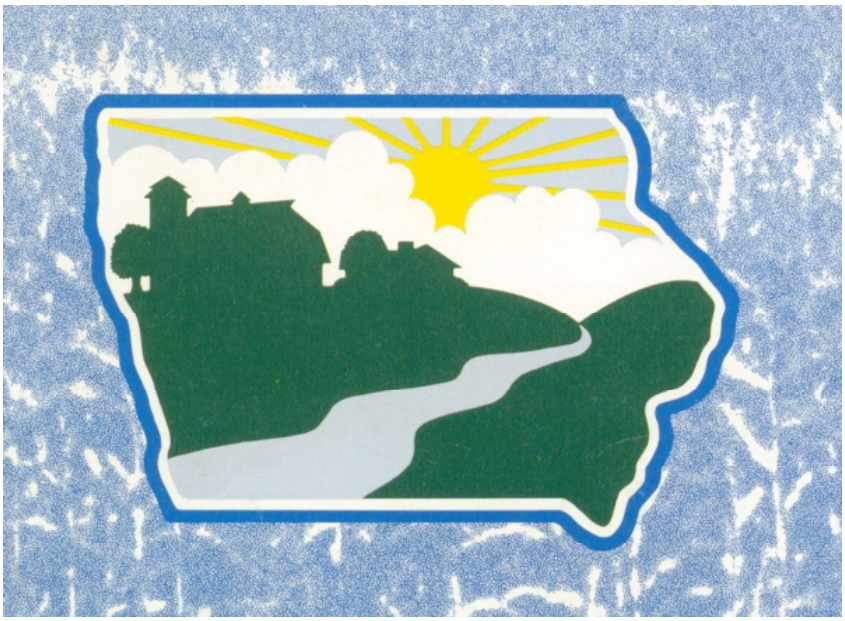
Broadening the Communities to Which We Belong: Iowa, Agriculture, and the Leopold Center for Sustainable Agriculture



Witches' brew

LEOPOLD CENTER

by John F. Obrycki

BROADENING THE COMMUNITIES TO WHICH WE BELONG: IOWA, AGRICULTURE, AND THE LEOPOLD CENTER

Submitted to the

School of Interdisciplinary Studies

(Western College Program)

in partial fulfillment of

the requirements for the degree of

Bachelor of Philosophy

Interdisciplinary Studies

by

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Miami University

Oxford, Ohio

2008

APPROVED

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BROADENING THE COMMUNITIES TO WHICH WE BELONG:

IOWA, AGRICULTURE, AND THE LEOPOLD CENTER

A thesis submitted to the Department of History, Miami University, in partial fulfillment of the Requirements for Honors in History

by

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2008

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BROADENING THE COMMUNITIES TO WHICH WE BELONG:

IOWA, AGRICULTURE, AND THE LEOPOLD CENTER

A thesis submitted to the Miami University Honors Program in partial fulfillment of the requirements for University Honors with Distinction

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ABSTRACT

It is the argument of this project that the Leopold Center for Sustainable Agriculture at Iowa State University provides a model* for an institutionalized approach to agricultural issues. Located at a land-grant university, created through legislative action, and currently operating on a budget of $2 million, the Center's approach to agricultural issues is a combination of economic, social, political, and ecological concerns that seeks to find production alternatives that are beneficial in the long-run for people and the planet. Furthermore, the Center brings together a broadly based agricultural community comprised of those within and outside of university settings to effectively conceptualize issues and enact change. Established in 1987 and named after Aldo Leopold, an important conservationist and wildlife management expert in the first half of the twentieth century, learning more about the Center's research efforts sheds insight into the current structure of the American agricultural system and the opportunities and limitations that exist in striving to shift the system towards more sustainable production methods. A dual practical and philosophical approach to fostering change in Iowa's farming system forms the foundation of the Center's efforts. The asterisk represents the constraints to the Center as a model from economic, social, and political factors. However, during the past 20 years the Center and the research it funds have been able to overcome some of these obstacles. The Center deserves closer investigation due to its wide-reaching implications and lessons for shifting agricultural production practices towards more sustainable methods.

Front cover: Iowa image from front cover of first annual Leopold Center report, 1989, "Witches' brew," from *Des Moines Register*, May 11, 1986, and Leopold Center logo from the Leopold Center for Sustainable Agriculture

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Finally, I would like to thank all those who participated in interviews for the project. Your comments, thoughts, time, and further questions greatly influenced my thinking and final argument used here. Though this current version of the project does not explicitly use quotes from individuals throughout, I hope the summary provided so far in chapter five provides a snapshot of thoughts on the Center. Thank you so much.

Preface

This project has been a two-year journey for me. While not representing the final destination, I do hope this project provides some semblance of a resting point from which a quick backward glance and assessment can be gathered. I look forward to expanding upon these ideas in the future, as I feel numerous issues can be delved into further. I hope this project is useful to those who are already aware of the Leopold Center to perhaps see the Center in a new way. I also hope this project is useful to someone who has no prior knowledge of the Center, Iowa, or the Groundwater Protection Act of 1987. Iowa's, and the Leopold Center's, efforts deserve closer investigation due to their broader implications for agricultural practices today and the ongoing debate about the future of the planet as we know it.

Table of Contents

Introduction

It is the argument of this project that the Leopold Center for Sustainable Agriculture at Iowa State University provides a model* for an institutionalized approach to agricultural issues. Located at a land-grant university, created through legislative action, and currently operating on an annual budget of $2 million, the Center's approach to agricultural issues is a combination of economic, social, political, and ecological concerns that seeks to find production alternatives that are beneficial in the long-run for people and the planet. Established in 1987 and named after Aldo Leopold, an important conservationist and wildlife management expert in the first half of the twentieth century, learning more about the Center's research efforts sheds insight into the current structure of the American agricultural system and the opportunities and limitations that exist in striving to shift the system towards more sustainable production methods.

That asterisk is important too, and can roughly equate to "sort of," "almost," or a similar quickly muttered sentiment that can be hidden in a polite cough. The Leopold Center's ability to enact change on the agricultural landscape is limited by the larger agricultural system the Center exists within. These larger limitations do not negate the Center as a model approach; rather they reinforce the broader concerns that must be considered when implementing new farming practices. Additionally, these limitations illustrate the challenges to the Center’s dual practical and philosophical approach to agricultural issues. The Leopold Center is located at the intersection of ideology and practice in seeking to change farming decisions through being grounded in Aldo Leopold’s land ethic and striving to research new farming techniques and production methods.

Agricultural decisions, just as with any other kind, are difficult. "Farmers make decisions in an uncertain environment," noted two agricultural economists from Iowa State University in an evaluation of several theories of farmers' decision-making processes.[1] We all make decisions within uncertain environments with potentially wide-reaching impacts that can only fully be understood in hindsight. Our decisions, farmers included, can be influenced from a variety of factors from macro to micro in scale that impose limitations on our choices and actions. For example, farmers' production decisions are influenced and limited by a variety of economic, social, political, and environmental factors. Weather is an important factor, as its variability can cause dramatic crop losses or bountiful harvests.[2]

The Center's research efforts focus on influencing farmers' decisions as well. By viewing the Leopold Center as a model of an institutionalized approach to agricultural issues, the focus of this project is to understand the process of the Center's creation and assess what it has accomplished for the past twenty years, including why the asterisk is necessary. The first two chapters of this project address America's economic and environmental problems with its agricultural system during the 1980s and places Iowa's concerns within a broader context. The next two chapters discuss Iowa's legislative approach to its groundwater pollution problems, including the efforts the state took to address agricultural concerns in the 1987 Groundwater Protection Act, and the importance of naming the Leopold Center after Aldo Leopold. The final two chapters

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[1] John L. Dillon and Earl O. Heady, *Theories of Choice In Relation to Farmer Decisions* (Ames, Iowa: Iowa State University, 1960), 1.
[2] *Ibid*.

highlight successful efforts of the Center and consider broader challenges and limitations that constrain the Center's ability to foster new agricultural practices in the state.

An Agricultural Problem
(1)

During the 1980s, a group of researchers and legislators in Iowa became concerned with the state's groundwater quality, including degradation caused by pesticides and fertilizers. The state passed the Groundwater Protection Act in 1987 to address sources of groundwater contamination, including agricultural ones, through the development of research, education, and demonstration programs. The Act's creation of the Leopold Center for Sustainable Agriculture at Iowa State University exemplified this approach. However, Iowa was neither alone in having groundwater problems nor in proposing solutions for increased water quality protection.

The goal of this chapter is to illustrate how Iowa's groundwater protection efforts, especially those pertaining to agricultural production, compare with other state and federal responses during the 1980s. This historical framing of the Iowa legislature's actions support the assertion of this project that the Groundwater Protection Act and the Leopold Center provide a model for institutionalized approaches to environmental and agricultural issues, particularly since the Groundwater Protection Act created a flexible framework for the Center to operate within. Though a unique piece of legislation for its use of a non-degradation goal for groundwater quality and an emphasis on broad-based research, education, and demonstration, others at the state and federal levels echoed these calls for holistic approaches to complex agricultural and environmental issues.

These echoes existed because concerns over farming practices in the 1980s were felt nationwide. "The agricultural system has been beset by numerous economic and environmental problems in the 1980s," wrote the National Research Council (NRC) in

Alternative Agriculture (1989), "that are associated with current conventional and agricultural practices." The book included a chapter titled "Problems in U.S. Agriculture" that described current agricultural dilemmas regarding the influence of international trade, degradation of surface and ground water quality, continued soil erosion, loss of genetic diversity, pesticide use, and food safety.[3] The solution to these problems offered by the NRC was a "systems approach to farming that is more responsive to natural cycles and biological interactions than conventional farming methods." These alternative agricultural practices included crop rotations, integrated pest management practices, tillage that promoted soil conservation, animal production systems that emphasized preventative management of diseases instead of frequent antibiotic use, and improving crops genetically to use nutrients more efficiently and reduce diseases and pests.[4]

To accomplish these goals the NRC recommended comprehensive research that "must include the interaction and integration of all farm operations and must consider the more comprehensive goals of resource management, productivity, environmental quality, and profitability with minimal government support," also noting, that "a limited amount of research has taken this comprehensive approach."[5] Clearly a new research direction was needed in the 1980s that would view farming systems holistically and be able to solve the myriad of problems facing agriculture.

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[3] National Research Council, Board on Agriculture, Committee on the Role of Alternative Farming Methods in Modern Production Agriculture, *Alternative Agriculture* (Washington, D.C.: National Academy Press, 1989), 85, 89. Quote pieced together from these two pages. Chapter 2, "Problems in U.S. Agriculture" is 89-134.
[4] *Ibid*, 135-137
[5] *Ibid*, 138

Water quality was one environmental issue during the 1980s that the NRC identified as needing systems based research efforts. Others in the 1980s echoed the NRC's call for holistic and interdisciplinary research, particularly for solving this problem.[6] Of all the agricultural problems in the 1980s, the National Research Council identified water pollution as "the most damaging and widespread environmental effect of agricultural production." The NRC cited an Environmental Protection Agency report in which 17 states listed agriculture as the primary or major nonpoint source of water pollution, including Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Oregon, and Utah. Additionally, 27 states listed agriculture as a nonpoint source pollution problem, less pronounced than a primary or major nonpoint source problem. These states included Arizona, Florida, Michigan, New Mexico, South Carolina, and Wisconsin.[7] These water quality problems included contamination of groundwater by pesticides and nitrogen fertilizers. Beginning in the 1940s and growing in use in the following decades, the

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[6] A few examples. George R. Hallberg, "Pesticide Pollution of Groundwater in the Humid United States," *Agriculture, Ecosystems and Environment*, 26 (1989): 299-367. "Resolving the problem of pesticides, and other agricultural impacts on groundwater and the environment will require a new focus for research and farm management. More integrated farm management, and more complete research into integrated farming systems is needed, with a focus on efficiency and off-site impacts rather than just maximizing yields," p. 359. James H. Andersen, "Agriculture and Natural Resources: The Broadening Horizon," in *Rural Groundwater Contamination*, ed. Frank M. D'Itri and Lois G. Wolfson (Chelsea, Michigan: Lewis Publishers, Inc., 1987), 3-14. "Resolving these problems requires an integrated effort by all segments of the agricultural community to gain the experience and data necessary to effect a satisfactory balance between efficient agricultural production and the protection of the greatest resources – water and soil," p. 11. Robert D. Libra, George R. Hallberg, and Bernard E. Hoyer, "Impacts of Agricultural Chemicals On Ground Water Quality in Iowa," in *Ground Water Quality and Agricultural Practices*, ed. Deborah M. Fairchild (Chelsea, Michigan: Lewis Publishers, Inc., 1987), 185-216. "Ground water quality problems related to agriculture can only be resolved through a more holistic approach to agricultural management and research," p. 214.

[7] NRC, *Alternative Agriculture,* 98-99

increased use of these chemicals posed significant problems for water quality.[8] Nitrogen contamination can come from numerous sources, including runoff followings application to farm fields, leaking septic tanks and sewage, and natural sources. In contrast, herbicides come from only one source; fertilizer use runoff.[9] Other threats to groundwater included hazardous wastes, leaking septic tanks, accidental spills, runoff from mining practices, and radioactive sources.[10]

The extent of groundwater contamination, especially groundwater that was used as drinking water was of concern. The NRC noted that almost 50% of all drinking water and 97% of rural drinking water in the United States came from groundwater. Recently before the publication of *Alternative Agriculture* in 1989, pesticides were detected in groundwater in 26 states and 25% of wells surveyed by the U.S. Geological Survey contained levels of nitrate-nitrogen above 3 mg/L; the threshold for identifying a water quality impact due to human activities. Furthermore, the USDA calculated that 46% of all counties in the United States had groundwater resources that were susceptible to agricultural contamination from pesticides or fertilizers.[11] A review of groundwater studies in the mid-1980s found that 17 pesticides pertaining to "routine" agricultural practices were reportedly found in twenty-three states. When taking into account all potential sources of groundwater contamination due to agriculture including the point sources of manufacturing, handling, and spills; not just those that could be attributed to

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[8] *Ibid*, 105
[9] Sources of nitrates and herbicides from the Environmental Protection Agency, "Drinking Water Contaminants," Environmental Protection Agency, http://www.epa.gov/safewater/contaminants/index.html.
[10] Veronica I. Pye, Ruth Patrick, and John Quarles, *Groundwater Contamination in the United States* (Philadelphia: University of Pennsylvania Press, 1983), 15-28.
[11] NRC, *Alternative Agriculture*, 105-108

"routine" agricultural practices, California was found to have 50 pesticides and related compounds in groundwater samples.[12]

The widespread detections of nitrogen fertilizers and herbicides were particularly considered problems because of the small concentrations necessary to impair human health. Additionally, rural wells and smaller municipalities might not have the treatment systems necessary to remove these contaminants from water supplies, for example nitrate removal systems. Why would these potentially dangerous chemicals be used? Nitrogen fertilizers have assisted in the yield increases for crops during the twentieth century, and use increased from under 400,000 tons in 1930 to over 11.5 million tons in 1985. Herbicides are a type of pesticide that targets unwanted plant growth and their development has been called "one of the most noteworthy scientific advances in agriculture."[13] Just as nitrogen fertilizer use is widespread, so too is herbicide use. For example, over 90% of the corn planted in Iowa was treated with herbicides each year during the 1990s and early 2000s, and frequently over 98% of corn acres were treated. Nitrogen use is similarly high, with over 90% of corn acres in the state treated. This is a

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[12] As summarized by George R. Hallberg, "Pesticide Pollution of Groundwater in the Humid United States," *Agriculture, Ecosystems and Environment* 26 (1989): 299-367. The study that found "at least" 17 pesticides in 23 states relating to agricultural practices was by Cohen et al., "Monitoring ground water for pesticides," in *Evaluation of Pesticides in Ground Water: American Chemical Society Symposium Series, 315*, ed. Garner et al. (Washington, D.C.: American Chemical Society), 170-196. Holden took into account all potential groundwater contaminants, including the California data, in Patrick W. Holden, *Pesticides and groundwater quality: issues and problems in four states* (Washington, D.C.: National Academy Press, 1986), 14-30.

[13] Don Paarlberg and Philip Paarlberg, *The Agricultural Revolution of the 20th Century* (Ames, Iowa: Iowa State University Press, 2000), 31-39. Nitrogen information on p. 34 and herbicides on p. 39.

considerable portion of the Iowa landscape, as corn covers approximately 1/3 of the state.[14] Widespread use and widespread detections were of concern.

By law, nitrates in drinking water are allowed up to 10 milligrams per liter (mg/L); nitrites, another form of nitrogen that can occur in drinking water, are allowed at 1 mg/L. The levels established for herbicides are much lower than the levels allowed by the EPA for nitrates and nitrites. For example, the level allowable for atrazine in drinking water is .003 mg/L. To put these numbers in perspective, imagine a two-liter bottle of water. To be potable, this water could at maximum have 20 mg of nitrates; equivalent to 20 paperclips in the two liter bottle. The maximum nitrite amount would be two paperclips in the entire two-liter bottle. The amount of atrazine allowable in that two-liter bottle of water that would be less than 1% of the weight of just one paperclip.[15]

Even at these seemingly small concentrations, nitrogen fertilizers and herbicides affect the human body if ingested. People who ingest high levels of nitrates or nitrites over the legally established limit, especially children under six months, are susceptible to methemoglobinemia, also known as "blue baby syndrome" because of the blue-gray skin color, termed cyanosis, that results. Symptoms include cyanosis, shortness of breath, and the development of a lethargic or irritable mood, and if not treated properly these symptoms can lead to coma and death. The skin turns blue when the red blood cells' hemoglobin, the molecule that transports oxygen in the body, is oxidized by the nitrate

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[14] NASS statistics for Iowa chemical use between 1991 and 2003. Available from National Agricultural Statistics Service, "Data and Statistics: Quick Stats," NASS-USDA, http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp. Selected Iowa and Chemical Usage query.

[15] Allowable limits from EPA, "Drinking Water Contaminants," EPA, http://www.epa.gov/safewater/contaminants/index.html.

and becomes methemoglobin, which cannot transport oxygen. Coma and death can result if half of the body's hemoglobin is turned in methemoglobin. Infants are particularly susceptible because they lack an enzyme called methemoglobin reducatase that is able to convert methemoglobin back into hemoglobin. Six infant deaths have been attributed to methemoglobinemia in the United States over the past thirty years. The publicized 1986 death of an infant in South Dakota from drinking water with high nitrate content added further impetus to the efforts of the Iowa legislature in passing the Groundwater Protection Act.[16] Older children and adults have higher levels of this enzyme and are less susceptible to methemoglobinemia, but chronic exposure to high levels of nitrates in drinking water has been linked to higher rates of cancer, thyroid disease, and diabetes.[17]

"Blue baby syndrome" and concerns over high nitrates in drinking water are nothing new to Iowa. Two cases of cyanosis caused by drinking water with high nitrates were described in Iowa in the 1940s by Hunter Comly in a 1945 article in the *Journal of the American Medical Association*.[18] Comly, a physician from Iowa City, treated two infants that drank well water with nitrate concentrations of 90 and 150 mg/L, well above the future standards that would be adopted by the EPA. These high concentrations were due to the shallow depth of the water well and to animal wastes, not specifically due to chemical inputs.[19] However, in Iowa, even as wells became better constructed, nitrate

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[16] DeWitt John, *Civic Environmentalism: Alternatives to Regulation in States and Communities*, (Washington, D.C.: CQ Press, 1994), 101.
[17] Lynda Knobeloch, Barbara Salna, Adam Hogan, Jeffrey Postle, Henry Anderson, "Blue Babies and Nitrate-Contaminated Well Water," *Environmental Health Perspectives* 108 (2000): 675, 678.
[18] Hunter H. Comly, "Cyanosis in Infants Caused By Nitrates in Well Water," *Journal of the American Medical Association* 129 (1945): 112-116.
[19] *Ibid*, 115, "The high nitrate water which the cyanotic infants ingested came from very undesirable wells. In many cases the wells were old, dug rather than drilled, had inadequate casings or none at all, and were poorly covered so that surface water, animal excreta and other objectionable material could enter freely."

contamination was still an important concern. From 1965 through the 1980s, approximately 18-22% of private wells sampled annually exceeded the nitrate level of 10 mg/L.[20] Nitrates are still an issue today, as the Des Moines Water Works installed the largest nitrate removal system in the early 1990s to treat surface water for high nitrate concentrations from the Raccoon River watershed, which has the highest nitrate concentrations of any Mississippi River tributary.[21]

Herbicides in drinking water can also cause significant health problems, and at much lower levels than 10 mg/L. Numerous chemicals are classified as herbicides, and some of the common herbicides in Iowa are alachlor, atrazine, cyanazine, metolachlor, and acetochlor.[22] As with drinking water standards, the Environmental Protection Agency regulates the use of these chemicals and classifies them according to toxicity. Acetochlor is a Class I, highly toxic; cyanazine is a Class II, mildly toxic; the others listed are Class III, slightly toxic. However, all five of these herbicides are classified as Restricted Use Pesticides (RUPs) and can only be purchased by applicators who are certified. In addition to toxicity there is also the issue of mobility, how the chemical moves through the soil and into water. Atrazine has the greatest potential for

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[20] Data from the University Hygienic Laboratory and cited by George R. Hallberg, "Nitrates in Iowa Groundwater," in *Rural Groundwater Contamination*, ed. Frank M. D'Itri and Lois G. Wolfson (Chelsea, Michigan: Lewis Publishers, Inc., 1987), 34.

[21] Highest nitrate level, see Des Moines Water Works, "Water Quality – Delivering Quality to You!," Des Moines Water Works, http://www.dmww.com/WaterQuality.aspx. For description of Des Moines' nitrate removal system, see Valerie White, "Agriculture and drinking water supplies: Removing nitrates from drinking water in Des Moines, Iowa," *Journal of Soil and Water Conservation* 51 (1996): 454-455.

[22] These are some of the most common herbicides found in Iowa's groundwater. See Koplin et al., "*Agricultural Chemicals in Iowa's Groundwater, 1982 – 1995*, *What are the Trends?,"* USGS, http://ia.water.usgs.gov/nawqa/factsheets/fs-116-97.html.

groundwater contamination because it will not break down as rapidly as the others in the soil; acetochlor is the least likely to reach groundwater sources.[23]

Unlike nitrates and nitrates that have defined drinking water standards, not all pesticides have standards. Only atrazine and alachlor of the five listed here have standards; with .003 mg/L and .002 mg/L allowed respectively. However, an additional drinking water standard, the Maximum Contaminant Load Goal, the level the EPA hopes to achieve in water quality, is set at 0 mg/L for these two herbicides. Alachlor causes problems with eye, liver, kidney, and spleen, as well as anemia and an increased risk of cancer. Atrazine causes problems with the cardiovascular and reproductive systems.[24] One of the first studies nationwide documenting pesticides, particularly the herbicide atrazine, in groundwater was conducted in Iowa in the mid-1970s. Though primarily concerned with detecting chlorinated-hydrocarbon based pesticides, such as DDT and DDE, that were of concern in the 1960s, the researchers also tested samples for atrazine, of the next generation of pesticides after those such as DDT and DDE that were supposed to be safer. The researchers found atrazine in the groundwater samples taken from alluvial aquifers, those closest to the land surface and most susceptible to contamination.[25]

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[23] Information on these herbicides comes from Extension Toxicology Network, "EXTOXNET," Oregon State University, http://extoxnet.orst.edu. This website is a cooperative project amongst Cornell University, Oregon State University (maintains and archives primary files), University of Idaho, and University of California-Davis, and Michigan State University Extension Offices. Each herbicide has its own page, http://extoxnet.orst.edu/pips/atrazine.htm, http://extoxnet.orst.edu/pips/alachlor.htm, http://extoxnet.orst.edu/pips/cyanazin.htm, http://extoxnet.orst.edu/pips/metolach.htm, http://extoxnet.orst.edu/pips/acetochl.htm.

[24] EPA, "Drinking Water Contaminants," EPA, http://www.epa.gov/safewater/contaminants/index.html.

[25] The study was Richard et al. "Analysis of various Iowa waters for selected pesticides: atrazine, DDE, and dieldrin," *1974 Pesticide Monitoring Journal* 9 (1975): 117-123. This study was noted as one of the first studies to document this new generation of pesticides by George R. Hallberg, "Pesticide Pollution of

The other three herbicides do not have drinking water quality standards established for them. Drinking water standards are set by the EPA through a regulatory process established by the Safe Drinking Water Act of 1986. The EPA develops two sets of standards, the Maximum Contaminant Level Goals (MCLGs), non-enforceable, and Maximum Contaminant Levels (MCLs) which are enforceable. The MCLGs are set for each chemical at which no negative or adverse health effects are known. The MCL is set as close to the MCLG as possible assuming feasible technology use and treatment methods. Due to the high number of chemicals, the EPA works through potential lists of chemicals and determines whether or not standards are required.[26] These are referred to as Contaminant Candidate Lists, and are required by the Safe Drinking Water Act. Both acetochlor and metolachlor were on the EPA's first Drinking Water Contaminant Candidate List (CCL) that was released in 1998, and remained on the second version of the list in 2005, referred to as CC2. Metolachlor was discussed in the EPA's document on determining regulations for selected contaminants on this list, but no standard was recommended. Acetochlor remains on the CCL list, but has not yet been considered. Cyanazine is not on the CCL list, though there the recommendations for the third CCL list closed in December 2006 and this list has not yet been released.[27]

Groundwater in the Humid United States," in *Agriculture, Ecosystems and Environment* 26 (1989): 299-367.

[26] Craig Vogt and Joseph Cotruvo, "Drinking Water Standards: Their Derivation and Meaning," in *Rural Groundwater Contamination*, ed. Frank M. D'Itri and Lois G. Wolfson (Chelsea, Michigan: Lewis Publishers, Inc., 1987), 213-224.

[27] EPA, "Drinking Water Contaminant Candidate List and Regulatory Determinations," EPA, http://www.epa.gov/safewater/ccl/index.html. The CC2 draft of recommendations for a portion of the CCL list is available as a pdf, http://www.epa.gov/safewater/ccl/pdfs/reg_determine2/report_ccl2-reg2_supportdocument_full.pdf, with a description available here, EPA, "Regulatory Determinations for Priority Contaminants on the Second Drinking Water Contaminant Candidate List," EPA, http://www.epa.gov/safewater/ccl/reg_determine2.html. The CC1 list was released in 2003 and

The process for establishing and enforcing drinking water standards is ongoing. Standards for some chemicals were essential in the 1980s due to the extent of groundwater contamination. As noted before by the NRC, almost 50% of all drinking water and 97% of rural drinking water in the United States came from groundwater. Some states, however, were more dependent on groundwater than others, and Iowa was one of them. An EPA study in 1977 found that some states including Illinois, Kentucky, Maryland, Michigan, and Virginia only had between 30 – 40% of their total populations relying upon groundwater as the source of drinking water. Seven states had over 80% of their total population rely upon groundwater for drinking water, including Florida, Hawaii, Idaho, Iowa, Mississippi, Nebraska, and New Mexico. The most dependent state was New Mexico with 92% of the total population using groundwater sources for drinking water. Iowa had 82% relying upon these resources. The data also separated data by urban and rural populations; of which 95% nationwide relied upon groundwater.[28]

Iowa had its issue, groundwater pollution, and its approach, institutional efforts that focused on cooperative research with the involvement of many disciplines with the goal of helping farmers adopt new practices. Other states had groundwater issues too,

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recommended 9 contaminants not be regulated from the entire CCL list. The current list has 51 contaminants, including degradation products of alachlor, a contaminant that is already regulated. There is another entire debate here concerning how standards are adopted and what evidence supports standards. Another important question that enters into a completely new discussion is how are these levels for the contamination developed? The articles in the *Des Moines Register* during 1986 discussed this with a front-page story, Larry Fruhling, "Ghost of 1976 lab fraud haunts water safety today," *Des Moines Register*, May 7, 1986, Front section, 1A, 2A., concerning the Industrial Bio-Test Laboratories in Chicago. This article discussed the difficulties in using data from this lab that had been operating for years, though under horrendous, and non-scientific conditions. One such substance discussed was cyanazine, under the tradename Bladex, Cyanazine is still unregulated.

[28] Pye, Patrick, and Quarles, *Groundwater Contamination in the United States*, 38-41

and several states had already developed legislative strategies before Iowa to deal with groundwater contamination. The Committee on Ground Water Quality Protection of the National Research Council reviewed several states' approaches to groundwater and reported in 1987 that, "no single program was found to address all aspects of ground water protection problems comprehensively."[29] Many states had already passed groundwater legislation by 1987 including Arizona, Connecticut, Florida, Kansas, Massachusetts, New Jersey, New York, and Wisconsin. These programs were focused on groundwater quality and protection, and primarily established standards, regulations, and methods for monitoring groundwater.[30] When compared to these other state approaches, Iowa's approach is unique because the state utilized a non-degradation approach to its groundwater resources and integrated an institutionalized cooperative approach through the state's emphasis on research, education, and demonstration in the implementation of Iowa's Groundwater Protection Act. The act addressed groundwater and agricultural concerns in the same bill, whereas other states may have separated these two. Iowa's approach of addressing groundwater and agricultural concerns in the same piece of legislation clearly reflect how intricately these two issues are connected in the state.

A brief discussion of several other state approaches during the 1980s provides a useful comparison for more fully understanding Iowa's approach. California addressed agriculture and environmental issues through a series of legislative acts in the 1980s. With respect to groundwater, the California legislature passed the Pesticide

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[29] National Research Council, Water Science and Technology Board, Commission on Physical Sciences, Mathematics and Resources, Committee on Ground Water Quality Protection, *Ground Water Quality Protection: State and Local Strategies* (Washington, D.C.: National Academy Press, 1986), 9.
[30] *Ibid*, for summaries of these programs see 24-73.

Contamination Prevention Act in 1985. This act was similar to the groundwater protection acts passed by other states in the early and mid-1980s. Some of the stipulations of the Pesticide Contamination Prevention Act required registration of pesticides and frequent groundwater monitoring.[31] With respect to agricultural practices, in 1986 the California legislature passed the Sustainable Agriculture Research and Education Act that called for the establishment the Sustainable Agriculture Research and Education Program (SAREP) by the Regents of the University of California.[32] The University of California Agriculture and Natural Resources and the University of California-Davis housed this program.[33] The Sustainable Agriculture Research and Education Act stipulated three goals for SAREP that emphasized long-term sustainable agriculture research and outreach to the public.[34] When compared to the California approach, Iowa's approach differs due to scale. The enabling legislation in California allotted $300,000 to the Sustainable Agriculture Research and Education Program; additional funding has been appropriated by the California Legislature to the program as well.[35] The Leopold Center operates on a budget roughly four times the size of the California budget, and the Leopold Center was contained within the comprehensive groundwater law of the state.

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[31] California Department of Pesticide Regulation, "The Pesticide Contamination Prevention Act," State of California, http://www.cdpr.ca.gov/docs/emon/grndwtr/prvntnact.htm.
[32] Code of California, Food and Agricultural Code, Section 550-555, Code of California, "California Law," State of California, http://www.leginfo.ca.gov/calaw.html.
[33] UCSAREP, "University of California Sustainable Agriculture Research and Education Program," University of California, http://www.sarep.ucdavis.edu/.
[34] The three-part mission: (1) the administration of competitive grants program for sustainable agriculture research, (2) publications and on-farm demonstrations would distribute information to the public, (3) continue to commit farmlands in the University of California system to sustainable agriculture research, from a combination of Code of California, Food and Agricultural Code, Section 550-555, http://www.leginfo.ca.gov/calaw.html, and http://www.sarep.ucdavis.edu/about/index.htm
[35] Gordon Meeks, Jr., *State Policy Issues in Sustainable Agriculture* (Denver: National Conference of State Legislatures, 1989), 27. From files of Ralph Rosenberg.

Though California's efforts are comparable to Iowa, it was Wisconsin's approach that gained Iowa's attention during the development of the Groundwater Protection Act.[36] This may be due in part to Wisconsin's legislation being passed earlier to California's, and that Iowa was already drafting their groundwater legislation during the mid-1980s. The 1983 Wisconsin Act 410 was signed into law in May 1984. The core component that interested Iowa legislators was the two-tiered standards program included in Wisconsin's groundwater law. Numerical standards were divided into enforcement standards and preventive action limits (PALs), with the latter limits less stringent than the former. Enforcement standards were tied to federal standards, such as the Environmental Protection Agency's maximum contaminant levels (MCLs) or standards from the Wisconsin Department of Health and Social Services. When PALs were reached, remedial actions were required to protect groundwater quality and sought to stay below enforcement standards. Violating the enforcement standard allows for further actions to protect groundwater quality, including prohibiting the activity that uses or produces the substance in question. In addition to this regulation and standards approach, Wisconsin also developed groundwater-related education efforts, including spots for television and radio and materials for schools.[37]

Iowa legislators, specifically Representatives David Osterberg and Paul W. Johnson, chose not to use a similar approach to Wisconsin based on practical and

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[36] DeWitt John, *Civic Environmentalism*, 97

[37] Wisconsin's efforts are discussed in several places. Thomas J. Dawson, "Wisconsin Programs on Groundwater Pollution Liability" in *Rural Groundwater Contamination*, ed. Frank M. D'Itri and Lois G. Wolfson (Chelsea, Michigan: Lewis Publishers, Inc., 1987), 328-329. Wisconsin's approach also discussed in National Research Council, Committee on Ground Water Quality Protection, *Ground Water Quality Protection: State and Local Strategies* (Washington, D.C.: National Academy Press, 1986), 72-73.

philosophical concerns with the other state's approach. Practically, these two state representatives were concerned that Iowa did not have enough knowledge about the extent of their own state's groundwater pollution to enact similar regulations. There were also concerns as to the feasibility of enforcing these standards due to the regulatory framework and employment necessary for the task. Philosophically, Representatives Osterberg and Johnson were concerned that adopting water quality standards was not the correct way to approach the problem of groundwater contamination. Instead the emphasis should instead be placed upon developing better ways to farm. Also, the legislators felt some regulations are difficult to enforce unless most people are already following the same regulations. Finally, Osterberg and Johnson wanted a less top-down approach to solving Iowa's groundwater contamination problems. Instead, a broader network was necessary to propose new ideas from several different places; for example the state government and state universities.[38]

In addition to state-level legislation, federal legislation also addressed agriculture and groundwater issues. Similar to the efforts of states other than Iowa, national legislation approached agriculture and groundwater as two separate issues. The Food Security Act of 1985 called for the Secretary of Agriculture to designate one state-level agricultural experiment station and one facility within the Agricultural Research Service (ARS) to examine "reducing farm input costs." The list included "using sustainable agricultural methods."[39] The creation of the Low-Input Sustainable Agriculture (LISA)

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[38] DeWitt John, *Civic Environmentalism*, 97-98

[39] Economic Research Service, "Provisions of the Food Security Act of 1985," USDA-ERS, http://www.ers.usda.gov/Publications/aib498/. The Act (Public Law 99-198) is in pdf format, http://www.ers.usda.gov/publications/aib498/aib498.pdf , 59

program in 1987 carried out this 1985 stipulation. The goal of LISA was to fund sustainable agricultural research into practices that might reduce the use of potentially harmful chemical inputs and agricultural techniques that lead to increased soil erosion and water quality contamination.[40] The LISA program was renamed the Sustainable Agriculture Research and Education (SARE) program in 1988. SARE has funded over 2,500 research projects.[41]

Other pieces of national legislation addressed groundwater contamination. The definition of "waters of the United States" that is used in legislation, including the Clean Water Act, does not contain the term *groundwater*.[42] Some national legislation contains sections that address groundwater contamination. The addition of underground storage tank (UST) provisions to the Resource Conservation and Recovery Act (RCRA) in 1984 included a section on groundwater contamination. A release of any kind from an underground storage tank requires investigation into the characteristics of the release, including potential contamination in groundwater wells.[43] The Safe Drinking Water Act (SDWA) includes provisions to protect groundwater sources used for drinking water from contamination. The addition of most of these provisions came during the 1990s.[44]

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[40] J. Patrick Madden, "The Early Years of the LISA, SARE, and ACE Programs," Western Region SARE, http://wsare.usu.edu/about/index.cfm?sub=hist_concept.
[41] SARE, "About Us," SARE, http://www.sare.org/about/index.htm. For estimated number of projects, SARE, "SARE Regions," SARE, http://www.sare.org/about/regions.htm.
[42] Duke K. McCall, "Clean Water Act," in *Environmental Law Handbook*, 18th Edition, ed. Thomas F.P. Sullivan (Lanham, Maryland: Government Institutes, 2005), 298.
[43] Karen J. Nardi, "Underground Storage Tanks," in *Environmental Law* Handbook, 18th Edition, ed. Thomas F.P. Sullivan (Lanham, Maryland: Government Institutes, 2005), 214. Covered in Section 9.8 of the UST portion of RCRA.
[44] Daniel J. Kucera, "Safe Drinking Water Act," in *Environmental Law* Handbook, 18th Edition, ed. Thomas F.P. Sullivan (Lanham, Maryland: Government Institutes, 2005), 459-461. At the time of the Groundwater Protection Act in 1987, the SDWA did not contain much on protection of groundwater.

There is no comprehensive groundwater protection legislation adopted at the national level.[45]

The federal government, particularly the Environmental Protection Agency and the United States Department of Agriculture, was also considering groundwater legislation, even holding a hearing within the House of Representatives on August 11, 1988, over pesticide contamination of groundwater. Representative James L. Oberstar from Minnesota resided and opened the hearing using agricultural war imagery. Rep. Oberstar saw "our food supply, vital to life" was being "threatened by some 2,000 species of weeds, 1,000 species of nematodes, and 10,000 species of insects, most of which live in my back yard, to say nothing of rodents, fungi, and other pests with which our farmers are forced to contend." Farmers were seen as on "the front line in the war against the pests." The dichotomy invoked by Rep. Oberstar was one of certain life or death, either use chemicals or die. America had difficult choices to make; "atrazine or starvation?" The topic of groundwater was also polarizing, "Some may argue that there is no problem and others, that we face another ecocalamity."[46]

Though opening with a seemingly dire sentiment, the hearing proceeded more or less in the middle of those two poles, with those participating in the hearing, many from Rep. Oberstar's home state of Minnesota, discussing the extent of and solutions to pesticide contamination of groundwater. The Honorable Senator Stephen Morse from the State of Minnesota offered a solution. "What we need is sustainable agriculture that will

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[45] Daniel M. Steinway, "Fundamentals of Environmental Law," in *Environmental Law Handbook*, 18th Edition, ed. Thomas F.P. Sullivan (Lanham, Maryland: Government Institutes, 2005), 8.
[46] House Committee on Public Works and Transportation, *Contamination of Ground Water by Pesticides*: *hearing before the Subcommittee on Investigations and Oversight*, 100th Cong., 2nd sess., 1988, 1-3.

make every attempt to minimize and reduce application and to sustain the resources, both of the land, the soil, and the water." But Senator Morse saw a problem; "what farmers tell me is that they don't have the resources to back them up as they try to move in that direction" towards these sustainable agricultural practices. Particularly "the Extension Service has been diluted," with so much emphasis on the entirety of rural life, "It's not everything to everybody."[47] Mr. Mark Maslyn, an assistant director within the American Farm Bureau Federation followed Senator Morse's testimony, and drew attention to the limited knowledge on pesticide contamination of groundwater. A lack of resources and a lack of research were two obstacles for adequately addressing these groundwater concerns. Mr. Maslyn also submitted for the record a paper written by Dr. Richard Fawcett from Iowa State University titled "Pesticides in Groundwater: Defining the Problem," which discussed concerns over the interpretation of Iowa groundwater data, particularly with regards as to solving the state's groundwater contamination problem. Dr. Fawcett noted that pesticide contamination of groundwater was "one of the most publicized issues in Iowa in 1987."[48]

As described above, Iowa was not the only state interested in groundwater contamination during the 1980s. The 1985 *Journal of Freshwater* listed twelve states with state specific groundwater statutes, twenty-seven states with existing groundwater quality protection policies in place, and twenty-eight states with policy under

[47] *Ibid*, 175
[48] *Ibid*, 177-186

development. Some states were counted in more than one category. Iowa was listed in the "policy under development" category.[49]

The Iowa legislature was developing a different type of groundwater policy, one grounded in research, education, and demonstration, with additional regulation; one that pushed for a non-degradation goal for contamination for all waters of the state; one that established research centers at the three public universities in Iowa; one that sought to answer Iowa's economic and environmental problems in the 1980s through fostering a conservation ethic in all Iowans. The act established the Leopold Center for Sustainable Agriculture at Iowa State University that is a model of an institutionalized ecological approach to agricultural issues. The next chapter addresses Iowa's specific groundwater contamination concerns about pesticides and fertilizers, and the policy the state developed as a result.

[49] No author, "Current Status of Groundwater Policy Development," *Journal of Freshwater* 9 (1985): 22. The issue was titled "Groundwater: New Perspectives, New Initiatives." This is excerpted from the US EPA, *Overview of State Groundwater Program Summaries*, Volume I, March 1985. This copy is included in the "Contamination of Ground Water by Pesticides" hearing, 279-321. "Current Status of Groundwater Policy Development," is found 301 of the publication.

The Iowa Problem
(2)

Turning the pages of the 1985 *Journal of Freshwater* provides a glimpse as to the cooperative and institutionalized policy under development in Iowa. This chapter describes this policy development process and demonstrates the importance and influence of Iowa's agricultural system. "Groundwater and Chemicals: The Risk of the Unknown" was the title of an article by Dr. George R. Hallberg, the chief of geological studies for the Iowa Geological Survey. Dr. Hallberg noted there was a new emphasis on groundwater contamination in the state following the spring of 1984 when "more than 40 public water supplies in Iowa went on notice for exceeding the drinking water standard for nitrates. The affected water supplies included Des Moines, the largest municipality in the country ever to exceed this standard." Recent research, particularly in northeast Iowa, focused on the connection between groundwater contamination and agricultural practices. Hallberg stressed that currently only shallow groundwater aquifers were showing contamination, "but this may simply be a function of time," leading to contamination of deeper aquifers.[50]

In the late 1970s and early 1980s states across the country, including Iowa, started finding pesticides in groundwater and treated drinking water.[51] Researchers in Iowa also continued to track nitrates in groundwater that originated from nitrogen fertilizers.[52]

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[50] George R. Hallberg, "Groundwater and Chemicals: The Risk of the Unknown," *Journal of Freshwater* 9 (1985): 23.
[51] George R. Hallberg, "Pesticide Pollution of Groundwater in the Humid United States," *Agriculture, Ecosystems and Environment* 26 (1989): 301-302.
[52] Two examples from *Rural Groundwater Contamination*. George R. Hallberg, "Nitrates in Iowa Groundwater," in *Rural Groundwater Contamination*, ed. Frank M. D'Itri and Lois G. Wolfson (Chelsea,

Questions were raised about the cause of these increasing pesticide and nitrate concentrations and about the full extent of the groundwater contamination in the state.[53] What level of chemicals and nitrates in drinking water could people tolerate?[54] What more could be learned about the relationship between farm practices and drinking water quality?[55] How could groundwater, and humans, be affected by a mixture of nitrates, pesticides, and herbicides?[56] What are the economic, social, and environmental costs of high yields? As a solution to the state's groundwater problems, Hallberg called for "a holistic perspective" in research, echoing Bailey's emphasis on cooperation and the NRC's systems approaches to agricultural concerns.[57]

Michigan: Lewis Publishers, Inc., 1987), 23-68, and Alfred Blackmer, "Losses and Transport of Nitrogen from Soils," in *Rural Groundwater Contamination*, ed. Frank M. D'Itri and Lois G. Wolfson (Chelsea, Michigan: Lewis Publishers, Inc., 1987), 85-103.

[53] George R. Hallberg, "Pesticide Pollution of Groundwater in the Humid United States," *Agriculture, Ecosystems and Environment* 26 (1989): 300-301. These recently formulated pesticides were supposed to break down quickly and not pose any problem. A few examples: Charles Bullard, "Half of cities' water tainted by pesticides," *Des Moines Register*, March 19, 1986, Front section. This front-page article in the *Des Moines Register* noted that public water supplies were not routinely tested for pesticides or other synthetic organic chemicals (p. 2A). However, in Larry Fruhling, "Ag chemicals emerge in groundwater study from Big Spring basin," *Des Moines Register*, May 5, 1986, Front section, Hallberg is quoted as saying, "The good news is that with everything we've compiled, we know we're at the very beginnings of these trends" (p. 12A). In Larry Fruhling, "Missing nitrogen: Fertilizer threatens Iowa groundwater," *Des Moines Register*, May 6, 1986, Front section, Winton Etchen of the Iowa Fertilizer and Chemical Association is quoted as saying, "We know we've got a problem and we're addressing it . . . Very simply, no one can tell us what happens to approximately 50 percent of the nitrogen we put on the ground" (p. 1A).

[54] Larry Stone, "Scientists see major chemical threat to water supplies," *Des Moines Register*, April 26, 1986, Front Section, p. 2A, Jim Baker, an agricultural engineer at Iowa State was quoted as saying, "But the real question is the level of chemicals that people can tolerate." As Larry Fruhling, "Missing nitrogen: Fertilizer threatens Iowa groundwater," *Des Moines Register*, May 6, 1986, Front section, stated, "The consequences to human health from nitrate-polluted water stumble into a worrisome abyss of ifs, ands, buts and maybes" (p. 6A).

[55] Larry Fruhling, "Ag chemicals emerge in groundwater study from Big Spring basin," *Des Moines Register,* May 5,1986, Front section, p. 1A, a quote from George Hallberg, chief of geological studies for the Iowa Geological Survey, about the work at Big Spring. "We've clearly been able to demonstrate that what we do on the land surface affects our groundwater, our drinking water."

[56] Larry Fruhling, "Water in Iowa tainted by farming chemicals," *Des Moines Register*, May 4, 1986, Front section, p. 4A.

[57] George R. Hallberg, "Pesticide Pollution of Groundwater in the Humid United States," *Agriculture, Ecosystems and Environment* 26 (1989): 302.

But any solutions or approaches to the agricultural system in Iowa were complicated by the sheer immensity of the agricultural system in the state. Consider if hogs were able to vote in Iowa. They outnumber humans in the state by a ratio greater than 6 to 1, and would certainly give a new definition to "pork barrel politics."[58] If corn plants could vote, Iowans would be outnumbered approximately 95,000 to 1.[59] Their campaign slogan might be, "We're all ears!" Beyond this simple comparison, Iowa is also culturally and economically dependent on agriculture.[60] These dependencies have long been recognized by Iowans. "The wealth of Iowa is definitely geared to her agricultural economy," wrote Iowa historian William J. Petersen in 1952.[61] "Her rich

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[58] Hogs outnumber Iowans 6.37 to 1. Using the population estimate of 2,966,334 from the Iowa Department of Economic Development, "Statistics," Travel Iowa, http://www.traveliowa.com/iowafacts/statistics.html, and the estimate of 18.9 million hogs from the Iowa Department of Agriculture and Land Stewardship, "Iowa Agriculture Quick Facts 2007," Iowa Department of Agriculture and Land Stewardship, http://www.iowaagriculture.gov/quickFacts.asp.

[59] Using the estimate of approximately 90,000 kernels of corn per bushel from the National Corn Growers Association Education, "Unit 1: Lesson 3 You Can Count On Corn," National Corn Growers Association, http://www.ncga.com/education/unit1/u1l3.html; using 800 as the average number of kernels per corn plant (and assuming one cob per plant as described by the website) from Iowa Corn, "Corn Use & Education: Frequently Asked Questions about Corn in Iowa," Iowa Corn Promotion Board/Iowa Corn Growers Association, http://www.iowacorn.org/cornuse/cornuse_20.html; and the 2,511,000,000 bushels of corn produced in 2007 from the National Agricultural Statistics Service (NASS), "Data and Statistics," United States Department of Agriculture NASS, http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp; the number of corn plants per Iowan, using the 2006 population estimate of 2,982,085 from the US Census Bureau, "Iowa," US Census Bureau, http://quickfacts.census.gov/qfd/states/19000.html, can be calculated. (2,511,000,000 bushels of corn)*(90,000 kernels of corn per bushel)/(800 number of kernels per corn plant), then divided by (2,982,085 population of Iowa) = 94728.19 corn plants per Iowan, roughly.

[60] 95% of Iowa's land was in farms in the 1940s, according to W.G. Murray, "Struggle For Land Ownership," in *1846-1946 - A Century of Farming in Iowa*, ed. Members of the Staff of the Iowa State College and the Iowa Agricultural Experiment Station (Ames, Iowa: Iowa State College Press, 1946), 1. Currently Iowa is slightly less economically dependent on agriculture due to growth in non-farm based industry. To learn more about Iowa's current economic dependence on agriculture, see Dave Swenson and Liesl Eathington, "Multiple Measures of the Role of Agriculture in Iowa's Economy," Department of Economics, College of Agriculture, Iowa State University, http://www.econ.iastate.edu/research/webpapers/paper_10180.pdf.

[61] Petersen continued to speculate that the state would prosper should agricultural production remain strong, even if all the industries of Iowa disappeared. However, if agriculture collapsed, "the bulk of Iowa industry would disappear with it and manufacturing centers would crumble in ruins." William J. Petersen, *The Story*

black soil, her invigorating climate, her abundant rainfall, and her intelligent and industrious farmers combine to give the state a position of pre-eminence in agriculture," wrote Petersen.[62] Many histories of Iowa emphasize the land's importance in the state's agricultural "pre-eminence."[63] This cultural dependence continues today. As the 2003 book *Renewing the Countryside – Iowa* noted, "Iowa's heritage lies in its rural and farming communities."[64] Iowa's very identity comes from agriculture. So it is an identity crisis for the state and the country when the industrialized agricultural system produces problems as well as record yields. Whether it was the "risk of the unknown" as characterized by Hallberg, or the "ugly side of a bountiful harvest," according to Larry Fruhling in the *Des Moines Register*.[65]

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of Iowa: The Progress of an American State, Volume II (New York: Lewis Historical Publishing Company Inc., 1952), 1063.

[62] *Ibid*, 1052

[63] Regardless of when these histories were written, they still illustrate Iowa's cultural ties to agriculture. Most histories written about Iowa summarize the value of the land to Iowa agriculture through one or two key sentences. Some authors go on from this to devote a chapter to the geological history of Iowa's soils, for example Leland Sage, *A History of Iowa* (Ames, Iowa: Iowa State University Press, 1974), 3-22. Sage focuses on the political history of Iowa, but includes a first chapter titled "The Beautiful Land," written by Dr. Herman L. Nelson, a professor of Geography (p. vii). Nelson notes that Iowa has the best climate for corn in the world (p. 7). Dr. Nelson opens with the definition of the word *Iowa*, "the beautiful land," and in discussing the history of the state writes, "But first there was the land. The chief concern of a proper Iowan should be always to understand his land" (p. 3). Dorothy Schwieder, *Iowa: The Middle Land* (Ames, Iowa: Iowa State University Press, 1996) emphasizes the social and economic history of Iowa. Yet early in the preface notes, "…in Iowa the land dominates. It does so in a particularly tidy fashion" (p. ix). More agriculturally-focused books also emphasize the quality of Iowa's farmland. William J. Petersen, *The Story of Iowa: The Progress of an American State, Volume II* (New York: Lewis Historical Publishing Company Inc., 1952), 1052, begins his chapter on agriculture in Iowa by noting the state is a "land of plenty," and attributes the productivity of Iowa's farmland to the state's soils, "invigorating climate," a good amount of rainfall, and "her (Iowa's) intelligent and industrious farmers," with soil being the most important natural resource in Iowa. Earle D. Ross, "An Overview," in *1846-1946 - A Century of Farming in Iowa*, ed. Members of the Staff of the Iowa State College and the Iowa Agricultural Experiment Station (Ames, Iowa: Iowa State College Press, 1946), v, notes that "Nature herself has provided the basic factors in Iowa's agricultural pre-eminence."

[64] Thomas J. Vilsack, foreword to *Renewing the Countryside – Iowa*, ed. Shellie Orngard and Jan Joannides (Ames, Iowa: Sigler Printing and Publishing, 2003), 7.

[65] Larry Fruhling, "Water in Iowa tainted by farm chemicals," *Des Moines Register*, May 4, 1986, Front section, 1A.

Dr. Hallberg was not the only one to respond to these concerns by looking for comprehensive, institutional, and education-based answers to Iowa's water troubles. In addition to drawing drinking water from the most polluted tributary of the Mississippi River, Des Moines is also the state capitol, and legislators were certainly noticing groundwater contamination.[66] During the 1980s, state legislative efforts focused on understanding Iowa's water resources and developing an institutional and cooperative strategy for groundwater protection. Water quality had been a concern in Iowa prior to the 1980s, but the issue certainly gained prominence during the decade. In 1957, the Iowa Water Law passed the legislature unanimously and formed the cornerstone of water regulation in the state. The act declared that Iowa's waters were the "wealth of the people." The water law established permit systems for large-scale water use and required minimal streamflow levels be met.[67]

In 1982, the Iowa legislature mandated the Water, Air and Waste Management Commission, within the state's Department of Water, Air and Waste Management, to complete a State Water Plan by 1985. The Iowa Water Plan focused on assessing the quality and availability of water resources in Iowa and preparing plans for the allocation of these water resources based upon present and future water use.[68] Most importantly for this project, the 1985 State Water Plan called for further study of the state's groundwater

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[66] Highest nitrate levels of any tributary from, Watershed and Clean Water Grants Program, "Iowa's Raccoon River and Walnut Creek Watershed: Where People and the Forest Connect for Clean Water," http://www.na.fs.fed.us/watershed/factsheets/Raccoon2001.pdf

[67] Water, Air and Waste Management Commission, "The 1985 State Water Plan" Iowa Department of Water, Air and Waste Management, http://www.iowadnr.com/water/files/1985waterplan.pdf. Quote from "Executive Summary," ii. A pdf of the document is available from Iowa DNR Water Quality, "Water Quantity," Iowa Department of Natural Resources, http://www.iowadnr.com/water/quantity.html. Page numbers cited are from the actual document. The 1978 State Water Plan is also available.

[68] *Ibid*, i

resources. The public was worried about its water. "In preparing the Water Plan the Department and Commission encountered a high degree of concern regarding the continued availability of high quality groundwater," the report stated. Though an issue of interest, no regulations concerning groundwater could be proposed because the Iowa Water Plan only addressed issues of water availability and use. "However," the report continued, "in view of the high utilization of groundwater and the potential for degradation of quality, the Commission is asking for a legislative mandate for the Department to prepare a Comprehensive Groundwater Protection Strategy."[69]

The commission received its mandate. In 1985, the Iowa General Assembly requested the Water, Air and Waste Management Commission to write the Iowa Groundwater Protection Strategy and report back to the legislature in 1987. The Environmental Protection Commission formed when the Water, Air and Waste Management Commission and Department of the same name reorganized. In the requested year it presented a groundwater strategy that focused on contamination from human activities.[70] The report contained 27 recommendations for groundwater protection to be implemented over the next decade, with 14 of these recommendations requiring actions by the state legislature. "When viewed as a whole," the report began, "the Strategy recognizes that the very presence of human activities has impacts upon the environment and the quality of groundwater. It (the report) also recognizes that we can

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[69] *Ibid*, iv

[70] Bernard E. Hoyer, James E. Combs, Richard D. Kelley, Constance Cousins-Leatherman, John H. Seyb "Iowa Groundwater Protection Strategy," Environmental Protection Commission, Iowa Department of Natural Resources, http://www.iowadnr.com/water/files/ground1987.pdf. A pdf of this document http://www.iowadnr.com/water/files/ground1987.pdf is available Iowa DNR Water Quality, "Water Quantity," Iowa Department of Natural Resources, http://www.iowadnr.com/water/quantity.html. Page numbers cited are from the actual document. *Iowa Groundwater Protection Strategy*, 2

do more to protect water quality and that society is demanding that we do more." The estimated cost of this ten-year plan was $230 million dollars.[71]

The Iowa Groundwater Protection Strategy utilized an "ethic of prevention" that protected the state "both from the known and the unknown," in addition to probably being "the least expensive way of ensuring our valuable drinking water sources, too." The report emphasized "protecting groundwater as a resource," and noted this was not to be confused with a plan for protecting drinking water.[72] Only broad protection of all groundwater would protect rural and urban Iowans.[73] The strategy recommended that non-degradation remain the goal of all groundwater policies and programs in Iowa. This meant that existing water quality conditions should be maintained, and that already contaminated water resources should be worked back to pre-contamination conditions.[74]

It was not just the Iowa legislature that was investigating groundwater pollution in the state; the press was also actively covering the topic too. The *Des Moines Register* emphasized this societal cost of agricultural production through their six-part groundwater series in May 1986 titled “Iowa’s Water: Not a Drop to Drink?” These six articles ran between May 4, 1986 and May 11, 1986, and focused on several aspects of Iowa's groundwater, including nitrogen runoff from farm fields, pesticides found in water samples, and groundwater research conducted in northeast Iowa. These articles also

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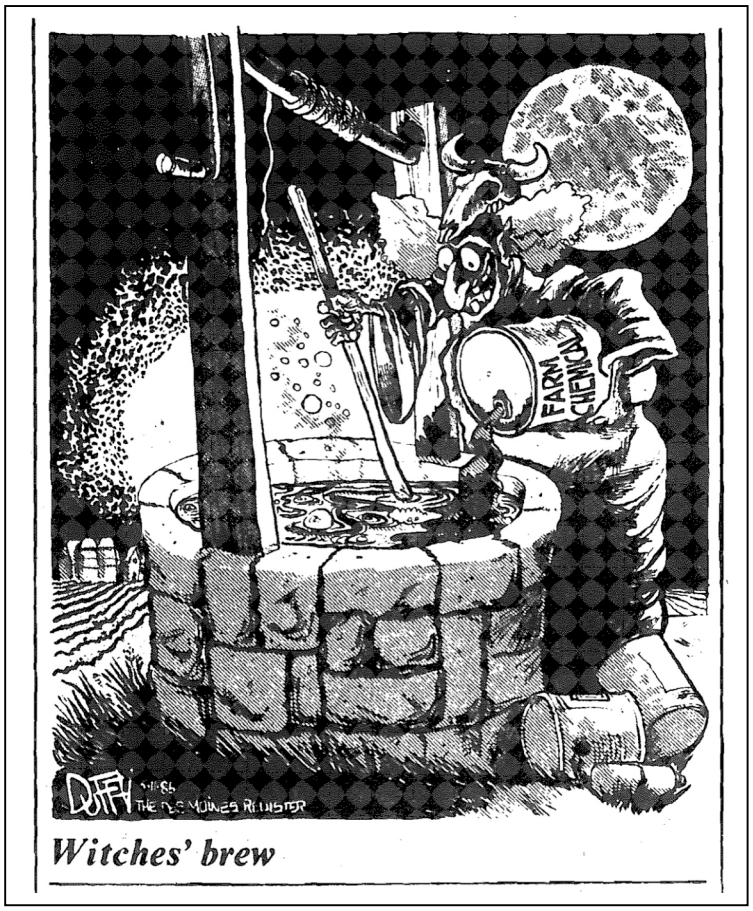
[71] *Ibid*, i
[72] *Ibid*, 3
[73] *Ibid*, 44. Mentioned throughout the Strategy, the alternative to the type of protection advocated is called "differential protection," and emphasizes protecting those areas for specific uses, for example, for a city's drinking water supply. However, the commission noted that Iowa’s population was not concentrated enough to warrant differential protection. In the late 1980s, Iowa’s population was approximately half urban and half rural. To protect all Iowans, groundwater throughout the state needed to be protected as well.
[74] *Ibid*, 43

featured several graphs and illustrations detailing the use of fertilizers and pesticides on Iowa's farmland and the location of drinking water supplies contaminated with these inputs, including this front-page editorial cartoon on May 11, 1986.[75]

Figure 1. Front-page editorial cartoon from *Des Moines Register,* May 4, 1986



Source: *Des Moines Register,* May 4, 1986, A1

[75] This was a six-part series that primarily ran on the front-page of the *Des Moines Register* on May 4-8, and 11, 1986. Other articles about groundwater were written in the *Register* and in other Iowa papers, but this series was prominent. Larry Fruhling "Water in Iowa tainted by farming chemicals," *Des Moines Register*, May 4, 1986, front page, A1; Larry Fruhling, "Ag chemicals emerge in groundwater study from Big Spring basin," *Des Moines Register*, May 5, 1986, front page, A1; Larry Fruhling, "Missing nitrogen: Fertilizer threatens Iowa groundwater," *Des Moines Register*, May 6, 1986, front page, A1; Larry Fruhling, "Ghost of 1976 lab fraud haunts water safety today," *Des Moines Register*, May 7, 1986, front page, A1; Melinda Voss, "Farm family worried about drinking others' chemicals," *Des Moines Register*, May 8, 1986, front page, A1; Larry Fruhling, "Farmers paying price of heavy chemical use," *Des Moines Register*, May 11, 1986, A1.

Des Moines Register reporter Larry Fruhling observed that, "the waters beneath Iowa's rich earth are becoming a caldron of farm chemicals and crop nutrients."[76] The *Iowa Groundwater Protection Strategy* also raised questions as to the safety of drinking this brew. "Equally important, our knowledge about acceptable levels of contamination for any one pollutant, much less for a 'stew' of contaminants, is extremely limited."[77] What was in this brew and who could be drinking it?

The number of Iowans partaking of the brew was a concern as approximately 80% of the state's population relied upon groundwater for drinking water and 75% of the poultry and livestock in state relied upon this resource too.[78] The brew contained a complex recipe, containing farm chemicals as noted by the National Resource Council, but also could have contributions from landfills, lagoons, agricultural drainage wells, and hazardous waste spills.[79]

Of these different ingredients, Iowa's agricultural system added the most to this recipe for the bubbling brew. The agricultural system of Iowa that intensively produced corn and soybeans on approximately 60% of Iowa's land surface facilitated the extensive

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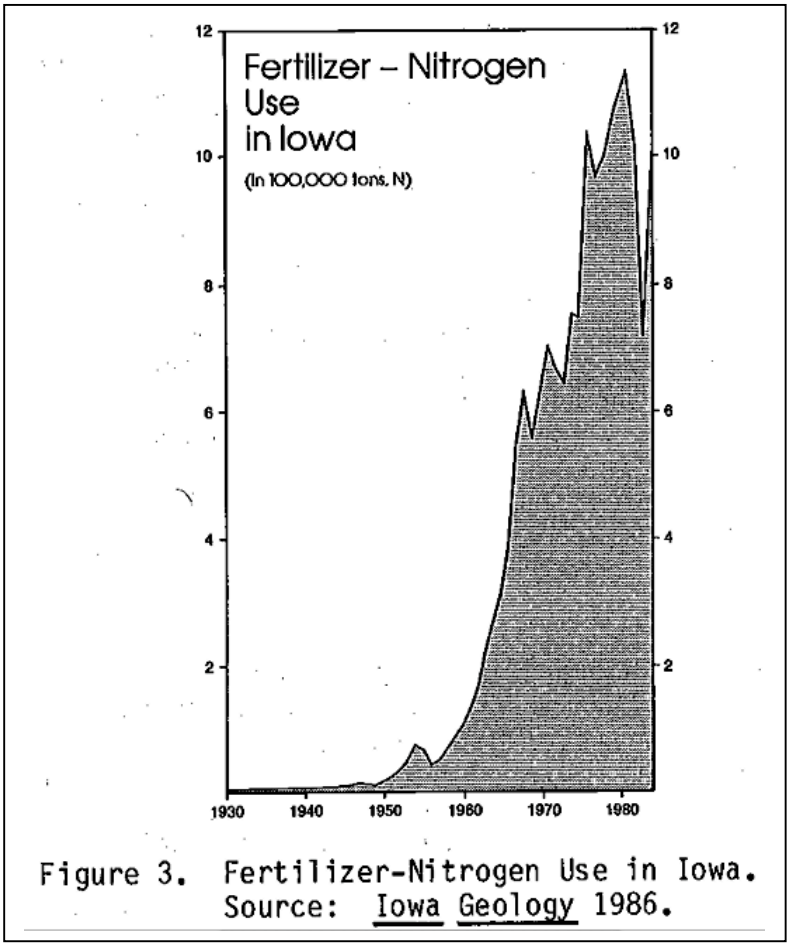
[76] Larry Fruhling, "Water in Iowa tainted by farming chemicals," *Des Moines Register*, May 4, 1986, front page, A1.
[77] *Iowa Groundwater Protection Strategy*, 44
[78] Jean Cutler Prior, Janice L. Boekhoff, Mary R. Howes, Robert D. Libra, and Paul E. VanDorpe, *Iowa's Groundwater Basics* (Iowa: Iowa Department of Natural Resources, 2003), 54-55. Available online http://www.igsb.uiowa.edu/gwbasics/
[79] For hazardous waste concerns, the report identified sites within the state and transport through the state as two primarily concerns. Iowa was found to have 146 hazardous waste facilities, about 1,300 agriculture chemical dealerships, and over 1,400 automotive service and repair shops. The transport of hazardous materials through the state was also of concern, considering there were 1,859 chemical spills. The report discussed land application of sewer sludge and animal waste for fertilizing purposes but did not see these as a significant threat to groundwater quality. *Iowa Groundwater Protection Strategy*, 20-21.

use of nitrogen fertilizers and pesticides, as noted by this graph in the 1987 *Iowa Groundwater Protection Strategy*.[80]

Figure 2. Nitrogen use in Iowa figure from the *Iowa Groundwater Protection Strategy,* 1987.



Source: *Iowa Groundwater Protection Strategy*, 12

[80] Corn has dominated Iowa's agricultural production since the 1890s, with rapid increased in production during the second half of the nineteenth century. Soybean production has also dramatically increased since the 1940s, with the cumulative effect that since the 1970s over 50% of Iowa is planted in corn and soybeans combined, and beginning in the mid-1990s consistently covered 60% of the state. These percentages calculated fron NASS planting data for corn and soybeans and the size of the state, 55,869.36 square miles, from US Census data. The industrialized infrastructure also changed the types of plants that were grown. Iowa farmers in the 1800s produced wheat, corn, oats, barley, rye, flax, hay, cattle, swine, sheep, and horses as described by Allan G. Bogue, *From Prairie To Corn Belt: Farming on the Illinois and Iowa Prairies in the Nineteenth Century* (Chicago: University of Chicago Press, 1963), 124. Between 1840 and 1900, Iowa farms produced hogs, hay, butter, corn, wheat, oats, potatoes, orchard fruits, raisins, wine, cheese, eggs, and poultry, from Benjamin Gue, *History of Iowa from the earliest times to the beginning of the twentieth century, Volume III: 1866-1903* (New York: The Century History Company, 1903), 287-289.

Extensive chemical use in agriculture rapidly increased during the second half of the twentieth century. For example, in the United States, use of nitrogen increased from 378 million pounds in 1930 to 11.5 billion pounds in 1985.[81] The 1987 Iowa Groundwater Protection Strategy, an important precursor to the Iowa Groundwater Protection Act, noted the increased use of nitrogen as a fertilizer in its report. Though planted acres of corn in the state began to substantially increase during the 1930s, nitrogen use minimally increased during the 1950s and dramatically jumped in the 1960s. The high peak on the graph in the early 1980s was approximately 1.1 million tons or 2.2 billion pounds; enough to cover every acre of Iowa with 60 pounds of nitrogen. Nitrogen use has declined from this peak in the early 1980s, with roughly 800,000 tons of nitrogen used on corn in the state during the 1990s and 2000s; equivalent to 1.6 billion pounds.[82] For example, between 1960 and 1976, a ten-fold increase in nitrogen fertilizer use occurred.[83]

Nitrogen fertilizers were used across the Iowa landscape, as approximately 1/3 of the state's 35 million acres are devoted to corn annually. To put this much of the land into one crop, the state's entire landscape was altered to develop and maintain an agricultural infrastructure. Prairies, wetlands, and forests that accounted for nearly the entire landscape of the state in the early 1800s were reduced to roughly 7% of the landscape today; replaced by farmland. Most notably, prairies were reduced from an

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[81] Don Paarlberg and Philip Paarlberg, *The Agricultural Revolution of the 20th Century*, 34

[82] Data from NASS Quick Stats database, specifically "Chemical Use." There are breaks in the data reflecting a shift in the surveying process of the National Agricultural Statistics Service. Corn is the largest user of nitrogen, so there has been some level of decrease in nitrogen use, though not as large as this data indicates. Use of nitrogen is lower than its peak in the late 1980s, however the use of nitrogen has remained constant during the 1990s and 2000s.

[83] George R. Hallberg, "Groundwater and Chemicals: The Risk of the Unknown," *Journal of Freshwater* 9 (1985): 23.

estimated 28.6 million acres in the early 1800s to approximately 28,000 acres currently.[84] Additionally, tiled fields, rural wells, drainage wells, roads, and railroads were all laid down to increase crop yields and facilitate transport to markets.[85] Also, the dramatic increase in the non-human population of the state, with nearly fifteen million hogs, seven million cattle and calves, and five million turkeys far outnumbered the human population of Iowa, just under three million people.[86]

Finally, the soil and geology of Iowa influenced the potential for groundwater pollution and added to the state's groundwater brew. The karst region of northeast Iowa, characterized by shallow groundwater resources and sinkholes, was found to be particularly susceptible to groundwater pollution and was studied through the Big Spring Basin Demonstration Project.[87] This same research effort was featured in the *Des Moines Register's* series on the state's groundwater in 1986. The most susceptible groundwater

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[84] Daryl D. Smith, "Iowa Prairie: Original Extent and Loss, Preservation and Recovery Attempts," *Journal of the Iowa Academy of Science* 105 (1998): 94, 96, 99, and Richard A. Bishop, "Iowa's Wetlands," *Proceedings of the Iowa Academy of Science* 88 (1981): 11-16. Wetlands were also reduced from 1.8 million acres to 26,740 acres, a 95% reduction. Prairies were reduced by 99.95%. Forests were not as dramatically reduced, with an estimated 6.7 million acres of forests in the 1850s, and 2.8 million acres today. There is always variability with these numbers. The numbers used here are from the Iowa DNR Forestry, "Iowa Forest Health," Iowa Department of Natural Resources http://www.iowadnr.com/forestry/health.html, and Aron Flickinger, "Iowa's Forest Health Report, 2006," Iowa Department of Natural Resources, http://www.iowadnr.com/forestry/files/06_foresthealth.pdf. Smith uses land cover estimates from a variety of sources, between 4.2 and 6.9 million acres. The 7% current coverage is a rough estimate, utilizing the above sources.

[85] Allan Bogue, *From Prairie to Corn Belt: Farming on the Illinois and Iowa Prairies in the Nineteenth Century*, (Chicago: University of Chicago Press, 1963), 281 notes that there were "few prairie farmers living beyond earshot of the locomotive's whistle in 1885." Bogue discusses these large landscape changes in several places, including the third chapter, "Farms on the Breaking," 67-85 and his eighth chapter, "How To Farm Sitting Down," 148-168.

[86] Comparing US Census data for Iowa with NASS 2007 production data for the state.

[87] Robert D. Libra, "Agriculture and Groundwater: The View from Big Spring," Iowa DNR Geological Survey, http://www.igsb.uiowa.edu/browse/bigsprng/bigsprng.htm. There is also a general project website, "Big Spring Basin Demonstration Project 1986-1992," http://extension.agron.iastate.edu/Waterquality/projects/bigspring.html. Karst regions are defined by large underground openings that form when "percolating waters dissolve rock along fractures and bedding places in limestone." Three characteristics of karst areas are sinkholes, caves, and streams, as described by

aquifers in the state were shallow ones that were within fifty feet of the land's surface, with the potential for contamination determined by the specific chemical's mobility, properties, breakdown rate, and the amount.[88]

This was the complex recipe of Iowa's groundwater brew. With a diversity of potential pollutants, the ethic of prevention that was promoted in the Iowa *Groundwater Protection Strategy* perhaps provided the best strategy as opposed to extensive regulation for specific sources. Protecting all aquifers in the state could also "set in place an ethic which can carry over into all personal and economic activities."[89] The strategy boldly proposed that "all of our resources and all of our people deserve protection."[90] Economics were not enough to adequately measure how important groundwater was to the state. "As a society, we must look at groundwater like the soils of the State. Both are important to the quality of life and are things to which dollar-and-cent values must not be assessed." To protect this indispensable resource, the Environmental Commission called upon the Iowa General Assembly to draft and pass groundwater specific legislation in 1987.[91]

The Iowa legislature answered this call by drafting a bill based upon research, education, and demonstration that was grounded in ecology and an institutional systems approach to the state's groundwater concerns. Beating at the core of this response, the philosophical and practical "heart and soul" of the Groundwater Protection Act, was a

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Charles R. Fitts, *Groundwater Science* (New York: Academic Press, 2002), 116. These cause problems because any chemical runoff, for example, can quicky and directly reach groundwater sources.
[88] Jean Cutler Prior et al., *Iowa's Groundwater Basics*, 62-63
[89] Bernard E. Hoyer et al., *Iowa Groundwater Protection Strategy*, 3
[90] *Ibid*, 44
[91] *Ibid*, 61

research center at Iowa State University focused on sustainable agriculture. Why was this center so important? What was unique about the Iowa legislature's bill in 1987? The next chapter seeks to address these questions.

A Legislative Response to Groundwater Pollution (3)

The commission received its request, for the second time. In 1987, the Iowa legislature drafted and passed the Iowa Groundwater Protection Act, using many of the recommendations from the Iowa Groundwater Protection Strategy. The concept of legislating a response to Iowa's groundwater concerns was not new. During the mid-1980s the Iowa legislature had a window of opportunity and did legislate research, education, and demonstration-based activities that would approach some of the agricultural problems in the state concerning groundwater.[92] However, what was new about the Groundwater Protection Act was that it furthered these current projects; for example, through providing further funding for the Big Spring Basin Demonstration Project in northeast Iowa, and also by broadening groundwater concerns to non-agricultural practices as well. The passage of this substantial act can be attributed to the right people, being at the right place, at the right time. The Groundwater Protection Strategy called for an ethic of prevention that could protect groundwater, but the Iowa legislature broadened this ethical consideration considerably in the passage of the Groundwater Protection Act by looking to Iowan Aldo Leopold and his Land Ethic, not

[92] In 1986 legislation passed that created the Agricultural Energy Management Advisory Council and the Integrated Farm Management Demonstration Project (IFMDP). The groundwater research at the Big Spring Basin Demonstration Project was additionally funded through the IFMDP. This is described by Gerald A. Miller and Susan S. Brown, "Big Spring: Farming From the Ground "Water" Up: Evolution of a Water Quality Project," Iowa State University Agronomy Extension, http://extension.agron.iastate.edu/waterquality/bigsprep.html. Also see DeWitt John, *Civic Environmentalism* (Washington, D.C.: CQ Press, 1994), 85-100, where he discusses efforts prior to the Groundwater Protection Act. For a discussion of windows of opportunity see Judith A. Layzer, *The Environmental Case: Translating Values into Policy* (Washington, D.C.: CQ Press, 2002), 16.

only to name the new sustainable agriculture research center at Iowa State University, but also to provide the "heart and soul" of the entire Groundwater Protection Act.

By using Leopold's ideas as the basis of the act, the Iowa legislature invoked Leopold's ethical and ecological ideas, most famously articulated in Leopold's *A Sand County Almanac*, published in 1949, in which he clearly defined the concept of the land ethic and its relationship to ecology. "That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics. That land yields a cultural harvest is a fact long known, but latterly often forgotten," Leopold wrote.[93] He also provided a broad definition of the land ethic: "the land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land." Leopold asserted that the use of this ethic held dramatic consequences for human dominance of the planet. "In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it."[94]

Aldo Leopold was born on January 11, 1887 in Burlington, Iowa and passed away on April 21, 1948. In addition to his *A Sand County Almanac* published in 1949, Leopold also wrote *Game Management*, a textbook on the subject, published in 1933. Leopold worked for the U.S. Forest Service in the American Southwest from 1909 to 1924, when he joined the Forest Products Laboratory in Madison, Wisconsin. In 1933, he became the chair of game management at the University of Wisconsin-Madison. The "Land Ethic" formally articulated in *A Sand County Almanac* is influential for proposing a relationship

[93] Aldo Leopold, *A Sand County Almanac and Sketches Here and There* (New York: Oxford University Press, 1949), viii-ix.
[94] *Ibid*, 204

with landscapes based not solely on economic value.[95] The Leopold Center for Sustainable Agriculture was the "heart and soul" of the Groundwater Protection Act because the Center provided the most focused and direct method of educating Iowans and fostering a conservation ethic.[96]

Just as Leopold broadly viewed the land, the Iowa legislature broadly viewed potential contamination of the state's groundwater. The act addressed numerous sources of groundwater pollution, including closing certain types of water wells, known as agricultural drainage wells, which drained farm fields by taking excess water directly into the groundwater below, regulating the disposal of hazardous wastes in Iowa landfills, and creating additional underground storage tanks rules. These tanks were below ground and usually held gasoline, natural gas, or septic systems. Other specific stipulations of the bill included conducting a rural well water survey and creating a groundwater vulnerability map that would illustrate how susceptible the state was to groundwater pollution. The act worked to protect Iowa's groundwater through the creation of long-term funding sources and an emphasis on research, education, and demonstration.

Carrying forward the Groundwater Protection Strategy's ethic of prevention, the goal of the act was "to prevent contamination of groundwater from point and nonpoint sources of contamination to the maximum extent practical," and if groundwater was contaminated, "to restore the groundwater to a potable state, regardless of present

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[95] Curt Meine, *Aldo Leopold: His Life and Work* (Madison, Wisconsin: University of Wisconsin Press, 1988), 518-520. Other brief descriptions of Leopold's life appear on the back cover of Aldo Leopold, *A Sand County Almanac* (New York: Oxford University Press, 1949) and on the back cover of *Aldo Leopold: The Man and His Legacy*, ed. Thomas Tanner (Ankeny, Iowa: Soil and Water Conservation Society, 1995).
[96] Paul W. Johnson, "What is the true value of the land?" *Des Moines* Register, June 26, 1988, Metro section, C1.

condition, use, or characteristics." This non-degradation goal was highly controversial. Neither other states nor the federal government adopted such a strict policy on groundwater pollution. From the Iowa legislators' perspective, creating standards for groundwater quality legalizes a certain level of contamination.[97] As former Executive Director of the Board on Agriculture for the National Research Council Charles M. Benbrook put it, such standards would create a "license to pollute."[98]

The non-degradation goal was openly debated during the passage of the act. Testimony from a March 11, 1987 public hearing on groundwater allowed proponents and opponents of non-degradation to voice opinions. Of the nineteen pieces of testimony offered on the act during the public hearing, eleven specifically discussed the non-degradation goal. The supporters of the goal included a local chapter of the Association for Public Justice, the League of Women Voters, the Sierra Club, the Director of the Iowa Department of Natural Resources, and the Iowa Association of County Conservation Boards. Some of the opponents of the goal were the Iowa Farm Bureau Federation, the National Agricultural Chemicals Association, the Iowa Soybean Association, and John Deere Component Works. Primarily these groups were concerned the non-degradation goal was unrealistic and too idealistic; some form of standards had to be adopted to protect groundwater quality.[99]

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[97] Gordon Meeks, Jr., *State Policy Issues in Sustainable Agriculture* (Denver, Colorado: National Conference of State Legislatures, 1989), 32.
[98] Charles Benbrook, "Agriculture and Groundwater Quality: Policy Implications and Choices" (paper presented at the 1989 annual meeting of the AAAS, San Francisco, California, January 17, 1989, 17.
[99] *Groundwater Protection Testimony*, March 11, 1987. From the files of former State Representative Ralph Rosenberg.

Though debated, the non-degradation goal remained within the Iowa Groundwater Protection Act. To achieve this goal, the Iowa legislature passed eight policies for groundwater protection (See Figure 1). Leopold's influence can be seen in the eighth policy to "strive to establish a conservation ethic among Iowans and should encourage each Iowan to go beyond enlightened self-interest in the protection of groundwater quality."[100]

[100] See Figure 1. Eight Groundwater Protection Policies from Iowa's Groundwater Protection Act, 1987 or Section 105 of the final version of HF 631, the Groundwater Protection Act of 1987, p. 3 - 4 of the act.

Figure 1. *Eight Groundwater Protection Policies from Iowa's Groundwater Protection Act, 1987*

"1. It is the policy of the state to prevent further contamination of groundwater from any source to the maximum extent practical."

"2. The discovery of any groundwater contamination shall require appropriate actions to prevent further contamination . . ."

"3. All persons in the state have the right to have their lawful use of groundwater unimpaired by the activities of any person which render the water unsafe or unpotable."

"4. All persons in the state have the duty to conduct their activities so as to prevent the release of contaminants into groundwater."

"5. Documentation of any contaminant which presents a significant risk to human health, the environment, or the quality of life shall result in either passive or active cleanup. In both cases, the best technology available or best management practices shall be utilized . . ."

"6. Adopting health-related groundwater standards may be of benefit in the overall groundwater protection or other regulatory efforts of the state. However, the existence of such standards, or lack of them, shall not be construed or utilized in derogation of the groundwater protection goal and protection policies of the state."

"7. The department (Iowa Department of Natural Resources) shall take actions necessary to promote and assure public confidence and public awareness . . . the department shall make public the results of groundwater investigations."

"8. Education of the people of the state is necessary to preserve and restore groundwater quality. The content of this groundwater protection education must assign obligations, call for sacrifice, and change some current values. Educational efforts should strive to establish a conservation ethic among Iowans and should encourage each Iowan to go beyond enlightened self-interest in the protection of groundwater quality."

Source: Groundwater Protection Act of 1987, final version of House File 631, p. 3 - 4 of the act, Section 105, that established a new section in the Iowa code, 455E.5 titled "Groundwater Protection Policies." These eight policies clearly show that groundwater protection was the responsibility of the state and the individual, and illustrate the combined practical and philosophical approach to groundwater contamination. Policies 1, 2, 5, and 6, approach groundwater contamination from the state-level and work to protect Iowa's groundwater resources. Policies 3, 4, 7, and 8 approach groundwater contamination from a philosophical approach by giving Iowans the right to groundwater and the duty to protect it, in addition to working towards a state-wide conservation ethic.

Though couching itself as an act for public health and safety in the preamble, the wording could easily have included "the health and safety of Iowa's landscape" because, as pointed out above, the Groundwater Protection Act was comprehensive in identifying sources of groundwater pollution and in its use of practical and philosophical approaches to the problems.[101] As a piece of legislation, the act described itself as "relating to public health and safety" and established "measures to improve and protect groundwater quality and to manage substances which pose health and safety hazards."[102] The act clearly noted the importance of groundwater to Iowa; "Protection of groundwater is essential to the health, welfare, and economic prosperity of all citizens of the state."[103]

In addressing the state's groundwater contamination, the act established certain institutional responsibilities and specific groundwater programs throughout the state. This emphasis on looking to institutions and state agencies to actively participate, and in cooperation with one another, is similar to the type of programs advocated by Liberty Hyde Bailey and the National Research Council. The Iowa Department of Natural Resources was given several new responsibilities including developing a groundwater monitoring network, completing a groundwater vulnerability map by 1991, creating a system for gathering and disseminating groundwater quality data, registering agricultural drainage wells and underground storage tanks, and developing a environmental education program about groundwater for students in grades seven and eight in cooperation with the

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[101] As comprehensive as possible. The act did not discuss animal confinements, for example. Something that was an issue in the 1980s, but not nearly as big of an issue as in later years. Yet the act did work to identify more than just agricultural sources and demonstrated that groundwater pollution was not just a farming problem.

[102] Iowa legislature, House File 631, 1987, 1. See appendix on legislature sources for description of accessing this online.

[103] *Ibid*, 2

University of Northern Iowa's Department of Education and Department of Environmental Education. The Department of Agriculture and Land Stewardship was given new responsibilities including encouraging sound agricultural practices, adopting certification rules and tests for pesticide applicator training, developing a program based on education and demonstration that advocates sound management of fertilizes and pesticides, and creating a program to stop contamination of groundwater from sinkholes. The Iowa Department of Public Health was directed to publish annual reports on a variety of topics including methemoglobinemia and pesticide poisoning. [104]

The state universities were also impacted by the Groundwater Protection Act. The Cooperative Extension Service was called upon to create new materials about soil test interpretation and the potential for groundwater contamination from overuse of pesticides and fertilizers.[105] The Groundwater Protection Act created three research centers at the state's public universities. Iowa State was given the Leopold Center. The University of Northern Iowa was given the Iowa Waste Reduction Center (IWRC) to assist Iowa small businesses in being aware of environmental regulations at no cost.[106] The University of Iowa was given the Center for Health Effects of Environmental Contamination (CHEEC) to research and "prevent adverse health outcomes related to exposure to environmental toxins."[107]

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[104] George R. Hallberg, Connie Cousins-Leatherman, and Richard Kelley, *The Iowa Groundwater Protection Act: A Summary*, (Iowa: Iowa Department of Natural Resources, 1987), 7-9. This 17 page summary of the act is difficult to find, I received my copy from Central College in Iowa. Other copies are in the State Library of Iowa and the National Agricultural Library.
[105] *Ibid*, 10
[106] Iowa Waste Reduction Center, "Iowa Waste Reduction Center," Business and Community Services at the University of Northern Iowa, http://www.iwrc.org/.
[107] Center for Health Effects of Environmental Contamination, "Center for Health Effects of Environmental Contamination," The University of Iowa, http://www.cheec.uiowa.edu/.

As Representative Paul W. Johnson noted, the development of the act took several years and received as much input from Iowans as possible. A group of researchers at the University of Iowa shared information with the Iowa Regents over concerns about the health effects of groundwater pollution, which in turn was shared with the Iowa legislature. Some researchers at Iowa State University worked to develop four new research centers at the university that would focus upon several different agricultural issues, including one looking at alternative agricultural practices, and also increase the state appropriation to the university, which had declined during the farm crisis of the 1980s. These concepts were shared with the legislators working on the groundwater protection act, and the sustainable agriculture research center was the one center that came through from Iowa State's ideas. The definition of "sustainable agriculture" developed by this small group of Iowa State researchers appears in the Groundwater Protection Act section establishing the Leopold Center. The Groundwater Protection Act defined the term 'sustainable agriculture' as "the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land."[108] The development of the Groundwater Protection Act's policies and programs was not an isolated legislative incident and clearly demonstrated a broader concern with groundwater contamination throughout the state.

[108] Code of Iowa, Section 266.39, Paragraph 1. Available from the Iowa Legislature General Assembly, "Iowa Law," State of Iowa, http://www.legis.state.ia.us/IowaLaw.html. Interestingly, similar legislation passed the California legislature in 1986, and created the state's Sustainable Agriculture Research and Education Program, however *sustainable agriculture* was not defined.

To implement its goals and policies, including supporting these newly-created research centers, the Groundwater Protection Act established the Groundwater Protection Fund within the treasury of the State of Iowa and created several methods of funding it, including increased fees, fines, and taxes. This fund contained five separate groundwater accounts, each one focused on different aspects of Iowa's groundwater contamination: Solid Waste Account, Agriculture Management Account, Household Hazardous Waste Account, Storage Tank Management Account, and an Oil Overcharge Account.[109] Since 1987, the receipts for the Groundwater Protection Fund average just under $11.9 million per fiscal year, and since 1997 the fund has averaged $12.7 million.[110] The largest account is the Solid Waste Account that has averaged $6.4 million since 1987, but more recently averaged $8 million annually. During the act's development and passage it was estimated the Groundwater Protection Fund would generate $65.6 million in the first five years of funding. Oil overcharge funds accounted for $17.5 million of this total and the remainder was funded through new fees.[111] Actual funding generated over the first five years was $52.5 million.[112]

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[109] All of these accounts remain today, except for the Oil Overcharge Account.

[110] Funding information from personal communication with the Deb Kozel of the State of Iowa's Fiscal Services Division, Agriculture and Natural Resources Appropriations Subcommittee.

[111] Iowa House Democratic Caucus, "The Iowa Groundwater Protection Act (HF 161) 1987 Summary," in *State Policy Issues in Sustainable Agriculture*, by Gordon Meeks, Jr. (Denver, Colorado: National Conference of State Legislatures, 1989), 49-52. Each of the accounts in the Groundwater Protection Fund were tied to fees on various products and activities. A household hazardous materials permit fee of $10, $25, or $100 dollars depending on gross retail sales; the registration fee for manufacturers of pesticides was increased to between $250 and $3,000 depending on gross retail sales, the state tonnage fee on solid waste disposal was incrementally increased to $3.50 per ton; a $15 storage tank management fee for underground storage tanks over 1,100 gallons; a $.75 increase per ton on nitrogen fees; and a pesticide dealer license fee of either $25 or 1/10 of 1% of gross retail sales for the dealer. This is summarized on page 52 of the appendix. The Leopold Center funding came from these final two fees.

[112] Total tabulated from Groundwater Protection Fund excel sheet provided by Deb Kozel of the Iowa Legislative Fiscal Bureau, personal communication.

The Leopold Center received funding through the Agricultural Management Account (AMA) within the Groundwater Protection Fund. This account generated revenue from fees on pesticides and fertilizers. The Department of Natural Resources, the Department of Agriculture and Land Stewardship, the Center for Health Effects of Environmental Contamination, and the State Hygienic Laboratory also received funding from the AMA.[113] On average annually, the Center receives $1.2 million from the Agriculture Management Account.[114] The Groundwater Protection Act created these long-term sources of funding to fulfill the goals of the act that were based on research, education, and demonstration.

"The uniqueness of our act lies in its calling upon all Iowans to develop a conservation ethic through a host of programs in research, education and demonstration," said Representative Paul W. Johnson. One of the leading legislators of the act, Paul W. Johnson, asked of current industrial practices, "Are they the result of a land ethic that views us as members of a biotic community?"[115] For Johnson, the answer was no, but the goal of the act was to instill a land ethic in Iowans through an emphasis on research, education, and demonstration.[116] Certainly the Leopold Center, supplying a conceptual

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[113] This summary appears in several places including the Leopold Center for Sustainable Agriculture, *Self-Study Document (with supporting materials) 1999-2006 Peer Review* (No location: No publisher, 2006), 8. From the Center archives.

[114] Funding information from personal communication with the Deb Kozel of the State of Iowa's Fiscal Services Division, Agriculture and Natural Resources Appropriations Subcommittee. Also funding information from Iowa's Board of Regents and Leopold Center. Since Fiscal Year 1997, the Center budget has averaged $1.37 million. Also from the state-level, the Center receives annual appropriations through funds allotted to Iowa State University, and these funds average $545,748.50 since Fiscal Year 1989.

[115] Paul W. Johnson, "What is the true value of the land?" *Des Moines Register*, June 26, 1988, Metro section, C1.

[116] Noting that the Groundwater Protection Act focused on research, education, and demonstration occurs in numerous places, including Paul W. Johnson, "Iowa's 1987 Groundwater Protection Act: Purpose and Process" (paper presented at Agricultural Chemicals and Groundwater Protection: Emerging Management and Policy, proceedings of a conference, St. Paul, Minnesota, October 22-23, 1987).

core of the Groundwater Protection Act, had three emphases in its mission. First, the Center was to research the environmental and socio-economic impacts of agricultural practices. Second, it should research alternative practices that strive for sustainable agriculture. Third, it should work with the Iowa State University Cooperative Extension Service to inform the public of its research findings.[117]

In short, the Center was set up to help create socially and ecologically sustainable agriculture, and it was the name of Aldo Leopold that provided the guidance. Dr. Dennis Keeney, the first Director of the Leopold Center, recognized the ethical and applied dual mission of the Center in implementing the Leopold's Land Ethic. "Naming the Leopold Center for one of Iowa's and the nation's foremost interpreters and caretakers of the land was significant. Aldo Leopold plainly stated his love of the land and the importance of being in harmony with it," wrote Keeney in 1988. "This is our role as well; not just to generate results, but to encourage wise land use. One without the other is hollow."[118] But what if the center had a different name? How much of the Center's mission and goals were from Leopold and how much were from the larger field of ecology? This discussion happened in the Iowa legislature, for the naming of the Center was anything but a certainty.

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[117] The three-part mission of the Center is summarized several places, including The Leopold Center for Sustainable Agriculture, "What is the Leopold Center?" Leopold Center for Sustainable Agriculture at Iowa State University, http://www.leopold.iastate.edu/about/leopoldcenter.htm. Also see the Leopold Center for Sustainable Agriculture, "Iowa 1987 Groundwater Protection Act," Leopold Center for Sustainable Agriculture at Iowa State University, http://www.leopold.iastate.edu/about/igpa.htm. The official code is available in Code of Iowa Section 266.39 from the Iowa Legislature General Assembly, "Iowa Law," State of Iowa, http://www.legis.state.ia.us/IowaLaw.html.

[118] Dennis Keeney, "From the Director," in *The Leopold Center for Sustainable Agriculture, The First Year,* ed. Carol Greiner (no location: no publisher, 1989), 1.

The Leopold Center's Name as a Fully Loaded .45 Automatic (4)

During March and April 1987, representatives in the state capitol, Des Moines, discussed the passage of the new Groundwater Protection Act. This act sought to comprehensively address Iowa's groundwater pollution problems. One of the proposed solutions was the creation of a new agricultural research center at Iowa State University that would research sustainable agricultural practices. Debate covered all aspects of this research center, including the new center's name. Rather than just being used on sharp-looking letterhead, the chosen name influenced the new center's institutional memory and direction. The focus of this chapter is to understand how Aldo Leopold's namesake and the phrase "sustainable agriculture" influenced the Center. Specifically, the Center's focus was narrowed to "sustainable" agricultural concerns and Aldo Leopold's writings, particularly *A Sand County Almanac* and the land ethic, provided a degree of institutional guidance. As a model institutionalized approach to agricultural issues, the example of the Leopold Center illustrates how a name can have a great impact and should be considered carefully.

Three choices for the new name arose during the legislative debates. The initial legislation introduced in the House of Representatives proposed the Leopold Center for Sustainable Agriculture, naming it after Aldo Leopold (1887-1948), a native Iowan famous for his conservation work and author of *A Sand County Almanac*. A subsequent amendment and debate in the House considered the Rachel Carson Center for Sustainable Agriculture, naming this research center after one of the pioneers of the environmental

movement -- Rachel Carson, author of *Silent Spring*, celebrating its twenty-fifth publication anniversary in 1987. On April 2, the House of Representatives voted down this amendment by a vote of 34 ayes to 62 nays, with 4 absent or not voting. When considering House File 631, as the Groundwater Protection Act was known during the legislative process, the Senate changed the name to the Agriculture Resource Management Research Center. In the ensuing conference committee to reconcile differences between the House and Senate versions of the bill, the Leopold Center for Sustainable Agriculture retained its original name and was placed at Iowa State University.[119]

In the following discussion it is important to not overemphasize the nominal determinism of the Center. By invoking Aldo Leopold and tagging this research center with the term "sustainable agriculture," the Iowa legislature influenced the ideological grounding of the Center and its focus on agricultural issues. An understanding of Aldo Leopold and "sustainable agriculture" illustrate the importance of the Center's name. The next chapter discusses outcomes of Center research since 1987 and provides examples of the influence of Center-funded projects. The "Leopold Center for Sustainable Agriculture" is, after all, just a name, and while names may occasionally serve as sources of general institutional inspiration they cannot solely be responsible for its activities. How did Aldo Leopold provide inspiration for the new research center? What did his namesake provide? A brief description of Leopold and his ideas addresses these questions.

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[119] See Appendix I that contains a legislative history of the Leopold Center for further discussion of these legislative debates.

Leopold proposed an ecological relationship with landscapes rather than one based solely on economic value. In *A Sand County Almanac* he clearly defined the concept of the land ethic and its relationship to ecology. "That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics. That land yields a cultural harvest is a fact long known, but latterly often forgotten," Leopold wrote.[120] He also invoked a broader community for humanity that included "soils, waters, plants, and animals, or collectively: the land." As an ecologist, Leopold was concerned with the interactions amongst organisms and the environment. He sought to analyze the life system of the planet, and in turn, promote the use a holistic, ecological worldview. Leopold worked to raise ecological awareness for he saw dangers in assuming humans are the dominant, ruling species on the planet. "In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it."[121] Leopold's ideas held implications for agricultural practices, because the use of a land ethic would push for practices that worked within living systems rather than through domination by chemical and mechanical means.

The question of how to relate to the entirety of the non-human world is not a question confined to the twentieth century; it stretches back to the beginnings of conservation in America. George Perkins Marsh, considered one of the nation's first environmentalists, published the substantial *Man and Nature; Or, Physical Geography as*

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[120] Aldo Leopold, *A Sand County Almanac and Sketches Here and There* (New York: Oxford University Press, 1949), viii-ix.
[121] *Ibid*, 204

Modified by Human Action in 1864.[122] Marsh questioned the conceptual divide between humans and the Earth, terming this the "great question" of "whether man is of nature or above her."[123] To answer Marsh's question, Leopold and a very few others during the 1930s and 1940s saw humans "of nature." During this time period a number of individuals emphasized human impacts on the United States' landscape. Similar to the land ethic in *A Sand County Almanac*, several contemporaries of Leopold published books, articles, and delivered speeches with calls for ethical concerns for the landscape, including Paul Sears, Hugh H. Bennett, Henry A. Wallace, Edward Graham, Fairfield Osborn, William Vogt, and Louis Bromfield.[124]

Yet of this group Leopold stands out within current scholarly discussions, and his importance helps to explain why legislators considered Leopold as the namesake for the new agricultural research center. Historian Donald Worster calls Leopold's textbook *Game Management* "the bible" on the subject. Additionally, Worster sees Leopold's essay "The Land Ethic," that concluded *A Sand County Almanac*, as signaling "the arrival

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[122] Donald Worster, *Nature's Economy: A History of Ecological Ideas*, *Second Edition* (USA: Cambridge University Press, 1994), 268.

[123] George Perkins Marsh. *Man and Nature, or Physical Geography as Modified by Human Action* (New York: Charles Scribner, 1865), 549.

[124] These individuals are described by Randal S. Beeman and James A. Pritchard. *A Green and Permanent Land: Ecology and Agriculture in the Twentieth Century* (Lawrence, Kansas: University of Kansas Press, 2001), 9-63. Particularly chapters 1 and 2, "Soil and the Crisis of American Civilization," and "An Ecological Basis for Culture and Agriculture." Some of these individuals, Paul Sears, author of *Life and Environment* (1939); Hugh H. Bennett, called "the father of soil conservation;" Henry A. Wallace, secretary of agriculture in the 1930s; Edward Graham, a Soil Conservation Service biologist; Fairfield Osborn, a voice for ecologically-based agricultural practices in the 1930s through the 1950s and early 1960s; and Louis Bromfield**,** started Malabar Farm and won Pulitzer Prize for *Early Autumn*, his book, in 1927. Prior to publication, pieces of *A Sand County Almanac* were similarly published in several different magazines and journals, including *Audubon Magazine*, *Journal of Wildlife Management*, and the *Wisconsin Conservation Bulletin*. Aldo Leopold lists the numerous publications that were used in *A Sand County Almanac* opposite the dedication page in the book. For example, publication of "The Conservation Ethic" in the *Journal of Forestry* Volume 31, No. 6, p. 634-643, from October 1933. Originally presented as a speech at the Fourth Annual John Wesley Powell Lecture in the Southwestern Division of the American Association for the Advancement of Science, in Las Cruces, New Mexico, on May 1, 1933.

of the Age of Ecology," and becoming "regarded as the single most concise expression of the new environmental philosophy."[125] Other recent scholarship emphasizes the importance of Aldo Leopold and the land ethic from historical, philosophical, and ecological perspectives.[126] Also not to be overlooked is the fact that Leopold, though born in Iowa, did substantial work in Wisconsin, and thus had a state tie with Senator Gaylord Nelson, a founder of Earth Day. Unlike books written by Leopold's environmentalist contemporaries during the 1930s and early 1940s, *A Sand County Almanac* was the only one reprinted, including 1966, 1968, and 1970 editions.[127]

Contemporary discussions of *A Sand County Almanac* also noted its importance. Charles Poore candidly discussed Leopold's work in the December 3, 1949 issue of *The New York Times*. "You may have noticed that the gentle art of nature writing sometimes breeds ferociously pugnacious authors," Poore began, but noted that Leopold's and another book being reviewed provided "a rather welcome change from that variety of battering." Apart from Leopold's nature writing, which Poore commented at times

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[125] Donald Worster, *Nature's Economy: A History of Ecological Ideas*, on *Game Management* 271, on Leopold's land ethic 284.

[126] Numerous works have been written about Leopold. J. Baird Callicott philosophically approaches Leopold in J. Baird Callicott, *In Defense of the Land Ethic: Essays in Environmental Philosophy* (Albany, New York: State University of New York Press, 1989). Leopold's importance to ecological thinking is considered by Richard L. Knight and Suzanne Riedel (eds)., *Aldo Leopold and the Ecological Conscience* (New York: Oxford University Press, 2002), and in Thomas Tanner (ed)., *Aldo Leopold: The Man and His Legacy* (Ankeny, Iowa: Soil and Water Conservation Society, 1995). From a historical perspective, Curt Meine, *Aldo Leopold: His Life and Work* (Madison, Wisconsin: University of Wisconsin Press, 1988) provides the current definitive work on Leopold and for an intellectual history see Julianne Lutz Newton, *Aldo Leopold's Odyssey* (Washington, D.C.: Island Press, 2006), that emphasizes the development of Leopold's ecological ideas. These are just a few of the books written about Leopold.

[127] Publication dates from Curt Meine, "Moving Moutains," in *Aldo Leopold and the Ecological Conscience*, ed. Richard L. Knight and Suzanne Riedel (New York: Oxford University Press, 2002), 22-23. Reissuing of *A Sand County Almanac* in Curt Meine, *Aldo Leopold: His Life and Work*, 526, and in Curt Meine, *Correction Lines: Essays on Land, Leopold, and Conservation* (Washington, D.C.: Island Press, 2004), 168. I checked reprint dates for other authors of the 1930s and 1940s using amazon.com. In *Aldo Leopold: His Life and Work*, Meine states that in the early 1960s, "Leopold was renowned within the conservation movement, but remained little known beyond it. The paperback edition (of *A Sand County Almanac*) changed all that," 526.

"disquietingly suggest(s) your personal responsibility for the disappearance of the buffalo and the passenger pigeon from Wisconsin's rural reaches," the *New York Times* book review discussed Leopold's thoughts on conservation. Poore clearly stated that Leopold understood humans must live with moderation in respect to the natural world, stressing that Leopold "knew that intelligently planned moderation had to be far more generally applied if humanity was to survive on this plundered planet."[128]

Leopold received slightly lengthier discussion by Hal Borland in a 1950 *New York Times* article. Borland's article, "The Land is Good," opened by describing *A Sand County Almanac* itself. "This book looks as harmless as a toy glass pistol filled with colored candy. It turns out to be a .45 automatic fully loaded." Borland characterized Leopold's well-written prose about the outdoors as "the candy in the gun," and the articulation of conservation as "the powder and lead, the real thing." Borland discussed the entire book, though focused on the final section of the work that contained Leopold's thoughts on conservation and the land ethic. Borland noted the book "is heavy going in some places, but chiefly because Leopold deals with big questions and opposes popular solutions" and "says that the displacements engineered by civilization are slowly killing off the roots of civilization itself."[129]

Agriculture's seeming ability to destroy the roots of civilization was one of the big questions Leopold and his contemporaries tackled during the 1930s and 1940s in their

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[128] Charles Poore, "Books of the Times," *New York Times*, December 3, 1949, Front section, 14.
[129] Hal Borland, "The Land is Good," *The New York Times*, July 16, 1950, Book review, BR6. The book was even recommended as a holiday present during 1949 from Oxford Books, along with other selections including *Stalin: A Political Biography*, *Layman's Guide to Modern Art,* and *Tante Marie's French Kitchen*. A supporting quote by Hugh H. Bennett compared Leopold to Thoreau and Muir. Display Ad 271, *New York Times*, December 4, 1949, p. BR29.

quest for greater ecological consciousness. They proposed a new farming system ethically and practically grounded in ecology, spawning a new movement called "permanent agriculture." This forerunner to current discussions of "sustainable agriculture" sought a more holistic worldview that valued soil quality and reduced tillage, while concurrently promoting the view that humans were integrated into, not dominant over, the natural world. These substantive discussions concerning ecologically based practical and philosophical approaches to agriculture that started in the 1930s formed the groundwork for the "sustainable agriculture" movement years later.[130]

Iowa wanted a center for "sustainable agriculture," not "alternative agriculture," opting for the former term that emerged during the late 1970s and gained prominence in the 1980s.[131] With the attachment of this term, the Leopold Center inherited a charged ideological discussion concerning the exact definition of "sustainability" that still affects the Center today. In his discussion of the term, Gregory McIsaac sees that "although there appears to be agreement that sustainability is good and desirable, there seems to be much less agreement on how to define or achieve it." These commonalities include preserving ecosystems, ensuring stability of natural resources, improving human communities, and continuing economic development.[132] These broad social, economic, and environmental concerns formed the foundation of four distinct types of sustainable agricultural practices: agroecology, organic farming, permaculture, and perennial polyculture. Agroecology emphasized agricultural practices supported by empirical

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[130] Beeman and Pritchard, *A Green and Permanent Land*, 35-46
[131] *Ibid*, 112. Also see Gregory McIsaac, "Sustainability and Sustainable Agriculture: Conceptual Evolution, Competing Paradigms, and a Possible Consensus," in *Sustainable Agriculture in the American Midwest*, ed. Gregory McIsaac and William R. Edwards (Chicago: University of Illinois Press, 1994), 1-34.
[132] *Ibid*, 10

science, organic farming strove to reduce or avoid entirely the use of fabricated herbicides, pesticides, and fertilizers, permaculture viewed the individual farm and small-scale technology as the key to sustainability, and perennial polyculture focused on scientific-based farming systems that require little tillage. In their discussion of these four systems, Beeman and Pritchard note "embedded in these systems was the notion that a renewal of rural society and a general ethical revival were required for a truly sustainable agriculture to take hold on the American landscape."[133] The National Research Council in *Alternative Agriculture* viewed sustainable agriculture as just one type of the more broadly defined alternative agricultural practices that included, "but is not limited to, farming systems known as biological, low-input, organic, regenerative, or sustainable."[134]

Through using its own definition of "sustainable agriculture" in the Groundwater Protection Act that echoed broader goals of sustainability, the Iowa legislature largely sidestepped some of these more specific debates by not advocating one distinct type of sustainable agriculture. For use in the Groundwater Protection Act, the term "sustainable agriculture" meant "the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land." The political situation in Iowa necessitated this broader approach. The term "organic agriculture" was not mentioned in the bill, however Rep. Paul W. Johnson notes that prior to the legislative debate on the bill, the lobbyists for the Iowa Fertilizer and Chemical Association

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[133] Beeman and Pritchard, *A Green and Permanent Land*, 116-117
[134] NRC, *Alternative Agriculture*, 4

"contacted their membership and told them that we were starting an organic-farming center with taxes on their products. A few days later we were met by 400 angry dealers in the Capitol rotunda."[135]

Aldo Leopold's namesake and the use of the term sustainable agriculture influenced the Center by providing guidance through Leopold's land ethic and placing the Center within larger debates over definitions of sustainability. These influences continue to present day. In the Center's third review in 2006, the review document noted that, "even though nearly 20 years have passed since the Center's founding, there are still debates about the definition of 'sustainable agriculture,' and how the Center should apply the principles of Aldo Leopold's 'land ethic' to 21st Century agriculture."[136] One example of Leopold's influence is through the Center's distribution of over 1,600 copies of *A Sand County Almanac* to libraries statewide in 1999 to mark the fiftieth anniversary of its publication, in addition to sending copies to state and county agricultural offices. The Center also "regularly distributes complimentary copies" of the book to learning communities within ISU and to individuals who participate in the Iowa Master Conservationist program offered through the state's extension service.[137] In addition to this ideological influence, Aldo Leopold exerts a physical influence on the Center, as a picture and short description of him is almost always featured in the beginning pages of each of the Center's annual reports. The Center's quarterly publication is called the

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[135] This story is told in two places. Paul W. Johnson, "What is the true value of land?" *Des Moines Register*, June 26, 1988, Metro section, C1. The visit by IFCA members is also told by DeWitt John, *Civic Environmentalism*, 105

[136] Leopold Center for Sustainable Agriculture, *Self-Study Document (with supporting materials) 1999-2006 Peer Review* (No location: No publisher, 2006), 12.

[137] *Ibid*, 37

Leopold Letter and keeps the public informed about the Center's research programs and considers issues Iowa farmers face when adopting sustainable agriculture. In addition to being available online, as of 2006, its print circulation was 6,000.[138]

Though Leopold's memory continues to exert a degree of influence on the Center, his greatest prominence in Iowa occurred during the passage of the Groundwater Protection Act. Leopold and his emphasis on conservation formed the core of the bill. Representative Paul W. Johnson wrote the educational emphasis of the act was "designed to heighten awareness of groundwater problems, assign responsibilities and instill what Aldo Leopold called the 'conservation ethic' in all Iowans."[139] This call for the development of a conservation ethic in all Iowans formed one of eight groundwater protection policies included in the Act, and combined with the namesake assigned to the new agricultural research center, heightened Leopold's visibility at the time. The combination of Leopold's ideas, his status as a native Iowan, and the strong support of a key group of legislators, especially Paul W. Johnson, led Aldo Leopold's name to prevail. The other two names lacked this combination of support. Though Rachel Carson was a well-known Pennsylvanian and her ideas had an ecological grounding similar to Leopold's, her ideas could be viewed as more focused on pesticide use and riddled with controversy when compared with Leopold's seemingly passive land ethic. Naming the Center the Agriculture Resource Management Research Center wholly removed the ecological ideas tied to either Leopold or Carson and undermined one of the core goals of

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[138] *Ibid*, 35

[139] Paul W. Johnson, "Iowa's 1987 Groundwater Protection Act: Purpose and Process" (paper presented at Agricultural Chemicals and Groundwater Protection: Emerging Management and Policy, proceedings of a conference, St. Paul, Minnesota, October 22-23, 1987), 167.

the legislation in instilling a conservation ethic in the state. During the difficult farming times of the 1980s, Leopold's land ethic offered a more complete response to the state's agricultural crises by offering a guiding philosophy and an ecological framework that the other two potential names lacked.

Aldo Leopold became the namesake and ideologically influenced the Center, but it is, after all, just a name. The sole goal of the Leopold Center was not to research and educate Iowans about Aldo Leopold, its focus was finding new agricultural practices that would answer the state's environmental and economic farming problems of the 1980s. Yet the chosen name gave a dual practical and philosophical mission to Leopold Center. The Center was asked to research sustainable agricultural practices to put these on the Iowa landscape, while being philosophically influenced by Leopold. Institutionally, this dual approach is difficult, but one the Center staff accepted. "This is our role as well; not just to generate research results, but to encourage wise land use. One without the other is hollow," wrote first Center director Dr. Dennis Keeney in the first annual report. In 1987, the Center had a name and funding and was just beginning on its sustainable agriculture efforts. "Obviously, this is a journey, not a destination," concluded Keeney, "but it's a journey well worth taking."[140] How did the Leopold Center fare on its journey? What has the Center accomplished on its journey? How does the Center serve as a model of an institutionalized, ecologically-based approach to agricultural issues? These are the questions addressed in the next chapter.

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[140] Dennis Keeney, "From the Director," in *The Leopold Center for Sustainable Agriculture: The First Year*, ed. Carol Greiner (no publication location, 1989), 2.

Fields of dreams: The Leopold Center and the Vision of Sustainable Agriculture
(5)

The first four chapters of this project placed the Leopold Center within an historical context to understand why the Center was created as an institutionalized approach to Iowa's economic and environmental agricultural concerns of the 1980s. The final two chapters of this project describe the ability of the Center to serve as a model* of this institutionalized approach. This chapter highlights some of its specific successes. The first section of this chapter describes the Center. Next, a qualitative and quantitative assessment illustrates its broad impact. Following this, two specific successes are used as case studies. Finally, five challenges to the Center's ability to enact change in Iowa's agricultural system are discussed.

Iowa. The name conjures up many images. Political caucuses and pigs perhaps? Corn too, tornadoes, maybe even soybeans, but Kevin Costner? *Field of Dreams*, set in Iowa and starring Kevin Costner and James Earl Jones, was Oscar nominated for Best Picture.[141] In the film, Costner's character hears a strange voice that orders him to build a baseball diamond in the middle of his cornfield, using the now famous phrase "if you build it, they will come." Costner's actions lead to some incredulous looks and gossip by the community. Is this guy crazy? He is offering an alternative view of what can be

[141] *Field of Dreams* lost to *Driving Miss Daisy*. Other films up for nomination were the Tom Cruise classic *Born on the Fourth of July*, the teenage classic *Dead Poets Society*, and Daniel Day-Lewis' excellent portrayal that won him Oscar for best actor, *My Left Foot: The Story of Christry Brown*. List from the Internet Movie Database, "Academy Awards, USA: 1990," IMDb, http://imdb.com/Sections/Awards/Academy_Awards_USA/1990. *Field of Dreams* is not the only recent film about Iowa, consider *Twister* (1996) or *Bridges of Madison County* (1995).

done with a cornfield; but baseball fields instead of cornfields? How ridiculous! He'll lose the farm!

Costner's character was not the only one in Iowa hearing voices in the 1980s. Iowans heard about the state's economic, social, and environmental problems. Unlike Costner's character, a lot of farmers, estimates are up to 20%, lost their farms in the 1980s.[142] The early part of the decade was captured by the farm crisis, but concerns for groundwater contamination continued into the middle part of the decade. A drought in 1988 brought more troubles. Many answered this chorus of crises, including the state legislature that passed the Groundwater Protection Act in 1987.

The Leopold Center, whose creation was prescribed by Iowa's Groundwater Protection Act, constituted an aspect of the state's response based on agricultural alternatives to these troubled voices of environmental and economic hardships facing farmers. The legislature gave the Leopold Center funding and the following three-part mission: first, research the negative impacts of agriculture; second, develop alternative agricultural practices; third, work with the state's Cooperative Extension Service to share the results with all Iowans. Far from being viewed as "crazy," as Costner's character was, the Center is a model for an institutionalized approach to agricultural issues because: (1) the Center funds research that might not have found funding elsewhere; (2) these research dollars can serve as "seed grants" to leverage larger funding sources in the future; (3) Center research brings people together from various backgrounds and disciplines to more fully understand the agricultural system; (4) the Center's funding and

[142] Beeman and Pritchard, *A Green and Permanent Land*, 5

efforts integrate top-down and bottom-up approaches to fostering change, and (5) the Center is a voice for change that increases awareness of sustainable agriculture.

The physical size of the Leopold Center is commensurate with the section of the Groundwater Protection Act that created it; quite small. Currently the ten Center staff occupy a cluster of offices in Curtiss Hall on Iowa State University's campus in Ames, Iowa; though it has also occupied other space around the campus. The specific section of the act that established the Center was 554 words long, one third of which described the Advisory Board; only 96 were used to outline the Center's mission. Other parts of the legislation included a definition of "sustainable agriculture," required the publication of an annual report, and set a few other regulations pertaining to the operations of the Center. One regulation capped the amount of money from the legislature that was able to be spent on salaries to ensure that plenty of money was available for research.

But do not let the physical footprint mislead you. Annually the Leopold Center operates on a $1.5 million dollar budget funded from taxes on fertilizer and pesticide fees.[143] The Center uses this funding in a variety of ways to fulfill its mission, including funding issue teams, operating a competitive grants program, planning and supporting education/outreach activities, in addition to conducting its own research. Between 1988 and 2002 the Center supported eight interdisciplinary issue teams that provided significant long-term funding, usually five years with the opportunity for continued

[143] Through the Agricultural Management Account of the Groundwater Protection Fund. Fees come from three areas: (1) pesticide registration fees, (2) pesticide dealer license fees, and (3) nitrogen-based fertilizer fees. The Center *normally* operates on a budget of $1.5 million that comes from the Agricultural Management Account and annual appropriations to the Center through Iowa State University. In 2002 and 2003, the Leopold Center had a $250,000 budget cut followed by a $1 million budget cut. See Appendix I, the legislative history of the Leopold Center for further details. These fees were part of the larger "user fee" concept that exists throughout the Groundwater Protection Act, taxing those practices that potentially could harm groundwater quality to fund efforts to reduce or eliminate the contamination possibility.

support, for groups of researchers to focus on a specific set of agricultural issues including cropping systems, human systems, animal management, animal waste management, agroecology, an integrated pest management team, weed management, and alternative swine management.[144] These large teams broadened the agricultural dialogue in the state by bringing together researchers, farmers, state employees, and representatives from state agriculture groups. Additionally, a general competitive grants program operated from 1988 until 2000 with annual requests for proposals funding one to three year grants. Between 1987 and 2006, the Center awarded over $10 million for over 300 grants, with an average of twenty to twenty five new projects funded each year. These projects covered a variety of topics including crop systems, agricultural and communities, ecology, livestock, marketing and food systems, and pest management.[145] The Center also participated in educational and outreach efforts. Between 1993 and mid-1998, over 8,500 people in the state were reached through almost 80 workshops, tours, and conferences. Additionally, the Center held six statewide conferences during this time period.[146]

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[144] Issue team structure and funding described in the Leopold Center for Sustainable Agriculture, *1993-1998 Peer Review* (no location: no publisher, 1998), 15-19. Most of the issue teams were organized in 1989-1990, though a few were added in the mid-1990s. These issue teams involved researchers from universities, farmers, and representatives from state organizations. These teams were funded $50,000 annually and also given funding equivalent to 20% of the team leaders' salary and benefits.

[145] Leopold Center for Sustainable Agriculture, *Self-Study Document (with supporting materials) 1999-2006 Peer Review* (No location: No publisher, 2006), 17-18. The categories for funded grants are decided by the Center to demonstrate its diverse support of research activities. In 2001, a reorganization of the Leopold Center resulted in the adoption of three focuses initiatives, Ecology, Marketing and Food Systems, and Policy. These initiatives replaced the general competitive grants program by offering initiative specific requests for proposals to better focus Center funded research. Also, these initiatives take responsibility for the education and outreach efforts of the Center, including supporting and hosting meetings relevant to the initiatives.

[146] Leopold Center for Sustainable Agriculture, *1993-1998 Peer Review* (no location: no publisher, 1998), 20. To support these education/outreach activities, the Center had calls for proposals that would be supported up to $3,000.

A quantitative and qualitative assessment illustrates the Center's impact. Quantitatively the final progress reports of 233 Leopold Center research grants were compiled from the Center's files and additional information was supplied by the Center's own data (See Figure 1). Qualitatively, fifty-three interviews with researchers, Center staff, farmers, and legislators were conducted during June through September 2006.[147] The data gathered from the 233 final grant reports are based on conservative estimates because some of the final reports in the Center files might not have listed full outcomes of the project, may not have been completed, or the project may have continued beyond the writing of the final report. Included within the two hundred and fifty-eight publications were peer reviewed and non-peer reviewed publications, white papers, pamphlets, and brochures.

Table 1. Outcomes from 233 final reports

Conference proceedings	161
Posters/presentations	1999
Field days	457
Theses (MA, PhD)	65
Abstracts	155
Book Chapter	19
Annual/Progress Reports	100
Publications	258
News articles	629
Extension publications	113

Source: Leopold Center archives, Curtiss Hall

Fifty of the 233 grants resulted in at least one peer-reviewed publication, roughly 22% of the sample projects. These fifty grants resulted in 99 publications that have been cited by others 1,697 times.[148] In addition to these outcomes, some final reports estimate the

[147]Partially supported by Miami University's Honors Program and a Dean's Scholar award. Center data for 233 final project reports collected during Summer 2007 from the Center's archives.

[148] This citation number was collected through using Web Of Science, ISI Web of Knowledge, and adding the total citations for the 99 publications. This number was collected in early January 2008. Grants also

number of people involved with presentations, field days, newsletter mailings, and other outreach efforts. Using this method, conservatively one can estimate Center findings have reached at least 137,849 people from Iowa, the United States, and the world, with the vast majority from Iowa or the greater Midwest.

Each of the three Center reviews conducted every five to six years also contains tabulations of research outcomes. In addition to reporting outcomes from competitive grants, the Center reviews include issue team data. These data provide a snapshot of the Center's work between 1987 and 2006, demonstrating the extensive impact of its supported research.[149] Due to changes in how Center data were reported, many categories could not be enumerated from 1987 through 2005. Five categories are shown in Table 2.

Table 2. Leopold Center funded research outcomes 1987-2005

Field days and tours	652
Presentations[1]	1307
PhD students supported	35
MS students supported	66
Peer reviewed journal articles	272

Source: Leopold Center Peer Review 1993, 1999, 2006, includes competitive grants program outcomes for 1987-2005, and issue team outcomes from 1993-1999

1 Compilation of the following categories: "Abstracts, oral and poster papers" (87-93 Review), "Presentations and seminars" (93-99 Review - issue teams), "Presentations and seminars" (93-99 Review - competitive grants), "Scholarly papers or presentations" (99-2005 Review)

utilized several other types of media to convey research findings, including print, radio, Internet, and video. Of the 233 research grants, 16 (7% of total) used websites or other internet interaction, 28 (12%) used radio interviews/broadcasts, 25 (11%) used videotapes or television spots, and 39 (17%) were education related. The education-related category counts those grants that directly involved primary and secondary students in the project through presentations, field trips, or integration into the curriculum.

[149] This does create some overlap between the two data sets. However, I collected data from 233 final reports to gain experience in this type of data collection and to also tabulate data pertaining to citations and peer-reviewed publications.

To qualitatively complement these two quantitative assessments, I interviewed fifty-three individuals associated with the Leopold Center during June through September 2006. Whereas the quantitative data provide aggregate data of research projects, the interviews provided insight into specific challenges and successes. Interviewees highlighted five main challenges for the Center: the relationship with mainstream agriculture, the size of the Center, level of funding, communication with agricultural groups, farmers, and the public, and the Center's involvement with policy. Seventy-two percent saw a challenge in the relationship between the Center and mainstream/conventional agriculture. Sixty-four percent noted communication as a challenge for the Center, both in reaching conventional agriculture audiences and in legitimizing the efforts of the Center. Fifty-two percent of the individuals interviewed felt the challenge of size was particularly relevant for the Center, in that the Leopold Center was too small, and the agricultural system was too big to effect any substantial change. Forty percent of those interviewed noted that not having enough funding or having funding come through appropriations by the Iowa Legislature, was a challenge to the Center. Twenty-eight percent saw policy as a challenge for the Center, particularly as to whether or not this should become a direct emphasis of its work.

Table 3. Successful Center supported projects

Project	Respondents (% of 53)
Food systems	26 (49%)
Swine hoops	23 (43%)
Riparian buffers	21 (40%)
Nitrate test	15 (28%)
Rotational grazing	7 (13%)

Source: Project interview tabulations

Yet within these challenges are the seeds of the Center's successes. Sixty-eight percent stressed the Center's ability to be a voice for change and sustainable agriculture, particularly in providing a space for sustainable agriculture discussions to occur. The ability of the Center to use its limited resources was seen by fifty-three percent of those interviewed as a success, particularly the Center's ability to fund projects that may not have been able to find funding elsewhere and to provide seed grants that give researchers the opportunity to begin a project and leverage larger funding continuation from more mainstream sources, such as the USDA. Forty percent saw the Center as raising the visibility and awareness of sustainable agriculture. In addition to these general successes, five Center projects were specifically mentioned.

Three of these five projects were interdisciplinary issue teams; the alternative swine confinement systems, known as "the hoop group," led by Dr. Mark Honeyman of Iowa State University (ISU); the riparian buffer strip research headed by Dr. Richard Schultz (ISU); and the rotational grazing research under the leadership of Dr. Jim Russell (ISU). The food systems research is part of the Leopold Center's Marketing and Food Systems Initiative led by Mr. Rich Pirog, who is a staff member of the Center. The nitrate test was a series of research projects most notably conducted by Dr. Fred Blackmer with an accompanying late-spring soil nitrate test the Leopold Center supported as well.

Two of these teams were highly successful in putting these alternatives into practice. One team researched the establishment of buffer strips, land between streams and farmland that would reduce runoff from the fields, improve water quality, and

stabilize stream banks.[150] The second team, known as the "hoop group," looked at new ways of raising hogs in hoop houses in an effort to reduce the negative environmental and health impacts of raising hogs in more traditional hog confinement systems. Each animal gets more space, the initial cost per pig is lower, the hoop is naturally ventilated, the floor is bedded with cornstalks, straw, and other materials, and waste is solid instead of liquid that is stored in large lagoons.[151]

These two issue teams illustrate the five successes of the Leopold Center. By providing long-term funding with minimal micromanagement, the Center allows researchers significant intellectual, logistical, and financial freedom. First, these issue teams were made possible by Center funding and would not have happened otherwise. Funding allowed startup activities to be conducted, the buffer team was able to develop landscape examples of their work and the hoop group was able to build prototype buildings for continued research. Dr. Mark Honeyman, a leader of the hoop structures research, said, "None of this would have been possible with not only the funding support but also the ethical and philosophical leadership of the Leopold Center."[152]

Second, these research dollars leveraged larger funding sources. The hoop group received external funding from sources including the USDA and Humane Society, and the buffer team received external funding from sources totaling over $3.5 million. Third, these issue teams brought together people from various backgrounds and disciplines to

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[150] Riparian Management Systems, "Frequently Asked Questions About Riparian Management Systems," Iowa State University, Riparian Management Systems, http://www.buffer.forestry.iastate.edu/HTML/FAQ.html.

[151] Hoop Structures for Livestock, "Comparisons," Iowa State University, http://www3.abe.iastate.edu/hoop_structures/swine/background/comparisons.html.

[152] Anne Larson, "Expanding the options for livestock producers," *Leopold Letter*, Fall 2007 Vol. 19 No. 3, 1,4. Also available online, http://pelennor.leopold.iastate.edu/pubs/nwl/2007/2007-3-leoletter/index.htm and the specific article, http://pelennor.leopold.iastate.edu/pubs/nwl/2007/2007-3-leoletter/livestock.htm.

understand more fully the agricultural system. The team of researchers includes academics, farmers, and state employees, to get a wide range of voices and concerns. Both issue teams were awarded the Iowa State College of Agriculture's Team Award, the highest honor at the institution for interdisciplinary research.

Fourth, these two issue teams integrate top-down and bottom-up approaches to agricultural systems by combining the increased visibility and funding of top-down approaches with successful small-scale presentations, field days, and one-to-one interactions that share information in a bottom-up approach. Fifth, these issue teams raised awareness of sustainable agricultural issues in the state and earned substantial recognition for doing so. In these collaborations it is difficult to assign full credit to any one organization or effort, but these two issue teams are highly influential. The buffer team's work is recognized as a model by the EPA and the USDA, and its demonstration site at Bear Creek in Central Iowa was selected as one of twelve "showcase" watersheds for the twenty-fifth anniversary of the Clean Water Protection Act and a National Research and Demonstration Area. The buffer team was involved in several different buffer initiatives in the state, and currently Iowa is the nation's leader in miles of buffer strips with over 400,000 acres enrolled in these programs.[153] The hoop group researchers held several successful conferences in the state that raised awareness of these alternative

[153] These two issue teams are described in several Leopold Center annual reports. Leopold Center (LC) 1991 Annual Report (AR): *A spectrum of possibilities for Iowa agriculture*, 16; LC 1992 AR, 9; LC 1993 AR: *Tomorrow's Agriculture, Today*, 13; LC 1994 AR: *Focus on Farmers*, 19-20; LC 1995-1996 AR: *Managing Change*, 7; LC 1996-1997 AR, 8; LC 1997-1998 AR, 22-23, 25, 27; LC 1998-1999 AR: *The Journey*, 11-12, 16-17, 21-22; LC 1999-2000 AR: *Seasons of Change*, 10-11, 14-15; LC 2000-2001 AR: *Directions*, 10-11, 13; LC 2001-2002 AR: *A Year in the News*, 10, 13-14; LC 2002-2003 AR: *The Art of Agriculture*, 15; and LC 2004-2005 AR: *Engaging Agriculture*, 11. Annual Reports published between 1991 through 1996-1997 edited by Elizabeth Weber and Annual Reports from 1997-1998 through 2004-2005 edited by Mary Adams.

techniques. There are now 2,500 hoop buildings for swine that are producing 5% of the state's hogs, with estimates of 4,000 hoop buildings in total in Iowa, providing alternatives to traditional hog confinement systems that normally hold upwards of 1,000 head each.[154] Hoop buildings can handle, depending on size, between 150 and 200 head.

But it still remains difficult for the Leopold Center to put new practices on the land and implement its dual practical and philosophical approaches to agricultural systems. The Center works to promote and research sustainable agricultural practices, yet at the same time an ecological view, as espoused by Aldo Leopold in his land ethic, is also necessary to inform and validate these new practices. The third director of the Center, Dr. Jerry DeWitt echoed a similar sentiment. DeWitt wrote of the necessity of the Center to use both "balance and boldness" in its efforts to promote sustainable agriculture in Iowa. "Bringing these two approaches to the forefront requires the gentle dance of balance that must be achieved to bring a more sustainable agriculture to Iowa," DeWitt wrote, "And in this cacophony of words and issues, we must be a voice, sometimes alone, testing and probing the familiarities and tradition that permeate Iowa agriculture and communities." For the Center must "address the practicalities of today," while at the same time being "prepared and willing to step forward, begin the dialogue and frame emerging issues and questions."[155]

In addition to this dual challenge, the Center's challenges and successes as outlined above have remained largely unchanged since the late 1980s, including those of

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[154] Land Stewardship Project Newsroom, "Swine Scientist: As Industry Consolidates, New Opportunities for Family Farmer Niche Markets Open Up: Sustainable Pork Research Making WCROC a Key Player," Land Stewardship Project, http://www.landstewardshipproject.org/pr/03/newsr_031124.html.
[155] Jerry DeWitt, "Letter from the Director," Leopold Center for Sustainable Agriculture, Annual Report 2005-2006, ed. Mary Adams, 4.

the Center's size, its relationship to mainstream agriculture, the level of funding, communication with a broad audience, and involvement in policy-making. The Center's ability to raise awareness of sustainable agriculture and fund projects has also remained unchanged as well. As a point of comparison, included in the 1993 Center review are excerpts of responses from individuals analyzing the Center. Several of these speak to the same challenges identified by those I interviewed more than a decade later of the relationship to mainstream agriculture, funding, communication, size, and policy.[156] Communication, cooperation, and inclusion were key themes in 1993 as they were in 2006. For example, the Executive Director of the Iowa Grain and Feed Association said, "I would hope that the future brings greater cooperation and the support of all parties involved in agriculture."[157] Others saw disconnects between the research the Center was doing and its ability to share relevant results with farmers. The Editor of the Soil and Water Conservation Society was "concerned that what you are doing and what it all

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[156] The following quotes are taken from the Leopold Center staff, *The Strategic Plan and Five-Year Review (with supporting materials) of the Leopold Center for Sustainable Agriculture* (no location: no publisher, 1993), specifically the section "Excerpts from Letters," appendix VI, 1-14. The Executive Director of the Iowa Institute for Cooperatives noted that the Center needed to be more focused on projects that work to modify "mainline agricultural practices as we find them in Iowa." He also stressed the importance of funding projects that "are not likely to be funded by other sources" (VI-1). The Vice-President of The Fertilizer Institute, in Washington DC agreed, noting "A question that should be asked about each project proposal is 'What practical effect will this have on Iowa agriculture regardless of the outcome of the study?" For some of the funded projects, it seems the answer would be 'minimal to none'" (VI-2). But the State Conservationist for the USDA Soil Conservation Service disagreed, the "Leopold Center funding has centered on Iowa's current major crops of corn and soybeans. More emphasis should be placed on studying forestry and alternative crops." He also questioned the low levels of funding available from the Leopold Center, though understanding that "seed grants" are important, he noted the cost of applying is sometimes greater than the grants (VI-4,5).

[157] *Ibid*, VI-6. The Agricultural Specialist of the Izaak Walton League of America added, "It seems the Leopold Center could improve its outreach to farmers and nonprofits. There will always be some tension between academic standards and on-the-ground results. It is undoubtedly a greater challenge to involve these groups than professors or extension professionals, or even the business community" (VI-6,7). The Director of the Iowa Department of Natural Resources encouraged the Center "to expand and enhance cooperative arrangements with Iowa institutions, ranging from DNR to Extension. As resources are declining it will be more and more critical to enhance and coordinate our efforts" (VI-8).

means isn't getting to many or most of farmers in the state." A representative from the Northwest Area Foundation noted, "I have concerns about the linkage between knowledge and practice. On one level, it would appear the Center is operating on the assumption that inadequate knowledge or technology is the major barrier to the adoption of more sustainable agricultural practices in Iowa." The representative continued, however, by questioning the push-pull existing between the Center's dual practical and philosophical approach to agriculture. "To what extent has the Center become focused on advancing the career objectives of academic researchers rather than meeting the needs of farmers?"[158]

Others providing feedback to the Center in the 1993 Peer Review also discussed the tension between these two approaches. The Agronomy Service Support Manager, of Pioneer Hi-Bred International saw a practical challenge for the Center. "The real challenge for the Leopold Center will be to focus on a 'moderate' approach to sustainable agriculture. If the Center charts this course by working on fine tuning refinements and practical approaches to production problems, it will be accepted and promoted by farm operators. Otherwise, they will ignore the Center and look for other groups to fill that role." But William C. Liebhardt, the Director of the Extension Agricultural Experiment Station at the University of California, wrote of several larger scale questions for the Center to address. "I believe that it would be very beneficial for the Leopold Center to

[158] *Ibid*, VI-1. The President of Practical Farmers of Iowa saw "the weakest link in the efforts of the center in the efforts made to educate farmers." Some comments praised the Center's efforts overall. Dale M. Cochran, Secretary of Agriculture, noted the value of creating the issue teams, particularly because it demonstrated the Center's emphasis on a "holistic approach." The Executive Director of the Institute for Alternative Agriculture, noted that "Since its inception, the Center has been watched carefully – by proponents of sustainable agriculture as well as by defenders of conventional agriculture. It has survived the scrutiny by demonstrating to all that it means business and that it will let neither its vision nor its programs be lured to the shelter of 'business as usual.'"

ask some of the tough questions about the structure of agriculture and maybe the way the land grant institutions function or could function in helping bring about a more sustainable agricultural system . . . I know these are all very tough issues, but your program has more resources than any in the country, and I believe you could provide some of the leadership to help get these issues on the table."[159]

The Center has always faced the same challenges: relationship to mainstream agriculture, the size of the Center, level of funding, effective communication, and kind of involvement in the policy-making process. These challenges fall within the greater dual practical and philosophical challenge facing the Leopold Center. The five main successes of the Center in funding research that might not have found funding elsewhere, providing "seed grants" to leverage larger funding sources in the future, bringing a variety of people together from various backgrounds and disciplines to more fully understand the agricultural system, integrating top-down and bottom-up approaches to agricultural systems. These successes focus upon buildings linkages throughout the agricultural system, linkages between disciplines and stakeholders as well as fostering a stronger tie between philosophical and practical approaches to agricultural issues. Yet successfully building these linkages and altering farming practices on a state-wide scale is limited economically, socially, philosophically, and politically. The final chapter of this project considers these limitations and the ability of the Center to engage with these. By working to broaden the agricultural communities and conversations it is involved with, the Center's efforts face issues much larger and older than its twenty year existence.

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[159] *Ibid*, VI-1.

Or Bust? Obstacles to the Leopold Center's Sustainable Agriculture Journey (6)

A long line of cars heading towards Kevin Costner's farm and baseball field provides the final shot of the film *Field of Dreams*. The prediction of James Earl Jones' character that people would travel from far and wide to come visit the ball field holds true. All of these people wanted to take a journey to this new destination to recover, and rediscover, a true passion for the purity of baseball and the nostalgia associated with it. The Leopold Center also started on a new journey in 1987 towards a sustainable agriculture destination that would recover the economic and environmental stability of farming practices in the state. The ticket for this journey was punched with the passage of the Groundwater Protection Act in 1987. This chapter addresses how the journey has gone so far, both for sustainable agriculture and Iowa's water quality. It identifies a few roadblocks and detours in the Center's dual efforts to foster a land ethic and promote the adoption of sustainable agricultural practices.

The journey is far from over, and this destination could not be reached in only twenty years. This point became obvious during my interviews with fifty-three individuals associated with the Leopold Center, and is illustrated with these three comments. One interviewee noted the Center started in 1986-1987, and added, "it's almost twenty years, probably going to be longer than that to really evaluate the success. I always figured it was a maybe fifty-year thing out there somewhere and the success of reaching fifty years of age is what we have to look at in a way" to gauge the Center's success. A member of the Center's advisory board echoed, "Twenty years is kind of a

short time really," for evaluating the success of the Leopold Center. Finally, another advisory board member spoke to the adoption of new practices by farmers using the example of the Center's work in rotational grazing led by Dr. James Russell. The board member noted that some farmers "might drive by a rotational grazing spot and laugh for three years, drive by three more years and, 'Hmm, he's still doing it, might be something there, hmm, maybe I'll go to a meeting or a demonstration.'" The board member continued, "After you think you've done all the demonstrating that you can, no there's still a need to be out there, a need to be demonstrating, not only so he (the farmer not practicing rotational grazing) can talk to his neighbor, but so he (same farmer) can go thirty miles down the road where that guy's (demonstrator) an expert."[160] Even though others, including myself, noted a final evaluation of the Center's success cannot currently be made, the past twenty years do provide a substantial time period to propose an evaluation.

Iowa's journey towards adopting sustainable agricultural practices is not as easy as visiting a baseball field. Unlike arriving at the baseball field, Iowa's "arrival" at a sustainable agriculture is a moving target. This trip takes significant amounts of time, not on the scale of hours or days, but decades if not generations. What goes into this journey, this process of arriving at a sustainable agriculture? Even with a mere twenty years perspective, several key roadblocks and detours to the Center's journey have become evident, reflecting economic, political, social, and philosophical issues. The Center has been able to overcome some of these obstacles, through research efforts to provide new economic opportunities for farmers through niche marketing, for example. Others are

[160] These quotes taken from interviews I conducted and transcribed from Summer 2006

outside the Center's control, such as the role of federal agricultural policy in shaping the country's farming system. Discussing these long-term roadblocks and detours places the Center within a broader agricultural and social system context. These discussions highlight those continual challenges that exist on the path to sustainable agricultural practices adopted statewide. The Leopold Center is not the only traveler on this path and the obstacles faced are ultimately global.[161]

One roadblock is economic. The National Research Council in *Alternative Agriculture* stated that "significant adoption of alternative practices will not occur until economic incentives change. This change will require fundamental reforms in agricultural programs and policies."[162] It is difficult to overcome the macroeconomic importance of farm policy in America. Discussions concerning the role of federal farm policy stretch back over seven decades. *The Century of Farming in Iowa* observed that "the decade 1930-1940 was a hard one for the Iowa farmer." The efforts of government agencies during the 1930s, the book continued, including the Agricultural Adjustment Administration, the Soil Conservation Service, and the Farm Security Administration, "changed farm management in a fundamental sense." The goal of each farmer was "still following the economic objective of maximum net income." Yet that objective became complicated in the 1930s because "from this time on his income was to be modified in various ways by action programs intended to co-ordinate agricultural activity in the

[161] The Leopold Center is not the only entity in Iowa working for the adoption of sustainable agricultural practices. For example, Practical Farmers of Iowa, started in 1985, the Iowa Model Farms Demonstration Project, and Iowa State University's agricultural efforts also strive to change the agricultural system. The Leopold Center, along with PFI, is one of the oldest efforts in the state.
[162] NRC, *Alternative Agriculture*, 23

various regions of the country, and to keep agriculture in balance with other industries."[163]

This fundamental change in management and emphasis on coordination of agricultural activities continues to this day. Writer Michael Pollan sees "the American food system is a game played according to a precise set of rules that are written by the federal government with virtually no input from any but a handful of farm-state legislators." For Pollan, "nothing could do more to reform America's food system," than to change these policies, which would also "improve the condition of America's environment and public health."[164]

The NRC emphasized the wide-reaching influence and consequences of federal farm policy as it sought the nationwide coordination that Pollan advocates. It acknowledged that "government policy influences the direction of agriculture through a variety of agricultural, economic, and regulatory programs and policies," and that "farm programs have enormous influence on the crops that are grown and on the choice of management practices." But the NRC also saw a much larger influence for government agricultural policy:

> In more than half a century of operation, government policy has not only affected commodity prices and the level of output, but it has also shaped technological change, encouraged uneconomical capital investments in machinery and facilities, inflated the value of land, subsidized crop production practices that have led to resource degradation such as soil erosion and surface and groundwater pollution, expanded the interstate highway system, contributed to the demise of

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[163] John Hopkins, "The Pattern of Farm Management," in *A Century of Farming in Iowa,* ed. Iowa State College Staff Members (Ames, Iowa: Iowa State University Press, 1946), 347-348.
[164] Michael Pollan, "Don't Call It the 'Farm Bill,' Call It the 'Food Bill,'" introduction to *Foodfight: The Citizen's Guide to a Food and Farm Bill*, by Daniel Imhoff (Heraldsburg, California: Watershed Media, 2007), 7.

> the railway systems, financed irrigation projects, and promoted farm commodity exports.[165]

Iowa's commodity-dependent agricultural system illustrates the broad reach of federal farm policy, particularly evident when considering farm income. Economically, most farmers' income comes from government payments and not from what their farm produces. Economist Michael Duffy found that between 1998 and 2002, government payments accounted for an average of 86% of Iowa farmers' net farm income.[166] Tempering this economic dependence is the fact that for two-thirds of Iowa farmers farm income does not even come close to comprising the majority of their total household income. The 2002 Census of Agriculture found that 42% of Iowa farm operators received less than one-quarter of their household income from farming, and an additional 14% received between one-quarter and one-half of their income from this source. A smaller number of farm operators remain highly dependent on agriculture for their household income; a mere 13% receive all of their income from farming while another 12.5% received between three-quarters and all of their income from farming.[167]

How does the Leopold Center get past this roadblock? Unable to go through it, the Leopold Center can detour around by building relationships and networks that increase farm income. The Center does not legislate farm policy and cannot offer every farmer in Iowa thousands of dollars to adopt a certain practice or plant a certain crop. This is not in the mission of the Center; it is a research institution. What the Center *can*

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[165] NRC, *Alternative Agriculture*, 65-75

[166] Michael Duffy and Darnell Smith, "Farmland Ownership and Tenure in Iowa: 1982-2002 A Twenty Year Perspective," Iowa State University Extension, http://www.extension.iastate.edu/Publications/PM1983.pdf, 4.

[167] 2002 Census of Agriculture, "Table 61. Summary by Tenure of Principal Operator and by Operators on Farm: 2002," USDA-NASS, http://www.nass.usda.gov/census/census02/volume1/ia/st19_1_061_061.pdf. Percentages calculated from table data.

do is fund projects and Center staff to research economic incentives and work towards increasing them for farmers. For example, the objectives of the Food and Marketing Systems Initiative, led by the Center's Rich Pirog, include researching marketing strategies and facilitating partnerships that foster new economic relationships based upon sustainable agricultural practices. Within this initiative the Center coordinates and participates in Value Chain Partnerships. These are similar to the issue team approach utilized by the Center in the late 1980s and 1990s because these partnerships bring together diverse groups of researchers, farmers, and business owners to discuss specific farming issues and challenges. One example of a partnership is the recently formed Small Meat Processors Working Group that focuses on establishing and supporting small, independent meat processors to sell produce within the state or regionally. The group "hopes to help small Iowa meat processors begin, upgrade or expand their businesses."[168]

Another roadblock for the Center to develop a land ethic and new agricultural practices is the economic view prevalent in how the state is marketed and views itself. Statistics about Iowa provided by the website www.traveliowa.com, maintained by the Iowa Department of Economic Development, stress that Iowa ranks first nationwide in pork, corn, and egg production, and second nationwide in soybean and red meat production. The first fact provided under the heading "Agriculture," is that "Iowa's total cash receipts for farm commodities in 2003 totaled $12.6 billion – the third largest in the country." The juxtaposition of the two final facts is particularly interesting because they illustrate the perceived need for the Iowa Department of Economic Development to show

[168] Leopold Center News Release, "New Group Tackles Meaty Issues Faced By Small Processing Plants," Leopold Center for Sustainable Agriculture, http://www.leopold.iastate.edu/news/newsreleases/2008/011508_meat.htm.

Iowa the number one agricultural state in the country. One fact notes Iowa is "first in the nation in number of acres set aside as riparian buffers," with "469,794 acres enrolled," as of January 31, 2005. These buffers are important in "reducing soil erosion, protecting water quality and stabilizing stream banks." The second fact points out that Iowa "produces more ethanol per year than any other state," with 840.5 million gallons currently produced each year, with plans for this number to expand by 275 million gallons annually. With much of Iowa's ethanol production currently coming from corn, the very benefits of riparian buffers could be negated. A 2008 report from the National Research Council noted that short-term increases in ethanol production would primarily come from higher corn production, and that "increased biofuels production adds pressure to the water management challenges the nation already faces."[169]

This "number one" mentality and economically-based relation to land has a substantial history in Iowa. During the nineteenth century, early accounts of the state transitioned from viewing its prairies as a wasteland to breaking through the sod to grab for black gold. Some early settlers really did not think prairie land amounted to much of anything. Historian Allan Bogue noted that new settlers in Iowa during the 1830s and 1840s viewed prairie land as a wasteland and tended to settle where timber areas could be cleared. An Iowan historian writing in 1836 noted, "The prairie land was regarded as worthless for purposes of agriculture, and was considered as a useless waste."[170] Once the sod was broken, however, the relationship between the newcomers and the land

[169] Committee on Water Implications of Biofuels Production in the United States, "Water Implications of Biofuels Production in the United States," National Research Council, Division on Earth and Life Studies, Water and Science Technology Board, http://www.nap.edu/catalog.php?record_id=12039, 3.
[170] Bogue, *From Prairie to Corn Belt*, 47

changed. "With the act of breaking," wrote Bogue, "the farm-maker crossed a great divide. Until that point his land was an investment, perhaps even a home; now it became a farm."[171] Years later, the obstacle of thick prairie sod was a mere afterthought. In 1946, *A Century of Farming in Iowa* concisely stated, "Iowa soils are productive," and that "except for the drainage of wet lands, Iowans have had little responsibility for the original productiveness of their land."[172] Sod was given one sentence. "Once the sod had been broken, they (the settlers) had more fertile soil than the farmers who had gotten to the state first and settled on timber land."[173] A similarly dramatic evolution in Iowans' relation to land is essential to fostering a land ethic.

The challenge of this detour rests in changing agricultural practices and altering the numbers based approach to farming data. Does Iowa need to be seen as "number one" in everything? How does the development of a land ethic, that would not emphasize these rankings as much, occur? Leopold couched this process in evolutionary terms, proposing "the land ethic as a product of social evolution because nothing so important as an ethic is ever 'written' . . . The evolution of a land ethic is an intellectual as well as an emotional process."[174] A long journey indeed. Curt Meine, author of the definitive Leopold biography, carries Leopold's assertion into the 21st century by questioning, "What forces will shape the land ethic in the future? How must the concept of a land ethic evolve in order to thrive and provide guidance to conservation in the twenty-first century?" Meine discusses several challenges that exist for the development of a land

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[171] Bogue, *From Prairie to Corn Belt,* 73
[172] J.B. Peterson and A.J. Englehorn, "The Soil that Grows the Crops," in *A Century of Farming in Iowa 1846-1946* ed. Iowa State College Staff Members (Ames, Iowa: Iowa State University Press, 1946), 18.
[173] *Ibid*, 20
[174] Leopold, *A Sand County Almanac*, 225

ethic, including being embraced by new constituencies, extending the land ethic to include marine and aquatic systems, confronting the challenges of human population growth and consumption, and transforming traditional economic worldviews.[175] Of these future challenges for the land ethic, the Center already faces the obstacle of altering traditional economic ideology. Similar to the numerous interpretations of "sustainable agriculture" discussed in the fourth chapter of this project, updating and operationalizing a land ethic, though a laudable goal, is difficult.

The Center continues to work past this roadblock, however. "Even though nearly 20 years have passed since the Center's founding, there are still debates about the definition of 'sustainable agriculture,' and how the Center should apply the principles of Aldo Leopold's 'land ethic' to 21st century agriculture," notes the 2006 Peer Review of the Center.[176] Changing mindsets is a journey comprised of a continual, cumulative process that permeates all Center activities. After twenty years the Center has made great strides in this effort to foster a rethinking about Iowa agriculture to include a greater acceptance of sustainable agricultural practices and seeing value in them. As a Center staff member noted, "I think we've changed the way of thinking" about agriculture.[177]

During any long journey unexpected weather events can impede travel. Especially in Iowa, a beautiful summer day can turn into an afternoon and evening of intense thunderstorms. Weather changes quickly. Political climate can change quickly too. Concern over groundwater use is just one issue within the state legislature's agenda.

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[175] Meine, *Correction Lines,* 210-221
[176] Leopold Center for Sustainable Agriculture, *Self-Study Document (with supporting materials) 1999-2006 Peer Review* (No location: No publisher, 2006), 12.
[177] Interview, Summer 2006

For the past twenty years state-level emphasis on groundwater protection, much like the resource itself, has slipped through the cracks. Iowa's groundwater protection efforts, culminating in the passage of the Groundwater Protection Act of 1987, have largely stalled. The shifting political climate, especially through the potential for adjusting funding sources for sustainable agricultural efforts, is a constant roadblock. This is not to suggest that groundwater quality as an issue is purposefully being ignored or as a resource being knowingly degraded. Rather, groundwater has not grabbed the state legislature to the extent the issue did in the mid-1980s. Much as rainfall gauges can indicate a changing weather climate, funding gauges indicate a changing political climate. When assessing changes in funding it is also important to remember Iowa's state budget went through times of reduced funding, especially in the early 2000s.[178]

The Leopold Center and statewide groundwater monitoring efforts have experienced reduced funding, and these reductions limit the opportunities to study Iowa's agricultural and hydrologic systems. Particularly for the Center, reduced funding causes fewer projects to be started, which constrains the visibility of the Center and the opportunity for researchers in Iowa to ask complex agricultural questions. In Fiscal Year 2003, the Center experienced a $250,000 budget cut and a later transfer of $1 million from the funding supplied by the Agriculture Management Account of the Groundwater Protection Fund that serves as the account for the pesticide and fertilizer fees established by the Act in 1987. This $1 million in funding from the Agriculture Management

[178] Iowa Legislative Services Agency, Fiscal Services, State of Iowa, General Fund Budget Changes, http://staffweb.legis.state.ia.us/lfb/, personal communication with Deb Kozel. In fiscal year 2002, budget appropriations decreased by 6%, and were still 4% below during FY 2004. The College of Agriculture at Iowa State faced budget shortfalls of $1.9 million due to this, as noted by Anne Fitzgerald, "ISU seeks more outside ag funding," *Des Moines Register*, April 25, 2004, Metro section, 5M.

Account of the Groundwater Protection Fund was appropriated normally during the next year. Appropriations from the Iowa legislature through Iowa State University to the Leopold Center have also declined during the years. Initially started in 1988 the budget allocation was $600,000, and has now fallen to approximately $450,000. These reductions in the Center's budget, though largely of short duration, could provide funding to several issue teams, for example, that reach levels of success and visibility similar to the Agroecology Issue Team and their buffer strips or the hoop houses of the Alternative Swine Management Research Team.

In addition to constraining the Center's ability to foster a land ethic and new sustainable agricultural practices in the state, budget difficulties also impact the understanding of the state's surface and groundwater quality. Inconsistent funding affects how state researchers can monitor the state's changing water quality conditions, and to even know if the Groundwater Protection Act has been successful. "The primary root cause of most of Iowa's monitoring program gaps and weaknesses is a lack of sufficient budget and staff to cover all the demands made of monitoring at all the spatial scales of interest," intoned the *Comprehensive Report of Ambient Water Quality Monitoring Programs in Iowa* in 2006.[179] Concerned with funding for background surface and groundwater quality monitoring, the report emphasized the $14 million allocated since the year 2000 for these efforts and stressed the annual $2.9 million budget as "certainly significant **especially relative to state funding in many other states**." The

[179] US EPA Region 7 and Iowa Department of Natural Resources, "Comprehensive Report of Ambient Water Quality Monitoring Programs in Iowa including Strategies To Address The Gaps And Weakness in the Ambient Water Monitoring Program," Iowa DNR, Geological Survey, http://wqm.igsb.uiowa.edu/Reports/Strategy2006.pdf, 31. Emphasis from original document.

estimated budget to successfully implement all aspects of the state's monitoring efforts was $6-8 million.[180] For example, the state's Water Level Well Network that measures the groundwater levels for 159 wells officially started in 1982 but suspended monitoring in 2004 following budget cuts. The program recommenced in 2005.[181] These data provide a foundation for understanding how deep groundwater is below the surface and how it is being used.

A report from the Iowa Water Summit in 2003 broadened the concerns for protecting groundwater quality beyond just funding. "While the lack of funding, especially state funding is apparent it is not the only challenge. Diffusion of responsibilities among multiple units and levels of government, inflexibility in administration, and lack of information, poor coordination, competing priorities and failure to leverage funds also inhibit progress."[182] These challenges are similar to the Center's own challenges of effectively communicating results and engaging with a broad audience. The similarities continue, however, as effective monitoring of Iowa's surface and groundwater quality is an ongoing process, just like the journey towards sustainable agriculture. To achieve both goals requires constant attention and sustained efforts. Complete understanding of all factors pertaining to the state's water quality takes years of research, aided by technological advances to assist in monitoring accuracy. Even the time to take water samples and model contaminants flows takes more than one day.

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[180] *Ibid*, 3

[181] Watershed Monitoring and Assessment, "Groundwater Level Network," Iowa DNR, Iowa Geological Survey, http://wqm.igsb.uiowa.edu/activities/groundwater/gwLevelWellNetwork.htm.

[182] Iowa Water Summit, November 2003, Current Programs, Resources and Deployment Report, http://www.iowadnr.com/water/files/reports/fcurrent.pdf, 3 The 2003 report concluded the page with the boldface statement, "If we all had the same understanding on the importance of water quality as we do quantity, real progress could be made."

Similarly, the agricultural system cannot be dramatically changed in one day, one month, or even one season.

The process of working towards greater understanding of the state's water quality and in implementing new agricultural practices seems to be cyclical. Just like construction on any given road, water quality issues and adoption of sustainable agricultural practices are not solved once and for all. These issues cycle, just like road construction on that one stretch of road you swear was dealt with last year but as soon as summer comes the signs go up again. Many parts of Iowa's agricultural system are cyclical. Year after year millions of acres of corn are planted, covering over 1/3 of the state, and year after year millions of pounds of herbicides and nitrogen are applied to over 90% of these acres. Decreases have occurred in the amount of nitrogen used. Down from the highs reached in the 1980s of 2.2 billion pounds, current nitrogen application on Iowa farm fields, primarily for corn production, is approximately 1.4 billion pounds. Even with these decreases, Iowa still frequently leads the nation in herbicide use and nitrogen use or is second to Illinois.[183] There's a season for growing crops and a season for having good stream water quality, and these don't overlap too much. After constant nitrate problems, Des Moines installed the largest nitrate removal system in 1992 that operates during peak periods of nitrate levels in the city's surface drinking water system.[184] Same old same old, right?

Not quite. Water quality and quantity issues are changing. In 2007, the Iowa Department of Natural Resources drew attention to the outdated comprehensive state

[183] NASS data, chemical use, all states
[184] Eric Woolson, "Raccoon River Watershed Project," The Journal for Surface Water Quality Professionals, http://www.stormcon.com/sw_0207_raccoon.html.

water plan from 1985. Though Iowans "are not facing an immediate shortage," of water, "there have not been resources at the state level to properly look at water quantity issues in recent years." Updating the water plan for the state is essential to taking into consideration population shifts from rural to urban areas, increasing water use from ethanol production, potentially changing water needs due to climate change, and continuing concentration of livestock production. "An updated plan is needed to avoid water shortages, crises and conflicts between water users in the future."[185] A presentation by State Geologist of Iowa, Bob Libra, calls for further action than just updating the state water plan to ensure the sustainability of Iowa's water resources, including new assessments of current water demand, enhanced groundwater level monitoring, increasing and improving the assessment tools in the process, and reviews of water permits. Estimating that four gallons of water are used to create one gallon of ethanol, Libra notes that "ethanol and other energy-related water demands won't 'dry-up' the state, but they are raising questions regarding sustainability and our water management system."[186]

The actual level of certain contaminants in groundwater is changing too. The best we can say is that at least some groundwater quality problems do not seem to be getting worse. At least this is the conclusion from comparing the level of seven contaminants of seventy-four wells from USGS groundwater surveys from the 1980s through the mid-2000s.[187] From the extensive data covered in these USGS water samples, seven

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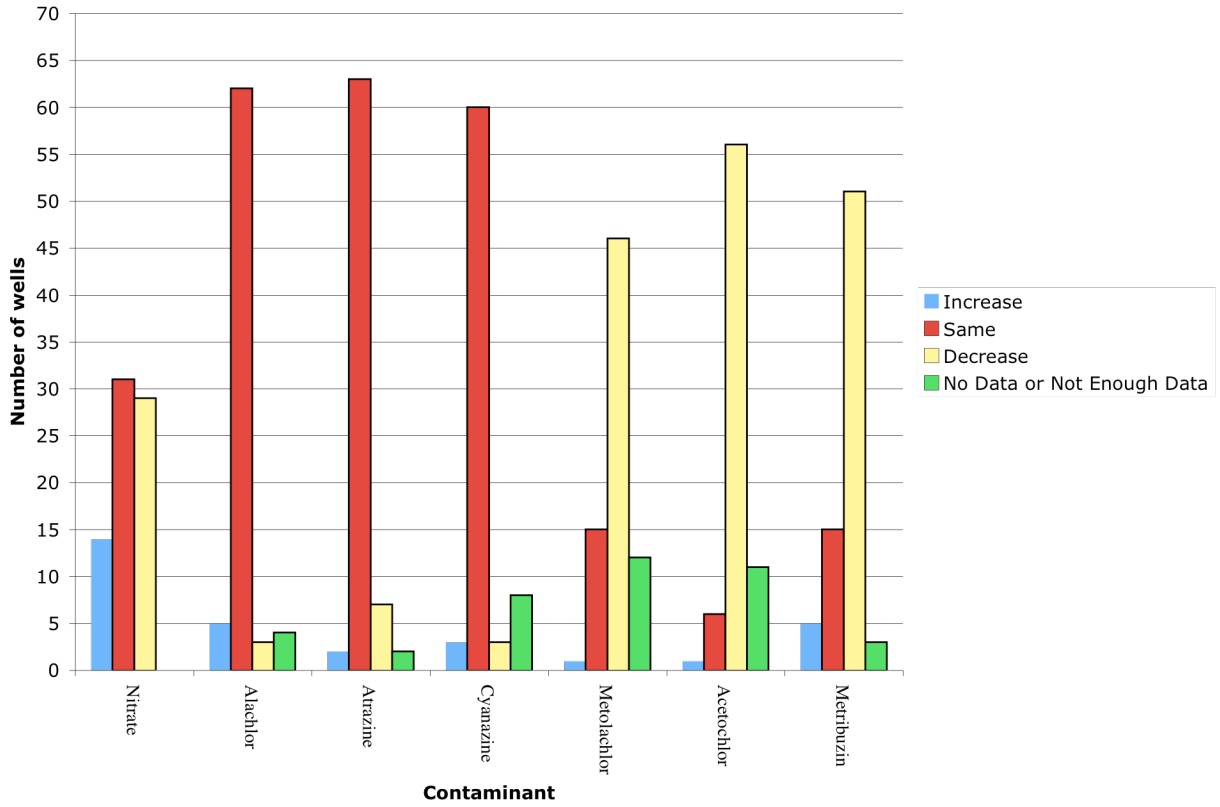
[185] Iowa DNR, "Water Quantity: Planning for Iowa's Future," Iowa DNR, http://www.iowadnr.com/water/files/quantityfact.pdf. Many great resources available at http://www.iowadnr.com/water/quantity.html.
[186] Presentation available online. Bob Libra, "Iowa's Water Resources," Iowa DNR, Geological Survey, http://www.iowadnr.com/water/files/quantityppt.pdf.
[187] Compared Schaap and Linhart, *Quality of ground water used for selected municipal water supplies in Iowa, 1982-96 water years: U.S. Geological Survey Open-File Report 98-3* (Iowa City, Iowa: Iowa DNR,

groundwater contaminants, level of nitrates and six herbicides, were selected based on their high use on the Iowa landscape and because these contaminants emphasized by other researchers before. The levels of these contaminants in these seventy-four wells for the most part either remained the same or decreased. Of all the wells tested only six exceeded any type of established water quality standard; all of these were for nitrate concentrations over 10 mg/L. Of these six wells, three consistently exceeded nitrate standards over the samples taken since the 1980s and three had nitrate levels rise and exceed the standard over this time period.

Geological Survey, 1998) and Littin, *Quality of Ground Water Used for Selected Municipal Water Supplies in Iowa, 1997-2002 Water Years: U.S. Geological Survey Open-File Report 2004-1048*, http://pubs.usgs.gov/of/2004/1048/. Did not consider breakdown products of the chemicals listed.

Figure 1. Change in level of seven contaminants for seventy-four Iowa wells, ca. 1980 - 2006



Source: Comparing groundwater data sites from Littin (2002) and Schapp and Linhart (1998) to identify those wells sampled consistently between the early 1980s and early 2000s. Individual well data gathered from USGS online database http://waterdata.usgs.gov/ia/nwis/gw

Though twenty years passed, Iowa still has substantial roadblocks and detours to attaining improved water quality and adoption of sustainable agricultural practices. Iowa's journey is a difficult one, equivalent to trying to reach a destination with no map, few directions, and no timetable for arrival. For "sustainable agriculture" is not really a single place, and would be difficult to assume you had arrived at any given point. Along the journey are roadblocks, detours, and changing weather conditions, as federal farm policy, philosophical and ethical relationships to landscapes, and levels of state funding

illustrate. Is the process itself part of the problem? No, because the goal of fostering sustainable agricultural practices in the state and groundwater protection was seen as a process from the beginning. The National Research Council in *Alternative Agriculture* saw a multi-step process that, once completed, would mean that "today's alternative farming practices could become tomorrow's conventional practices, with significant benefits for farmers, the economy, and the environment."[188] One of the lead legislators on the Groundwater Protection Act commented to me that his goal for every piece of legislation he worked on, "was to put in place a process, I don't know the answers to a lot of things, but we need a place for people to work on them." First Center director Dennis Keeney echoed these comments. "Obviously, this is a journey, not a destination. But it's a journey well worth taking."[189]

And it is a journey that cannot be taken alone. To successfully reach a sustainable agriculture for the state many travelers need to be on board. This traveling process takes time, as noted by the three interview examples at the beginning of this chapter. To see new practices, informed by and informing new ethical relationships to land, on farm fields, as illustrated by one of the advisory board member's comment at the beginning of this chapter, could easily take decades. Every field, every farmer, is an opportunity for these changing practices and ideologies. But there is no set timetable for these changes to occur. Even without a timetable, the simple beauty of traveling to sustainable agriculture is that when you arrive, you are physically in the same spot you left from. The view just looks different because the landscape and your view of it have changed. This journey is

[188] NRC, *Alternative Agriculture*, 23
[189] Dennis Keeney, "From the Director," in *The Leopold Center for Sustainable Agriculture: The First Year*, ed. Carol Greiner (no publication location, 1989), 2.

transformative, both philosophically and practically, as new ethical relationships to land and new practices reflecting these new ethical concerns are visible. By working as a catalyst and a convener, the Center seeks to travel with as many others as possible and to foster new ethical relationships to land, grounded in Leopold's land ethic, and to promote adoption of tangible sustainable agricultural practices on the farm.

And in broadening the communities that are traveling along to sustainable agriculture, you are included too. Here is your ticket, fare paid all the way through. There may be unexpected and anticipated delays, breakdowns, roadblocks, and the weather is always variable. The trip may take awhile, but don't worry, it will end right where it began. You might even arrive in time for dinner. And, more importantly, your children and generations to come will be home for dinner too. The journey's already begun, but it's easy to stop and add you. Welcome aboard. Welcome home.

What You Should Take On Our Journey

The Leopold Center has a simple story. State has groundwater pollution problems, passes legislative act, makes research center for sustainable agricultural practices, center funds projects. It's just you need to help write the ending. How? Think, talk, listen, ask questions. Learn about farming. Think. About your future, future generations, and where your food and water come from. Learn about farm policy, learn about any policy. Talk to your neighbor, talk to anybody. And while you are doing this, think about this too. These are two pictures taken by the Agroecology Issue Team at one of their buffer strip sites.[190] The first picture was taken in 1990, the second in 1996. This area is now recognized as a National Research Demonstration Site by the USDA. This is what happens when a group of people start taking a journey together. This is what home looks like.

[190] Photo on left is from 1990. Photo courtesy of the Department of Natural Resource Ecology and Management (NREM) at Iowa State University, taken by Dr. Dick Schultz, http://www.buffer.forestry.iastate.edu/Photogallery/before_after/Images/ris0001.jpg.
Photo on right is from 1996. Photo courtesy of the Department of Natural Resource Ecology and Management (NREM) at Iowa State University, taken by Tom Schultz, http://www.buffer.forestry.iastate.edu/Photogallery/before_after/Images/ris0009.jpg.

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Appendix I. A Legislative History of the Leopold Center for Sustainable Agriculture

The following document is a summary collection of legislation in the Iowa Legislature that has created and affected the Leopold Center for Sustainable Agriculture at Iowa State University. All legislation discussed directly addresses the Center in one way or another, which does ignore the larger issues surrounding these pieces of legislation, for example the entire Groundwater Protection Act. It is at times difficult to retain a proper context for the Center by specifically focusing on legislation relating to the Center and ignoring the larger implications of specific pieces of legislation. However, a tradeoff between a comprehensive understanding of the legislation itself for better understanding specifically how the Center was affected must occur to illustrate as fully as possible the relationship between the Iowa Legislature and the Leopold Center in a concise manner.

A short summary of the Leopold Center's original text as outlined in the Groundwater Protection Act of 1987 is placed at the beginning of this legislative history to provide a context for the Center. The legislation begins in 1987, with the introduction of House File (HF) 606 in the Iowa House of Representatives. This bill later became HF 631, the Groundwater Protection Act, after discussions in both the House and Senate. Yet several bills since 1987 have affected the Center and its funding sources, and these are summarized following the Groundwater Protection Act. Finally, an appendix is attached to the legislative history, containing the actual legislative text of the bills discussed.

Summary of the Leopold Center

The Leopold Center for Sustainable Agriculture at Iowa State University was established with the passage of the Groundwater Protection Act in 1987. The legislation that created the Center was House File 631, and the Center was enrolled in the Iowa Code in Section 266.38. The Leopold Center was established within Section 230 of HF 631 in a concise manner.

For the purposes of the legislation, "sustainable agriculture" was defined as, "the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land."

The Center was established with the following three-part mission: (1) to conduct and sponsor research to identify and reduce negative environmental and socio-economic impacts of agricultural practices, (2) research and assist in developing alternative practices consistent with a sustainable agriculture, and (3) work in association with the Iowa State Extension service to inform the agricultural community and the general public of the Center's findings.

A thirteen-member Advisory Board was established, and consisted of the following members: three persons from Iowa State University (ISU), two from the University of Iowa, two from the University of Northern Iowa (UNI), two from private colleges and universities, one from the Iowa Department of Agriculture and Land Stewardship, one from the Iowa Department of Natural Resources, and one man and one woman actively engaged in agricultural production as appointed by the State Soil Conservation Committee. The Board was required to provide a list of three candidates to the President of ISU for director of the Center. The Board also would advise: (1) the director on the development of a budget, (2) on the policies and procedures of the Center, (3) in funding of research grant proposals, and (4) concerning program planning and review. Length of terms were set at four years.

All employees of the Center were employed by ISU, and the Center's director was required to prepare an annual report.

House File 606
Introduced: March 20, 1987 by the House Committee on Energy and Environmental Protection
Final Action: Withdrawn April 15, 1987

The first version of what was to become the Groundwater Protection Act was introduced on March 20, 1987 by the Committee on Energy and Environmental Protection of the Iowa House of Representatives. The bill, House File (HF) 606, was introduced and referred to the Committee on Ways and Means on March 20, 1987. The bill was then assigned to a Ways and Means subcommittee composed of Johnson (chair), Doderer, and Schnekloth on March 20, 1987. Only one amendment was filed to HF 606, amendment H-3313, on March 23, 1987. This amendment did not address the sections of HF 606 concerning the Leopold Center. On April 15, 1987, Rosenberg of Story withdrew HF 606.

Two sections of HF 606 dealt with the Leopold Center. The first section addressed the funding of the Center, and the second section established the Center. Funding for the Center was outlined within Section 111 of HF 606. This section established the Groundwater Protection Fund, which funded the following five accounts: Solid Waste Account, Agriculture Management Account (AMA), Household Hazardous Waste Account, Storage Tank Management Account, and a Municipal Water Account. The AMA was found in Section 111, subsection 2, paragraph b, and appropriated $1.5 million dollars to the Leopold Center. The remainder of the AMA funds were appropriated as follows: $1 million to the Iowa Department of Natural Resources (IDNR) to fund county sanitation programs, and the remainder of the funds to the Iowa Department of Agriculture and Land Stewardship (IDALS) for cost-sharing programs.

The funds for the AMA came from four sources: (1) a groundwater protection fee levied on a pesticide dealer license fee from Iowa Code Section 206.8A, (2) half the fees from a pesticide registration fee from Iowa Code Section 206.12, subsection 3, (3) money from the animal waste management grant fund, and (4) other moneys designated for agricultural management purposes.

The second section of HF 606 that addressed the Leopold Center was Section 233 that established the Center at Iowa State University. This early version of the Center had

several interesting differences from the final version that was passed in HF 631, including the presence of House and Senate members on the Center's Board of Directors, and the absence of a definition for "sustainable agriculture," that is now found at the beginning of Iowa Code 266.38.

House File 631

Introduced: March 24, 1987 by the House Committee on Ways and Means
Final Action: Signed by Governor Terry Branstad on June 9, 1987
Summary: Established Leopold Center at ISU, appropriated funds through Agriculture Management Account of the Groundwater Protection Fund, created Advisory Board

The first version of House File (HF) 631, that eventually passed as the Groundwater Protection Act, was introduced in the Iowa House on March 24, 1987 by the Committee on Ways and Means. Two sections in the introduced version of HF 631 addressed the Leopold Center, found in the same sections of the bill as within HF 606. The first section established funding for the Center through the creation of the Agriculture Management Account (AMA) in Section 111. The AMA was one of the five accounts created within the Groundwater Protection Fund. The other accounts were the following: Solid Waste Account, Household Hazardous Waste Account, Storage Tank Management Account, and a Municipal Water Account.

The AMA received funds from four sources: (1) a groundwater protection fee levied on a pesticide dealer license fee from Iowa Code Section 206.8A, (2) half the fees from a pesticide registration fee from Iowa Code Section 206.12, subsection 3, (3) money from the animal waste management grant fund, and (4) other moneys designated for agricultural management purposes. As in HF 606, $1.5 million dollars were appropriated from the AMA for the Center. The rest of the funds within the AMA were distributed by the following: $1 million appropriated to the Department of Natural Resources to fund county sanitation programs, and the remainder of the funds in the AMA were appropriated to the Iowa Department of Agriculture and Land Stewardship (IDALS) for cost-sharing and groundwater programs.

Section 233 of HF 631 was the second portion of the bill pertaining to the Center, and this section established the Leopold Center and outlined its creation. The introduced version of HF 631 did not define "sustainable agriculture" and included members of the Iowa Congress on the Center's Board of Directors, the same as HF 606. Overall, HF 606 and the introduced version of HF 631 were similar with regards to the Leopold Center.

Amendments to House File 631 in the Iowa House

There were five amendments that affected Section 229 of HF 631, the section that created the Center. First, "sustainable agriculture" was defined and placed at the beginning of Section 229. This change was made through the passage of House Amendment (H)-3384, proposed by Mullins of Kossuth, Plasier of Sioux, McKean of Jones, Johnson of Winneshiek, and De Groot of Lyon. It was proposed on Wednesday, March 25, 1987, and adopted Thursday, April 2, 1987.

Second, through the adoption of H-3596, the Center was to conduct research in conjunction with the agriculture experiment station at Iowa State University. This was a change from working in conjunction with the Iowa cooperative extension service in agriculture and home economics that had been present in the introduced version of HF 631. H-3596 was proposed by Johnson of Winneshiek, Cooper of Lucas, Fogarty of Palo Alto, Muhlbauer of Crawford, Gruhn of Dickinson, and Skow of Guthrie on Thursday, April 2, 1987, and adopted Thursday April 2, 1987.

Third, the passage of H-3472 removed members of the Iowa Legislature from the Centers' Board of Directors. This amendment was proposed by Stromer of Hancock on March 30, 1987, and adopted on April 2, 1987. However, H-3472 was amended by H-3584 prior to its passage.

Fourth, H-3584 designated the State Soil Conservation Committee as the selecting authority for two members of the Board of Directors for the Center that were actively engaged in agricultural production. Previously the legislature had this selection authority in the introduced version of HF 631. Bennett of Ida proposed H-3584 on April 2, 1987, it passed on April 2, 1987, and amended H 3472. The passage of the newly amended H 3472 resulted in these two changes to Section 229.

Fifth, H-3362 designated the director of the Center as an employee of the State of Iowa. This was proposed by Rosenberg of Story on March 25, 1987, and passed on April 2, 1987.

There were three amendments to Section 229 that did not pass, but are interesting to note. First, H-3434 added a fifth point at the end of Section 229 to read: “All grants and projects sponsored by the center shall be administered jointly by the center and the

experiment station." This amendment was lost by a vote of 32 ayes to 47 nays. H-3434 was filed by Bennett of Ida, Mullins of Kossuth, and McKean of Jones on March 24, 1987, and was lost on April 2, 1987.

Second, H-3443 proposed to change the name of the Center to the "Rachel Carson Center." Hansen of Woodbury and McKinney of Dallas introduced this amendment on March 27, 1987. It was lost on April 2, 1987 by a vote of 34 ayes and 62 nays.

Third, H-3392 was filed on March 25, 1987, and proposed to remove the Leopold Center entirely from the Groundwater Protection Act. Koenigs of Mitchell, Cooper of Lucas, Fogarty of Palo Alto, Skow of Guthrie, Gruhn of Dickinson, and Muhlbauer of Crawford filed this amendment, though it was withdrawn on April 2, 1987.

House File 631 in the Iowa Senate

House File 631, as amended by the House, passed the House on April 2, 1987 with 81 ayes and 16 nays. It was then sent to the Iowa Senate where it was read for the first time on April 6, 1987. The bill was referred to the Senate Committee on Environment and Energy Utilities on the same day. On April 7, 1987, the bill was assigned to a subcommittee comprised of Deluhery (chair), Gronstal, and Schwengels.

On April 20, the subcommittee recommended the passage of HF 631 with the passage of Senate File (S)-3698, which made changes to the Leopold Center and it's funding. S-3698 was filed on April 20, 1987. Instead of appropriating 1.5 million dollars to the Center, S-3698 recommended that 36.6% of the funds in the Agriculture Management Account be appropriated to the Center. Further changes to the appropriations to the AMA were made, including the following appropriations: nine thousand dollars to the Iowa Department of Public Health, 1.2% to the Iowa Department of Natural Resources for grants for well-testing, and 13.3% of the funds to the Iowa Department of Agriculture and Land Stewardship for programs related to agriculture drainage wells. S-3698 made only minor changes to Section 229 of HF 631 by adding "of science and technology" to any references to Iowa State University in the section.

On April 21, 1987, HF 631 was referred to a Joint Committee on Agriculture and Natural Resources. On Thursday, April 23, the Joint Committee recommended the passage of HF 631 with the passage of S-3770 and S-3771, which were filed the same day. S-3770 proposed several changes to the Leopold Center, including changing the name to the "Agriculture Resource Management Research Center," and rewording all of Section 229. S-3770 also altered the sources of funding for the Agriculture Management Account and did not appropriate any funds to the Agriculture Resource Management Center. The funds from the AMA were appropriated to the following sources: $580,000 maximum to the Department of Natural Resources for rural water testing grants, $980,000 maximum to the Department of Natural Resources for closing abandoned rural wells, $79,000 maximum for the time period July 1, 1987 to June 30, 1988 to develop a plan for the establishment of the Center for Health Effects of Environmental Contamination, 18% of the funds from the AMA were appropriated to IDALS for

programs to eliminate contamination through agricultural drainage wells, and any remaining funds were appropriated to the IDALS for financial incentive programs and groundwater programs.

S-3770 also created the Oil Overcharge Account in the Groundwater Protection Fund through which the Agricultural Resource Management Research Center would receive funding. Ten million dollars maximum were appropriated to the Agriculture Energy Management Council for the time period July 1, 1987 to June 30, 1992. Of this amount, four million dollars maximum was appropriated to the Agricultural Resource Management Research Center for the purpose of sponsoring and conducting applied studies on best management practices and best appropriate technology for chemical-use efficiency and reduction.

S-3770 was divided into three sections, A, B, and C, during its discussion in the Senate. The Oil Overcharge Account was placed within Section A. Most of the Leopold Center changes in S-3770 were placed within Section C. However, the name change to the Agriculture Resource Management Research Center was placed within Section A. On April 24, 1987, S-3770C was withdrawn. S-3770A was passed on April 24, 1987, and the Leopold Center was renamed the Agricultural Resource Management Research Center.

Following the withdrawal of S-3770C, Hurley W. Hall (the Chair of the Committee on Natural Resources) filed S-3818 on April 24, 1987. S-3818 amended S-3698, the amendment that had been proposed by the subcommittee of the Committee on Environment and Energy Utilities on April 20. S-3818 amended Section 229 of HF 631 and included much of the text that S-3770 had originally recommended concerning the Agricultural Resource Management Research Center.

S-3818 was adopted by a vote of 40 ayes to 5 nays on April 24, 1987, and S-3698, as amended by S-3818, was passed on April 24, 1987. Two other committees, the Committee on Appropriations and the Committee on Ways and Means, recommended the passage of HF 631, as amended, on April 24, 1987.

On April 27, 1987, the Senate changes to HF 631 were filed in the House as H-4027, which included the Agriculture Resource Management Research Center

(ARMRC), its funding through the Oil Overcharge Account as specified in S-3770A, and the changes to the ARMRC's definition as specified in S-3818.

Conference Committee for House File 631

The House rejected H-4027, the amendment to HF 631 that was submitted by the Senate, with a vote of 19 ayes to 57 nays on April 28, 1987. Following this on April 28, the Senate insisted on the passage of its amendment, H-4027, and appointed its half of a conference committee to resolve the differences between the House and the Senate. The conference committee from the Senate was as follows: Senator Patrick J. Deluhery (chair) of Scott, Senator Berl E. Priebe of Kossuth, Senator Larry Murphy of Fayette, Senator Dale L. Tieden of Clayton, and Senator Rife of Muscatine (The final conference committee report was not submitted on the part of Senator Rife of Muscatine).

On April 29, 1987, the House appointed its own members to the conference committee. The committee was as follows: Ralph Rosenberg of Story (chair), Paul W. Johnson of Winneshiek, Sue Mullins of Kossuth, Paulin of Plymouth, and Don Shoultz of Black Hawk. The committee report was report was released on May 8, 1987, and presented a new approach to the Leopold Center, which had its name changed back from the Agriculture Resource Management Research Center.

Thirty-five percent of the funding in the Agriculture Management Account was appropriated to the Leopold Center for Sustainable Agriculture at Iowa State University of Science and Technology. The following funds of the AMA were appropriated as follows: $9,000 to the Iowa Department of Public Health, 2% to the Department of Natural Resources for water testing grants, $79,000 maximum was appropriated for the time period July 1, 1987 to June 30, 1988 for developing a plan for the creation of the Center for Health Effects of Environmental Contamination (CHEEC), with at most 9% of the AMA annually appropriated to the CHEEC after July 1, 1988, and 13% of the AMA was appropriated to the IDALS for financial incentive programs relating to agriculture drainage wells and sinkholes.

The conference committee report also appropriated $800,000 in funds from the Oil Overcharge Account to the Leopold Center for the fiscal year beginning July 1, 1987 and ending June 30, 1988.

The conference committee report returned much of text to Section 229 that had been passed by the House but subsequently rejected by the Senate. However, the conference committee report included the following additions: the director and staff of the Center were employees of Iowa State University, an Advisory Board was created as opposed to a Board of Directors for the Center, only $500,000 of the funds from the AMA could be used for salary and benefits of the Center's staff and director, and the Director was required to prepare an annual report.

Rosenberg of Story brought up the committee report for consideration in the House on May 8, and moved for the bill to be read one final time before its passage. The House passed the conference committee report with 85 ayes, 10 nays, and 5 absent or not voting on May 8, 1987.

In the Senate the conference committee report was filed on May 8, and it was adopted on May 9, 1987. Senator Deluhery moved the adoption of the conference committee report in the Senate, and it was adopted by a voice vote. The Senate passed HF 631 with 34 ayes, 11 nays, and 5 absent or not voting. On May 10, HF 631 was signed by the Speaker of the House, the President of the Senate, and sent to the Governor. On June 9, 1987, Governor Terry Branstad signed HF 631 into law as the Groundwater Protection Act. The Leopold Center for Sustainable Agriculture was officially established at Iowa State University, and was enrolled in the Iowa Code, Section 266.38.

House File 774 in the House, Senate, and Conference Committee
Introduced: April 24, 1989 by the House Committee on Appropriations
Final Action: Signed by Governor Terry Branstad on June 5, 1989
Summary: Appropriated funds to Leopold Center through funds for ISU, outlined research grants program at Leopold Center

House File (HF) 774 was introduced by the Committee on Appropriations on April 24, 1989, and made two additional changes to the Leopold Center. First, this bill set the precedent for funds to be annually appropriated to the Center through funds earmarked for Iowa State University. HF 774 appropriated $750,000 to the Leopold Center for agricultural research grants. Second, within Section 45, 46, and 47 of HF 774, three new sections in the Iowa Code were created, Section 266.39A, B, and C, respectively. These three sections were titled, "Agricultural Research," "Research Grants," and "Legislative Review Committee."

Section 45 of HF 774 established Section 266.39A, "Agricultural Research," directed Iowa State University to conduct research on the environmental and social impacts of agriculture, including an agriculture tenure study every five years.

Section 46 of HF 774 established Section 266.39B, "Research Grants," and established a comprehensive agricultural grant research program at the Leopold Center. Included in this description were guidelines for the approved research proposals, including assisting Iowa in maintaining productive soil and viable communities, enhancing the profitability of farmers, and increasing awareness of agriculture health and safety problems.

Section 47 of HF 774 created a legislative review committee within Section 266.39C. This committee was created to review the research conducted by Iowa State University and the Leopold Center. Furthermore this committee would make recommendations to Iowa's General Assembly about funding agricultural research. The committee was composed of the chairpersons of both Committees on Agriculture, both chairpersons of the Joint Appropriations Subcommittees on Education and Agriculture and Natural Resources, and minority party members.

On April 25, 1989, Blanshan of Greene and Tabor of Jackson filed H-4186, which removed Section 266.39C from HF 774. H-4186 was adopted on April 25, 1989. Also

filed on April 25, 1989 was H-4195 by Maulsby of Calhoun that altered the $750,000 research appropriation from "the Leopold Center," to a more general, "agricultural research." H-4195 also recommended removing 266.39B and 266.39C from HF 774. On April 25, 1989, H-4195 was lost.

The House passed HF 774 with 99 ayes and 0 nays on April 25, 1989. HF 774, as passed, appropriated $750,000 for research grants to the Leopold Center, and added Sections 266.39A and 266.39B to the Iowa Code. The bill was then sent to the Senate for consideration on April 26, 1989.

On April 28, 1989, Senator Richard Varn filed S-3990, which reduced the Center's appropriation from $750,000 to $600,000. S-3990 was adopted on April 28, 1989. This was the only change to HF 744 the Senate made to the sections directly concerning the Leopold Center.

The Senate changes to HF 774 were submitted to the House as H-4341 on April 28, 1989. The House refused to concur on May 1, and the Senate insisted on May 1. This resulted in the creation of a conference committee. The members appointed to the committee on the part of the Senate: Richard J. Varn (chair), Larry Murphy, and Wilmer Rensink. The members appointed to the committee on the part of the House were: Jack Hatch (chair), Ruhl Maulsby, Mary Neuhauser, Don Shoultz, and Brent Siegrist.

On May 6, 1989, the conference committee report was released. The funding for the Leopold Center was proposed to be $600,000, and no changes were made to new proposed Sections 266.39A and 266.39B. The conference report passed the House on May 6, 1989 with 88 ayes and 0 nays. The conference committee passed the Senate on May 6, 1989 with 45 ayes and 3 nays. Governor Terry Branstad signed HF 774 on June 5, 1989.

House File 139
Introduced: January 26, 1999 by Cecelia Burnett of Story County
Final Action: Assigned to subcommittee on February 15, 1999

House File 412
Introduced: March 1, 1999 by House Committee on Agriculture
Final Action: Signed by Governor Vilsack on April 29, 1999
Summary: Increased membership on the Leopold Center's Advisory Board

HF 139 was introduced by Cecelia Burnett of Story County on January 26, 1999, and proposed to increase the membership of the Advisory Board for the Leopold Center. HF 139 was referred to the Committee on Agriculture on January 26, 1999 and on February 15, 1999, it was assigned to the subcommittee consisting of David Johnson, Daniel Huseman, and Paul Scherrman. This was the end of action on HF 139.

House File 412 was proposed by the House Committee on Agriculture on March 1, 1999, and proposed to increase the membership of the Advisory Board for the Leopold Center. The text of the bill remained unchanged as when introduced by Burnett in HF 139. The bill added a new paragraph to Iowa Code Section 266.39, and added four people to the Advisory Board as representatives of the following farmer organizations: the Iowa Farm Bureau Federation, the Iowa Farmers Union, Practical Farmers of Iowa, and the Agribusiness Association of Iowa. These representatives were to be appointed by the titular head of the respective organizations, and this addition to the Board increased the total membership to seventeen. Several of these organizations had ex-officio status on the Center's Advisory Board prior to this legislation.

The House passed HF 412 with 97 ayes and 2 nays on March 10, 1999. On March 11, 1999, HF 412 was introduced in the Senate and referred to the Committee on Agriculture. On March 17, 1999, HF 412 was assigned to a subcommittee with Behn, Judge, and Zieman. On March 25, the Committee on Agriculture recommended the passage of HF 412 with 13 ayes and 2 absent or not voting. On April 15, 1999, the Senate passed HF 412 with 46 ayes and 0 nays. Governor Vilsack signed HF 412 on April 29, 1999.

Senate File 65
Introduced: January 23, 2001 by the Senate Commmittee on Appropriations
Final Action: Signed by Governor Vilsack, with veto, on February 6, 2001
Summary: Unobligated funds from Groundwater Protection Fund were transferred to help fund the low-income energy assistance program

SF 65 appropriated unobligated funds from the Groundwater Protection Fund, so that any further appropriations that could occur would have to come from the specifically earmarked monies within the Fund. Without understanding the context of SF 65, House File 725, filed later in 2001, does not present a full picture of the financial situation for the Groundwater Protection Fund.

The Senate Committee on Appropriations introduced SF 65 on January 23, 2001. Formerly SF 65 was Senate Study Bill (SSB) 1014. This bill provided supplemental funding for the fiscal year starting July 1, 2000 for the low-income home energy assistance program. Several different sources of funding were appropriated to help cover this supplemental funding, including the Groundwater Protection Fund, the Innovations Fund, and the Housing Program Fund. In the original SSB-1014, $5,900,000 was appropriated from the Groundwater Protection Fund for this purpose. These funds were to come from unencumbered and unobligated funds in the Groundwater Protection Fund. When SF 65 was introduced in the Senate, the bill appropriated $6,553,024 from the unobligated funds of the Groundwater Protection Fund.

Only two amendments were filed to SF 65 in the Senate, and neither of them directly addressed the section with the appropriations from the Groundwater Protection Fund, found Section 3 of the bill. One of the amendments, S-3004, which did not pass, proposed to remove the other sources of appropriations and offered alternatives for the low-income housing supplemental funding, but did not offer an alternative to the Groundwater Protection Fund appropriation. SF 65 passed the Senate on January 24, 2001 with 30 ayes and 20 nays.

Five amendments to SF 65 were filed in the House, and three of these proposed to remove the section appropriating funds from the Groundwater Protection Fund. First, Kreiman of Davis, Hatch of Polk, Mascher of Johnson, Seng of Scott, Tremmel of Wapello, and Myers of Johnson filed H-1024 on January 25, 2001. H-1024 proposed to

appropriate twenty million dollars from the general fund to the Department of Human Rights for the fiscal year from July 1, 2000 to June 30, 2001, to cover the supplemental funding for the low-income housing energy assistance program. The amendment was lost on January 30, 2001 with 45 ayes and 55 nays.

Second, Mertz of Kossuth filed H-1025 on January 25, 2001, and proposed to remove the Groundwater Protection Fund appropriation from SF 65. H-1025 was lost on January 30, 2001, with 45 ayes and 55 nays. Third, Murphy of Dubuque filed H-1026 on January 25, 2001, and proposed to remove several sections of SF 65, including section 3 that appropriated funds from the Groundwater Protection Act. Murphy withdrew H-1026 on January 30, 2001.

SF 65 passed the House on January 30, 2001 with 56 ayes and 44 nays. The House made a few changes to SF 65 that were filed in the Senate as S-3009 on January 31, 2001. The Senate passed SF 65 with the amendments of S-3009 on January 31, 2001 with 29 ayes and 21 nays. SF 65 was sent to Governor Vilsack on February 5, 2001. The bill appropriated $2,343,051 from the Innovations Fund, $2,446,260 from the Housing Program Fund, and $6,553,024 from the Groundwater Protection Fund for the low-income home energy assistance program. The bill also made several changes in chapter 1220 of the 2000 Iowa Acts regarding funding for administrative costs to operate the low-income housing energy program, among other issues.

Governor Vilsack vetoed several sections of SF 65 on February 6, 2001 when he signed the bill, including reducing the appropriation from the Groundwater Protection Fund from $6,553,024 to $4,127,270, which was currently the actual amount of unobligated moneys in the Fund and was therefore able to be transferred without reducing currently earmarked funding within the Groundwater Protection Fund.

House File 725
Introduced: April 18, 2001 by the House Committee on Appropriations
Final Action: Signed by Governor Vilsack, with veto, on May 25, 2001
Summary: $250,000 appropriated from the Leopold Center following Governor Vilsack veto

In Section 9 of House File 725, introduced on April 18, 2001, by the House Committee on Appropriations, $500,000 in funds specifically appropriated to the Leopold Center were appropriated to the IDALS and to the IDNR. $250,000 of the total were appropriated to the IDALS for the operations of the department's laboratory pesticide programs. $250,000 of the total were appropriated to the IDNR for the environmental protection division of the IDNR. The Leopold Center appropriation was the only specific appropriation from the Groundwater Protection Fund in HF 725. Some other appropriations in HF 725 included $75,000 from the Iowa Comprehensive Underground Storage Tank Fund Board, $40,000 from the Forestry Management and Enhancement Fund, and $450,000 from the Stormwater Discharge Permit Fees.

H-1647 was filed on April 23, 2001, and proposed removing the appropriations from the Leopold Center and increasing the appropriations to the IDALS and IDNR programs to cover the loss of the appropriation from the Leopold Center. H-1647 was filed by May of Worth, Greimann of Story, and Shoultz of Black Hawk. The amendment was withdrawn by May of Worth on April 25, 2001.

H-1682 was filed on April 24, 2001, by Drake of Pottawattamie. The amendment made several alterations in the appropriations in HF 725, the result of which for the Leopold Center was a reduction from $250,000 appropriated to the IDALS to a $100,000 appropriation. H-1682 was adopted on April 25, 2001. Prior to the adoption of H-1682, amendment H-1688 was proposed by May of Worth to H-1682. Several appropriations were altered, and the appropriations from the Underground Storage Tank Board and the Leopold Center were removed. However, H-1688 was lost by a vote of 44 ayes to 51 nays.

On April 25, 2001, HF 725 passed the House with 57 ayes and 42 nays. The Senate had the bill introduced on April 26, 2001. S-3555 was filed on April 27, 2001 by Bill Fink and Johnie Hammond. This amendment had the same appropriation changes as

H-1647, and proposed removing the appropriation from the Leopold Center. S-3555 was lost on April 27, 2001, with 22 ayes, 27 nays, and 1 absent or not voting.

HF 725 passed the Senate with 29 ayes and 20 nays on April 27, 2001. The bill was sent to the Governor on May 8, 2001. Governor Vilsack signed HF 725 on May 25, 2001 and vetoed sections of the bill. Section 9 of the bill, which appropriated funds from the Leopold Center had a portion of it vetoed, as the $100,000 appropriated to the IDALS for their pesticide program was removed by Vilsack. Also, Governor Vilsack vetoed an unnecessary transfer of $40,000 in funds from the DNR Forestry Management and Enchancement Fund to the IDALS. Governor Vilsack expressed concern about appropriating funds from the Leopold Center, especially when the funds were to be used to fund pesticide programs.

"The Legislature has similarly chosen to underfund the Leopold Center for Sustainable Agriculture in this bill. The Leopold Center is recognized nationally for its role in providing farmers the tools necessary to implement farming practices aimed at conserving natural resources and reducing negative impacts on agriculture thereby avoiding the need for regulation while maintaining profitability. The Legislature's action will result in a decrease in sustainable alternatives to environmental regulation available to Iowa farmers." page 520

. . . This item redirects $100,000 from the groundwater protection fund to support the Leopold Center to the DALS for the operations of their pesticide program. These provisions take money from a program targeted at reducing the need for pesticides and transfer it to a program that provides training for pesticide applicators. While both are important programs to Iowa agriculture, research funding for one will reduce the demand for the other" page 521

House File 2627
Introduced: May 28, 2002 by the House Committee on Appropriations
Final Action: Signed by Governor Vilsack on June 12, 2002
Summary: $1 million appropriated from the Leopold Center

House File 2627 was introduced by the House Committee on Appropriations on May 28, 2002 during the May 28 Extraordinary Session. This extremely long document, at 181 pages long, was a bill for settling the $216 million budget deficit (shortfall) that the Iowa legislature was facing. On page 152 of the bill, in Section 186, $1,000,000 was proposed to be appropriated from the funds for the Leopold Center in the Agriculture Management Account to the state's general fund.

H-8708 was filed on May 28 by Murphy of Dubuque and was lost with 44 ayes and 52 nays. One change this amendment proposed was removing the appropriation from the Leopold Center, which is found in the first few lines of page 2 of H-8708.

House File 2627 passed the House with 52 ayes and 44 nays. The bill was then introduced into the Senate, and substituted for Senate File 2334. S-5519 was filed, and this amendment was similar to H-8708. S-5519 was filed by nineteen members of the Senate, including Patrick J. Deluhery, Johnie Hammond, Bill Fink, and Michael E. Gronstal. S-5519 was not adopted by a vote of 20 ayes to 28 nays, with 2 absent or not voting.

H-2627 was passed in the Senate on May 28, 2002, with 26 ayes, 22 nays, and 2 absent or not voting. The bill was sent to the Governor on May 28, and was signed by the Governor, with vetoes, on June 12, 2002. Though several sections were vetoed or altered by Governor Vilsack, Section 186, with a $1,000,000 appropriation from the Leopold Center and the Agriculture Management Account remained intact.

Funding Sources for the Agriculture Management Account

The funding for the Agriculture Management Account of the Groundwater Protection Fund comes from the following three sources within the Iowa Code: Sections 200.8, subsection 4, 206.8 subsection 2, and 206.12, subsection 3**.** The latter two sections have also been altered by the Iowa Legislature.

Section 200.8, subsection 4

This subsection places a fee on nitrogen-based fertilizer that is based upon the percentage of nitrogen in the product. Nitrogen solutions of eighty-two percent are taxed at seventy-five cents per ton. This fee is used as the baseline for taxes on any other nitrogen-based formulations. In Section 207 of the final version of House File 631, as approved by the Governor Branstad, subsection 4 to Section 200.8 was created and has remained the same until present day.

Section 206.8, subsection 2

This subsection places an annual license fee on pesticide dealers based on the gross retail sales of pesticides sold for use in Iowa by the dealer in the previous year. If the pesticide dealer sells less than one hundred thousand dollars in gross retail pesticide sales, then they have the option to pay either a fee based on one-tenth of one percent of sales from the previous year or to pay based upon the following scale for their annual gross retail pesticide sales:

$25, if sales less than $25,000

$50, if $25,000 or more but less than $50,000

$75, if $50,000 or more but less than $75,000

$100, if $75,000 or mores but less than $100,000

For sales over $100,000, the pesticide dealer pays a license fee based on one-tenth of one percent of the gross retail pesticide sales in the previous year.

This section also contains provisions for late fees for all dealers. For each fee, up to $25 is retained for the administration of the annual license fee program, and the remaining amount from each fee is placed in the Agriculture Management Account.

In Section 219 of the final version of House File 631, as approved by the Governor, subsections 2 and 3 of Section 206.8 were amended to specify portions of the pesticide license fee to be deposited in the Agriculture Management Account. In this early version, the minimum annual license fee was twenty-five dollars, though the pesticide dealer could also pay based on one-tenth of one percent of gross retail sales of all pesticides sold by the dealer in the previous year. The fee was paid to the Department of Agriculture and Land Stewardship, and the initial $25 of each fee went to the administration of the program.

With the passage of SF 2247 in 1988, the language in Section 206.8, subsection 2 was altered so that pesticide dealers paid the greater of the two license fee systems, either $25 or a fee based on one-tenth of one percent of the gross retail sales of all pesticides sold at retail for use in the state by the pesticide dealer in the previous year.

With the passage of SF 33 in 1991, the language in Section 206.8 was made to match that of present day. The passage of SF 33 removed the language that specified the dealer must pay the greater of the two fee systems.

Section 206.12, subsection 3

Every pesticide has to be registered with the Department of Agriculture and Land Stewardship. This subsection places a fee for the registration of pesticides by the sellers. The registration fee is set annually at one-fifth of one percent of gross sales within Iowa, and the minimum fee is $250 and the maximum fee is $3000 for each and every brand and grade offered for sale in Iowa, except as noted. Products with gross annual sales of less than 1.5 million dollars will have a fee levied of whichever is greater, the $250 or the one-fifth of one percent of the gross annual sales. Fifty dollars of each fee goes to the administration of the program, and the remainder of each fee is deposited in the Agriculture Management Account.

Section 206.12, subsection 3, was amended by Section 222 of the signed version of House File 631, so that sellers of pesticides in Iowa had to register and pay a fee based on one-fifth of one percent of gross sales within Iowa for each and every brand and grade with a minimum fee of $250 and a maximum fee of $3000. Fifty dollars of each fee was used to administer and enforce the program, and the rest was placed in the Agriculture Management Account.

With the passage of SF 2247 in 1988, 206.12 subsection 3 was amended to specify that the annual registration fee for gross annual sales of products under $1.5 million dollars is the greater of either $250 or one-fifth of one percent.

Amendments to House File 631 in the Iowa House, prior to conference committee and passage

There were five amendments that affected Section 229 of HF 631, the section that created the Leopold Center for Sustainable Agriculture. The full text of these two pages of the bill are below, with the underlined sections indicating a change has occurred. Following the underlined section is a description of the amendment that made the change in the bill's text. One of the amendments removed the members of the Iowa Congress from the Advisory Board, and as such does not have an underlined section to refer to. Also, the underlined, "NEW SECTION" on page 27, line 21, already existed when HF 631 was introduced in the House, and indicated a new section will be added to the Iowa Code, in this case Section 266.38, with the passage of this bill, and does not reflect changes from amendments in the Iowa House.

(page 27)
Sec. 229. NEW SECTION. 266.38 LEOPOLD CENTER FOR SUSTAINABLE AGRICULTURE.
1. For the purposes of this section, "sustainable agriculture" means the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land.

This change was made through the passage of H-3384, proposed by Mullins of Kossuth, Plasier of Sioux, McKean of Jones, Johnson of Winneshiek, and De Groot of Lyon. It was proposed on Wednesday, March 25, 1987, and adopted Thursday, April 2, 1987.

2. The Leopold center for sustainable agriculture is established at Iowa State University. The center shall conduct and sponsor research in conjunction with the Iowa agricultural experiment station at Iowa State University of science and technology to identify and reduce negative

This change was made through the passage of H-3596, proposed by Johnson of Winneshiek, Cooper of Lucas, Fogarty of Palo Alto, Muhlbauer of Crawford, Gruhn of Dickinson, and Skow of Guthrie. It was proposed on Thursday, April 2, 1987, and adopted Thursday, April 2, 1987.

environmental and socio-economic impacts of agricultural practices. The center shall also research and assist in

35 developing emerging alternative practices that are consistent
(page 28)
1 with a sustainable agriculture. The center shall develop
2 educational framework necessary to inform the agricultural
3 community and the general public of its findings.
{ 4 3. A board of directors is established consisting of the
5 following members:
6 a. Three persons from Iowa State University, appointed by
7 its president.
8 b. Two persons from the University of Iowa, appointed by
9 its president.
10 c. Two persons from the University of Northern Iowa,
11 appointed by its president.
12 d. Two representatives of private colleges and uni-
13 versities within the state, to be appointed by the association
14 of private colleges and universities.
15 e. One representative of the department of agriculture and
16 land stewardship, appointed by the secretary of agriculture.
17 f. One representative of the department of natural re-
18 sources, appointed by the director.

This change, removing members of the legislature from the Board of Directors was made through the passage of H-3472, proposed by Stromer of Hancock. It was proposed on March 30, 1987, and adopted April 2, 1987. H-3472 was amended before its passage by H-3584.

19 g. One man and one woman, actively engaged in agricultural
20 production, appointed by the <u>state soil conservation</u>
21 <u>committee</u>.

This change was made through the passage of H-3584, which amended H-3472, and was consequently passed as a piece of H-3472. H-3584 was proposed by Bennett of Ida on April 2, 1987 and passed on April 2, 1987.

22 The director of the center shall coordinate the appointment
23 process for compliance with section 69.16A.

4. The board shall employ, as an employee of the state of Iowa, a full-time director to operate the center. The

This change was made through the passage of H-3362 proposed by Rosenberg of Story on March 25, 1987, and passed on April 2, 1987.

director shall employ research staff, subject to the approval of the board.

5. The board shall solicit input from the public through a public hearing process implemented throughout the state.

Appendix II. Comparison of *Alternative Agriculture* (1989) and *The State and the Farmer* (1908)

But the problems and solutions described in *Alternative Agriculture* were not new concepts. "It is the commonest thing for the onlooker to say that farming must be more 'scientific.' Of course this is true, but not in the way in which the onlooker commonly conceives it," wrote Liberty Hyde Bailey in *The State and the Farmer* (1908). "It is the easiest thing to make the most stupid failures by merely appropriating the scientific facts and discoveries of the investigators; it is quite another thing to work these facts into a good system, but this is a matter of slow and laborious growth," he concluded, critiquing the National Research Council's research recommendations by 80 years.[191] The NRC agreed on these integration challenges, particularly noting institutional obstacles to this approach. "On the whole, land-grant universities and the USDA have not adequately integrated the results of this research into productive systems."[192]

Writing in the early 1900s, Bailey, like the NRC, saw contemporary problems with agriculture in the United States and proposed solutions, noting "we have never heard more about agricultural decline than within the past ten and twenty years, notwithstanding that this is the very time when the agricultural colleges and experiment stations and governmental departments have been expanding knowledge and extending their influence."[193] Bailey outlined several problems for agriculture, including resource conservation and lack of attention to rural issues and rural populations. He also pointed to the needs of rural areas, including increased technical knowledge about agriculture,

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[191] Liberty Hyde Bailey, *The State and the Farmer* (New York: MacMillan Company, 1908), 67.
[192] NRC, *Alternative Agriculture*, 188
[193] Bailey, *The State and the Farmer*, 49

broadened governmental protection, a cooperative business spirit, more "centers of interest" in non-urban areas, and the "need of real personal starting-power and enthusiasm; of gumption; of enterprise that gets things done."[194]

As evidenced by *Alternative Agriculture* in 1989 and *The State and the Farmer* in 1908, agriculture had problems and calls for institutional responses for several decades. The NRC identified problems by focusing on post-World War II economic and environmental shifts in agricultural practices, specifically the increase in specialization and reliance on the off-farm inputs of chemicals and machinery.[195] Bailey surveyed much of nineteenth century American agriculture and emphasized shifts in the geographic location of production, farming practices, and involvement of institutions, notably government and universities.[196] In their analysis of agricultural problems, other scholars use broader time frames. Beeman and Pritchard (2001) see "in episodic cycles from the late nineteenth century through the present day, American farmers have been going broke."[197] Wes Jackson sees humans living in a "'fallen world': the nature that produced us – particularly nature's ecosystems that fed and clothed us as we gathered and hunted – has been almost totally destroyed or seriously damaged during the 8000-10000 yr of agriculture. We *have* really changed the face of the earth."[198]

The institutional answer provided by the NRC and Liberty Hyde Bailey emphasized changing the face of agriculture. Both agreed upon the farmer as the

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[194] *Ibid*, 72
[195] NRC, *Alternative Agriculture*, 85
[196] Bailey, *The State and the Farmer*, 5. See Chapter One, "The Agricultural Shift," 5-54.
[197] Randal S. Beeman and James A. Pritchard, *A Green and Permanent Land: Ecology and Agriculture in the Twentieth Century* (Lawrence, Kansas: University of Kansas Press, 2001), 3.
[198] Wes Jackson and Jon Piper, "Necessary Marriage Between Ecology and Agriculture," *Ecology*, 70 (1989): 1591.

ultimate decision maker.[199] But how would these farmers change their practices? With education; particularly through the institutional efforts of state and land-grant institutions. However, Bailey raised a question. "Of course, the fundamental corrective of it all is education," he concurred, "but we should indicate what the nature of this education ought to be."[200]

The nature of this education, according to both Bailey and the NRC, was to be a guide for the farmer to provide new opportunities and new ways of farming. For example, the NRC saw that farmers are "told too little about the ecological, biological, and economic relationships associated with the use of agricultural chemicals," and recommended that agricultural producers "need guidance and management tools to balance stewardship and production objectives."[201] Bailey, writing 80 years previous, had a similar goal of providing guidance for farmers. He expressed concern that educational efforts should not "develop a man who will go about his farming leaning with one arm on the government and with the other on the college or experiment station, at every turn asking for recipes in franked packages." The farmer had to stand individually for "it is not the business of government to test every farmer's seeds," rather "to teach every farmer how to test his own seeds." Furthermore, the utmost goal of education

[199] NRC, *Alternative Agriculture*, 23, "Ultimately, farmers will be the ones to decide. However, significant adoption of alternative practices will not occur until economic incentives change." Bailey, *The State and the Farmer*, 56, "We must never overlook the importance of these farm producers to society, nor forget that they deserve as much from society as any other persons."
[200] Bailey, *The State and the Farmer*, 73
[201] NRC, *Alternative Agriculture*, 16

should be "to allow native individual responsibility and initiative to develop in the man who stands directly on the land."[202]

Though using different terminology, both Bailey and the NRC emphasized cooperative efforts; for Bailey primarily amongst individuals, the state, and institutions; the NRC added additional weight to integration amongst disciplines. Much of *Alternative Agriculture* was concerned with identifying new research areas and developing agricultural practices particularly through systems or interdisciplinary work that would address the environmental and economic concerns of agriculture in the 1980s. Bailey had a similar solution grounded in cooperation amongst individuals and the state to resolve the agricultural challenges of the early 1900s.[203] Though there were differences between their two approaches, the NRC and Bailey agreed upon the use of institutional, cooperative education efforts that provided assistance to farmers, and both clearly outlined several agricultural problems of their respective time periods.[204]

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[202] Bailey, *The State and the Farmer*, 74-75. A corollary to this statement was "if it is necessary to stimulate enterprise, the effort should lie preferably with the institution or agency that is nearest to the man and his problem."

[203] *Ibid*, 114

[204] There were differences in how they went about education, however. For example, both discussed the value of using single farms as models for others. The entire second half of *Alternative Agriculture*, 247-418, highlighted successful case studies of utilizing these innovative practices from around the United States, including the Thompson and BreDahl farms in Iowa. Yet Bailey critiqued the entire model farm concept, noting that it exists under unnatural conditions and that even if one model farm was in each county it would still be unable to represent all aspects of agriculture within the county. Bailey saw the model farm idea as "impracticable and one now seldom hears it mentioned" (Bailey, 85-86). The NRC saw case studies as useful into providing "insights into how the real world works," and "can indicate promising directions for further research and help demonstrate how many different factors – economics, biology, policy, and tradition – interact," (NRC, 247).

Appendix III. Secondary Literature on the Leopold Center

The only unifying characteristic of secondary literature on the Leopold Center for Sustainable Agriculture is that the Center is described as addressing agricultural issues. The emphasis and attention paid to the Center varies, from using it as the example of sustainable agriculture in Iowa to just another example of sustainable agriculture research efforts in the state. The literature does not present a unified view of the Center, and every secondary source ties the Leopold Center to a different, larger issue. Some place the Leopold Center within the center of their argument, while others place it near the periphery.

Benbrook (1991) provides a substantive assessment of the Leopold Center early after its creation in *Protection Iowa's common wealth: Challenges for the Leopold Center for Sustainable Agriculture*. Benbrook raises several questions relevant to this project, and in future versions his article will be integrated more fully. For example, Benbrook discusses the inherent difficulties of defining "sustainability," the role of the Center of bringing together individuals from different backgrounds and providing linkages, and the global implications and influences on Iowa farmers and the Center itself.

Carroll (2006) firmly places the Leopold Center as the central component of sustainable agriculture at Iowa State University and describes some of the Center's sustainable agricultural efforts, noting the importance of the Center for getting projects off the ground. Carroll (2006) characterizes the Center as the direct implementation of sustainable agriculture philosophy that directly comes out of Aldo Leopold's "Land Ethic" (p. 63). Malloy (1992) uses the Leopold Center as a central component to his argument when he analyzes the relationship between the organizational structure of the Center and its goals and ideology. The emphasis of Malloy (1992) is evaluating the "organizational implementation of research goals" for the Leopold Center and for the Center for Health Effects of Environmental Contamination, both formed by the Iowa Groundwater Protection Act (pg. 6).

Other authors discuss the Center as a less-central piece to their arguments, with the majority placing the Center within discussions of sustainable agriculture programs and/or efforts. DeWitt and Francis (2006) discuss the Leopold Center within the larger context of the sustainable agriculture movement in Iowa, which includes discussions of the efforts of the USDA Sustainable Agriculture Research and Education (SARE) program in the state (p. 145-149). The Center serves as an example of sustainable agriculture research, but unlike Carroll (2006), DeWitt and Francis (2006) do not solely focus on the Center.

Similar to DeWitt and Francis (2006), Butler and Flora (2006) mention the Center, specifically the work of Mr. Pirog on food systems, as one of many examples of institutional models for sustainable agriculture (p. 208). Interestingly, the connection between the University of Northern Iowa's Local Food Project and the Leopold Center is not mentioned, though both are discussed. Francis et al. (1995) use the Center as one example of a sustainable agriculture program in an assessment of the impact sustainable agriculture programs have on land grant universities in the United States (p. 25). Some aspects of the Center serve as models for other institutions, including its long-term

research program, newsletter, and annual reports (p. 30). Hesterman (2006) discusses the Center within the context of the history and development of funding for sustainable agriculture research, and as one of many examples discusses the Kellogg Foundation's grant to a collaborative project that included the Center, Practical Farmers of Iowa, and Iowa State Extension (p. 282). Doherty (1990) discusses the Leopold Center within a larger project on the politics of the passage of Groundwater Protection Act in 1987 and the role interest groups played in this political debate and future elections (pg. 2).

There are some misconceptions that occur in the secondary literature as well. To more fully understand the Center, it is important to discuss a few of these. Carroll (2006) ties the Leopold Center with the Integrated Farm Management Demonstration Program (p. 66). However, the IFMDP was created in 1986 by the Agriculture Energy Management Advisory Council. This Council was created by the Iowa legislature, also in 1986, and was funded by oil overcharge dollars. Though certainly involved with on-farm research, the Leopold Center was not the creator of the IFMDP (see DeWitt John, *Civic Environmentalism*, 92-93, 99-100). In his discussion of the farmers' organization Practical Farmers of Iowa (PFI), Bell (2004) slightly mixes the Center's history by associating PFI with the creation of the Leopold Center by Iowa State University in 1989. The Center was created through the passage of the Groundwater Protection Act in 1987, and while individuals from Iowa State were involved in the creative process, the university did not solely create the Center.

Finally, Beeman and Pritchard (2001) discuss the Center as receiving a "limited mandate" from the Iowa legislature that "falls far short of directing the center to revolutionize agriculture, to eliminate the use of chemical pesticides and herbicides, or to established social justice for farmers" (p. 157). However, I argue the Leopold Center received a broad mission from the Groundwater Protection Act that included researching "negative environmental and socio-economic impacts of agricultural practices," "developing emerging alternative practices that are consistent with a sustainable agriculture," and sharing these results. Beeman and Pritchard (2001) also compare the funding for the Leopold Center with the funding appropriated by Iowa State to the College of Agriculture's experiment stations. The College of Agriculture funding of $79 million dollars dwarfs the Center's budget. While the funding difference is important, I think a more in-depth look at what College of Agriculture funding is used for on a project level can give a better indication as to the number of projects in the state directly related to sustainable agricultural practices as opposed to a general funding comparison.

Beeman, Randal S. and James A. Pritchard. *A Green and Permanent Land: Ecology and Agriculture in the Twentieth Century*. Lawrence, Kansas: University of Kansas Press, 2001.

Bell, Michael Mayerfeld. *Farming for Us All: Practical Agriculture and the Cultivation of Sustainability*. University Park, Pennsylvania: Pennsylvania State University Press, 2004.

Benbrook, Charles. "Protecting Iowa's common wealth: Challenges for the Leopold Center for Sustainable Agriculture," *Journal of Soil and Water Conservation* 46 (1991): 89-95.

Butler, Lorna Michael and Cornelia Butler Flora. "Expanding Visions of Sustainable Agriculture." In *Developing and Extending Sustainable Agriculture: A New Social Contract*, (New York: Haworth Food & Agricultural Products Press, 2006), 203-224.

Carroll, John E. *The Wisdom of Small Farms and Local Food: Aldo Leopold's Land Ethic and Sustainable Agriculture*. New Hampshire: University of New Hampshire, 2005.

DeWitt, Jerry and Charles A. Francis. "Transformation in the Heartland: Emergence of Sustainable Agriculture in Iowa." In *Developing and Extending Sustainable Agriculture: A New Social Contract*, (New York: Haworth Food & Agricultural Products Press, 2006), 141-156.

Doherty, Steven J. *The politics of the 1987 Iowa groundwater protection act*. Masters Thesis. Ames, IA: Iowa State University, 1990.

Francis, Charles, Clive Edwards, John Gerber, Richard Harwood, Dennis Kenney, William Liebhardt, and Matt Liebman. "Impact of Sustainable Agriculture Programs on U.S. Landgrant Universities." *Journal of Sustainable Agriculture*, Vol. 5, No. 4, p. 19-33, 1995.

Hesterman, Oran B. "Impacts of Private Foundations on Sustainable Agriculture and Food Systems." In *Developing and Extending Sustainable Agriculture: A New Social Contract*, (New York: Haworth Food & Agricultural Products Press, 2006), 261-288.

Malloy, Michael J.A. *Research outcomes of the Iowa Groundwater Protection Act of 1987: An organizational analysis*. Masters thesis. Ames, IA: Iowa State University, 1992.

Appendix IV. Guide to Accessing Groundwater Protection Act Online

Legislative Sources
Special thanks to Mandy Easter, Law Librarian in the State Law Library of Iowa and to Joyce Lindstrom the Government Information Librarian from Parks Library at Iowa State University.

To access information about House File 606 and House File 631:
Go to the legislature's web site at www.legis.state.ia.us.
Click on "Search," the last green box on the left-hand side of the page.
Click on the heading "Archive Library" on the next page.
Click on the "Retrieve" button on the left side of the page.
Click on the blue "Browse" button towards the bottom of the page.
Click on "Bill Books."
Click on "72nd General Assembly 1987-1988."
Click on "House File."
Click on "1987."
Click on "HF 000000631."
Use the arrow beside "Page 1 of 390" at the top right of the page to navigate through the first 62 pages of the original bill.

Go to http://docstar.legis.state.ia.us/dswv/
Click Retrieve
Click Browse
Click Bill Books
Select 72nd General Assembly 1987-1988
Click on "House File."
Click on "1987."
Click on "HF 000000631."

HF 631 is a 390 page file that can be downloaded as a .tiff file.
Page 1-63 of the file is the text of the original HF-631, as proposed by the Commitee on Ways and Means on March 24, 1987
Page 64 - Fiscal Note, H-3564 to House File 631 requested by Representative Shoultz on April 1, 1987
Page 66 - Fiscal Note House File 631, requested by Rep. Doderer on March 25, 1987
Page 80 - Fiscal Note For H-3586 to Amendment H-3566 to HF 631, requested by Rep. Osterberg on April 1, 1987
Page 81 - Fiscal Note For H-3566 to HF 631, requested by Rep. Osterberg on April 1, 1987
Page 82 - Fiscal Note For H-3596 to HF-631 requested by Rep. Johnson on April 1, 1987
Page 90 - H-3362, 3366, 3370, 3374, 3375,
Page 91 - H-3357, 3355, 3364, 3363
Page 92 - H-3371, 3377, 3379

Page 93 - H-3380, 3382,
Page 94 - H-3381, 3383, 3385,
Page 95 - H-3386, 3387, 3388, 3384
Page 96 - H-3391
Page 97 - H-3391 page 2, H-3392
Page 98 - H-3393, 3394, 3397
Page 99 - H-3390, 3389
Page 100 - H-3401, 3402, 3404, 3406,
Page 101 - H-3395, 3396, 3398, 3399, 3400
Page 102 - H-3407, 3408, 3411
Page 103 - H-3405
Page 104 - H-3416, H-3417,
Page 105 - H-3410, 3412, 3413, 3415,
Page 106 - H-3418, 3430, 3434
Page 107 - H-3428, 3431
Page 108 - H-3440, 3443, 3446
Page 109 - H-3447, 3451
Page 110 - H-3467, 3469, 3472, 3479
Page 111- H-3453, 3454, 3461, 3464
Page 112- H-3482
Page 121 - end of H-3482, H-3480
Page 122 - H-3521, 3522, 3533, 3536
Page 123 - H-3487, 3503
Page 124 - H-3549, 3550, 3559, 3560
Page 125 - H-3534, 3540
Page 126 - H-3564
Page 127 - H-3564 page 2
Page 128 - H-3566
Page 131 - H-3577
Page 132 - H-3577 page 2, H-3576
Page 133 - H-3578
Page 136 - H-3578 end, H-3575, H-3579
Page 137 - H-3588
Page 139 - H-3588 end, H-3580
Page 140 - H-3589, 3590
Page 141 - H-3586, 3584, 3583
Page 142 - H-3596
Page 146 - H-3608, 3594, 3592
Page 147 - H-3597, 3603
Page 148 - page 13 of Fiscal Note April 13, 1987 from Sen. Deluhery
Page 149 - page 14 of Fiscal Note, April 13, 1987 from Sen. Deluhery
Page 150 - Fiscal Note to House File 631 as passed by the House, requested by Sen. Deluhery on April 6, 1987 and published on Apr. 13
Page 151 - FN page 2

Page 161 - FN page 12
Page 162 - Fiscal Note for Amendment S-3770 to House File 631 and Amendment S-3771 to Amendment S-3698 to House File 631 requested on April 23 by Sen. Deluhery
Page 174 - FN page 13
Page 175 - House File 631 as Amended and Passed by the House April 2, 1987
Page 202 - Leopold Center Section (page 27 of HF 631)
Page 203 - Leopold Center Section (page 28 of HF 631)
Page 234 - end of HF 631 as passed by House
Page 235 - Fiscal Note for Amendment S-3698 to House File 631, requested by Sen. Deluhery on April 20, 1987
Page 245 - page 11 of FN
Page 246 - S-3516
Page 249 - end of S-3516, S-3511
Page 250 - S-3698
Page 262 - end of S-3698
Page 263 - S-3770
Page 269 - end of S-3770
Page 270 - S-3713, 3754, 3755, 3756
Page 271 - S-3771
Page 275 - end of S-3771
Page 276 - S-3789
Page 277 - S-3780, 3782, 3783, 3788
Page 278 - S-3792, 3793, 3794, 3795
Page 279 - S-3790
Page 280 - S-3799, 3800
Page 281 - S-3796, 3797, 3801
Page 282 - S-3809, 3810
Page 283 - S-3804, 3805, 3807
Page 284 - S-3818
Page 285 - S-3812
Page 286 - Fiscal Note Senate Amendment H-4027 to HF 631 requested by Rep. Johnson
Page 299 - Page 14 Fiscal Note
Page 300 - H-4027
Page 319 - H-4027 end
Page 320 - Report of the Conference Committee on House File 631
Page 350 - end of the report
Page 351 - House File 631 as presented to governor
Page 390 - end of House File 631 as presented to gov

Index for Senate and House Journals
72nd General Assembly
1987-1988 Regular Session
1987 Extraordinary Sessions
ISU Call Number: J87 I8231 72nd 1987-88
key pgs HBH 224-229 for HF 631 bill history
HBH 212 for HF 606

(on the covers of these books, "Senate Journal" and "House Journal" are used, though the official title is "Journal of the Senate" and "Journal of the House")

Senate Journal Volume I
72nd General Assembly
1987 Regular Sessions
January 12 - May 4
Published by State of Iowa, Des Moines, IA
ISU Call Number: J87 I82j 72nd 1987 v. 1

Senate Journal Volume II
72nd General Assembly
1987 Regular Sessions
May 5 - May 10 1987 Extraordinary Sessions
Published by State of Iowa, Des Moines, IA
ISU Call Number: J87 I82j 72nd 1987 v. 2

House Journal Volume I
72nd General Assembly
1987 Regular Session
January 12 - April 15
Published by State of Iowa, Des Moines, IA
ISU Call Number: J87 I81j 72nd 1987 v. 1

House Journal Volume II
1987 Regular Session
April 8 - May 10
1987 Extraordinary Sessions
Published by State of Iowa, Des Moines, IA
ISU Call Number: J87 I81j 72nd 1987 v. 2