NASA DEVELOP Summer Term 2023

This project was recently awarded through the Bureau of Indian Affairs (BIA). Work is expected to start around March 2023, but site work will commence in the Summer of 2023. The project is scheduled to end in August 2024. This project will be a collaboration between the Native Village of Unalakleet (NVU) and the National Renewable Energy Lab's Cold Climate Housing Research Center (CCHRC-NREL) in Fairbanks, Alaska. **There is an opportunity for a team from the DEVELOP program to add depth to this project by providing a community preparing to relocate with information on resilience planning and how to protect their critical infrastructure.**

Community concerns

The community of Unalakleet, Alaska, is planning a managed retreat from the current site on the shoreline of Norton Sound to a nearby hillside area in response to recent flooding and erosion caused by sea-level rise. The most recent statewide threat assessment report (the Denali Commission) designates Unalakleet as the eighth-most at-risk remote community in the state; it is threatened by coastal erosion, flooding, and permafrost degradation. Current decision-making process

As the community plans its managed retreat, this project will enable NVU to make informed decisions by providing housing designs for an already platted subdivision. CCHRC-NREL's focus will be creating plan documents for an energy-efficient, culturally informed, and environmentally resilient dwelling. Their work will include site analysis (e.g., geotechnical, structural engineering assessments, climatic conditions), proactive responses to the changing climate, and holistic, community-centered designs. The results from this project will enable NVU to proceed with shovel-ready projects in a structured and systematic way, adding to the community's resilience and long-term health. Existing plats offer guidance but verifying them with aerial imagery and analysis would be helpful.

Potential useful end products

This retreat is in its early stages, but this kind of effort can take years to plan and execute. The sense of urgency cannot be understated. There is a need for data, analysis, and information sharing. The DEVELOP team, likely working in the Climate application area, could address several issues, including:

1) Clarifying discrepancies with existing plats, reassessing a road that did not go to plan, updating the status of recent damage to the road, and further extending the road system;
2) How should the community assess areas future expansion?
3) How do drainage patterns affect current and future site selection;
4) Looking at the town's current site, how should the retreat proceed—what buildings/functions should move first?

Potential deliverables include printed and digital content that can be shared with the community and the NVU planning committee. Maps or other visual information would be accompanied by written analyses written for professionals to assist with future planning efforts and for non-professionals in the community.

Study area

Unalakleet is the most southern Iñupiaq community in Alaska, located on the coast of Norton Sound at the mouth of the Unalakleet River (Fig. 1, Fig. 2; 63°53'51.6 "N 160°46'27.8 "W). This remote town lacks road access. It sits on a four-mile-long gravel spit (i.e., sandspit), about 14 feet above sea level. In this area, coastal communities traditionally relocated inland during winter, but this is no longer in practice.

The community of Unalakleet is experiencing coastal erosion from two sides: the ocean (i.e., Norton Sound) from the west and the Unalakleet River from the east and south. Erosion on the ocean side of the spit is apparent after storm surges with evidence of shoreline retreat. Erosion caused by the Unalakleet River is even more severe, averaging two feet per year. Fortunately, higher ground is nearby, and the city administration has explored options for a retreat since 2003 (Fig 2a). Aside from the loss of shoreline, increased storm surge also threatens the town's water supply, which runs along the coastline.

The new location, informally called the Hills Subdivision (63°53'51.6 "N, 160°46'27.8 "W), is about 1.5 miles northeast of the town at the base of the Nulato Hills (Fig. 2a). Phase 1 of this development will initiate a plan for further expansion of the new location. Geotechnical analyses of the subdivision were conducted in 2020 for a topographic survey and road development. The phase 1 subdivision is already partially occupied, although the road is unfinished. The terrain of the hillside subdivision presents different challenges from that of the coastline. For example, while the Unalakleet spit has well-drained soil composed of silty, gravelly sediments and sedimentary lagoon deposits, the slopes of the Nulato Hills are alpine tundra with thin, cobbly soil with some sand and gravel over fractured bedrock and occasional rocky outcrops (i.e., discontinuous permafrost). Determining the best foundation systems for new buildings will be one of the first tasks of this project.

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Fig. 1: Unalakleet and Norton Sound as seen from the Nulato Hills.

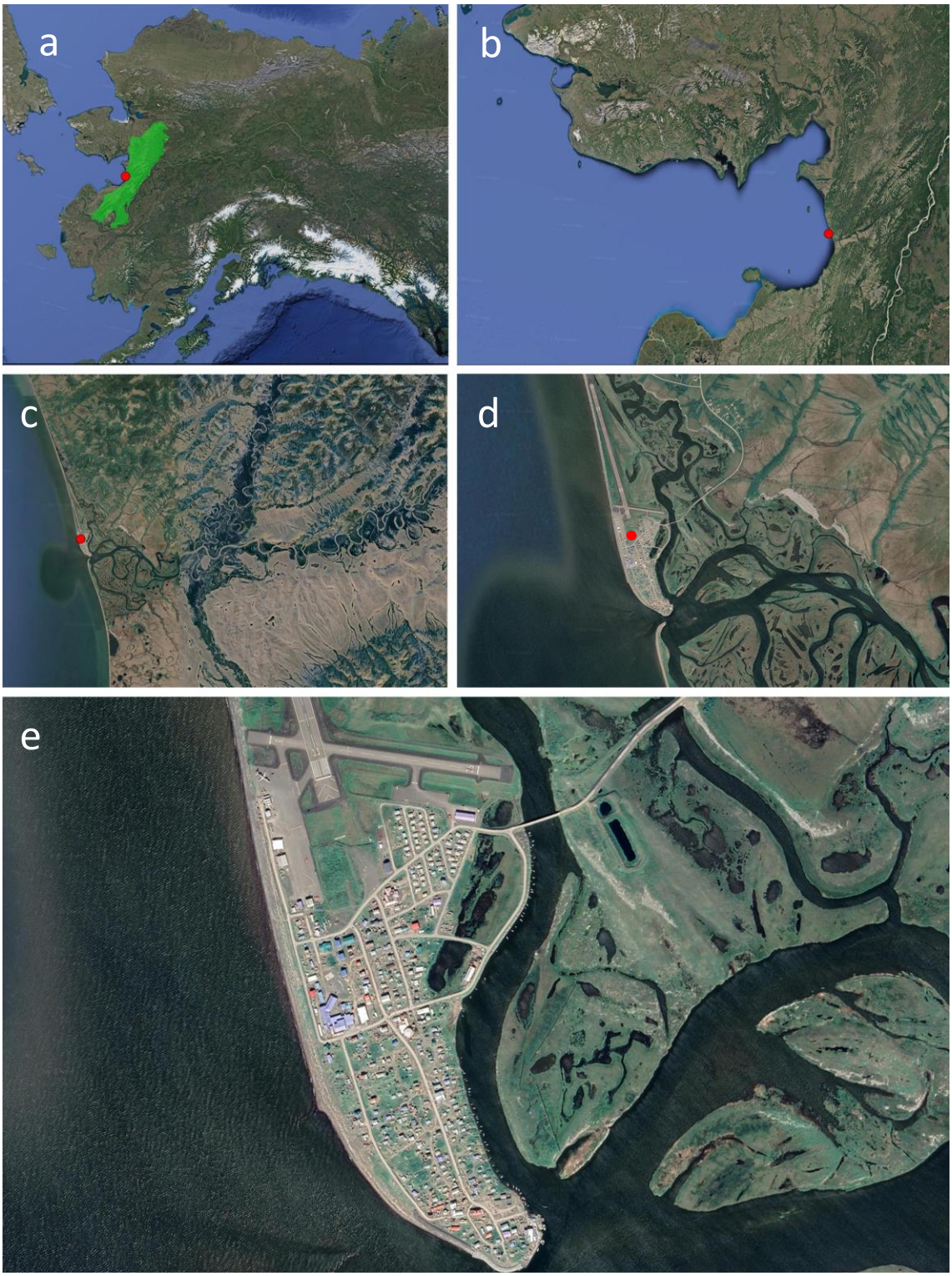

Fig. 2: Location of Unalakleet, Alaska (red dot). The Nulato Hills (a) are shaded in green.