Evolution of Agri-Environmental Policy in the United States

Laura McCann
Agricultural and Resource Economics
University of Western Australia
Nedlands, WA 6907
Lmccann@agric.uwa.edu.au

Abstract:

Agricultural policy in the United States over the last fifteen years has increasingly included conservation aspects starting with the Conservation Reserve Program, Conservation Compliance, Swampbuster, and Sodbuster provisions of the 1985 Farm Bill. Another development is that the Soil Conservation Service has been renamed the Natural Resource Conservation Service, reflecting its expanded mandate. While regulation of non-point source pollution has been left to state governments, there are recent developments toward bringing agricultural pollution under federal control. In the future we will see a mix of federal and state policies, increasingly relying on regulation and economic incentives as well as new technologies. A policy of phased implementation of policy instruments is proposed.

Introduction:

In the United States, the most important agri-environmental issue is water pollution, both surface water and groundwater. Natural resource management issues such as wildlife preservation, wetlands, and old growth forests are also important. Air pollution, such as that from large confinement hog operations, is a localized problem but will become increasingly important due to structural trends in livestock industries as well as the increase in people desiring a rural lifestyle. Aesthetic considerations such as landscape preservation are less important than in Europe.

Due to the success of legislation such as the Clean Water Act in cleaning up point sources of pollution in the United States, there is a general realization that further progress will require more emphasis on nonpoint sources such as households and farms. The vast majority of water pollution problems, both surface and groundwater, in the United States are from nonpoint sources, and agricultural sources in particular. The defining characteristic of nonpoint sources is the difficulty of measuring their pollution emissions. This feature alone does not explain the fact that we seldom observe economically efficient policies in the real world. Current policy instruments in the U.S. include education, cost sharing/technical assistance, land retirement, and conservation compliance rather than policy instruments suggested by economists such as input, output or emissions taxes. To explain observed policies we must also examine models of decision-making and political economy. The

development of practical, politically palatable, and implementable policies will take account of these realities as well as economic theory.

Agri-environmental policy worldwide is a jury-rigged affair and the United States is no exception. This reflects an incremental model of decision making where: 1) changes are made at the margin so mistakes will be small and 2) policy options are evaluated based on past experience, resulting in the fact that policies accumulate over time (Doyle and Kellow 1995). The rational/comprehensive model, the kind that environmental economists work with, is very information intensive and time consuming to develop and can lead to policy paralysis according to Doyle and Kellow (1995). I suggest that the rational/comprehensive model should be used as an overall goal with the acknowledgement that attaining that goal will probably occur via incremental steps.

A study of political economy suggests what will happen, rather than what should happen and is a major focus of this paper. Ringquist (1993) indicates that environmental regulation in practice will represent a compromise between scientific, economic and political elements of the environmental policy context. While Ringquist was discussing point source pollution, this is probably, if anything, more true for the nonpoint case. For recommendations on what policies should be implemented from the point of view of economic efficiency, the reader is referred to the plethora of articles and books on environmental and agri-environmental policy.

Background:

Institutions and history are important to the discussion of agri-environmental policies for a number of reasons. They affect transaction costs (North 1990) as well as real and perceived property rights allocations (Bromley 1992), and because they impose constraints as to what policies are politically viable (Cochrane and Runge 1992). It is also possible that existing institutions can be used for new purposes. Institutions and norms change only slowly. Rollings and Jiggins (1999) propose that it takes 10-15 years for changes in agricultural production technologies to work themselves through institutional systems. Perhaps most importantly, history provides concrete lessons as to what works and what doesn't.

This section presents an overview of some of the organizations involved with agri-environmental policy in the United States and a history of agri-environmental policy including a discussion of the political economy issues involved. Potter (1998) gives a thorough account of agri-environmental policy in the U.S. and the E.U. with an emphasis on political economy.

Organizations

A variety of organizations are involved with agri-environmental policy at all levels of government; federal, state and local. Several of these organizations are described to give a context for the subsequent discussion. It also highlights the fact that some of the problems associated with nonpoint source pollution management are related to the lack of coordination, if not competition and conflict, between agencies.

In his history of U.S. agriculture, Cochrane (1979) describes the development of agricultural organizations and institutions. Several of the most important ones date from the late 19th century. The United States Department of Agriculture was established in 1862 while Lincoln was President, although it was almost organized as a bureau within the Department of the Interior. The original objectives included collecting and publishing statistics, introducing new plants and animals, providing information to farmers, and conducting chemical analyses on soils and plants. USDA evolved into a strong scientific research organization although this role has diminished over time relative to other activities. The Food and Drug Act was passed in 1906 and regulatory functions of the act were carried out by USDA. The Bureau of Forestry (now U.S. Forest Service) was created in 1901 under President Theodore Roosevelt, as part of USDA. It was not until the New Deal policies of the 1930's that USDA was involved with action programs to deal with the economic problems of farmers. USDA has a very broad range of activities involving both the regulation and promotion of agriculture. The Department and its agencies administer the farm bill programs.

The National Resource Conservation Service (NRCS), part of USDA, began as the Soil Conservation Service (SCS) with the passage of the Soil Conservation Act in 1935, at the height of the Dust Bowl and the Depression. Over the years the emphasis has been on enhancing agricultural productivity.   On-site rather than off-site benefits of erosion control were the major concern. In the 1990's, SCS was renamed NRCS to reflect its broadened mission to preserve resources such as water and wildlife as well as soil (NRCS 1996a). NRCS field staff are posted in 2,500 locations around the country, primarily in counties, and represent 72% of NRCS employees. Soil conservationists help individual landowners and organizations by providing technical and financial assistance, and they also manage land reserve programs such as the Conservation Reserve Program (CRP). Among science and technology occupations in NRCS, 43% are engineers, 27% are soil scientists, and only 4% are agronomists.

While the land grant university system is not directly involved in policy development, it is very involved in agri-environmental issues through its research and extension activities. The Morrill Act, passed in 1862, enabled land grant agricultural colleges to be set up in each state. In 1887 the Hatch Act provided funding towards agricultural experiment stations which are part of the land grant universities in each state. The last of the three missions of the land grant colleges was established in 1914 with the Smith-Lever Cooperative Extension Act. Federal matching funds were provided to states, which took over extension activities conducted by USDA at the county level (Cochrane 1979).

The Environmental Protection Agency (EPA) is a relative newcomer. It was established in 1970 under President Richard Nixon to expand knowledge about and protect the environment. The new agency was to be responsible for "research, monitoring, standard-setting, and enforcement" (EPA 2000, p. 2). It is interesting to note that implicitly the only policy envisioned was command and control. Setting up of EPA involved a reorganization of existing governmental activities since many of them were along media lines. The reorganization brought in elements from the Departments of the Interior, Health, Education and Welfare, and Agriculture, as well as the Atomic Energy Commission. The emphasis was on pollution abatement rather than broader environmental and resource management issues. Historically, the EPA has been involved with point sources of pollution, while agricultural nonpoint source pollution has been addressed through USDA. EPA has 10 regional offices and enforcement varies by region (Ringquist 1993).

In each state, there are usually several organizations relating to environmental protection and/or agriculture. As an example, several organizations in Minnesota and their role with respect to water quality are discussed. The University of Minnesota Extension Service (Extension) was created in 1909 and the first county agent was hired in 1912 (MES 1992). The most recent statement of their mission is "to involve people in improving the quality of life and enhancing the economy and the environment through education, applied research and the resources of the University of Minnesota" (p. 1). Extension represents the outreach function of the University of Minnesota, which is a land grant university. At the county level, extension educators, formerly known as extension agents or county agents, have half their salary paid by county government, and the other half by the University of Minnesota. They organize educational programs, distribute information developed by campus-based staff, and meet with individuals. Many campus-based extension faculty also hold research and/or teaching appointments. Their role is to provide statewide expertise in their area of specialty.

The Minnesota Pollution Control Agency is based in St. Paul but also has five regional offices. MPCA was established in 1967 "to protect Minnesota's environment through monitoring environmental quality and enforcing environmental regulations" (MPCA 1997). It is a regulatory agency that has authority in the areas of solid waste, hazardous waste, air quality and surface and ground water quality. They monitor air and water quality to identify problems, set standards and develop rules, enforce compliance with regulations and standards, develop permits to control polluting activities, and provide technical assistance and education, as well as responding to environmental emergencies. Their current focus is to help regulated industries and individuals comply with the rules, with enforcement activities as a last resort (MPCA 1997). Eighteen other states have mini-EPA's, eleven include environment in health organizations, and sixteen have superagencies that incorporate pollution control, energy and natural resource management, and fish and wildlife management (Ringquist 1993).

The Minnesota Department of Agriculture (MDA) is primarily a regulatory agency: it administers inspection programs to ensure food safety and is responsible for ensuring the quality and proper use of agricultural inputs such as fertilizers and seed. It also promotes Minnesota agriculture with its ag marketing and development program. MDA performs licensing and certification functions, such as fruit and vegetable grading, that facilitate sales of agricultural products. They also collect and report data on livestock numbers, farm income, crop yields, etc. MDA does not have district offices but some staff, such as inspectors, are located outstate.

The Board of Soil and Water Resources (BWSR) is a state agency that provides assistance to local units of government and serves as a coordinating body for state and local resource management activities. BWSR provides training, funding, and technical support to promote improved natural resource management. BWSR works closely with the SWCD's (discussed below) and encourages the formation of watershed districts. They also oversee the 46 watershed management organizations. BWSR approves county water plans and encourages counties to establish programs and regulations that preserve land and water resources. BWSR also administers the RIM program and the Permanent Wetland Preserves Program which are carried out by the SWCD's. The Board itself consists of 12 voting members representing county commissioners, SWCD supervisors, watershed representatives, and citizens, as well as 5 non-voting members representing various agencies. They include the Department of Natural Resources (DNR), MPCA, MDA, University of Minnesota, and the Department of Health.

The Soil and Water Conservation Districts (SWCD's) are local units of government established by state law. Each of the 91 districts is governed by five locally elected supervisors. They coordinate and implement a wide variety of federal, state and local resource conservation programs, conduct educational programs, provide financial assistance, and plan and install conservation measures. They work one-on-one with land users and have traditionally worked very closely with NRCS (formerly the Soil Conservation Service). Potter (1998) indicates there is evidence that the SCS was captured by the Soil Conservation Districts.

It is interesting to note that in Minnesota the MPCA predated the EPA and the Minnesota Extension Service existed before federal funding was available. More generally it is the case that the states provide testing grounds for innovative policies. Ringquist (1993) indicates that states provide leadership and innovation with respect to environmental policy, although the Clean Water Act was necessary because the states weren't doing their job prior to 1970. Air and water pollution regulation began in the states, shifted to the federal level, and is now shifting back to the states. State regulations often go beyond federal requirements and some successful programs are copied in federal legislation. States are also able to move more quickly than the federal government (Ringquist 1993). Ringquist indicates that the role of the states will increase in the future due to reduced increased capacity at the state level and the trend towards policy decentralization. This mirrors the fact that USDA used to be the primary agricultural research organization whereas, according to Cochrane (1979), it has now been eclipsed by the land grant universities.

With respect to agri-environmental pollution, there also seems to be a trend towards increased state responsibility. Ribaudo (1997) indicates that state programs have proliferated in the last 20 years. As in the case of point sources, state regulations often go beyond federal requirements and provide the basis for federal legislation (Ribaudo personal communication). According to Ervin et al. (1998) the federal government should provide funding as well as national objectives but that implementation should occur at lower levels of government. They say that "…there is growing evidence that successful implementation can only occur at the state, local and farm levels due to the enormous variation in landscapes, watersheds, and farming practices" (p. 12).

History

One of the important things to note from a history of agri-environmental policy and environmental policy is the incremental nature of policy changes with several notable exceptions. Agricultural policy experienced fundamental and lasting changes in the 1930's.

The period of the late 1960's and early 1970's saw huge changes in policy with respect to point source pollution including the establishment of the EPA and the Clean Water Act. A period of significant change with respect to agri-environmental policy was the 1985 Farm Bill which signaled a shift from resource conservation goals to pollution reduction. Dramatic changes have usually been accompanied by a fortuitous confluence of forces. In general though, we see a gradual tightening of policy, and more draconian policy instruments, when environmental objectives aren't met. It is suggested that, with nonpoint pollution policies in particular, this incremental approach may be necessary and that we should plan for a staged implementation of policy instruments. This issue is discussed in more detail at the end of the paper.

The important role of political economy is highlighted by examining the history of agri-environmental policy in the United States. Browne et al. 1997 discuss some "rules" under which agricultural policy is made: "1) Congress is always reactive, 2) Nobody – and everybody – is in charge in Congress, and that's especially true of the committees, 3) Constituents matter more to Congress than policy analysts, or anyone else, and 4) Congress cares more about the noise from farmers than about the number of farmers." Shogren (1998) also learned the importance of understanding the policy process during his stint at the Council of Economic Advisors.

The early history of agricultural policy in the United States consisted of opening up new lands and populating the countryside (sound familiar?). The 1930's included two major disasters for farmers, the Depression and the Dust Bowl. The severity of these problems, as well as a President, Franklin Roosevelt, whose motto was that if one thing didn't work "try another, but above all try something", led to a variety of social programs which have endured to the present. The agricultural policies implemented as part of the New Deal were designed to increase farmer incomes and keep the soil on the land. The Agricultural Adjustment Act of 1933 paid farmers to take land out of production to increase prices for a limited number of commodities (wheat, corn, rice, tobacco, cotton, and peanuts). Note that this was possible because the United States is a "large" country in terms of grain production. Benefit payments were limited to those farmers who reduced cropped area, a *quid pro quo*. The Dust Bowl lasted from 1931 to 1939 and in 1936 there was a requirement to put the idled land into soil conserving uses or "conservation reserves" for a year or more. Even at this point there was a form of conservation compliance. According to Swanson (1993), a basic assumption of New Deal programs was that farmers couldn't afford to invest, instead of being unwilling to invest in conservation. Subsidizing land conservation, rather than penalizing land degradation has a

long history. Cost-sharing and technical assistance for soil conservation have been part of American agri-environmental policy ever since. The real forerunner of the Conservation Reserve Program though, was the Soil Bank program begun in 1956. It consisted of 3-10 year contracts for conservation uses, annual rental payments, and cost sharing for soil investments. The last contracts expired in the 1970's. The program was not very successful on the environmental front and was another vehicle to transfer money to farmers (Potter 1998). Another example of an old idea that has been incorporated in recent legislation is decoupling. Decoupling of income support and production was first suggested by Agriculture Secretary Brannan in 1948 but it would be almost 50 years before it became a reality. While increased interest in off farm effects of agriculture seems new, it is not. A USDA publication from 1962 "Land and Water Resources – A Policy Guide" discusses the major elements of a recommended policy. While supporting farm incomes and productive resources was stressed, conservation of land and water resources, prevention of air and water pollution, improved fish and wildlife habitat and expanded recreational activities all are mentioned as policy goals.

The history of water pollution policy in the U.S. as outlined by Tietenberg (1992) exhibits characteristics of an incremental decision making process. It also demonstrates the increasing power of the federal government with respect to water pollution regulation. Water pollution policy began in 1899 with the Refuse Act which was primarily to improve navigation in rivers. Barges were the major form of long-distance transport in the United States until the railroads replaced them and even now there is significant barge traffic on rivers such as the Mississippi. The 1948/1956 Water Pollution Control Act provided monies to build waste treatment plants and gave the federal government the power to call enforcement conferences. In 1965 the Water Quality Act established water quality standards for interstate waterways, required that states file implementation plans, and focused on secondary treatment of waste. The 1972 Clean Water Act called for elimination of discharges to ensure fishable, swimmable waters by 1983. It set effluent standards based on technology. Unfortunately it was too stringent to be implemented. The Safe Drinking Water Act was passed in 1974, followed by the Clean Water Act in 1977. This act extended deadlines in the 1972 Act and distinguished between conventional and toxic pollutants. Nonpoint sources were seen as a state responsibility with the federal government providing planning funds (Tietenberg 1992). The Clean Water Act defined confined animal feeding operations as point sources of pollution but specifically exempted agricultural stormwater discharge and return flows from irrigation (Centner and Risse 1999).

The Clean Water Act of 1972 did have some repercussions for nonpoint sources of pollution. An amendment required that states identify nonpoint sources of pollution and enact regulations to control it. Another amendment gave the federal government the ability to regulate drainage and modification of wetlands if it affects navigable waters. The definition of confined animal feeding operations of more than 1000 animal units as point sources of pollution was mentioned previously. Other areas where the federal government is involved in regulating agricultural production is the requirement for testing and regulation of pesticides and the Endangered Species Act (Ervin et al. 1998).

In the 1970's there was pressure from environmental groups to examine the role of agriculture in the pollution and degradation of natural resources (Potter 1998). There had been an assumption that farmers were good managers. Environmentalists saw things differently and it was realized that agricultural support programs were exacerbating environmental problems. Cochrane and Runge (1992) indicate that technical change has driven and been driven by agricultural policy. Policies and technical advances led to increased land prices which led to intensification of land use with negative consequences for the environment. High prices in the 1970's meant that marginal land was brought into production. In addition, the commodity programs pushed the shift to monoculture (Reichelderfer 1990). Programs from the 1930's focused on on-site problems from soil erosion but there was a realization that off-site problems were a bigger problem. Also in the 1980's there was a realization that groundwater pollution was an issue and that biodiversity was decreasing due to loss of wetlands and prairies (Potter 1998). In 1976, Congress required USDA to show that its conservation programs were decreasing soil erosion. A Resource Conservation Appraisal was conducted in 1977 and this may have been an instrumental factor in the success of the strong conservation provisions of the 1985 Farm Bill. In 1977 the proportion of subsidized "conservation practices" that actually were soil conserving was only 45% (GAO 1977). Government programs weren't targeted and there was little coordination between commodity and conservation programs. Details and implementation matter. Cook (1983, p. 476) said "the failure to leverage more enduring conservation benefits with a $12 billion public investment [being due] to a singular lack of foresight, creativity and commitment at the highest levels of USDA commodity and conservation policymaking". Farmers began to realize that regulation was a real possibility so both the National Assn. of Conservation Districts and the Agricultural Stabilization and Conservation Service (part of USDA) began to support conservation compliance. A USDA commissioned survey found that 60 percent of farmers said that it made good policy sense.

The Conservation Reserve Program was suggested by the American Farmland Trust in 1984 indicating the important role of policy entrepreneurs (Potter 1998).

According to Potter (1998), changes in policy require a concensus about the problem and its causes but budgetary pressures in conjunction with information on the environmental effects of agriculture were required to enable the 1985 Farm Security Act. Low agricultural prices in the early 1980's meant that budget exposure due to the farm programs was very high. A diverse political coalition produced the 1985 Farm Bill and it encountered little resistance. The environmental provisions had three goals, to save soil, cut production and support farm income. The 1985 Farm Bill is considered to be the most progressive conservation legislation since the New Deal and similarly relied on a confluence of factors for its political success. The provisions of the 1985 Farm Bill; Conservation Compliance, the Conservation Reserve Program (CRP), Swampbuster, and Sodbuster, as well as lessons learned and subsequent legislation are described in the next section.

Many of the current conservation programs are linked to past and current farm income support policies and the incentives to comply depend on the level of program payments. While a description of those policies is beyond the scope of this paper, a brief summary is appropriate. Given the fact that the United States is "large" in many of the grain markets, production levels in the United States affect world prices. Therefore, income support programs have tried to reduce production through set asides while at the same time supporting prices through deficiency payments and other programs. Cochrane and Runge (1992) describe this as having one foot on the brake and the other on the gas pedal. Participation in the farm programs is voluntary but participation rates have been high. Payments are based on a "base acres" concept, which takes into account past planting history and is the maximum number of acres of production on which farmers could receive deficiency payments. Deficiency payments were calculated as #acres x base yield x (target price – market price). Farmers could "build base" by planting more of a program crop for a number of years and losing base is an issue that conservation programs have had to take into account.

Current Agri-Environmental Policies:
Policy Objectives and Criteria

There are two important questions in environmental policy from an economist's viewpoint, 1) what is the optimal level of pollution, and 2) what policy instruments should be used to achieve that goal. With nonpoint source pollution, it is often difficult to determine the

optimal level of pollution because damages (and thus benefits of abatement) are difficult to determine so cost-effectiveness of achieving some environmental goal is often the policy objective (Horan and Ribaudo 1999, Weersink et al. 1998). In addition to cost-effectiveness, other objectives mentioned by Weersink et al. (1998) include ecological effectiveness, monitoring and enforcement costs, administrative costs, and incentives for innovation. Braden and Segerson (1993) suggest three criteria for evaluating policies: targetability, enforceability, and correlation with environmental quality. Budget exposure and political feasibility are other issues that drive the policies we see in practice. Another issue that seems to be important is fairness or distributional impacts of the policy (McCann 1999) which may be linked to political feasibility. Transaction costs are a large component of total costs and these costs vary by policy, up to a factor of 10 in one study (McCann and Easter 1999b). Studies of environmental programs in the EU have also found that both the magnitude and variability of transaction costs are large (Falconer and Whitby 1997). Horan and Ribaudo (1999) indicate that design-based incentives relating to variable inputs, fixed inputs, or management practices may have fewer informational problems for farmers and may be easier to verify for administrators than performance based incentives. Another issue that should be taken into account, and which is related to transaction costs, is the vulnerability to problems of enforcement and rent seeking behavior.

It is interesting to note that from a principal agent point of view, any policy is vulnerable to several moral hazard problems. Politicians enact legislation which may or may not be designed and implemented by the agency in the way it was intended. When the guidelines or regulations are transmitted to the regional or state level, they may be understood or implemented differently than the agency intended. At the local level, there is again potential to apply the guidelines and regulations differently than intended at the state or federal levels. This problem has been documented with respect to a variety of government programs. In addition, there is the more recognized principal agent problem of the local government representative and the farmer.

Federal policy instruments

The literature suggests that taxes are superior to standards and that emissions taxes are superior to input taxes or output taxes. Horan and Ribaudo (1999) indicate that they know of no performance-based incentives (such as an emission tax) implemented to date. Current federal policies also do not conform to the polluter pays principle but primarily rely on voluntary participation and positive incentives.

Extension programs are used to disseminate information that is increasingly related to soil conservation, water quality, pesticide use, etc. rather than increasing yields. Previous extension efforts would have included information on reducing productivity losses associated with soil loss. Extension has been a well respected and popular program but increasingly farmers are turning to private consultants who would not be expected to emphasize public good outputs as much as extension agents. While extension efforts can raise awareness and perhaps change attitudes, there is probably little scope for them to effect expensive changes in farming practices (Feather and Cooper 1995). Marsh et al. (1994) conducted a detailed study of the effect of extension programs on the adoption of lupins and found that, while it accelerated adoption, it did not affect the final level of adoption. Despite this, extension probably has a role in enabling more effective but less popular policies in the future.

Cost-sharing and technical assistance programs for soil conservation efforts are also not a recent development as indicated earlier but there is pressure to make them more focused on activities with obvious off-farm benefits. It is a voluntary program. Generally a farmer approaches staff at the county level who examine the problem on the farm and design a solution such as terraces. The government pays half or more of the cost of installing the practice. Given the large number of NRCS staff with engineering rather than agronomic training, management solutions have probably not been given an appropriate emphasis (McCann 1997). A survey of farmers in Minnesota found that this program was not especially popular, especially among the less educated farmers (McCann and Easter 1999a).

Conservation Compliance provisions were part of the 1985 Farm Bill. Under this program, government payments would be withheld from farmers with highly erodible land[1] that did not have a conservation plan developed by 1990 and fully implemented by 1995 (Napier 1990). Since 1988, farmers can be subject to an alternative conservation systems approach if they can show compliance would cause undue hardship. Local staff from SCS/NRCS were responsible for helping farmers develop plans and for monitoring compliance. Cost-sharing was available to implement plans. Implementation was sometimes less than ideal. One problem was that farmers would redefine field boundaries to reduce the amount of land that was defined as highly erodible. In general though, it has been an effective program in that it leveraged existing funding to gain environmental benefits and has been fairly well accepted by the farming community. Examples of practices implemented include conservation tillage, contouring, terraces, and grassed waterways. Dickason and Magleby

---

[1] Highly erodible was defined as an erodibility index greater than 8. The erodibility index is equal to the maximum predicted average annual rate of erosion divided by the average soil tolerance.

(1993) estimated that this would result in a 12% decrease in total erosion. Because this policy was targeted to highly erodible land, it was more cost efficient, from both abatement and transaction cost perspectives. Various studies have found it to be cost effective with a benefit-cost ratio of 2:1 found in a USDA-ERS study mentioned in Horan and Ribaudo (1999). The 1994 NRCS Status Review (USDA, NRCS 1996 cited in Horan and Ribaudo 1999) found that only 3% of relevant fields were not in compliance.

Swampbuster and Sodbuster were also provisions of the 1985 Farm Bill. During the 1970's high prices had encouraged fence-row to fence-row cultivation and these policies were implemented to secure remaining wetlands and grasslands. Another role was to prevent farmers from degrading their land and then signing up for CRP (Potter 1998). Under these provisions, farmers who drained wetlands or plowed up grasslands susceptible to erosion were barred from receiving government payments for the entire farm and from participating in other government programs such as crop insurance and loans. It was felt that this was a rather draconian response. There was some dispute as to the definition of a wetland with the government having a more broad definition than farmers. Again, if farmers weren't involved in government programs they weren't affected by this legislation. My impression is that these were the least well accepted provisions of the 1985 Farm Bill and this probably led to lax implementation at the local level.

The centerpiece of the 1985 Farm Bill was the Conservation Reserve Program (CRP) which has a precedent in the Soil Bank of the 1950's. At a time of low prices and thus large budget exposure, as well as mounting pressure to reduce erosion, the CRP was designed to accomplish multiple objectives[2]. The goal was to retire 45 million acres of highly erodible cropland and land along streams. Placing land in the CRP displaced base acreage, thus reducing the acres on which commodity support was received. Farmers can bid to put land in the CRP for a 10-year period in a series of sign-up periods. If bids are accepted, a contract is written and contracts are binding if land ownership is transferred. Penalties for violation of the contract are severe, the same as for violation of the Swampbuster and Sodbuster provisions. For both Conservation Compliance and CRP, approximately 15% of farms were

---

[2] Brubaker and Castle (1982) indicated that it is unwise to link soil conservation policies to general agricultural policies that may or may not continue on their own merits. On the other hand, it is common to find multi-objective policies and it may be a necessary condition to get legislation passed. The enduring strength of the farm bills is due in part to the coalition of legislators from agricultural areas and those from large urban areas that benefited from the Food Stamp Program and surplus commodity donations.

to be randomly checked for compliance. No more than 25% of the cropland in any county can be enrolled in CRP to limit the effect on rural economies. Land must be put in conserving uses such as grass cover or preferably trees and shrubs and the government pays 50% of the initial establishment costs. Farmers could mow the grass but not use it for animal feed except under crisis situations. Trees may be harvested for commercial use. While the original conservation impetus was soil conservation, wildlife habitat has proved to be one of the more important benefits from the program.

There were several problems associated with the CRP bidding process as summarized in Potter (1998). Costs of the program were higher and environmental benefits lower than initially hoped. While bidding was designed to be much more economically efficient than a flat rate, after the first few sign-ups the ASCS essentially set an upper bound and accepted all bids below the bound that met conservation criteria. Farmers learned what this price was and most bids were at or near the cut-off so it essentially became a set price. Also, prices didn't vary by region so low-productivity land in the Great Plains was receiving quite a windfall. Another problem was that the conservation criteria weren't well developed and became even more fuzzy at the local level. The Secretary of Agriculture had discretion over eligibility rules, enrolment targets, and bid acceptance criteria so the design and implementation were probably different from that envisioned. This is an example of the principle agent problem between politicians and bureaucrats. The CRP story shows the importance of design and implementation details.

Subsequent modifications have tightened criteria to get more environmental benefits (Potter 1998). The 1990 Food, Agriculture, Conservation and Trade Act set up new CRP procedures that took expected benefits into account (via an Environmental Benefits Index) in addition to opportunity cost and was targeted with respect to location. Targeting of subsequent sign-ups appears to have been successful. In the 1990 Farm Bill, CRP was to be used to protect groundwater as well as surface water. A Wetland Reserve Program was set up to permanently convert land to wetlands. Also during this period the Water Quality Incentive Program (WQIP) was set up to provide incentive payments to improve pesticide and nutrient management, reduce excess animal waste application and improve irrigation water management.

The 1996 Federal Agricultural Improvement and Reform Act represented a major breakthrough in that payments were decoupled from production, an idea first suggested in 1948. The Act replaced deficiency payments with direct payments not tied to production but to past base levels. Decoupling lowers the incentive to overapply fertilizers and pesticides

and also allows farmers to choose crops, some of which such as soybeans, may be more environmentally friendly than program crops such as corn. This would probably not have been possible, given the increased transparency of the payments, if commodity prices had not been high at the time. Farmers have resisted this idea in the past because of the appearance of receiving "welfare", rather than payment for a product (Cochrane and Runge 1992). Another innovation was that payments were to be phased out over seven years and discontinued in 2002. CRP and WRP were recommissioned and riparian lands, filter strips and grassed waterways now receive a 20% bonus payment (Ogg, 1999).

The 1996 Farm Bill also set up the Environmental Quality Incentives Program or EQIP, which provides education, technical assistance and cost-sharing and incorporates WQIP. Farmers submit proposals outlining conservation measures they will implement along with a bid and if accepted, a contract is signed for a 5-10 year period. Cost sharing payments can be up to 75% of the cost of the project but an offer selection system is in place for cost sharing related to structural practices (USDA 1996). While CRP is aimed at the extensive margin, EQIP provides a financial incentive with respect to management practices and fixed inputs (Horan and Ribaudo 1999). Questions that should be asked about these programs are 1) whether they are primarily to improve environmental quality or, as with previous programs, a new way to distribute money to the rural sector, and 2) whether the transaction costs are prohibitively high.

There are several cases where point-nonpoint trading schemes have been set up but to date there have been few if any trades (Horan and Ribaudo 1999). A trading scheme was also set up for point sources of water pollution in the Fox River in Wisconsin although no trades had occurred up until 1997. Many of the problems that make nonpoint source pollution control difficult, also make trading difficult. Taff and Senjem (1996) suggest that farmers should be credited for easily observable practices via a prior practice agreement to reduce the uncertainty involved with emissions levels. Design characteristics of the scheme and property rights are important. Once again, details are shown to be important in practice. Perhaps a careful analysis of what limited trades in these other cases would be helpful. It seems that while this is appealing on a theoretical basis, and has worked for sulfur dioxide emissions in the United States, it has limited potential for nonpoint source pollution.

State policy instruments

In the United States as in Australia, state governments have the power to enact and enforce environmental policies. There are a variety of state regulations and programs relating to agri-environmental pollution which can be viewed as policy experiments. A survey of

state policies for nonpoint source pollution by Ribaudo (1997) indicates that most policies in place are of the command and control variety. They consist of regulations regarding input use and management practices that may be applicable statewide or targeted to areas of specific concern. In contrast to past federal policy, many of the state programs are mandatory rather than voluntary. Almost 30 states are able to regulate farmer behavior instead of just offering incentives for compliance. While federal policy has until recently focused on surface water quality, perhaps related to the navigable waters issue, many of the state regulations relate to protecting groundwater quality. Few of the state laws are comprehensive, i.e. covering all aspects of agricultural pollution, but rather focus on a particular pollutant or water body. Enforcement is often through citizen complaint which is problematic since any particular individual will probably experience small damages. The examples in the paper also indicate the incremental nature of policy making as well as the explicit "tightening of the screws" policy that is proposed in this paper. A full discussion of state policies is beyond the scope of this paper but some examples may be useful.

Vermont has a comprehensive, non-targeted water quality law that requires adoption of technology standards and monitors them (Ribaudo 1997). All farmers are required to follow a set of "accepted agricultural practices" to reduce nonpoint source pollution. The required practices must be technically feasible and cost-effective because financial assistance is not provided. An example of a required practice is vegetative buffer strips along permanent waters. Failure to adopt the required practices results in a non-compliance warning and continued failure to comply can result in legal action and administrative penalties. Ribaudo (1997) indicates that Vermont also has a targeted program of more stringent BMP's for specific areas. The BMP's are initially voluntary and encouraged through a cost-sharing program. If water quality goals are not met, the BMP's will be required on specific farms.

Nebraska has a system of targeted technology standards to address groundwater contamination (Ribaudo 1997). The state is divided into local government bodies called Natural Resource Districts (NRD's). In 1986 the Nebraska legislature allowed NRD's to require certain best management practices, such as proper irrigation scheduling and timing of fertilizer applications, in order to protect water quality. In the Central Platte NRD, areas are divided into Phase I, II, and III depending on nitration contamination levels. Agricultural practices on all farms in the area are increasingly restricted at higher levels of contamination. This may encourage peer pressure to comply and thus reduce enforcement costs since the farmers want to avoid more costly BMP's (Ribaudo 1997). A moral suasion example is the

Groundwater Foundation based in Nebraska but which has spread to 33 states and two Canadian provinces (Kuzelka et al. 1999). It is a community based groundwater protection program, much of which has been oriented towards nonpoint sources. It supports teams comprised of local citizens and representatives of business and government to identify problems at the local level and develop "Result Oriented Activities" to solve them.

The following example from Florida highlights the often incremental nature of policy change compared to the sudden changes exemplified by the 1985 Farm Bill. Lake Okeechobee in south-central Florida provides a case study of regulatory policies to reduce phosphorus (P) pollution from nonpoint sources (Boggess et al. 1993). Agriculture accounts for 95% of P in the Lake, primarily from dairy and sugar operations. Policy regarding the Lake has been an evolutionary process with ever more stringent BMP's being put into place. In 1973 the Florida legislature established a project to prevent the eutrophication of Lake Okeechobee including funding for research, but by 1984 the P concentrations had doubled. There was a dairy buyout in 1987 and new dairies have to conform to P performance standards, in the form of a maximum allowable level of P runoff. There is a 67% cost sharing program for waste management technologies for dairy operations. Monitoring has become more localized and complex over time. Marginal cost of P cleanup of Lake Okeechobee is increasing at an increasing rate. It was estimated that it cost $100 per cow to get the first 0.5 mg/l P reduction but that the dairy buyout cost $1000 per cow to hopefully get another 0.4 mg/l reduction. Over $35 million has been spent cleaning up Lake Okeechobee over a 10 year period (nominal dollars). More recently, the Everglades Forever Act in Florida has a per acre tax on cropland that increases over time if a 25% P reduction goal is not met (Ribaudo 1997).

In Minnesota, two innovative voluntary programs are of interest. The Reinvest In Minnesota program (RIM) purchases permanent easements from farmers. It is an example of a more general instrument called a conservation easement (Boyd et al. 1999). In the RIM program, the government essentially purchases most but not all property rights to the land. It is a legal property transaction and given the division of the bundle of property rights, the transaction costs are probably higher than a simple sale of the property. CRP contracts are only for 10 years which conservationists find too short a period and the RIM is permanent which some farmers object to (McCann and Easter 1999a). An interesting area of study would be the optimal length of contract, perhaps 30 years. Another innovation is the River Friendly Farmer Program. Farmers who meet a variety of criteria for soil conservation and appropriate fertilizer and pesticide use are given a plaque they can put up on their property

showing they are a River Friendly Farmer. There is talk that some farmers who qualify aren't especially environmentally friendly. Also, a recognition program probably won't be enough to encourage farmers to undertake costly changes. On the other hand, this program is low cost and popular with farmers (McCann and Easter, 1999a). Minnesota has a fertilizer tax in place but the rate is about 0.175% which would not affect farmer decision making.

While not usually discussed in the context of agri-environmental policy, management of livestock waste is an important and growing problem in the United States. Problems include movement of pathogens and nutrients into surface and groundwater, odor problems, and spills from waste lagoons. Under the Clean Water Act, confined animal feeding operations (CAFOs) with over 1000 animal units and certain operations with over 300 animal units are subject to permitting (Centner and Risse 1999). In some states this is handled by a state government organization and in other states it is done by the Environmental Protection Agency. Permits may contain effluent and/or bypass limitations and several states have adopted more stringent regulations than the federal government. For example, in Minnesota, farms with greater than 10 animal units are required to obtain a permit if they construct a new feedlot, expand, change ownership or cause a pollution hazard. Farmers subject to permit are also required to have a manure management plan. In Oklahoma, if an operation has more than 2500 animal units it is required to have a waste management plan, an odor management plan, a carcass disposal plan, an erosion control plan, and best management practices as well as notifying affected property owners. Regulations passed in Maryland require nutrient management plans for essentially all animal feeding operations as well as requiring phytase or similar compounds to be fed to chickens. States have various regulations regarding the design of lagoons, soil sampling, filter strips, spray application, setback provisions, and certification for consultants. Many of the policies reviewed by Centner and Risse seem to be technology standards. One aspect of the Clean Water Action Plan is that mandatory comprehensive nutrient management plans are required to be developed by 2003 and implemented by 2009 for those subject to the permitting process. Manure applied to fields which subsequently entered waterways through runoff was not subject to Clean Water Act regulations (Centner and Risse 1999). Having regulations on the books does not guarantee they will be implemented and enforced. In Minnesota there is a perception that feedlot regulations aren't fully enforced (McCann and Easter 1999a).

Canadian Policy Instruments

While a survey of Canadian policy is beyond the scope of this paper, some of the major policies are mentioned in Wersink et al. (1998) from which the following is drawn.

The 1989 reform of Canadian Agricultural policy included environmental sustainability as one of four goals. Major agri-environmental problems include soil and water quality (particularly nitrate contamination), wildlife loss, and climate change. Moral suasion, along with education, has been the most popular policy option. It has recently been supplemented with technical and financial assistance. As in the U.S. case, these voluntary approaches haven't worked. Canada has reduced levels of support to agriculture, such as withdrawing the Western Grain Transportation Act. Financial incentives have been provided for abating inputs such as conservation tillage, permanent cover, and manure storage facilities. Cross compliance has not been used in Canada. An example of informal point – nonpoint trading of P has occurred between a waste treatment plant and local farmers. The Environmental Farm Plan is a popular program that began in Ontario in which farmers are offered a financial incentive to complete a series of modules to evaluate their own operation. Site specific technical assistance is available if a problem is identified. The authors suggest other possible policies including performance bonds, economic incentives, markets for environmentally friendly produce, regulations, and low cost loans for transition periods. Wersink et al. conclude, as have others (Easter 1991, Braden and Segerson 1993) that the optimal strategy will probably include a mix of instruments.

Future Outlook:

Obviously any discussion relating to the future represents speculation and much of the rest of the paper falls into that category. It is probably safe to say though, that agri-environmental reform looks set to continue.

Representative James Oberstar from Minnesota proposed the first bill (H.R. 550) to deal with nonpoint source pollution at the federal level, the Nonpoint Source Water Pollution Prevention Act of 1997. The bill was defeated but it may signal a new era in nonpoint source pollution regulation. The latest development (1998) is the Clean Water Action Plan which resulted from the White House asking federal agencies, led by the United States Department of Agriculture (USDA) and the Environmental Protection Agency (EPA) to develop and implement a five year plan to improve the nation's water resources. The Clean Water Action Plan includes 111(!) key actions including improved inter-agency cooperation, a strategy to increase the number of wetlands, nutrient management plans to minimize pollution caused by animal feeding operations, a National Conservation Buffer Initiative, increased technical assistance and information access, and funding for curbing polluted runoff and for watershed restoration (USG 1999). The Clean Water Action Plan represents increased federal

involvement and, significantly, more EPA involvement in nonpoint source pollution. According to Horan and Ribaudo (1999) "The recent Clean Water Action Plan suggests that Federal programs are likely to become even more focused on nonpoint pollution and that coordination with state programs will increase. In particular, greater emphasis is likely to be placed on the use of economic incentives and enforceable mechanisms to reduce nonpoint pollution". In December of last year, both Al Gore and Dan Glickman announced the bad news from the 1997 National Resources Inventory. The rate of forest loss is increasing, soil erosion control has stalled since 1995, and farmland is being lost to urbanization at an increasing rate.

It has been obvious from the examination of the history and political economy of agri-environmental policy in the United States that there has to be a confluence of factors for radical policy change. Many ideas first proposed decades ago are only recently being incorporated into policy. It may be that there needs to be a crisis of some kind to get the federal government to seriously examine taxes and regulations for non-point source pollution. This might be a budget crisis or an environmental crisis. Policy development has been a slow process with incremental change punctuated by periods of more comprehensive changes. Future trends include further incremental changes but at an increasing rate due to: 1) more policy experience about what works and what doesn't, in the United States and elsewhere, 2) increasing demand for environmental amenities with increasing incomes (Ruttan 1971), 3) more monitoring data so it is easier to measure progress or the lack thereof, and 4) better science so we are more quickly able to determine the causes and solutions to problems.

Given the level of activity at the state level and the use of successful state programs as the basis for federal regulations (Ribaudo, personal communication) an increased state role is both desirable and likely. On the other hand, while federal government has been involved in voluntary nonpoint source pollution policies, it will be increasingly involved in regulating agriculture. Nonpoint regulations at the federal level will appear in the near term but even taxes may be examined seriously depending on the budget situation and the environmental situation. Decades of, at best, moderate policy success means that farmers see the writing on the wall and are softened up for more effective policies. Targeting of programs and regulations will become more common. It makes good economic sense and also makes sense to farmers and policy makers.

Animal agriculture is being carefully examined. It is a case where the pace of change in the industry has outstriped the institutional capacity to deal with it. Structural change and economies of scale favor large hog and poultry operations, which have the potential to cause

major problems. In addition to manure management, odor from these operations will become an increasing problem which will have to be addressed. Air pollution from agriculture will become a more important issue, not only because of the odor issue with animal waste, but also nitrogen losses to the air from lagoons (Ogg 1999). It seems there is probably quite a bit of potential for technological change to help address these problems. Ogg (1999) suggests that there are opportunities for the economic use of hog and poultry manure but that transportation costs are a limiting factor. Therefore technological changes in manure treatment, storage and transportation have potential. Perhaps the technologies will first be developed in Europe where the pressures are particularly intense.

Technological advances have the potential to lower the costs of abatement as well as monitoring costs. Improvements in monitoring technologies will make some policy instruments more viable than is currently the case. If measurement technologies increased dramatically enough, we might no longer have "nonpoint" source pollution. As an alternative to increased regulation or increased subsidies, encouraging complementary technologies which decrease costs and improve environmental quality has potential (Ervin and Graffy 1996). As an example of a complementary technology, improvements in design of conservation tillage equipment, coupled with the decreased labor requirements mean this technology will be increasingly adopted on its private economic merits. Other technologies with potential include GIS, precision farming, and measurement tools for on-farm use. On the other hand, technological changes will not occur until economic incentives exist, so changes in regulations or pollution taxes will spur the needed technological change. As in the case of point sources of pollution, abatement costs will probably be less than expected due to adaptation and new technologies.

Recommendations:

If one were designing agricultural and agri-environmental policy from scratch one could avoid some mistakes that have been made in the United States and elsewhere. For example, it is recognized that agricultural production policy and agri-environmental policy should be explicitly coordinated from the outset. Barkley (1997) calls for research on the important but little studied area of policies in conflict. Responsibilities should be located in the same agency or department but this is probably not sufficient. Policies which encourage and subsidize agricultural production almost invariably lead to more environmental degradation and loss of natural ecosystems than for the unsubsidized situation. Developing countries often subsidize polluting inputs such as fertilizers. Subsidizing irrigation systems is

also a cause of pollution in many cases. It is very difficult to dismantle policies that subsidize an industry once initiated. Economic incentives transmitted through the price system are probably even more important than in the case of nonpoint pollution so not subsidizing polluting outputs or polluting inputs should be a fundamental rule.

More fundamentally, governments need to be careful about what property rights are implicitly and explicitly given to landowners. As Bromley (1992) indicates, farmers were not explicitly given the right to pollute but currently they implicitly have that right (although this seems to be changing). In addition, it is also important to examine the most appropriate level for property rights to be placed (Challen 2000). When individuals are sold or given the right to productively use land there should be an explicit duty to conserve the resource and limit externalties as a condition for use of the land. In any case, the institutional framework should be set up such that legal action can be fairly easily taken against polluting firms.

Another issue is the role of the states versus the federal government. This has been discussed to some extent earlier in the paper. States are closer to the problem which is especially important in nonpoint source pollution but not all states have the capacity to handle the responsibility. Vogle (1997) indicates that there is better knowledge but also more potential for capture at lower levels of government. State and local levels of government need to be vigilant against capture and coordination needs to be designed to minimize this problem, for example by setting objective, measurable goals. I would suggest that a mixture of federal, state and local responsibility would be appropriate given variable local conditions yet far reaching environmental impacts. Again, this would be a useful and interesting area of research.

Some government policies such as exchange rate policy can have an indirect but significant effect on agriculture (Krueger et al. 1991). Similarly, the design of the tax system in most countries indirectly subsidizes polluting inputs since they are tax deductible so the cost to the farmer is less than the market price. Perhaps a lump sum deduction should be examined to rectify this problem. Alternatively, farmers should have to prove that the inputs they are claiming do not have any negative effect on the environment. It may even be feasible to use the tax system to target programs if tax returns are linked to information on the characteristics of the farm.

Optimal policy sequencing

Even if institutions and prices do not encourage pollution, Pareto-relevant externalities will probably exist. Then what? Several authors suggest that a mix of policy instruments will be appropriate in the case of nonpoint source pollution. This paper suggests

that, in addition, there is an optimal sequencing to policy instruments. First, research into the nature and causes of the problem, as well as ongoing monitoring of air, surface water, and groundwater quality, is required to provide the necessary information base for further action. In particular it would be useful if scientists measured data that was relevant for environmental policy analysis. Monitoring of populations of plant and animal species may be particularly useful in some cases. It is important, however, to guard against waiting to act until we have perfect information. Development of some rules of thumb about the appropriate amount of information would be useful.

Given solid information, how should we proceed? As Ervin and Graffy (1996) suggest, we should "pick the low hanging fruit first". Moral suasion, education and extension may have some effect, particularly in cases where information is not readily available to farmers and where the linkages between farm practices and environmental effects are difficult to observe. It may also be somewhat effective if recommended practices are low cost and easy to implement. This type of policy has been implemented extensively in practice and has been shown insufficient to reach the optimal level of abatement. I argue that giving voluntary methods a chance is a necessary condition for acceptance of stricter policies both on the part of politicians and farmers. It is interesting to point out that Frey and Oberholzer-Gee (1987) found evidence that support for a nuclear facility actually decreased when compensation was offered and call this effect motivation crowding out.

It is often the case that we know what is causing the problem and we've tried educational programs to encourage farmers to voluntarily change their management practices to no avail. Now what? Encouraging research to come up with win-win solutions is a popular and potentially very successful policy. Ervin et al. (1998) indicate that technological improvement is one element of a more enlightened strategy for the U.S. that also includes clear, measurable objectives, more rewards for participation in environmental programs, increased reliance on market mechanisms, and a devolution of responsibility to the states. There needs to be an incentive for new technologies to be developed. The induced innovation hypothesis (Hayami and Ruttan 1985) suggests that technologies will be developed and adopted which economize on relatively scarce resources. Since externalities are by definition external to the market, the appropriate price signals do not exist. While Runge (1999) indicates that pressure for change can occur outside of the price system, these signals would be greatly attenuated.

Typical programs seen at this point would be cost-sharing and technical assistance but these programs would need to be carefully designed to not repeat the U.S. experience where

funds ended up being used for increased production rather than environmental benefits. The effectiveness of these programs has probably been quite limited (Horan and Ribaudo 1999). To repeat, details and design matter and these are areas that we are not well equipped to analyze. Hopefully we can improve on this rather than relying on trial and error. I view programs such as EQIP as costly but perhaps necessary given the history and institutional environment in the United States. The success of Conservation Compliance depended on pre-existing programs as a *quo* for conservation practices. Programs like the CRP and RIM are very costly and perhaps not necessary if the institutional framework has been set up correctly. These types of programs should be compared to outright purchase of land by the government or environmental groups. In one instance the transaction costs were significantly lower for an input tax or a regulatory solution than a land retirement program (McCann and Easter 1999b). None of these policies is in line with the polluter pays principle.

The economic efficiency arguments for taxes or subsidies rather than regulation are strong. From a practical point of view however, there may be a role for regulation of easily observable practices. States have been able to implement regulations regarding nonpoint source pollution but their effectiveness has not been carefully examined (Ribaudo 1997). A problem with regulations backed up with fines or legal liability rules is that the measurement problems at the heart of nonpoint source pollution mean that noncompliance is difficult to prove in court. Another, more difficult line of attack would be to tax polluting inputs and practices. This would be very difficult to actually implement but may be a real possibility when the easy, cheap and/or popular instruments have been tried and found wanting. Weersink et al. (1998) indicate that some states have passed input taxes but that the goal seems to have been to raise revenue, not change behavior.

Conclusions:

Experience in the United States has shown the key role of political economy in determining what policy instruments are actually implemented. It has also demonstrated that details in the design and implementation of policies is important. The nature of nonpoint source pollution means that transaction costs will be higher than for the point source case and these should be taken into account in policy evaluation. Institutions matter and implicit and explict property rights will affect what policies are feasible.

Conservation Compliance was quite effective, especially given the fact that it leveraged existing government payments, and fairly well accepted by farmers. The effectiveness of Conservation Compliance, Swampbuster and Sodbuster depended on an

existing system of payments that could be withdrawn. The Conservation Reserve Program had a range of benefits, particularly soil conservation and wildlife habitat, but was quite expensive. Improved targeting has increased the effectiveness of the program. The Environmental Quality Incentives Program is designed to maximize benefits per dollar spent and they will probably be able to use knowledge gained from CRP about the bidding process and targeting. There is a trend towards regulation of nonpoint source pollution, beginning at the state level. Intensive livestock facilities will be increasingly toughly regulated and odor will become an increasingly important issue. Opinions and political acceptability evolve over time.

A phased implementation of policies, as suggested in this paper, has several advantages. It matches the incremental nature of policy reform that policy-makers are comfortable with, it allows experience to prove that voluntary actions are not working, or to stop at that level if they do work, it allows farmers to adjust, and it allows and encourages technological change.

References:

Barkley, Paul W. 1997. "Policy versus Policy" *Choices* Third Quarter, 1997, p. 1.

Boggess, W.G., E.G. Flaig and C.M. Fonyo. 1993. "Florida's Experience with Managing Nonpoint-Source Phosphorus Runoff into Lake Okeechobee" In: <u>Theory, Modeling and Experience in the Management of Nonpoint-Source Pollution</u> C.S. Russell and J.F. Shogren (eds). Kluwer Academic Publishers, Norwell, Mass.

Boyd, James, Kathryn Caballero, and R. David Simpson. 1999. "Carving Out Some Space: A Guide to Land Preservation Strategies" *Resources* Summer 1999/Issue 136, pp. 10-13.

Braden, J.P. and K. Segerson. 1993. "Information Problems in the Design of Nonpoint-Source Pollution Policy" In: <u>Theory, Modeling and Experience in the Management of Nonpoint-Source Pollution</u> C.S. Russell and J.F. Shogren (eds). Kluwer Academic Publishers, Norwell, Mass.

Bromley, Daniel W. 1992. "Chapter 1. Entitlements and Public Policy in Environmental Risks" In <u>The Social Response to Environmental Risk: Policy Formulation in an Age of Uncertainty</u> Daniel W. Bromley and Kathleen Segerson, eds. Kluwer Academic Publishers, Boston.

Browne, William P., Kristen Allen, and David B. Schweikhardt. 1997. "Never Say Never Again: Why the Road to Agricultural Policy Reform Has a Long Way to Go" *Choices* Fourth Quarter, pp. 4-9.

Brubaker, S. and E. Castle. 1982. "Alternative Policies and Strategies to Achieve Soil Conservation" In: H. Halcrow, E. Heady, and M. Cotner (eds.) <u>Soil Conservation Policies, Institutions and Incentives</u> Soil Conservation Society of America, Ankeny, Iowa.

Centner, T.J. and M Risse. 1999. "U.S. Regulations Regarding Diffuse Animal Waste Pollution" In: Proceedings of the International Conference on Diffuse Pollution. CSIRO. Perth, Western Australia, 16-20 May, 1999.

Challen, Ray. 2000. <u>Institutions, Transaction Costs and Environmental Policy: Institutional Reform for Water Resources</u> Edward Elgar, U.K.

Cochrane, Willard W. 1979. <u>The Development of American Agriculture: A Historical Analysis</u> University of Minnesota Press, Minneapolis, Minnesota.

Cochrane, Willard W. and C. Ford Runge. 1992. <u>Reforming Farm Policy: Toward a National Agenda</u> Iowa State University Press, Ames, Iowa.

Cook, K. 1983. "Soil Conservation: PIK in a Poke" *J. of Soil and Water Conservation* Vol. 44 (5), pp. 362-366.

Dales, J.H. 1968.   "Land, Water and Ownership" *Canadian Journal of Economics* November 1968

Dickason, C and R. Magleby, 1993. "Erosion Reduction Benefits for U.S. Soil Conservation. Economic Research Service. USDA, Washington, D.C.

Doyle, Timothy and Aynsley Kellow. 1995. Chapter 6. In: Politics and Policy Making in Australia.

Easter, K.W. 1991. "Differences in the Transaction Costs of Strategies to Control Agricultural Chemical Offsite and Undersite Damages" Dept. of Agricultural and Applied Economics, Univ. of Minnesota, Staff Paper 91-42.

EPA. 2000. "Reorganization Plan No. 3 of 1970". http://www.epa.gov/history/faqs/reorganization.htm 11/01/00

Ervin, David E. and Elisabeth A. Graffy. 1996. "Leaner Environmental Policies for Agriculture" *Choices* Fourth Quarter 1996, pp. 27-33.

Ervin, David E., C. Ford Runge, Elisabeth A. Graffy, Willis E. Anthony, Sandra S. Batie, Paul Faeth, Tim Penny, and Tim Warman. 1998. "Agriculture and the Environment: A New Strategic Vision" *Environment* Vol. 40 (6) July/August 1998, pp. 8-15, 35-40.

Falconer, Katherine and Martin Whitby. 1997. "Disaggregating Transaction Costs for Countryside Stewardship Policies: The Case of Environmentally Sensitive Areas" Paper to the Agricultural Economics Society Conference on Designing Agri-environmental Policy Mechanisms: Theory and Practice. 2 December, 1997.

Feather, P.M. and Joseph Cooper. 1995. "Voluntary Incentives for reducing Agricultural Nonpoint Source Water Pollution" USDA ERS AG Information Bulletin Number 716. May.

Frey, Bruno S., and Felix Oberholzer-Gee. 1997. "The Cost of Price Incentives: An Empirical Analysis of Motivation Crowding Out" *AER* Vol. 87(4), September 1997.

GAO. 1977. To Protect Tomorrow's Food Supply – Soil Conservation Needs Priority Attention Report to the U.S. Comptroller General, General Accounting Office, Washington, D.C.

Hayami, Yujiro and Vernon W. Ruttan. 1985. Agricultural Development: An International Perspective The Johns Hopkins University Press, Baltimore.

Horan, Richard D. and Marc O. Ribaudo. 1999. "Policy Objectives and Economic Incentives for Controlling Agricultural Sources of Nonpoint Pollution" *J. of the American Water Resources Association*, Vol. 35 (5) (October 1999) pp. 1023-1035.

Krueger, Anne O., Maurice Schiff, and Alberto Valdes (eds.) 1991. The Political Economy of Agricultural Pricing Policy Johns Hopkins University Press for World Bank.

Kuzelka, R., R.D. Horner, R. Herpel, and S. Seacrest. 1999. "Protecting Groundwater: The Environmental Bottom Line" In: Proceedings of the International Conference on Diffuse Pollution. CSIRO. Perth, Western Australia, 16-20 May, 1999.

Marsh, S.P., D.J. Pannell, and R.K. Lindner. 1994. "Extension and Adoption of Lupins in Western Australia" In: Proceedings of the First Australian Lupin Technical Symposium, Perth, Western Australia, 17-21 October, 1994, pp. 191-211.

McCann, Laura. 1997. Evaluating Transaction Costs of Alternative Policies to Reduce Agricultural Phosphorus Pollution in the Minnesota River. Ph.D. Dissertation. University of Minnesota.

McCann, L. 1999. Agency Perceptions of Alternative Salinity Policies: Are They Measuring Transaction Costs, or Fairness? Presented at the 1999 International Symposium on Society and Resource Management: Application of Social Science to Resource Management in the Asia-Pacific Region. Brisbane, Queensland, 7-10 July, 1999.

McCann, L. and K.W. Easter. 1999a. Farmer versus Agency Attitudes Regarding Policies to Reduce Agricultural Phosphorus Pollution in the Minnesota River. *Review of Agricultural Economics*. Spring/Summer 1999, Vol. 21(1).

McCann, L and K.W. Easter. 1999b. Evaluating Transaction Costs of Nonpoint Source Pollution Policies. *Land Economics*. August 1999, Vol. 75(3).

Minnesota Pollution Control Agency. 1997. "About MPCA" Available: http://www.pca.state.mn.us/about/index.html. May 21, 1997.

Napier, Ted L. 1990. "Chapter 1. The Conservation Title of the Food Security Act of 1985: An Overview" In: <u>Implementing The Conservation Title of the Food Security Act of 1985</u> Ted L. Napier, Ed. Soil and Water Conservation Society, Ankeny, Iowa.

North, Douglass C. 1990. <u>Institutions, Institutional Change and Economic Performance</u> Cambridge University Press.

NRCS a. 1996. <u>America's Private Land: A Geography of Hope</u> USDA-NRCS, Program Aid 1548.

Ogg, Clayton. 1999. "Benefits from Managing Farm Produced Nutrients" *J. of the American Water Resources Association*, Vol. 35 (5) (October 1999) pp. 1015-1021.

Potter, Clive. 1998. Against the Grain: Agri-Environmental Reform in the United States and the European Union. CAB International, Oxon U.K.

Reichelderfer, K. 1990. "Environmental Protection and Agricultural Support: Are Tradeoffs Necessary?" In: K. Allen (ed.) <u>Agricultural Policies in a New Decade</u>, Resources for the Future, Washington, D.C., pp. 201-230.

Ribaudo, Marc. 1997. "Managing Agricultural Non-Point Source Pollution: Are States Doing the Job?" in D. Southgate, J. Hammonds, and M. Livingston, eds., <u>Devolution of Environmental Policy</u> (Columbus, Ohio: Resource Policy Consortium, Ohio State University)

Ringquist, Evan J. 1993. Environmental Protection at the State Level: Politics and Progress in Controlling Pollution. M.E. Sharpe, New York.

Rollings, Neils and Janice Jiggins. 1999. Workshop held at Conservation and Land Management, Baron-Hay Court, Perth. 5th August, 1999.

Runge, C. Ford. 1999. "Stream, River, Delta: Induced Innovation and Environmental Values in Economics and Policy" Working Paper WP99-2. Center for International Food and Agricultural Policy, University of Minnesota.

Ruttan, Vernon W. 1971. "Presidential Address: Technology and the Environment" *American Journal of Agricultural Economics*, Vol. 53(5), December 1971, pp. 707-717.

Shogren, Jason F. 1998. "Do All the Resource Problems in the West Begin in the East?" *Journal of Agricultural and Resource Economics* 23 (2), pp. 309-318.

Swanson, L. 1993. "Agro-Environmentalism: The Political Economy of Soil Erosion in the USA" In: S. Harper (ed.) <u>The Greening of Rural Policy: International Perspectives,</u> Belhaven Press, London. Pp. 99-118.

Taff, S.J. and N. Senjem. 1996. "Increasing Regulators' Confidence in Point-Nonpoint Pollutant Trading Schemes" *Water Resource Bulletin* Vol.32(6): 1-6.

Tietenberg, Tom. 1992. Chapter 18. Water Pollution. In: Environmental and Natural Resource Economics, Third Edition. HarperCollins Publishers, Inc.

USDA. 1962. Land and Water Resources: A Policy Guide.

USDA. 1996. Digest of Conservation Provisions of the Federal Agriculture Improvement and Reform Act of 1996. http://www.nhq.nrcs.usda.gov/OPA/FB96OPA/FBDigest.html 21/12/99

U.S. EPA and USDA. 1998. Clean Water Action Plan: Restoring and Protecting America's Waters. U.S. Environmental Protection Agency EPA-840-R-98-001, Washington, D.C.

USG. 1999. The Clean Water Action Plan – Fact Sheet. http://cleanwater.gov/news/fact_sheet.html 22/12/1999.

Weersink, Alfons, John Livernois, Jason F. Shogren, and James. S. Shortle. 1998. "Economic Instruments and Environmental Policy in Agriculture" *Canadian Public Policy – Analyse de Politiques* Vol. 24(3), pp. 309-327.