5.5 Land degradation: incidence and susceptibility

The fragile nature of our soils and landscapes, coupled with intensive land use, can result in deterioration of the land resource. In this particular study we look at the potential of a soil to resist degradation under different management systems. Some land deterioration processes are natural, such as soil creep, but their rate has been accelerated since European settlement and associated changes in land use. The Shire of Romsey hosts many different uses, as outlined in the Land Use section, and contains a wide variety of landscapes and soils with varying resistance to land degradation. More detailed information on a particular map units susceptibility to degradation is outlined in Section 4.2.

5.5.1 Dryland salinity

Dryland salinity is the result of saline ground water reaching the soil surface or plant root zone and affecting plant growth and soil properties. It is caused by excess water infiltrating through the soil profile into the groundwater system. This process is aggravated in areas where native vegetation has been removed and replaced with shallow-rooted species, causing rain water, in excess of plant requirements to run off as surface flow or peculate through the profile to the groundwater table. The ground water level then rises until it reaches the surface at lower points in the landscape.

The areas within the landscape that contribute to the groundwater are known as recharge areas. The areas showing signs of salinity and high watertables are discharge areas. High recharge areas generally have shallow soils which contain a large percentage of coarse material, such as gravel or sand. They usually occur on the higher parts of the landscape such as ridges and crests. Potential recharge refers to the ability of an area to contribute to the groundwater system. Land management has a major influence on recharge to groundwater, for example, an area has a high potential recharge but because of existing dense tree cover, accession to the groundwater is low. However, accession would be high if the trees were replaced with shallow-rooted native pastures.

Contributions to the groundwater system can be either on a regional basis; carried through to adjacent sub catchments, or local; within the sub catchment boundary. The Shire of Romsey, with its range of geomorphological types, possesses a number of potentially high recharge areas. High recharge areas include the yellow granitic crests and steep slopes (Dg2a, Dg2b), the basalt cones and steep slopes and areas with greater than 50% rock outcrop (Qba, Qbb, Qbr), the steep crests and slopes and the moderately steep slopes of the Kerrie Conglomerate (Dsa, Dsb, Dsc).

5.5.2 Sheet Erosion

Sheet erosion arises when the forces due to rainfall, flowing water and gravity overcome the cohesion and weight of the soil particles. This usually occurs when rainfall exceeds the infiltration capacity of the soil and run-off results.

The soils most susceptible to sheet erosion have low infiltration capacities, occur on steep slopes, have heavy textures, poor structure and are dispersive, and have minimal vegetation cover. They generally have had a change in land management from native vegetation cover to cropping or grazing.

Landscapes that are highly susceptible to sheet or rill erosion in the Shire are the steep and moderately steep slopes and steep drainage depressions of the sedimentary lithologies (Ssb, Ssc, Ssh), the steeply sloping hills of the Devonian sediments (Dsb), the steep and moderately steep slopes of the basalt and volcanic lithologies (Qbb, Qvb, Qvc), granitic steep slopes and steep drainage depressions, (Dg2b, Dg2h, Dg1b) and the steeply sloping drainage depressions of the rhyodacite (Drh) (see figure 5.8). Sheet erosion also occurs on all of the Mount William Complexes.

5.5.3 Gully Erosion

Gully erosion is the removal of soil resulting in the forming of channels deeper than 300 mm that will disrupt normal farming operations (Charman and Murphy 1991). Gullies generally evolve in drainage lines where runoff and seepage accumulates. The lower drainage lines in the catchment are particularly prone as they receive a greater volume of water. Gullies are most common in catchments with moderate to steep slopes and where native vegetation removal is extensive (see Figure 5.9).

Figure 5.8 Sheet erosion on the on the steep sedimentary hills

Figure 5.9 Gully erosion on the sedimentary lithology

5.5.4 Mass movement

Mass movement occurs when gravitational stresses on soils exceed resistance and the soil moves down slope. Usually a combination of factors will contribute to mass movement. Rock and soil weathering, increases in soil water content, vegetation removal, slope and man made interferences, such as road building, are all important causes. There is a high occurrence of mass movement on the greenstone slumps of the Mount William 1 complex and the Ordovician sediments and the Cambrian chert of the Mount William 2 complex. Some steep and moderately steep slopes throughout the Shire are highly susceptible to mass movement (Dg1b, Drb, Drc, Qvc, Qvb, Qbb, Dsb).

5.5.5 Wind erosion

Wind erosion is the movement of soil particles by wind. It occurs on soils of light texture under conditions of low rainfall and strong winds, and is most extensive on the inland farming areas where rainfall is below 375 mm per annum (Charman and Murphy 1991). The incidence of wind erosion is relatively low in the Shire, although exposed crests on the volcanic, basalt and granitic soils are susceptible due to their light textured topsoils (Qva, Qba, Dg1a, Dg2a). Other areas with light textured topsoils and a high organic matter content is ostensibly highly susceptible to wind erosion (Drh, Dg2c, Qvc, Qbf, Ssh), although they are seldom exposed to the elements.

5.5.6 Soil structure decline

Soil structure decline is a result of cropping practices. It costs the State approximately $40 million per annum in lost productivity and unfortunately is difficult to detect and often goes unrecognised. Traditional cultivation techniques, not designed for Australia's weakly structured topsoils, break down soil aggregates into finer particles. These finer particles can slump together forming a seal on the soil surface that impedes the flow of water and air. This reduction in permeability and aeration decreases plant germination and growth, and increases run-off and consequently soil erosion. Excessive cultivation can also produce a hard pan at the bottom of the cultivation layer. As cultivation is not common in the Shire, soil structure decline is not a major concern.

5.5.7 Soil acidification

Soil acidification is a land degradation problem that has only been recognised in recent years. It involves declining pH values to levels low enough to retard plant growth through associated nutritional and microbiological changes (Maheswaran and Crawford 1992). This decline is caused by a number of processes associated with agricultural systems: application of ammonium based fertilisers, large amounts of product removal and nitrate leaching from subclover based pastures.

Soil types most susceptible to soil acidity include those with light textures, low organic matter contents and moderate acidity, and those used for agriculture (Maheswaran and Crawford 1992).