NPS Climate Change Scenario Planning (CCSP) Workshop

Anchorage, Alaska

22-25 February 2011

Executive Summary:

Changing climatic conditions are rapidly impacting environmental, social, and economic conditions in and around National Park System areas in Alaska. With over 50 million acres of parklands to administer, Alaska park managers need to better understand possible climate change trends in order to better manage Arctic, subarctic, and coastal ecosystems and human uses of these areas. National Park Service (NPS) managers have been exploring scenario planning as an alternative approach for science-based decision-making in the face of an uncertain future. Climate change scenarios will help prepare NPS Alaska park managers for impending changes to make informed decisions with least regrets for future outcomes.

NPS and the University of Alaska's Scenarios Network for Alaska Planning (UAF-SNAP) are collaborating on a three-year project that will help Alaska NPS managers, cooperating personnel, and key stakeholders to develop plausible climate change scenarios for all NPS areas in Alaska. Final products will include climate change scenario planning exercises and reports for all the NPS units in Alaska, with efforts organized around each of the four inventory and monitoring (I&M) networks.

The first stage in this project was a climate change scenarios training workshop with NPS contractor Global Business Network (GBN) at which participants learned how to develop scenarios based on nested frameworks of critical uncertainties, and then fleshed out the beginnings of climate change scenarios for two pilot parks, as described below. The workshop was facilitated and led by Jonathan Star of GBN.

The South-West Alaska Network (SWAN) was the first of the NPS regions to be examined in its own scenarios workshop, based on the framework introduced by GBN, and led by a core team who had gone through at least one such training. This network includes Kenai Fjords, Katmai, Lake Clark, Alagnak, and Aniakchak. Participants included representatives from the parks in question, NPS staff from the Anchorage office, SNAP personnel, and key individuals from other agencies, businesses, and communities with a stake in this region. These individuals contributed a wide range of perspectives and expertise to the inputs and outcomes of the workshop.

General findings included predictions of changes in species and their assemblies, disappearance or changes to subsistence resources, loss of cultural resources, risks to infrastructure, and changes in interpretation opportunities. Participants agreed that most or all potential scenarios pointed toward a need for coordinating communication and partnerships with other public and private entities, tuning planning processes to account for multiple possibilities, increasing the fluidity and connections between research and monitoring, and compiling seamless data sets. They further suggested the need for increased monitoring of the PDO, ocean acidification, and ecosystems; science outreach and education to multiple audiences; use of portable, flexible structures rather than permanent infrastructure; and collaborative promotion of energy efficient technologies

Pre-workshop webinars:

Prior to the in-person workshop in Anchorage, participants took part in three webinars, held weekly. The webinars covered the following:

Webinar 1: Introduction to scenarios planning, led by Nancy Fresco of SNAP

Webinar 2: Southwest Alaska climate drivers (see Appendix B), led by Nancy Fresco

Webinar 3: Southwest Alaska climate change effects (Appendix C) led by Bob Winfree, NPS, with input from the group

Further information and shared files:

For further detail about the workshop described in this document, see the summary PowerPoint "SWAN Climate Scenarios" available on line at http://www.snap.uaf.edu/webshared/Nancy%20Fresco/NPS/ Other files available at the above site include:

- *All three webinars, as pdf files*
- *A summary of the August workshop*
- *NPS Maritime and Transitional climate talking points paper*
- *SNAP regional maps showing projected changes in temperature, precipitation, thaw date, freeze date, and season length*
- *Climate drivers tables for SWAN*
- *Climate effects tables for SWAN, including participant input and comments*
- *SNAP climate briefs for Katmai, Kenai Fjords, and Lake Clark*
- *Participant list*
- *Workshop presentations, as pdf files*

Other documents will be added to this site as they are produced.

Workshop Summary:

The workshop began with a plenary session on the fundamentals of scenario planning. Scenarios were defined as hypotheses about the future, rather than predictions. Scenarios are intended to be stories of divergent yet plausible, relevant, and challenging paths that stretch thinking and provide a tool to navigate change. Scenarios development involves five steps: orient, explore, synthesize, act, monitor (Figure 1). In the first step, **orient**, participants considered the questions "What is the strategic issue or decision that we wish to address?" and more specifically, "How can NPS managers best preserve the natural and cultural resources and values within their jurisdiction in the face of climate change?" and, "How will climate change effects impact the landscapes within which management units are placed over the next 50 to 100 years?" In the second step, **explore**, participants discussed what critical forces will affect the future of our issue. Critical forces – in this case, climate drivers -- generally have unusually high impact and unusually high uncertainty. In other words, what changes in climate are most important, most uncertain, and most likely to drive major change in park conditions and NP management?

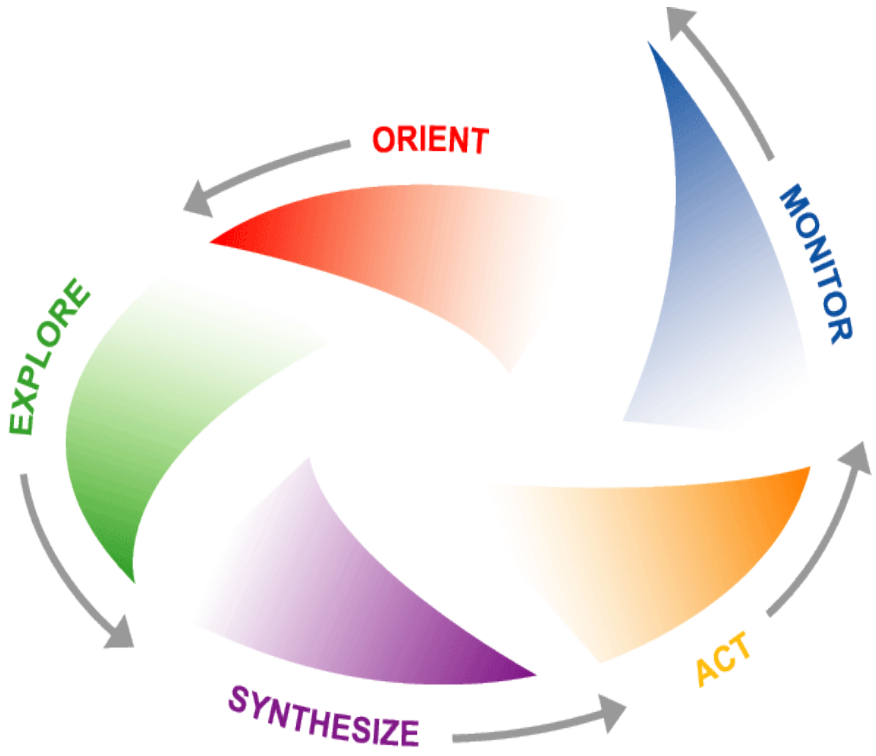

Figure 1. This diagram, provided by GBN, shows the stages in the scenarios building process.

Participants broke into two focus groups to select these critical forces and to develop scenarios: the Coastal group, and the Riverine group. Each group first considered potential critical uncertainties with regard to future climate. The groups used those drivers to develop potential scenarios matrices (Figure 2). From these matrices each group selected one matrix to further develop and build narratives for the future.

In the second stage of the workshop, each group nested their original matrix within a higher level socio-political matrix representing varying degrees of public concern and varying degrees of institutional involvement with climate change (Figure 3). This secondary framework was slightly altered from the framework presented by GBN, which focused more on high-level government responses. The third stage in scenarios building, **synthesize**, asked participants to turn bullet-point scenarios into stories. With sixteen (or more) choices available, each group needed to select only 3-4 to turn into narratives and planning tools. To do this, each group focused on scenarios that were *Relevant, Divergent, Plausible, and Challenging*. They explored each of these, identifying implications or "effects," which were pulled from the effects tables (see Appendix C) and Talking Points papers created prior to the workshop. Each group outlined future actions appropriate to the selected scenarios. Ultimately, each group took the first step towards the fourth scenarios-building stage, **act**, by drafting a list of suggested management decisions from their findings.

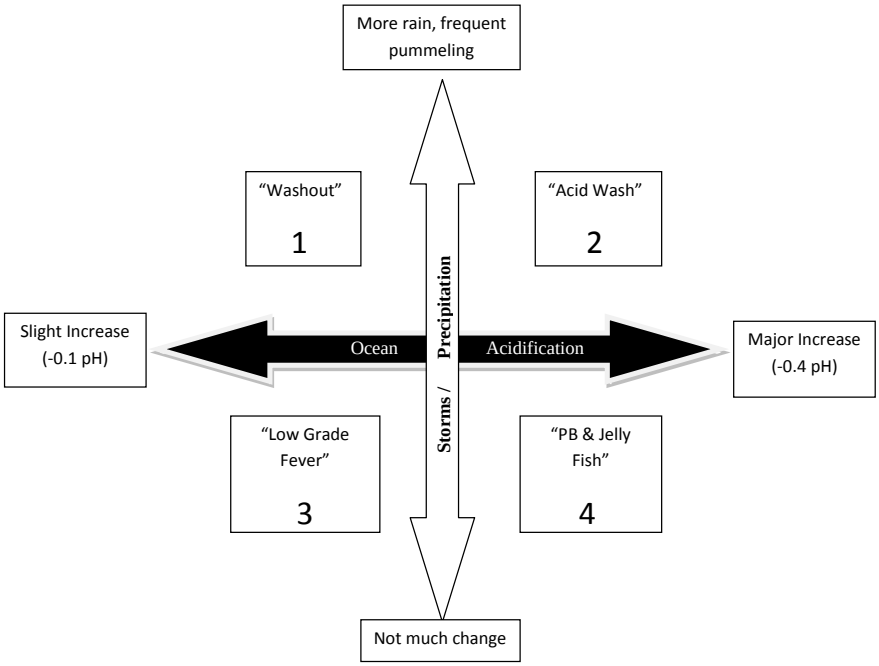

Figure 2. This is an example of a matrix produced by the Coastal group.

The notes below summarize this process for both groups. The associated PowerPoint presenation focuses on the work of the Coastal group.

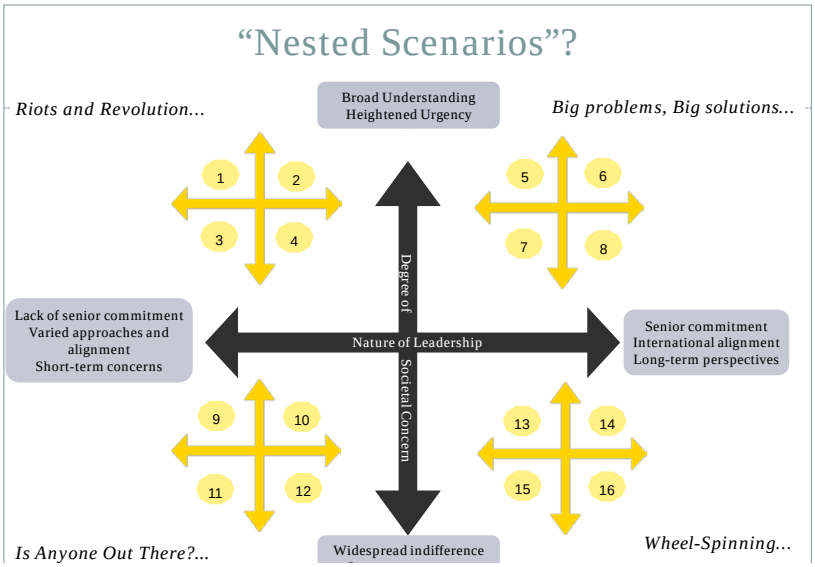

Figure 3. This high-level matrix provided by GBN was used to nest climate scenarios in a socio-political context.

COASTAL GROUP

Driver Selection

Each group started by considering potential drivers in the context of their certainty and importance (Table 1). These critical forces were initially termed "climate drivers," but when this caused confusion regarding cause and effect – given that these forces do not drive climate, but are driven by it – they were renamed "scenario drivers based on climate." For the purposes of scenario planning, drivers that are highly important and highly uncertain are the most crucial. Although this table was initially given the headers "uncertain" and "predetermined" both groups were uncomfortable with those labels. Several participants suggested that both importance and certainty should be viewed on sliding scales, rather than as absolutes.

Table 1. Drivers as rated for certainty and importance by the coastal group.

Climate Drivers (or, "Scenario Drivers based on Climate")	Uncertain	High certainty	Important
Temperature	X		X
Precipitation	X		X
Freeze-up		X	
Length of growing season		X	
Sea Level	X		
Water availability	X		
Relative Humidity	X		
Wind Speed (separate from Aleutian Low)	X (duration)	X (increase)	
PDO	X		
Extreme Events (temperature)		X	
Extreme Events (precipitation)	X	X	
Extreme Events (storms)		X	X

Additional drivers introduced by the group:

- Ocean Acidification
- Salinity (onshore/near shore)
- Aleutian Low
- Extreme Event (wind)
- AK Coastal Current

Selected drivers to explore:

- **Acidification**: slight increase (-.1 pH) → major increase (-.4 pH) **Votes: 10**
- **Temperature**: +2 C by 2050/+3 C by 2100 → +4C by 2050/+6C by 2100. **Votes: 9**
- **Storms**: No/slight change → Frequent (biannual pummeling). **Votes: 6**

- **Precip** (i.e., mean annual precip): same/some local decrease→ more rain, more total water. **Votes: 6**

Climate Scenarios

The Coastal group decided to use the following drivers:

- Ocean Acidifiation
- Combination of storms and precipitation (aka water availability)

These were combined, using endpoints derived from the Drivers Table, to create four quadrants (Figure 4) as described below.

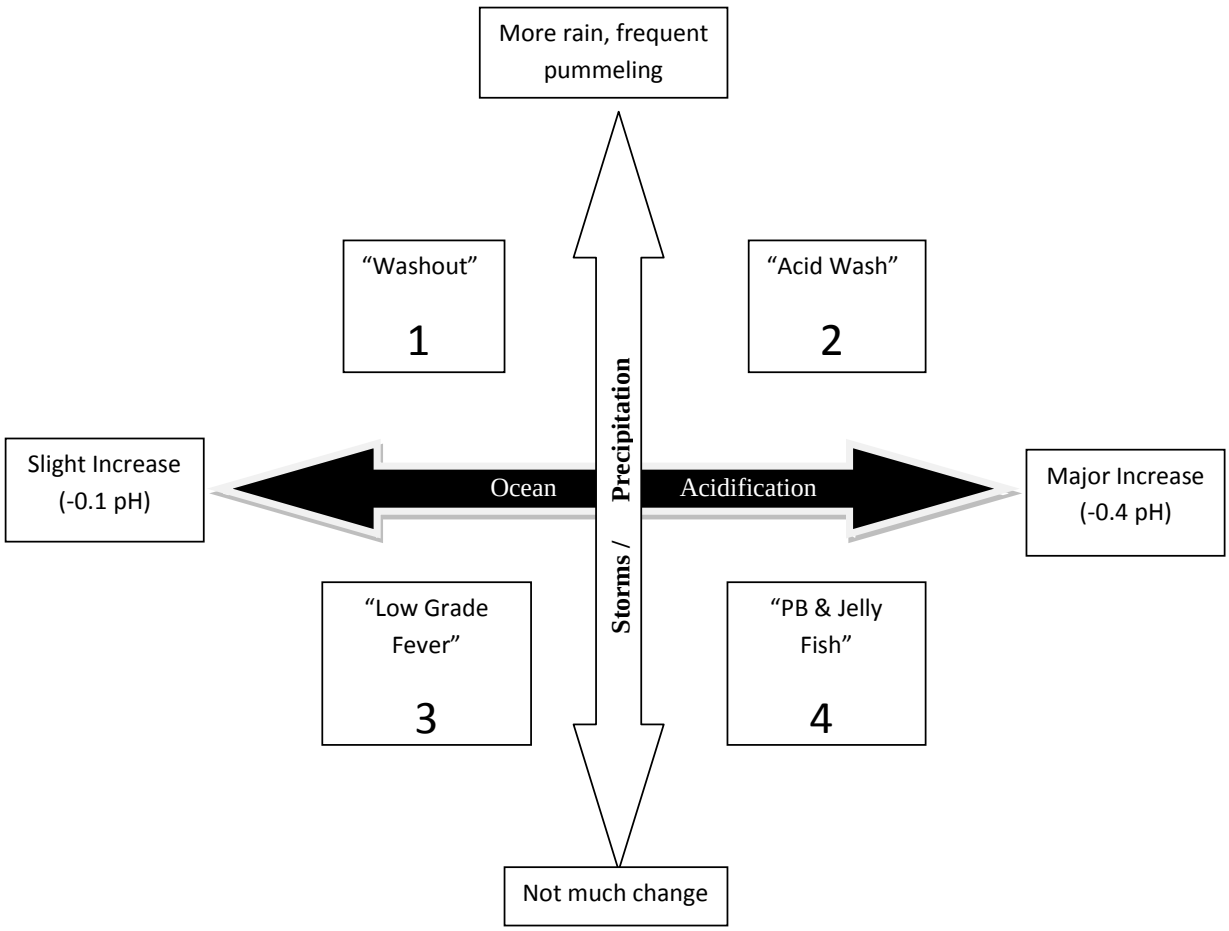

Figure 4. Matrix showing the intersection of changes in storms and precipitation and changes in ocean acidification, as each pertains to coastal regions. Each quadrant yields a set of future conditions which are plausible, challenging, relevant, and divergent. The details of each quadrant are described in the text.

1. **"Washout":**
   - changes to habitat (influx of salt water)
   - trail /road washout
   - regular riparian disturbances
   - more dynamic/changing coast leading to erosion
   - larger floodplain and wetland
   - less appealing destination
   - destruction of cultural resources due to coastal erosion (communities/ facilities)
   - possible need to relocate communities

2. **"Acid Wash"**
   - ecotourism crash
   - removal of biota (fish, birds, sea mammals)
   - spawning areas destroyed
   - subsistence/recreation opportunities changed
   - coastal erosion
   - catastrophic collapse of salmon
     - collapse of fishing (subsistence, sport, commercial)
     - collapse of community cohesion/culture
   - destruction of cultural resources/infrastructure
   - loss of clam/mussel habitat and marine mammals that rely on them
   - requests from communities to intro species for subsistence/sport
   - change in species composition (more deer?)
   - possible need to relocate communities.

3. **"Low Grade Fever" (note: temperature change dominates)**
   - increased drying of upland areas
   - change in habitat (veg./animal composition)
   - biomass may increase or decrease depending on location and veg.
   - increased growing season
   - less soil moisture
   - increased glacial wasting?
   - veg. expansion into deglaciated coastal areas
   - redistribution of terrestrial mammals

4. **"PB & Jelly Fish"**
   - loss of coastal species with exoskeleton →cascading effects for seabird populations and subsistence uses (both egg collecting and salmon)
   - increase in jellyfish
   - changes in fisheries (perhaps from salmon to tuna)

- type of change could shift appeal to visitors
- dramatic habitat change

Nested Scenarios

Each of the four climate scenarios described above can be nested within a larger social/institutional framework, as shown in Figure 5. This framework explores how each story might play out in a world with greater or lesser degrees of societal concern and institutional commitment. Note that this framework was altered slightly from that presented by GBN, in which the horizontal axis was defined as "governmental" rather than "institutional" and was thus interpreted to take place at a national and international scale rather than at a national, state, and local scale. Sixteen scenarios present far too many possible futures. Thus, each group selected three divergent scenarios to pursue further. The three highlighted in red were selected by the Coastal group, and are described below, including their implications, important management actions, and research and information needs.

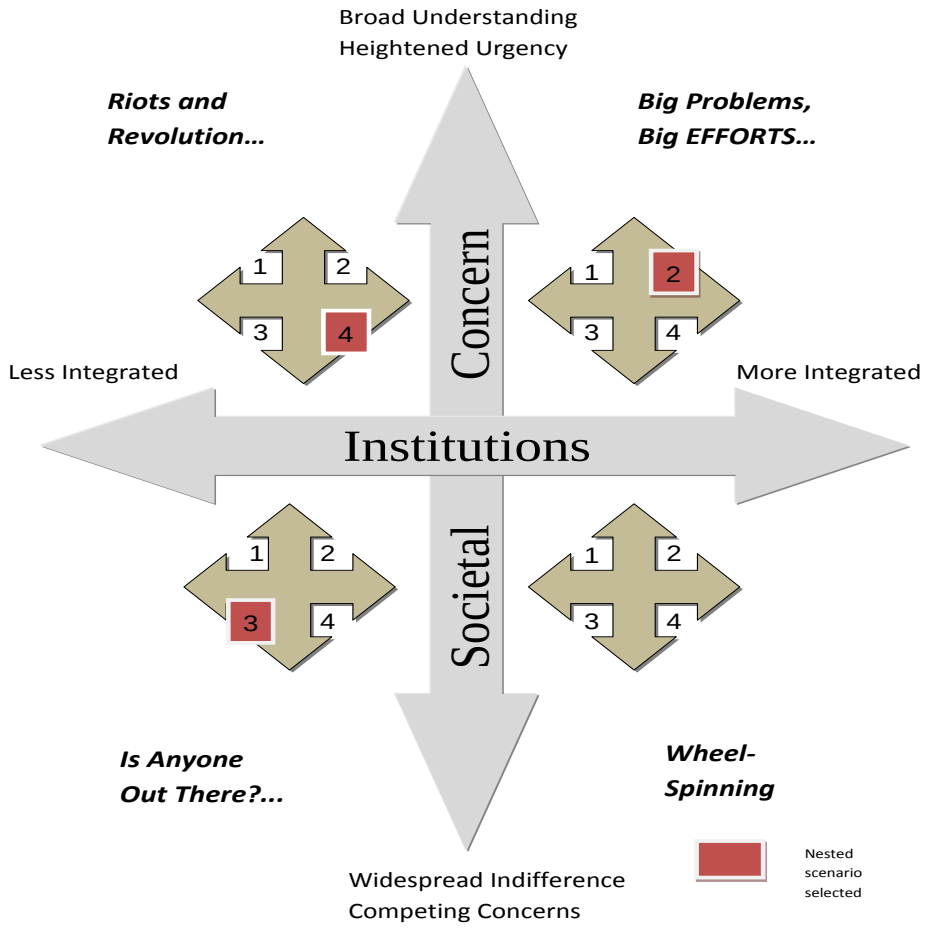

Figure 5. Matrix showing Coastal climate scenarios nested in a social/institutional framework.. Each quadrant yields four linked scenarios; three are selected in red. The details of these three are described in the text.

Nested Scenario 1: PB&J/Riots and Revolution: "Jellyfish Jamboree, Fishing Fiasco"

The Narrative:

A phone conversation between Danny and his grandfather

--Hey Grandpa! How's it going?

--Oh, hi Danny. I miss you! How's life in Anchorage?

--Pretty good... I miss being able to go fishing with you, though -- even if we usually got nothing but jellyfish. Mom and Dad are just happy they have jobs again. I guess people still need interpretive rangers and port workers here.

--It was different twenty years ago, Danny. The fishing... well, you wouldn't believe how good the salmon fishing used to be. There were tons of mussels, and crabs, oysters, clams... you name it. Lots of visitors used to come to see the animals that fed on those fish, too.

--Yeah, that's what you always tell me. Mom and Dad say they used to see bears all the time, and tons of birds, and seals and otters and stuff. How come no one did anything about it when all those animals started to disappear?

--Well... it's hard to explain. We knew it was happening, but it was pretty tough to get the people with the power to do anything about it. They just weren't organized. There was a lot of arguing between the Council, and the Parks people, and the Fish and Wildlife people – all of those government folks. Some of them wanted to help, but they had no funding, and no plan. In the village, folks got depressed when they couldn't go fishing any more, and they felt like they just couldn't maintain their way of life.

--What about you, Grandpa? You're not depressed, are you? You should have moved to Anchorage with us!

--No, no, Danny. I'll stay here. I can't be a fisherman anymore, but there are still a few caribou worth hunting, and there might be a fish farm starting up. Maybe I could work there. Of maybe I can get an interview with that new oil and gas exploration company that is supposed to be moving into town soon. If the government isn't gong to help us, we just have to help ourselves, I guess.

Implications

a. Natural Resources
   - Pest and disease: increased parasite loads → marine mammals, ungulates
   - Plant diseases: veg dieback
   - PSP (paralytic shellfish poisoning) increase
   - Glacial retreat or disappearance
   - Veg shifts with impacts to ungulates: increased black spruce, woody upright veg (alder/willow)
   - Major fisheries and ocean trophic restructuring
     - Failing: salmon, halibut
     - Gaining: unknown
   - Invasives
     - Marine: range extensions from BC/WA of tunicates and green crab
     - Terrestrial: new invasives, rapid proliferation in distribution and diversity. Range extensions.
   - Species of concern: migratory birds and marine mammals

b. Cultural Resources
   - Archaeological site loss
   - Cultural disconnect of sacred or significant sites

c. Socioeconomic
   - Oil and gas development: potential for mining, operational season changes
   - Alcoholism and disease in people with dietary and social changes
   - Decline and conflicts in commercial and sport fisheries/struggles with permitting and regulations for historic and or/emerging fisheries
   - Village population declines w/ loss of subsistence and traditional economic base
   - Reduced interest in marine wildlife viewing
   - Impacts on transportation options (overland, river boat, float plane access) due to loss of snow and ice

d. Facilities
   - Fire safe communities become a priority
   - Changing priorities for facility funding as use patterns change and resource attractions shift location/

e. Communication
   - Communications budgets cut; face-to-face interaction lessens
   - Public demands info; managers unable to meet demands (lack of funding, decentralized info)
   - Visitor (external audience)
     - Lack of changing venues to engage visitors
     - Fewer tour boat visitors
     - Poor access to glaciers

        - Bear viewing moved or diminished

f. Subsistence
    - Loss/decline of traditional hunting species; some replacement species
    - Increase in occurrence of paralytic shellfish poisoning: health impacts to local population
    - Collapse of salmon in both maritime and riverine lifeways
    - Plant/berry harvest: change in timing (phenology) and species
    - Loss of language and traditions as local demographic changes (e.g. marine mammal customs and crafts)

Important Management Actions

- Energy development—renewable village development
- Economic development (local and community ventures and employment)
- Partnerships with NGOs and community groups (LCCs, RACs, development groups, local gov't, native orgs)
- Convert to local resource use
- Streamline public engagement by issues rather than by jurisdiction
- Implement facility standards for green energy use and efficiency
- Provide forums for sharing scientific efforts and expertise

Research and Information Needs

- Develop relevant communication strategies to feed into existing networks; assign accountability
- Resource monitoring: shared responsibility and protocols between communities and agencies
    - Water quality
    - Fish and wildlife populations
    - Invasive species
- Trophic interaction linkages research
- Ocean acidification research
- Facilitation of academic research with clearly communicated needs
- Economic/energy development: emphasize mitigation options and build planning (NEPA) capacity

Nested Scenario 2: Acid Wash/Big Problems, Big Efforts: "Acid Reflex"

The Narratives:

#1: A tect chat between Anna and her boyfriend

Background:

This world in 2030: Steadily declining benthic community has led to loss of charismatic iconic megafauna and a drastic food web shift. Similar to a boom/bust economy, the bottom has dropped out of the fisheries industries as well as tourism. Small towns dependent on these resources, including subsistence communities, are facing major economic challenges. Frequent pummeling from intense storms has wreaked havoc on infrastructure. Concerned communities are coming together with institutions in a concentrated effort to creatively problem-solve the enormous issues they are facing.

Major impacts: Absent and altered fish communities create a ripple effect from subsistence users to birds and mammals. Increased storm surges impact productivity of waterfowl and cause dramatic coastal erosion. Density dependent diseases (prevalence and/or severity of outbreaks), pose greater risks to species survival. Access to roads and trails becomes difficult.

Issues facing management: Subsistence communities asking for introduction of surrogate species and/or increased harvest of remaining species. Agencies are no longer able to meet their mandate of protecting certain species so they are facing a re-working of mission. Utilizing available funding becomes a problem of rapid prioritization and implementation. Interagency plus robust public/private sector integration in the form of a problem-solving task-force aka "ecosystem cooperative". Media and public "support" proves to be overwhelming at times. Increased pressure for natural resource development and activities to replace those lost… managers have to address user conflicts. Marine spatial planning becomes a necessity.

Extended 3G 6:17 AM
Messages
(616) 443-3515
Edit
Call
FaceTime
Add Contact
Feb 24, 2011 6:15 AM
hi! Just got to exit. The road was super nice.
huh? i thought that road was awful... ??
yeah, but they just had some insane storm. i guess the roads are the first thing they fix.
so when's the fishing trip start? you meet w/ the guide?
It's canceled :(apparently lots of bad blood b/w commercial/sport/subsistence here… i don't totally know what's going on
bummer! i'm sorry :(can you go with another company?
well, i went to the permit office to see if i could find out more, but the line was out the door, so i gave up.
but in better news, i think i may have found a job. some nps guy told me about it. "spatial marine planning" ...!!!
details.... ????
Like ocean floor zoning. I guess they need good GIS people asap-apparently they have tons of funding, can't even keep up with the hiring.
cool... i guess. if you want to live in seward.
just got to the lodge. this place is a dump. half the windows are boarded up, and there's not even power.
ok. going to dinner.
don't overspend.
how was it?
i had the salmon. it was so good. a bit of a splurge, sorry!
ANNA! we've talked about this. how much?
68 :/ but i am really sick of jellyfish. sorry!
it's ok. call me before you go to bed.
k... i would, but my phone's almost dead and there's no power.
k. have fun tomorrow at the ECC meeting.

 # 2: The twentieth annual meeting of the Southwest Alaska Collaborative Planning Team

Michael:

Good morning, and welcome everyone, to the twentieth annual meeting of the Southwest Alaska Collaborative Planning Team. Just to remind you, today we have the special privilege of having not only many interested Alaskans and several members of the press covering the event, but also two members of our state legislature toggled in via multi-media holo-screenplex to hear our needs and concerns -- welcome, Nace Ayer and Cash Baggs -- and our very own Alaska State Legislator, Newt Eymes.

As most of you know, my name is Michael Shepherd. I'm honored to be hosting this event. I've been part of this process from the start, and in the past 20 years with the Park Service I've really earned all these gray hairs. We've seen a lot of changes in two decades, as we've struggled to adjust to the acidification of our coastal waters and the heavy rain and storms that have been pummeling our coastline, and although we've put in a lot of work during that time, there's still a lot to be done.

With that, let's have a quick round of introductions. Let us know who you are, and just a few sentences about why you're joining us here today. If we could start with our honored guests?

Bud

I'm Representative Newt Eymes, and I'm happy to report that I'm working on a bill that would help coastal communities all over the US, and particularly here in Alaska. I'd like to know how Congress can help aid your communities in the shift away from salmon fisheries -- which I know are steeply declining -- as the basis for both your subsistence economies and your cash economies. We're working to help you create new sources of jobs and revenue such as your wind farm – which I hear has been cranking out the power -- and your new hydro plants. We're also hoping to help out in your new agricultural sector (I sure do love a good rhubarb pie).

Chuck

Nace Ayer here. I'm working for you guys down here in Juneau, and let me tell you, those of us in the legislature aren't going to want to hear a lot of sob stories and funding requests. All I hear from your area is complaints: "The salmon are declining, the shellfish are dying off, our historic sites have washed out, the glaciers aren't where they used to be, we have flooding and erosion and the park visitors aren't coming any more." You guys have been doing a lot of planning and a lot of science-y research-y stuff for twenty years, working with those university folks, the co-management people, the Feds, and even the greenies. We want to know where it's gotten you.

Fritz

Hi there, glad to be toggled in. I'm Cash Baggs. If I could beg to differ with my colleague Nace, I've already been hearing good things about your progress – for example, the green energy initiative in which the Park Service shares all the newest conservation innovations with neighboring

communities, and has hooked six villages into the zero-carbon grid. I think there are plenty of projects that the folks down here in Juneau would be interested in, during our upcoming budget cycle.

Michael

Thank you. And now let's hear from our team members. We have a few here in the room, and others toggled in. Perhaps you could each let us know a bit about what working groups and projects you've been involved in, and what you're hoping to see accomplished in the coming year?

Brooke

Thanks Michael. I'm Annie Molls, director of the Charismatic Megafauna Tour Company. Well, we've had some tough times with all the rainy weather, and we've had to cancel our Cute Critters tour – there just aren't frequent enough viewings of sea otters and seals to keep the visitors happy. But the new moveable floating dock that NPS put in is great – totally storm-proof. It means that we can still get our boats out for our ocean tours. We're planning a new one called See Jellyfish Before You Die. We could really use some help from the agency folks in helping bolster that with your education and interpretation programs. We'd also looking forward to the report from the interagency monitoring team and the researchers from UA about what species are coming in, and what is likely to show up in the next few years, so we can gear our new tours towards those species.

Bill

Good morning. I'm Bill Ding, from NPS. I've been working on the new infrastructure developments at the Park – the moveable glacier kiosks, the floating dock, the foldable signs. I want to hear how those are working out for our visitors and for our partners in the tourism industry. We've got some ideas for ways to keep our bridges and roads from washing out, but we may need some funding to make that happen, so I'm glad to have our representatives toggled on. [Even you, Nace Ayer]

Sue

My name is Olive Ryteer, and I'm from the village of Pertinent. We've appreciated the help we've been getting from the new green energy plan, and the cooperative management agreement is really helping, but we still feel like our way of life is slipping away from us. The salmon fishing has been terrible for years now, and the caribou hunting is no good either. Folks are getting depressed, and that leads to all kinds of troubles. We're worried that if more folks move away, we may lose our school. We'd like to see more help finding us jobs, and more information on new ways to maintain our subsistence lifestyle.

Anna

Hi there. I'm Anna Collagist, from the University of Alaska. I've been part of the interagency monitoring team. With a gaggle of grad students slaving away in partnership with the folks from NPS, USFWS, and NOAA, we've been doing near-shore and offshore surveys of fish, shellfish, and bird populations, as well as assessing ocean pH and availability of food sources at all trophic levels. I'll be presenting some results that I think will be interesting to you, Annie. It looks like a major trophic shift is

going on, and if you can point out some new species as well as some old species to your visitors, you could create a brand new Watch Climate Change As it Happens tour.

Nancy

Hi, I'm Raina Snow from the University of Alaska. I've been working with all my agency, business, and non-profit colleagues from the Climate Working Group to improve our climate modeling techniques, and to try to get a handle on what we can expect from the PDO, ENSO, and all the other acronyms.

Michael

Thank you, planning team. Well, it sounds like we have our work cut out for us, so let's get going on today's work session!

Implications

a. Natural Resources
   - benthic community decline
   - food web shift
   - local extinction, mass redistribution
   - coastal erosion
   - extremely moist conditions
   - unknown glacial dynamics

b. Cultural Resources
   - flooding and wave action → loss of known historic sites
   - loss of historic record (undiscovered sites)

c. Socioeconomic
   - Questions of prioritization re: private vs. public aid
   - livelihoods stressed, leading to industry shift (tourism, fishing)
   - natural resource development—need for energy and jobs
   - community relocation?

d. Facilities
   - Increased risk of flood/mudslide/erosion effects on structures
   - access to roads and trails more frequently compromised
   - potential effects on coastal communities and way of life(bridges/roads/river swell)
   - private ecotourism accessibility (inholdings, lodges, docks, etc) compromised

e. Communication
   - media/public involved at every step
   - need for a highly evolved communication network
   - potential misaligned message delivery

f. Subsistence
   - Loss of fish, game, "revenue" (community asset)
   - Shift in way of life

- Search for surrogates

Important Management Actions

- Mission Statement evolution
- Removal of artificial barrier between research/monitoring/management loop
- Fostering public/private partnerships (e.g. ecosystem cooperatives/LCCs)
- Protecting and providing access to sacred cultural sites
- Comprehensive risk assessment for roads, bridges, trails, structures
- Temporary/portable facilities
- Species specific mitigation planning (economic driver species)
- Foster transitional community coping mechanisms
- Synchronize public/private education and outreach

Research and Information Needs

- Overall, more robust monitoring and research
- Acidification research
- Alternative energy/ alternative facilities research
- Exploratory husbandry
- Glacial monitoring
- Robust benthic, fish, seabird, mammal monitoring
- Mapping of cultural resources
- Coastal engineering

Other Issues

- Increased capacity re: acquisition and grants
- Develop disaster response capacities (e.g. evacuation plans, interagency coordination)

Nested Scenario 3: Low Grade Fever (Cold PDO), Is Anyone Out There: "Is There a Doctor in the House?"

The Narratives:

#1: Low-grade Fever

Low magnitude change (minimal increases in ocean acidity, precipitation and storm activity, and temperature; temperature increase ameliorated by cool-phase PDO, yet still measurable; temperature effects drive biological and physical responses) was addressed within an environment of low public concern and low institutional commitment

Ocean acidification and increased precipitation and storm activity are primary drivers. Temperature continues to rise at a rate of approximately +2 °C over the next half century. A cool-phase (-) PDO is in effect until approximately 2030, at which time a shift to warmer, drier (+PDO) conditions is expected. The increase in mean annual temperature has been ameliorated by the cool-phase (-) PDO.

Summer and winter temperatures have been ≤ average over the past 20 years. Precipitation has been highly variable, with a few years of above-average snowfall and other years characterized by cold, dry conditions. Rates of glacial recession have decreased (e.g., at the termini), but thinning continues. Relatively low rates of change (temperature) and high variability (precipitation) result in barely perceptible climatic changes in southwest AK; i.e., climate conditions seem to be relatively stable.

Public perceptions of climate change are as follows: (1) Changes are slight enough to be perceived by the public as benign or even positive; (2) there is low media coverage of climate change, at least in southwest AK, due to lack of dramatic environmental changes, and this contributes to public complacency. Given the lack of change, those who question climate change gain credibility. There is little public pressure on politicians to deal with climate change issues in SW Alaska, and there have been no climate-related emergencies. Conditions remain stable, familiar.

Because of this perceived lack of change, climate change funding has dried up, at least for southern AK. There is still concern within the agencies about the effects of climate, particularly following the imminent shift in PDO (- to +); however, convincing the public that climate effects may be serious has become increasingly difficult. Large increases in temperature may be evident at higher latitudes, in contrast to the more subtle changes occurring in southwest AK, and thus may divert political and economic support away from SW AK. Meanwhile, the US carbon footprint (GHGs) has increased, although there has been some progress in clean/alternative energy, including increased reliance on natural gas. An aging population has put increasing pressure on the economy, and the national debt, health care, social security

and other funding priorities have superseded climate change in terms of importance in the public view. Agency programs, including climate change funding, have been cut.

Major impacts on the bioregion include increased shrub cover; increased biomass, including woody biomass, and increased C uptake and sequestration. There are potential increases in drought stress in upland vegetation, including forests, as well as continued insect damage and/or forest dieback. However, ecosystem changes have been incremental, and mostly related to succession. A cool-phase PDO may result in reduced salmon runs, but potentially increased productivity in shellfish (shrimp/crab). Moose may benefit from increased shrub cover (willow cover), whereas caribou habitat will decline. With increased warming and lower snowpack depths at low elevations, deer may expand into new habitat. Sea lion and harbor seal populations, which may have bottomed out by 2010-2020 may see a slow recovery going into 2030. While fisheries resources diminish elsewhere in the world, the AK fishery (SW Alaska) becomes ever more valuable.

Management issues are driven in part by public perception. Convincing the public of the likelihood of sudden warming associated with a shift to warm-phase (+) PDO remains difficult. Agencies are faced with a lack of funding to educate public and/or adapt to or mitigate change. Agency mandates make rapid response to climate-related issues unlikely/difficult, and there is little impetus for a change in agency structure. Pressures from external communities are relatively low, but still some predator control issues remain. A variable environment (e.g., variable snowpack & freeze dates) results in an uncertain regulatory climate. Shifts in the timing of hunting season are needed annually, and yet there is resistance on the part of the leadership (agency) to remain responsive. The baseline that agencies rely on to set hunting seasons is highly variable, all over the map. Some interagency coordination exists at the landscape level (LCCs), although NPS will have some of the last habitat that will support species that are losing out to climate. As a result, NPS will be asked/expected to act as a biodiversity reserve. Biological stresses (e.g., drought stress, forest dieback, increasing fuel loads) and pressure from land managers and clients to mitigate these stresses will drive management decisions. Competition for resources continues among subsistence, sport, and commercial harvest users.

Other areas of AK may have changed more than southwest; focus on climate change may be on Arctic/Interior, and SW AK may be lost in the shadows. As a result, some resources previously allocated to climate change adaptation/mitigation in SW Alaska may be reallocated to the Arctic/Interior. These factors lead to a shift in priorities at the regional and national levels, and eroding budgets (no budget increases)

#2: The Doctor's Slide Show

Dr. Deunough Harm, a retired physician, adjusts the focus on the image of the massive brown bear he photographed in Katmai last summer. It takes up the entire screen. He is addressing a group of his friends and colleagues, most of them who have spent their careers in the biological sciences, at an informal gathering in his home in Annapolis, MD. He spent two weeks traveling in southwest Alaska last August, fitting in a glacier tour (KEFJ), a bear-viewing trip to Brooks Camp (KATM), and a trout-fishing trip in LACL. He visited southwest Alaska because he views it as one of the few relatively intact, biologically diverse ecosystems remaining in 2030, and he avoided a visit to Denali and other Interior and Arctic locations in Alaska because fires and smoke make these places miserable and unhealthy. The message he heard repeatedly from park interpreters, however, was one of impending, and potentially very significant, environmental change. Here is an excerpt from his travelogue:

'We went on one of those glacier tours, and the glaciers were spectacular. We didn't see many calving glaciers, apparently because most of the tidewater glaciers have receded onto land in the last several decades. The park rangers talked a lot about climate change, but when you see the size of these glaciers with your own eyes, it's hard to believe the bleak predictions. In fact, the ranger admitted that one of the glaciers we saw had advanced some in the last couple of years. I didn't really understand why a glacier could be increasing in size if the world's in climate change crisis. '

'We ate seafood, mostly salmon, almost every night, but it was more expensive than I'd expected. I thought being this close to the source would make it cheaper, but I guess that wild fish is expensive, no matter where you go. It was a lot better than the farmed stuff we eat here, and we were on vacation, after all.'

'Speaking of fish, the bears didn't seem to be having any problems, although the ranger at Brooks Camp said that there were fewer bears now than when the salmon runs were really big. I was glad that we reserved our bear viewing trip ahead of time. I saw people getting turned away, since many of the tours were sold out. We flew to a beach in Katmai from Homer and watched bears digging for clams in the mudflats. Our guide said that if the ocean continues to acidify, the bears and other wildlife may have trouble finding clams in the future. Our pilot was a native guy who said he had moved his family to Homer because it was too expensive to live in the village anymore.'

'If the park rangers and guide are right, I suggest that everyone visit Alaska soon. They say the kind of big changes we're already seeing on the eastern seaboard, like the breakup of Assateague Island into Assateague Archipelago, will be hitting Alaska soon due to a shift in the PDO.'

His friend, Dr. C. N. Salmon, a retired fisheries biologist from Seattle, leaned forward. 'Are you talking about the Pacific Decadal Oscillation? We used to see strong salmon runs in warm-PDO years in

Alaska. Nobody really knows what causes the PDO, but it tends to run on 20 to 30 year cycles. If they're expecting a shift from cool- to warm-phase PDO conditions, that change alone could really strengthen the already low-level warming that everyone else is dealing with. I would expect that the glaciers in southern Alaska will start receding rapidly again!'

(From a societal impacts perspective, recognition of PDO is important because it shows that "normal" climate conditions can vary over time periods comparable to the length of a human's career or generation.)

Implications

a. Natural Resources
   - Vegetation changes
     - Shrubs increase
     - Forest fuel loads increase
     - Animal movements impeded
     - Moose increase
     - Caribou decrease
   - Fisheries
     - Shellfish increase
     - Salmon decrease

b. Cultural Resources
   - Living cultural resources and traditional lifeways around subsistence fishing and hunting supported/enabled until 2030.

c. Socioeconomic
   - Climate change mitigation and adaptation funds sent to other areas w/ more pronounced change
   - Competition for fish and wildlife intensifies between subsistence/commercial/sport users
   - Eroding budgets lead to shifts in priority
   - Alaska resources increase in value (e.g. fish, clean water, clean air, energy resources)→visitor destination

d. Facilities
   - Visitation increase →need for visitors facilities (e.g. trails, lodging, VCs, access, marinas)
   - Replace old or build new facilities with new sustainable technologies
   - Energy resources development: pressure to develop oil and gas (Bristol Bay), coal (Chitina), wind farms, tidal facilities, geothermal, hydro.

e. Communication
   - Climate change hard to sell in SWAN area, but rest of world suffering
   - New communications technologies emerge, presenting challenges and opportunities

- Public disbelieving re: climate change in SWAN
- Scenario planning becomes widely used

f. Subsistence
    - Subsistence resources remain available until 2030, but rural lifestyles are more expensive and less viable.
    - Traditional lifeways around subsistence fishing and hunting supported/enabled until 2030.

Important Management Actions

- Reach out for interagency cooperation to effectively communicate PDO oscillations and imminent climate change.
- Advocate for more flexible and responsive management of fish and wildlife
- Develop flexible, portable infrastructure
- Model desired green behaviors
- Due to shrinking budgets, use partnerships to address management needs

Research and Information Needs

- Thorough ethnographic studies of subsistence lifeways
- Ecosystem mapping to identify critical near shore areas
- Monitor elements of PDO shift (e.g. air and ocean temps, precip, fisheries, benthos, coastal wildlife)

Common No Regrets Actions

- Collaborate with researchers monitoring programs to track changes in PDO and ocean acidification
- Model, collaborate and promote energy efficient technologies
- Increase fluidity and connections between research and monitoring
- Conduct coastal/marine ecosystem monitoring
- Identify and cooperate with private/public entities for partnerships
- Portable, flexible structures
- Re-imagine how institutions can work together to solve common problems.

RIVERINE GROUP

Table 2. Drivers as rated for certainty and importance by the Riverine group.

	Uncertain	High Certainty	Important
Temperature		X	X
Precipitation	X		X
Freeze-up date		X	
Length of ice free season (rivers/lakes)		X	
River/Stream temperatures		X	
Length of growing season		X	
Water availability (stream flow)		X	
Relative Humidity	X		
Wind Speed		X	
PDO	X		
Extreme Events (temperature)		X	
Extreme Events (precipitation)	X		
Extreme Events (storms)	X		
Soil Moisture			

Additional drivers introduced by the group:

- Volcanic eruptions (local acidification)
- PDO/AO/Jetstream
- Variable Stream Flow

Selected drivers to explore:

- Precipitation (variability)
- Temperature (variability)
- Thaw days (more/less)
- PDO (warm/cold phase)

Group decided to use:

- Thaw days (more/less)
- Precipitation (low/high variation)
- PDO would be included with Thaw days looking at cold phase PDO with less Thaw days and warm phase PDO with more Thaw days to push the extreme possibilities.

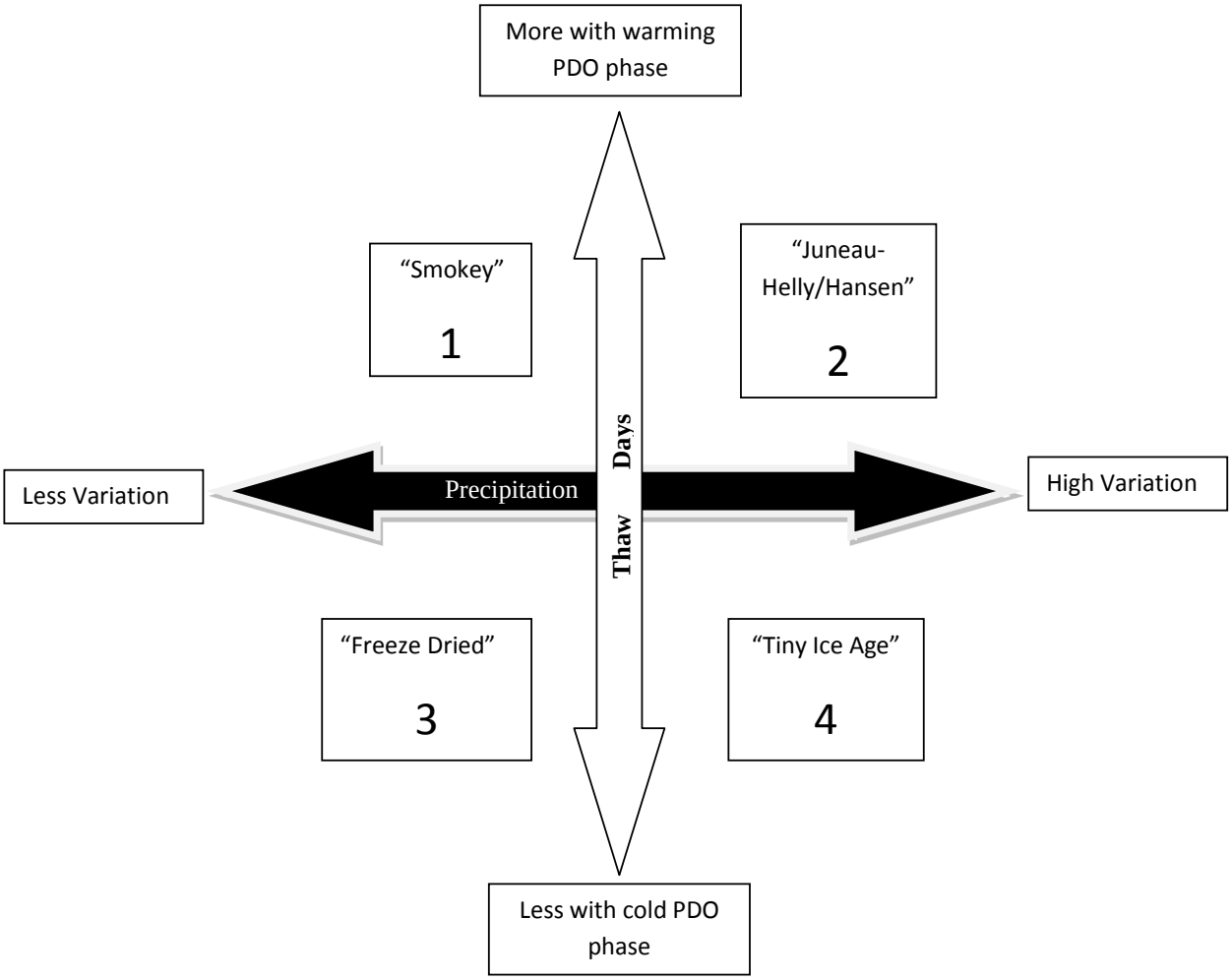

Figure 6. Matrix showing the intersection of changes thaw days (summer season) and precipitation, as each pertains to inland (riverine) regions. Each quadrant yields a set of future conditions which are plausible, challenging, relevant, and divergent. The details of each quadrant are described in the text.

1. "Smokey"

- Drought stressed vegetation
- Increase in disease/pests
- Longer growing season
- Maximum shrub expansion (less overland access)
- Long-term reduction stream flow
- Initially higher stream flows from seasonal glacial melt
- Reduction/loss glaciers
- Increased fire on landscape

- 40% reduction in salmon fry due to smaller fry.
- KATM Brooks Camp barge requires glacier melt for high lake levels…this world would minimize access with warming and less precipitation.
- Less biting insects
- Decrease in waterfowl
- Exposure of cultural resources
- Lowering of groundwater tables.
- More fugitive dust with Pebble Mine
- Decrease in stream flow
- Increase competition in water.
- Decrease in subsistence (difficult winter travel)

2. "Juneau/Helly Hansen"

- Increase in rain on snow events (increased flooding events)
- Thicker vegetation
- Increase erosion
- Increase lightening
- Increase evaporation (soil drying)
- More berries (good habitat for bear, moose, caribou)
- Decrease in alpine tundra
- Arrival of black bear
- Increase in waterfowl
- Increase in park infrastructure impacts
- Decrease in backcountry visitation (increase in rain, reduction of flying days)
- Increase in hurricanes
- Increase rain on snow events (flooding)…decrease in salmon
- Increase difficulty in controlling contamination (runoff)
- Increase in avalanches

3. "Freeze Dried"

- Permafrost persists
- Decrease in productivity (plant, berries)…impact on wildlife
- Overland access continues
- Competition of water resources (mining, communities)
- Facilities/infrastructure stable
- Slow retreat of tundra ponds
- Extend range of Dahl Sheep
- Lichens stable, supporting caribou
- High wind potential
- Brown bear decrease

4. "Tiny Ice Age"

- Increase damage risk in cultural resources/infrastructure
- Increase bear activity for Brooks Camp (KATM)
- Decrease in ungulates
- Decrease in bark beetle and fire
- KATM Brooks Camp barge has adequate Naknek Lake water depth to access
- Stable glaciers
- High summer stream flows
- Increase in winter access.

Divergence summary:

1. "Smokey"

- Increase fire potential (converging non-fire systems to fire)
- Conversion of ponds, riparian systems/structure to new ecosystems
- Reduction in glaciers
- Significant restriction to winter access
- Broad landscape-level habitat/ecosystem shifts/changes

2. "Juneau/Helly Hansen"

- Wildlife generally doing well (caribou may be impacted)
- Extreme events/flooding may impact (storms, mudslides, avalanches)
- High threats to infrastructure
- Impacts to visitor use access

3. "Freeze Dried"

- At extreme may impact salmon fry (decrease)
- Limited vegetation growth
- Significant economic cost-of-living issues

4. "Tiny Ice Age"

- Glaciers stable/growing
- Winter travel (access) good
- Pest/disease moderate
- Extreme events may impact salmon

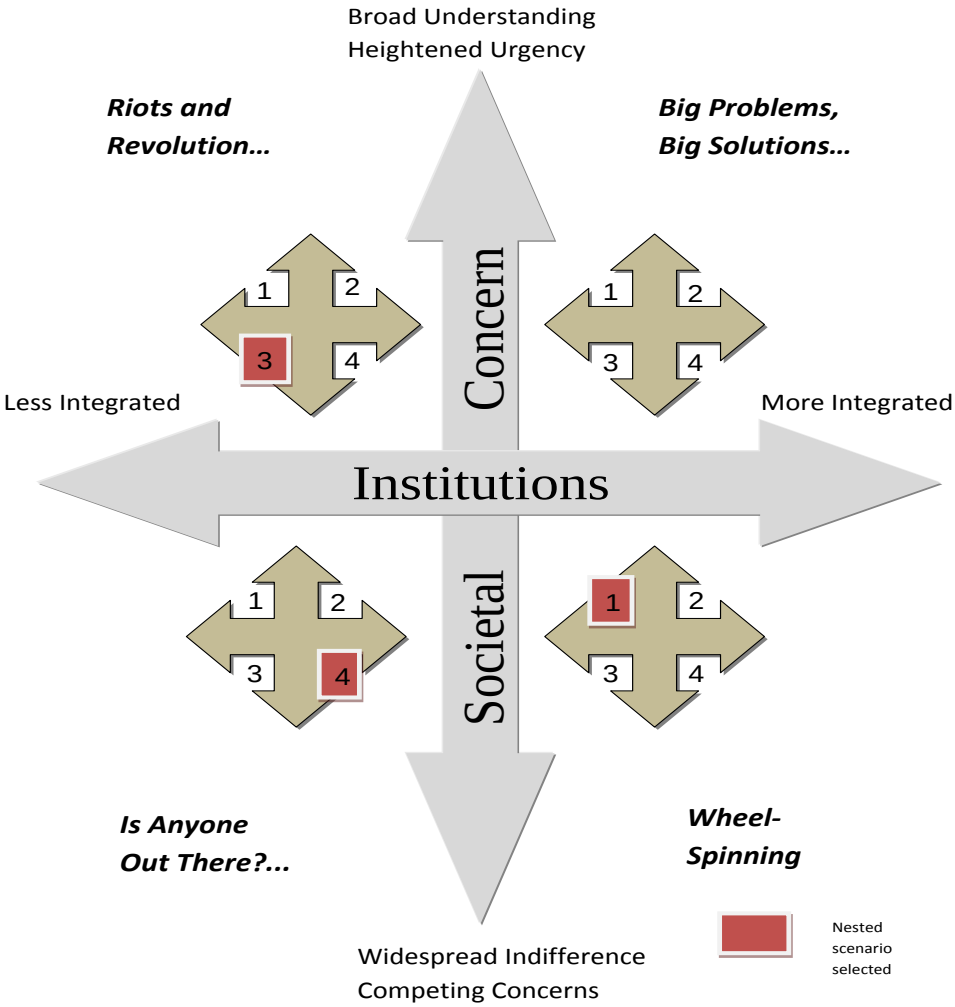

Figure 7. Matrix showing Riverine climate scenarios nested in a social/institutional framework. Each quadrant yields four linked scenarios; three are selected in red. The details of these three are described in the text.

Nested Scenario 1: Smokey/Wheel Spinning

The Narrative:

1: An Ecologist's 30-Year Perspective

The day started off like so many in the past, checking the weather and prepping equipment. The winds were finally favorable for a day on the lake. As we motored outside of Hardenburg Bay, a smoky haze obscured the mountain tops to the west and a fourth fire of the season. I wondered if I'd ever see the mountain tops before field season ended. As we boated up towards the head of Lake Clark I looked south at Tanalian Mountain and noted the brown patches appeared larger this summer compared to last year. I recall my first trips to Lake Clark and observing a green jungle of alder dominating the lower mountains. Now stem rust, a new disease to Alaskan flora, is wiping out large patches of alder. "At least that green wave stopped spreading up the mountain side," I remarked to my crew mate. Down low next to the lake the birch displayed a hint of autumn already. We were a good two months away from peak autumn colors but the signs of drought stress were obvious.

After a half hour boat ride we reached our first sampling site at the head of the lake. The upper lake is unusually quiet these days. I remarked how years ago the sound of rushing water would drown out one's thoughts as waterfalls cascaded off the mountains. But with the glaciers gone up top, the waterfalls are a mere trickle of their former self. Another slurry bomber passed high overhead. As we started our sampling sequence I lowered a Secchi disc over the side of the boat to check water clarity. "Ten meters" I called out. "Definitely not the turbid waters I remember earlier in my career," I thought. The Tlikakila River, once the primary source of glacial water flowing into Lake Clark, now runs crystal clear and the upper lake resembles the deep blue waters of Kijik Lake. Taking away a watershed's glaciers is like putting a tourniquet on the river. Greatly reduced flows and sediment loads down this Wild River have reduced a once braided network of constantly shifting river channels into a single canal wadeable throughout most of summer. The once vast river delta that was such an obstacle for boaters in my younger days is now stabilized and overgrown by the forest of 15' spruce and birch.

Not long into our second sampling site the day's first boat load of anglers passed by making their way to the Tlikakila. The clear stable waters now support a popular rainbow trout fishery. No one in their right mind would have fished that river twenty years ago. After completing our sampling we decided to make our way up to the old river delta and take a quick count of the sockeye salmon staging along the lakeshore. As we strolled down the beach schools of sockeye stirred about, most fish were crimson red with a few blush fish mixed in. In 2007 I visted my first fish camp just down river from Nondalton. Back

then the sockeye run was peaking in the Newhalen River around July 20th. But from the looks of these fish most have been here at least a month already. Now four guide boats were beached just up the shoreline. Lake Clark—a rainbow trout destination, it was starting to look like some of the more popular Katmai fisheries of yesteryear. I recall when guides departed Port Alsworth via float plane early each morning, transporting clients to fish the rainbow trout waters around Lake Iliamna. Now they sleep in and take a boat ride up-lake. We stopped and talked with one of the guides. I wanted to know if he had spotted any sockeye spawning activity upriver. "We're a week or two early," he remarked. The greatly diminished flows and clear waters of the Tlikakila River sure made it easier for bears to fish. It used to be the Tlikakila River held the latest spawning population of sockeye salmon in Bristol Bay with peak spawning activity occurring in October, sometimes into November, after the glaciers stopped melting and the river cleared up. It was the best area to find a heavy concentration of brown bears late into the fall as they took advantage of a reliable food source just before hibernation. But now the Tlikakila sockeye are just like any other population in the area, spawning in early August even late July in a hot year, and the bears are forced to forage for berries in autumn as most sockeye are decaying when the heavy frosts hit in late September.

As we made our way back to headquarters the smoky haze dropped in low over Port Alsworth; given the wind direction I was certain another fire had popped up following last night's storm. State fire crews and Park officials were hosting a public meeting that night to lay out the Park's plan for the summer fire season. Regardless of the plan I was pretty sure I knew what the public response would be—no more smoke. Guess I can't blame them, why live in a place like this if you can't see the mountains? Despite the reality of the situation that this summer's fire season was becoming the norm, the public remained indifferent or unwilling to adapt. Biologist tried to put a positive spin on the situation: "Just think of the moose habitat this will create in ten years." But that rationale fell on deaf ears. Many long time residents wanted to bring back the good ol' days when the Mulchatna caribou herd wandered through the park. But the Mulchatna herd resides mostly north of Bethel these days in the drying Y-K Delta area. I doubted Lake Clark would ever see caribou again as most of the park's tundra was shifting to a boreal forest ecosystem. Even in my short time in the park, the sockeye runs have undergone many changes. But, they still return every eyar, at least for now. When the salmon stop returning the people will take notice. I hope we're ready to deal with that possibility when the time comes. As I started pondering that scenario I couldn't help but count down my days to retirement.

#2 Nondalton village council letter

Name: Rick Delkitte III, Chief DATE 2/1/2030

Organization: Nondalton Village Council

Address: Gen. Del., Nondalton, Alaska 99563

Phone: (907) 781-2218 Fax: (907) 781-2119

This proposal suggests a change to (check all that apply):

_ Harvest season X Methods and means of access

_ Harvest limit _ Customary and traditional use determinations

What regulation do you wish to change?

This proposal affects mechanized access to traditional subsistence hunting and fishing areas in GMU 9(B) within Lake Clark National Preserve.

Current Regulation:

Unit 9(B)—Lake Clark National Park and Preserve—ORV use is prohibited except on trails designated through special regulations in accordance with 36 CFR 4.10.

New Authorization:

The Nondalton Village Council proposes the designation of the Long Lake trail, a portion of which crosses Lake Clark National Preserve, for necessary subsistence purposes.

Justification:

Local commercial, sport and subsistence salmon seasons have been closed for 3 years due to drought, low water and persistant poor returns. Few moose and caribou are seen locally due to decades of localized harvest of low density ungulate populations. Poor berry crops and fewer small game and waterfowl have made subsistence more difficult. Residents are forced to range further from the village, but boat travel is hampered due to extremely low water in Sixmile Lake and the Chulitna River - Nondalton's primary method of summer access for almost a century. Due to increased wildfire in the last 20 years, moose have done better further to the north, but we have no efficient means to get to these areas except by overland travel. Air transport is cost prohibitive, and in some areas, unlawful. The shortest route is via the Long Lake trail, which would save considerable fuel expense for unemployed families. We need this access to provide the

meat we can neither afford, nor fish for while salmon seasons are closed.

Residents of Nondalton have used the Long Lake trail for centuries, and for the last 80 years, for winter mechanized snow machine travel. While the trail has never before been used for summer/fall overland travel by mechanized means, the wetlands the trail once traversed have completely dried and no longer dominate the region as they once did. It is an established trail that can be interpreted by 36 CFR 4.10 to be eligible for designation and we request it be so designated.

Should this request be approved?

This proposal is intended to preserve Title VIII opportunity as required by ANILCA.
The trail can be designated through special regulation following 36 CFR 4.10.

<u>Implications</u>

a. Natural Resources
    - Physical
        - Hydrological cycle changes
        - Reduction in available water
        - PDO phase (which phase the PDO is in is an implication)
    - Reduction in available water
    - PDO phase
b. Biological
        - Major biome shift
        - Increase in fire, increase in pests/disease
        - Pond Conversion to uplands
        - ESA Issues Species management concerns
c. Cultural Resources
        - Exposure of artifacts
d. Socio/Economic
        - Conservation of F&W for subsistence & recreation
        - Access and transportation issues
e. Facilities
        - Infrastructure risks, fire protection costs
        - Melting permafrost, damage to infrastructure (buildings)
f. Interpretation and Education
        - Maintaining relevant agency in-reach efforts
        - Public/visitor education costs and challenges
        - Greater need for public application of ecosystem services

g. Protection
    - Fire management, public safety risks
    - F&W regulations, harvest quotas, seasons

<u>Important Management Actions</u>

- Re-evaluation of Agency Mission
- Environment Planning-What is purpose of land.
- Secure water rights and Implement water conservation. Include anticipate increase in fire proofing, natural resource engineering.
- Increase in fire proofing
- Natural Resource Engineering
- More monitoring data.

Nested Scenario 2: Tiny Iceage/Is Anyone out there?

The Narrative:

Troy Hamon at KATM

Bear activity in southwest Alaska is still noteworthy in the year 2030, a remarkable piece of stability in the middle of a world that seems to be losing its grip on normal. The southwest coast of Alaska has been subject to a series of cooler and wetter years that defy the worldwide climate shift that has manifested itself through the loss of barrier islands on the Atlantic Coast of the nation, as well as a prolonged drought in the desert southwest. The apparent anomaly, due to local effects of a cooling phase in the Pacific Decadal Oscillation, has largely escaped notice because so many other things are going so wrong. But there are challenges here that are not getting a lot of attention. Bears are still easily seen along the salmon spawning grounds that consist of rivers connecting large lakes. But the tributary streams have been nearly abandoned, as their increasing frequency of floods and high water events have decimated many of those salmon spawning areas and made them difficult to fish. The ocean returns of salmon are down as well, but the persistent effort to market wild salmon against the farmed salmon industry has lost ground, and there is less market available, so commercial fishing effort has declined in tandem with the lower run sizes, and most fish processing facilities are barely hanging on. The stability of glaciers in this region, when most of the world has been reporting widespread loss of glaciers, is noteworthy, and there are even some glaciers that are growing. Wildlife populations have been hit hard by the deep snow conditions accompanied by especially cold winters, but access to wildlife for local subsistence hunters has been improved by the ease of overland travel in the winters. The rising costs of fuel and the migration of rural residents to urban centers has minimized the demand for subsistence resources, however, and the reductions in wildlife have not been especially problematic for the agency. Local agency representatives find they are challenged to make local citizens and their home offices understand the sheer magnitude of change that likely awaits. When the cold phase of the PDO comes to an end, a transition to a warmer phase will likely result in a near catastrophic rearrangement of local ecosystems and physiography. Preparing the agency and the public has been the focus of a new education initiative, and the intention is to tag informational bulletins and twitter-based responses to climate pieces that mention local variability, oscillations, or ocean climate phases in order to keep the message of impending changes in the public eye.

Implications

a. Natural Resources
    - Physical
        - Glaciers stable
        - Water levels high
        - Water front erosion increases
        - Increase in storm damage
b. Biological
    - Salmon decrease
    - Bears increase
    - Ungulates
c. Cultural Resources
    - Storm damage increases
d. Socio/Economic
    - Access is good
    - Tourism is stable
    - Decrease in commercial fisheries
    - Decrease demand in subsistence
    - Municipal tax revenue decreases
    - Snowmachine, etc. emerging recreation
e. Facilities
    - Increase storm damage
    - Increase facility maintenance costs
    - Significant budget decrease
    - Maintenance access good
f. Interpretation and Education
    - Audiences unaware of masking PDO
    - Subsistence connection to resources decrease
    - Harvest management more critical

Important Management Actions

- Identify/manage infrastructure based on charging demand and reduce costs.
- Identify opportunities for shared technical expertise
- Interagency partnerships

Research and Information Needs

- TEK- critical element to facilitated subsistence.
- Water and climate data

- Fish and wildlife population data.

Other Issues

- Institutional barriers to subsistence use (human movement, species availability)
- Marketing ecological services (local – national)

Nested Scenario 3. Freeze Dried/Riots and Revolution

The Narrative:

An open letter to Senator Will Goforth, by the Peninsula, Alaska, Mayors Council. Published by the Alaska Daily News, July, 2030.

Dear Senator Goforth,

We the undersigned appreciate your many years of wise public service and support for Alaska's coastal communities. We are writing today to ask your help again in dealing with a crisis for which government agencies seem unable or unwilling to help our communities. You are well aware of the importance of community, place, and subsistence to rural Alaskans. While most of the people in our communities still live a subsistence lifestyle, it has become harder to subsist, and harder to maintain a viable community. After more than a decade of continually diminishing stream flows and sharply declining salmon returns, many local fishers have been forced to sell their salmon permits, their livelihood and their family legacy to out-of-state businesses. When our fish processing plant closed, more left to seek wage work elsewhere. We were devastated when enrollment dropped below the stated minimum enrollment, and we fear that since the school closed, there will soon be few younger people and families left in the community. With the prohibitively higher costs of fuel and electricity, we are thankful that some residents still have good paying jobs in government and community services, although the number of such positions has also declined with falling tax revenue. A few residents have also found jobs with new construction, wind farms, and mining operations on nearby state and corporation lands, but too many good jobs seem to be filled by Outsiders. The federal and state agencies have compounded the challenges faced by our communities. For example, with the loss of our salmon resource, we have increasingly looked to hunters to provide for our aging residents. However, the decades-long drought, coupled with a history of water resources mismanagement, deforestation by wildland fires and mining impacts, and steadily increasing federal predator protection, has made it increasingly necessary for hunters to travel long distances to find harvestable wildlife. Agency regulators don't seem to appreciate that the changed landscape and unrealistic hunting seasons make access boat, foot, and snow machine unreliable. Now, those same agencies are working against our hunters, by denying use of ORVs to access to herds on government lands. Senator, we need the agencies to work with our public, not against us, and we desperately more good jobs in our rural communities before all our young families move away to hub communities and urban areas. Today, we are asking for your sponsorship for the "Salmon for our Children" bill, a program to fund construction and operation of an expanded network of government-funded community salmon hatcheries. We also ask for your support of a local-hire mandate, provisions for securing any necessary

water rights from adjacent federal lands, and reasonable community access to federal lands by ORV in this bill.

Respectfully,
The Members of the Peninsula Mayors Council

Implications

a. Natural Resources
   - Physical
     - Less water, cool PDO/stable temperature
     - Poor condition for salmon
     - Less snow and more ORV use
     - Intensified wildlife/fish management
b. Biological
   - Subsistence/extraction conflicts
   - Wildlife shifts
c. Cultural Resources
   - Stable archaeology
d. Socio/Economic
   - Difficult access
   - Fewer local owned fish permits
   - Deficits, inflation, less real $ for land/resource management
   - Population (out migration). Lost TK and local culture
   - Less salmon harvest
   - Higher cost of living, energy.
e. Facilities
   - Greater fire risk, but facilities OK
f. Intrepretation and Education
   - Hard to put SE AK in CC context with cool PDO
   - Loss of TK and living culture
   - Regulatory F&W bottlenecks (access, seasons, allocations)

Important Management Actions

- Intensive management triggers Title 8 harvest preference
- Protect current and future critical habitats, migration routes, ecosystem services.
- Get missing players to the CC scenario table at subsequent workshops
- Adjust regs to harvest realities (more flexible process)
- Resume ANILCA local hire authority

- Long-term $ for invasive species management.

Research and Information Needs

- Science outreach and education to multiple audiences
- Need higher understanding of AK protected areas in global context.
- Funding for interdisciplinary studies
- Social scientist for LCC and DOI CSC and agencies
- Communication in LCCs
- All of Bristol Bay should be in one LCC, not split
- Enhance ethnography program
- Explain relevance of resource protection when developable resources become scarce (ecosystem services)
- Validate CC models with I&M data going forward

Other Issues

- Is this a paradym shift from naturalness? What does this tell us?

Common Implications

Natural Resources (Physical): PDO Phase, Hydrological Cycle

Natural Resources (Biological): Wildlife shifts, Increase Fire, Increase Pest/Disease, Pond Conversion to Uplands

Socio/Economics: Conservation of F&W for subsistence and Recreation, Access/transportation issues.

Facilities: Infrastructure Risks, Fire Protection Costs, Increase Facility Maintenance Costs

Interpretation/Education: Audiences unaware of masking PDO, Regulatory F&W bottlenecks (access, seasons, allocations), Greater need for public appreciation of ecosystem services, Maintaining Relevant Agency In-Reach Efforts

Co-management of Bristol Bay Region complicates and fragments subsistence lifestyle.

Common No Regrets Actions

- Coordinating communication with other agencies.
- Tune Planning Process to account for multiple possibility
- Need for seamless data sets.
- Get missing players to the CC scenario table at subsequent.

- Science outreach and education to multiple audiences.