

Output Generation

For a given model solution, the optimization model generates a series of output variables in a standard GAMS output file. Customized computer programs are used to extract and organize selected output variables and associated values for display and analysis.

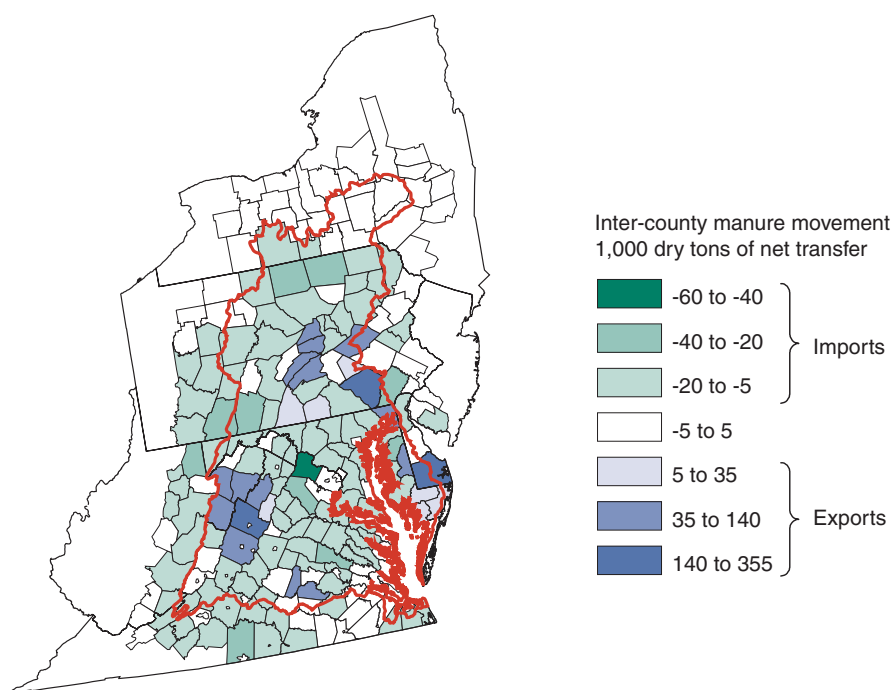
Appendix 4 includes a list of report variables from a standard output file. Report variables include those endogenously derived within the model, plus additional variables computed from the solution results. Report variables are organized under costs, acres, manure quantities, manure nutrients, and hauling distance.

Model reporting variables are reported at various spatial scales—county grid, county aggregate, and full basin levels. Model solution values for edge counties, or those that straddle the watershed boundary, are apportioned by share of farmland within the watershed to more accurately account for manure disposition at the basin level. Consequently, aggregate values may be reported only for the full modeled area and watershed area (without sinks). Aggregate costs are also reported with and without adjustments for chemical fertilizer savings.

Map presentations, developed in ARC-View, are generated from output solution variables reported at a county level. Maps are particularly useful in highlighting spatial values across the basin under various policy and resource assumptions. Figure 9 presents a sample map for the Chesapeake

Figure 9

Net manure exports in the Chesapeake Bay watershed assuming landowner willingness to accept manure of 60 percent



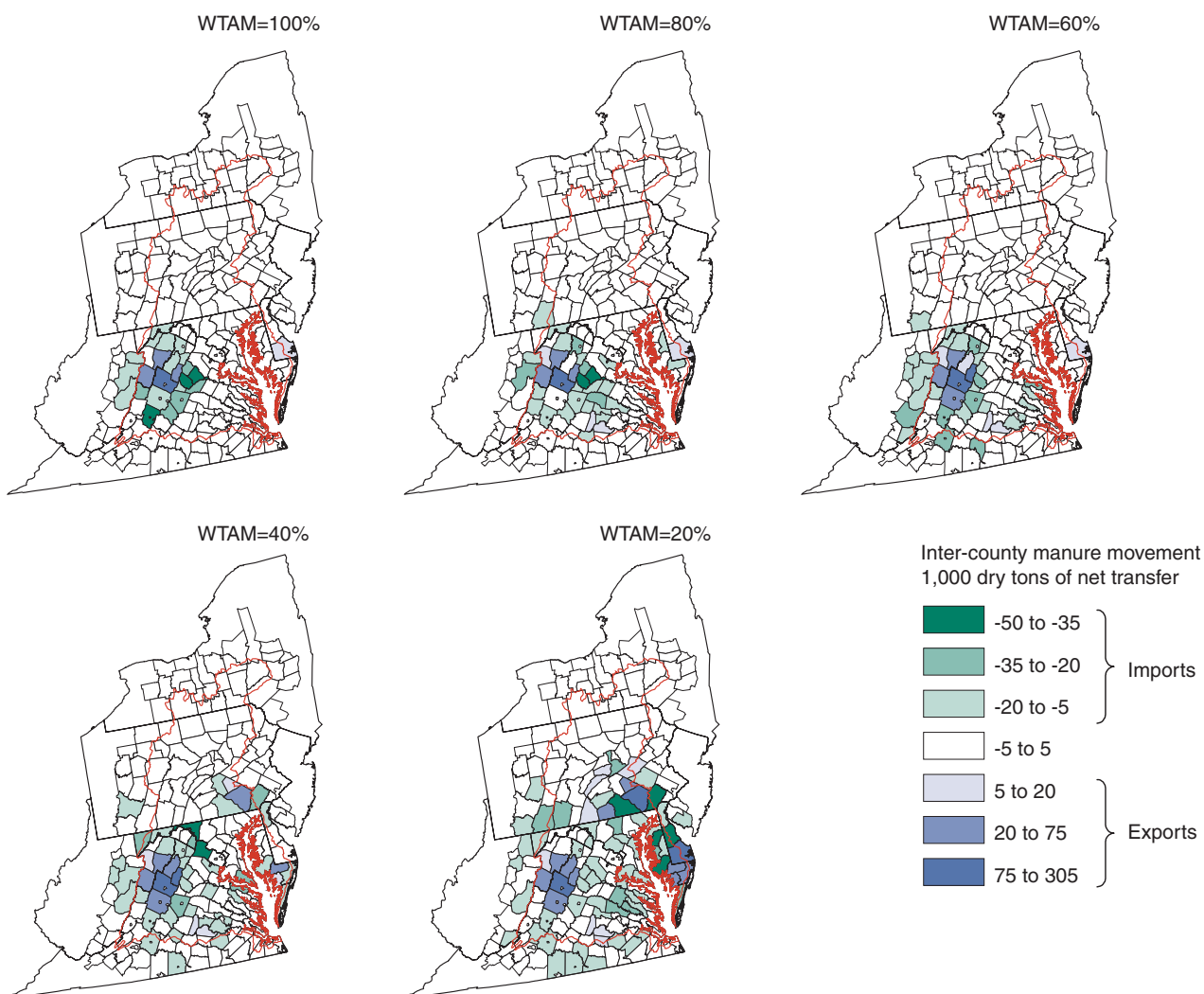
Source: U.S. Department of Agriculture, Economic Research Service.

Bay watershed, indicating net manure exports under a P standard, given a landowner-willingness-to-accept-manure level of 60 percent. Figure 10 presents a multi-sequence map set that captures the effect of alternative levels of landowner willingness to accept manure on county-level exports and imports under an N standard. Figure 10 shows that as the willingness to accept manure declines, the model transports manure increasingly longer distances and that more counties become net manure importers to access adequate land at the basin level to meet an N standard.

Maps may also be used to isolate key information for a single county. Figure 11 shows manure transfers from a single source county (Rockingham County, VA) to destination counties across the basin under a P standard. As manure transfers are estimated simultaneously across all counties, the direction and volume of manure flows that minimize aggregate costs to the basin necessarily reflect the effect of competing manure sources in neighboring counties.

Figure 10

Effect of landowner willingness to accept manure (WTAM) on the spatial distribution of manure transfers in the Chesapeake Bay watershed, based on 1997 animal production and an N standard

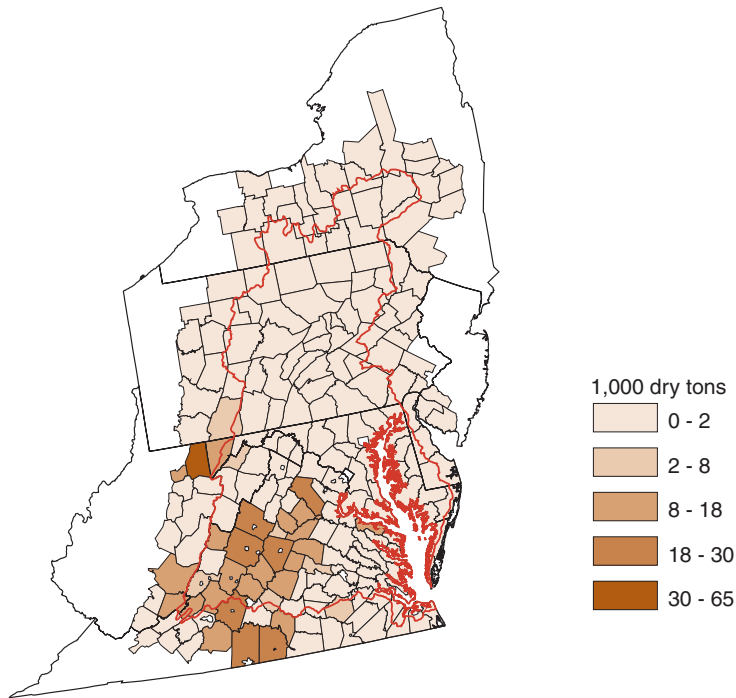


Source: U.S. Department of Agriculture, Economic Research Service.

Output data at the aggregate basin level may best be characterized in graphical form. In figure 12, a pie chart shows the share of manure produced in the Chesapeake Bay watershed, by disposition of use. In figure 13, a segmented bar graph is used to depict the disposition of manure under alternative levels of willingness to accept, given a P standard. Figure 14 presents a combination bar-line graph showing both manure management costs and manure quantities exceeding land application levels across alternative willingness to accept levels under a P standard. (For more discussion about these outputs, see Ribaudo et al., 2003.)

Figure 11

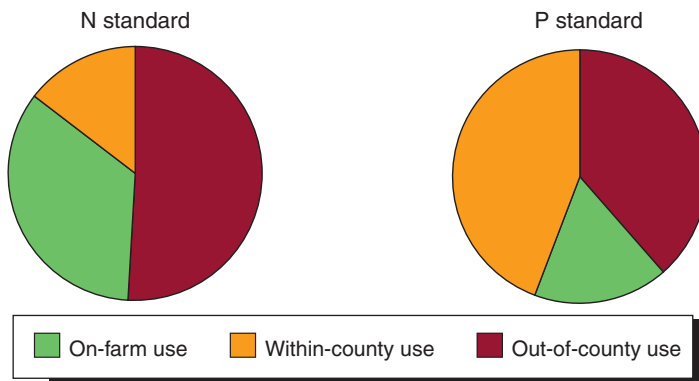
Manure transfers from Rockingham County, Virginia, with a P standard and 60-percent willingness to accept manure



Source: U.S. Department of Agriculture, Economic Research Service.

Figure 12

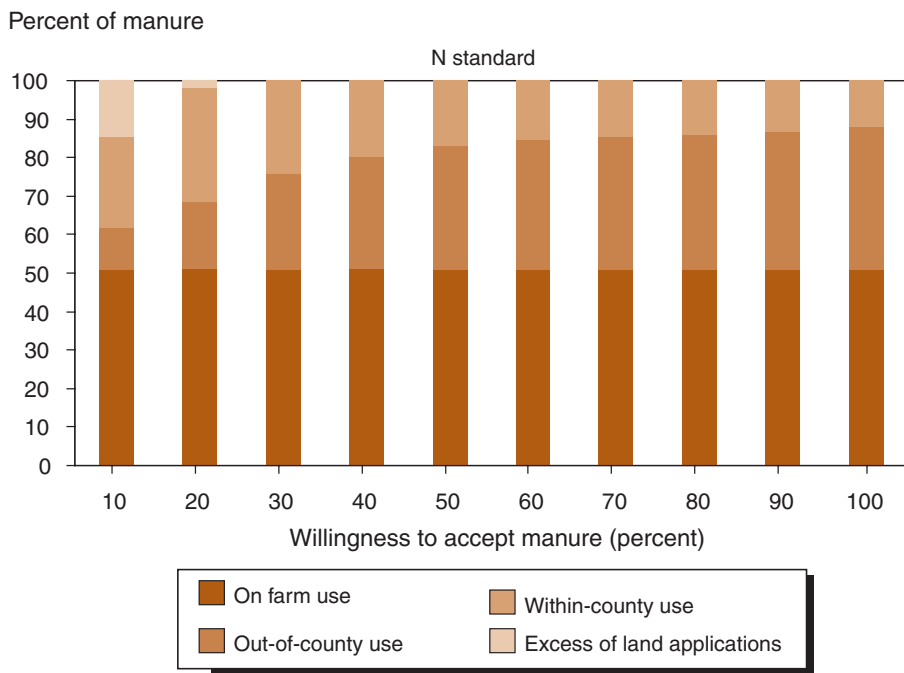
Disposition of manure in the Chesapeake Bay watershed under both N and P standards with a willingness to accept manure of 70 percent



Source: U.S. Department of Agriculture, Economic Research Service.

Figure 13

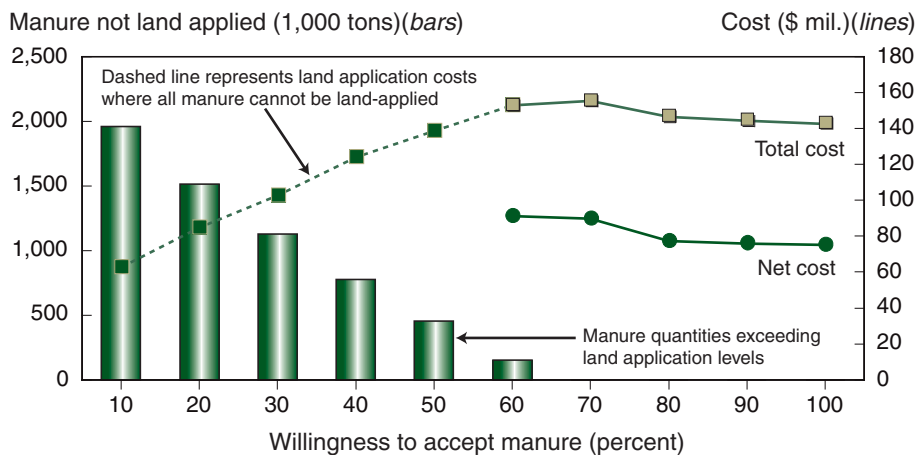
Effect of landowner willingness to accept manure on manure disposition in the Chesapeake Bay watershed



Source: Ribaldo et al., 2003.

Figure 14

Effect of landowner willingness to accept manure on land application costs and manure exceeding land application capacity in the Chesapeake Bay watershed: P standard



Source: Ribaldo et al., 2003.