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Restore America's Estuaries

Bringing Dead Zones Back to Life

How Congress, Farmers and Feedlot Operators Can Save America's Most Polluted Bays

August 2001

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This report was made possible through the generous support of the W.K. Kellogg Foundation, the Joyce Foundation and The McKnight Foundation.

OVERVIEW

Farmers can produce far more than food and fiber -- they can also produce clean water. Many farmers are willing to do more to protect and improve water quality in the nation's bays by applying fertilizer and manure with greater care, managing manure properly, restoring wetlands and streamside buffers, and otherwise changing the way they farm to reduce polluted runoff. But, most farmers are rejected when they seek federal financial and technical assistance to implement these simple, cost-effective practices. This fall, legislators will have an opportunity to reward farmers when they help protect and restore the nation's bays when Congress renews federal farm programs.

Farmland and ranchland covers more than half of the American landscape,[i] so it is no surprise that agriculture dramatically impacts the water quality of many of the nation's bays. Nearly nine-out-of-ten raindrops fall on private land -- mostly farm and ranch land -- before flowing into rivers, lakes and bays. Consequently, polluted runoff from farms, ranches and feedlots is among the leading reasons that 44% of the bay waters assessed by state officials cannot support fishing or swimming.[ii]

Low-oxygen "dead zones" are the most dramatic and ecologically significant challenge facing many of America's bays. Although bays receive pollution from many sources, nutrient-rich runoff from farms and feedlots is among the leading contributors to periodic dead zones.

According to models developed by the U.S. Geological Survey and other federal agencies, in fact, agricultural runoff is the leading pollutant source for these dead zones in 13 of the nation's 17 most polluted bays.[iii] In each of these bays, agricultural runoff contributes at least one-third of the pollutants that cause low oxygen levels, toxic algae blooms, and contribute to the loss of underwater grasses that provide critical habitat for fish, crabs and other commercially-important species.[iv] Although America's environmentally troubled bays dot the entire coastline, most bays affected by agriculture border the Mid-Atlantic, Southeast and the Gulf of Mexico.[v] The watersheds of these bays include row crops that have used steadily greater amounts of chemical fertilizers since the 1950s; many are increasingly dominated by large feedlots that produce more manure than can be safely applied on nearby farmland.[vi]

THE CHALLENGE

Impacts of Polluted Runoff on Bays

Polluted runoff from farms and feedlots promotes a complex array of problems in bays, beginning with the excessive growth of algae, which, in turn, can lead to other more serious symptoms. By triggering the growth of algae, polluted runoff reduces the amount of oxygen dissolved in bay water in two ways: by consuming oxygen at night, and through decomposition when the algae die.

Percent of Nitrogen Flow Into U.S. Bays From Agricultural Runoff	
Highly Eutrophic Bays	
Bays	Nitrogen from Agriculture
Lower Laguna Madre	70
Northern Gulf of Mexico [3]	65
Neuse River [1]	63
Delaware Inland Bays	63
San Francisco Bay	56
Corpus Christi Bay	53
Baffin Bay [1]	51
Tijuana Bay [1]	51
Potomac River [1]	48
Upper Laguna Madre	46
Chesapeake Bay [2]	45
Patuxent River [1]	33
Lake Pontchartrain [1]	32
Newport Bay [1]	31
Calcasieu Lake	20
Barnegat Bay	11
Florida Bay	
Other Troubled Bays	
Caloosahatchee River [1]	76
Tangier/Pocomoke Sounds [1]	76
Galveston Bay	70
Sabine Lake	69
Mobile Bay	64
Choctawatchee Bay [1]	62
Tampa Bay	58
San Antonio Bay [1]	56
Tomales Bay [1]	48
Perdido Bay [1]	43
Charlotte Harbor	41
Indian Harbor	38
Pamlico Sound	37
York River [1]	37

Note: The nation's highly eutrophic bays were identified by NOAA in a 1999 assessment of the nation's estuaries. Other troubled bays are those bays which NOAA classified as moderate-highly eutrophic.

[1] calculations derived from the USGS SPARROW model for NOAA's assessment.
[2] US EPA, Chesapeake Bay Program, Watershed Model, Phase 4.3, 2000.
[3] National Science and Technology Council, Committee on Environment and Natural Resources, An Integrated Assessment of Hypoxia in the Northern Gulf of Mexico, 2000.

The source of data for all other bays is Alexander, R.B., Smith, R.A. , Schwartz, G.E., Preston, S.D., Brakebill, J.W., Raghavan, S and Pacheco, P.A., Atmospheric Nitrogen Flux From the Watershed of Major Estuaries of the United States: An Application of the SPARROW Watershed Model, in Coastal and Estuarine Studies, American Geophysical Union, 2001, p. 138.

When dissolved oxygen levels get too low, the variety of species that can survive dramatically declines. Although some species simply leave dead zones, oxygen levels can get low enough to cause fish kills. Many species, including young fish and shellfish, are unable to escape. In general, these "dead zones" feature fewer long-lived species such as clams and crabs and favor smaller, short-lived species such as worms.[vii]

Nutrients in farmland runoff also trigger more subtle changes in tiny life forms that can in turn reduce the variety and productivity of commercially-important fish populations. Many of the microscopic organisms that form the base of the bay food web face major disadvantages as "dead zones" develop. For example, zooplankton that graze on algae in surface waters during the night and migrate to the bay's bottom waters in the daytime to escape predators may be more vulnerable if a bay's bottom waters feature low oxygen levels. Certain kinds of phytoplankton that fuel the production of the food ultimately consumed by larval fish decline when polluted runoff into bays increases.[viii]

In some cases, shifts in the make-up of microscopic organisms can make blooms of toxic algae -- known as red tides or brown tides -- more frequent and extensive. Among thousands of microscopic algae species are a few dozen species that produce powerful toxins that harm both fish and people. Toxic algae have contaminated shellfish consumed by people, caused massive fish and shellfish kills, and even caused marine mammal and seabird deaths. Although these algae blooms occur naturally, the number of blooms has increased as polluted runoff from farms has increased. The algae-like organism Pfiesteria is an example of a toxic organism that scientists have linked to increased runoff from feedlots. Major blooms of Pfiesteria occurred in 1997 in the Chesapeake Bay and the bays of the Pamlico Sound.

Algal blooms and related effects of polluted runoff also harm the bay grasses that are a critical ecological component of many coastal bays. Bay grasses provide food and shelter for a rich and diverse array of fish, and serve as important spawning grounds for many fish species. In some bays, fertilizers intended for crops instead fuel the production of algae which block sunlight used by bay grasses. Fertilizers can also accelerate the growth of algae called epiphytes that grow on the surface of bay grasses, encrusting leaves directly and thereby blocking the sunlight these grasses need. Nurtient-rich runoff from farmland can also trigger the growth of unwanted seaweeds that overwhelm coral and bay grasses.

As bay grasses decline, sediments are more easily stirred up, further reducing the sunlight bay grasses and coral need to grow.[ix] Polluted runoff also contributes to an important shift away from corals and the coralline algae that help build reef structure and towards algal turfs and seaweeds that overgrow coral reefs.[x]

Sources of Excessive Nutrients into Bays

A national assessment of 138 bays and the northern Gulf of Mexico found moderate high and high "eutrophic" conditions in 44 estuaries -- that is, these estuaries featured a variety of environmental problems caused by the introduction of excess nutrients, including low dissolved oxygen, reduced sunlight, loss of underwater grasses, growth of seaweed, harmful algal blooms, and changes in the kinds of algae present.[xi] Low dissolved oxygen levels or "dead zones" were found in 42 of the assessed bays, primarily in Gulf of Mexico, Mid-Atlantic and South Atlantic regions. Moderate or high losses of bay grasses were found in 27 of the assessed bays, primarily in the Gulf of Mexico and Mid-Atlantic regions.

Agricultural runoff poses major challenges for many of the nation's most polluted bays. Agricultural runoff is the leading source of nitrogen for 13 of the 17 bays federal officials identified as highly eutrophic.[xii] In each of these bays, farmland runoff contributes at least one-third of the pollutants that cause low oxygen levels, toxic algae blooms, and contribute to the loss of underwater grasses that provide critical habitat for fish, crabs and other commercially-important species.[xiii] In addition, more than half of the bays featuring moderate-high symptoms of nutrient pollution also receive one-third or more of these nutrients from agriculture.

Farmland Runoff

Agriculture contributes excess nitrogen and phosphorus to bays from two basic sources. The first results from the application of excess fertilizer to crop fields -- the impact of farmland runoff on the nation's bays has grown steadily as fertilizer applications have tripled since 1960.[xiv] Nutrients found in fertilizer -- nitrogen and phosphorous - wash off farms in solution or by binding to eroding soils. The nutrients found in fertilizer enter bays through several pathways: by washing off fields into nearby creeks, percolating through the soil, or by directly entering groundwater that feeds streams. Nutrients reaching many bays can be washed off farms hundreds or thousands of miles upstream.

Livestock Runoff

The second major source of this excess nitrogen and phosphorus comes from the manure associated with livestock: hogs, poultry and beef and dairy cows. Livestock produce 130 times more waste per year than all Americans combined. Increasingly, hogs, poultry and many cows are kept primarily or exclusively in large feedlots, where the manure is concentrated. The predominant manure management technique involves storing this waste in an open lagoon, and then spraying the waste on adjacent fields. But this primitive technology presents challenges: one, manure lagoons leach nitrogen and phosphorus into the groundwater; two, many lagoons or pipes used to convey waste to farm fields fail or leak; three, manure can not be cost-effectively transferred more than a few miles, so manure is typically applied to cropland in inappropriate levels; and four, significant amounts of nitrogen evaporates from lagoons and feedlots into the air as ammonia and ultimately descends into bays or lands draining into bays.[xv]

Livestock concentration poses major new challenges for many bays. Although the total number of livestock operators has declined by 50 percent since 1982, animal production has increased by 10 percent and the number of large feedlots has doubled. Livestock operators in 152 counties in 23 states now produce more waste than can be safely applied on all the fields in those counties even if it completely replaced commercial fertilizer for crops. [xvi] Even though large operators pose new challenges, small and medium-sized livestock operators continue to produce three-quarters of the manure generated from dairy feedlots, and roughly half of the manure from poultry and hogs.[xvii]

Wetlands and Streamside Buffer Loss

Modern agricultural methods have also contributed to bay problems by constructing extensive drainage networks that drain wetlands, which help intercept and filter farmland runoff. Many farms also extend crop fields to the edge of streambanks, eliminating streamside vegetation that can also filter farmland runoff. In general, these wetlands and streamside buffer zones can absorb most of the phosphorus found in farmland runoff, and can convert much of the nitrogen in farmland runoff into harmless nitrogen gas.

Two Case Studies

Several commercially and recreationally important bays are impacted by farmland and feedlot runoff.

Northern Gulf of Mexico

Polluted runoff from farmland is the leading cause of an 8,000 square-mile "dead zone" in the northern Gulf of Mexico, an area the size of New Jersey.[xviii] Farmland and feedlot runoff contribute 65 percent of the nitrogen reaching the Gulf, where dissolved oxygen levels have fallen too low to support many forms of marine life.[xix] Although the Mississippi River and its tributaries drain two-thirds of the nation, farmland growing corn and soybeans in Illinois, Iowa, Indiana, Ohio and southern Minnesota are the primary sources of the pollution being delivered to the Gulf.[xx] As the dead zone has grown in size, scientists have recorded direct mortality of both fish and their food base.

Chesapeake Bay

A variety of factors have contributed to low dissolved oxygen levels and the loss of bay grasses in the Chesapeake Bay: polluted runoff from farms and feedlots, deforestation and wetland loss, discharges by wastewater treatment plants, air pollution from cars, as well as the loss of oysters that would filter algae and other organic matter from the water column. However, farmland and feedlot runoff are among the leading sources of nitrogen to the Chesapeake, contributing 27 and 18 percent, respectively.[xxi]

As nitrogen loadings increased, problems in the Chesapeake Bay have intensified since the mid-1950s, including high production of algae, increasingly turbid water, major declines in bay grass abundance and diversity, and lower dissolved oxygen levels.[xxii] Concentrations of chlorophyll a -- an indication of algae production -- have increased tenfold in the seaward regions of the bay and doubled elsewhere. Bay grasses began to decline in the mid-1960s, disappearing entirely from the Patuxent and lower Potomac Rivers. By 1980, many areas of the Bay that once contained abundant grass beds featured little or no bay grass production. Seasonal dead zones have been a common feature of the Bay since deforestation, but scientists have documented larger, longer-lasting "dead zones" in recent years.

THE SOLUTIONS

Experience shows that farmers and feedlots operators will respond to economic incentives to help reduce polluted runoff. For example, more than one-third of all farmers have changed the way they plow their fields to reduce polluted runoff into nearby streams.[xxiii] In the last five years, farmers have installed buffer strips of trees and plants along one million miles of streams to intercept runoff and filter out pollutants.[xxiv]

Many more farmers and feedlot operators are willing to help protect and improve water quality in bays. But most farmers and feedlots operators seeking federal financial and technical assistance to reduce polluted runoff into bays have been rejected due to inadequate federal funding. The nation's largest conservation backlogs are in states like Texas, North Carolina and Florida -- states where many of the bays threatened by agricultural runoff are located.

Today, less than 10 percent of federal farm spending rewards farmers, ranchers and feedlots operators who help clean up polluted bays. Because so little federal funding is dedicated to U.S. Department of Agriculture conservation programs, 70 percent of the farmers and ranchers seeking federal funds to improve water quality in bays were rejected this year.[xxv] Half of the farmers and ranchers seeking basic technical assistance to improve bay water quality were also rejected due to inadequate federal funding. And, farmers offering to restore more than 500,000 acres of wetlands -- which intercept and filter polluted runoff headed to bays -- are being turned away.[xxvi] The nation's failure to reward farmers, ranchers and feedlots operators who offer to reduce pollution into bays significantly affects commercial and recreational uses of these water bodies, places more pressure on waste water treatment utilities, and increases drinking water treatment costs.[xxvii]

Farmland Practices

Many agricultural practices can significantly reduce polluted runoff into the nation's bays. Testing soil or plant tissue to calculate fertilizer needs can help farmers apply no more fertilizer than needed, testing is employed by only one-third of the acres planted in corn, wheat, soybeans, or cotton.[xxviii] Injecting fertilizer directly into soils instead of spraying it can reduce losses by as much as 35% while increasing yields.[xxix] By splitting nitrogen fertilizer into separate applications during and after spring planting, farmers can reduce fertilizer losses by as much as 40% without reducing crop yields.[xxx] Even so, most corn, soybean, cotton, and potato fields are fertilized either before planting in the spring or in the fall, when fertilizer losses are sure to be high.[xxxi]

Planting winter cover crops can absorb a significant amount of the nitrogen that soils tend to release during the winter from the reservoir left by the summer's fertilizer. Farmers who adopt tillage practices that plow the land less deeply, cover fields with crop residues, or plant seeds without turning over the soil can reduce soil erosion and the phosphorous that bonds to soil particles. Although many farmers use these techniques, most farmers do not.[xxxii]

Farmers can also install a wide variety of buffers – strips of trees or grasses -- to intercept and filter runoff water. Buffers placed along fields or with fields and that are designed to intercept groundwater can remove much of the sediment and nutrients from runoff.[xxxiii] Restored wetlands can also filter runoff and water from farm drainage systems. When properly designed and located, wetlands can also remove most of the sediment and fertilizer in agricultural runoff.[xxxiv]

Basic conservation farmland and feedlot conservation practices -- such as precise fertilizer and manure applications, the use of winter cover crops, and soil-conserving tillage -- could significantly reduce nitrogen loadings to nearby streams.[xxxv] If 10 percent of farmers in the Mississippi River basin were to switch from corn and soybean production to alfalfa or alfalfa-grass mixtures, nitrogen losses could be annually reduced by 500,000 tons of nitrogen.[xxxvi] Restoring 5 million tons of wetlands would annually remove 300,000 tons of nitrogen, and restoring 19 million acres of floodplain bottomland forests would also annually remove 300,000 tons of nitrogen.[xxxvii]

Livestock Practices

Some smaller and medium-sized livestock operations can make significant water quality improvements through simple measures. Many operations can reduce excess runoff by storing waste more carefully, by measuring the nutrient content of manure and soil, by applying manure with better calibrated machines, and by directing applications away from erosion-prone areas and streamside land. One study found that farmers put twice the amount of manure needed on fields simply because of inaccurate field spreaders.[xxxviii] Many dairy farmers have found they can reduce feed by following careful feeding regimens, and reduce both costs and the volume of manure. By rotating cows through fenced pastures, dairy farmers can reduce waste-related threats, improve animal health, and reduce feed costs.[xxxix] For larger livestock operations, new technologies are required but viable, including technologies that capture air emissions and that process the nutrients in manure so that manure could be used better locally or transported to regions with sufficient land for safe field applications.[xl]

Reforming Farm Programs

When legislators renew federal farm programs this fall, Congress has an opportunity to increase USDA funding to reward farmers and feedlots operators who implement practices that help reduce polluted runoff into the nation's bays. This year, Congress will provide more than $25 billion in federal farm spending, but less than 10 percent will be dedicated for voluntary UDSA conservation programs that compensate farmers for implementing practices that curb polluted runoff. In the next Farm Bill, Congress will decide how to spend more than $17 billion on annually on agriculture.

Many farm practices that improve the environment also reduce farm costs. For example, farmers can save money by using less fertilizer. But, in many cases, benefits are uncertain and some practices impose new costs. For example, farmers who apply fertilizers in the spring rather than the fall face higher fertilizer prices and greater likelihood of bad weather. For these reasons, incentives are often needed to encourage farmers to implement these practices.

Unless Congress provides adequate incentives for farm and feedlots conservation, there is little likelihood that the nation will clean-up our polluted bays. To clean up these bays, federal farm programs should meet demand for local technical assistance and should reward farmers, ranchers and private foresters who take steps improve water quality. In particular, Congress should:

- Reward Farmers for Clean Water – Congress should reward farmers, ranchers and foresters who reduce the presence of sediment, fertilizer and animal waste in runoff through better tillage practices, stream buffers, or other practices.

- Help Farmers Restore Wetlands – Congress should expand incentives for farmers, ranchers and foresters to rest and restore environmentally sensitive lands, including wetlands.

- Promote Better Manure Management – Congress should help small and medium-sized farmers store manure properly, apply manure more sparingly, use rotational grazing rather than feedlots, and adopt manure reuse practices. Congress should focus a significant portion of these funds on promising technologies to process and reuse manure to solve the problem of how to manage manure in areas where manure is concentrated.

Today, more than 90 percent of federal farm payments provide income subsidies to the one-third of America's farmers who grow commodity crops like corn, soybeans, wheat cotton and rice, and most of these funds flow to large farms in the Great Plains. These subsidies encourage farmers convert range and pastureland to produce crops that require heavy fertilizer applications

Congress has an opportunity to reward environmental stewards when legislators reauthorize federal farm programs this fall. But the Farm Bill passed in July by the House Agriculture Committee would continue to dedicate most federal funds for commodity crop subsidies, reject most environmental stewards when they seek federal financial and technical help, and would weaken federal wetland protections. Boosting funds for conservation payments would not only clean-up America's bays, but would also ensure that federal farm payments flow to all farmers and all regions.[xli]

Reps. Ron Kind (D-WI), Wayne Gilchrest (R-MD), Sherwood Boehlert (R-NY), have introduced H.R. 2375, the Working Lands Stewardship Act of 2001, which by contrast provides more than $6 billion in annual conservation payments to farmers, ranchers and private forest landowners.[xlii] The Working Lands Stewardship Act would annually provide $2 billion to farmers who implement water quality practices, and would focus $100 million annually on innovative manure management technologies and $300 million annually on assistance for managed grazing. The Working Lands Stewardship Act would also provide sufficient funds to restore 9 million more acres of stream buffers and sufficient funds to restore 300,000 acres of wetlands annually. The bill also expands efforts to allow states to target federal conservation funds at high priority resources, including polluted bays.

The next Farm Bill present a rare opportunity to clean up America's most polluted bays, reward environmental stewardship, and ensure that farm programs benefit all farmers and all regions.

NOTES

[i] U.S. Department of Agriculture, Economic Research Service, Agriculture and Environmental Indicators, 1997, p. 1.

[ii] Id.

[iii] Alexander, R.B., Smith, R.A. , Schwartz, G.E., Preston, S.D., Brakebill, J.W., Raghavan, S and Pacheco, P.A., Atmospheric Nitrogen Flux From the Watershed of Major Estuaries of the United States: An Application of the SPARROW Watershed Model, in Coastal and Estuarine Studies, American Geophysical Union, 2001, p. 138. See also US EPA, Chesapeake Bay Program, Watershed Model, Phase 4.3, 2000. NOAA identified the nation's highly eutrophic bays in Bricker, S.B., C.G. Clement, D.E. Pirhalla, S.P. Orlando, and D.R.G. Farrow. 1999, National Estuarine Eutrophication Assessment: Effects of Nutrient Enrichment in the Nation's Estuaries. NOAA, National Ocean Service, Special Projects Office and the National Centers for Coastal Ocean Science. Silver Spring, MD. 71 pp."

[iv] Id.

[v] Bricker, S.B., C.G. Clement, D.E. Pirhalla, S.P. Orlando, and D.R.G. Farrow. 1999, National Estuarine Eutrophication Assessment: Effects of Nutrient Enrichment in the Nation's Estuaries. NOAA, National Ocean Service, Special Projects Office and the National Centers for Coastal Ocean Science. Silver Spring, MD. 71 pp."

[vi] US Department of Agriculture, Economic Research Service, Confined Animal Production and Manure Nutrients, 2001

[vii] Howarth, B., et al., Nutrient Pollution of Coastal Rivers, Bays and Seas, in Issues in Ecology, Fall 2000, pp. 3-6.

[viii] Id.

[ix] Id.

[x] Id.

[xi] Bricker, S.B., C.G. Clement, D.E. Pirhalla, S.P. Orlando, and D.R.G. Farrow. 1999, National Estuarine Eutrophication Assessment: Effects of Nutrient Enrichment in the Nation's Estuaries. NOAA, National Ocean Service, Special Projects Office and the National Centers for Coastal Ocean Science, at 11.

[xii] Alexander, R.B., Smith, R.A. , Schwartz, G.E., Preston, S.D., Brakebill, J.W., Raghavan, S and Pacheco, P.A., Atmospheric Nitrogen Flux From the Watershed of Major Estuaries of the United States: An Application of the SPARROW Watershed Model, in Coastal and Estuarine Studies, American Geophysical Union, 2001, p. 138. See also US EPA, Chesapeake Bay Program, Watershed Model, Phase 4.3, 2000. NOAA identified the nation's highly eutrophic bays in Bricker, S.B., C.G. Clement, D.E. Pirhalla, S.P. Orlando, and D.R.G. Farrow. 1999, National Estuarine Eutrophication Assessment: Effects of Nutrient Enrichment in the Nation's Estuaries. NOAA, National Ocean Service, Special Projects Office and the National Centers for Coastal Ocean Science. Silver Spring, MD. 71 pp."

[xiii] Id.

[xiv] Alexander, et al. Atmospheric Nitrogen Flux From The Watersheds of Major Estuaries of te United State: An Application of the SPARROW Watershed Model, in Coastal and Estuarine Studies, American Geophysical Union, Pages 119-170, 2001. In addition to polluted runoff, approximately 25 percent of the fertilizer applied to fields is volatized as ammonia into the atmosphere. Some polluted bays receive significant amounts of nutrient pollution from air deposition -- both from the combustion of fossil fuels, and from the volatization of fertilizers.

[xv] K. Cochran, J. Rudek & D. Whittle, *Dollars and Sense: An Economic Analysis of Alternative Hog Waste Management Technologies* (Environmental Defense 2000) p. 11; NRC, op cit., p. 134-35.

[xvi] US Department of Agriculture, Economic Research Service, Confined Animal Production and Manure Nutrients, 2001

[xvii] Id at p. 67, Table 6-3.

[xviii] Farmland runoff transported down the Mississippi is also a leading cause of low oxygen levels in Louisiana's Lake Pontchartrain and Calcasieu Lake.

[xix] National Science and Technology Council, Committee on Environment and Natural Resources, An Integrated Assessment of Hypoxia in the Northern Gulf of Mexico, 2000, at 23.
[xx] Id at 22.
[xxi] US EPA, Chesapeake Bay Program, Watershed Model, Phase 4.3, 2000
[xxii] http://state-of-coast.noaa.gov/bulletins/html/eut_18/case.html
[xxiii] M. Padgitt, D. Newton, R. Penn & C. Sandretto, *Production Practices for Major Crops in U.S. Agriculture, 1990-1997* (USDA, Economic Research Service Statistical Bulletin Number 969, 2000), p. 67.
[xxiv] Personal Email Communication with Max Schnepf, Coordinator of the USDA Buffer Initiative (May 24, 2001) (providing summary data on USDA's buffer initiative).
[xxv] US Department of Agriculture, Environmental Quality Incentives Program Fact Sheet, June 2001
[xxvi] US Department of Agriculture, Wetlands Reserve Program Fact Sheet, June 2001.
[xxvii] For a variety of reasons, some bays are more susceptible to polluted runoff than others. For more information, see Bricker, S.B., C.G. Clement, D.E. Pirhalla, S.P. Orlando, and D.R.G. Farrow. 1999, National Estuarine Eutrophication Assessment: Effects of Nutrient Enrichment in the Nation's Estuaries. NOAA, National Ocean Service, Special Projects Office and the National Centers for Coastal Ocean Science. Silver Spring, MD. 71 pp."
[xxviii] USDA, Economic Research Service, Agriculture and Environmental Indicators, pp. 204-24 (see table 4.5.4).
[xxix] Id. p. 216.
[xxx] Id.
[xxxi] Id.
[xxxii] USDA, Natural Resources Conservation Service, Geography of Hope, p. 38 (roughly 38% of farmers use conservation tillage).
[xxxiii] R. Lowrence L.S. Altier, J.D. Newbold, R.R. Schnabel, P.M. Groffman, J.M. Denver, D.L. Correll, J.W. Gilliam, J. Robinson, R. Brinsfield, K Staver, W. Lucas & A. Todd.. "Water Quality Function of Riparian Forest Buffers in Chesapeake Bay Watersheds," *Environmental Management*, Vol. 21, pp. 687-712. (1997).
[xxxiv] W. J. Mitsch, J.W. Day, Jr., J. Wendell Gilliam, P. Groffman, D.L. Hey, G.W. Randall & N. Wang, *Reducing Nutrient Loads, Especially Nitrate-Nitrogen, to Surface Water, Groundwater and the Gulf of Mexico, Topic 5 Report of the Integrated Assessment on Hypoxia in the Gulf of Mexico* (NOAA Coastal Ocean Program Decision Analysis Series No. 19, May 1999). P. 95.
[xxxv] Integrated Hypoxia Assessment, supra note 22, at 39.
[xxxvi] Id.
[xxxvii] Id at 42
[xxxviii] National Research Council, Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution (National Academy of Sciences Press, 2000) p. 278.
[xxxix] Id at pp. 39-42.
[xl] Dollars and Sense, supra note 17, pp. 25-36.
[xli] Only 15 states received a combined annual average of $12.2 billion in FY 1998 and FY 1999 -- or 74 percent of all direct payments to farmers. At the same time, five of the nation's largest agricultural states -- Florida, California, New York, North Carolina, and Pennsylvania -- received a combined annual average of $918 million -- or just 6 percent of federal farm spending even though these states jointly account for 29 percent of the gross revenues earned by America's farmers and ranchers. If Congress merely fulfilled the existing $2 billion conservation backlog, many states would receive more federal farm funds than they now receive from the existing $20 billion farm program. For example, farmers in Florida -- where three of the nation's 17 most polluted bays are located -- would receive approximately $72 million if Congress provided sufficient funding to meet current demand for USDA conservation programs, or 45 percent more funding than Florida farmers received from USDA, on average, in FY 1998 and 1999. Ten other states would also receive more funding from conservation payments than from existing USDA payments if Congress merely met existing conservation demand -- New Jersey, Connecticut, Maine, Massachusetts, Nevada, New Hampshire, Rhode Island, Vermont, Alaska and West Virginia. And while future conservation demand is difficult to predict, conservation funding in nine states -- Utah, Wyoming,

Virginia, Pennsylvania, Oregon, New York, Maryland, Hawaii, Delaware -- would likely exceed current USDA payments if conservation funding reached $6 billion or more annually. Most Congressional districts in California would also receive more funding than is currently provided by USDA under this scenario.

[xlii] In addition, Rep. John Thune (R-SD) and 30 members of Congress have introduced H.R. 1949, the Conservation Security Act of 2001, which provides approximately $4 bilion in annual payments to farmers and ranchers who implement basic conservation practices, such as better management of fertilizer.