influence on social policy, the prediction itself may change the system's behavior. Second, the incomplete and inaccurate world data base currently available does not permit precision, even for conditional long-term predictions of social systems. Thus purposes 1 and 2 do not appear to be feasible goals for a long-term social model.

Although precise long-term predictions for social systems do not seem to be attainable, a conditional, imprecise understanding of the global system's dynamic properties is possible. That level of knowledge is less satisfactory than a perfect, precise prediction would be, but it is still a significant advance over the level of understanding permitted by current mental models. It should provide a useful input to future policy decisions—about population control, energy consumption, and investments in new technologies, for example—that will have a significant impact on human society for many decades to come.

Figure 1-1 illustrates the four possible behavior modes that a growing population can exhibit over time. The mode actually observed in any specific case will depend on the characteristics of the carrying capacity—the level of population that could be sustained indefinitely by the prevailing physical, political, and biological systems —and on the nature of the growth process itself. One of these basic behavior modes must characterize any physically growing quantity, such as pollution, productive capital, or food output. *The purpose of World3 is to determine which of the behavior modes shown in Figure 1-1 is most characteristic of the globe's population and material outputs under different conditions and to identify the future policies that may lead to a stable rather than an unstable behavior mode.*

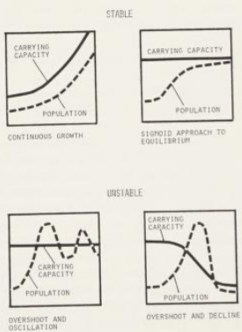

Figure 1-1 Four possible modes of population growth

1.5 DEFINITION OF MODEL TIME HORIZON

The time horizon of a model is the period over which the modeler is interested in the system's behavior. That period usually corresponds either to the time necessary for the system to manifest a behavior mode of interest or to the time required for the system to respond fully to some proposed new set of policies.

A human lifetime is about 70 years, persistent pollutants may circulate in the environment for 50 years, capital equipment may be used for 10 to 50 years, and new technologies may require 30 to 80 years to be developed and implemented globally. Thus the dynamics of human population and capital growth and their interaction with the environmental carrying capacity could extend over more than 100 years. We chose to simulate World3 for two centuries, beginning in 1900. The model's behavior over the 1900–1970 period can be compared with historical behavior for a rough test of model utility. The projection of the model's behavior to the year 2100, about two human lifetimes beyond the present, traces out the future implications of the assumptions we made about the system.

It was mechanically possible to continue the computer analysis past the year 2100. We did not do so because the validity of many important assumptions so far into the future is questionable and because information about developments that might occur beyond the year 2100 could have little impact on present-day decisions.

1.6 IDENTIFICATION OF MAJOR SYSTEM ELEMENTS

The choice of a 200-year time horizon automatically limited the dynamic phenomena we had to include explicitly in the model to events characterized by time constants ranging from 20 to 200 years. For example, the following dynamic phenomena occur over the relevant time period and could conceivably influence the behavior of the system:

Demographic transition
Soil erosion
Displacement of labor with capital
Passage of pollutants through food chains
Health care advances
Resource substitution

All these processes were included explicitly or implicitly as dynamic factors in the model. Events that take place over a very long period, compared with the model's time horizon (ice ages, genetic evolution), or a very short period (minor business cycles, seasonal weather variations) were treated in one of three ways: they were excluded from the model entirely, represented by a constant factor, or subsumed in the model's coefficients.

Even with the exclusion of very long-term and short-term factors, innumerable variables remained that could be incorporated into a world model. Since we were not trying to answer all possible questions about the system, nor to predict its exact future, extensive detail was unnecessary in World3. It was also undesirable because a