2024 Arctic Report Card

Walt Meier (NSIDC)
Sue Natalie (Woodwell)
Rick Thoman (ACCAP)

Alaska Center for Climate Assessment and Policy
January 29, 2025

Today's Agenda

Webinar Introduction

Arctic Report Card Video

Background and 2024 Headlines (Rick)

Sea Ice (Walt)

Carbon Cycling (Sue)

Wrap-Up (Rick)

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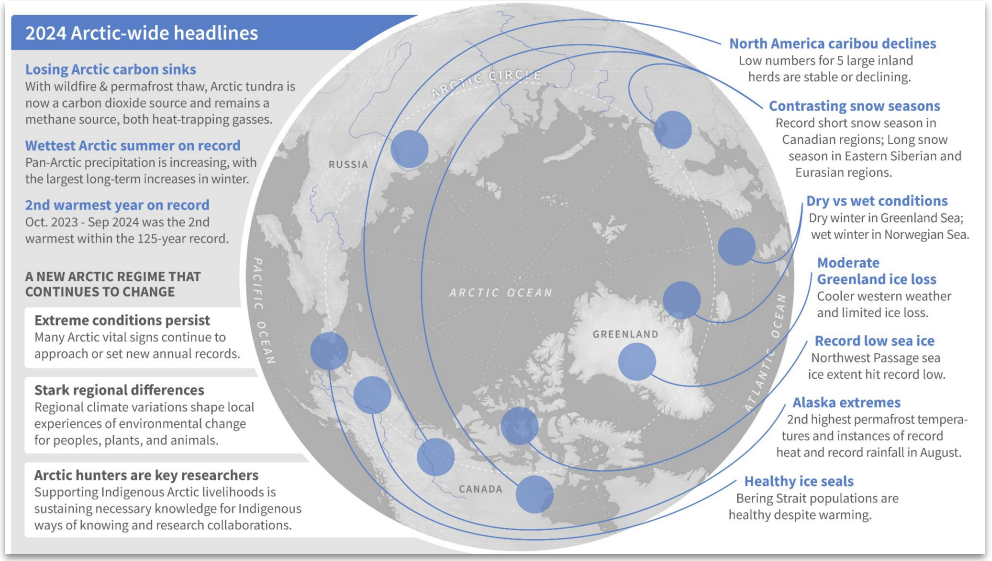
Arctic Report Card Basics

Timely & peer-reviewed source for clear, concise & reliable information on the current state of Arctic environmental system

Intended for a wide audience: teachers, students, decision & policymakers and scientists

- Annually since 2006
- Supported by NOAA's Arctic Program Office…but NOT focused on NOAA activities
- Evolving content & format



Rick Thoman ● Alaska Center for Climate Assessment & Policy
International Arctic Research Center

Arctic Report Card Structure

- Authors
  - Diverse backgrounds
  - Volunteer their time
- Web and Video
  - Integral to today's Arctic Report Card
  - Led by NOAA experts
  - Help support essay author teams
- NOAA Communications
  - Coordinates AGU Rollout
  - Media
  - Agencies

2024 Arctic Report Card Editorial Team

- Coordinating Editor
  - Cindy Garcia (NOAA/Arctic Program Office)
- General Editors (2021-present)
  - Twila Moon (NISDC)
  - Matthew Druckenmiller (NSIDC)
  - Rick Thoman (UAF)

Arctic Report Card Content

- Vital Signs
  - Annual updates on eight recurring topics
- Indicators
  - Topics updated every 3-5 years
    - Glaciers, permafrost, marine & terrestrial mammals
- Frostbites
  - New, emerging and newsworthy items

VITAL SIGNS

Surface Air Temperature

Precipitation

Terrestrial Snow Cover

Greenland Ice Sheet

Sea Ice

Sea Surface Temperature

Arctic Ocean Primary Productivity: The Response of Marine Algae to Climate Warming and Sea Ice Decline

Tundra Greenness

OTHER INDICATORS

Migratory Tundra Caribou in a Warmer Climate

Arctic Terrestrial Carbon Cycling

Ice Seals of Alaska

FROSTBITES

The Original Researchers: Hunters are Scientists Deserving Sustained Support

Arctic Report Card 2024

- Vital signs focus: October 2023 through September 2024
- Released at AGU December 10, 2024
- 12 essays
- Rapid production
  - First drafts mid-Sept, internal & external reviews
  - Final essays by mid-November
- 82 authors from 13 countries

DOI: 10.25923/b7c7-6431

T.A. Moon, M.L. Druckenmiller and R.L. Thoman; Eds.

Rick Thoman ● Alaska Center for Climate Assessment & Policy
International Arctic Research Center

2024 Arctic Report Card Headlines

Physical components

Second warmest year (Oct-Sep)

Summer 2024 wettest and second warmest

Above average snow but earlier than average spring melt

Sea surface temperatures late summer 4-7ºF above normal…except Chukchi Sea

Primary productivity (plankton blooms) below average

Arctic Animals

Migratory caribou herds have declined dramatically recent decades but coastal herds steady or increasing

Ice seals near Alaska remain healthy although ringed seals show a shift in diet

People

Indigenous hunters are the original Arctic researchers —Ittaq Heritage and Research Centre

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Arctic Sea Ice: Recap of the 2024 Arctic Report Card +

ACCAP Seminar, 29 January 2025

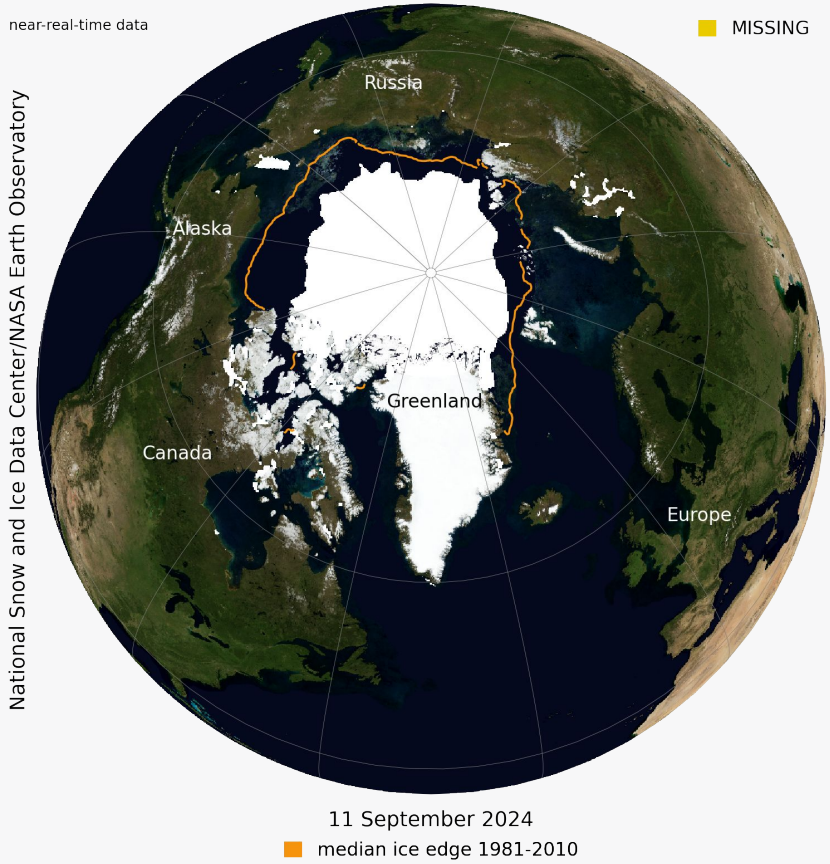
Walt Meier

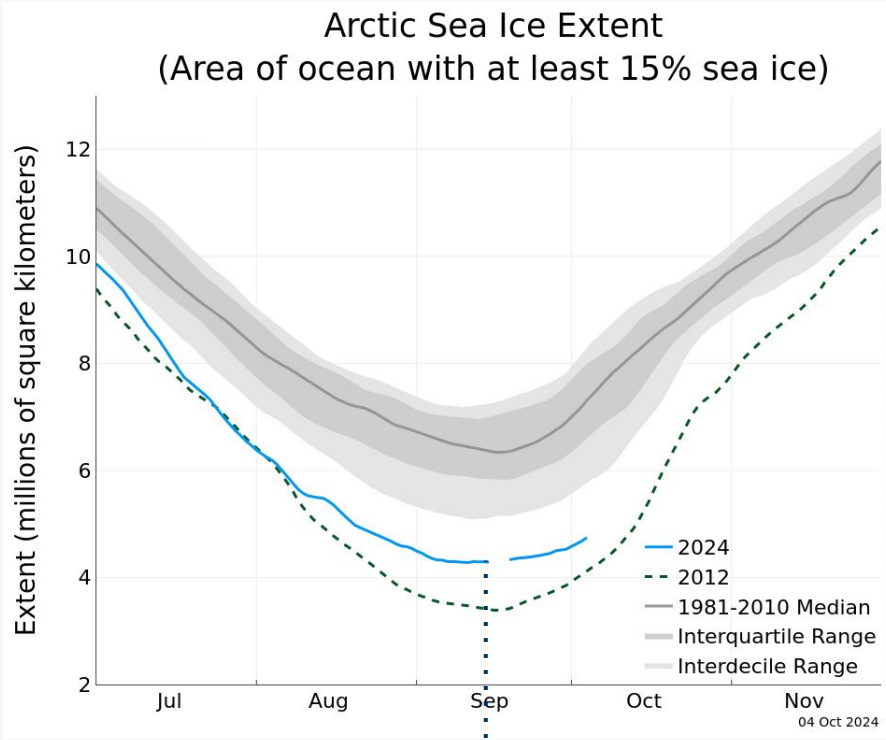
National Snow and Ice Data Center, University of Colorado, Cooperative Institute for Research in Environmental Sciences

CIRES University of Colorado Boulder

NSIDC

2024 MINIMUM, 7TH LOWEST



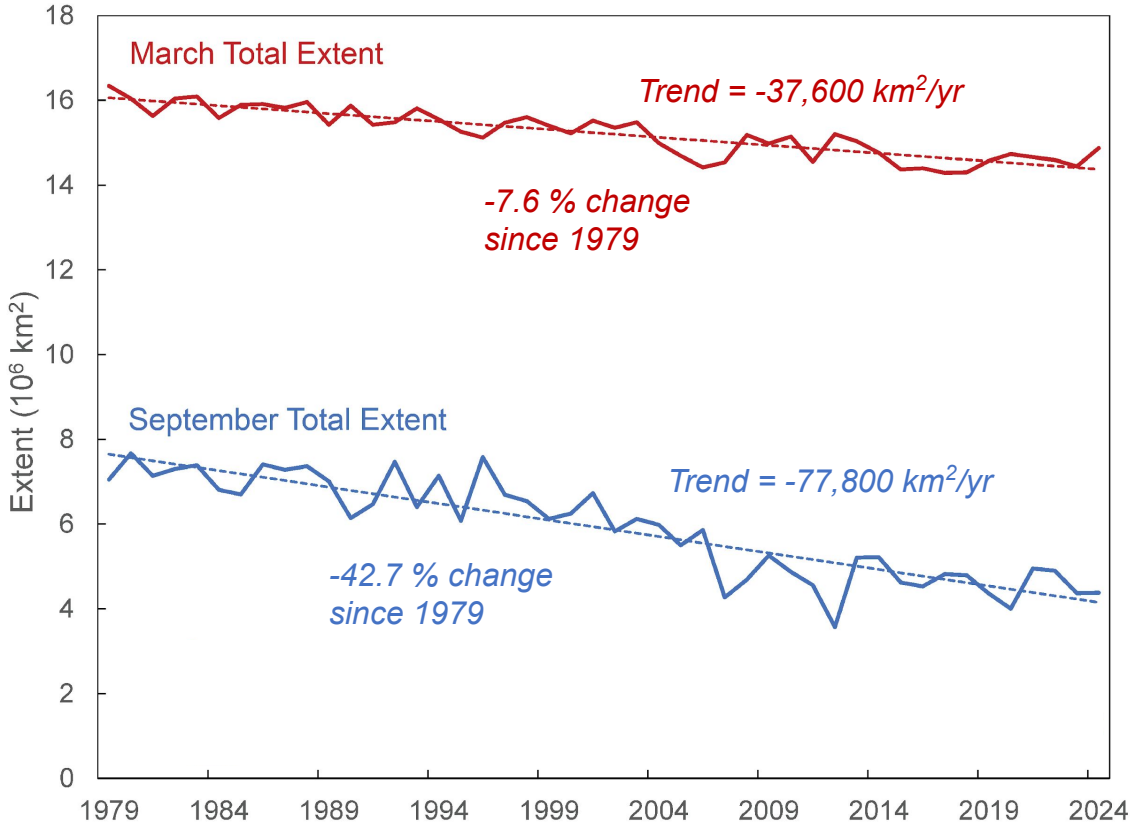


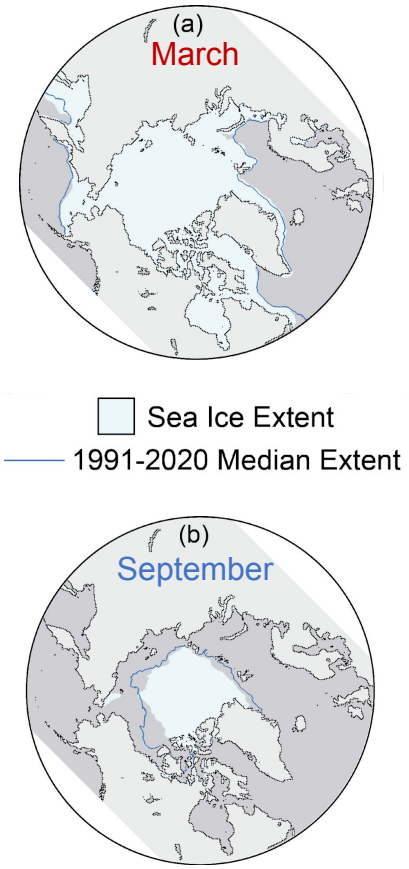
11 September, 4.28 x 10^6 km^2

7th lowest extent

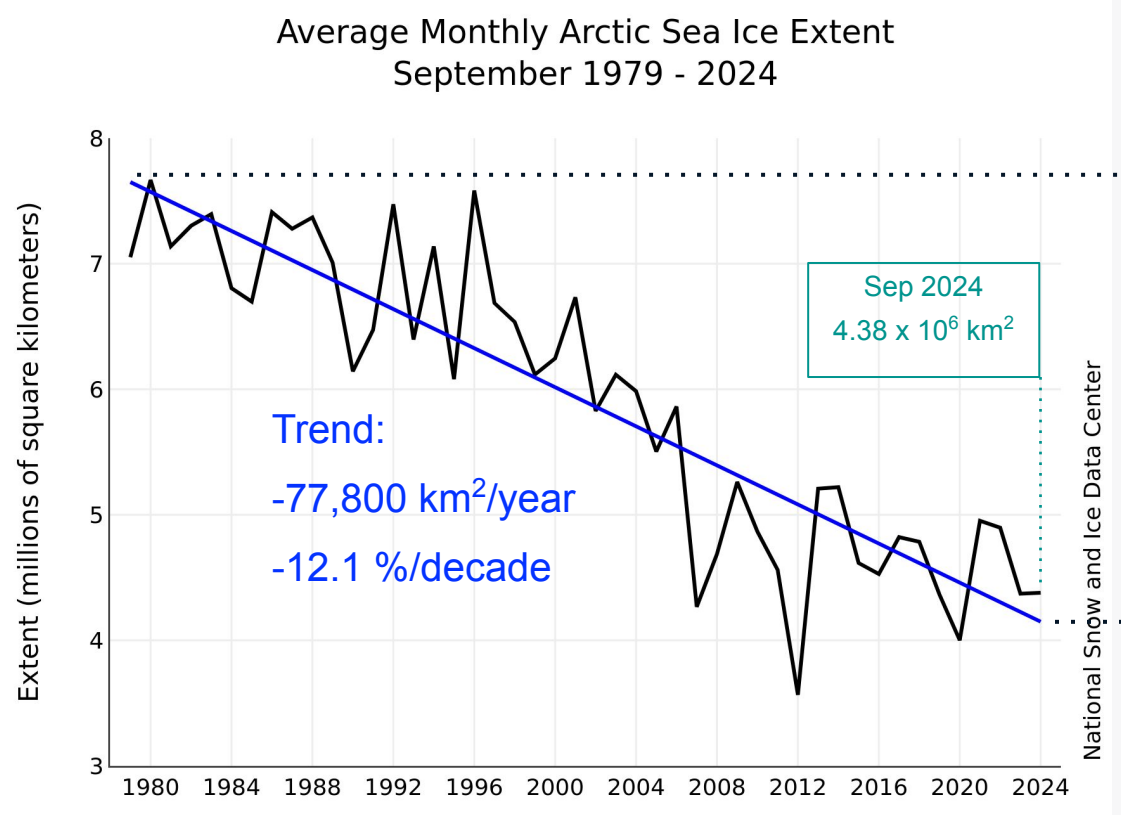
NSIDC Sea Ice Index, https://nsidc.org/data/seaice_index

March and September Sea Ice Extent





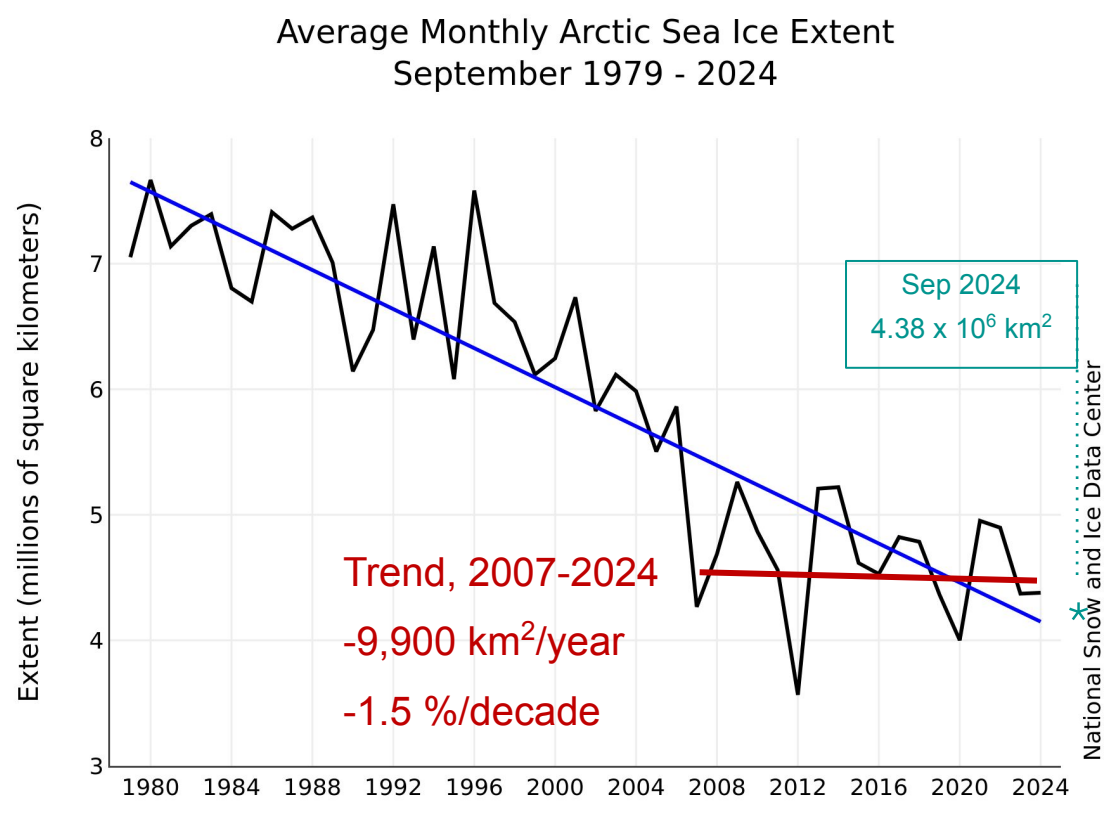
Arctic September average



-3.50 x 10^6 km^2

-45.8% loss since 1979

Arctic September average



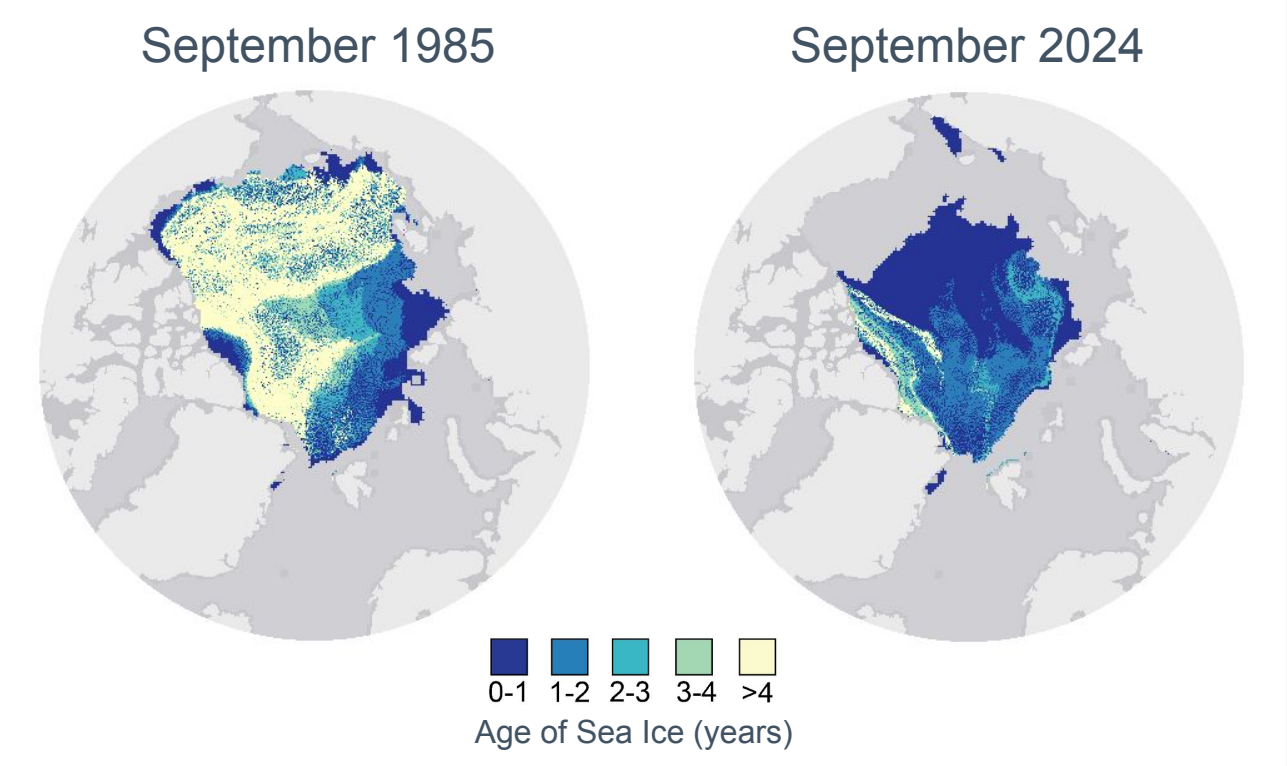
Since 2007, variability, but no substantial trend.

But no recovery!

2007 to 2024 are the 18 lowest Septembers in the 46-year satellite record

NSIDC Sea Ice Index, https://nsidc.org/data/seaice_index

Sea ice age – older ice is generally thicker ice

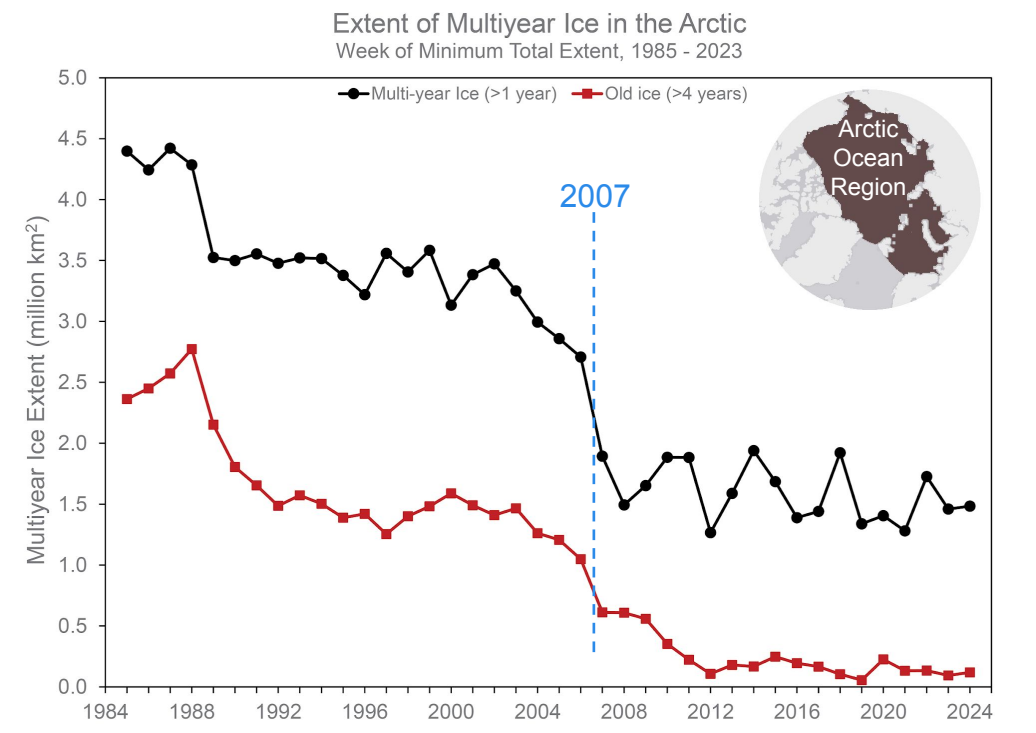


Much less multi-year ice than in the 1980s.

Arctic now dominated by thinner seasonal sea ice.

Tschudi et al., 2019, https://doi.org/10.5067/UTAV7490FEPB

Sea ice age – September trend



Variability in multiyear ice since 2007, but no substantial trend

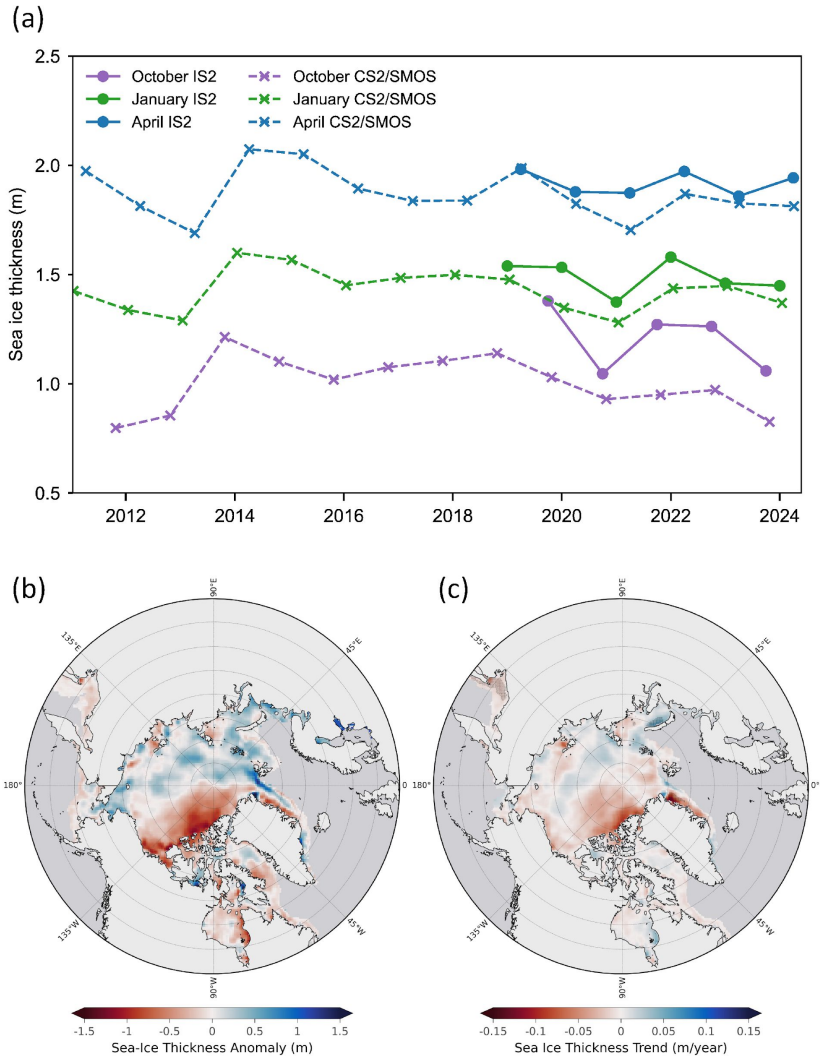
But no recovery!

Almost no “old” ice (>4 years) remaining in the Arctic

Tschudi et al., 2019, https://doi.org/10.5067/UTAV7490FEPB

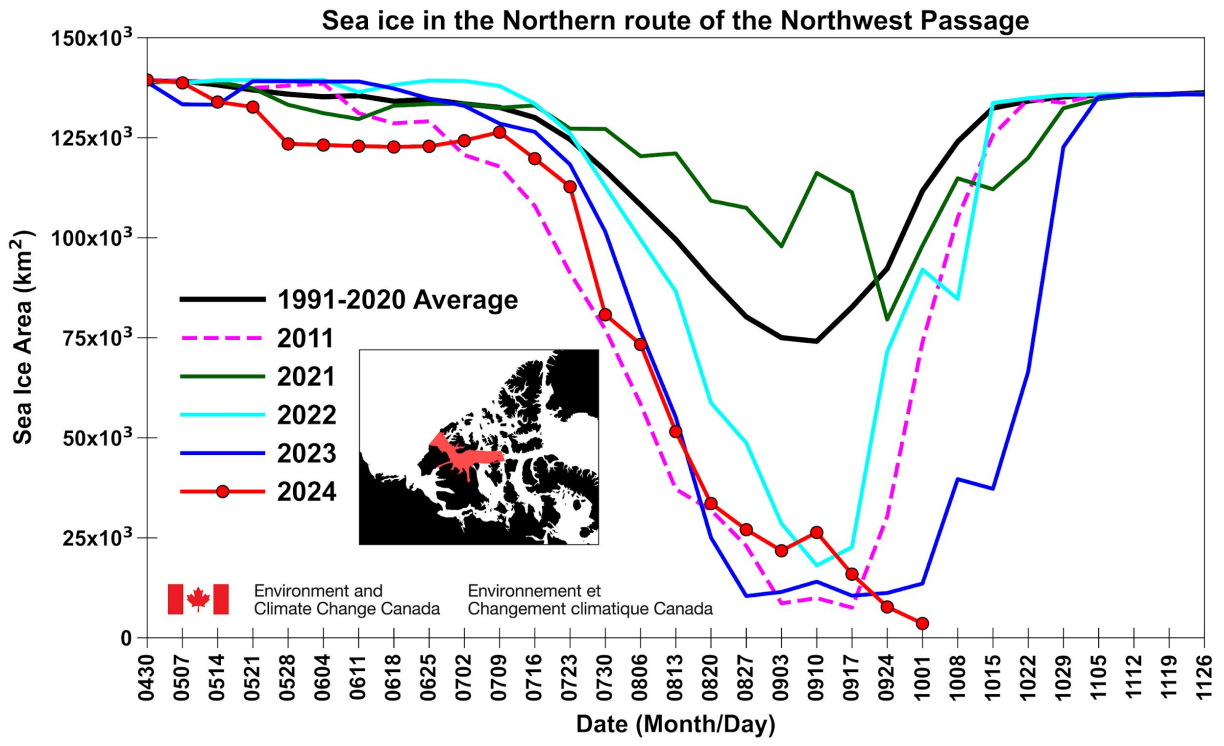
Sea ice thickness

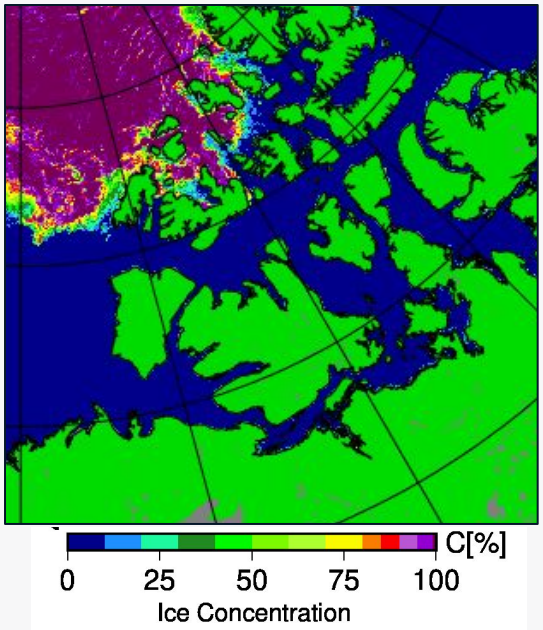
- Less comprehensive thickness data; shorter timeseries - consistent data mostly from satellite altimeters.
- Variability in thickness ice since 2010, no substantial trend. **But no recovery!**
- Earlier data from submarine and early satellite data indicate 2010-2024 period is ~50% thinner than the 1980s and earlier decades.



Data from NASA ICESat-2, ESA CryoSat-2, and ESA SMOS
Image by Alek Petty, NASA Goddard, and Stefan Hendricks, AWI

Arctic, record low Northwest Passage



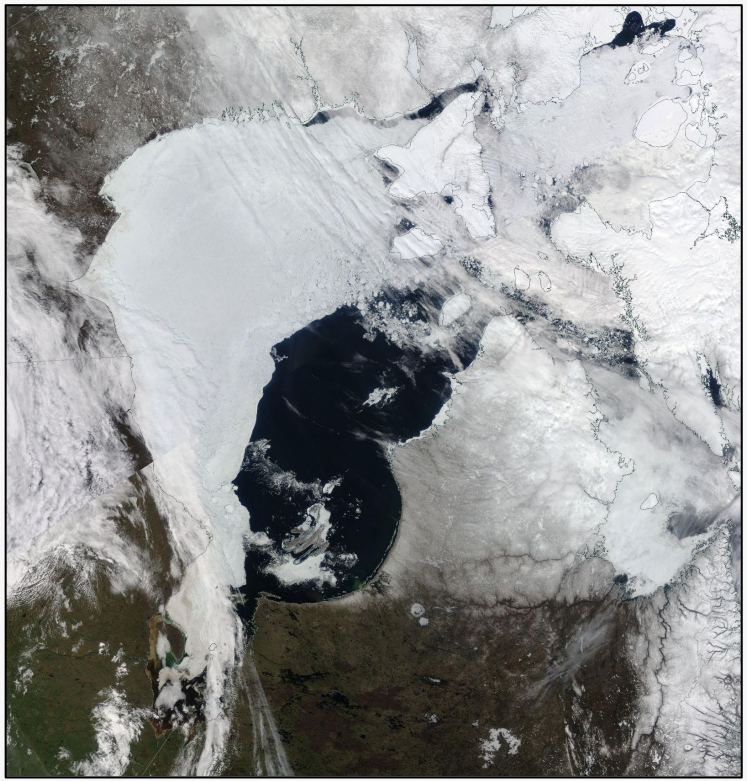


1 October 2024
AMSR2 Sea Ice Concentration
Univ. Bremen

Northern route extent (M'Clure Strait), through 1 October 2024
Steve Howell, Env. Climate Change Canada; Data from Canadian Ice Service analyses

Univ. Bremen Sea Ice, https://seaice.uni-bremen.de/sea-ice-concentration/amsre-amsr2/

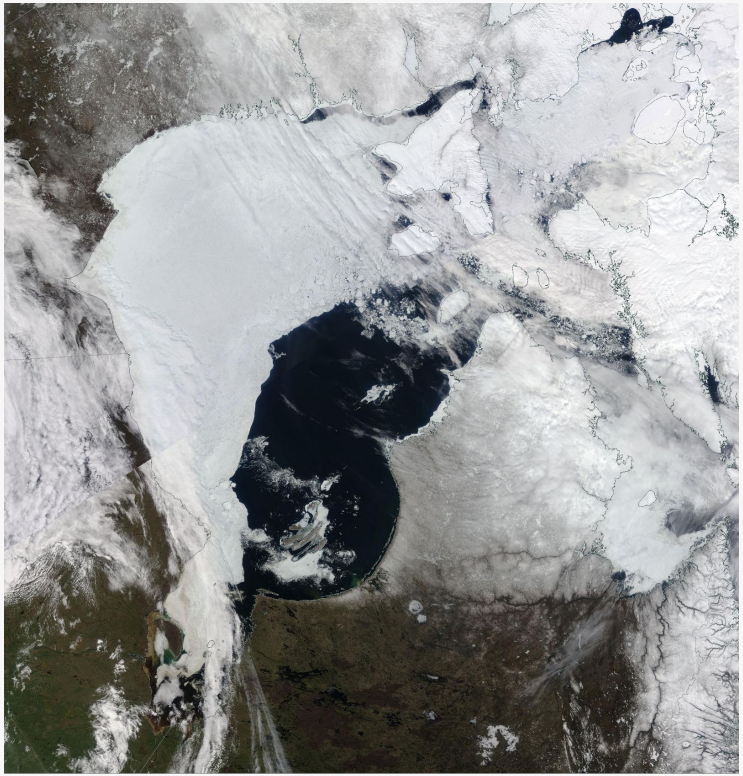
Hudson Bay – Early opening in the East



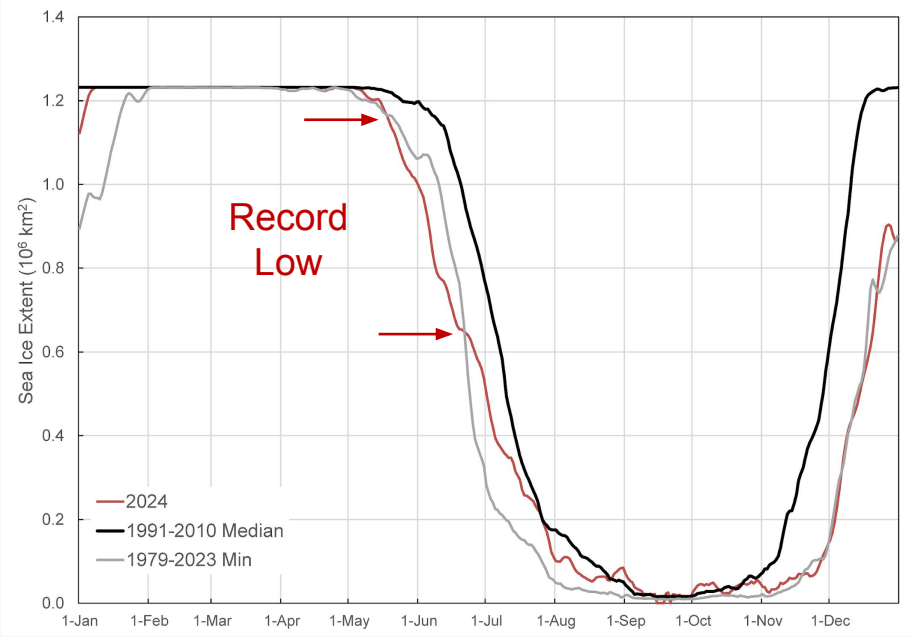
Hudson Bay, May 26, 2024
NASA Worldview, MODIS True Color mosaic

- Eastern Hudson Bay open water starting in early May record low Hudson Bay extent
- Hudson Bay normally opens in June from the west.
- Main reason was strong easterly winds push ice across the bay.
- Thick, deformed ice lasted longer than normal into the summer in the west.

Hudson Bay – Early opening in the East



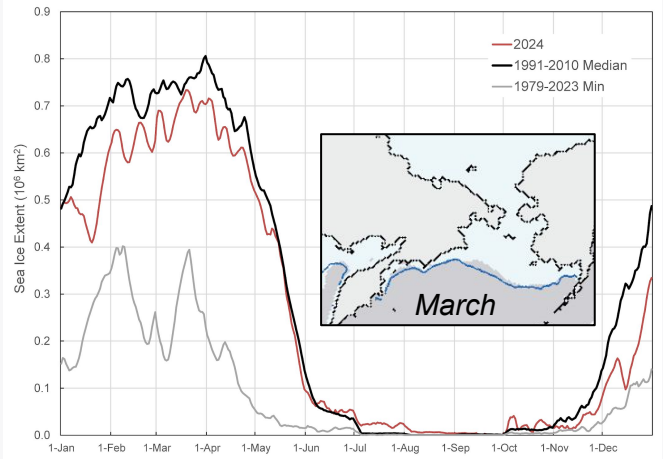
Hudson Bay, May 26, 2024
NASA Worldview, MODIS True Color mosaic



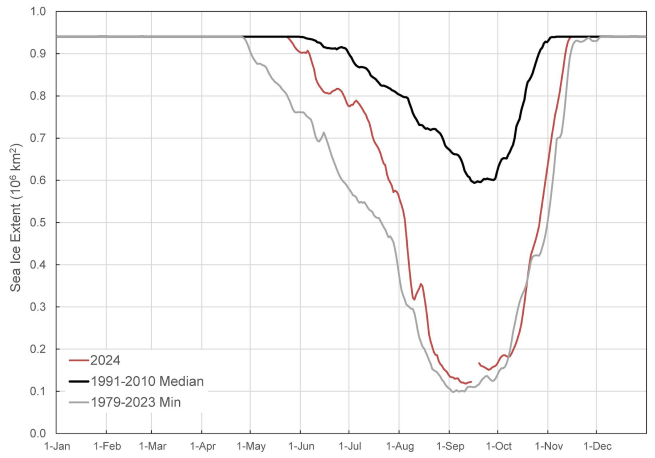
- Record low Hudson Bay extent from mid-May through most of June.
- Late freeze-up, near-record low in November and December

Alaska region sea ice extents

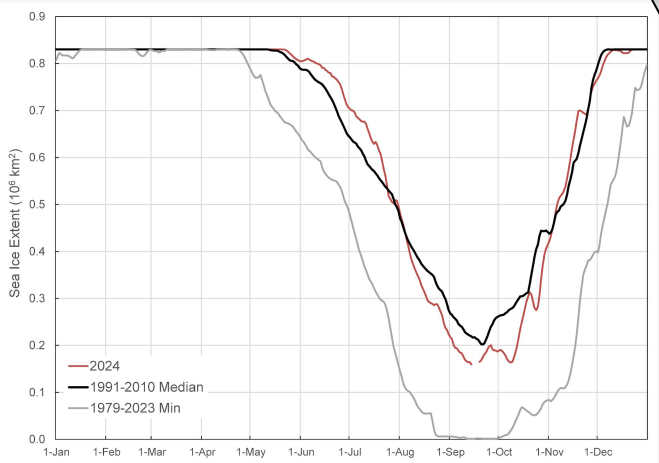
Bering Sea

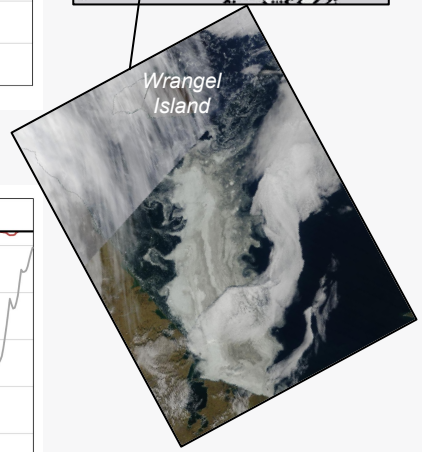


Beaufort Sea



Chukchi Sea





MODIS, 1 Sep 2024

Bering – near-normal winter
Beaufort – low summer
Chukchi – near-normal* summer

**persistent "dirty" ice near Wrangel Island*

NSIDC Sea Ice Index, https://nsidc.org/data/seaice_index
NASA Worldview, https://worldview.earthdata.nasa.gov

Thanks to:

- NASA Cryospheric Sciences Program
- NASA Snow and Ice Distributed Active Archive Center
- NOAA@NSIDC Program
- Steve Howell for NWP data and figures
- Alek Petty, Stefan Hendricks for thickness figure

- Extent data from the NSIDC Sea Ice Index https://nsidc.org/data/seaice_index
- NSIDC Sea Ice Today https://nsidc.org/sea-ice-today

NSIDC

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Arctic Terrestrial Carbon Cycling
2024 Arctic Report Card

S. M. Natali, B. Rogers, E. A. G. Schuur, V. Romanovsky, H. Alcock, K. Arndt, E. S. Euskirchen, G. Falvo, G. Fiske, G. Hould-Gosselin, J. Hung, A. Kholodov, S. Potter, O. Sonnentag, and A. -M. Virkkala

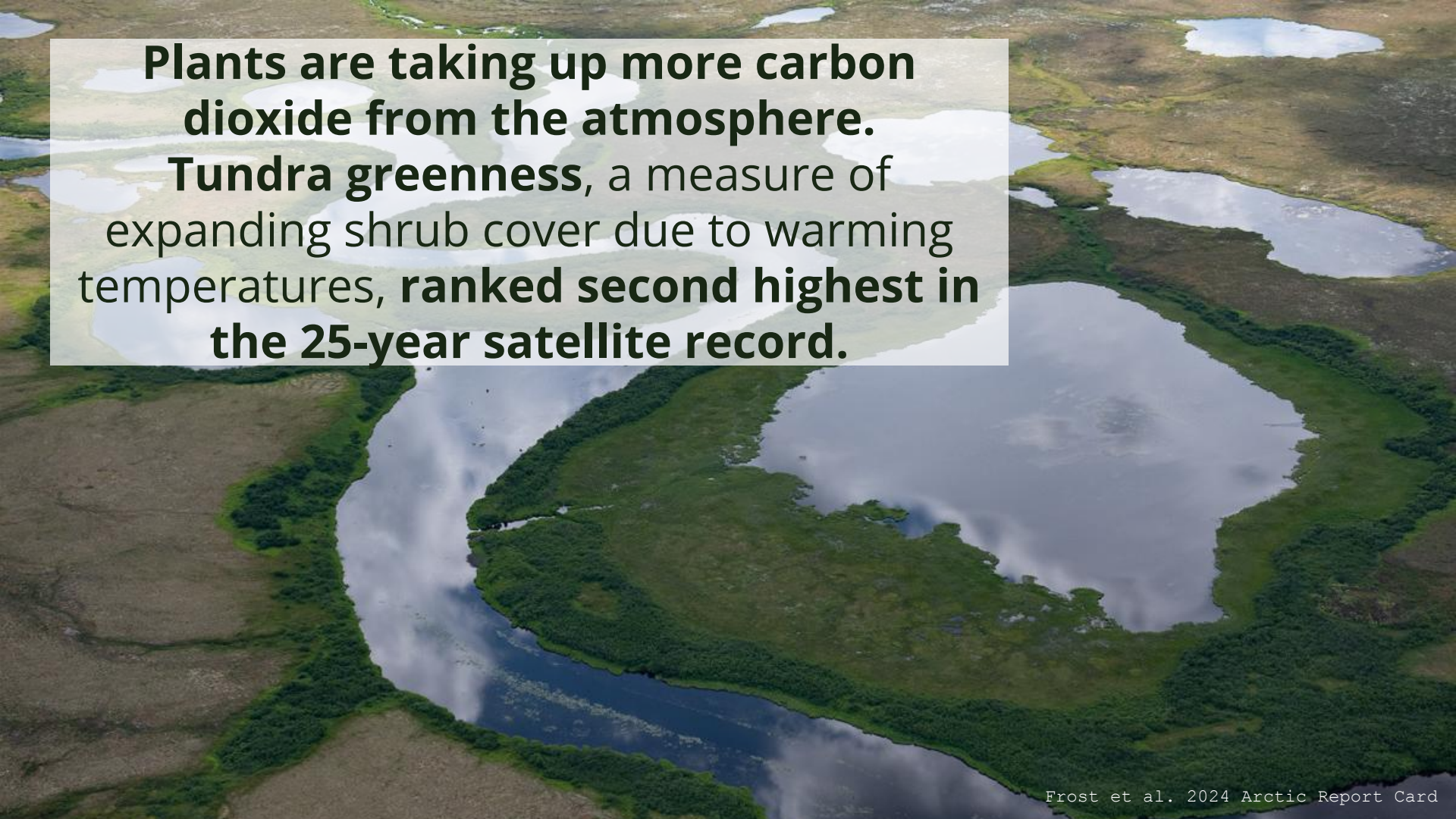
Alaska Center for Climate Assessment and Policy Seminar 29 January 2025

Sue Natali
Woodwell Climate Research Center

PERMAFROST PATHWAYS

Woodwell Climate Research Center

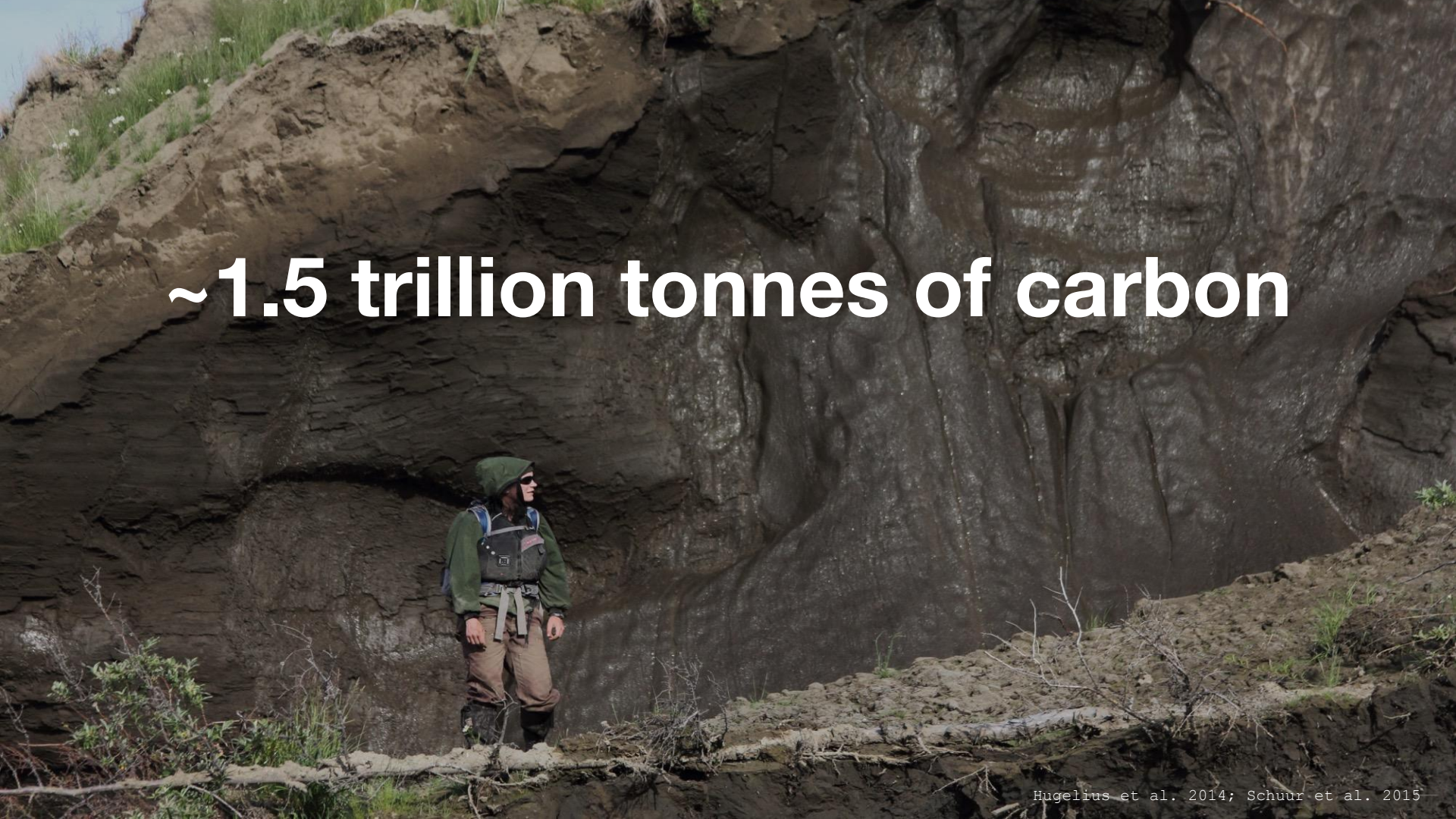

Flux Sites
Tundra
Boreal
Wetland
Entire Network
Biome
Tundra
Boreal Forest
ARCTIC CIRCLE



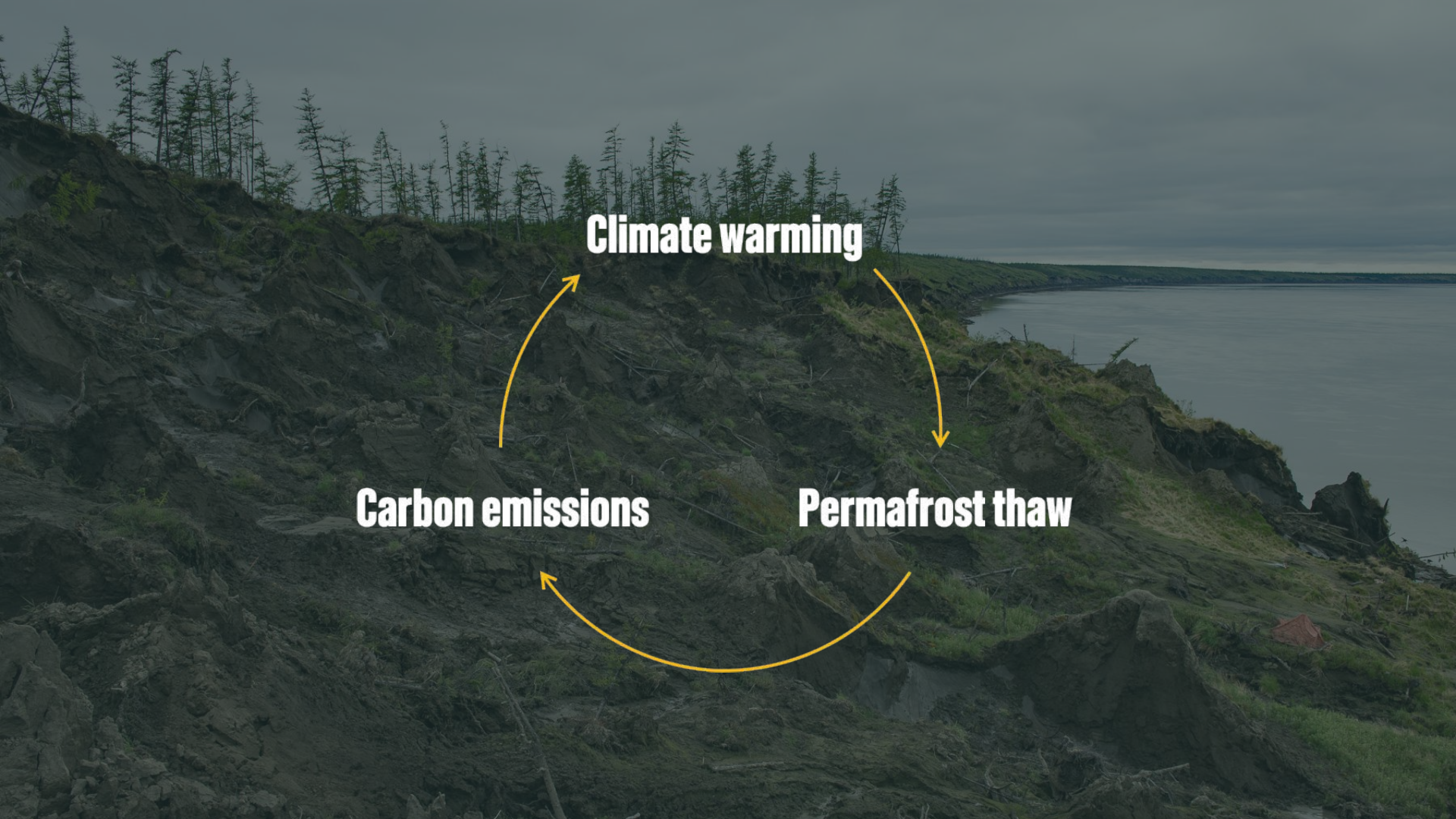
Plants are taking up more carbon dioxide from the atmosphere.

Tundra greenness, a measure of expanding shrub cover due to warming temperatures, **ranked second highest in the 25-year satellite record.**

Frost et al. 2024 Arctic Report Card



Hugelius et al. 2014; Schuur et al. 2015


Climate warming
Permafrost thaw
Carbon emissions

Alaskan **permafrost temperatures in 2024** were the **second warmest on record.**

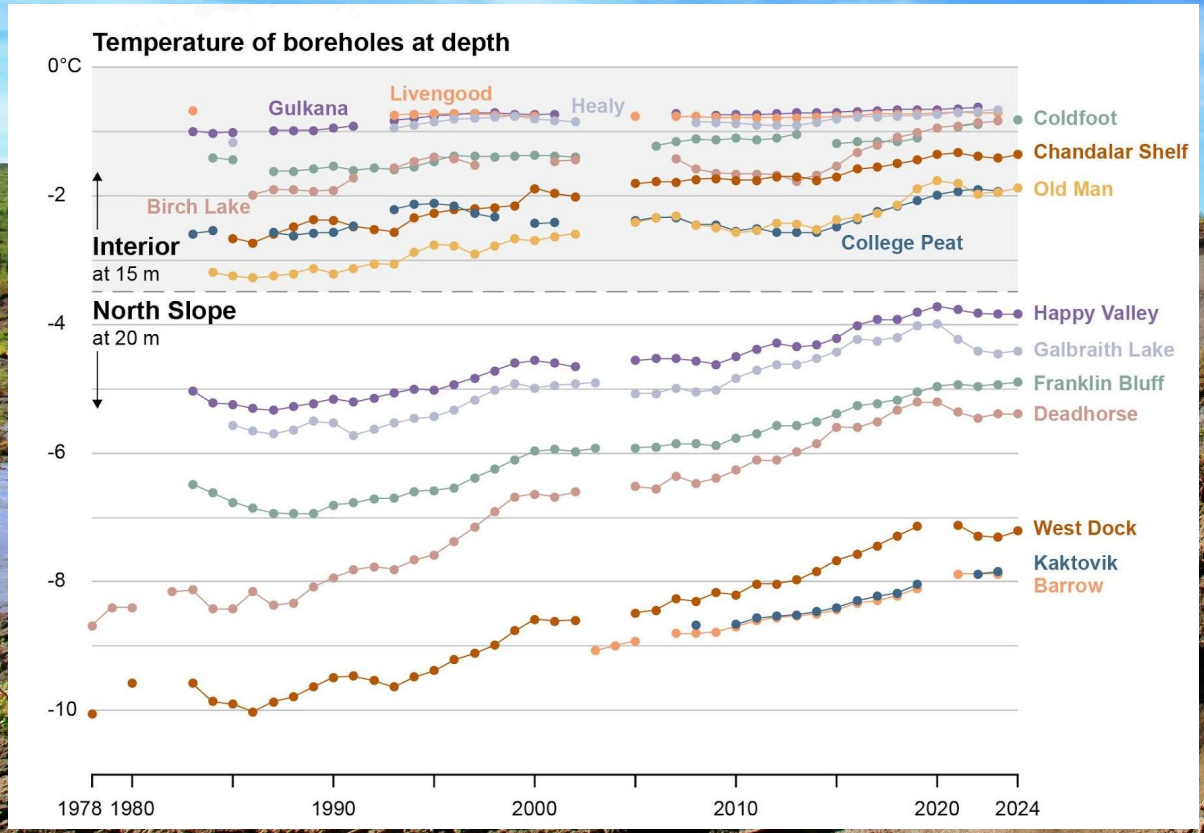


Photo: Scott Zolkos

Circumpolar **wildfire emissions averaged 207 million tons of carbon per year** since 2003.

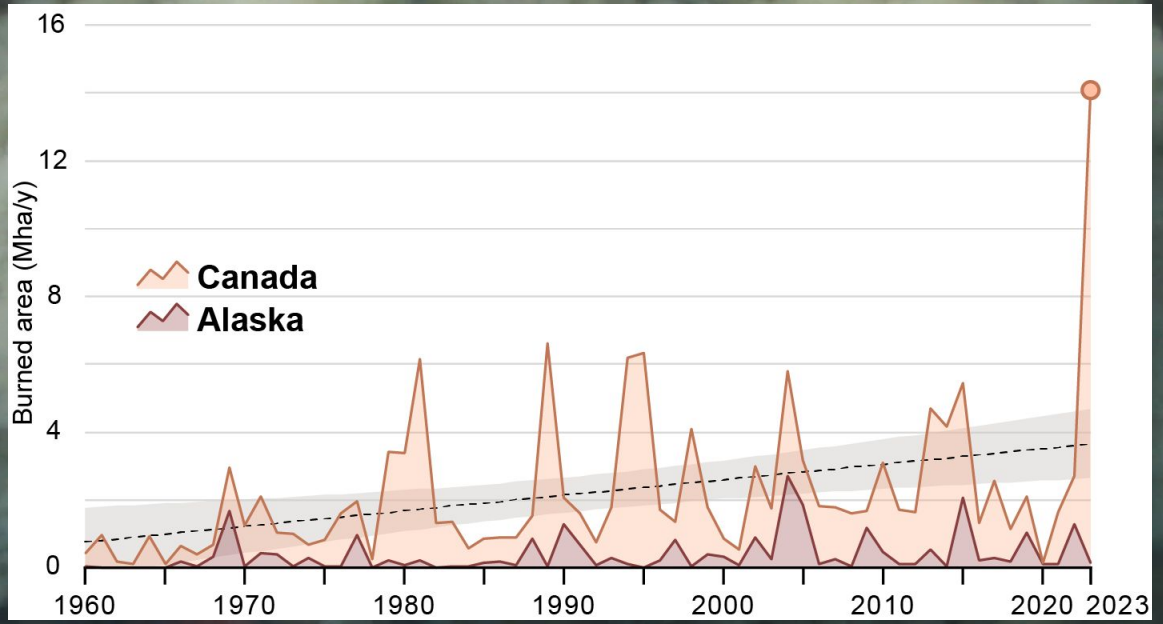
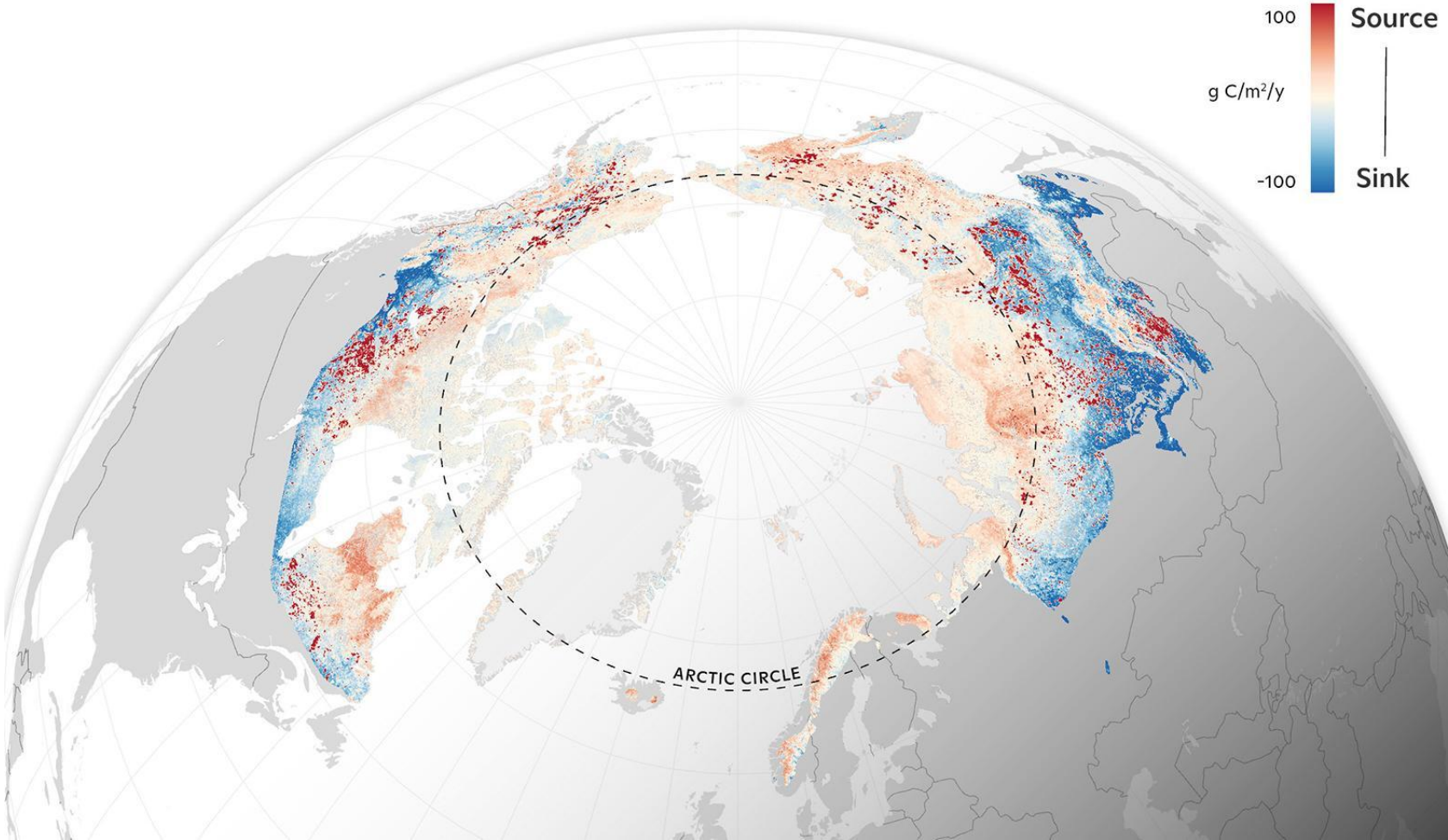
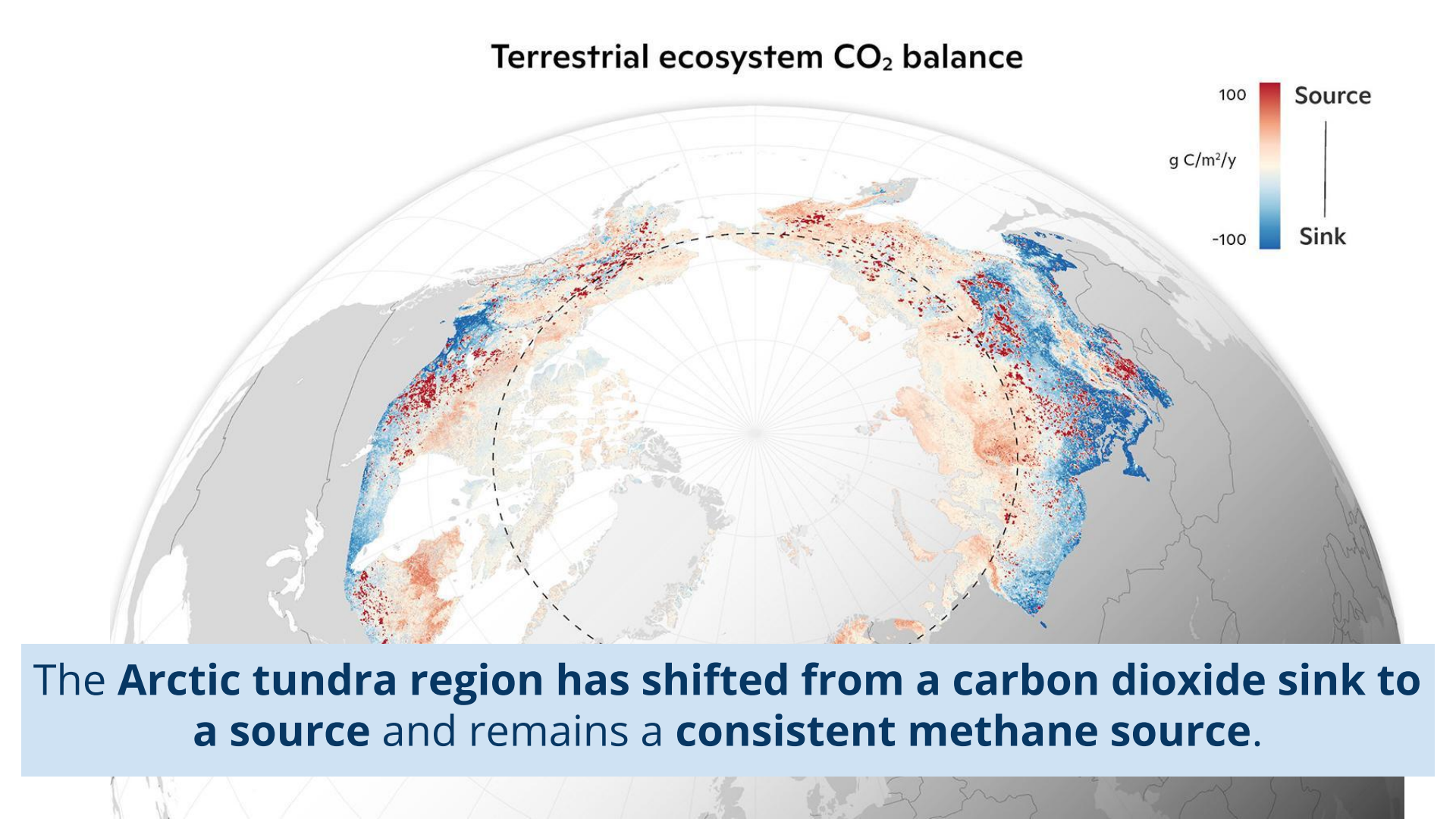


Photo: Chris Linder

Terrestrial ecosystem CO_2 balance





The **Arctic tundra region has shifted from a carbon dioxide sink to a source** and remains a **consistent methane source**.

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Arctic Report Card Landing Page

https://arctic.noaa.gov/report-card/

2024 Arctic Report Card

https://arctic.noaa.gov/report-card/report-card-2024/

2024 Arctic Report Card video

https://www.youtube.com/watch?v=0yqGquGQbqA

Go to the 2024 Arctic Report Card