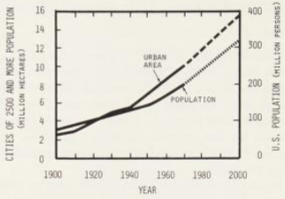

Figure 4-58 U.S. population and urban area
Source: M. Clawson, B. Held, and C. H. Stoddard, *Land for the Future* (Baltimore: The Johns Hopkins University Press for Resources for the Future, 1965), p. 102. Copyright © by The Johns Hopkins University Press.

Year	GNP per Capita (dollars per person-year)	Industrial Output per Capita[1] (dollars per person-year)	Urban-Industrial Land per Capita (hectares per person)
1910	1,500	570	0.093
1920	1,700	650	0.091
1930	1,900	720	0.086
1940	2,200	850	0.093
1950	2,500	980	0.100
1960	2.900	1,160	0.102

[1]GNP data converted to industrial output as shown in Figure 3-3.

Figure 4-59 Urban-industrial land per capita in the United States
Source: U.S.D.A. 1962.

At the present rate of disappearance, several of the Swiss cantons will have lost all tilled land before the end of the century. And Denmark now sees the end to the breaking of new land on the poor marshlands of Jutland in compensation for the good, fertile soils lost to urbanization, etc., on the islands of Fyn and Sjaelland. [Borgstrom 1970*b*, p. 312]

In World3 we hypothesized that the amount of urban industrial land per capita UILPC is a function of the industrial output per capita IOPC. We assumed that most, but not all, of this land is taken from arable land rather than from land without agricultural potential, since cities almost always arise at the heart of an agricultural region, and roads and airports are most cheaply built on level ground. In drawing the relation between urban industrial land per capita UILPC and the industrial output per

capita IOPC shown in Figure 4-60, we also assumed that land use is less extravagant in the world as a whole than in the United States. Further, we assumed that urban-industrial land per capita UILPC in a primitive society amounts to 50 square meters per person or 0.005 hectare per person. This figure is the hypothesized minimum land use, more or less the area of a simple dwelling.

```
UILPC.K=TABHL(UILPCT,IOPC.K,0,1600,200)                    117, A
UILPCT=.005/.008/.015/.025/.04/.055/.07/.08/.09            117.1, T
    UILPC   - URBAN-INDUSTRIAL LAND PER CAPITA (HECTARES/
              PERSON)
    TABHL   - A FUNCTION WITH VALUES SPECIFIED BY A TABLE
    UILPCT  - UILPC TABLE
    IOPC    - INDUSTRIAL OUTPUT PER CAPITA (DOLLARS/
              PERSON-YEAR)
```

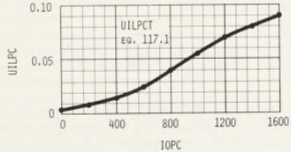

Figure 4-60 Urban-industrial land per capita table

Land Removal for Urban-Industrial Use LRUI The total area of urban-industrial land required UILR by the population POP at any given level of economic development is obtained by multiplying the required per capita use by the population:

```
UILR.K=UILPC.K*POP.K                                       118, A
    UILR    - URBAN-INDUSTRIAL LAND REQUIRED (HECTARES)
    UILPC   - URBAN-INDUSTRIAL LAND PER CAPITA (HECTARES/
              PERSON)
    POP     - POPULATION (PERSONS)
```

The variable UILR expresses a goal: the amount of land needed by the world's population for urban-industrial use. It will increase if either the population or the industrial output per capita increases. We further assumed that the economic system will work to adjust the actual urban-industrial land UIL to the urban-industrial land required UILR goal within a ten-year time period. This adjustment delay of ten years, called the urban-industrial land development time UILDT, represents average planning and construction delays. The assumption was also made that arable land, once used for urban-industrial purposes, cannot be returned to agricultural production (at least not within the 100–200 year time horizon of this study).