

**NASA Sensors used to Analyze Patterns of Change along the California Coast**  
**NASA Ames Research Center**  
**Earthzine/DEVELOP Virtual Poster Session, Summer 2011**  
**Video Transcript**

“NASA Ames DEVELOP National Program partnering with the National Park Service and our science advisor, Robert Steers from the Golden Gate National Recreation Area, present ‘The Changing California Coast: The Effect of a Variable Water Budget on Coastal Vegetation Succession’. Special thanks to our team and science advisers for making this possible. National Applications include...climate...ecological forecasting...and water resources.”

“The objectives of the project are to:

1. Determine if vegetation succession rates are changing in the study area.
2. Identify climate and ecosystem variables which contribute to succession among grassland, shrubland and forest.
3. Identify changes in climatic trends along the California coast between 1975-2010 and determine the effect of these changes on vegetation succession.

“Our study area was the undeveloped California coast between Sonoma and Big Sur. The area is characterized by a dry, Mediterranean-like climate with wet winters and dry summers lasting 3-7 months. The vegetation can be broadly classified into three categories: grasslands, shrublands, and forests. Common vegetation includes the coastal redwood, Douglas Fir, and coyote brush.”

“The water budget for the area is defined both by precipitation and rate of evaporation, influenced by winter rain, summer fog drip, cloud cover, fog cover, humidity, slope, and aspect. However, many coniferous species are poor regulators of their water, so they are dependent on an extensive water budget to prevent evapotranspiration.”

“Succession occurs when certain types of vegetation encroach upon others. This may be due to either anthropogenic or non-anthropogenic activities. Anthropogenic activities include grazing, burning, development, and emission-causing activities such as transportation. Non-anthropogenic activities include fire and a dynamic climate. Regardless of the cause, successional rates have accelerated over the past century and changes in the water budget have been thought to induce the encroachment of grasslands into shrublands, and shrublands into forest.”

(Methodology) “First, to identify areas of succession, we used a Normalized Difference Vegetation Index (or NDMI) to choose field points. We used those field points and C-CAP data to train a Landsat supervised classification. Let’s break it down. The NDMI measures differences in vegetation moisture. Here you can see that it picks up greatly on agriculture, but also recognized large areas of non-ag change. The green symbolizes an increase in vegetation cover, while the red symbolizes a decrease.”

“We generated random points to ground-truth, half of which were areas of succession, while the other half were non-succession areas. We documented the percent vegetation as being grassland, shrubland, forest, or other. For areas that were inaccessible, we took a waypoint on the GPS and noted it for analysis.”

(Methodology) “We then used our field points along with C-CAP data to train a Landsat supervised classification. C-CAP, a collaborative effort between NOAA and partners, is a data set of vegetation classes for the United States. We classified Landsat images for years 2006, 2010, and 2011. We then compared these to the water budget of the area.”

(Results) “The classification change detection was a more accurate way to detect vegetation succession than the NDMI.”

“Succession increased with a lower maximum temperature and higher minimum temperature. Increased fog cover and precipitation tended to encourage forest encroachment. However, all succession may have also been influenced by grazing, fire, fire suppression, and development, which may confound results.”

“The north showed higher rates of forest encroachment as compared to the south, correlating to a wetter climate, and supporting our hypothesis.”

“Succession rates show a positive correlation with an increased water budget. However, other variables can have a strong impact on these rates. To better understand this relationship, further research is being conducted.”