

# How Does Climate Change Impact Aquatic Net Community Production? - A Novel Mesocosm

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Understanding the biological processes of natural ecosystems is integral to predict their responses to anthropogenic climate change and increasingly extreme climate events. Specifically, being able to quantify net primary production (NPP) as it is a fundamental ecological parameter dictating community food web structure and carbon sequestration. Traditional *ex situ* and discrete laboratory experiments cannot fully account for the complex biological processes that occur in aquatic ecosystems. These experiments often use Winkler incubation methods for bottled water samples. Current *in situ* chamber options are limited in their physical scope. Some experiments have measured primary productivity in flora using benthic enclosures. Other experiments have quantified spatially discrete geochemical changes in the water columns by using either the Eulerian or Lagrangian fluid motion models. This paper proposes a non-invasive two-chambered mesocosm, coupled with an equilibrator and weather station, to accurately calculate levels of net primary production (NPP), gross primary productivity (GPP) and total respiration (R) in aquatic communities. This two-chambered mesocosm is specifically equipped with water quality sensors and designed so that one bottle is clear, allowing for photosynthetic activity, while the other is dark, not allowing light to penetrate and therefore no photosynthetic activity. Equilibrator data from the aquatic community sample allows for the calculation of pCO<sub>2</sub>, aiding our calculations of NPP, GPP, and R. The entire system was fully deployed for three days. The data trends measured are consistent with expected natural cycles and show that our novel mesocosm is a reliable non-invasive method to measure NPP, GPP, and R in aquatic ecosystems. This tool also may provide a standardized approach to quantify marine community productivity and it can be deployed for longer periods of time to understand the trends between NPP and anthropogenic climate change. This study is part of a larger effort to explore how climate change is impacting net community production.