# CALIFORNIA STATE SCIENCE FAIR
# 2013 PROJECT SUMMARY

**Name(s)**

**Maya A. Josyula**

**Project Number**

**S0803**

**Project Title**

## Earth's Carbon Sinks: Exploring the Effects of Melting Arctic Ocean Ice

**Abstract**

**Objectives/Goals**

This project studies how the Arctic Ocean is responding to increasing atmospheric carbon dioxide (CO(2)) and global warming. Sea surface temperature (SST) and chlorophyll a measure CO(2) absorption by air-sea exchange of CO(2) and carbon fixation by phytoplankton respectively. My hypothesis was that both will be higher when more sea ice has melted, as in the year 2012.

**Methods/Materials**

I tested this hypothesis by comparing MODIS/AQUA remote sensing data of the Beaufort Sea for May-October of 2012 with data from a previous year with minimum summer ice, 2007.

**Results**

The sea surface temperature and chlorophyll concentration of the Beaufort Sea were generally higher in 2012, which confirmed my hypothesis. Water in the Beaufort Sea was warmer in 2012 than in 2007 for all the months that I considered. In July and August of 2012, SST was 30-50% higher compared to the same months in 2007. Chlorophyll a concentration was higher during the seasonal blooms of July and September in 2012. In August, the dip in chlorophyll a was lower for 2012 than in 2007.

**Conclusions/Discussion**

Discussion: I think that the August dip is because nutrients in the surface waters were depleted by the earlier seasonal bloom. Higher water temperatures in 2012 caused greater stratification which prevented nutrients from being brought up from colder, nutrient-rich deep water. There was probably more mixing in August 2007 because the water was colder, and the chlorophyll a value was therefore higher.

Conclusion: I conclude that rapid melting of ice due to global warming results in more CO(2) fixation by phytoplankton. However, rising sea temperatures will offset this increase by reduced air-sea exchange of carbon due to decreased solubility. Higher temperatures further produce more stratification of the surface waters and can deplete nutrients during phytoplankton blooms, decreasing their productivity. The ocean may not be able to regulate the increased CO(2) amounts being introduced into the atmosphere. We need to actively find other ways to reduce our carbon footprint.

**Summary Statement**

I studied remote sensing data of sea surface temperature and chlorophyll a concentration in the Beaufort Sea, and found that they were both higher during 2012 when Arctic ice was at a record low.

**Help Received**

Prof. K. Arrigo (Stanford University) suggested that I look at chlorophyll a to measure carbon production, and that I limit myself to a region of the Arctic; Zach Brown (Stanford University) sent me a SeaDAS tutorial; Prof. G. van Dijken (Stanford University) provided ice data.