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UCSB Scientists Track Environmental Influences on Giant Kelp with Help from Satellite Data

Scientists at UC Santa Barbara have developed new methods for studying how environmental factors and climate affect giant kelp forest ecosystems at unprecedented spatial and temporal scales.

The scientists merged data collected underwater by UCSB divers with satellite images of giant kelp canopies taken by the Landsat 5 Thematic Mapper. The findings are published in the feature article of the May 16 issue of Marine Ecology Progress Series.

In this marriage of marine ecology and satellite mapping, the team of UCSB scientists tracked the dynamics of giant kelp –– the world's largest alga –– throughout the entire Santa Barbara Channel at approximately six-week intervals over a period of 25 years, from 1984 through 2009.

David Siegel, co-author, professor of geography and co-director of UCSB's Earth Research Institute, noted that having 25 years of imagery from the same satellite is unprecedented. "I've been heavily involved in the satellite game, and a satellite mission that goes on for more than 10 years is rare. One that continues for more than 25 years is a miracle," said Siegel. Landsat 5 was originally planned to be in use for only three years.

Forests of giant kelp are located in temperate coastal regions throughout the world. They are among the most productive ecosystems on Earth, and giant kelp itself provides food and habitat for numerous ecologically and economically important near-shore marine species. Giant kelp also provides an important source of food for many terrestrial and deep-sea species, as kelp that is ripped from the seafloor commonly washes up on beaches or is transported offshore into deeper water.

Giant kelp is particularly sensitive to changes in climate that alter wave and nutrient conditions. The scientists found that the dynamics of giant kelp growing in exposed areas of the Santa Barbara Channel were largely controlled by the occurrence of large wave events. Meanwhile, kelp growing in protected areas was most limited by periods of low nutrient levels.

Entire forests can be wiped out in days, but then recover in a matter of months."

Satellite data were augmented by information collected by the Santa Barbara Coastal Long Term Ecological Research Project (SBC LTER), which is based at UCSB and is part of the National Science Foundation's Long Term Ecological Research (LTER) Network. In 1980, the NSF established the LTER Program to support research on long-term ecological phenomena. SBC LTER became the 24th site in the LTER network in April of 2000. The SBC LTER contributed 10 years of data from giant kelp research dives to the current study.

The scientists said that interdisciplinary collaboration between geographers and marine scientists is common at UCSB and is a strength of its marine science program.

Daniel C. Reed, co-author and research biologist with UCSB's Marine Science Institute, is the principal investigator of SBC LTER. Reed has spent many hours as a research diver. He explained: "Kelp occurs in discrete patches. The patches are connected genetically and ecologically. Species that live in them can move from one patch to another. Having the satellite capability allows us to look at the dynamics of how these different patches are growing and expanding, and to get a better sense as to how they are connected. We can't get at that through diver plots alone. The diver plots, however, help us calibrate the satellite data, so it's really important to have both sources of information."

The fourth author of the paper is Philip E. Dennison. He received his Ph.D. in geography at UCSB and is now an associate professor in the Department of

Geography at the University of Utah.

The research team received funding from NASA and the National Science Foundation.

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