the scope for lime in temperate and boreal forestry is much more limited. Moreover, few field trials have been concerned with entire forested catchments. In this sub-section positive and negative aspects of the liming technique will be discussed.

Numerous calcium-based alkaline materials are available for the neutralization of acidified soil. However, for most situations, crushed limestone ($CaCO_3$), flaked or hydrated lime ($Ca(OH)_2$), and unslaked lime or quicklime (CaO) are the most readily available and effective materials. A variety of substances have been proposed for use as neutralization agents (Grahn and Hultberg 1975).

The data available up to now do not indicate obvious effects on forest ecosystems caused by acid deposition. However, the potential of the available techniques for remedial action warrant examination in the event that subsequent data indicate forest degradation.

9.3.1 The Application of Lime to Agricultural Soils

Microorganisms and higher plants respond to their chemical environment, and soil kinetics are a key factor in determining agricultural soil productivity. There are two major groups of factors which bring about large changes in soil pH: (1) those which result in increased adsorbed hydrogen and in turn release aluminum, and (2) those which increase the content of adsorbed bases. Both organic and inorganic acids are formed when organic matter is decomposed. The simplest and perhaps the most widely found is carbonic acid (H_2CO_3) which results from the reaction of CO_2 and water. The solvent action of H_2CO_3 on the mineral constituents of the soil is exemplified by its dissolution of limestone or calcium carbonate. Because carbonic acid is relatively weak, it cannot account for the low pH values found in many soils. Inorganic acids such as H_2SO_4 and HNO_3 are suppliers of hydrogen ions in the soil. These acids, along with the organic acids, contribute to the development of acid conditions. Sulphuric and nitric acids are formed, not only by the organic decay processes, but also from the microbial action on certain fertilizer materials such as sulphur and ammonium sulphate. In the latter case both nitric and sulphuric acids are formed.

Podzolization is an example of a process by which strong organic acids are formed. The organic debris is attacked largely by fungi which have among their important metabolic end products relatively complex but strong organic acids. As these are leached into the mineral portion of the soil, they not only supply hydrogen for adsorption, but they also replace bases and encourage their solution from the soil minerals. Leaching also encourages acidity. Therefore, bases which have been replaced from the colloidal complex or which have been dissolved by percolating acids are removed in the drainage waters. This process encourages the development of acidity in an indirect way by removing those metallic cations which might compete with hydrogen and aluminum on the exchange complex.