Harvests of other important subsistence resources including berries have been unreliable in recent years. In 2012 there was no significant berry harvest in Pilot Point. Berries simply did not appear, perhaps related to the heavy snow, late spring and delayed thaw in 2012. Berry bushes are sensitive to temperature, rain and snow conditions, and declining harvest has been attributed to climate change in other northern regions (Zubov L, 2012). Warming temperatures are however increasing the growing season in some parts of Alaska. This will improve opportunities for growing vegetables which can be a significant contribution to local harvest and increase food security and good nutrition.



*Reduced berry harvests has been attributed to climate change.  
Mike Brubaker, 2012.*

*“We had absolutely no berries this year, neither black, blue or cranberries. There were lots of dead patches in the berry bushes.”*

Sue Evanoff

**Recommendation:** Loss of the primary subsistence resource (caribou) and the increasing cost of store bought foods raise concerns about food security for Pilot Point. Because there has been a harvest failure for the primary subsistence resource, performing a focused survey of harvest and health implications of environmental change is a priority. Developing more vegetable gardens is one way Pilot Point residents could enhance food security and nutrition. Local environmental observers can engage in activities to monitor harvest conditions and impacts on wildlife and wild foods. Key contacts: icing events - Ryan Wilson-Wilderness Society; berries - USGS; caribou and harvest surveys - ADF&G; Shorezone mapping - FWS; vegetable gardening - BBNA, UAF cooperative extension and USDA.



*Local vegetable garden.  
Photo courtesy of Tracy Veal.*

*“We have great soils in this area for agriculture. We are looking for ways to take advantage of climate change to improve our self sufficiency.”*

Roland Briggs



*Climate change is affecting seasons for bird, fish and wildlife harvest.*

*Photo courtesy of Al Evanoff.*

*“The waterfowl have been staying later over the past decade. The waterfowl season peak used to be October 1st, now it is more like October 15th.”*

*Rick Reynolds*



# FINDINGS

## **Temperatures have increased over the long term.**

Over the past half century, the area has become warmer with increasing frequency of extreme high temperatures. Due to climate change, seasonal changes including variation in the timing of freeze-up, break-up and green-up are expected as are increases in the frequency and intensity of extreme weather. Pilot Point would benefit from systems that ensure energy, water, sanitation, health services, and food security in times of natural disaster, extreme weather, transport interruption and shortages. Attention to climate projections is important for informed engineering and design decisions.

## **Over the years there has been less snow accumulation.**

Over recent decades, Pilot Point residents report a general decline in snow accumulation. This has resulted in changes in the modes of travel including fewer snow machines and more ATVs. Declines in precipitation may have implications for community well water supply, and for plants, birds, and wildlife. Precipitation models predict early winter amounts that are the same or declining through 2019 and gradual increases in most other months. Attention to climate projections is important for informed engineering and design decisions.

## **Changing sea ice and storm conditions are contributing to coastal erosion.**

The ice season is changing and generally becoming shorter, while the incidence of storms is increasing. The impact can be seen on the shoreline by erosion and consequential damage to roads, property, and infrastructure. Understanding potential future impacts is a priority so that appropriate shore protection and planning measure can be implemented.

## **Storm driven erosion has caused the bulkhead at Dago Creek to fail.**

Storm activity has resulted in the damage to the community bulkhead, critical infrastructure for loading and unloading of boats, product and equipment. Repairs to the bulkhead are necessary from both an economic and safety standpoint, and to prevent failure of the bulkhead. Photographic monitoring of areas vulnerable to erosion is recommended.



*“We could be totally energy self-sufficient in Pilot Point if we use our wind resources and capture methane from the swamps and natural seeps.”*

Roland Briggs

**Low lying areas are at increasing risk of storm surge and flooding.**

Erosion, decreased sea ice (in some years), storm intensity, and sea level rise are among factors which may be increasing risk of flooding in vulnerable areas. This includes the roads and trails extending north and south from town, the bulkhead where commerce is carried out, private fish camps in Southbeach, power lines along the shore, and the old Alaska Packers Association Cannery. Attention to storm and sea level projections is important for informed planning, engineering and design decisions.

**Changing wildlife behavior is a safety concern.**

Residents of Pilot Point report increasing numbers of and changes in the behavior of wolves and bears. This is raising concerns about subsistence resources and safety. Continued sharing of local observations and a research partnership to look into these reports is recommended for Pilot Point other Bristol Bay communities.

**Invasive plants and wildlife are becoming established with uncertain effect.**

Residents report a variety of unusual wildlife sightings, in particular birds including Golden Eagles, Northern Shrikes, American Kestrels among other. Also, invasive plants are reported in the Bristol Bay Region including orange hawkweed, yellow toadflax, and oxeye daisy. With changing climate some vegetation and wildlife species will be stressed and invasive species are to be expected. A Local Environmental Observer (LEO) network member in Pilot Point is available to monitor these occurrences and to help coordinate technical assistance as needed.

**Harvest of important subsistence foods is declining.**

There has been no comprehensive harvest assessment performed in Pilot Point in a quarter century. The last was in 1987 (ADF&G) at a time when the primary subsistence food was caribou, which accounted for approximately 60% of the total reported harvest. But there has been no significant caribou harvest in the past decade, because of a harvest restrictions and the lack of availability. Determining the harvest status in Pilot Point is important for addressing the social, economic, and health needs of the community. A new harvest assessment is recommended.

*“There is just a little bit of bank left at Swamp Lake. Once it is gone it will be right up against the road. The banks used to be high.”*

Sue Evanoff



# CONCLUSION

Pilot Point is experiencing a range of climate related effects including increasing precipitation and temperature, extreme weather, altered seasons, and the related effects of erosion, flooding, and changes in vegetation, birds, fish and wildlife. Public health considers climate change based on effects to mental health, injury, disease, and food and water safety and security. In Pilot Point, health critical infrastructure is increasingly vulnerable including roads, communication and power lines, the bulkhead, and commercial and subsistence harvest camps. Behavioral health workers should be aware of psychological stress reported by residents especially during storms or prolonged periods of poor weather.

Unusual wildlife encounters have also been a source of stress and anxiety in particular local conflicts with bears and wolves. Public health officials, wildlife managers and academics should be aware that diet has been significantly impacted from over a decade of caribou harvest closure and unreliable berry harvest. This report aims to raise awareness about these issues and to help Pilot Point acquire partnership and resources for further understanding. The goal is to assist local and regional leaders to make informed planning decisions, find community appropriate development strategies, and pursue a safe, healthy, and sustainable future.

*For more information, contact the Center for Climate and Health by e-mail at [akaclimate@anthc.org](mailto:akaclimate@anthc.org) or by phone (907) 729-2464.*



*Old boat pushed inland by flooding.  
Mike Brubaker, 2012.*

*It is hoped this report will help  
Pilot Point make informed decisions  
and find community appropriate  
adaptation strategies.*

**Figure 6. Climate Change Health Assessment Findings, Pilot Point, Alaska**

<b>Topic</b>	<b>Observed Change</b>	<b>Community Impacts</b>	<b>Health Concerns</b>	<b>Adaptations</b>
<b>Temperature</b>	Increases in temperature, variability and extremes	Travel disruptions, infrastructure damage, timing of seasons	Supply shortages, accident and injury, mental stress	Enhance systems for self-sufficiency and emergency preparedness
<b>Precipitation</b>	Extreme weather, increased precipitation, less snow	Travel challenges and disruptions due to extremes and marginal weather	Supply shortages, accident and injury, mental stress, depression	Enhance systems for self-sufficiency and preparedness, encourage social activities
<b>Storms</b>	More storms, extreme and poor weather, and less winter shore ice	Damage to infrastructure, travel challenges and disruptions	Supply shortages, accident and injury, mental stress, depression	Engineer for extremes, phased relocation, encourage social activities
<b>Erosion</b>	Less shore ice, storms and flooding are increasing erosion	Damage to roads and associated utilities, bulkhead, and fish camps	Damage or disruption to critical health infrastructure	Shore hardening activities, engineer for extremes, phased relocation
<b>Landscape</b>	Rapid tree growth, new coastal wetlands, invasive plants	New waterfowl habitat, loss of tundra to woodlands, loss of berry plant habitat	Food security, potential for new or increased pollen allergens, mental health	Monitor changes (LEO); inform clinics on emerging environmental concerns; manage invasive plants
<b>Wildlife</b>	Increasing encounters with bears and wolves, new bird species	Increased caution with children and pets, concerns about invasive species	Food security, public safety, anxiety and related mental health	Monitor wildlife changes and events (LEO), and assess wildlife change causes
<b>Subsistence</b>	Decline in caribou harvest, variable berry harvest	Dietary change, increased dependence on moose, fish and waterfowl	Food security and related mental health issues	Monitor subsistence events (LEO), perform comprehensive harvest survey, and encourage healthy food

## APPENDIX A

### ***Community and Regional Contributors***

Anecdotal data was collected on observations and experiences from local experts in health, wildlife, Inupiat culture, weather, subsistence, education, sanitation, local governance, law enforcement, and emergency services.

	<b>Type</b>	<b>Name</b>	<b>Position</b>	<b>Association</b>
1	Local knowledge	Sophie Abyo	Elder	Resident
2	Local knowledge	Janice Ball	Post Master	U.S. Postal Service
3	Local knowledge / energy	Roland Briggs	Public Works	City
4	Governance	Sue Evanoff	Mayor, Tribal Admin.	City / Native Village
5	Local knowledge	Orin Evanoff	Student	Youth
6	Environment	Sue Flensburg	Environmental Planner	BBNA
7	Local knowledge	Diane Griechen	Proprietor	Loon Lake B & B
8	Local knowledge	Dan Kingsley	Fisherman	Independent
9	Business	Greg Kingsley	Proprietor	Loon Lake B & B
10	Local knowledge	Rick Reynolds	Resident	Resident
11	Governance	Victor Seybert	Council Member	Borough / Tribal Council
12	Environment	Nikki Shanigan	Environmental Manager	Native Village
13	Local knowledge	Joe Shanigan	Student	Youth
14	Environmental Health	Jennifer Skarada	Sanitarian	BBAHC
15	Local knowledge	Tom Slate	Fisherman	Independent
16	Health	Tracy Veal	Community Health Aide	BBAHC

## APPENDIX B

### *Pilot Point Climate and Health Web Resources*

Topic	Resource	Location
Climate / Health Study	Center for Climate and Health	<a href="http://www.anthc.org/chs/ces/climate/links.cfm">www.anthc.org/chs/ces/climate/links.cfm</a>
Community Profile	State of Alaska Community Database	<a href="http://www.commerce.state.ak.us/dca/commdb/CF_BLOCK.htm">http://www.commerce.state.ak.us/dca/commdb/CF_BLOCK.htm</a>
Regional Climate Data	Alaska Climate Research Center, UAF	<a href="http://climate.gi.alaska.edu/Climate/Location/TimeSeries/KingSalmon.html">http://climate.gi.alaska.edu/Climate/Location/TimeSeries/KingSalmon.html</a>
Temperature Charts	Scenario Network for Alaska Planning	<a href="http://www.snap.uaf.edu/charts.php">http://www.snap.uaf.edu/charts.php</a>
Precipitation Charts	Scenario Network for Alaska Planning	<a href="http://www.snap.uaf.edu/charts.php">http://www.snap.uaf.edu/charts.php</a>
Extreme precipitation	NOAA Atlas 12	<a href="http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_ak.html">http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_ak.html</a>
Weather Spotters	NWS Extreme Weather Spotter	<a href="http://www.weather.gov/skywarn/">http://www.weather.gov/skywarn/</a>
Precipitation Monitor	Collaborative Snow, Rain, Hail Program	<a href="http://www.cocorahs.org/">http://www.cocorahs.org/</a>
Erosion Data	USACE Community Report, 2009	<a href="http://www.poa.usace.army.mil/AKE/Home.html">www.poa.usace.army.mil/AKE/Home.html</a>
Flood Data	USACE Flood Hazard Database	<a href="http://66.223.166.160/usace_disclaimer.html">http://66.223.166.160/usace_disclaimer.html</a>
Coastal Observations	National Weather Service	<a href="http://www.nws.noaa.gov/om/coop/index.htm">www.nws.noaa.gov/om/coop/index.htm</a>
Season Observations	USGS Phenology Network	<a href="http://www.usanpn.org/">www.usanpn.org/</a>
Local Environ. Observers	LEO - ANTHC	<a href="http://www.anthc.org/chs/ces/climate/leo/">http://www.anthc.org/chs/ces/climate/leo/</a>
Regional Health Profile	Alaska Native Tribal Health Consortium	<a href="http://www.anthctoday.org/epicenter/assets/data/bristol_bay/bristolbay_data.html">http://www.anthctoday.org/epicenter/assets/data/bristol_bay/bristolbay_data.html</a>
Regional Climate Studies	Western Alaska LCC	<a href="http://www.arcus.org/western-alaska-lcc">http://www.arcus.org/western-alaska-lcc</a>
Food Harvest Data	Alaska Department of Fish and Game	<a href="http://www.adfg.alaska.gov/sb/CSIS/index.cfm?ADFG=harvInfo.harvestCommSelComm">http://www.adfg.alaska.gov/sb/CSIS/index.cfm?ADFG=harvInfo.harvestCommSelComm</a>

# APPENDIX C

## **Resolution of Support – Native Village of Pilot Point**

Pilot Point Tribal Council  
PO Box 449, Pilot Point, AK 99649

### **RESOLUTION 2012-05-01**

A RESOLUTION REQUESTING THAT ANTHC, BBNA, BBAHC, AND MAP WORK WITH THE NATIVE VILLAGE OF PILOT POINT IN THE PERFORMANCE OF A CLIMATE CHANGE HEALTH ASSESSMENT.

WHEREAS: the environment is changing as demonstrated by warming temperatures, diminished ice, thawing permafrost, increased erosion, dropping river levels, and the invasive species; and

WHEREAS: the effects of these changes on public health are not well understood; and

WHEREAS: local observations provide evidence of climate change, and Arctic projections suggest that the effects are expected to accelerate in coming years; and

WHEREAS: local government and health entities need to be aware of changes that can affect infrastructure, mental health, injury, and disease, so as to plan appropriate response actions; and

WHEREAS: the Alaska Native Tribal Health Consortium (ANTHC) has resources to perform a Climate Change Assessment, working with Bristol Bay Native Association, Bristol Bay Area Health Corporation, and Marine Advisory Program; and

WHEREAS: the ANTHC Center for Climate and Health has demonstrated capacity monitoring health indicators, interpreting epidemiologic data, and assessing potential impacts from climate change; and

WHEREAS: the Native Village of Pilot Point would benefit from the technical assistance related to climate impacts to develop adaptive measures for protection of community health; and

WHEREAS: the Native Village of Pilot Point through our environmental department has staff who could work with ANTHC in performing an assessment; and

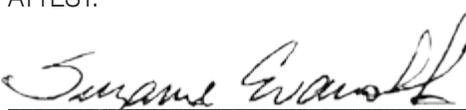
WHEREAS: the products from this assessment would be of value to the Native Village of Pilot Point to develop adaptation plans for climate change and to acquire needed resources; and

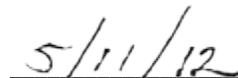
NOW THEREFORE BE IT RESOLVED THAT: The Pilot Point Tribal Council hereby requests that the Alaska Native Health Consortium, Center for Climate and Health, perform a Climate Change Assessment in Pilot Point.

### **CERTIFICATION**

We, the undersigned, do hereby certify that the Pilot Point Tribal Council is comprised of five (5) members, of whom 5 were present at a duly constituted meeting this 11th day of May, 2012 and that Resolution 2012-05-01 was adopted by an affirmative vote of 5 Yeas and 0 Nays.

ATTEST:

  
\_\_\_\_\_  
Suzanne Evanoff, Administrator

  
\_\_\_\_\_  
DATE

## APPENDIX D

### Glossary

<b>AACD</b>	Alaska Association of Conservation Districts
<b>ACCAP</b>	Alaska Center for Climate Assessment and Policy
<b>ACRC</b>	Alaska Climate Research Center
<b>ANTHC</b>	Alaska Native Tribal Health Consortium
<b>ADF&amp;G</b>	Alaska Department of Fish and Game
<b>ADEC</b>	Alaska Department of Environmental Conservation
<b>BBNA</b>	Bristol Bay Area Native Association
<b>BBAHC</b>	Bristol Bay Area Health Corporation
<b>CAHM</b>	Climate and Health Measure
<b>CCH</b>	Center for Climate and Health
<b>CCHA</b>	Community Climate and Health Assessment
<b>CCHRC</b>	Cold Climate Housing Research Center
<b>CDC</b>	Centers for Disease Control
<b>CSIS</b>	Community Subsistence Information System
<b>CVI</b>	Climate Vulnerability Index
<b>DHSS</b>	Department of Health and Social Services
<b>EIS</b>	Environmental Impact Statement
<b>EPA</b>	Environmental Protection Agency
<b>FWS</b>	United States Department of Fish and Wildlife Service
<b>GIS</b>	Geographic Information System
<b>GLOF</b>	Glacier Lake Outburst Flood
<b>HIA</b>	Health Impact Assessment
<b>HVA</b>	Hazard Vulnerability Assessment
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>L&amp;PB</b>	Lake and Peninsula Borough
<b>LEO</b>	Local Environmental Observer
<b>NTC</b>	Nondalton Traditional Council
<b>NOAA</b>	National Oceanographic and Atmospheric Administration
<b>NPS</b>	National Park Service
<b>NWS</b>	National Weather Service
<b>SNAP</b>	Scenario Network for Alaska and Arctic Planning
<b>SWAN</b>	Southwest Alaska Network Inventory and Monitoring Program
<b>SWASHP</b>	Southwest Alaska Salmon Habitat Partnership
<b>UAA</b>	University of Alaska, Anchorage
<b>UAF</b>	University of Alaska, Fairbanks
<b>USG</b>	United States Geologic Service
<b>WALCC</b>	Western Alaska Landscape Conservation Cooperative

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Tyler and Travis Seybert and Everett Evanoff with a good harvest of geese and ducks.  
Photo courtesy of Sue Evanoff.





*A view of Mount Chiginagak Volcano, aka "Old Smokey."  
Photo courtesy of Sue Evanoff*



*ANTHC would like to express our special thanks to the residents of Pilot Point and other parts of the Bristol Bay region, who provided their time, knowledge and assistance during this project:*

*Sophie Abyo*

*Janice Ball*

*Roland Briggs*

*Sue Evanoff*

*Orin Evanoff*

*Sue Flensburg*

*Diane Griechen*

*Dan Kingsley*

*Rick Reynolds*

*Victor Seybert*

*Nikki Shanigan*

*Jennifer Skarada*

*Jennifer Robinette*

*Tom Slate*

*Tracy Veal*

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The City of Pilot Point  
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The Lake and Peninsula Borough  
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The Alaska Climate Research Center  
The Scenario Network for Alaska Planning  
The University of Alaska Fairbanks Geophysical Institute  
The State of Alaska Department of Community Commerce & Economic Development  
The State of Alaska, Department of Health and Social Services  
The State of Alaska Department of Fish and Game  
The State of Alaska Division of Homeland Security and Emergency Management  
The State of Alaska Department of Environmental Conservation  
The National Oceanographic and Atmospheric Administration  
The National Weather Service  
The United States Geologic Survey  
The U.S. Army Corps of Engineers  
The U.S. Centers for Disease Control - Arctic Investigations Program  
The Environmental Protection Agency  
The U.S. Fish and Wildlife Service*



For more information please contact:  
Center for Climate and Health, Alaska Native Tribal Health Consortium: (907) 729-2464

Find this report and other information about climate and health at our website:  
<http://www.anthc.org/chs/ces/climate/index.cfm>

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