

## Natural Systems Technical Working Group

Draft Adaptation Options for NS TWG Discussion – March 20, 2009

*(UPDATED AFTER FEB. 6 AAG MEETING)*

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### **NS-1 Incorporate Climate Change into Commercial Fisheries Management and Assist Fishing Communities and Users in Adaptation**

#### **Recommended Adaptation Option**

The State of Alaska should take into account climate change impacts when developing commercial fisheries policy and management options. The State should develop a program to assist the commercial fishing industry, including the communities and user groups reliant on the industry, in adapting to the impacts from climate change.

#### **Option Description**

Recent scientific evidence indicates the seas around Alaska are responding to warming trends in the last few decades in ways that may substantially influence circulation patterns, food webs and productivity regimes. Some of these changes could have major impacts on Alaska's bountiful commercial fisheries with potentially different consequences in the Gulf of Alaska, the Bering Sea and the Arctic Ocean. These impacts include:

- Changes in fish distribution and catch composition;
- The northern migration of species such as pollock (in some cases outside of U.S. waters);

- Movement of some fish farther away from on-shore processors, harbors, and communities, requiring further travel;
- The transient appearance of new species such as tuna; and
- Declines in the Bering Sea in the catch of crab, shrimp, and in some locations, halibut, with a corresponding increase in some species such as cod.

No one really knows the cause of or significance of these changes nor those projected for the future such as the opening up of the northern Bering Sea and Arctic Ocean to the possibility of commercial fishing; increasing abundance of new species; need for new gear; continued declines in benthic species; and potentially more dangerous fishing conditions due to greater storms, less weather predictability, and the need to travel greater distances. Nor do we know the potential economic impacts on businesses, fishing-reliant communities, and individual Alaskans, some of which may be positive, others negative.

Although Alaska's system of abundance based management is designed to be broadly responsive to changing species and abundance distributions, climate change and other unpredictable environmental impacts are not explicitly considered in current Alaska fishery policies and management plans and practices, likely due to their uncertainty and complexity. This option would enable the state of Alaska to consider climate change impacts on species abundance and distribution when developing commercial fisheries policy and management plans, including a continued precautionary approach to the opening and management of new commercial fisheries, and taking climate change into account when considering the rationalization of various commercial fisheries. The State could also urge NOAA Fisheries and the North Pacific Fishery Management Council to continue to consider climate change impacts when making decisions affecting federally-managed fisheries. The proposed 10-year moratorium on commercial fishing in the Arctic EEZ is one example. Because environmental impacts on commercial fisheries can be extremely difficult to predict, the success of these options would be greatly enhanced with a robust system of monitoring and stock assessment.

Most fisheries-reliant communities - and many components of the commercial fishing industry itself - do not have sufficient information to respond to these potential changes. They don't know how imminent those changes might be, and if they are of sufficient significance to warrant infrastructure development such as retooling of fish processing plants, the development of new harbors and industry support facilities. This option would facilitate development of a program to provide information about current and projected changes in commercial fishing due to climate change, and work with communities and the commercial fishing industry to develop the capacity and the infrastructure needed to adapt to those changes. The challenge will be to provide information about extremely uncertain impacts due to mechanisms we do not fully understand. A robust monitoring program covering both physical and chemical ocean conditions and biological populations would however, allow us to document the important changes in ocean conditions and fish abundance and distribution that are likely by-products of climate change. As such, we could respond, even without full understanding.

Without this option, fishing-reliant communities and the commercial fishing industry and fishermen themselves will be less certain about how to respond to current and projected environmental changes that will affect their industry. Although fishing has always been an uncertain endeavor and history shows tremendous fluctuations in stock abundance, particularly for salmon, the changes we potentially face under various projected climate change scenarios may alter the scale of past experience. Appropriate fisheries policy and management responses to these changing conditions that support conservation and avoid economic losses to Alaskans will require a significant partnership among state agencies, local communities, and industry partners.

## Option Design

**Structure/design:** The option is divided into four major components that meet short term, intermediate, and long-term needs.

1. The first is a review of commercial fishing related statutes, policies, management actions, and programs to determine if and how climate change considerations might be included in these. This could begin immediately, and be completed within a year, with possible changes to state laws and regulations requiring additional time. It could be implemented by state agencies including the Alaska Departments of Fish and Game, Law, Environmental Conservation, Natural Resources, Commerce, Community and Economic Development. Another approach would be to appoint an independent commission that would include climate change experts, stakeholders (including commercial fisheries-reliant communities and fishing industry representatives), and agency representatives.
2. The second is a comprehensive assessment of existing fish species and stock monitoring programs to determine their effectiveness and how better information could facilitate meaningful responses to likely changes brought on by climate change. A panel made up of agency scientists and independent scientific experts would be valuable in providing this analysis.
3. The third component is development of a centralized source of information (such as the *Center for Knowledge Sharing on Climate Change and Arctic Issues*, that is proposed as a separate option) regarding climate projections on the commercial fishing-dependent environment, adaptation tools, technical assistance, and support for communities and businesses to enhance their capacity to plan for and adapt to climate change. Providing this central portal for information would require state funding and implementation, but could begin with a simple web portal to provide access to the most current, reliable information about climate change and associated impacts. This would require significant collaboration and coordination among all the various state, federal, municipal agencies and other organizations including the university that are currently providing various pieces of this information. It would also require some methodology for determining the accuracy and reliability of information.
4. The fourth component is a long-term strategy to work with fishing-reliant communities and businesses to identify the needs for modified or new infrastructure to meet the changing needs of the industry, including possible construction, loans, etc. These actions would depend on how short- or long-term projected changes occur and would need involvement of communities, fishing businesses, climate change scientists, and state and federal agencies.

**Participants/Parties involved:** Described above.

### Evaluation:

- Review of existing statutes, regulations and policies will determine the efficacy of including climate change considerations and a possible framework for doing so.
- A periodic assessment of existing research and monitoring programs should occur, with identification of continuing gaps, and development of a plan for providing essential information.

### Research and Data Needs:

1. Research what other countries, U.S. federal agencies and other states are doing to incorporate climate change considerations into commercial fishing policies and management. Assess what is appropriate to Alaska conditions. Identify inconsistencies and/or gaps in regulations, statutes and policies that affect our ability to effectively address and manage climate change impacts on natural resources. Assess policies for prioritizing survey work, and include climate change impacts as a consideration. **High Priority for near-term.**

2. Building upon existing agency activities, develop a comprehensive long-term monitoring program, including physical and biological components, to inform the commercial fishing community about ecosystem changes. This includes a robust program for monitoring fisheries abundance and distribution, as well as keeping the state catalog of anadromous fish streams current. Also includes monitoring of ocean and coastal habitat, including ocean currents, temperature, salinity, and acidification. Associated with this is the need for monitoring of human activities, their potential effects on the ecosystem, and monitoring of community and industry socioeconomic data to track trends. Improved monitoring would provide policy and decision makers greater confidence when allocating resources and managing fisheries, by distinguishing human-caused changes due to global warming from natural variability. **High priority.**
3. Research potential impacts/ramifications of climate changes to ocean, coastal, cryosphere (sea ice and glaciers), estuarine, and freshwater ecosystems, the ecosystem services that they provide, and the wildlife, fisheries, and societal impacts of these changes. Consider developing a set of reliable physical and biological indicators of climate change and related community impacts to identify the most effective ways to implement short-, mid-, and long-term status and trend monitoring across broad areas and multiple land management units. Consider low-tech monitoring techniques to cover broad geographic regions. **Medium priority.**
4. Synthesize current information about climate change impacts on fisheries and assess its reliability and degree of uncertainty. Understand how productivity of coastal and estuarine systems may change. **Lower priority.**
5. Possible research is needed on new infrastructure to meeting engineering requirements of a changing climate. **Lower priority for commercial fishing sector.**

### Implementation Mechanisms

1. The review of existing statutes, regulations, and policies could be done either by existing state staff, or by establishing an expert panel. Proposed changes could require legislative or regulatory changes.
2. Ensuring a robust research and monitoring program cannot be accomplished with state funds alone, and requires significant federal, university, and other sources of funding. The state should work with these entities to develop a long-term funding approach that makes use of multiple funding sources.

### Related Policies/Programs and Resources

**Related Policies/Programs/Actions:** Related programs include those of federal agencies such as NOAA, USGS, US Fish and Wildlife Service, National Park Service, EPA, and National Science Foundation. A state-federal integrative initiative – the Alaska Ocean Observing System – is working with stakeholder groups to assess existing monitoring needs and develop an overall approach for filling in observing gaps.

Key stakeholders include the various commercial fishing industry sectors (fishers, processing, value-added, vessel support such as harbors and pilots, etc.), coastal communities that rely on commercial fishing, relevant state and federal agencies, and others.

**Available Resources:** Resources currently exist, but funding is not sufficient to implement the four components of this recommendation. A new funding mechanism, such as an Ocean Trust Fund, if implemented at the federal level could be used to fund these efforts.

## Feasibility

**Feasibility and Constraints:** The state could realistically implement these actions, although funding for a robust monitoring program would require substantial federal funding. The Alaska Ocean Observing System provides a mechanism for coordinating the various monitoring efforts.

A review of existing statutes, regulations and policies is feasible. The end result may be that existing institutions have sufficient flexibility to consider climate change impacts. However, if changes are recommended, adding the additional uncertainties of climate change could add new constraints to decision-making and raise concerns about more decisions ending up in the court system.

## Adaptation Benefits and Costs

Significant documentation exists in the peer reviewed literature to show that increased monitoring of fish and wildlife populations and habitat (including ocean conditions) leads to improved resource management. With less precise forecasts and trends, fisheries resources are either over- or under-harvested, both resulting in significant economic losses.

The Alaska Fisheries Science Center budget for federal research in Alaska is about \$40 million a year. The Alaska Department of Fish and Game's commercial fisheries budget for 2009 is about \$80 million from state, federal and other funds. Given Alaska's huge geographic scope, remoteness, and logistical challenges, these budgets could easily double in order to provide for a more robust research and monitoring program. However, given their value, in the billions, and their job creation, this investment could have huge payoffs.

## TWG Approval and Deliberations

During the ranking and evaluation by TWG members, this option was the highest ranked option with no minority views. It ranked high for all criteria, particularly significance, effectiveness and cost considerations. The TWG is in concurrence about the ranking of this option.

## NS-2 Review and Modify Alaska's Wildland Fire Policies and Programs

NO CHANGE IN THE FOLLOWING FROM FEBRUARY 2008 – STILL NEEDS COMPLETION

### Recommended Adaptation Option

The State will thoroughly review, and modify as appropriate, Alaska's wildland fire policy and programs to address potential climate-induced increases in wildland fire frequency, size and geographic location.

### Option Description

Wildland fires occur commonly throughout much of Alaska and have a wide range of effects on social, health, economic and biological conditions.

This option would address these concerns via a variety of actions that range from changes to current policy, increased planning and education at the community and individual homeowner levels and increased active management of high-risk fuel types.

There are several goals that this option proposes to address:

- Especially in tundra ecosystems, keep large amounts of organic material stored in place and prevent emissions of greenhouse gases (GHGs) by excluding or minimizing the severity of wildland fire in this ecosystem

- Reduce risks to human health (respiratory) and to human improvements
- Utilize woody material removed from fuels management activities in bioenergy applications to offset fossil fuel used in home and community heating applications
- Maintain a healthy ecosystem that provides habitat for a variety of species, many of which are important to subsistence life styles
- Engage local communities in planning and implementation of fire management in the lands that directly affect them.

These goals will be addressed by actively managing high-risk fuel types via fuel-reduction programs for individual homes and communities via increased education and planning efforts. These plans are called Community Wildfire Protection Plans (CWPP), while the individual outreach would be via an education program called Firewise. The interagency community that provides wildfire protection and education services in Alaska already uses these tools, but the programs would be expanded and updated to address changing conditions, perhaps in collaboration with the proposed Alaska Center for Climate-Change Solutions.

Additionally, the Alaska Interagency Wildland Fire Management Plan (AIWMP) would be reviewed for the North Slope portions of the state within the context of a policy discussion on fire in the tundra ecosystem. Currently fire in this ecosystem is a relatively rare event, and most of the region is planned for a “limited” response. In layman’s terms this means no initial attack on fire starts except in very specific circumstances. Some call this the “let burn” policy, but this terminology over-simplifies the option.

Without a discussion and review of the AIWFMP many of the current policies will continue and will not reflect the changing conditions and needs of the ecosystem and the wildlife and humans that depend on it.

## Option Design

### **Sub Option 1: Community Wildfire Protection Plans (CWPP)**

**Structure/design:** Increase the capacity of communities to initiate, complete and implement a CWPP. This program is already well established and has a template for developing a planning effort. Communities will need technical assistance in developing plans and maps that show fuel types and community improvements. This could be accomplished through close collaboration with the proposed Alaska Center for Climate-Change Solutions. Once risk maps are completed, projects for treating hazard fuels can be designed and ranked.

#### **Targets/goals:**

- Complete five new plans each year for the next ten years.
- Keep all current plans updated.
- Establish a statewide CWPP coordinator as part of the Division of Forestry or the Alaska Wildland Fire Coordinating Group (AWFCG).

#### **Timing:**

- Can begin immediately, but need to increase the number of plans being prepared or updated.
- Within ten years complete 50 new plans and within 20 years have all communities with fire risk completed.
- Results will accrue indefinitely into the future so long as plans are updated and implemented.

**Participants/Parties involved:** Numerous individual communities and federal and state agencies involved in wildland fire management activities and national, state and local governments. Specific agencies would include: State of Alaska, DNR, Division of Forestry, ADF&G, Wildlife Conservation, Habitat Divisions, Bureau of Land Management, Alaska Fire Service, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, National Park Service, the proposed Alaska Center for Climate-Change Solutions.

**Evaluation:** Periodic review of the CWPP's would be required to determine if community goals and projects are being implemented on the ground. Reviews should be made at the community level annually and a more comprehensive update made every five years if conditions warrant.

**Research and Data Needs:** There are no specific research needs for this sub option but, as noted in the design section, there would be needs for data in the form of vegetation (fuel) maps that are usually compiled from satellite imagery. Ortho rectified imagery would show human improvements and vegetation and a base map is needed for the state. Currently only portions of the state have this information available. In addition, fine-scale projections of future fire regime, prepared by SNAP at the University of Alaska, would benefit communities in preparing their Community Wildfire Protection Plans.

### **Sub Option 2: Policy Change to the Alaska Interagency Wildland Fire Management Plan**

**Structure/design:** Reviews of the Alaska Interagency Wildland Fire Management Plan (AIWFMP) are part of the current process provided for in the plan; they can occur on an annual basis. The interagency community that oversees the plan would need to engage communities, landowners, and managers in a formal review process of the protection levels for their lands. A discussion on the merits of higher protection levels for areas of the tundra ecosystem would be undertaken as part of the annual review. It may be necessary to update sections of the plan to better reflect climate-change issues and concerns as they relate to wildland fire and its management in the state.

#### **Targets/goals:**

- Complete plan review for tundra ecosystems within two years to identify resources at risk (including air quality in communities) and appropriate responses of fire suppression.
- Identify components of a CWPP (see sub-option 1) appropriate to communities in tundra-dominated ecosystems.
- Update plan to reflect climate-change issues and strategies as they relate to management of wildland fires
- Reduce or avoid GHG emissions from tundra fires (set a tonnage goal?) Plan and document these effects in ways that allow the State to claim carbon credits in the context of whatever national carbon-trading legislation is developed.

#### **Timing:**

- Begin plan review in 2009 and have any modified protection levels in place for the 2011 fire season.
- Results will accrue over time, depending on the level of success of the increased protection policy.

**Participants/Parties involved:** Individual land owners and managers on the north slope and the fire suppression agencies, mainly the Alaska Fire Service (AFS), Alaska Wildland Fire Coordination Group and the Division of Forestry. In addition, local government and researchers at the University of Alaska and other institutions and agencies should be involved in discussing the nature and feasibility of potential policy changes.

**Evaluation:** There should be monitoring of fire occurrence and burn intensity, on an as-needed basis, to determine if objectives and goals of the policy change are being met. Agency or university researchers could do this monitoring. Concurrent monitoring of lightning strikes and climate trends would allow inference on whether there is an increasing trend in potential area burned in tundra on the North Slope.

**Research and Data Needs:**

- Further work on burn intensity mapping and quantification of GHG emissions from recent fires should be completed. Some work has been initiated. Studies should look at both the long- and short-term emissions from fire in tundra and changes in the dynamics of permafrost response in boreal forest and tundra. Research on the relative contribution of GHG emissions from tundra ecosystems that are independent of fire is also needed to put fire release of GHGs in context (e.g., release of methane CH<sub>4</sub> from melting permafrost; it has >20 times the effect on climate warming than release of CO<sub>2</sub>).
- Evaluate mitigation strategies for communities in tundra-dominated ecosystems to create fuel breaks at the wildland interface (e.g., gravel perimeter road around community) to reduce risk of wildland fire spreading among structures, as well as spread of fire from communities into wildlands (e.g., escaped trash fires at dumps).
- Additional research should be conducted on the impacts of fire on winter caribou range and changes in vegetation patterns and succession caused by fire.
- Modeling work to help quantify what would happen under an increased fire protection strategy scenario and the current management action. (This could help quantify the third goal bullet above). Modeling is also needed to assess future fire dynamics under a suite of potential future climate scenarios. SNAP, at the University of Alaska, has these modeling capabilities.

**Sub Option 3: Develop a comprehensive fuels management program to treat high-risk areas to minimize negative impacts of wildland fire on humans and to increase beneficial aspects, especially wildlife habitat.**

**Structure/design:** Examine strategic applications of wildland fire use or mechanical fuel treatments to break up extensive areas of fire-prone black spruce forests, in part by creating fuel breaks of less flammable early succession post-fire vegetation that connects to other natural fuel breaks such as wetlands.

**Targets/goals:**

- Work in conjunction with CWPP's at the community level to identify fuel-reduction projects.
- Reduce GHG emissions and lessen health impacts from wildland fire events.
- In fire-dependent ecosystems, allow wildland fire to continue to play an important role in maintaining healthy ecosystems, while meeting the needs of communities that utilize these ecosystems
- Utilize woody fuels from hazard fuel treatment, if feasible, in wood biomass applications

**Timing:**

- Fund and implement fuel reduction projects identified in current CWPP's, 2009 forward.
- Take advantage of wildland fire starts to remove hazard fuels during late fire season or during other strategic times during the fire season. Variable time frame depending on fire season activity, but utilize strategy during each fire season.

**Participants/Parties involved:** Primarily the wildland fire suppression agencies in the state: Division of Forestry, Alaska Fire Service and the U.S. Forest Service. These agencies would need to work with



communities, land managers, Alaska Native Corporations and other entities to fully implement this option.

**Evaluation:** Utilize a statewide Fire Plan Coordinator to develop metrics to track and monitor the accomplishments of the stated strategies. Acres treated by both fire use and mechanical methods on an annual basis could be one metric. Acres of fuel types in a condition class above normal to gauge level of risk and thus risk reduction by these treatments.

Establish baseline conditions across geographic regions and track via modeling expected outcomes under different treatment scenarios.

#### **Research and Data Needs:**

- Determine if mechanical fuel treatments are achieving the desired condition class change in the fuel type.
- Conduct further assessments of harvesting systems to economically produce wood biomass fuels for use in space heating applications. (See related item NS-7)

#### **Implementation Mechanisms**

To be completed.

#### **Related Policies/Programs and Resources**

To be completed.

#### **Feasibility**

To be completed.

#### **Adaptation Benefits and Costs**

To be completed.

#### **TWG Approval and Deliberations**

During the ranking and evaluation by TWG members, this option was the second-highest ranked option with no minority views. The option ranked particularly high in terms of feasibility, timing and adaptive capacity. The TWG is in concurrence about the ranking of this option.

### **NS-3 Manage Climate Change Impacts on Watersheds, Stream flow, Groundwater and Instream Flow**

#### **Recommended Adaptation Option**

The State of Alaska will improve the capacity of its water management program to adapt to the impact of climate change on the diverse needs for freshwater in Alaska, through: (1) acquisition of essential data on stream flow and groundwater hydrology, (2) improved coordination among water resource agencies and the public, (3) reservations of water in rivers and lakes to protect fish and wildlife habitat, and (4) adjusting laws, policies and practices as necessary. The broad range of beneficial uses of water in Alaska include those of communities, industries, transportation/utility systems, and natural ecosystems. It is critical that the State's water managers have scientifically sound water information in order to apply effective water management strategies in what could be a significantly altered future environment.

## Option Description

This option is designed to ensure effective adaptive management of fresh water for users in Alaska, including, but not limited to, communities, industries, transportation/utility systems (including hydroelectric/hydrokinetic projects) and ecosystems (for fish, wildlife, recreation, aesthetics and other values.), in the face of changing climatic and hydrologic conditions.

**Future Trends:** Climate-change projections suggest that surface water abundance in Alaska could become more variable and might become seasonally limiting in more areas across the state. For example, as permafrost degrades, increasingly permeable soil could cause perched lakes and other surface water sources to disappear for much of the year. These lakes and streams constitute a source of freshwater for many northern Alaskan communities. In many cases, communities may not find a suitable surface or groundwater source to replace lost surface water.

Changes in surface water hydrology will vary by region, but substantial changes in precipitation, water storage in the soil, surface water base and peak flow rates, and stream runoff timing are expected to occur. Changes in groundwater storage must also be expected. In addition to expected changes in water quantity for human use, declines in stream flow and warmer temperatures threaten fish and wildlife habitat as well as navigability of watercourses essential for rural transportation.

### Issues of Concern:

- 1) **Lack of Basic Hydrologic Data:** The State of Alaska's Water Use Act (AS 46.15) and State Water Policy (Administrative Order No. 130) provide the structure for water appropriation and management in Alaska, following the prior appropriation doctrine (First in Time-First in Right). Alaska's water management statutes, regulations, policies and practices generally have the flexibility and adaptability to take into account potential impacts of a changing climate. However, water resources managers must have scientifically sound hydrologic data (both surface and groundwater) to use for modeling and to make informed decisions. Collection of hydrologic data in Alaska has been historically underfunded and in most parts of Alaska are not sufficient to adequately describe seasonal or long-term hydrologic characteristics or support modeling of future conditions without a large range of uncertainty.

Stream gaging of surface water flow in Alaska is woefully inadequate. Fifty or more years ago, the federal US Geological Survey (USGS) established networks of stream gages throughout the western United States; they have never provided comparable coverage in Alaska, even in the most developed regions of the state. In the western Lower 48 states, there is approximately one stream gage for every 400 square miles and the density in eastern states is even higher. In Alaska, there is approximately one USGS stream gage for every 7,500 square miles.<sup>1</sup> Less than one percent of Alaska's rivers or lakes have historic flow or water level data. Without adequate data, there can be little confidence in the hydrologic models upon which managers rely.

While the USGS used to match State funding 1:1 to install and operate stream gages, it has now significantly reduced these federal fund contributions. Data from these gages is essential for many uses including modeling, permitting, planning, engineering designs, flood prediction and control, and water appropriations. Alaska must continue the existing stream gaging network and establish additional gages in strategic locations, to be able to effectively manage its water resources under changing climatic conditions.

Groundwater hydrologic data is even more lacking. The USGS has one groundwater monitoring well in the entire state, in Anchorage. The state is currently unable to determine how much groundwater is

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<sup>1</sup> The best surface water hydrology data available in the State is from a gaging network on the North Slope, maintained by the University of Alaska. This data is not transferable to other regions.

available, even in regions that are of key importance to communities and to industry; it is likely that groundwater is being “mined” in key areas (that is, more groundwater consumed than replenished) and climate change may worsen that situation.

- 2) **Need for Policy-Level Emphasis and Coordination:** The Alaska Water Resources Board (authorized in 1966 by AS 46.15.190-240) has been unfunded and inactive since 1994. Since that time, the State has lacked a forum for communication and coordination between State water management agencies, and between State managers and the public. It is essential to reestablish this agency/public body to advise the Governor on matters related to water management. The Board can help ensure that the State adapts its water resource programs to Alaska’s changing climate and environmental needs, and can also help the state combine and leverage funds and other resources.
- 3) **Need to Increase Pace of Adjudications for Instream Flow Reservations:** One of the State’s policies for water management is to ensure adequate water supplies to protect fish habitat. The State Department of Natural Resources (DNR) and Department of Fish and Game (ADF&G) have been working collaboratively to secure water appropriations for instream flows for major fish streams in Alaska, for streams that have adequate gaging data (at least five years). This work is underway, but it would be very beneficial to increase the pace at which adjudications are completed to provide protection on the numerous fish bearing water bodies throughout Alaska<sup>2</sup>.

**Recommendations to Address Issues of Concern:** As detailed in the Option Design section below, it is recommended that the State take the following actions to address the issues of concern regarding water management, to adapt effectively to changing climatic conditions:

- Obtain necessary data regarding surface and groundwater hydrology, so the State can confidently run models and develop climate change scenarios that address water management risk assessments, policies and appropriation decisions. This would require additional funding to develop and implement a strategic action plan that prioritizes data acquisition needs.
- Reestablish the Alaska Water Resources Board, to improve coordination among state agencies and with the public regarding water management, including the potential need to adapt the water right adjudication process, and statutes and regulations related to the allocation of water and its uses.
- Increase State efforts to ensure that adequate instream flows are available for the protection of fish and wildlife habitat.
- Continue to adapt Alaska’s water rights adjudication process, and where necessary the statutes and regulations related to the allocation of water and its uses, to provide additional flexibility when needed to adapt to climate change.

## Option Design

### Structure/Design:

- 1) Provide the necessary data regarding surface and groundwater hydrology (through a strategic action plan that prioritizes needs) to improve the State’s capacity to incorporate climate scenarios into its water management risk assessments, policies and decisions.

It is recommended that the State of Alaska, in close coordination with the USGS, retain the stream gaging network that exists in the state, and substantially and strategically expand the network to

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<sup>2</sup> Conservatively, it has been estimated there are over 15,000 fish bearing streams and millions of fish bearing lakes in Alaska. Many water bodies have never been surveyed for fish so it is assumed that actual numbers are much higher.

provide the data necessary to be able to confidently model and manage Alaska’s water resources under changing climatic conditions. Effective coverage for Alaska would mean continuation of existing gaging stations, and installation and operation of approximately 400-500 additional stream gages. A network of 50-75 groundwater-monitoring wells should also be established in areas of the state where groundwater is heavily used (e.g., Anchorage, Mat Su Valley, portions of Fairbanks and Kenai).

Installation of stream gages and groundwater monitoring wells should be done strategically, with initial emphasis on areas where pressure on diminishing water resources would be felt first (e.g., population centers, areas where industrial uses are occurring or expected) and secondly, in consideration of improving USGS regional prediction models. Cost effectiveness and feasibility of installations must also be considered.

Implementation steps could include:

- For the stream gage network, work with the USGS and the University to revisit and update the 1996 study, “Evaluation of the Streamflow-Gaging Network of Alaska in Providing Regional Streamflow Information” (USGS Water-Resources Investigations Report 96-4001). This would result in an updated strategic plan for allocation of financial resources to meet the most pressing surface water hydrology data needs.
  - For groundwater monitoring wells, coordinate with USGS, University and affected communities on development of a strategic plan for establishing a network of wells in areas where groundwater is or is projected to be heavily used.
  - Work with Congress, the USGS and others to support and obtain additional federal funding for baseline hydrologic monitoring in Alaska, including the allocation of funds identified for USGS work in Alaska under the 2009 Alaska Water Resources Act.
  - Increase State appropriations for cooperative funding for this essential hydrologic data collection.
- 2) Reestablish the Alaska Water Resources Board, to improve coordination among state agencies and with the public regarding water management, including the potential need to adapt the water right adjudication process, and statutes and regulations related to the allocation of water and its uses.

Reestablishment of the Alaska Water Resources Board would provide needed policy-level emphasis to water resource management issues and programs. The Board includes representation from DNR, ADF&G and the Department of Environmental Conservation (DEC), as well as seven public representatives appointed by the Governor. The Board’s duties are to inform and advise the Governor on all matters relating to the use and appropriation of water in the State of Alaska, including “... studies of the state’s water supplies and plans for future requirements” (AS 46.15.210(4)), which is particularly relevant to meeting the challenge of adapting to climate change.

- 3) Increase State efforts to appropriate reservations of water for fish and wildlife habitat to provide protection for fish and wildlife resources.

DNR and ADF&G have been working collaboratively to secure appropriations for reservations of water for major fish bearing streams in Alaska that have adequate gaging data (at least five years). While this work is underway, it would be highly beneficial to increase the pace at which adjudications are completed, particularly for the approximately 150 fish bearing streams in Southcentral and Interior Alaska for which there is adequate data for assessment of instream flow needs and water right adjudication.

- 4) Continue to assess the water right adjudication process, and where necessary the statutes and regulations related to the allocation of water and its uses, to provide additional flexibility when needed to adapt to climate change.

DNR and the reestablished Alaska Water Resources Board should work together to ensure that Alaska's water resource management laws, policies, and practices allow the State to adapt to the effects of climate change. Incorporating climate change considerations in water management is critical to the sustainability of Alaska's communities, industries and ecosystems. This may include using available data and assessment tools to identify areas where there is risk that future water needs will not be met, and development of long-term water management strategies for these regions. (It is important, however, to note that confidence in the results of risk assessments is directly related to the availability of useful hydrologic data. The Arctic Water Resources Vulnerability Index (AWRVI) is a promising tool for the North Slope of Alaska, where there is better data coverage; however, the lack of data in many other areas of Alaska would be a significant constraint to conducting risk assessments.)

**Targets/goals and Timing:** The goal is to provide more effective management of Alaska's water resources under changing conditions, through adaptive management supported by and adequate hydrologic data and modeling.

Potential targets and timing include:

- Take immediate steps to increase the surface and groundwater hydrologic data available for Alaska, through the strategic expansion of data collection sites. (Targets and accomplishments are dependent upon funding.)
- Reestablish the Alaska Water Resources Board, within one year.
- Complete adjudication for the approximately 150 fish bearing streams in Southcentral and Interior Alaska that have adequate flow records to reserve water for fish and wildlife, within five years of receipt of funding.
- When data permits, conduct vulnerability and risk assessments to determine areas of the State most at risk for not having water needs met (for communities, industry, transportation/utilities and/or ecosystem health).
- On-going adjustment of water management laws, policies and practices, as required to adapt to changing conditions.

**Evaluation:** Metrics could be established around accomplishment of specific targets, dependent on funding. DNR, in close coordination with the Alaska Water Resources Board, would be the appropriate lead for evaluation of progress.

**Participants/Parties involved:** DNR, ADF&G, DEC, University of Alaska, USGS, Alaska Water Resources Board, non-government organizations, local and tribal governments, industry, public

**Research and Data Needs:**

- As described in more detail above, gather data on hydrologic parameters (surface and ground water) throughout the state to establish baselines and support modeling, to better understand the broad range of impacts of climate change on freshwater in Alaska.
- Develop new tools to assist water managers in addressing climate change such the USGS's *StreamStats* application for assessing stream flow and basin characteristics in gaged and ungaged watersheds (see <http://water.usgs.gov/osw/streamstats/>).

## Implementation Mechanisms

The primary need for implementation of these recommendations is Cabinet-level emphasis, intention, and funding. No new legislative authority is required. Reestablishment of the Alaska Water Resources Board, which operated for 15 years but was disbanded in approximately 2001 due to budget considerations, is recommended. More specific implementation steps are provided in the Option Design section, above.

## Related Policies/Programs and Resources

**Related Policies and Programs:** These recommendations build upon existing government structures for water resources management in the State of Alaska, as provide in Alaska Administrative Order No. 130 (dated July 1992), and applicable State statutes and regulations. The DNR, Division of Mining, Land and Water has the statutory responsibility, authority and expertise to manage Alaska’s water resources, in coordination with many other parties, including ADF&G, DEC, University of Alaska, USGS, Alaska Division of Ocean and Coastal Management, other federal agencies, local and tribal governments, and non-government organizations (e.g., watershed groups, conservation organizations). State and federal management agencies and the University coordinate at the staff level through the Interagency Hydrology Committee for Alaska (IHCA); however, this group does not have authority to allocate resources (funding, staffing) or provide the policy-level commitment needed to implement these recommendations.

**Available Resources:** Funding is the key limitation to fulfilling these recommendations. The State and the participants/parties listed above have the expertise and authority to implement the recommendations, provided funding was available for required staffing, equipment, logistics, and other costs.

## Feasibility

These recommendations could be feasibly implemented if funding were appropriated, perhaps using funding from the federal stimulus package that is allocated to Alaska, or funding targeted for USGS work in Alaska (\$8.2 million) through the 2009 Alaska Water Resources Act. (The limitation on use of the USGS funding is that it cannot be accessed while the USGS is under the continuing resolution that currently applies to the USGS budget).

As detailed above, the primary constraint or limiting factor to effective water management under changing conditions is the lack of sufficient surface and groundwater hydrologic data. There will be a substantial delay between actions taken (establishment of a data collection network) and benefits realized (more accurate water resource modeling and more effective management), because of the time needed to accumulate a meaningful hydrologic database.

## Adaptation Benefits and Costs

**Benefits:** The primary benefits of these recommendations will be improving the State’s capacity to provide fresh water for the wide range of beneficial uses, into the future. By closing existing substantial data gaps and strengthening the management structure, the State will be better prepared to develop a strategic approach to water management, assess risk of water shortage and the need for replacement sources within and between regions, avoid over-appropriation, and protect beneficial uses.

In the short-term (up to five years), the State can recognize benefits through increased coordination of water management issues at the policy level, coordination of resources to tackle data shortages, and completing reservation of water appropriations for key fish bearing water bodies.

However, gains in hydrologic data and data application will be long-term, due to the expense associated with establishing the monitoring network and obtaining a sufficient time series of data

**Costs:** Collecting additional hydrologic data is a very high cost item, due to the need to establish, maintain and monitor many surface water gages and groundwater monitoring sites in remote sites

throughout Alaska. A sufficient network of 400-500 stream gage sites would require an estimated cost of \$25,000 - \$40,000/year, for a total annual cost of \$10-20 million for surface water data collection. Installation of 50-75 groundwater wells is estimated at \$450,000-\$675,000, with additional annual staff costs to monitor the wells. (A look at current projects give a sense of the expense – a three year groundwater study in the Mat Su Valley is costing the State \$295,000/year and the USGS \$75,000/year, to provide groundwater baseline data for a limited area in the valley.)

Data collection would undoubtedly have to be prioritized, since the price tag is high. However, continuing to delay in filling this essential data need will be costly to Alaska. Costs to establish the network and collect this data will increase, and Alaska will be faced with high costs in the future as conflicts over limited water increase, and resource value and economic growth is negatively impacted by lack of water or ongoing conflict over appropriations.

Lower cost implementation steps would include reestablishing the Alaska Water Resources Board (estimated cost of \$50,000/year) and providing additional staffing in DNR and ADF&G to complete the reservation of water appropriations for fish bearing systems with adequate data for adjudication (estimated cost of \$500,000/year for the next five years.)

It is expected that the State and federal government would need to help bear the costs of implementation of these recommendations, with possible participation by the private sector.

### **Natural Systems TWG Approval and Deliberations**

During the ranking and evaluation by TWG members, this option was the ranked third with no minority views. The option ranked highest in terms of its potential significance and benefits, and implementation timing (actions could be initiated relatively quickly). The TWG is in concurrence about the ranking of this option.

## **NS-4 Reduce Introduction and Spread of Invasive Species**

### **Recommended Adaptation Option**

The State of Alaska will expand efforts to become an active partner in addressing the problem of invasive species in the state, primarily through establishment of the Alaska Invasive Species Council and implementation of strategic actions to prevent and control invasive and eruptive species.

### **Option Description**

More and more non-native species are turning up in Alaska, and lengthening growing seasons and less severe winters increase their likelihood of establishing and their rate of spread. The involvement of the State of Alaska is critical to controlling the introduction and spread of invasive species, yet to date the State's participation in efforts to prevent, control and respond to invasives has been modest. Through establishment of the Alaska Invasive Species Council and implementation of a strategic invasive species program, the State will express its commitment to prevention and control of invasive and eruptive species, and will join its efforts with work already underway by federal agencies and private entities.

The combination of changing climate and increasing globalization has dramatically increased the rate of introductions of non-native, invasive species to Alaska. Invasive species threaten every Alaskan ecosystem, from near-shore marine environments to arctic tundra. Invasions by non-native species have the potential to damage important economic sectors such as fisheries and forestry, as well as to alter fire cycles and subsistence opportunities. Longer growing seasons and less severe winters increase the opportunity for non-native species to become established and spread in Alaska (e.g. the recent dramatic spread of birdvetch (*Vicia cracca*) in the Fairbanks area). Insects are expanding their ranges in the state,

and in some cases exacerbating vector-borne diseases. In addition, shifts in climate have contributed to heretofore atypical but dramatic eruptions of some native species (e.g. spruce beetles in Southcentral Alaska).

Alaska still has the opportunity to prevent the myriad problems that invasive species can provoke. If allowed to become widespread, invasive species can cause gradual and irreversible degradation of entire ecosystems, with substantial negative impact to local economies. Once invasive species become widespread, the possibility and economic feasibility of controlling them declines dramatically.

This option would take advantage of the opportunity that still exists to prevent the spread of invasive species to large areas of the state. Limited state funds would be far more effectively spent on prevention than on control.

Implementation of this option would include:

- **Creation of an Alaska Invasive Species Council**, through State support for House Bill 12 “Establishing the Alaska Council on Invasive Species,” introduced January 9, 2009). State representatives to the Council will include the Alaska Departments of Fish and Game (ADF&G), Natural Resources (DNR), Environmental Conservation (DEC), Transportation and Public Facilities (DOT&PF) and University of Alaska. The primary purpose of the Council will be to coordinate the State’s new and pro-active involvement in invasive species issues. The Council will review the current funding mechanisms and levels for State agencies to manage noxious weeds and aquatic nuisance species on the lands and waters under their authority. The Council will establish criteria for the prioritization of invasive species response actions, and prepare an annual report to the governor and to the relevant policy committees of the Senate and House of Representatives.

Under the policy and strategic direction of the Alaska Invasive Species Council and the work of staff from represented agencies, additional actions would be implemented to address Alaska’s most pressing invasive species challenges, including:

- **Develop modern and comprehensive noxious weed regulations.**
- **Encourage Alaskan agricultural producers, greenhouses and nurseries to enter the native-plants-as-revegetation-materials market.**
- **Work with Canada through appropriate diplomatic channels** to encourage the control and eradication of a variety of weeds, insects, aquatic nuisance species, and marine invasives (e.g. spotted knapweed, *Spartina*, green crab) in British Columbia, the Yukon, and NWT to reduce their spread towards Alaska.
- **Work with shellfish mariculture industry** on education and best management practices to prevent, identify and control non-native organisms that arrive with shellfish stock.
- **Evaluate ballast water treatment technologies now available.**
- **Evaluate the impact of hull fouling on the spread of invasive marine organisms to Alaskan waters.**

This option would contribute to and build on work underway by the statewide Alaska Committee on Noxious and Invasive Plant Management (CNIPM) and by the Alaska Invasive Species Working Group (AISWG).

## Option Design

**Structure/design:** This option allows the State of Alaska to strengthen its commitment and organize its efforts through formation of the Alaska Invasive Species Council. Through the Council, the State and



join forces with already-established federal efforts (US Forest Service, National Park Service, US Fish & Wildlife Service) and public sector programs (Cooperative Weed Management Areas, Watershed Partnerships, CNIPM, AISWG) to coordinate a cross-land-ownership program on invasive species in Alaska. This proposal includes tasks that can be implemented at both small and large scales. Examples of the types of actions that could be taken are provided in this section.

Currently, invasive plant propagules are being spread unintentionally in gravel and fill material used in construction projects statewide. Yet most of the state's material sales sites (gravel pits) remain, at this point, weed-free. A gravel pit certification program would be a simple means of documenting and maintaining weed-free status for state-owned pits. The next step would be to encourage that gravel used by Alaska DOT&PF and in other state construction projects come from certified pits only.

Routine road maintenance operations of the DOT&PF also spread invasive plant propagules, rapidly and unnecessarily increasing the distribution of those species. Simple changes in the timing, methods and equipment used in these activities would eliminate this acceleration of spread.

At present, the only plant/agricultural materials entering the state that are inspected in any way are potatoes and tomatoes. Nursery starts are being shipped into Alaska from outside the state with a wide variety of noxious weed contaminants. Western tent caterpillars are routinely found pupating on ornamental trees and shrubs brought to Alaska from the lower 48. In 2007, a 747 cargo plane of Christmas trees from Oregon was flown directly to Alaska after being rejected for off-loading in Honolulu by the Hawaii Division of Agriculture. The shipment was infested with a variety of species of insects and contaminated with soil, which was then distributed around Anchorage when the plane was off-loaded with no inspection whatsoever. As Alaska's climate warms, such introductions will increasingly lead to new established populations. For some species, the consequences for Alaskan ecosystems are potentially devastating. An inspection program is needed that would include all nursery materials and Christmas trees entering the state as well as wood shipping containers, pallets and wood products for exotic wood borers.

The University of Alaska Fairbanks (UAF) has begun to develop a management plan for the significant invasive plant infestations on the UAF campus. UAF facilities services and the UAF administration should be recognized for their commitment to this effort; it should be expanded to address similar issues at the Palmer Experiment Station. The next step would be to use these projects as a starting point from which to address and manage invasive plant infestations around all state-owned administrative sites, buildings, storage areas, parking lots and other public facilities.

Plant species now recognized as invasive are still being used for revegetation projects around the state, in part because commercial sources of native plant seed or starts are extremely limited. Demand for native plant revegetation materials far outstrips supply. The state could initiate a small-grants program to encourage Alaskan agricultural producers, greenhouses and nurseries to enter the native-plants-as-revegetation-materials market. A next step would be to require that construction projects on state land revegetate with native species.

The State should work with and encourage the shipping industry to adopt any of the many treatment technologies now available to reduce the impact of ballast water in Alaska offshore environments. Ballast water coming into Alaska must be tested to gauge the range and types of organisms present. Ballast water may have the ability to transfer pathogens - such as a possible *Vibrio* outbreak, and may have implications to the health of the shellfish industry and human health. The state should consider regulation such as that for Washington and Oregon to protect Alaskan waters from ballast water release.

The State of Alaska should work to develop educational outreach materials and best management practices to prevent, identify and control non-native organisms that arrive with shellfish stock. Work with the shellfish mariculture industry to educate about and monitor for green crab occurrence in State.

The State should actively support the outcomes of a National Marine Fisheries Service (NMFS) -funded *Spartina* response plan.

The State should determine if action should be taken to address hull fouling as a vector to Alaska. This would involve evaluating the results of research funded by Prince William Sound Regional Citizen's Advisory Council (PWSRCAC) for possible follow up on additional research, education, or best management practices.

### **Targets/goals:**

- Establish the Alaska Invasive Species Council. (State support for HB 12).
- Re-fill the integrated vegetation management position at the Alaska DOT&PF (position has been vacant since January 2008).
- Establish a dedicated plant/wood products quarantine inspector in the Division of Agriculture *with regulatory authority*.
- Implement actions identified as strategic priorities by the Council, such as the actions described in the Structure/Design section, above.

**Timing:** The groundwork for many of the targets/goals described above has already been laid. In some cases the only ingredient missing is committed State of Alaska involvement. Thus, many of these goals can be accomplished quickly, within two to five years.

**Participants/Parties involved:** There are a wide variety of entities that can participate in these efforts, including public and private organizations with broad expertise in the areas discussed. A partial list would include: DNR, DOT/PF, DEC, ADF&G, Alaska Committee for Noxious and Invasive Plant Management, Alaska Invasive Species Working Group, Alaska Cooperative Extension Service, Association of Alaska Conservation Districts, U.S. Forest Service, State and Private Forestry, National Oceanic and Atmospheric Administration, US Fish and Wildlife Service, USDI National Park Service, USDI Bureau of Land Management, USDA Agricultural Research Service, Juneau Watershed Partnership, Anchorage Cooperative Weed Management Area, Alaska Center for Coastal Studies, and Prince William Sound Regional Citizen's Advisory Council.

**Evaluation:** The body charged with monitoring these efforts would be the newly-formed Alaska Invasive Species Council.

**Research and Data Needs:** Research is needed on a variety of topics associated with invasive species in Alaska, including:

- Commercial production of native plant materials for revegetation projects,
- Appropriateness of existing ballast water technologies for Alaska,
- Spread and distribution of *Spartina*, green crab and tunicates in Alaskan coastal waters, and
- Effectiveness of new road maintenance equipment, schedules and methods in reducing the spread of invasive plant propagules.

### **Implementation Mechanisms**

- Support the creation of the Alaska Invasive Species Council. Legislative authority for the Council is proposed in HB 12, a bill "Establishing the Alaska Council on Invasive Species," introduced January 9, 2009.

- Through the policy and strategic direction of the Council and the work of agencies represented on the Council, implement actions targeted to address Alaska’s most pressing invasive species challenges (see Option Description, above).
- Fill necessary State agency positions to support the strategic work of the Council.

### Related Policies/Programs and Resources

Several federal agencies have developed strong invasive species programs in Alaska, beginning in about 2000. Two ad-hoc groups (Alaska Committee for Noxious and Invasive Plant Management and Alaska Invasive Species Working Group) have made important advances in the development of a coordinated invasive species response system. Websites, publications, sub-committees, annual meetings, listservs, all are up and functioning well. Those groups are primarily composed of representatives of federal agencies, the University of Alaska, the Soil and Water Conservation Districts, and the Cooperative Weed Management Areas.

Involvement by representatives of the State of Alaska has been modest, perhaps with the exception of ADF&G. Because invasive species don’t respect land ownership boundaries, the State’s DOT&PF, DEC, and DNR needs to become fully involved.

Seventeen states have established invasive species councils. It has been their experience that resources are effectively combined and leveraged with decision makers come together in these councils, so much more is accomplished at less cost. The existing Alaska Invasive Species Working Group has worked hard and accomplished a lot over the past three years, but sees the establishment of a Council as essential to provide a group that can make policy decisions and more effectively involve the State agencies. This is especially important given the growing concern with invasive species in light of the changing climate in Alaska.

### Feasibility

All of the proposed actions are feasible. None are very expensive. Alaska is isolated from most of the worst invasive species problems in North America. Compared to the lower 48, the Yukon and northern British Columbia are very clean. We have few points of entry; few ports and very few roads coming into the state.

### Adaptation Benefits and Costs

**Benefits:** Alaska’s intact ecosystems are its most fundamental asset. The benefits to be gained by protecting those ecosystems from invasive species cannot be overstated. In Alaska, the subsistence lifestyle, our sport and commercial fisheries, hunting, trapping, wildlife viewing, the timber industry, and much of the tourism industry are directly connected to and fully reliant upon the functioning and intact ecosystems in our state.

The advancement of invasive species into intact ecosystems can be likened to the spread of an irreversible cancer. Sometimes it happens slowly, sometimes it happens very fast. The effects are difficult to predict, but invasive and eruptive species that threaten Alaskan ecosystems are directly aided and propelled by the changing climate.<sup>3</sup>

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<sup>3</sup> Alaska must learn from the consequences of inaction or insufficient action in other systems: kudzu and cogongrass in the American southeast, gypsy moths across the northeast, zebra mussels in the Great Lakes (and now spreading across the west), Chinese carp in the Mississippi watershed, tamarisk along water systems throughout in the southwest, leafy spurge and spotted knapweed in western rangelands, purple loosestrife in wetlands across the lower 48, the brown tree snake on Guam, the Emerald Ash Borer in the upper Midwest, rats and foxes in seabird colonies on islands in the Aleutian chain. Asian long-horned beetles,

Success in this program would have several components, all of them feasible, none of them complex or especially costly. Establishment of the Alaska Invasive Species Council would provide immediate benefit, through coordinated policy and strategic direction, and coordination and leveraging of state resources. The DNR Division of Agriculture would develop an inspection program for untreated wood products and agricultural/horticultural products entering the state. This program would have regulatory authority. State employees in a wide variety of agencies would be trained to recognize and report non-native species. State agencies would participate in coordinated planning with federal partners on rapid-response plans to non-native insect and pathogen outbreaks. State agencies would review their own operations and modify or eliminate activities that contribute to introductions and spread.

The timeframe for realizing benefits is both short- and long-term. Alaskans would realize the ultimate benefits through the continued functioning of our ecosystems: producing fish, timber, and wildlife. Key uncertainties center on predicting the impacts of, and prioritizing responses to, a wide variety of potential invaders or eruptive species. However, a sophisticated system for ranking the invasiveness of plants in Alaska has been developed and is already being widely used: (<http://www.fs.fed.us/r10/spf/fhp/invasive/invasiveness%20ranking%20report.pdf>). Similar systems are being discussed for insects, pathogens, and marine organisms.

**Costs:** Implementation of this option would not be high cost. Costs would be contained by: (1) acting early to prevent and control invasive and eruptive species, (2) building on existing State of Alaska staffing and programs, and (3) coordinating and leveraging resources among state agencies, federal agencies and other partners. Depending upon the exact actions taken, costs could be associated with the following elements of this recommendation:

- Limited staff increases, especially a plant/wood products quarantine inspector in DNR Division of Agriculture and re-fill of the vegetation management position in DOT&PF;
- Support needed research efforts to support development of policies and best management practices;
- Development and implementation of regulations and best management practices;
- Possible small-grant program to encourage development of native-plants-as-revegetation-materials market.

The Council would determine the appropriate scale of the program, in keeping with the resources available.

The critical factor that will determine the likelihood of success and the cost of effective implementation is timing. Prevention is much more cost-effective and feasible than control. Alaska is in an enviable condition right now, with respect to invasive species. Compared with other states, there are relatively few non-native or erupted species in Alaska and they are not yet widespread. However, more and more non-native species are turning up each year, and it is expected the changing climate will exacerbate their spread. It would be fiscally prudent to implement these actions proactively rather than reactively.

## **TWG Approval and Deliberations**

During the ranking and evaluation by TWG members, this option was ranked fourth, with no minority views. It ranked highest in terms of significance, timing and feasibility. The TWG is in concurrence about the ranking of this option.

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found for the first time in Worcester, Massachusetts in August, 2008, now threaten the maple trees of New England and eastern Canada.

## NS-5 Provide for Adaptive Management of Fish and Wildlife

### Recommended Adaptation Option

The State of Alaska should improve its capability to accomplish adaptive management for fish and wildlife species harvested in Alaska, to be able to assure sustainable management of these important resources under conditions of rapid and substantial climatic change. Two specific actions are proposed to achieve this end:

- Sub-Option 1: Develop and adopt a more timely regulatory process for the harvest of game, to be able to adapt and respond to short- and long-term changes in climate that can decrease harvest success under a static harvest season.
- Sub-Option 2: Develop a coordinated framework for monitoring the abundance and distribution of fish and wildlife in Alaska, to facilitate adaptation of resource development, harvesting systems, and conservation of biological diversity in response to changes caused directly or indirectly by climate change; including a system for coordinating the management, sharing and dissemination of monitoring data.

### Sub-Option 1: Adopt a More Adaptive Regulatory Process for Game Harvest

#### Option Description

This sub-option describes the need for a timely regulatory process for the harvest of game in Alaska, in response to short- and long-term changes in climate that can decrease harvest success under a static harvest season. Developing an option for in-season game harvest management is described below, along with challenges of its implementation. (Note that this recommendation focuses on management of game harvest, as fisheries management already provides for adaptive in-season management, as discussed further below.)

The rate of climate change in recent years is perceived to be disrupting historic patterns of movement and behavior by game animals (e.g., large forest fires, warm periods during rut) and transportation options for hunters during hunting seasons (e.g., low water depth in rivers, formation of ice adequate for safe travel). There is concern by some hunters that the regulatory process for changing hunting seasons is too slow for timely adaptation to changing conditions, resulting in lower hunting success (proportion of people who harvest an animal compared to the number who attempt to harvest an animal). The current system of abundance based management of salmon stocks, with delegated emergency order authority coupled with in-season monitoring efforts, should provide a framework for responding to climate change impacts on stock distribution and abundance. A system of robust and timely stock assessments is the key to appropriate in-season management actions.

The goal of this sub-option is to conduct a comprehensive review of laws, regulations, and policies on sustainable harvest of wildlife in Alaska and recommend changes that allow for more timely, coordinated, and effective adjustment of state and federal hunting regulations to allow hunters to adapt to effects of climate change. The current model used for commercial and subsistence salmon fishery management may provide some insight into how this could be accomplished.

Hunting seasons restricted to inopportune periods may hinder harvest success of wild game as a food source, complicate care of meat in the field, force unsafe travel, or encourage illegal hunting during closed periods, especially where subsistence harvest is critical in remote communities. Requests to shift hunting seasons are occurring more frequently in certain regions (e.g., September moose hunts in western Interior), which increases workload and decreases efficiency for regulatory authorities and local advisory groups. Some rural residents perceive a lack of concern by management agencies and regulatory

authorities, which will hinder the cooperation necessary for effective harvest management and wildlife conservation in remote areas.

### Option Design

**Structure/design:** Unlike some commercial and subsistence fisheries, presently it is not possible for local wildlife managers to extend hunts in-season or increase bag limits of game where appropriate. Emergency season closures do occur on some registration hunts when a general harvest quota is reached; but encourages strong competition to hunt early, when meat care may be difficult.

This sub-option recommends that a working group focused on a community or small region (as a test case) develop a proposal to the Board of Game for an in-season management option that would allow managers to avoid a hunting season in warm weather. The charge would be to design a hunting season and harvest quota system that is flexible and informed by knowledge of local conditions to allow a season extension if short-term weather hindered harvest during a general season (no restriction on access by non-local hunters) and the harvest quota for the community/region is not met. Communication and close cooperation between managers and hunters to ensure timely harvest reporting would be critical for low abundance animal populations to avoid overharvest with this approach.

**Targets/goals:** One goal would be a reduction in the number of proposals to the Board of Game and Federal Subsistence Board that request shifting hunting season dates later because of trends in warmer conditions during fall and early winter hunts. A second goal would be to allow hunting at times when travel is safe and meat can be preserved in good condition.

**Timing:** A working group could provide input through the local Fish and Game Advisory Committee (state) and Regional Advisory Council (federal) for development of a test proposal for a community or small region. Initial recommendations for changes in regulations could be completed within one year. The Alaska Board of Game and Federal Subsistence Board each convene annually but address regional issues (e.g., Southeast, Southcentral, Interior, Western/Arctic in state system) for wildlife on a two-year cycle. Thus, the entire process to put a new (flexible) regulation in place in a particular region may take up to three years.

**Participants/Parties involved:** Hunters, state and federal wildlife managers, Alaska Board of Game/Local Advisory Committees, Federal Subsistence Board/Regional Advisory Councils, and tribal organizations (e.g., Association of Village Council Presidents).

**Evaluation:** Effectiveness would be gauged as fewer proposals to shift seasons or create additional hunting seasons, community harvest needs being met (subsistence harvest monitoring), and a sustainable harvest that does not cause wildlife population declines (population monitoring, harvest reporting).

**Research and Data Needs:** The most common request for harvest regulation adaptation to date has been to shift moose hunting seasons later in autumn when weather is cooler (change to warmer weather in early September for parts of the Interior was documented by National Weather Service on request of Alaska Department of Fish and Game in 2008). Managers are concerned that shifting a hunt into the rut period (when bulls are preoccupied with breeding) can increase hunting success, which could be a problem in low-density populations or those with a low bull:cow ratio. Research on rutting behavior would require long-term observational studies, which would be challenging in boreal forest. A literature review about the effects of temperature on rut timing and the potential effect of allowing moose hunting during the rut on productivity of moose is warranted. It would also be instructive to understand the effect of temperature and rainfall patterns on river level for motorboat access in autumn and the effect of temperature patterns on ice formation for winter travel on both freshwater ice and sea ice. The travel relationships are complex, encompassing both natural sciences (climate, hydrology) and human behavior.

## Implementation Mechanisms

Progress would occur by choosing a test case area of state where weather during hunting season has been a problem, asking for participants for a working group (one representative from each group noted in previous section), setting goals and a timeline for developing a regulatory proposal, and providing the group with the resources for meetings to occur. A local test case in the Bush where good cooperation already exists is advisable before attempting a more complex process on the road system or a process that is regional or statewide in scope. These types of collaborative efforts to resolve hunting issues or conflicts have occurred in Alaska in the past. This test case would demonstrate the feasibility and effectiveness of providing for this type of timely and adaptive game harvest management more broadly in Alaska.

No new legislative authority would be needed to implement this option. The Alaska Board of Game sets hunting regulations for all lands statewide, and these regulations apply for all hunts on state and private lands (including Alaska Native allotments and Native corporation lands). The Federal Subsistence Board may separately set hunting regulations on some federal lands to ensure subsistence needs of federally-qualified rural residents are met, which may result in a priority for rural residents at times when sustainable harvest is less than demand by all hunters.

There would need to be a mechanism for resolution of state and federal harvest management in times of perceived game shortage in rural areas, when a subsistence priority could be given to rural residents on federal lands (see Feasibility section below).

**Related Policies/Programs/Actions:** There are good examples of consensus-based stakeholder groups to address hunting issues (Western Arctic Caribou Working Group) and fishing issues (Yukon River Drainage Fisheries Association) in Alaska.

**Available Resources:** Travel funding would be required for a working group to convene two to three times over several months to one year to draft a proposal (federal partners may be able to assist with funding). Depending on the schedule, additional travel funding may be needed for the rural Fish and Game Advisory Committee because some committees have funding only for one meeting per year. The working group would submit a proposal to the Board of Game at the next available cycle.

If a quota system was adopted by the Board of Game, it may require extra resources for ADF&G staff to travel to communities that do not have a license vendor so hunting licenses and harvest reporting information can be issued to hunters. Timely reporting would require hunters to provide ADF&G with harvest data by phone or email within a short period after harvest (e.g., three days) so a manager could estimate if a season extension is advisable.

## Feasibility

The Alaska National Interest Lands Conservation Act of 1980 (ANILCA) required a subsistence hunting and fishing preference for rural residents of Alaska on federal lands, which compose 60% of the state. In the 1989 McDowell decision, the Alaska Supreme Court upheld the common use clause in the Alaska Constitution that provides for access to game by all Alaska residents. Since 1990, dual regulations for hunting and fishing have existed on most federal lands in Alaska (determined by Title VIII of ANILCA). While amending ANILCA or the State Constitution is problematic, it would be feasible to adopt a State regulation allowing manager discretion to extend season length for harvest up to a sustainable quota that meets subsistence harvest needs for a rural community or communities; this would eliminate the need for additional hunts on federal lands. Regulations that are simpler, apply to all land ownership, and are consistent over time are more likely to be understood and embraced.

Participating hunters will have to be convinced of the value of harvest reporting as a benefit to meeting their subsistence needs, because law enforcement alone is unlikely to be an effective means of change. Some people prefer cow moose (often more fat than bulls) or hunting in winter (additional season), when options exist for overland travel by snowmachine and easier meat care. Some requests to adjust timing of

harvest seasons may occur in areas where harvest is already managed to the sustainable limit (e.g., harvest in warm weather is more difficult but the quota is already being met). In that instance, shifting a State moose hunting season open to all residents and possibly even non-residents from early September to late September or early October (during the active rut, when bull moose are more vulnerable) may increase harvest success to beyond sustainable yield. Allowing a winter hunt for bulls on federal lands (particularly after bulls have begun to drop their antlers) may increase the harvest of cows. This is a particular problem in low-density moose populations, which are common in predation-limited systems of the boreal forest in rural Alaska. Coordination of state seasons and federal subsistence seasons is critical to prevent overharvest, particularly of cow moose during winter hunts.

### **Adaptation Benefits and Costs**

Regulatory proposals to state and federal boards for fish and game management often create substantial workload for agency staff and boards, so success would be commonplace options for in-season management that would reduce the number of regulatory proposals. Better coordination of state and federal regulatory processes for fish and game management should also reduce duplication of efforts. An ancillary benefit may be to reduce the tendency for conflict between user groups and management agencies that having dual regulations for federal lands or waters can bring. The need for coordination is not unique to climate-driven issues, but concerns over climate change may serve as the catalyst for innovation, particularly in game management. The time frame for local case studies (if successful) to spread to larger regions or statewide is unknown because of the increasing complexity of dealing with resource allocation closer to the road system (high access potential for harvesters). Whether this approach could be applied successfully statewide is unknown.

Data collection to assess fish stocks or game populations in the short term is on-going, regardless of climate change. The travel and staffing costs to implement a local case study over one year with a working group in a rural area (outlined above) would be small in comparison to the public process for a complex issue that includes a large number of stakeholders from a much larger geographic region. A large or complex process would also likely require additional planning and support staff in agencies.

### **Sub-Option 2: Develop a Coordinated Monitoring Framework for Fish and Wildlife to Facilitate Adaptive Management**

#### **Option Description**

Changing climate is expected to continue influencing the distribution and possibly the quality of habitat for fish and wildlife in Alaska, which may cause declines in some native species and increases in other species. Important distributional changes in stocks may occur for some marine and freshwater fish species.

The goal of this sub-option is to coordinate efforts to monitor fish and wildlife species or stock abundance changes, evaluate the risk of species loss or decreased genetic diversity, and ensure that information and tools are in place for adaptive management to be implemented where feasible and warranted. Developing and using a coordinated system for managing, sharing and disseminating monitoring data is a key part of this recommendation. Through coordination, agencies could combine efforts and leverage funding to document changes sooner and make adaptive management possible. Adaptive management could include changing harvest patterns or taking steps to restore populations if adequate habitat remains.

A decline or change in distribution of harvested species or stocks could have important economic impacts on local communities that rely heavily on commercial fishing. These changes may also have implications for food supplies, particularly for remote communities as the cost of transportation fuel increases. Climate change may also threaten populations of non-game species, leading to potential biodiversity loss or restrictions on uses of lands for some purposes. Indirectly, change in location of major vegetation types



has implications for wildland fire regimes, which is the primary agent of habitat enhancement for game in boreal forest. Climatic changes may also accelerate loss or fragmentation of rare habitats (e.g., alpine in Yukon Tanana uplands) important to some endemic species (e.g., Alaska marmot). Changes in near shore marine circulation patterns may alter food webs or migratory pathways for fish, and changes in freshwater flow and temperature regimes may impact salmon spawning habitat and juvenile survival.

### Option Design

This sub-option recommends that the agencies and other entities that monitor fish and wildlife species abundance and distribution in Alaska develop a coordinated framework that documents existing monitoring efforts, identifies priorities for monitoring in the context of climate change, and identifies gaps and potential for collaboration. The option would also include development and use of a common structure for cataloging and disseminating monitoring information. (See additional detail in Implementation Mechanisms, below.)

**Targets/goals:** The initial target would be completing a coordinated framework for monitoring efforts for fish and wildlife. Quantitative targets or goals would need to be developed by participants once a review of the existing efforts is assembled in a single framework. Existing escapement goals for salmon species and stocks can be used to evaluate potential impacts of climate change on abundance, productivity, and distribution.

**Timing:** Various levels of collaboration on monitoring biological diversity for scientific and conservation purposes has occurred in the past. It should not be a lengthy process for a comprehensive participant group to meet to develop a monitoring framework and protocols for coordination and sharing of monitoring data.

**Participants/Parties involved:** State and federal management agencies, University of Alaska, tribal organizations, non-government organizations, citizen science efforts, and private business (e.g., oil companies).

**Evaluation:** Increased efficiency in obtaining fish and wildlife monitoring information at a single source, particularly as large development projects are undertaken (oil or gas pipelines, railroads, roads for resource extraction) that require comprehensive environmental studies.

**Research and Data Needs:** Once a review of the existing efforts has occurred, participants could identify gaps in knowledge, prioritize inventory and monitoring needs, and suggest protocols.

### Implementation Mechanisms

This sub-option would initially be implemented through meeting(s) of State and federal agencies, the University and other entities involved in fish and wildlife monitoring, to catalog monitoring efforts across fish and wildlife species, aquatic and terrestrial ecosystems, regions and jurisdictions to develop a monitoring framework that catalogs existing monitoring efforts, identifies priorities for monitoring in the context of climate change, and identifies gaps and potential for collaboration. Meeting participants would also discuss and develop protocols for improving coordination of monitoring data, so it can be more readily accessed and shared across organizations.

A data coordinator position would be required to link extant monitoring programs into an archival network for data exchange. The coordinator could be housed in a government agency that already has a substantial data archive. Alternatively, it could be located in a neutral organization such as the University of Alaska that has secure base funding (office space, internet data server, and technical specialists) and seeks operational/maintenance funding from conservation foundations and various agency members that contribute data on species status. A membership charter for the network to document responsibility of contributors (free access to data, providing metadata on sources of information, funding for upkeep of host website, etc.) would be needed. Several efforts to coordinate monitoring have already occurred in

the last few years (see Related Policies/Programs/Actions below). No new authorities would be needed to implement this recommendation.

### Related Policies/Programs and Resources

**Related Policies/Programs/Actions:** Efforts to inventory and monitor the status of species and their environments already exist in many forms and organizations. Harvested species are monitored by ADF&G. Non-game vertebrates, invertebrate animals, and plants are monitored through several groups or efforts, such as the High Latitude Ecological Observatory (part of national non-government organization), regional inventory and monitoring networks (National Park Service), the Comprehensive Wildlife Conservation Strategy (ADF&G), and the Alaska Natural Heritage Program (University of Alaska-Anchorage). Efforts are presently underway with respect to forecasting the effects of climate change on terrestrial, marine and freshwater species and ecosystems. (See Section I of the Natural Systems Technical Working Group Catalog or Adaptations and Policy Options, December 2008, which provides an overview of changes to Alaska’s habitats and dependent species due to climate change, and future trends.)

**Available Resources:** State and federal agencies have numerous monitoring programs in place already. Results of gap analysis can identify the need for new monitoring efforts. Indigenous knowledge may be highly useful to sampling design. Potential for citizen science involvement is high for some monitoring tasks and would leverage labor across our vast geography, although training and testing of observers will be necessary for some species or purposes.

### Feasibility

ADF&G and the University of Alaska can play lead roles for the State in coordinating development of a fish and wildlife monitoring framework, and for coordination of fish and wildlife monitoring data. The financial resources required to host and maintain a coordinated internet database could be estimated during the review of existing data sets and where gaps in data exist.

There would be a start-up period of perhaps one to two years before all the various entities and information sources are coordinated to fully identify data gaps and make existing data available in a consistent structure. Some data may be proprietary (e.g., private industry reports), and some will require filtering for posting on a public database (e.g., reduced geographic resolution for species listed as threatened or endangered). The funding required for sampling of data gaps would likely be substantial, and the time delay until a “useful” product exists depends on the desired resolution or intended uses of the data.

### Adaptation Benefits and Costs

Development of a coordinated fish and wildlife monitoring framework would help ensure that the coverage and products of existing monitoring programs are well understood by all monitoring entities, that opportunities for collaboration and leveraging of effort are identified (and can be pursued), and that monitoring gaps are identified for species, ecosystems, or regions that should be addressed due to the potential for substantial change in fish and wildlife abundance and distribution due to climate change.

Benefits of a common structure for cataloging and disseminating monitoring information on species status and distribution would be better access to information for managers and harvesters of exploited stocks or populations. As the speed and success of adaptation by harvesters increases through information and technology, respectively, timely information on status of exploited populations would benefit in-season management decisions. This would be especially important as species ranges change and harvest systems may develop in new areas, thus lack the benefit of historic management experience in a particular area.

The cost of collaboration to develop a monitoring strategy and identify and consolidate sources of monitoring data is not expected to be large. However, there will be a long-term cost of staff (technical

specialists and administrators) and computer hardware and software to update and maintain a database with strict protocols for data quality and to ensure its security on an internet server. Data collection costs would continue to be borne by the various contributors or end users.

## **NS-6 Develop Capacity in New Forestry and Wood Biomass Opportunities**

**NO CHANGE YET IN THE FOLLOWING FROM FEBRUARY 2008 – STILL NEEDS COMPLETION**

### **Recommended Adaptation Option**

The State should invest in economic development and infrastructure to attract and facilitate development of industrial capacity, at appropriate scales, to use insect- or fire-damaged timber and underutilized and new sources of wood biomass.

### **Option Description**

As the changing climate stresses the forests of Alaska, mortality of trees will increase due to insects, fire and tree decline agents. Finding economic and innovative uses for dead, small and underutilized species will help managers confront this forest health crisis and provide for resilient forests more able to withstand rapid change.

This option would invest in developing and deploying new harvesting technology and silvicultural techniques and demonstrate a variety of wood biomass systems to produce heat and power for rural and urban communities.

There are several goals for this option:

- Replace fossil fuels with a renewable, locally produced fuel that is considered carbon-neutral with regard to greenhouse gas (GHGs) emissions
- Create local employment in harvesting, silvicultural work and in operation of energy facilities, especially in rural communities
- Actively manage forestlands for a variety of social, economic and biological benefits
- Demonstrate the feasibility and economics of different bioenergy technologies, from small to larger scale for space heating and electrical needs

This option would build on work initiated by the Wood Energy Task Force in 2002 and continue efforts to complete feasibility studies, engineering, financing and construction of biomass space heating facilities for public buildings. There are several different scales that this can occur at, from individual wood-pellet stoves, solid-wood boilers, and wood-chip boiler systems. The option would also explore the use of wood chips in co-firing applications with coal to produce electricity in large-scale utility settings.

Without investment and demonstration of these types of projects and facilities the technology will be slow to develop and “catch-on” in Alaska. While there has been significant movement toward a variety of alternative energy options, wood biomass consistently ranks near the top in economics and ability to be implemented quickly. By demonstrating different technologies at a variety of scales, communities will be able to choose the best options for their situation. This would include fuel type, quantities available on a sustainable and economic basis, heat-load need, and a variety of other factors. In turn, this will permit forest managers to aggressively address forest health issues and utilize wood that would otherwise increase fire hazard and cause further declines in stand and community resilience.

## Option Design

**Structure/design:** This option has several different facets that work together to achieve the overall result of utilizing dead, small, or underutilized tree species to improve overall forest health and to form the basis of a wood bioenergy industry. This industry can function at several scales and can be as simple as an energy-efficient wood stove in a single-family dwelling, to a large, complex wood-energy plant in an urban community. The important aspect of this proposal is that it can be implemented at both the small and large end of the wood-energy spectrum, with numerous options in between. A community can scale their options to what they are comfortable with.

Currently in the state there are several installations of Garn boilers, they use solid wood, much like a wood stove, but on a larger scale. They are used for space heating needs and can heat public buildings and other small-to-medium-sized buildings. There is a need to demonstrate a wood chip system that is more automated than the Garns and can handle large heat loads, such as an entire high school, hospital, or prison. There are two communities, Delta and Tok, that are considering a project like this, and both have applied to the Alaska Energy Authority (AEA) grant program to secure funds to move ahead with this work.

The next step up would be to look at a co-firing opportunity with an electric utility. In a system like this coal and wood chips would be burned together to produce the steam required to run turbines and generators to make electricity. The University of Alaska is interested in this off-the-shelf technology for a proposed new generating unit at the Fairbanks campus.

All of these options are viable short-term solutions that have been in use in other parts of the nation and world for many years. Our cheap supplies of energy have prevented their evaluation and use in the state, and there is a need demonstrate their reliability, and economics.

In addition, air quality and related health issues have been raised concerning fine particulate matter, called PM-2.5 by the EPA. Recently the community of Fairbanks joined the city of Juneau in being a non-attainment area for the PM-2.5 standard. Wood-burning appliances, especially older wood stoves and some outdoor wood furnaces will not meet this standard. Wood pellet stoves and boilers can meet this standard, and homeowners may need to switch to this type of fuel, if they wish to continue utilizing wood fuels. There is a need to manufacture wood pellets in Alaska, and at least one company has taken steps to do so, but there is much work to do on the harvesting and transportation side to ensure pellets can be produced economically.

Why is all this so important for helping with climate change. Whenever wood is burned it offsets a fossil fuel, like oil, coal or natural gas. Wood also produces CO<sub>2</sub> when combusted, but new trees are taking the harvested trees place in the forest. These young trees sequester carbon and thus are considered carbon-neutral from a GHG perspective. Additionally, if the U.S. or the state adopts a cap-and-trade program for GHGs, the fuel offsets mentioned above can be sold as carbon credits in carbon exchange markets such as the Chicago Climate Exchange (CCX).

### Targets/goals:

- Construct a wood chip boiler installation at a public school or similar facility and have it operational by 2010
- Complete feasibility studies for five communities interested in wood-energy projects annually for each of the next ten years
- Develop and demonstrate harvesting and transportation systems using currently available equipment for wood energy facilities. Demonstrate one road system and one rural harvesting system

- Establish a wood-energy coordinator position in the Division of Forestry to provide technical assistance to communities and AEA to determine sustainability of wood supplies for wood energy projects

#### **Timing:**

- Build on projects already initiated; this would enable rapid deployment of wood energy systems beginning in 2009. Additional projects can be brought on line as fast as feasibility studies, engineering, financing and construction can be accomplished.
- Over the next ten years numerous projects can move forward in both urban and rural communities
- Results will be both short- and long-term and can be expected to continue through the design life of the facility

**Participants/Parties involved:** There are a number of entities that can participate in this effort, ranging from public and private organizations with expertise in the areas discussed. A partial list would include: Alaska Energy Authority, Wood Energy Task Force, Division of Forestry, U.S. Forest Service State and Private Forestry, Department of Energy, U.S. Forest Service Forest Products Lab, Tanana Chiefs Conference, University of Alaska and others

**Evaluation:** The main type of monitoring would take place on the forest management side of this proposal. Managers would ensure that forest health and productivity was being maintained on sites and that best management practices (BMPs) were being applied. The state's Forest Resources and Practices Act could provide both effectiveness and implementation monitoring of BMPs.

Forest certification via a third party organization, such as the Sustainable Forestry Initiative (SFI) or the Forest Stewardship Council (FSC) could also ensure appropriate management standards are in place.

**Research and Data Needs:** The concept that wood fuels are carbon neutral should be thoroughly examined. This is a complex topic that involves carbon budgets and cycles in a dynamic environment. Protocols for certifying carbon storage and sequestration rates are needed for boreal and coastal forests.

Research in new harvesting equipment or application and adaptation of current equipment should be supported.

Air quality monitoring and testing of various wood burning appliances should be completed in an arctic environment. The Cold Climate Housing Research Center would be an ideal place to conduct this needed work.

#### **Implementation Mechanisms**

To be completed.

#### **Related Policies/Programs and Resources**

To be completed.

#### **Feasibility**

To be completed.

#### **Adaptation Benefits and Costs**

To be completed.

#### **TWG Approval and Deliberations**

During the ranking and evaluation by TWG members, this option was the ranked seventh, with no

minority views. The TWG is in concurrence about the ranking of this option.

## NS-7 Support Local Sustainable Agriculture in Alaska

### Recommended Adaptation Option

The State of Alaska will develop a program to support sustainable agriculture in Alaska that will improve, secure and sustain the supply of quality food for all Alaskans, to respond to new challenges and opportunities presented by a changing climate and other future challenges (e.g., increasing food transportation costs to and within Alaska).

### Option Description

Option NS-8 will seek to improve, secure, and sustain the supply of quality food for Alaskans by expanding and enhancing food production in rural and urban Alaska.

Option NS-8 will be incorporated into the Alaska Division of Agriculture's (ADOA) strategic planning process with the purpose of complementing the ADOA efforts to expand community-based agriculture across Alaska. (See Objective 3.2 of ADOA's strategic plan, *Challenges and Opportunities for the Future - While Meeting the Needs of Today*, 2009, which calls for addressing climate change effects on the agriculture sector.)

The goal of this option is to develop a program to improve, secure and sustain the supply of quality food for Alaskans. To understand this goal, one has to look not only at what we can grow, but also infrastructure/processing capabilities, marketing, etc. One of the largest hurdles to truly sustainable agriculture in Alaska is the seasonality of our production combined with the lack of infrastructure / processing capabilities. For instance, Alaska is probably capable of producing more vegetables, but only so many of them can be consumed while still 'fresh'. The market for unprocessed vegetables (such as potatoes, which can be stored year round) is also limited. The amount of cold storage available in the state may also be another limiting factor.

Anecdotal observations indicate that well over 98% of Alaska's total food supply is imported into the state. With the current uncertainty in the national and global economies the security of that food supply is at risk. The impacts of climate change on the food producing capabilities of the state are unknown but can be expected to provide both opportunity and the need for adaptive change. The state has a history of food production including agriculture, commercial seafood harvesting, and wildlife hunting. There is both an opportunity and a need to build on our history to create a new system of food production that can maximize the potential of the state to feed itself.

### Option Design

This is the heart of the option discussion. It is suggested that it be divided into the following sections.

**Structure/design:** Four initiatives or tasks are needed to improve, secure and sustain the Alaskan food supply for the future:

- 1) Encourage community-based agriculture,
- 2) Research the magnitude and composition of food consumption in the state,
- 3) Research the sources of food supply and the risk associated with high reliance on imported foods, and

- 4) Develop in cooperation with the University a strategic Alaska food policy to increase reliance on locally produced food sources through agriculture, seafood harvesting, and subsistence activities.

**Targets/goals:**

- ADOA will provide the leadership to create an Alaska Food Coalition of producers, providers, and consumers.
- ADOA will work to support the expansion of locally produced food through farmers markets and community-based agriculture initiatives.
- ADOA will partner with the University of Alaska to design and conduct the research identified above.
- ADOA will facilitate the development of a draft Alaska Food Policy by the Alaska Food Coalition.

**Timing:**

- Year One: begin and complete task 1 above and begin work on task 2.
- Year Two: Continue support for task 2 above and work on tasks 1 & 3 by facilitating the development of research initiatives in collaboration with the Alaska Food Coalition and the University of Alaska.
- Year Three: Continue work on task 2 and support for research initiatives including funding and information.
- Year Four: Begin facilitating the development of an Alaska Food Policy with the Alaska Food Coalition based on new research findings.

**Participants/Parties involved:** The Alaska Division of Agriculture will serve as lead for implementation of NS-7. ADOA will be assisted by the UAF Cooperative Extension Service, the UAF School of Natural Resources and Agricultural Sciences, and others.

The first task of NS-7 will be to organize the Alaska Food Coalition to include representatives of producers, consumers, processors and providers.

**Evaluation:** Create a data collection system to record production and consumption progress related to the goal of creating a secure and sustainable food system in Alaska.

Continue work with the Alaska Food Coalition to evaluate how programs and policies are meeting the needs identified by the coalition.

**Research and Data Needs:** The research need associated with NS-7 is to conduct an analysis of the demand and supply for food, including an analysis of how this demand is currently met. The findings of this research would inform development of a strategic Alaska Food Policy and serve as a baseline to measure future progress of this option NS-8. Following the accomplishment of this task, the ADOA strategic plan will be reviewed to see how much of Alaska's supply of food could be provided by local growers in the various communities (i.e., examine potential for import substitution opportunities).

This research is a HIGH priority for implementation of NS-8. The Alaska Food Coalition would have an important role in coordination to accomplish this research.

## Implementation Mechanisms

First: Need to prepare an **analysis of Alaska's DEMAND for food** -- this is for ALL types of food (not just agriculture sector – Note: Need to analyze by subregions, since there are great differences in different geographic regions and differences rural / urban, etc.):

- What is Alaska's food need?
- To what extent are our current needs met?
- What needs are not met (i.e., current hunger)?
- What are the sources of our food supply?
- What is the risk to our food supply, under different potential change scenarios?

Second: Research findings regarding Alaska's food supply and demand would be incorporated into the ADOA Strategic Planning Process and used to develop a strategic Alaska Food Policy addressing the following questions:

- What is the capacity of Alaska to be self-sufficient in food production?
- How can agriculture contribute to the food needs of Alaskans?
- How can the seafood industry contribute to the food needs of Alaskans?
- How can subsistence and personal use activities contribute to the food needs of Alaskans?
- How can a marketing and distribution system be created to deliver Alaska produced food to Alaskans?

The Alaska Food Policy “Findings” will also identify the need for any legislative action.

The ADOA is well placed to provide leadership for this effort. Implementation of NS-8 will require the creation of a new stakeholder group (the Alaska Food Coalition) to coordinate the activities of agencies and industry involved in food production, processing, and marketing. ADOA will need an increase of professional staffing (2.0 FTE at a minimum) to support this effort.

## Related Policies/Programs and Resources

**Related Policies/Programs/Actions:** There are many state and federal programs with (potential) food related responsibilities that will need to be consulted and/or included in the Food Coalition as stakeholders. (See the ADOA Economic Development Resource Guide at <http://www.commerce.state.ak.us/dcra/edrg/EDRG.htm>)

**Available Resources:** The ADOA is well placed to provide leadership to implement NS-8, but will need an increase of professional staffing (2.0 FTE at a minimum) to support this effort.

## Feasibility

It is very feasible and realistic for the State to implement NS-8, through the leadership of ADOA. However, ADOA has limited resources to take on this additional and important task, and would require a minimum of 2.0 FTE additional professional staff. Additional resources would also be needed to support the Alaska Food Coalition process and research. (See Costs section, below).

## Adaptation Benefits and Costs

**Benefits:** The long-term benefit is to reduce the food supply risks for Alaskans, in light of changing climatic conditions in Alaska and other future challenges (e.g., increased costs for food transportation to and within Alaska.) The short-term benefits will be the development of information, a coordinating body, and a strategic plan to accomplish the long-term benefits to include:



- A comprehensive analysis and assessment of Alaska's food needs and vulnerabilities -- important to determining how critical it might be for Alaska to have a policy and subsequent actions promoting local sustainable food sources.
- Vital information for identifying market opportunities for locally-produced agriculture and other locally-produced foods (e.g., seafood).
- Increased economic opportunity for Alaska businesses.
- Improved nutrition, particularly in rural communities (= health benefits). Reduced hunger (by meeting more of Alaska's food need).

**Costs:** Cost of these implementation steps will include:

- Funding for new positions and related support for the ADOA (a minimum of 2 FTE is anticipated).
- Funding for research identified in tasks above (estimated \$100,000) – estimate based on consultation with Dr. Bret Luick, University of Alaska Fairbanks, Cooperative Extension Service regarding implementation of the on-going Alaska Food Cost Survey (See <http://www.uaf.edu/ces/fcs/2008q1data.pdf>)
- Funding to support meetings and work of the Alaska Food Coalition (e.g., travel, staff support, meeting expenses).

Data sources used for estimates and additional references are provided in Attachment 1.

### **TWG Approval and Deliberations**

During the ranking and evaluation by TWG members, this option was the ranked last, with no minority views, due to its lower rankings for significance, benefits and timing. The TWG is in concurrence about the ranking of this option.

**Attachment 1: References**

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