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Hillside seepages

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'Hillside seepage' is a local, descriptive term applied to almost any wet patch occurring out of the valley bottom. Depending on their surface appearances, 'hillside seepages' are described as 'springs', 'soaks', 'wet patches', or seeps.

Whatever they are called, seeps can cause problems. The land in the seep is wet, unworkable and non-productive. If the seep is saline and the water flows downhill, further land is lost from production, bared and subject to erosion. Even small seeps, while not affecting much land, break up a paddock and complicate the working pattern for tillage and harvest.

Definition of terms

To understand the causes of seeps, it is necessary to define some terms used in describing water flow through soils.

Hydraulic conductivity is a measure of capacity of a soil to transmit water under unit hydraulic gradient. Since we are mostly concerned with groundwater the relevant measure is the saturated hydraulic conductivity. (This measure is often referred to as permeability although this is not strictly correct.)

Hydraulic gradient is the gradient, or slope, between the pressure of water measured in two different parts of the soil. Water moves down the hydraulic gradient from an area of high pressure to an area of low pressure.

Flow velocity of water through a soil is the hydraulic conductivity times the hydraulic gradient.

Causes of seeps

Seeps occur when water is forced towards the soil surface. When the water comes to within 1.5 to 2 metres of the surface the first signs of a potential seep appear. Plants will stay green longer in spring and early summer and the soil surface will be damper. With time and the right conditions free water will eventually seep out of the surface and may run a considerable distance downhill.

Seeps can be either fresh or saline. Fresh seeps are often developed as soaks for stock water supplies.

The amount of salt in seepage water depends on the origins of the water. In general, if the water has travelled through the deeper layers of the soil profile, which have a high salt storage, the seep will be saline. Seeps which are fed by shallow flowing water, or water that has come through sandy soil, tend to be relatively fresh. The salinity of the seepage water gives a clue as to its origin and to what is causing the seep.

Types of seep

Four main topographical structures cause seeps in southern Western Australia.

Bedrock high seeps result when the bedrock comes close to the soil surface. Groundwater moving downslope is impounded behind the bedrock high and forced towards the soil.
Seep caused by a bedrock high

(In all figures, the position of the seep has been accentuated.)

\[\text{\textbf{Seep caused by a dyke}}\]

\[\text{\textbf{Seep at the base of a sandy rise}}\]

\[\text{\textbf{Seep caused by a change in slope}}\]

\[\text{\textbf{Seep caused by a change in slope}}\]

surface. The bedrock high is occasionally visible on the surface as a 'rock bar'.

These seeps are usually saline and not associated with a change in soil texture. They might be improved with drains immediately above or in the seep.

\textit{Dyke or texture change seeps} occur when soil of lower hydraulic conductivity cuts across a slope. The low conductivity soil may be the result of weathering of a dyke. The seeps are usually saline and associated with a change in soil texture. However, if the dyke cuts across a deep sand the seeps can be fresh.

Dyke outcrops sometimes appear on the soil surface across and up-slope from the seep. Dykes can also be detected by using a magnetometer, which is a common geophysical instrument. Commercial geophysicists experienced in detecting dykes can be consulted.

These seeps can sometimes be improved by sub-surface drainage up-slope of the dyke. The Department of Agriculture has started experiments to examine the possibilities of cutting through the dykes.

\textit{Seeps at the base of sands} occur at the downslope junction of deep sandy soils and fine textured soils such as clay or clay loam. Water perches in the sand on top of the clay and moves downslope, coming out at the base of the 'sandhill'. These seeps are usually fresh since sandy soils store little salt. However, if water coming through clayey soils enters the seepage water, the seeps can be saline.

These seeps, if relatively fresh, can be developed for stock water supplies. If they are saline a drain at the base of the sandy rise can be used to safely dispose of the saline water and prevent it from flowing over fresh soils downslope.

\textit{Seeps at the change of slope} occur because there is a reduction in hydraulic gradient downslope. As a result the soils downslope cannot transport the water being fed from up-slope and water builds up at the break of slope. These seeps are usually saline, not associated with a soil textural change and are characterised by a concave slope. Sub-surface drainage at, or above, the seep may be effective, but the recharge area feeding the seep will have to be treated too.