lustrates the behavior mode of the model as the simulation is continued to the year 2100. The succeeding sensitivity tests and policy runs are presented in the same format to facilitate their comparison with the reference run. Two plots of additional variables from the reference run are given in Runs 7-6B and 7-6C (Figures 7-8 and 7-9, respectively) to provide a more thorough understanding of the mechanisms responsible for the observed behavior.

World3 Reference Run Run 7-6A (Figure 7-7) depicts the behavior of the seven major model variables as the world model is run from 1900 to 2100. This run assumes that the general values and policies that guided the world system from 1900 to 1970 will continue into the future. The global population, after reaching the 1970 level of 3.6 billion people, continues to grow to a level of 6 billion in the year 2000 and peaks at about 7 billion in the year 2030. After that time, the crude death rate CDR exceeds the crude birth rate CBR, so the population POP declines. Food per capita FPC rises steadily throughout the twentieth century to more than 500 vegetable-equivalent kilograms per person-year, but it declines sharply after 2015. Industrial output per capita IOPC reaches a maximum value of 375 dollars per person-year in 2015. The index of persistent pollution PPOLX reaches a peak of 11 times the 1970 level of pollution in the year 2035.

The behavior mode exhibited by the reference run shown in Figure 7-7 is overshoot and decline. Population and capital grow past their sustainable physical limits and then return to a preindustrial level of development. Growth is halted in this run through the effects of nonrenewable resource depletion.

Additional Variables from the Reference Run The reference run can be better understood by examining the behavior of several additional model variables from the same computer run, shown in Run 7-6B (Figure 7-8) and Run 7-6C (Figure 7-9). As the nonrenewable resource fraction remaining NRFR drops below 0.5 in the year 2015, the fraction of capital that must be allocated to obtaining those resources FCAOR begins to rise above its minimum level of 0.05 (Run 7-6B). Thus industrial capital must be diverted from the production of industrial output toward obtaining the resources necessary to sustain that output. When investment in industrial capital no longer exceeds depreciation, the industrial capital base declines, reducing industrial output IO and industrial output per capita IOPC.

As industrial output IO declines, the total agricultural investment TAI is also forced to decrease (Run 7-6B), even though the agriculture sector tries to compensate for the reduction in food per capita FPC by increasing the fraction of industrial output allocated to agriculture FIOAA after the year 2025.* The decrease in total agricultural investment TAI causes the agricultural inputs per hectare AIPH to decline after a short delay. Because the model's agricultural sector is highly capital intensive at this stage of its development, a decrease in agricultural inputs per hectare AIPH

*FIOAA declines again after 2040, however, as the decline in industrial output per capita IOPC causes a decline in the indicated food per capita IFPC.

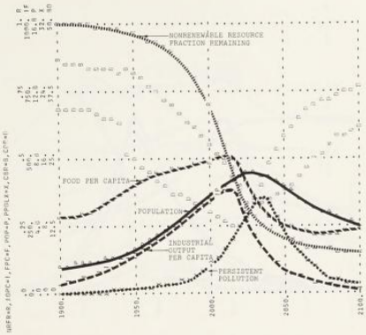

Figure 7-7 Run 7-6A: World3 reference run
This is the World3 reference run, to be compared with the sensitivity and policy tests that follow. Both population POP and industrial output per capita IOPC grow beyond sustainable levels and subsequently decline. The cause of their decline is traceable to the depletion of nonrenewable resources. Runs 7-6B and 7-6C illustrate the mechanisms that force population POP and industrial output per capita IOPC to decline.

immediately depresses land yield LY, that is, the amount of food per hectare harvested from the arable land AL under cultivation (Run 7-6C). The decline in yields causes food per capita FPC to decrease sharply after 2015, and as FPC nears the level of subsistence the lifetime multiplier from food LMF begins to decline. This chain of causal interactions eventually forces the population POP to decline after the year 2030.

It should be emphasized that the reference run (Figure 7-7) is not a prediction of the precise values of any of the model variables in the future, nor does it necessarily represent the most likely behavior mode of the real world. It is termed the reference run only because the output is obtained from the reference model structure and parameters; it is unchanged by any new policies, technologies, or values. The strongest statement of certainty we can make about this run is that it represents the most likely behavior mode of the system if the process of industrialization in the future proceeds in a way very similar to its progress in the past, and if the technologies and value