ERIC
RESOURCE APPLICATIONS

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Soil Mapping

SoilSelect

Application

Soils represent the fundamental resource utilised in virtually all land use enterprises. In agriculture soils determine the suitability of land for different uses and crops. Soils also strongly affect engineering activities such as road construction and waste water disposal.

The ERIC soil mapping methodology was developed to provide a reliable and highly cost effective means of obtaining detailed soil information needed for land management. In mapping paddock level detail across regions it provides the information needed for planning as well as management.

Approach

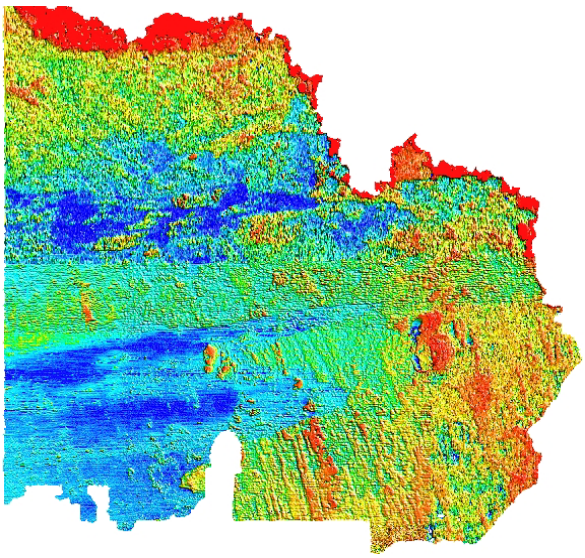
SoilSelect is an integrated package containing three main modules that address:

- Mapping of soil related patterns.
- Field soil sampling and laboratory analysis of soil properties.
- Production of soil property maps to address specific requirements.

The mapping is usually based on airborne gamma radiation data (radiometrics) as these can provide paddock level detail with regional coverage. Few field samples are required to identify the soil properties associated with the classes because of the strong relationship between the radiometric patterns and soil properties.

The radiometric data are numerically analysed to identify classes that map patterns of variations in soils. Field sample sites are identified from these classes. A multi-staged approach is used with numerical analysis and field sampling to improve reliability.

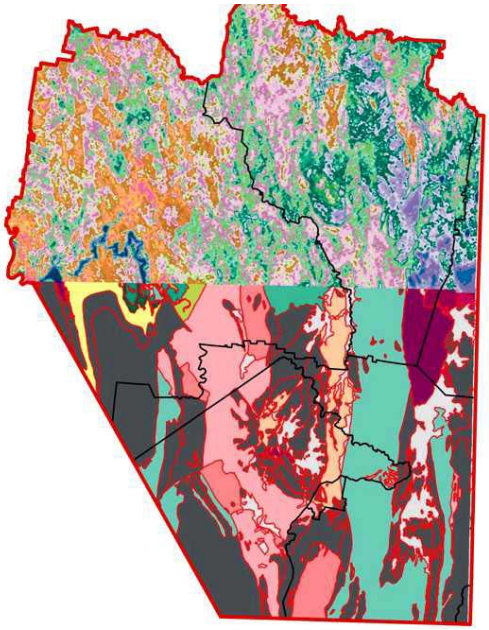
Radiometric image for the Mallee region, Victoria.
Red (river): recent alluvial clays
Blue: sand dunes



An initial field sampling checks the consistency of soil properties associated with the radiometric classes. A second field sampling provides reliable labels for the mapped classes.

The soil properties associated with the mapped radiometric classes are determined through laboratory analysis. Samples are obtained for the different soil horizons and most information has been found to come from the A2 and B2 horizons. Properties routinely determined include depth, texture, pH, salinity, dispersibility and oxidation-reduction potential.

Soils (upper) and geology (lower for the ACT wine region

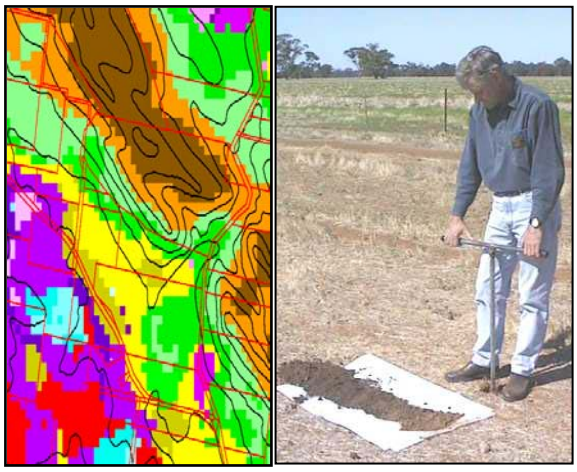


Presentation of Results

Grouping radiometric classes where soil properties do not differ maps the main patterns of soils. Grouped classes are then labelled according to their soil properties to produce maps for properties such as texture and pH of the different soil horizons.

Land use is affected by a range of soil properties thus the combined information is used when addressing particular applications. Soils having properties particularly suitable for particular applications, such as viticulture, can be readily identified and mapped.

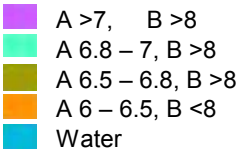
Field soil sampling

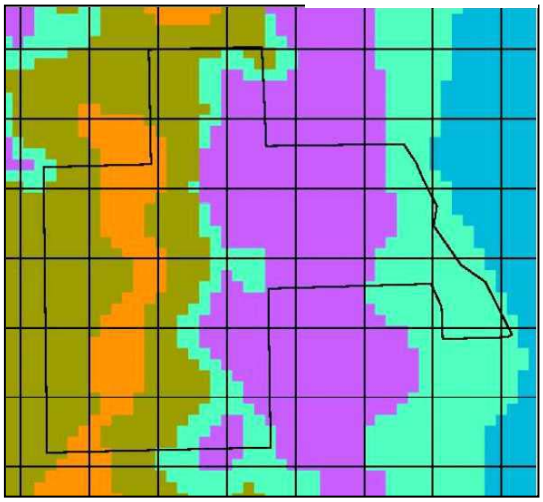


Particular classes can be grouped to highlight potential risks, such as salinity. Classes having highest salinity can be used to map salinity hazard and risk. This information helps identify the causes of adverse salinity and hence helps improve land management and remediation.

The main use of the soil property information lies in analysis of the data for specific applications. For example, the requirement may be for deep clay soils with low salinity and dispersibility. Classes having the specified soil properties can be identified and presented as a thematic map using GIS, as in Fig. 8.

Soil pH for a 500ha landholding





Consultation / Reporting

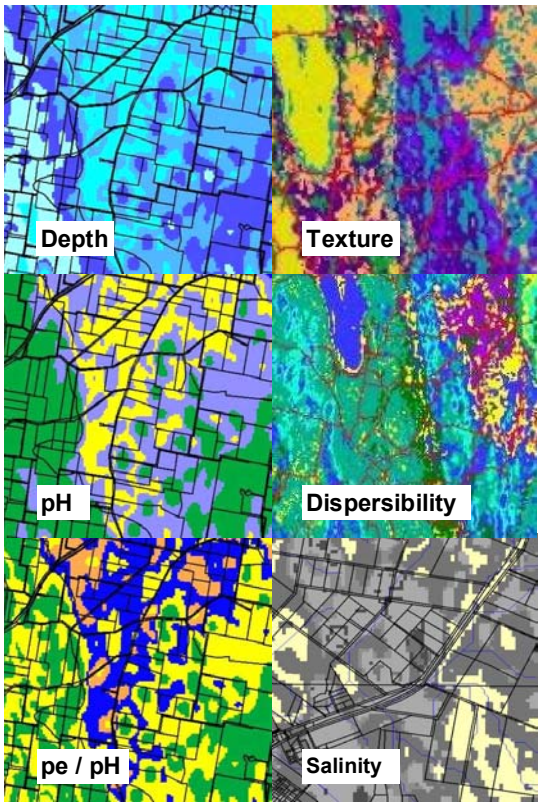
The identification of field sample sites from the radiometrics allows involvement of clients and stakeholders in sampling. This provides benefits in reducing costs and promoting understanding and application of the information.

The report contains maps of soil properties, and feature maps identifying sites having characteristics either favourable or unsuitable for particular applications.

Soil Property Measurements

The soil properties routinely measured are selected for cost effectiveness. Other

properties are generally most cost effectively determined once the main patterns of soils are known. The soil maps provide a basis for improving the value of sampling to address requirements such as fertiliser application.



The ERIC research, along with that of many others, has identified the importance of organic matter and soil structure in determining the health and productivity of soils. ERIC personnel have developed a measurement for a new soil property that quantifies the effect of soil organic matter and of different clays in adsorbing water. This measurement provides a means of monitoring improvements and degradation to soils associated with land management.

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

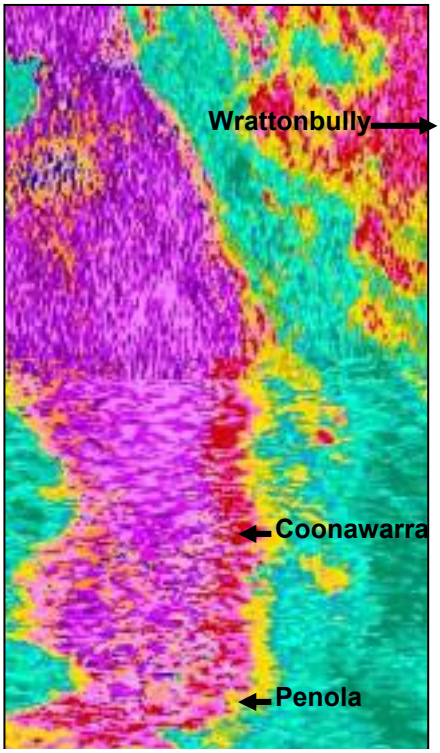
Benefits of SoilSelect

Benefits provided by SoilSelect include:

- Mapping of soil properties relevant to management.
- Paddock level detail with regional coverage.
- Involvement of stakeholders promoting application.
- Highly cost efficient.

Detail on benefits in addressing dryland salinity is contained in a dryland salinity capability statement and reports.

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)

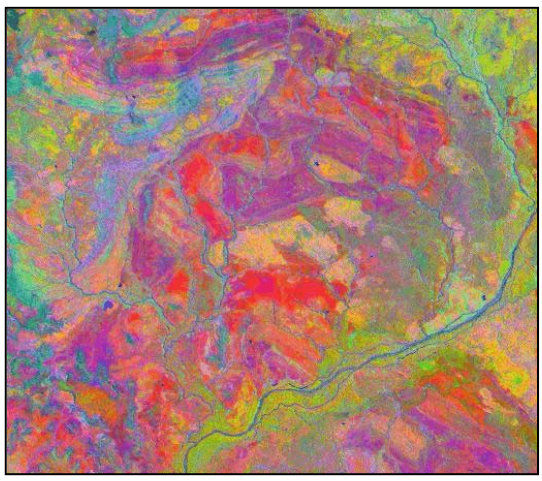
Alternate Mapping Methods

The coverage of radiometrics used for the SoilSelect method is extensive but not complete. When suitable radiometrics are unavailable the alternatives include geo-discriminant analysis of optical satellite imagery, ground electro-magnetics (EM) and surface fitting a grid of field observations. The soils are still described by way of their physical and chemical properties hence these methods provide alternative means of extrapolating information from the site samples.

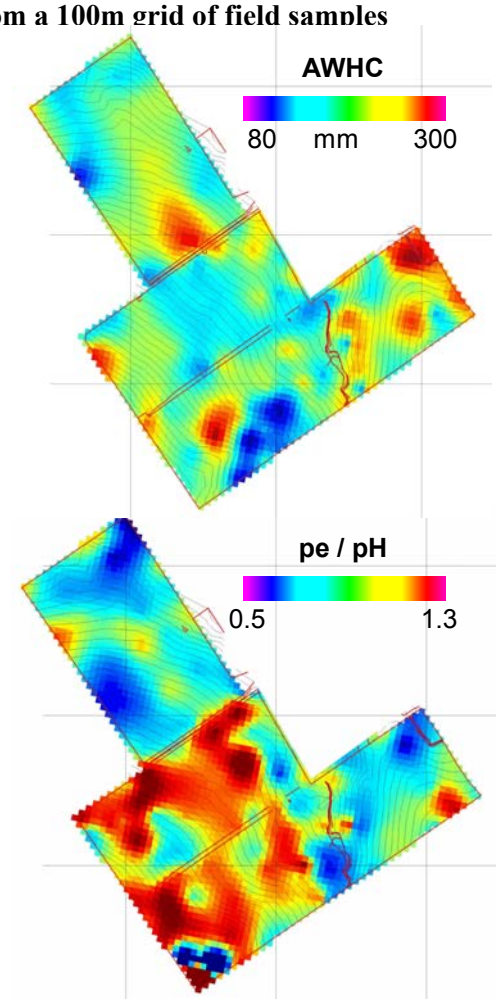
Geo-discriminant analysis is applicable where soil is exposed and is best based on imagery obtained during droughts. The mapped patterns reflect land use as well as differences in soils hence the results require visual interpretation. The results can be highly effective in mapping local variations in soils but considerable effort is required to provide consistent results across regions.

EM is used when desired, as when addressing statutory requirements, but is not recommended as the signal responds to many factors including clay, water and inductive materials such as ferrous ions. Determining what is being mapped requires considerable field sampling and is expensive. Best results are obtained when an area is uniformly wet but such conditions are difficult to achieve. Dry conditions during measurement are undesirable.

Geo-discriminant analysis
Red = ferric, blue = ferrous, green = clay



Landholding soil property maps produced from a 100m grid of field samples



Surface fitting a grid of field samples can provide detailed information for intensive developments such as viticulture. However, the density of samples needed to produce a good result cannot be determined until after the measurements have been obtained. In some areas a 100m grid can produce useful results while a 10m grid may be needed in other areas. As field sampling is the most costly part of soil surveys this method is the most expensive.