



GPP/NPP Products for the AGRO site for the year 2000

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Introduction

The basic scaling protocol and its rationale are described in Reich et al. (1999).

Temporal Scaling of LAI

For each crop type (corn and soybean), a representative LAI trajectory was developed based on LAI trajectories observed at the flux tower in previous years (Meyers, 2001) and studies in the literature (Rochette et al., 1995, 1996; Turner et al., submitted). The trajectories were then shifted in time such that each intersected the mean measured LAI for its crop type on a specific date. For corn, that date was July 5th and for soybean it was August 16th. At each 25 m grid cell, the trajectory was then scaled in magnitude over the complete growing season by the ratio of grid cell LAI (from the BigFoot LAI product) to mean measured LAI from Gower et al. (2001a), again using the July reference date for corn and the August date for soybean.

The calculation of maintenance respiration in BGC requires an estimate of plant biomass and associated nitrogen content. Leaf biomass was based on the prescribed LAIs and the specific leaf areas for each crop type. The leaf carbon to nitrogen ratio was determined as part of the calibration procedure described below. Stem biomass was based on a time varying allometric relationship to leaf biomass. Parameterization of the time courses for the allometric relationships was from studies in the literature (Rochette et al., 1995, 1996). Root biomass was assumed equal to leaf biomass and root C to N ratio was assumed twice that of leaf C to N. Stem N concentrations were based on Bigfoot measurements of tissue nitrogen contents in 1999 (Gower et al., 2001b).

Model Parameterization and Calibration

The Biome-BGC model (Running and Hunt, 1993) was used for scaling GPP and NPP. This version of the model uses the nitrogen based maintenance respiration and photosynthesis parameterizations for C3/C4 species from version 4.1.1 (NTSG, 2001). Model parameters were derived from the literature and recommendations by the model developers (NTSG, 2001). The model was calibrated for the site using half of the BigFoot NPP measurements (Gower et al., 2001a) by adjusting the foliar carbon to nitrogen (N) ratio. For each crop type, model runs for these calibration sites were made using the spatially and temporally varying LAI described above. The calibration model runs were made over the range of foliar C to N ratios observed in 1999 (Gower et al., 2000) and the value which gave the lowest mean square error



was used in the final scaling procedure (15 for corn, 11 for soy).

Model Implementation

The model was run independently at each 25 m resolution grid cell using the same meteorological data file and the same assumed soil water holding capacity of 44 cm. Initial soil water content was assumed 20 cm. [BigFoot land cover](#) was used to prescribe crop type and the BigFoot spatially and temporally varying LAI data layers to prescribe LAI. Daily outputs for GPP were saved along with annual NPP. The resulting NPP surface is shown in Figure 1.

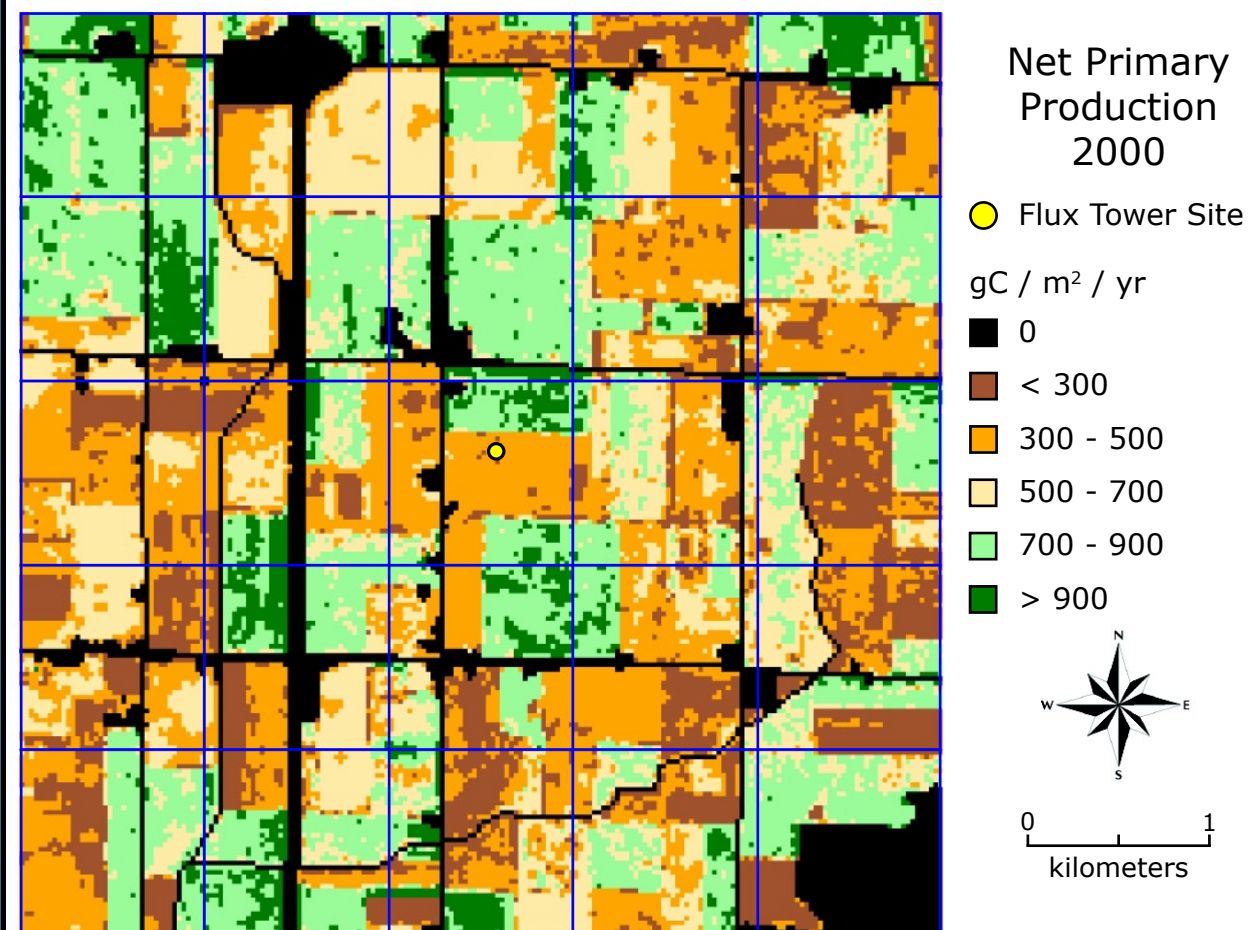


Figure 1. Net primary production for AGRO 2000. Blue lines show 1km grid in BigFoot 5km x 5km area.



Model Validation

Model simulated NPP was compared with observed NPP at the validation grid cells (Figure 2).

Aggregating GPP and NPP for Comparison with MODLand Products

Within a 25 m resolution grid cell, GPPs were averaged over eight day bins associated with the MODLand products. These eight-day averages, including the zero GPP cells in the noncrop cover classes, were then averaged over each 1 km grid cell (e.g. Figure 3). NPPs in all 25 m grid cells, again including the non-crop cover classes, were averaged spatially to get a 1 km resolution NPP data layer (Figure 4).

Literature Cited

Gower, S.T., et al. 2001a. Year 2000 LAI measurements at the AGRO site.

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Rochette, P., Desjardins, R.L., Pattey, E., Lessard, R. 1995. Crop net carbon dioxide exchange rate and radiation use efficiency in soybean. *Agronomy Journal* 87:22-28.

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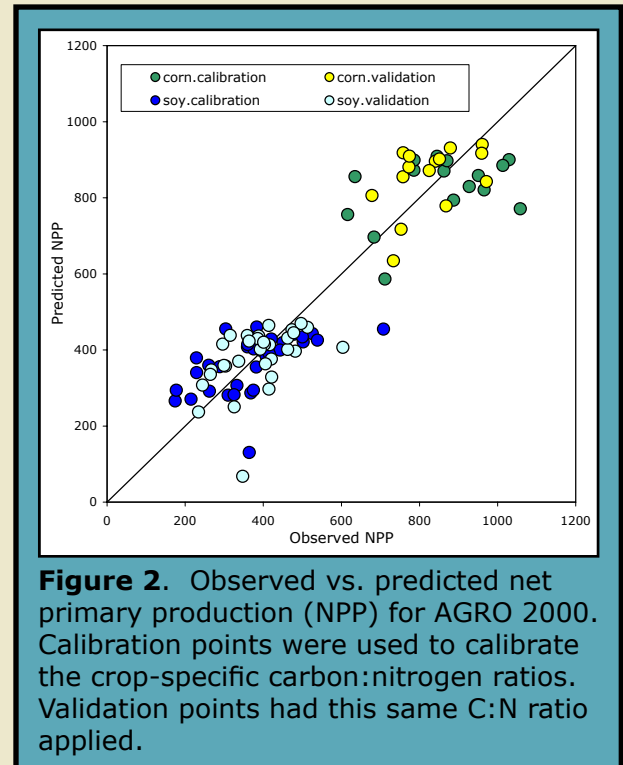


Figure 2. Observed vs. predicted net primary production (NPP) for AGRO 2000. Calibration points were used to calibrate the crop-specific carbon:nitrogen ratios. Validation points had this same C:N ratio applied.

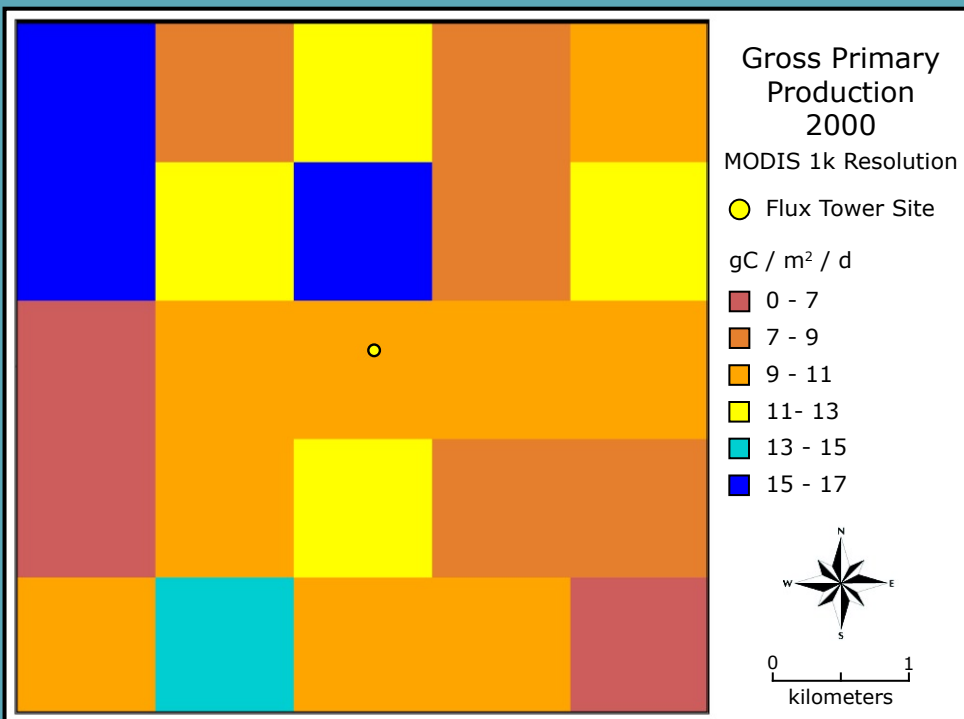


Figure 3. Average gross primary production (GPP) for an eight day period in mid-summer (June 28 - July 5)

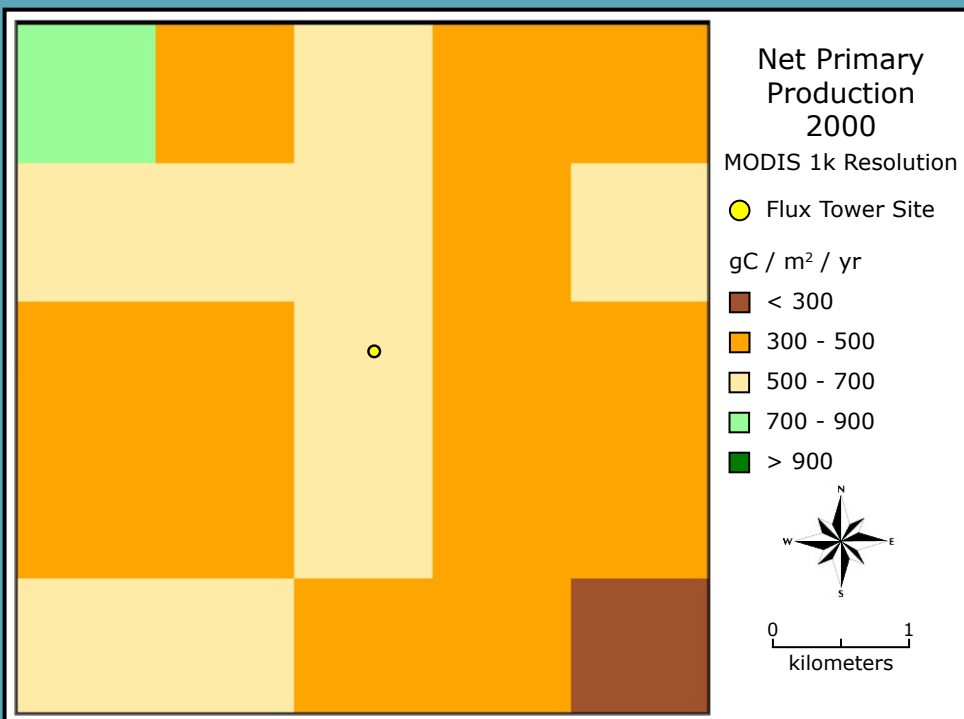


Figure 4. Average yearly net primary production (NPP) for AGRO 2000