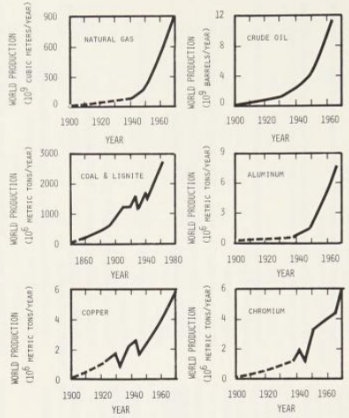
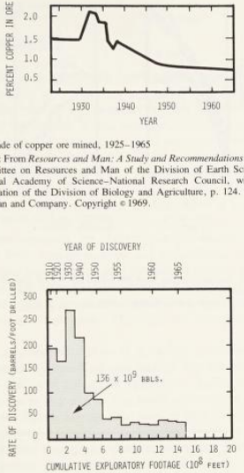


Figure 5-2 Exponential growth in world production of nonrenewable resources
Sources: Data from CRAM 1969, *Minerals Yearbook* 1970, U.N. 1970.

and Morse 1963). Figure 5-4 shows the cost per unit of product for the aggregate U.S. minerals industry from 1870 to 1957. There are a few potentially significant exceptions; for example, Figure 5-5 shows that the long-term trend of natural gas exploration is toward rising costs.

In addition to long-term cost trends, resource prices often reflect short-term cost fluctuations caused by delays in the acquisition of new production capacity. However, because the primary purpose of the model is to explain long-term trends, short-term fluctuations are not represented. An explanation of the dynamic determinants of resource commodity price cycles can be found in Meadows (1970).

Another long-term trend in the supply of global nonrenewable resources is the increasing dependence of the more industrialized countries on the resources of the developing countries. A prime example is oil in the United States. Until 1948 the United States was a net exporter of oil, but by 1970 it was importing 22 percent of its



A. Grade of copper ore mined, 1925–1965
Source: From *Resources and Man: A Study and Recommendations* by the Committee on Resources and Man of the Division of Earth Sciences, National Academy of Science–National Research Council, with the cooperation of the Division of Biology and Agriculture, p. 124. W. H. Freeman and Company. Copyright © 1969.

B. Crude oil discoveries per foot of exploratory footage in the United States, exclusive of Alaska, 1860–1967
Source: Hubbert 1967, p. 2223.

Figure 5-3 Declining grade of copper ore mined and declining returns to exploratory drilling for crude oil

oil (NPC 1971, p. 13), and this percentage has been steadily increasing. Although this trend may have a profound influence on the world economy in the future, in World3 its effects were considered to be mainly political in nature and were not modeled.*

*The international political implications of resource scarcity are to be studied under National Science Foundation Grant no. GI-34808X, a research project titled "The Dynamics of Long-Term Resource Availability" to be conducted at the Thayer School of Engineering, Dartmouth College, from 1972 to 1975.