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## Soil and Temperature Studies Help Vintners Produce Quality Grapes

### The Wine Country--GIS Puts Down Roots

Soil means different things to different people. To a housekeeper, it's something to be washed from clothes and swept out the door. To an engineer, it acts as support for structures and construction material. In gardening circles, the saying is that if it gets on your clothes it's dirt, and if you want to plant something in it, it's soil.

To farmers, agriculturists, horticulturists, and anyone interested in growing plants, soil is a vital living component of the environment--the part of the earth in which the roots of a plant grow. Understanding soil and its components with respect to the needs of a plant can help growers affect plant performance. According to David Jones, owner of the Lava Cap Winery in Placerville, California, "A soil's characteristics, such as its nutrient content, water retention properties, and thickness, highly influence the plant's growing conditions."



Heat contours for the area east of Placerville are shown for the hottest day of 1999.

To Jones, it's about planting the right plant in the right soil. He studies soil properties because they affect the quality of his grapes, and in the winemaking industry, quality is everything. "You can't control these conditions," he says, "but you can select for them."

## Fertile Soil for a Bumper Crop

A geologist who taught at the University of California, Berkeley, and worked for the U.S. Geological Survey, Jones was familiar with GIS and was interested in using it at



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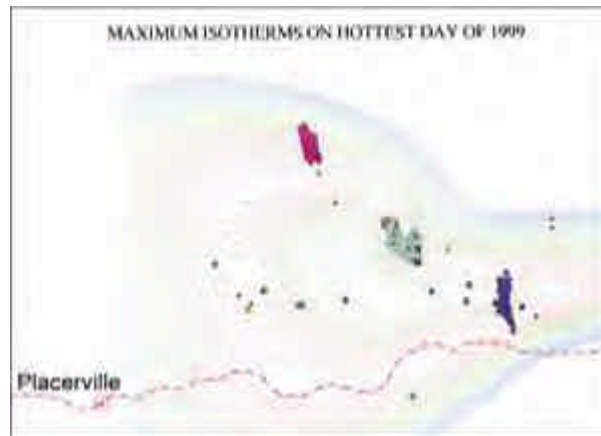
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## The Wine Country--GIS Puts Down Roots

the winery. "I was trying to determine why one vineyard is better than another," he says. He has been using ESRI's ArcView since 1991--and more recently, ArcView I Analyst--to study the area's characteristics such as geology, soil, temperature, and hydrology. As the vineyard expands, GIS has been a useful tool helping him determine what to plant where.

in El Dorado County. At nearly 3,000 feet, it is in an area known as Apple Hill that's more famous for the 49er gold miners than the El Dorado wine production. "We knew that we had a good fruit growing region because we had one of the highest productivity rates for pears in the whole State," he says. "But we didn't know all the things that we know now."

The residual soils map of El Dorado County shows the location of vineyards color-coded by elevation.



Heat contours for the area east of Placerville are shown for the hottest day of 1999.

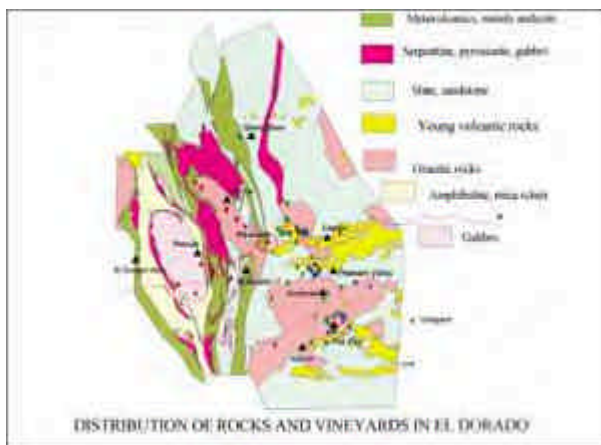
to compile a simplified soils map in ArcView. He digitized soils maps of El Dorado County using data from a geological study of the County that he and his students had done. "Rather than studying a very detailed soil classification, I was interested in looking at the residual soils, which reflect the character of the underlying bedrock,"

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the winery. "I was trying to determine why one vineyard is better than another," he says. He has been using ESRI's ArcView since 1991--and more recently, ArcView Spatial Analyst--to study the area's characteristics such as geology, soil, temperature, and hydrology. As the vineyard expands, GIS has been a useful tool helping him determine what to plant where.

Jones established Lava Cap in 1981 with the purchase of a 65-acre pear ranch located in El Dorado County. At nearly 3,000 feet in the Sierra Nevada foothills, it is in an area known as Apple Hill that's more famous for the 49er gold miners than the El Dorado wine appellation. "We knew that we had a good fruit growing region because we had one of the highest productivity rates for pears in the whole State," he says. "But we didn't know all the things that we know now."



**The residual soils map of El Dorado County shows the location of vineyards color-coded by elevation.**

The first GIS project for Lava Cap was to compile a simplified soils map in ArcView. He digitized soils maps of El Dorado County and used data from a geological study of the County that he and his students had previously done. "Rather than studying a very detailed soil classification, I was interested in looking at the residual soils, which reflect the character of the underlying bedrock," he says.

"The geologic map served perfectly for that purpose because it was

quickly apparent that the soils classification very closely paralleled the geologic unit."

The soils study determined that most of the residual soils in the Sierra foothills area developed from weathered granitic rock. In contrast, the soils in and around Lava Cap formed from volcanic rock thrown from volcanoes located east of Lake Tahoe. Erosion has depleted most of this lava cap except for along the higher ridges of Apple Hill. The 49ers knew that gold was abundant in those volcanic soils, and today Jones is learning that the lava cap's soil lends distinctive rich varietal flavors and intense aromas to his wine.

## One Thing Leads to Another

Using the GIS to study the soils of the area has led Jones to do an assessment of the area's water systems including reservoirs, canals, and pipelines. His water database was the basis for developing a county program that aims to regain some of its water rights.

"We're finding the GIS to be more and more useful," he says. From geology, soil, and water assessments, Jones has now moved into temperature monitoring and studying

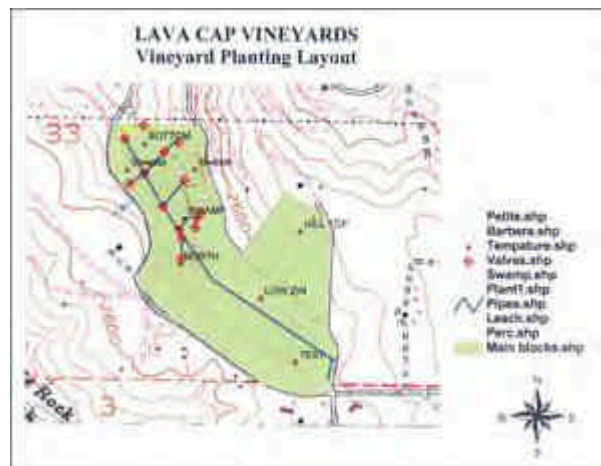
solar energy with the GIS. "Different varieties of grapes have different characteristics in terms of both soil and temperature," he says, "and temperature varies enormously in individual vineyards."

Using an automatic recorder, Jones keeps track of the temperatures and then does heat summation calculations for Lava Cap. The summation, called degree days, is based on the amount that the daily mean temperature exceeds 50 degrees during the grape-growing season. He imports that database into the GIS and uses ArcView Spatial Analyst to plot contours of the heat values.

"The contours of the heat values compare very closely with the contours of the land surface. The land surface actually controls the distribution of the heat," says Jones. "This method has given us a much better feeling for what kind of grapes to plant."

## Dispelling a Myth

Textbooks about grape growing have made generalizations about temperatures in certain areas and created misconceptions according to Jones. One false impression was that the foothills where Lava Cap is located are too hot to grow good wine grapes, and only cooler places like Napa can produce the best wine. Jones knew from experience that the Napa Valley could be very hot in the summer at the same time the foothills were cool and beautiful. "I was on a crusade to correct this misconception," he says, and that got him studying temperatures.



The Lava Cap vineyard's planting plan is overlaid on a topographical base.

As the acreage of Lava Cap has expanded, Jones has used his GIS database extensively to determine what kind of grapes to plant. Chardonnay and Sauvignon Blanc varieties are planted high on north-facing slopes for maximum protection from frosts and the hot summer sun. Zinfandel vines, which are frost tolerant, thrive on west- and southwest-facing slopes with maximum sun exposure. Preferring cooler conditions, the Cabernet Sauvignon and Merlot vines grow on north-facing slopes with excellent air circulation for frost protection.

Lava Cap has expanded to 130 acres, but the temperature coverage is a few hundred square miles. Several of Jones' neighbors have joined his network, and there are now 50 temperature recorders sending in data that is enabling Jones to take his work to a regional scale. The recorders are calibrated with California Irrigation Management Information System weather stations, which are located throughout the State and

provide reference data to growers.

"We have a neighbor who had the wrong grapes planted in the wrong spot," says Jones. "They never would get ripe. When we did the heat summation for the area, it was apparent why they didn't get ripe."

Jones' goal is to prepare a heat contour map of the entire agricultural area of the County and update it annually. "This information would be valuable to people who are interested in purchasing land and developing it for agriculture."

The French word "terroir" means more than land and refers to the other attributes of a vineyard that contribute to a wine's complexity. Jones says that there are still a lot of unknowns, but GIS is helping him define the word. "The more you know about your grapes and the more you get them in the right place, the better chance you have of achieving high quality."

For more information, contact David Jones (e-mail: [lavacap@calweb.com](mailto:lavacap@calweb.com)). Lava Cap's Web site at [lavacap.com](http://lavacap.com) includes temperature, soils, and hydrology data.

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