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Farms, Their Environmental Harms, and Environmental Law

Part 1

by

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Farms are one of the last uncharted frontiers of environmental regulation in the United States. Despite the substantial environmental harms they cause—habitat loss and degradation, soil erosion and sedimentation, water resources depletion, soil and water salinization, agrochemical releases, animal wastes, nonpoint source water pollution, and air pollution—environmental law has given them a virtual license to do so. When combined, the active and passive safe harbors farms enjoy in most environmental laws amount to an "anti-law" that finds no rational basis given the magnitude of harms farms cause. This Article comprehensively documents the environmental harms farms cause and the safe harbors they enjoy in environmental law, then argues for a core federal statute that blends regulation, information, tax, incentive, and trading instruments to address several of the major sources of harm. This Article shows that conventional prescriptive regulation simply will not effectively fit the geographic, economic and political demographics of farms, but that the proposed blend of instruments could achieve significant gains in farming's environmental performance without excessive administrative or compliance complexities and costs.

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INTRODUCTION

Farms and farming are intrinsically linked with human civilization, and have had a dramatic impact on our planet's landscape and environmental systems.[1] Environmental regulation in the United States, though young when compared to other fields of law, is a highly developed body of law. Unfortunately, a wide chasm exists between these two social endeavors— farms are virtually unregulated by the expansive body of environmental law that has developed in the United States in the past 30 years. Yet the absence of an environmental regulation program for farms presents us with the opportunity to create one from scratch. The time for taking advantage of that

1. *See* A.M. MANNION, AGRICULTURE AND ENVIRONMENTAL CHANGE 227 (1995) ("Agriculture, to state the obvious, has had a profound influence on the Earth's surface and the processes that operate thereon. There are few parts of the globe that remain unaffected by agriculture."); P.A. Matson et al., *Agricultural Intensification and Ecosystem Properties*, 277 SCI. 504, 504 (1997) ("Expansion of agricultural land is widely recognized as one of the most significant human alterations to the global environment."); Peter M. Vitousek et al., *Human Domination of Earth's Ecosystems*, 277 SCI. 494, 494 (1997) ("The use of land to produce goods and services represents the most substantial human alteration of the Earth system.").

opportunity is long overdue.

To acknowledge that farms pollute and degrade the environment should neither indict farming as a way of life nor denigrate the ideals farmers hold. Farming in America is a deeply-rooted cultural institution with many noble qualities and important economic and social benefits, but it is also an industry with much in common with other industries, their owners, and their workers. Acknowledging that industries cause environmental damage has not generally been regarded as an attack on the people or the institutions involved. Nor should it be so for farms. The plain truth is that farms pollute ground water, surface water, air, and soils; they destroy open space and wildlife habitat; they erode soils and contribute to sedimentation of lakes and rivers; they deplete water resources; and they often simply smell bad. These effects are and always have been consequences of farming in general.[2] What is amazing is that these consequences have escaped serious regulatory attention even through the recent decades of environmental awakening. The organic farming[3] and sustainable agriculture[4] movements that

2. Farming has caused widespread environmental degradation for centuries. For example, the January 1849 *Scientific American* included a report of the practice, common in England at the time, of steeping wheat in an arsenic solution before sowing it to prevent loss of the crop to worms and birds. Although successful in achieving its intended agricultural purpose, the magazine condemned the practice for the adverse effect it had on partridges and pheasants, concluding "we can afford to feed both men and birds." *See 50, 100, and 150 Years Ago–Biocides for Agriculture*, SCI. AM., Jan. 1999, at 14. Six thousand years ago, Sumerian irrigation practices salinized water and soils to the point of inhibiting food production, a factor many historians believe contributed to the decline of the Sumerian culture. *See* Mohamed T. El-Ashry et al., *Salinity Pollution From Irrigated Agriculture*, 40 J. SOIL & WATER CONSERVATION 48, 48 (1985). For comprehensive histories of agriculture from the perspectives of its effects on the environment and vice versa since the dawn of agriculture, see generally MANNION, *supra* note 1, at 31-226 and DANIEL E. VASEY, AN ECOLOGICAL HISTORY OF AGRICULTURE, 10,000 B.C.-A.D. 10,000 (1992).

3. In the midst of some uncertainty as to what organic farming is, Congress passed the Organic Foods Production Act as part of the 1990 Farm Bill to require the United States Department of Agriculture (USDA), with the assistance of a newly-created National Organic Standards Board, to promulgate national standards for marketed organic foods. *See* 7 U.S.C. §§ 6501-6522 (1994); *see also* Kenneth C. Amaditz, *The Organic Foods Production Act of 1990 and Its Impending Regulations: A Big Zero for Organic Foods?*, 52 FOOD & DRUG L.J. 537 (1997). USDA proposed standards in 1997, *see* Dep't of Agric., Proposed Rules, National Organic Program, 62 Fed. Reg. 65,850 (1997) (to be codified at 7 C.F.R. pt. 205), on which it has received over 300,000 comments claiming the standards were contrary to the Board's recommendations and at odds with the organic farming industry's goals. Information about organic farming and the standards, including USDA's proposed rule and all the comments, is available at Agric. Marketing Serv., USDA, *National Organic Program Home Page* (visited Apr. 6, 1999) <http://www.ams.usda.gov/nop>. Although USDA has announced it will make substantial revisions to the rules based on the comments, several organic farming and food protection advocacy groups have

are gaining momentum from within the farming community may be steps in the right direction, but they are not panaceas. At best these steps should be taken in addition to, rather than in lieu of, an effort to rein in the environmental impact of farms through a concerted, comprehensive regulatory framework.

To be more accurate, it is not entirely true to say that environmental law has never addressed farming or that farms have wreaked environmental damage unbeknownst to the political institutions that generate such laws. Rather, Congress has actively prevented their intersection through a nearly unbroken series of decisions to exclude farms and farming from the burdens of federal environmental law, with states mainly following suit.[5] Congress has erected what I will call a vast "anti-law" of farms and the environment. While federal, state, and

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organized continuing campaigns against USDA's proposals. *See* International Center for Technology Assessment, *Organic Watch* (visited Apr. 6, 1999) <http://www.icta.org/projects/cfs/orgwtch.htm>; Campaign for Food Safety, *Save Organic Standards* (visited Apr. 6, 1999) <http://www.purefood.org/organlink.html>. Whatever the outcome of USDA's rules, at present organic farming represents a small proportion of the total farm economy— total retail sales of what are marketed as organically grown foods rose to just over $3.5 billion in 1996. *See Is Organic Better?*, NEWSWEEK, June 1, 1998, at 55.

4. The sustainable agriculture movement focuses on ways to promote natural resource stewardship in agriculture while still maintaining the economic profitability of farms and the social vitality of farming communities. *See* James Stephen Carpenter, *Farm Chemicals, Soil Erosion, and Sustainable Agriculture*, 13 STAN. ENVTL. L.J. 190, 220-43 (1994); Neil D. Hamilton, *Sustainable Agriculture: The Role of the Attorney*, 20 Envtl. L. Rep. (Envtl. L. Inst.) 10,021 (1990); Robert Myers et al., *Developing an Enduring American Agriculture*, 12 NAT. RESOURCES & ENV'T 110 (1997); *see also* VERNON W. RUTTAN ED., AGRICULTURE, ENVIRONMENT, AND HEALTH: SUSTAINABLE DEVELOPMENT IN THE 21ST CENTURY (1994) (overview of sustainable agriculture movement). Some commentators have described the sustainable agriculture movement as part of a larger "New Agriculture" movement through which a "network of farmers, consumers, educators, community activists, food marketers, and chefs are combining to offer alternatives to [farm] industrialization," Neil D. Hamilton, *Greening Our Garden: Public Policies to Support the New Agriculture*, 2 DRAKE J. AGRIC. L. 357, 358 (1997), while others have expressed the concern that the sustainable agriculture movement may play into continued efforts by farming interests to project the "agroecological opium" that farms are environmentally benign, or even have the potential to be environmentally beneficial, thereby making the case to keep environmental regulation of farms an adjunct to overall farm support policies. *See* Jim Chen, *Get Green or Get Out: Decoupling Environmental from Economic Objectives in Agricultural Regulation*, 48 OKLA. L. REV. 333, 337 (1995).

5. *See* John Davidson, *Conservation Agriculture: An Old New Idea*, 9 NAT. RESOURCES & ENV'T 20, 20 (1995) (noting that "nearly every major federal environmental statute exempts production agriculture"). As pointed out in this Article, in recent years some states have begun to move ahead of the federal government in environmental regulation of agriculture on certain fronts. *See* William L. Oemichen, *State Government Service to the Agriculture of Tomorrow*, 2 DRAKE J. AGRIC. L. 247 (1997). Even taken together, however, these state efforts by no means reverse the basic theme of safe harbor for farming in environmental law.

local governments have been busy addressing most other forms and sources of environmental degradation, farms remain largely unburdened by environmental law,[6] yet move steadily up the ranks of the worst threats to the environment. Today, farms stand at or very near the top of that list in many categories of environmental degradation.[7]

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6. As one leading agriculture law scholar has put it, whereas many sectors of the economy are exploring "next generation" environmental policy, "agriculture is different. It never had coherent first-generation environmental protection programs." C. Ford Runge, *Environmental Protection from Farm to Market*, *in* THINKING ECOLOGICALLY: THE NEXT GENERATION OF ENVIRONMENTAL POLICY 200, 200 (Marian R. Chertow & Daniel C. Esty eds., 1997). Runge points out that even after 30 years of modern statutory environmental law, "[N]o significant environmental controls have been placed on farm practices even where agricultural activities are a primary cause of pollution problems." *Id.* at 201; *see also* Chen, *supra* note 4, at 350-51 ("Unlike agriculture, which enjoys environmental exemptions both explicit and implicit, virtually every other industry in the United States must face a comprehensive battery of environmental obligations."); Davidson, *supra* note 5, at 20 ("In contrast to the national response to other environmental problems . . . the response by lawmakers to agricultural pollution has been cautious and exploratory."); Margaret Rosso Grossman, *Agriculture and the Environment in the United States*, 42 AM. J. COMP. L. 291, 293 (1994) ("Despite the serious effects of agricultural pollution, little direct environmental regulation of farming practices has occurred, and some federal farm policies have encouraged environmentally harmful practices."); J.W. Looney, *The Changing Focus of Government Regulation of Agriculture in the United States*, 44 MERCER L. REV. 763, 771 (1993) ("The least pervasive area of agricultural regulation is at the farm level."). For background on the law of farms and the environment—what little there is of it—see K. Jack Haugrud, *Agriculture*, *in* SUSTAINABLE ENVIRONMENTAL LAW 451-574 (Celia Campbell-Mohn et al. eds., 1993) (environmental law treatise chapter covering agriculture); Symposium, *Agriculture and Forestry in a Changing World*, 9 NAT. RESOURCES & ENV'T 3 (1995). *See also* Sally J. Kelley et al., *Agricultural Law: A Selected Bibliography, October 1992-December 1995*, 61 MO. L. REV. 877, 909-33 (1996) (covering books and articles on agriculture and wetlands, land use, water rights, water quality, pesticides and herbicides, sustainable agriculture, and soil conservation). The U.S. Environmental Protection Agency (EPA) maintains the "Ag Center," an internet site devoted to assisting the agricultural community in understanding and complying with environmental laws. *See* National Agric. Compliance Assistance Ctr., Agric. and Ecosystems Div., Office of Compliance, U.S. EPA, *About the Ag Center* (visited Apr. 22, 1999) <http://es.epa.gov/oeca/ag/about.html>. By accessing the "Laws and Policies" portion of the site, visitors can obtain what EPA claims are plain-English descriptions of how environmental laws apply to farming and links to related sites.

7. For example, farms rank as the leading cause of water quality impairment in our nation's lakes and rivers. *See* OFFICE OF WATER, U.S. ENVTL. PROTECTION AGENCY, NATIONAL WATER QUALITY INVENTORY 1994 REPORT TO CONGRESS ES-12 to ES-19 (1994) [hereinafter NATIONAL WATER QUALITY INVENTORY]. This dubious distinction is not limited to farms in the United States. France's Ministry of the Environment recently presented an exhaustive analysis of the environmental consequences of French agriculture, finding that agriculture is that nation's top water consumer, top national emitter of nitrates, and second-highest emitter of phosphates. Environmental problems in France associated with these and other agricultural practices include levels of nitrates in drinking water and groundwater far beyond European Union norms as well as growing concentrations of toxic substances in soils. *See* Lawrence J.

It may be that farming has escaped attention because "[a]griculture's vintage— its sheer age as a human activity— obscures its long-term effects on the environment."[8] But the cumulative effects of more than 450 years of crop and livestock farming in America are no longer obscure; if we continue to leave farms unregulated, it is by choice, not by ignorance.

We ought not ignore the pressing need for environmental regulation of farms simply because farming and farmers are melded into American ideology.[9] Given how distant the lay conception of farms is from reality, ideology seems a poor reason to favor farming in this respect. Rather, "the simple expedient of treating agriculture like any other activity— no more virtuous or villainous— promises to restore some semblance of allocative efficiency and distributive justice to American farm policy."[10] With this expedient in mind, this Article outlines in detail how farms, with the sanction of law, have dramatically degraded the environment. One would be hard pressed to identify another industry with as poor an environmental record and as light a regulatory burden.

For those readers who may be unconvinced or unaware of the impact farms have had on the environment, Part I of this Article inventories the environmental harms that farms cause. Unfortunately, this exercise is a necessary step because many farm interests portray efforts to regulate farms as being premised on "bad science" and exaggerated descriptions of the environmental dangers that farms pose.[11] But the reality is that

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Speer, *Report Blames Agriculture for Damages to Environment, Recommends Eco-Taxes*, Daily Env't Rep. (BNA), Mar. 15, 1999, at A-7. For a thorough discussion of European policies regarding agriculture and the environment, see Margaret Rosso Grossman, *Agro-Environmental Measures in the Common Agricultural Policy*, 25 U. MEM. L. REV. 927 (1995).

8. Chen, *supra* note 4, at 337.

9. A leading scholar of American agricultural law sums it up best in observing that "[m]uch of the favorable regulation enacted for agriculture can be traced to the special status of farming in American society." Grossman, *supra* note 6, at 293. American ideology tends to romanticize farms, focusing on the Jeffersonian agro-society roots of democracy, the plight of dust bowl farmers, and the peacefully bucolic farm by the side of the road. In fact, American farms comprise one of the most massive, self-interested, economically anti-competitive, and politically powerful industries in our nation's history. *See generally* Jim Chen, *The American Ideology*, 48 VAND. L. REV. 809, 810-31 (1995). For a concise social and political history of farming in America, see Haugrud, *supra* note 6, at 460-74.

10. Chen, *supra* note 9, at 875-76.

11. *See, e.g.*, NATIONAL LEGAL CENTER FOR THE PUBLIC INTEREST, FARMERS, RANCHERS AND ENVIRONMENTAL LAW (1995). Many farm advocates remain in deep denial of the industry's environmental failure. For example, one leading farm advocate recently advocated that growth control laws should put farms "legally out of

farming, particularly in the modern American style, is an intensive land use involving a multitude of polluting and land transforming activities.[12] The magnitude of its environmental impacts is not readily apparent from studying individual farms; rather, serious environmental degradation results from the aggregation of harmful farming practices across large areas. When compiled on regional, national, and global levels, the numbers are quite alarming.[13] Environmental law can no longer ignore the fact that farming is integrally related to the future of our national and global environmental quality.

Part II of this Article provides an inventory of the many provisions of environmental laws that exempt, release, and excuse farms from regulation.[14] Some of these provisions can be understood, in isolation, as rational responses to the need for efficient administration of environmental law and the importance of farming to other social and economic goals. When the sheer mass of this anti-law is considered as a whole, however, it defies reasonable explanation. There is simply no rational relationship between the magnitude of the environmental harms farms cause and the response of environmental law.[15]

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the reach of development for the foreseeable future" because in addition to food, they "provide environmental amenities like scenic open space, wildlife habitat and unpaved watersheds; and [farms] demand few public services." Edward Thompson, Jr., *"Hybrid" Farmland Protection Programs: A New Paradigm for Growth Management?*, 23 WM. & MARY ENVTL. L. & POL'Y REV. 831, 831 (1999) (author is Senior Vice President for Public Policy, American Farmland Trust).

12. Its adverse impacts include not only environmental degradation, which is substantial in its own right, but also effects outside the scope of this Article, such as occupational safety risks, food quality impairment, animal mistreatment, the risks of biogenetic engineering, and the promotion of resistant bacteria harmful to humans.

13. A 1998 report prepared jointly by the World Resources Institute, the United Nations Environment Program, the United Nations Development Program, and the World Bank identified "intense agricultural development" as one of three "drivers of change" in the global environment. Alec Zacaroli, *Environmental Degradation Causes Millions of Premature Deaths Per Year, Report Says*, 29 Env't Rep. (BNA) 113 (1998). The other two were industrial development and increased energy use.

14. The favorable treatment of farms is by no means limited to environmental regulation. *See* Chen, *supra* note 9, at 875 n.353 (collecting farm safe harbor provisions in antitrust laws, labor laws, minimum wage laws, bankruptcy laws, tax laws, motor carrier laws, and animal welfare laws).

15. For additional legal commentary on some of the safe harbors farms enjoy from environmental regulation, see Haugrud, *supra* note 6 (discussing the general coverage of the environmental law of farms); Elaine Bueschen, *Pfiesteria Piscicida: A Regional Symptom of a National Problem*, 28 Envtl. L. Rep. (Envtl. L. Inst.) 10,317 (1998) (focusing on water pollution control laws); Larry C. Frarey & Staci J. Pratt, *Environmental Regulation of Livestock Production Operations*, 9 NAT. RESOURCES & ENV'T 8 (1995) (focusing on exemptions covering animal waste runoff); Drew L. Kershen, *Agricultural Water Pollution: From Point to Nonpoint and Beyond*, 9 NAT. RESOURCES & ENV'T 3 (1995) (focusing on water pollution control laws); Grossman,

The solution to this disconnection between effect and response is complex. It may be that "[t]raditional agriculture quakes at the idea that environmental law will come to the farm."[16] If so, perhaps the approach of *traditional* environmental law is the problem. Protecting the environment from farms is not merely a matter of applying traditional approaches that have worked with other industries. Rather, as Part III of this Article demonstrates, the geographic, economic, and political settings of the farming industry call for approaches that may be outside the box of conventional environmental law. The environmental regulation of farms must incorporate several key features if it is to succeed where traditional models of environmental law surely would not. First, it must relate to farms the way farms relate to the landscape— that is, as numerous, disperse, and diverse operations having cumulative effects over large geographic scales. Second, it must take full advantage of market incentives and adaptive management techniques as means of keeping farms and their regulatory burdens flexible and responsive to rapidly changing social and economic conditions— that is, it must avoid relying exclusively on command-and-control regimes that have dominated modern federal environmental law. Finally, it must relate to farms the way farms relate to the relevant decisionmaking bodies— that is, local and state governing bodies must be sufficiently empowered to form arms-length cooperative relationships with federal regulatory authorities.

Satisfying these criteria through a national environmental law system for farms probably will not require a completely new model of environmental law. Farms may present a special case requiring unconventional responses, but we are not completely inexperienced in dealing with these issues in similar contexts. Although environmental law has deliberately overlooked farms, it has tested a variety of regulatory models in other settings, from heavily centralized command-and-control schemes to relatively decentralized market-based trading systems. Many of these programs have successfully managed problems similar to those presented by farms. The ingredients for an appropriate approach to regulating farms thus are already developed and in use, albeit scattered throughout a multitude of other environmental regulation programs. My proposed framework for a farm-environment management law, outlined in Part IV of this Article,

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supra note 6, at 299-330 (discussing the general coverage of the environmental law of farms).

16. Chen, *supra* note 4, at 351.

cherry picks from existing successful environmental law programs to assemble a comprehensive legal framework that responds to the geographic, economic, and political setting of the farming industry. The anti-law of farms and the environment could thus be replaced with a body of positive law that responsibly addresses the problems of the future.

I

THE ENVIRONMENTAL HARMS OF FARMS

The United States Department of Agriculture's (USDA) 1997 Census of Agriculture (Census)[17] defines a farm as "a place which produced and sold, or normally would have produced and sold, $1,000 or more of agricultural products during 1997."[18] In 1997, over 1.9 million such operations fit that description in the United States.[19] Data from the Census and from other studies reveal the size and diversity of the industry we call farming and the massive aggregate impact it has on the environment.

A. Some Background on Farms and Farming

Farms cover over 930 million acres of the United States, with roughly equal divisions of cropland and pastureland/rangeland accounting for the vast majority of that total.[20] The total market

17. The results of the 1997 Census of Agriculture are available at NATIONAL AGRIC. STAT. SERV., U.S. DEP'T OF AGRIC., 1997 CENSUS OF AGRICULTURE (visited Feb. 10, 1999) <http://www.nass.usda.gov/census/> [hereinafter CENSUS]. USDA's National Agricultural Statistics Service conducts the census in years ending in the numbers 2 and 7 by sending report forms to all known ranchers and farmers, who by law must return the completed forms even if they conducted no agricultural operations. *See* National Agric. Stat. Serv., U.S. Dep't of Agric., *Frequently Asked Questions About the Census of Agriculture* (visited Feb. 10, 1999) <http://www.nass.usda.gov/census/ census97/cenfaqs.htm>.

18. *Id.* This Article examines the environmental effects and regulation of *farms* only. Crop production farms are categorized into oilseed and grain farming, vegetable and melon farming, greenhouses and nurseries, tobacco, cotton, sugarcane, hay, and all other crops. *See* CENSUS, *supra* note 17, at United States Data 69, tbl.47. Livestock farming is categorized into beef cattle, cattle feedlots, dairy cattle and milk production, hogs and pigs, poultry and eggs, sheep and goats, animal aquaculture, and other animal production. *See id.* The environmental effects and regulation of "upstream" industries that supply farms, such as pesticide manufacturing and seed suppliers, and of "downstream" industries that are supplied by farms, such as meat packing and other food processing and distribution, are vast topics in their own right and outside the scope of this Article. For an excellent discussion of the regulation of the agriculture industry as broadly defined to include these related sectors, see Looney, *supra* note 6.

19. *See* CENSUS, *supra* note 17, United States Data at 19, tbl.7.

20. *See id.* at 8, fig.4. This is roughly 45% of the United States' 2.1 billion acres of total land mass. Adding forest land to crop and pasture land brings the figure to 75%. *See* RUTHERFORD H. PLATT, LAND USE AND SOCIETY 6-8 (1996).

value of agricultural products sold by American farms in 1997 was just under $200 billion,[21] and total expenses were over $150 billion.[22] Individual farms, meanwhile, are tremendously diverse. For example, roughly half of American farms generate annual product values under $10,000, accounting for less than 1.5% of total farm production value, whereas roughly 3.6% of farms generate over $500,000 in annual product value, accounting for over 56% of total farm production value.[23] Over half of farms are under 500 acres in size, whereas only 4% are over 2000 acres.[24] Over 85% of farms, mostly the so-called "small farms," are owned by individuals or families; corporate farms make up under 5% and partnerships just under 9%.[25] The four principal crops, in order of acres in production, are corn, soybeans, hay, and wheat.[26] The principal livestock, in order of production value, are cattle, poultry, and hogs.[27] As a point of reference, farms in the United States produced over 98 million head of cattle, 366 million egg layer chickens, 6.75 billion broilers and meat chickens, and 61 million hogs in 1997.[28]

Despite their diversity, one feature is common to all farms: they are part of an industry. Farms owned an estimated $110 billion in machinery and equipment in 1997.[29] They spent a total of over $6 billion on gasoline and other fuels,[30] over $18 billion on chemical fertilizers, crop control chemicals, and other agricultural chemicals combined,[31] and over $2.75 billion on electricity.[32] The payroll for farms in 1997 was over $14 billion for hired farm labor and over $2.9 billion for contract labor.[33] In short, farming is a vast industry in the United States which, in turn, supplies and is supplied by other industries.[34]

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21. *See* CENSUS, *supra* note 17, United States Data at 7, fig.3.
22. *See id.* at 98, tbl.49.
23. *See id.* at 6, fig.2.
24. *See id.*
25. *See id.*
26. *See id.* at 8, fig.5.
27. *See id.* at 9, fig.6.
28. *See id.* at 10, tbl.1.
29. *See id.*
30. *See id.* at 23, tbl.14.
31. *See id.*, tbl.15.
32. *See id.* at 100, tbl.49.
33. *See id.*
34. The American "food and fiber" industry as a whole accounts for $1 trillion in economic activity every year, or "over 15 percent of our gross domestic product," Allison Rees Armour-Garb, *Minimizing Human Impacts on the Global Nitrogen Cycle: Nitrogen Fertilizer and Policy in the United States*, 4 N.Y.U. ENVTL. L.J. 339, 346 (1995), one of every six jobs, and the largest export component in the economy— over $50 billion annually. *See* NATURAL RESOURCE CONSERVATION SERV., U.S. DEP'T OF

B. *The Inventory of Environmental Harms Farms Cause*

Another attribute that farms share is that they degrade the environment. The magnitude of that effect, however, is something that is difficult for most nonfarmers to grasp.[35] Consider the typical farming process: first, remove all existing vegetation from the land and level it; second, deploy a single-species regime of crop or livestock; third, cultivate the crop or livestock with water and chemicals; finally, remove the crop or livestock and associated waste products from the land and start over. A number of environmental harms flow directly and necessarily from that basic reality of farming: (1) habitat loss and degradation; (2) soil erosion; (3) water resources depletion; (4) soil salinization; (5) chemical releases; (6) animal waste disposal; (7) water pollution; and (8) air pollution.[36] In each of these categories, farms are a significant source of environmental harm.

1. *Habitat Loss and Degradation*

The consequences of modern agriculture on wildlife habitat are undeniable, from habitat elimination to more direct effects on water and wildlife species.[37] The "structure and diversity of the agroecosystem can also influence the movement of wildlife

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AGRIC., GEOGRAPHY OF HOPE 7, 27 (1996) [hereinafter GEOGRAPHY OF HOPE]; Looney, *supra* note 6, at 763.

35. For example, the 1998 comprehensive Roper Starch survey of adult Americans' environmental perceptions, the seventh in an annual series of such surveys, revealed that although most Americans claim they know a "fair amount" about environmental issues and problems and list clean water as a top priority, only one in five knows that run-off is the most common form of pollution of streams and rivers. Nearly half of people surveyed mistakenly believe the most common source of water pollution is industrial discharges, and 15% believe it is garbage dumping by cities. *See* THE NATIONAL ENVIRONMENTAL EDUCATION & TRAINING FOUNDATION, ROPER STARCH WORLDWIDE, THE NATIONAL REPORT CARD ON ENVIRONMENTAL KNOWLEDGE, ATTITUDES AND BEHAVIORS 5-6, 23 (1998). Americans simply do not perceive farms as the leading source of water pollution.

36. To some extent these eight categories interrelate and overlap. For example, farm irrigation practices lead to water resource depletion and soil salinization; the pollutants carried in nonpoint source water runoff from farms include chemicals, animal waste, and eroded soils; farms release nitrogen into the environment through chemical applications and animal waste. Nevertheless, the literature on the impacts of farming on the environment tends to break the problem down into these discrete topics, each of which is susceptible to measurement and study. Thus, I use them to organize both the factual overview of the environmental harms of farms, as well as some of the measures I propose to reform the law of farms and the environment.

37. *See* NATIONAL BIOLOGICAL SERV., U.S. DEP'T OF THE INTERIOR, OUR LIVING RESOURCES: A REPORT TO THE NATION ON THE DISTRIBUTION, ABUNDANCE, AND HEALTH OF U.S. PLANTS, ANIMALS, AND ECOSYSTEMS 424 (1995) [hereinafter OUR LIVING RESOURCES].

between natural and agricultural systems and affect their use of such systems."[38] Despite the ability of perennial, vegetationally diverse agro-ecosystems with complex structure to provide important habitats for many birds and other animals typically found in undisturbed habitats,[39] farms pose an enormous net negative to wildlife.

Farming no longer poses a significant direct threat of habitat loss. Most direct loss of habitat resulting from conversion of land areas to farming has already occurred.[40] In fact, the United States loses a small portion of its available farmland each year, mainly to urban and suburban land uses.[41] But the magnitude of the historical transformation of undisturbed habitat to farming was immense— after all, at one time virtually all of the 930 million acres currently in farming uses were undisturbed habitat. The fact that these habitat losses were experienced in the past does not obviate the seriousness of their continuing impacts to wildlife in the present.[42] Further, habitat losses to

38. Matson et al., *supra* note 1, at 507.

39. *See id.*

40. For example, "conversion of wetlands to agricultural land has declined steadily since the 1950s." GEOGRAPHY OF HOPE, *supra* note 34, at 52. Over 790,000 acres of wetland were lost on non-Federal lands between 1982 and 1992, for a yearly loss estimate of 70,000 to 90,000 acres. Agriculture was responsible for 87% of the loss of wetlands from the mid-1950s to the mid-1970s, but only 54% of the loss from the mid-1970s to the mid-1980s. *See* NATIONAL WATER QUALITY INVENTORY, *supra* note 7, at ES-28 to ES-29.

41. Between 1992 and 1997, farmland in the United States fell from 946 million acres to 932 million acres, a loss of about 1.5% in five years. In 1964, land in farming was about 1.1 billion acres, about 18% more than we have today. *See* CENSUS, *supra* note 17, United States Data at 10, tbl.1. Between 1982 and 1992, 3 million acres of cropland were converted to commercial or residential uses. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 30; Myers et al., *supra* note 4, at 111. The highly visible impact of urbanization on prime quality agricultural land lying at the urban fringe has led several states to implement narrowly focused farmland protection laws. *See* Haugrud, *supra* note 6, § 8.2(B)(1)(b), at 323-30; *see also* George E.H. Gay, *State Solutions to Growth Management: Vermont, Oregon, and a Synthesis*, 10 NAT. RESOURCES & ENV'T 13 (1996); Henry E. Rodegerdts, *Land Trusts and Agricultural Conservation Easements*, 13 NAT. RESOURCES & ENV'T 336 (1998); Jeanne S. White, *Beating Plowshares into Townhomes: The Loss of Farmland and Strategies for Slowing its Conversion to Nonagricultural Uses*, 28 ENVTL. L. 113 (1998). The federal government also has entered the arena. For example, the Farmland Protection Policy Act of 1981 directs federal agencies to take farmland preservation into account when administering their authorities, *see* 7 U.S.C. §§ 4201-4209 (1994), and the 1996 Farm Bill authorized USDA to initiate a Farmland Protection Program through which the federal government can join with state, tribal, and local governments to acquire conservation easements on land that farmers want to preserve in agriculture, *see* Pub. L. No. 104-127, § 388, 110 Stat. 888, 1020 (1996) (codified at 16 U.S.C. § 3830 (1994 & Supp. III 1997)); *see also* Grossman, *supra* note 6, at 330; Haugrud, *supra* note 6, § 8.2(B)(1)(a), at 483; Rodegerdts, *supra*, at 337.

42. For example, reduced habitat is the most common threat to endangered

farms have not been geographically uniform throughout the nation.[43]

The continuing loss of valuable habitat on farms themselves is often overlooked. The amount of undisturbed grass-dominated cover and non-cropped areas on farms has decreased, resulting in lower availability of habitat and higher losses to predators of many species of wildlife.[44] In many agricultural areas, crucial wildlife habitat components such as undisturbed grassland have been dissected into small, isolated patches.[45] Habitat diversity on farms has also declined drastically as a consequence of the elimination of hay and pasture once needed by draft animals and a shift to crop monocultures.[46] In addition, wetland drainage, consolidation of fields and farms, and elimination of fence-rows and idle areas have reduced habitat diversity even further, thereby diminishing the populations of wildlife that once co-existed with crops on farms.[47] Increased agrochemical use has also been implicated in the long-term decline of species that relied on farmland as part of their habitat base.[48]

Despite these losses, the truly pernicious effects of farming on habitat today occur off-site.[49] For example, gaseous and dissolved nitrogen oxide and ammonia emitted from agricultural ecosystems are transported to and deposited in downwind and

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species. *See* William Stolzenburg, *Habitat Loss Affects 88 Percent of Species*, NATURE CONSERVANCY, Nov.-Dec. 1997, at 6; David S. Wilcove et al., *Quantifying Threats to Imperiled Species in the United States*, 48 BIOSCI. 607 (1998). The effects of habitat loss on species viability may not be fully manifested for decades or centuries, *see* Michael L. Rosenzweig, *Heeding the Warning in Biodiversity's Basic Law*, 284 SCI. 276, 277 (1999), and for many endangered species, habitat restoration is a necessary ingredient for recovering the species from the path toward extinction, *see* Theodore C. Foin et al., *Improving Recovery Planning for Threatened and Endangered Species*, 48 BIOSCI. 177, 179-80 (1998).

43. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 23 (map of farmland distribution in the United States). For example, the Mississippi River ecosystem, which covers almost 40% of the contiguous United States, has lost over 75%, and in some places 95%, of its floodplain to farmland, urban development, and impoundments. *See 500,000 Acres Will Shield Waterways from Farm Runoff*, EDF NEWSLETTER, June 1998, at 1, 3 (discussing plans to restore some of the converted floodplain).

44. *See* OUR LIVING RESOURCES, *supra* note 37, at 424. Harvested cropland has increased by 20 million acres since 1987. *See* CENSUS, *supra* note 17, at United States Data 19, tbl.7.

45. *See* OUR LIVING RESOURCES, *supra* note 37, at 424.

46. *See id.*

47. *See id.*

48. *See id.*

49. *See* Matson et al., *supra* note 1, at 507 ("Although agroecosystems are typically managed in isolation from other ecosystems within a region, the physical, ecological, and biogeochemical changes that take place within them have numerous consequences for adjacent, and even distant, ecosystems.").

downstream terrestrial and aquatic ecosystems. This deposition causes inadvertent fertilization, which can lead to acidification, eutrophication, shifts in species diversity, and effects on predator and parasite systems.[50] Transport of pesticides beyond farm boundaries also causes severe damage to wildlife and habitat functions.[51] Similarly, because evaporation and concentration effects cause irrigation return-flows to carry greater concentrations of salt and minerals than found in irrigation water sources, fish and wildlife populations downstream often suffer.[52] Also, high erosion rates associated with cultivated agriculture can lead to sedimentation in reservoirs and lakes, which reduces the lifetime of these water systems as aquatic habitat.[53] Overall, therefore, farming has caused and continues to cause significant habitat degradation both on the farm and off.[54]

2. *Soil Erosion and Sedimentation*

Converting natural ecosystems to permanent agriculture results in a loss of soil organic matter, thus increasing the erosion potential of the soils.[55] As a result, farms are by far the leading national cause of soil erosion.[56] In 1997, for example, there were 375 million acres of cropland in the United States, of which 103.5 million acres were considered "highly erodible."[57] In 1982, forces of erosion moved almost 3.1 billion tons of soil from

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50. *See id.*

51. *See* Carpenter, *supra* note 4, at 213-18; *Report Links Wildlife Decline to Chemical Exposure*, 30 Env't Rep. (BNA) 718 (1999).

52. *See* Matson et al., *supra* note 1, at 508.

53. *See id.*; Carpenter, *supra* note 4, at 218-19.

54. When land conversion, farm practices, and the offsite effects of pesticides and fertilizers are combined, farming has significantly affected 38% of the listed endangered species. *See* Wilcove et al., *supra* note 42, at 610-12. For additional economic and legal analysis of the relation between farming and habitat, see Jan Lewandrowski & Kevin Ingram, *Policy Considerations for Increasing Compatibilities Between Agriculture and Wildlife*, 39 NAT. RESOURCES J. 229 (1999).

55. *See* Matson et al., *supra* note 1, at 506.

56. For example, 90% of all the soil erosion that happens in Illinois, about 158 million tons per year, occurs on farms. THE NATURE OF ILLINOIS FOUND. & ILL. DEP'T OF ENERGY AND NATURAL RESOURCES, THE CHANGING ILLINOIS ENVIRONMENT: CRITICAL TRENDS 59 (1994).

57. *See* Natural Resources Conservation Serv., U.S. Dep't of Agric., 1997 National Resources Inventory— Summary Report tbl.14, *available at* <http://www.nhq.nrcs.usda.gov/NRI/1997/> (visited Dec. 7, 1999) [hereinafter 1997 National Resources Inventory]. Highly erodible cropland is generally steeper and less fertile, requires more inputs to maintain production, and can be damaged by high erosion rates. *See* Carpenter, *supra* note 4, at 204-05 (explaining protocol for evaluating highly erodible land).

America's cropland, 1.4 billion by wind and 1.7 billion by water.[58] This loss of topsoil is replenished at a rate of less than one inch in 200 years.[59]

Depending on a variety of factors,[60] between 25 and 40% of soil that erodes from a field will reach a water body.[61] Erosion thus leads directly to sedimentation in reservoirs and lakes.[62] Yearly soil discharge from agriculture land to waterways in the United States is estimated at over 1 billion tons of sediments and 447 million tons of total dissolved solids.[63] The Mississippi River alone carries 331 million tons of topsoil to the Gulf of Mexico annually.[64]

Sediments not only reduce the lifetime and uses of water systems,[65] but also carry significant amounts of pollutants. Both "instream suspended sediment and bedload are, by volume, the largest category of pollutants in the United States."[66] "High levels of suspended sediments can also reduce net primary production in freshwater and marine systems, ultimately affecting" the feeding and reproduction of fish and aquatic invertebrates.[67] Farming also releases nutrients and other chemicals that are absorbed by the sediment soil particles entering streams and rivers as a result of soil erosion.[68] Bottom sediment contaminated with pesticides and other agricultural chemicals is an increasing problem in watersheds around the nation.[69]

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58. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 36.

59. *See* Charles M. Cooper & William M. Lipe, *Water Quality and Agriculture: Mississippi Experiences*, 47 J. SOIL & WATER CONSERVATION 220, 220 (1992).

60. "[T]he rate and amount of [soil organic matter] loss depends on a number of factors, including climate and soil type as well as numerous factors directly influenced by cropping systems, such as the amount of organic inputs, crop coverage of the soil, tillage practice, and length and type of fallow." Matson et al., *supra* note 1, at 506.

61. *See* David Zaring, *Federal Legislative Solutions to Agricultural Nonpoint Source Pollution*, 26 Envtl. L. Rep. (Envtl. L. Inst.) 10,128, 10,129 (1996).

62. *See* Matson et al., *supra* note 1, at 508. Wind erosion contributes to the aerosol content of the atmosphere, playing a large role in climate and air pollution. *See id.*

63. *See* Cooper & Lipe, *supra* note 59, at 220.

64. *See id.*

65. *See* Carpenter, *supra* note 4, at 210 ("[T]he hundreds of millions of tons of eroded soils deposited in waterways disrupts navigation, fills reservoirs, increases the costs of water treatment, and limits recreational uses.").

66. Cooper & Lipe, *supra* note 59, at 220; *see also* Carpenter, *supra* note 4, at 210-11.

67. Matson et al., *supra* note 1, at 508.

68. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 40.

69. For example, EPA recently delivered to Congress a report entitled *The Incidence and Severity of Sediment Contamination in Surface Waters of the United States*, identifying 7% of watersheds sampled as containing areas of probable concern

Through improved soil management technology and practices, soil erosion is to some extent on the mend.[70] Average cropland erosion rates in tons per acre per year for 1997 were substantially lower than erosion rates for 1982.[71] Most of this improvement, however, occurred by 1992, with little additional performance improvement since that time.[72] Moreover, even these improved rates are 12 times higher than soil formation rates, meaning net losses of cropland soils each year at an annual cost to society in excess of $29 billion.[73] Indeed, some new "good farming" practices actually increase soil erosion rates.[74] Soil erosion associated with farming thus continues to reduce soil productivity and substantially affect water quality and atmospheric resources.[75]

3. *Water Resources Depletion*

Farms use vast quantities of water. In 1992, for example, farmers in the United States irrigated 49 million acres of agricultural land,[76] and by 1997, that number had soared to 55 million acres.[77] Over 40% of the energy used by agriculture is

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because of contaminated bottom sediment, and including agricultural runoff as one of the leading causes. *See* Notice of Availability of Report to Congress, 63 Fed. Reg. 2237, 2238 (1998).

70. Between 1982 and 1997, total erosion on all cropland decreased by 42%. In 1982, erosion totaled 3.07 billion tons, and by 1997 it had been reduced to 1.9 billion tons. *See* 1997 Natural Resources Inventory, *supra* note 57, fig.3. Some controversy has developed over whether the picture looks even better than that. Most of the erosion figures discussed in the text are derived from large scale models of erosion rates. A recent study based on a watershed-specific survey of historical "markers" of soil loss and sedimentation suggests that erosion rates have fallen dramatically from the 1970s to the 1990s, though the study is not without its critics. *See* James Glanz, *Sharp Drop Seen in Soil Erosion Rates*, 285 SCI. 1187 (1999); R. Monastersky, *Erosion: Dustup over Muddy Waters*, 156 SCI. NEWS 116 (1999).

71. *See* 1997 National Resources Inventory, *supra* note 57, at 7 (noting that combined water and wind erosion rates fell from 7.4 in 1982 to 5.0 in 1997).

72. *See id.* tbls.10 & 11 (showing rates of water and wind erosion for cropland in each state for years 1982, 1987, 1992, and 1997). The amount of highly erodible land in cropland production, which fell significantly from 1982 to 1992, has also leveled off through 1997. *See id.*

73. *See* David Pimentel & Edward L. Skidmore, *Rates of Soil Erosion*, 286 SCI. 1477 (1999).

74. For example, farmers who use impermeable plastic sheet mulch, which is better than vetch-covered rows at retaining soil moisture and temperature, experience higher soil erosion rates. *See Plastic Mulch's Dirty Secrets*, 156 SCI. NEWS 207 (1999).

75. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 34.

76. *See* CENSUS, *supra* note 17, United States Data at 10, tbl.1.

77. *See id.* On a global scale, 40% of crop production comes from the 16% of agricultural land that is irrigated. *See* Matson et al., *supra* note 1, at 506.

devoted to irrigation.[78] Although irrigation acreage in the western states declined from 1982-1992 as the use of groundwater for irrigation became increasingly uneconomical,[79] irrigation acreage in the eastern United States has expanded in that time period as farmers attempt to reduce the risk of drought.[80]

Overpumping of groundwater sources for irrigation is a serious concern in many regions,[81] leading to effects such as water table drawdown, land subsidence, desertification, destruction of natural springs and associated wildlife habitats, and saltwater intrusion.[82] Yet as old surface water reservoirs lose capacity due to siltation and new ones become increasingly difficult or impracticable to site,[83] increases in agricultural production will raise the demand for irrigated water from groundwater sources. Irrigation water for farms, from all sources, can be expected to become more scarce "as competition for withdrawals increases with human population growth and development."[84] Complicating this problem are massive federal subsidies for existing and expanded farm irrigation infrastructure and supply.[85] Agricultural demand for water thus

78. *See* Lindsey McWilliams, *Groundwater Pollution in Wisconsin: A Bumper Crop Yields Growing Problems*, ENV'T, May 1984, at 25, 27.

79. For a comprehensive history and future prognosis of irrigated farming in western states, see COUNCIL FOR AGRICULTURAL SCIENCE AND TECHNOLOGY, FUTURE OF IRRIGATED AGRICULTURE (1996).

80. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 31.

81. For example, intensive irrigation has drawn down the huge Ogallala aquifer that stretches across Kansas, Nebraska, and Colorado, posing the possibility of future shortages and reduced productivity. *See* Sandra Postel, *When the World's Wells Run Dry*, WORLD WATCH, Sept.-Oct. 1999, at 30, 32; Runge, *supra* note 6, at 204; Robert R.M. Verchick, *Dust Bowl Blues: Saving and Sharing the Ogallala Aquifer*, 14 J. ENVTL. L. & LITIG. 13 (1999); Erla Zwingle, *Ogallala Aquifer: Wellspring of the High Plains*, NAT. GEO., Mar. 1993, at 83.

82. *See* Barton H. Thompson, Jr., *Water Allocation and Protection: A United States Case Study*, *in* EARTH SYSTEMS: PROCESSES AND ISSUES 476 (W.G. Ernst ed., 2000).

83. *See* Matson et al., *supra* note 1, at 506.

84. *Id.* Irrigation also leads to significant alteration of surface water systems and habitat, as large surface storage reservoirs must be constructed to convert seasonal stream flows to permanent water supplies. The effects of such projects have been tremendous and irreversible in many areas of the nation, particularly in the West. *See* Harrison Dunning, *Confronting the Environmental Legacy of Irrigated Agriculture in the West: The Case of the Central Valley Project*, 23 ENVTL. L. 943, 944-54 (1993). The classic discussion of the issue is found in MARC REISNER, CADILLAC DESERT (1986).

85. The Bureau of Reclamation has spent billions of dollars developing sources of economically inefficient irrigation water for western farmers. *See* Thompson, *supra* note 82, at 483 (noting the irony that this subsidized water encourages western farmers to grow crops that other federal subsidy programs pay midwestern and southern farmers *not* to grow, even though the latter could grow them more economically).

appears to be headed upward on a collision course with competing uses.

4. Soil and Water Salinization

In addition to being a significant user of limited water supplies, irrigated farming continually degrades its surrounding environment in arid and semi-arid areas through the salinization of soils and water.[86] Irrigating arid and semi-arid soils leaches salts and other minerals from the soil, causing them to accumulate in the plant root zone and retard plant growth.[87] Highly salinized soil is useless for agriculture, and reclaiming it is economically difficult, if not impossible.[88] Over 570 million acres of the continental United States have a moderate to severe potential for soil and water salinity problems,[89] and an estimated 20 to 25% of all irrigated land in the United States suffers from saline-induced yield reductions.[90] At least 48 million acres of cropland and pastureland are categorized as saline, and recent surveys indicate that this number is growing at a rate of 10% a year.[91]

For farmers, the solution to salinized soil is to flush the salinized soils with more high quality water than is needed for the crops so that the excess water carries away the leached salts.[92] Often this flushing process is accomplished through installation of an underground drainage tile system, which captures the irrigation water as it percolates through the soils, collects it into an underground drainage pipe network, and then efficiently moves the saline-rich waters away from the farmland in a drainage ditch system.[93] The salts that have been flushed from the irrigated farmlands end up in irrigation return flows which typically carry substantially higher concentrations of salt and minerals than their original surface or groundwater

86. *See* Matson et al., *supra* note 1, at 506.

87. *See* El-Ashry et al., *supra* note 2, at 49 ("Repeated application of water to land for irrigation results in the accumulation of salts in the upper layers of soil."). Saline soils are those that contain sufficient salts to adversely affect plant growth. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 33.

88. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 33.

89. *See id.*

90. *See* El-Ashry et al., *supra* note 2, at 48.

91. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 33.

92. *See* El-Ashry et al., *supra* note 2, at 49 ("To maintain agricultural productivity, these salts must be leached out of the crop root zone.").

93. *See* Gary Bobker, *Agricultural Point Source Pollution in California's San Joaquin Valley*, 9 NAT. RESOURCES & ENV'T 13, 13 (1995) (noting that hundreds of thousands of farmland acres in the San Joaquin Valley employ such tile systems).

sources.[94] This salinized water has potentially devastating effects on downstream aquatic systems.[95] Indeed, "[i]rrigation-related salinity is the major water quality problem in the semiarid western states, where significant quantities of salts occur naturally in rocks and soils."[96]

5. *Agrochemical Releases*

Farms are massive users of chemicals, including insecticides, herbicides, and fungicides.[97] Every year, over "750 million pounds of pesticides are applied to agricultural crops yearly" in the United States.[98] Since 1979, agriculture has been responsible for about 80% of all pesticide use in the United States,[99] and pesticide use on farms has nearly tripled since 1964.[100] "Four of the most prevalent herbicides— atrazine, simazine, alachor, and metolachlor— are applied nationwide, and grain belt states receive large shares of the estimated 135

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94. The "leaching fraction" of the irrigated water— the excess needed for leaching away the salts— will contain unnaturally high salt concentrations because of the intended "salt loading" effect and because the irrigation return water is further concentrated by evaporation. *See* El-Ashry et al., *supra* note 2, at 48-49.

95. One of the most tragic examples is the Kesterson National Wildlife Refuge, which was created when financial troubles caused a planned irrigation return flow "regulation" project to become a terminal reservoir for return flow waters in California's Central Valley. Seen as a potential waterfowl haven, selenium-laden return flow water collected in the vegetation and invertebrates, eventually causing tremendous damage to the waterfowl. *See* Dunning, *supra* note 84, at 953-54; Bobker, *supra* note 93, at 14-15.

96. El-Ashry et al., *supra* note 2, at 49.

97. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) defines pesticides to include nitrogen stabilizers and "substances intended for preventing, destroying, repelling, or mitigating any pest . . . [or] for use as a plant regulator, defoliant, or desiccant." 7 U.S.C. § 136(u) (1994). The pesticide industry involves about 30 major manufacturing companies, 100 smaller companies marketing the active ingredients of pesticides, 3,300 product formulators who take the raw pesticide ingredients and produce finished pesticide products, and over 29,000 pesticide distributors. About 600 distinctive groups of active ingredients are found in the 45,000 pesticide products that are marketed in the United States. About 1.2 billion pounds of pesticides, valued at over $6.5 billion, are sold each year in the United States, over 70% of which are used in farming. *See* P.S.C. Rao et al., Inst. of Food and Agricultural Sciences, Fact Sheet SL-53, Regulation of Pesticide Use 1-2 (rev. ed. 1997). For more on FIFRA and farming, see *infra* text accompanying notes 259-73.

98. Zaring, *supra* note 61, at 10,129.

99. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 45. About 25% of pesticide use in the United States is in California. *See* James Liebman et al., Pesticide Action Network and Californians for Pesticide Reform, Rising Toxic Tide-Pesticide Use in California, 1991-1995, *available at* <http://www.igc.org/panna/risingtide/textoftide.html>. Pesticide applications on farms in the United States have risen dramatically since the 1960s, while land in cultivation has remained about the same. *See* Carpenter, *supra* note 4, at 191.

100. *See* Zaring, *supra* note 61, at 10,129.

million pounds" of herbicides used annually.[101] Although pesticides have undoubtedly improved agricultural efficiency and human living conditions immensely,[102] their adverse environmental impacts are also undeniable.

A significant fraction of pesticides applied to agricultural systems fails to reach its target pests and moves into the soil where it poses immediate and long-term environmental threats.[103] For example, chlorinated hydrocarbons such as DDT can persist in the environment for decades after their use, while organophosphates and carbamates are short-lived but acutely toxic.[104] As urban areas increasingly encroach upon farmlands or even encompass them, the danger that residents will be exposed to harmful levels of pesticide increases.[105]

Pesticides from farm applications have also infiltrated adjacent ecosystems through a multitude of pathways, including discharges and runoff to surface waters,[106] leaching to ground water,[107] and aerial drift.[108] These unwanted pesticide migrations

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101. Penny Loeb, *Very Troubled Waters*, U.S. NEWS & WORLD REPORT, Sept. 28, 1998, at 43.

102. For an aggressive defense of the use of pesticides, arguing that this and other technology-intensive farming practices will allow the Earth easily to support the projected population of 10 billion, see DENNIS T. AVERY, SAVING THE PLANET WITH PESTICIDES AND PLASTIC (1995).

103. *See, e.g.*, *Plastic Mulch's Dirty Little Secrets*, *supra* note 74, at 207 (measuring and comparing chemical runoff from fields using different kinds of mulch). Even when pesticides reach their target, long-term environmental effects remain, for example, the problem of increasing pest resistance. *See* Matson et al., *supra* note 1, at 505. Once pests develop resistance to pesticides, farmers typically respond by increasing the quantity of the pesticide applied or shifting to other pesticides, fueling the pests' resistance buildup mechanisms. Today, nearly 1,000 major agricultural insect, disease, and weed pests are immune to common pesticides. *See* LESTER R. BROWN ET AL., VITAL SIGNS 1999, at 124 (1999).

104. *See* Matson et al., *supra* note 1, at 508.

105. For example, in 1999, the New Jersey Historic Pesticide Contamination Task Force estimated that 5% of the state's land is affected by agricultural pesticides and recommended that areas formerly used for agricultural purposes should be tested for pesticide residue before they are developed. Some local jurisdictions in New Jersey already impose such a requirement. *See Task Force Urges Sampling of Farm Areas for Pesticide Residues Before Development*, 29 Env't Rep. (BNA) 1896 (1999). Recent studies indicate that humans, and even fetuses, continue to be exposed to pesticides that have long been banned in the United States. *See Pesticide Exposure Begins Early*, 156 SCI. NEWS 47 (1999).

106. *See infra* text accompanying notes 48-51.

107. A soil's vulnerability to leaching of pesticides and other agricultural chemicals depends upon three principal factors: (1) the propensity of soils to leach pesticides and nitrates; (2) the amount and timing of rainfall; and (3) the extent of chemical use. The coastal plains stretching from Alabama, Florida, and Georgia, as well as the Corn Belt and the Mississippi River Valley all have the highest vulnerability to leaching agrochemicals. *See* Robert L. Kellogg et al., *The Potential for Leaching of Agrichemicals Used in Crop Production: A National Perspective*, 49 J. SOIL

can have significant adverse impacts on the diversity and abundance of nontarget species as well as complex effects on ecosystem processes and trophic interactions.[109] The threat also extends to human health; more than 14 million Americans drink public water obtained from river sources that contain herbicides,[110] and millions more ingest pesticides in drinking water obtained from groundwater sources.[111]

Fertilizers are another major agrochemical pollutant.[112] Farmers apply nitrogen, phosphorous, and potassium to promote crop growth; however, when applied inappropriately or in excessive amounts the excess nutrients are carried from farmlands into waterways. Fertilizer application rates have increased dramatically.[113] American agriculture now discharges

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& WATER CONSERVATION 294, 294-97 (1994). Not surprisingly, pesticides from every major chemical class have been detected in groundwater. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 48. The United States Geological Survey's 1999 National Water Quality Assessment report, which analyzes 5,000 water samples from 20 major river and groundwater areas of the country, found at least one pesticide at detectable levels in more than 90% of water and fish samples from all streams. *See* U.S. GEOLOGICAL SURVEY, U.S. DEP'T OF THE INTERIOR, USGS CIRC. 1225, THE QUALITY OF OUR NATION'S WATERS: NUTRIENTS AND PESTICIDES (1999); *see also Chemicals Widely Present in Stream, Potential Threats Uncertain, Study Finds*, Daily Env't Rep. (BNA), Mar. 22, 1999, at A-3. In 1992, the EPA reported that 132 pesticide-related compounds, 117 parent pesticides, and 16 pesticide degradates had been found in ground water in 42 states. *See* NATURAL RESOURCES DEFENSE COUNCIL, TROUBLE ON THE FARM, GROWING UP WITH PESTICIDES IN AGRICULTURAL COMMUNITIES 28 (1998) [hereinafter TROUBLE ON THE FARM].

108. *See infra* text accompanying notes 174-77.

109. *See* Matson et al., *supra* note 1, at 508. For example, evidence is mounting that the presence of certain pesticides in water bodies is linked to increasing rates of amphibian deformities. *See* J. Raloff, *Thyroid Linked to Some Frog Defects*, 156 SCI. NEWS 212 (1999). Ironically, the unintended effects of pesticide use have direct ramifications for farms. For example, farmers must compensate for reduced pollination resulting from declining honeybee populations lost to pesticides, and must apply excess pesticides when pesticides kill the pests' natural predators. *See generally* Carpenter, *supra* note 4, at 213.

110. *See* Loeb, *supra* note 101, at 43. Indeed, several water supply systems recently sued the manufacturer of the herbicide atrazine for the costs of removing the chemical from their water supplies. *See No Class Action for Herbicide Cleanup Costs: Water Systems Have No Standing, Court Says*, Daily Env't Rep. (BNA), Apr. 9, 1999, at A-2. For a detailed review of the impact of farm chemical releases on groundwater and some of the legal instruments that can be used to regulate those practices, see Debbie Sivas, *Groundwater Pollution from Agricultural Activities: Policies for Protection*, 7 STAN. ENVTL. L.J. 117 (1987-1988).

111. The State of California reported that 22 pesticides were detected in a total of 436 groundwater wells in 1996. *See* TROUBLE ON THE FARM, *supra* note 107, at 28. A 1997 survey of water contamination found that about 4.3 million Americans in 245 communities are exposed to levels of carcinogenic herbicides in drinking water that exceed the EPA's benchmark of "acceptable" cancer risk. *See id.*

112. *See* Carpenter, *supra* note 4, at 201-03.

113. In 1987, 1.38 million farms spent $6.7 billion applying fertilizer to 211

1.16 million tons of phosphorous and 4.65 million tons of nitrogen into waterways annually.[114] Land use models identify agriculture as the leading source of nitrogen and phosphorus in the environment, accounting for 76 and 56%, respectively.[115] These nutrients, so beneficial on the farm, threaten associated water resources by fostering excessive plant growth.[116] Nutrient runoff from farms thus influences the health of natural systems by stimulating eutrophication of estuaries and coastal marine environments, resulting in anoxic conditions that are toxic to aquatic animal populations.[117]

6. *Animal Waste*

Driven by economies of scale and new production and processing technologies, industrialization of the livestock production sector[118] has produced unprecedented livestock concentrations in the United States.[119] As a result, the United States produces 200 times more livestock waste than human waste.[120] "Livestock in the United States produce approximately 1.8 billion metric tons of wet manure per year, much of which reaches surface water after being applied to fields as fertilizer."[121]

Although many farming operations contain their animal waste in on-site structures, spills occur frequently and with drastic effects. For example, a 100,000 gallon spill in Minnesota killed almost 700,000 fish along 19 miles of a major stream. As a result, a downstream dairy operation had to dump 3,000 pounds of milk after cows drank infected water and half the pregnant

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million acres; ten years later 1.2 million farms spent $9.6 billion applying fertilizers to 233 million acres. *See* CENSUS, *supra* note 17, at United States Data 23, tbl.15; *see also* Zaring, *supra* note 61, at 10,129.

114. *See* Cooper & Lipe, *supra* note 59, at 221.

115. *See* Carpenter, *supra* note 4, at 201 (seven million tons per year in 1960; nineteen million tons per year in 1994).

116. *See generally* GEOGRAPHY OF HOPE, *supra* note 34, at 41.

117. *See* Matson et al., *supra* note 1, at 507; Zaring, *supra* note 61, at 10,129. Although most attention regarding the environmental impacts of fertilizer runoff has been devoted to its nutrient loading effect, recent studies have suggested that fertilizers may pose toxicity threats as well. *See* OFFICE OF SOLID WASTE, U.S. ENVTL. PROTECTION AGENCY, ESTIMATING RISK FROM CONTAMINANTS CONTAINED IN AGRICULTURAL FERTILIZERS 1-1 (1999) (draft report); J. Raloff, *Fertilizer: Hiding a Toxic Pollutant?*, 156 SCI. NEWS 245 (1999).

118. For further discussion of these industry trends, see *infra* text accompanying notes 386-90.

119. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 41.

120. *See* Ted Williams, *Assembly Line Swine*, AUDUBON, Mar.-Apr. 1998, at 26, 31.

121. Zaring, *supra* note 61, at 10,129.

animals aborted.[122] The Missouri Department of Natural Resources found that 63% of all large animal feeding operations had spills between 1990 and 1994.[123] In North Carolina, a 25 million gallon hog-waste spill is the biggest on record, and killed 10 million fish and closed 364,000 acres of coastal wetlands to shellfishing in 1995.[124] The Illinois Environmental Protection Agency reported that 15 out of 22 randomly inspected manure lagoons in western Illinois were illegally discharging wastewater into streams in 1998.[125] In Iowa, 60 spills have been recorded since 1992. One of those, a 1.5 million gallon spill in 1995, killed 8,861 fish, polluted thirty miles of river, and closed a primary recreation area.[126] Recently, several cases involving intentional bypasses of manure holding ponds have resulted in substantial criminal fines.[127]

Spills and illegal discharges are merely the tip of the iceberg, however. Even proper farm waste management releases immense amounts of waste and waste-related pollutants. For example, California's Central Valley is home to 1,600 of the state's 2,400 dairies, and its 891,000 cows create as much waste as 21 million people.[128] Creeks in that area often contain 200 times more ammonia than the level that is poisonous for fish.[129] Dairy manure pollution in California is a significant cause of fishery depletion.[130]

Cows are not the only source of waste management problems on farms. For example, chicken manure contains twice as much phosphorous as human waste.[131] The 625 million chickens raised annually in the Delmarva area, which includes portions of Delaware, Maryland, and Virginia, produce 3.2 billion pounds of waste annually, the constituents of which include 13.8 million

122. *See* Williams, *supra* note 120, at 28.

123. *See id.*

124. *See id.* at 27.

125. *See* NATURAL RESOURCE DEFENSE COUNCIL & CLEAN WATER NETWORK, AMERICA'S ANIMAL FACTORIES: HOW STATES FAIL TO PREVENT POLLUTION FROM LIVESTOCK WASTE 26 (1998) [hereinafter AMERICA'S ANIMAL FACTORIES].

126. *See id.* at 34.

127. *See* Carolyn Whetzel, *Dairy Farm Ordered to Pay $250,000 for Polluting California River in CWA Case*, 29 Env't Rep. (BNA) 2572 (1999); Pamela Najor, *Iowa Hog Farm Pleads Guilty to Discharge in First Criminal Manure Discharge Case*, Daily Env't Rep. (BNA), June 29, 1999, at A-4.

128. *See* AMERICA'S ANIMAL FACTORIES, *supra* note 125, at 15. A mature dairy cow produces as much waste as 34 people, or an average of 114 pounds of waste per day, or 22.5 tons of manure per year. *See id.*

129. *See id.* at 16.

130. *See id.* (noting that salmon and steelhead fisheries are down more than 90% from their historic levels).

131. *See id.* at 50.

pounds of phosphorous and 48.2 million pounds of nitrogen.[132]

Hogs are a major pollution source as well. In North Carolina, the significant progress made by municipal and industrial sources of pollution has been largely offset by agricultural pollution, primarily runoff from hog production facilities. North Carolina has been the fastest growing swine-producing state in the country, as the number of hogs has increased from 3.7 million in 1991 to more than 10 million in 1998.[133] In 1998, the North Carolina Department of Environment, Health and Natural Resources investigated 1,595 drinking water wells located on property adjacent to hog and poultry production facilities and found that 10.2% of the wells tested were contaminated with nitrate levels above current drinking water standards, and 34.2% of the wells tested exhibited detectable nitrate levels.[134] According to EPA estimates, in 1995 agriculture in eastern North Carolina was responsible for airborne emissions of 179 million pounds of ammonia nitrogen per year. Hog operations alone were responsible for 73% of these emissions.[135] Indeed, current scientific studies find that at least 67% and perhaps as much as 95% of the total nitrogen produced by swine is actually volatized to the atmosphere as ammonia nitrogen,[136] making land and water pollution control measures largely a moot point.

7. *Nonpoint Source Water Pollution*

In addition to pollutants released in irrigation return flows, farms release massive quantities of pollutants through runoff from fields and livestock operations. These releases are collectively known as nonpoint source water pollution.[137]

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132. *See New NPDES Permit Condition to Hold Chicken Producers Accountable for Waste*, Daily Env't Rep. (BNA), Mar. 22, 1998, at A-2.

133. *See* AMERICA'S ANIMAL FACTORIES, *supra* note 125, at 73. For current background on hog farms in North Carolina and elsewhere, see Environmental Defense Fund, *Hog Watch* (visited Feb. 2, 2000) <http://www.hogwatch.org>.

134. *See id.* at 76.

135. *See id.*

136. *See id.* at 77.

137. EPA defines nonpoint water pollution as "water pollution caused by rainfall or snowmelt moving over and through the ground and carrying natural and human-made pollutants into lakes, rivers, streams, wetlands, estuaries, coastal waters, and ground water." Section 319 Federal Consistency Guidance, 63 Fed. Reg. 45,504, 45,504 (1998). Agricultural nonpoint source pollution thus includes "runoff from manure disposal areas, and from land used for livestock and crop production." Federal Water Pollution Control Act (Clean Water Act), 33 U.S.C. § 1288(b)(2)(F) (1994). By legislative decree, if not physical reality, agricultural nonpoint source pollution also includes "return flows from irrigated agriculture." *Id.*; *see infra* text accompanying notes 185-93 (explaining the origins of this legislative fiction).

Nonpoint source pollution from all sources accounts for 65-75% of the pollution in the nation's most polluted waters.[138] In 33 states, nonpoint source pollution is the most significant form of pollution affecting streams and rivers.[139] In Iowa, Missouri, Montana, Nebraska, and Wisconsin, nonpoint source pollution accounts for over 90% of stream and river pollution.[140] In 42 states, nonpoint sources are the predominant source of pollution in lakes,[141] and in six states nonpoint source pollution accounts for 100% of lake pollution.[142]

Farms are the major source of nonpoint water pollution nationally,[143] with farm runoff acting as a primary transport mechanism for fertilizers, animal wastes, pesticides, sediments, and bacteria.[144] For example, commercial fertilizers in farm runoff have widespread and pernicious effects,[145] leading to eutrophication as the nutrient laden runoff promotes rapid algal and plant growth, and attendant consequent depletion of oxygen resources.[146] Overall, nitrate concentrations from fertilizer runoff have increased three- to tenfold in our nation's surface waters

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138. *See* Zaring, *supra* note 61, at 10,128.

139. *See id.*

140. *See id.*

141. *See id.* at 10,128-29.

142. *See id.* at 10,129.

143. *See* Kershen, *supra* note 15, at 3 ("Near unanimous agreement exists that agricultural nonpoint source pollution is the largest contributor."). EPA's 1994 *National Water Inventory* ranks agriculture, defined as crop production, pastures, rangeland, feedlots, and other animal holding areas, as the leading source of water quality impairment in lakes and rivers, in both cases by wide margins, and the third leading cause of impairment in estuaries. NATIONAL WATER QUALITY INVENTORY, *supra* note 7, at ES-11 to ES-12, ES-15 to ES-18. Federal government efforts to control agricultural nonpoint source runoff have proven costly. For example, since fiscal year 1994, the federal government has spent $3 billion annually to address nonpoint source runoff. USDA spent a total of $11 billion in that period, primarily on farm soil conservation programs designed to reduce sedimentation loading of streams. EPA, which spent $225 million in fiscal year 1998 funding state and regional programs to control nonpoint source pollution, has estimated that it will cost $9.4 billion annually to control what it says are the three main sources of nonpoint pollution: agriculture, silviculture, and animal feeding operations. *See* U.S. General Accounting Office, GAO/RCED-99-45, Water Quality: Federal Role in Addressing— and Contributing to— Nonpoint Source Pollution 4-5 (1999); *Methodology Used to Calculate Costs of Nonpoint Pollution Inadequate, GAO Says*, Daily Env't Rep. (BNA), Mar. 16, 1999, at A-10.

144. *See* Cooper & Lipe, *supra* note 59, at 220-22.

145. For example, commercial fertilizers, animal manure, and atmospheric deposition, in that order, are the primary nonpoint sources of nitrate in surface water and groundwater. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 48.

146. *See* NATIONAL WATER QUALITY INVENTORY, *supra* note 7, at ES-9; GEOGRAPHY OF HOPE, *supra* note 34, at 41-45; Matson et al., *supra* note 1, at 507. The eutrophication effect is also discussed *supra* at the text accompanying note 50.

since the early 1900s.[147] Commercial fertilizers today are the dominant nonpoint source pollutant in the western, central, and southeastern United States,[148] and their effects can be felt far from the farm source. For example, hundreds of thousands of tons of agricultural fertilizers applied in the enormous Mississippi River watershed reach Louisiana's Gulf Coast estuaries, contributing to an offshore hypoxic "dead zone."[149] Eighty percent of the nitrogen delivered to the Gulf originates more than a thousand miles upstream above the confluence of the Ohio and Mississippi Rivers— almost all of it from cropland runoff.[150] Agriculture is also a major source of nutrient discharge into the watershed of the Chesapeake Bay, where inputs of nitrogen and phosphorous have led to excessive plankton production and the demise of submerged aquatic vegetation.[151] Other coastal regions have experienced similar hypoxia

147. *See* Matson et al., *supra* note 1, at 507.

148. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 48.

149. *See id.* at 44; Runge, *supra* note 6, at 205.

150. The Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 directs a newly formed federal task force on the hypoxia issue to assess the ecological and economic impacts of hypoxia in the Gulf and develop a plan for controlling the effects by 2000. *See* Coast Guard Authorization Act of 1998, Pub. L. No. 105-383, § 604(a)-(b), 112 Stat. 3411, 3449 (1998). The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) recently released reports on a series of comprehensive studies it had funded on the Gulf hypoxia effect. *See* National Center for Coastal Ocean Science, NOAA, U.S. Dep't of Commerce, *Hypoxia in the Gulf of Mexico* (visited May 17, 1999) <http://www.noaa.gov/products/pubs_hypox.html>. One report concludes that "[t]he principal source areas for the nitrogen that discharges to the Gulf are watersheds draining intense agricultural regions in southern Minnesota, Iowa, Illinois, Indiana, and Ohio." "Nonpoint sources contribute about 90% of the nitrogen and phosphorous discharging to the Gulf. Agricultural activities are the largest contributors of both nitrogen and phosphorous." DONALD A. GOOLSBY ET AL., FLUX AND SOURCES OF NUTRIENTS IN THE MISSISSIPPI-ATCHAFALAYA RIVER BASIN 14 (1999); *see also Clean Water Act Should Be Strengthened to Address Nutrient Reduction, Group Says*, Daily Env't Rep. (BNA), Mar. 30, 1999, at A-10. The task force has finalized the assessment phase of its mission and has begun to develop an action plan proposal. *See* Notice of Fifth Meeting of the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, 64 Fed. Reg. 56,788 (1999) (notice of availability of the report and public comment period, and of task force decision to begin work on action plan).

151. *See Water Quality Policies Must Be Integrated Among Air, Water, Land, USGS Official Says*, Daily Env't Rep. (BNA), Mar. 8, 1999, at A-2. The United States Geological Survey's National Water Quality Assessment found that 85% of nitrogen contributed to the Chesapeake Bay is from groundwater and the atmosphere, suggesting that integrated management will be needed to address watershed degradation, nonpoint source pollution, total maximum daily loads, and wetlands protection. *Id.*; *see also* Thomas E. Jordan et al., *Effects of Agriculture on Discharges of Nutrients from Coastal Plain Watersheds of Chesapeake Bay*, 26 J. ENVTL. QUALITY 836, 836 (1997).

problems.[152]

Animal waste is another major component of farm runoff, accounting for one-third of all water impairments attributable to agriculture.[153] "Livestock in the United States produce approximately 1.8 billion metric tons of wet manure per year, much of which reaches surface water supplies after being applied to fields as natural fertilizer."[154] In 1996, the Maryland Department of Environment reported that approximately 93% of Maryland waters that fail to meet state water quality standards do so because of excessive nutrient pollution.[155] The Department also estimated that 326 million pounds of nitrogen and 19 million pounds of phosphorous enter the Chesapeake Bay every year.[156] The effect of these nutrient loads goes beyond eutrophication of aquatic habitat; entire ecological processes are affected. For example, *Pfiesteria piscicida*, a one-celled organism that lives in many estuaries and rivers and under certain conditions eats away at fish's scales, has been implicated in massive fish kills in rivers leading to the Chesapeake Bay and other Atlantic and Gulf Coast estuaries, forcing the closing of many rivers to commercial and recreational uses.[157] According to scientists, the *Pfiesteria piscicida* outbreaks are correlated with increased nitrate levels in rivers caused by chicken waste, which, when applied to crops as "natural" fertilizer, runs into the watershed.[158]

Overall, runoff of topsoil, silt, sediment, manure, nutrients, chemicals, and other pollutants from agricultural nonpoint sources is the leading source of impairment in the Nation's rivers,[159] affecting 60% of the impaired river miles.[160] Agriculture is the leading source of impairment in lakes as well, affecting

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152. *See* Oliver A. Houck, *TMDLs IV: The Final Frontier*, 29 Envtl. L. Rep. (Envtl. L. Inst.) 10,469, 10,470 (1999).

153. *See* Frarey & Pratt, *supra* note 15, at 8. Farm animal waste management is discussed in more detail *supra* at the text accompanying notes 118-36.

154. Zaring, *supra* note 61, at 10,129.

155. *See* AMERICA'S ANIMAL FACTORIES, *supra* note 125, at 50.

156. *See id.*

157. *See generally* JoAnn M. Burkholder, *The Lurking Perils of Pfiesteria*, SCI. AM., Aug. 1999, at 42; Carol Jouzaitis, *Fish-Killing Microbe Found in Fourth River*, USA TODAY, Sept. 15, 1997, at 3A.

158. *See, e.g.*, John P. Almeida, *Nonpoint Source Pollution and Chesapeake Bay Pfiestera Blooms: The Chickens Come Home to Roost*, 32 GA. L. REV. 1195 (1998); Bueschen, *supra* note 15, at 10,317-19; Burkholder, *supra* note 157, at 46.

159. From 1984 through 1996, the percentage of rivers designated as "impaired," meaning that they cannot support aquatic life and are unsafe for fishing and swimming, grew from 26% to 36%. *See* Loeb, *supra* note 101, at 42.

160. *See* GEOGRAPHY OF HOPE, *supra* note 34, at 40; NATIONAL WATER QUALITY INVENTORY, *supra* note 7, at ES-14; Zaring, *supra* note 61, at 10,129.

50% of impaired lake acres, or 2 million lake acres.[161] Agriculture also pollutes 34% of impaired estuarine waters.[162] Groundwater, on which half of the U.S. population and most rural communities depend,[163] is also substantially threatened from polluted farm runoff.[164]

8. *Air Pollution*

Although farms are often associated with unpleasant odors, many people overlook the fact that farms are significant sources of chemical air pollution. Fertilizer is a source of several greenhouse gases, including carbon dioxide, nitrous oxide, and methane,[165] and leads to increased emissions of gases that play critical roles in tropospheric and stratospheric chemistry and air pollution.[166] Worldwide, agricultural soils emit nitrogen oxides (commonly known as NO_x) at estimated rates of up to 25% of the emissions from global fossil fuel combustion.[167] Once in the

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161. *See* NATIONAL WATER QUALITY INVENTORY, *supra* note 7, at ES-19; Zaring, *supra* note 61, at 10,129.

162. *See* NATIONAL WATER QUALITY INVENTORY, *supra* note 7, at ES-25.

163. More than 97% of the nation's rural drinking water comes from underground aquifers, and over 50% of the nation's population relies on groundwater as its source of drinking water. *See* Erik Lichtenberg & Lisa K. Shapiro, *Agriculture and Nitrate Concentrations in Maryland Community Water System Wells*, 26 J. ENVTL. QUALITY 145, 145 (1997).

164. Groundwater is especially susceptible to nitrate contamination from the nitrogen sources in commercial inorganic fertilizer and manure. *See id.* at 145-47; *see also* Carpenter, *supra* note 4, at 202-03; Runge, *supra* note 6, at 204. Nitrogen is present in water as nitrate-nitrogen (known as NO_3-N) and converts to nitrites, which have acute toxic effects at high concentrations. Nitrates and nitrites are also suspected to have carcinogenic effects either through secondary conversion to other compounds or in synergistic effects with pesticides also found in contaminated waters. *See generally* Lichtenberg & Shapiro, *supra* note 163, at 145; Carpenter, *supra* note 4, at 202. Rising use of commercial fertilizer has been suspected as a primary source for increasing NO_3 concentrations found in groundwater, which at some locations reaches levels deemed unhealthy for human consumption. *See* N.R. Kitchen et al., *Impact of Historical and Current Farming Systems on Groundwater Nitrate in Northern Missouri*, 52 J. SOIL & WATER CONSERVATION 272, 272 (1997) ("Nitrates attributable to fertilizers and manure have been found in the groundwater of every agricultural region of the nation."); Zaring, *supra* note 61, at 10,129. Water in one-fourth of the wells in many agricultural areas has become unsafe to drink because of high levels of nitrates. *See* Loeb, *supra* note 101, at 43.

165. *See* Matson et al., *supra* note 1, at 507-08. EPA estimates that agricultural activities were responsible for seven percent of total U.S. greenhouse gas emissions in 1997. *See* OFFICE OF POLICY, U.S. EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-1997, at 5-1 (1999), *available at* U.S. EPA, *U.S. Emissions Inventory—1999* (visited Mar. 21, 2000) <http://www.epa.gov/oppeoee1/globalwarming/publications/emissions/us1999/index.htm>.

166. *See* Matson et al., *supra* note 1, at 507.

167. *See id.*

atmosphere, NO_x is a critical regulator of tropospheric ozone, a key component of smog, and a threat to human health, agricultural crops, and natural ecosystems.[168] NO_x is also "transported and deposited in gaseous or dissolved solution forms to downwind terrestrial and aquatic ecosystems," leading to acidification, eutrophication, shifts in species diversity, and changes in predator and parasite systems.[169] Wind erosion also contributes to the aerosol content of the atmosphere, which plays a critical role in climate change as well as air pollution.[170]

Animal waste is another major source of air pollution. In Minnesota, large-scale feedlots emit hydrogen sulfide at levels vastly exceeding state air quality standards for other industries.[171] According to EPA estimates, agriculture in eastern North Carolina was responsible for airborne emissions of 179 million pounds of ammonia nitrogen in 1995, with hog operations responsible for 73% of these emissions.[172]

Pesticide dispersal in the air is also often overlooked in comparison to more visible and documented pollution problems, but it is significant. Sources include fumigants, wind erosion of pesticide-laden soil particles, and aerial drift from spraying.[173] In California, two weeks of ambient air monitoring near sugar beet and potato fields for the carcinogen fumigant Telone II measured ambient air levels that exceeded the safe level for chronic inhalation exposures,[174] and 19 of 26 monitored pesticides have been detected in and around California communities between 1986 and 1998.[175] Fog samples gathered in suburban Maryland and in agricultural regions of California revealed up to 16 different agricultural pesticides.[176] Thus, farms pose a substantial threat to air quality.

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168. *See id.*

169. *Id.* For example, air pollution is the leading cause of water quality impairment in the Great Lakes, with pesticides and nutrients being significant components of that impairment. *See* NATIONAL WATER QUALITY INVENTORY, *supra* note 7, at ES-20 to ES-22.

170. *See* Matson et al., *supra* note 1, at 508.

171. *See* AMERICA'S ANIMAL FACTORIES, *supra* note 125, at 53. "[T]he Minnesota Pollution Control Agency . . . confirmed through a testing program that half of the CAFOs tested were exceeding state standards for hydrogen sulfide, some by up to 50 times," and "[v]iolations occurred on a frequent basis, with one operation exceeding the half-hour standard 32 times over 19 days." *Id.*

172. *See id.* at 76.

173. *See* TROUBLE ON THE FARM, *supra* note 107, at 29.

174. *See id.*

175. *See* Zev Ross & Jonathan Kaplan, Californians for Pesticide Reform, *Poisoning the Air* 1 (1998), *available at* (visited Apr. 8, 1999) <http://www.igc.org/cpr/poisoned_air/air_execsum.html> (compilation of state government testing data).

176. *See* TROUBLE ON THE FARM, *supra* note 107, at 30.

II

THE ENVIRONMENTAL LAW SAFE HARBORS THAT FARMS ENJOY

Getting a handle on the environmental law of farms is difficult. There is no unified code of environmental law for farms. Federal environmental law is scattered throughout many statutes, making it difficult to piece together the various provisions that could apply to farms. Although the general theme at the federal level is hands-off, no express or implied preemption prevents states from more aggressively regulating farms. To date, however, states have generally not chosen to regulate the environmental impacts of farming in any comprehensive manner.[177] We are left, therefore, with a collection of provisions, spread throughout many different laws, which combine to form what I call the "anti-law" of farms and the environment. There are few exceptions to this anti-law.

A. *An Inventory of Safe Harbors for Farming*

The anti-law of farms and the environment comes in two forms. Some laws, while not expressly exempting or even mentioning farms, are structured in such a way that farms escape most if not all of the regulatory impact. Other laws expressly exempt farms from regulatory programs that would otherwise clearly apply to them. Together, these passive and active exemptions provide a large safe harbor for farms from the impact of environmental law.

1. *Clean Water Act*

The Clean Water Act (CWA)[178] prohibits the "discharge of any pollutant by any person"[179] into waters of the United States and establishes a series of permit programs designed to regulate the discharge of pollutants provided certain conditions are met. Though seemingly straightforward, this prohibition is riddled with important exemptions for farms. Although the CWA defines "pollutant" to include "agricultural waste discharged into water,"[180] other provisions of the statute put discharges of agricultural wastewater, stormwater, and fill material largely

177. The same political forces that operate on the federal level to impede regulation of farms no doubt operate with equal or greater force at the state and local level. *See infra* notes 391-401 and accompany text.

178. 33 U.S.C. §§ 1251-1387 (1994). For an overview of the CWA programs, see THE CLEAN WATER ACT HANDBOOK (Parthenia B. Evans ed., 1994).

179. 33 U.S.C. § 1311(a) (1994).

180. *Id.* § 1362(6).

beyond regulatory reach.

a. Wastewater Permits

Section 402 of the CWA establishes a permitting program, known as the National Pollutant Discharge Elimination System (NPDES), to regulate the discharge of pollutants.[181] NPDES permits may be issued only if, among other conditions, the permittee satisfies a set of technology-based[182] and water quality-based[183] limitations on the amount and quality of discharged effluent. For almost twenty years, the NPDES program focused on discharges of wastewater effluent from "industrial" processes— that is, water which had come into contact with process wastes or which was used as a waste disposal medium.

Many wastewater discharges from agriculture, such as the collected return flow from irrigated fields, appear to fit within the NPDES permit program as generally described. Indeed, EPA knew that this interpretation was inescapable under the CWA as it was originally enacted.[184] Awed by the prospect of issuing NPDES permits to two million farms, EPA thus promulgated an administrative exemption from the statute's unambiguous terms.[185] The courts struck down that exemption as contrary to the clear intent and meaning of the CWA,[186] but in 1977 Congress overruled the courts and codified EPA's farm exemption. The original version of the CWA defined discharge of a pollutant as "any addition of any pollutant to navigable waters *from any point source.*"[187] To exempt farm irrigation return flows

181. *See id.* § 1342.

182. *See id.* §§ 1311, 1316-1317.

183. *See id.* §§ 1312-1315.

184. *See* Kershen, *supra* note 15, at 3 (explaining that EPA took a broad view of its CWA jurisdiction, leading the agency to conclude that farm irrigation return flows channeled in ditches and other conveyances were covered).

185. *See* 38 Fed. Reg. 18,000, 18,003 (1973) (previously codified at 40 C.F.R. § 125.4). The regulation provided that "the following do not require an NPDES permit: . . . (j) Discharges of pollutants from agricultural and silvicultural activities, including irrigation return flow and runoff from orchards, cultivated crops, pastures, rangelands, and forest lands," with an exception for discharges from large confined animal feeding operations and large irrigation projects. *Id.*

186. *See* NRDC v. Costle, 568 F.2d 1369 (D.C. Cir. 1977). EPA argued that the regulatory exemption was necessary to allow the agency to avoid the "administrative infeasibility" of issuing and administering millions of farm NPDES permits. *See id.* at 1374. Although the court rejected EPA's position, it explained that EPA could accomplish most of its objectives by promulgating a general permit describing and authorizing the classes of discharges it had sought to exempt entirely. *See id.* at 1380-82. EPA later accepted the court's invitation. *See* 42 Fed. Reg. 6846 (1977).

187. 33 U.S.C. § 1362(12) (1994). The "point" in point source refers to the requirement that the discharge be from "any discernible, confined and discrete

from the reach of NPDES wastewater discharge permits, Congress adopted the fiction that "these sources were practically indistinguishable from any other agricultural runoff"[188] and simply redefined "point source" to exclude "return flows from irrigated agriculture."[189] Congress drove home the point in Section 402 as well, dictating that EPA may not "require a permit under this section for discharges composed entirely of return flows from irrigated agriculture,"[190] and, leaving nothing to doubt, elsewhere described irrigation return flows as "agriculturally . . . related *nonpoint* sources of pollution."[191] Through this exemption, therefore, farms that discharge soils, animal wastes, fertilizers, and pesticides via return flows into waters of the United States need no authorization for such discharges under the CWA.[192]

b. Stormwater Permits

Although EPA's focus for the first twenty years of the NPDES program was on process wastewater, the CWA always provided

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conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged." *Id.* § 1362(14).

188. S. REP. NO. 95-370, at 35 (1977), *reprinted in* 1977 U.S.C.C.A.N. 4326, 4360.

189. Clean Water Act of 1977, Pub. L. No. 95-217, § 33(b), 91 Stat. 1566, 1577 (1977) (codified at 33 U.S.C. § 1362(14) (1994)).

190. Pub. L. No. 95-217, § 33(c), 91 Stat. 1566, 1577 (1977) (codified at 33 U.S.C. § 1342(l)(1) (1994)).

191. *Id.* § 33(a) (codified at 33 U.S.C. § 1288(b)(2)(F) (1994)) (emphasis added).

192. It is through this exemption, for example, that hundreds of thousands of acres of California farm lands using subsurface drainage tile fields discharge polluted wastewater to the San Joaquin Valley watershed. *See* Bobker, *supra* note 93, at 14-16. The exemption does not apply to other wastewater discharges a farm might produce, such as animal waste collected from feed lots, or manure distributed from spreaders onto farm lands, when ultimately discharged through a point source. *See* Concerned Area Residents v. Southview Farm, 34 F.3d 114 (2d Cir. 1994); *see also* Kershen, *supra* note 15, at 4; Susan E. Schell, *The Uncertain Future of Clean Water Act Agricultural Pollution Exemptions After* Concerned Area Residents for the Environment v. Southview Farms, 31 LAND & WATER L. REV. 113 (1996). Recently, for example, state and local prosecutors in California joined in filing four lawsuits against dairy operators in San Joaquin County for allegedly allowing cattle manure runoff to pollute waterways. *See* Carolyn Whetzel, *Attorney General, County District Attorney File Civil Complaints Against Dairy Operators*, Daily Env't Rep. (BNA), May 6, 1999, at A-9. Also, a court recently held that wastes removed from NPDES-regulated manure holding ponds and spread on land as fertilizer remain subject to the continuing jurisdiction of the NPDES permit, meaning that unpermitted discharges of nonpoint runoff from the manure are illegal. *See* Community Ass'n for Restoration v. Henry Bosma Dairy, 65 F. Supp. 2d 1129 (E.D. Wash. 1999) (granting motion for summary judgment); Susan Bruninga, *Land Application of Manure Subject to CWA Requirements, Court Says*, 30 Env't Rep. (BNA) 173 (1999).

EPA the authority, under certain conditions, to require permits for stormwater discharged through point sources. In 1987, Congress renewed EPA's attention to polluted stormwater through a series of amendments outlining in detail a framework for NPDES permitting of municipal and industrial stormwater discharges.[193] In the course of doing so, however, Congress made it clear that the stormwater NPDES program would not extend to farm stormwater runoff. As it had in 1977 for irrigation return flows, Congress defined "point source" so as to exclude "agricultural stormwater discharges."[194] Hence, like irrigation return flows, stormwater from farms collected in ditches, canals, and other conveyances, and the pollutants carried in it, are beyond NPDES stormwater program coverage.[195]

c. Dredge and Fill Permits

The third major CWA water pollutant discharge permitting program, found in Section 404 of the statute, covers "the discharge of dredged or fill material into the navigable waters."[196] This so-called dredge-and-fill permit program has been the nation's principal vehicle for wetlands protection.[197] Prominently excluded from the program, however, are discharges "from normal farming . . . activities such as plowing, seeding, cultivating, minor drainage, harvesting for the production of food, . . . or upland soil and water conservation practices."[198] A

193. *See* Water Quality Act of 1987, Pub. L. No. 100-4, Title IV, §§ 401-405, 101 Stat. 65, 65-69 (1987) (codified at 33 U.S.C. § 1342 (1994)).

194. Pub. L. No. 100-4, Title V, § 503, 101 Stat. 75, 75 (1987) (codified at 33 U.S.C. § 1362(14) (1994)). Congress believed these activities "have no serious adverse impact on water quality," that regulating them under the dredge and fill permit program would produce "no countervailing environmental benefit," and that they would be "more properly controlled by State and local agencies." S. REP. NO. 95-370, at 76, 77 (1977), *reprinted in* 1977 U.S.C.C.A.N. 4326, 4401; *see also* 123 CONG. REC. 26,707 (1977) (remarks of Sen. Anderson) ("The exemption of these activities from permit requirements will greatly simplify the administrative process and reduce the potential redtape burden.").

195. *But see supra* note 192 (discussing cases applying NPDES program to irrigation and stormwater runoff carrying pollutants from manure piled onto farmlands).

196. 33 U.S.C. § 1344 (1994).

197. For a history of how Section 404, which does not mention the word "wetlands," has become associated *primarily* with wetlands protection, see Jason Perdion, *Protecting Wetlands Through the Clean Water Act and the 1985 and 1990 Farm Bills: A Winning Trio*, 28 U. TOL. L. REV. 867, 869-73 (1997).

198. 33 U.S.C. § 1344(f)(A) (1994). Additional exemptions apply to "construction or maintenance of farm or stock ponds or irrigation ditches," *id.* § 1344(f)(1)(C), and "construction or maintenance of farm roads," *id.* § 1344(f)(1)(E). *See generally* Perdion, *supra* note 197, at 874-77.

significant limitation on this "normal farming" exemption is that it does not apply to activities intended to bring a wetlands area into a use to which it was not previously subject.[199] Hence, "normal farming" does not include the conversion of a natural wetlands area to a rice farm or the conversion of farmed wetlands into upland cultivated farmlands.[200] Nevertheless, continued farming in wetlands, or activities designed to reclaim historically farmed wetlands, has accounted for substantial loss and degradation of wetland ecosystems since the enactment of the CWA.[201]

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199. *See* 33 U.S.C. § 1344(f)(2) (1994). This so-called "recapture" provision has generally been construed broadly by courts and administrative agencies, making the normal farming exemption narrow and tricky for farmers. *See, e.g.*, U.S. ARMY CORPS OF ENGINEERS, SECTION 404 AND AGRICULTURE INFORMATION PAPER (1990) (addressing various scenarios under the normal farming exemption and recapture provision); *see also* Perdion, *supra* note 197, at 877-83.

200. The recapture provision addresses only those conversions of wetlands to farming accomplished through discharges subject to Section 404. Two important limitations on the scope of that jurisdiction apply to farms. First, farm wetland areas converted to cropland uses before December 25, 1985— so-called "prior converted croplands"— are not subject to Section 404. *See* 58 Fed. Reg. 45,008 (1993). Second, a recent court decision holding that the Section 404 program does not reach draining and clearing activities that do not involve more than incidental redischarge of small amounts of debris opens the door to relatively easy conversion of many wetlands to farming free of any Section 404 consequences. *See* National Mining Assoc. v. United States Army Corps of Engineers, 145 F.3d 1399 (D.C. Cir. 1997); *see also* Revisions to the Clean Water Act Regulatory Definition of "Discharge of Dredged Material", 64 Fed. Reg. 25,120 (1999) (codified at 33 C.F.R. pt. 323 and 40 C.F.R. pt. 232) (revising regulations to correspond to *National Mining* decision and explaining background thereof). Some farmers already have attempted to take advantage of this turn of events by draining wetlands for conversion to crop uses. *See, e.g., In re* Slinger Drainage, Inc., CWA App. No. 98-10, 1999 WL 778576 (EPA App. Bd. 1999) (finding that a farmer who drained wetlands after *National Mining* decision violated Section 404 because installation of drainage tiles involved more than incidental redischarge). Such conversions may nonetheless have undesirable consequences to farmers under farm subsidy programs and thus may not be widely implemented. *See infra* text accompanying notes 356-61.

201. *See* NATIONAL WATER QUALITY INVENTORY, *supra* note 7, at ES-27 to ES-29 (noting that agriculture was responsible for 54% of national wetland losses from the mid-1970s to the mid-1980s, and remains the leading source of wetland degradation). One of the murkiest issues involving wetlands and farming is the delineation of wetlands on farms and the determination of which such areas are prior converted croplands for purposes of Section 404 and farm subsidy programs. *See* Justin Lamunyon, *Wetlands and the Swampbuster Provisions: The Delineation Procedures, Options, and Alternatives for the American Farmer*, 73 NEB. L. REV. 163 (1994). Recently, environmental groups have alleged that USDA, the lead agency for delineation of wetlands on farms, has used poor delineation methodology and undercounted wetlands on farming land. *See* Susan Bruninga, *Group Says Oversight Inadequate in Delineations on Farmland Tracts*, 30 Env't Rep. (BNA) 313 (1999); Susan Bruninga, *Group Charges EPA Overlooks Failings in Farmland Delineations, Seeks Review*, Daily Env't Rep. (BNA), June 14, 1999, at A-6.

2. *Nonpoint Source Water Pollution*

In a classic example of passive nonregulation, the repeated references in the CWA to "*point* source" as an essential criterion for application of the NPDES program create one of the largest safe harbors in environmental law for farms— the failure to regulate *nonpoint* sources of water pollution. The size of this harbor and its effects have not gone unnoticed.[202] It has, however, remained largely open, particularly for farms.[203]

Efforts to address nonpoint source water pollution in the CWA and other statutes have been feeble, unfocused, and underfunded. For example, Section 208 of the CWA required states to develop area-wide waste treatment management plans that were to include a process for identifying nonpoint sources and establishing feasible control measures.[204] Upon EPA's approval of a state's plan, the state could receive federal assistance for the planning process.[205] With high expectations, Congress used the program as the rationale for moving irrigation return flows from the point source side of the CWA to the nonpoint source side[206] and for excluding normal farming from the Section 404 dredge-and-fill permit program.[207] Similarly, in the 1987 amendments, Congress added Section 319 to the statute, requiring states to prepare "state assessment reports" that identify waters which cannot reasonably be expected to meet water quality standards because of nonpoint source

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202. *See* Scott D. Anderson, *Watershed Management and Nonpoint Source Pollution: The Massachusetts Approach*, 26 B.C. ENVTL. AFF. L. REV. 339, 339-40 (1999) ("[T]he control of nonpoint source pollution continues to frustrate the [Clean Water Act's] stated goal to 'restore and maintain the chemical, physical, and biological integrity of the Nation's waters.'"); Kershen, *supra* note 15, at 3 (recounting descriptions of nonpoint source pollution as "'the neglected legacy and unfinished agenda' of federal water pollution laws").

203. For a comprehensive overview of federal regulation of nonpoint source water pollution from farms, see Zaring, *supra* note 61; George A. Gould, *Agriculture, Nonpoint Source Pollution, and Federal Law*, 23 U.C. DAVIS L. REV. 461 (1990).

204. *See* 33 U.S.C. § 1288(a) (1994); *see also* Haugrud, *supra* note 6, § 8.2(C)(3)(b)(i), at 540-41.

205. *See* 33 U.S.C. § 1329(f) (1994); *see also* Haugrud, *supra* note 6, § 8.2(C)(3)(b)(ii), at 541-42.

206. *See* S. REP. NO. 95-370, at 35 (1977), *reprinted in* 1977 U.S.C.C.A.N. 4326, 4360 ("All such sources, regardless of the manner in which the flow was applied to the agricultural lands, and regardless of the discrete nature of the entry point, are more appropriately treated under the requirements of section 208(b)(2)(F)."); *see also supra* text accompanying notes 185-93.

207. *See* S. REP. NO. 95-370, at 76 (1977), *reprinted in* 1977 U.S.C.C.A.N. 4326, 4401 (noting that Section 404 need not extend to normal farming activities because they will be "controlled by State and local agencies under section 208(b)(4)").

pollution.[208] States must prepare "state management programs" prescribing the "best management practices" to control sources of nonpoint pollution.[209] When EPA approves a state's assessment reports and management plans, the state is eligible for federal financial assistance to implement its programs.[210]

In the absence of any concrete, enforceable federal blueprint for addressing nonpoint source pollution, the success of Sections 208 and 319 depended largely on state initiative. It is little surprise, then, that neither Section 208 nor Section 319 produced meaningful results.[211] Congress thus took a more aggressive step in Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990,[212] amending the Coastal Zone Management Act[213] (CZMA) to add a requirement that any state with a federally approved coastal zone management plan[214] must develop a Coastal Nonpoint Pollution Program subject to federal review and approval.[215] States must identify land uses leading to nonpoint source pollution and develop measures to apply "best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives."[216] When EPA and the National Oceanic and Atmospheric Administration approve a state's Coastal Nonpoint

208. *See* 33 U.S.C. § 1329(a) (1994).

209. *See id.* § 1329(b).

210. *See id.* § 1329(h).

211. An EPA Advisory Committee recently summed up the weakness of the Section 208 and 319 programs by explaining that "EPA had no 'hammer' provision for States not adopting programs and no ability to establish a program if a State chose not to." EPA TMDL Federal Advisory Committee, Discussion Paper, Nonpoint Source-Only Waters 5 (1997) (on file with author). *See generally* Anderson, *supra* note 202, at 344 (noting that "the section 208 program failed to make any significant progress" and under Section 319 "EPA continues to lack the authority to require the states to take any affirmative action"); Kershen, *supra* note 15, at 4 (noting that "section 208 gave states great discretion . . . and carried no enforcement penalties" and under Section 319 "the states have been slow to act and EPA has limited enforcement authority to make states act."); Zaring, *supra* note 61, at 10,130, 10,132 (noting that Section 208 was "toothless" and Section 319 suffered from "not enough carrot, not enough stick"). EPA continues nonetheless to devote considerable resources to the Section 319 program, largely in the form of increased funding for states that EPA is proposing be tied to the requirement that states follow "key elements" EPA is in the process of developing. *See Chances for Clean Water Bill Dim; EPA to Use Existing Authorities on Nonpoint Sources*, Daily Env't Rep. (BNA), Jan. 20, 1999, at S-18.

212. Pub. L. No. 101-508, Title VI, § 6217 (1990), 104 Stat. 1388-314.

213. 16 U.S.C. §§ 1451-1464 (1994).

214. For a description of the CZMA coastal management plan provisions, see *infra* text accompanying note 431.

215. *See* 16 U.S.C. § 1455b (1994). *See generally* Clare Saperstein, *State Solutions to Nonpoint Source Pollution: Implementation and Enforcement of the 1990 Coastal Zone Amendments Reauthorization Act Section 6217*, 75 B.U. L. REV. 889 (1995).

216. 16 U.S.C. § 1455b(g)(5) (1994).

Pollution Program, the federal government agrees not to fund, authorize, or carry out projects inconsistent with the state's plan.[217] For coastal states, this requirement can serve as an impetus for more aggressive regulation of nonpoint source pollution, but federal funding assistance is woefully short of the expected cost of plan preparation and implementation.[218]

Another federally-based incentive for state regulation of nonpoint source pollution derives from the CWA's program for determining Total Maximum Daily Load (TMDL) waste load allocations under Section 303(d) of the CWA.[219] Where application of the technology-based NPDES permit discharge limits does not bring a water body within ambient water quality standards,[220] the TMDL program implements a procedure to

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217. *See id.* § 1455b(k). EPA has recently outlined the guidelines for federal consistency determinations. *See* Section 319 Federal Consistency Guidance, 63 Fed. Reg. 45,504 (1998).

218. *See* ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION 973 (2d ed. 1996) (noting that EPA estimated the cost of implementing the measures contemplated in the program at $390 million to $590 million, whereas only $50 million in grant money was available).

219. *See* 33 U.S.C. § 1313(d) (1994).

220. Water quality standards are based on two components: (1) designated uses of the water body, such as recreation or water supply, and (2) water quality criteria, which set concentration levels for individual pollutants designed to attain particular designated uses. Water quality standards thus are designed to regulate ambient water pollution concentrations for identified pollutants in different classes of waters. *See* 33 U.S.C. § 1313(c) (1994); *see also* PERCIVAL ET AL., *supra* note 218, at 937. One of the difficulties facing efforts to apply the water quality standards program to water pollution from farming is that, at present, no federally-promulgated water quality criteria exist for nutrients from nitrogen and phosphorous discharges. EPA, however, is in the process of developing them. *See* Office of Water, U.S. Envtl. Protection Agency, Nutrient Criteria Technical Guidance Manual: Rivers and Streams (review draft of Sept. 1999); Office of Water, U.S. Envtl. Protection Agency, Nutrient Criteria Technical Guidance Manual: Lakes and Reservoirs (review draft of Apr. 1999); U.S. Envtl. Protection Agency, Notice of National Strategy for the Development of Regional Nutrient Criteria, 63 Fed. Reg. 34,648 (1998); *see also* Susan Bruninga, *Effort to Set Nutrient Criteria Premature, Too Burdensome on POTWs, Officials Say*, 30 Env't Rep. (BNA) 172 (1999); Susan Bruninga, *Regulating Nutrients, Implementing Controls Focus of EPA Meeting on Draft Criteria*, 30 Env't Rep. (BNA) 310 (1999); Karen L. Werner, *Project to Guide States in Development of Limits for Pesticides in Impaired Waters*, 30 Env't Rep. (BNA) 1284 (1999). In the meantime, some states have developed their own nutrient criteria in the absence of federal guidelines, though the process has often been contentious. *See* Pamela S. Clarke & Stacey M. Cronk, *The Pennsylvania Nutrient Management Act: Pennsylvania Helps to "Save the Bay" Through Nonpoint Source Pollution Management*, 6 VILL. ENVTL. L.J. 319 (1995); Alfred R. Light, *The Myth of Everglades Settlement*, 11 ST. THOMAS L. REV. 55, 62-65 (1998) (discussing litigation over Florida's water quality criteria for phosphorous); McElfish, *supra* note 232, at 10,197. The Ecological Sciences Division of the Department of Agriculture's Natural Resources Conservation Service is also developing policies for providing nutrient management technical assistance in connection with programs protecting highly erodible lands and wetlands. *See* 64 Fed. Reg. 19,122 (1999).

impose more restrictive discharge limits on the NPDES permittees.[221] Under the TMDL program, states must identify impaired water bodies, calculate the total maximum daily loading of pollutants that the water body can tolerate while still meeting water quality goals, and then allocate the necessary reduction in total discharges among NPDES dischargers and, theoretically, nonpoint source dischargers of that pollutant.[222]

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221. The TMDL program thus represents the intersection of the CWA's technology-based and water quality-based components of regulation. For comprehensive explanations of the TMDL program, see Robert W. Adler, *Integrated Approaches to Water Pollution: Lessons from the Clean Air Act*, 23 HARV. ENVTL. L. REV. 203, 215-30 (1999); Office of the Administrator, U.S. EPA, *Report of the Federal Advisory Committee on the Total Maximum Daily Load (TMDL) Program (1998)*, (visited Feb. 8, 2000) <http://www/epa.gov/OWOW/tmdl>, and in particular review the series consisting of Oliver A. Houck, *TMDLs: The Resurrection of Water Quality Standards-Based Regulation Under the Clean Water Act*, 27 Envtl. L. Rep. (Envtl. L. Inst.) 10,329 (1997); Oliver A. Houck, *TMDLs, Are We There Yet?: The Long Road Toward Water Quality-Based Regulation Under the Clean Water Act*, 27 Envtl. L. Rep. (Envtl. L. Inst.) 10,391 (1997); Oliver A. Houck, *TMDLs III: A New Framework for the Clean Water Act's Ambient Standards Program*, 28 Envtl. L. Rep. (Envtl. L. Inst.) 10,415 (1998); Oliver A. Houck, *TMDLs IV: The Final Frontier*, 29 Envtl. L. Rep. (Envtl. L. Inst.) 10,469 (1999). The TMDL program lay dormant for almost twenty years before a series of lawsuits against states and EPA in the early 1990s resulted in court-imposed deadlines for completing the TMDL process in many states. *See* Adler, *supra*, at 221; Houck, *TMDLs, Are We There Yet?*, *supra*. As the weight of litigation turned against them, EPA and the states worked to develop a plan to carry out the TMDL program nationally over a twelve year period beginning in 1998. For current information on this development and the status of the TMDL program, see Office of Water, U.S. Envtl. Protection Agency, *Total Daily Maximum Load (TMDL) Program* (visited June 10, 1999) <http:/www.epa.gov/OWOW/tmdl>.

222. *See* 33 U.S.C. § 1313(d) (1994). EPA recently distributed proposed TMDL regulations designed to include many nonpoint sources in the full scope of the TMDL program. *See* Proposed Revisions to the Water Quality Planning and Management, 64 Fed. Reg. 46,011 (1999) (to be codified at 40 C.F.R. § 130.33(b)(6)); Revisions to the National Pollutant Discharge Elimination System Program and Federal Antidegradation Policy in Support of Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. 46,057 (1999) (proposed rule amending various provisions of 40 C.F.R. pt. 122). *See generally* Lisa E. Roberts, *Is the Gun Loaded This Time? EPA's Proposed Revisions to the Total Maximum Daily Load Program*, 6 ENVTL. LAW. 635 (2000). Nevertheless, there is far from universal agreement as to whether the CWA allows allocation of a portion of the pollutant load to nonpoint sources. Indeed, farming groups have initiated litigation challenging EPA's authority to implement the TMDL program so as to assign allocations to nonpoint sources. *See* Susan Bruninga, *Suit Challenging EPA Authority to Set TMDLs for Nonpoint Sources Concerns Cities*, Daily Env't Rep. (BNA), May 27, 1999, at A-2; Houck, *TMDLs IV*, *supra* note 152, at 10,474. Some members of Congress have also questioned EPA's authority in this regard. *See* Susan Bruninga, *House Panel Members Question EPA Authority to Issue TMDL Proposal*, 30 Env't Rep. (BNA) 1241 (1999). EPA's Federal Advisory Committee on TMDL's declined to address these legal issues in its final report. *See* Office of the Administrator, U.S. Envtl. Protection Agency, *Report of the Federal Advisory Committee on the Total Maximum Daily Load (TMDL) Program* 42 (1998) (visited Feb. 8, 2000) <http://www/epa.gov/OWOW/tmdl>. In the first judicial opinion on the question, a California federal

States must include TMDL implementation as part of "continuing planning process" programs that EPA must approve in order for a state to retain delegation to administer the NPDES permit program within its boundaries.[223]

The TMDL program stops there, however, providing no independent source of authority for enforcing load reduction allocations.[224] Enforcing allocations for NPDES permit dischargers is a straightforward matter of tightening NPDES permits to reduce total discharges of the pollutants of concern.[225] For nonpoint sources, however, the most EPA can say is that TMDL load allocations are to be "enforced" through the Section 319 program,[226] which, as pointed out above, fails to secure real gains in control of nonpoint source discharges from farms.

EPA has recognized the obstacle this dichotomy poses to TMDL program implementation. In waters impaired primarily or exclusively by nonpoint sources, EPA has proposed a policy that allows states that promulgate demonstrable means of reducing nonpoint source pollution in a given water body to ease the burdens on NPDES permittees.[227] Where that approach does not

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district court held that agricultural nonpoint source pollution must be included in TMDL determinations, but that states have discretion as to the load reduction allocation between point and nonpoint sources. *See* Pronsolino v. Marcus, No. C99-01828WHA (N.D. Cal. Mar. 30, 2000). Given the complexities involved in the TMDL and waste load allocation calculations, it appears likely that the implementation process will continue to face litigation challenges at virtually every stage. *See* Dana A. Elfin, *Challenges to Total Maximum Daily Loads Possible Following Upcoming EPA Regulation*, 30 Env't Rep. (BNA) 311 (1999) (reporting that discharger groups are filing "pre-litigation type comments" on proposed TMDL allocations).

223. *See* 33 U.S.C. § 1313(e)(3)(C) (1994).

224. *See* Office of Water, U.S. Envtl. Protection Agency, *Total Maximum Daily Load (TMDL) Program, Memorandum from Robert Perciasepe, EPA Assistant Administrator, to Regional Administrators and Regional Water Division Directors Re: New Policies for Establishing and Implementing Total Maximum Daily Loads* (Aug. 8, 1997) (visited Feb. 1, 2000) <http://www.epa.gov/OWOW/tmdl/ratepace.html> [hereinafter Perciasepe Memorandum] ("A TMDL improves water quality when the pollutant allocations are implemented, not when a TMDL is established. . . . Section 303(d) does not establish any new implementation authorities beyond those that exist elsewhere in State, local, Tribal, or Federal law."). Because the TMDL program is limited in this respect, establishing TMDLs "trigger[s] no additional obligations on the part of any [nonpoint source]." Federal Advisory Committee, *supra* note 211, at 5.

225. *See* 33 U.S.C. § 1312(a) (1994); *see also* Perciasepe Memorandum, *supra* note 224 ("[P]oint sources implement the wasteload allocations within TMDLs through enforceable water quality-based discharge limits in NPDES permits authorized under section 402 of the CWA.").

226. *See* Perciasepe Memorandum, *supra* note 224 ("[P]rograms and efforts for control of nonpoint sources should be described in the State nonpoint source management program under section 319.").

227. For example, one of EPA's proposed policies is designed to prevent degradation of existing water quality levels by requiring that new significant point sources in a watershed offset their pollutant load with reductions in the existing

work, EPA suggests that states simply declare, presumably as a matter of state law, that offending nonpoint sources are actually point sources and require state-issued NPDES permits and full TMDL compliance.[228] Nonpoint source pollution, a significant contributor to water quality degradation, has been unregulated for decades. Substantial gains in water quality thus could be achieved through such an intense focus on nonpoint source pollution. In addition, the marginal costs of pollution reduction for nonpoint sources might be well below those that NPDES permittees would bear to achieve the same reductions in pollutant loads. Although it is questionable whether the EPA can use the TMDL program in such a manner or require states to do the same, the program may allow states to do so in order to balance the costs of water quality improvement between point and nonpoint sources.[229]

The problem with relying on the CZMA's program and CWA's TMDL program as the foundations for regulating *farm* nonpoint pollution is that neither program addresses farms specifically at

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baseline load by a ratio of less than one-to-one. Where the reductions are made to nonpoint source pollution sources, EPA has explained that "the discharger's NPDES permit would need to contain any conditions necessary to ensure that the load reductions from the nonpoint source will be realized." 64 Fed. Reg. 46,057, 46,071 (1999); *see also* Perciasepe Memorandum, *supra* note 224 (noting that under the TMDL program, "where any wasteload load allocation to a point source is increased based on an assumption that loads from nonpoint sources will be reduced, the State must provide 'reasonable assurances' that the nonpoint source load allocations will in fact be achieved"); Office of Water, U.S. EPA, *Ensuring That TMDLs Are Implemented—Reasonable Assurance* (visited Oct. 10, 1999) <http://www.epa.gov/OWOW/tmdl/ensure.html> ("In allocating reductions to nonpoint sources, States must provide reasonable assurance that those nonpoint sources will meet their allocated amount of reductions.").

228. *See* Office of Water, *supra* note 227 ("Reasonable assurance is satisfied by designating these [nonpoint] sources as point sources and issuing them an NPDES permit.").

229. EPA cannot mandate the methods by which states accomplish this balancing, but the agency has suggested that states may institute "regulatory, non-regulatory, or incentive-based [measures], depending on the program." Perciasepe Memorandum, *supra* note 224. The use of incentive-based measures could, for example, allow NPDES dischargers to pay for nonpoint source dischargers' reductions in discharge loads and thereby ease restrictions in their NPDES permits. The irony is that farms, the leading source of water pollution in America, would be paid to stop polluting. This prospect is likely to pit farms and other nonpoint sources against NPDES dischargers, which are more likely to support EPA's suggestion that reasonable assurance can also be demonstrated through the direct regulation of nonpoint sources. EPA has essentially left it to each state to decide how to resolve the debate, but it has made clear that a state's failure to resolve the debate will result in federal imposition of TMDLs and load allocations. *See* Office of Water, *supra* note 227 ("Because reasonable assurance is a required element of a TMDL, EPA may then disapprove that State's TMDL. If EPA disapproves a TMDL, EPA must establish the TMDL.").

the federal level. States, in other words, will have the discretion to achieve the general goal of nonpoint source pollution control in ways that do not place serious burdens on farms, or leave farms entirely unregulated.[230] Some states have done exactly that in their initial TMDL implementation policies.[231] Indeed, in a recent series of comprehensive studies of state law, the Environmental Law Institute identified few states with any meaningful program regulating farm nonpoint source pollution, much less an actively enforced one.[232] Most states have followed the federal lead and focused on point source pollution; of those that have ventured into addressing nonpoint source pollution, most leave farms out of the picture.[233] EPA remains fundamentally powerless to require otherwise.[234] Hence, while the impetus for state regulation of nonpoint pollution is growing under the CZMA and the CWA, farms appear poised to slip

230. Even if the CWA allows EPA to include nonpoint sources directly in the TMDL program, in the end "states have discretion in allocating pollution loads among sources as long as the allocations will meet TMDL targets." Report of the Federal Advisory Committee, *supra* note 211, at iii. States will be free to leave farms out of the picture even if other nonpoint sources such as urban runoff are covered. Indeed, although EPA's proposed TMDL rules aggressively invite states to cover more farm animal feeding operations as point sources, *see* 64 Fed. Reg. 46,057, 46,074 (1999), the proposed rules are otherwise silent with respect to farms. For further discussion of the animal feeding operations issue, see *infra* text accompanying notes 307-26.

231. For example, Florida recently enacted a TMDL implementation statute that subjects only *nonagricultural* nonpoint source pollution to load allocations by the Florida Department of Environmental Protection, leaving agricultural sources subject to voluntary best management practices developed by the Florida Department of Agriculture. *See* FLA. STAT. ANN. § 403.067(7)(c) (nonagricultural sources) & 403.067(7)(d) (agricultural sources).

232. *See* ENVIRONMENTAL LAW INSTITUTE, ENFORCEABLE STATE MECHANISMS FOR THE CONTROL OF NONPOINT SOURCE WATER POLLUTION (1997); ENVIRONMENTAL LAW INSTITUTE, RESEARCH REPORT: ALMANAC OF ENFORCEABLE STATE LAWS TO CONTROL NONPOINT SOURCE WATER POLLUTION (1998); James M. McElfish, *State Enforcement Authorities for Polluted Runoff*, 28 Envtl. L. Rep. (Envtl. L. Inst.) 10,181, 10,195-99 (1998).

233. *See* ENVIRONMENTAL LAW INSTITUTE, ENFORCEABLE STATE MECHANISMS, *supra* note 232, at iii ("Agriculture is the most problematic area for enforceable [nonpoint source water pollution] mechanisms. Many laws of general applicability . . . have exceptions for agriculture. Where state laws exist, they often defer to incentives, cost sharing, and voluntary programs."); McElfish, *supra* note 232, at 10,182. Although "no state is entirely without any enforceable authority relevant to nonpoint source discharges . . . some states have few such authorities [and] others have adopted a bewildering array of enforceable tools . . . paired with equally bewildering arrays of exemptions and exclusions." *Id.*

234. For example, EPA has explained that for water bodies impaired primarily or exclusively by nonpoint source pollution, the primary implementation mechanism for the TMDL program "will generally be the State section 319 nonpoint source management program coupled with State, local, and Federal land management programs and authorities. For example, voluntary, incentive-based approaches at the State and local level can be used. . . ." Perciasepe Memorandum, *supra* note 224.