Chapter 1

Acidification - a major form of land degradation.

Introduction

Degradation of agricultural soils in many parts of the world is related to several processes including water and wind erosion, waterlogging, salinisation and acidification. Soil pH decline in agricultural systems can be attributed to the use of intensive farming practices. Farming practices such as continuous cropping, long-term cultivation and the introduction of long-term annual pastures, which usually contain a legume such as subterranean clover (*Trifolium subterraneum*), have all had an enormous impact on soil degradation processes. (*State of the Environment Report 1991*)

In particular, the concept that soil acidity may be affecting plant production came from the pioneering work of Williams and Donald (1957) and Williams (1980), who showed that soils around Canberra under continuous pasture systems gradually became more acid.

Soil acidification is a naturally occurring process in soil formation; however, significant changes imposed upon the native ecosystem by intensive farming systems have greatly accelerated this process. It is generally recognised that acid inputs into the soil arising from the biological carbon and nitrogen cycles are the most significant in pastoral and crop systems (Helyar and Porter 1989).

The consequences of soil acidification have a number of implications for rural and urban communities, including:

- Reduced farm productivity
- Loss of ability to grow crops of higher economic value
- Reduced farm income and associated flow-on effects
- Secondary impacts: increased salinity, erosion, soil structural decline and water quality impacts.

It is estimated that 23% of Victoria's agricultural land is losing production due to acid soils.

Land degradation through the action of soil acidification is estimated to have affected some 90 million hectares of agriculturally productive land in Australia, where between 29 and 35 million of those hectares are highly acid with a pH_{Ca}<4.8 (Chartres *et al.* 1990, AACM 1995). Lost productivity on these soils has been attributed to a decline in soil fertility and the development of toxic levels of aluminium. For these soils there have been few solutions other than to ameliorate them with lime.

In Victoria, approximately 3 million hectares of agricultural land or 23% of the state's agriculturally productive soils are estimated to be affected by losses in productivity due to acidity (Parnell *et al.* 1992). More than half of the affected soils are located in north-eastern Victoria, including about 400,000 ha of cropping land (Coventry and Maden 1989). The distribution of strongly acid soils and other soils at risk from acidification in south-eastern Australia is shown in Figure 2

Surface soil pH_{Ca} - present

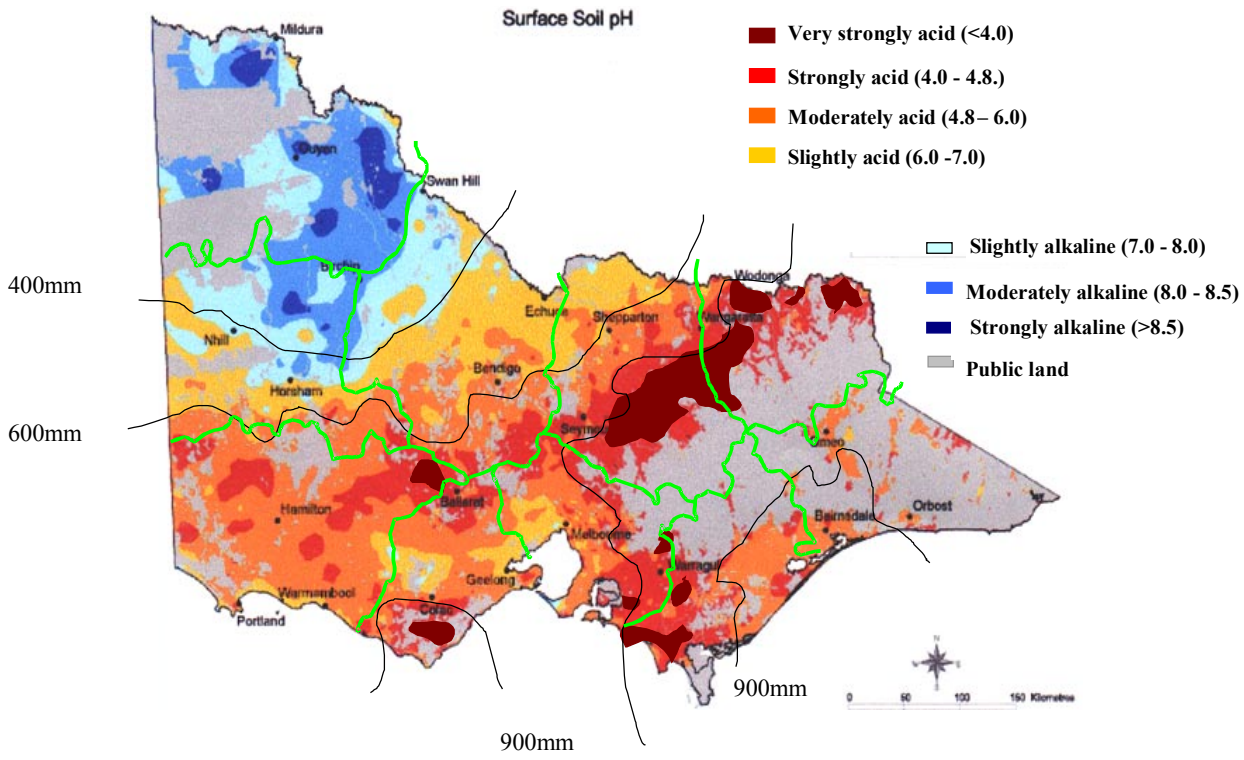

Figure 2. Estimation of surface soil pH_{Ca} in Victoria at present

This broadscale map was generated by NRE's State Chemistry Laboratory who applied geo-statistical techniques ('kriging') to the mean pH of the locations (+/- 0.5 of a pH unit). It indicates the geographic trends in the acidity and alkalinity of surface soils across Victoria's agricultural land. This map cannot indicate soil pH at the paddock scale and it should only be used as an indicator of likely pH at a regional scale. Considerable variations in soil pH will occur within a region. This map is published on the Victorian Resources Online website (www.nre.vic.gov.au/vro).