effects in forest growth. Forest liming is further complicated because the inaccessibility of forests makes application difficult (Bache 1980).

Sweden is one of the few countries where forest liming is practised. The first attempts to lime forest lands in Sweden were made 67 years ago. The most recent lime applications were made at a rate of 5 - 10 metric tons/ha on 0.2 hectare plots in 12 areas. Various combinations of fertilizer were also applied. It was pointed out (Fraser et al. 1982) that after 25 years 50% of the lime was not leached from the soil. Research from 1971 to 1978 at Lisselbo (Fraser et al. 1982) where sulphuric acid and lime were applied to plots, was described. Annual precipitation of 700 mm leaches between 2.0% and 11.6% of the lime since application. Two preliminary conclusions from these studies are important: (1) liming has little effect on the growth of forest trees and (2) lime persists in undisturbed forest soils, despite 700 mm of annual precipitation.

Tveite and Abrahamsen (1980) report the results of field experiments located in two different areas of southern Norway. The authors present results from the Norwegian field experiments with artificial acidic deposition and liming added to pine and spruce forests. All experiments included treatment with 25 or 50 mm/month of artificial acidic deposition with different pH, applied during the frost-free time of the year. After five years of treatment no negative growth effects of the acid applications are apparent and there were no effects of liming found.

No useful purpose would be served by documenting here a comprehensive list of such trials, but a few typical published results exemplify the unattractiveness of the approach. For 45-year old jack pine (Pinus banksiana Lamb.) in the Boreal Forest of Ontario, calcium at 448 kg/ha gave no response except where nitrogen, phosphorus and potassium had also been applied (Morrison et al. 1977b). A further trial with 55-year old but poorer quality jack pine, also north of Lake Superior, again only showed a growth response to lime where nitrogen, phosphorus and potassium has also been applied. Indeed, the suggestion was the lime by itself exercised a depressive effect upon growth by adversely affecting soil microbiological processes (Morrison et al. 1977a). The complexity of lime effects is apparent from the work of Adams and his colleagues (1978) on the acid peaty gleys of Northern Ireland. There, lime did not increase the growth of Sitka spruce (Picea sitchensis Carr.), but it did affect the soil microbiology and the viability of the mycorrhizal root association. As might be expected, the pH of the litter was raised from 4.0 to 6.0 - 6.5, a result that has been of serious concern to those aware of the optimum soil conditions for the spread of rot fungi such as Formes annosus (de Azevedo and Moniz 1974).

The possible effects associated with liming forested ecosystems are still unknown but experiments of watershed liming may provide some insight. Bengtsson et al. (1980) report on experiments of watershed