

Appendix G. Other Economic Activities Technical Work Group Recommended Adaptation Options

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EA-1. Evaluate Capability Needs for Potential Expansion of Arctic Economic Activities

Recommended Adaptation Option

Alaska must recognize and address the potential needs that increased Arctic economic activities may create. These needs are likely to include requirements for presence and capacity at all levels (federal, state, local, Non-Governmental Organizations-NGOs) to ensure adequate protection for the environment and human health and safety, while supporting economic growth in Arctic coastal waters. This recommendation proposes addressing these needs through planning among various agencies and authorization and implementation of a Capital Improvement Project (CIP) to identify the infrastructure and capabilities needed to provide means to comply with state, federal, and international regulations while supporting the expansion of economic activity in the region as climate changes.

Option Description

Melting sea ice in the Arctic Ocean could result in increased ship presence and infrastructure requirements to support environmental and safety protections. Potential gaps may exist in emergency response and regulatory oversight capabilities. This option recommends recognition that the potential for increased Arctic economic activities may result in a need to address potential gaps in infrastructure and the ability of agencies at multiple levels (federal, state, local, NGOs) to protect the environment, human health, and safety.

This option recommends coordination and planning among Alaska State Agencies such as the Department of Commerce, Community and Economic Development (ADCCED); Department of Environmental Conservation (ADEC); Department of Natural Resources (ADNR); and Department of Transportation (DOT); federal agencies such as the U.S. Coast Guard and Environmental Protection Agency (EPA), and local and tribal entities to explore response and regulatory needs for environmental and health and safety support in the Arctic. The recommendation is for authorization for a CIP, most likely to be managed by DOT, with involvement of federal, state, and other agencies and stakeholders to collaboratively identify the infrastructure and capabilities to address response and regulatory needs specifically concerning the Arctic maritime industry as climate change drives the expansion of economic activity. For the purposes of this recommended option, the Arctic Ocean area encompasses all U.S. waters north of and including Norton Sound.

Overview

Many scientific models predict that Arctic sea ice will continue to retreat, creating longer ice-free summers along the Alaska Arctic coast. This will result in growth of maritime economic activities in this region such as shipping, mining, fishing, tourism, and oil & gas exploration. The oil & gas industry is estimated to have the greatest potential for substantial economic growth in the Arctic. To a small extent, this is already happening today. To support increased economic activity, ports, infrastructure, and other facilities are expected to follow as warming temperatures result in longer seasonal access. This will bring increased ship traffic and a greater human presence, not only creating job and business opportunities, but also requiring investments to ensure essential government functions such as safety, security, and environmental protection are provided.

This option recommends that Alaska recognize and address the potential for increased Arctic economic activities and identify the gaps in government capabilities (federal, state, local, NGOs) to provide an adequate presence in the Arctic coastal region. For example, the state and federal agencies must be prepared to conduct emergency response operations (search and rescue, pollution remediation), regulate industry (tourism, oil & gas, and fishing) and protect U.S. sovereignty. In essence, most state and federal government agencies with regulatory responsibilities in Alaska will realize a need to expand their presence to the Arctic region commensurate with the growth in economic activity.

Alaska has a vital interest ensuring the future success of its Arctic maritime community and the ongoing responsible development of the region's natural resources. In today's economy, shipping and maritime infrastructure are essential elements of the marketplace. To be prepared for the future, a strategy is needed in the State that maximizes capabilities to sustain a productive Arctic maritime infrastructure and economy. Capabilities refer to the infrastructure and resources needed to regulate, prepare, protect, prevent, and respond as needed to maintain a viable maritime economy.

As an example of the need, there is a possibility that ten years from now a robust commercial fishing industry will exist in the Arctic Ocean. What services will be needed to support this industry? For example, is there a need for the state to expand Arctic towns/ports to fully support means to address safety and environmental concerns associated with increased commercial fishing activity? What buildings, stores, utilities, roads, communications, docks, etc are needed? Are there inland inter-modal (rail, road, barge, air) transportation systems needed to connect the Arctic fishing industry to other areas of Alaska? What job training opportunities for local residents might develop?

Implementing this option will provide the State with the information for planning to ensure capabilities for future economic growth are in place, and will put the State in a better position to compete for federal funding to meet the demands of the future. Moreover, extending government programs into the Arctic is resource intensive. There could be tremendous opportunities to share costs, facilities, equipment, and responsibilities among agencies at varying levels of government, thus increasing efficiency and strengthening interagency partnerships. For example, the U.S. Coast Guard shares common responsibilities with ADEC and the Alaska Departments of Fish & Game (ADF&G) and Military & Veterans Affairs (ADMVA)/Homeland Security.

Developing future scenarios as recommended in EA-2: "Develop and Evaluate Future Scenarios for the Alaska Economy and Consider Potential Investments" and implementation of this recommended option will allow the State to address issues such as the possibility of controlling/limiting Arctic industry operations until further studies and/or preparations are conducted. This course of action is the one taken by the North Pacific Fishery Management Council, preventing the expansion of commercial fishing in the Arctic. Although, this option does not specifically address natural systems, the results of completing this recommended project will also provide valuable information addressing Arctic subsistence issues.

If this recommendation is not implemented, Alaska will lack needed understanding of what capabilities are required to meet expanding economic growth, miss opportunities for efficiencies with other agencies, and be less competitive in an austere Federal budget climate.

Option Design

Structure/design

The primary component of this option is overseeing a study to be conducted through an Arctic infrastructure CIP, managed by the Alaska Department of Transportation (AK-DOT) with participation from other state departments represented on the Climate Change Sub-Cabinet, as well as federal agencies. AKDOT would contract a firm with relevant Alaska and Arctic experience to identify the capabilities required to address response and regulatory needs in the Arctic region if climate change drives the expansion of economic activity. This effort will compile information on real and potential industry growth in the Arctic coastal region, determine areas for government services expansion and infrastructure needs. It would provide recommendations on approaches to foster cooperation for expansion under various scenarios of industry growth.

Targets/Goals

The overarching objective is to develop an understanding of the requirements and strategies for organizations (federal, state, local, NGOs) to expand capabilities in the Arctic, and to recommend a schedule of that expansion focused on immediate needs, potential needs in 5-10 years, and longer term needs that are 10+ years in the future. The end goal is creation of a document to identify capabilities gaps, recommended improvements, primary agency responsibilities, and an action/implementation plan.

The State will have immediate benefits of information available to strategically plan and prioritize projects to appropriately address environmental and human health and safety needs as the economy adapts to growing opportunities in the Arctic.

Timing

A key first step in the success of this recommendation is the completion of the EA-2 - to develop an understanding of potential economic activity scenarios to serve as the base data supporting the determination of future infrastructure and capability expansion. Identification of a firm with relevant Alaska and Arctic experience to be contracted under the CIP would need to be done as soon as practicable thereafter. Arctic maritime industry is already starting to expand. There is presently a lack of capabilities for current conditions; any expansion would increase risk and exasperate the need for increased presence. .

Parties involved

This option recommends that the Governor's Office task AK-DOT to implement a CIP to begin the process of forward planning for the Arctic capabilities/requirements assessment. This would likely occur after development of economic scenarios addressed in EA-2. If a new state climate change task force or council is established to manage several new projects, this group could also manage the CIP.

Evaluation

The firm contracted under the CIP should be given a period of time to review and understand the goals of this option, create a two year work plan identifying key milestones, and submit periodic progress reports. AK-DOT will review and approve the work plan and monitor progress. Correction/changes can be made upon review of the quarterly reports.

Research and Data Needs

Data identifying climate models and their predicted impact on Arctic economic growth; data developed through the completion of economic scenarios under EA-2.

Implementation Mechanisms

Implementation of this option requires state approval and funding of a new Arctic CIP. To proceed with this option, the Governor's Office will need to assign AK-DOT (primary manager) authority to plan with other state and federal agencies the implementation of the CIP and commit funds to contract a firm to carry out the CIP. Assistance from federal, state, academic, and industry participation will be solicited similar to the process used with the Climate Change Advisory Groups, including assistance from both the North Slope Borough and NW Arctic Borough. DOT should involve each agency with responsibility in the Arctic.

Related Policies/Programs and Resources

Related Policies and Programs

- U.S. Coast Guard District 17 (Alaska) is conducting an Arctic capabilities analysis.
- U.S. Arctic Research Commission has conducted an Arctic Marine Shipping Assessment.
- The Institute of the North is coordinating several programs relating to current and future Arctic industry.
- Alaska's FY2010 funding proposal has \$0.5 million to be matched by the Denali Commission for a long term harbor study.

Available Resources

Available resources are unknown at this time. This option will require commitment of state funding.

Feasibility

This proposed option is primarily within the authority of the State with assistance from federal agencies and industry. Representatives from various federal agencies should be engaged and their timing/availability could be a constraining factor. Strategic partnerships with all affected agencies is required to ensure overall agreement on recommendations of future capability needs for Alaska to move forward in synch with industry growth – all agencies would retain authorities. A limiting factor is funding to manage the project. The key unknowns affecting the success of this recommendation are the uncertainty of future trends in climate change and economic feasibility of industry to expand industrial operations in the Arctic.

Adaptation Benefits and Costs

The first step preparing for the future and one of the most significant aspects of appropriately adapting is evaluating information to predict future needs and requirements. Economic development due to climate change will center on the Arctic Region transportation system, natural resources industry, and tourism industry. This information can be applied as major, uncertain changes occur to identify capabilities required to ensure an orderly economic expansion into the Arctic, increased safety for citizens, environmental protection, and reduced expenditures through cost sharing. The benefits of identifying capability needs and gaps also include exposing potential blind spots that might otherwise be overlooked, increasing ability to quickly and appropriately recognize and adapt to a scenario in its early stages, and providing decision makers with time to work out approaches as needs and gaps are identified.

Successful implementation of this recommendation will generate a strategic document assessing current infrastructure and capabilities and determining the level of increase needed for various economic scenarios. This information will give the State the foundation to allocate resources to establish an appropriate level of infrastructure and presence in a timely manner as economic activities change. The benefits of completing this option will remain effective indefinitely. Even with scenarios, regulatory requirements, and industry changes from current forecasting analysis, the information from this recommendation will need updating. The bulk of the work to establish the initial baseline data would be completed, making any future updates quicker and less costly.

The State will need to commit resources for AK-DOT to develop and implement a CIP, including identifying the costs to contract a firm with relevant Alaska and Arctic experience to conduct the assessment and committing the funds to proceed with the project. The costs to complete this option range greatly depending on the breadth and scope of the analysis required. The costs can range from \$300,000 to \$3,000,000 based on the level of detail at which this analysis is conducted. While no comparable or similar project exists to better define the cost, an example of a defined cost estimate to conduct a risk assessment project within the state of Alaska is the Risk of Vessel Accidents and Spills in the Aleutian Islands. After the M/V Seledang Ayu was involved in a marine casualty near the Aleutian Islands, the vessel representatives were required to pay \$3,000,000 to the National Fish and Wildlife Foundation for the purpose of conducting an Aleutian Islands risk assessment of the shipping hazards.

Status of Group Approval

Approved unanimously, with no objection.

EA-2: Develop and Evaluate Future Scenarios for the Alaska Economy

Recommended Adaptation Option

Alaska should provide funding to conduct a project that develops and evaluates possible scenarios examining the next 40 years of the economy in Alaska based on potential effects from climate change. This project would then identify opportunities and challenges for existing and potential future sectors of a sustainable, robust Alaskan economy that provides a high-quality of life for Alaskans.

Option Description

Components of the Alaska economy could experience varying impacts due to potential effects of climate change. Impacts could occur in areas such as energy and food supply, affecting the lives of all Alaskans. An assessment of economic strengths, weaknesses, opportunities and threats (“SWOT analysis”) by sector is needed to both better understand current components of the economy and potential future components. This understanding will aid state agencies and other stakeholders in identifying and acting on optimum adaptive strategies and policies to help address future conditions. It is not possible to quantify the extent of economic impacts due to climate change or to develop appropriate strategies for addressing them without more accurately defining the conditions of the operating environment. This option recommends that Alaska provide initial funding to conduct and manage a project to develop and evaluate economic scenarios for Alaska, based on potential climate change effects. A component of these scenarios will be examination of issues and opportunities in current and potential future sectors to maintain a robust Alaskan economy.

Overview

This option recommends a series of steps leading to an understanding of potential future (within next 40 years) economic conditions for Alaska and potential options to influence those economic conditions to maintain a robust economy for the State. Climate modeling data about future conditions (e.g., temperature changes, precipitation, and snow and ice cover, sea level rise, and ground subsidence) will be integrated with socio-economic data such as population migrations, changing energy demands, cultural developments, and policies at the state or national levels to examine possible economic futures. The current state of the economy will be outlined in detail to understand the contributions of various sectors. Scenarios will be developed that take current variables and conditions as a starting point and examine the effects of various future conditions such as changes in land use, energy use, water and food availability, infrastructure development, regulations, demographics. Future economic scenarios will examine challenges in terms of possible job losses in current sectors and opportunities that may result in both existing and new sectors. The scenarios developed will provide potential ways to consider the future of the Alaskan economy and aid planning and investment decisions.

The current economy of Alaska is dependent on the responsible development of its natural resources. Specifically, the oil and gas industry generates more than 80% of the revenue that funds State government. Commercial fishing, mining, tourism, and forestry also currently contribute to the State coffers. It is critical to the future of Alaska that the responsible development of these natural resources be managed effectively and be encouraged to provide ongoing state revenue. The unique Alaskan environment and experiences of the state in dealing with climate impacts may potentially result in gains or losses of existing jobs, and also may provide opportunities for new and as yet unforeseen economic activities. Based on the scenarios that are to be investigated, the need for adjustments and investments in existing sectors as well as potential opportunities for exploring jobs in new sectors will be identified. Potential sources of appropriate funding will be examined and considered to support job growth to help sustain the Alaska economy.

Potential new sectors could include greenhouse gas management, renewable energy (e.g., tidal, wind, hydroelectric, solar, biomass), energy efficiency, sustainable infrastructure development, and increased and sustainable agriculture development. Although there is some potential to develop new “green”

economic sectors for Alaska, it is highly unlikely that the level of activity generated in these sectors could replace the current natural resource based economy, which is dependent on a robust oil and gas industry. It will be imperative to address issues such as the natural gas pipeline, new resource developments in the oil and gas sector, potential infrastructure for increased agriculture, as well as other natural resource developments to maintain a sound economy. A warming climate could significantly contribute to enhanced access to natural resources, as well as longer growing seasons and with opportunities for more locally produced and marketed food supplies.

Economic assessments and exploration of job losses and potential job creation must include consideration of credible climate change models, assumptions, expectations and planning scenarios that make use of reliable scientific methods and that are within statistical confidence limits to be determined by the State. If the range of potential changes can be defined over target time frames, then actual challenges and opportunities can be anticipated and plans and funding developed to help anticipate or influence future conditions.

Better understanding of the potential range of economic impacts due to the range of possible climate changes is needed to anticipate challenges and opportunities. Having a better understanding of the potential economic scenarios, Alaskans will improve their ability to predict future conditions and to develop and implement adaptive strategies to try to ensure robust economic conditions for the state. Response actions will be implemented by various state agencies and private entities, as appropriate. Efforts will need to be extended for coordination with various legislative actions to coordinate priorities and expenditures.

Option Design

Structure/design

Phase 1: Develop Scenarios

1. Identify appropriate funding and contracting mechanism for developing and evaluating potential economic scenarios.
2. Establish project organization, and schedule. Prepare option plan document, including scope, objectives, resources, performance measures and feedback mechanisms.
3. Establish climate change assumptions, expectations, and uncertainties, using and building on the work completed by University of Alaska Fairbanks (UAF) Scenarios Network for Alaska Planning (SNAP), the U.N. Intergovernmental Panel on Climate Change (IPCC), and other models as they become available. Develop climate change planning scenarios for appropriate climate parameters (temperature, precipitation, snow and ice cover etc) and federal, State and regional climate policy regimes.
4. Based on input from numerous experts, identify significant existing economic sectors of the Alaska economy, such as fisheries, oil and gas, mining, and shipping, and potential new economic sectors, including renewable energy, energy efficiency, adaptive technologies and sustainable development. Identify key expertise with Alaska experience in these areas to understand their current role in the Alaskan economy and the potential roles going forward.
5. Outline critical variables that have an impact on the economy, including federal and State policies and regulations, funding, employment demographics, cultural expectations, land use regulations, etc.
6. Develop scenarios about the potential future options for the Alaskan economy based on a 40 year timeframe. Prepare economic segment SWOT analysis.
7. Prepare draft and final reports, soliciting public and expert comments as appropriate.
8. Establish climate change economic review board or panel to consider the economic scenarios and outline needed actions to help address possible future conditions.
9. Implement ongoing monitoring of actual climate changes to apply to climate modeling efforts to assess actual changes to the climate for ongoing efforts to identify new opportunities and minimize risks.

Phase 2: Based on the evaluation of scenario results, explore needs and options for economic development

1. Using guidance provided by the climate change economic review panel (Phase 1, Step 8), identify specific areas requiring attention for future economic conditions. This may include addressing and investing in existing economic sectors or new sectors. This may also entail promoting or exporting scientific innovation and engaging strategically on national and regional climate change policies.
2. Explore and engage in (as appropriate) national/regional climate change legislation that addresses the following:
 - Receive equitable share of federal nature-based and physical infrastructure adaptation funding for Alaska;
 - Identify financial incentives for developing low carbon-equivalent fuels (e.g. natural gas pipeline);
 - Identify financial incentives for geologic and forest carbon sequestration activities (e.g., carbon credits for controlling forest fires, replanting);
 - Identify options for exploiting opportunities for developing local-based sustainable food supplies;
 - Continue to receive substantial Research and Development (R&D) funding for Alaska-based research institutions
 - Continue appropriate levels of funding for federal/State/local agencies operating within Alaska.
3. Consider use of possible funding from potential national/regional climate carbon markets to foster innovation, including:
 - Provide appropriate financial incentives to promote affordable renewable energy and efficiency efforts across Alaska;
 - Encourage Alaska Industrial Development and Export Authority (AIDEA) or another state clearinghouse to create loans to assist sustainable businesses and communities;
 - Enhance the Alaska Energy Authority's role in developing affordable renewable energy;
 - Provide tax incentives to sustainable businesses and communities;
 - Build out infrastructure to support (inter-tie expansion, communications, ports, roads, etc.);
 - Consider the cost-effectiveness of nature-based adaptation strategies versus new infrastructure development (e.g., in some places it may be less expensive to protect a coastal wetland than build a seawall to reduce community risk from coastal erosion/inundation);
 - Develop complete net metering regulations;
 - Develop and enforce standards for collecting community-level business and economics data over time;
 - Develop research and development export clearinghouse to market ideas and innovation outside of Alaska to new marketplaces; and
 - Evaluate existing job training and education programs and identify possible adjustments to develop a workforce that meets future community and statewide economic needs.

Targets/Goals

The overarching goal of this option is to prepare the state of Alaska and its residents for potential future economic opportunities and challenges associated with climate change. This also includes positioning the state to seek and receive appropriate levels of funding that may be available from numerous sources, including possible markets that may regulate greenhouse gases (GHGs). Alaska must seek to maintain a robust natural resource based economy as well as address potential job losses, innovate for new job markets, and position itself manage any economic changes. The time frame for this strategy is within the next 40 years.

Timing

- Phase 1: Complete final report on evaluation of potential scenarios for the Alaskan economy prior to the end of 2009.
- Phase 2: Initiate work to identify potential areas of focus and/or for investments by early to mid-2010. Assess potential appropriate funding sources and begin seeking funding by mid-late 2010.

Parties involved

- Appropriate oversight from Governor's office or appropriate State agencies (see below)
 - Department of Commerce, Community & Economic Development (ADCCED)
 - Department of Environmental Conservation (ADEC)
 - Department of Natural Resources (ADNR)
 - Department of Revenue
- The Institute of Social and Economic Research (ISER), the University of Alaska, the Alaska Center for Climate Assessment and Policy, a program funded by the National Oceanic and Atmospheric Administration (NOAA) at UA-Anchorage and UAF, or other suitable economic or scientific academic entity could lead the overall effort
- UAF Institute of Northern Engineering and/or International Arctic Research Center would assemble a panel of scientific and engineering authorities (e.g., industry and regulatory agencies) to establish climate change assumptions, expectations and uncertainties
- An entity, such as UAF SNAP, would prepare climate change scenarios following the climate change panel assumptions
- The AIDEA, which provides means of financing to promote economic growth and diversification in Alaska, may provide an opportunity for partnership/coordination to foster green innovation and economic development.
- The following should be involved as stakeholders and partners in this effort:
 - Alaska Energy Authority
 - AK Oil and Gas Conservation Commission
 - US Arctic Research Commission
 - Cold Climate Housing Research Center
 - Native Corporations
 - Sustainable business owners and operators
 - Industries developing low carbon-equivalent resources (Natural Gas, Renewables, etc.)
 - Universities
 - Other relevant non-governmental organizations
 - Other local/State/federal agencies operating in Alaska
 - Other identified stakeholders

Evaluation

Assign project scoping and management accountability to a suitable State of Alaska economic or scientific academic entity (to be named by Sub-Cabinet). Assign oversight accountability to a lead agency (to be named by Sub-Cabinet). Effectiveness measures and performance indicators will be proposed by the project management entity and evaluated by the oversight agency. A formal comprehensive independent audit or assessment should be conducted prior to implementation and then perhaps every other year to validate and revise both climate change and economic scenario assumptions as needed.

Research and Data Needs

Research will be needed to:

1. Identify scenario building and evaluation method and climate modeling method most appropriate for north circumpolar regions
2. Establish climate change assumptions, expectations, and uncertainties for Alaska, including development of a list of suitable climate parameters for use in climate and economic modeling with described statistical confidence limits.
3. Identify and obtain data to characterize current components of the Alaska economy
4. Assess economic response to climate change scenarios for each segment of the Alaskan economy

Implementation Mechanisms

Action and funding by the Sub-Cabinet to authorize a study to develop and evaluate scenarios is needed. This could be performed under the authority of ADEC or other appropriate agencies. Development of panels of experts may require additional state action such as Executive Order or legislation. Solicitation and distribution of funding, should it occur will require state authorization.

Related Policies/Programs and Resources

Related Policies and Programs

The UAF SNAP (<http://www.snap.uaf.edu/>) program is tasked with developing high quality predictions for Alaskan climate; however, they are funded to produce climate scenarios of air temperature and precipitation only. This information is certainly essential, but not all that is needed to best understand the economic implications of climate change.

Available Resources

This information is required for planning by multiple State and federal agencies operating in Alaska. It is anticipated that costs could be distributed among multiple beneficiaries of such an effort.

Feasibility

The proposed action would need to be supported by available technical and budgetary resources, though the exact needed resources are currently uncertain. The project should be coordinated with other federal, State, and private entities (such as the American Society of Civil Engineers) with interest and expertise in climate change issues and the economic implications. Public and interagency involvement will be needed to conduct economic assessment, and to prepare and review and comment on draft and final report documents.

Adaptation Benefits and Costs

Costs would need to be evaluated by the State. Benefits can be expected in the form of public policy adjustments resulting from improved knowledge of the requirements to minimize the potential negative impacts to economic activity, and possibly grow some sectors of the economy, more cost effectively compared with the no action alternative. There may be some substantial up-front costs from administering the option, and it will need to be demonstrated that the long-run benefits from this process will offset the early costs. Generally, it has been shown in economics literature that making early investments in workforce development are worthwhile.

Based on similar assessment activities that are underway with the Heinz Center, NOAA and International Arctic Research Center (IARC), rough estimated costs for the option follow. These are only estimates.

- Organize current data, facilitation, development of variables: \$100,000
- Develop uncertainty and related analyses and data configuration: \$100,000
- Collaborate with economists to facilitate their analyses and write reports: \$75,000

Status of Group Approval

Approved unanimously, with no objection.

EA-3. Improve Availability of Mapping, Surveying, Charting, and Imagery Data

Recommended Adaptation Option

The Climate Change Sub-Cabinet should direct Alaska to invest in an accurate and high-resolution statewide digital base map that includes a DEM and an acquisition system for imagery and encourage the involvement of other stakeholders. This option should ensure that the base map and associated data are available to all users, with a first priority on mapping coastal areas and floodplains.

Option Description

Accurate, timely information about the distribution and magnitude of changes is needed to better address economic challenges and opportunities. To assess change, a good baseline of existing conditions is needed. This baseline includes map imagery, elevation data, bathymetric data, and habitat, landcover, and soils information. Changing boundaries, especially shorelines, potentially have large ownership and regulatory implications. High resolution imagery and elevation mapping are required to properly assess changes in permafrost degradation and thermokarst development, glacier melting, streambed changes, coastal erosion and many other dynamic geomorphic processes that will have real economic impacts on Alaska. A precise definition of the height of the mean sea level surface throughout the state is needed. Accurate bathymetric mapping will also improve the quality of navigational charts, leading to safer passage through new northern sea routes.

Overview

This option will improve the availability of real-time mapping, surveying, charting, digital elevation models (DEM), and imagery data to provide means to better track and understand economic impacts of and opportunities to address climate change. Additionally, it provides support for ongoing management and distribution of this spatial information through a geographic information system and open standards web services. Development of these spatial data sets will contribute to a more robust information infrastructure to plan and adapt to climate change. Coordination with UA Research Centers, the U.S. Coast Guard, and NOAA is a recommended approach for this option. This option will make data available in near real time, with a first priority on coastal areas and floodplains, as they will be changing the most with warming temperatures and changing climate, sea ice, and storm patterns. Changing shorelines in and around communities and other infrastructure can lead to significant costs for relocation or protection. Near real time imagery data is also extensively used by wildfire fighters; wildfire incidence is anticipated to grow in coming years due to the changing climate. Imagery and elevation information is needed and utilized by all state agencies and private entities engaged in land management, monitoring, planning, or development. Bathymetric data are needed by all vessels (including the U.S. Coast Guard), as well as those entities addressing habitat and economic development activities in the Arctic.

The state is creating a digital basemap through the [Statewide Digital Mapping Initiative](#) (SDMI) program, and this climate change adaptation option should use the SDMI as a vehicle for implementation. The SDMI and Geographic Information Network of Alaska (GINA) have developed an effective and widely used data archive, distribution, and web services system that can be used to manage data for this initiative. Consideration should be given to establishing means to integrate bathymetry data as well. This existing infrastructure can be used to save cost and produce immediate results.

Option Design

Structure/design

There are two major components to this option: a DEM and imagery.

- 1) Alaska lacks an accurate statewide DEM. The current base DEM for Alaska is the National Elevation Dataset (NED), which is maintained by the U.S. Geological Service (USGS) and is

based on Alaska's 50-year-old USGS topographic maps. The NED DEM has widespread inaccuracies, making it unusable for many applications. Alaska needs an accurate base DEM at a reasonable resolution and accuracy that serves a broad range of applications. For areas that need higher accuracy and resolution, such as floodplains and coastal areas, improved products can be acquired to meet project requirements.

2) The second component is the need for a statewide system for acquiring real-time accurate imagery. One option would be to acquire a satellite ground station that would enable agencies to capture real-time imagery from satellites. This real time data would serve two purposes: a) provide real time monitoring and emergency response needs, and b) build a consistent, accurate, statewide base map image layer. SDMI is also researching other imagery options, and will be summarizing those in a white paper to be published in the spring of 2009.

Targets/Goals

- 1) Develop an accurate DEM for the entire state, with a priority on coastal areas and floodplains, as they will change the most under climate change.
- 2) Develop a system for acquiring imagery for Alaska and making the real time and archived imagery easily available to the public, agencies, and academia.

Timing

The timing is dependent upon the availability of funding. In the short-term, high-accuracy airborne Light Detection and Radiation (LiDAR) surveys could also be flown to create DEMs for areas of critical interest, such as flood plains or eroding shorelines. A parallel effort is underway to develop the specifications for an imagery acquisition system, and should be complete in spring of 2009. One option has been identified, and could provide real time, high-resolution imagery in the short term. This is establishment of a satellite ground receiving station that could be operating within a few months of approval by leveraging existing capabilities at GINA, SDMI, and NOAA satellite reception facilities in Fairbanks. No comparable initiative has been proposed at this time for bathymetric mapping and a subsea DEM.

Parties involved

Currently, the SDMI effort is being led by ADNR, ADMVA, and UA. Federal mapping leadership is also being provided by the USGS, the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS). This mapping information will be utilized by a wide array of users and stakeholders. Stakeholder involvement has already been engaged through SDMI-sponsored surveys, workshops, and planning efforts. In addition, NOAA's National Environmental Satellite, Data and Information Service (NESDIS) has a Fairbanks Command and Data Acquisition Station has committed to provide satellite reception antennas, equipment, and operations staff to support ground receiving operations.

All state, federal, and local resource agencies will benefit from this mapping effort, and should contribute. Academia, emergency and disaster management agencies, and the aviation and transportation agencies and industry will also benefit greatly. Coordination with UA-associated research centers is needed, as well as U.S., Canadian, and international researchers. The federal government is engaging mapping issues through the National Digital Orthoimagery Program, National Digital Elevation Program, and the Imagery for the Nation initiative—representatives of which have met in or visited Alaska within the past year. The SDMI intends to expand its State agency membership beyond ADNR, ADMVA, and UA to include AK-DOT (already participating), ADCCED, ADEC and the Alaska Department of Public Safety.

Evaluation

With mapping projects, concrete evaluation criteria are possible; some suggested metrics are:

- Total area with new base map imagery produced (square kilometers)
- Total area with new DEMs produced
 - Statewide: mid-accuracy and resolution (square kilometers)
 - Critical project areas: high-accuracy and resolution (square kilometers)
- Length of shoreline mapped (kilometers)
- Area of habit, landcover, or soils mapped (square kilometers)

Economic and public welfare evaluation criteria include:

- Effectiveness and timeliness of emergency response
- Cost avoidance for emergency response due to better informed decisions
- Cost avoidance for land management monitoring; i.e. fewer field inspection trips can be made if near real time satellite data is available
- Increased public safety through well-informed response or evacuation
- Increased efficiency of routine mapping performed by Geographic Information System (GIS) professionals
- Improved aviation safety
- Faster, more accurate NEPA studies
- Improved transportation planning
- New mineral resources identified through better DEMs and imagery
- Improved and better informed erosion mitigation efforts such as revetments

Research and Data Needs

As explained above, the initial research and development work for this option is nearly complete. Planning reports and whitepapers are available. The last of a series of SDMI-funded, formal planning documents will be published by June 30, 2009 and can be found at the SDMI Web site: <http://www.alaskamapped.org/>.

Implementation Mechanisms

The implementation mechanism for onshore mapping, SDMI, is already in place. SDMI is willing to serve as a governing body, or can be used as a template if a broader representation is required.

Related Policies/Programs and Resources

Related Policies and Programs

Many agencies and private interests are acquiring DEM and imagery data to support their Alaska projects and resource management responsibilities. The goal of this effort is to continue to coordinate existing mapping efforts within the community, to address the broader statewide needs that do not fall under a specific project or resource management imperative, and to establish statewide baseline imagery and elevation data sets against which future changes can be measured. Mapping efforts are currently ad-hoc and agency or entity mission driven; the gap is a broad, consistent, refreshed statewide coverage.

NOAA has a related program important for elevation mapping in Alaska. The Gravity for the Re-definition of the American Vertical Datum (GRAV-D) program is an airborne gravity survey to improve the accuracy of the vertical datum, by mapping the geoid (or mean sea level elevation), which, for Alaska, can be several meters off. This is an approved NOAA project and Alaska is the top priority to be mapped, but it will need federal funding. On behalf of Alaska, the SDMI has supported federal efforts to allocate funding for the program. This program is expected to cost approximately \$6.4 million.

Feasibility

The technology to perform these tasks exists and is available off the shelf. The expertise to implement the program to create, maintain, and distribute these improved statewide imagery and elevation data already exists within SDMI, GINA, NOAA, USGS, and other state and federal partners. The SDMI has spent more than a year performing extensive surveys, hosting workshops, writing whitepapers, and publishing planning documents. The requirements, uses cases, and business drivers are well understood and documented. Parts of the program—imagery reception, processing, and distribution and high-accuracy elevation mapping—are ready and could move forward almost immediately. The statewide mid-accuracy DEM acquisition will use mature, reliable technology and could be initiated rapidly, however, significant funding will have to be secured.

Adaptation Benefits and Costs

There is an ongoing cost of continuing to operate with outdated and inaccurate imagery and elevation data. Resource management, science, engineering, and policy decisions are often made based on imagery and elevation data that were collected 30 to 50 years ago under conditions that made production of highly accurate products impossible. This program will reduce those costs by providing a consistent, accurate, current, baseline framework for decision-making and planning.

SDMI has received state funding for \$6 million. Using this funding, the most comprehensive archive of Alaska imagery and elevation data has been assembled and these data are available for download and through open standards web services. The existing Web site has served thousands of users and many terabytes of data in 2008. Usage is on track to at least triple in 2009. These data, however, are not always current, nor of high-enough resolution to be useful in addressing climate change effects within Alaska.

Additional resources are needed as previously described – with specific state responsibilities falling into two areas: (1) digital elevation data and (2) the acquisition of satellite imagery for monitoring and assessing changes. An interagency effort has already identified the specifications for a statewide DEM, and an implementation plan is currently being developed which will identify a strategy for acquiring the funding. The following table depicts potential costs for these efforts, as well as other data needs currently being discussed or potentially funded by other agencies. As noted, some of these costs are estimated or unknown at this time.

Estimated Summary of Costs for Data Acquisition			
Data	Potential Funding Entity	Annual Funding	5 Year Total
DEM: High accuracy LiDAR for critical areas	State of Alaska	??\$1,000,000	??\$5,000,000
High-accuracy orthoimage map production	???	??\$300,000	??\$1,500,000
Real-time monitoring and data distribution	???	??500,000	??\$2,500,000
GRAV-D: fix gravity model for Alaska	NOAA, State of Alaska		\$6,400,000
DEM: Statewide Airborne IfSAR (20-foot contour accuracy)	USGS, BLM, State of Alaska		??\$80,000,000
Imagery: Satellite Ground Receiving Station	???	??\$1,200,000	??\$6,000,000

Higher resolution DEM data (based on Interferometric Synthetic Aperture Radar [IfSAR] data acquisition and processing for a 20 foot contour interval) is estimated to cost between \$50-100 million.

UAF and the NOAA NESDIS Fairbanks Command and Data Acquisition Station have extensive, existing satellite ground receiving and processing facilities, storage capabilities and tools and personnel developed for distribution of large geospatial datasets. The estimated funding necessary for a satellite ground station is between \$6 and \$10 million.

SDMI's goal is to produce a digital basemap that is accessible by the general public. Licensing data for general public use comes at a higher cost, and decisions will have to be made if some data should have a more limited license, at least initially, to enable agencies to use it in the immediate term.

Status of Group Approval

Approved unanimously, with no objection.