ESTIMATING VEGETATION PRODUCTIVITY FOR THE CONTERMINOUS UNITED STATES USING SATELLITE OBSERVATIONS

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WHY THIS RESEARCH

- VEGETATION PRODUCTIVITY IS A MEASUREMENT USED TO DEFINE THE STATE OF VEGETATION OVER TIME AND ACROSS ECOSYSTEMS
- THESE ECOSYSTEMS ARE CRITICAL FOR THE FUTURE OF SOCIETY, FOR EXAMPLE :
  - GRASSLANDS FOR BEEF AND DAIRY PRODUCTION
  - AGRICULTURE FIELD FOR SUPPORTING CROPS,
  - FOREST FOR TIMBER
- THESE ARE JUST A FEW EXAMPLES OF **THE IMPORTANCE OF MONITORING VEGETATION PRODUCTIVITY**

WHY THIS RESEARCH

- TO ESTIMATE ANNUAL VEGETATION PRODUCTION OVER LARGE AREAS USING SATELLITE DATA
- TO FACILITATE THE GENERATION OF FUTURE DATA FOR UPCOMING YEARS

OBJECTIVES

1. PRODUCE A DATASET OF AN ESTIMATE FOR ANNUAL VEGETATION PRODUCTIVITY FOR THE CONTERMINOUS U.S.
2. GENERATE A REPRODUCIBLE WORKFLOW FOR FUTURE YEARS.

METHODOLOGY

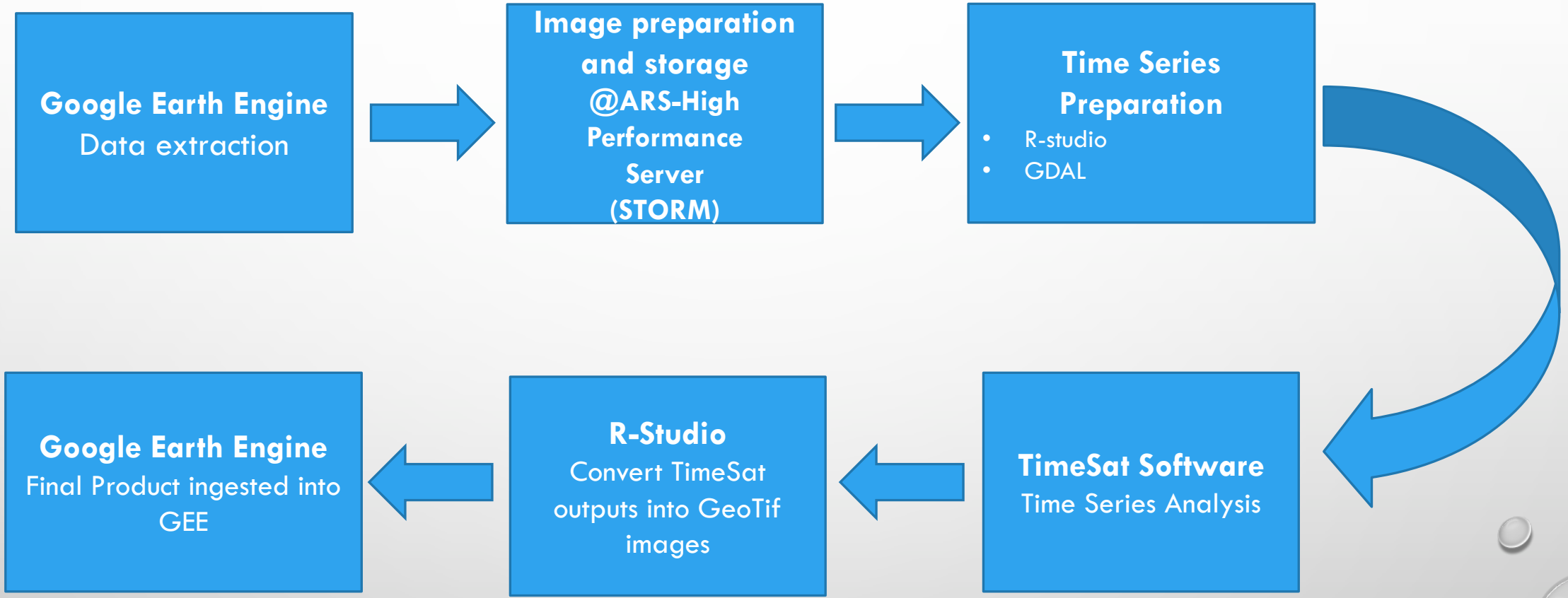
- **ENHANCED VEGETATION INDEX** (EVI) – GREENNESS VALUE FROM TERRA-MODIS (**MOD**ERATE-RESOLUTION **I**MAGING **S**PECTRORADIOMETER)

Greenness value

- $$EVI = G \frac{\rho_{NIR} - \rho_{red}}{\rho_{NIR} + C_1 \rho_{red} - C_2 \rho_{blue} + L}$$ ***Ratio of Red, Blue, Near-IR and coefficients***

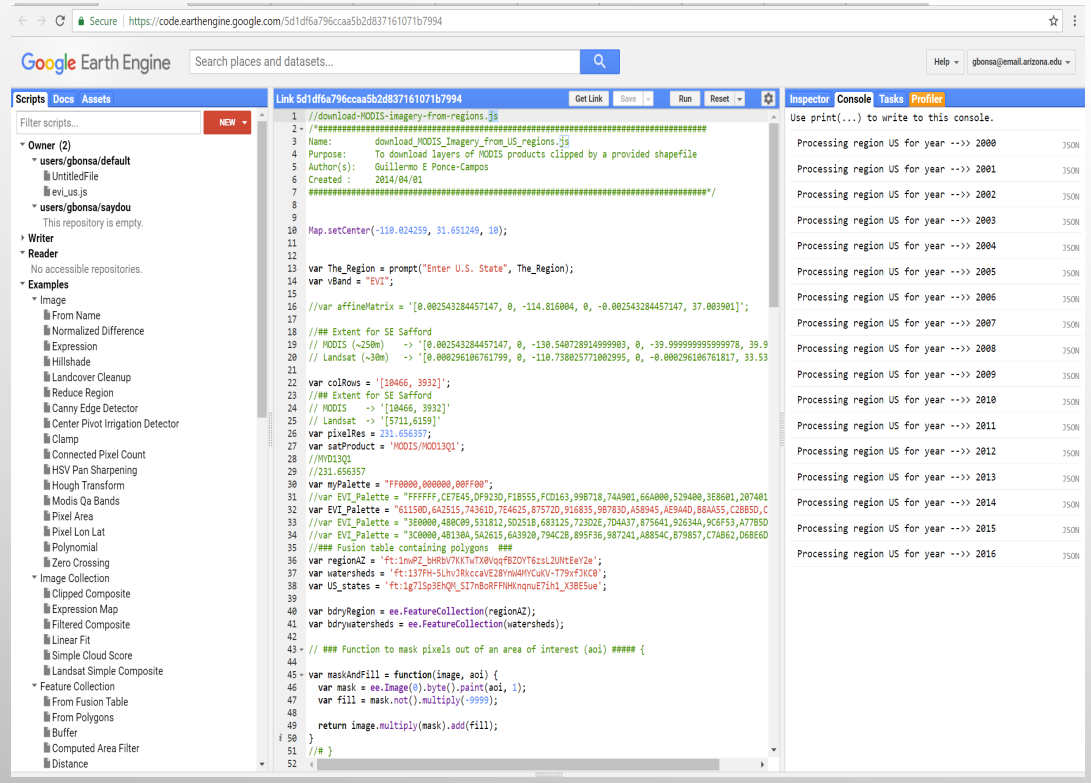
- TIMESAT – TIME SERIES ANALYSIS
- R-STUDIO

THE WORKFLOW



GOOGLE EARTH ENGINE (GEE) AND MODIS

- GOOGLE EARTH ENGINE (GEE)



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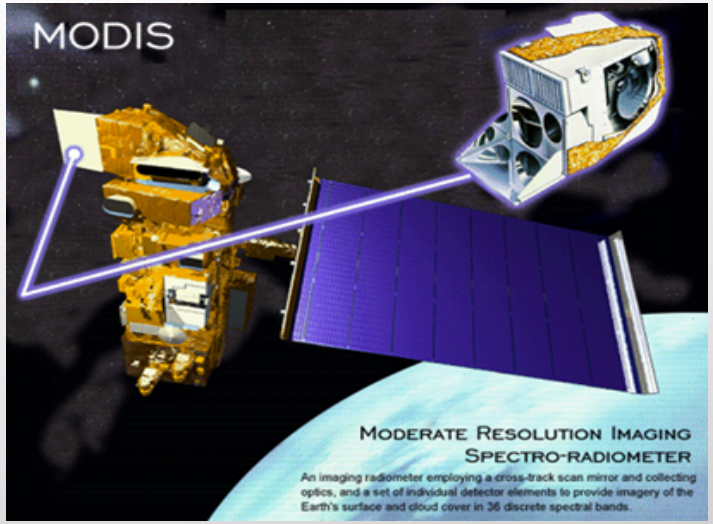
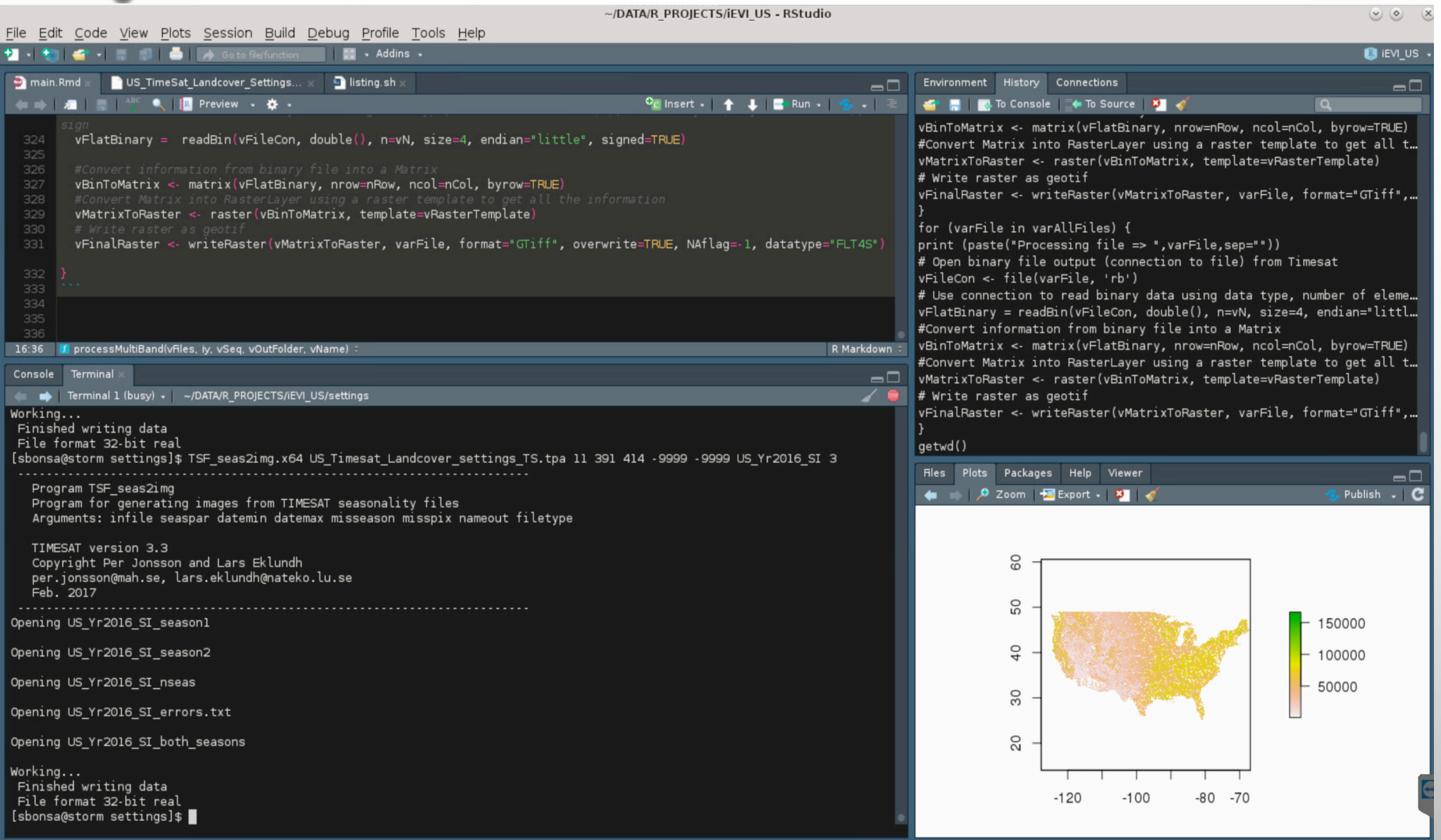


•MODIS (MODerate-resolution Imaging Spectroradiometer)

RSTUDIO
INTEGRATED DEVELOPMENT ENVIRONMENT

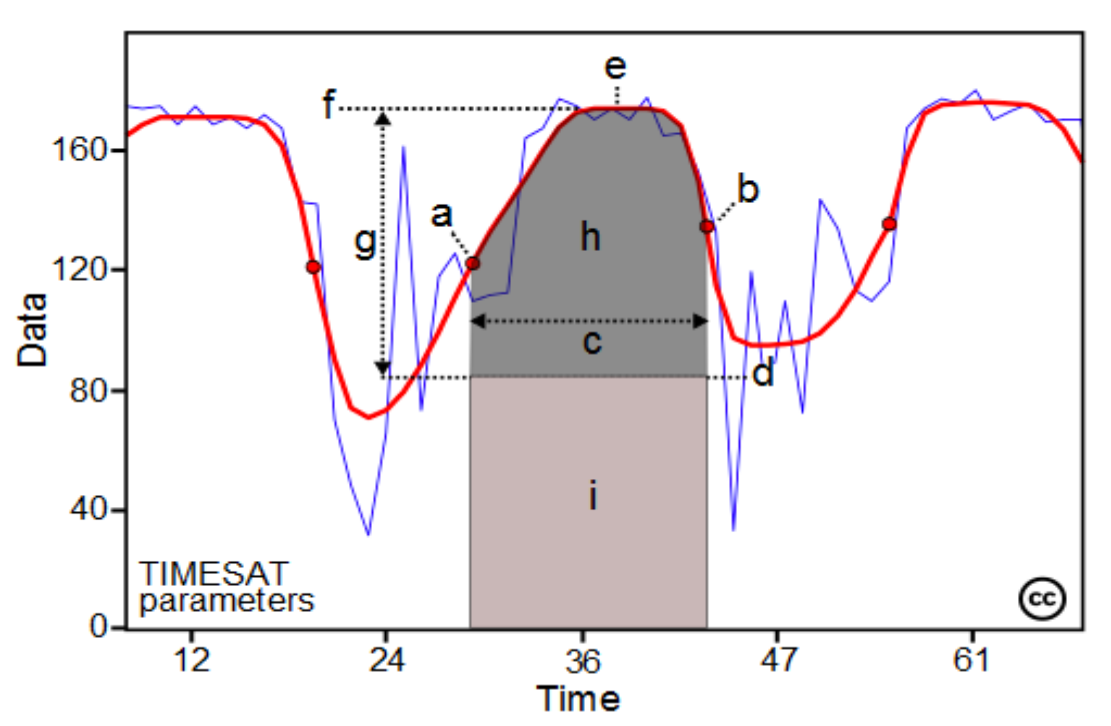


- Image processing
- Time series preparation
- Output images generation

TimeSat

One pixel over time, raw EVI data (blue), smoothed (brown).

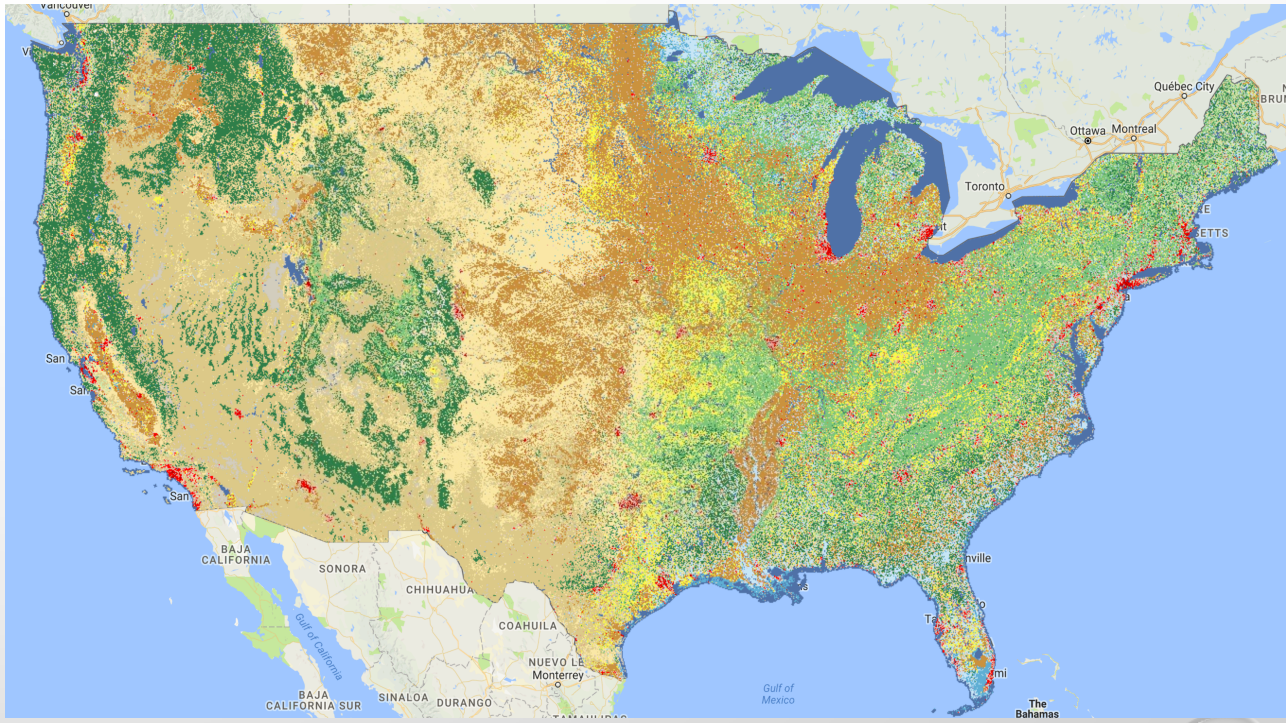
Output values from TimeSat for each pixel



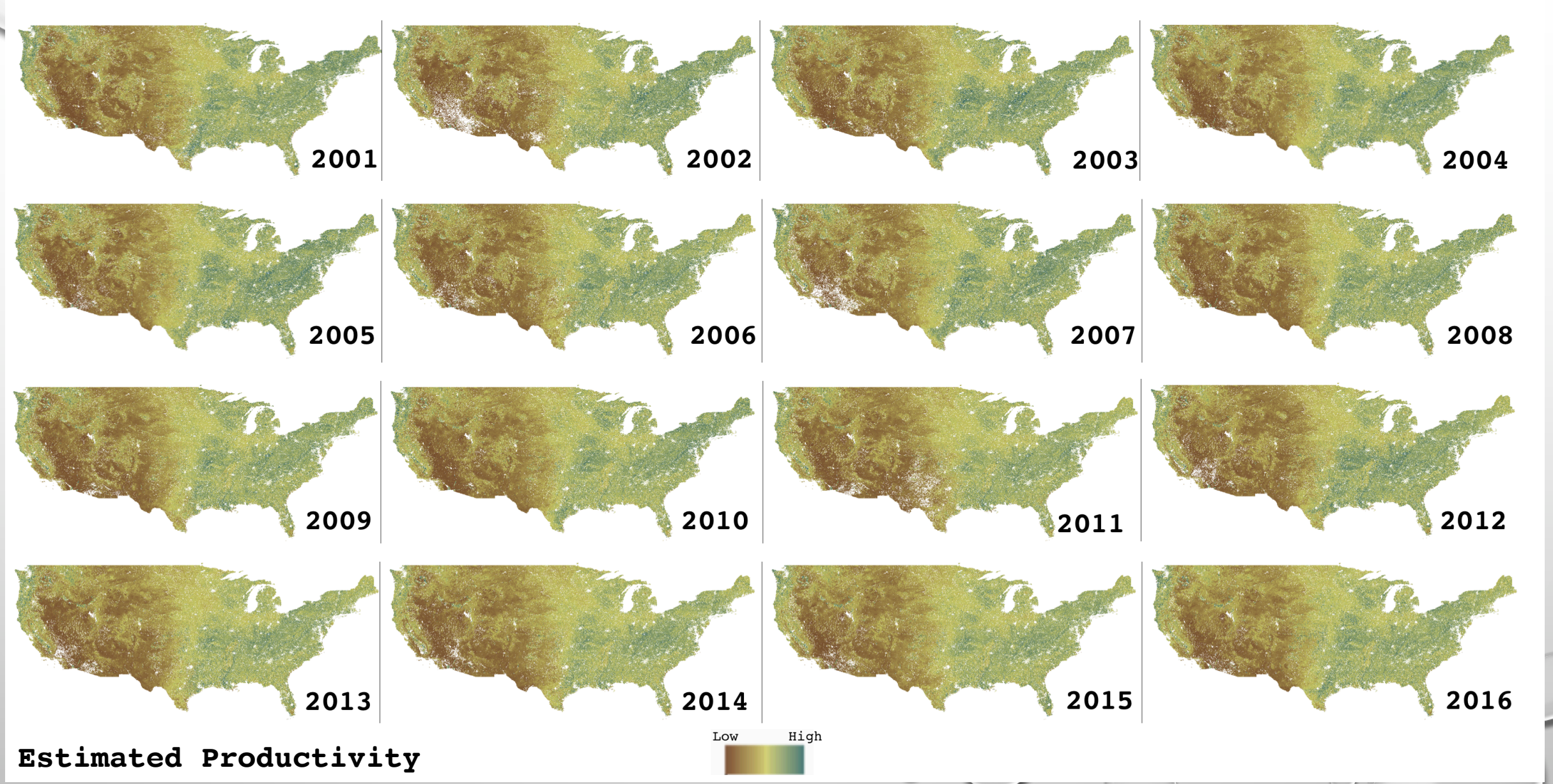
- *FIGURE 1. SOME OF THE SEASONALITY PARAMETERS GENERATED IN TIMESAT: (A) BEGINNING OF SEASON, (B) END OF SEASON, (C) LENGTH OF SEASON, (D) BASE VALUE, (E) TIME OF MIDDLE OF SEASON, (F) MAXIMUM VALUE, (G) AMPLITUDE, (H) SMALL INTEGRATED VALUE, (H+I) LARGE INTEGRATED VALUE. THIS FIGURE IS LICENSED UNDER A CREATIVE COMMONS ATTRIBUTION-NONCOMMERCIAL-NODERIVS 2.5 SWEDEN LICENSE. IT IS FREE TO COPY AND USE IN OTHER WORK*

National Landcover Dataset (USGS,2011)

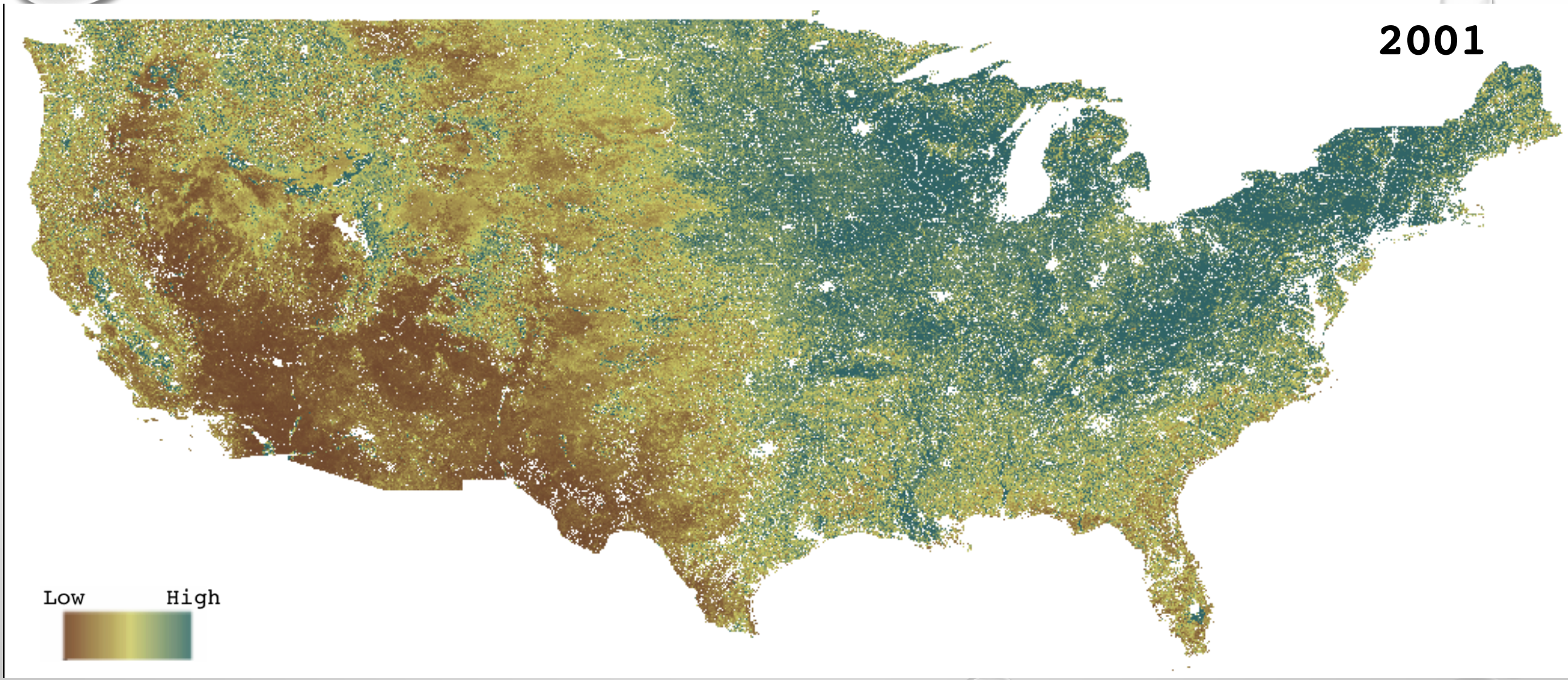
Landcover classes (E.g. Forest, Agriculture, Grasslands, etc.) are used to support TimeSat parameterization. Each class can have its own parameters for time series analysis.



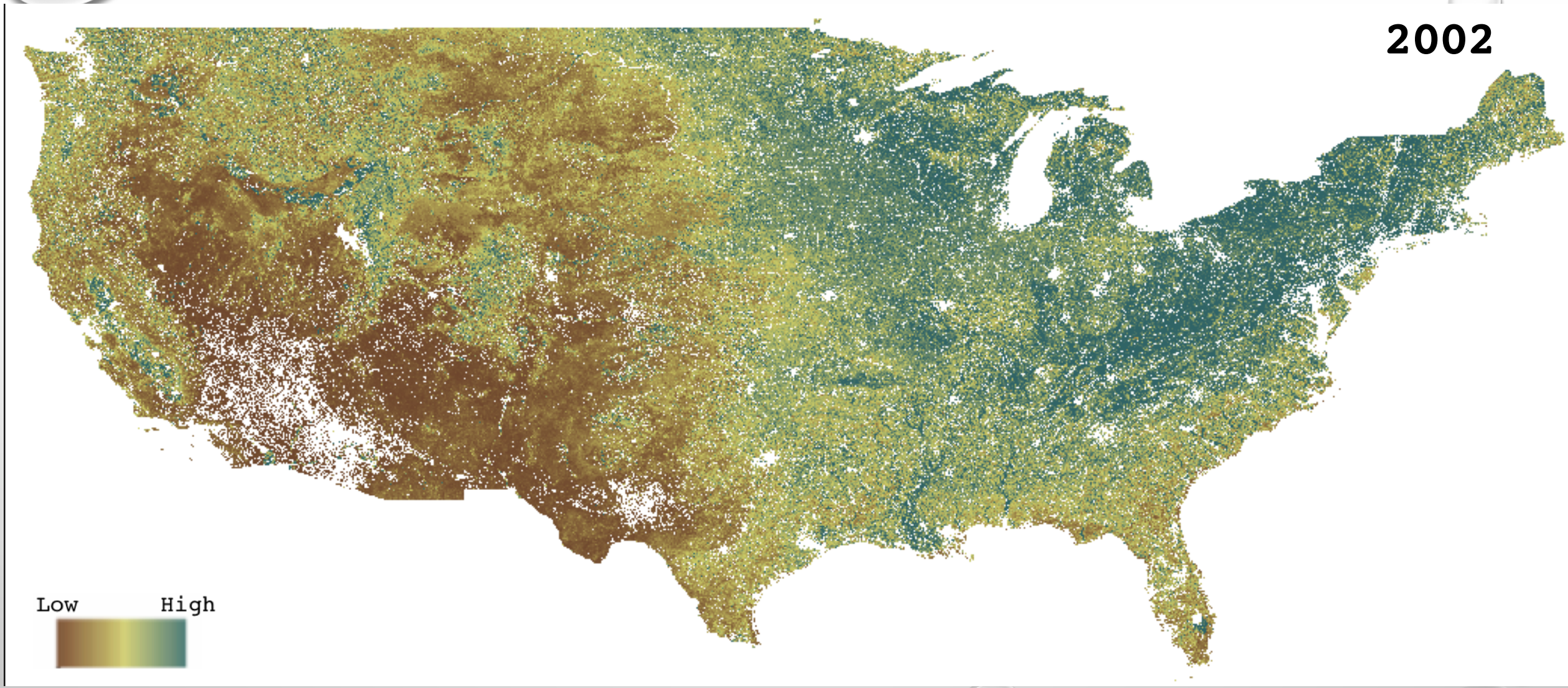
RESULTS: OBJECTIVE 1



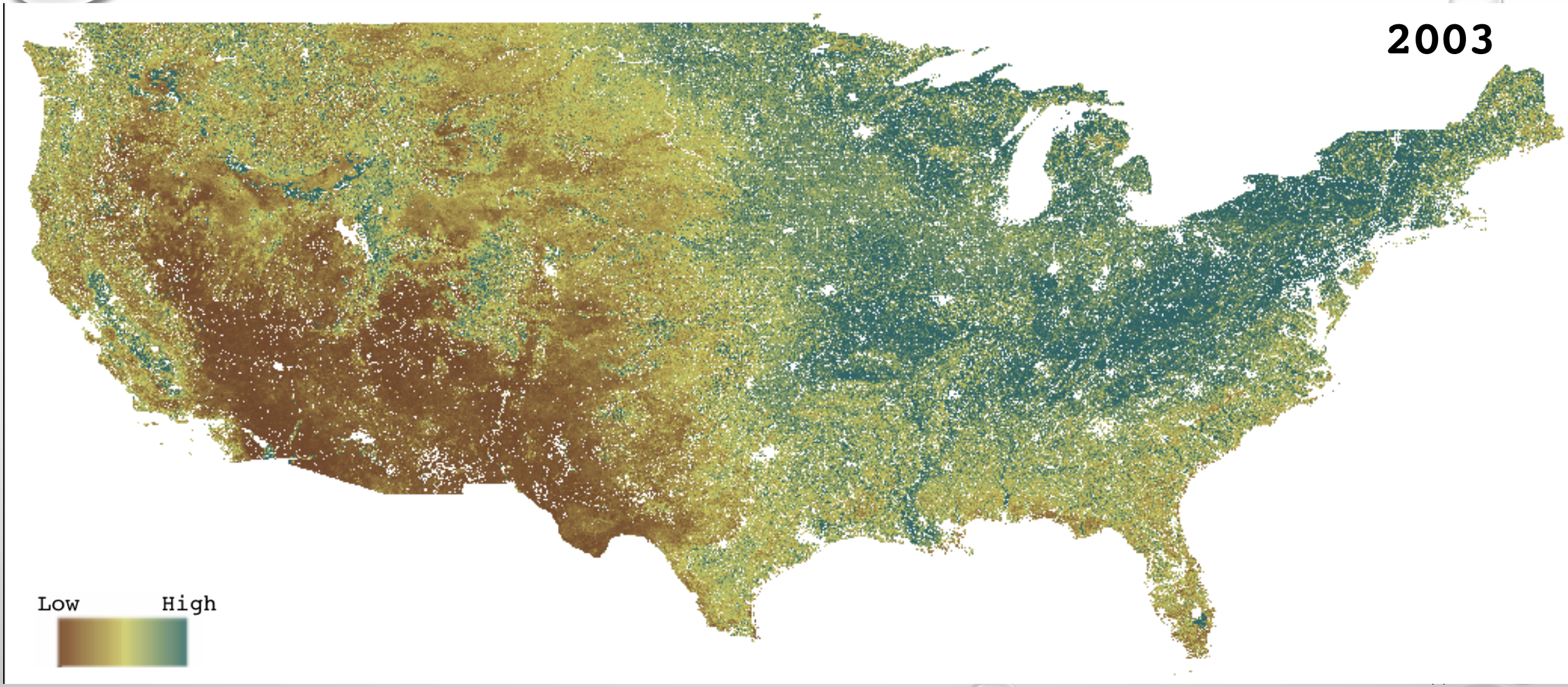
Estimated Productivity



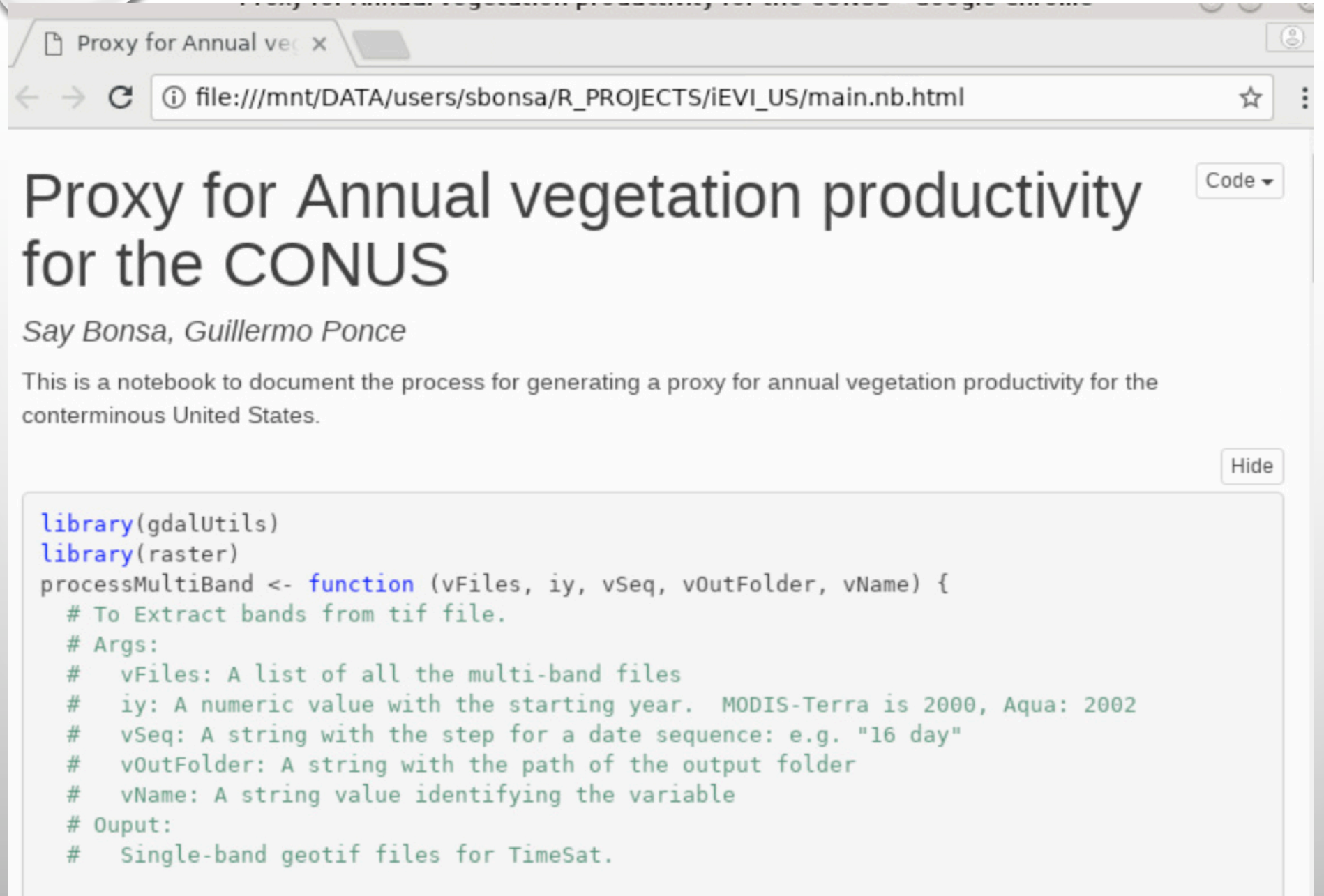
Estimated Productivity



Estimated Productivity



RESULTS: OBJECTIVE 2



Processes were documented as a **R-Notebook** for reproducibility

TAKE HOME MESSAGE

- DATASET WILL BE AVAILABLE IN GOOGLE EARTH ENGINE
- CAN BE USEFUL FOR SCIENTISTS INTERESTED IN VEGETATION AT REGIONAL SCALES
- WORKFLOW CAN BE ADAPTED FOR OTHER TIME SERIES DATASETS, (E.G. CLIMATE)
- VERY EASY TO UPDATE FOR FUTURE USE
- FUTURE WORK WILL BE PERFORMED FOR VALIDATION.

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USDA ARS

NASA