

Figure 4-5 The global consumption of pesticides, 1948-1968  
Source: Data from FAO 1970b.

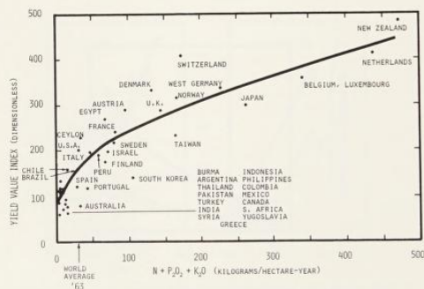


Figure 4-6 Decreasing returns to fertilizer use  
Source: Williams and Couston 1962.

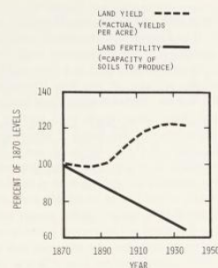


Figure 4-7 Land fertility decrease in Ohio, U.S.A., 1870-1938

*The high yields are maintained through modern agricultural inputs (fertilizer, pesticides, and machinery), even though the natural capacity of the soil to produce seems to be decreasing.*  
Source: Salter, Lewis, and Slipper 1941.

### 4.3 BASIC CONCEPTS

#### Definitions of Food and Arable Land

Food is produced not only by the cultivation of arable land, although land cultivation is at present by far the most important source of food for human consumption. Other sources of food are the ocean and the world's grazing lands (lands that cannot be cultivated but still produce vegetation in amounts that can sustain grazing animals). However, the current and potential food output from fisheries and from livestock feeding on grazing land is small compared with the food output from the cultivation of arable land, as we shall show in the following paragraphs. Because we believe that these other sources of food are relatively insignificant and will remain so, we chose to neglect food obtained from the ocean and from grazing land in World3.

The world's grazing lands currently cover 3.6 billion hectares, an area somewhat larger than the potentially arable land area of 3.2 billion hectares (see Figure 4-17). The average carrying capacity of the world's grazing lands is roughly 1 animal unit per 20 hectares (PSAC 1967, vol. 2, p. 429), where 1 animal unit is equivalent to the production of 100 kilograms of meat per year. If it is assumed that 7 kilograms of vegetable crops are needed to produce 1 kilogram of meat (see section 4.5, loop 1), this yield amounts to 35 vegetable-equivalent kilograms per hectare-year. Thus the vegetable-equivalent food yield from grazing land is low even compared with the traditional yield of 600 vegetable-equivalent kilograms per hectare-year that can typi-