7. SOIL CONSERVATION

The ultimate aim of land system mapping and the characterisation of the land systems in terms of climate, geology, topography, soil and vegetation is to promote the conservation, in its widest sense, of the soil resource. Soil deterioration in the study area can take the form of:

– erosion by water, wind and gravity - nutrient decline by leaching and by removal of produce

- structure decline by compaction or frequent cultivation of the surface soil

– salting, and - waterlogging.

During field work, the present extent and severity of soil deterioration are noted, and these, coupled with a knowledge of relationships between environmental features, lead to a diagnosis of the hazards inherent in different kinds of land. The hazard is an estimate of the degree of physical and chemical deterioration of the soil which can occur due to disturbance of the soil and vegetation. This estimate needs to be made, and the kind of potential deterioration needs to be specified, before appropriate management practices for soil conservation can be formulated.

Soil deterioration can take place under natural conditions. It can happen suddenly, for example, erosion after a heavy rain storm following destruction of the vegetative cover by a bushfire, or it can be a very slow process. Nutrient decline, for example, may occur gradually in some ecosystems where there is high percolation and leaching. On the whole, though, erosion under natural conditions can be regarded as negligible. Many forms of deterioration, however, are initiated and greatly accelerated as a result of human activity. Often this deterioration is so extensive that the original productivity of the land is lost. It is obvious that it is essential to maintain the productivity of the land. A knowledge of the land and its inherent susceptibility to deterioration should be used to determine appropriate land use and any management practices necessary to prevent deterioration.

Types of Deterioration and Management Practices in the Study Area

1. Sheet Erosion

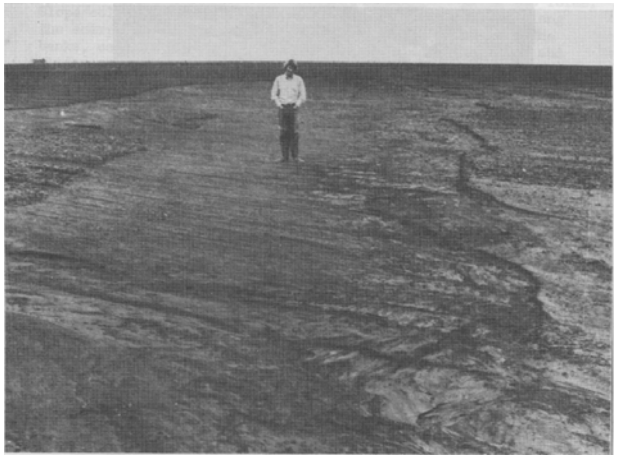
Sheet erosion is the removal of surface soil by overland water flow. This type of deterioration is perhaps the most common type in the survey area where it affects the soils to different degrees depending on slope, surface protection, structure, etc. Soils on the Ordovician and Silurian sediments with hard-setting surfaces are generally the most affected. However, all soil types are prone to sheet erosion, particularly where slopes are steep and the surface soil is exposed.

Geological or natural erosion may be responsible for the shallow soils found on the stony rises of the Wollert land system; sheet erosion may be removing the soil at a sufficiently rapid rate as to prevent the formation of deep soils with a well developed profile.

Maintenance of a good vegetative cover of pasture species, or of bushland where it is uneconomical or undesirable to establish pastures, is essential to slow down the erosion process. Vegetative cover both reduces the amount of overland flow and protects and binds surface soil particles so that they are unable to be transported by surface flow.

2. Rill Erosion

Rill erosion has a similar mechanism to sheet erosion but the removal of soil is more severe and occurs in shallow channels formed by a concentration of water. As with sheet erosion, it is currently more common on soils developed from Ordovician and Silurian sediments. (Photograph No. 2).

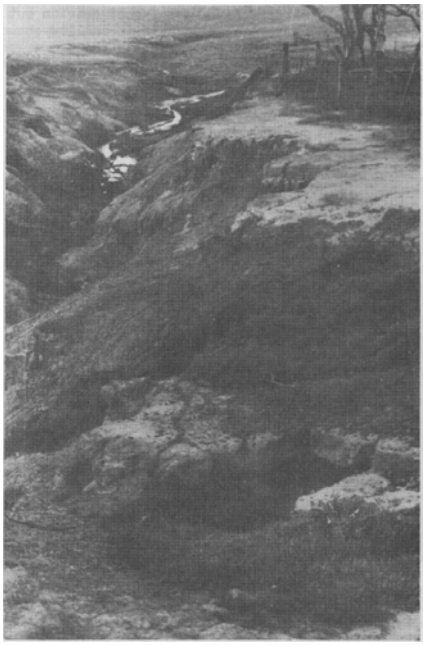


Photograph 2 — Rill and sheet erosion

Management practices should include the ones mentioned above as well as reducing effective slope length by strip cropping, ploughing on the contour or at a slight angle to it, minimum tillage, and leaving the soil in rough clods.

3. Gully Erosion

Gully erosion is the development of deep channels by the action of water, both localised surface flow and concentrated sub-surface seepage. This type of erosion usually occurs where there are dispersible clayey subsoils and is accentuated on slopes and where vegetation has been cleared. In the study area, soils and topography developed on Ordovician and Silurian sediments, in particular, often have these susceptible soils. For example, gully erosion is quite common in the Darraweit Guim, Marnong, Springfield, Mernda, Doreen and Arthurs Creek land systems, all on Silurian sediments, and in the Sunbury land system on Ordovician sediments. (Photograph No. 3).



Photograph 3 - Gully and tunnel erosion

Management practices should aim at spreading the surface runoff evenly and reducing the amount of water infiltrating through the subsoil. Decreased infiltration can be brought about by increasing the cover of both shallow and deep-rooted perennial plant species - this increases the amount of water lost from the soil by transpiration.

4. Tunnel Erosion

Tunnel erosion or piping is the formation of conduits in the sub-soil by the percolation of water and usually occurs where unstable (dispersible) clays are present. This type of deterioration is usually the beginning of gully erosion as the topsoil collapses into the cavities formed and is carried away by water, leaving a channel. The conditions required for its onset are therefore the same as those for gully erosion. (Photograph No. 3).

Management practices to prevent tunnel erosion are identical to those which help to prevent gully erosion and rill erosion, i.e. those which decrease surface flow and the amount of infiltrating water.

5. Mass Movement

Mass movement is migration down the slope of soil and/or rock by the action of gravity, often aided by saturated conditions in the deep subsoil or parent rock.

In the survey area this type of deterioration occurs in two forms. Slope collapse occurs as a natural geological phenomenon along the scarps of the Deep Creek where the river has undercut the banks, causing the basaltic scarps to collapse. Landslips and slides occur in the Mt. William land system (Photograph No. 4) where removal of trees has increased the water content of the subsoil. This increased water content, combined with soil properties such as high clay content, has enabled the surface soil to slide over the underlying subsoil.

Photograph 4 - Mass movement

Management practices should focus only on areas where significant economical damage is done by such mass movements. The risk of landslips and slides can be diminished by controlling runoff, infiltration and seepage. Retaining a sufficiently large number of trees can help to achieve this.

6. Salting

Salting is the accumulation of soluble salts in low lying areas. Plant species differ in their ability to survive in salinised areas, e.g. clovers and cocksfoot can tolerate low salt concentrations and phalaris and lucerne high salt concentrations. Salt pans develop where salt levels are too high for any plant to survive.

Within the study area there are few areas affected by salting. One area is on the eastern boundary of the Silurian sediments (in Marnong land system) and the basalt flow (in Mickleham land system). It seems that water percolating through the Paleozoic sediments picks up salts in the subsoil and flows to the surface at the junction of the sedimentary rocks and the basalt, resulting in the accumulation of salt (Photograph No. 5). Salting can also be found in soils on sedimentary rocks along road reserves where there have been drainage blockages (Photograph No. 6).

Photograph 5 - Salt affected area

Management to prevent or restrict salting must take the water-balance of the locality into account. Large-scale clearing of bush, with subsequent establishment of shallow-rooted or annual pasture species, is causing a much greater proportion of the infiltrating rain water to escape below the root zone than before. This increased seasonal seepage flows towards low lying areas, picking up some salt on the way. It not only increases the salt concentration of the groundwater but causes this now salty groundwater to rise to the surface in the depressions. Thus, the use of deep-rooted perennial pasture species to use up more water is part of good management.

7. Wind Erosion

Wind erosion is the loss of soil by the action of wind. Although conditions necessary for severe wind erosion are not present in the study area, windbreaks, stubble mulch tillage, leaving a rough surface after cultivation and crop rotations (including a pasture phase) are some practices which can be used to ensure that this type of erosion is minimal.

Photograph 6 - Salting due to drainage blockage