# Climate Change Planning in Alaska's National Parks

## SOUTHWEST ALASKA INVENTORY AND MONITORING NETWORK (SWAN)

**February 22-25, 2011**

**Anchorage, Alaska**

# Scenario Building:

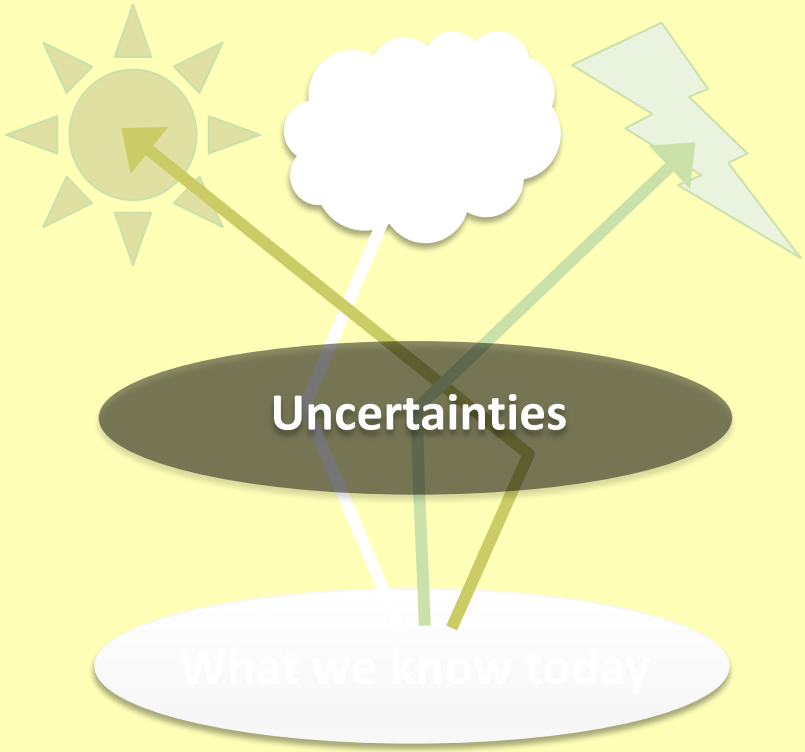
## Choosing drivers and applying impacts

# 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





Copyright 2010 Monitor Company Group

# Selecting Drivers

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

**CRITICAL UNCERTAINTIES**
BIOREGION: _____

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

ERT-HLY 2010

Copyright © 2010 Monitor Company Group, L.P. — Confidential



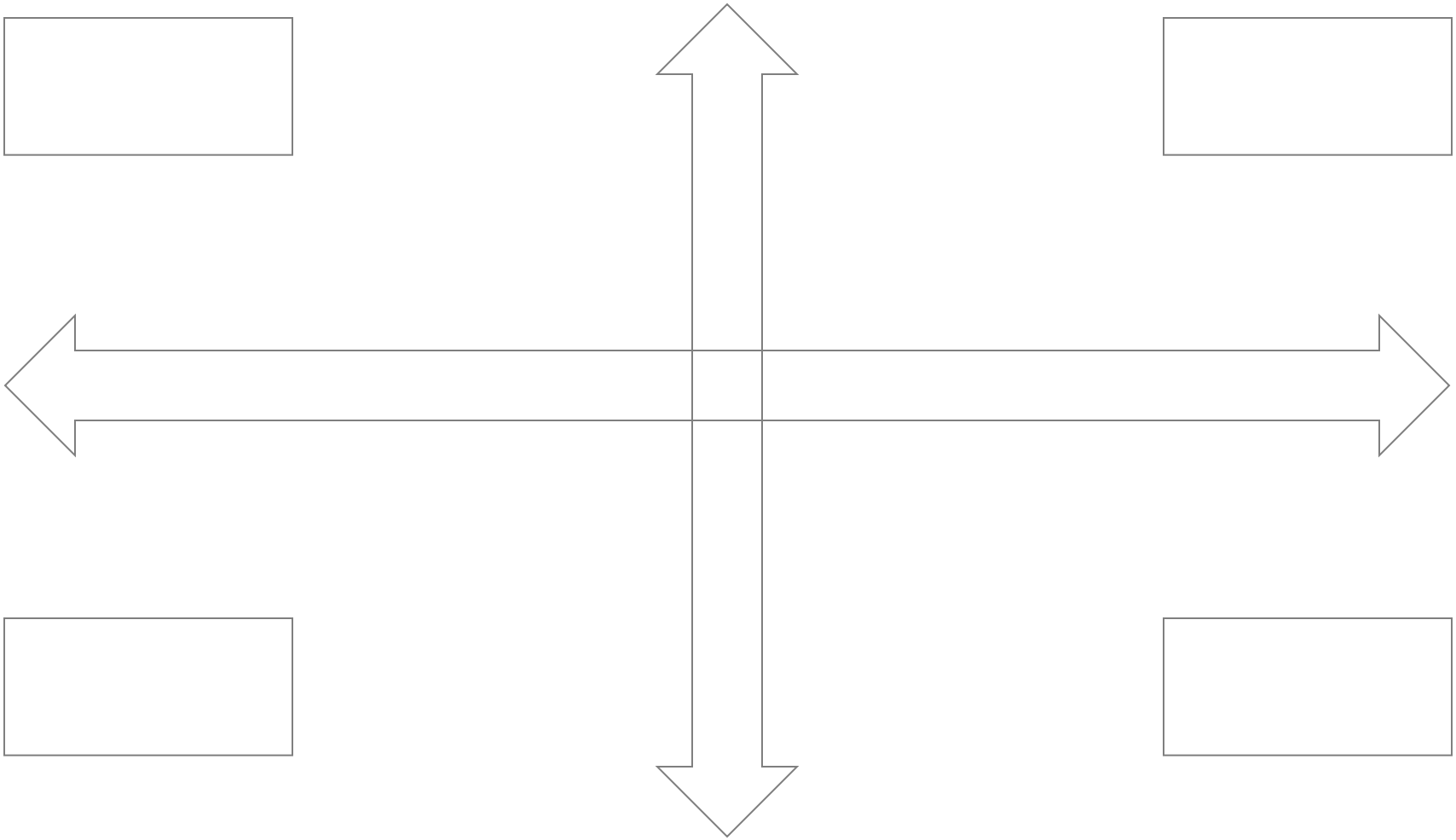
Copyright 2010 Monitor Company Group

# Selecting Drivers – Key points

- Climate drivers are the **Critical forces** in our scenarios planning process.
- Critical forces generally have unusually **high impact** and unusually **high uncertainty**
- We are aiming to create scenarios that are:
  - **Challenging**
  - **Divergent**
  - **Plausible**
  - **Relevant**

# CLIMATE SCENARIOS

BIOREGION: _____



# CLIMATE SCENARIOS

BIOREGION: _____

Pick drivers with a wide range of possible outcomes

Choose drivers that impact several sectors, e.g tourism, subsistence, and wildlife, not just one

Select drivers with a high enough likelihood to be convincing to stakeholders

Select drivers with effects in most of the parks in the network

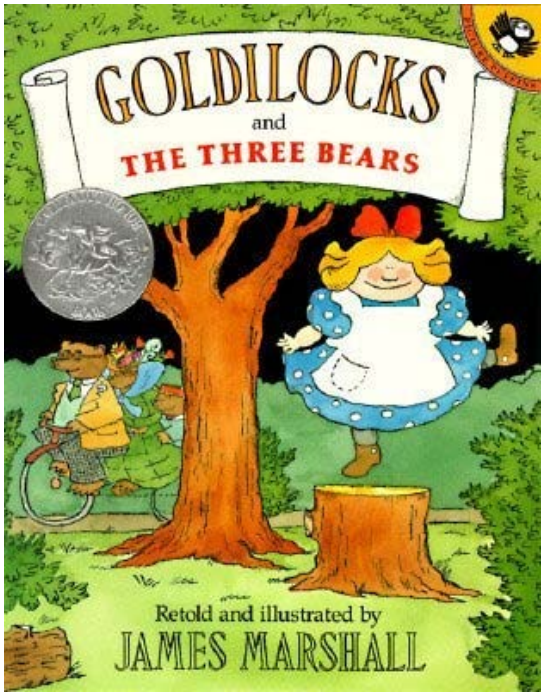
Avoid pairs of drivers that are too similar – think of the effects of crossing them with one another

Choose drivers that lead to the effects that are most critical

# Keep in mind….

**We will be synthesizing our results 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



# Keep in mind…

| Name | Species | Hair/Fur | Age | Appetite Level | Size | Preliminary Porridge Assessment | Preliminary Mattress Assessment |
|---|---|---|---|---|---|---|---|
| **Goldilocks** | Human | Blonde | 8 | Moderate | Petite | N/A | N/A |
| **Papa** | Bear | Brown | 12 | High | Big | Too Hot | Too Hard |
| **Mama** | Bear | Tawny | 11 | Moderate | Medium | Too Cold | Too Soft |
| **Baby** | Bear | Red-Brown | 3 | Low | Small | Just Right | Just Right |

**Effective storytelling matters!**


Copyright 2010 Monitor Company Group

# Southwest AK Climate Drivers (pt. 1)

| Climate Variable | General Change Expected | Specific Change Expected & Reference Period | Size of Expected Change Compared to Recent Changes | Patterns of Change | Confidence | Source & Context |
|---|---|---|---|---|---|---|
| Temperature | Increase | 2050<br>+2°C ±1.5°<br>2100<br>+4°C ±2° | Large | More pronounced in autumn-winter | >95%<br>*(for sign)*<br>*Very Likely* | IPCC (2007) and SNAP/UAF |
| Rain and snow (precipitation) | Increased snowfall during winter, but shorter snow season | Winter snowfall<br>Increase in frequency and intensity | Recent changes not well established | Increased percentage of precipitation will fall as rain. Mean winter temps above freezing for large areas by 2100 | Large uncertainty in timing of snowmelt | AMAP/SWIPA (Snow, Water, Ice and Permafrost in the Arctic, 2011); SNAP/UAF |
| Freeze-up date | Later in autumn, or not at all | 2050: 5-10 days<br>2100: 10-20 days | Large | Large increase in areas that rarely freeze, particularly along coastlines | >90%<br>Very likely | SNAP/UAF |
| Length of ice-free season for rivers, lakes | Increase | 2050: 7-10 days<br>2100: 14-21 days | Large | Largest near coasts where sea ice retreats or does not form, open water season lengthens | >90%<br>Very likely | IPCC (2007); SNAP/UAF |
| River and stream temperatures | Increase | 2050: 1-3°C<br>2100: 2-4°C | Large | Consistent with earlier breakup or lack of ice formation, and higher summer temperatures | >90%<br>Very Likely | Kyle and Brabets (2001) |
| Length of growing season | Increase | 2050: 10 to 20 days<br>2100: 20 to 40 | Continuation of recent changes | Largest near coasts | >90%<br>Very likely | IPCC (2007);<br>SNAP/UAF |

# Southwest AK Climate Drivers (pt. 2)

| Climate Variable | General Change Expected | Specific Change Expected & Reference Period | Size of Expected Change Compared to Recent Changes | Patterns of Change | Confidence | Source & Context |
|---|---|---|---|---|---|---|
| Sea level | Increase | 2050: 3 inches to 2 feet<br>2100: 7 inches to 6 feet | Large | Large uncertainties, esp. at upper end of range | >90% on sign | IPCC (2007) |
| Water availablility (soil moisture during growing season, as measured by precip minus potential ET) | Decrease | 2050: decrease of 0-20+%<br>2100: decrease of 10-40+% | Recent changes not well established | Most profound changes in areas where sub-freezing temperatures have historically limited PET. Much uncertainty regarding role of winter water storage and spring runoff | >90%<br>Very likely, but likelihood varies by region | SNAP and The Wilderness Society |
| Relative Humidity | Little change | 2050: 0% ±10%; 2100: 0% ±15% | Small | Absolute humidity increases | 50% *About as likely as not* | SNAP/UAF |
| Wind Speed | Increase | 2050: +2% ±4%; 2100: +4% ±8% | Small | More pronounced in winter and spring | >90% (sign) *Likely* | Abatzoglou and Brown |
| Pacific Decadal Oscillation (atmospheric circulation) | Decadal to multidecadal circulation anomalies affecting Alaska | Unknown | Large (comparable to climatic jump in 1970s) | Major effect on Alaskan temperatures in cold season | Natural variation, essentially unpredictable | Hartmann and Wendler (2005, J. Climate) |

# Southwest AK Climate Drivers (pt. 3)

| Climate Variable | General Change Expected | Specific Change Expected & Reference Period | Size of Expected Change Compared to Recent Changes | Patterns of Change | Confidence | Source & Context |
|---|---|---|---|---|---|---|
| Extreme Events: Temperature | Warm Events Increase / Cold Events Decrease | 2050: increase 3-6 times present for warm events; decrease to 1/5-1/3 of present in cold events; 2100: increase 5-8.5 times present in warm events; decrease 1/12 to 1/8 of present in cold events | Large | Increase in frequency and length of extreme hot events decrease in extreme cold events (winter) | Modeled and observed >95% *Very likely* | Abatzoglou and Brown; Timlin and Walsh, 2007, *Arctic* ) |
| Extreme Events: Precipitation | Decrease/Increase | 2050: -20% to +50%; 2100: -20% to +50% | Large | Increase in frequency and contribution especially in winter. Largest increase in autumn (large intermodel differences). Decreases in spring. Percent of annual precipitation falling as extreme events increases. | Modeled and observed *Uncertain* | Abatzoglou and Brown* |
| Extreme Events: Storms | Increase | Increase in frequency and intensity | Any increases exacerbated by sea ice reduction and sea level increase | | >66% *Likely* | Rachel Loehman |

# Drivers selected, August workshop

| | | |
|---|---|---|
| Less | Water availability | More |
| Normal | Stream/lake temps | Warmer |
| Less | River basin hydrology | More |
| Measureable | Ocean Acidification | Catastrophic |
| Historical | Extreme precip/storms | Significant increase |
| Negative (colder) | PDO | Positive (warmer) |

# Climate Drivers

- Climate drivers are the **critical forces** in our scenarios planning process
- Critical forces generally have unusually **high impact** and unusually **high uncertainty**
- Climate drivers table specific for SE Alaska were compiled by John Walsh and Nancy Fresco of SNAP (see handouts).
- All scenarios are created by examining the intersection of two drivers, creating four sectors
- **Selection of drivers** is crucial to the planning process

# Climate Effects

*Climate effects are the outcomes of the critical forces or drivers, as expressed by significant changes in particular parks. Points to consider include:*

- Time frame (20 years?  100 years?)
- Uncertainty (of both driver and effect)
- Severity of effect (and reversibility)
- Scope: what parks, who is impacted?
- Repercussions: what is the story?
- Feedback to policy