Erosion and Alaska Native Communities

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MAGNITUDE OF THE CHALLENGE

Extent of the Problem

The authoritative Government Accounting Office (GAO) prepared a very informative, if now dated, assessment of Alaska Native villages and the relocation challenges of erosion and flooding.[1]

GAO observed that most of Alaska's more than 200 Native villages are affected to some degree by flooding and erosion. Thirty-one villages were identified that face imminent existential threats from coastline erosion, flooding, and rising temperatures.

The erosion threat is at its most severe in Alaska. Alaska has a longer coastline, about 44,000 miles, than the rest of the United States combined. About 6,600 miles of that coastline, and many low-lying areas along the state's rivers, are subject to severe erosion and flooding.[2]

And the Arctic region is warming faster than anywhere else on Earth. The consequences are a combination of melting sea ice, thawing permafrost, and sea-level rise that is eroding the Alaska shoreline.[3]

It is interesting that the famous Times-Picayune newspaper of New Orleans is reporting on Alaska erosion, a problem familiar to those in Louisiana. Those in Louisiana relate to Alaska's sea ice issues; in Louisiana vast marshlands do the same job as sea ice, buffering communities from storms. As these marshes erode, coastal areas are made more vulnerable to surging waves and flooding.[4]

Rate of Change

The Alaska Arctic region is warming faster than anywhere else in the United States. Understanding the rates and causes of coastal change in Alaska is needed to identify and mitigate hazards that might affect people and ecosystems.[5]

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1 "Alaska Native Villages: Limited Progress Has Been Made on Relocating Villages Threatened by Flooding and Erosion," Government Accounting Office, January 3, 2009, https://www.gao.gov/assets/300/290468.pdf

2 "BOEMRE Helps State of Alaska Cope with Erosion Issues," Bureau of Ocean Energy Management, Regulation and Enforcement, October 1, 2010, https://www.boem.gov/BOEM-Newsroom/Press-Releases/2010/press1001.aspx

3 "Who's Still Fighting Climate Change? The U.S. Military," National Geographic, February 2, 2017, https://news.nationalgeographic.com/2017/02/pentagon-fights-climate-change-sea-level-rise-defense-department-military/

4 "Crumbling Alaska coast suffering 'death-by-a-thousand-cuts': report," Times-Picayune, December 4, 2017, http://www.nola.com/environment/index.ssf/2017/12/crumbling_alaska_coast_sufferi.html

5 "Climate impacts to Arctic coasts," Pacific Coastal and Marine Science Center, United States Geological Survey, June 2018, https://www.usgs.gov/centers/pcmsc/science/climate-impacts-arctic-coasts?qt-science_center_objects=0#qt-science_center_objects

Eroding permafrost coasts are indicators of Arctic change. The coasts are susceptible to the combined effects of declining sea ice extent, increases in open water duration, more frequent and impactful storms, sea-level rise, and warming permafrost.[6]

The USGS reports that along the Arctic coast of Alaska, coastal erosion is widespread, may be accelerating, and is threatening defense and energy-related infrastructure, coastal habitats, and Native communities.

In the United States, only coastal areas in Louisiana and Mississippi on the Gulf Coast have higher average erosion rates than Alaska's north coast between the Canadian border and Icy Cape.[7]

While Alaska's north coast experiences both erosion and accretion, it is predominantly erosional, retreating on average about 1.4 meters per year. High rates of erosion, up to 20 meters per year, occur along some sections of coast.

Some 84 percent of the shoreline showed retreat over the long term (1940s to 2010s) and 77 percent over the short term (1980s to 2010s). Average rates of change increased over the short term and are higher on the Beaufort Sea coast than the Chukchi Sea coast.

The National Academy of Sciences[8] has estimated future coastal erosion losses for Alaska villages known to be at risk. It is assumed that erosion rates will increase proportionally with the lengthening of the coastal ice-free season. The projected increases in the length of the ice-free season are pronounced. For example, the ice-free season in the northern coastal region is projected to increase from today's approximate 120 days to over 200 days by the 2085 to 2095 period.

The Academy's analysis also emphasizes future flooding risks and suggests that financial impacts could be reduced by proactive investment in adaptation. The largest monetary benefits of adaptation could be achieved by modifying road drainage systems to reduce flooding impacts.

Duration of the Issue

Notwithstanding the influence of climate change, an older study on the erosion history of the Alaska Beaufort coast is informative.[9]

The study found that coastal erosion has been a major landscape-altering mechanism over at least the historical record. Of the seven coastal features identified in the 1830s, only two remain. Of the four-known cultural/historical sites along this coastline, only one remains. Loss of modern infrastructure has also occurred. Of the three petroleum test wells drilled near the coast, one has been destroyed, erosion of the second is expected within the next decade, and the third will be consumed within the next 50 years.

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6 "A decade of remotely sensed observations highlight complex processes linked to coastal permafrost bluff erosion in the Arctic," United States Geological Survey, October 24, 2018, https://pubs.er.usgs.gov/publication/70200025

7 "Updated assessment of erosion rates on Alaska's Arctic coast," United States Geological Survey, November 28, 2017, https://www.usgs.gov/center-news/updated-assessment-erosion-rates-alaska-s-arctic-coast?qt-news_science_products=3#qt-news_science_products

8 "Climate change damages to Alaska public infrastructure and the economics of proactive adaptation," National Academy of Sciences, January 10, 2017, http://www.pnas.org/content/114/2/E122.full

9 "Modern Erosion Rates and Loss of Coastal Features and Sites, Beaufort Sea Coastline, Alaska," January 4, 2008, http://pubs.aina.ucalgary.ca/arctic/Arctic61-4-361.pdf

IMPACTS OF EROSION

Widespread Physical Impacts[10]

Coastal erosion along the Arctic coast of Alaska is threatening Alaska Native villages, sensitive ecosystems, energy and defense related infrastructure, and large tracts of Alaska Native, state, and federally managed land. Riverine erosion also severely impacts numerous Alaska Native villages. And beyond the scope of this short report, flooding impacts are considerable.

Physical impacts also have major cultural, security, and socio-economic consequences.

Examples of Impacts (that have Financial Consequences)

In addition to the radar site and runway challenges faced by the military, other examples of costly impacts include an eroding runway in Point Hope in northwest Alaska. The Arctic Ocean over the last five years has eroded about 50 feet of safety area at one end, needed by planes for emergencies. Plans call for skewing the runway about 30 degrees, so it will be more parallel to the coast. The work is expected to cost $17 million.

As another example, the Noatak River is threatening the runway in Noatak. Erosion there is impacting the road to the airport and is approaching the apron. The plan is to move that airport more than a mile, at an estimated cost of about $25 million.

News reports[11] also mention an example of a costly flooding event, as the Dalton Highway flooded south of Deadhorse, near the Prudhoe Bay oil fields, in May 2015.

The Alaska village of Napakiak recently received $449,000 in federal funding to help the community respond to erosion and other effects of climate change. The village of less than 400 residents has lost 50 feet of its shoreline since May 2018. A storm destroyed Napakiak's boat and hovercraft landing, which residents rely on for food and supply deliveries.[12]

Other examples are found elsewhere. These erosion and flooding examples are a subset of a wide plethora of costly public projects to address climate change related impacts.

Archeological Losses

Erosion on the Alaska Arctic Coast also illustrates the loss of cultural sites that provide a record of human settlement in the Arctic. Verified disappearing cultural and historical sites include Esook, a hundred-year-old trading post now underwater on the Beaufort Sea floor, and Kolovik (Qalluvik), an abandoned Inupiaq village site that may soon be lost. At another site, near Lonely, Alaska, a picture

10 "Northern Alaska Coastal Erosion Threatens Habitat and Infrastructure," July 2, 2015, https://www.technology.org/2015/07/02/northern-alaska-coastal-erosion-threatens-habitat-infrastructure/

11 "Pricey projects loom for Alaska as erosion threatens runways, roads and more," Anchorage Daily News, March 10, 2018, https://www.adn.com/alaska-news/environment/2018/03/09/pricey-projects-loom-for-alaska-as-erosion-threatens-runways-roads-and-more/

12 "Alaska village gets funding for erosion, climate change," The Seattle Times, August 19, 2018, https://www.seattletimes.com/nation-world/alaska-village-gets-funding-for-erosion-climate-change/

was taken of a wooden whaling boat that had rested on a bluff overhanging the ocean for nearly a century. A few months later, the boat had been washed away to sea.[13]

Another study on the Alagnak River in southeast Alaska illustrates loss of artifacts at a prehistoric village site to riverine erosion.[14]

SELECTED FEDERAL AGENCIES | RELEVANT NOTES

Denali Commission

One Denali Commission program of relevance is the Village Infrastructure Protection (VIP) program, dedicated to assisting rural Alaska communities that are threatened by erosion, flooding, and permafrost degradation. The program goal is to mitigate the impact of these threats with respect to safety, health, and the protection of infrastructure. The Commission has received no new recurring appropriations for the VIP Program. However, in FY16, FY17, and FY18 the agency invested a total of $34 million of its discretionary program funds for VIP related initiatives, primarily in support of four vulnerable communities (Newtok, Kivalina, Shaktoolik, and Shishmaref).[15]

In March 2018 Congress doubled its funding for the Denali Commission to $30 million. Half of that money will be used to help move the Yup'ik village of Newtok.[16] The new money is aimed at addressing the most urgent needs of Alaska villages facing erosion, flooding and permafrost degradation, according to instructions accompanying the bill.[17]

The Denali Commission will provide $22 million to help the erosion-threatened village, Newtok, move to higher ground, nine miles away. The river erodes toward the village at about 70 feet a year, based on historical average. The federal spending bill approved in March provided most of the money, $15 million. The remainder of the $22 million includes pre-existing agency funds and a required state match of $2.5 million.[18]

Interior

Recent Alaska accomplishments at the Department of the Interior include opening the 1002 Area, responsible energy development, a long-overdue agreement for a life-saving road for the people of King Cove, and the nomination of Alaskans to serve in high-ranking key positions.[19]

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13 "Erosion Doubles Along Part of Alaska's Arctic Coast; Cultural and Historical Sites Lost," United States Geological Survey, May 2009, https://soundwaves.usgs.gov/2009/05/research2.html

14 "A Norton Traditional Village Site on the Alagnak River. Southwest Alaska," Alaska Journal of Anthropology, 2007, http://www.alaskaanthropology.org/wp-content/uploads/2017/08/Vol_5_1-Bundy_AJA_v5n1.pdf

15 "Village Infrastructure Protection," Denali Commission, https://www.denali.gov/programs/village-infrastructure-protection/

16 "Commission coordinating Alaska village relocation awaits new leader," Arctic Today, May 3, 2018, https://www.arctictoday.com/commission-coordinating-alaska-village-relocation-awaits-new-leader/

17 "Congress poised to approve $15M for village relocation in Alaska," Alaska Public Media, March 22, 2018, https://www.alaskapublic.org/2018/03/22/congress-poised-to-approve-15m-for-village-relocation-in-alaska/

18 Federal agency commits $22 million to help erosion-threatened village move, Anchorage Daily News, April 29, 2018, https://www.adn.com/alaska-news/rural-alaska/2018/04/29/federal-agency-commits-22-million-to-help-erosion-threatened-village-move/

19 "Quarter 1 in Review: Interior Releases Comprehensive List of First Quarter 2018 Accomplishments Under President Trump & Secretary Zinke, " August 9, 2018, https://www.doi.gov/pressreleases/promises-made-promises-kept-interior-releases-comprehensive-list-accomplishments-under

Interior's Strategic Plan for Fiscal Years 2018 to 2022 is a document of note. Erosion is specifically referred to only once, under the United States Geological Survey. Mention is made of monitoring natural hazards risk such as coastal erosion.[20]

Asked about the federal government's role in helping to relocate some of the villages, which could cost hundreds of millions of dollars, Secretary Zinke said the new administration wants to respond to the desires of individual communities, rather than impose policies from the top down. "There's a role because we represent the tribes and Native Alaskans. We're their advocate," he said. But he added: "What the specific solution is, I don't think anyone knows at the moment." [21]

Indian Affairs Tribal Resilience Program

The Bureau of Indian Affairs (BIA) Tribal Resilience Program provides federal-wide resources to Tribes to build capacity and resilience through leadership engagement, delivery of data and tools, training, and tribal capacity building. Direct funding supports tribes, tribal consortia, and authorized tribal organizations to build resilience through competitive awards for tribally designed resilience training, adaptation planning, vulnerability assessments, supplemental monitoring, capacity building, and youth engagement. Areas of emphasis include:

- Training (design/deliver by tribes to grow regional capacity)
- Adaptation (strategic planning, vulnerability assessments, supplemental monitoring)
- Capacity Building (scoping out where to start, proposal preparation, etc.)
- Youth
- Ocean and Coastal

In general, these themes correspond well with possible 2019 action items for coastal and riverine erosion affecting Alaska Native communities.[22]

Through the BIA Tribal Climate Resilience Program, limited funding is prioritized to help those on the front lines of climate change prepare, plan, and build capacity. This program helps Alaska Native Villages, such as Kivalina, where coastal erosion threatens to erase entire communities and their way of life.[23]

Federal Emergency Management Agency

With Federal Emergency Management Agency (FEMA) support, after their land became threatened by erosion, the village of Newtok was awarded $1.7 million to move seven homes along the Ninglick River, as its swell has continued to erode the banks on which the homes rest. FEMA also recently allocated $4.46 million to Matanuska residents.

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20 "Strategic Plan for Fiscal Years 2018 to 2022," Department of the Interior, https://www.doi.gov/sites/doi.gov/files/uploads/fy2018-2022-strategic-plan.pdf

21 "Trump's Interior secretary talks about administration's Alaska plans and priorities," Anchorage Daily News, December 22, 2017, https://www.adn.com/politics/2017/12/22/trumps-interior-secretary-talks-about-administrations-alaska-plans-and-priorities/

22 "Tribal Resilience Program," Indian Affairs, https://www.bia.gov/bia/ots/tribal-resilience-program

23 "Toward a Bright Future: The Interior Department's Record of Progress," January 5, 2017, https://www.doi.gov/blog/exit-memo

The money comes from the Hazard Mitigation Grant Program. Naturally occurring erosion, such as Newtok is experiencing, is not eligible for aid through the normal state or federal disaster declaration process, according to an official.[24]

In 2017, during FEMA Region 10's 2017 Mitigation Summit, a number of stakeholders from federal, state, and non-governmental organizations met to discuss the possibility of developing a Risk Mapping, Assessment and Planning (Risk MAP) approach that focuses on Alaska Native communities who are increasingly being impacted by environmental threats such as flooding, erosion, and permafrost degradation.[25]

Adaptation Responses to Climate-Related Hazards comprise:

- Protection-in-Place
  - Shoreline protection measures and other controls to prevent/minimize the effects of coastal or riverine threats
  - Allows the community to remain in its current location
- Migration
  - Gradually moving property and development away from hazard-prone areas
  - Community must have suitable, developable land nearby
- Relocation
  - Moving entire community to entirely different location not vulnerable to natural hazards
  - Usually considered only after determination that other methods of dealing with hazard threats would not be feasible[26]

National Oceanic and Atmospheric Administration[27]

Alaska Sea Grant is part of the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks and part of the National Sea Grant Program, a division of NOAA. The group observes that flooding and erosion affect over 87% of the rural communities spread across Alaska's rivers and coastlines. Although the occurrence of these hazards is broadly established, there is minimal monitoring equipment or mapped data throughout Alaska.

A protocol for monitoring coastal erosion has been developed by the Alaska Division of Geological & Geophysical Surveys (DGGS), University of Alaska Fairbanks (UAF), Bristol Bay Native Association, and Alaska Sea Grant. Collaborators are working with local teachers and Tribal Environmental Coordinators throughout the state to collect baseline erosion surveys.

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24 "Alaska village gets $1.7 million to buy out homes threatened by erosion," March 21, 2018, https://www.ktuu.com/content/news/Alaska-village-gets-17-million-to-buy-out-homes-threatened-by-erosion-477548113.html

25 "Assistance to Imminently-Threatened Alaska Native Villages," Alaska Mapping Business Plan, 2017, https://www.commerce.alaska.gov/web/Portals/4/pub/AMBP4.pdf

26 "Risk Mapping, Assessment and Planning (Risk MAP): Assisting Imminently-Threatened Alaska Native Villages," U.S. Arctic Research Commission, October 10, 2017, https://www.commerce.alaska.gov/web/Portals/4/pub/USARC_Presentation_SRCox.pdf

27 "Overview: Flooding and erosion in Alaska," Alaska Sea Grant, December 14, 2017, https://seagrant.uaf.edu/topics/environmental-hazards-alaskas-coasts/flooding-erosion/

United States Geological Survey

The USGS is closely involved with marine erosion. For example, USGS maintains a National Assessment of Coastal Change Hazards.[28] As coastal populations continue to expand, and infrastructure and habitat are increasingly threatened by erosion, there is increased demand for accurate information regarding past and present trends and rates of shoreline movement.

USGS gathers baseline data on Alaska's changing shoreline and the forces that are driving change to help scientists develop models of the future shoreline. This research can help government officials protect villages, mitigate threats to oil and gas infrastructure, and manage habitat for endangered and threatened species.

Environmental Protection Agency

The agency summarizes the Alaska native erosion situation as follows: Thawing permafrost, loss of coastal sea ice, sea level rise, and more intense extreme weather events are also increasing erosion and flooding along Alaska's northwestern coast. More than 30 Native villages are either in the process of or in need of relocating their entire village. In Shishmaref, Kivalina, and Newtok, for example, erosion is causing extensive damage, creating new dangers to residents, and deepening pressure to relocate. However, due to high costs and land constraints, tribal communities in Alaska have been experiencing difficulty relocating to safer areas.[29]

It may be of note that EPA maintains a Climate Change Adaptation Resource Center. The Center manages Case Studies for Climate Change Adaptation. It appears that no case studies have yet been conducted in the Alaska region. The consultant suggests that the potential for an Alaska case study on erosion be explored. (One case study is Quinault Indian Nation Plans for Relocation.[30])

Government Accounting Office

While now very dated, in the 2009 report noted at the outset of this report to AFN, GAO observed that federal disaster programs have provided limited assistance to villages, and that no comprehensive relocation program exists; furthermore, Federal Emergency Management Agency (FEMA) disaster preparedness and recovery programs have provided limited assistance to villages.

GAO stated that federal programs to assist threatened villages prepare for and recover from disasters and to protect and relocate them are limited and unavailable to some villages. FEMA has several disaster preparedness and recovery programs, but villages often fail to qualify for them.

Among GAO recommendations, in 2009, was that Congress consider designating, or creating, a lead federal entity that could work in conjunction with the lead state agency to coordinate and oversee village relocation efforts.

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28 United States Geological Survey, National Assessment of Coastal Change Hazards, https://marine.usgs.gov/coastalchangehazards/

29 "Climate Impacts in Alaska," Environmental Protection Agency, January 19, 2017, https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-alaska_.html

30 "Case Studies for Climate Change Adaptation," Environmental Protection Agency, https://www.epa.gov/arc-x/case-studies-climate-change-adaptation#tab-4

Federal Resilience Programs for Alaskan Communities

During the previous federal administration, a report was prepared by the Coastal Erosion Working Group (CEWG). CEWG, which included representatives from the Executive Office of the President as well as ten federal agencies, was tasked with examining opportunities for federal action to address the imminent threats that coastal erosion and flooding pose to Alaskan Arctic coastal communities. CEWG adjudged that a catalog of federal programs would be useful for Alaskan coastal communities seeking to address erosion, flooding, and other resilience challenges. The referenced "Catalog of Federal Resilience Programs for Alaskan Communities" [31] was developed by CEWG.

Communities in Alaska that face challenges associated with coastal erosion, flooding, and other climate-related risks can use this catalog to find information, technical assistance programs, and potential funding resources. Generally speaking, federal programs address the following themes:

Information Gathering and Evaluation: Risk assessment and monitoring activities, including assessing hazards like coastal erosion, mapping subsistence patterns, and tracking natural climate variability;

Capacity Building: Training, education, and community planning efforts, including digital access to tools and development of administrative needs to inform resilience planning;

On-site Measures: Maintaining and strengthening infrastructure, land, and livelihoods within a community. Examples include redesigning roads and evacuation routes due to climate change impacts and investing in infrastructure that generates economic returns; and

Relocation: Activities that support the relocation of entire communities or certain community assets, including new site identification and development.

It can be observed that these summary themes encompass numerous areas for potential action in 2019, especially perhaps community capacity building stressing adaptation.

Note: Numerous other federal agencies may be relevant, for example, the Bureau of Reclamation.

UNITED STATES MILITARY

U.S. Army Corps of Engineers: Alaska District

While not especially focused on erosion, the program mix of this organization is relevant. The major programs focus on military construction, civil works, and environmental cleanup.

- Military construction projects once accounting for the largest portion of the district's workload but are declining while other programs, such as humanitarian assistance to Asia and foreign military sales, are increasing.
- The civil works program operates and maintains 52 river and navigation projects along the coast of Alaska. Of these projects, 36 are small boat harbors, 10 are channels, four are breakwaters, and two are river projects.

31 "Climate Resilience in Alaskan Communities; Catalog of Federal Programs," Coastal Erosion Working Group, September 2, 2015, https://www.denali.gov/images/documents/Other_Commission_Reports/Catalog_of_Federal_Resilience_Programs_for_Alaskan_Communities.pdf

- The formerly used defense sites program has identified 312 environmental cleanup and restoration projects within the state. To date, 132 projects have been completed.[32]

Dating back to 2006, the U.S. Army Corps of Engineers prepared an informative report on Alaska Village Erosion.[33] It addresses erosion issues in the communities of Bethel, Dillingham, Kaktovik, Kivalina, Newtok, Shishmaref, and Unalakleet. The Corps examined erosion rates and control, potential relocation, and impacts to Alaska Native culture and tradition. The questions asked were: what are the costs of ongoing erosion, what would it cost to relocate a community, and how much time do these communities have left before they are lost to erosion.

Community	Costs of Future Erosion Protection	Cost to Relocate	How Long Does The Community Have*
Bethel	$5,000,000	N/A	> 100 years
Dillingham	$10,000,000	N/A	> 100 years
Kaktovik	$40,000,000	$20 - 40 Million	> 100 years
Kivalina	$15,000,000	$95 - 125 Million	10 - 15 years
Newtok	$90,000,000	$80 - 130 Million	10 - 15 years
Shishmaref	$16,000,000	$100 - 200 Million	10 - 15 years
Unalakleet	$30,000,000	N/A	> 100 years

A more recent estimate: two Alaska Native tribes, the Newtok and Kivalina, have requested help from the federal government to relocate from coastal areas facing shoreline erosion and the loss of sea ice essential for hunting. According to the inspector general's office, the Army Corps of Engineers estimates it would need up to $130 million to relocate the Newtok and as much as $400 million to move the Kivalina.[34]

Air Force Civil Engineer Center

The combination of melting sea ice, thawing permafrost, and sea-level rise is eroding the Alaska shoreline enough to damage several Air Force radar early warning and communication installations. At one base, half a runway has given way to erosion, preventing large planes from using it. Damage to a seawall has allowed waves to wash onto the runway at another base. Thawing permafrost has also affected access to training areas.[35]

BEM Systems, Inc. is working on a multi-year effort to support the Air Force Civil Engineer Center in Arctic Alaska. There, increasing temperatures and stronger storms have combined to dramatically

32 U.S. Army Corps of Engineers: Alaska District, https://www.poa.usace.army.mil/About/
33 "Alaska Village Erosion Technical Assistance Program," US Army Corps of Engineers, April 2006, http://www.cakex.org/sites/default/files/documents/AVETA_Report.pdf
34 "The Energy 202: Internal watchdog says Interior should focus on climate change. It isn't." Washington Post, November 22, 2017, https://www.washingtonpost.com/news/powerpost/paloma/the-energy-202/2017/11/22/the-energy-202-internal-watchdog-says-interior-should-focus-on-climate-change-it-isn-t/5a14acd130fb0469e883f75b/?utm_term=.0b604abd1ea8
35 "Who's Still Fighting Climate Change? The U.S. Military," National Geographic, February 7, 2017, https://news.nationalgeographic.com/2017/02/pentagon-fights-climate-change-sea-level-rise-defense-department-military/

increase erosion rates along the shoreline of the North Slope. Mechanical and thermal erosion result in shoreline recession rates that far exceed those in the lower 48, threatening historic radar sites that have been in use since the Cold War.[36]

Under a $1.1 million contract, the Air Force wants a University of Alaska Anchorage research center to improve estimates for anticipated shoreline loss at two radar sites in northeast Alaska, officials said last week. The stations are at Oliktok Point near the North Slope oil fields and Barter Island near Canada. Over time, the shorelines have been creeping closer to these coastal stations.[37]

STATE OF ALASKA

Adapt Alaska

In 2016 communities from the Aleutians to the Chukchi Sea came together for a series of four coastal resilience and adaptation workshops, with a fifth workshop held in southeast Alaska. The five workshops were organized by numerous partner organizations. The workshops were an opportunity to discuss the greatest challenges facing coastal communities and to share science and local knowledge to facilitate collaborative monitoring, mitigation, and adaptation strategies. The Adapt Alaska project continues while expanding partnerships.[38]

A 2017 report titled, *A Toolbox for Resilience and Adaptation in Coastal Arctic Alaska*, was funded by the Bureau of Indian Affairs and the U.S. Fish and Wildlife Service. The report states that in 2017 the U.S. Department of the Interior is coordinating a multi-agency effort with the State of Alaska to develop an Adaptive Village Relocation Framework for Alaska. This guide includes a selection of tools and success stories from around Alaska to help communities, resource managers, and decision makers maintain resilience and adapt to change.[39]

State of Alaska Primer on Erosion Issues in Alaska

This is a somewhat dated but excellent primer on erosion issues in Alaska. Attention is drawn in particular to the sections in Chapter 4 on Technical Assistance and Funding Assistance.[40]

Climate Action for Alaska Leadership Team

Climate Action for Alaska Leadership Team: One area of focus was coastal erosion. In September 2018 a group of Alaskans submitted a report on policy ideas for climate change. The press reports uncertainty concerning the future for this initiative.[41] The website is inactive.

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36 "BEM Analyzes Shoreline Erosion in Arctic Alaska," Dec 7, 2017, https://bemsys.com/bem-analyzes-shoreline-erosion-in-arctic-alaska/

37 "Erosion is creeping toward Alaska's coastal radar sites," Anchorage Daily News, March 21, 2018, https://www.adn.com/alaska-news/environment/2018/03/20/erosion-is-creeping-toward-alaskas-coastal-radar-sites/

38 Adapt Alaska, https://adaptalaska.org/about-adaptak/

39 "A Toolbox for Resilience and Adaptation in Coastal Arctic Alaska," ADAPT, 2017, http://adaptalaska.org/wp-content/uploads/2017/10/ak-adaptation-toolbox.pdf

40 Understanding and Evaluating Erosion Problems, State of Alaska, 2013, https://www.commerce.alaska.gov/web/portals/4/pub/Understanding&EvaluatingErosionPub.pdf

41 "With election of Dunleavy, is Walker's climate action team out in the cold?" November 16, 2018, https://www.ktoo.org/2018/11/16/with-election-of-dunleavy-is-walkers-climate-action-team-out-in-the-cold/

Other Alaska Agencies

Other Alaska agencies active in erosion issues include the Alaska Native Tribal Health Consortium, the Alaska Energy Authority, the Division of Community and Regional Affairs, academic institutions, and the Alaska Federation of Natives, among others.

Economic Development Strategy for Alaska, 2017 to 2022

The draft Comprehensive Economic Development Strategy for Alaska, 2017 to 2022,[42] produced by the Alaska Department of Commerce, Community, and Economic Development in 2017, makes reference to using USDA grants and HUD Block grants to pursue funding for villages requiring relocation due to coastal or riverbank erosion. (This point does not appear to be addressed in the Year One Update of the Plan.[43])

Note: This short report separates federal and state agencies. This does not suggest that the agencies do not collaborate.

ALASKA DELEGATION

Representative Don Young has strongly supported the work of the Denali Commission. The Denali Commission, started in 1998, is an independent federal agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska. To date, more than 240 Alaska Native Villages and over 100 communities have been served by the Denali Commission and as a result have seen reduced energy costs and increased access to health services. Representative Young regards the Denali Commission as a force multiplier in terms of funding improvements.[44]

Senator Lisa Murkowski recently called for an urgent focus on assistance for Alaskan communities facing coastal erosion. During an Energy and Water Development Appropriations Subcommittee hearing examining the U.S. Army Corps of Engineers' budget request for Fiscal Year 2019, Senator Murkowski cited threats to the northern community of Utqiagvik, facing serious winter storms, receding sea ice, and greater coastal erosion.[45]

In a 2017 speech to the Alaska Federation of Natives, Senator Murkowski noted that almost every Alaska village faces changing weather patterns, increased erosion, and changing migration patterns of the fish, game, and other subsistence resources. Precious artifacts are lost as melting permafrost and storm-caused erosion damage exposes sites containing important objects from thousands of years ago. The impacts of climate change fall disproportionately on rural Alaska. The challenge is to improve the resilience of Alaska communities now, not wait for the disasters to come.[46]

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42 "A Comprehensive Economic Development Strategy For Alaska, 2017 to 2022," Alaska Department of Commerce, Community, and Economic Development, 2017, https://northernopportunity.com/wp-content/uploads/2017/05/FINAL-DRAFT-State-of-Alaska-Comprehensive-Economic-Development-Strategy.pdf

43 "A Comprehensive Economic Development Strategy For Alaska, 2017 to 2022; Year 1 Update," Alaska Department of Commerce, Community, and Economic Development, July 30, 2018, https://www.commerce.alaska.gov/web/Portals/6/pub/AlaskaCEDSYear1Update.pdf?ver=2018-08-21-073023-487

44 "House Passes Bipartisan Package of Appropriations Bills," July 28, 2017, https://donyoung.house.gov/news/documentsingle.aspx?DocumentID=399007

45 "Murkowski Urges for Swift Action on Addressing Coastal Erosion," April 19, 2018, https://www.murkowski.senate.gov/press/release/murkowski-urges-for-swift-action-on-addressing-coastal-erosion-

46 "Speech: Alaska Federation of Natives (AFN)," October 21, 2017, https://www.murkowski.senate.gov/press/speech/speech-alaska-federation-of-natives-afn

Senator Dan Sullivan recently discussed erosion and other issues with villagers in the Yukon-Kuskokwim Delta. It is reported that Senator Sullivan said that the main problem is getting funding that is already available delivered to those communities who need it. He noted that funding was increased for the Denali Commission, a federal agency that is helping some communities move. The Senator observed that the best solutions will come from community members. "One of the solutions is to build our own housing with our own materials." [47]

Senators Murkowski and Sullivan introduced the ANCSA Improvement Act of 2017 to correct oversights in the original Act and other federal statutes to respond to challenges ranging from erosion to incomplete land selections affecting Alaska Native communities.[48]

INTERNATIONAL ORGANIZATIONS

Arctic Council

During its Chairmanship of the Arctic Council, the United States initiated a process of long-term strategic planning for the Council. Finland,[49] the 2017 to 2019 Chair, recognizes the need to set long-term strategic goals that extend beyond the two-year chairmanship periods. In favorable international conditions, these could be confirmed at an Arctic Summit. Advocates could consider advancing erosion (and flooding) as an issue that would benefit from suitable long-term strategic goals.

ADAPTATION GOING FORWARD

Moving Beyond Resilience to Adaptation[50]

Alaska is home to 40% of the total U.S. tribal population. Many are already experiencing higher temperatures, decreasing sea ice, and melting permafrost. These features are threatening the health, economy, and culture of Alaska Native peoples, despite their history of living close to the land and adapting to natural changes. Key vulnerabilities include the loss of protective sea ice which will increase coastal erosion, thus threatening coastal communities. Alaska Native communities will have to retreat and relocate away from impacted areas, but this is difficult, in part due to high costs and limited availability of funds to use for relocation.

Furthermore, a reduction is anticipated in the availability of many animals that people rely on for their traditional way of life, due to changes in species migration, sea ice, and the presence of competing animals. The ice on rivers and coastlines is thinner and travel becomes dangerous, making hunting, fishing and other activities more challenging, and can lead to loss of life and equipment. This may make it difficult to harvest resources needed for healthy traditional communities.

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47 "Sen. Sullivan talks erosion, Donlin Mine and jobs in Y-K Delta visit," Alaska Public Media, August 10, 2018, https://www.alaskapublic.org/2018/08/10/sen-sullivan-talks-erosion-donlin-mine-and-jobs-in-y-k-delta-visit/

48 "Murkowski: ANCSA Improvement Act Fulfills Federal Promises to Alaska Natives," February 7, 2018, https://www.energy.senate.gov/public/index.cfm/2018/2/murkowski-ancsa-improvement-act-fulfills

49 "Finland's Chairmanship of the Arctic Council in 2017 to 2019," Ministry for Foreign Affairs of Finland, http://www.formin.finland.fi/public/default.aspx?nodeid=50020&contentlan=2&culture=en-US

50 "Adapting to Climate Change: Alaska," Department of Environment, June 2016, https://www.epa.gov/sites/production/files/2016-07/documents/alaska_fact_sheet.pdf

Adaptation to a changing environment goes beyond resilience by taking actions to address future risks. Adaptation refers to how communities anticipate, plan, and prepare for changing conditions.

In several Alaskan Native communities, urgent planning discussions are underway about how to adapt, and potentially relocate. Newtok, a Yup'ik Eskimo coastal community, has worked for a generation to relocate to a safer location as conditions have changed. Between 2004 and 2006, three storms accelerated coastal erosion and repeatedly flooded the village water supply, spread raw sewage throughout the community, displaced residents from homes, destroyed subsistence food stores, and shut down essential utilities. The loss of the town's barge landing, where supplies and heating fuel were delivered, created a fuel crisis. Saltwater is also contaminating the community water supply, and by 2017, erosion is projected to reach the school, the largest building in the community. Federal legislation does not authorize relocation funding, nor does it authorize the community to repair or upgrade storm-damaged infrastructure in flood-prone locations.

More Erosion Research and Better Erosion Data

Although Alaska's north coast experiences both erosion and accretion, it is predominantly erosional, retreating on average about 1.4 meters per year; very high rates of erosion, up to 20 meters per year, occur along some sections of coast, such as Drew Point, Alaska. The numerous low-lying barrier islands, which provide habitat for nesting birds, buffer wave energy reaching the mainland coast, and regulate salt and freshwater exchange in the lagoons, are extremely mobile and experience high rates of both erosion and accretion.

Human adaptation to these changes is difficult. Though major infrastructure in villages can be moved, relocation comes at great cost and with some concern that new sites might also be at risk from future erosion. Gathering baseline data on Alaska's changing shoreline and the forces that are driving change can help scientists develop models of a future shoreline. This research can help government officials protect villages, mitigate threats to oil and gas infrastructure, and manage habitat for endangered and threatened species.

The change in erosion rates is likely the result of several changing Arctic conditions, including declining sea-ice extent, increasing summertime sea-surface temperature, rising sea level, and possible increases in storm power and corresponding wave action. More long-term work is needed to understand the interplay of these factors and how they drive changes in coastal erosion.[51]

Coastlines change in response to a variety of factors, including changes in the amount of available sediment, storm impacts, sea-level rise, and human activities. How much a coast erodes or expands in any given location is due to some combination of these factors, which vary from place to place.

The coauthor of a 2015 USGS report[52] opined that "There is increasing need for this kind of comprehensive assessment in all coastal environments to guide managed response to sea-level rise and storm impacts."

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51 "Climate impacts to Arctic coasts," Pacific Coastal and Marine Science Center, United States Geological Survey, June 2018, https://www.usgs.gov/centers/pcmsc/science/climate-impacts-arctic-coasts?qt-science_center_objects=0#qt-science_center_objects

52 "Northern Alaska Coastal Erosion Threatens Habitat and Infrastructure," United States Geological Survey, 2015, https://soundwaves.usgs.gov/2015/09/

In Alaska there is a relative dearth of data on coastal erosion. Records, such as tide gauges, which provide a record of how high waters get during storms, are lacking compared to the contiguous U.S.

Despite Alaska's vast size, there are only three tide gauges along the western coast of Alaska and only one along the northern coast, and their records do not go far back in time.[53]

Better coastal and riverine erosion data gathering can be suggested as a priority for 2019 and beyond.

Expectations

The experts in Alaska working with erosion-threatened coastal communities like Newtok, Shishmaref, Kivalina, and Shaktoolik said in interviews that they never expected that the federal government would deliver the hundreds of millions of dollars that could ultimately be needed to relocate those villages. That kind of funds never materialized during in any recent federal administration. Many people think the federal government is unlikely to ever devote enough money and capacity to relocate entire rural villages.[54]

MISCELLANEOUS OBSERVATIONS

Climate-induced Displacement of Alaska Native Communities

An informative but somewhat dated (January 30, 2013) report from Brookings/London School of Economics addresses Climate-Induced Displacement of Alaska Native Communities.[55]

The report considers four principal issues:

- Decreasing Arctic sea ice extent and warmer temperatures are having detrimental effects on many Alaska Native coastal communities
- Permafrost, which keeps the land intact and habitable along the northwestern Alaskan coast, is melting
- Erosion, accelerated by decreased sea ice extent and thawing permafrost, is leading Alaska Native villages to seek relocation of their communities
- Changes in the abundance and distribution of wildlife and marine life

Four communities requiring relocation in their entirety are summarized: Newtok, Shishmaref, Kivalina, and Shaktoolik.

And risks associated with coastal and riverine erosion and flooding in another eight villages exploring relocation options are summarized: Allakaket, Golovin, Hughes, Huslia, Koyukuk, Nulato, Teller, and Unalakleet.

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53 "Alaska's Coast Is Vanishing, One Storm at a Time," Scientific American, November 30, 2017, https://www.scientificamerican.com/article/alaskas-coast-is-vanishing-1-storm-at-a-time/

54 "With focus on hurricanes, erosion-threatened Alaska villages wonder if they'll get any help from Trump," Anchorage Daily News, October 8, 2017, https://www.adn.com/alaska-news/rural-alaska/2017/10/08/with-focus-on-hurricanes-erosion-threatened-alaska-villages-wonder-if-theyll-get-any-help-from-trump/

55 Climate - Induced Displacement of Alaska Native Communities, Brookings/London School of Economics, January 30, 2013, https://www.brookings.edu/wp-content/uploads/2016/06/30-climate-alaska-bronen-paper.pdf

The report concludes that the creation of an adaptive governance framework, which can dynamically respond to the needs of communities, is critical.

The report recommends that Congress should amend disaster relief legislation so that communities are able to use existing funding mechanisms to construct infrastructure at relocation sites that are not within the disaster area.

Congress should also enact legislation to provide a relocation governance framework so that communities have the ability to relocate when the traditional erosion and flood control devices can no longer protect residents in place. In this way, the United States can create a model adaptation strategy that facilitates an effective transition from protection in place to community relocation that can serve as a model for governments throughout the world.

Other points

Alaska Natives among those imploring UK to do more to combat erosion, permafrost melting, and displacement of animals[56]

Leaders from Interior Athabascan tribes, the Inuit, and the Saami people described the impact climate change is having on their communities in the Arctic, and the role the UK must take in helping address the problem. The meeting has significance for the upcoming revision of the UK government's Arctic policy.

Field school will be organized at Utqiaġvik (Barrow), Alaska in 2018, to focus on land-fast sea ice monitoring and coastal erosion[57]

This project supports research and education collaboration among the Arctic University of Norway, the University of Alaska Fairbanks, USA, and the University of Calgary, Canada.

Canada Arctic Oceanographic Processes[58]

The focus of this project by Canada's Department of Fisheries and Oceans was to understand coastal oceanographic processes in the Southern Beaufort Sea, and the related waters of the western Canadian Arctic, driven by intense storms and severe weather. This area is important because the use of the coastal marine and terrestrial environment by Canadian northerners is an integral part of their life style, and these environments are being impacted by coastal erosion processes, related to marine storms that tend to be growing stronger.

Canada's National Research Council's Arctic Program[59]

Canada's National Research Council's Arctic Program engages with, among others, business interests within burgeoning Arctic industries such as mining, tourism, commercial fishing, and oil and gas. Canada's Arctic encompasses opportunities and huge engineering challenges surrounding environmentally safe and sustainable economic development. The Arctic Program develops technologies that will ensure the sustainable and low-impact development of the North while also increasing the quality of life for Northerners through more reliable and relevant infrastructure.

56 "Arctic Indigenous leaders tell UK it must do more to combat climate change," Independent, December 11, 2017, http://www.independent.co.uk/environment/arctic-climate-change-indigenous-leaders-tell-uk-do-more-warning-a8104501.html
57 "Arktiske sommerskoler: et samarbeid mellom Norge, USA og Kanada," https://www.forskningsradet.no/prosjektbanken/#/project/NFR/261786/Sprak=en
58 "Impacts of Severe Arctic Storms and Climate Change on Arctic Oceanographic Processes," http://www.ec.gc.ca/api-ipy/
59 Arctic Program, National Research Council, https://www.nrc-cnrc.gc.ca/eng/solutions/collaborative/arctic.html

One opinion about international cooperation[60]

An important consideration is how best to convey to our international partners that we need to set priorities together. This is the best way to avoid friction and conflict emanating from misunderstandings of what is being undertaken in the Arctic. What more can we learn from how other countries are dealing with Arctic challenges? Government can't act alone; how do we get the business community more involved? And finally, how do we keep politics at bay in order to get things done? As regards erosion, the consultant suggests that Alaska is the center of the most erosion stress, and the likely location of best solutions that will interest other Arctic nations in 2019 and beyond.

60 "The Crisis in the Arctic," January 17, 2018, https://www.politico.com/magazine/story/2017/01/the-crisis-in-the-arctic-214649

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