ERIC
RESOURCE APPLICATIONS

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Dryland Salinity

Application

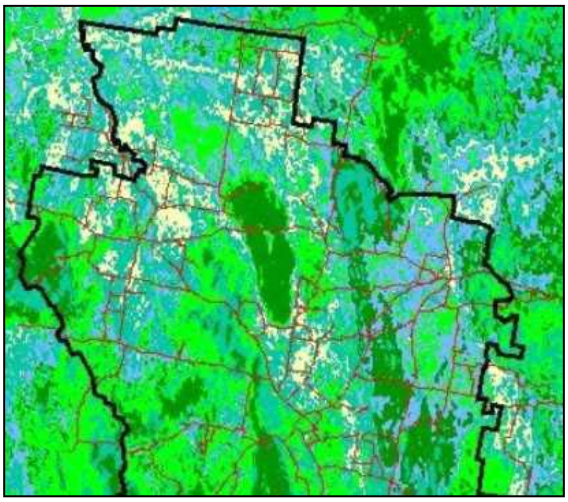
Dryland salinity has been identified as the number one environmental issue for Australia. The reasons include the salinity of Murray River water used to supply Adelaide, the often dramatic visual impact of salinity, the loss of productive agricultural land and threats to biodiversity.

In June 2004 the House of Representatives Standing Committee on Science and Innovation released the report, *Science overcoming salinity: Coordinating and extending the science to address the nation's salinity problem.* This inquiry sought to identify deficiencies in existing programs and the means for improving outcomes. After almost 30 years of salinity being a Commonwealth Government research priority the general prognosis has been that the situation will worsen with no substantive improvement for at least 25 years.

The inquiry accepted several central points in submissions by ERIC personnel. The model previously officially given as THE general model for dryland salinity was recognised as being a special case of a more general model. A need for industry involvement in research was identified. Also, measurements of subsurface salinity using electro-magnetics (EM) were identified as not providing useful information for land managers.

The ERIC salinity products derive from industry research that was associated with the delivery of commercial services. The ERIC services are directed at applying modern technologies and information to

Regional salinity
ECe (dSm^{-1}) of the B2 horizon. Yellow > 0.9, Lime 0.6-0.9, Blue-greens 0.1 - 0.3



support land managers, councils, catchment management boards, Land Care groups and other stakeholders in successfully addressing dryland salinity issues.

Approach

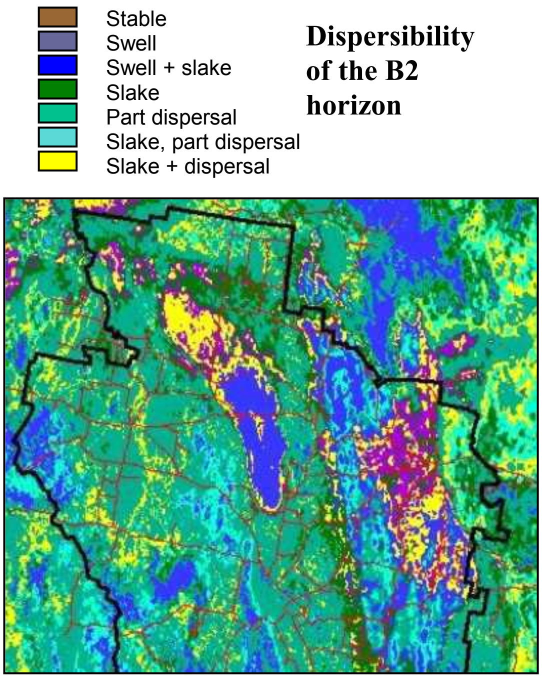
For information to be effective in addressing dryland salinity it should:

- Identify the causes of adverse salinity outcomes to allow identification of appropriate remedial actions.
- Provide the information needed to effect remediation.
- Be in a form that can develop community capability.

That is, identifying the presence of salinity alone is not sufficient.

Dryland salinity is associated with dryland agriculture and is associated with changes to the soil and vegetation. Also, most

Dispersibility of the B2 horizon

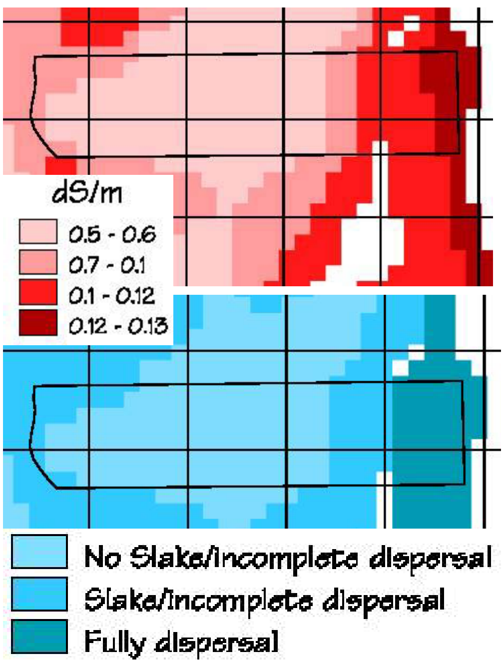


remediation and management options relate to the soil and vegetation. Knowledge of subsurface structure can be important in determining salinity expressions but dryland salinity cannot be resolved by a focus on subsurface structure or groundwater flow systems.

The basic elements of the approach are:

- A focus on measurement rather than modeling.
- Close interaction with those on the land (the intended beneficiaries).

Soil salinity (red) and dispersibility for a landholding (kilometer grid)



- Development of a sound understanding of the processes causing dryland salinity and those that affect expressions by way of realised outcomes.

The approach seeks to identify what actually occurs rather than rely on uncertain predictions of what is thought should occur.

The focus on measurement and interaction with those on the land are crucial in developing and testing basic theoretical understanding. It promotes the delivery of effective services by way of information, technology transfer and other such support.

Background Information

Several papers produced by ERIC personnel are available on the web site. In chronological order they include:

1. Salinity is natural
2. Scenario for dryland salinity
3. Dryland salinity: providing solutions
4. What model for dryland salinity?
5. Comparison of EM and radiometrics for mapping salinity.

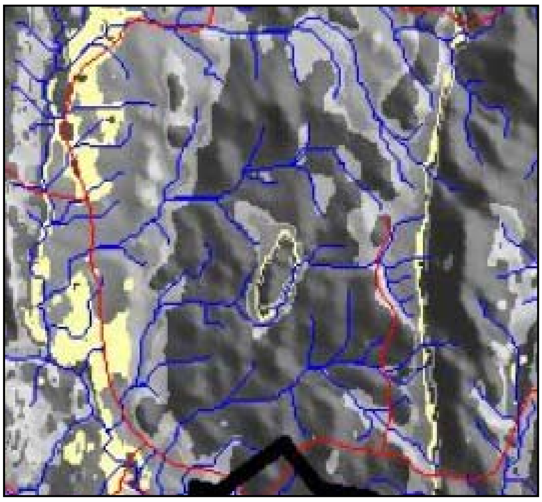
Key conclusions in the papers include:

- Impacts of dryland salinity can arise in several ways. Dryland salinity is not a single factor and hence cannot be addressed by any single measurement.
- Dryland salinity is CAUSED by degradation of soil structure deriving largely from loss of soil organic matter.
- Expressions of dryland salinity are structurally controlled and can relate strongly to geology.
- Adverse salinity impacts mainly occur in areas of Australia with Mediterranean climates.
- The rising groundwater model is not general (it is a very special case). A general model is outlined.

Products and Services

The products and services have been developed around the SoilSelect soil property maps. The SoilSelect results

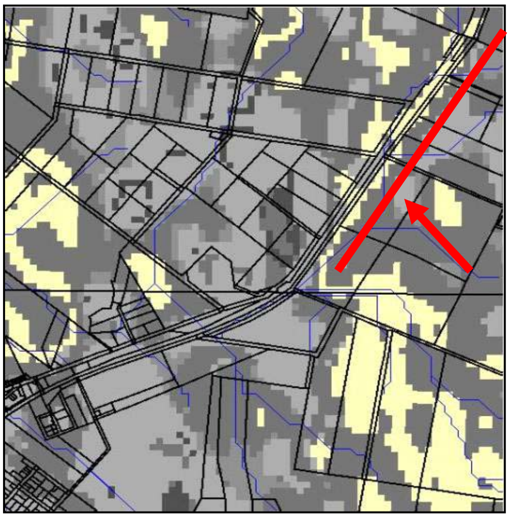
Salinity associated with a stream line (left), break of slope (centre) and a fault line (right)



provide information on the distribution of salt in soils but also provide information on other soil properties, such as texture and dispersibility. The comprehensive information on soil properties helps develop understanding. Also, the comprehensive soil information is essential in implementing effective remediation and land management generally.

With regional results the patterns of high salinity and dispersibility do not coincide. Dispersibility can arise with low salinity due to high sodium adsorption ratios thus the mapping of salt levels alone does not adequately address dryland salinity.

Stretch of road subject to annual damage from salinity

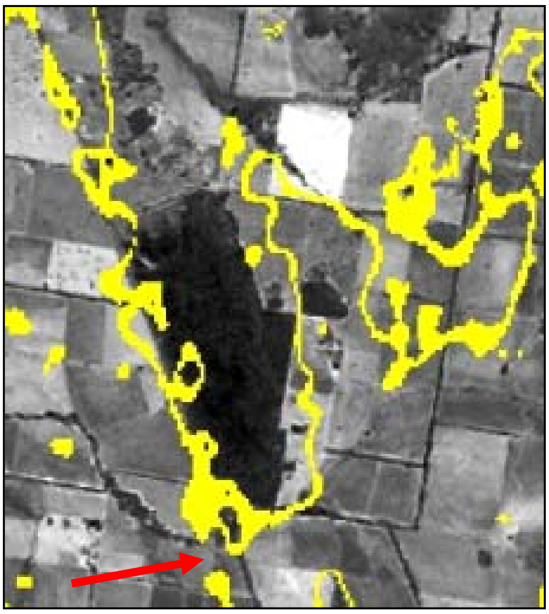


The SoilSelect mapping can provide paddock level detail with regional coverage. The results therefore provide the regional context needed for effective planning but also provide the site detail needed for application of results in management. In the land holding example the highest salinity is associated with high dispersibility indicating very high risk.

A number of expressions of dryland salinity have been identified with Soil Select results. The three examples illustrated here are associated with accessions around a drainage line, at the break of slope around a hill, and along a fault line. Other expressions in this region are associated with geological unconformities, such as boundaries between geological formations, and where the fault lines run from hills onto plains. There are usually multiple forms of expression of salinity within regions.

Knowledge of the reason for salinity impacts can often allow effective remediation where previous attempts have failed. Identification of the cause of annual damage to a stretch of highway arose as being its location on a salinity pathway (fault line) allowed implementation of permanent repairs.

Saline class extrapolated from an adjoining shire. Satellite image background



Radiometric Salinity Class

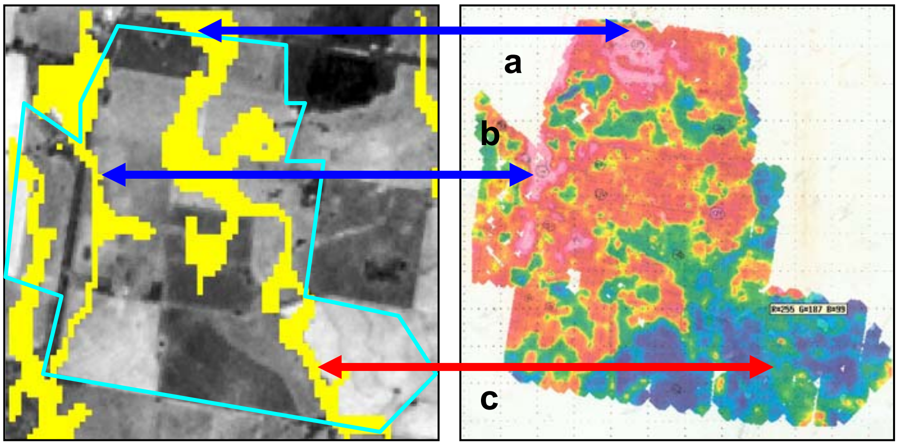
ERIC personnel discovered that the radiometric data contained a distinct signature associated with salinity. This allows salinity results to be extrapolated across adjacent shires and across overlapping radiometric surveys. The extrapolated salinity class identifies the presence of significant salinity but does not identify its level.

The extrapolated salinity class has the same high spatial resolution as the reference SoilSelect results. It similarly identifies surficial pathways for the flow of water and salt. The example here shows a meandering drainage line in flat terrain. However, the seepage drainage pattern has been disrupted by road drainage so that the salt is diverted from the stream and now runs along the road side drain.

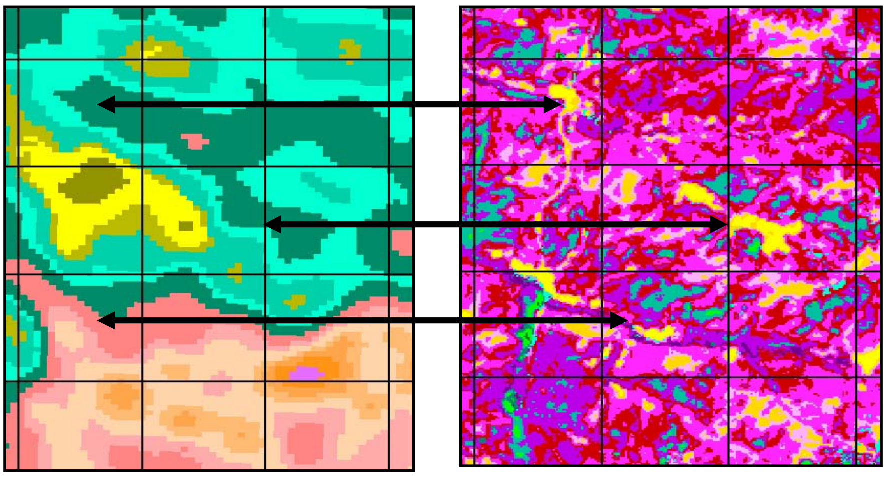
It is suggested that the salinity class derives from cosmogenic ^{24}Na. While this has yet to be proven the hypothesis accords with many features of the results, including the lack of persistence of the salinity class in the stream line below the road.

The salinity class is surficial while the EM31 provides a bulk measure to around 6m depth. Comparison of results for a landholding identifies similarities but there are also differences. The salinity class identifies pathways for surficial flow of water and salt and so helps develop understanding of how the adverse salinity is arising.

Field observation is generally needed for interpretation of SoilSelect results. However, other imagery can be used to help interpret what is occurring. In the example below salt scalds identifiable in satellite imagery are associated with a particular radiometric class that is generally associated with the boundary between geological formations.



Comparison of a radiometric salinity class and EM31 results. Blue arrows link previously known saline areas.



Radiometric soil classes (left) and land cover classes from a satellite image.

The dark green class in the radiometrics lies on the boundary between geological formations.

Salt scalds are bright yellow in the satellite image.