GiS Professional

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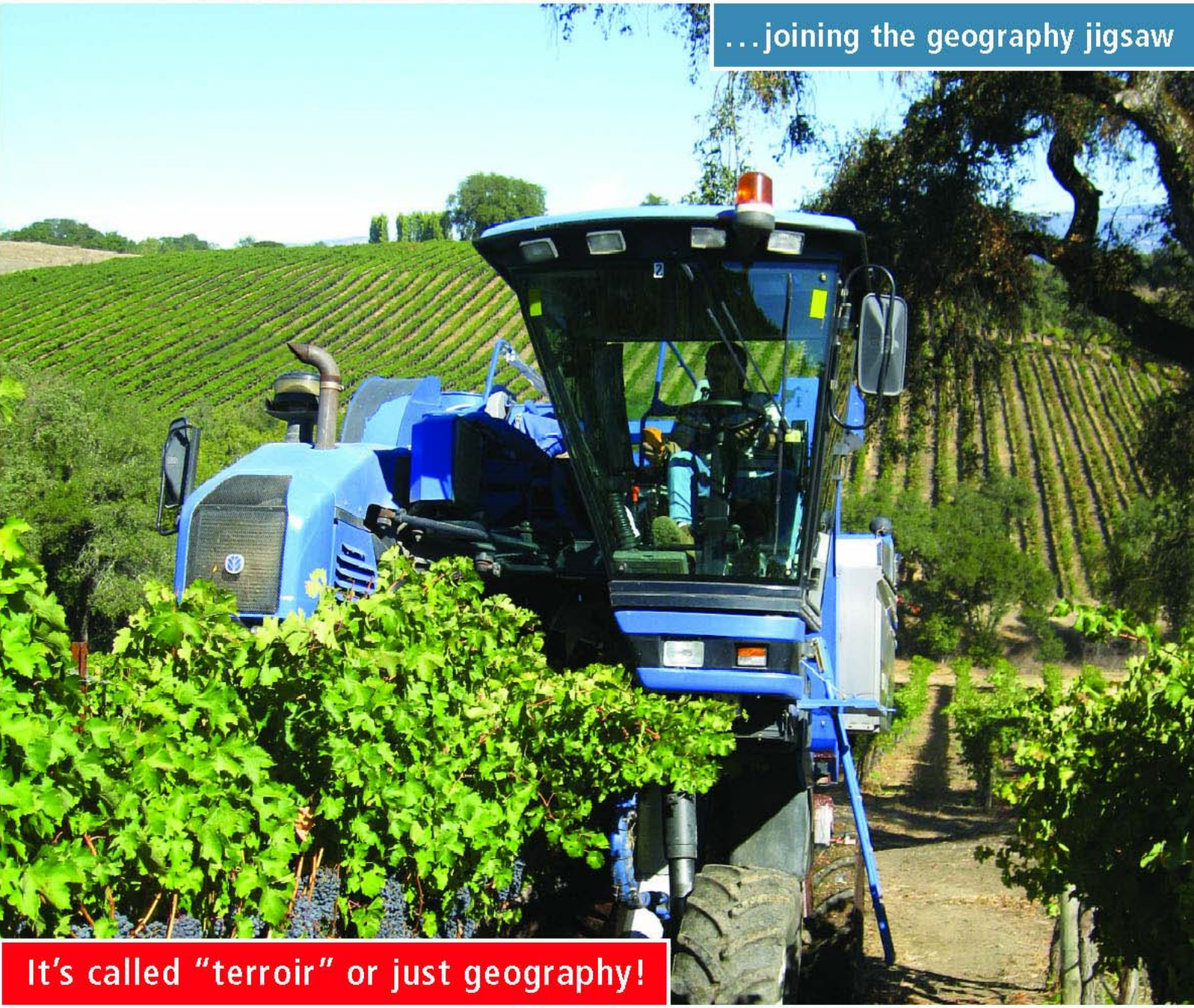
...joining the geography jigsaw



It's called "terroir" or just geography!

Esri: Looking for heroes and guinea pigs!

Geo-enabling with Microsoft

GIS education 'never stands still'

GI helps bin the news in the City

Banff's mobile solution 'a big win for GIS'

Ordnance Survey's digital history

and much more with

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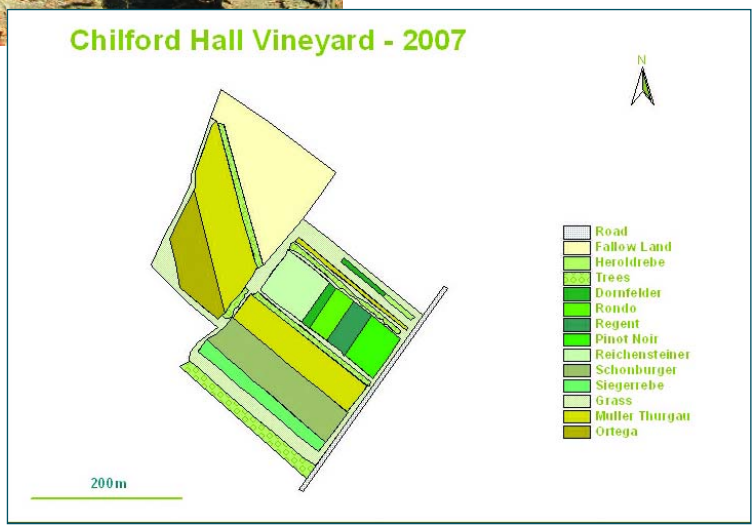
Left: Figure 1 - Mechanised Grape Picking (Harvest Pro Mechanical courtesy of Greg Kovacevich, Vineyard Ops. Inc., USA).

Below: Figure 2 - GIS-based map of a vineyard.



Grape Expectations - digital data in the vineyard

GIS guided by satellite navigation, explains **David R. Green**, is helping vineyard owners develop better wines and manage their terroir more efficiently.

> ***Satellite imagery is used to acquire information about the vines . . .***

WINE IS A VERY POPULAR ALCOHOLIC beverage all around the world. Vineyards and wineries are tourist attractions with tours, wine festivals, and wine tastings becoming regular features on many calendars. Consumers are also far more aware and better educated about the many different wines from different countries, their origin and quality, the many different grape varieties, the vineyard environment (the "terroir" as our neighbours across the channel would say), the process of wine production, and the taste of the wine in the bottle.

But how many of us are aware that vineyard managers are increasingly using digital data and mobile geospatial technologies to assist in managing the vineyard, helping to grow better grapes and to produce better quality wines?

Precision Viticulture (PV) PV is the use of geospatial technologies to study and exploit the geographical and temporal variability in the vineyard, providing a more objective basis for many management practices. PV is most often associated with vineyards in the USA, Australia, and Canada but in recent years it has been used in Spain, Slovenia, New Zealand, and even the UK.

A number of different spatial technologies and applications fall under the heading of PV.

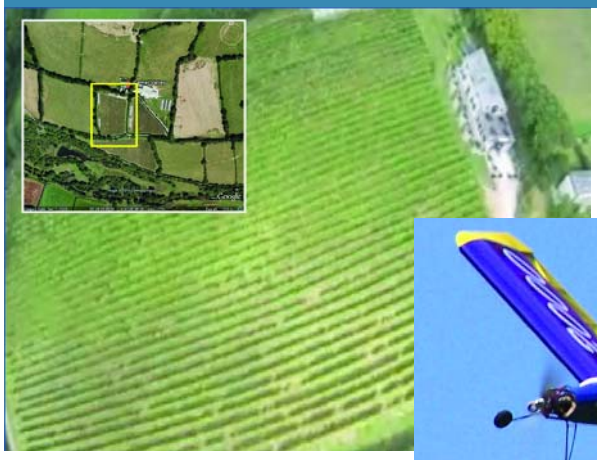
GNSS, GPS and GIS Global Navigation Satellite Systems (GNSS – increasingly the successor to standalone GPS) in the driver's cab are used to help navigate machinery around the vineyard. GNSS-enabled equipment is also used to position the trellis posts supporting the vines, and to provide centimetre accuracy in the positioning and spacing of the plants and rows. In addition, GNSS guided equipment can help deliver doses of fertiliser, pesticides, and herbicides exactly where they are needed in the vineyard as well as helping to prune vines and pick grapes (Figure 1).

GPS-based mobile mapping units running geographical information systems (GIS) enable vineyard managers to undertake detailed mapping of a vineyard. An accurate, detailed and professional map for display at the vineyard, in brochures, and on the website is very important in an increasingly professional industry. The GIS provides a toolbox to input, manage and visualise both map and image data and an efficient way to manage vineyard databases and information. Google Earth (GE) can also be used to create a simple GIS. (Figure 2).

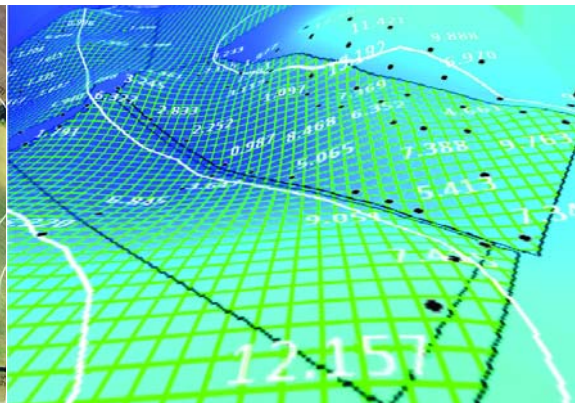
Imagery Colour and colour infrared aerial photography and satellite imagery have both been widely used with digital image processing software to yield up-to-date vineyard information on soils, soil moisture and grapevine condition including biomass and yield. Satellite imagery is used to acquire information about the vines from 'normalised vegetation difference indices' and airborne LIDAR can provide detailed digital terrain models and digital surface models of a vineyard site.

Acquisition of low-cost photographic and digital imagery is now also possible with miniature and larger UAVs (unmanned aerial vehicles) fixed-wing and helicopters (Figure 3).

GIS apps: viticulture



Left and below: Fig 3 - Model Airborne Platforms to fly Airborne Video Imagery of a vineyard.



Left: Fig 5 - Draping a Soil Moisture Map over a Digital Terrain Model (DTM)

Ground-based environmental data PV can also involve the acquisition of ground-based data including information about the vineyard microclimate (minimum and maximum temperatures, light intensity, wind speed, and relative humidity), helping to optimise grape crop management during the growing season. Low-cost micro-meteorological sensors can be operated in an automated mode, providing wireless data collection from multiple locations in the vineyard. With their exact locations known, these measurements become useful to monitor the variability of different aspects of the vineyard microclimate. They can be correlated with slope, aspect and topography of the site to study soil moisture and drainage patterns, cold air drainage (the effects of physical barriers such as tree shelter-belts, terracing, and ditches, on cold air pooling and potential frost pockets), and to help maximise exposure to the sun for ripening the grapes (Figure 4).

Visualisation tools Most GIS have visualisation tools to display spatial information in the form of semi-realistic 3D views and fly-throughs. Additional layers of information can easily be overlaid on the terrain models to provide a visual

Right: Fig 4 - Field Data Collection Kit for Monitoring and Mapping in the Vineyard.

GIS apps: viticulture

> ***. . . they lead to better grape yields and ultimately a better vintage of wine.***

correlation between the different layers, e.g. soils and slope (Figure 5).

Modelling Plant growth, canopy reflectance and inversion models, have been developed to provide estimates of 'leaf area index' and biomass. Computer-based simulation models of vine plant growth can help to develop greater insight into canopy development as well the sun-shade relationships that exist in the distinctive vineyard rows.

A grape future Precision viticulture techniques clearly offer many benefits for aspects of vineyard management. However, they are not yet universal due to potentially prohibitive hardware and software costs, lack of expertise, and the scale of operation required to justify them. The acquisition of greater knowledge and understanding about the vineyard is important because they lead to better grape yields and ultimately a better vintage of wine. There are also many other benefits such as a improved and more complete records of vineyard information that can be updated, mapped and studied, providing the basis for a comprehensive decision support system. In an industry worth many millions of dollars each year this investment in new geospatial technology is very important to ensure the harvesting of the best quality grapes and the production of the very best wine.

• David R. Green of University of Aberdeen, Scotland, UK has been working with Chilford Hall Vineyard, Cambridgeshire and the Camel Valley Vineyard, in Cornwall to explore the potential role of Precision Viticulture in UK vineyards.

Sparkling opportunity for England

The Royal Institution of Chartered Surveyors (RICS) has already been researching how GIS can assist in finding the best sites in England for viticulture. A recent report in their FIBRE series, Champagne comes to England, assesses the potential of GIS in the identification of prime vineyard sites in south east of England.

There is a strong UK market for high quality sparkling wines, most of which are currently imported. RICS believes that improvements in wine production techniques, allied to a changing climate and to the presence of geological formations similar to those found in the Champagne region of France, mean that it is increasingly possible to grow and produce such wines in south east England. Not only will this reduce wine imports to the UK, but it will also offer diversification potential to farms in south east England, while creating new employment opportunities.

The report explores the use of GIS to help find the best locations for growing vines. This can be achieved by analysing where in the region particular combinations of geological, topographical and meteorological factors combine to reproduce the conditions likely to produce quality grapes.

The authors, **Chris Foss** and **David Morris** of Plumpton College and **Niall Burnside** and **Neil Ravenscroft** of the University of Brighton used a standard GIS package to map 11 parameters according to their threshold values; i.e. the point at which the parameter was judged to become marginal from a viticultural point of view. Although there is a lack of field scale datasets a hard logic approach was employed and areas were deemed to be either suitable or unsuitable for viticultural purposes (a 'Boolean approach'). The maps were then digitally overlaid to identify prime vineyard areas.

They found that the prime areas in the region were:

- **The southern edge of the Weald in Kent and East Sussex**
- **The southern slopes of the Chilterns north west of London**
- **Chalk outcrops in the western South Downs and southern Hampshire.**

•More information from https://communities.rics.org/connect.ti/Wikigeo/groupHome

For more information, contact:

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