INTRODUCTION

What is soil?

Soil is a natural mixture of inorganic and organic solids, air, water, and microorganisms. All these phases, influence each other, they also interact with the rest of the environment.

Reactions in the soils solids affect water and air quality, water and air weather the solids, and microorganisms catalyze many of the reactions. Soil chemistry involves all these reactions but emphasizes on the soil solution that is, the thin aqueous film surrounding soil particles.

Soil-ion interactions

The study of soil chemistry was first started by people who were interested in plant growth and crop production, that is soil fertility specialists. However, soil chemistry became a separate (though related) field from soil fertility about one hundred and fifty years ago when cation exchange reactions in soils were discovered. From that point people realized that soils could be studied apart from plants, yet the results would still have implications for plant growth, soil fertility, and environmental quality.
As you know, the immediate sources of nutrients that plants can take up are solutes, electrolytes, and non electrolytes in the soil solution. There are many processes that can control the entry of ions and molecules into the soil solution. Some of the major processes are:

1. Mineral weathering, for example the dissolution of feldspar to form kaolinite.
   
   \[ 2\text{KAlSi}_3\text{O}_8 + 9\text{H}_2\text{O} + 2\text{H}^+ = \text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4 + 2\text{K}^+ + 4\text{Si(OH)}_4 \]

2. Organic matter decomposition that releases N, S and many other nutrients; complication of metals by organic acids.

3. Irrigation and rain that add salts to the soil.

4. Fertilization, liming.

5. Adsorption, desorption by clays, for example, phosphate sorption, potassium fixation.

6. Oxidation/reduction (redox)
   
   \[ \text{Fe}^{3+} + e^- \longrightarrow \text{Fe}^{2+} \]