Effects of a rapidly warming climate on the (western) Kenai Peninsula

John Morton
Kenai National Wildlife Refuge
15.7° above 20th century average for Alaska! (since 1925)

“Of course it’s concerning. Alaska’s changing and it’s changing very rapidly. We’re going to have to adapt”

- Rick Thoman
Retired NWS manager
Alaska is warming at 2-3 X Lower 48 rate

Climate warming effects are not masked by other human-caused drivers of change

Kenai Peninsula may be best studied locale in AK outside of high arctic
Winter (average temperatures < freezing) in Soldotna decrease from 5 to 3 months by 2100...
Dramatic ecological responses to rapidly warming climate

- decreasing available water (60% loss since 1968)
- drying wetlands (6 – 11% per decade)
- receding glaciers (11% surface area, 21m elevation)
- rising treeline (1m/yr) and shrubline (2.8m/yr)
- unprecedented SB beetle outbreak (triggered by 2 consecutive warm summers)

Official fire season is now April 1 instead of May 1.
Woody shrubs encroach into 8,000 year old Sphagnum peatlands

Berg et al. 2009
Western Kenai coastline losing 1 ft/year in past 50 years
Warming climate will add $3.6 - $6.1 billion (10-20%) by 2030 to public infrastructure costs in AK
Forecasted growing season length (days > 0°C)*

2010–2019
196-219 days

2090–2099
220-243 days

*as 10-year averages assuming mid-range emissions (A1B) from the 5-model average at 2km resolution
Salmon in 47 of 48 non-glacial streams experience thermal stress in July

- Maximum temperatures not to be exceeded:
  - egg & fry incubation = 13°C
  - spawning areas = 13°C
  - migration routes = 15°C
  - rearing areas = 15°C
  - and may not exceed 20°C at any time

Mauger 2011, Mauger et al. 2017
Changing migration window in last decade

- Earlier arrival records for 33 species
- Later departure records for 38 species
- 27 new species since 2007
Harvested species likely to change in abundance on the Kenai Peninsula

Alpine habitat loss and novel pathogen

Wetter and more snow at high elevations

Warmer winter nights in Lowlands
Forecasting the Kenai Peninsula’s landscape through 2100

- Climate envelope modeling using Random Forests™
- A1B scenario decadal averages for temperature, precipitation (SNAP)
- Landcover type with greatest % cover in 2km pixels
- If previous landcover type for each timestep (2039, 2069, 2099) $P > 0.5$ then stay; if $P < 0.5$ then landcover type with highest probability
Questions????

WHAT MOVES HAVE YOU MADE IN RESPONSE TO CLIMATE CHANGE?
— PETER

ABOUT 5 METERS INLAND.