REVEGETATION

# IDENTIFYING AND MANAGING ACID SCALDS ON YOUR PROPERTY

*Steve Appleyard*

Acid scalds are the most visible indication that acid sulfate soils have been disturbed and are causing environmental harm. They are areas of bare land where vegetation has been killed by sulfuric acid, mineral salts and toxic metals drawn to the surface by capillary action as a result of the reaction of natural iron sulfide minerals with air in the soil profile. They typically start out as small bare patches a few metres across, but if not actively managed, they can expand to cover areas of more than 10 hectares over time intervals of as little as 5 to 10 years. Acid scalds as large as 200 hectares in area are known to occur in New South Wales and Queensland.

*Acid scald near Yunderup, Peel Region*
*Photo: S. Appleyard*

On the eastern seaboard, acid sulfate soils usually only occur in coastal areas at elevations of less than about 5 metres above sea level. However, in Western Australia they have a much wider distribution. Acid sulfate soils are known to be associated with wetlands across the Swan and Scott Coastal Plains, and occur in groundwater discharge areas near the Whicher, Darling and Gingin Scarps. They are also found in some parts of the Wheatbelt.

Acid scalds may resemble (and are often mistaken for) saline seeps that result from the discharge of salty groundwater in areas affected by dryland salinity. Soils in acid scalds are also often very saline, and may be covered by a salt crust. However, acid scalds cannot be rehabilitated in the same way as ordinary salinised land. Attempts to revegetate acid scalds with trees or other deep-rooted perennials usually only accelerate the expansion of the scalds due to the lowering of the water table, and planted trees typically die *en masse* after a few years because of the effects of acidity and metal toxicity.

## IDENTIFYING ACID SCALDS

Fortunately, there are a number of visual indicators and simple field tests available to help you identify acid scalds on your property.

Typical visual indicators of acid scalding include:

- *Iron staining* – bare soils in scalds are often (but not always!) covered by a precipitate of iron oxides which are a rusty red-brown colour. Water in drains near scalds is also often turbid and yellow-brown to red-brown in colour due to iron, and iron staining often occurs on fence posts and near the base of trees in affected areas.
- *Surface deposits of black, oily-looking material (iron monosulfides)* – scald surfaces often have patches of black, oily material in waterlogged areas, particularly in winter. Occasionally the entire soil surface in scalds turns jet-black in winter, and then dries to a white or pale-brown colour in summer. The black material contains iron monosulfide minerals that are formed by bacteria in waterlogged conditions when there is a large amount of iron available.
- *Butter-yellow deposits (jarosite)* – Dry surface crusts on scalds often have streaks or small patches of yellow material that consist of iron sulfate minerals such as jarosite. These mineral deposits also form along old root channels below the ground surface where air percolates into the soil profile. These yellow minerals are a by-product of the reaction of iron sulfide minerals with air and only form when the soil pH is less than about 3.7.
- *"Fluffy" salt crusts* – salts that accumulate in dry periods on acid scalds are mainly soluble sulfate salts rather than the chloride salts that accumulate in

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areas affected by dryland salinity alone (both issues can occur together!). Sulfate salt crusts often have a "fluffy" appearance and resemble the deposits on corroded car-battery terminals rather than the more typical "sugar-crystal" like appearance of chloride salts.

- *Wetland plants* – wetland sedges and rushes often grow in areas underlain by acid sulfate soils. Tree species associated with wetlands such as *Melaleuca* species may also occur in these areas.

- *Ponded water clarity and colour* – Water that collects in pools or in excavated dams on highly acidic soils often appears to be crystal clear and have a turquoise or milky-blue tinge as the acidic conditions cause suspended sediments to precipitate out of the water column. The blue colour is caused by a fine precipitate of aluminium minerals and indicates that the water is likely to be highly toxic to aquatic organisms and vegetation.

- *Smell* – there is often a faint "burnt sulfur" or "gunpowder" smell in areas with acid scalds due to the release of small amounts of sulphur dioxide gas from oxidising sulfide minerals in shallow soil near scalds. Grey or black coloured soil beneath the water table in these areas typically has a "rotten egg" smell due to the presence of small amounts of hydrogen sulfide gas in this material.

*Iron monosulfides covering an acid scald, Leschenault Inlet*
*Photo: S. Appleyard*

In addition to these visual indicators, soil pH tests are helpful for identifying acid scalds. These can be simply carried out with pH test strips by mixing about one teaspoon of soil with five teaspoons of deionised water in a small plastic container and measuring the pH of the slurry. A second test is carried out in the same way using concentrated (30%) hydrogen peroxide instead of water (handle hydrogen peroxide with care, as this is a highly corrosive chemical - wear plastic gloves and safety glasses when using!). It is recommended that soil samples are tested at depth intervals of about 25 cm to ensure that any acid sulfate soil materials are identified. Hydrogen peroxide with a concentration of 19% can also be used, although reactions may take longer to occur. Solutions of hydrogen peroxide with this concentration are readily available from pool and spa supply shops (usually called "spa protector" or "spa sanitizer").

Soil pH values of less than 4 tested with water or after reaction with hydrogen peroxide are clear indicators of current acid sulfate soil conditions or the potential for these conditions to develop. Other indicators that acid sulfate soil materials may be present are: a "volcanic" reaction of soil with hydrogen peroxide (may take up to 10 minutes for the reaction to take place – be patient!), and; a pH drop of more than 2 between water and peroxide measured soil pH values. Further details of testing methods for acid sulfate soils can be found on the Department of Environment web site (www.environment.wa.gov.au).

## REHABILITATING ACID SCALDS

### Drainage management

The first step for rehabilitating acid scalds is to assess the extent to which land on your property has been drained.

Although a number of factors contribute to the formation of scalds (including fire, erosion, stock trampling etc.), the primary cause is often excessive drainage which drops the regional water table and exposes iron sulfide layers in the subsoil to air. This initiates a chain of chemical processes that generate acidic water which is then drawn to the soil surface by capillary action.

To prevent this happening, it is important to keep the water table above the iron sulfide layers (i.e. above the depth where there is a positive reaction of a soil sample with hydrogen peroxide). In the short term, this can be done by installing drop boards or temporary weirs in drains (sand filled bags can be quite effective) to effectively raise the base of the drain which controls the height of the local water table. If there has been extensive disturbance of acid sulfate soils in a catchment, regional drainage may have to be altered to reduce soil oxidation and the export of acid from the catchment. This has been done successfully in acid sulfate soil areas in New South Wales and Queensland and involves both reducing the number of drains in the catchment (i.e. reducing drainage density) and changing deep drains into broad shallow drains which do not penetrate beneath the water table.

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Guidance on drainage management in areas with acid sulfate soils is available in a recent publication by Land and Water Australia and New South Wales government agencies called "Restoring the Balance: guidelines for managing floodgates and drainage systems on coastal floodplains". The document is available in PDF format at the following web site:

http://www.agric.nsw.gov.au/reader/floodgate-guidelines.

## Revegetation of scalds

The following measures for revegetating acid scalds have been developed by Mark Rosicky at Southern Cross University in Queensland and have been successfully used to rehabilitate scalds near Capel:


*Changes in rehabilitation density in a scalded area near Capel one year after rehabilitation measures were implimented. Photo: Christine Webb*

(i) *Fencing* – scalded areas are very sensitive to disturbance. Trampling of bare soil by stock can increase the oxidation of iron sulfide minerals and disrupt plant germination and growth. Fencing allows stock to be excluded from degraded areas until they are rehabilitated, and then allows access to these areas to be controlled to prevent a new scald developing.

(ii) *Surface disturbance* – scarifying or rotary hoeing the soil surface in scalds helps prevent acid solutions being "wicked" to the surface and accumulating as toxic salts. It also helps create vegetation germination sites.

(iii) *Ridging and furrowing* – creating linear ridges about 30 cm high and 1 – 2 m wide with adjacent furrows in scalded areas helps create a variety of germination sites, and provides some drainage for seedling roots.

(iv) *Liming* – the amount of stored acidity in badly scalded areas is generally too large to be managed by liming. However, lime application in newly planted areas can locally reduce acidity near roots and help plants get established.

(v) *Mulching* – mulching is the single most effective treatment for scalds. It prevents evaporation from the soil surface and slows the accumulation of acidity and salinity in shallow soil which encourages the regrowth of vegetation.

(vi) *Plant selection for revegetation* – local wetland sedges (NOT tree species) are usually the best plants to establish in scalded areas. These can be planted directly into a mulch layer on ridges constructed on the scald. Sedges will stabilise the soil sufficiently to allow other vegetation to become reestablished from the soil seed bank or by ingress from adjacent land.

For more info. contact Mark Rosicky on 0418 495 714, or email: mrosic10@scu.edu.au.

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