1. Introduction

Alaska and the Arctic are warming more rapidly than any other place on the planet. Alaska has warmed significantly over the past several decades with an average increase in mean annual temperature of 1.9° C since 1950 and as much as a 50% increase in the frost-free season in the boreal forest region during the past century. The warming has been greatest in winter. Alaska has nearly 34,000 miles of coastline with 80% of the population living near the coasts (US Census) and 10% of the economy based in commercial fisheries. Coupling these facts with the importance of coastal and living marine resources to Native subsistence food harvest, ongoing coastal, marine and shoreline climate impacts are a major concern. Impacts are being observed and experienced now.

Alaska's state government, tribal governments, communities, industry, as well as the state and federal agencies that manage transportation and natural resources are seeking assistance as they plan for, and adapt to climate change. With immediate and tangible climate impacts affecting Alaskan citizens, their economy, and natural resources there is an on-going need for information, assistance, and guidance in adaptation planning.

The Alaska Center for Climate Assessment and Policy's (ACCAP) work encompasses the entire state of Alaska. Our core foci are coastal and living marine resources, applied climate downscaling, water availability, sea ice, wildfire, and community adaptation planning (http://ine.uaf.edu/accap/).

ACCAP's Core Office is headed by PI and Lead Scientist Daniel White, professional engineer and hydrologist. Program Coordinator and Research Professor in Geography, Sarah Trainor works in needs and vulnerability assessment, community adaptation planning, collaborations with federal, state and regional entities, and decision-support tool development. Philip Loring, Research Professor in Adaptation and Coastal and Living Marine Resources works closely with communities in needs and vulnerability assessment and decision support tool development. Outreach and Education Specialist Brook Gamble works directly with stakeholders in communicating adaptation solutions and needs assessments. Co-Investigator John Walsh is meteorologist and President's Professor of Global Change at the International Arctic Research Center. He is Director of the Center for Global Change and was Lead Author for the IPCC Fourth Assessment, Working Group II (Polar Regions), 2004-07. Co-Investigator Craig Gerlach, is Professor in the Center for Cross Cultural Studies and works in food security and climate and health impacts.

A complete list of stakeholders/users is too extensive to include in full, however, core collaborators include the Alaska Governor's Climate Change Sub-Cabinet, the Alaska Sea Life Center (ASLC), Native Tribal Governments and Non-profit organizations such as Manillaq, Inc., industry, the Arctic and other upcoming Alaska Fish & Wildlife Service Landscape Conservation Cooperatives (FWS LCC), the Alaska Department of Interior Climate Science Center, other federal agencies such as Bureau of Land Management (BLM), National Park Service (NPS), and conservation NGOs. We collaborate closely with other NOAA entities in Alaska including the Alaska Regional Collaboration Team, the National Weather Service (NWS), the Pacific River Forecast Office, Alaska Sea Grant (ASG), the Alaska Ocean Observing System (AOOS) and the newly instated Alaska Regional Director for Climate Services.

2. Core ACCAP Activities

Stakeholder interaction and outreach is infused and integrated into every aspect of our work, including climate modeling and addressing regional vulnerabilities. These interactions include needs assessment, vulnerability assessment, user collaboration in model downscaling and in designing research studies and user partnership in developing, testing, and evaluating research information products and tools. Our core activities integrate research and decision-support tool innovation.

Monthly Climate Webinars: ACCAP webinars foster discussion and information exchange between scientists and stakeholders in a forum that is accessible state-wide. The webinar is toll-free and presentations are available via standard internet connection. Archived podcasts, presentations, and summaries from 2007-present are available on our website. Recent webinar topics include: changes and uncertainty in Alaska's water resources, permafrost degradation and monitoring, climate change and Alaska fisheries, implications of ocean acidification for Alaska, and mapping tools for Alaska climate change projections (http://ine.uaf.edu/accap/teleconference.htm).

Sea Ice: ACCAP works to evaluate and project sea ice conditions affecting Alaskan coastal communities, marine ecosystems, oil and gas development, and offshore transportation. Through leveraged funds with National Science Foundation (NSF), Study of Environmental Arctic Change (SEARCH) program, we now have Arctic Sea Ice Outlook (http://www.arcus.org/search/siwo), including recently released walrus outlook for subsistence hunters. ACCAP has also developed an up-to-date, comprehensive, and practical guide to sea-ice and climate information resources that are relevant to Arctic Alaska coastal community leaders and local user groups for planning, subsistence activities, and way of life.

Native Climate Impacts and Adaptation: We have broadened our Native stakeholder partnerships to include work with the Alaska Native Tribal Health Consortium (ANTHC) and their Center for Climate and Health. The current project assesses climate health impacts in North West Alaska. We are also working closely with tribal communities along the length of the Yukon River documenting traditional knowledge and climate impacts specific to fisheries and changing seasonality. Additionally, we are pursuing collaborations with the Alaska Native Knowledge Network to continue hosting and organizing Alaska-wide video-conferences to enhance communication and innovation in climate impact assessment and adaptation in rural Native villages.

Interpreting Downscaled Climate Projections: ACCAP works closely with the University of Alaska's Scenarios Network for Alaska & Arctic Planning (SNAP, http://www.snap.uaf.edu/) to provide downscaled temperature, precipitation, and growing season projections for Alaska, now available in Google Earth format. ACCAP scientists collaborate with the Alaska Governor's Climate Change Sub-Cabinet, local governments, and other stakeholders to provide accurate, reliable, and timely information, interpret the implication of climate projections, assist in adaptation and mitigation planning, and develop products that meet regional adaptation needs. In collaboration with SNAP we now have web-based tools for producing community scale graphs and state-wide maps to 2km resolution of temperature, precipitation, and growing season. Tutorials demonstrating how to access and download these tools were highlighted in our monthly webinar series and are available on our website.

Quarterly Newsletter: We have recently initiated a quarterly climate information newsletter, the Alaska Climate Dispatch (http://ine.uaf.edu/accap/dispatch.htm). This publication

is a partnership the Alaska Climate Research Center (ACRC), SEARCH Sea Ice Outlook, National Centers for Environmental Prediction (NCEP), and the NWS. Contents include seasonal weather and climate summaries and regional weather, wildfire, and sea ice outlooks. Guest columnists may provide information on related topics such as El Nino and El Nina, hydrology, and permafrost. Interpretive and clearly written text, full-color pictures, charts, and maps provide decision-makers with a timely snapshot of a wide range of Alaska's diverse weather and climate issues.

Best Management Practices for Communities at Risk: Many communities in Alaska are faced with multiple threats to infrastructure and quality of life due, in part, to projected changes in precipitation, temperature, and related incidences of flooding and erosion. We have developed a guide with a matrix approach to communities at risk so that decision-makers are well informed on planning related to climate change and uncertainty, risk management, and relocation. The guide includes steps from planning through execution, perspectives on community engagement, partial relocation, site development costs, and timing. Sustainability recommendations focus on defining sustainability, future energy planning, planning for a changing cost of living, and available transportation corridors.

Wildfire Decision Support Tool: In 2010 we completed the second year of a pilot web-based decision-support tool to forecast area burned by wildfire for Interior Alaska. We work closely with the State of Alaska Division of Natural Resources (DNR), BLM, FWS, NPS, and Bureau of Indian Affairs (BIA), to refine the model. This tool is based on a gradient boosting model that takes advantage of strong linkages between teleconnection indices, weather, and fire in Alaska and makes use of available Climate Prediction Center data (CPC). ACCAP also partners with the Alaska Joint Fire Science Consortium to enhance communications between fire science managers and make the research more applicable and useful to people on the ground (http://ine.uaf.edu/accap/research/season_fire_prediction.htm).

Coastal and Living Marine Resources: ACCAP partners with the ASG Marine Advisory Program (MAP) to develop climate change outreach materials and provide community workshops to assess climate change vulnerability and create adaptation strategies for coastal communities. Additionally, we are collaborating with the ASLC and UAF scientists to provide multimedia content for a new climate change exhibit opening at the Center in 2010. The ASLC hosts 150,000 visitors per year from around the world. ACCAP has engaged ASG MAP agents and University of Alaska faculty in a mini-grants program to meet user demand for climate information products in coastal and living marine resources. The products will assist marine-dependent communities adapting to a changing climate. Funded projects in the summer 2010 include: implementing seminars, MAP training, and outreach for ocean acidification and adaptation information; developing a citizen based science observation program for invasive crab species in south east Alaska; developing a climate change adaptation decision tool for marine-dependent communities; creating a community guidebook for marine species range extension and invasive species in Northern Alaskan waters; and using NCEP reanalysis and other data to create community presentations and real-time information for local and regional scale coastal sea ice break-up.

Program Evaluation: ACCAP conducted a program evaluation in summer 2010 including a web-based survey and targeted semi-structured interviews with attendees of the webinar series from ACCAP's main stakeholder groups. A complete report of the ACCAP evaluation will be released in Oct. 2010 and will be available on our website. Evaluation results will be used in an iterative process of tool development and improvement.

3. ACCAP assessment services activities for FY10: National Assessment

ACCAP's National Assessment activities will place a strong emphasis on stakeholder engagement, responding directly to the following questions:

- What are or might be the best methods for engaging stakeholders to identify the appropriate research, tools or information for decision support?
- What support is required to develop and sustain these activities over time?
- What climate sensitive decisions are these stakeholders currently making, and what might be the decisions in the future?

Planned activities include:

Activity 1: Engagement of sectoral and regional stakeholder groups via ACCAP-organized sessions and side meetings at in-state gatherings (symposia, conferences, annual meetings). Our specific strategy for this activity is to target a set of 8-12 stakeholder meetings, arrange special sessions, side meetings or associated events to focus on adaptation and mitigation capacity of the stakeholder group, and select 2 or 3 ACCAP scientists to represent ACCAP at the meeting..

Consistent with ACCAP's current approach to stakeholder interactions, we will target meetings that are sectoral (e.g., transportation, energy, fishing, infrastructure, wildfire), geographic (e.g., North Slope, South East, South Central, Interior), and government oriented (i.e. Alaska Governor's Climate Change Sub-Cabinet, Alaska Municipal League, Borough Government). In the first month of the project we will create systematic and consistent adaptation and mitigation assessment protocol that will be executed during these meetings. The climate change information services, assessment and decision landscape in Alaska is evolving rapidly with many new entities including a new NOAA National Climate Regional Director position in Anchorage, a USGS Alaska Science Center, and two FWS LCCs (Arctic and Western Alaska). ACCAP has existing relationships with the key decision leaders of these endeavors and will prioritize engaging and strengthening these collaborations.

Activity 2: Synthesis of outcomes of stakeholder engagement into a peer-reviewed journal article and a white paper report to NOAA. The journal paper and white paper will address the following questions posed in the call for proposals, including: Who are the key opinion leaders? Who are the key intermediaries? What kind of scientific research (physical, social, natural, etc) is required? What are the key state, federal and other entities? What strengths and areas of expertise do each have to offer? What factors are most significant in limiting stakeholder capacity to adapt?

Activity 3: Initiation of an adaptation/mitigation webinar series and a newsletter in order to enhance the pool of stakeholders, to increase awareness adaptation and mitigation options for stakeholder partners, and to inform users of products and services relevant to adaptation and mitigation.

Summary of National Assessment Deliverables:

1) Matrix of commonalities of adaptation and mitigation capacities and needs, distinguished by sector and by spatial scale (regional, Alaska-wide, Alaska-and-national) (Month 12).

2) Peer reviewed journal paper and white paper report to NOAA addressing adaptation and mitigation capacity, to be submitted within 6 months of completion of project's Year 1.

3) Distribution of results through a newly initiated ACCAP quarterly newsletter, as a means to inform stakeholder of available products and services to assist with adaptation and mitigation planning and implementation.

4) Strengthened regional partnerships with the groups listed under Activity 1.

4. Long range, planning decisions ACCAP supports

- **Alaska State Climate Change Strategy** (http://www.climatechange.alaska.gov/). On September 14, 2007, former Governor Sarah Palin signed Administrative Order No. 238, officially forming the Alaska Climate Change Sub-Cabinet. The Sub-Cabinet is charged with preparing and implementing an Alaska Climate Change Strategy. This strategy deals with state policies for anticipated climate change. Components include adaptation, mitigation, research needs and immediate action (i.e. communities in need of immanent re-location.) Specific components of adaptation include: public infrastructure, natural systems, health and culture, and economic activities. Mitigation components include: oil and gas, transportation and land use, energy supply and demand, forestry, agriculture and waste management. Advisory group reports were submitted to the sub-cabinet in January 2010. ACCAP was active in the strategy development and will support the Sub-cabinet as they develop and implement resulting policy.

- **Coastal Zone Management.** Coastal and shoreline vulnerabilities are a large concern in Alaska, especially in rural Native communities. ACCAP leverages existing NOAA funding for "Social Vulnerability of Alaska Communities to Climate Change" (SOVAC) an interdisciplinary project focused on the geographical region of the western Alaska coast. The main objective of the SOVAC project is to determine how weather and climate two aspects of community vulnerability: physical, as manifested in infrastructure damage caused by eroding coastlines, and food-systems security, which has an array of components ranging from marine and riverine ecosystems to the increasing reach of globalization into these communities. We are also seeking leveraged funding to compile and analyze state-wide information related to sea level, isostatic rebound, and community impacts.

5. Common local decisions that scale up to regional significance

Climatic change is, in many ways, a spatial challenge. Decisions made and actions taken at the local scale often have wider ramifications. Similarly, regional scale decisions can have strong implications on the local scale. Local and regional coordination and communication, therefore, is a priority service for ACCAP. Decisions with cross-scale implications in Alaska include:

- Village relocation due to coastal erosion impacts transportation, regional cultural integrity, and the provision of health care and K-12 education.
- Marine dependent communities respond to ocean acidification, northward shift in species range, and shift from benthic to pelagic ecosystems impacting local and regional economies, in particular commercial fishing.
- Federal agencies such as the Coast Guard, Navy and Department of Homeland Security Changing are strategizing responses to the implications of changing Arctic sea ice conditions on transportation and resource development. This impacts the economies, physical environment and environmental conditions in local communities.