CHAPTER

7 Tropical rain forests

SECTION A

Soils

Soils are a synthesis of organic and inorganic matter. In tropical humid climates, where both constituents are in abundance, the soils that develop can only be regarded with surprise. A typical tropical rain forest soil has a thin topsoil, and is low in nutrient content, poorly sorted and relatively infertile. The zonal soil group is referred to as **laterite** or **latisol** and the basic characteristics are shown in **7.1**. These soils are partially studied or mapped, and the uniform vegetation cover hides a considerable variety of soil types.

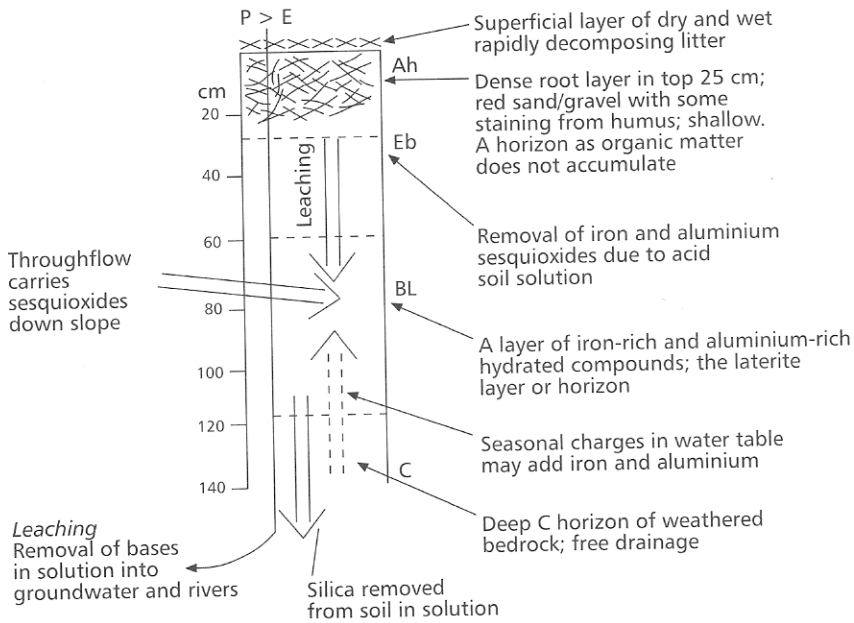

Figure 7.1 A generalised profile of a tropical humid soil

Tropical humid soils tend to share four main characteristics (**7.1**):

- **Acidity** Tropical forest soils are naturally acidic. With precipitation greater than evaporation, the dominant movement of water is downwards and this removes bases in solution (**leaching**). Infiltrating water gains acidity from organic acids that are released as organic matter decomposes, thus forming an acidic soil solution. Through cation exchange, hydrogen in the soil solution is exchanged with nutrients stored on clay and humus particles. The nutrients are removed in solution into groundwater, and eventually into rivers. Over

time, this causes a build-up of hydrogen in the soil, increasing acidity and the loss of nutrients from the soil. This results in a loss of fertility. With precipitation frequently over 3000 mm and evaporation of approximately 350 mm, leaching is a dominant process in the humid Tropics.

- **Depth** Tropical humid soils often develop on deep accumulations of regolith and have extended B and C horizons of up to 100 m. The subsoil dominates, with slightly modified weathered parent material. It is this that determines the soil colour, the brown/black staining of humus usually being absent. This allows large volumes of precipitation to infiltrate before the soil reaches saturation and reduces rates of surface run-off.
- **Iron concentrations** Latisols are frequently red in colour, indicating an accumulation of ferric compounds. The acidic soil water breaks down clay particles into silica and sesquioxides (iron and aluminium compounds in clay). Under high temperatures, the silica is moved downwards while the sesquioxides are retained in the upper soil. This process is termed **ferrallitisation**. This produces a relatively infertile soil, as the laterite horizon is low in nutrients and concentrated iron is toxic to plants. When the soil is exposed and dries, it produces a resistant crust and breaks down to form a fine red dust which is susceptible to aeolian erosion. The surface accumulation of iron and aluminium is often too great to have just originated from clay in the upper soil horizons. It is thought that there is a lateral movement of sesquioxides in solution, as these soils frequently occur at the base of slopes where groundwater collects. After deforestation, the surface is exposed to direct sunlight, causing increased evaporation and the upward movement of groundwater. This produces a red, iron-rich surface layer (**plinthite**) that bakes to a hard crust in dry periods and becomes sticky mud after heavy rain.
- **Humus** Although fall-out from tropical forest vegetation is high, humus accumulation in the soil is low. Typically, organic matter is limited to the top 10 cm and there is little incorporation into the lower horizons. This occurs because of the extremely rapid breakdown of surface organic matter and the rapid leaching of organic material. At the base of slopes or in poorly drained areas (in particular, abandoned river channels), peaty soils develop, with far greater concentrations of organic material.

Review

1 Try to explain what is meant by the term **soil fertility**.

2 Explain why tropical humid soils:

- tend to have a low content of organic matter
- are often rich in iron and aluminium.

3 Why is leaching such a vigorous process in tropical humid soils?