


Satellites & Students

HIGH SCHOOL STANDOUTS EARN THACHER SCHOLARS AWARDS

 Rachael Born of Norfolk, Va., and Scott Elder of Chino Hills, Calif., were 2007 recipients of the Thacher Scholars Awards, a secondary-school competition that challenges students to design and conduct exemplary projects involving satellite observations of the Earth. The competition is held annually by the Institute for Global Environmental Strategies (IGES) in an effort to engage the next generation of scientists in the use of geospatial technology to study the environment.

"With so many environmental challenges facing our world, it is important that young scholars are engaged in science and technology projects to better understand the planet," said Theresa Schwerin, IGES associate director for education. "Rachael and Scott best exemplified the spirit of this competition and demonstrated thoughtful uses of remote sensing. We hope they will pursue careers in science and technology."

The Thacher Scholars Award was founded in honor of the late Peter S. Thacher, a former IGES board member. Thacher was an internationally recognized leader in promoting the use of satellite remote sensing. He served as deputy director of the United Nations Environment Program, as an advisor to NASA and, until the time of his death in 1999, as president of the Earth Council Foundation-U.S.

A major goal of the award is to introduce students to the numerous uses of satellite observations in Earth science research, ranging from climate prediction to archaeology. Entries were judged based on scientific and technical accuracy; creativity and originality; quality of presentation; thoroughness of research, methods and procedures; and quality of conclusions.

RACHAEL BORN

Born, who will be a 12th-grader this fall at Norfolk Technical Center, earned the first-place award of \$2,000 with her project titled, "The Chesapeake Bay — A National Treasure in Decline." Born correlated the amount of rainfall within the Chesapeake Bay watershed with the health of the bay and its ecosystem. She used river discharge data, satellite images showing chlorophyll concentrations, and measurements of dissolved oxygen in her research.

The Chesapeake Bay is the nation's largest estuary. Its watershed spans six states and the District of Columbia. Pollutants enter the bay through the approximately 150 rivers and streams that feed into it. Increased nutrient runoff can trigger large blooms of phytoplankton (microscopic algae) that may have harmful effects on marine ecosystems.

At first, the algae can block sunlight from penetrating into the water. Without



RACHAEL BORN



SCOTT ELDER

sunlight, underwater plants are unable to perform photosynthesis and eventually die. Later, when the algae die, their decomposi-

DAN STILLMAN

Science Communications Manager
Institute for Global Environmental
Strategies
Arlington, Va.
[http://www.strategies.org/
ThacherScholars](http://www.strategies.org/ThacherScholars)

tion depletes the water of dissolved oxygen. Fish and other aquatic animals depend on oxygen and on the habitats provided by submerged vegetation for survival.

An assessment released in April by the Chesapeake Bay Program found that most of the bay's waters were "degraded," its habitats at risk, and its fish and shellfish populations below historic levels, despite more than 20 years of restoration efforts.

"The first thing that you notice after moving from a Midwestern state to Norfolk, at least in elementary school, is that there is water everywhere," said Born, who was a third-grader when she moved to Virginia from Indiana. "Unlike everyone else, who just seemed to take it for granted, I learned as much as I could about the beach and water."

To test her hypothesis that increased rainfall, which typically results in more nutrients carried into the bay, is related to poor water health, Born examined images of chlorophyll concentrations and dissolved oxygen levels for years in which river discharge into the bay was unusually low or high. Estimates of chlorophyll concentrations are derived

from observations of ocean color by NASA's Sea-viewing Wide Field-of-view Sensor (SeaWiFS). The greener the water, the more phytoplankton and, thus, chlorophyll there is. See *Figure 1*.

Born's findings largely supported her hypothesis, and her success in the competition has inspired her to consider science as a possible career.

"While I have always loved science, winning this award has reaffirmed my interests in science research," said Born, who plans to attend a summer workshop in atmospheric, Earth and space sciences at the University of Wisconsin. "While I am still very undecided about what I want to do with my life, this award has motivated me to look at what science programs colleges offer."

SCOTT ELDER

Elder, who will enter the 12th grade this fall at Chino Hills High School, garnered the second-place prize of \$1,000 with "Tracking Storms in the Ionosphere."

Solar activity triggers storms in the ionosphere, which can delay Global Positioning System signals. Elder showed

that GPS altitude measurement errors (caused by the signal delay) can be used to track these storms. Predicting solar storms is critical because of their potential to disrupt power grids and satellite communications, and to injure astronauts traveling through space.

A GPS receiver pinpoints the location of the solar storm, including altitude, using radio frequency signals transmitted by the GPS constellation of satellites. Elder conducted his study by collecting one month of daily altitude measurements with a GPS receiver, and graphing the altitude errors against Kp, an index that measures geomagnetic activity. Elder then used images from NASA's Solar and Heliospheric Observatory satellite to identify the solar activity responsible for spikes in the Kp data.

The graphs of altitude error and Kp index were a close match, indicating a correlation between the two.

Elder first became interested in the connection between GPS signals and the ionosphere during the seventh grade, when he submitted a project on the topic to the 2003 California State Science Fair. Later, he received a 2004 President's Environmental Youth Award for a project in which he set up a laboratory in his room to monitor pollution in a local creek. Elder was congratulated by President Bush at a White House ceremony honoring the presidential award winners.

As Elder prepares to start his senior year in high school this fall, he's already thinking ahead to a possible college major in environmental biology. "Winning the Thacher Award showed me that I can combine my love of satellites with the environment," said Elder, who is working this summer with the city of Chino Hills water department on a project to map sources of stream pollution using GPS technology.

Elder's father, Mike, says that "being recognized (through the Thacher Award)... has inspired Scott to continue to advance his use of satellite technology for studying and protecting our environment." ❄

FIGURE 1 //

SeaWiFS Chlorophyll Concentration

