National Aeronautics and Space Administration

ALASKA ECOLOGICAL CONSERVATION II

Using NASA Earth Observations to Identify Recent Changes in Vegetation Phenology and Its Impacts on Caribou Migration

Levi Mitchell

Jackie Encinas

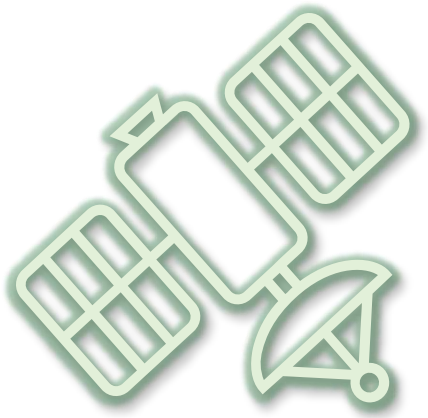
Peter Vailakis

Gareth Miller

DEVELOP

Massachusetts – Boston | Summer 2024

Presentation Outline



Background

Research Partners
Community Concerns

Methods

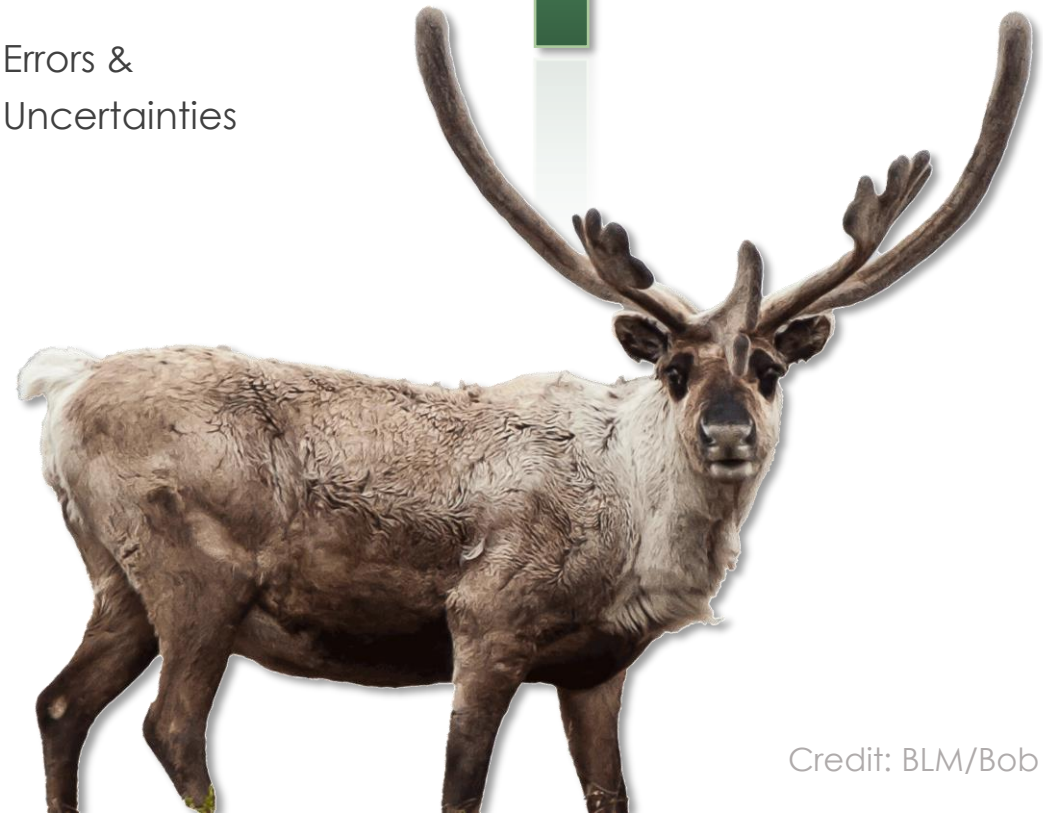
Study Area
Objectives
Earth Observations

Results

Errors &
Uncertainties

Conclusion

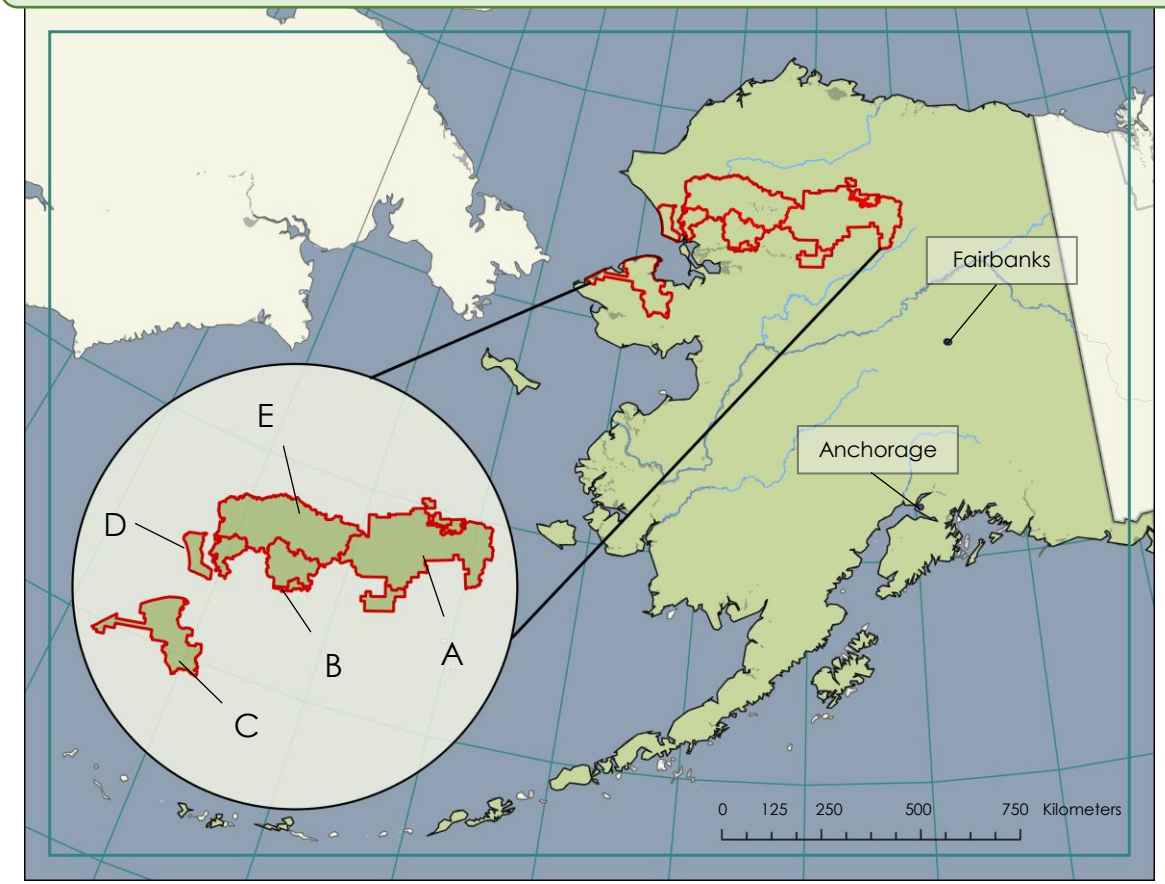
Feasibility
Acknowledgements



Credit: BLM/Bob Wick

Partner

Arctic Inventory and Monitoring Network



Data from WWU and Alaska Geoportal

Parks of Interest

A. *Gates of the Arctic National Park and Preserve*

B. *Kobuk Valley National Park*

C. *Bering Land Bridge National Preserve*

D. *Cape Krusenstern National Monument*

E. *Noatak National Preserve*

Community Concerns


Credit: BLM/Bob Wick

Caribou calving is influenced by the availability of nutrient-rich vegetation.

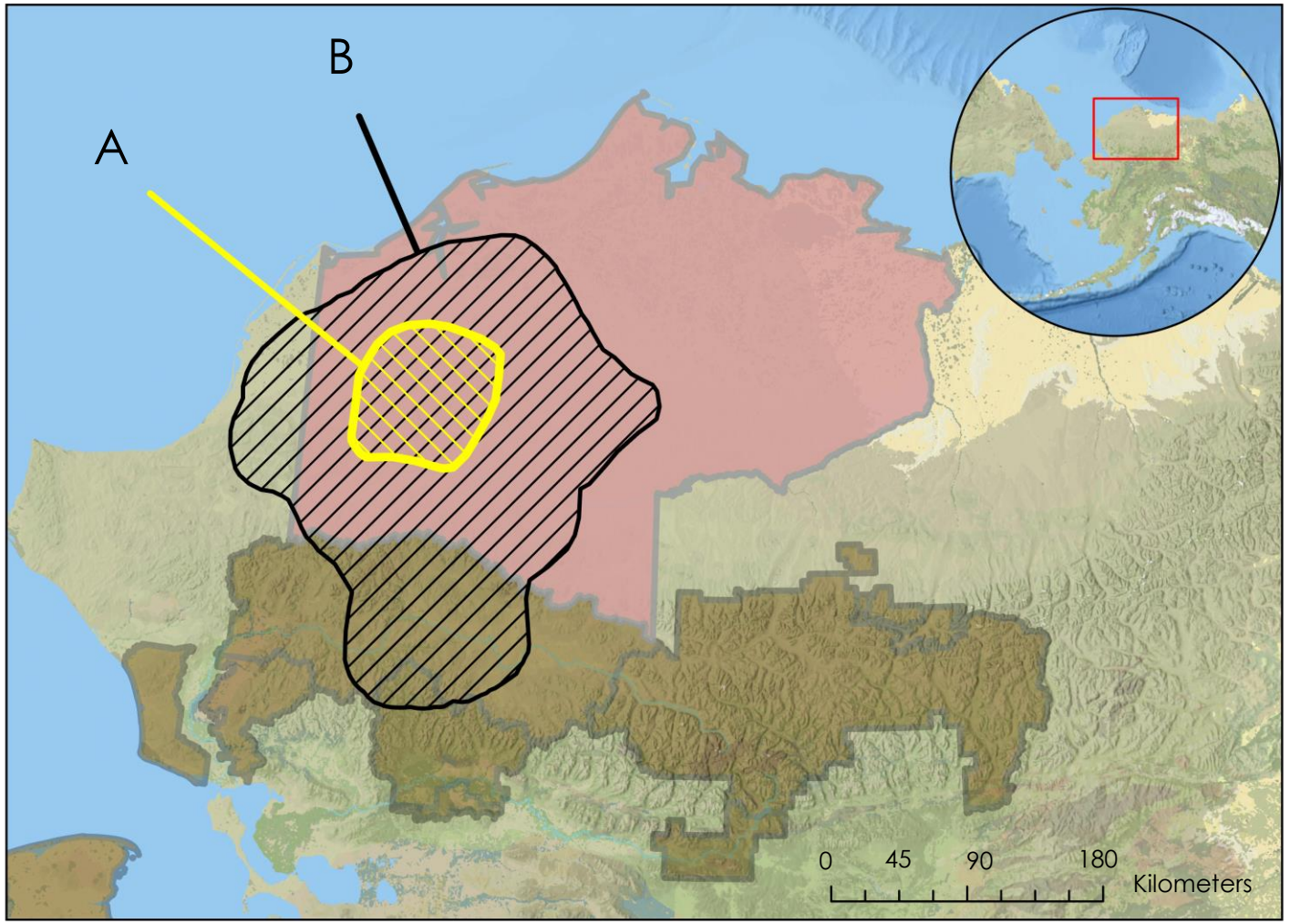

Credit: NPS


Credit: NPS/Zak Richter

Study Area & Period

Site A: Highest density of calving sites

Site B: Lower density of calving events



Data from Esri, Alaska Geoportal, Earthstar Geographics, and USGS

Objectives

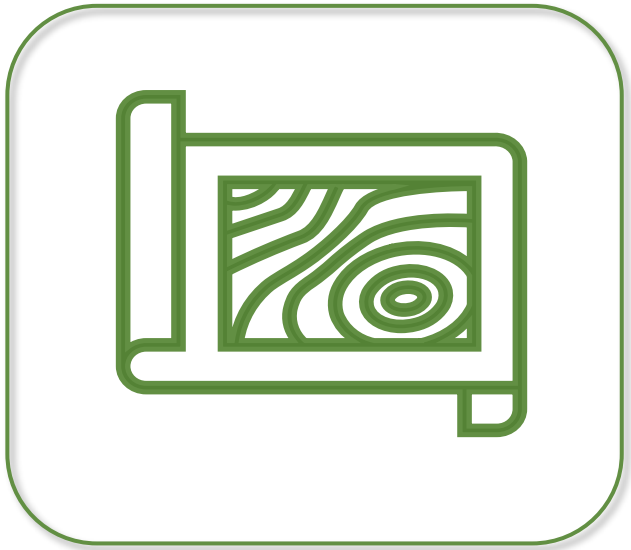
Time Series Plots

2000 – 2024

Annual Green-up, ΔNDVI, peak NDVI, and length of season

Time Series Maps

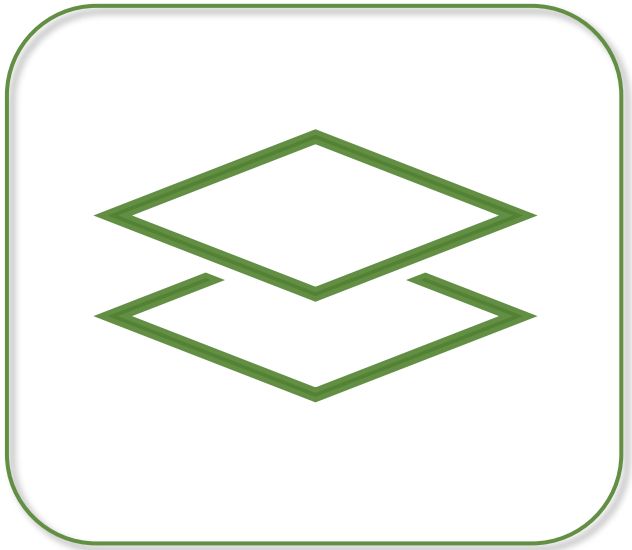
Yearly



Time lapse visualization of seasonal vegetation phenology

NDVI Composite

2000 – 2024



Composite image of reoccurring high density NDVI values

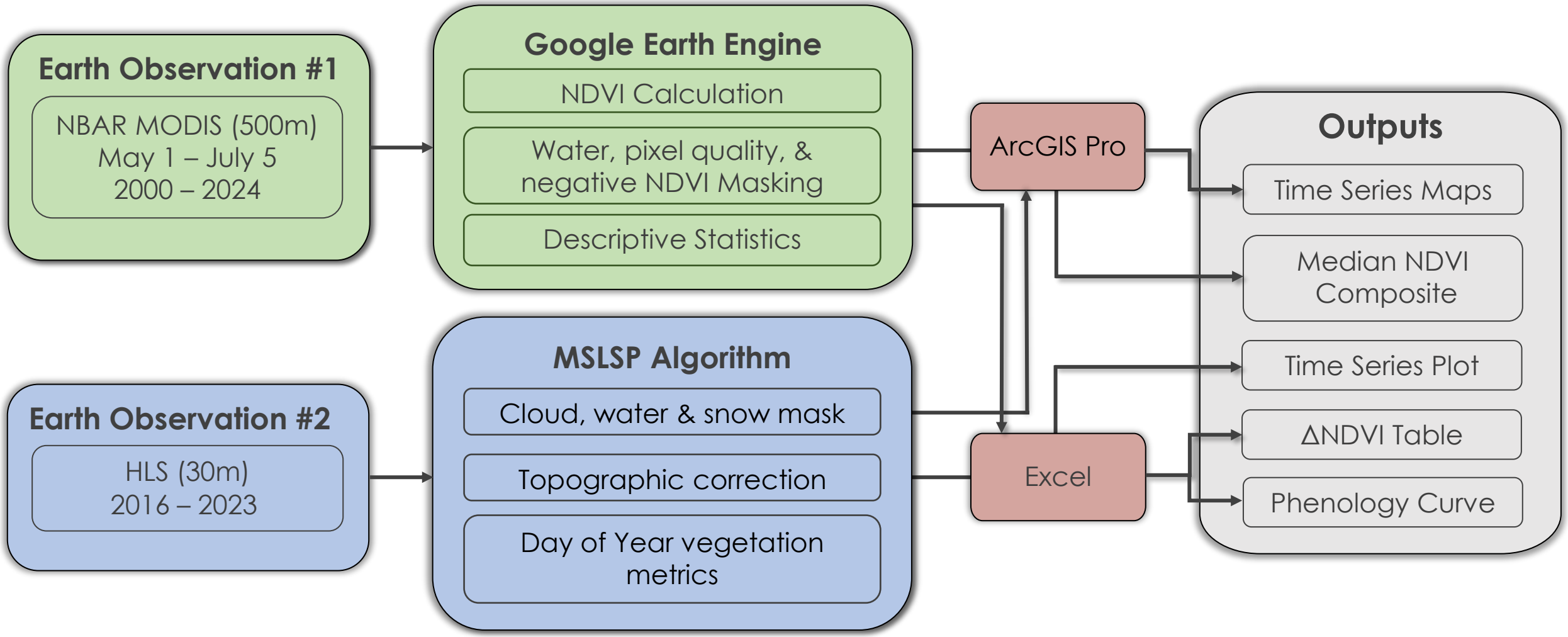
Earth Observations

HLS Product (30m)

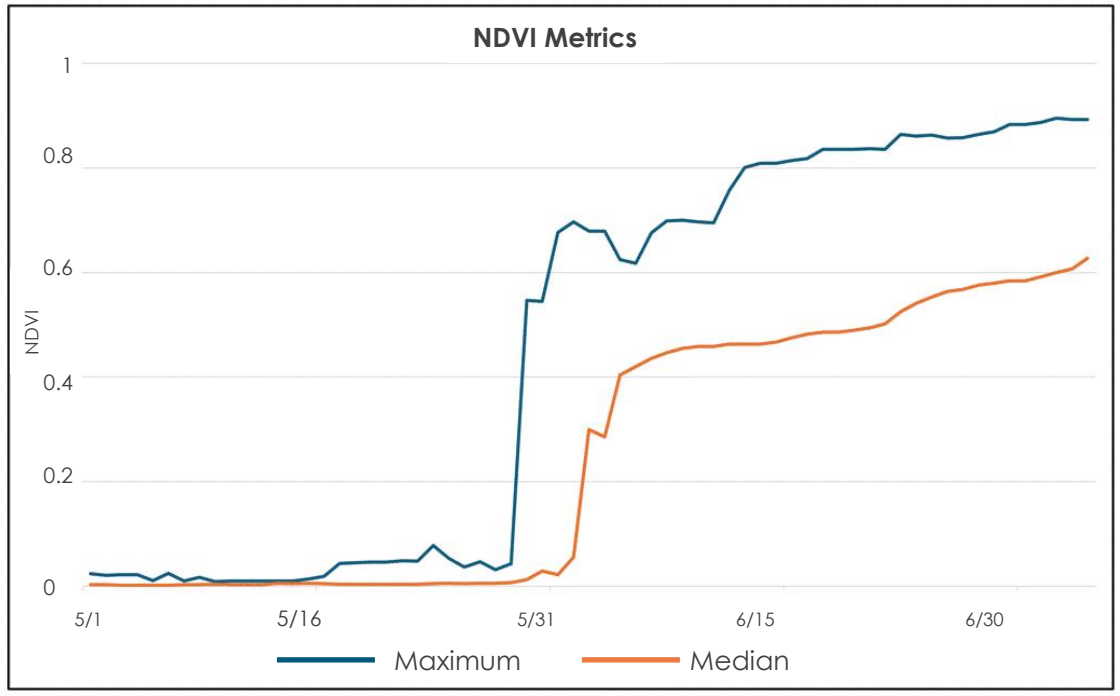
NBAR MODIS Product (500m)

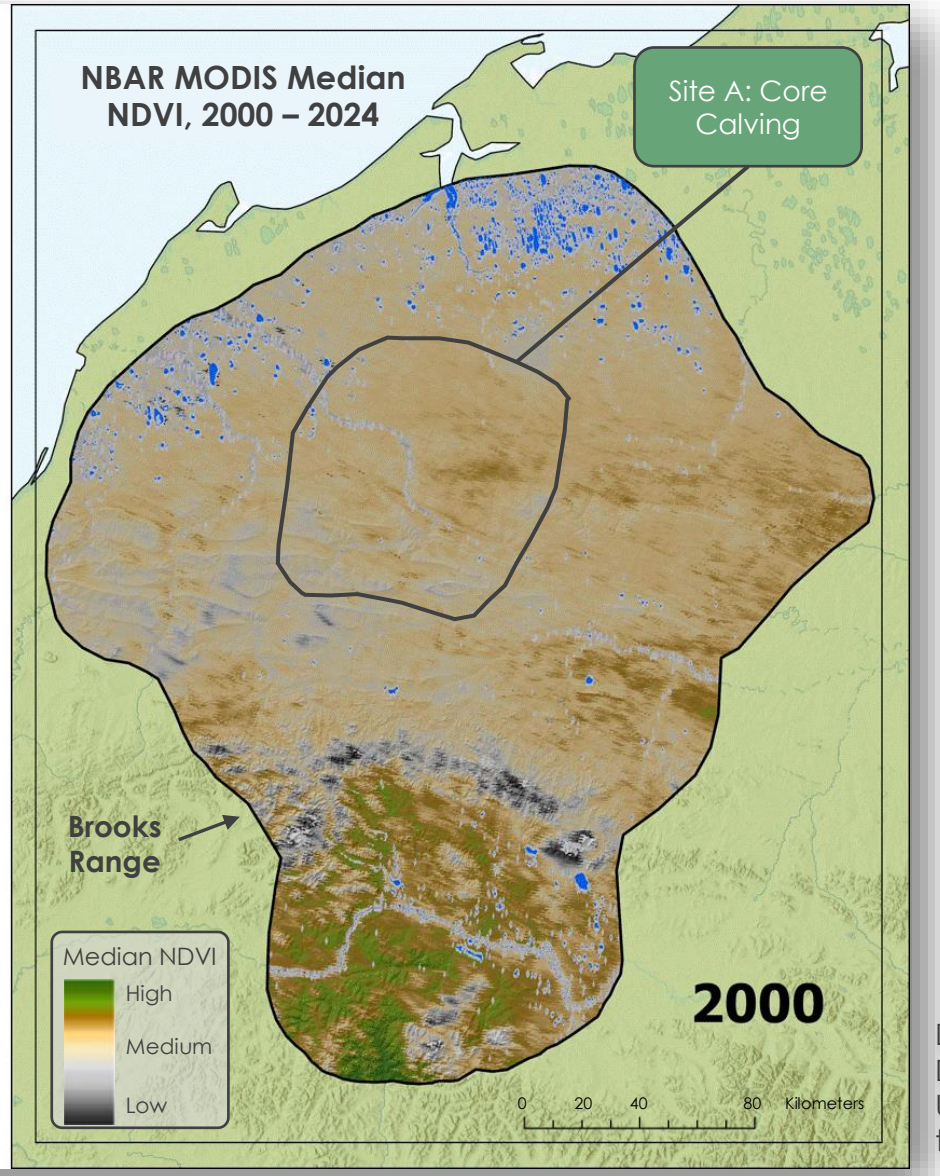
2000 2005 2010 2015 2016 2020 2023 2024

Methodology



Results - NBAR MODIS Time Series

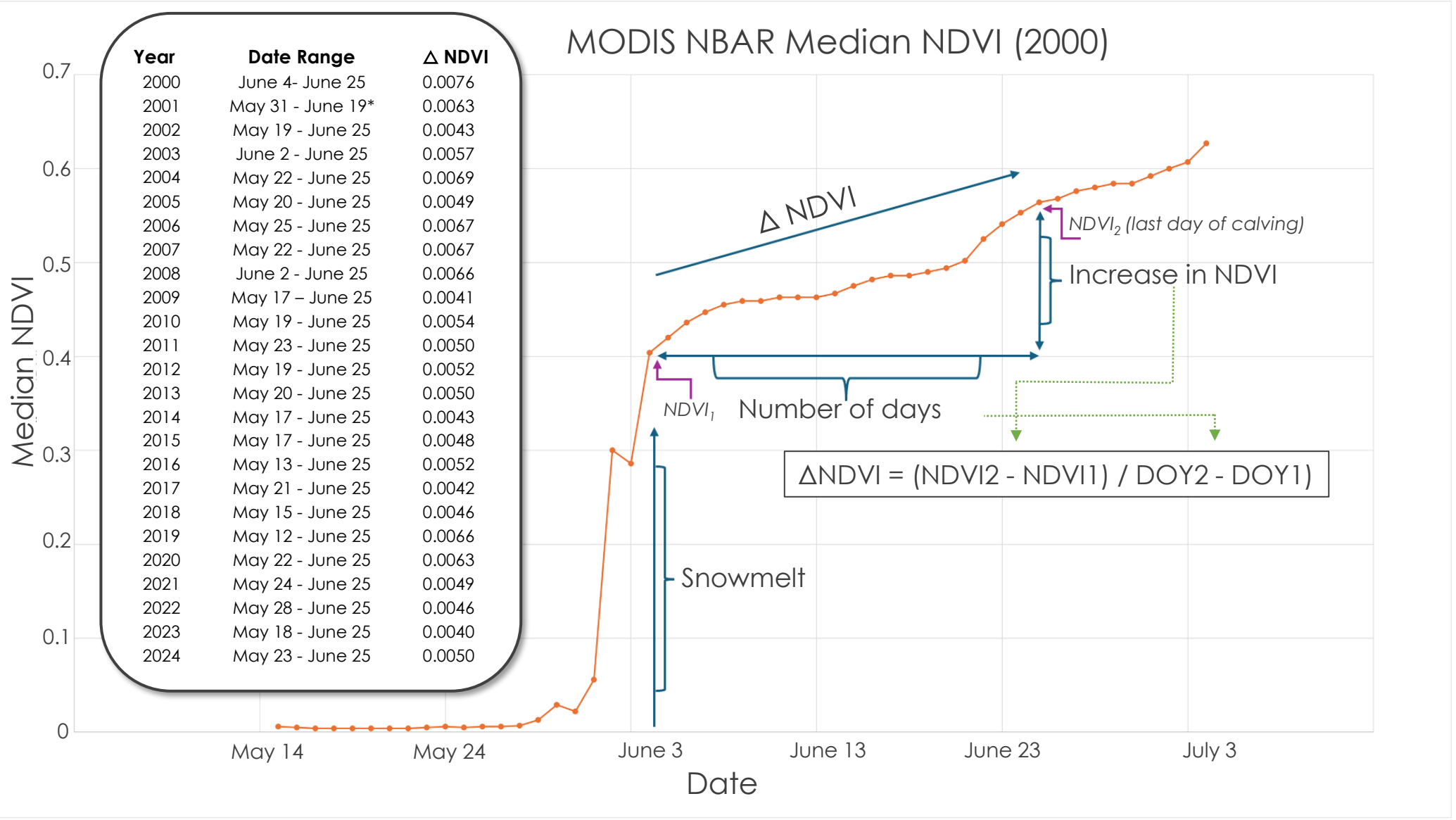




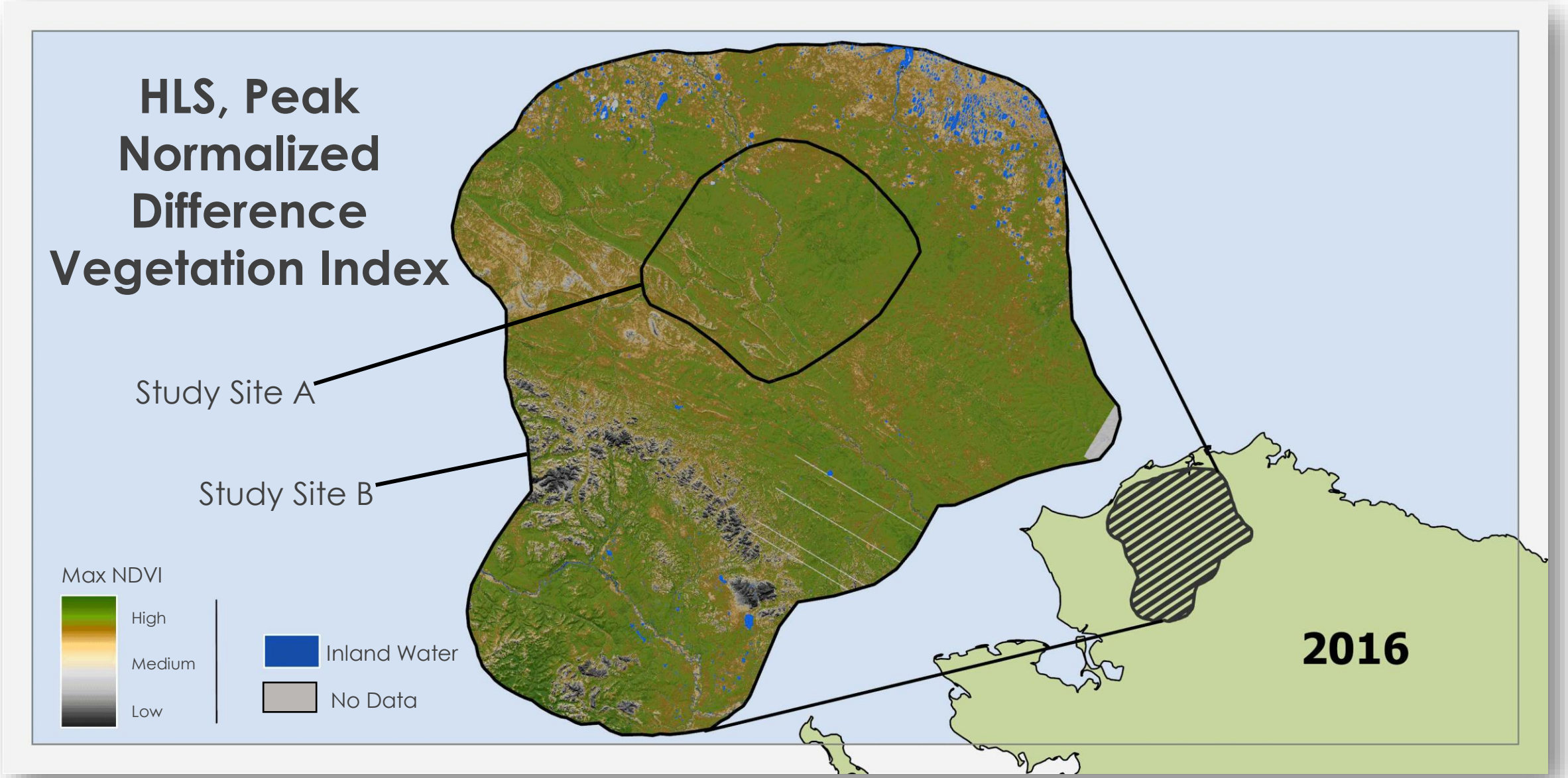
Data from Data basin, USGS, Esri terrain

Results – MODIS ΔNDVI

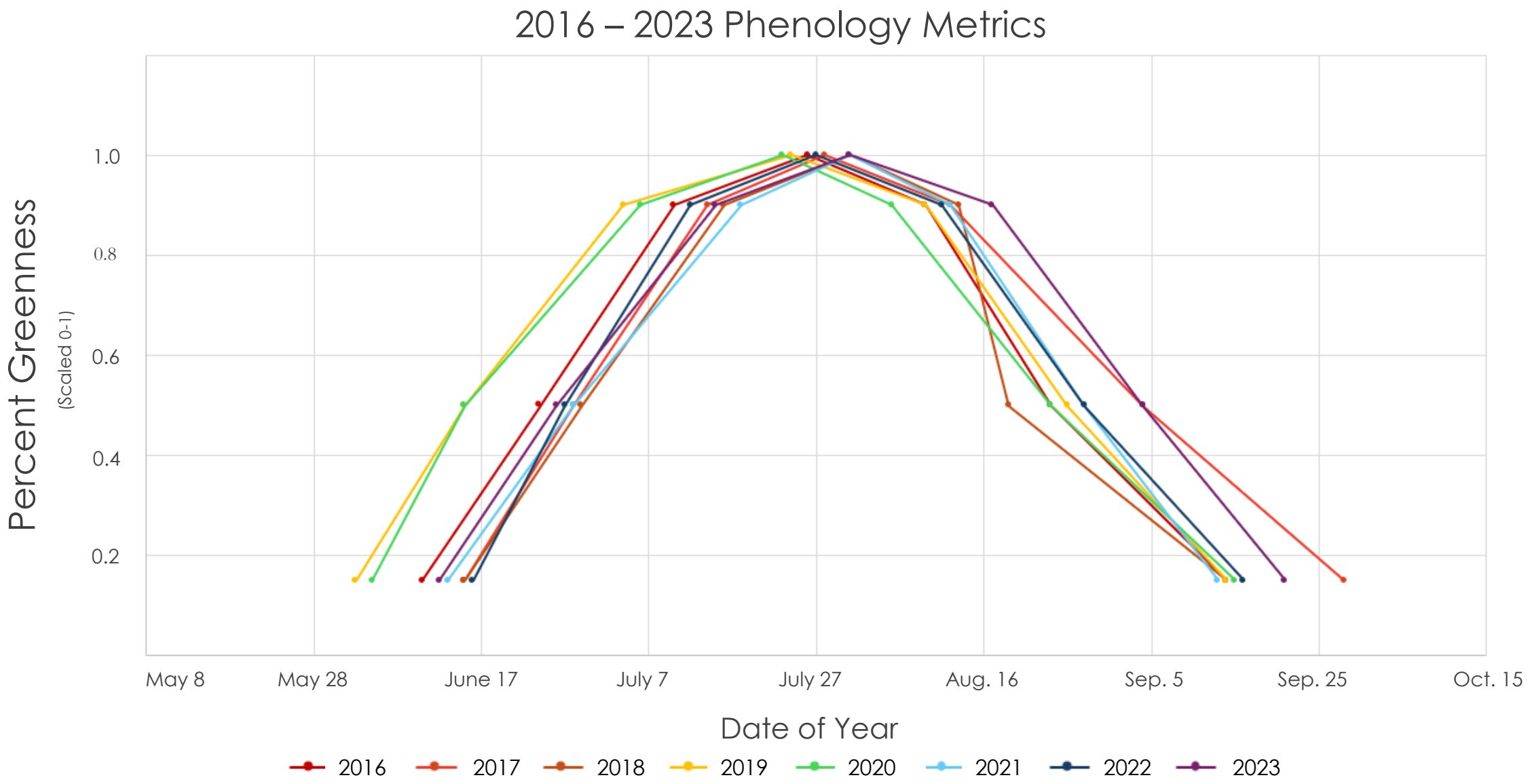
Year	Date Range	Δ NDVI
2000	June 4- June 25	0.0076
2001	May 31 - June 19*	0.0063
2002	May 19 - June 25	0.0043
2003	June 2 - June 25	0.0057
2004	May 22 - June 25	0.0069
2005	May 20 - June 25	0.0049
2006	May 25 - June 25	0.0067
2007	May 22 - June 25	0.0067
2008	June 2 - June 25	0.0066
2009	May 17 – June 25	0.0041
2010	May 19 - June 25	0.0054
2011	May 23 - June 25	0.0050
2012	May 19 - June 25	0.0052
2013	May 20 - June 25	0.0050
2014	May 17 - June 25	0.0043
2015	May 17 - June 25	0.0048
2016	May 13 - June 25	0.0052
2017	May 21 - June 25	0.0042
2018	May 15 - June 25	0.0046
2019	May 12 - June 25	0.0066
2020	May 22 - June 25	0.0063
2021	May 24 - June 25	0.0049
2022	May 28 - June 25	0.0046
2023	May 18 - June 25	0.0040
2024	May 23 - June 25	0.0050



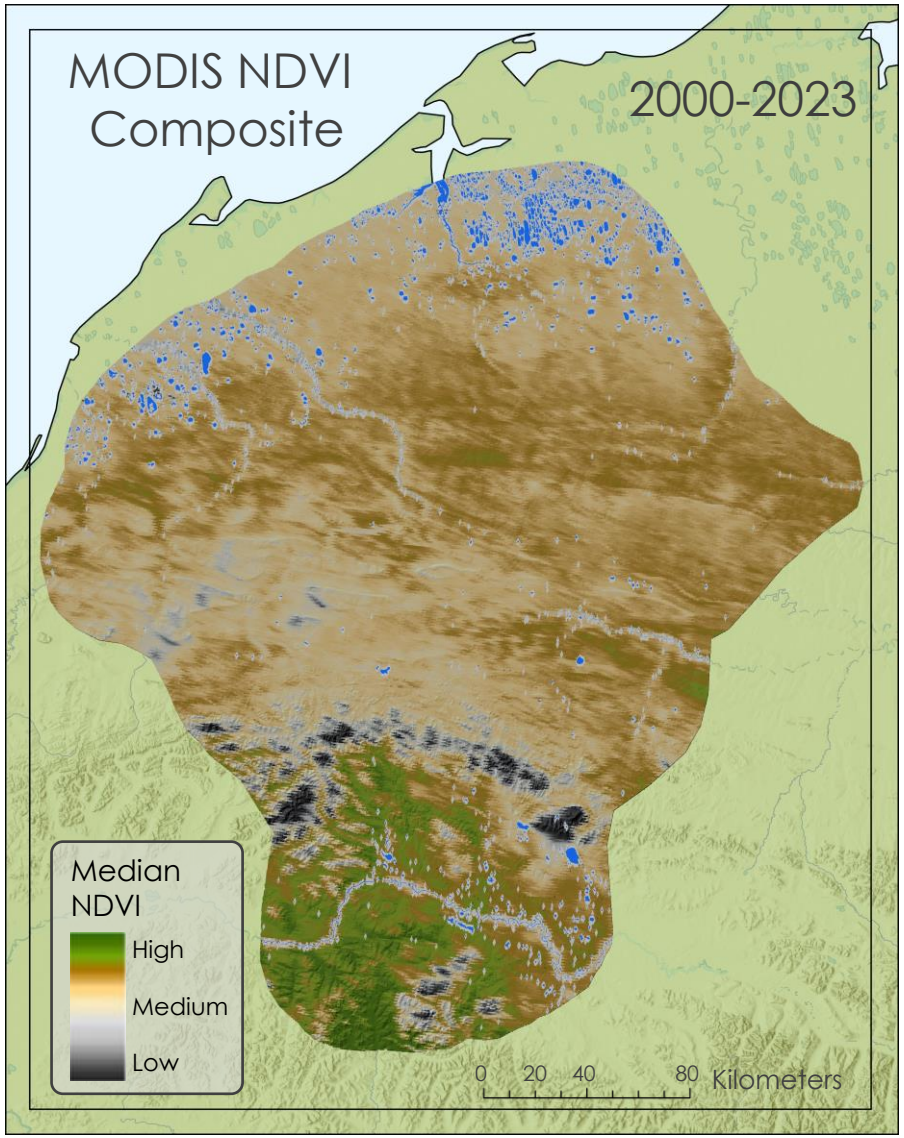
Results – HLS Time Series Maps

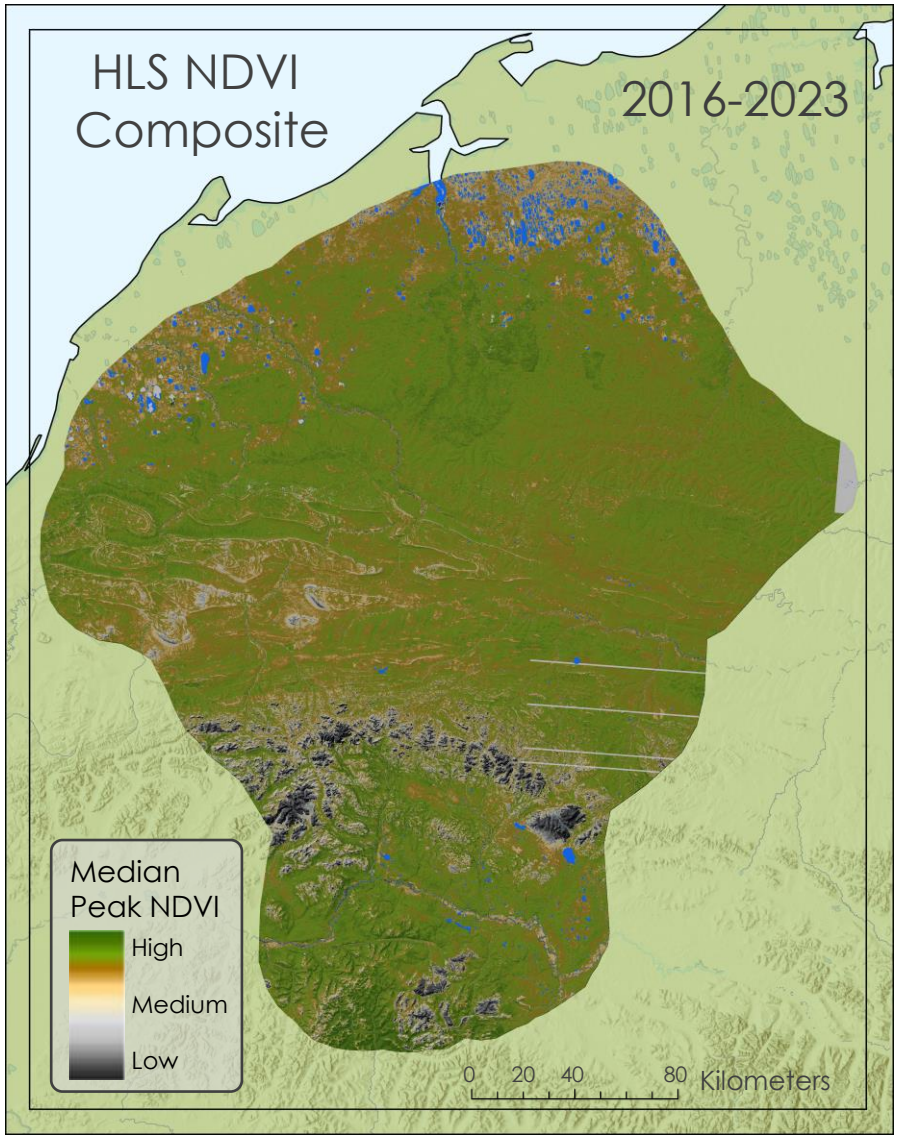


Results – HLS Phenology Curve



Results – MODIS / HLS NDVI Composite





Data from Data basin, USGS, Esri terrain

Errors & Uncertainties

- NBAR MODIS Smoothing & Sensor Error
- Water Masking
- Negative NDVI values
- MSLSP Product Timeframe

Conclusions

- Feasibility of using NASA Earth observations for temporal NDVI analysis
- NBAR MODIS was limited by its spatial resolution and image smoothing
- MSLSP was limited by its temporal availability
- ΔNDVI is a useful calculation of vegetation quality and rate of growth

Acknowledgments

Project Partners and Advisors:

- **Kyle Joly** – National Park Service, Gates of the Artic National Park & Preserve
- **Seamore Zhu** – Lead Science Advisor (Boston University PhD Candidate)
- **Dr. Mark Friedl** – Science Advisor (Boston University)
- **Madison Arndt** – NASA DEVELOP Massachusetts – Boston Lead

Past Contributors:

- **Christian Sarro** – NASA DEVELOP Spring 2024 Project Lead
- **Levi Mitchell** – NASA DEVELOP Spring 2024 Participant
- **Mahnoor Naeem** – NASA DEVELOP Spring 2024 Participant
- **Ben Silver** – NASA DEVELOP Spring 2024 Participant

* *"This material contains modified Copernicus Sentinel data (2016-2023), processed by ESA."* *

This material is based upon work supported by NASA through contract 80LARC23FA024. Any mention of a commercial product, service, or activity in this material does not constitute NASA endorsement. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration and partner organizations.