# Using NPScape Data and Advanced Satellite Products to Compare Land Surface Phenology Inside and Outside of National Park Units in the Great Plains

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U.S. Department of the Interior
U.S. Geological Survey

# Background…

- *“Parks are part of larger ecological systems and must be managed in that context” (Fancy, Gross, & Carter, 2008).*

- **Work funded through the USGS/NPS National Park Monitoring Project. Starting third year of funding.**

- **Primary objective: help park managers use cutting edge moderate- (250m) and high- (30m) resolution remote sensing products to place I&M observations within the context of the larger ecosystem.**

USGS

# Background…

- The foundation for this work is existing and freely available remote sensing data products:
- NASA-funded 250m spatial resolution land surface phenology product for North America
- Landsat data available from USGS for free.
- These products represent a significant national investment in ecosystem monitoring.

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# Objectives:

- Integrate land cover data with vegetation phenology data.
- Visually compare different land cover datasets.
- Compare two vegetation indices filtered by a select land cover type and a single land cover metric.

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# Goal:

- Demonstrate how NPScape products can be expanded with remotely sensed vegetation indices at multiple spatial scales.

# Initial parks: selection criteria

- Focused on three networks: *Northern Great Plains, Heartland, and Southern Plains*
- At least one park per network
- Fairly large in spatial extent
- Fairly native grassland
- Available data from NPScape program

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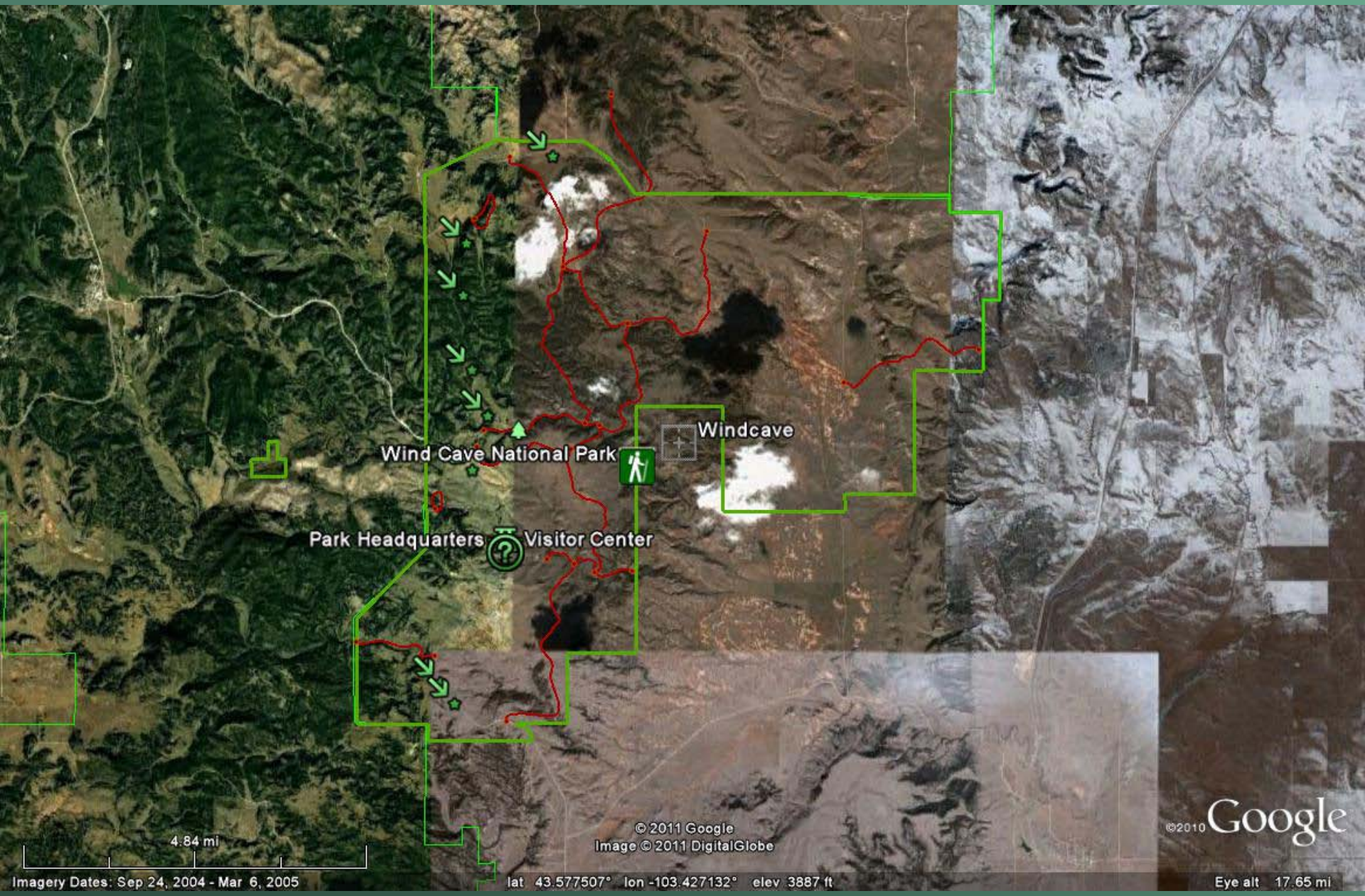
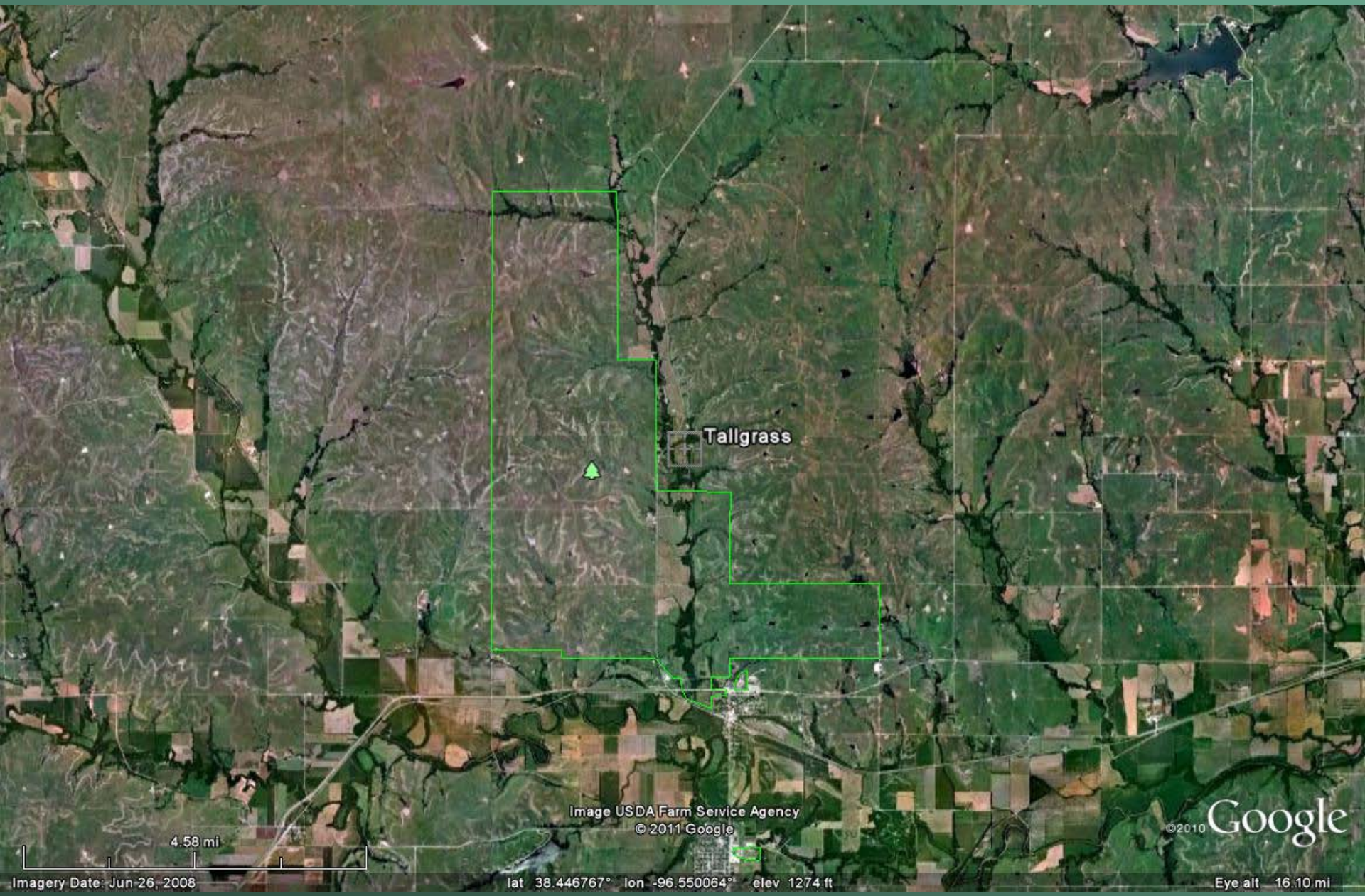
North Coast & Cascades
Rocky Mountain
THRO
Upper Columbia Basin
Greater Yellowstone
Northern Great Plains
WICA
Great Lakes
Northeast Temperate
Klamath
Eastern Rivers and Mountains
Northeast Coastal & Barrier
San Francisco Bay Area
Sierra Nevada
Northern Colorado Plateau
Heartland
National Capital
Mojave Desert
TAPR
Cumberland / Piedmont
Southern Colorado Plateau
LAMR
Mid Atlantic
Mediterranean Coast
Southern Plains
CHIC
Sonoran Desert
Appalachian Highlands
Southeast Coast
Chihuahuan Desert
Gulf Coast
South Florida / Caribbean

# Theodore Roosevelt NP

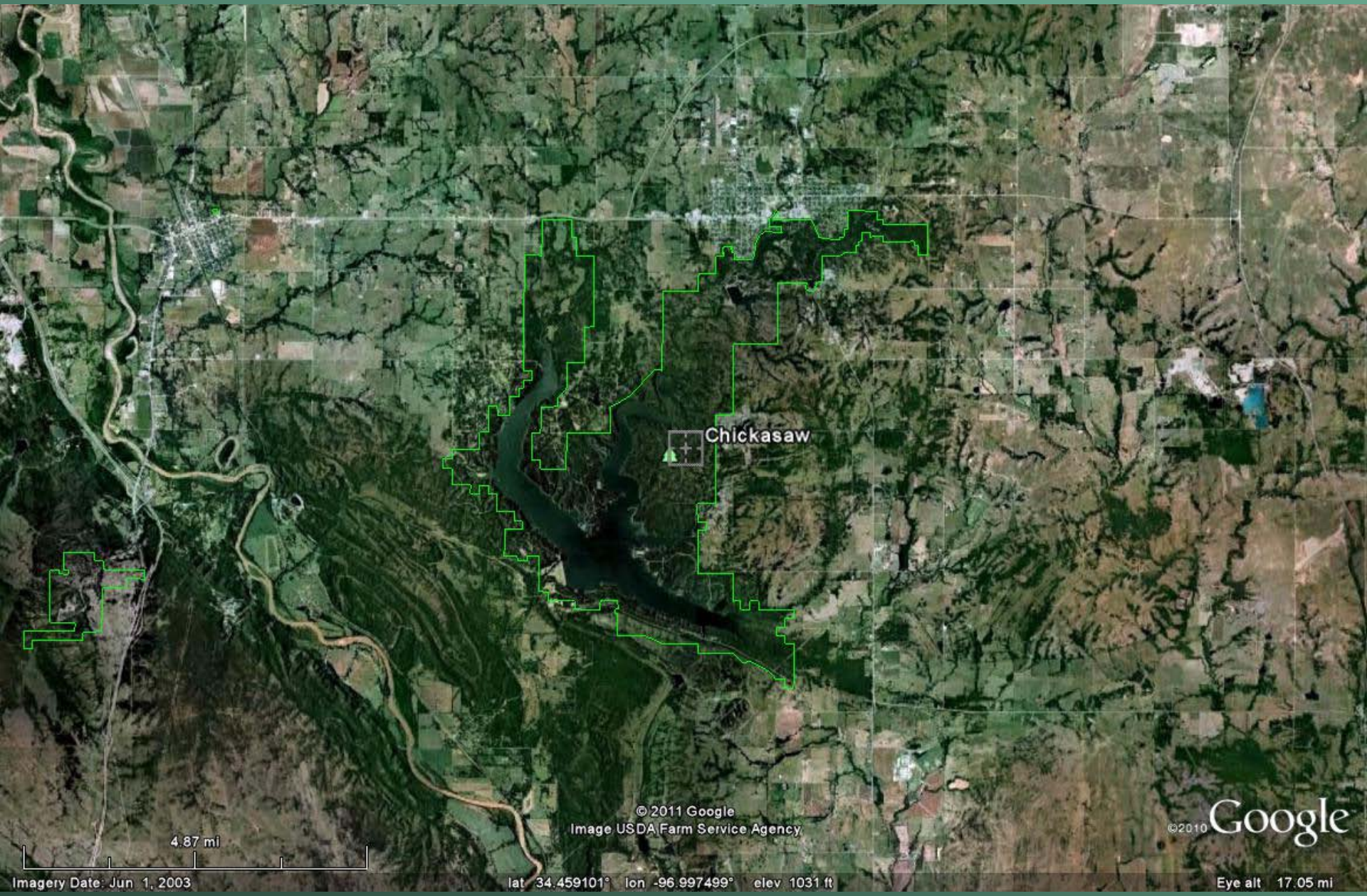
# Windcave NP


Windcave
Wind Cave National Park
Park Headquarters
Visitor Center
© 2011 Google
Image © 2011 DigitalGlobe
4.84 mi
Imagery Dates: Sep 24, 2004 - Mar 6, 2005
lat 43.577507° lon -103.427132° elev 3887 ft
©2010 Google
Eye alt 17.65 mi

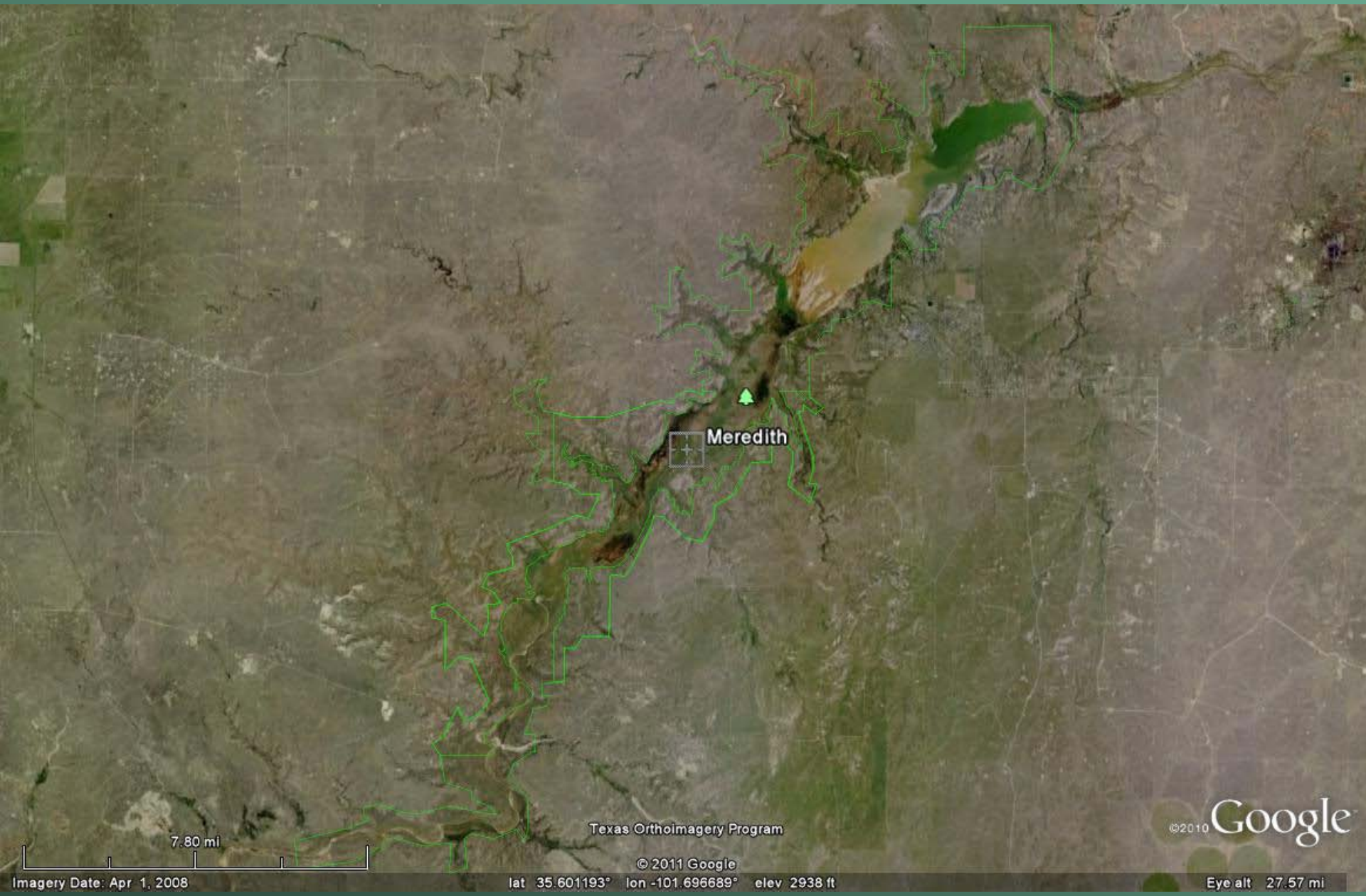
# Tallgrass Prairie NP



# Chickasaw NRA



# Lake Meredith NRA



# NPScape Landcover Measures

- Phase 1 metrics processing SOP: Landcover area per category, natural vs. converted landcover, landcover change, and impervious surface metrics

- Phase 2 North American Landcover metrics processing SOP: Landcover area per category and natural vs. converted landcover metrics

# North American Landcover dataset

- NALC reclassified to Anderson Level 1 landcover classes
- NALC native landcover classes
- NALC reclassified to Natural or Converted landcover classes

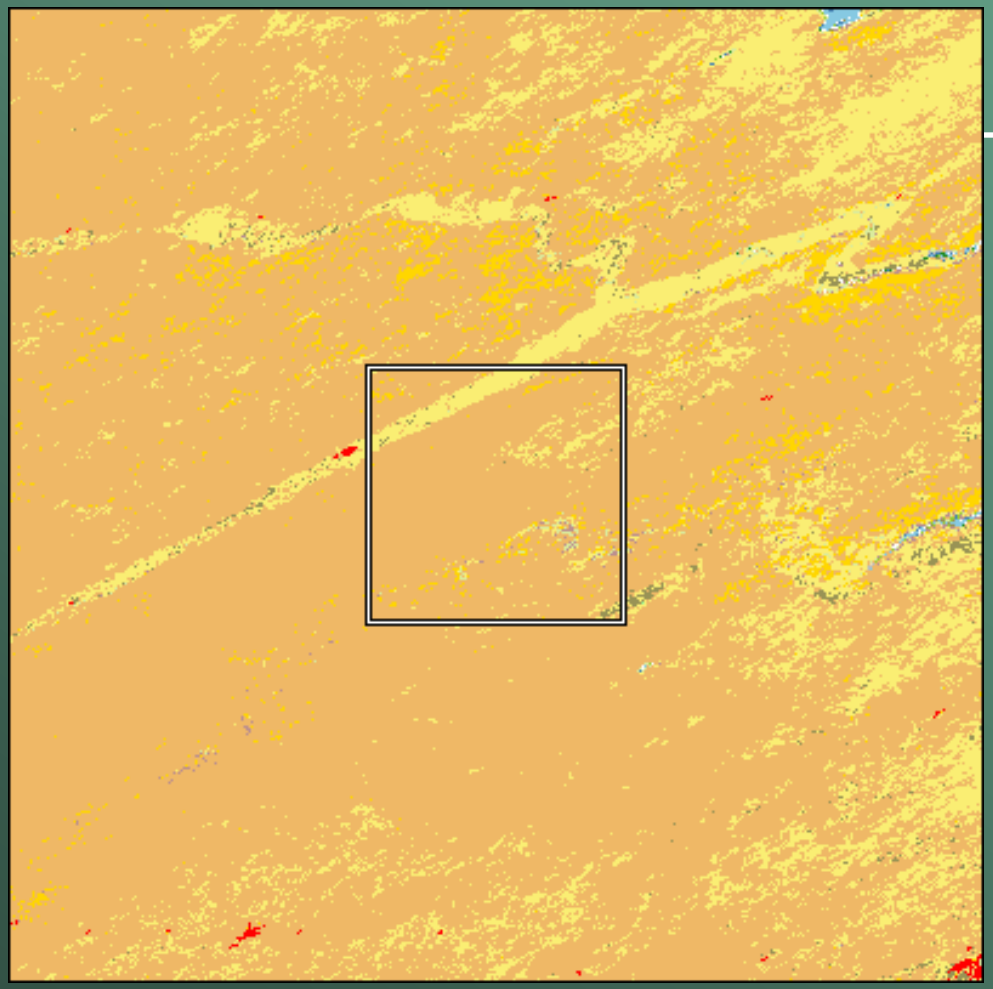
# Landcover datasets

NALC source data is a raster composed of 250m pixels within 19 thematic classes.

MODIS landcover dataset composed of 250m pixels within 17 thematic classes.

Visual comparison

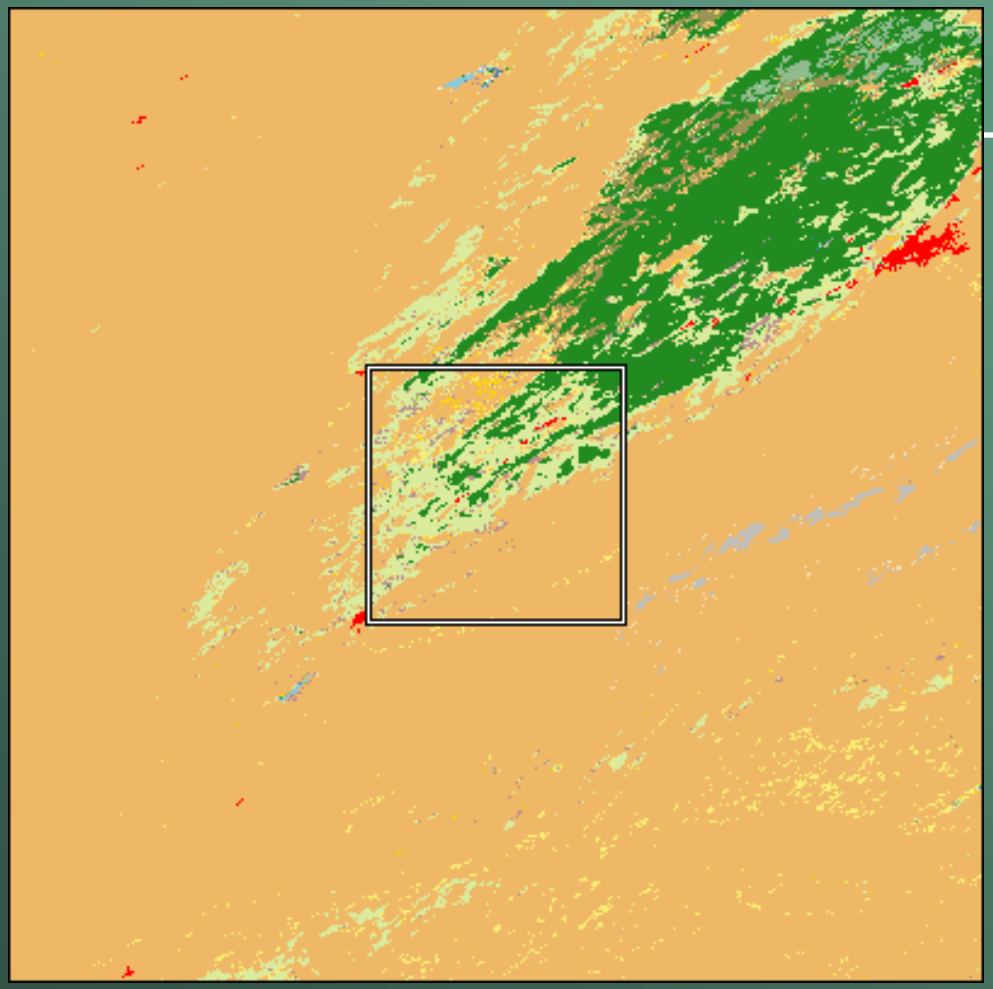
# Theodore Roosevelt NP



- (0) Water
- (1) Evergreen Needleleaf Forest
- (2) Evergreen Broadleaf Forest
- (3) Deciduous Needleleaf Forest
- (4) Deciduous Broadleaf Forest
- (5) Mixed Forests
- (6) Closed Shrublands
- (7) Open Shrublands
- (8) Woody Savannas
- (9) Savannas
- (10) Grasslands
- (11) Permanent Wetlands
- (12) Croplands
- (13) Urban and Built-Up
- (14) Cropland/Natural Vegetation Mosaic
- (15) Snow and Ice
- (16) Barren or Sparsely Vegetated
- IGBP Water Bodies / Unclassified / Fill Value

USGS

# Windcave NP



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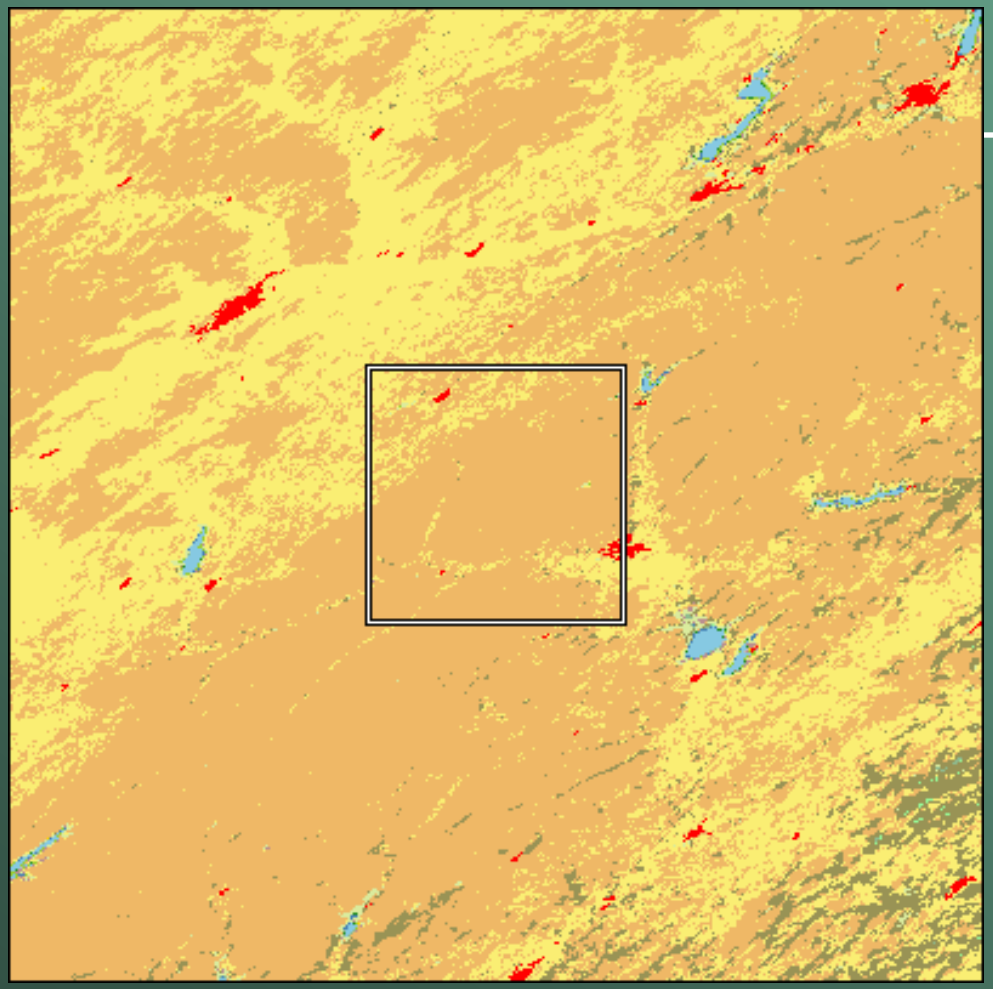

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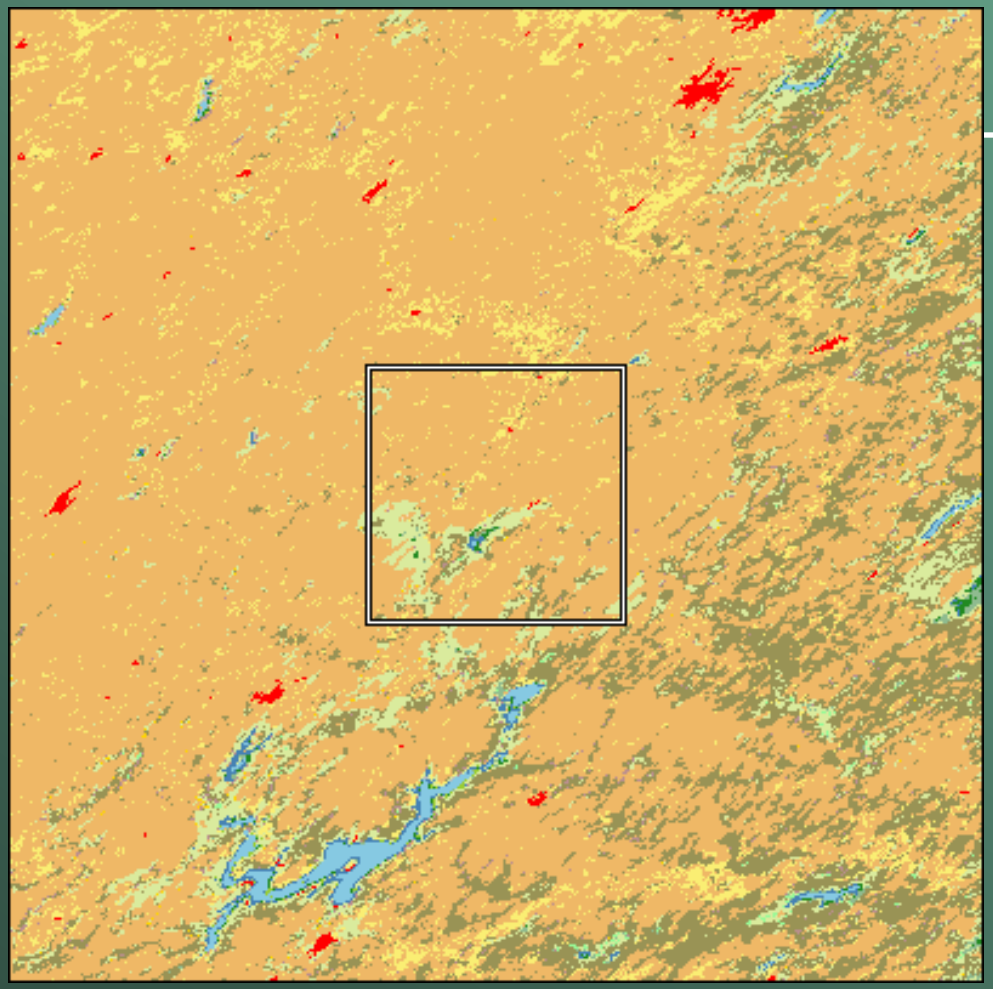

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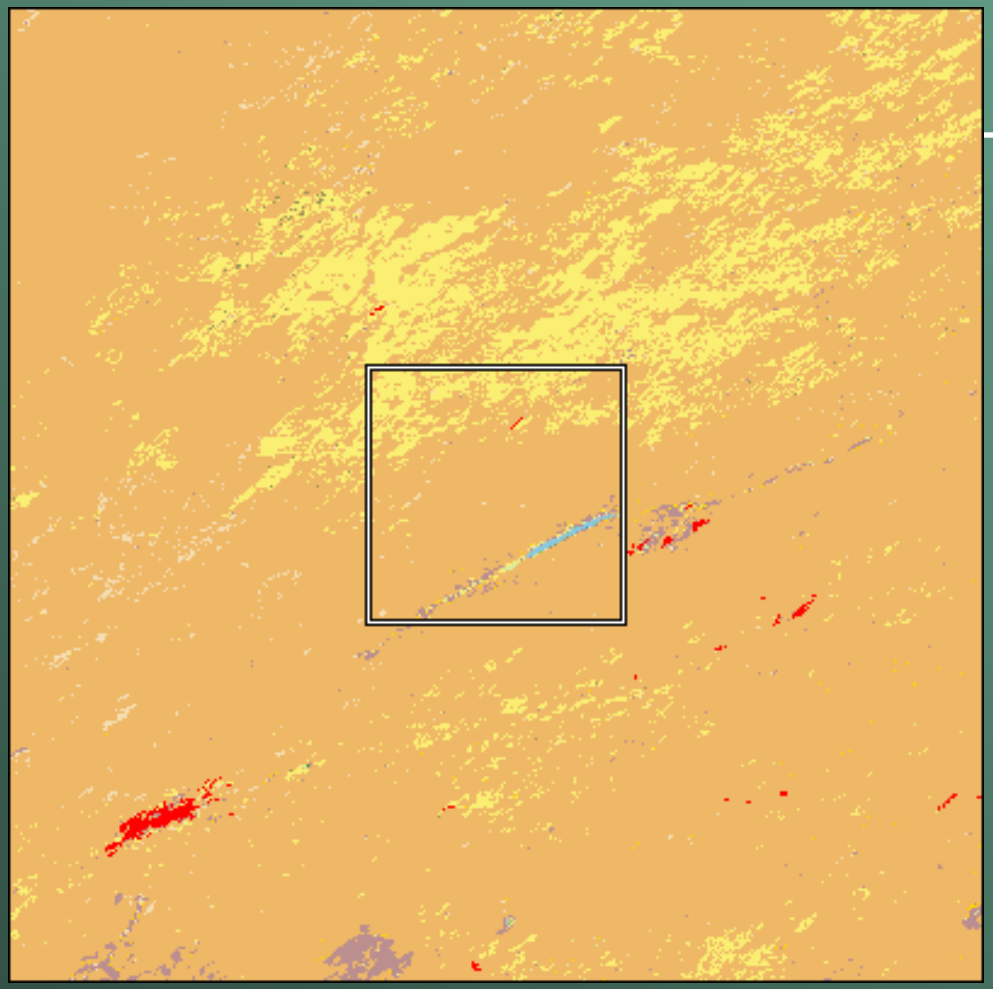

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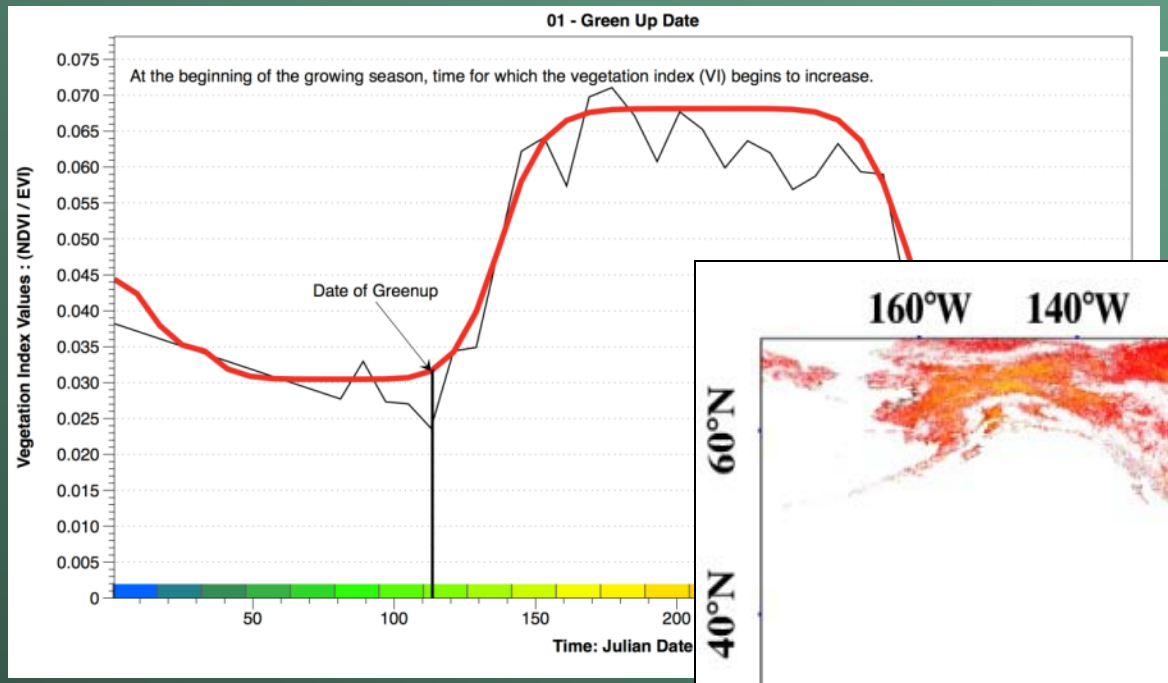
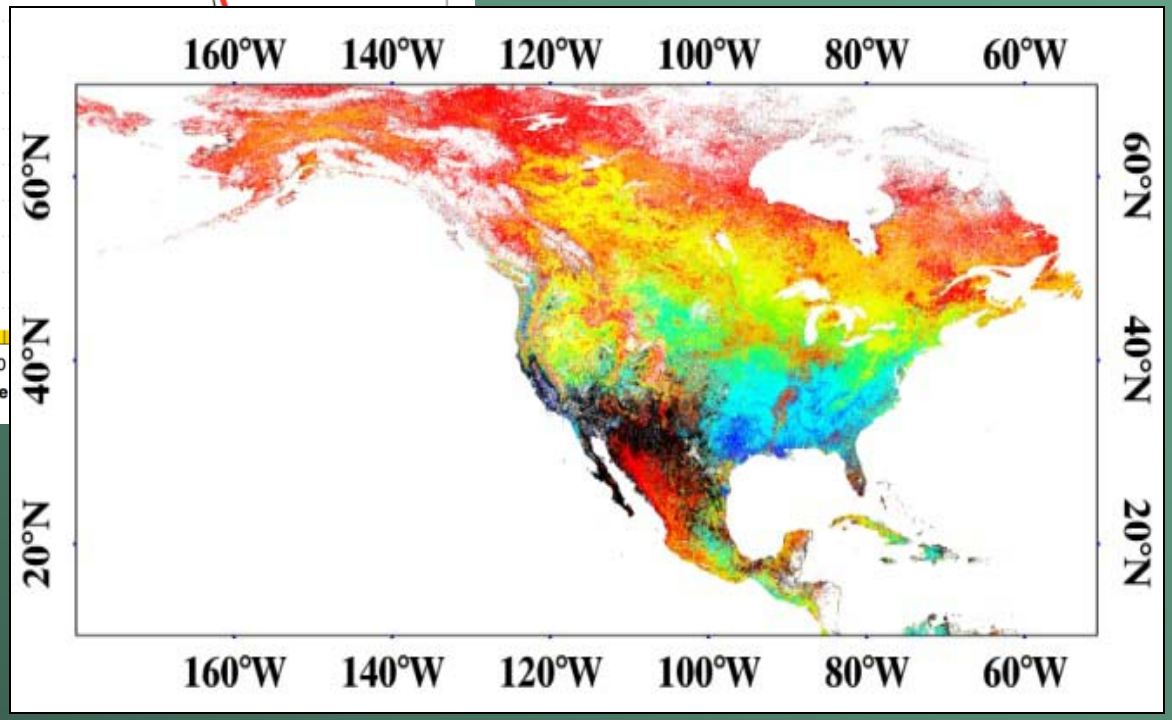
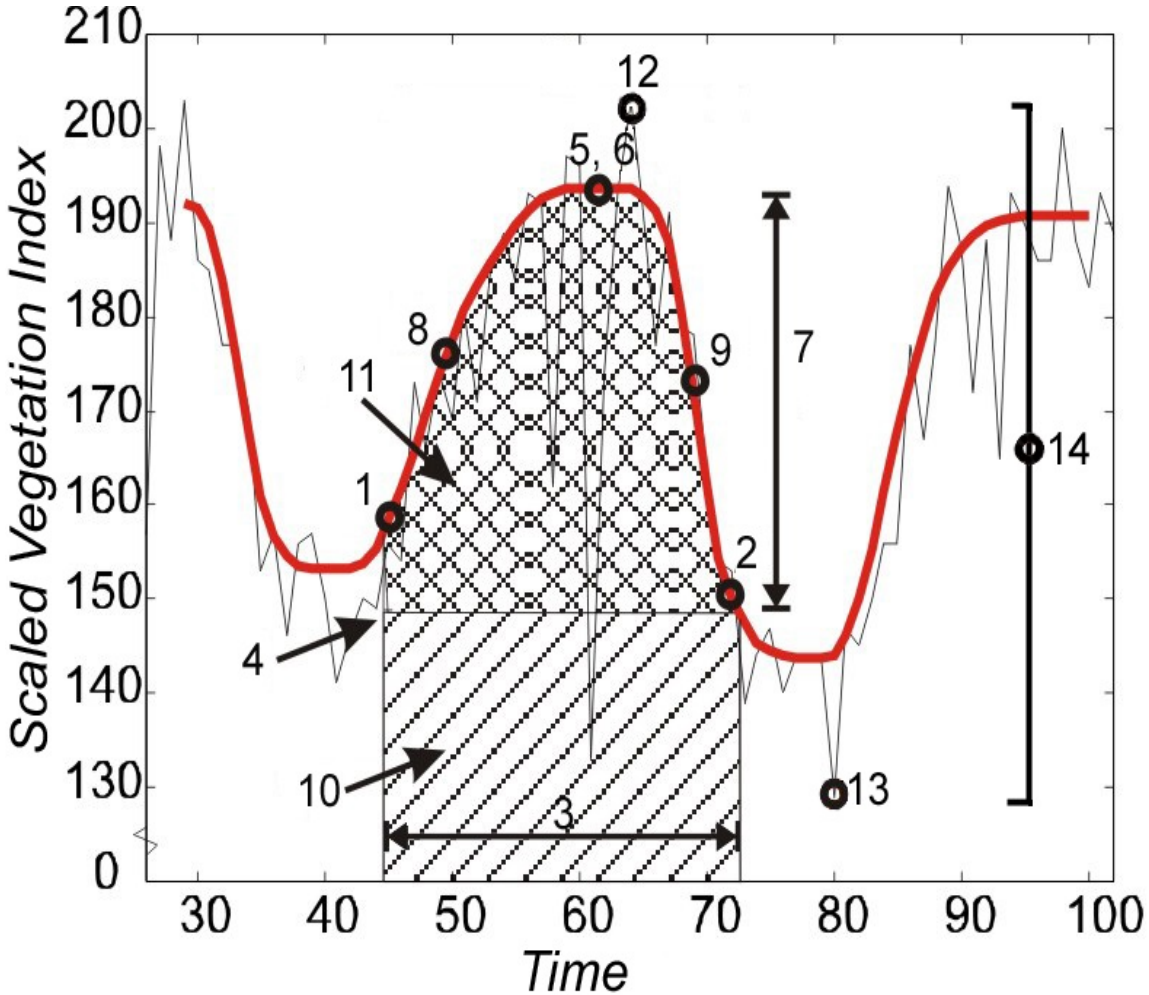
# MODIS land surface phenology data



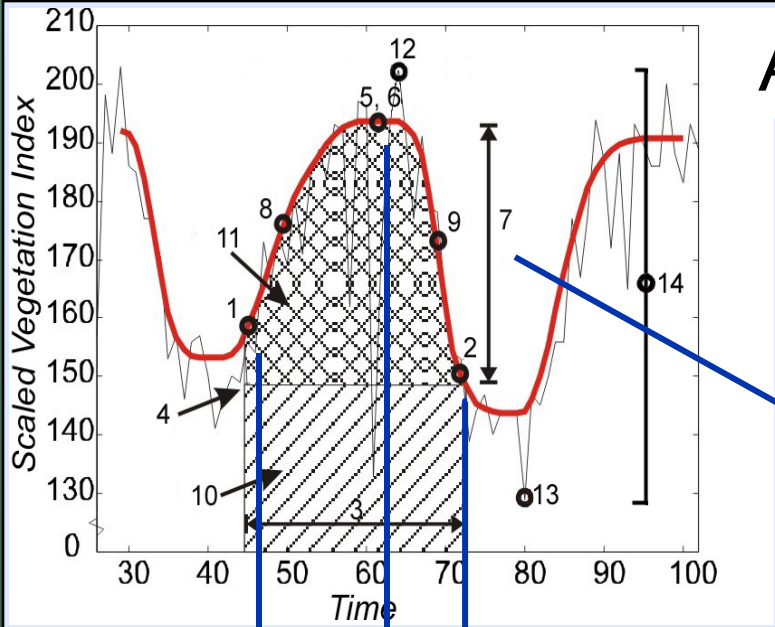
# Modified TIMESAT Parameters



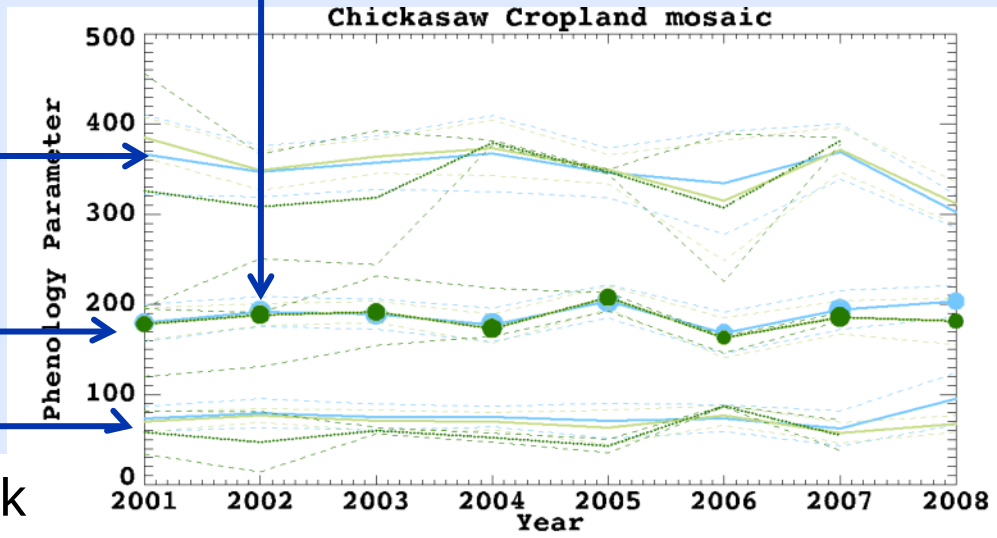

1. Beginning of season
2. End of season
3. Length of season
4. Base value
5. Peak time
6. Peak value
7. Amplitude
8. Left derivative
9. Right derivative
10. Integral over season - absolute
11. Integral over season - scaled
12. Maximum value
13. Minimum value
14. Mean value
15. Root Mean Square Error

Phenology Product User Guide, Tan et al
http://accweb.nascom.nasa.gov/project/docs/User_guide_PHN.pdf.

# Annual vegetation time series




Size of dot relative seasonal range

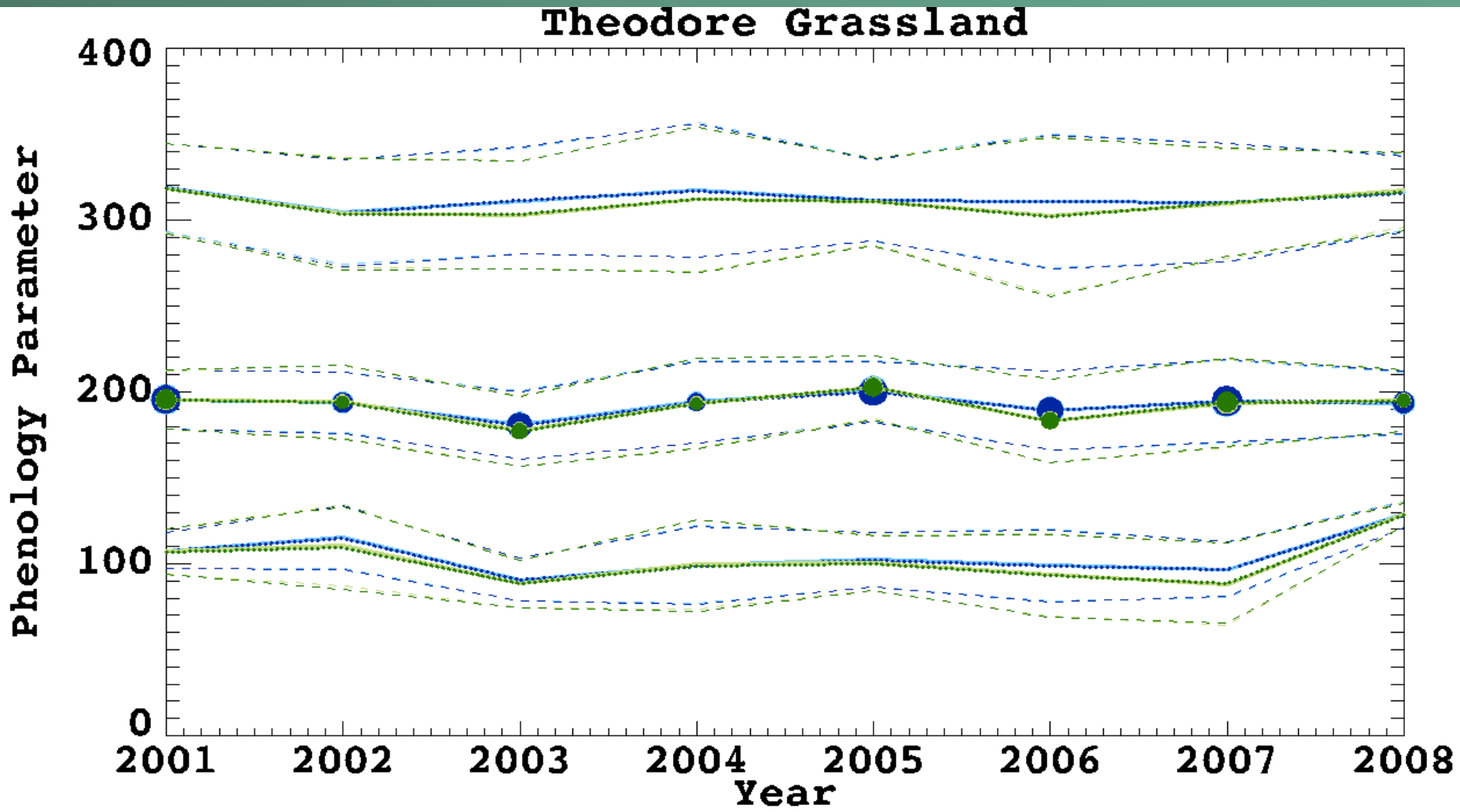



Summary graphic for each park

Blue lines = Inside the park

Green lines= outside the park

# THRO (with MODIS land cover)

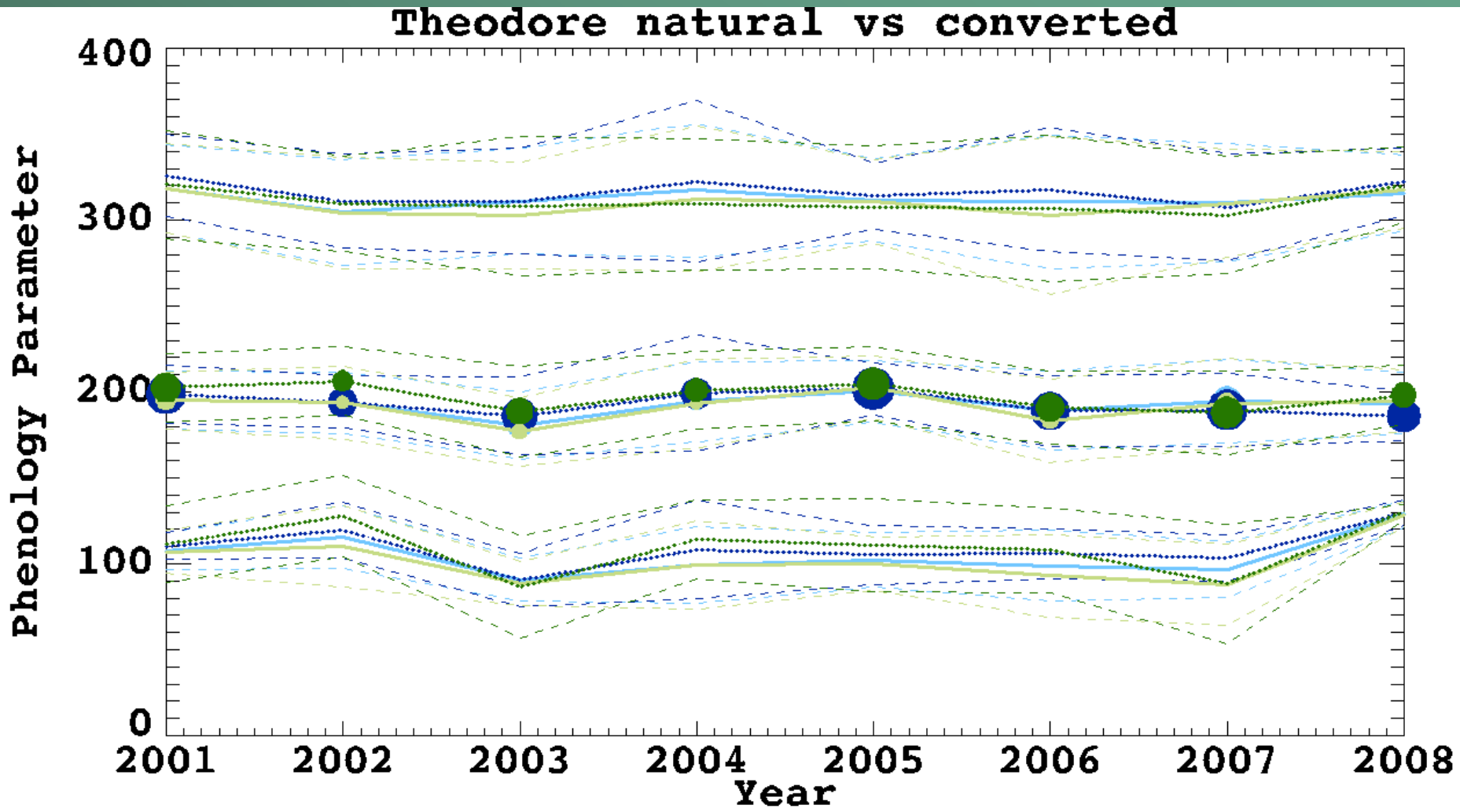



Blue = Inside the park
Green = outside the park

darker colors are filtered by land cover class

Size of dots proportional to the annual range in NDVI

# THRO (with NPScape: Natural areas)

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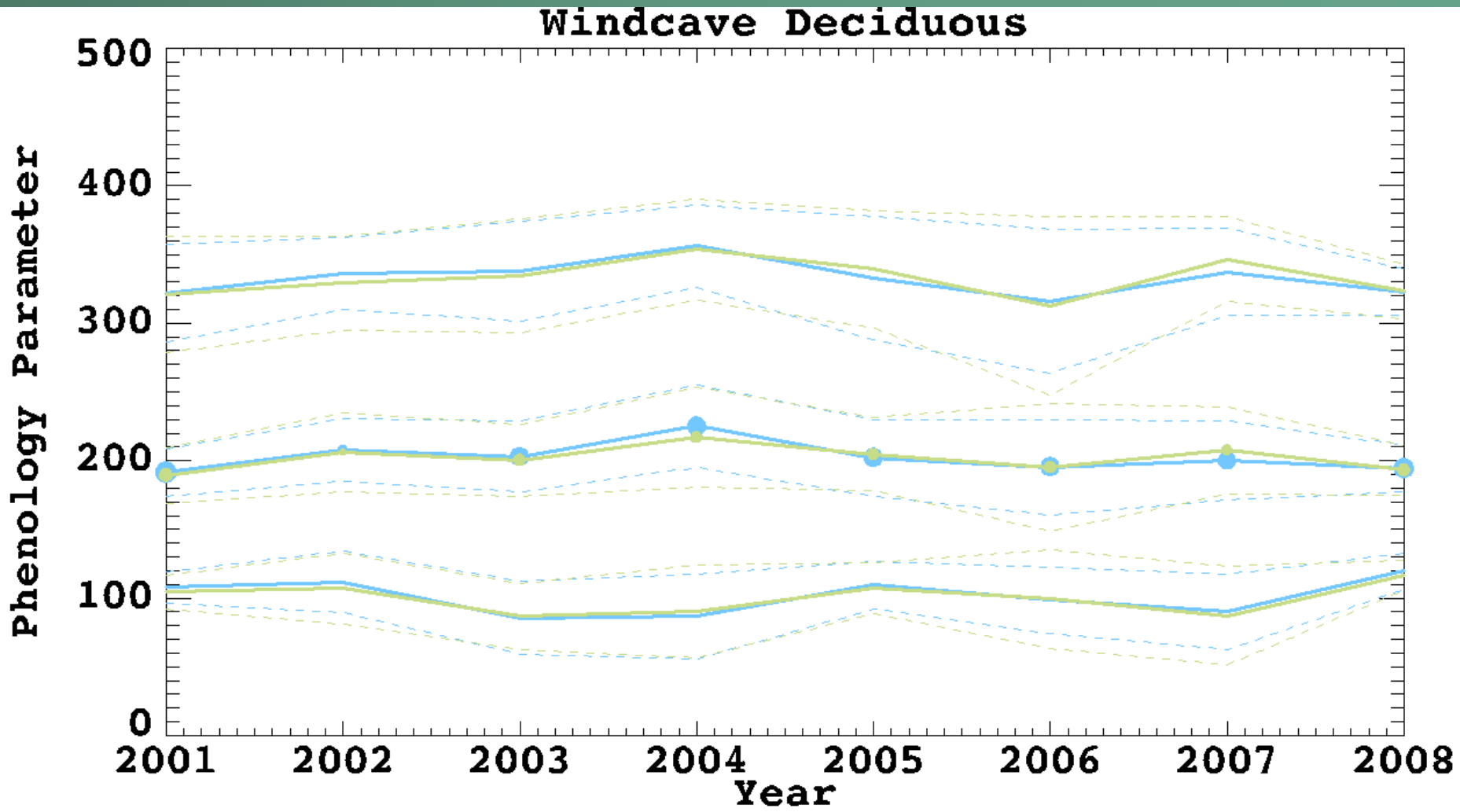
darker colors “natural” areas
lighter colors are “converted”

Size of dots proportional to the annual range in NDVI

# WICA (with MODIS land cover)

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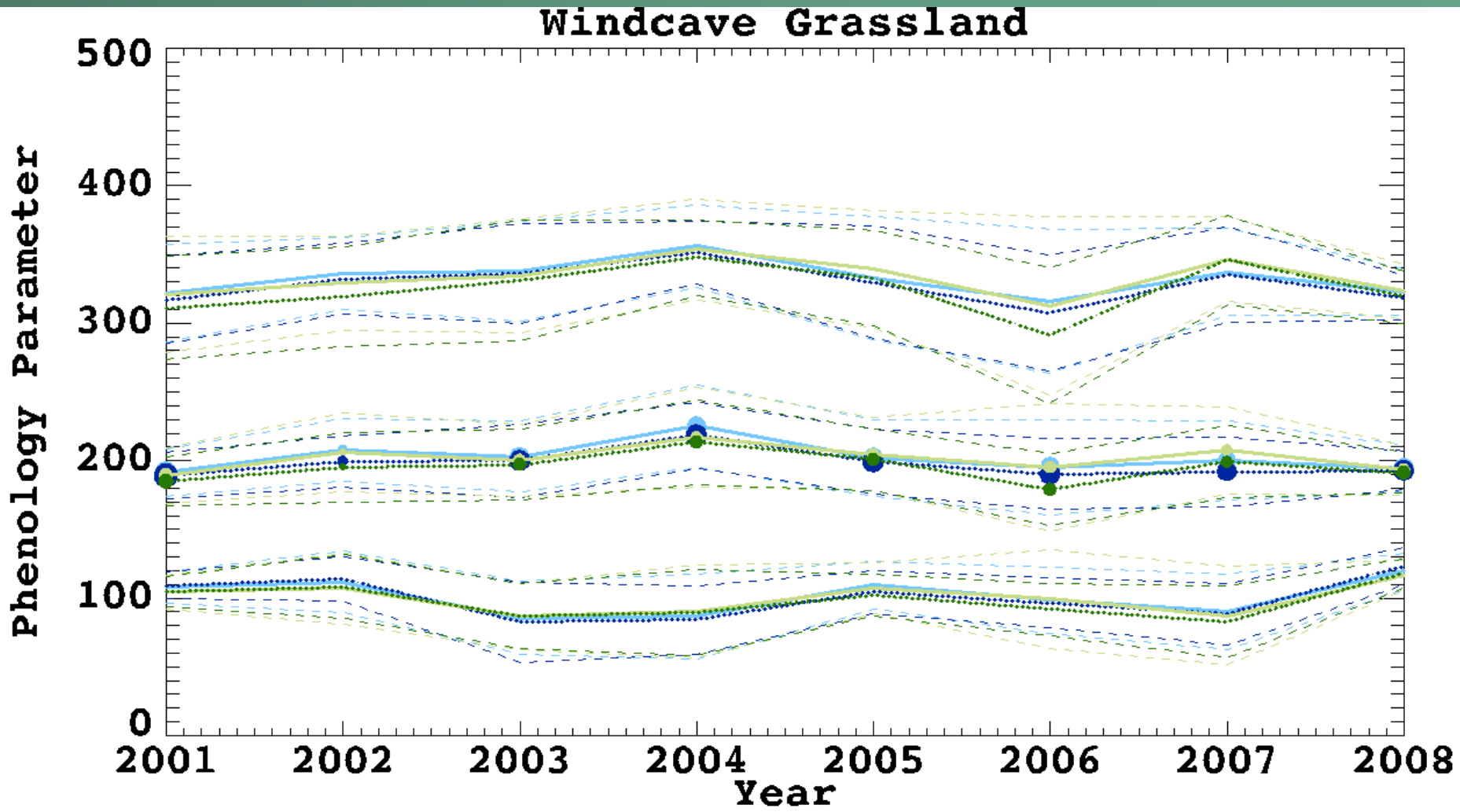


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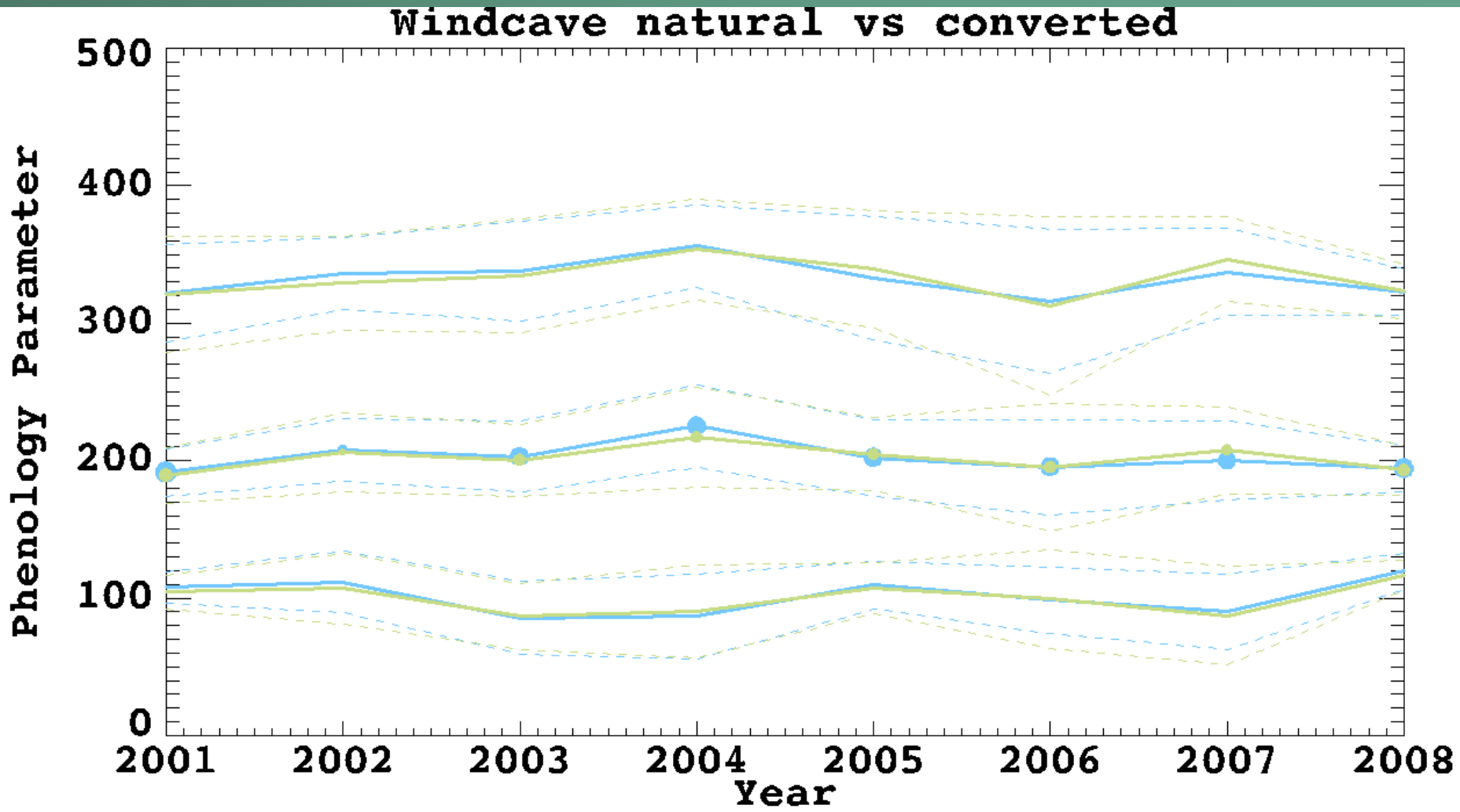


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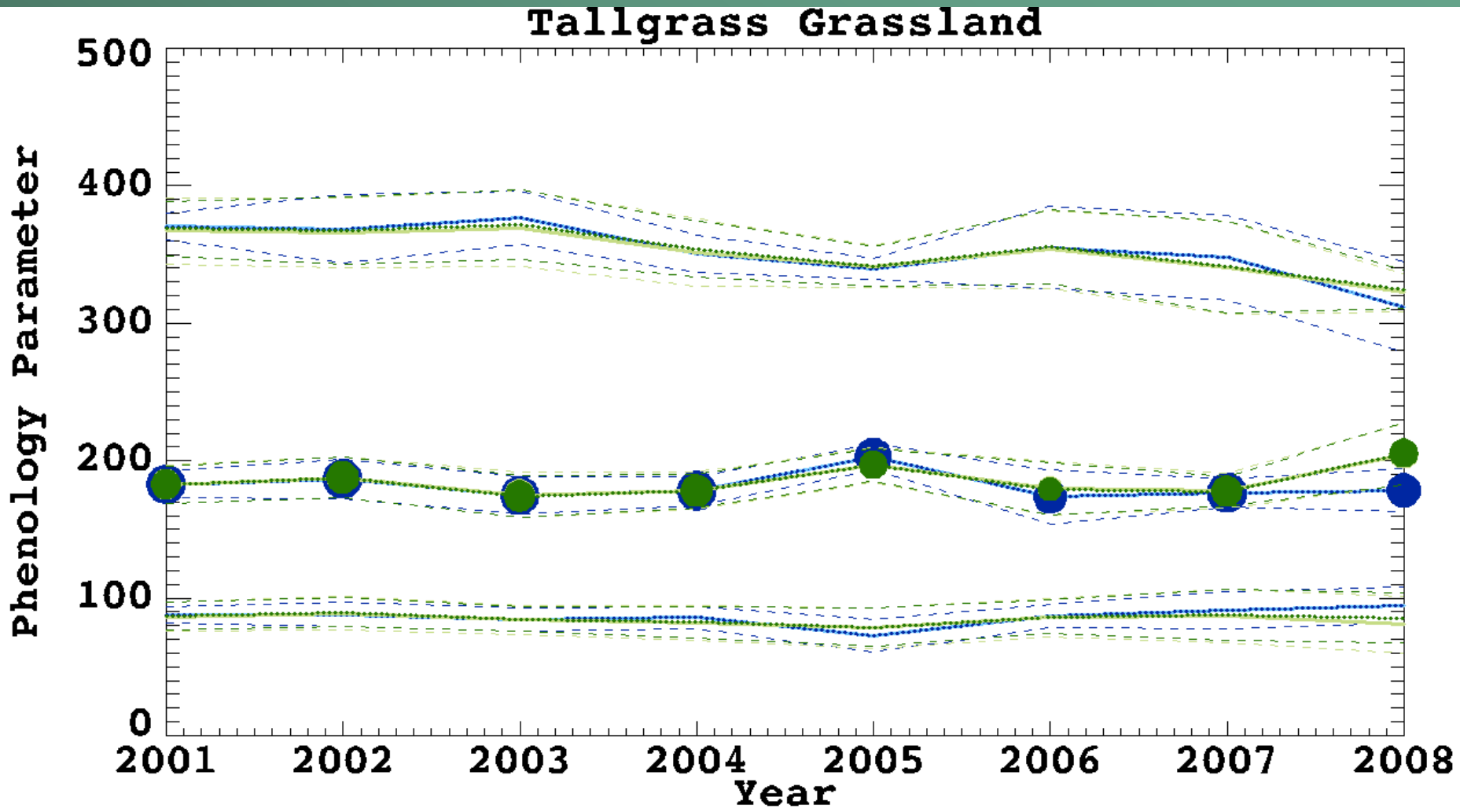
# TAPR (with MODIS land cover)

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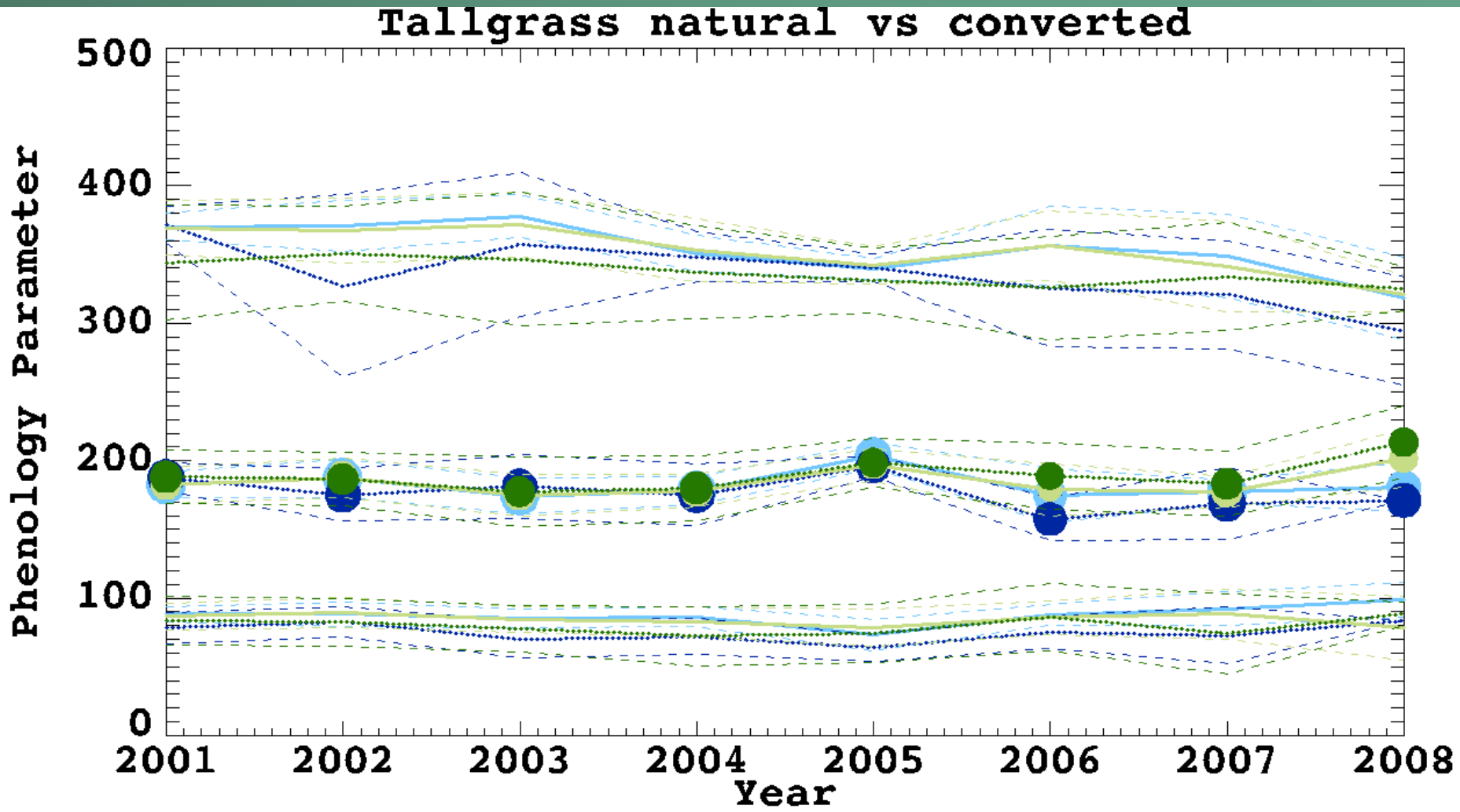


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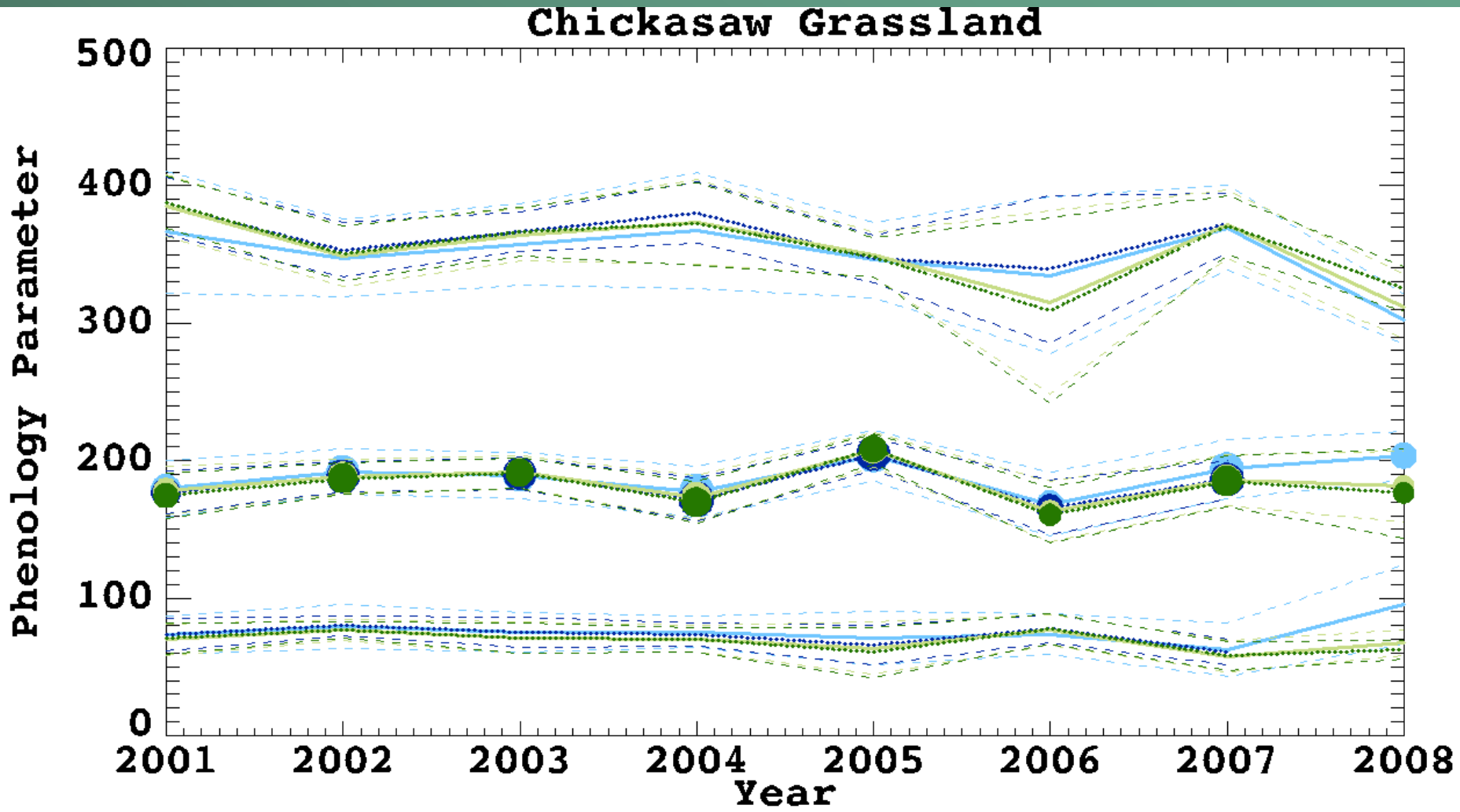
# CHIC (with MODIS land cover)

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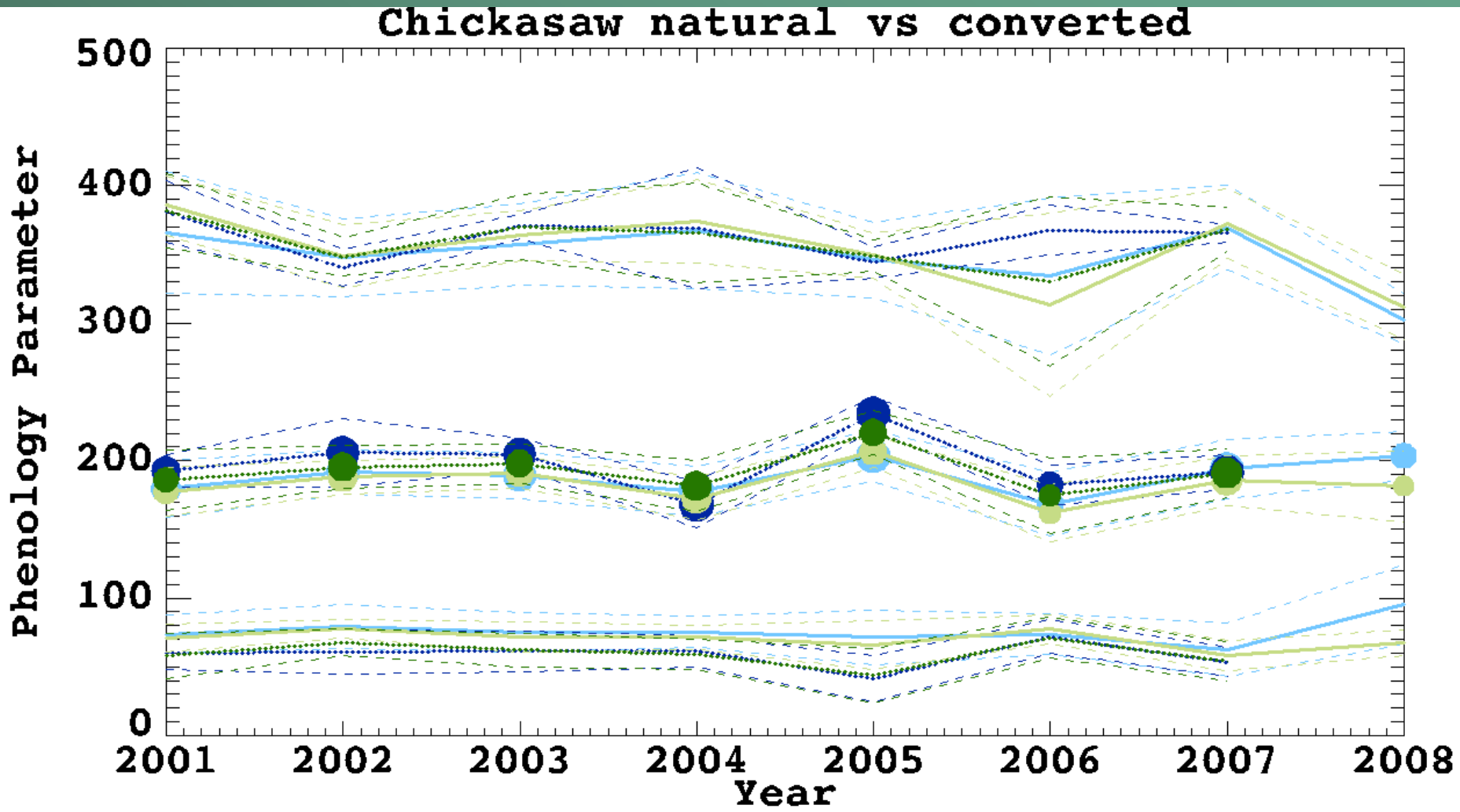


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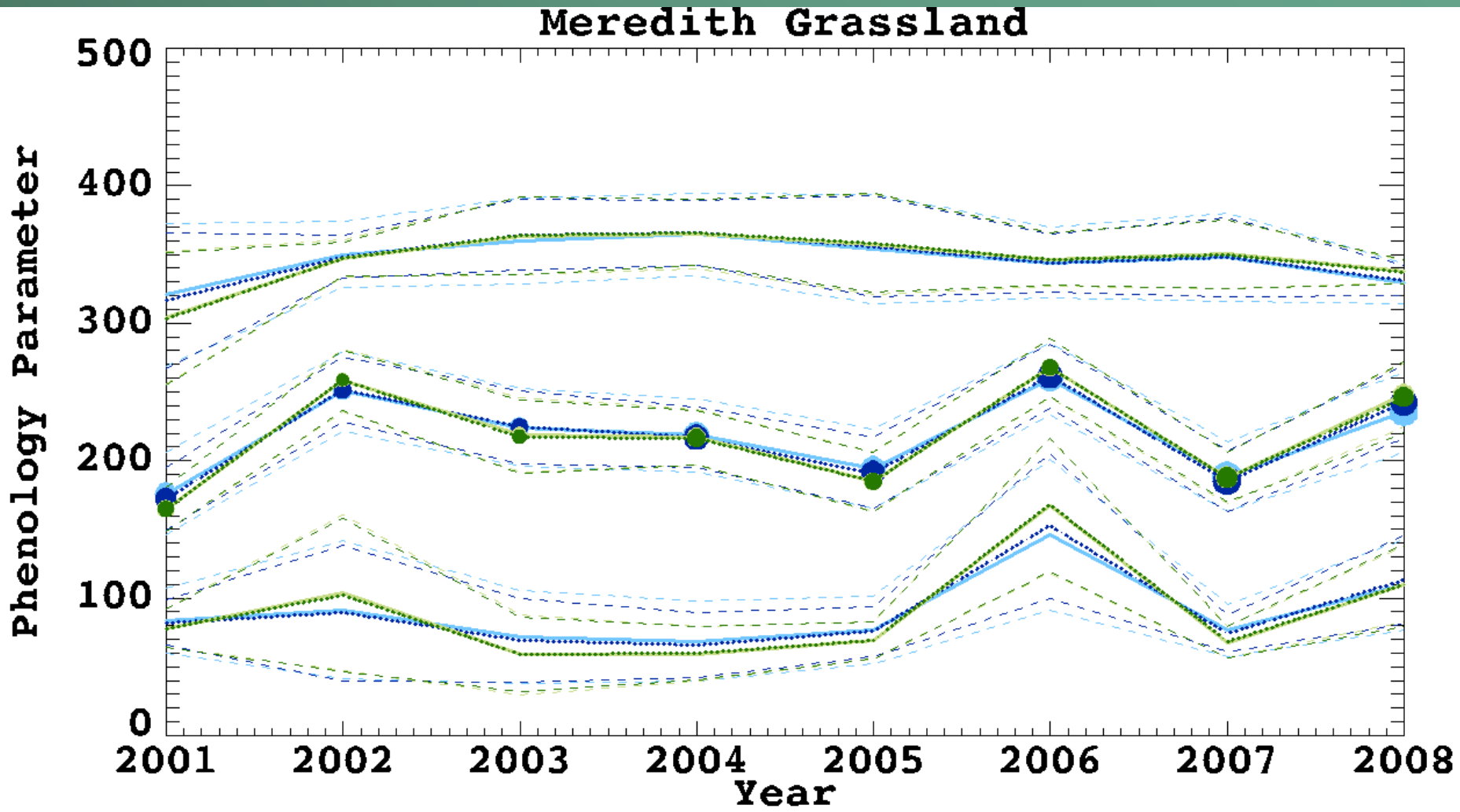
# LAMR (with MODIS land cover)

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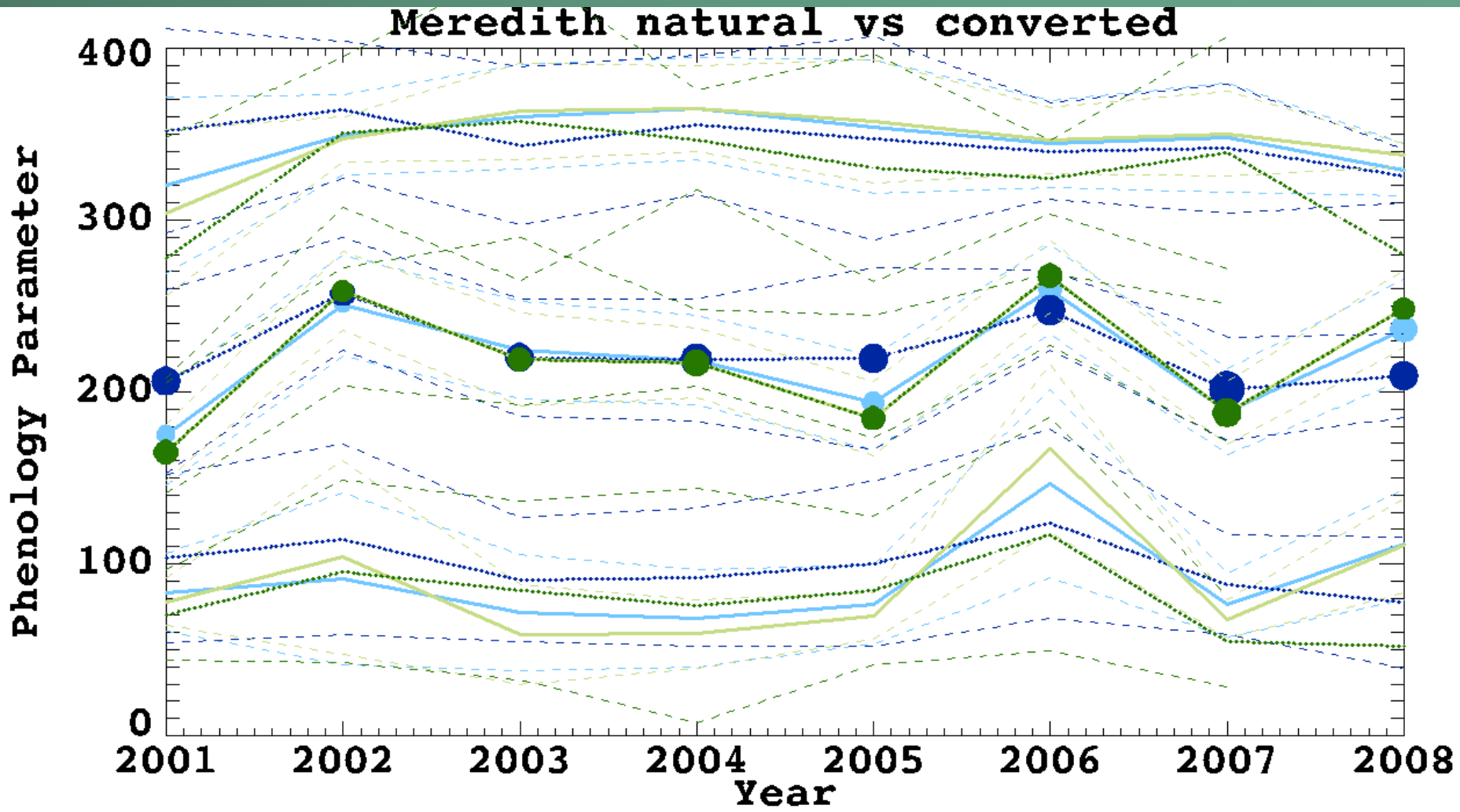


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# Summary

- Preliminary work
- Expand to include designated areas of analysis
- Further integration with NPScape
- Explore finer scale spatial resolution

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