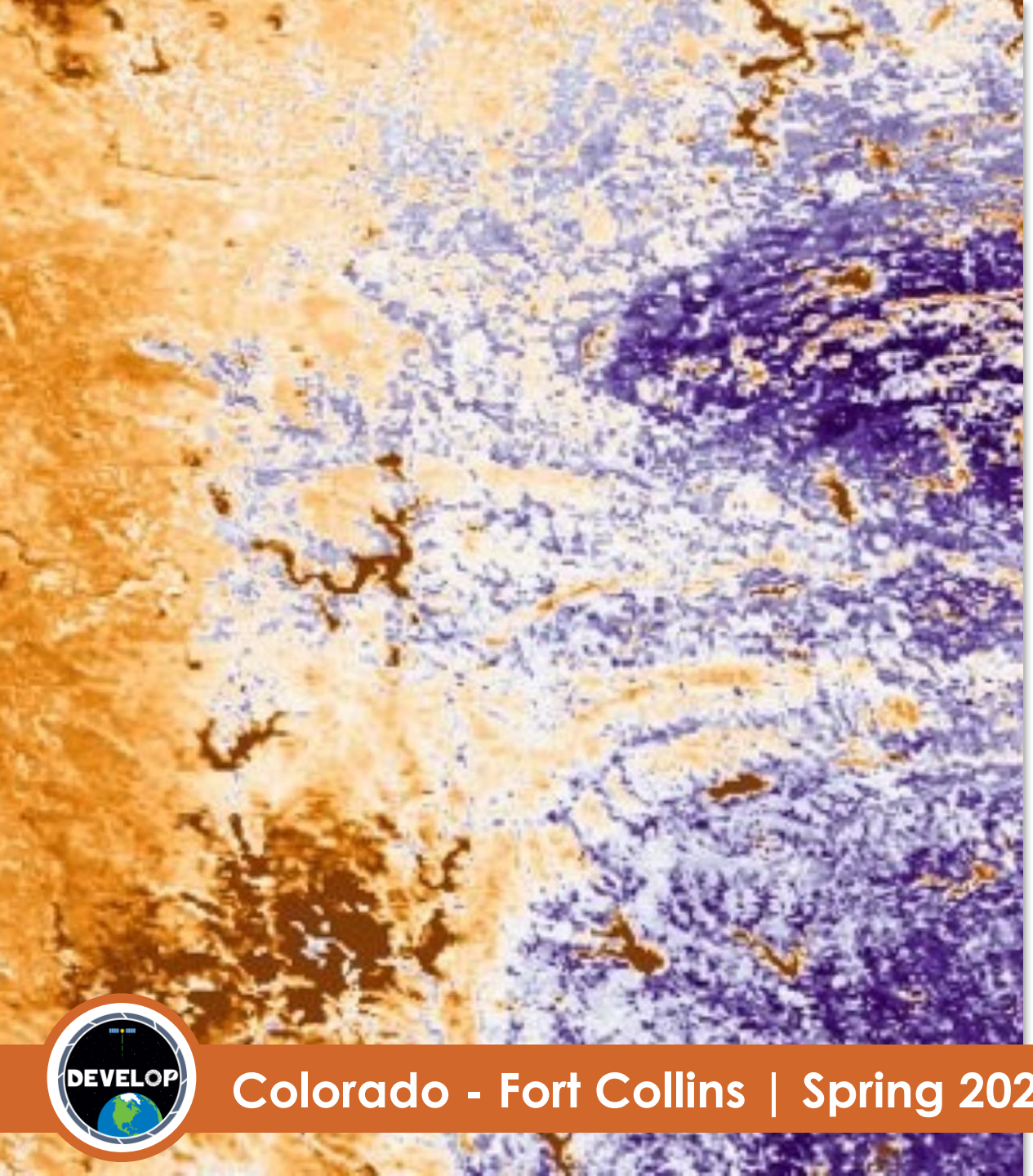


National Aeronautics and Space Administration

OKLAHOMA & TEXAS AGRICULTURE

Mapping Grassland Productivity on South Central Oklahoma and Texas Ranch Lands to Evaluate Management and Quantify Soil Carbon Fluxes

Ashley Bañuelos

Joseph Dale

Alyssa Spencer

Yezzen Khazindar

DEVELOP

Colorado - Fort Collins | Spring 2024

SCIENTIFIC BACKGROUND

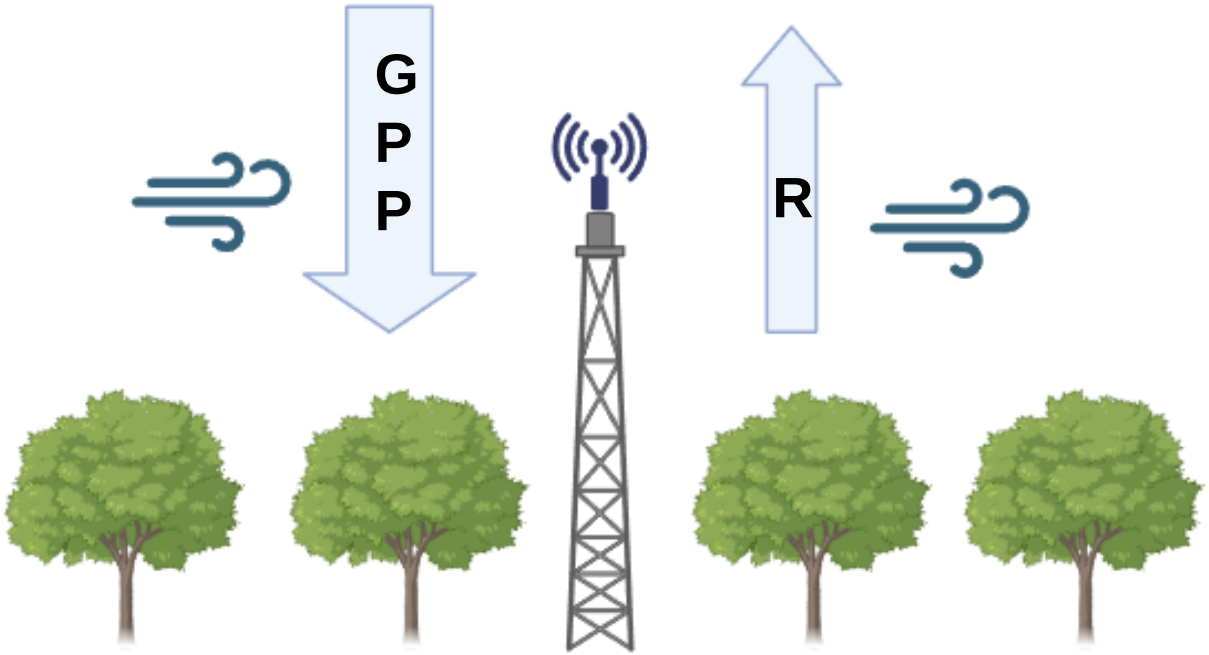


Image credits: Ashley Banuelos

- Gross primary production (GPP) is the amount of **carbon captured by plants**
- Net primary production (NPP) is the amount of **carbon stored as biomass** in vegetation **after respiration** (R)

PROJECT PARTNERS

USDA - Agricultural Research Service

Image Credit: USDA

CSU - Colorado State University

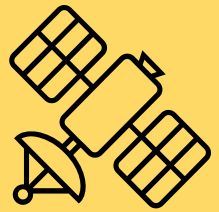
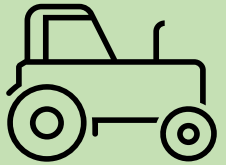
Noble Research Institute

Image Credit: Noble Research Institute

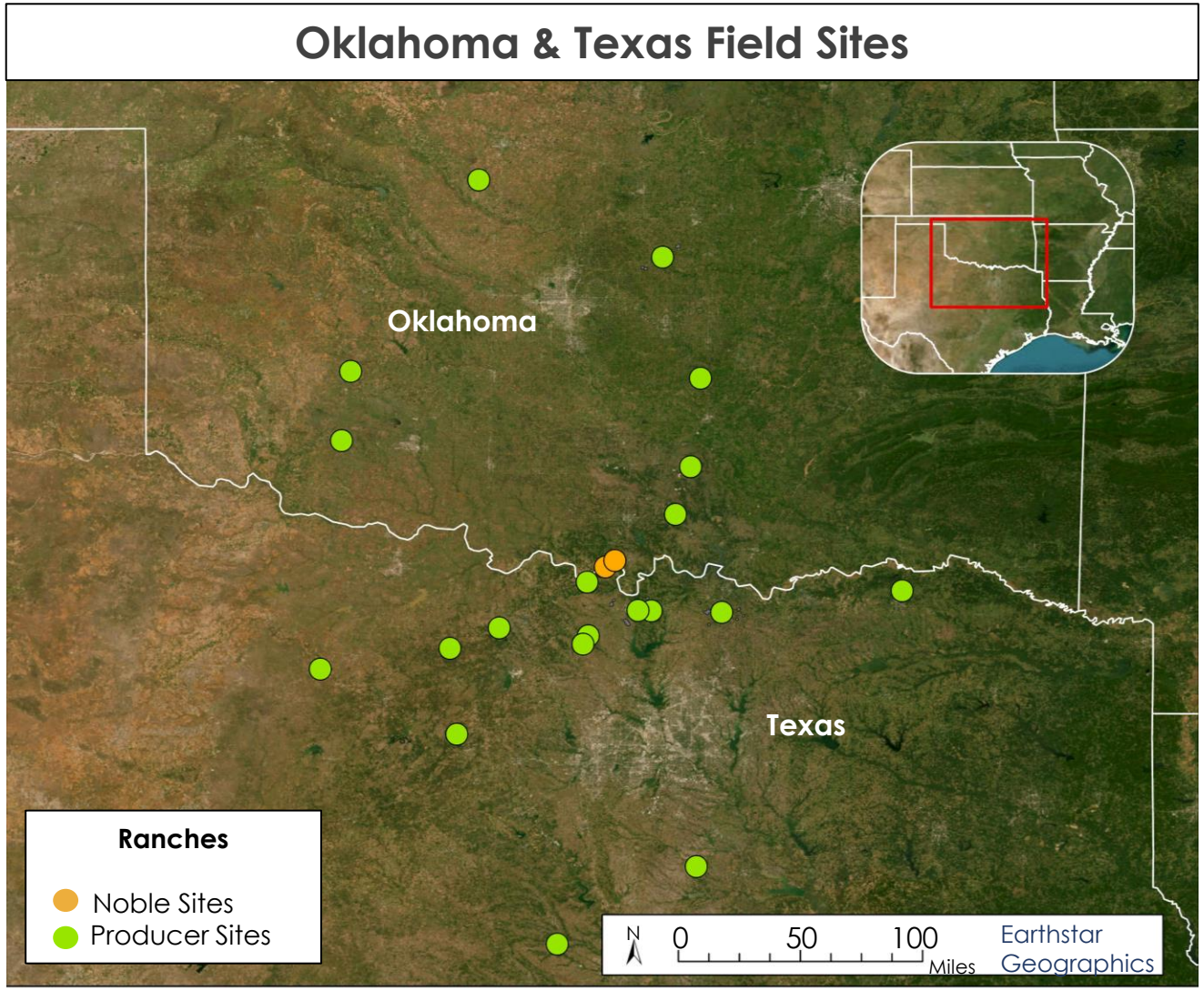
COMMUNITY CONCERNS

Noble Research Institute Project:
3M – MONITORING, MANAGEMENT, METRICS

Investigation of ecosystem functions

- Remote sensing & rangeland health 
- Rangeland management & soil health 
- Ranching & socioeconomic well-being 

STUDY AREA & STUDY PERIOD



Basemap: Sources: Esri, DeLorme, HERE, Earthstar Geographics

Study Area:

- Texas and Oklahoma
- 20 producer sites
- 2 Noble Research Institute sites

Project Time Period:

2001–2019:

NPP model comparison
Vegetation type

2022–2023:

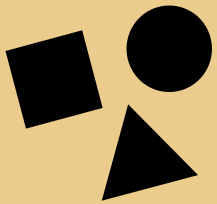
Biomass comparison

PROBLEMS ADDRESSED

1. **Limited research** on how grazing impacts forage production

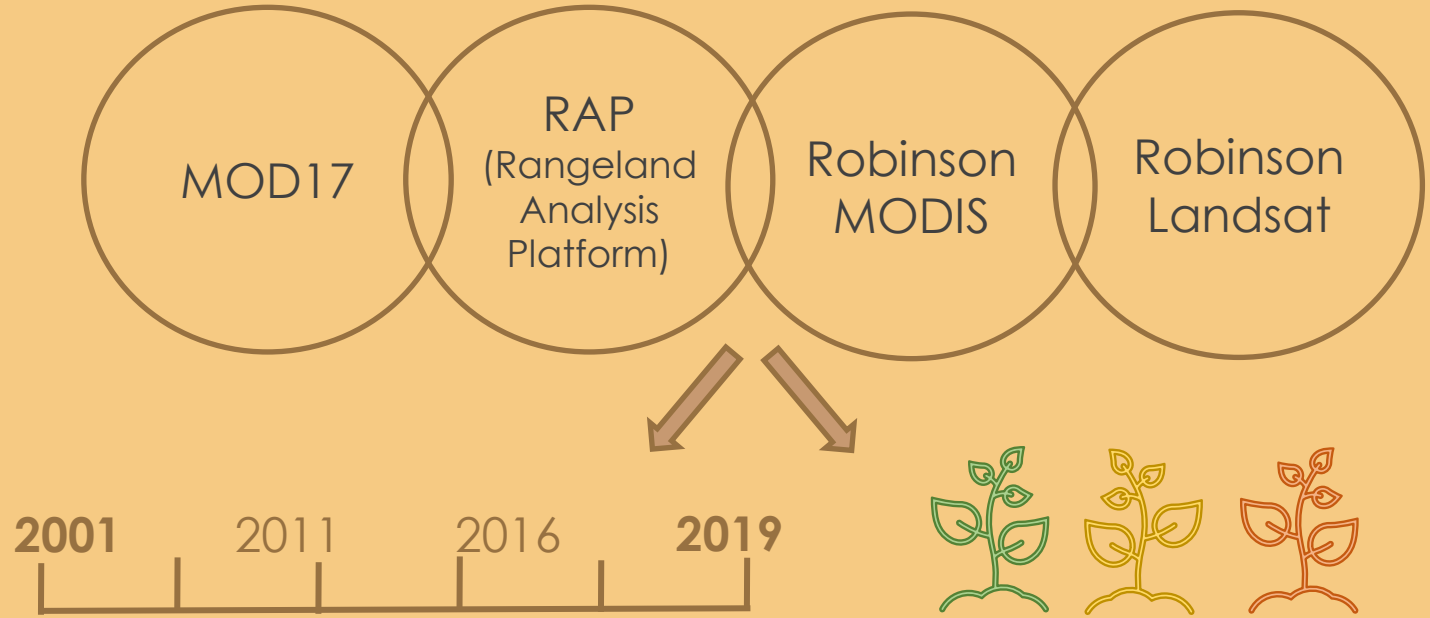
2. **Oversimplified** bio-geochemical models

Compare NPP models to better parameterize biogeochemical models

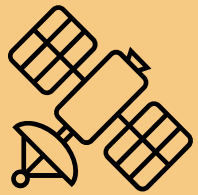


PROJECT OBJECTIVES

1. **Assess and compare NPP variability across models**

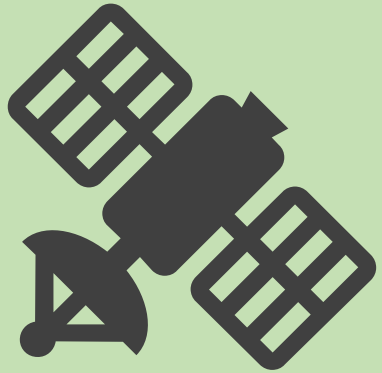


PROJECT OBJECTIVES



Assess and compare NPP variability across models

2. **Compare RAP biomass values to field collected biomass data**

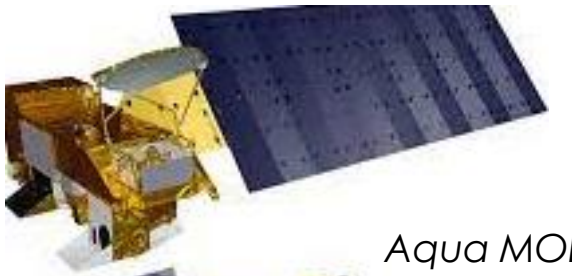


vs.

EARTH OBSERVATIONS

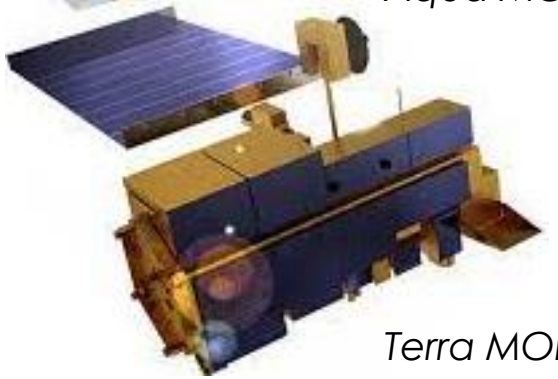
MODIS

MOD17



Aqua MODIS

Robinson MODIS

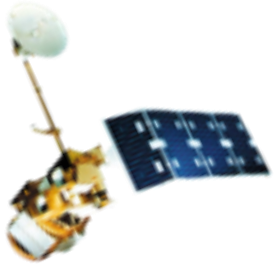


Terra MODIS

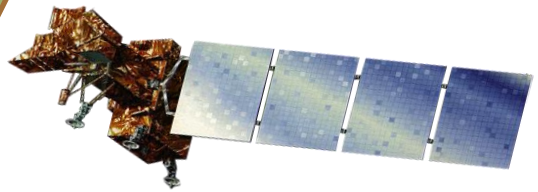
Landsat

RAP

Rangeland Analysis Platform

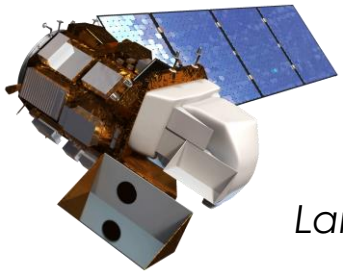


Landsat 5 TM



Landsat 7 ETM +

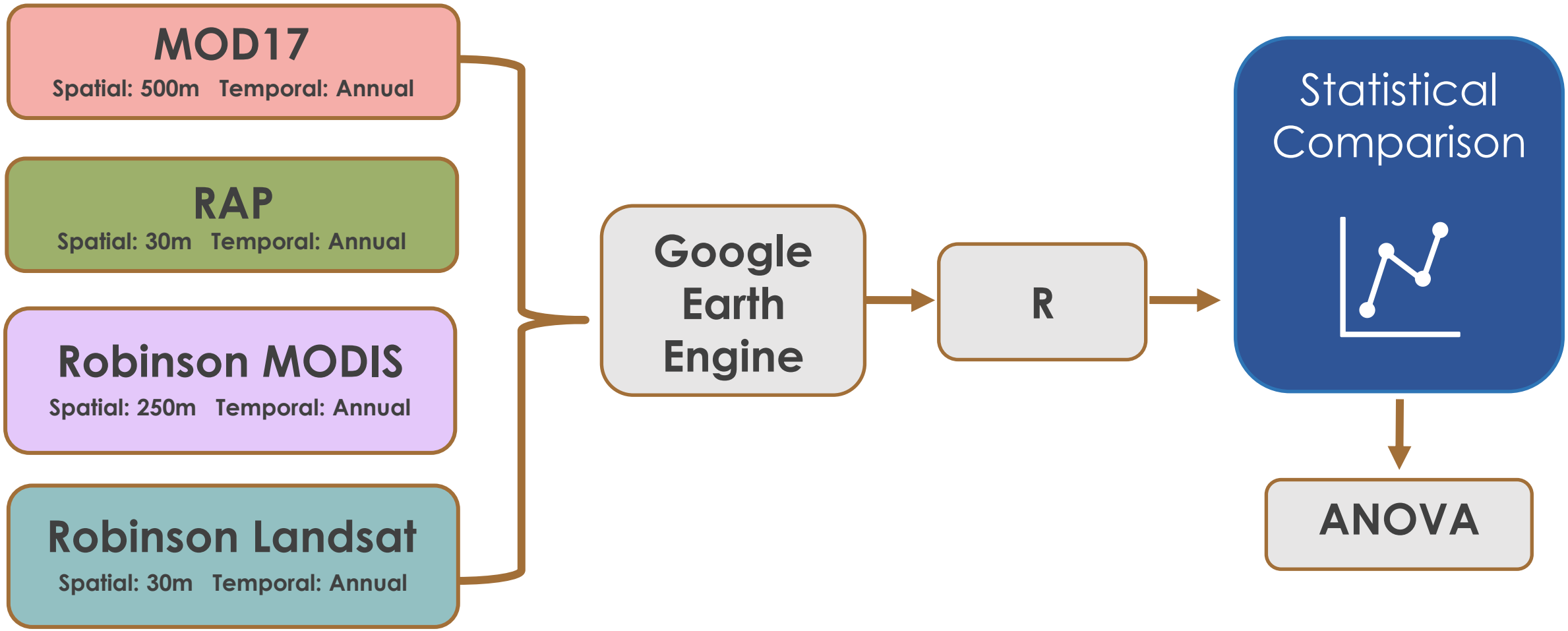
Robinson Landsat



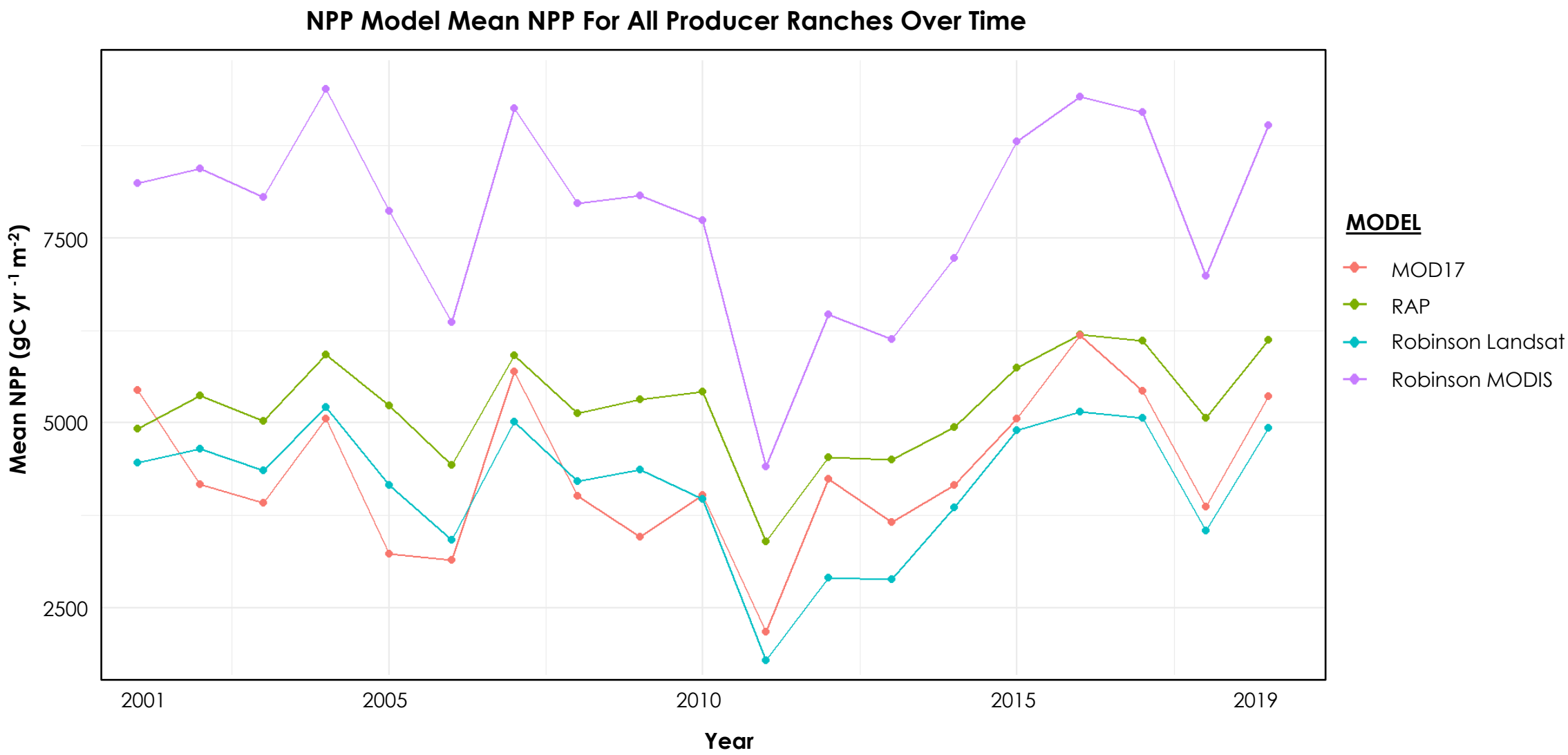
Landsat 8 OLI

Image credits: NASA

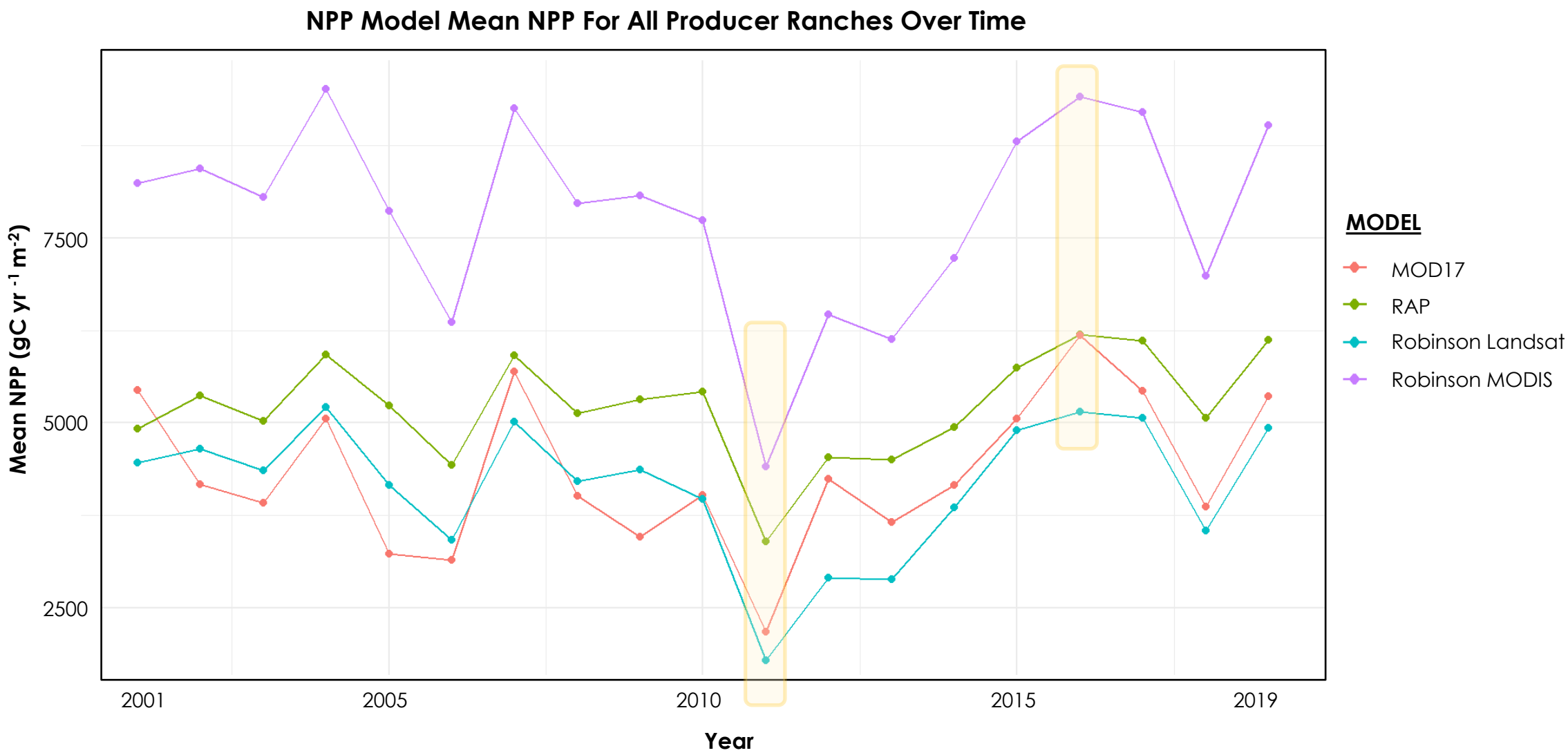
OBJ. 1 - NPP MODEL COMPARISON



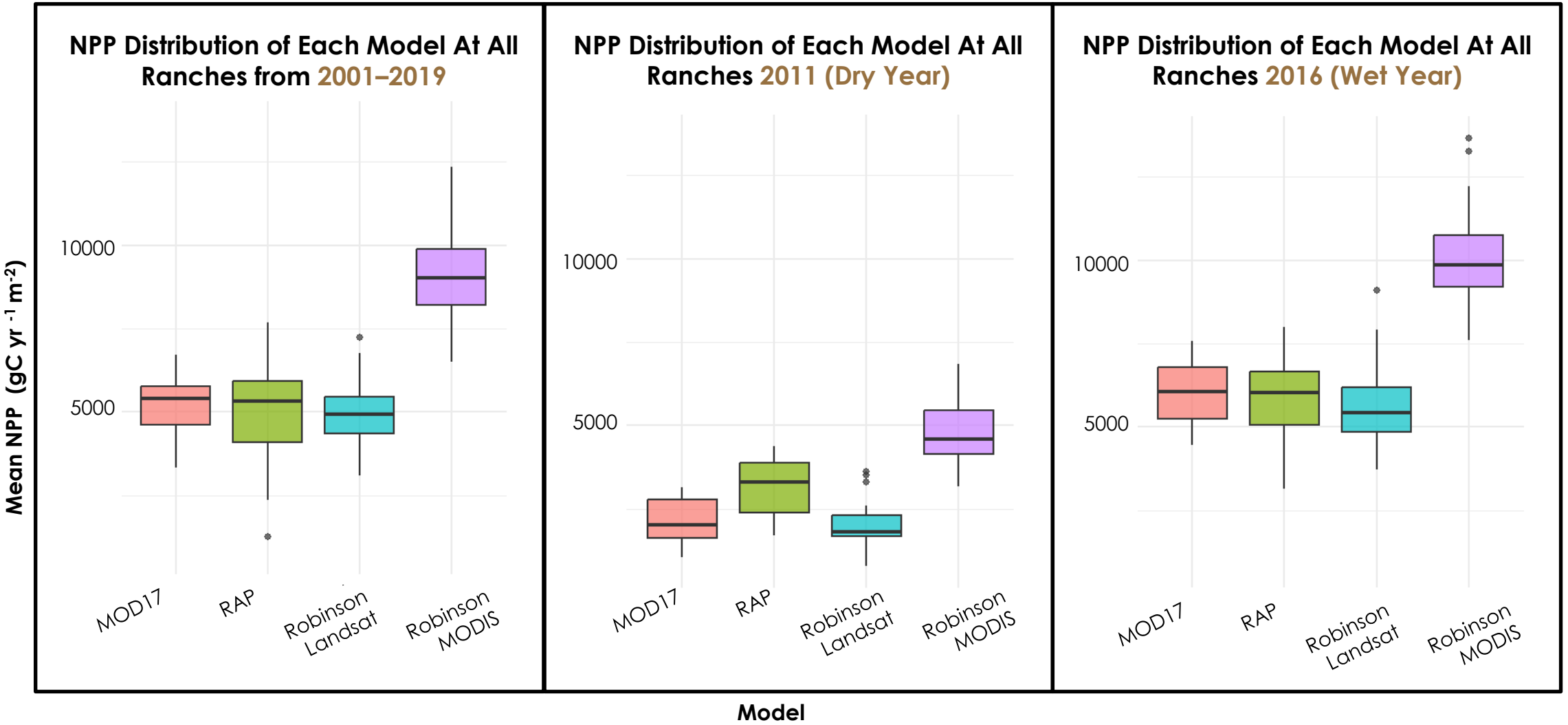
NPP DISTRIBUTION OVER TIME



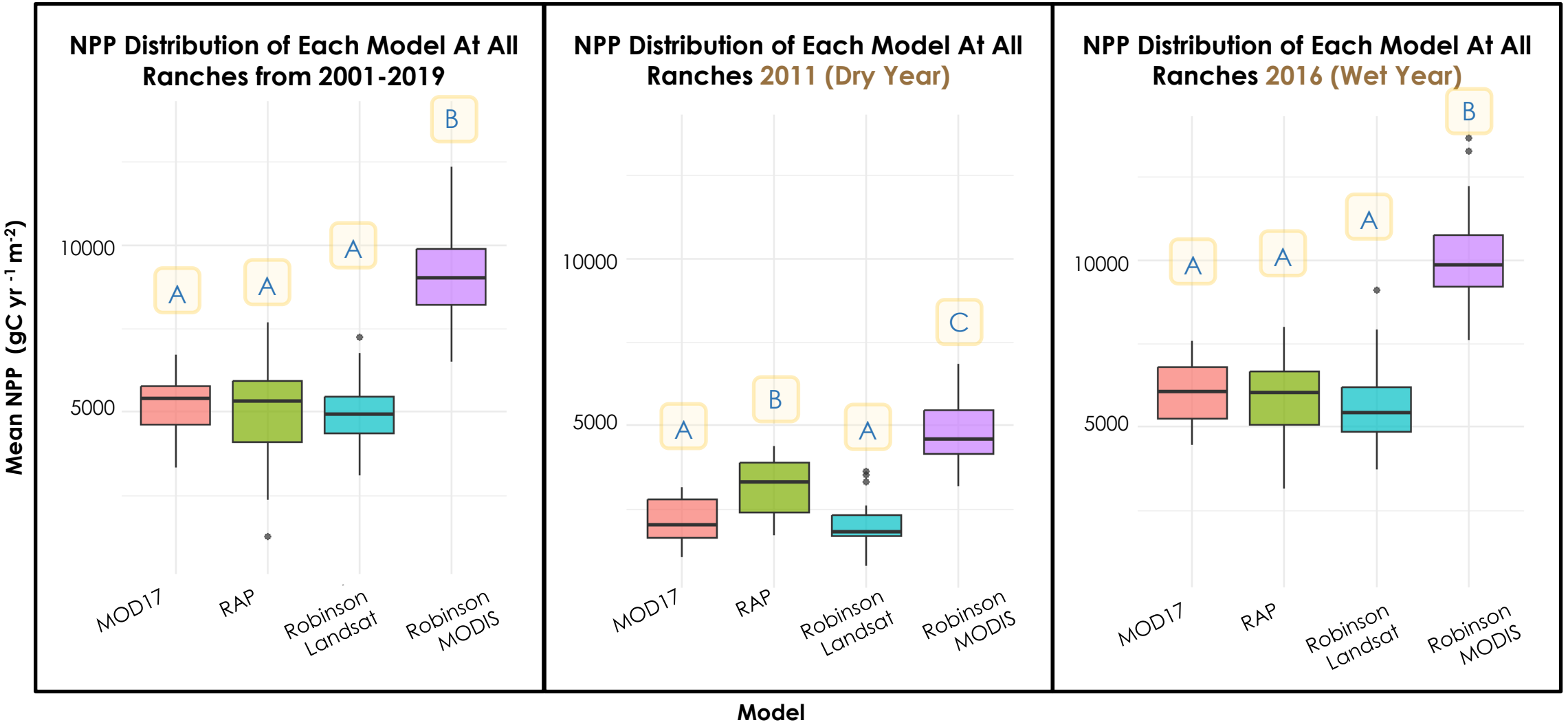
NPP DISTRIBUTION OVER TIME



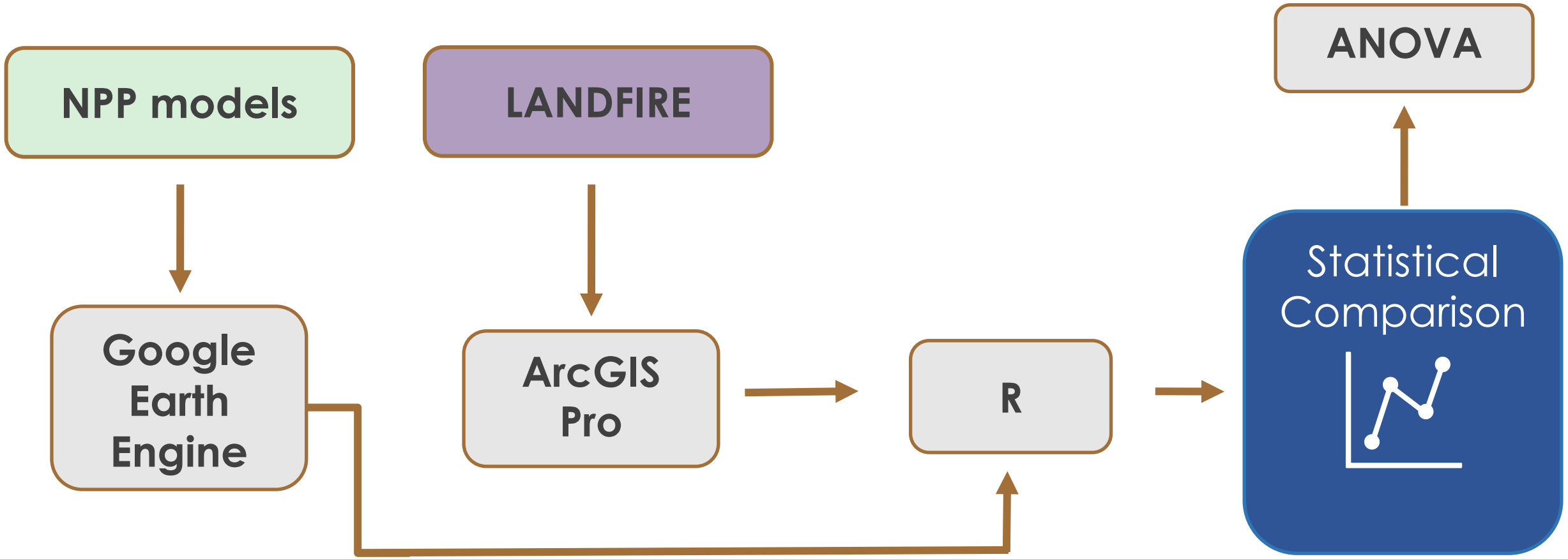
NPP COMPARISON FROM ALL YEARS



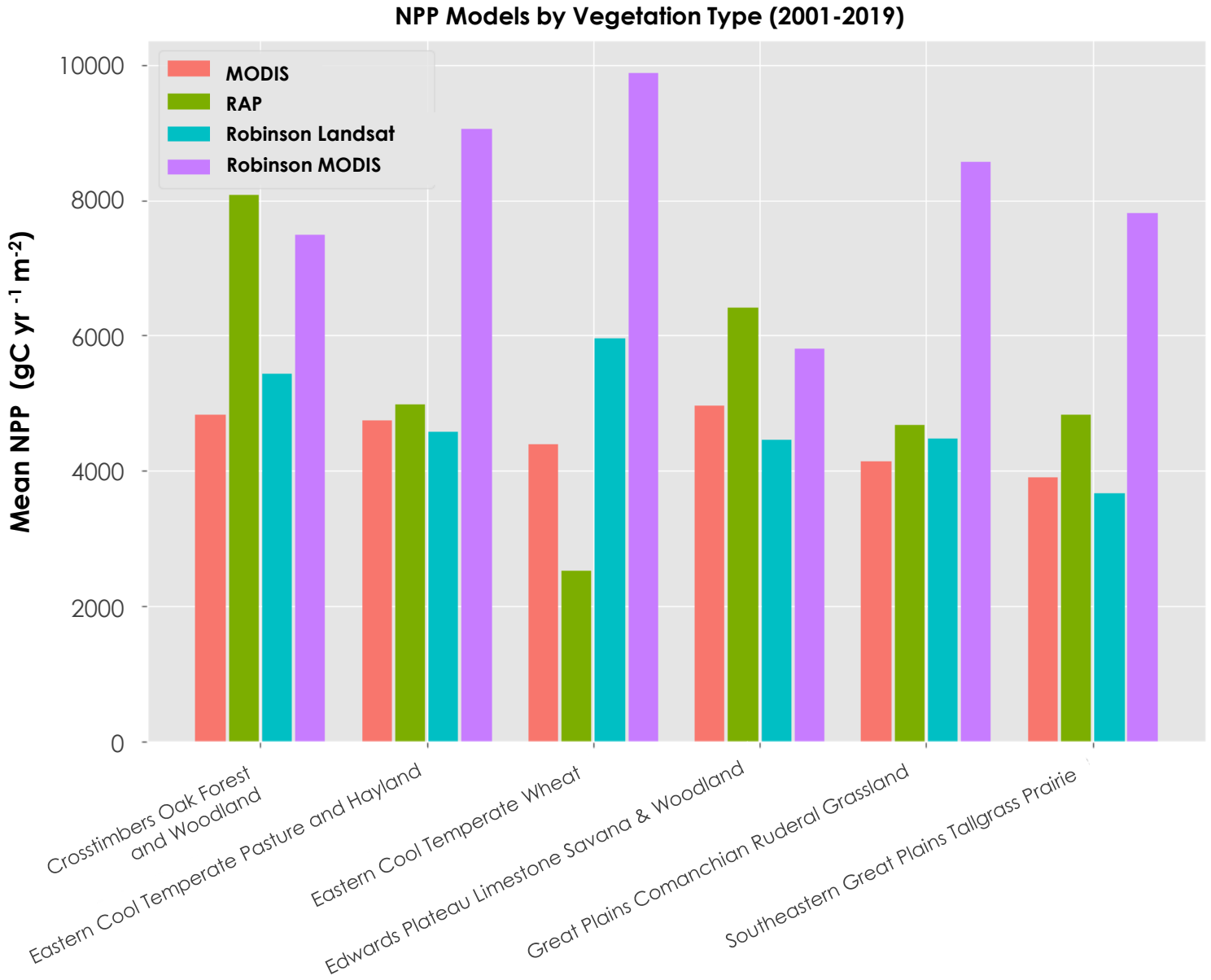
NPP COMPARISON FROM ALL YEARS



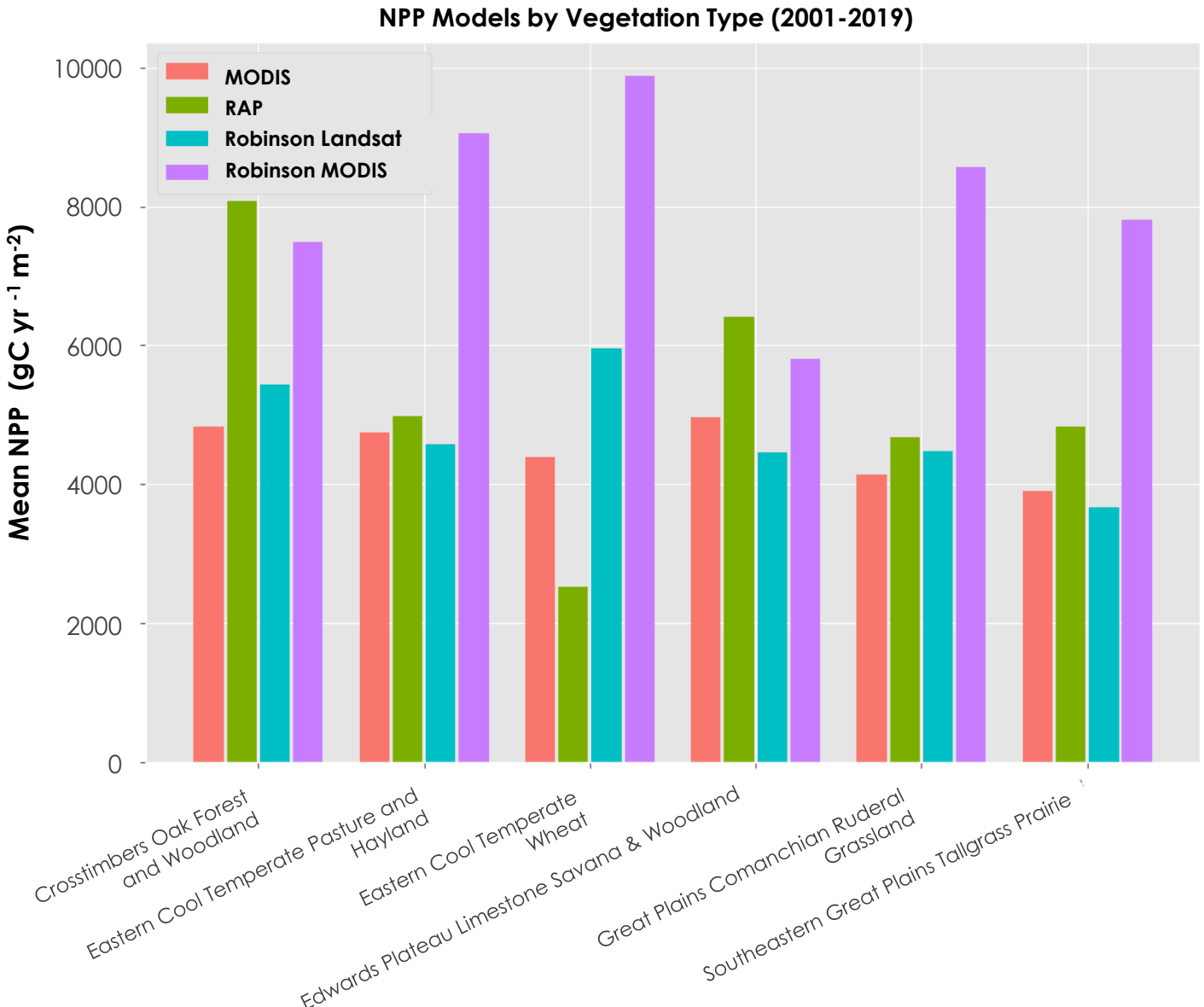
OBJ. 1 - NPP & VEGETATION ANALYSIS

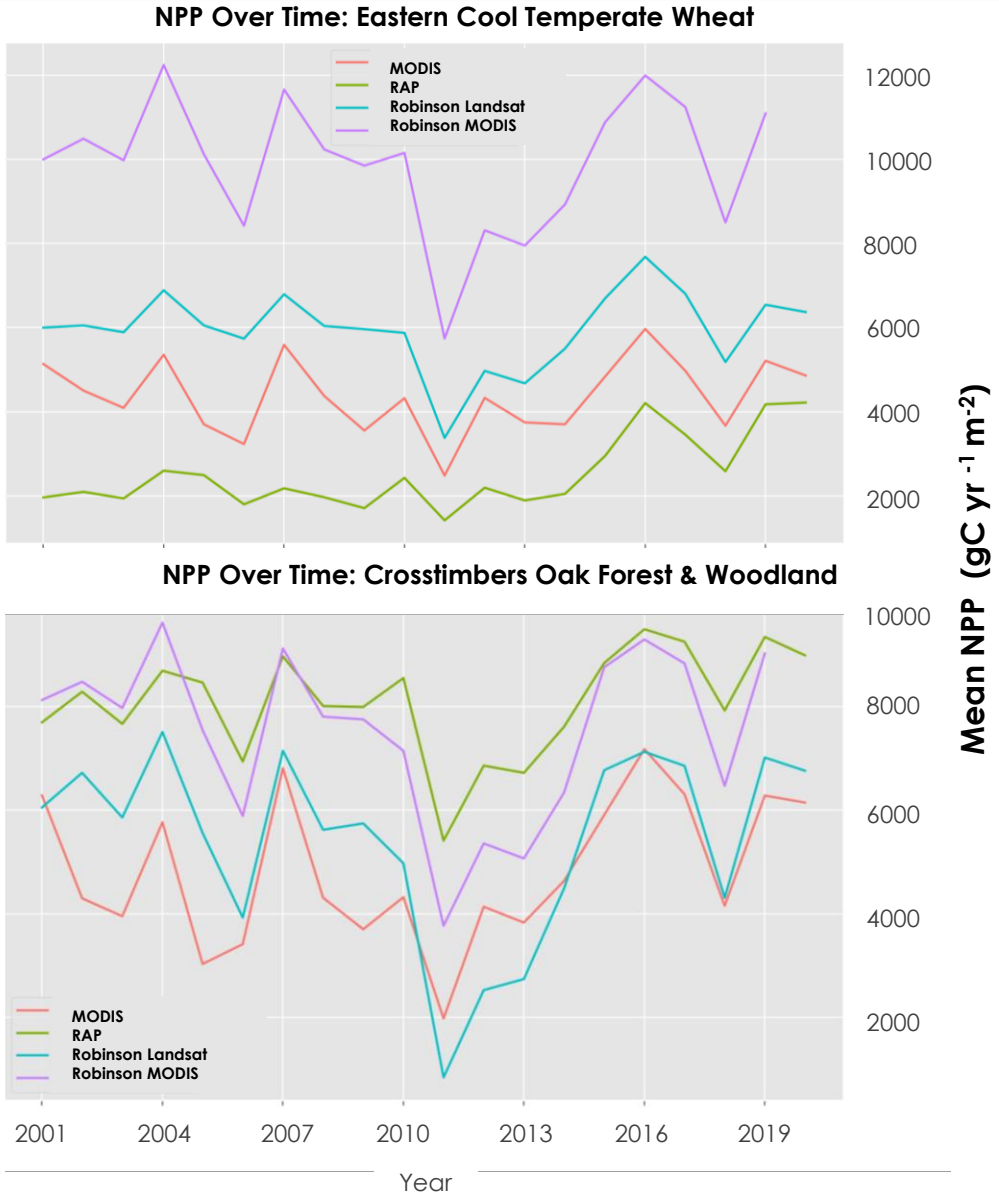


NPP MODELS BY VEGETATION

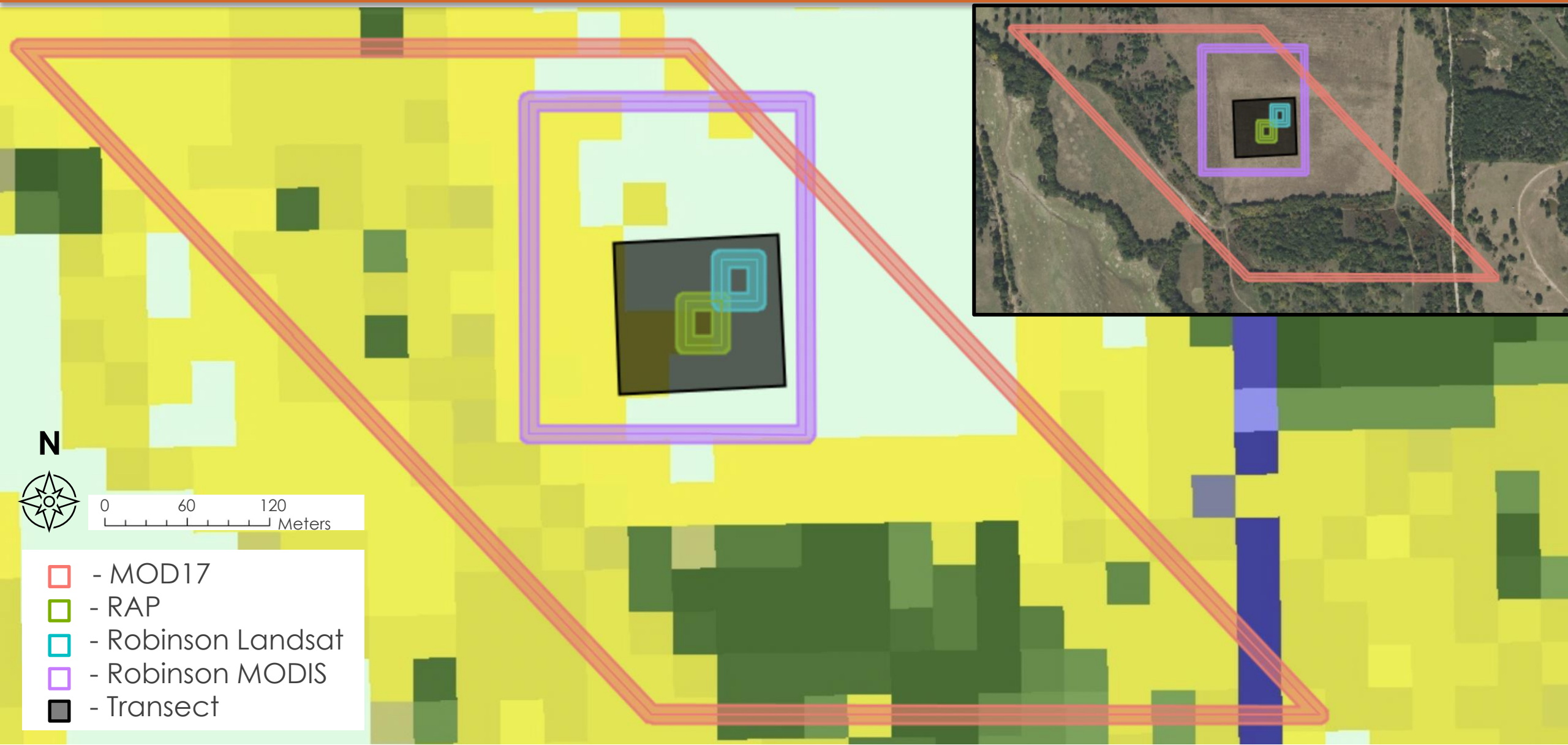


NPP MODELS BY VEGETATION

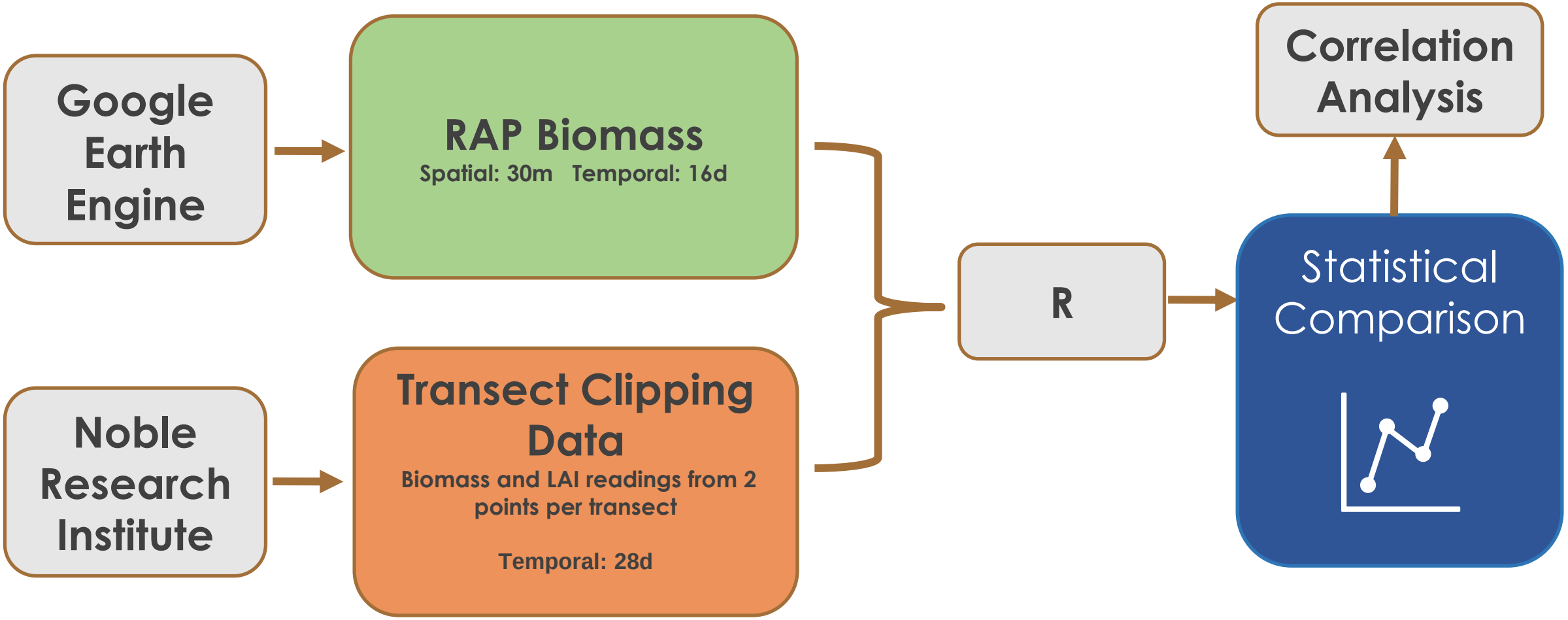




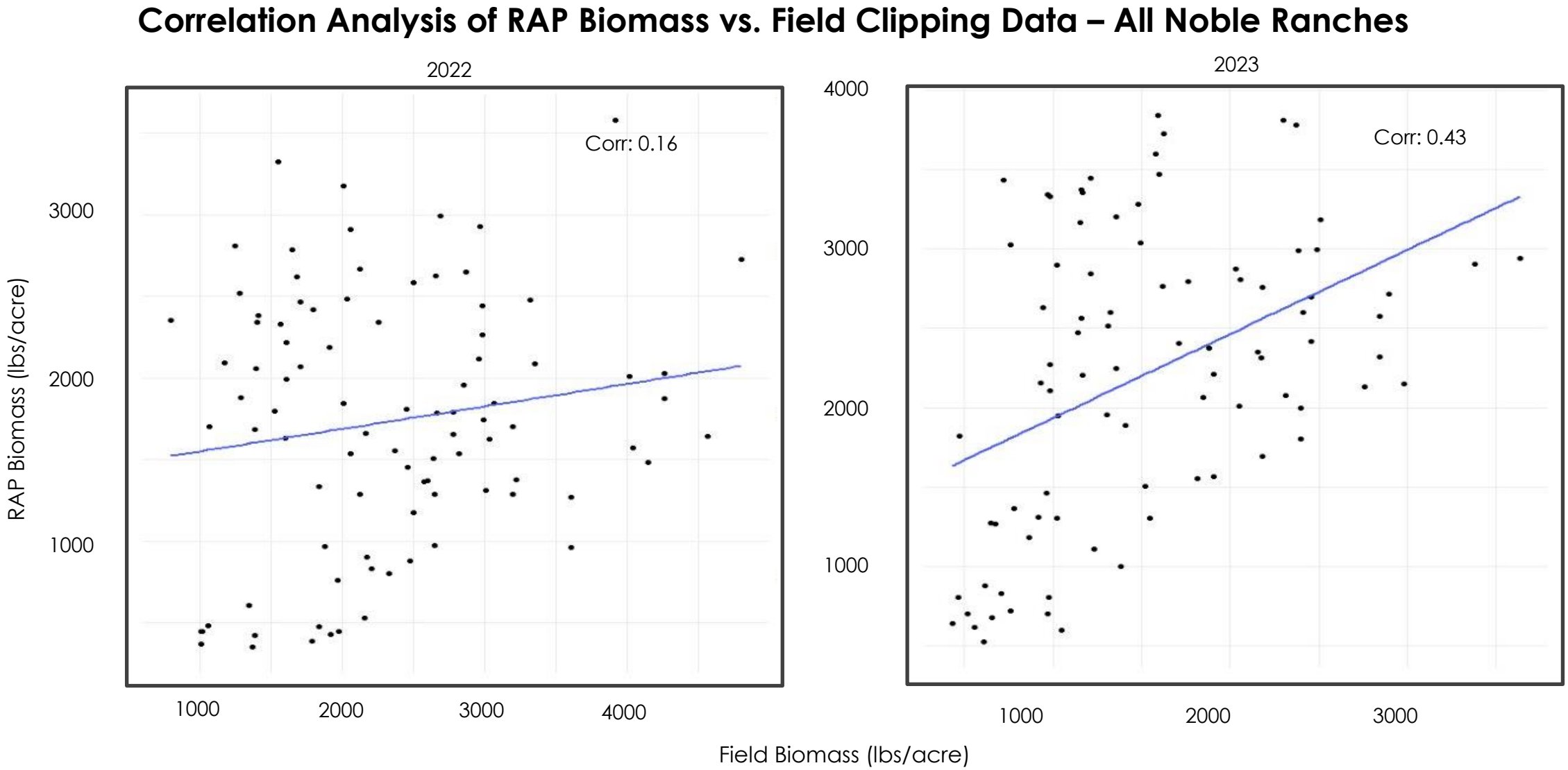
PIXEL SIZE & NPP MODELS



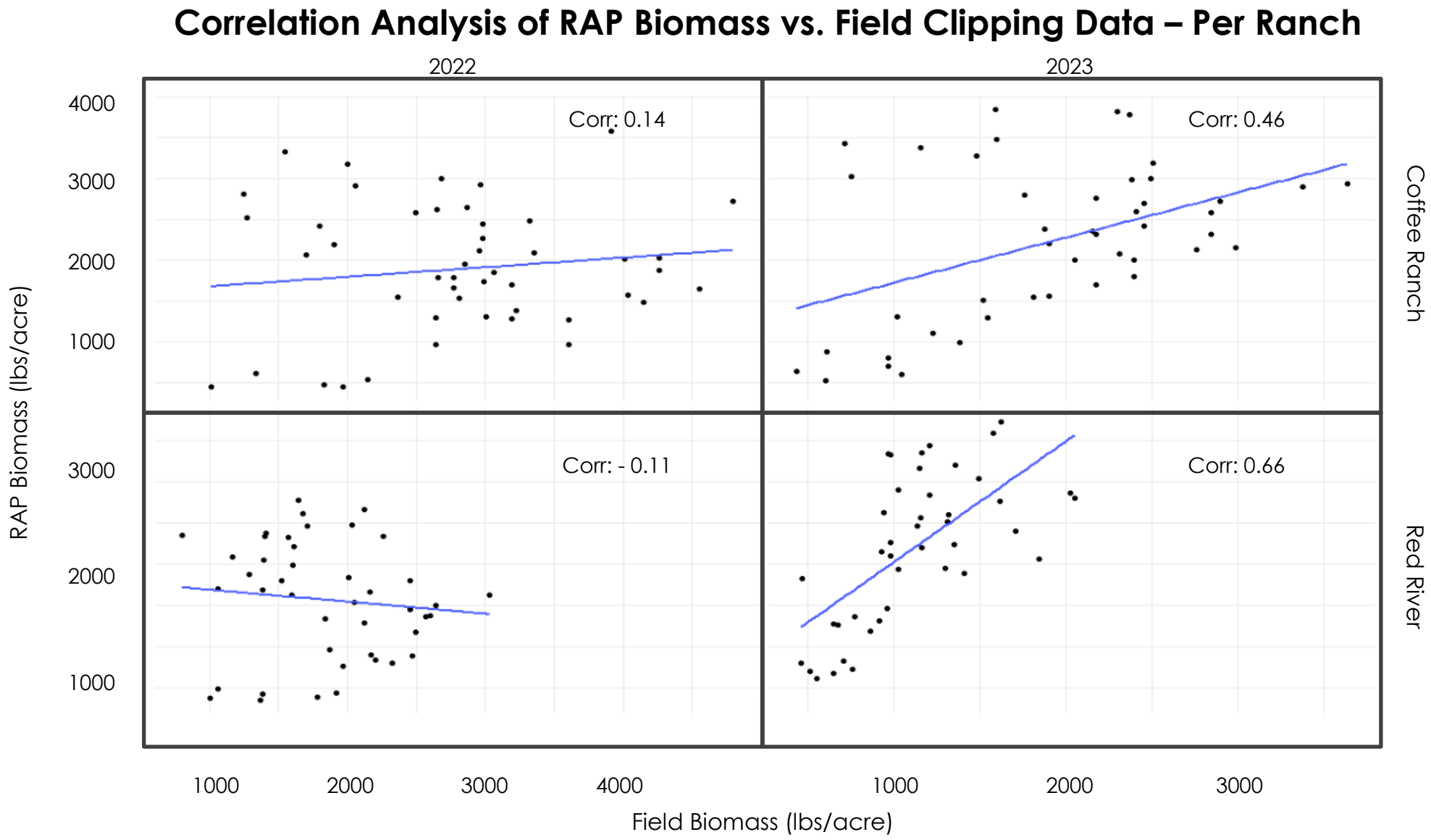
OBJ. 2 – RAP BIOMASS VS GROUND TRUTH



RAP BIOMASS VS GROUND TRUTH - LANDSCAPE



RAP BIOMASS VS GROUND TRUTH – By Ranch

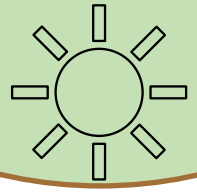


MAIN TAKEAWAYS

Robinson MODIS **significantly differed** from the other models **across all years** and during wet and dry periods

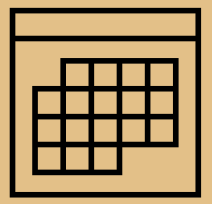
Vegetation proved to be an **important factor** when comparing these models

RAP Biomass correlated well in 2023 but not in 2022, **warranting further investigation** to determine the role of drought



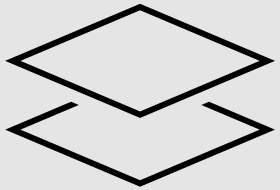
LIMITATIONS

Additional field data over time could confirm RAP's biomass product's reliability during droughts



More frequent NPP product availability would improve the assessment of annual patterns

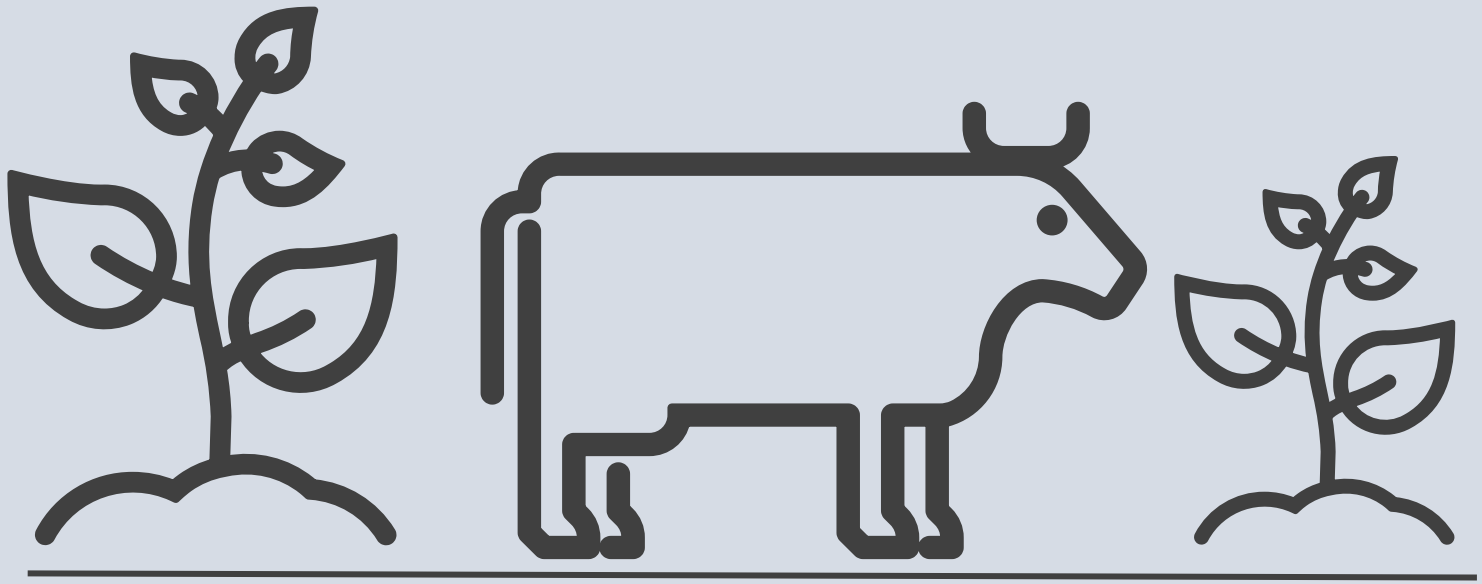
Clouds led to missing dates in RAP Biomass data, affecting the comparison with field data



Large spatial resolution of Robinson MODIS resulted in capturing values outside of study areas

FUTURE WORK

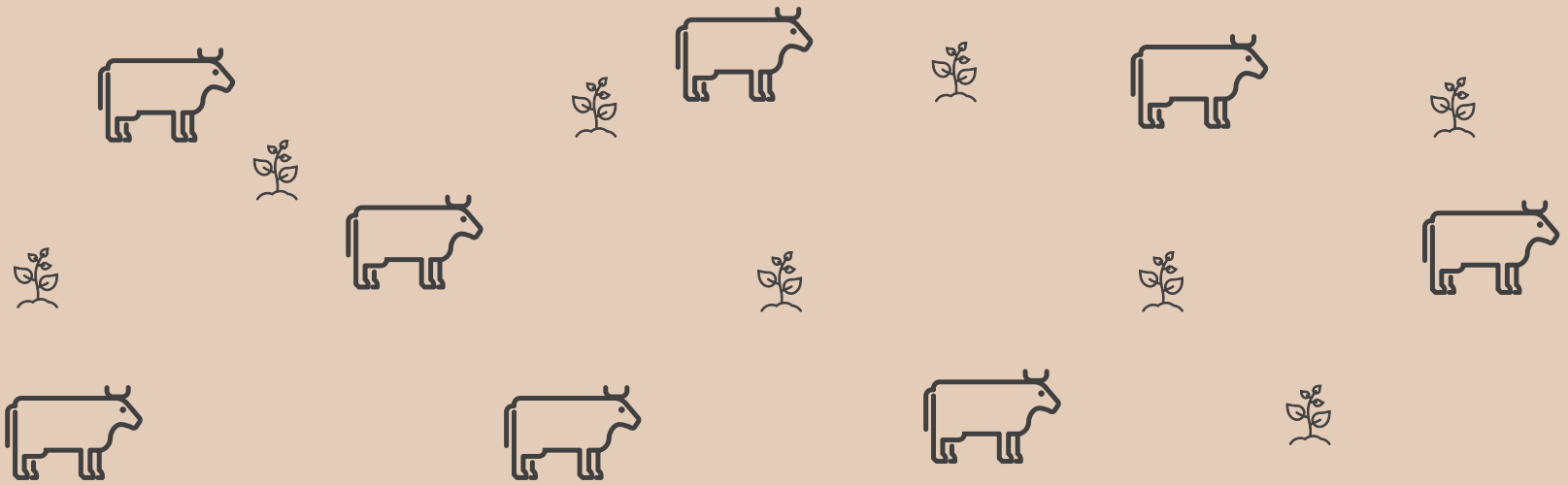
Analyze RAP biomass sensitivity to grazing



FUTURE WORK

Analyze RAP biomass sensitivity to grazing

NPP models and RAP biomass analysis by grazing management practices



FUTURE WORK

Analyze RAP biomass sensitivity to grazing

NPP models and RAP biomass analysis by grazing management practices

Use eddy covariance tower data to evaluate NPP model accuracy

ACKNOWLEDGMENTS

Partners

- **Isabella De Faria Maciel**, Noble Research Institute, *Regenerative Systems Research Manager*
- **Martha Anderson**, USDA - Agricultural Research Service, *Research Physical Scientist*
- **Feng Gao**, USDA - Agricultural Research Service, *Research Physical Scientist*
- **Sean Kearney**, USDA - Agricultural Research Service, *Spatial Ecologist*
- **Keith Paustian**, Colorado State University, *Distinguished Professor*
- **Yao Zhang**, Colorado State University, *Research Scientist*

NASA DEVELOP

- **Truman Anarella** (Lead, Colorado – Fort Collins)

Science Advisors

- **Anthony Vorste**r, Colorado State University, *Natural Resource Ecology Laboratory*
- **Nicholas Young**, Colorado State University, *Natural Resource Ecology Laboratory*
- **Paul Evangelista**, Colorado State University, *Natural Resource Ecology Laboratory*
- **Catherine Jarnevich**, United States Geological Survey, *Fort Collins Science Center*
- **Christopher Tsz Hin Choi**, Colorado State University, *Natural Resource Ecology Laboratory*

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Thank you! Questions?