Geophysical Research Abstracts
Vol. 19, EGU2017-9391-1, 2017
EGU General Assembly 2017


# Agroecosystem productivity in a warmer and $CO_2$ enriched atmosphere

Carl Bernacchi (1,2), Iris Köhler (2), Donald Ort (1,2), Steven Long (2), and Thomas Clemente (3)

(1) Agricultural Research Service, United States Department of Agriculture, Urbana, IL USA, (2) Department of Plant Biology, University of Illinois, Urbana, IL USA, (3) University of Nebraska - Lincoln

A number of in-field manipulative experiments have been conducted that address the response of key ecosystem services of major agronomic species to rising $CO_2$. Global warming, however, is inextricably linked to rising greenhouse gases in general, of which $CO_2$ is the most dominant. Therefore, agroecosystem functioning in future conditions requires an understanding of plant responses to both rising $CO_2$ and increased temperatures. Few in-field manipulative experiments have been conducted that supplement both heating and $CO_2$ above background concentrations. Here, the results of six years of experimentation using a coupled Free Air $CO_2$ Enrichment (FACE) technology with variable output infrared heating arrays are reported. The manipulative experiment increased temperatures (+ 3.5°C) and $CO_2$ (+ 200 $\mu$mol mol$^{-1}$) above background levels for on two major agronomic crop species grown throughout the world, *Zea mays* (maize) and *Glycine max* (soybean). The first phase of this research addresses the response of plant physiological parameters to growth in elevated $CO_2$ and warmer temperatures for maize and soybean grown in an open-air manipulative experiment. The results show that any increase in ecosystem productivity associated with rising $CO_2$ is either similar or is offset by growth at higher temperatures, inconsistent with the perceived benefits of higher $CO_2$ plus warmer temperatures on agroecosystem productivity. The second phase of this research addresses the opportunity to genetically modify soybean to allow for improved productivity under high $CO_2$ and warmer temperatures by increasing a key photosynthetic carbon reduction cycle enzyme, SPBase. The results from this research demonstrates that manipulation of the photosynthetic pathway can lead to higher productivity in high $CO_2$ and temperature relative to the wild-type control soybean. Overall, this research advances the understanding of the physiological responses of two major crops, and the impact on ecosystem services, to atmospheric conditions with the ultimate goals of better understanding agronomic responses to global change and improved representation of these processes in ecosystem models.