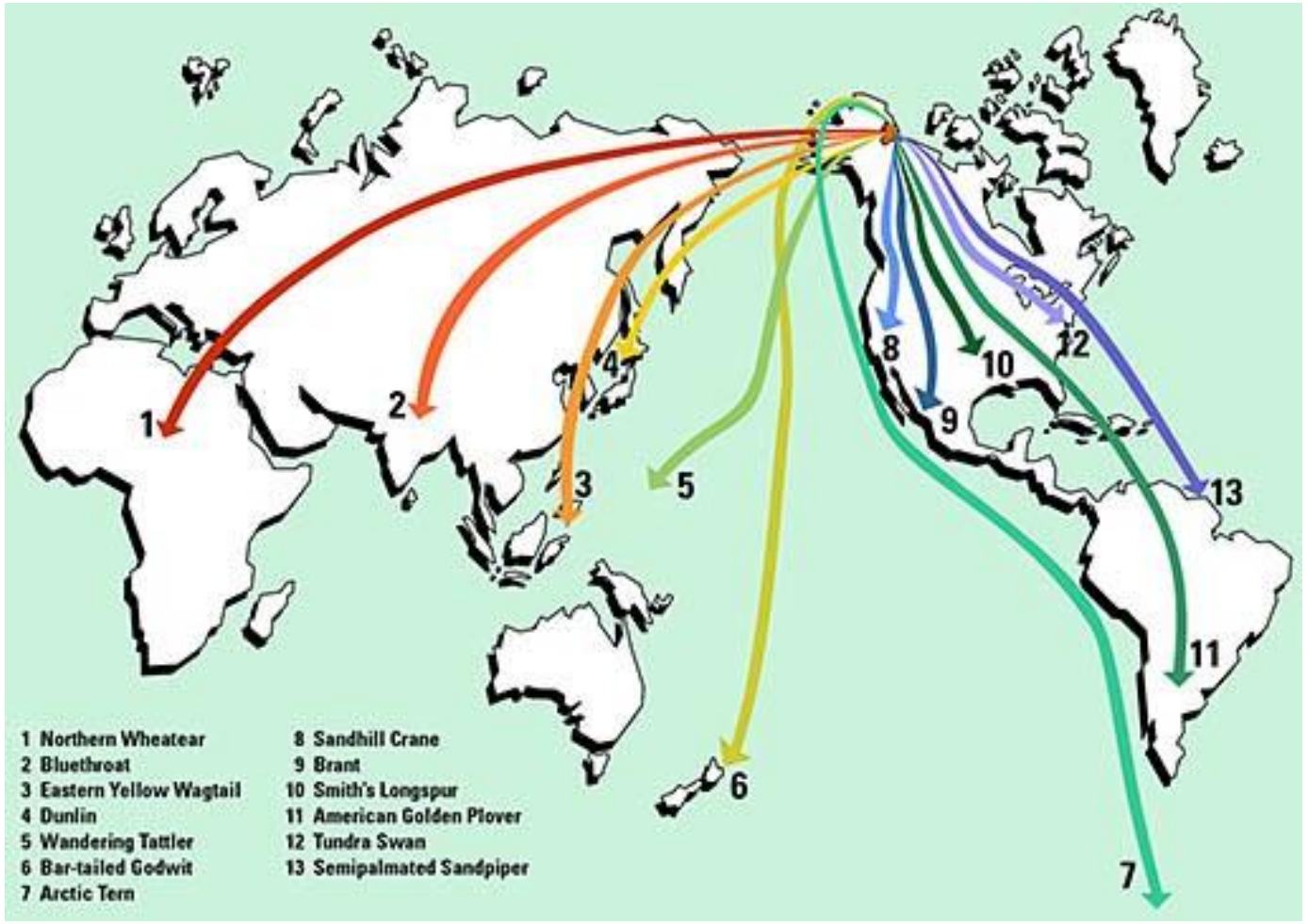
Arctic Ecology – A 2018 Update Dr. Natalie Boelman

Earth2Class Workshops
1 Dec 2018



Natalie serves as a Lamont Associate Research Scientist

Natalie's main research interests include:

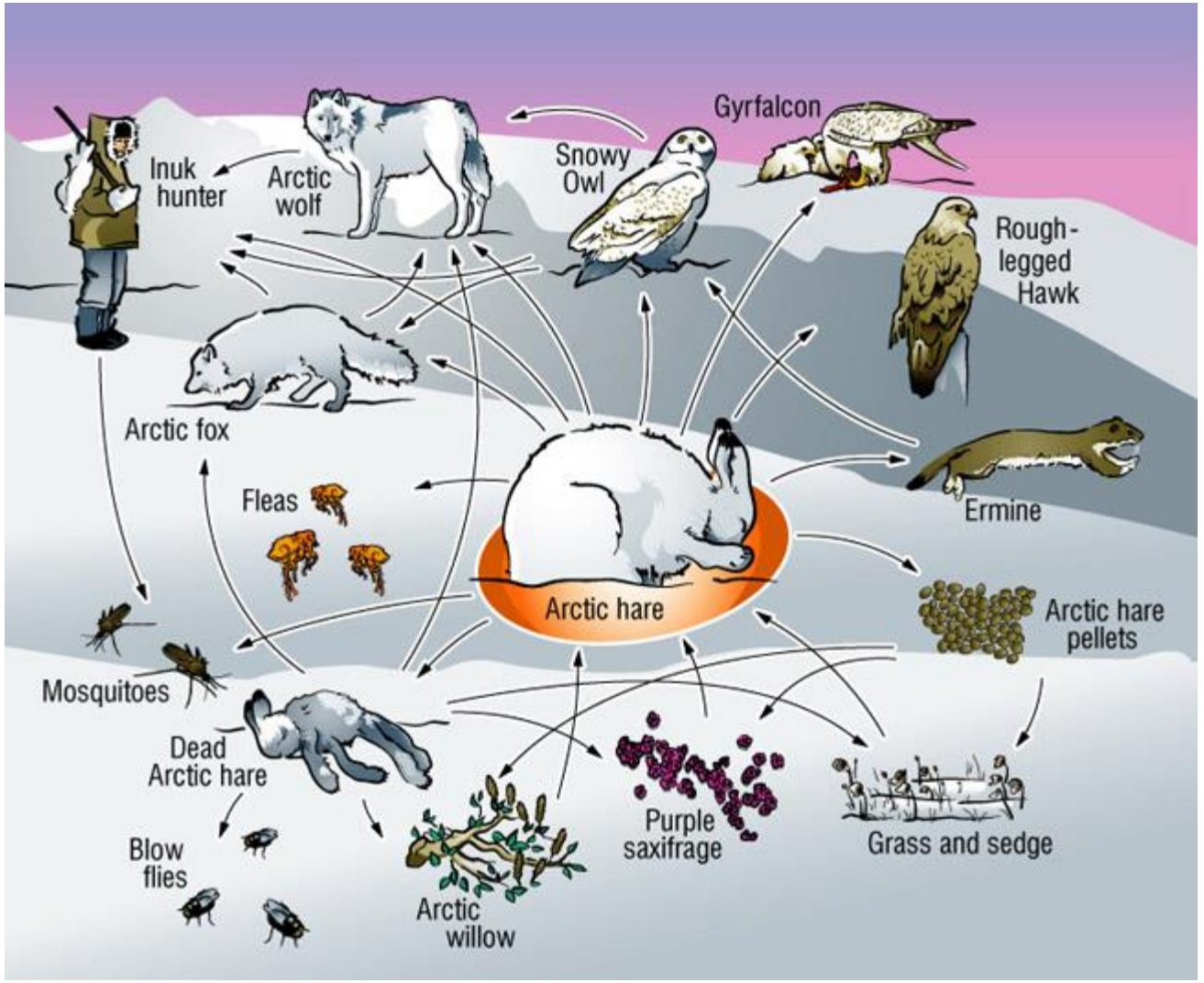
- Consequences of Arctic-boreal warming on tundra flora, fauna, and trophic dynamics
- Roles of animals in mediating effects of Arctic warming
- Use of field surveys, near/remote sensing, and bioacoustics to study ecological form and function in the Arctic tundra

Examples of Natalie's Research

- How do factors such as temperature, rain, snowfall, and wind affect reproduction both directly and indirectly (e.g. through their effects on food availability)? Monitored clutch survival in these two species from egg-lay through fledge at field sites located near Toolik Field Station (North Slope, Alaska) https://onlinelibrary.wiley.com/doi/10.1111/jav.01712

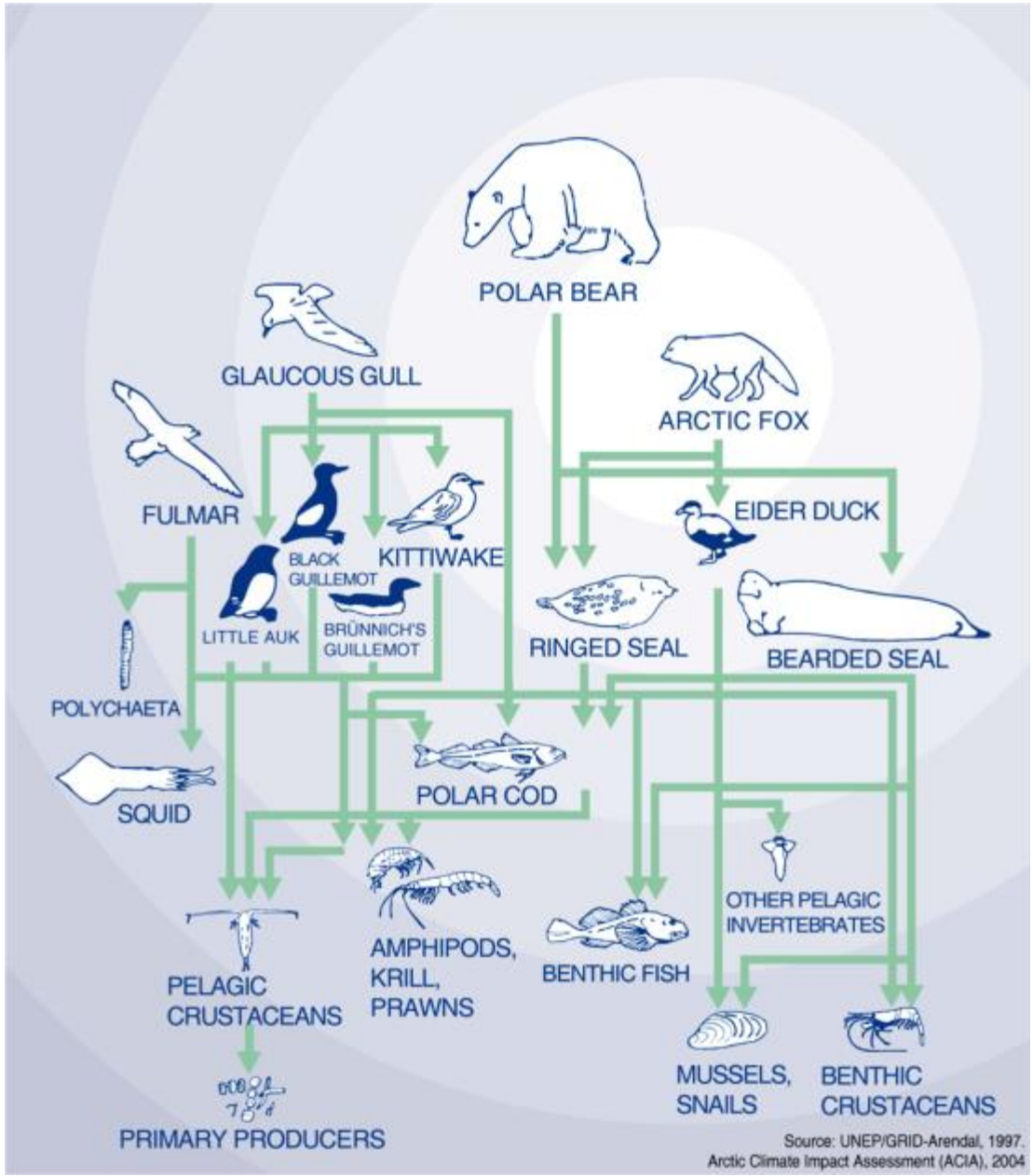
- Bioacoustic networks could vastly expand the coverage of wildlife monitoring to complement satellite observations of climate and vegetation. Automated signal processing and machine learning approaches estimated dates on which songbird communities arrived at arctic breeding grounds http://advances.sciencemag.org/content/4/6/eaaq1084

Arctic Terrestrial Food Web



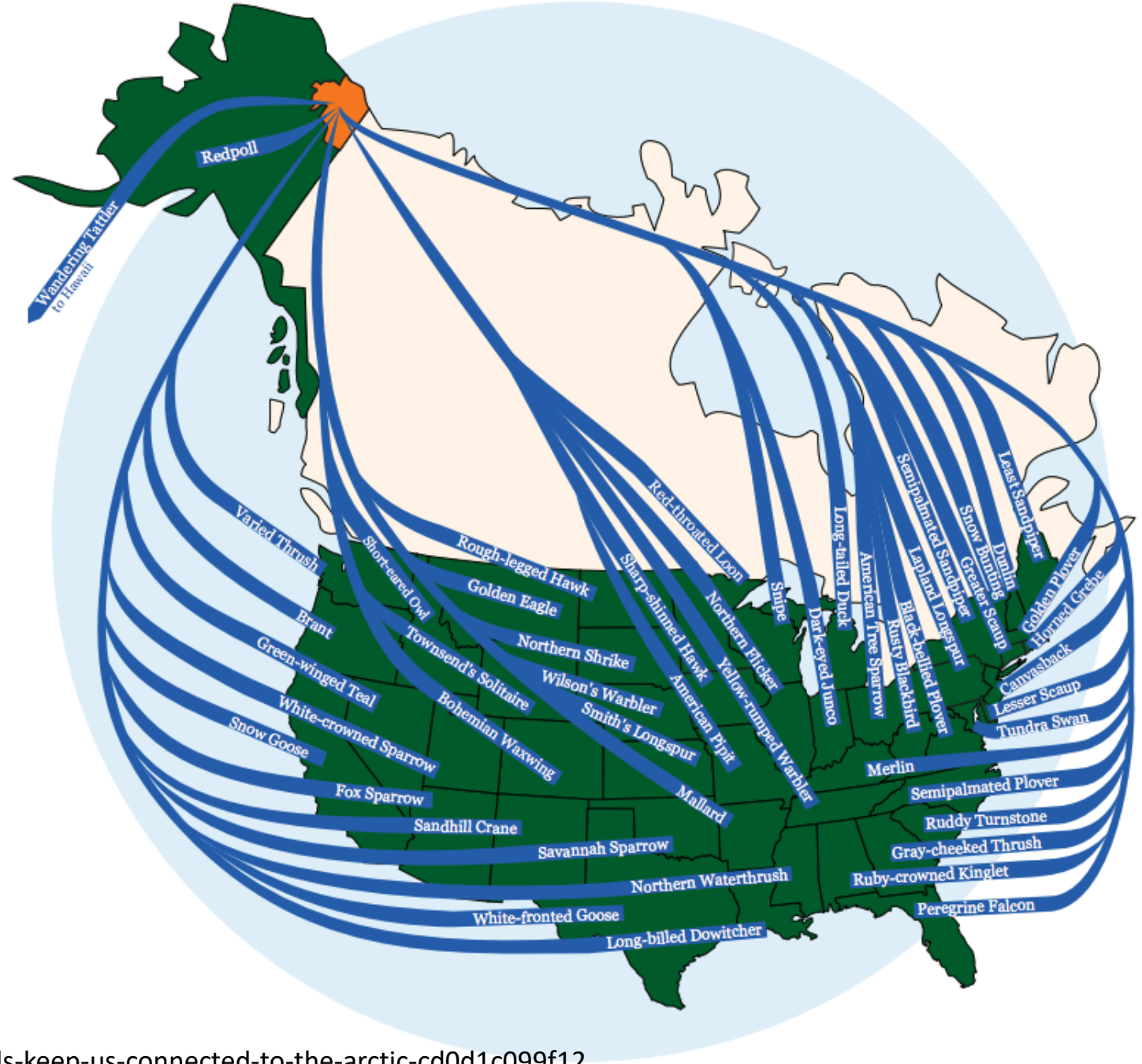
http://nature.ca/ukaliq/images/a196_fwb_e.jpg

Related Arctic Land-Sea Food Webs



http://apassionforscience.pbworks.com/f/1365252535/coastal-arctic-food-web-drift-ice.png

What starts in the Arctic may not stay in the Arctic



https://medium.com/usfws/birds-keep-us-connected-to-the-arctic-cd0d1c099f12

[This graphical presentation does not indicate the flight routes birds take to arrive at individual states.]

ANWR

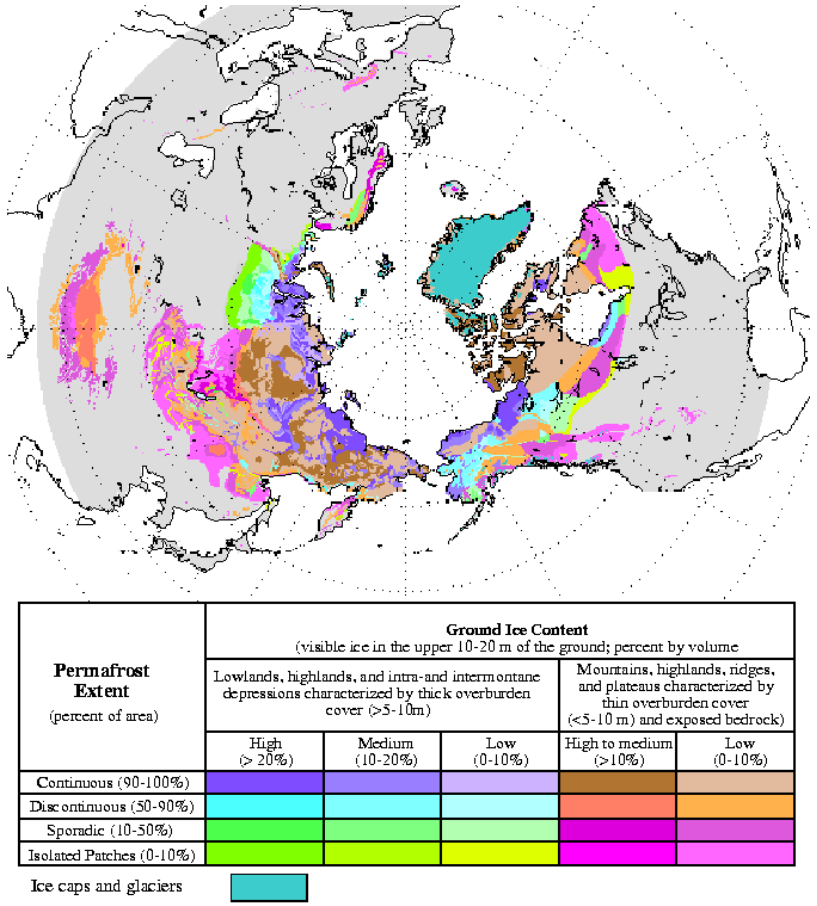
- Largest NWR (>19 million acres)
- Estab. 1960
- Biggest, wildest publicly-owned land – few roads
- More than 700 species, many migratory
- Adjacent to Canadian national parks
- https://www.fws.gov/refuge/arctic/

https://en.wikipedia.org/wiki/Arctic_National_Wildlife_Refuge

https://medium.com/usfws/birds-keep-us-connected-to-the-arctic-cd0d1c099f12

Permafrost

- Ground (soil or rock) at or below freezing point for 2 or more years
- 24% of exposed land in Northern Hemisphere
- Potential for permanent melting with +1.5 deg C (2.7 deg F)



https://en.wikipedia.org/wiki/Permafrost#/media/File:Circum-Arctic_Map_of_Permafrost_and_Ground_Ice_Conditions.png

ANWR Oil Drilling Controversy

- Congress passed approval for drilling in “1002area” in 2017 (after about 50 tries)
- Approx. 2000 acres in coastal plain
- Alaska has vast oil and natural gas reserves
- Many worked by “native corporations”

Questions abound over

- How much is recoverable?
- Impact on flora and fauna?
- Impacts of oil spills?
- Transporting to refineries?
- Threat to native lifestyles?

- New Cold War in Arctic Region

Natalie Boelman and Oil Drilling

- Main reason she and her colleagues are able to gather data is because of the Trans-Alaska Pipeline System
- 800-mile network of tubes and pump stations carries crude oil from northern coast to southern coast, abutting ANWR on part of its route
- Access roads run alongside the pipelines so that workers can maintain the pipes. Pipeline company works with researchers to access some restricted roads
- Questions of how this might change with current Administration’s plans

Potential problems

Effect of pipeline on caribou much less than anticipated

Large trucks used for exploration and development can destroy tundra plants and impact permafrost

In spring, most water bodies—large and small—filled with ducks, geese, and other mating birds – oil drilling may affect this greatly

Calving ground for caribou

Impact of climate change

- Higher temperatures, melting glaciers, thawing permafrost, and rising sea levels are indications of warming throughout the Arctic.
- Sea ice thinned and decreased
- Rising sea level along coastal plain
- Melting changes due to albedo changes
- Faster, more severe in Arctic

Selected impacts on larger animals

Major calving ground for Porcupine (Rover) caribou – questions about decrease in population size due to encroachments

Spring coming earlier, but caribou still sticking with age-old patterns– missing prime foraging time

Polar bears affected by lack of sea ice to go hunting,

Must access dens on land at different times

More reliance on human trash piles, unusual prey – negative effects on health

Marine ecosystems also affected by climate changes

Toolik Field Station
Institute of Arctic Biology
68° 38' N, 149° 36' W

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Announcements

New Reservation System. All reservations and project registrations are now made in the **myToolik** system. Please note that all truck seat reservations will now be made as part of a housing reservation. Lots of new exciting features will be added to the system over the coming months.

New Shipping Address!
Your name/Your PI's name
IAB Toolik 757005
1038 Toklat Way
Fairbanks, AK 99775-7005

Need a fuel account? Please request your 2018 fuel account here.

Comment form: Comments, compliments, suggestions for improvement

Toolik at a Glance

Reservations
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- Project Registration
- Truck Calendar QuickView
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- Freight Tracking

Environmental Data Center
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- Request Service
- Weather Data
- Naturalist Journal
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GIS & Remote Sensing
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Science Support Services
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- Contact Science Support

4th National Climate Assessment https://nca2018.globalchange.gov/

- Climate change creates new risks and exacerbates existing vulnerabilities in communities across the United States
- Without substantial and sustained global mitigation and regional adaptation efforts, climate change is expected to cause growing losses to American infrastructure and property and impede the rate of economic growth over this century
- Affects natural, built, and social systems we rely on individually and through connections. Interconnected systems increasingly vulnerable to cascading impacts often difficult to predict, threatening essential services within and beyond the Nation's borders

NCA2018

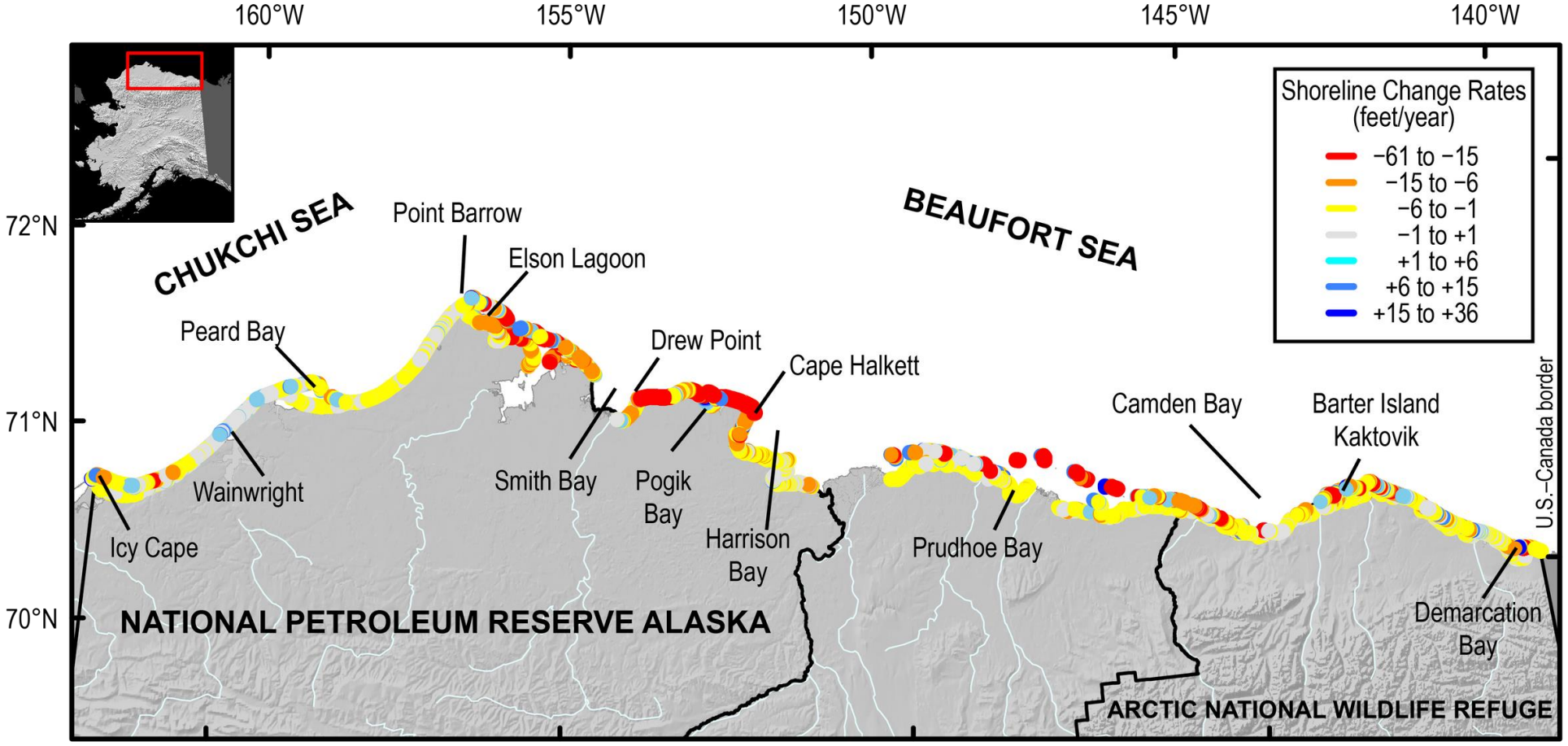
- Communities, governments, and businesses working to reduce risks from and costs associated with climate change by taking action to lower greenhouse gas emissions and implement adaptation strategies; do not yet approach the scale considered necessary to avoid substantial damages to the economy, environment, and human health over the coming decades
- Ecosystems and the benefits they provide to society are being altered by climate change; impacts are projected to continue. Without substantial and sustained reductions in global greenhouse gas emissions, transformative impacts on some ecosystems will occur

NCA 2018 Alaska

- Fish and wildlife habitats , species distribution, and food webs increasingly affected by thinning summer sea ice, increasing temperatures, and ocean acidification.
- Warming will accelerate ecosystem alterations in ways that are difficult to predict, making adaptation more difficult.
- Communities and their infrastructure continue to be affected by permafrost thaw, coastal and river erosion, increasing wildfire, and glacier melt; directly impact how and where many Alaskans will live

https://nca2018.globalchange.gov/chapter/26/

NCA 2018 Alaska, cont'd.



The map is of the north coast of Alaska and shows color-coded shoreline erosion rates, which can lead to the loss of habitat, cultural resources, and infrastructure.

- The Arctic may be far away in walking distance, but it is closely and directly connected with the rest of the World in many ways.
- The changes of climate and ecosystems occurring there are of significance to us.

  Let’s learn more now. This afternoon, we will try to create some lesson plans based on ideas presented, your knowledge and experience.