Whats new with MODIS NPP and GPP

MODIS/VIIRS Science Team Meeting

May 20, 2015

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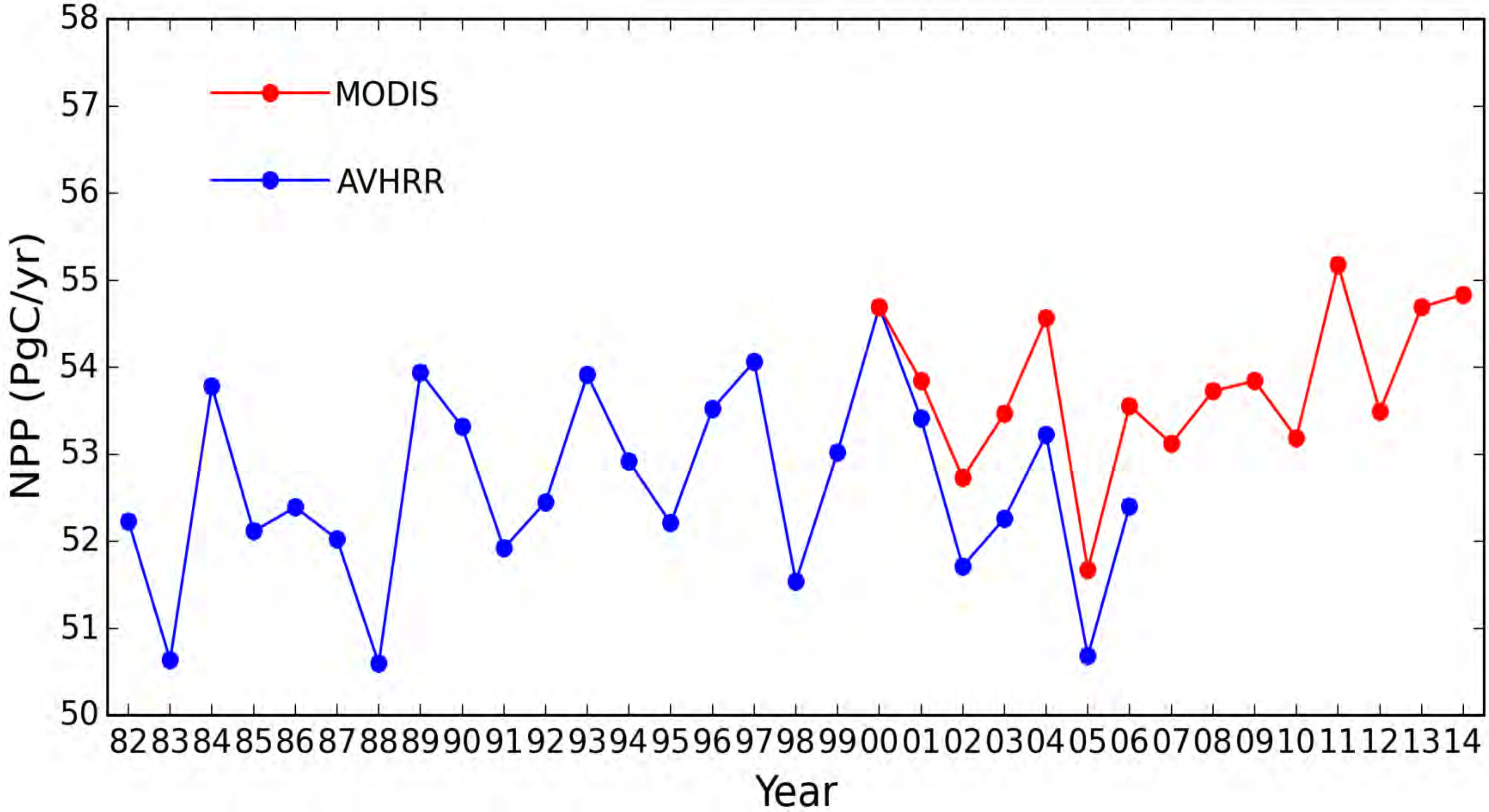
GLOBAL NPP TREND



SUSTAINABILITY

Ecosystem services lost to oil and gas in North America

Net primary production reduced in crop and rangelands

By **Brady W. Allred,[1*] W. Kolby Smith,[1,2] Dirac Twidwell,[3] Julia H. Haggerty,[4] Steven W. Running,[1] David E. Naugle,[1] Samuel D. Fuhlendorf[5]**

water use. Before this work, little has been done in examining these types of data and their relations with ecosystem services at broad scales.

of carbon per year, we convert to equivalent biomass-based measurements to provide context and discussion.

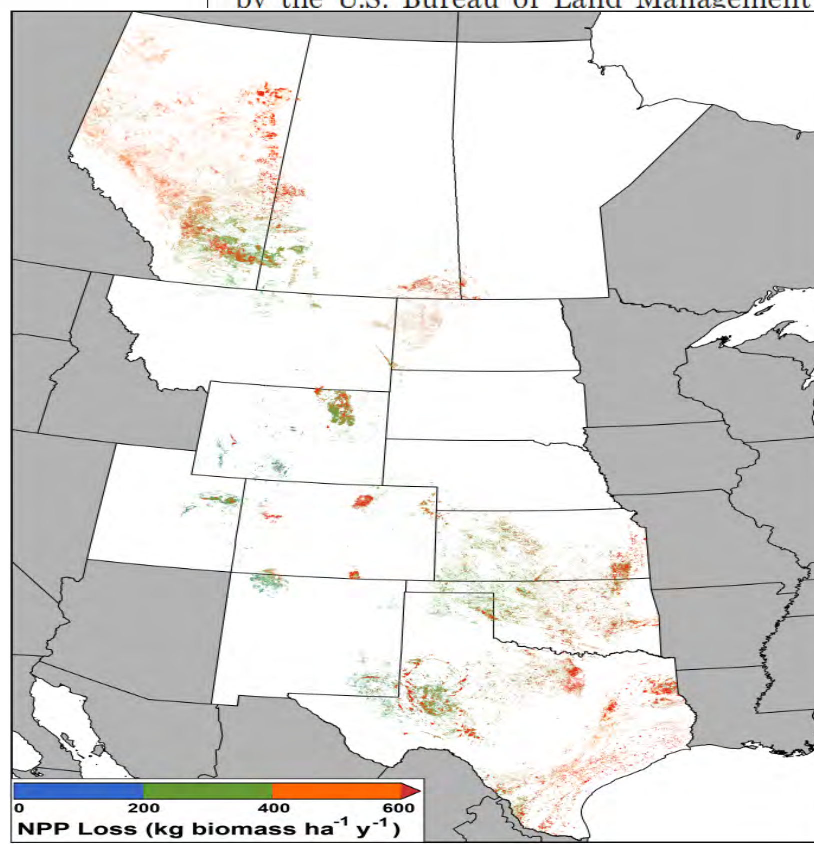
We estimate that vegetation removal by oil and gas development from 2000 to 2012 reduced NPP by ~4.5 Tg of carbon or 10 Tg of dry biomass across central North America (see the chart on page 402, left). The total amount lost in rangelands is the equivalent of approximately five million animal unit months (AUM; the amount of forage required for one animal for 1 month), which is more than half of annual available grazing on public lands managed by the U.S. Bureau of Land Management

<u>From 2000 – 2012</u>

50,000 new wells / year

3 million ha land lost

4.5 Tg C of NPP lost / yr



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LETTER

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Contribution of semi–arid ecosystems to interannual variability of the global carbon cycle

Benjamin Poulter[1,2], David Frank[3,4], Philippe Ciais[2], Ranga Myneni[5], Niels Andela[6], Jian Bi[5], Gregoire Broquet[2], Josep G. Canadell[7], Frederic Chevallier[2], Yi Y. Liu[8], Steven W. Running[9], Stephen Sitch[10] & Guido R. van der Werf[6]

For example, in Australia:

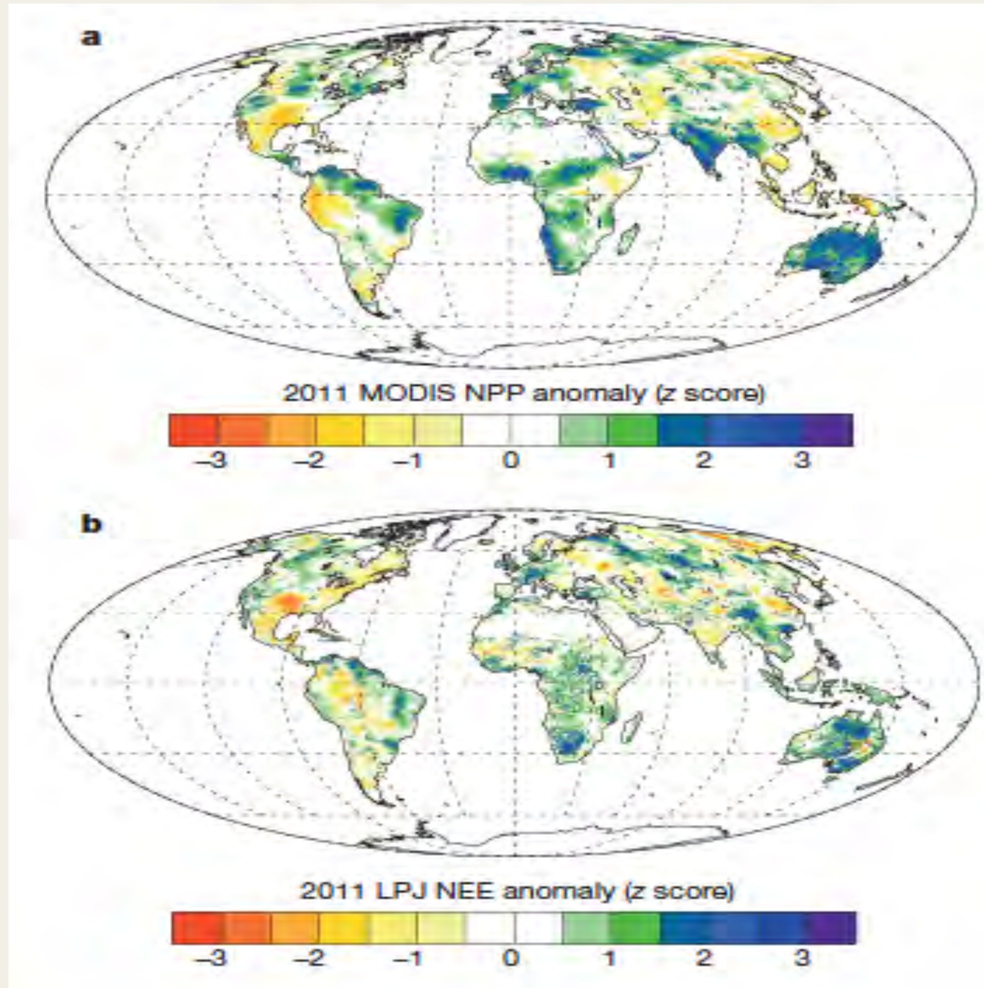
- 45% increase in NPP (LPJ and MODIS)
- 9% increase in Rh (LPJ)
- 29% decrease in fire emissions from GFED & GFAS observations

Net effect

- 0.84 Pg C sink in Australia
- Explained 60% of global anomaly
- Semi arid regions explained 51% of total land sink in 2011

Climate attribution

- Precipitation driven
- Regional lag effects
    - Enhanced soil moisture from 2010 precipitation in semi-arid regions
    - Decrease in tropical Rh after 2010



(Poulter et al 2014)

CellPress

Global satellite monitoring of climate-induced vegetation disturbances

Nate G. McDowell[1], Nicholas C. Coops[2], Pieter S.A. Beck[3], Jeffrey Q. Chambers[4], Chandana Gangodagamage[1], Jeffrey A. Hicke[5], Cho-ying Huang[6], Robert Kennedy[7], Dan J. Krofcheck[8], Marcy Litvak[8], Arjan J.H. Meddens[5], Jordan Muss[1], Robinson Negrón-Juarez[4], Changhui Peng[9], Amanda M. Schwantes[10], Jennifer J. Swenson[10], Louis J. Vernon[1], A. Park Williams[11], Chonggang Xu[1], Maosheng Zhao[12], Steve W. Running[13], and Craig D. Allen[14]

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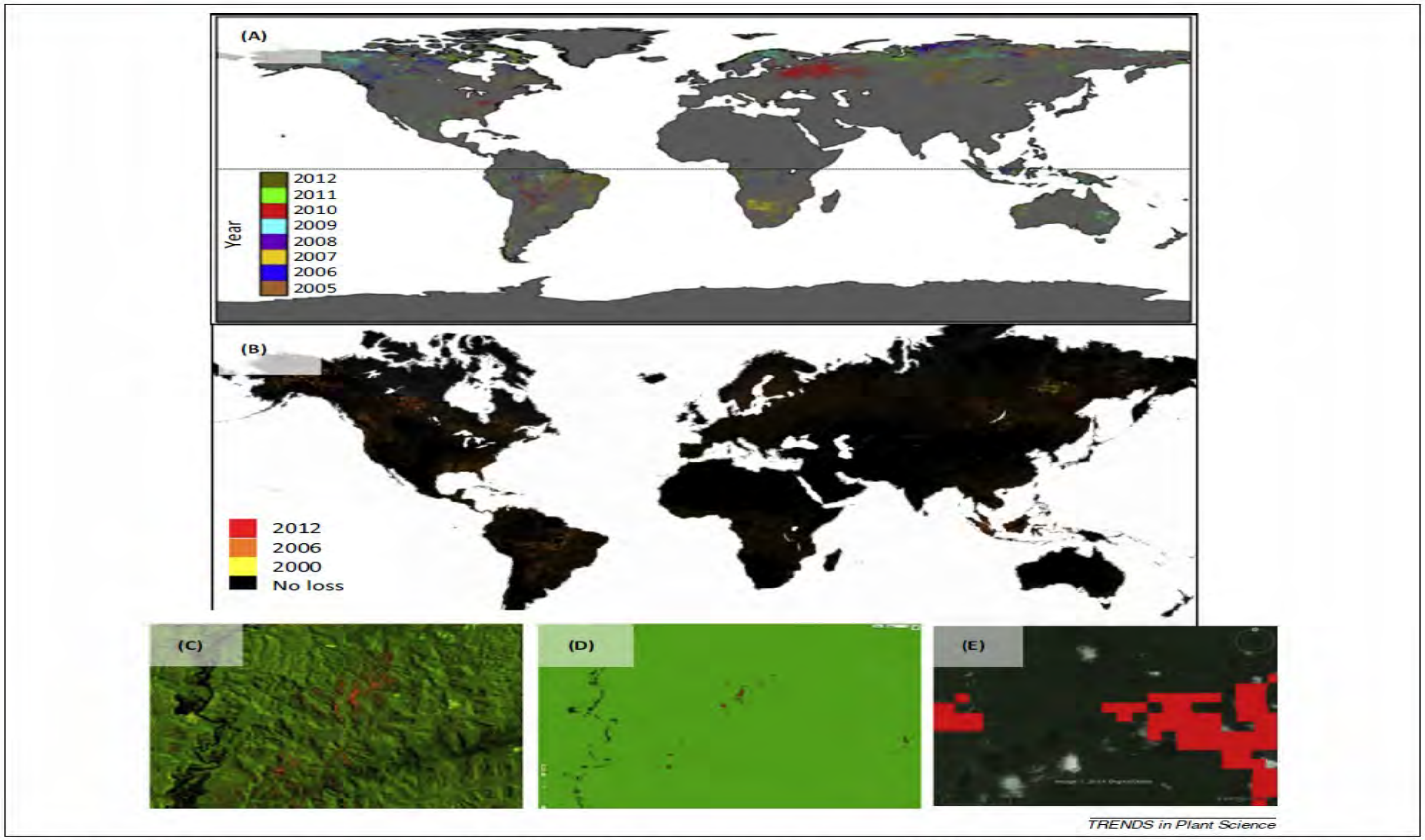

Figure 2. Examples of global monitoring capabilities. **(A)** The Moderate Resolution Imaging Spectrometer (MODIS) Global Disturbance Index (MGDI; 500 m), and **(B)** the Landsat-based global forest change detections (30 m). The approximate year of detection for each system is provided within each legend. Each of these maps represents major breakthroughs for the time period. In (B), Hansen *et al.* [29] provided the first user-friendly, interactive web-based tool that allowed examination of the global patterns of forest loss and gain since year 2000 via 30-m resolution Landsat analysis. **(C–E)** show a zoomed-in landscape near Manaus, Brazil. The ground-referenced data set (C) is a Landsat 5 TM scene (30-m spatial resolution) collected on July 29 2010, comprising RGB using bands 5, 4, and 3, and the disturbance is a severe storm that hit the Amazon basin on January 16–18 2005 [51]. Forest loss from [29] is shown in (D), and (E) is the MGDI. (C,D) both show results from 30-m resolution imagery (Landsat); however, (C) was improved using ground-truth data. Comparing (C) and (D) highlights that, while the new tool from [29] is a radical step forward, without ground evaluation it fails to pick up mortality at finer scales that may be a dominant component of global mortality. Nonetheless, the improvement of using 30-m resolution imagery is clear when comparing (C,D) to MGDI (E), which has a resolution of 500 m.

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Perspective

A regional look at HANPP: human consumption is increasing, NPP is not

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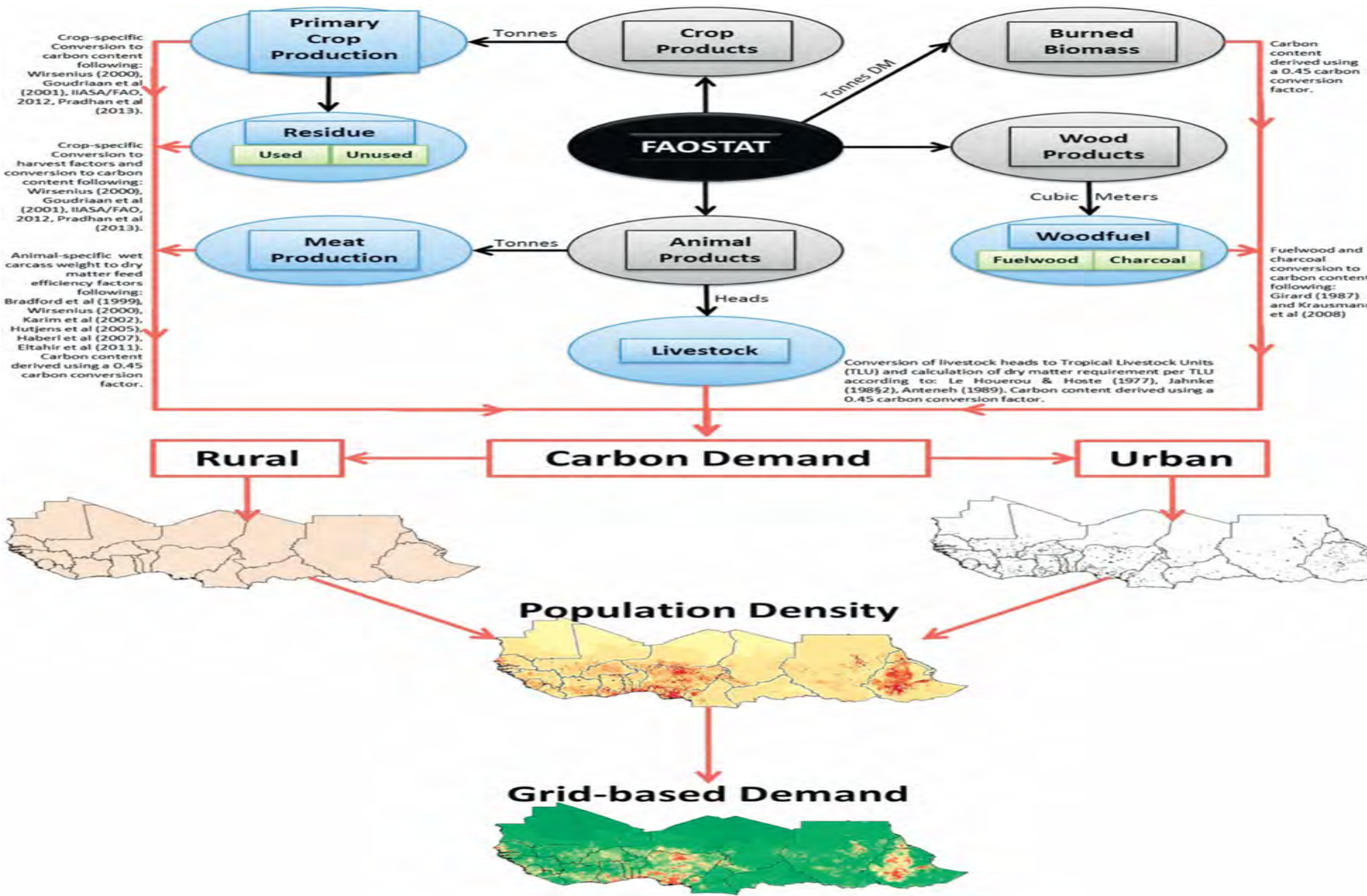
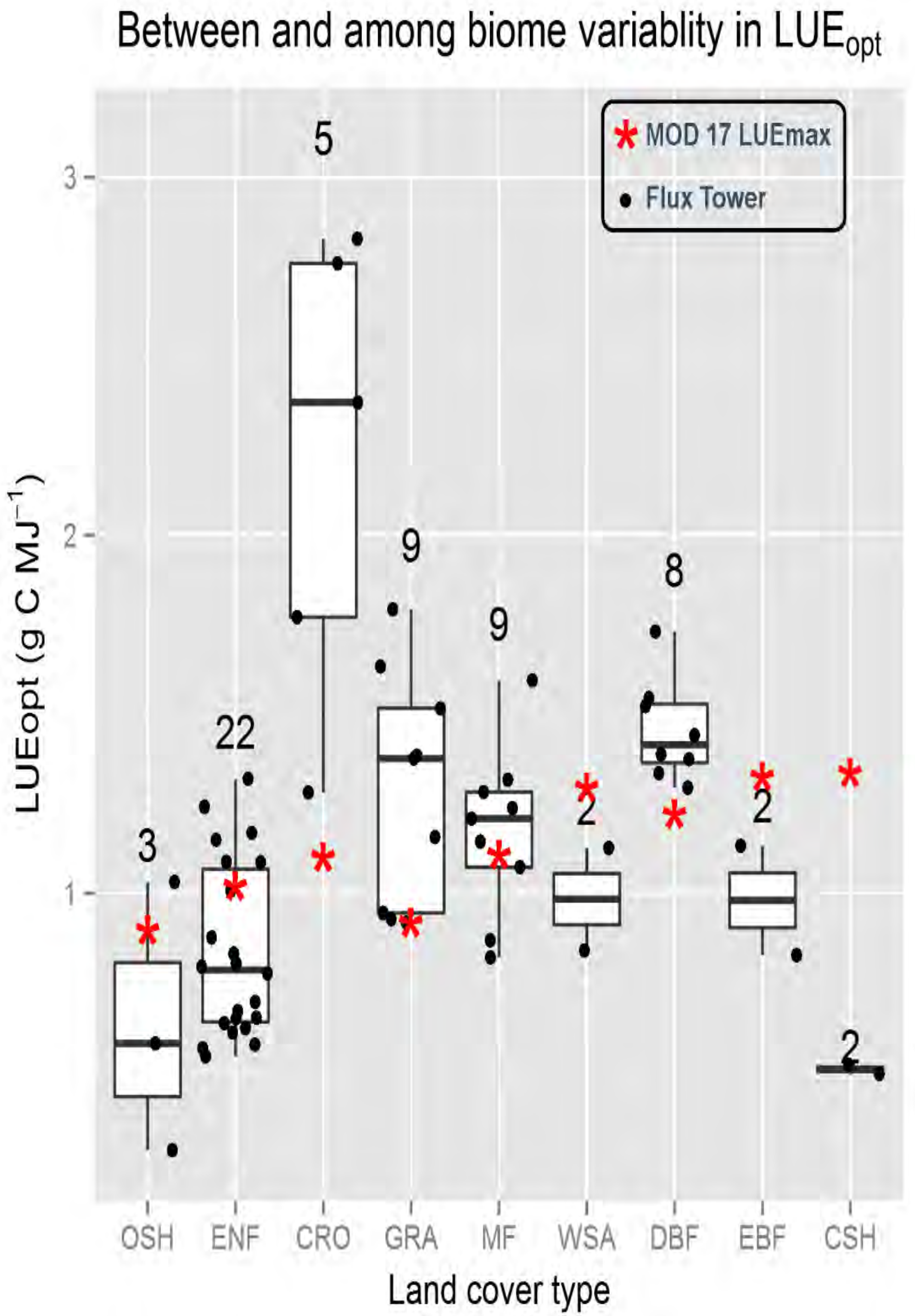
Abstract
Abdi *et al* (2014 *Environ. Res. Lett.* **9** 094003), have adapted the concept of comparing supply and demand of annual plant production known as human appropriation of net primary production (HANPP) to a region of the Sahel with rapid population growth. They found that HANPP more than doubled over the study period of 2000–2010, from 19% to 41%, suggesting increasing vulnerability of these populations to food insecurity.



Spatial variability in LUE_{opt}

- Croplands show largest LUE_{opt} variability.
- MOD17 LUE_{max} < LUE_{opt} for CRO, GRA, DBF
- MOD17 LUE_{max} > LUE_{opt} for CSH.
- Aggregating LUE_{opt} variability within coarse plant functional type (PFT) classes leads to large model LUE and GPP error.



Spatially explicit estimation of optimal light use efficiency for improved satellite data driven ecosystem productivity modeling. Nima Madani, John S. Kimball, Steve W. Running. AGU 2014


Traits
Topogra phy
Soil water
Crop areas
Percent cover
17 Tower Testing sites
Testing
Geo-statistical Generalized Additive Model
45 Tower Training sites
LUE_{opt}

AGU PUBLICATIONS

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Journal of Geophysical Research: Biogeosciences

RESEARCH ARTICLE

10.1002/2014JG002709

Key Points:

- Quantifying ecosystem optimal light use efficiency
- Optimum light use efficiency shows spatial variability within and among biome types
- Spatially explicit optimum light use efficiency dramatically improves remote sensing ecosystem productivity modeling

Improving ecosystem productivity modeling through spatially explicit estimation of optimal light use efficiency

Nima Madani[1,2], John S. Kimball[1,2], David L. R. Affleck[3], Jens Kattge[4], Jon Graham[5], Peter M. van Bodegom[6], Peter B. Reich[7,8], and Steven W. Running[2]

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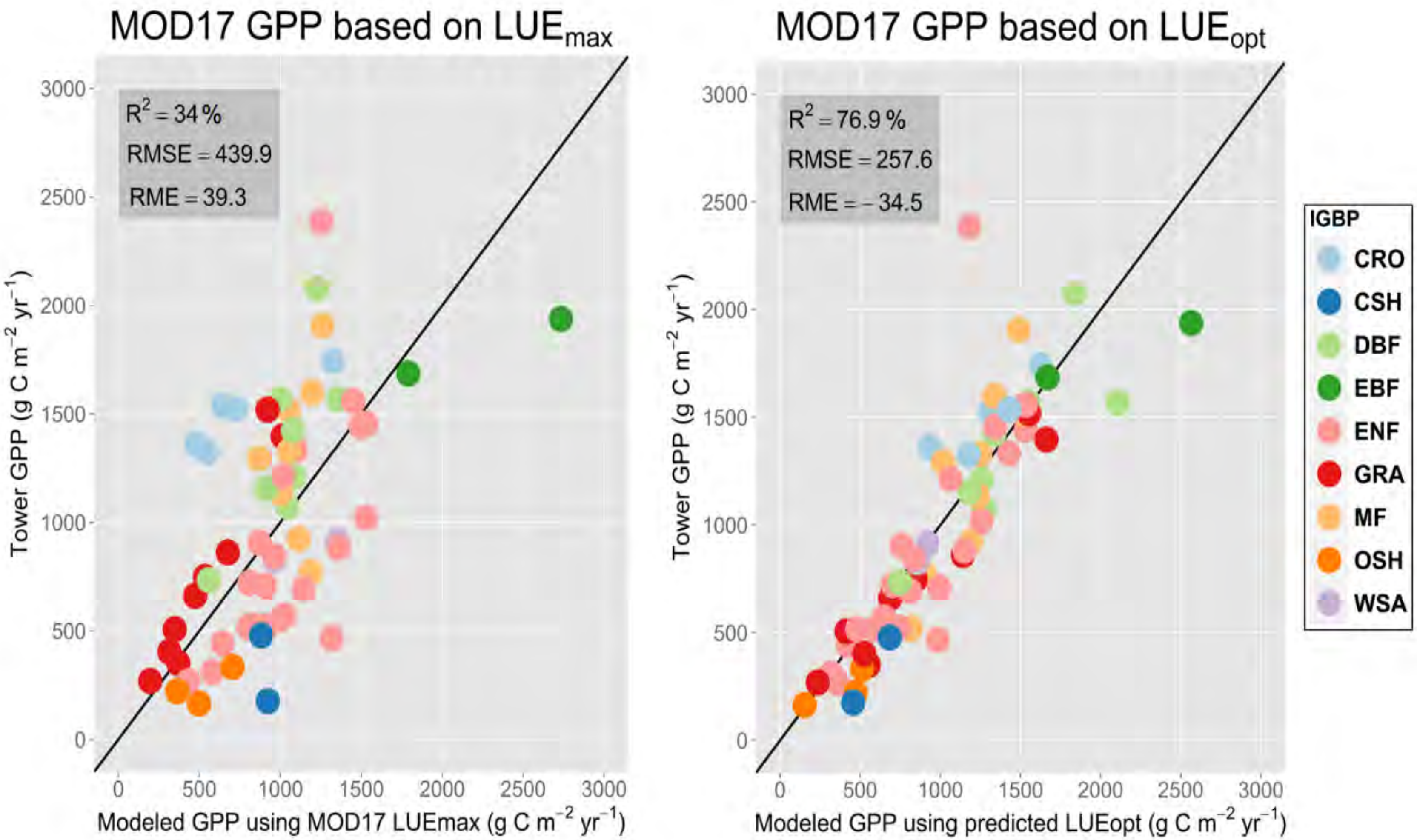
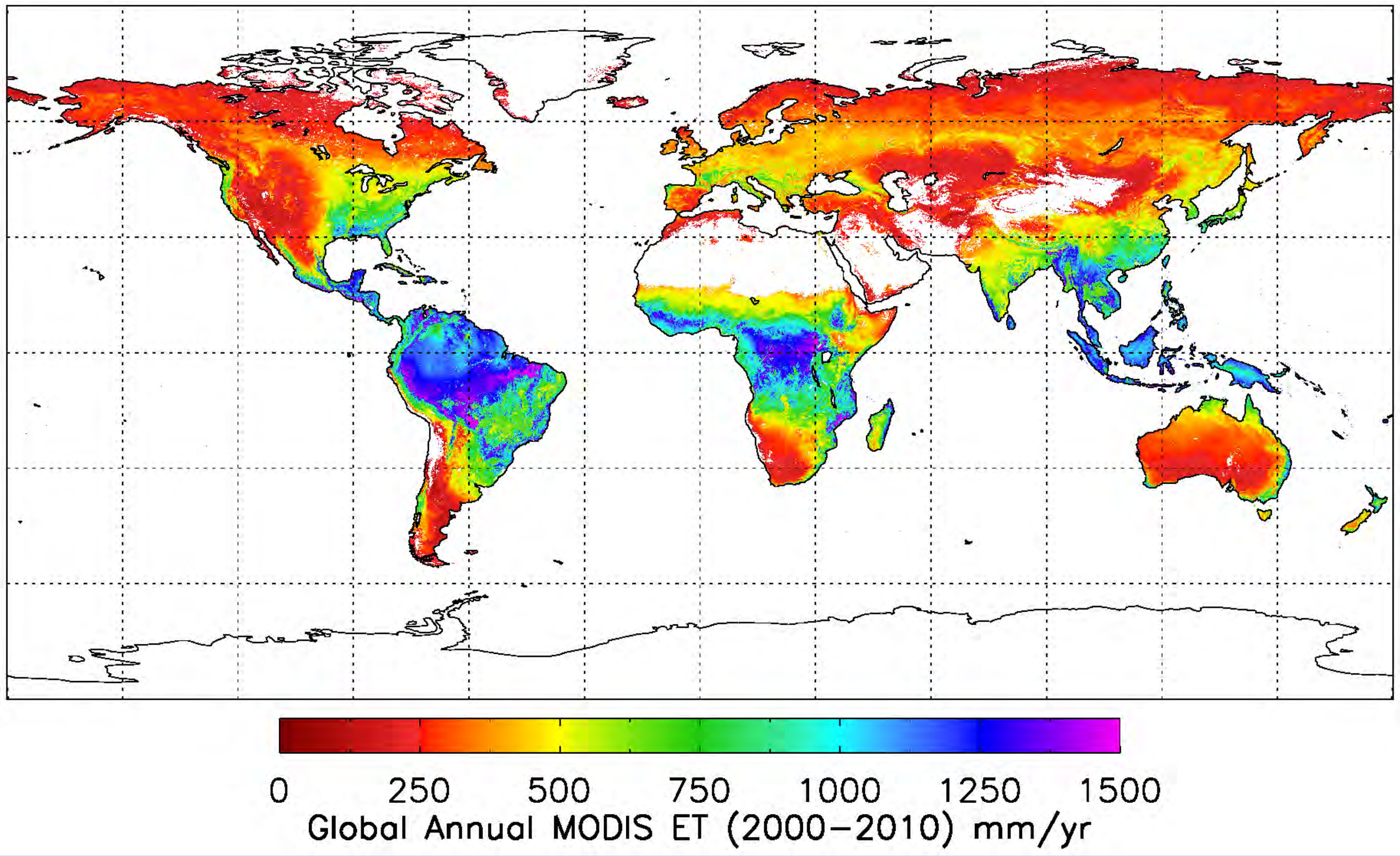
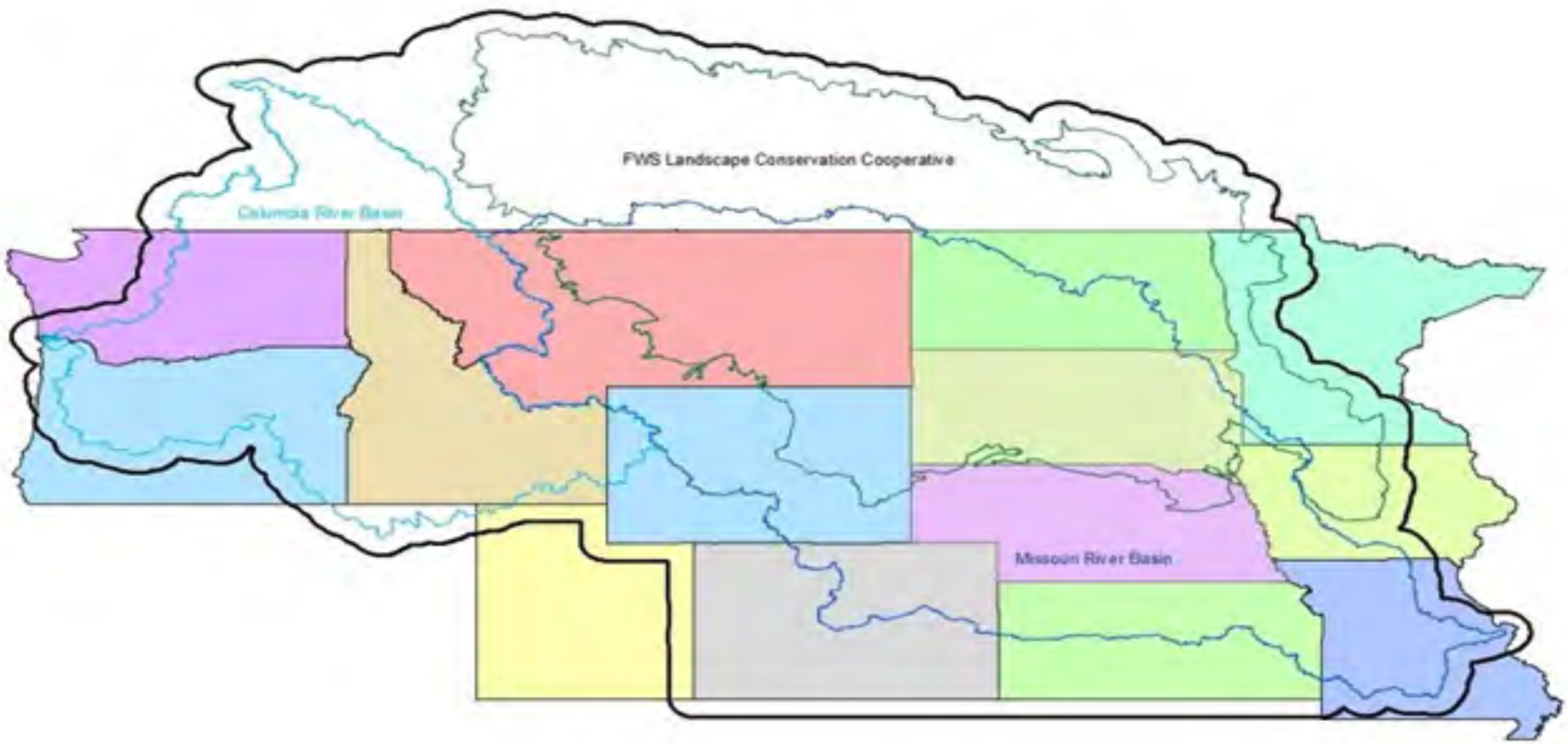


Global Annual 1-km ET over 2000-2010

Global average MODIS ET over vegetated land surface is 568.7 ± 358.2 mm yr^{-1}.



MOD 16/17 with 1km daily meteorology, with USGS



Net Primary Productivity Indicator

Net Primary Productivity Yearly Anomaly