Climate Change Planning in Alaska’s National Parks

NORTHWEST ARCTIC INVENTORY AND MONITORING NETWORK (ARCN)

Webinar #1
Part I: General Background

OVERALL PROJECT BACKGROUND
FOCAL PARKS
PARTICIPANTS
WHAT IS SNAP?
OVERVIEW OF WEBINARS
PRE-WORKSHOP READINGS
Changing climatic conditions are rapidly impacting environmental, social, and economic conditions in and around National Park System areas in Alaska.

Alaska park managers need to better understand possible climate change trends in order to better manage Arctic, subarctic, and coastal ecosystems and human uses.

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.
What is most important to Alaskans and other Arctic partners?
- What changes are most likely?
- What changes will have the greatest impact?
- What are we best able to predict?
- How can we adapt to those changes?

Scenarios are linked to SNAP models
- Climate models
- Models of how people use land and resources
- Other models linked to climate and human behavior

www.snap.uaf.edu
There is now unequivocal scientific evidence that our planet is warming.

How this warming will affect climate systems around the globe is an enormously complex question.

Uncertainty and variability are inevitable.

Climate change presents significant risks to natural and cultural resources.

Understanding how to address uncertainty is an important part of climate change planning.

[See also ppt entitled “Understanding the Science of Climate Change: Climate drivers and climate effects”]

Webinar#1

- Introducing the basic concepts of scenarios planning, as outlined by GBN;
- Outlining the data and resources available through SNAP and other sources;
- Underscoring the general importance of planning for climate change;
- Reviewing the case studies from the August 2010 ARCN/SWAN training and February 2011 SWAN meeting, including all decision-making processes and generation of intermediate steps and results.
Reminder of the role of climate drivers in the scenarios planning process
Overview of climate drivers for the Southwest Alaska park network
Discussion of a climate drivers table generated by John Walsh and Nancy Fresco
Case studies and examples by Don Calloway
“Homework” assignments
- Climate effects presentation by Bob Winfree
- Case studies and examples by Don Calloway
- Group discussion of climate effects table
  - Individual input
  - Drivers grouped by category
  - Differences in opinion
  - Variations between parks
The Art of the Long View, emphasis on first 4 pages (pp. 3-6); User’s Guide (pp. 227-239); and Appendix (pp. 241-248). These can all be read for free on Amazon at [http://www.amazon.com/Art-Long-View-Planning-Uncertain/dp/0385267320](http://www.amazon.com/Art-Long-View-Planning-Uncertain/dp/0385267320) in the page previews (“Click to Look Inside”)

- SNAP one-page fact sheet (*Tools for Planners*) and link to website for optional browsing.
- Detailed notes from the February meeting.
Readings (pt. 2)

- **Boreal and Arctic Talking Points**, entire document, online at [http://snap.uaf.edu/webshared/Nancy%20Fresco/NPS/Webinar%20ARCN/](http://snap.uaf.edu/webshared/Nancy%20Fresco/NPS/Webinar%20ARCN/)

- **Beyond Naturalness** by David N. Cole and Laurie Yung, entire book, but with a focus on pp. 31-33. This section is available for preview on Google Books. [http://books.google.com/books?id=gfErgkCyoHkC&printsec=frontcover&cd=1&source=gbs_viewapi#v=onepage&q&f=false](http://books.google.com/books?id=gfErgkCyoHkC&printsec=frontcover&cd=1&source=gbs_viewapi#v=onepage&q&f=false)

- **Northwest Alaska Climate Drivers table**
Part II:
Data and Information Sources

SNAP METHODS
SNAP DATA
SNAP MAPS
NPS TALKING POINTS PAPERS
CLIMATE DRIVERS
CLIMATE EFFECTS
Projections based on IPCC models

- Calculated concurrence of 15 models with data for 1958-2000 for surface air temperature, air pressure at sea level, and precipitation
- Used root-mean-square error (RMSE) evaluation to select the 5 models that performed best for Alaska, 60-90°N, and 20-90°N latitude.
- A1B, B1 and A2 emissions scenarios
- Downscaled coarse GCM data to 2km using PRISM
Benefits of downscaling

GCM output (ECHAM5)
Figure 1A from Frankenberg et al., Science, Sept. 11, 2009

0.5 x 0.5 degrees to 2 x 2 km

CRU data and SNAP outputs after PRISM downscaling
SNAP data

- Temperature
- Precipitation (rain and snow)
- Every month of every year from 1900 to 2100 (historical + projected)
- 5 models, 3 emission scenarios
- Available as maps, graphs, charts, raw data
- On line, downloadable, in Google Earth, or in printable formats
SNAP complex linked models

- Season length
- Shifting plants and animals (biomes and ecosystems)
- Soil temperature and permafrost
- Water availability
- Forest fire

Soil temperature at one meter depth: 1980’s, 2040’s, and 2080’s (Geophysical Institute Permafrost Lab, UAF)
Temperature projections for Dec-Jan for selected decades (composite A1B model)
Unfrozen* season length predictions for selected decades (composite A1B model)

* Time between when running mean temperature crosses the zero point in spring and in fall
Available for *Alaska Maritime and Transitional* and *Alaska Boreal and Arctic*

Provide park and refuge area managers and staff with accessible, up-to-date information about climate change impacts to the resources they protect

Talking Points have three major sections:
- a regional section that provides information on changes, organized around seven types of impacts
- a section outlining No Regrets Actions that can be taken now to mitigate and adapt to climate changes
- and a general section on Global Climate Change arranged around four topics

Access these and other documents at http://www.snap.uaf.edu/webshared/Nancy%20Fresco/NPS/
PART III:

GLOBAL BUSINESS NETWORK (GBN)

SCENARIOS PLANNING PROCESS
Facilitated and led by Jonathan Star of Global Business Network (GBN)

Participants included trainers, NPS staff from diverse regions and departments, SNAP researchers, and representatives of cooperating agencies.

Participants learned how to develop scenarios based on nested framework of critical uncertainties

Fleshed out the beginnings of climate change scenarios for two pilot park networks
Scenario Planning vs. Forecasting

- Scenarios overcome the tendency to predict, allowing us to see multiple possibilities for the future

- Forecast Planning
  - One Future

- Scenario Planning
  - Multiple Futures

What we know today

-10%  +10%

Uncertainties

What we know today
Explaining Scenarios: A Basic GBN Scenario Creation Process

This diagram describes the 5 key steps required in any scenario planning process:

1. **Orient**: What is the strategic issue or decision that we wish to address?
2. **Explore**: What critical forces will affect the future of our issue?
3. **Sythesize**: How do we combine and synthesize these forces to create a small number of alternative stories?
4. **Monitor**: As new information unfolds, which scenarios seem most valid? Does this affect our decisions and actions?
5. **Act**: What are the implications of these scenarios for our strategic issue, and what actions should we take in light of them?
Step one: Orient

What is the strategic issue or decision that we wish to address?

How can NPS managers best preserve the natural and cultural resources and values within their jurisdiction in the face of climate change?

To answer this challenge, we need to explore a broader question:

How will climate change effects impact the landscapes within which management units are placed over the next 50 to 100 years?
Step Two: Explore

What **critical forces** will affect the future of our issue?

**CRITICAL UNCERTAINTIES**

**BIOREGION: ____________**

Over the next 50 – 100 years, what will happen to . . . ?

Critical forces generally have unusually **high impact** and unusually **high uncertainty**
CLIMATE SCENARIOS

BIOREGION: ______________

Combining two selected drivers creates four possible futures
“Nested Scenarios”?

Riots and Revolution...

Nesting each story in a social framework creates 16 possibilities

Lack of senior commitment
Varied approaches and alignment
Short-term concerns

Big problems, Big solutions...

Senior commitment
International alignment
Long-term perspectives

Nature of Leadership

Degree of Societal Concern

Broad Understanding
Heightened Urgency

Widespread indifference
Competing concerns

Is Anyone Out There?...

Wheel-Spinning...
### NESTED SCENARIO DETAILS

**BIOREGION:**

<table>
<thead>
<tr>
<th>Socio-Political</th>
<th>Bioregion Climate</th>
</tr>
</thead>
</table>

**Describe This World in 2030**

**Major Impacts on the Bioregion**

**Issues Facing Management**

### Step 3: Synthesize

The 16 possible futures created in the preceding steps must be narrowed down to 3-4 scenarios that are relevant, divergent, challenging, and pertinent. Each has its own narrative (story).
Step Three: Synthesize

How do we combine and synthesize these forces to create a small number of alternative stories?

• Sixteen (or more) choices available (4x4)
• Need to select only 3-4 to turn into narratives and planning tools
• Focus on scenarios that are:
  • Relevant
  • Divergent
  • Plausible
  • Challenging
• Create a narrative (story) about each scenario
### Effective storytelling?

<table>
<thead>
<tr>
<th>Name</th>
<th>Species</th>
<th>Hair/Fur</th>
<th>Age</th>
<th>Appetite Level</th>
<th>Size</th>
<th>Preliminary Porridge Assessment</th>
<th>Preliminary Mattress Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goldilocks</td>
<td>Human</td>
<td>Blonde</td>
<td>8</td>
<td>Moderate</td>
<td>Petite</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Papa</td>
<td>Bear</td>
<td>Brown</td>
<td>12</td>
<td>High</td>
<td>Big</td>
<td>Too Hot</td>
<td>Too Hard</td>
</tr>
<tr>
<td>Mama</td>
<td>Bear</td>
<td>Tawny</td>
<td>11</td>
<td>Moderate</td>
<td>Medium</td>
<td>Too Cold</td>
<td>Too Soft</td>
</tr>
<tr>
<td>Baby</td>
<td>Bear</td>
<td>Red-Brown</td>
<td>3</td>
<td>Low</td>
<td>Small</td>
<td>Just Right</td>
<td>Just Right</td>
</tr>
</tbody>
</table>
Step 4: Act
Categorizing Options to Help Set Strategy

**Robust:** Pursue only those options that would work out well (or at least not hurt you too much) in any of the four scenarios

OR

**Bet the Farm / Shaping:** Make one clear bet that a certain future will happen — and then do everything you can to help make that scenario a reality

OR

**Hedge Your Bets / Wait and See:** Make several distinct bets of relatively equal size

OR

**Core / Satellite:** Place one major bet, with one or more small bets as a hedge against uncertainty, experiments, and real options
Part IV: SWAN Workshop Results, Coastal

Selected drivers  
Climate scenarios  
Nested scenarios  
Implications  
Actions  
Research  
No regrets actions
Selected Drivers (Coastal)

Drivers as rated for certainty and importance by the Coastal group.

<table>
<thead>
<tr>
<th>Climate Drivers (or, “Scenario Drivers based on Climate”)</th>
<th>Uncertain</th>
<th>High certainty</th>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Precipitation</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Freeze-up</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Length of growing season</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Sea Level</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Water availability</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Relative Humidity</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Wind Speed (separate from Aleutian Low)</td>
<td>X (duration)</td>
<td>X (increase)</td>
<td></td>
</tr>
<tr>
<td>PDO</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extreme Events (temperature)</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Extreme Events (precipitation)</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Extreme Events (storms)</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

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**

Additional drivers introduced by the group:

- Ocean Acidification
- Salinity (onshore/near shore)
- Aleutian Low
- Extreme Event (wind)
- AK Coastal Current
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.
Climate scenarios 1&2 (coastal)

"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

"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.
### Climate scenarios 3&4 (coastal)

#### “Low Grade Fever”

- 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

#### “PB & Jelly Fish”

- loss of coastal species with exoskeleton \(\rightarrow\) 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
Matrix showing Coastal climate scenarios nested in a social/institutional framework. Each quadrant yields four linked scenarios; three are selected in red.
Coastal Nested Scenario 1: PB&J/Riots and Revolution: “Jellyfish Jamboree, Fishing Fiasco”
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 going to help us, we just have to help ourselves, I guess.
## Coastal Nested Scenario 1: PB&J/Riots and Revolution: “Jellyfish Jamboree, Fishing Fiasco”

### Implications

#### 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

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

#### 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

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

#### 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

#### 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)
Coastal Nested Scenario 1 (cont’d):
PB&J/Riots and Revolution: “Jellyfish Jamboree, Fishing Fiasco”

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
  o Water quality
  o Fish and wildlife populations
  o 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
Common No Regrets Actions: Coastal

1. Collaborate with researchers monitoring programs to track changes in PDO and ocean acidification
2. Model, collaborate and promote energy efficient technologies
3. Increase fluidity and connections between research and monitoring
4. Conduct coastal/marine ecosystem monitoring
5. Identify and cooperate with private/public entities for partnerships
6. Create portable, flexible structures
7. Re-imagine how institutions can work together to solve common problems.
Part V: Conclusions

Choosing Response Strategies

Common No Regrets Actions
- Data, research, and monitoring
- Collaboration and outreach
- Flexibility and innovation

Next Steps
Robust responses are common no-regrets actions, but they are not the only possibility. In some cases, it may make sense to hedge bets to avoid an occurrence that appears in only one or two scenarios, or to set up core and satellite responses to deal with variability among scenarios.
No regrets actions: data, research and monitoring

1. Create seamless data sets
2. Collaborate with researchers and monitoring programs to track changes in PDO and ocean acidification
3. Increase fluidity and connections between research and monitoring
4. Conduct coastal/marine/onshore ecosystem monitoring
No regrets actions: collaboration and outreach

1. Coordinate communication with other agencies
2. Get missing players to the climate change scenario table at subsequent meetings
3. Provide science outreach and education to multiple audiences
4. Identify and cooperate with private/public entities for partnerships
5. Re-imagine how institutions can work together to solve common problems.
No regrets actions: flexibility and innovation

1. Tune planning process to account for multiple possibilities
2. Model, collaborate and promote energy efficient technologies
3. Create portable, flexible structures
Next Steps

**The scenario planning process doesn’t end with “SYNTHESIZE”**

- Teleconferences and webinars to confirm results and fill in gaps
- Discussion of how to turn plans (no regrets management actions) into concrete actions
- Development of outreach tools and information, including final report
- Dissemination of scenarios and explanations of the process and results to a broad audience
- Feedback from a wider audience
- Linkages with planning for other park networks