```
TABHL  - A FUNCTION WITH VALUES SPECIFIED BY A TABLE
LFDRT  - LFDR TABLE
PPOLX  - INDEX OF PERSISTENT POLLUTION
           (DIMENSIONLESS)
```

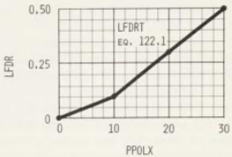

Figure 4-62 Land fertility degradation rate table

The total amount of land fertility degradation LFD occurring in one year, measured in vegetable-equivalent kilograms per hectare-year-year, is obtained by multiplying the current land fertility LFERT by the land fertility degradation rate LFDR:

```
LFD.KL=LFERT.K*LFDR.K                                  123, R
    LFD    - LAND FERTILITY DEGRADATION (VEGETABLE-
                EQUIVALENT KILOGRAMS/HECTARE-YEAR-YEAR)
    LFERT  - LAND FERTILITY (VEGETABLE-EQUIVALENT
                KILOGRAMS/HECTARE-YEAR)
    LFDR   - LAND FERTILITY DEGRADATION RATE (1/YEAR)
```

It is not easy to determine how fast fertility will degrade if no land fertility regeneration efforts are undertaken. The experiment illustrated in Figure 4-63 does indicate land fertility degradation rates of the order of 0.7 percent per year at the intensity used in Illinois in the first half of the twentieth century. This conclusion is based on the assumption that the organic content of soils is a good indicator of land fertility, so that land fertility degrades at the same rate as organic matter disappears. On the other hand, much higher degradation rates—of the order of 10 percent per year—were observed at a similar cultivation intensity in an experiment conducted under tropical conditions in Yambio, Africa, around 1970 (Figure 4-64). The differences in degradation rates may well be explained by differences in the soils, crops, and climate. We assumed an average land fertility degradation rate LFDR equal to 2 percent per year for the pollution level occurring in 1970. We also hypothesized that an agricultural and industrial intensity resulting in a pollution level 30 times the 1970 level will destroy the average land fertility at a rate of 50 percent per year if no efforts are made to counteract the destruction. As the discussion under loop 5 indicates, the natural land fertility regeneration rate assumed in World3 is sufficient to counterbalance some of the degradative forces. Thus, if sufficient funds are allocated to land maintenance, even at the maximum land fertility degradation rate the equilibrium land fertility can be maintained at one-half the inherent land fertility.

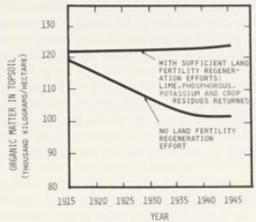

Figure 4-63 The influence of soil treatment on organic matter
Source: Snider 1950.

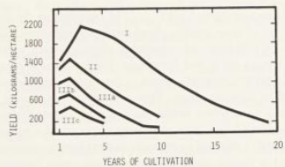

Figure 4-64 The decline of fertility of some Northern Rhodesian soils under continuous cultivation to maize without manure or fertilizers
I indicates stronger red earths and clays,
II indicates transitional soils, and
III indicates light soils.
Source: Allan 1965, p. 95.

Loop 5: Land Fertility Regeneration

We have already indicated that we believe the damage to soil fertility to be reversible; that is, given time, natural processes will restore fertility, and these processes can be enhanced by man. Historically, the regenerative processes seem to have been strong. Certain soils have been cultivated for thousands of years without appreciable reduction of soil fertility, and some may have even increased in fertility. Today, while the intensive use of soil may increase the fertility degradation forces, mankind is also equipped with an unprecedented ability to aid the natural regenerative processes. It is impossible to be certain about the outcome of this new balance of degradation and regeneration. We assumed in the model that the soil fertility will be