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VITICULTURE

Introduction

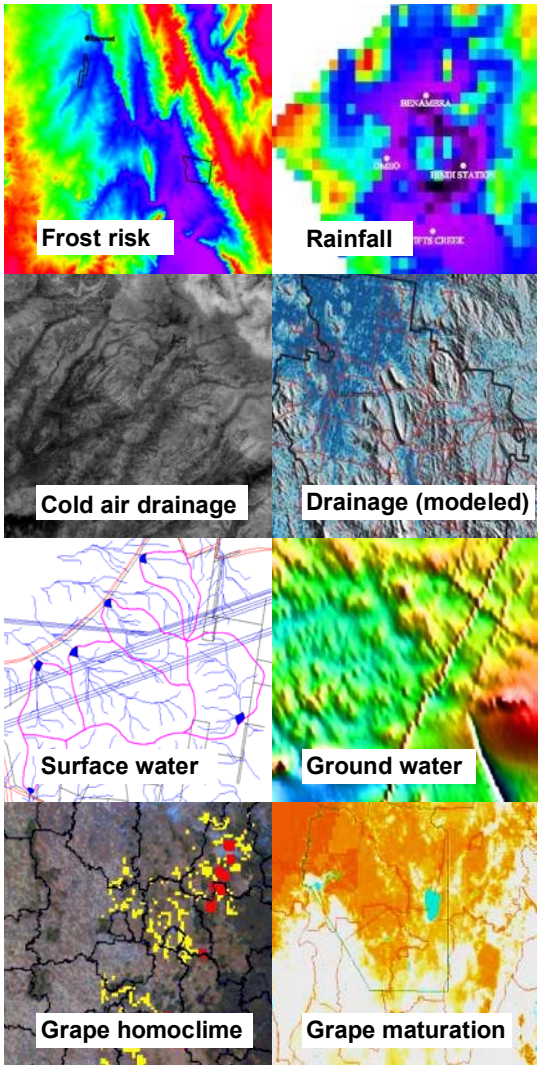
The ERIC capability centres on mapping and evaluating environmental resources that affect viticultural performance, and includes the monitoring of performance. Mapped information developed includes frost risk, climate suitability, soils, and variations in vine performance.

The information is used for viticulture site selection, planning and management to reduce risk with new developments and increase profitability with existing operations. ERIC links with experts in vineyard development and winemaking to deliver a comprehensive service.

Regional Climate

Climate affects vines throughout all stages of development. A cold period is required to reset the clock that determines phenological development while the temperature or thermal climate must be adequate to allow maturation of the fruit and development of appropriate levels of sugars. Frost at flowering can kill all fruit while rain and high humidity near harvesting promote disease and reduce fruit yield and quality. Variations in climate within these broad requirements greatly influence performance.

The control of vine development is complex and depends primarily on day length and cumulative temperature, where the thermal requirements are usually represented as heat degree days. The plant physiological development is effectively independent of biomass production



Homoclimes

The climatic characteristics of prime viticultural areas can be identified using 'key climatic requirements' and this information used to identify areas of Australia with similar characteristics. This analysis identifies the general suitability of areas for different grape varieties.

Frost Risk

Frost can significantly affect profitability, particularly in cool climate regions often targeted for premium wines. ERIC has mapped frost risk across Australia for different months from climatic data on minimum temperatures, where this can be used to assess risk by growers and insurance companies.

Vine Development (EHDD)

ERIC has implemented a computer implementation of Gladstones' effective heat degree day calculations (EHDD) to predict maturation dates across Australia and within regions. This can provide more detail on vine development and suitability than given by a homoclime analysis.

Site Characteristics

Site characteristics moderate the general climate and strongly affect performance. Site characteristics are sometimes poorly considered in site selection because of the potential for modification through management but the best wine producing vineyards naturally have favourable conditions. The ability to modify site characteristics is always limited, particularly for factors such as climate and soil structure.

Land Use & Water

Statutory regulations affect the clearing of land for development and the harvesting of water for irrigation. ERIC uses satellite imagery and ground observations to determine the area of land available for development, and the volume of surface water that can be harvested. Satellite and airborne geophysical data are used to assess the potential for groundwater.

Terrain

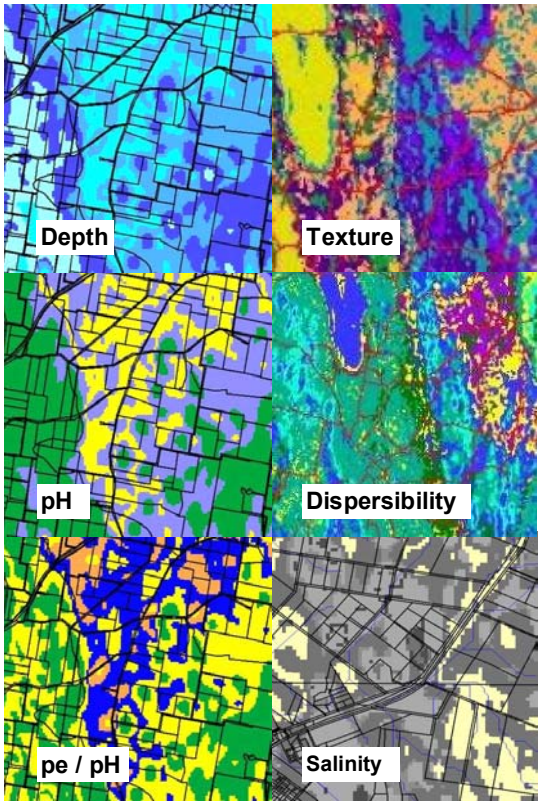
Aspect is of prime importance in cool climates where warm aspects are desired. Slope and position in the landscape similarly affect temperature and therefore vine performance, and they additionally affect drainage of soil water. The requirements in cool areas are for east, north east slopes, and good drainage of cold air and water.

ERIC analyses elevation data to identify slope, aspect, and drainage of water and cold air. Where available, night time thermal imagery is used to confirm patterns of cold air drainage.

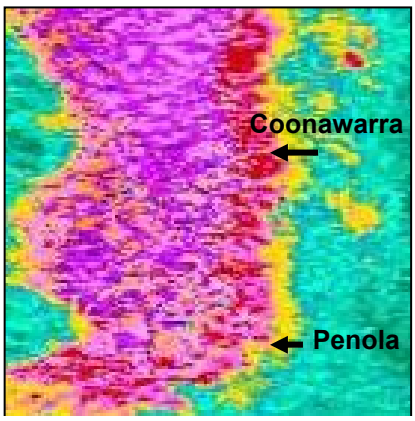
Soil

Grapevines grow on a wide range of soil types and in most positions in the landscape, and there is no single correct answer as to the soil requirements as defined by existing soil maps. This apparent irrelevance of soils arises because of the use of soil type rather than soil properties, and the interaction between soils and other factors in determining the effective environment. Soils moderate the effects of factors such as rainfall and potential evaporation, hence the significance of soil properties varies depending on these factors.

The soil 'property' of universal relevance is drainage. Freely draining soils are highly desirable, while waterlogged soils are unusable. Soil pH is also universally identified where the range should be between 6 and 8.



Coonawarra Soils



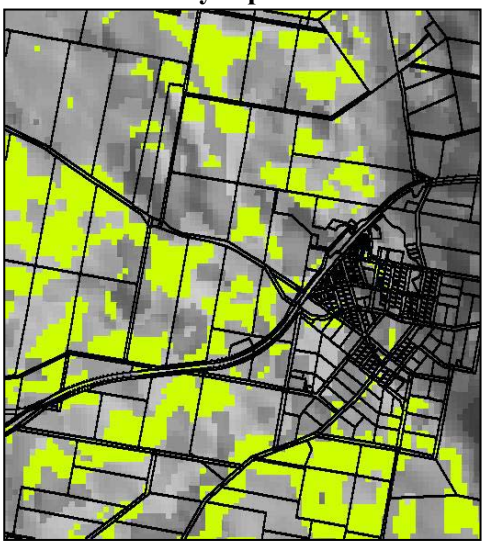
Pink: solodized solonetz (sandy red clay)
Red: terra rossa (red clay)
Purple: rendzina (black clay)
Yellow: transitional
Green: podsol (deep sand over clay)

Drainage is often inferred from soil texture and colour but the relevant objective measure is the oxidation reduction potential or redox (eH or pe). The levels and patterns of pe indicate hydration and, in association with pH, determine the solubility of ions.

Factors additional to the above include fertility, bulk density and the occurrence of layers that are impermeable and/or impenetrable to roots. A good rooting depth is desirable where this is linked to drainage and the soil water holding capacity.

Perceptions of fertility requirements vary as fertility can generally be readily managed. However, soil structural defects are expensive to rectify, thus the physical properties of the soil profile require most attention in site selection.

Enterprise site selection. Silty-clay to medium-clay, pe/pH 1.1-1.4, depth > 50cm. Northerly aspect.



ERIC uses a variety of techniques to map soils depending on the available data but all approaches are based on the collection of field information on soil properties relevant to plant performance. Highest resolution soil maps are produced where appropriate radiometric data are available as this allows full implementation of the ERIC SoilSelect methodology.

Field sampling and laboratory analysis are used to identify the soil properties associated with the mapped soil patterns. Sites with particular combinations of properties suitable for particular grape varieties can then be mapped, as with a deep soil of moderate texture with alkaline pH. The radiometric data usually provide regional coverage and hence can be used to identify areas with similar characteristics to known favourable sites.

Sites where appropriate radiometric data are not available are initially addressed by applying a lithological analysis of optical satellite imagery, where this identifies the patterns of parent material or minerals. More detailed maps are produced by sampling soils on a regular grid and mapping soil properties mapped using surface fitting routines.

Information for the different soil properties important in vine performance and management are interpreted to map soil management units. This interpretation includes information derived from the field measurements, such as soil water holding capacity which is used to address irrigation.

Crop Monitoring

The most cost effective information is provided by optical satellite imagery where this can be analysed to identify spatial patterns of variation in vine development. The satellite imagery provides information on crop condition as well as abundance or biomass. High resolution airborne imagery

can be used to provide more detailed information.

Ground observations are used to identify the reasons for variations in vine performance mapped by the imagery. Reliable maps of terrain and soil properties are usually essential for this assessment.

Information Integration

ERIC combines the information from different sources, presenting it as geo-registered maps. This allows integration with other information, such as costs and market analysis, to produce detailed development and management plans. The information is fundamental for business development in addressing risk and profitability.

Image Analysis