feature articles

# NASA Ames DEVELOP Interns: Helping the Western United States Manage Natural Resources One Project at a Time

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*Every summer for the past seven years, students ranging from high school to graduate level gather at NASA Ames Research Center (ARC) as part of the DEVELOP Internship Program.*

**Introduction**

The western half of the United States is made up of a number of diverse ecosystems ranging from arid desert to coastal wetlands and rugged forests. Every summer for the past seven years, students ranging from high school to graduate level gather at NASA Ames Research Center (ARC) as part of the DEVELOP Internship Program[1]. Under the guidance of **Jay Skiles** [ARC—*Ames DEVELOP Manager*] and **Cindy Schmidt** [ARC/San Jose State University—*Ames DEVELOP Coordinator*], they work as a team on projects exploring topics such as: invasive species, carbon flux, wetland restoration, air quality monitoring, storm visualizations, and forest fires. The study areas for these projects have been in Washington, Utah, Oregon, Nevada, Hawaii, Alaska, and California. Interns combine data from NASA and partner satellites with models and *in situ* measurements to complete prototype projects demonstrating how NASA data and resources can help communities tackle their Earth Science-related problems.

**Invasives Threaten Western Ecosystems**

Invasive plants and animals can become a serious threat to ecosystems by consuming resources that native species need to survive, including water, nutrients, and space. During the summer of 2003, a team of interns worked with the Pyramid Lake Paiute Indian Tribe located in Nevada to map the spread of *Lepidium latifolium*—also known as "tall white top" or "perennial pepperweed." They also created a model to predict the future spread under two scenarios: intensive weed management practices and unmanaged practices. The tribe used these results to inform future management decisions.

Surrounded by "tall white top" in Nevada, **Douglas Gibbons** [Utah State University] collects data during the summer of 2003.

Another way invasive species can be detrimental to surrounding plant communities is to render the environment inhospitable to native plants. *Tamarix ramosisima*, common name "tamarisk" or "salt cedar," has invaded *riparian*—stream or river bank—ecosystems in much of the Southwest. By secreting salt from its leaves, tamarisk can redistribute salt from the soil profile to the soil surface, inhibiting germination and growth of other plant species. In 2008, DEVELOP interns conducted a project in Utah, where there is an ongoing study relating to the use of a beetle, *Diorhabda elongata*, as a biocontrol for tamarisk. Interns used Landsat data to analyze the feasibility of using remote sensing to monitor the spread of the beetles. Tamarisk defoliation and decreased plant health are the primary indicators of beetle presence and can be detected with remote sensing imagery. Interns also used the vertical salt profile and other *in situ* data to produce habitat suitability maps for tamarisk and the beetle in Dinosaur National Monument.

[1] To read more about the DEVELOP program, please see pp 7-9 in *The Earth Observer's* March-April 2010 issue [**Volume 22, Issue 2**], pp 11-13 in the May-June 2010 issue [**Volume 22, Issue 3**], and pp 10-12 in the July-August 2010 issue [**Volume 22, Issue 4**].

**Protecting Pacific Rim Ecosystems**

Ames DEVELOP interns have also conducted studies in Alaska and Hawaii. In 2006, the International Polar Year, a team of interns worked with Synthetic Aperture Radar (SAR) and Moderate Resolution Imaging Spectroradiometer (MODIS) data to characterize ice thickness in the Yukon–Kuskokwim Delta region of Alaska. These data were then compared with airborne thermal imagery of Pacific walrus (*Odobenus rosmarus divergens*) populations. The results of the study suggest that walrus prefer medium and some thin ice floes, possibly for predator avoidance purposes. These insights can be useful for the conservation and stewardship of the walrus.


**Supriya Iyer** [Leland High School - San Jose, CA] presents her team's poster and animations at the American Geophysical Union conference in San Francisco in December 2008.

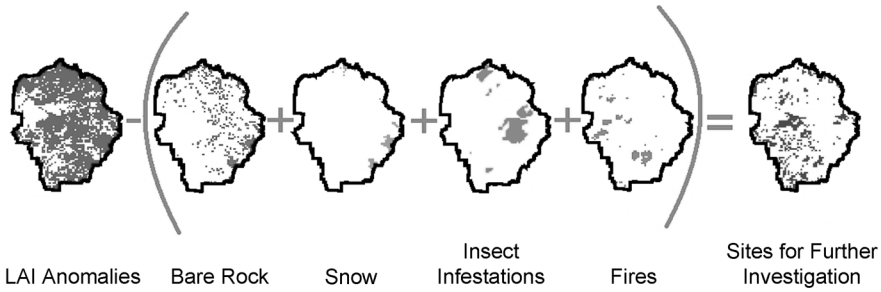
Cyclones and typhoons in the Pacific Ocean cause large amounts of destruction every year, and are equivalent in size and strength to hurricanes experienced along the Atlantic and Gulf coasts of the U. S. Scientists from the National Oceanic and Atmospheric Administration (NOAA) and other countries around the Pacific Basin are studying past storms in order to better prepare for future events. In 2007, NOAA asked Ames DEVELOP to create a series of geo-visualizations of major storm and high water events that could be incorporated into the Pacific Region Integrated Climatology Information Products (PRICIP) Portal. Interns spent the summers of 2007 and 2008 incorporating storm tracks with surface wind speed and direction, precipitation accumulation, sea surface temperature, and sea surface height data, from NASA's Quick Scatterometer (QuikSCAT), Tropical Rainfall Measuring Mission (TRMM), Jason-1, and Aqua satellites.

**Fighting Fire with Fire: Remote Sensing for Forest Management**

Forest managers have to consider a wide range of issues, such as carbon budgets, fires, and forest health in their decision-making processes. Located in southern Oregon, the Fremont–Winema National Forest's timber is harvested yearly, both for monetary return and to reduce standing fuel load. During the summer of 2004, DEVELOP interns studied how tree harvesting and wildfires could affect the carbon budget using Landsat and *in situ* data, along with *FlamMap*—a fire behavior mapping and analysis program—and NASA Carnegie-Ames-Stanford-Approach (CASA) models. It was determined, based on the interns' inputs to the NASA–CASA model, that regardless of how long a forest is left to regenerate after selective cuts, Net Ecosystem Productivity will not equal pre-fire productivity if timber is harvested. Additionally, the interns produced fire rate-of-spread and flame length maps to highlight areas of high risk for severe fires.

**Casey Cleve** [San Francisco State University] takes a soil sample to be analyzed for carbon in the Fremont–Winema National Forest of Oregon during the summer of 2004.

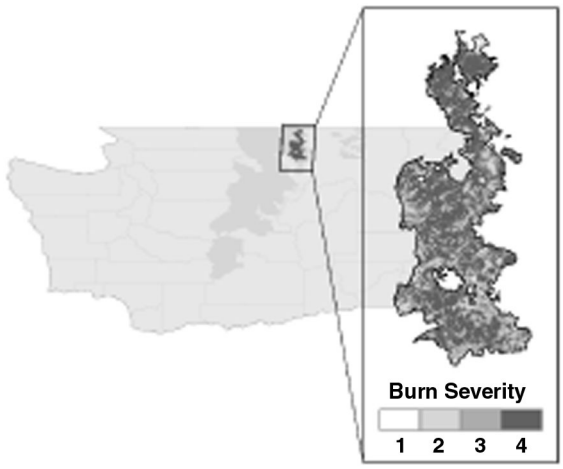
*The DEVELOP internship program not only offers valuable research experience to the students, but is also an important community resource. Local, statewide, tribal, and national partners have benefited from Ames DEVELOP's projects.*




A visual representation of steps taken to remove known causes of LAI anomalies in Yosemite National Park (outlined in black) is shown here. The final map highlights sites for further investigation from the 2006 study.

According to the National Park Service, Yosemite National Park hosted 3.7 million visitors in 2009. Leaf Area Index (LAI) is one of several indices derived from satellite imagery that are used to monitor forest health. In 2006, interns mapped unexplained Leaf Area Index (LAI) anomalies to aid the National Park Service in monitoring ecological disturbances. MODIS LAI data were processed by the Terrestrial Observation and Prediction System (TOPS) model from 2001–2005. Known areas of insect infestations, snow cover, and recent wildfires were removed. The resulting map showed areas where additional investigation was needed to improve the understanding of the anomalies.

Until recently, fire suppression was a common practice in forest management. This has led to a high buildup of fuels on the forest floor and, thus, an increase in fire severity. In 2008, a DEVELOP team performed a burn severity assessment on the Tripod Complex Fire. This fire burned 175,000 acres in 2006 in Washington's Okanogan–Wenatchee National Forest. The interns combined *in situ* data with data from Landsat and MODIS imagery to create a burn severity map. These data have since been used in additional studies relating to the impact of the Tripod Fire.




A DEVELOP team produced this burn severity classification of the Tripod Complex Fire in Washington State during the summer of 2008.

As the 10-week intensive summer projects end, the results are handed off to the partners, allowing them to make new decisions about the topic using completed maps, datasets, and results. The interns are also given the opportunity to present the results at conferences such as those of the American Society of Photogrammetry and Remote Sensing (ASPRS) and the American Geophysical Union (AGU). The DEVELOP internship program not only offers valuable research experience to the students, but is also an important community resource. Local, statewide, tribal, and national partners have benefited from Ames DEVELOP's projects. These projects have supplied them with an impressive set of data and information produced in a relatively short time; this allows not only for a rapid assessment of project results but also provides information to inform policy decisions.

If you have any questions about other projects Ames DEVELOP interns have completed, or the DEVELOP internship program in general, please visit: *develop.larc.nasa.gov*. ■