Livestock and Poultry
Waste-Control Costs

Farmers once clearly valued animal waste as a nutrient-rich fertilizer. With the trend toward larger-scale production facilities, however, farmers (and society) now often view animal waste as a pollutant-disposal problem. Under some proposals for reauthorizing the Clean Water Act (CWA), livestock and poultry producers would face stiffer controls on animal waste in areas with impaired surface waters. Farm bill discussions also mention transferring cost-sharing money into animal waste management from crop-based conservation programs. What might be the cost of improved manure management? Which sectors would be most affected and how would this change their financial outlook?

Regulatory background
Animal waste—which contains pathogens, salts, heavy metals, phosphorus, nitrogen, and other nutrients—can pollute surface and groundwaters, especially fragile wetland ecosystems such as the Chesapeake Bay estuary. Runoff from confined livestock operations has led to high pathogen levels in numerous lakes and rivers, impairing shellfishing, aquaculture, sport fishing, boating, and swimming.

Currently, the CWA requires certain controls for confined animals on large-scale operations. Proposals for the new CWA would require more costly manure management systems for smaller livestock operations located in areas vulnerable to animal waste pollution. Similarly, any new cost-sharing for animal waste management in the 1995 farm bill would need to target smaller (i.e., unregulated) operations in vulnerable areas to maximize water quality improvements. In our research, the costs of improved manure management would fall disproportionately on dairy and broiler chicken producers because they tend to be concentrated in areas classified as vulnerable. Cost sharing in the 1995 farm bill likely would have to offset these costs for voluntary adoption to occur.

The U.S. Environmental Protection Agency (EPA) currently requires runoff management on large-scale livestock operations (i.e., at least 1,000 animal units) which confine animals for at least forty-five days during the year. EPA treats operations of at least 1,000 animal units (an animal unit, or A.U., consists of one beef animal, 0.7 dairy animals, 2.5 hogs, and 100 broiler or layer chickens) or 300 animal units that discharge directly into surface water as point-source polluters, subject to regulation under EPA’s National Pollutant Discharge and Elimination System (NPDES). Over 6,000 large-scale operations (defined as having 1,000 A.U. or more) fall under these regulations, accounting for half of the nation’s egg layer and broiler chicken inventories, 80 percent of all feedlot beef, 20 percent of swine, and 8 percent of dairy inventories (U.S. EPA 1993). Many of these facilities
In addition, the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA)—the first federal program to require specific measures to address nonpoint source pollution from agricultural erosion and runoff—impose waste management regulations on most livestock producers in coastal areas. According to the 1987 Census of Agriculture, the 734 coastal counties produce about 19 percent of U.S. dairy sales and 19 percent of poultry sales, along with 4 percent, 9 percent, and 5 percent of sheep, hog, and cattle sales, respectively.

CZARA is our best predictor of the form of a new CWA, but the two would differ in at least one key way: the CWA (and the farm bill) would likely target "impaired" areas. While targeting minimizes the costs of new controls for the agriculture sector as a whole, producers in certain areas would still face substantial costs. As yet, neither researchers nor policy makers have provided a definition of "impairment."

All of the CWA proposals considered in the last Congress incorporate CZARA-like requirements to reduce pollutant loadings to the nation's watersheds. The Senate bill reauthorizing the CWA (S. 2093), for example, calls for state requirements on the livestock sector to implement specific measures to control runoff. New livestock waste management provisions would likely require retention ponds and solids separation basins in combination with vegetative practices, such as filter strips between production facilities and nearby surface water. While many farm practices also threaten groundwater, CWA explicitly protects only surface waters.

Animal waste control methods
Traditional disposal methods collect and store waste material in large lagoons and separation basins. After solids break down by fermentation, farmers stir the slurry and apply it to fields with irrigation water in much the same way as commercial fertilizer. However, unlined lagoons may leak and heavy rains may breach a lagoon's holding capacity, spilling waste into nearby surface waters or leaching it into aquifers.

Alternative approaches separate and reuse the leftover solids, which can be further separated mechanically, and then reused as bedding or feed for livestock, trucked to other farms and disposal facilities, or added to a compost pile and sold or given to local gardeners. In some cases, manure is used as a feedstock for biogas generators to produce electricity. Advanced flushing and scraping systems permit almost complete reuse of the waste, and the storage lagoons can provide habitat for wild ducks and geese.

Problems persist, however, for producers who
The problem is especially acute for poultry producers, who generally do not grow their own feed and lack a convenient location for disposal.

Because of handling and transportation costs, markets for animal waste have developed only slowly. Proposed regulations would raise the costs of on-site disposal and boost the incentive to transport the waste elsewhere for proper use or disposal.

Costs of proposed manure management practices

We estimated total annual compliance costs at about $66 million (figure 1), which is quite low compared to provisions of the CWA covering industrial and municipal water pollution control costs. EPA estimated these at $37.5 billion in 1987 (Carlin, Scodari, and Garner 1992). However, the animal waste controls would cover only 3 percent of the nation's counties—the ones that met the two criteria, discussed in the box on the next page.

Dairy and broiler costs accounted for about 70 percent of the total costs in the five sectors examined. Although smaller in gross sales than dairy or beef, control costs for the broiler sector alone accounted for over 42 percent of the total. The high compliance cost for broilers occurs because of the large number of broiler-producing facilities in "vulnerable" counties. The vulnerable areas represent less than three percent of all counties but include 31 percent of all broiler chickens, compared to 20 percent of layers, 13 percent of beef animals, 9 percent of dairy cows, and 2 percent of hogs.

Costs per farm (table 1), however, are several times higher for beef than for the other livestock sectors, reflecting the large number of animals per farm in the vulnerable counties. On an animal-units basis, abatement costs dairy producers almost two and a half times that for any other sector. To what extent can farmers in the affected areas afford to comply with the proposed regulations? The ratio of compliance costs to sales (table 2) are highest for dairy producers, particularly in the Northeast, Southeast, Appalachia, Delta, and Pacific regions.

Hog producers face high cost-to-sales ratios in the Northeast, Appalachia, and Delta regions.

The swine and egg-layer chicken sectors are comparatively unscathed under the proposed regulations, together accounting for only 10 percent of the estimated costs. Swine producers would face the lowest compliance costs, primarily because they have the least concentrated production technology of these sectors. Sharply increased hog production in North Carolina in recent years, now the second leading state in pork production, may imply higher compliance costs for this area than we report. However, since most of these producers are very large, concentrated units, they may already have appropriate manure management systems in place.

Economics

Economics and politics limit the stringency of environmental statutes. Historically, policy makers have sought to avoid enterprise closures. The CZARA, for example, requires that controls should be "economically achievable." To give a better account of the economic impact of the potential animal waste controls, we offer some comparisons of compliance costs with profitability (i.e., net farm income) by enterprise type and region. Our examples show that compliance costs might burden small producers in vulnerable areas even if the costs were not burdensome nationally.

A few examples, based on Economic Research Service's Farm Cost and Return Survey, emphasize this point. In the Pacific region, compliance costs of $12,200 per dairy farm represent a large amount compared to the net farm income of $17,200 for farms with gross sales of $50,000 to $250,000. For a confined beef facility in the Northern Plains in the same sales class, per-farm compliance costs would be $57,900, while net farm income is $26,700. For swine in the Delta region, estimated compliance costs are $6,800, while net farm income is a negative $800. For broilers in the South-

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<th>Swine</th>
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Note: Gross sales figures taken from 1987 Agricultural Census. The states in each production region are: Appalachia: KY, NC, TN, VA, WV; Corn Belt: IA, IL, IN, MO, OH; Delta: AR, LA, MS; Lake: MI, MN, WI; Mountain: AZ, CO, ID, MT, NM, NV, UT, WY; Northeast: CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT; Northern Plains: KS, ND, NE, SD; Pacific: CA, OR, WA; Southeast: AL, FL, GA, SC; Southern Plains: OK, TX.
East and Delta regions, compliance costs may be $4,600, compared to a net farm income of $21,400. Despite our smaller-than-anticipated national cost estimate of $66 million in annualized costs, resource reallocations between sectors and regions might result.

Costs of compliance

Some proposals for a new Clean Water Act would require improved, and more costly, manure management systems. In addition, farm bill discussions mention transferring cost-sharing money into animal waste management from crop-based conservation programs. Any cost assessment of improved manure management will depend crucially on which parts of the country are classified as "impaired." Because a consistent and comprehensive assessment of surface water impairment does not exist for the U.S., analyses rely on proxies for impairment to show vulnerability, as does ours. If our definition of "vulnerable" is approximately correct, then our estimates suggest the compliance costs of animal waste controls proposed for a new CWA, or, alternatively, the budgetary outlay of cost sharing in the 1995 farm bill.

Our estimates generally indicate small national compliance costs for confined livestock production, but costs might be burdensome to the broiler sector in particular, and to livestock producers in any sector in areas vulnerable to pollution. Broiler and dairy producers alone account for roughly 70 percent of the total estimated costs, while beef producers account for another 19 percent.

Localized rather than aggregate costs could produce significant economic dislocation and political concern.

For more information


The views expressed are those of the authors and are not necessarily shared by the U.S. Department of Agriculture.

Estimating the Costs of New Regulations

The reauthorized CWA would be different in at least one respect from CZARA. Under the new CWA, only areas that are "impaired" by agricultural pollution would be subject to the new livestock waste management regulations. Unfortunately, no comprehensive national assessment of surface water impairments from agricultural pollution exists (U.S. EPA 1994; Knopman and Smith 1993). Proxies must be used for impairment—or more precisely, for "vulnerability"—since the proxy can indicate a potential problem but cannot document that an actual problem exists. In our assessment of the compliance costs of extending CZARA-like requirements to inland areas, we identify a vulnerable county as one in which

- surface waters cover over 1 percent of its area (about two-thirds of counties) and;
- phosphorus applications from manure exceed 20 pounds per acre.

The 1 percent rule for surface water eliminates the driest third of the counties, but phosphorus application thresholds are more arbitrary and vary by region. The scarcity of surface water is a proxy for distance between surface water and animal production. The 20 pounds/acre rule for phosphorus is a proxy for availability of this nutrient for transport to surface waters. Nutrients, more than any other contaminant in animal manure, cause downstream damage to water supplies and ecosystems. Researchers generally consider phosphorus in particular to be the limiting nutrient in inland surface waters. Most waterbodies already contain enough other nutrients (nitrogen and potassium) so that sizable reductions can have little effect on surface water quality. Phosphorus applications in excess of crop needs will likely cause buildup in the soil, creating a potential for surface water quality impairment. We based the limit of 20 pounds per acre on the phosphorus needs of corn for grain, an economically important and phosphorus-needy crop. Thus our definition likely underestimates vulnerable acreage. Based on 1987 Census of Agriculture data, approximately 3 percent of U.S. counties fit the above criteria.

To estimate annual compliance costs, we combined Census data on confined livestock operations with cost estimates for animal waste management technologies developed by EPA (DPRA). We looked at the five largest livestock sectors: beef, dairy cow, swine, broiler chicken, and egg-layer chicken operations.