

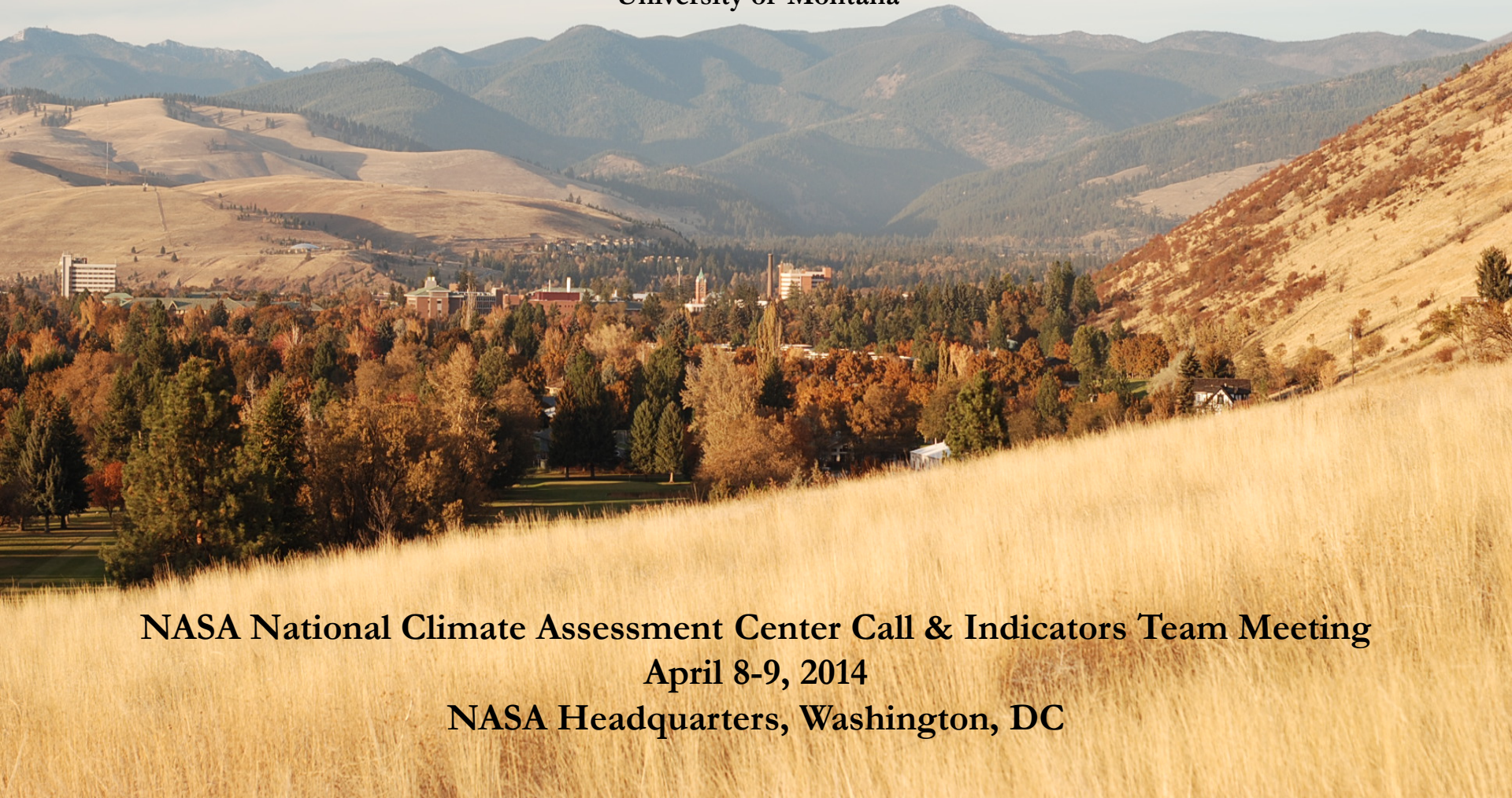
Translating EOS Datasets into National Ecosystem Biophysical Indicators

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Numerical Terradynamic Simulation Group (NTSG)

College of Forestry & Conservation

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NASA National Climate Assessment Center Call & Indicators Team Meeting

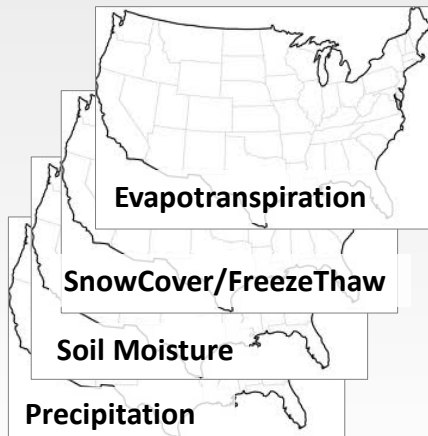
April 8-9, 2014

NASA Headquarters, Washington, DC



Ecosystem Productivity & Vegetation Health Indicators

Data Inputs



EOS Datasets and historical/future products

Data Product	Sensor	Time Span
Gross/Net Primary Productivity	AVHRR	1982-present
	MODIS	2000-present
	VIIRS	2011-present
Growing Season Length	AVHRR	1982-present
	MODIS	2000-present
	VIIRS	2011-present
LAI & FPAR	AVHRR	1982-present
	MODIS	2000-present
	VIIRS	2011-present

Evapotranspiration	MODIS	2000-present
Snow Cover	NOAA NESDIS, SMMR, SSMI, AMSR-E	1966-2011
	MODIS	2000-present
Freeze/Thaw ESDR	SSMR, SSMI, AMSR-E	1979-2011
	SMAP	2014-
Soil Moisture	AMSR-E	2002-2011
	SMAP	2014-
Precipitation	NCEP/NCAR Reanalysis or MERRA	1948-present

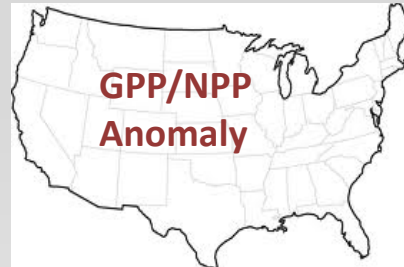


Ecosystem Productivity & Vegetation Health Indicators

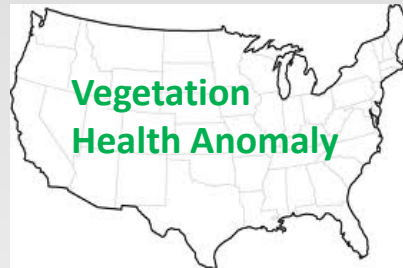
Data Inputs



Carbon Based Annual Anomaly



Vegetation Annual Anomaly

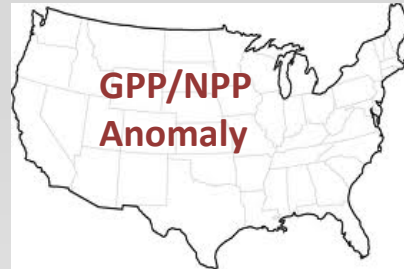


Ecosystem Productivity & Vegetation Health Indicators

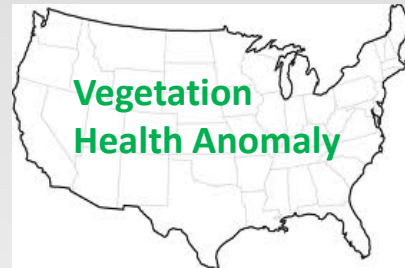
Data Inputs



Carbon Based Annual Anomaly



Vegetation Annual Anomaly



Ecosystem Productivity



Vegetation Health



Ecosystem Productivity and Vegetation Indicators

Yearly Status (12+ years)

Multi-Year and Decadal Trends



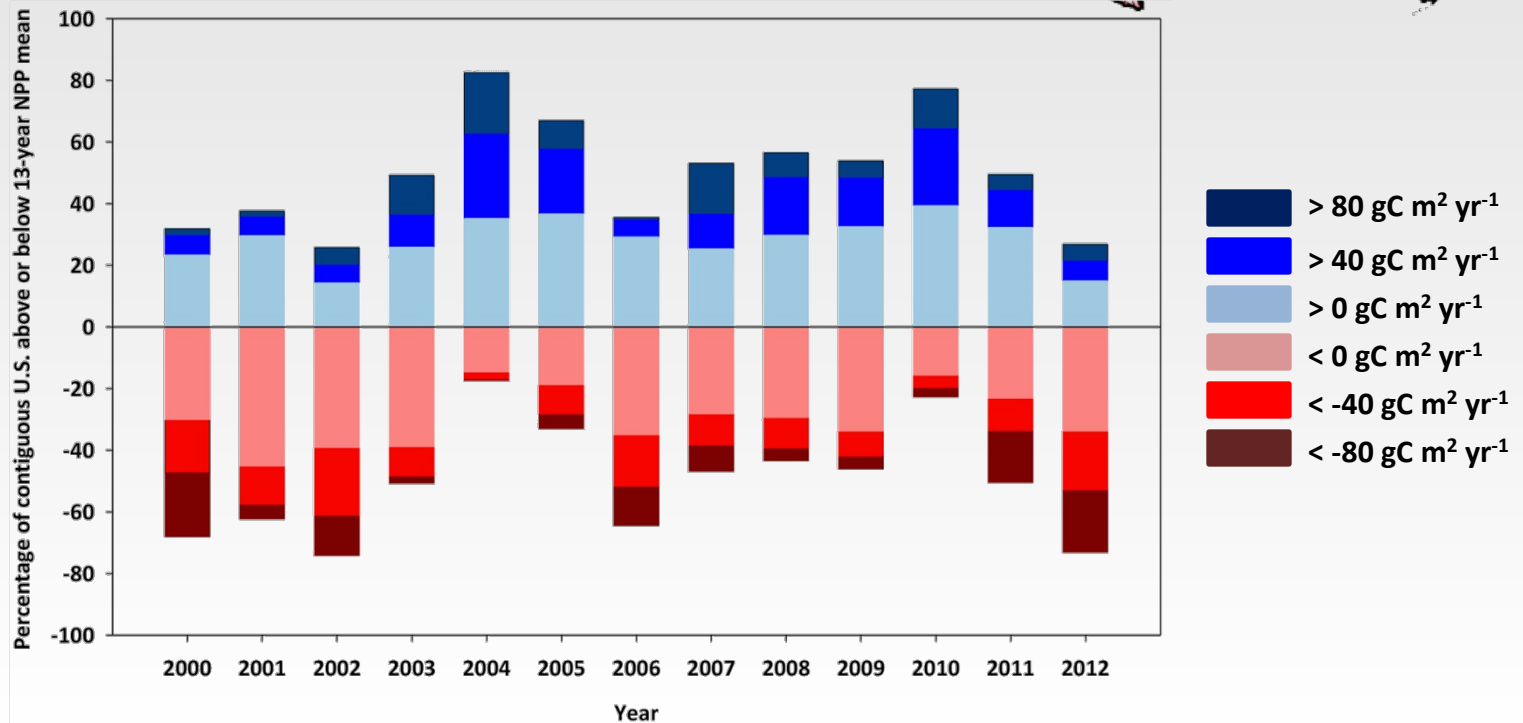
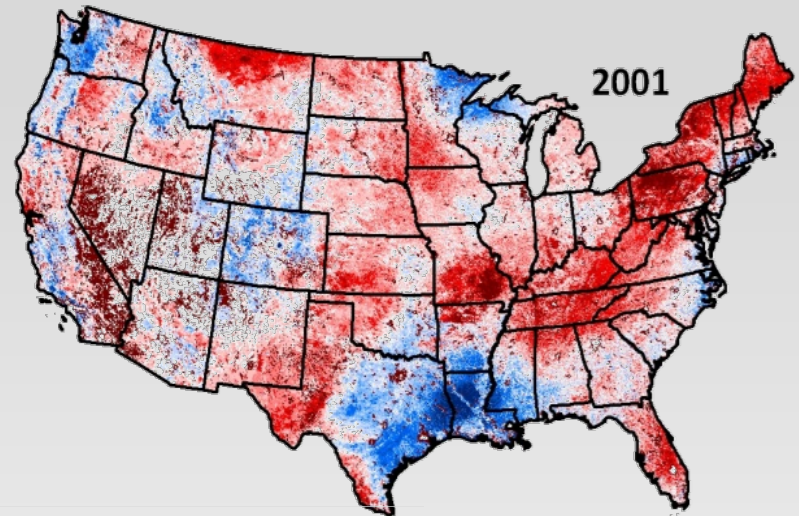
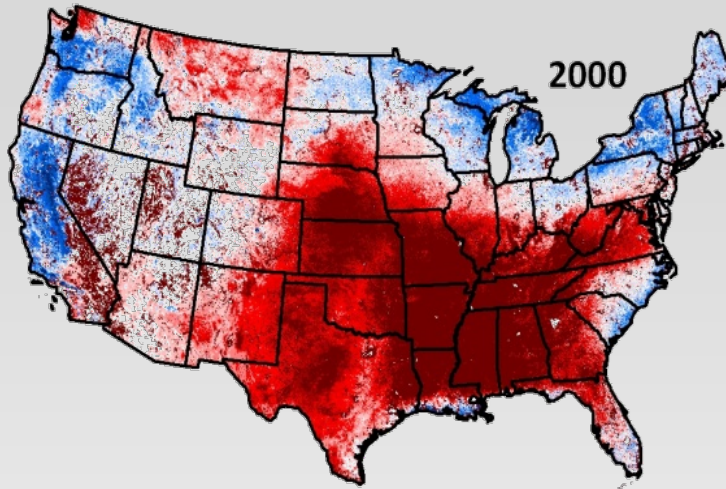
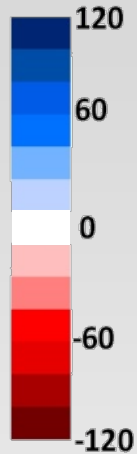
NPP/GPP Indicators & USGCRP NCA Pilot Indicators

- **The GPP and NPP Indicators can be stand-alone indicators of ecosystem health and productivity.**
- **GPP and NPP Indicators also overlap with Forest Growth/Productivity, Land Cover, Crop Production, and Phenology Pilot Indicators as proposed in the Pilot Indicator System Report.**
 - **Annual NPP Anomalies can be used to inform and refine the Pilot Indicators based on FIA estimates of Forest Growth/Productivity, Forest-Grassland-Rangeland-Pastureland Extent, and Crop Production.**
 - **Seasonal GPP can aid in downscaling Phenology Indicators of potential growing season from coarse microwave data and upscale spring indices indicators based on meteorological data and plant observations.**
- **Potential for synergy with other proposed NASA Indicators; Crop Models, Weather Types, Fire Risk, Regional Climate Models, Land Cover change.**

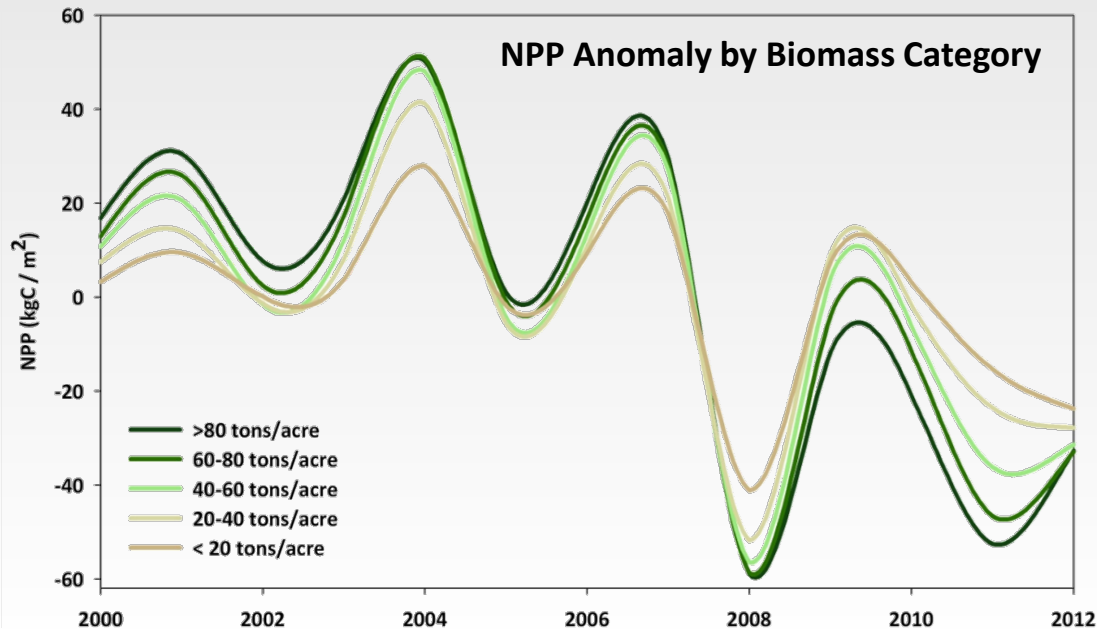
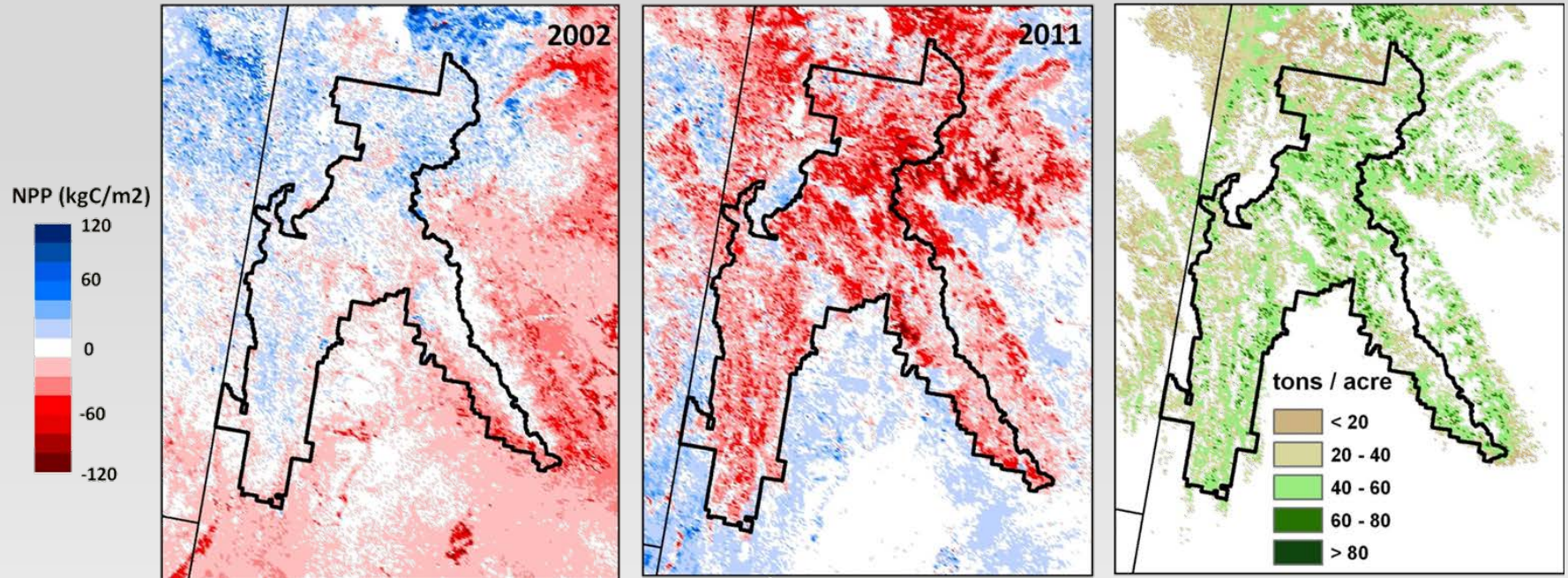
NPP Anomaly – Initial Results

Net Primary Productivity Yearly Anomaly

NPP (kgC/m²)

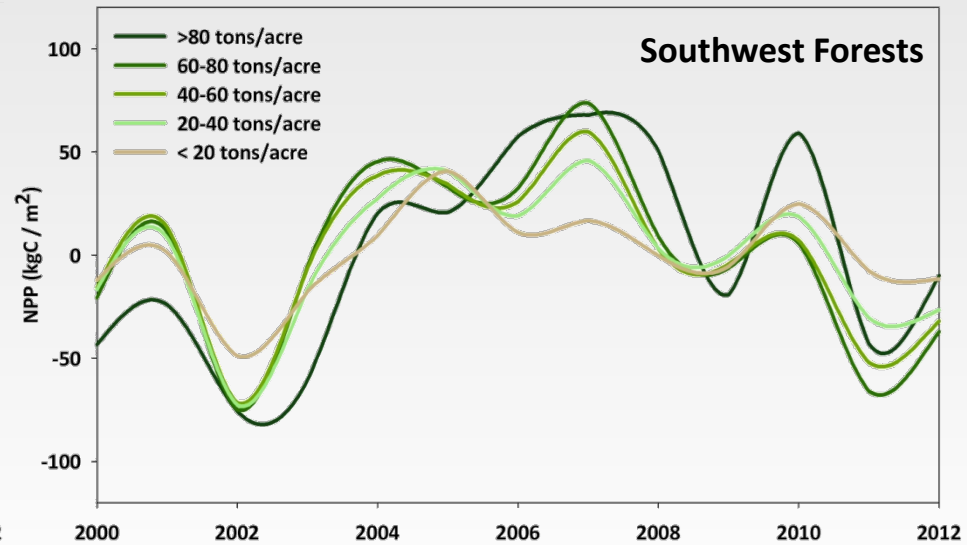
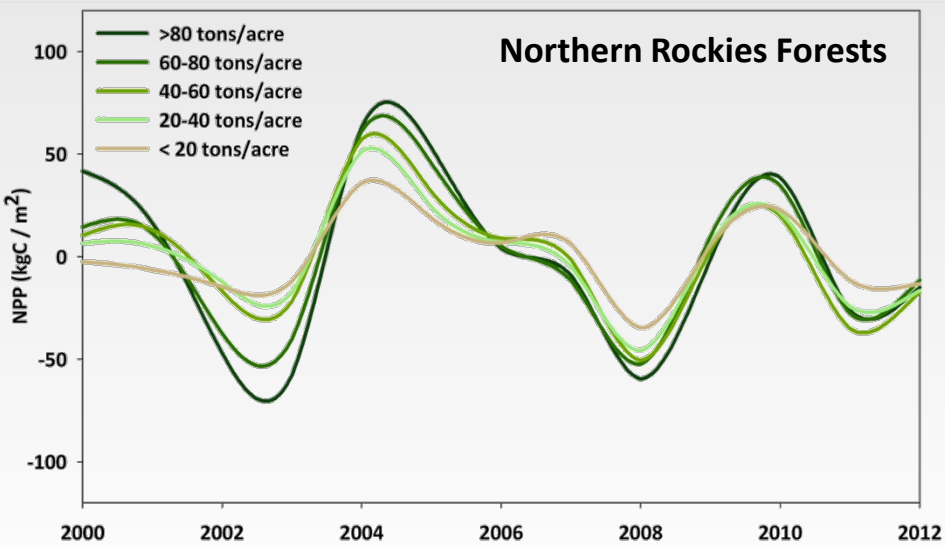
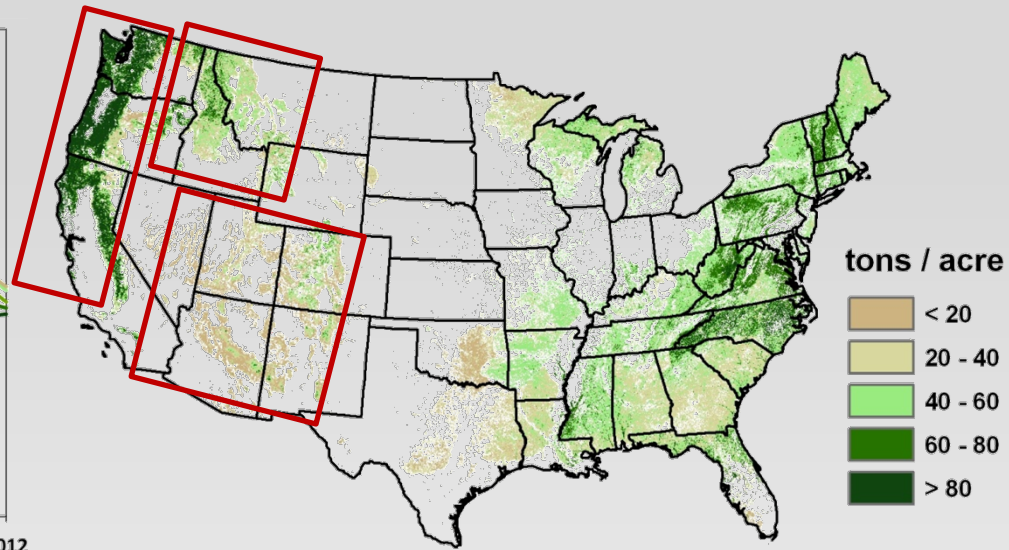
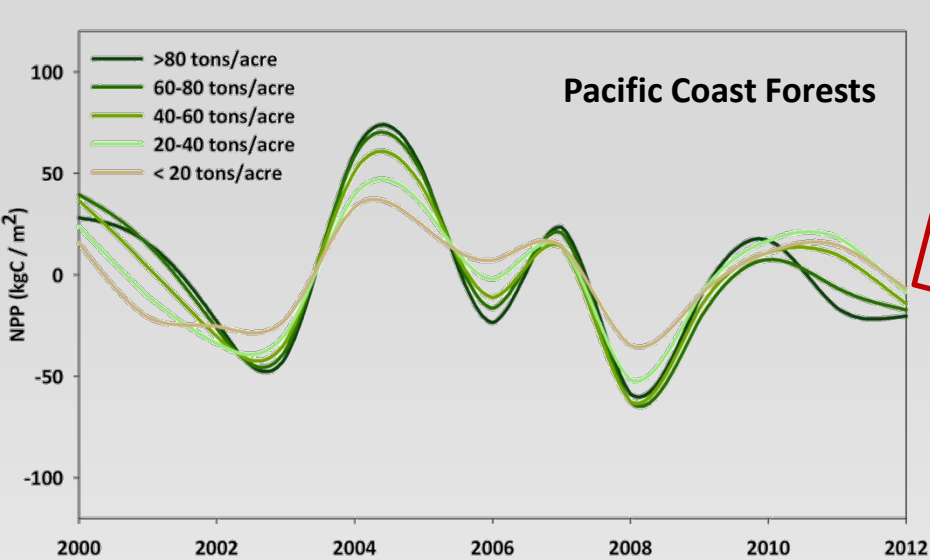


NPP Anomaly over Bridger-Teton National Forest

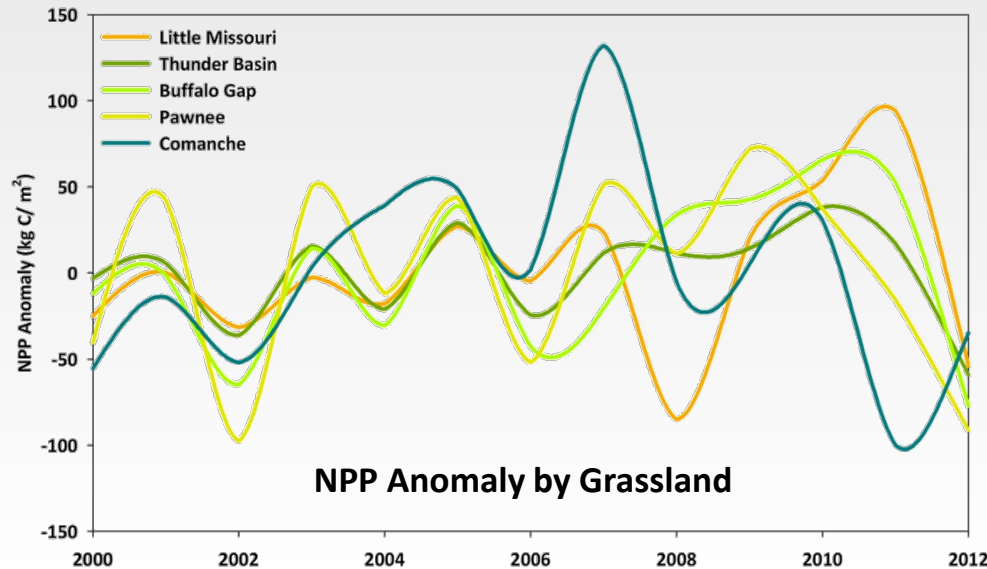
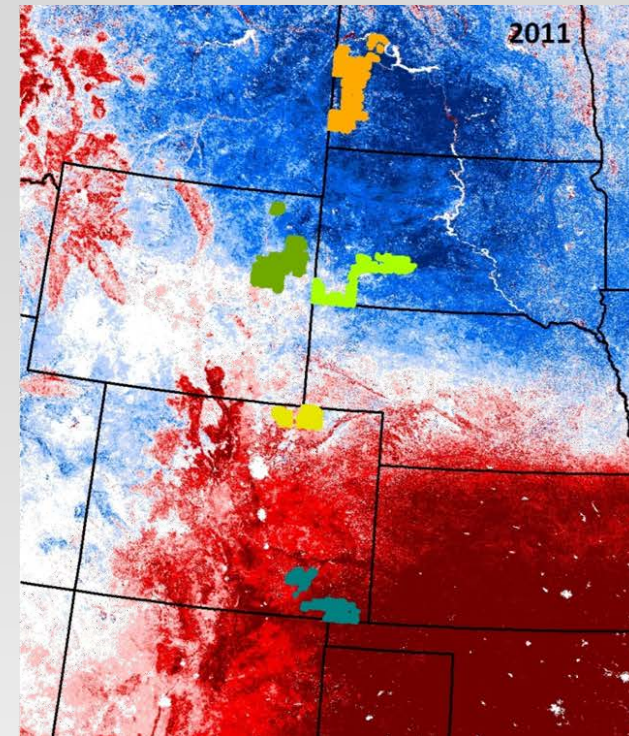
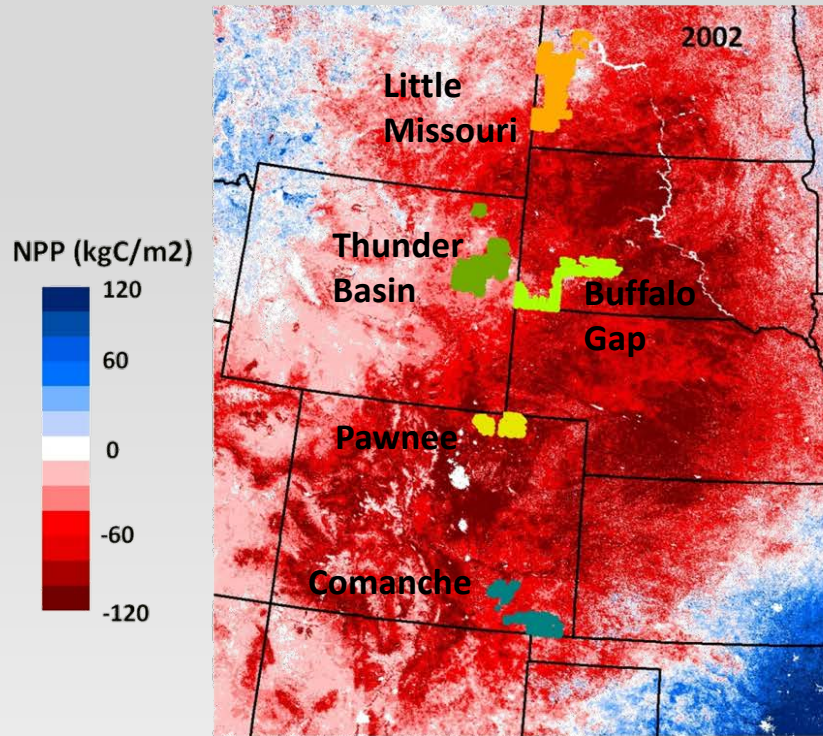


High resolution (1km) anomaly maps allow land managers to pinpoint areas of concern or assess the effects of land-management practices or disturbance.

NPP Anomalies & FIA RSAC Forest Biomass



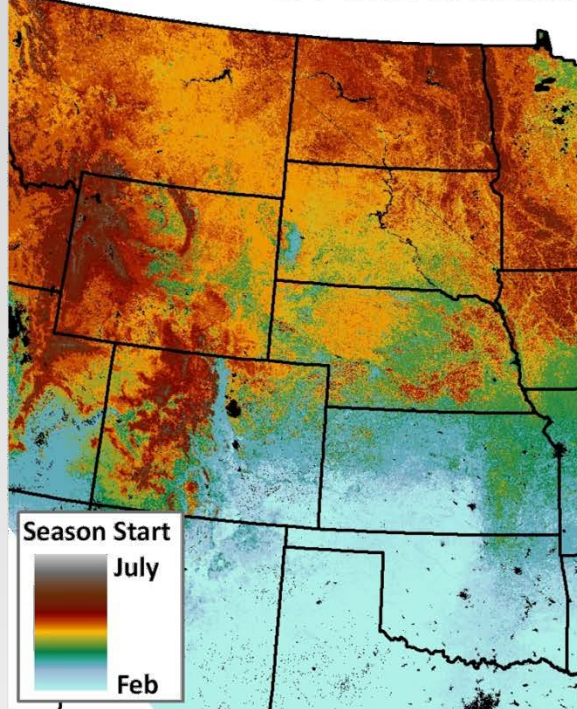
NPP Anomaly & U.S. National Grasslands



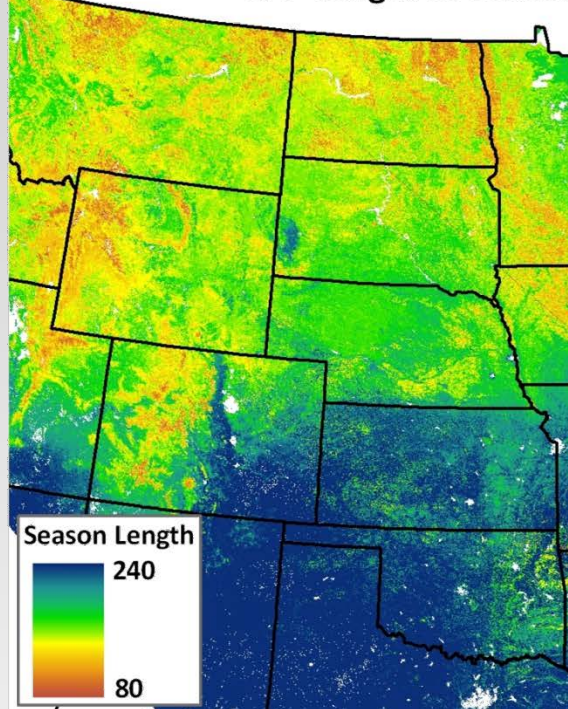
- U.S. National Grasslands displayed common fluctuations in the first half of the decade and diverged in the second half.
- Does this divergence relate to climatic shifts between the northern and southern Great Plains?

NPP, GPP & Great Plains Phenology

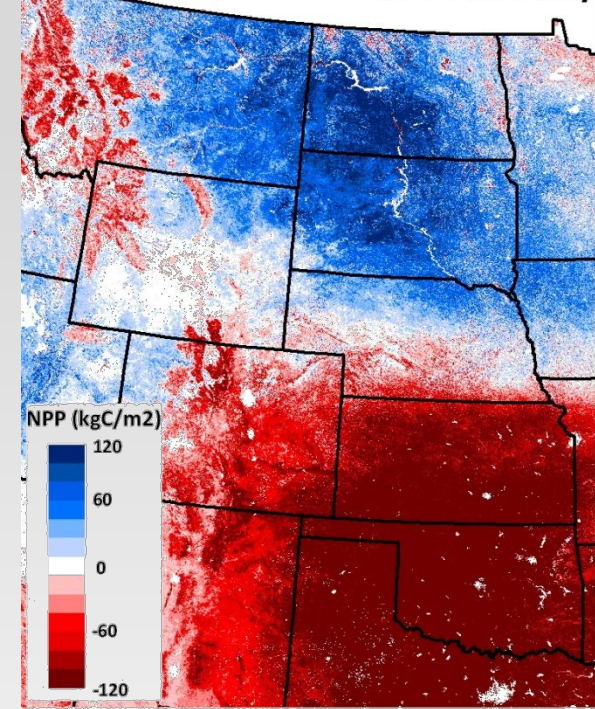
2011 GPP Start of Season



2011 GPP Length of Season

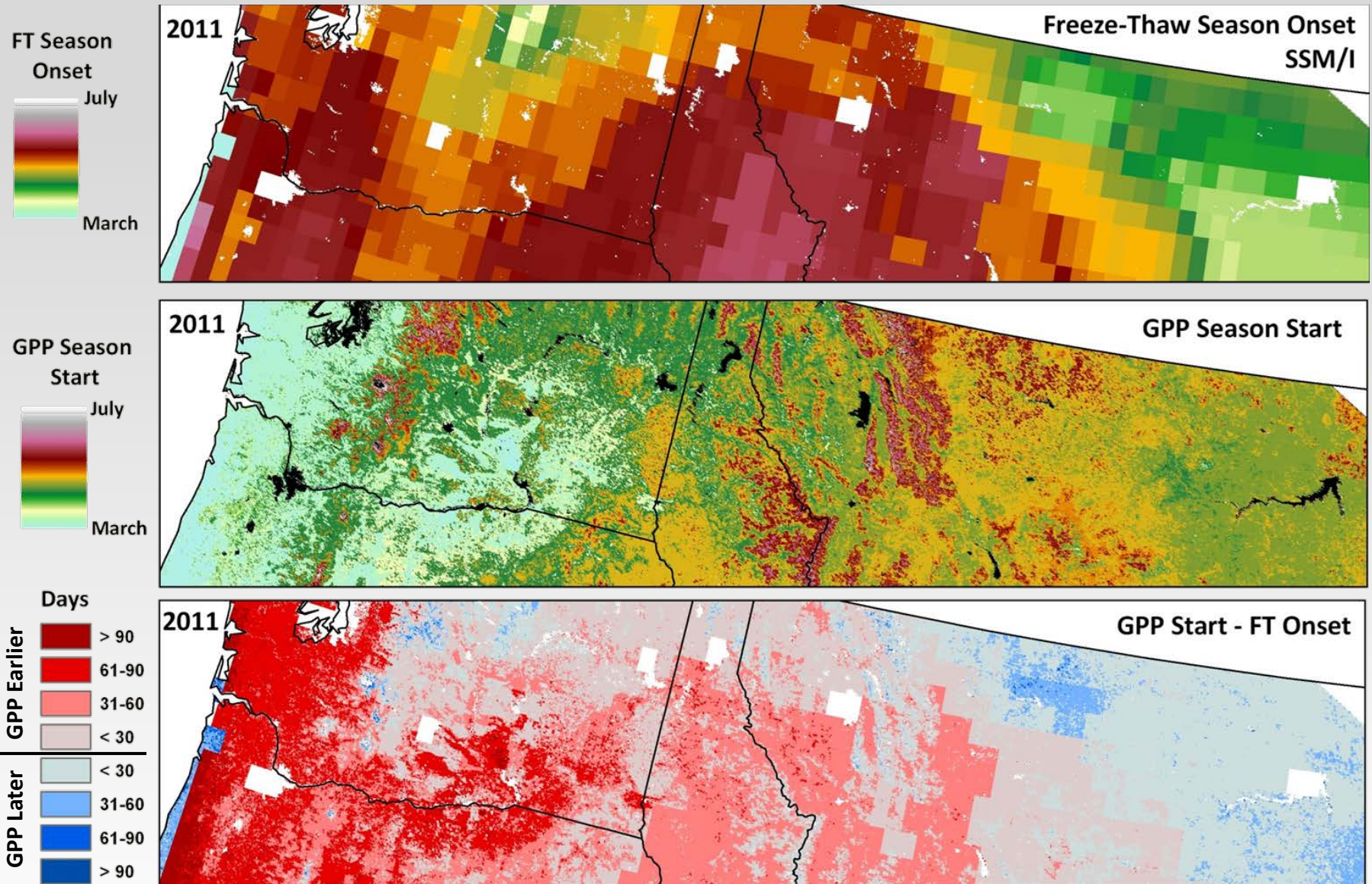


2011 NPP Anomaly



- GPP Start of Season phenology metric is calculated as 8-day period which exceeds 20% of seasonal maximum and length of season is number of days above this threshold.
- Earlier season starts and longer lengths do not necessarily coincide with NPP increases.
- Southern Great Plains states displayed early onset and long seasons yet extremely low NPP anomalies.

Freeze-Thaw Season Onset & GPP Season Start



- Freeze-Thaw Season Onset is derived from satellite microwave SSM/I data at 25km resolution.
- GPP Phenology can be used to refine or downscale the Freeze-Thaw Potential Growing Season Indicator.

Summary & Future Considerations

EOS Indicators

- The EOS derived Ecosystem Productivity and Vegetation Health Indicators can be stand-alone indicators for inclusion in the Pilot System.
- These Indicators can also be integrated with other Pilot Indicators, specifically, Forest Growth/Productivity and Phenology Indicators.

Stakeholders

- Land Managers; monitoring forest health, fire risk, treatment/harvesting effects, wildlife migration patterns.
- Ranching operations for grazing/movement of animals.
- Farming and Crop Insurance Industries.

Questions

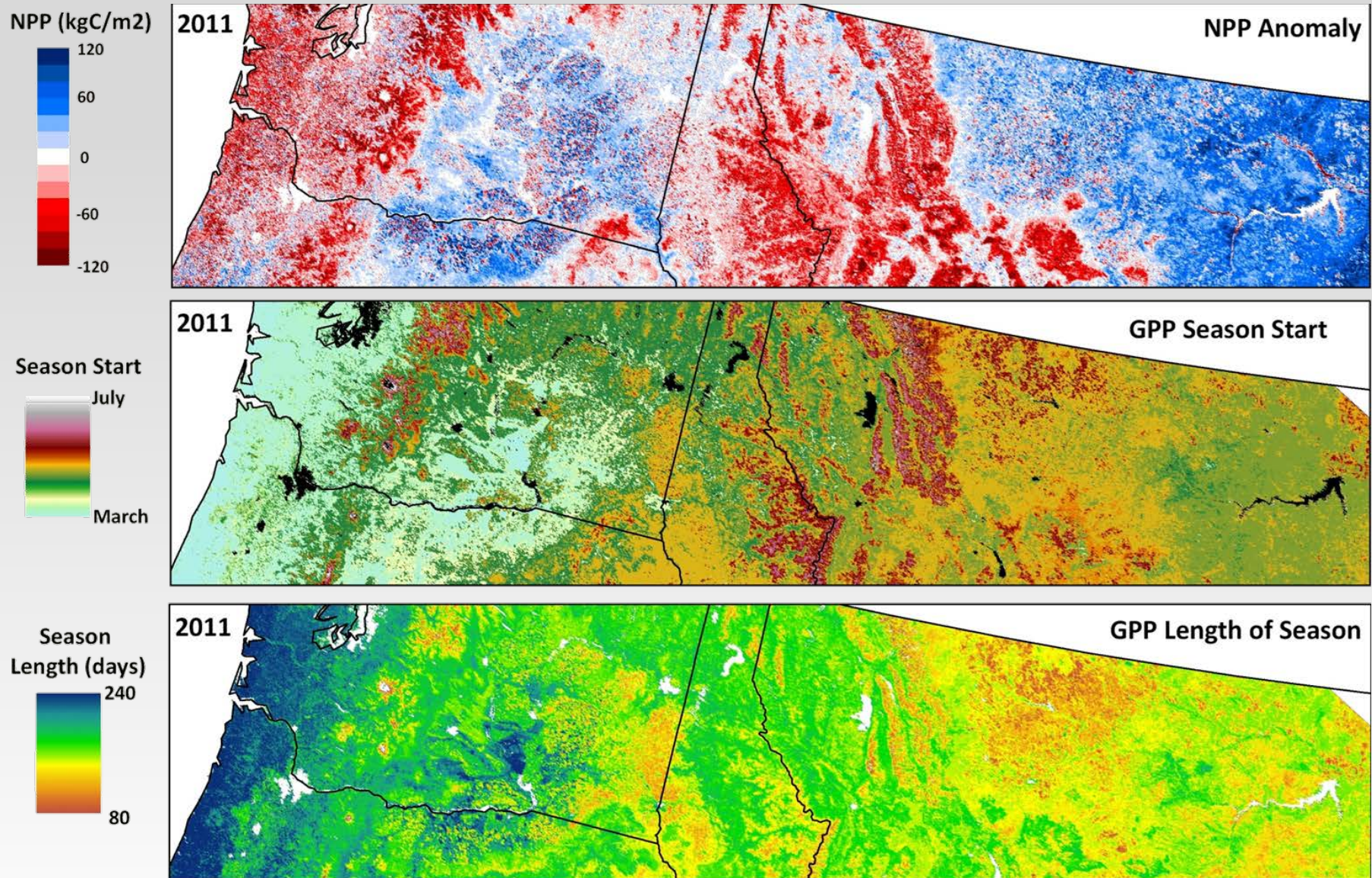
- Is one of our goals to synthesize the proposed NASA NCA Indicators?
- Will there be a standardized format or framework for the resulting Indicators (maps in common projections, common color palettes, indicators presented as anomalies relative to a specific baseline)?



Questions or Comments?



NPP, GPP & Northwest GPP Phenology



- Synergistic use of these Indicators can better inform the underlying drivers of NPP Anomalies.
- Are yearly NPP Anomalies driven by phenological timing? Climate constraints? Both in tandem?