

**A Comparative Analysis  
of State Regulations  
for Use of Agricultural Chemicals**

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**Abstract**

Policies to regulate pesticides at the national level have not changed as new issues, such as groundwater contamination, have emerged. Therefore, various states are responding. This paper discusses recent state initiatives in regulating pesticides to prevent groundwater contamination, and suggests trends in these policies. A survey of legislators who have sponsored pesticide/groundwater contamination legislation is presented. Survey results show the factors affecting bill introduction, the influence of interest groups on the bills, important issues in bill debate, and trends in future legislation. A statistical analysis of the survey states and survey responses is also presented, using economic, political, and physical factors as explanatory variables.

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## Introduction

U.S. agricultural production has grown at an unprecedented rate since World War II, and pesticides have contributed significantly to that growth (Antle and Capalbo 1986). Although the benefits of pesticide use are immediate, recognition of the external costs has been slow to come. As added information on the external impacts of pesticides used in agriculture has developed, problems including pest resistance, secondary pest outbreaks, pesticide residuals in the environment, and pesticide contamination of food have been increasingly recognized.

In response to concerns about pesticides, public policy has evolved from protecting farmers as users of pesticides to protecting the public from adverse external effects. Recent developments in the technology for pesticide detection have contributed as well to increased public concern about chemical residues in the environment, and in particular, about pesticides in groundwater. This concern has led to renewed interest in regulatory policies.

At the national level, efforts to extend the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA) have not been successful. Alternatively, some states have pushed ahead with pesticide regulation. While fear of "patchwork quilt" regulation is prompting the pesticide industry to urge federal action, environmental and consumer groups have supported advanced regulation in a number of states (Bureau of National Affairs 1987). At present, farm groups appear to have sided with the

chemical industry on pesticide/groundwater issues, but this coalition appears to be fragile at best (Padgitt 1987).

In short, the current pesticide policy debate includes a diversity of interest groups interacting at various government levels. An understanding of the origins and the nature of state-level pesticide/groundwater policy is becoming increasingly important as the regulatory role of states is expanding. This knowledge is imperative for economic policy analysis (Strand and Bockstael 1989; Miranowski, Hrubovcak, and Sutton 1989). To contribute to an understanding of the institutions and the policy process, this paper evaluates a survey of state pesticide/groundwater legislation during 1987 and 1988. This assessment provides current information on how state policy is formed and what trends in state pesticide regulation are likely in the future.

### **Background**

Originally a bill that protected buyers from unscrupulous pesticide producers and dealers, FIFRA has since become the dominant federal regulatory statute for pesticides. FIFRA initially authorized the U.S. Department of Agriculture (USDA) to regulate the sale and use of pesticides. However, USDA was given little power to enforce FIFRA. In addition, USDA was sympathetic to farm interests and had limited incentive to regulate pesticides that were beneficial to farmers. Although most states also regulated pesticides in this early period, the associated statutes largely paralleled FIFRA. Federal policies protecting users and consumers were the dominant force in regulation.

Executive Reorganization Plan Number 3 created the Environmental Protection Agency (EPA) in 1970, establishing it as the primary regulator of pesticides, and transferring authority away from USDA. In 1972, FIFRA was amended with the passage of the Federal Environmental Pesticide Control Act (FEPCA). FEPCA gave EPA the authority to register pesticides for general and restricted use, to cancel or suspend registration, and to explicitly consider environmental protection in regulating pesticides, as well as socioeconomic costs and benefits (Antle and Capalbo n.d.).

Only minor amendments have been made to FIFRA since 1972. Attempted major revisions, such as those in the 99th Congress, have failed because of lack of consensus on issues such as risks of groundwater contamination, patent term restoration, farmer liability, and tolerance standards (Mayes 1989). However, the 100th Congress ignored these controversial issues and amended FIFRA. The amendment included increased registration fees, accelerated reregistration of older pesticides, elimination of indemnification payments, and increased regulations on storage, disposal, and handling of pesticides.

In recent years, there have been extensive analyses of pesticide policy issues at the federal level. MacIntyre (1987) and Bosso (1987) have both focused on the development of pesticide policies. MacIntyre discussed the political and economic forces that have shaped pesticide policy from the immediate post-war period to 1970 and concluded that conspiratorial behavior of interest groups was not the driving force in the development of federal pesticide policy during this period. Bosso also considered political factors in assessing the history of pesticide policy from the immediate postwar era into the 1980s. Bosso described how

the influence of the agricultural community was superseded by environmental and consumer influence over time, and how more restrictive pesticide policies have evolved in response.

While legislators and interest groups struggled with the pesticide law at the federal level, states began to take action. One of the primary issues prompting policy initiatives at the state level was information about pesticide contamination of groundwater (see Chavas 1989). In 1979 the pesticide aldicarb was found in Long Island groundwater. Shortly thereafter, pesticides were found in the groundwaters of Florida, California, and Wisconsin (Holden 1986). Since then, more than 60 pesticides have been found in the groundwaters of 30 states (Batie and Diebel n.d.).

Swift state legislative action has followed. The more site-specific nature of these problems has also contributed to the success of states in adopting pesticide regulations. The federalist policies of the Reagan administration may have encouraged state action in regulating pesticides. Analyses of the development of state policies include Batie and Diebel's work, which provided a historical overview of state agrichemical/groundwater policy development and presented a taxonomy of various state policies. Benbrook (1989) briefly reviewed state and federal policies with respect to agricultural chemicals and groundwater quality, and suggested that future policies include economic as well as environmental concerns. The Bureau of National Affairs (1987) also reported on trends in federal and state policies.

Congress has periodically increased the authority of EPA through various statutes such as FEPCA (1972), the Safe Drinking Water Act (1974),

the Clean Water Act (1977), the Resource Conservation and Recovery Act (1976), and the Comprehensive Environmental Response, Compensation, and Liability Act (1980). The increased authority has enabled EPA to provide incentives for state-level pesticide regulation through its 1987 Proposed Pesticide Strategy. Suggesting a multipronged management approach with varied federal and state roles, EPA has mandated that states develop and implement management plans based on area-specific differences in groundwater use, value, and vulnerability. The strategy has encouraged coordination among state agencies and state and local governments, as well as among different states.

Through the Proposed Pesticide Strategy, EPA will administer uniform policies for pesticides, establish generic prevention measures for groundwater threats independent of local vulnerability, encourage a strong state role in preventing and responding to pesticide contamination, and oversee state management plans. If management plans do not address ground- and surface water contamination problems, EPA will intervene to restrict or regulate pesticide use (USEPA 1987).

As states have moved ahead to contain pesticide contamination, special-interest groups have become concerned with the consequences of state authority and the setting of local tolerance standards (Davis 1987). In this process, environmental and consumer interest groups have tended to support states' rights to set water standards under various federal statutes, including the Clean Water Act and the Safe Drinking Water Act. Chemical industry groups have tended to support uniform national standards.



### State Policies

A number of states have supported combined pesticide and groundwater legislation. New York, Florida, California, and Wisconsin were among the first states to find pesticides in groundwater, and to implement associated regulatory policies. In the 1987-1988 legislative session, twenty-three other states considered such legislation. This legislation is the focus of the survey and its analysis. Of the legislation surveyed, that of Iowa, Connecticut, Arizona, and Hawaii is selected for special comment here because of high levels of legislative activity or significant new groundwater legislation. The following describes briefly the policies of the four lead states and the four others highlighted from the survey.

#### New York

Pesticide contamination of groundwater was first discovered in Long Island, New York--aldicarb was detected. Subsequent monitoring has since revealed residues of 12 additional pesticides, including ethylene dibromide (EDB) and carbofuran (Holden n.d.). Experimental studies have found it impossible to use aldicarb on Long Island and remain within state clean groundwater guidelines. However, withdrawal of the pesticide would have seriously undermined farmers' ability to control the Colorado potato beetle. Although no specific legislation was passed to address this problem, state and local officials acting in conjunction with pesticide manufacturers moved to restrict the use of aldicarb to selected regions of Long Island. A monitoring system was established to detect pesticides throughout New York, concentrating on Long Island (Holden n.d.). Remedial actions and restrictions apply if groundwater problems are detected.

**Florida**

EDB contamination of groundwater prompted Florida to pass the 1983 Water Quality Assurance Act. This act addressed surface water as well as groundwater. Largely administrative, it established a pesticide review council within the Department of Agriculture and Consumer Services, giving it the authority to (1) review EPA data on pesticides; (2) initiate scientific studies on pesticides when there is preliminary evidence of unreasonable adverse effects on health or the environment, or when there is doubt about the veracity of data submitted for registration; (3) apprise EPA of the environmental conditions where intense pesticide use is occurring; (4) request EPA to provide test data generated in Florida or in simulated conditions such as those found in Florida; (5) request information from EPA concerning decisions on pesticide registration; (6) make recommendations to the commissioner of agriculture on the sale or use of a chemical that has been reviewed; and (7) evaluate the feasibility of biological pest controls. The act also established a groundwater monitoring network.

**California**

In 1983 California enacted the Pesticide Contamination Prevention Act. This act laid the foundation for the collection of data on pesticide contamination of groundwater and established provisions for monitoring soils and water. The act required coordination between the departments of Food and Agriculture and Health Services. Water quality standards were permitted to be stricter than those of the EPA in this act. In cases of contamination, registrations were canceled unless the registrant provided

proof that the pesticide was not a threat, or that use could be modified to reduce additional contamination, or if the pesticide withdrawal was found to cause a severe hardship on the agricultural industry.

However, public concern over agricultural chemicals in public and private water supplies has led to a demand for greater regulation of agricultural chemicals in California. In 1986, Proposition 65 was passed with the support of 63 percent of the voters (Batie and Diebel n.d.). Proposition 65 established the Safe Drinking Water and Toxic Enforcement Act, making it illegal for a firm with ten or more employees to knowingly discharge any chemical found to cause cancer or reproductive problems. The burden of proof in Proposition 65 is on the polluter rather than the state. In addition, the governor is required to report annually to the legislature a list of chemicals known to cause cancer or reproductive problems.

#### **Wisconsin**

Discovery of aldicarb in Wisconsin groundwater supplies in 1980 triggered a legislative response. In 1983, Wisconsin Act 410 was passed. The act established a two-tier system of standards for each regulated substance, consisting of enforcement standards and preventative action limits. Activities that resulted in contamination levels equal to or greater than the enforcement standard were prohibited. Preventative action limits triggered remedial action by the regulatory agencies and were set at 10, 20, or 50 percent of the enforcement standard, depending on the toxicological characteristics of the substances.

Wisconsin Act 410 gave various state agencies authority to establish standards, resulting in standards for almost all related pesticides found in Wisconsin groundwater to date. As is the case in California, these standards can exceed those of the EPA. In addition, Wisconsin has established standards for more chemicals than the EPA. A complex system of monitoring was established for multiple purposes, including problem assessment, risk assessment, and database development. Cooperation between agencies in sharing and coordinating the database on pesticides was mandated. The act also established a compensation fund to assist in repair or replacement of contaminated wells. Funding was to be obtained from registration fees for pesticides and a fertilizer tax. Taxes and fees were not established to affect use of agricultural chemicals, but simply as sources of revenue (State of Wisconsin).

#### Iowa

The Iowa Groundwater Protection Act of 1987 is perhaps the most comprehensive piece of state legislation considered. Although it was primarily a research and education bill, it was expected to raise between \$38 million and \$46 million in revenue within five years of passage (Hallberg, Cousins-Leatherman, and Kelly 1987). Revenues were to be obtained from increased registration fees for pesticides, household hazardous substances, solid wastes, underground storage tanks, and a tax on chemicals. Revenues were allocated to various funds within a Groundwater Protection Fund, established by the act.

There are four major components of the Iowa Groundwater Act, each regulating a potential source of groundwater contamination. The four sources identified include solid wastes, household hazardous substances, storage tanks, and agriculture. An account was established within the Groundwater Protection Fund for each area. Funds within the Agricultural Management Account were to be obtained from an assessment of license fees on pesticide dealers (0.1 percent of gross annual sales); registration fees for manufacturers (between \$250 and \$3,000 per year, based on 0.2 percent of gross annual sales in Iowa, with exceptions by rule); and a nitrogen fertilizer tax of \$0.75 per ton, based on an 82 percent nitrogen solution.

Funds from this account were to be allocated to education and demonstration projects, monitoring of private rural wells, and programs to close abandoned wells. Revenues from this account also were allocated to the Leopold Center for Sustainable Agriculture, located at Iowa State University. The Leopold Center was established by the act to identify and reduce the negative impacts of agriculture on the environment, society, and the economy, as well as to conduct research on sustainable agriculture. The Iowa Groundwater Act also established a Center for Health Effects of Environmental Contamination, which was to conduct research on the health effects of pesticide contamination, as well as other types of contamination.

The Iowa Groundwater Protection Act was the result of several years of legislative activity. Minor bills had been introduced in previous

legislative sessions that dealt with selected aspects of the act; however, it was not until 1987 that a comprehensive bill succeeded. Popular opinion supported the bill, as reflected by results from a Des Moines Register poll taken before the bill was passed (Roberts and Lighthall 1988). Several legislators active in the passage of this bill are currently developing additional legislation on surface water.

### **Connecticut**

In the 1982 Potable Drinking Water Law, the principle of strict liability for groundwater contamination was established. Under this principle, the state did not have to prove fault, negligence, or harm in assessing liability. No exemptions from liability were to be made, even when farmers were applying chemicals according to label directions. Controversy arose and farmers in Connecticut forced reconsideration of the act (Batie and Diebel n.d.). The result was House Bill 5981, which released farmers from potable water liability provided that they applied agricultural pesticides according to label directions; agreed to submit a plan for minimizing future groundwater contamination; and kept records on pesticide use, application rates, dates, and acreage treated for 20 years. Although this bill released farmers from potable water liability, they remained liable for property damage or personal injury. In addition, chemical companies were still liable for groundwater contamination. HB 5981 also established a pesticide contamination response account for short- and long-term contamination problems. The bill was passed into law as Public Law 88-211, with a unanimous vote.

## Arizona

Since the early 1980s environmental concerns have been important in Arizona. The passage of the 1986 Environmental Quality Act was the result of a four-year effort by an environmental coalition, several legislators, and Gov. Bruce Babbitt (Meeks 1987). Largely for groundwater quality, the act created a Department of Environmental Quality to regulate water and air quality and waste management programs. Aquifer classification by use, groundwater quality standards, and pesticide regulation were included in the act.

In 1987 those most involved in the Environmental Quality Act introduced new legislation to expand regulation of potential groundwater contaminants. Two bills--Senate Bill 1341 and Senate Bill 1415--were introduced, both with similar content. Both bills failed: SB 1415 died in committee, and SB 1347 passed both houses but was vetoed by Governor Meecham. These bills would have established a Water Quality Assurance Revolving Fund financed from registration fees on fertilizers, pesticides, hazardous products, and industrial discharges. This fund would have financed remedial actions, monitoring, water degradation research, and administration costs.

## Hawaii

Legislators in Hawaii have been active in sponsoring legislation on pesticides and groundwater quality. While there was no comprehensive piece of legislation, such as the Iowa Groundwater Act, sixteen bills were introduced during the one-year period used for the survey and analysis. These bills included provisions for pilot programs for pesticide disposal,

pesticide use restrictions, recordkeeping requirements, equipment requirements, liability assignments, establishing citizen complaint centers, workshops, monitoring groundwater, and developing systems to identify vulnerable areas and penalties.

### **State Policy Instruments**

Economic, compliance, and administrative provisions are three types of policy instruments being used by states that have legislated groundwater policy (Table 1). The first type, economic provisions, consists of pesticide taxes, registration fees, permit and license fees, and liability assignments. These provisions influence user and producer behavior through economic incentives. The second category, compliance provisions, also influences user and producer actions. However, the policy instruments in this category directly affect behavior by restricting pesticide use, disposal, and equipment, or by requiring test data, dealer and applicator licensing, or recordkeeping by manufacturers, dealers, and users.

Underlying the definitions for the first two categories is the concept of property rights for pesticide users, dealers, manufacturers, and consumers. Property rights refer to a bundle of entitlements that define the owner's rights, privileges, and limitations for use of a resource (Tietenberg 1988). To the extent that pesticides are not taxed or assigned other fees or liabilities, and to the extent that pesticide use is not restricted, pesticide users, dealers, and manufacturers have the right to use, sell, or produce pesticides. As these restrictive policy instruments are more fully implemented, thereby limiting behavior, property rights will



Table 1. State Policy Instruments

Policy Instrument	NY	FL	CA	WI	AZ	CT	HI	IA
<b>Economic Provisions</b>								
Pesticide tax			X					
Registration fee			X	X	X			X
Applicator and dealer fee								
Liability						X	X	X
<b>Compliance Provisions</b>								
Information requirements		X	X					X
Disposal and handling requirements							X	X
Equipment requirements							X	
Applicator and dealer requirements							X	X
Recordkeeping requirements						X	X	X
Sales and use requirements	X	X		X			X	X
<b>Administrative Provisions</b>								
Water quality funds		X		X	X	X		
Remedial action	X		X	X	X	X		X
Enforcement			X	X		X	X	X
Monitoring	X	X	X	X	X		X	X
Database development			X	X			X	X
Standards			X	X				X
Research		X	X	X	X		X	X
Coordination among agencies			X	X				X
Education/training					X		X	X
Pilot projects							X	X
Citizen complaints							X	

NY = New York  
 FL = Florida  
 CA = California

WI = Wisconsin  
 AZ = Arizona  
 CT = Connecticut

HI = Hawaii  
 IA = Iowa

be changed and transferred from the users, dealers, and manufacturers to the general public.

Administrative provisions, the third category, primarily address state regulatory agencies. This category includes policy instruments used by the agencies to address short- and long-term contamination problems. These provisions affect pesticide users, dealers, and manufacturers indirectly, often through changes in economic and compliance provisions. Administrative provisions may also have direct effects on the rest of society.

From Table 1, note that the first states to act in addressing pesticide contamination tended to respond more through administrative provisions than through economic and compliance provisions. The policy instruments used were directed more to immediate problems of contamination, and less to making institutional changes to prevent future contamination. A review of the four highlighted states in the survey shows more use of the instruments in the economic and compliance categories. Therefore, views on property rights appear to be moving from relatively few restrictions on sale and use of pesticides toward greater restrictions in this area. This results in a greater assignment of property rights to consumers of contaminated groundwater. Support for these more active and comprehensive environmental policies is reflected in the aforementioned popularity of the Iowa Groundwater Protection Act, and by the success of Proposition 65 in California.

The total number of provisions in all bills for each state policy instrument is recorded (Table 2). Observe that surveyed states have considered a wide variety of policy instruments. Within the economic category, registration fees and applicator and dealer fees were the most commonly considered provisions. Applicator and dealer requirements, as well as sales and use requirements, were the most commonly considered compliance provisions. Enforcement and research were the most frequently introduced administrative provisions.

### Survey Design

The state survey instrument was constructed to track the development of pesticide/groundwater bills through the legislative process. Legislators were asked to indicate for how many years the pesticide/groundwater issue was of concern, the importance of various factors in stimulating interest in the bill, and the influence of various interest groups. They also were asked to rank the importance of selected issues being debated.

A question on modifications made to the bill was asked as well. For bills that failed, legislators were asked to indicate key factors and interest groups involved. Legislators also were asked about their plans for reintroducing failed legislation or introducing new legislation, what provisions would be included, and the stands they expected various groups to take. Legislators who indicated they would not sponsor new legislation were asked the reasons for their decisions. Finally, legislators were asked about their tenure, occupation outside the legislature, and constituencies (urban, rural, or suburban). (See Appendix A--Survey Instrument.)

**Table 2. Numbers of Policy Instruments in States Surveyed**

Policy Instrument	AL	AZ	CA	CT	GA	HI	IL	IA	KS	ME	MA	MI	MN	MO	NY	NC	OH	PA	RI	SD	VT	WA	WI	Total <sup>a</sup>	Total <sup>b</sup>	
<b>Economic Provisions</b>																										
Pesticide tax			1					1																	2	2
Registration fee	2	2						4	2	1	3	1	2			1				1	1			2	12	22
Applicator and dealer fee	2							4	3				2	1	2					1				1	8	16
Liability			1	2	1	2	1						1		3					1					8	12
<b>Compliance Provisions</b>																										
Information requirements								1			2				2	1		1							5	7
Disposal and handling requirements						2		3			3		3		4		1					2			7	18
Equipment requirements						1							2				1								3	4
Applicator and dealer requirements			1			1		4	2		5	1	1	2	3	1		1		1					12	23
Recordkeeping requirements				1		3		1			2		1	2	3										7	13
Sales and use requirements			1			3		2			1	3	2	1	2	1	1	3	1				1		13	22
<b>Administrative Provisions</b>																										
Water quality funds		2						3							2						1				4	8
Remedial action		2	1			1	1	1			1		2		2						1			1	10	13
Enforcement	2	2	1	3		3		1	3	1	2	1	2	2	3							1		1	15	28
Monitoring		2				2		1						1							1	1			6	8
Data base development			1			1		2			3			3							1				6	11
Standards								1	1															1	3	3
Research		2	1				2	2		2	3	1							2	1	1				10	17
Coordination between agencies			1			1		2		1	1		2	3							1				8	12
Education/training		2				1	2	2				1	1						2	1	1				9	13
Pilot projects						2		1					1												3	4
Citizen complaints						1					5														2	6

<sup>a</sup> Number of states that introduced bills with the indicated policy instruments.

<sup>b</sup> Number of policy instruments introduced in all bills in all states.

Sponsors of state pesticide/groundwater legislation for 1987-1988 were identified from a list of 252 measures introduced to regulate pesticides. This list was obtained from Information for Public Affairs (IPA), a firm maintaining a database on current state legislation. From this list, 101 bills in 23 states were considered to be motivated by concerns about groundwater contamination. Sponsors and cosponsors of the bills were determined from IPA information or by contacting the state legislative research offices and libraries. Three hundred and forty-seven legislative sponsors or cosponsors were surveyed.

The survey was conducted by mail using the Dillman (1978) procedure. The pretest used 17 legislators from Iowa, most of whom were involved in debate on the the Iowa Groundwater Protection Act. Only minor changes in the survey instrument were made as a result of the pretest. Therefore, responses from the pretest were included in this analysis of the survey.

Cosponsors were surveyed because information on the primary sponsor was not always available. Respondents totaled 171 legislators, yielding an overall return rate of 49 percent. However, 36 (10 percent) of these respondents did not complete the questionnaire, either because they were cosponsors and felt that they were unable to answer satisfactorily, or because they were unsure about the applicability of the survey to their legislation. By omitting these respondents from the original sample size, the rate falls to 43 percent. Another way to view the response rate is by considering that 135 legislators (39 percent of the original sample) returned completed questionnaires. The three response rates are given by state in Table 3. Responses were obtained for 74 of the 101 bills,

**Table 3. Survey statistics by state, including number of bills, number of legislators surveyed, and response rates**

State	Number of Bills	Number of Legislators	Completed Surveys	Withdrawn	Response Rates <sup>a</sup> (%)		
					A	B	C
Alabama	2	2	1	1	100	100	50
Arizona	2	14	8	-	57	-	-
California	7	9	6	-	67	-	-
Connecticut	1	19	9	-	47	-	-
Georgia	1	1	0	-	0	-	-
Hawaii	15	41	13	6	46	37	32
Illinois	2	2	1	-	50	-	-
Iowa	6	17	11	-	65	-	-
Kansas	5	32	16	6	69	62	50
Maine	3	7	4	1	71	67	57
Massachusetts	7	23	11	-	48	-	-
Michigan	3	25	6	7	52	33	24
Minnesota	5	19	7	1	42	39	37
Missouri	7	9	6	-	67	-	-
New York	16	43	13	5	42	34	30
North Carolina	2	2	0	1	50	-	-
Ohio	2	2	0	-	0	-	-
Pennsylvania	3	20	4	-	20	-	-
Rhode Island	3	8	4	1	63	57	50
South Dakota	2	4	2	-	50	-	-
Vermont	1	1	1	-	100	-	-
Washington	4	28	7	5	43	30	25
Wisconsin	2	19	5	2	37	29	26
<b>Total</b>	<b>101</b>	<b>347</b>	<b>135</b>	<b>36</b>	<b>49</b>	<b>43</b>	<b>39</b>

<sup>a</sup> Calculation of response rates: A = (no. completed surveys + withdrawals) ÷ no. legislators surveyed. B = no. completed surveys ÷ (no. legislators - withdrawals). C = no. completed surveys ÷ no. legislators.

representing 74 percent of those bills introduced during the sample period. The numbers of bills considered, legislators surveyed, questionnaires completed and returned, and respondents who withdrew are listed, along with response rates (Table 3).

The bills tended to be team efforts, with more than half the respondents (55 percent) indicating the bill was introduced by a group of legislators. In many cases, the bills studied were the result of concerns expressed over several years. More than half the respondents indicated concerns leading to the legislation were expressed three or more years before the particular bill was considered.

Results from survey question 2 (see Appendix A), on factors stimulating interest in the bill, are summarized (Table 4). Interest group pressure was the most significant factor in stimulating the legislation, with 37.2 percent of the respondents indicating it was very important and 24.8 percent indicating it was somewhat important. Interest in the bill was stimulated by informal discussions by legislators (56.2 percent indicated this was very important or somewhat important). State or federally sponsored research, interim committees, and the media also influenced the legislation. Another important factor was evidence of contamination, or an existing environmental crisis in the legislator's district. Ten percent of the respondents identified this factor as a write-in answer.

The purpose of survey question 4 was to determine the influence of interest groups before and during introduction of the bills. Results from this question are summarized (Table 5). Two similar questions also were asked, one about the legislation after introduction and one about future

**Table 4. Factors Stimulating Interest in the State Legislation**

How important were each of the following factors in stimulating interest in drafting this bill?

Factors	VI	SI	MI	SU	VU	NR
	-----Percentage Responding-----					
State or federally sponsored research	21.2	19.0	13.9	19.0	14.6	12.3
Special interest group concerns	37.2	24.8	13.1	9.5	5.1	10.3
Commission appointed by legislature	9.5	13.1	13.1	8.0	33.6	22.7
Legislative proposals from other states	5.1	18.2	15.3	23.4	22.6	15.4
National legislative proposals	6.6	18.2	11.7	18.2	29.9	15.4
Informal discussions on bill between legislators	27.0	29.2	19.7	8.8	5.8	9.5
Interim committees	13.1	21.2	12.4	8.8	21.9	22.6
Media	10.9	21.2	21.2	19.0	16.8	10.9

Note: For responses, VI = very important, SI = somewhat important, MI = of moderate importance, SU = somewhat unimportant, VU = very unimportant, and NR = no response.



Table 5. Responses on Interest Groups

Please indicate the influence the following interest groups exerted before and during the introduction of this bill.

Interest Groups	SP	WP	NI	WN	SN	NR
	-----Percentage Responding-----					
Farmers	26.5	21.3	16.9	14.0	14.7	6.6
Agricultural commodity organization	13.2	17.6	34.6	14.7	12.5	7.4
Agribusiness representatives	11.0	18.4	31.6	16.2	12.5	10.3
Chemical industry representatives	10.3	14.7	17.6	22.8	27.9	6.7
Consumer groups	38.2	22.8	24.3	2.9	3.7	8.1
Medical experts	14.7	30.1	39.0	2.2	2.9	11.1
Economic experts	5.1	21.3	52.9	5.1	3.7	11.9
Environmental experts	57.4	25.7	7.4	2.9	1.5	5.1
Department of agriculture	27.9	31.6	16.2	13.2	4.4	6.7
Department of natural resources	40.7	22.2	20.0	7.4	2.2	7.5

Note: For responses, SP = strong positive influence, WP = weak positive influence, NI = no impact, WN = weak negative influence, VU = strong negative influence, and NR = no response.

legislation. Both had nearly identical responses to those received for question 4.

Judging from the results listed in Table 5, legislators viewed interest groups and other interested parties as having had significant influence on the bills. Farmer interest groups exerted both positive and negative pressure in regard to passage, but they tended to be more positive in nature. Chemical industry representatives clearly exerted a negative influence on the legislation, while agribusiness and agricultural commodity organizations did not exert a strong influence in either direction.

The strongest influence was exerted by environmental and consumer groups, both supporting passage of the legislation. State departments of agriculture and natural resources also had strong positive influences on the passage. Interestingly, economists were not much of a factor in influencing the passage of the targeted legislation. It also is interesting to note that the groups with the most significant impacts on legislation, according to the sponsors of the legislation, tended to represent public rather than private interests. This may reflect the increased importance of the public interest groups as discussed by Bosso (1987).

The most important issues raised in debates on the bills surveyed were groundwater contamination by agricultural chemicals and resulting health risks. More than 40 percent of respondents answering this question indicated these two issues were most important in the debate on the bill with which they were affiliated. The least important issue was the impact of the legislation on agribusiness (Table 6).

Table 6. Responses on issues

If the bill was debated by the full legislative body, please rank the importance of each of the following issues. (1 = most important issue.)

Issues	1	2	3	4	5	6*	NR <sup>a</sup>
	-----Percentage Responding-----						
Concern about groundwater contamination by agricultural chemicals	40.4	21.2	20.2	2.0	6.1	5.1	5.0
Concern about the potential impact of legislation of farm income	19.2	16.2	13.1	22.2	16.2	8.1	5.0
Concern about the potential impact of legislation on agribusiness	4.0	18.2	13.1	25.3	26.3	6.1	7.0
Concern about health risks resulting from contamination	41.4	24.2	13.1	11.1	5.1	1.0	4.1
Concern about environmental risks from agricultural chemicals	22.2	31.3	16.2	8.1	13.1	4.1	5.0

<sup>a</sup>NR = No response.

\* A sixth rank is included to indicate that an open-ended answer was allowed.

The most common factors affecting bill failure were concerns about impacts on farm income, the power of special-interest groups, and agenda decisions of committee chairpersons. Approximately half the legislators indicated they would be involved in introducing the same or similar legislation in the future. One-half or more of the legislators indicated that they planned to include provisions for groundwater monitoring, enforcement, and revenue enhancement in the new bills (Table 7). Those who indicated that they would not initiate similar legislation tended to cite as a reason that a competing bill was already available. In cases where legislation was successful, legislators said they preferred to wait for the legislation to be implemented before considering other action.

The legislators surveyed had served an average of four terms. Thirty percent considered themselves full-time legislators, while 21 percent were farmers. Of the respondents to the survey, 82 belong to the Democratic party (61 percent) and 53 belong to the Republican party (39 percent). Legislators held an average of 3.74 committee assignments, and 0.55 committee chair positions. Fifty-six percent of the legislators served on the committees that considered the bills they sponsored, and 14 percent of the legislators chaired the committees that considered their bills. Forty-five percent of the legislators represented areas described as rural or a mix of rural and suburban.

### Survey Analysis

To more fully investigate the factors influencing the development of pesticide and groundwater legislation, an exploratory multivariate analysis of the survey data was conducted. The analysis was descriptive in nature

**Table 7. Responses on Provisions**

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Which of the following do you plan to include in the new bill?

Provisions	Percentage Indicating Yes
Monitoring of groundwater	56.9
Enforcement of legislation	70.8
Targeting of specific chemicals in legislation	38.5
Targeting of specific areas in legislation	45.3
Phase-in period	39.1
Special studies	39.1
Revenue enhancement	51.6
Deadlines	45.3
Education/demonstration projects	43.8
Research	48.4

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and was based on partial reduced form specifications rather than a fully developed theoretical framework. Thus, the results are preliminary and best viewed as a summary of survey responses.

#### **Data for the Analysis**

The regression analysis was conducted using two approaches for defining the dependent variables: by state and by legislator. State-level regression equations in effect summarize the bills and bill features by state. In contrast, legislator-level regression equations summarize the survey responses by the number of legislators who completed the survey, which varies by state. Therefore, the implicit weighting differs between the two types of regression equations.

Dependent Variables. Four groups of different regression specifications were estimated. The first group included two equations: one relating the number of pesticide/groundwater regulation bills introduced in each state legislature (from 0 to 16), and one qualitative choice equation for bill introduction (1 for one or more bills introduced; 0 otherwise). For these two specifications or models there were 50 observations--one for each state of the Union.

The second group of regression specifications involved the policy instrument types reflected in the bills introduced during the survey period. Recall that these were classified as economic, compliance, or administrative. For each state and in any bills introduced, if the instrument in question was included, an associated qualitative choice variable was given a value of 1. These variables were then summed over policy instruments in each of the three types. Equal scoring for each state was given to all policy instruments within the three types. The

resulting summary scores were used as dependent variables in the regression analysis. Since the scoring was only for states that had introduced bills, there were 23 observations for each equation in this second group.

In the third set of regression models, a qualitative choice variable for the two most commonly considered policy instruments within each of the three instrument categories was used as the dependent variable. The most commonly considered economic provisions were registration fees and dealer and applicator fees. The most common compliance provisions were dealer and applicator requirements and sale and use restrictions. The most common administrative provisions were enforcement and research. Therefore, six equations with this specification were estimated, with 23 observations for each.

The fourth group of regressions involved information on interest group influence in the legislative process (see Table 5). Legislator impressions on the influence of the four most important interest groups (farmers, chemical companies, consumer groups, and environmentalists) were modeled. The value of the dependent variable representing each interest group was calculated using a simple scoring rule. This rule assigned a value of 2 for each legislator reporting a strong positive influence, 1 for weak positive influence, 0 for no influence, -1 for weak negative influence, and -2 for strong negative influence. The scored response variable values were calculated for each legislator. The resulting variables were used as dependent values in this fourth set of regressions. There were 117 observations for each of the regression models in this group. A detailed description of the dependent variables is given in Appendix B.

Independent Variables. Selected variables were used to determine the effects of political, economic, and physical factors on the dependent variables. The explanatory variables used were

- DUM: a dummy for states that were early implementers of groundwater protection measures (New York, Florida, California, and Wisconsin);
- NP: the number of pesticides found in state groundwater sources (Nielsen and Lee 1987);
- PSGO: the number of people in the state identified by Nielsen and Lee (1987) as being served by public water supplies whose groundwater sources may become contaminated by pesticides;
- PFI: percentage of total personal income within a state attributable to farming in 1986 (U.S. Department of Commerce 1987);
- AIUSE: pesticide use by state in pounds of active ingredients in 1982 (Gianessi 1986);

A general description of the models is given in Appendix B.

Statistical Models. For all but the first group of specifications, three alternative regression models were estimated. The first regression included all the explanatory variables and ordinary least squares (OLS) estimations. Using results from this specification, the variables with low significance levels were omitted, resulting in a reduced number of explanatory variables in the model. Two regression estimates were applied with the reduced model: OLS and seemingly unrelated regressions (SUR). In general, there was little difference between the results for the two estimators of the parameters for the reduced model.



For the first group of equations, OLS was used to relate the number of bills introduced by each state to the explanatory variables. A logit model was used for the qualitative choice specification on bill introduction. Only OLS and SUR results are reported for models in group two (the six policy instrument variables). These models had qualitative dependent variables. However, results with estimation procedures reflecting the special properties of the dependent variable were inconsistent, perhaps because the true nonlinearity was not captured.

## Results

Results for the Bills. Results from the first group of regressions are provided (Table 8). The OLS regression explained about 50 percent of the variation for the number of state bills introduced, and the Cragg-Ohler  $R^2$  was 26 percent for the qualitative choice model. Although most of the explanatory variables in the regressions had estimated coefficients that were not highly significant statistically, all had plausible signs with the exception of PSGO, the variable for number of people consuming groundwater threatened by contamination. The most significant coefficients in the number of bills specification were for NP and DUM, although AIUSE had the most statistically significant coefficient in the qualitative model. Both these models showed that three factors had positive impacts on both the likelihood of a state introducing pesticide/groundwater legislation, and the number of bills in states that introduced such legislation: (1) the number of pesticides detected in groundwater, (2) the tendency to have implemented earlier pesticide/groundwater regulation, and (3) the amount of pesticides used. The share of income attributable to

Table 8. Regression Analysis of Bills Introduced

	Intercept	DUM	PSGO	NP	PFI	AIUSE
Number of Bills	0.95 (1.85)	4.94 (2.96)	-1.15 (-2.59)	0.72 (3.05)	-16.20 (-1.09)	0.06 (2.00)
$R^2 = 0.4784$						
Qualitative Variable for Bills	-0.84 (-1.58)	31.81 (0.00)	-0.33 (-0.82)	0.32 (1.11)	-9.77 (-0.65)	0.05 (1.61)
$R^2 = 0.2597^a$						

Note: Figures in parentheses indicate t-statistic levels.

<sup>a</sup>Cragg-Ohler  $R^2$ .

farming in a state negatively affected the probability that states introduced legislation and the number of bills introduced.

These same explanatory factors were then used to describe the presence of overall categories of policy instruments and selected instruments in the bills introduced. Results from the second group of regressions, which were for the three policy instrument types, are listed in Table 9. Overall the explanatory power was good for this group of regressions, with 66 percent of the variation explained for the economic provisions, 38 percent for the compliance provisions, and 48 percent for the administrative provisions. Statistical significance levels for the estimated coefficients show that the important variables influencing inclusion of these types of provisions in the water quality bills were the number of pesticides detected in groundwater and the percentage of income from farming. Interestingly, the coefficient on the PFI variable tended to be positive in these regressions. This supports the impressions that legislators had of a generally positive influence of farmers on legislation to limit groundwater contamination from pesticides. However, the result contradicts the finding from the estimated bill introduction model (Table 8). These two results suggest the contradictory position of farmers as users of chemical inputs and as potential consumers of contaminated groundwater. However, the result may in a sense be a statistical artifact.

In Table 10, results from the third group of regressions for the selected policy instruments are reported. These results show somewhat less explanatory power and fewer statistically significant variables than the general policy instrument category models. However, four of the six models had explanatory power of 20 percent or greater. Again, percentage of

Table 9. Regression Analysis of Policy Instruments

Models	Intercept	DUM	PSGO	NP	PFI	AIUSE
<b>Economic Provisions</b>						
OLS (full)	0.61 (2.47)	1.09 (2.09)	-0.03 (-0.89)	0.02 (0.28)	22.51 (3.50)	0.02 (1.26)
$R^2 = 0.6622$						
OLS (reduced)	0.53 (2.64)	0.96 (2.50)			25.00 (4.44)	0.01 (1.18)
$R^2 = 0.6407$						
SUR (reduced)	0.53 (2.69)	1.04 (2.90)			25.49 (4.62)	0.01 (1.07)
$R^2 = 0.6392$						
<b>Compliance Provisions</b>						
OLS (full)	1.15 (1.78)	0.03 (0.02)	-0.07 (-0.76)	0.46 (2.13)	-7.32 (-0.43)	0.04 (1.08)
$R^2 = 0.3756$						
OLS (reduced)	0.87 (1.77)			0.45 (2.61)		0.02 (0.94)
$R^2 = 0.3457$						
SUR (reduced)	0.89 (1.81)			0.44 (2.59)		0.02 (0.93)
$R^2 = 0.3455$						
<b>Administrative Provisions</b>						
OLS (full)	1.43 (1.64)	-0.13 (-0.07)	-0.96 (-0.78)	0.50 (1.74)	44.25 (1.95)	0.04 (0.85)
$R^2 = 0.4792$						
OLS (reduced)	1.14 (1.68)			0.50 (2.26)	55.81 (3.07)	
$R^2 = 0.4444$						
SUR (reduced)	1.18 (1.77)			0.48 (2.24)	56.01 (3.09)	
$R^2 = 0.4439$						

Note: Figures in parentheses indicate t-statistic levels.

Table 10. Regression Analysis of Policy Instruments

Model	Intercept	DUM	PSGO	NP	PFI	AIUSE
<b>Registration Fee</b>						
OLS (full)	0.49 (2.43)	-0.09 (-0.22)	-0.01 (-0.03)	-0.03 (-0.03)	9.35 (1.79)	-0.004 (-0.32)
$R^2 = 0.2307$						
OLS (reduced)	0.38 (2.88)				8.41 (2.06)	
$R^2 = 0.1752$						
SUR (reduced)	0.38 (3.14)				8.35 (2.62)	
$R^2 = 0.1752$						
<b>Dealer and Applicator Fee</b>						
OLS (full)	0.23 (1.19)	-0.003 (-0.01)	-0.05 (-0.17)	0.10 (1.52)	5.91 (1.15)	0.001 (0.12)
$R^2 = 0.4529$						
OLS (reduced)	0.07 (0.59)	0.43 (1.77)			11.74 (3.45)	
$R^2 = 0.4240$						
SUR (reduced)	0.04 (0.35)	0.41 (2.02)			13.46 (5.72)	
$R^2 = 0.4157$						
<b>Dealer and Applicator License</b>						
OLS (full)	0.13 (0.80)	0.63 (1.83)	-0.04 (-0.66)	-0.04 (-0.73)	10.22 (2.40)	0.01 (0.77)
$R^2 = 0.2645$						
OLS (reduced)	0.21 (1.44)			0.10 (1.99)	6.30 (1.58)	
$R^2 = 0.2625$						
SUR (reduced)	0.23 (1.65)			0.08 (1.97)	6.91 (1.77)	
$R^2 = 0.2561$						

Table 10. Continued

Model	Intercept	DUM	PSGO	NP	PFI	AIUSE
Sales and Use Restrictions						
OLS (full)	0.45 (2.32)	0.48 (1.18)	-0.17 (-0.64)	0.04 (0.64)	-6.00 (-1.19)	0.01 (1.13)
$R^2 = 0.2825$						
OLS (reduced)	0.42 (2.69)	0.48 (1.61)			-4.59 (-1.04)	0.01 (1.45)
$R^2 = 0.2353$						
SUR (reduced)	0.43 (2.85)	0.47 (1.88)			-4.35 (-1.01)	0.01 (1.76)
$R^2 = 0.2349$						
Enforcement Provisions						
OLS (full)	0.67 (3.30)	0.48 (1.13)	-0.23 (-0.81)	0.03 (0.44)	-2.39 (-0.45)	0.01 (0.44)
$R^2 = 0.1518$						
OLS (reduced)	0.58 (5.24)	0.42 (1.41)				
$R^2 = 0.0902$						
SUR (reduced)	0.56 (5.24)	0.53 (2.22)				
$R^2 = 0.0841$						
Research Provisions						
OLS (full)	0.34 (1.53)	-0.29 (-0.61)	-0.42 (-0.14)	0.05 (0.69)	3.12 (0.54)	-0.002 (-0.12)
$R^2 = 0.0634$						
OLS (reduced)	0.41 (2.85)			0.03 (0.54)		
$R^2 = 0.0143$						
SUR (reduced)	0.43 (3.30)			0.01 (0.30)		
$R^2 = 0.0098$						

Note: Figures in parentheses indicate t-statistic levels.

income from farming and number of pesticides detected in groundwater were the most significant of the explanatory variables. As expected, the general findings from the regressions in groups two and three were similar.

Results for the Legislators. The hypothesized explanatory factors were used to investigate the influence of the selected interest groups on the bills as reported by legislators in the survey. Four interest groups were considered: farm, agrichemical, consumer, and environmental. These groups were considered because of the degree of influence they exerted based on the tabular analysis (Table 5). Results from the regression analysis applied for this fourth group of specifications are reported in Table 11.

The farm interest model showed that the percentage of income from farming in a state, the number of pesticides detected in groundwater, and the number of people served by public water supplies in areas with contamination potential all negatively impacted the influence of farm groups on pesticide/groundwater legislation. However, the dummy variable for early-implementing states and the amount of pesticides used had a positive impact on the influence of the farm interest group.

The estimated impacts of these same variables on the influence exerted by agrichemical representatives was similar to that for the farm interest, with a sign change on the state dummy coefficient, which was statistically insignificant in both models. In each of these models, the percentage farm income variable was significant. Results for PFI indicate that the higher the proportion of farm income in a state, the more likely farmers and agrichemical representatives were to have a negative influence on

Table 11. Regression Analysis of Interest Group Influence

Model	Intercept	DUM	PSGO	NP	PFI	AIUSE
<b>Farmers</b>						
OLS (full)	1.32 (4.77)	0.38 (0.83)	-0.81 (-2.17)	-0.24 (-3.17)	-25.97 (-3.37)	0.03 (2.53)
$R^2 = 0.2281$						
OLS (reduced)	1.28 (4.71)		-0.63 (-2.09)	-0.22 (-3.09)	-25.70 (-3.35)	0.03 (2.43)
$R^2 = 0.2222$						
SUR (reduced)	1.21 (4.65)		-0.50 (-1.89)	-0.22 (-3.12)	-24.82 (-3.26)	0.03 (2.26)
$R^2 = 0.2206$						
<b>Agrichemical Representatives</b>						
OLS (full)	-0.10 (-0.38)	-0.33 (-0.74)	-0.15 (-0.42)	-0.19 (-2.59)	-18.36 (-2.48)	0.02 (1.85)
$R^2 = 0.1394$						
OLS (reduced)	-0.23 (-1.11)			-0.22 (-3.16)	-16.62 (-2.33)	0.02 (2.30)
$R^2 = 0.1228$						
SUR (reduced)	-0.23 (-1.13)			-0.21 (-3.13)	-16.14 (-2.30)	0.02 (2.24)
$R^2 = 0.1227$						
<b>Consumer Groups</b>						
OLS (full)	0.53 (2.69)	-0.43 (-1.33)	0.42 (1.58)	0.13 (2.31)	2.69 (0.49)	-0.01 (-0.59)
$R^2 = 0.1404$						
OLS (reduced)	0.59 (3.42)	-0.36 (-1.35)	0.32 (1.84)	0.11 (2.36)		
$R^2 = 0.1367$						
SUR (reduced)	0.61 (3.55)	-0.43 (-1.63)	0.30 (1.73)	0.12 (2.51)		
$R^2 = 0.1357$						



Table 11. Continued

Model	Intercept	DUM	PSGO	NP	PFI	AIUSE
Environmental Groups						
OLS (full)	1.04 (5.57)	-0.09 (-0.30)	0.22 (0.89)	0.10 (1.85)	8.25 (1.59)	-0.01 (-1.09)
R <sup>2</sup> = 0.0792						
OLS (reduced)	1.15 (7.87)			0.09 (1.96)	7.05 (1.41)	-0.004 (-0.69)
R <sup>2</sup> = 0.0701						
SUR (reduced)	1.15 (7.89)			0.09 (1.93)	6.82 (1.38)	-0.004 (-0.64)
R <sup>2</sup> = 0.0701						

Note: Figures in parentheses indicate t-statistic levels.

pesticide/groundwater legislation. The explanatory power was reflected by  $R^2$ 's of 23 percent in the full farm model and 14 percent in the full agricultural model.

The consumer and environmental interest model results are also given in Table 11. Results of these regressions show that as the numbers increased for pesticides detected in groundwater, the population publicly serviced by groundwater sources in potentially contaminated areas, and the percentage of farm income, consumer groups exerted a stronger positive influence on the legislators. A negative sign on the state dummy variable suggested that consumer and environmental groups tended to exert a weaker influence on legislators in states that were early implementors of groundwater protection. The most statistically significant variable for these two models was the number of pesticides detected in groundwater supplies. The explanatory power of the two full models is shown by  $R^2$ 's of 14 percent for the consumer groups and 8 percent for the environmental groups.

Overall, the exploratory regression results show that the variables considered in the exploratory or descriptive models explain significant variation for bill introduction, interest group influence, and policy instruments incorporated in the surveyed legislation. Results also indicate the importance of specific variables in reflecting tendencies of states to consider groundwater protection legislation, the number of bills, interest group influence on the legislation, and types of policy instruments included.



### Conclusion

Advances in the detection of pesticides in the environment, along with increased awareness of potential health and environmental issues from pesticides, have stimulated a demand for federal pesticide/groundwater policies, which have not been forthcoming. As a consequence, a number of states have responded with introductions of legislative measures. As states have developed these policies, emphasis has changed from protection of pesticide users toward protection of the general public from the external effects of pesticide use.

Pesticide/groundwater legislation introduced by the states in the 1987-1988 legislative period has been examined, with specific emphasis on key states and bills. A review of legislation in key states indicates movement toward the increased inclusion of economic and compliance instruments in more recent bills, following early legislation in which policy provisions were more administrative in nature.

Sponsors of this legislation were surveyed for their impressions about the legislative process. Data was collected on factors that influence the introduction and passage of bills, the importance of several interest groups in the legislative process, the issues involved, and plans for future legislation. Generally, farmers, chemical companies, consumer groups, and environmentalists all were seen to exert exerted strong influence on the legislation.

An exploratory regression analysis of the factors influencing bill introduction, bill features, and legislators' impressions was then conducted. The explanatory variables used captured economic, political, and physical characteristics of the states. Results suggest substantial

effects of these variables across different specifications and for the features of the bills as well as the impressions of legislators. The results for the variable intended to reflect farmer interests were mixed, probably because of the potential for both positive and negative impacts of pesticides on this interest group.

In recent years states have continued to take a role in developing pesticide/groundwater legislation more active than that of the federal government. Even EPA's Proposed Pesticide Strategy suggests a role for the federal government as a standard setter for the states. The states must then develop compliance programs. Although benefits are derived from programs tailored to states, inconsistencies in the programs from state to state also are a result. The patchwork of legislation has limitations for economies of scope. However, results from the analysis indicate that states that develop these policies have followed highly systematic tendencies.

Finally, an intent of the analysis and survey was to contribute to the understanding of the political economy of pesticide policy development; i.e., the issue of what factors are shaping pesticide/groundwater policies and how these policies are being shaped. Chavas (1989), Rausser (1989), and Cummings and Harrison (1989) highlight the importance of understanding the political and economic nature of policy formation for more effective economic analysis. The results obtained in this paper indicate that the impact of interest groups on legislation is apparent even in simple exploratory models. Results of the survey of legislators and pesticide/groundwater legislation have provided insights on factors shaping policy, the role of interest groups, and the types of policy instruments likely to be considered in future state bills.

**Appendixes**

First we would like to get some basic information on the legislation. For the questions where the responses are numbered, please circle the number by your answer.

1. Please indicate how this bill was introduced:

- 1 Individual Legislator
- 2 Group of Legislators
- 3 Legislative Committee

2. How important were each of the following factors in stimulating interest in drafting this bill?

- 1 Very Important (VI)
- 2 Somewhat Important (SI)
- 3 Moderate Importance (MI)
- 4 Somewhat Unimportant (SU)
- 5 Very Unimportant (VU)

<u>Factors Stimulating Interest</u>	<u>VI</u>	<u>SI</u>	<u>MI</u>	<u>SU</u>	<u>VU</u>
a) State or federally sponsored research	1	2	3	4	5
b) Special interest group concerns	1	2	3	4	5
c) Commission appointed by legislature	1	2	3	4	5
d) Legislative proposals from other states	1	2	3	4	5
e) National legislative proposals	1	2	3	4	5
f) Informal discussions on bill between legislators	1	2	3	4	5
g) Interim Committees	1	2	3	4	5
h) Media	1	2	3	4	5
i) Any other factors (Please explain below)	1	2	3	4	5

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3. How long has concern about this type of bill been expressed?

- 1 One year or less
- 2 One to three years
- 3 Three to five years
- 4 More than five years

4. Please indicate the influence the following interest groups exerted before and during the introduction of this bill:

- 1 Strong positive influence (SP)
- 2 Weak positive influence (WP)
- 3 No impact (NI)
- 4 Weak negative influence (WN)
- 5 Strong negative influence (SN)

Interest Groups	SP	WP	NI	WN	SN
a) Farmers	1	2	3	4	5
b) Agricultural commodity organizations	1	2	3	4	5
c) Agribusiness representatives (other than chemical)	1	2	3	4	5
d) Chemical industry representatives	1	2	3	4	5
e) Consumer groups	1	2	3	4	5
f) Medical experts	1	2	3	4	5
g) Economic experts	1	2	3	4	5
h) Environmental experts	1	2	3	4	5
i) Department of Agriculture (or equivalent department)	1	2	3	4	5
j) Department of Natural Resources (or equivalent department)	1	2	3	4	5
k) Other interest groups (Please explain below)	1	2	3	4	5

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In the following section, we would like to request information about the debate (on the floor) and formal hearings (in committee) on the proposed legislation.

5. If the bill was debated by the full legislative body, please rank the importance of each of the following issues. (Use 1 to represent the most important issue, 6 to represent the least important issue).

Issues	Rank
a) Concern about groundwater contamination by agricultural chemicals	_____
b) Concern about the potential impact of legislation on farm income	_____
c) Concern about the potential impact of legislation on agribusiness	_____
d) Concern about health risks due to contamination	_____
e) Concern about environmental risks from agricultural chemicals	_____
f) Concern about any other issues (Please explain below)	_____

6. Was the proposed bill modified as a result of debate or hearings?

- 1 Yes  
2 No (Skip to Question 8)

## 7. What types of modifications were made to the bill?

<u>Modification</u>	<u>Yes</u>	<u>No</u>
a) Provisions for monitoring of groundwater	1	2
b) Provisions for enforcement of legislation	1	2
c) Targeting of specific chemicals in legislation	1	2
d) Targeting of specific geographical areas in legislation	1	2
e) Phase-in period	1	2
f) Provisions for special studies	1	2
g) Provisions for revenue enhancement	1	2
h) Deadlines	1	2
i) Provisions for education/demonstration projects	1	2
j) Provisions for research	1	2
k) Other modifications (Please explain below)	1	2

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## 8. What groups tended to support or oppose the proposed legislation?

- 1 Strong supporter (SS)
- 2 Weak supporter (WS)
- 3 No position (NP)
- 4 Weak opponent (WO)
- 5 Strong opponent (SO)

Interest Group	SS	WS	NP	WO	SO
a) Farmers	1	2	3	4	5
b) Agricultural commodity organizations	1	2	3	4	5
c) Agribusiness representatives (other than chemical)	1	2	3	4	5
d) Chemical industry representatives	1	2	3	4	5
e) Consumer groups	1	2	3	4	5
f) Medical experts	1	2	3	4	5
g) Economic experts	1	2	3	4	5
h) Environmental experts	1	2	3	4	5
i) Department of Agriculture (or equivalent department)	1	2	3	4	5
j) Department of Natural Resources (or equivalent department)	1	2	3	4	5
k) Other interest groups (Please explain below)	1	2	3	4	5

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9. If the bill was defeated or vetoed, how important were the following factors?

- 1 Very Important (VI)
- 2 Somewhat Important (SI)
- 3 Moderate Importance (MI)
- 4 Somewhat Unimportant (SU)
- 5 Very Unimportant (VU)

Factors	VI	SI	MI	SU	VU
a) Questions of state jurisdiction	1	2	3	4	5
b) Insufficient evidence of the net detrimental impact of chemicals on the environment	1	2	3	4	5
c) Insufficient evidence of significant health risks from chemical residuals	1	2	3	4	5
d) Concern about impacts on farm income	1	2	3	4	5
e) Concern about impacts on agribusiness income	1	2	3	4	5
f) Concern about the impacts on the overall state economy	1	2	3	4	5
g) Feasibility of administration	1	2	3	4	5
h) Power of special interest group	1	2	3	4	5
i) Agenda decisions of committee chairman	1	2	3	4	5
j) Bill died at end of legislative session	1	2	3	4	5
k) Any other factors (Please explain below)	1	2	3	4	5

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10. If the bill was defeated or vetoed, what interest groups, if any, were involved?

	1	2
	Involved in defeat/veto (I)	Not involved in defeat/veto (NI)
Interest Group	I	NI
a) Farmers	1	2
b) Agricultural commodity organizations	1	2
c) Agribusiness representatives (other than chemical)	1	2
d) Chemical industry representatives	1	2
e) Consumer groups	1	2
f) Other interest groups (Please explain below)	1	2

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Next we are requesting information on the prospects of groundwater legislation in your state.

11. If passed, do you plan to introduce a related bill in the future?

- 1 Yes (Skip to Question 13)
- 2 No (Skip to Question 15)
- 3 Does not apply

12. If failed, do you plan to reintroduce this bill or a related bill?

- 1 Yes (Continue to Question 13)
- 2 No (Skip to Question 15)

## 13. Which of the following do you plan to include in the new bill?

<u>Features of New Bill</u>	<u>Yes</u>	<u>No</u>
a) Provisions for monitoring of groundwater	1	2
b) Provisions for enforcement of legislation	1	2
c) Targeting of specific chemicals in legislation	1	2
d) Targeting of specific geographical areas in legislation	1	2
e) Phase-in period	1	2
f) Provisions for special studies	1	2
g) Provisions for revenue enhancement	1	2
h) Deadlines	1	2
i) Provisions for education/demonstration projects	1	2
j) Provisions for research	1	2
k) Other modifications (Please explain below)	1	2

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## 14. What groups do you expect to support or oppose the new bill?

- 1 Strong supporter (SS)
- 2 Weak supporter (WS)
- 3 No impact (NI)
- 4 Weak opponent (WO)
- 5 Strong opponent (SO)

Interest Groups	SS	WS	NI	WO	SO
a) Farmers	1	2	3	4	5
b) Agricultural commodity organizations	1	2	3	4	5
c) Agribusiness representatives (other than chemical)	1	2	3	4	5
d) Chemical industry representatives	1	2	3	4	5
e) Consumer groups	1	2	3	4	5
f) Medical experts	1	2	3	4	5
g) Economic experts	1	2	3	4	5
h) Environmental experts	1	2	3	4	5
i) State Department of Agriculture (or equivalent department)	1	2	3	4	5
j) State Department of Natural Resources (or equivalent department)	1	2	3	4	5
k) Other interest groups (Please explain below)	1	2	3	4	5

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Skip to question 16

15. How important were the following factors in your decision to not reintroduce this bill, or introduce a new bill?

- 1 Very Important (VI)
- 2 Somewhat Important (SI)
- 3 Moderate Importance (MI)
- 4 Somewhat Unimportant (SU)
- 5 Very Unimportant (VU)

Factors	VI	SI	MI	SU	VU
a) Competing bill was available	1	2	3	4	5
b) Limited interest in water quality legislation	1	2	3	4	5
c) Little chance of passage	1	2	3	4	5
d) Administration of the bill not feasible	1	2	3	4	5
e) Question of state authority	1	2	3	4	5
f) Uncertainties raised in the debate on the current proposal	1	2	3	4	5
g) Need for further study of monitoring and regulatory mechanisms	1	2	3	4	5
h) Other factors (Please explain below)	1	2	3	4	5

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Finally, we have some questions about you and your constituency.

16. As of the 1988 session, how many terms had you served as legislator?



17. During the term in which you sponsored this bill, how many bills did you sponsor? (Include this bill)

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18. How many of the bills you sponsored passed into law?

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19. Apart from the legislature, what is your occupation?

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20. Which best describes your constituency?

- 1 Urban
- 2 Rural
- 3 Suburban

21. Are there any other comments you would like to make regarding the history of the bill, plans for administration of the bill, the distribution of the costs and benefits of the bill, or any other aspects of the bill?

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Iowa State University appreciates your help with this project. If you wish to have a copy of this study please circle (Yes No). Thank you.

## Appendix B

## Dependent Variable Description

The endogenous variables used in the analysis are described below by group.

## Group one:

NB: The number of pesticide/groundwater bills introduced during the 1987-88 period by state (range from 0 to 16).

SB: 1 if pesticide/groundwater bill was introduced;  
= 0 otherwise

## Group two:

DEP: The sum of qualitative choice variables representing consideration of any economic provisions over all bills by state.

$$= \sum_{i=0}^{16} EP_i$$

where  $EP_i = 1$  if any economic provision was considered in a bill;

= 0 otherwise.

DCP: The sum of qualitative choice variables representing consideration of any compliance provisions over all bills by state.

$$= \sum_{i=0}^{16} CP_i$$

where  $CP_i = 1$  if any compliance provision was considered in a bill;

= 0 otherwise.

DAP: The sum of qualitative choice variables representing consideration of any administrative provisions over all bills by state.

$$= \sum_{i=0}^{16} AP_i$$

where  $AP_i = 1$  if any administrative provision was considered in a bill;

= 0 otherwise.

Group three:

DERF: A qualitative choice variable representing consideration of registration fees for any bill by state

= 1 if registration fees were considered in any bill;

= 0 otherwise.

DEPF: A qualitative choice variable representing consideration of dealer and applicator fees for any bill by state

= 1 if dealer and applicator fees were considered in any bill by state;

= 0 otherwise.

DCPR: A qualitative choice variable representing consideration of dealer and applicator requirements for any bill by state

= 1 if dealer and applicator fees were considered in any bill;

= 0 otherwise.

DCUR: A qualitative choice variable representing consideration of sale and use restrictions for any bill by state  
= 1 if sale and use restrictions were considered in any bill;  
= 0 otherwise.

DAEP: A qualitative choice variable representing consideration of enforcement provisions for any bill by state  
= 1 if enforcement provisions were considered in any bill;  
= 0 otherwise.

DARP: A qualitative choice variable representing consideration of research provisions for any bill by state  
= 1 if research provisions were considered in any bill;  
= 0 otherwise.

Group four:

Q4A: A scored variable representing the influence of farm groups on a bill as reported by a legislator (range from -2 to 2).

Q4D: A scored variable representing the influence of chemical industry groups on a bill as reported by a legislator (range from -2 to 2).

Q4E: A scored variable representing the influence of consumer groups on a bill as reported by a legislator (range from -2 to 2).

Q4H: A scored variable representing the influence of environmental groups on a bill as reported by a legislator (range from -2 to 2).

A generalized form of all the models considered is as follows:

$$NB = a_0 + a_1 * DUM + a_2 * NP + a_3 * PSGO + a_4 * PFI + a_5 * AIUSE$$

where  $a_i$ 's represent linear coefficients.

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