sure on the adaptive technological process, for technological advances of smaller magnitudes and costs are now able to keep resource usage, pollution, and food per capita at their desired levels. Since physical growth has been slowed, the delays in technological development and implementation are also less critical to their effectiveness. In Run 7-29 the stable behavior is maintained through the year 2100, whereas in earlier runs (7-22 and 7-23) the attempts to maintain growth by the continual application of technological policies caused the system to decline within the 200-year time horizon of the model.

Stabilization Policies Introduced in the Year 2000 Run 7-30 (Figure 7-41) shows the behavior of the model if the adaptive technological and social policies outlined in the previous run are not implemented until the year 2000. Postponing the implementation of these policies allows the growth of population POP and industrial output per capita IOPC to continue for an additional 25 years. In this period, population POP increases by another 2 billion people and industrial output per capita IOPC almost doubles. In the year 2000, social and technological policies are implemented in an attempt to stabilize population and industrial output per capita. Because of the higher population POP and industrial output per capita IOPC in that year, however, the magnitude of the technological advances required to reduce resource consumption, reduce pollution, and increase food per capita to their desired levels is considerably greater than in the previous run. Thus the capital costs of the new technologies must be considerably higher than those of the technologies developed 25 years earlier (Run 7-29). These higher costs cause industrial output per capita IOPC to decline after the year 2030.

Run 7-30 shows that, in the growing world system, the postponement of stabilization policies for a number of years may render the policies less and less effective. At any given time numerous equilibrium states are possible for the system, each having various combinations of population, capital, and food, service, or agricultural outputs. However, continued physical growth limits society's options for achieving a stable state. In addition, the policies necessary to reach an equilibrium state become more stringent and more costly. Runs 7-28 and 7-29 suggest that, because of the delays in the system, equilibrium cannot be attained immediately—even with rather optimistic assumptions about technological and social changes. Run 7-30 indicates that the sooner the approach to such a state is begun, the more favorable and sustainable the outcome will be.

The general conclusions reached from our analysis of the World3 model are summarized in Chapter 8. The runs described in this section demonstrate that a carefully planned combination of social and technological policies can circumvent the overshoot and decline mode of behavior and move the model system toward long-term equilibrium (Runs 7-28 and 7-29). The selected combinations of policies in those runs are successful because they act to offset the three system characteristics that cause overshoot and decline: (1) the stabilization of population and capital eliminates the continually increasing pressures on the global carrying capacity; (2) by anticipating the signals that indicate the detrimental effects of continued growth, the stabilization of population and capital circumvents the delays in the feedback processes that control growth; and (3) even though growth is stabilized, new and improved technologies are needed to offset the continuing depletion of nonrenewable resources, pollution accumulation, land erosion, and land fertility degradation in the World3 model. Finally, Run 7-30 indicates that even a 25-year postponement of the combined social and technological policies of the two previous runs will severely reduce their effectiveness. In the finite world system modeled in World3, society will attain a more favorable and sustainable equilibrium state the sooner it begins to manage the transition to global equilibrium.

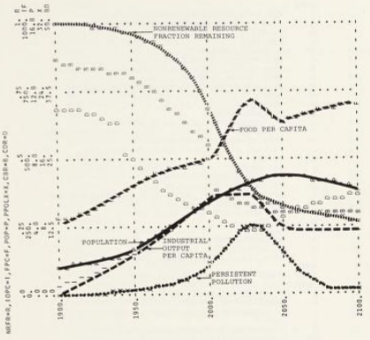

Figure 7-41 Run 7-30: stabilization policies introduced in the year 2000
The combination of adaptive technological and social policies of the previous run are not introduced until the year 2000. The continuation of growth for an additional 25 years further erodes the carrying capacity of World3; therefore, the policies that led to equilibrium 25 years earlier are no longer effective.

APPENDIX: PROGRAM LISTING OF WORLD MODEL EQUATIONS

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*     WORLD3: THE DYNAMICS OF GROWTH IN A FINITE WORLD
NOTE  STANDARD MODEL
NOTE
NOTE  POPULATION SECTOR
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