Quantifying distribution in carbon uptake across a global measurement network of terrestrial ecosystems

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Annually, terrestrial ecosystems globally remove from the atmosphere a net of approximately 3 Gigatons of carbon. This net removal is generally the effect of two opposing processes: gross primary productivity (photosynthesis) or ecosystem respiration from plants and soils. These two processes are functions of sunlight, temperature, and moisture. However these environmental variables differentially affect these two processes depending on the time of year and the type of ecosystem. This presentation expands upon previous work where we apply a variation on the Gini Coefficient to quantify the distribution in carbon uptake and the associated environmental measurements. The data used come from a global dataset of 164 ecosystems, collectively totaling upwards of 425000 half-hourly measurements of carbon uptake across a total of 1172 site years. Across the entire dataset we found that contrasting results for comparing the sensitivity of gross primary productivity and ecosystem respiration to temperature and sunlight, showcasing the effect of temperature on regulating these environmental processes. These results provide an alternative way to characterize and group ecosystems together beyond other commonly used metrics such as ecosystem composition or mean annual temperature.

Keywords: Gross primary productivity, ecosystem respiration, Gini coefficient