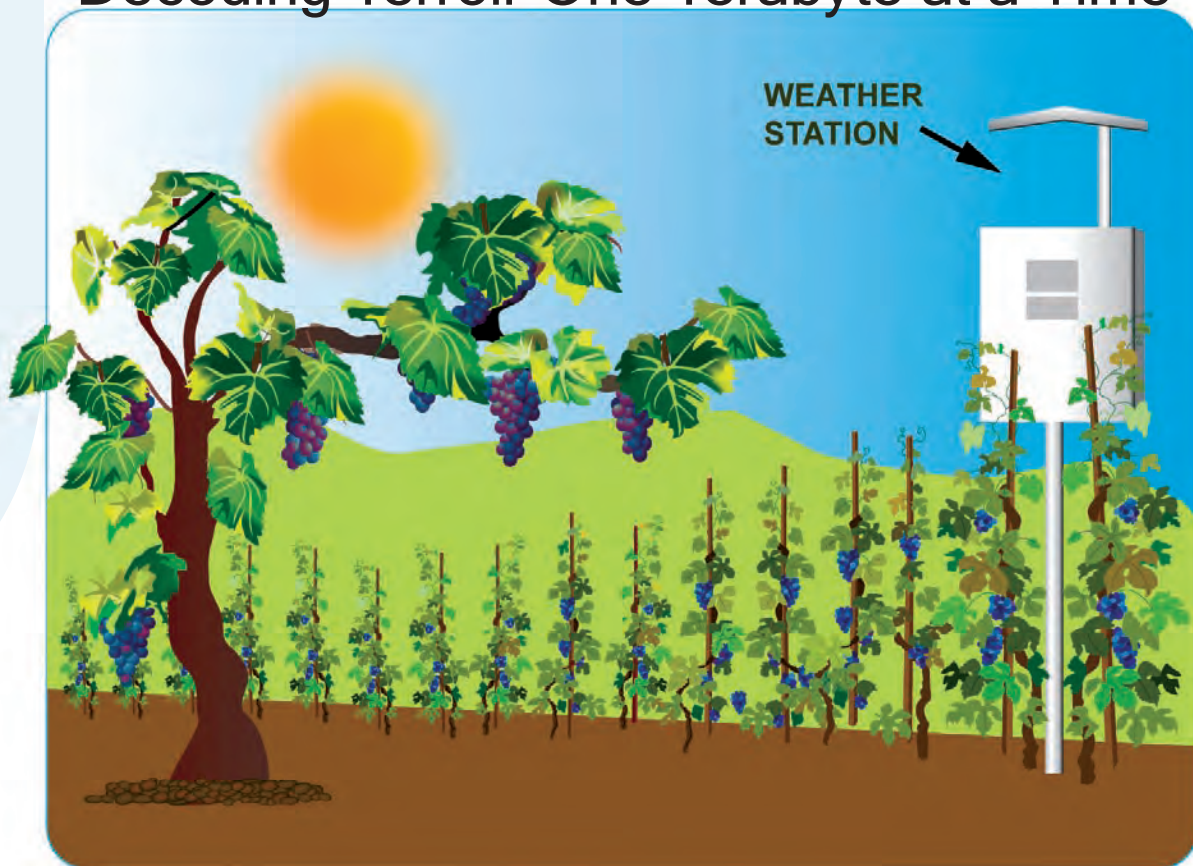


Vino-Tech

Decoding Terroir One Terabyte at a Time



JASON TESAURO

Loosely paraphrasing Gil Scott-Heron, the wine revolution will not be Parkerized. Despite the influence of the international style, flying winemakers, micro-oxygenation, and the like on wine scores, auction prices, and buying habits, the most profound and lasting effects on the industry may emerge from a far more surprising place: the viticulturist's laptop.

In *The World Atlas of Wine*, Hugh Johnson and Jancis Robinson, MW, write that the Cistercian and Benedictine monks of the Côte d'Or "tasted the soil"—so eager were they to explore its potential and distinguish one cru from another." That it took the good brethren centuries to delineate these vineyard blocks is a testament to their perseverance and talents. But modern producers don't have an eternity to find heaven in the fields. A new age has begun, one that answers prayers in pixels rather than penances. Pour a glass and pull out your smart phone—it's about to get digital in here.

Co-author of *The Modern Gentleman: A Guide to Essential Manners*, *Savvy* & *Vice*, Jason Tesauro has worked at Virginia's Barbourville Vineyards since 2002. With Champagne saber in hand, he specializes in wine, spirits, and men's lifestyle as a contributor to *Maxim*, *Match.com*, and *Washingtonian* and *Richmond* magazines, while sipping and studying for the Certified Sommelier exam.

Eyes in the Sky

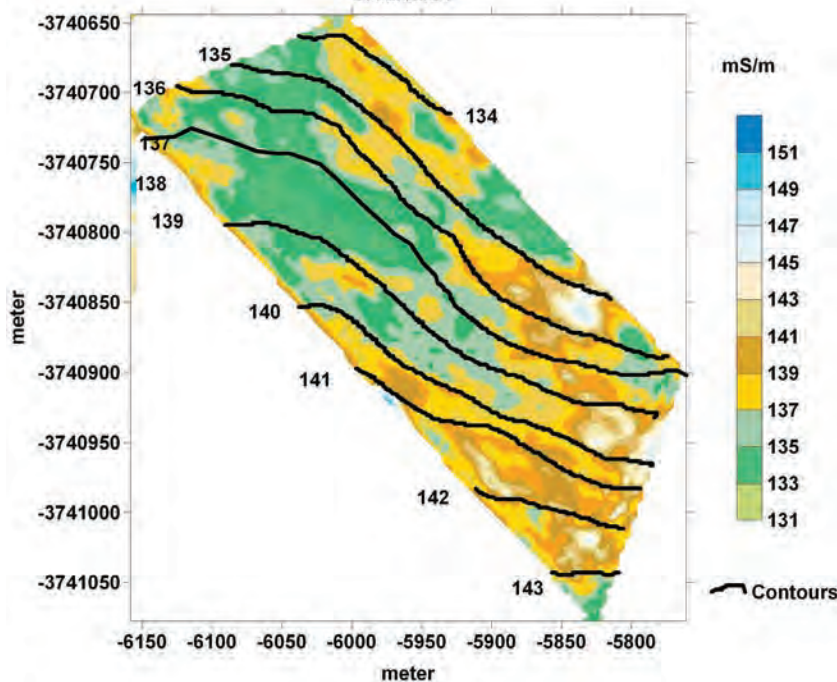
Precision or zonal viticulture (PV) is the practice of managing vines according to specific geographic coordinates. Although it's not exactly brand new, PV is quickly evolving from an assortment of innovations used primarily by big agriculture and the U.S. government into a specialized array of techniques for grape growers. It starts with GPS. Developed by the Department of Defense, the ubiquitous global position-

Vineyard work at Vilafonté (below); electromagnetic vineyard map (bottom).



vilafonte vineyards

EM Map and Contours
2006/02/24



VINEYARD INFORMATION TECHNOLOGY

EM38 Ground-Penetrating Radar (GPR): Uses electromagnetic pulses to create three-dimensional soil-composition maps, examine root distribution, and measure moisture.

Normalized Difference Vegetation Index (NDVI) and Green Biomass Index (GBI): Monitor vine vigor and diseases via infrared satellite.

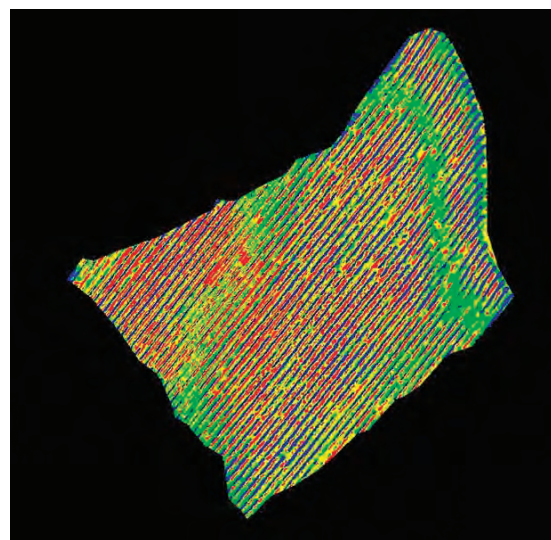
Sap-flow sensors: Measure how much water, or sap, is flowing through the vine, allowing water stress to be computed in real time.

Near-infrared spectroscopy (NIRS): Senses the chemical properties of fruit, permitting vines to be classified by their color, phenolics, pH, or Brix.

Wireless weather stations: Provide micrometeorological data on specific vineyards, perhaps avoiding (or inspiring) sleepless nights during spring frost alerts.

ing system now provides not only turn-by-turn directions to the nearest *enoteca*, but the ability to precisely geo-reference vineyard topography. Obviously, in a plot of any size, it's impractical to monitor every vine every day. GPS makes it possible to get a bird's-eye view without losing the detail that plant-by-plant investigation affords.

"What I was looking for was remote-sensing technology," says Phil Freese, winegrowing partner at Vilafonté in South Africa. During his 13 years as Robert Mondavi's vice president of wine growing, Freese laid out the first Opus One vineyards; he also worked with NASA to combat vine disease. "During the Cold War," he explains, "the U.S. used U-2 spy planes to image Russian wheat in spring to get an idea of crop potential," with the goal of leveraging strategic-arms negotiations. One program, the Normalized Difference Vegetation Index, was designed to anticipate food shortages by gathering the visible and near-infrared light reflecting off leaves. Freese found out that much of the science was developed at NASA's Ames Research Center, just south of San Francisco, and with phylloxera ravaging Napa and Sonoma counties in the early 1980s, he successfully lobbied Congress to declassify these military technologies. "We needed a way to identify sick vines from above and se-



Mike Ratcliffe, Zelma Long, and Phil Freese of Vilafonté (left); Vilafonté NDVI map (right); Alan Lakso, professor of pomology and viticulture at Cornell University (bottom).

lectively harvest,” he says. “They were looking for an application, and I was looking for a tool.”

Digital Terroir

Stirred into one alphabet soup, GPS, GPR, and NDVI supply both macro- and micro-perspectives by means of a digital map of the terroir, showing differences in soil, terrain, and climate. Equipped with this information, viticulturists can subclassify their plots into smaller, more uniform zones; for example, Jordan Vineyard & Winery divided its 30 blocks into 90 after a comprehensive soil-mapping study. “Like raising a family, you can’t treat every child the same way,” says Alan Lakso, a professor of pomology and viticulture at Cornell University in Ithaca, N.Y. “Because of the places we typically put vineyards, there’s a lot of soil variation. Difference mapping guides growers to appropriate varietal and clonal selections and farming practices. It identifies fruit best handled separately and fruit best blended together.” Rather than resembling Mondrianesque squares and rectangles, micro-farmed blocks look like gerrymandered political districts, following natural soil skeins.

“You have to know your soils,” says Edgar Lantz, owner and grower at Sam Brannan Vineyards in Calistoga, Calif. He had an analyst dig test holes, check the roots, and place sensors, or nodes, at key data-collection spots. “We have 23 acres,” he notes, “so we’re micromanaging our vineyards into small blocks of 2-2.5 acres of different clones and varieties. My neighbor has 175 acres—he hits the button and waters 20 acres at a time, but he might have 10 different soils

or holding capacities. Some he hits right on the money, some get too much.” Lakso maintains that the greatest value of PV is “helping avoid bad situations and identifying differences so that you can improve ripening.”

“If you want consistency, you need hard data,” agrees Mike Ratcliffe, managing director of Warwick Estate and Vilafonté. “You build a library of data and reduce standard deviation as much as possible. If you do x , you get y . Technology is transferable, but intellectual capital is not. It’s all about taking mistakes off the table, minimizing risk, and getting things right the first time.”

Vine-Specific Irrigation

Although soil-moisture sensors have been available for years, they can’t measure exactly how much water is getting through to deep vine roots. Guesswork can lead to wasteful irrigation, “and in context of global warming, we want to be water-efficient,” says Thibaut Scholasch, a French agronomist with doctorates in viticulture and micro-technology. “Berries trained in arid conditions are healthier and lead to wines with more color. Irrigate often, and you have berries swollen like golf balls.”

In 2008, Scholasch co-founded Fruition Sciences, a viticultural management company with offices in Montpellier, France, and Oakland, Calif. Over that short period,





Fruition Science's sap-flow sensor (left) and co-founder Thibaut Scholasch (right).

Fruition has built up a list of marquee California clients, including Araujo Estate, Dana Estates, Harlan Estate, Hartwell Estate, Ovid Vineyards, Ridge, Spottswoode Estate, and Vineyard 29. Its primary instrument is the sap-flow sensor—a bracelet that wraps around the stalk and reports every 15 minutes on how the vine is transpiring (losing moisture through its leaves) and responding to weather demands. “A severe lack of water causes plants to wither rather than produce a bountiful harvest,” says Scholasch. “When water is abundant, plants ignore fruit development in favor of vegetative growth, which puts them in worse trouble if the supply abruptly dries up. For plants, water is addictive—the more you give, the more it needs. Using sensors, you train a plant to use less and break this vicious cycle. No longer do you just go on instinct.” Lakso summarizes this deficit-irrigation philosophy as “survive but not thrive.”

“We’re a very controversial company because of what we are saying,” Scholasch admits. “It doesn’t fit the poetic mystery of why a varietal found its own balance in arid conditions. But our technology helps focus minds on the right questions. We are not killing the mystery; we’re recentering it by paying more respect to the plants.” Naysayers argue that nothing can replace the human eye and experience, but Scholasch counters, “It’s a different magnitude from manual observation. When you see visual symptoms, the game is already over.”

Lantz is a believer; after he installed the



nodes on his vines, he saw a drastic reduction in water usage—“well over 50% savings in the first year, and we saved on power bills to pump water as well. In the second year, I understood the system: soil temperatures, pressure bombs, graphs measuring stress. You don’t hurt the vine, but you get stingy. In the three years that I’ve been monitoring, quality is immensely greater. If we didn’t have the sensors, we never would’ve known. I firmly believe in this, but it’s a slow-moving train. Talk to me in five years.”

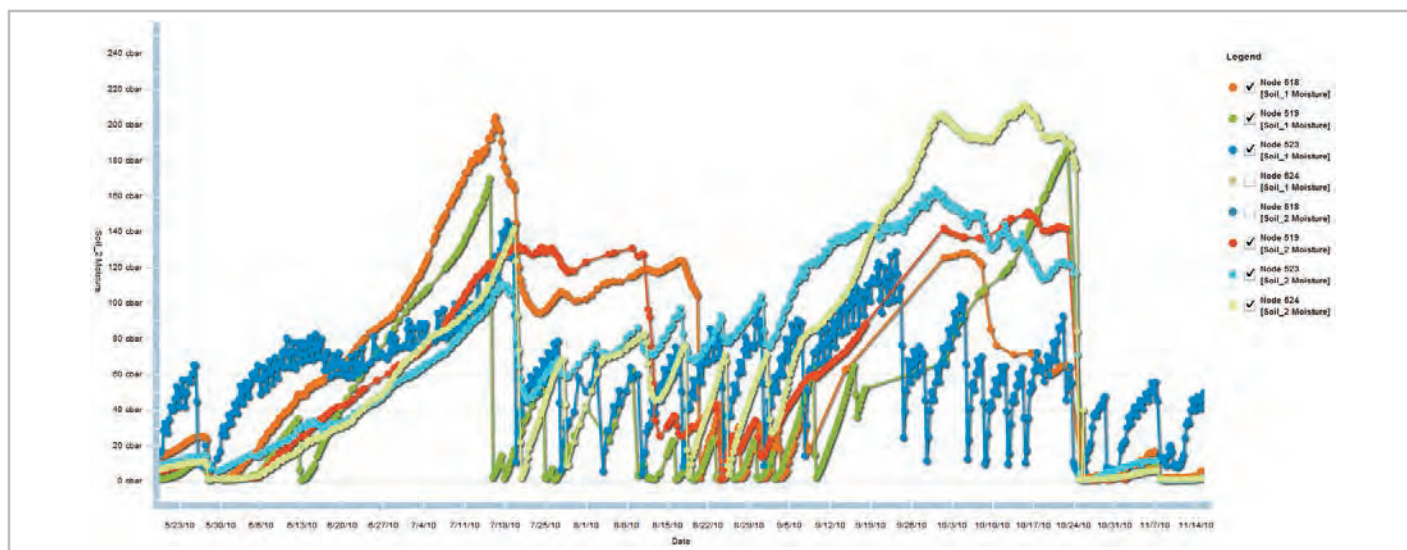
The High-Tech Vineyard

As the digital toolbox has been assembled, a new term has entered the lexicon: Vineyard Information Technology (VIT). Growers can be notified immediately via e-mail or text of any severe vine-stress conditions or weather forecasts, and virtually all information is accessible by laptop or smart phone. Integrated software merges precision farming data with accounting figures to produce true profit maps. As Freese puts it, “Everyone is asking the practical question: Does it help you grow better wine?” A recent Australian study estimated that NDVI and targeted management can boost profit margins by 15% or more. “Once people see that connection, we’ll get a second wave of support,” says Freese. “Winemaking is very technical already; it’s just slower on the vineyard side.”

Harlan Estate vineyard manager Mary Maher is charged with cultivating some of the Napa Valley’s most revered terroir. Along with



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Soil-moisture graph for Konrad Vineyards in Napa Valley.

traditional methods, she employs a high-tech drainage system, NDVI, and sap-flow sensors. Even though Harlan has no trouble earning top scores and stratospheric prices, Maher reports that “we’re always looking to make better decisions. Our growers do NDVIs every year—our goal is uniform growing blocks and ripening, with a higher percentage of acres and tons that go into the bottle.” Maher refers to her viticultural approach as “a three-legged chair: the people who farm, observations on the ground, and these new tools.”

With the help of sap-flow sensors, Maher is able to monitor irrigation more effectively, especially on difficult hillside terrains. “We think we understand the plant, but we don’t always know its water needs,” she says. “You see it wilting and presume it’s thirsty, but the plant’s actually protecting itself and doing fine. Now we water differently and less.” In 2010, when Napa Valley endured heavy May rainfall, technology trumped common sense. “You think the soil is completely saturated because it’s a wet spring,” Maher recalls, yet her sensors indicated otherwise. “The soil drained much faster than anticipated, and we actually irrigated earlier than usual.” Still, Maher is careful not to overstate technology’s role: “It’s not as simple as looking at a screen and saying ‘let’s water.’ It can’t totally substitute foot-on-the-ground viticulture. Any red flags, you take that information into the field and verify it.”

California Tech

Both technology and tightening water

rights have spurred a conscious movement toward sustainable practices on the West Coast. Not surprisingly, the Wine Industry Technology Symposium was founded in Napa in 2005, and scores of viticultural consultancies are based nearby. As Freese explains, California is a hotbed of development for economic reasons as well: “Napa has the support of owners willing to spend money. High-tech industry is how many of them made their fortunes in the first place.” Considering the proximity of Silicon Valley, you’re door to door from Adobe Systems to Araujo Estate’s whiz-bang vineyard-management systems in about two hours.

Over the next few years, the new technology is bound to go global. “It doesn’t feel very new to us,” says South Africa’s Ratcliffe. “For seven or eight years, it’s been part of our everyday planning and usage, though even people at the top of their game have never heard of these tools. It’s still pretty niche considering a lot of guys are just learning about canopy management. Eventually, the best technology trickles down to the entire industry if it’s cheap enough.”

For both sommeliers and consumers, technology tends to float all boats, improving the quality of even entry-level wines. And if you’re concerned about hyper-manipulated “Frankenwines,” Lakso has a riposte: “Don’t worry, you can do all these things and still produce an awful bottle of wine.” Vintage variation remains one of the most dynamic aspects of viticulture. Short of farming beneath retractable domes to guard against hail and hurricanes, the best way to weather a capricious Mother Nature is to understand her whims and adjust intelligently. 🍷