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LYMAP,K=CLIP(LYMAP2,K,LYMAP1,K,TIME,K,PYEAR)      105, A
LYMAP - LAND YIELD MULTIPLIER FROM AIR POLLUTION
(DIMENSIONLESS)
CLIP - A FUNCTION SWITCHED DURING THE RUN
LYMAP2 - LYMAP, VALUE AFTER TIME-PYEAR
(DIMENSIONLESS)
LYMAP1 - LYMAP, VALUE BEFORE TIME-PYEAR
(DIMENSIONLESS)
TIME - CURRENT TIME IN THE SIMULATION RUN
PYEAR - YEAR WHEN POLICY IS IMPLEMENTED (YEAR)

LYMAP1,K=TABHL(LYMAP1T,IO,K/1070,0,30,10)           106, A
LYMAP1T=1/1/.7/.4                                  106.1, T
LYMAP1 - LYMAP, VALUE BEFORE TIME-PYEAR
(DIMENSIONLESS)
TABHL - A FUNCTION WITH VALUES SPECIFIED BY A TABLE
LYMAP1T - LYMAP1 TABLE
IO - INDUSTRIAL OUTPUT (DOLLARS/YEAR)
1070 - INDUSTRIAL OUTPUT IN 1970 (DOLLARS/YEAR)

LYMAP2,K=TABHL(LYMAP2T,IO,K/1070,0,30,10)           107, A
LYMAP2T=1/1/.7/.4                                  107.1, T
1070=7.9E11                                          107.2, C
LYMAP2 - LYMAP, VALUE AFTER TIME-PYEAR
(DIMENSIONLESS)
TABHL - A FUNCTION WITH VALUES SPECIFIED BY A TABLE
LYMAP2T - LYMAP2 TABLE
IO - INDUSTRIAL OUTPUT (DOLLARS/YEAR)
1070 - INDUSTRIAL OUTPUT IN 1970 (DOLLARS/YEAR)

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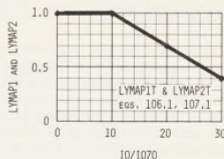


Figure 4-52 Land yield multiplier from air pollution table

Loops 1 and 2: The Investment Allocation Decision

At any point in time, society can choose to employ its total agricultural investment TAI either to develop new land or to increase the intensity with which existing arable land is cultivated. We assumed that this choice can be adequately represented by marginal productivity considerations: in World3 more agricultural investment is allocated to land development if the marginal (physical) productivity of land development MPLD (measured in vegetable-equivalent kilograms per dollar) is higher than the marginal (physical) productivity of agricultural inputs MPAL (also in vegetable-equivalent kilograms per dollar). In other words, we assumed that the next food dollar tends to be invested in the activity that will result in the larger additional crop.

Fraction of Investment Allocated to Land Development FIALD If every society operated as a perfect profit-maximizer and had access to all the information needed to do so, all agricultural investment would be allocated to the activity with the highest marginal productivity. However, institutional constraints, communication problems,

and different traditions tend to force social systems into economically suboptimal positions. Such imperfections are represented in Figure 4-53 by the relationship between the fraction of agricultural investment allocated to land development FIALD and the ratio of the marginal productivity of land development MPLD and the marginal productivity of agricultural inputs MPAL.

As Figure 4-53 indicates, we assumed imperfect market operations to the extent that 15 percent of the total agricultural investment TAI is allocated to land development even when MPAL is twice as large as MPLD. The curve in Figure 4-53 is also meant to include in an admittedly rough way the imperfections that arise in the real world through the uneven geographic distribution of fertile land and agricultural capital—imperfections compounded by complications arising from international politics. It must be stressed that the curve in Figure 4-53 represents a hypothesis that is acceptable only because it produces a realistic model behavior and because sensitivity testing (see section 4.6) reveals that the overall dynamic model behavior is not very sensitive to the exact form of the graph.

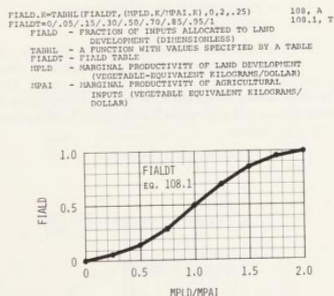


Figure 4-53 Fraction of investment allocated to land development table

Marginal Productivity of Land Development MPLD The marginal (physical) productivity of land development MPLD is the additional amount of crops that will be produced from the next dollar invested in land development. Once developed, the new arable land will produce an additional crop every year—unless the land is taken out of production to be kept fallow or to make room for construction, or because of irreversible erosion. We assumed that such land withdrawal is not anticipated by