SCIENTISTS AND ENVIRONMENTAL POLICY: A CANADIAN-U.S. PERSPECTIVE

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I. INTRODUCTION

Recent research by Donald Alper and James Loucky documents the new realities of the social, economic, and political landscape of North America where "transnational contacts and interactions have called into question the traditional national sovereignty function of borders, stirring controversy about new relationships and forms of association that transcend national functions."[1] Alper and Loucky contend that the areas of greatest convergence will be related to common interests and geography with environmental concerns being the most likely catalyst for greater transnational cooperation. The formation of the Commission for Environmental Cooperation (CEC) under the auspices of the North American Agreement on Environmental Cooperation (NAAEC) to help prevent potential trade and environmental conflicts and to promote the effective enforcement of envi-

*A list of acronyms used in this article is provided on page 25.

ronmental law between Canada, Mexico, and the United States seems to bear out Alper and Loucky's contentions.

Moreover, the recent release of the 1997 *Continental Pollutant Pathways* report by the CEC, which focuses on a lingering environmental problem (air pollution), suggests that the only way to address environmental concerns is through the lens of a transboundary and North American perspective. Victor Lichtinger, the executive director of the Secretariat of the CEC at the time of the report's release,[2] summarized this view:

> Acting alone, no nation of North America will be able to protect adequately its domestic environment or its citizens from pollutants transported along continental pathways. While pollutants are not constrained by political boundaries, programs to reduce them often are, and domestic decisions continue to be made with little reference to their implication for all of North America.[3]

The release of the *Continental Pollutant Pathways* report appears to mark the beginning of a new era of transnational environmental cooperation.[4] There are great hopes that the North American Agreement on Environmental Cooperation, which went into effect in January of 1994 at the same time as the North American Free Trade Agreement, will actually foster trinational cooperation on the issue of continental pollutant pathways in North America.

This movement toward a continental approach involving Canada, Mexico, and the United States is quite laudable. But it is important not to forget that it was preceded by a contentious debate

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at the national, bilateral, and global levels. In fact, just getting to the point where two of the countries that signed this trinational agreement (Canada and the United States) could establish a single bilateral accord on their transboundary air pollution took almost two decades of what some called a bitter and protracted policy disagreement.[5] The optimism posited by the formation of the CEC and release of the *Pathways* report must also be tempered by the knowledge that over the past several years, both the funds and human resources dedicated to scientific research on air pollution have declined substantially in Canada and the United States.[6]

To establish a better understanding of the factors that foster successful cross-border environmental cooperation (as represented by the *Pathways* report), this study examines the existence of the earlier policy debate between Canada and the United States leading up to the 1991 signing of *The Agreement Between the Government of the United States of America and the Government of Canada on Air Quality* (commonly referred to as the *Air Quality Accord).* One of these factors is the linkage of science to environmental policy making. To date, there have been a plethora of studies establishing the preeminence of politics over science in coming to environmental policy agreements,[7] but there has been little written (and understood) from the scientists' perspective.

The purpose of this study is to investigate the articulation of science in public policy within a transboundary, environmental, and political context from the perspective of the scientists who actively participated in the policy debate over transborder air pollution.[8] There will be a discussion of how scientists view the influence of science on environmental policy making and whether or not there is too much faith in science to solve environmental problems. There will also be a discussion of how scientists perceive both the transboundary nature of our environmental problems and the worth of bilateral environmental agreements.

In addition, the study will highlight differences in perspectives between United States and Canadian scientists. This dichotomy is used because the formulation of the *Air Quality Accord* occurred (as noted earlier) only after a long and drawn-out policy debate between the United States and Canada which highlighted the fact that scientists in each country function under two distinct types of regulatory policy.[9] As Kathryn Harrison and George Hoberg point out, the Canadian approach relies heavily on scientific judgment and limits

public debate about the scientific basis of policy decisions, while the United States approach is characterized by open conflict over regulatory science, including public debate over the interpretation of scientific evidence.[10] Harrison and Hoberg also observe that Canadian officials tend to place a greater emphasis on the truth-seeking character of science, whereas in the United States the regulatory process places greater emphasis on the value-laden policy components of science.[11]

It has also been documented that the debate over transborder air pollution during the past several decades was marked by considerable mistrust between United States and Canadian scientists due to the politicization of the acid rain issue and its different significance for the two countries.[12] Scholars have provided evidence that, despite extensive collaboration between United States and Canadian scientists, each country responded differently to its cross-border air pollution problems and that the political controversy created by these different views was not only a handicap to joint Canadian-United States scientific research, but it defined a clear and drastic mismatch between what politics needs and science can offer.[13] This study will assess the significance of differences found between scientists on both sides of the border and provide a critique of what these differences mean to the resolution of future environmental policy problems. Finally, this study offers hope that the experience of formulating the contents of the *Air Quality Accord* at the bilateral level will be used to facilitate a more successful approach at the continental level, especially as it pertains to the part that science and scientists play.

II. BACKGROUND

The *Air Quality Accord*, signed by Prime Minister Brian Mulroney and President George Bush on March 13, 1991, is said to have "marked a new era of cooperation aimed at helping guarantee cleaner air and a healthier environment for millions of Canadians and Americans." [14] Whether or not this has come about is still open to debate. But what is not debatable is that science and scientists have been central to the development of a transborder air pollution policy between Canada and the United States.[15] The role that scientists played in the policy discussion prior to the signing of the *Air Quality Accord* has been well documented by many scholars.

Roy Gould asserts that the politics and science involved in the policies used to structure the *Accord* "became so thoroughly inter-

twined that they were barely distinguishable." [16] James Regens and Robert Rycroft are convinced that politics, economics, and science dominated the evolution of a United States-Canadian transboundary air pollution policy.[17] Others, while maintaining the prominence that scientific studies played in the evolution of the policy making, also documented what they believed were the misrepresentation and distortion of the science for political ends.[18] There are accusations that the "scientific community...felt the chilling effect of politics to a degree unprecedented in recent times" [19] and that "members of the scientific community [saw] their studies become political tokens in the debate while they themselves [became] sometimes willing, sometimes reluctant, political actors in the controversy." [20]

Despite these questions of politicization, the importance of science and scientists to the establishment of agreements on transboundary air pollution is firmly set forth in the text of each of the transboundary air pollution agreements that Canada and the United States have reached since the advent of bilateral talks in the late 1970s. In the *Memorandum of Intent Between the Government of Canada and the Government of the United States Concerning Transboundary Air Pollution* (*MOI*), signed in August of 1980, it was "resolved as a matter of priority both to improve scientific understanding of the long range transport of air pollutants and its effects and to develop and implement policies, practices and technologies to combat its impact." [21] Furthermore, in coming to their conclusions that acid rain was a serious environmental and transboundary problem for both Canada and the United States, the authors of the 1986 *Joint Report of the Special Envoys on Acid Rain* cited their reliance on scientific communities in providing them with "an intensive educational effort designed to provide...a quick but comprehensive overview of this scientifically complex issue" and defined one of their major tasks as pursuing "means to increase exchange of relevant scientific information." [22] Finally, the *Air Quality Accord* itself provides two articles and an annex dealing specifically with how to carry out coordinated and cooperative scientific activities to improve the understanding of transboundary air pollution.[23]

The attention that science and scientists have received in the establishment of a United States-Canadian bilateral agreement on air quality appears to support one of Karen Litfin's conclusions, which was based on her study of global environmental cooperation. She observes that "because science is a primary source of legitimation

and because scientists help to define environmental problems, the language of international environmental policy debates can be expected to be flagrantly scientific." [24] Yet it is important that we go beyond just observing that scientists play a central role in transboundary environmental policy making. Because the social role of contemporary science is "at a time when the relation between knowledge and power is more contentious than ever," [25] there exists a need for a better understanding of the linkage between science and environmental policy making at the transnational level.

This study explores the science-policy linkage through the eyes of the scientists themselves. Scientists' perceptions are important because from the very beginning of the United States-Canadian debate over transboundary air pollution (centered on acid rain), scientists were called upon to communicate objectively the scientific facts and uncertainties and to describe the expected outcomes following the best scientific practices.[26] The scientific community was expected to provide "the best available science to figure out the causes and effects of acid rain and how to control it." [27] Because there remain serious questions about the role that scientists played in the development of the *Air Quality Accord* and because scientists will continue to play a central role in the implementation of the tenets set forth by the *Accord*, it is worth our while to explore how scientists viewed the making of this policy.

III. METHODS AND DATA

For this research project, both natural scientists (33 each from the United States and Canada) and social scientists (32 from the United States and 31 from Canada) were interviewed by the author from March through November, 1997.[28] The natural-social science dichotomy was used because previous research has suggested that differences exist between how natural scientists and social scientists perceive the science-policy linkage.[29] For instance, in their work at The Udall Center at the University of Arizona, Helen Ingram *et al.* point out that in dealing with the formation of environmental policy, natural scientists often portray themselves as outside the political process and as poorly understood by politicians, while social scientists believe that natural scientists wield a great deal more influence than they admit to having.[30] Other scholars have noted differences in training and expertise between natural and social scientists [31] and have argued that a gap "often divides the social sciences and humani-

ties from the physical and biological sciences" [32] such that social scientists are not accorded the same status as natural scientists.[33]

The majority of respondents interviewed worked for universities (U.S. = 66%; Canada = 66%) or the government (U.S. = 31%; Canada = 33%).[34] All had earned their Ph.D. except for one United States natural scientist who had two master's degrees in forest ecology, and two social scientists (one from the United States and one from Canada) who had earned their master's degrees and had extensive work-related experience in environmental policy making.[35]

The criteria for selection of those to be interviewed differed based on the type of scientists they were. The targeted population for interviews of natural scientists consisted of those who had met *one* of the following criteria: testified at congressional or parliamentary hearings on transboundary air pollution, participated in review of the National Acid Precipitation Assessment Program (NAPAP), served on the task force implementing the Canada-United States Air Quality Accord, or published peer-reviewed scientific research on transboundary air pollution or in an area related to transboundary air pollution. Natural scientists interviewed were represented by a wide range of disciplines, including chemistry (15), atmospheric science (13), biology (16), ecology (8), forestry (3), engineering (6), and geology (5).

Because the number of social scientists working specifically on transboundary air pollution policy in both the United States and Canada is quite limited, the targeted population for interviews consisted of those social scientists who were directly involved in teaching, research, or environmental policy making. Social scientists interviewed were represented by a wide range of disciplines, including political science (28), economics (9), international studies (4), public administration and policy (10), history (2), sociology (2), and environmental studies (8).

The interviews for this research project were built around five questions:

* Do you think science has had a large or small influence on present day environmental policies?
* Do we, as a society, put too much faith in science to solve our environmental problems?
* Do we, as a society, view environmental problems more in a transboundary nature than we have in the recent past?

* Do current environmental laws and policies sufficiently deal with present day environmental problems?
* What is the value of bilateral environmental agreements such as the 1991 Canada-United States Air Quality Accord?

IV. RESULTS

A. The Influence of Science

Previous research has confirmed that science and scientists [36] remain central to environmental policy making; that is, scientists play a prominent role in developing alternative solutions to environmental policy problems and in generating a long-term climate of ideas which directly affects policy makers' thinking.[37] However, recent research findings by Harrison and Hoberg, based on their case studies of dioxin and radon in Canada and the United States, also suggest that science and scientists may be overrated in their ability to affect environmental policy making:

> [Our] third major conclusion is that while science and technology can be important driving forces, they are best considered necessary but not sufficient conditions for the emergence of issues...Changes in science and technology clearly can play many roles: permitting detection of new problems, increasing understanding of new hazards to health and the environment, and presenting new solutions to existing problems. However,...uncertainties in science allowed the [United States and Canada] to adapt different scientific assumptions...Scientific knowledge and technological capability alone do not guarantee adoption of an issue.[38]

The first two interview questions attempt to sift out how scientists perceive the impact of science in solving our present-day environmental problems. The results of the first interview question, "Do you think science has had a large or small influence on present day environmental policies?" are presented in Table 1. Overall, we see that those who participated in this study generally view science as having a large or moderate impact on present day environmental policies, with "large impact" being the more common answer. Respondents argued that environmental policies would not exist without science because it is the scientists who "define the issue...and provide the framework of discussion, provide the entire underpinning of the whole policy." [39] There was a general consensus among

those interviewed that it is the scientists who "make the environment speak [and] articulate what is happening in the environment" such that science gets translated into policy.[40, 41]

Table 1
Scientists' Perceptions of Scientific Influence

The interview question was: "Do you think science has had a large or small influence on present day environmental policies?"

	United States		*Canada*	
	Natural Scientists (n=33)	*Social Scientists* (n=32)	*Natural Scientists* (n=33)	*Social Scientists* (n=31)
Large	48.5%	68.8%	63.6%	58.1%
Moderate	21.2%	25.0%	30.3%	29.0%
Small	30.3%	6.3%	6.1%	12.9%

Statistically significant differences occur between
® natural and social scientists in the United States (.05 level).
® United States and Canadian natural scientists (.05 level).

Source: Author's Computation

But there was also a recognition that science is limited by the fact that it is only part of a much larger social and cultural context. Two of the respondents described this limitation as follows:

> Science is constantly being mediated. While in many cases there would have been no policies if it hadn't been for scientific findings...that doesn't mean that science caused what occurred. There is so much other stuff out there -- the media, public education -- those are just as important as the science...And while science is always behind [environmental policy making], it is only one part of the actual total experience.[42]

> Both science and policy making are located in a broader puddle. They are part of an overall culture where normative ideas are good, real, and possible. But we still have political expediency. There's a certain kind of research

that is funded and certain policies are supported. Science and policy are tied together in this culture.[43]

It is important to note that United States natural scientists do not share the majority view that science has had a large influence on our present-day environmental policies. In fact, there is a statistically significant difference between United States natural and United States social scientists and also between United States natural scientists and Canadian natural scientists, with a much smaller percentage of United States natural scientists (48.5%; as opposed to U.S. social scientists = 68.8%, Canadian natural scientists = 63.6%, and Canadian social scientists = 58.1%) perceiving that science is having a large impact on present-day environmental policies. Along these lines, United States natural scientists were much more apt to describe the development of environmental policy in terms of the science being overcome by politics and special interests. During the interviews, five times as many United States natural scientists as United States social scientists, Canadian natural scientists, or Canadian social scientists referred to the influence of politics over science. One United States natural scientist felt that when you were looking at the science-policy linkage and thinking in terms of equity and fairness, then:

> Raw political power often counts for more... Policy makers sometimes listen just to pick up the nuances that support their preconceived ideas and the other is filtered out. Scientists talk about uncertainty and use "weasel words" that are often seized by that side of the issue as indicating grave doubts.[44]

Another United States natural scientist put it this way:

> Yes, policy makers listen but they have agendas of their own and their level of listening reflects their personal biases. If they find scientists who agree with their preconceived notions then they become their champion and seek to minimize, and are critical of, anyone who disagrees.[45]

Other United States natural scientists described their frustration with policy makers in terms of how their own research findings were received by policy makers.

> Policy makers will look in your eyes and have their eyes open and write things down. But there is a real question about their comprehension. They say all the good things to you...but when all is said and done, I suspect that the vast majority of policy makers miss the vast majority of what scientists have to say.[46]

> I was asked to do a technical analysis for EPA and it was clear from the beginning that they already had the answer they wanted and just wanted me to justify the answer. They wanted to hear, but got concerned when my findings deviated from expectations. They did not want to be inconvenienced.[47]

B. Faith in Science

The results of the second interview question, "Do we, as a society, put too much faith in science to solve our environmental

Table 2
Scientists' Perceptions of Faith in Science

The interview question was: "Do we, as a society, put too much faith in science to solve our environmental problems?"

	United States		*Canada*	
	Natural Scientists (n=33)	*Social Scientists* (n=32)	*Natural Scientists* (n=33)	*Social Scientists* (n=31)
Yes	43.8%	65.7%	51.5%	51.6%
No	56.3%	25.0%	45.4%	48.4%
Do not know	0%	9.4%	3.0%	0%

Statistically significant differences occur between
® all natural and social scientists (.10 level).
® all United States and all Canadian scientists (.05 level).
® natural and social scientists in the United States (.05 level).

Source: Author's Computation

problems?" are presented in Table 2.[48] The numbers appear to indicate a difference between the Canadian and the United States respondents. Within Canada, there is essentially no difference between how social and natural scientists answer this question with approximately one-half the scientists saying "yes" and one-half saying "no." However, in the United States there is a substantial and statistically significant difference between social and natural scientists, with a much higher percentage of social scientists (65.7%) than natural scientists (43.8%), believing that we put too much faith in science to solve our environmental problems.

Even though 56.3 percent of United States natural scientists interviewed personally believe that we do not put too much faith in science, there were claims among this group that a huge skepticism and cynicism has developed within society about science's ability to solve environmental problems, and the public is not willing to modify its views based on the best science because it has not taken the time to really understand the science.[49] On the other hand, there were also claims that Americans were "worshiping the gods of science and technology" and were "shockingly ignorant, misinformed...and manipulated" with respect to what science can provide society.[50]

Of those answering "yes" to this question, many (18) remarked that solving our environmental problems went way beyond science; that is, solutions would only be found in the vast nature of our cultural and social heritage. The general view was that "we tend to feel science and scientists ought to be able to fix things and get discouraged and angry when they don't. We don't realize that other factors determine what gets done...and that some problems are not amenable to scientific solutions."[51] The respondents also pointed out that "science by itself will not get you anywhere. The most important thing is still man. You must combine both things -- good science and wise use by people."[52]

The idea that the solutions to our environmental problems transcend science and rest with "man's" ability to make value judgments in a complex world was a common refrain among those interviewed. One Canadian social scientist remarked that:

> There is a tendency to think you can get technological fixes and more often you can...but ultimately there are social, political, and economic questions as well. There's a question of how much economic growth

> and population growth can there be on this planet. There is no scientific solution available for that.[53]

Another Canadian social scientist contended that:

> We have a real tendency to say that technological fixes can solve problems that are...grounded in social, cultural, and economic issues...[But], we cannot rely on technology. We must put things in the appropriate cultural context or it isn't going to work.[54]

Many respondents (16) also felt that this enthusiastic faith in science to solve our environmental problems has come about because we have had so many successes in the past. They observed that whenever "we think we're falling behind, it's been science that's brought us back" and that science "has addressed our problems for so long and so well that we've forgotten what the real problems are."[55] One respondent even went so far as to pronounce that "most of what we have today we have because of the decision to go to the moon."[56] In fact, the reference to science's ability to put man on the moon was used by several of those interviewed to describe the power of science in the eyes of the public.

Of the respondents answering "no" to this question, many (19) felt that the problems we face today in solving our environmental problems are exacerbated because we do not put enough faith in science, that science offers the only key to success. This feeling was expressed by a much larger number of natural scientists than social scientists (14 to 5).

C. The Transboundary Nature of Environmental Problems

The next interview question was intended to ferret out differences in how United States and Canadian scientists viewed the cross-border relationship in terms of their perception of the nature of transboundary environmental problems. Some scholars have recently championed the idea that we have now moved into a third generation of environmental problems, one dominated by global environmental issues that transcend all national borders.[57] This transformation is described as one where:

> There is growing recognition that national and global pollution are interdependent and, as a consequence, a purely domestic solution to most of the nation's major environmental problems is untenable.[58]

The results of the third interview question, "Do we, as a society, view environmental problems more in a transboundary nature than we have in the recent past?" are presented in Table 3. Three groups [United States natural scientists (87.5%), Canadian natural scientists (93.9%) and Canadian social scientists (93.5%)], by an overwhelming majority, felt that we do view our environmental problems in a more transboundary nature today. In contrast, barely half of United States social scientists (53.1%) felt that was true.

Table 3
Scientists' Perceptions of Transboundary Environmental Problems

The interview question was: "Do we, as a society, view environmental problems more in a transboundary nature than we have in the recent past?"

	United States		*Canada*	
	Natural Scientists	*Social Scientists*	*Natural Scientists*	*Social Scientists*
	(n=33)	(n=32)	(n=33)	(n=31)
Yes	87.5%	53.1%	93.9%	93.5%
No	12.5%	46.9%	6.1%	6.5%

Statistically significant differences occur between
® all natural and all social scientists (.01 level).
® all United States and all Canadian scientists (.01 level).
® natural and social scientists in the United States (.01 level).
® United States and Canadian social scientists (.01 level).

Source: Author's Computation

Of those respondents who answered this question "yes," many (25) felt that we are now in the realm of large, global environmental problems and that this was essentially brought about by the advent of global economies, global communication networks, and the inter-

nationalization of scientific findings. This belief is summarized by a Canadian social scientist:

> We do view environmental problems as being more transboundary in nature, especially since the whole disclosure of the environment as shaped by the view of the planet from outer space. There is a greater connection with the globalization of capital, commodities, and images -- a greater sense that the environment is global.[59]

There were many references to the idea that the world has become much more complex and interrelated because of the globalization of the economy, the globalization of communications, and the current attention directed toward large environmental issues (like global warming and the deterioration of the stratospheric ozone layer) in a way that makes people more aware of environmental problems in other countries. Respondents spoke of the global village metaphor as being more widely understood today and of the "irrelevance of boundaries in dealing with environmental issues."[60] Along these lines, those interviewed also asserted that it was science that has clearly demonstrated the transboundary reality of environmental issues.

It is interesting to note that a much larger number of Canadian (25) than United States respondents (5) put this interview question in the context of United States-Canadian transboundary environmental problems like acid rain and Great Lakes' pollution. This perception is explained by a Canadian natural scientist:

> From the Canadian perspective, we've always thought about [environmental problems] as transboundary. If there's any evolution, you'll probably find it south of the border...It is a given for air quality. We look at things apart from just the local area. Ever since the early days of acid rain -- since then, it has always been a North American dimension.[61]

This difference in United States and Canadian perspectives also showed up among respondents who felt that we do not view environ-

mental problems in a transboundary way. United States respondents (especially social scientists) were more apt to speak of the insular nature of United States environmental policy making and the lack of United States leadership with respect to international environmental issues. One United States natural scientist, who insisted that environmental problems were not necessarily viewed by society as transboundary in nature, gave his personal perspective on the Canadian influence:

> In spite of years of argument and problems like acid rain and ozone and in spite of a substantial history of scientific cooperation, my sense is that pollution problems that get people's attention are local in nature and that's how we view them. There is not much interest in global problems and people tend not to worry about their down stream neighbors. Governments may...but there is a sense that the Canadians pushed us into that; that they thought they could solve their pollution problems if they got the United States to do their part.[62]

This perception was supported by another United States natural scientist who declared that changing the focus from a local problem to a transboundary problem allowed policy makers to "pass the blame and...not do anything about the 'real' problem."[63]

D. The Sufficiency of Present-Day Environmental Laws and Policies

While some scholars have described a new era of cooperation between the United States and Canada represented by "a more integrated effort within both governments to mobilize the bilateral relationship," [64] others have insisted that Canada has become increasingly dependent on the United States with respect to the quality of its environment, [65] and that:

Sharing the border is an uneven experience, one that has fallen mainly to Canadians, who have reason to pay more attention to the relationship. But cordial relations cannot be taken for granted, and future accord will depend on Americans making an effort to understand the Canadian view.[66]

In addition, there has been much made of the inability of both Canada and the United States to enforce either their own domestic environmental laws and regulations [67] or their international environmental agreements.[68] Moreover, in specific reference to large differences between the official text of treaties and the reality of their implementation, some scholars have classified the signing of the Air Quality Accord as "hardly a bold step" toward binational responsibility for a shared environment.[69] The final two interview questions were designed to explore whether scientists on both sides of the border viewed the environmental laws and bilateral agreements of Canada and the United States in such a disapproving light.

The results of the fourth interview question, "Do current environmental laws and policies sufficiently deal with present day environmental problems?" are presented in Table 4. The vast majority of United States social scientists (78.1%), Canadian natural scientists (81.8%), and Canadian social scientists (80.6%) believe that current environmental laws and policies do not sufficiently deal with present day environmental problems. However, barely half of United States natural scientists (53.1%) felt this way.

Table 4
Scientists' Perceptions of Current Environmental Laws and Policies

The interview question was: "Do current environmental laws and policies sufficiently deal with present day environmental problems?"

	United States		*Canada*	
	Natural Scientists	*Social Scientists*	*Natural Scientists*	*Social Scientists*
	(n=33)	(n=32)	(n=33)	(n=31)
Yes	37.5%	21.9%	18.2%	19.4%
No	53.1%	78.1%	81.8%	80.6%
Do not know	9.4%	0%	0%	0%

Statistically significant differences occur between
® all United States and all Canadian scientists (.10 level).
® natural and social scientists in the United States (.10 level).
® United States and Canadian natural scientists (.05 level).

Source: Author's Computation

Of those respondents that answered "no" to this question, 27 felt that there was a need for a fundamental overhaul of the entire regulatory system. Typical of this response was a United States social scientist's claim that:

> Our present-day laws are structured to deal with "old" problems like air and water pollution and so we have created a system to tax, criminalize, and regulate these big problems...But the next generation of problems will have more to do with people's mentality, like driving cars and consumers that perpetuate abuse on the planet. Our laws do not systematically address this part of the new generation of environmental problems.[70]

It was also pointed out that today's legislation is fundamentally flawed because science takes time to find solutions but policy makers are under pressure to act immediately, and this leads to premature policies, and failure.[71] The idea that legislation is almost always outdated by the time it is enacted was prevalent among those interviewed. As two United States natural scientists put it:

> Environmental laws are put in place to solve the problems of the time. But we are creating problems on a daily basis that we don't understand. Laws are developed in the past and do not address today's ramifications.[72]

> A tremendous evolution has taken place in environmental issues...There have been so many changes in the environment and such a large growth of information that there now needs to be a corresponding change in the way we do science and policy.[73]

An additional concern listed by 19 of the respondents was that the laws we had in place were simply not being implemented or enforced; that is, our environmental problems had nothing to do with the lack of laws and everything to do with the political will to enforce them. Some respondents called the existence of environmental laws a "form of public relations."[74] One Canadian natural scientist described the problem this way:

> Canadians are always trying to distance themselves from the United States -- trying to show we are different...We are hood-winked into thinking our environmental laws are better. But for the most part, Canadians are wrong...the problem is enforcement. If we would do what we say, things should be "OK." But we don't. The policy is there but we don't implement it.[75]

Finally, with respect to interview question four, some respondents (11) referred to the fact that environmental laws were intricately linked to economic concerns and that environmental protection was tied to economic competitiveness. Several respondents took this concept further and argued that environmental laws were not effective because they are not able to modify behavior as it relates to growth. One Canadian social scientist explained:

> Scientists who are looking at the big picture and grand ideas believe we need a fundamental change in our system, a complete redistribution of wealth. That is not going to happen and the laws we have in place do not deal with that.[76]

E. The Value of Bilateral Environmental Agreements

The results of the fifth interview question, "What is the value of bilateral environmental agreements such as the 1991 Canada-United States Air Quality Accord?" are presented in Table 5. Two things stand out from these results. First, a large percentage of United States natural scientists (39.4%) fall into the category of "Do not know." Second, compared to United States social scientists (25.0%), Canadian natural scientists (39.4%) and Canadian social scientists (19.4%), a much smaller percentage of United States natural scientists (9.1%) believe that bilateral environmental agreements have had a major impact. These differences are both statistically significant and substantial.

Table 5
Scientists' Perceptions of Bilateral Environmental Agreements

The interview question was: "What is the value of bilateral environmental agreements such as the 1991 Canada-U.S. Air Quality Accord?"

	United States		*Canada*	
	Natural Scientists (n=33)	*Social Scientists* (n=32)	*Natural Scientists* (n=33)	*Social Scientists* (n=31)
Major	9.1%	25.0%	39.4%	19.4%
Moderate	24.2%	21.9%	18.2%	22.6%
Minor	27.3%	37.5%	33.3%	48.4%
Do not know	39.4%	15.6%	9.1%	9.7%

Statistically significant differences occur between
® all United States and all Canadian scientists (.05 level).
® natural and social scientists in the United States (.10 level).
® United States and Canadian natural scientists (.01 level).

Source: Author's Computation

A large number of those interviewed (24) pointed out that bilateral environmental accords are important for leverage and accountability, and another 16 respondents maintained that bilateral environmental accords were important as the first step in a long-term negotiation process. Canadian, rather than United States, respondents were more apt to say that bilateral agreements were an important first step (13 to 3) and that such agreements could be used as leverage against the other country (16 to 8).

In defending the need for bilateral environmental agreements, respondents spoke of such things as the ability of the accords to provide "subtle, continuous forms of presence," "public commitment," and the ability to open up "avenues for behavioral and value changes."[77] One Canadian natural scientist asserted that we should never underestimate the longevity of these agreements because they last longer than governments.[78] A United States social scientist made the case for the value of bilateral accords as follows:

> Bilateral environmental accords provide a written, living document -- a framework, a mechanism for common understanding for both science and politics...and codify the fact that you can come to a scientific understanding as a basis for policy understanding.[79]

However, many other respondents stated that these agreements serve predominantly "political" rather than "substantive" interests and argued that bilateral agreements failed because there were no mechanisms for enforcement. Statements were made that bilateral environmental agreements have "no real teeth," that the decisions are "political, not scientific," and that it becomes "a question of political will, and transboundary agreements do not solve that problem."[80] Along these lines, a Canadian natural scientist summarized his perceptions of bilateral agreements:

> There is a tendency for the policy maker, once the accord is signed, to believe the problem is solved and then the money dries up and you don't get to follow through, to see if it is useful. And there is a tendency to move on to other problems. But it is important to keep on.[81]

Several respondents, in referring specifically to work coming out of the Air Quality Accord, spoke of an intentional attempt by policy makers not to put into place a third-party mechanism (such as the International Joint Commission) to insure compliance, and of a deliberate attempt to keep the process "behind closed doors" and "sheltered from public scrutiny."[82] On the other hand, several of those interviewed praised the reporting and monitoring requirements of the Accord for "keeping the issue simmering and forcing cross-border contacts."[83]

V. DISCUSSION AND CONCLUSION

The purpose of this study is to enhance what we know about the articulation of science with respect to the policy making process leading to the establishment of the Canada-United States Air Quality Accord. In particular, the focus is on how United States and Canadian scientists (both natural and social) viewed several key aspects of

the transborder air pollution policy debate, including the influence of science (and scientists) in resolving that debate. Previous research, as noted earlier in this essay, has documented both the importance of science to environmental policy making and the pivotal role that scientists play in formulating such policies. However, studies have also highlighted the chilling effect that politics can sometimes have on the scientific community. Furthermore, scholars have previously documented marked differences between how natural scientists and social scientists and between how United States scientists and Canadian scientists approach the environmental policy making process. Along these lines, several findings from this study stand out.

First, the majority of respondents do believe that science has a large impact on environmental policy making. They view the work of scientists as important and essential to the policy making process. There is also an appreciation of the limitations of science and support for the idea that science is only one part of a larger process that involves many other dimensions. Rather than viewing scientists as providing all the answers, this study found that most of those interviewed (including natural scientists) were grounded in the knowledge that scientific work and scientific findings must be considered in a larger context; that is, the work of scientists needs to be tempered by social and cultural considerations that transcend the scientific process. There was also a strong recognition that environmental policy has passed into a new realm of policy making, one that goes far beyond national borders and encompasses a global view of the future where the environment is intricately entangled with social, political, economic, and communication networks that span the globe.

On the other hand, among a large portion of the respondents, most notably United States natural scientists, there exists a cynicism about the role science plays in the environmental policy making process. Less than half of the interviewed United States natural scientists felt that science was having a large influence on present-day environmental policies and less than 10 percent viewed bilateral environmental agreements between Canada and the United States as providing a substantial value. These percentages are especially noteworthy when compared to the much higher percentages of confidence exhibited by the other groups of respondents. These percentages, and the numerous comments of natural scientists marking little faith in policy makers' ability to listen to "good" science,

makes it appear that the "chilling effect" of politics on science, described by Regens, Rycroft, Gould, Kahan, and others (as presented earlier in this paper), that was pervasive during the formulation stage of transboundary air pollution policy development in the 1980s and early 1990s remains on the minds of scientists as they continue their efforts to link science to policy. Furthermore, these findings support the characterization established by Ingram *et al.* that natural scientists portray themselves as outside the political process and as misunderstood by politicians.[84]

It should be noted, though, that cynicism about the science-policy linkage is reflected among all the respondents, not just United States natural scientists. The vast majority of the respondents felt that our current environmental laws and policies were inadequate. In fact, there was a strong recognition that the command-and-control regulatory system in place today is not capable of dealing with the fast-changing world of environmental problems -- that while our environmental problems are becoming more sophisticated, our regulatory system remains static and incapable of responding to this new series of complex environmental issues.

In addition, when you factor in the respondents who answered "do not know" to the final interview question, large percentages of scientists (both natural and social) on both sides of the border had very little faith in the value of bilateral environmental agreements to bring about change. While respondents spoke of these agreements as being an important first step and a necessary ingredient for establishing effective control of transboundary air pollution, they also had serious doubts about the political will of the policy makers to actually implement and enforce the agreements.

Essentially, we may be observing scientists attempting to reconcile the hope (and rhetoric) established by the signing of the Air Quality Accord and the creation of the Commission for Environmental Cooperation with the reality that policy makers are not funding key aspects of the science needed to make these efforts successful. For example, monies for environmental monitoring of air pollution have been drastically cut over the past few years by both the United States and Canada at the very time scientists are emphasizing the need for stronger monitoring efforts.[85] Instead of moving in a direction that they perceive as not only necessary and appropriate but also promised by the recent policy agreements, scientists in both countries are witnessing a dismantling of the current environmental monitoring

apparatus. What we are left with is a scientific community disenchanted with the end results of public policy making and hence less likely to embrace future research endeavors that are conceived within a system they view as flawed.

This study also found important differences between United States and Canadian respondents. Reflecting the imbalances in vulnerability to cross-border air pollution [86] and Canadian environmental dependence on the United States,[87] Canadian respondents were more apt to view their environmental problems in conjunction with their neighbor to the south and United States respondents more apt to view their environmental problems in the context of their own country. In other words, Canadian respondents (as opposed to United States respondents) spoke more often of the need to consider what was happening in their neighboring country, of the need for scientific cooperation with their neighbor, of the importance and value of bilateral agreements, and of the need to go beyond their borders to solve environmental problems.[88] Moreover, Canadian respondents had much less faith in current U.S. environmental laws and policies to deal sufficiently with present day environmental problems.

These particular findings are quite disheartening because they are consistent with previous findings (see Note 11) suggesting that, even after many years of interaction between scientists in Canada and the United States, there remains a large gap between how Canadians and Americans perceive their relationship with respect to transboundary air pollution. Finding these differences among scientists, an elite group of actors active in the environmental policy-making process and who generally profess to the tenets of rigor and objectivity as expressed in the scientific process, supports the idea that social and cultural norms strongly influence the world of science and scientists. While this may come as no surprise, it diminishes the hope, as expressed by McKinney and Konrad (see Note 66), that Americans will really make a greater effort to understand the Canadian point of view.

This study also found that the Canadian policy-making system appears to bring about more convergence in views (at least between natural and social scientists) than does the American system. If you look closely at the percentages marking how Canadian natural scientists and social scientists answered the interview questions, one observes little difference in the overall results (except for the final

question). However, when one looks at the percentages marking how United States natural scientists and social scientists answered the interview questions, one observes a great divergence. There is a good chance that this difference reflects (as suggested by previous research and delineated earlier in this essay) the different institutional foundations of each of the countries. Whereas the United States system is marked by open conflict and public debate over regulatory science, the Canadian system limits public debate about the scientific basis of policy decisions.

Whatever the reason, the fact remains that Canadian and United States scientists differ in their perceptions about cross-border pollution. Moreover, this imbalance in perceptions has a direct consequence on the resolution of future public policy disagreements between Canada and the United States, especially from the Canadian perspective. For if the United States remains ambivalent toward (and even continues to ignore) what Canadians view as important, it means that the Canadians will have to use massive amounts of valuable resources to illuminate cross-border pollution problems in such a way that the United States pays attention.

More importantly, this divergence of views between Canada and the United States signifies the difficulty that lies ahead in truly coming to a continental environmental solution. For if the United States and Canada are straining to successfully implement their bilateral environmental policies, the implementation of policies across *three* countries with distinct political, social, and cultural systems faces a very difficult path.

ACRONYMS

CEC	Commission for Environmental Cooperation
NAAEC	North American Agreement on Environmental Cooperation
NAPAP	National Acid Precipitation Assessment Program
MOI	Memorandum of intent

NOTES

Financial support for this research from both the Canadian Embassy in Washington, DC and the Idaho State Board of Education is gratefully acknowledged.

[1] Donald K. Alper and James Loucky, "North American Integration: Paradoxes and Prospects," *The American Review of Canadian Studies* (Summer, 1996): 177-178.

[2]Victor Lichtinger resigned as the Executive Director of the Secretariat of the CEC effective March 1, 1998. Mr. Lichtinger, a Mexican citizen, was the first Executive Director and had served in this position since July 1994. CEC Secretariat Director Janine Ferretti, a Canadian, has been appointed interim Executive Director.

[3] Commission for Environmental Cooperation, *Continental Pollutant Pathways: An Agenda for Cooperation to Address Long Range Transport of Air Pollution in North America* (Montreal: CEC Secretariat, 1997), vii.

[4] It should not be forgotten that there has been longstanding United States-Canadian cooperation on transborder environmental policy since the signing of the Boundary Waters Treaty of 1909, which created the International Joint Commission. See John E. Carroll, *Environmental Diplomacy: An Examination and a Prospective of Canadian-U.S. Transboundary Environmental Relations* (Ann Arbor: The University of Michigan Press, 1986).

[5] See John Carroll, *Environmental Diplomacy: An Examination and a Prospective of Canadian- U.S. Transboundary Environmental Relations*; and Jurgen Schmandt, Judith Clarkson, and Hilliard Roderick, *Acid Rain and Friendly Neighbors: The Policy Dispute Between Canada and the United States* (Durham: Duke University Press, 1988).

[6]See Commission for Environmental Cooperation, *Continental Pollutant Pathways: An Agenda for Cooperation to Address Long Range Transport of Air Pollution in North America*, ix.

[7] See Ernest Yanarella and Randal Ihara, *The Acid Rain Debate* (Boulder; Westview Press, 1985); Archie Kahan, *Acid Rain: Reign of Controversy* (Golden: Fulcrum Press, 1986); and Roy Gould, *Going Sour: Science and Politics of Acid Rain* (Boston: Birkhauser, 1985).

[8] The focus of this study is not on the transboundary air pollution debate, but on scientists who participated, commented, or studied different aspects of this debate.

[9] See John Carroll, *Environmental Diplomacy: An Examination and a Prospective of Canadian- U.S. Transboundary Environmental Relations*; Jurgen Schmandt, Judith Clarkson, and Hilliard Roderick, *Acid Rain and Friendly Neighbors: The Policy Dispute Between Canada and the United States*; Everett Cataldo,"Canadian Acid Rain Policy: Institutional, Rational and Societal Perspectives," *The American Review of Canadian Studies* (Spring, 1990); and Leslie R. Alm, "The U.S.-Canadian Acid Rain Debate: The Science-Politics Linkage," *The American Review of Canadian Studies* (Spring, 1990):

[10] Kathryn Harrison and George Hoberg, *Risk, Science, and Politics: Regulating Toxic Substances in Canada and the United States* (Montreal: McGill-Queen's University Press, 1994), *168-184.*

[11] Previous research has also suggested that Canadians not only are more sympathetic to environmental protection but are also more supportive of environmental regulation [See Brent S. Steel, Mary Ann Steger, Nicholas Lovrich, and John Pierce, "Consensus and Dissension Among Contemporary Environmental Activists: Preservationists and Conservationists in the U.S. and Canadian Context," *Government and Planning* (8, 1990): 379-393]. Others have suggested that Canadians tend to perceive higher risks from acid rain pollution than do their United States counterparts [See Mary Ann Steger, John Pierce, Brent Steel, and Nicholas Lovrich, "Information Source Reliance and Knowledge Acquisition: Canada/U.S. Comparisons Regarding Acid Rain," *Western Political Quarterly* (39, 1988): 747-764], that Canadians are more likely to believe that both the United States and Canada are responsible for the pollution [See John C. Pierce, Mary Ann Steger, Nicholas Lovrich, and Brent Steel, "In Bed with the Elephant: Canadian and American Public and Activists' Perceptions of Responsibility for Acid Rain." Paper delivered at the tenth biennial meeting of the Association for Canadian Studies in the United States (November, 1989), 21], and that Canadians have a greater appreciation for the degree of scientific and technological collaboration needed to deal with problems such as transboundary air pollution [See William C. Winegard, *Canada and the United States in the 1990s: An Emerging Partnership* (Washington, DC., 1991), 4-5].

[12] See Leslie R. Alm, "Scientists and the Acid Rain Policy in Canada and the United States," *Science, Technology, & Human Values* (Summer, 1997): 399-368.

[13] See Bruce Forster, *The Acid Rain Debate: Science and Special Interests in Policy Formation* (Ames: Iowa State University Press, 1993).

[14] United States Environmental Protection Agency, *United States-Canada Air Quality Agreement: Progress Report* (Washington, DC: Government Printing Office, 1992), 1.

[15] Following the lead of Daniel Sarewitz [See *Frontiers of Illusion: Science, Technology, and the Politics of Progress* (Philadelphia: Temple University Press, 1996), pp. 4-5], this study defines "science" as reflecting a social consensus that treats the validity of the scientific method as proven. In this regard, the term "science" is meant to encompass all of the natural sciences (e.g., physics, chemistry, biology, astronomy, earth science) but to exclude the social sciences (e.g., political science, economics sociology, history). Hence, when the term "scientists" is used in this essay, it refers to natural scientists and any references or discussion of social scientists will be explicitly identified.

[16] Roy Gould, *Going Sour: Science and Politics of Acid Rain*, 89.

[17] See James Regens and Robert Rycroft, *The Acid Rain Controversy* (Pittsburgh: University of Pittsburgh Press, 1988), 4.

[18] See Ernest Yanarella and Randal Ihara, *The Acid Rain Debate;* Archie Kahan, *Acid Rain: Reign of Controversy;* and Roy Gould, *Going Sour; Science and Politics of Acid Rain.*

[19] Roy Gould, *Going Sour: Science and Politics of Acid Rain*, 5.

[20] Ernest Yanarella and Randal Ihara, *The Acid Rain Debate*, 1. Also, see Archie Kahan, *Acid Rain: Reign of Controversy*, 139-159.

[21] U.S. Department of State, *Memorandum of Intent Between the Government of Canada and the Government of the United States Concerning Transboundary Air Pollution* (Washington, DC: Government Printing Office, 1980), 1.

[22] Drew Lewis and William Davis, *Joint Report of the Special Envoys on Acid Rain* (Washington, DC: Government Printing Office, 1986), 5.

[23] U.S. Department of State, *The Agreement Between the Government of the United States of American and the Government of Canada on Air Quality* (Washington, DC: Government Printing Office, 1980), Article III, Article VI, and Annex 2.

[24] Karen T. Litfin, *Ozone Discourses: Science and Politics in Global Environmental Cooperation* (New York: Columbia University Press, 1994), 9.

[25] Stephen Bocking, *Ecologists and Environmental Politics: A History of Contemporary Ecology* (New Haven: Yale University Press, 1997), ix.

[26] See Ellis B. Cowling, "The Performance and legacy of NAPAP," *Ecological Applications* (Volume 2, 1992): 113; and Milton Russell, "Lessons from NAPAP," *Ecological Applications* (Volume 2, 1992): 107.

[27] Leslie Roberts, "Learning from an Acid Rain Program," *Science* (March 15, 1991): 1302.

[28] The interviews consisted of asking large, philosophical questions about the linkage of science to policy. The questions themselves were designed around the theoretical concepts discussed earlier in this paper. While questions were asked in a "yes/no" format, they were designed to be open-ended and the respondents were asked for their perceptions based on their personal experience.

[29] Others who have used the classification of scientists into the categories of natural and social sciences besides Sarewitz (See note 15) are Helen Ingram, H. Brinton Milward, and Wendy Laird, "Scientists and Agenda Setting: Advocacy and Global Warming." A paper prepared for Western Political Science Association Annual Meeting, March 23, 1990, Newport Beach, California; and Frances Lynn, "The Interplay of Science and Values in Assessing and Regulating Environmental Risks," *Science, Technology, and Human Values,* (Spring, 1986).

[30] See Ingram *et al.*, "Scientists and Agenda Setting: Advocacy and Global Warming," 5.

[31] See Nicholas A. Ashford, "Re:Disclosure of Interest: A Time for Clarity," *American Journal of Industrial Medicine* (28, 1995): 612; Stephen Bocking, *Ecologists and Environmental Politics: A History of Contemporary Ecology*, 5-6; and Frances Lynn, *Science, Technology, and Human Values*, 48.

[32] William Hagan, "Culture Wars," *Science* (265, 1994): 853.

[33] See Roger Pielke, Jr. "Asking the Right Questions: Atmospheric Sciences Research and Societal Needs," *Bulletin of the American Meteorological Society* (78): 262; Daniel Sarewitz, *Frontiers of Illusion: Science, Technology, and the Politics of Progress*, 26; and James A. Smith, *The Idea Brokers; Think Tanks and the Rise of the New Policy Elite* (New York: The Free Press, 1991), 14.

[34] Three of the scientists interviewed were working for private industry.

[35] There is no claim here that this is a purely random sample from a comprehensive population. However, I believe that it is a sample that is representative of scientists working in the environmental arena. Over the past decade, I have been gathering names (from my reading and research) of both natural and social scientists who were involved in environmental issues, especially as it pertained to acid deposition, clean air policy, and United States-Canadian environmental policy making. I used this list as the starting point of my research, contacting scientists via mailings, the internet, and by phone. From my original contacts I received commitments from 58 percent of united States scientists and 61 percent of Canadian scientists to be interviewed. I then proceeded to conduct my interviews by phone (40 percent) and in person (60 percent). I spent most of May through October 1997 "on the road conducting these interviews. There was a definite attempt to insure equal numbers of scientists from the United States and Canada and from both the natural and social science areas. Furthermore, a very wide array of disciplines is represented, both university and government scientists are represented, and all geographical areas in the United States and Canada

are represented. Finally, interviewees were guaranteed confidentiality. *Canadian Journal of Political Science* (March 1991): 25.

[36] Remember, for the purposes of this essay, the terms "science" and "scientists" refer to the natural sciences (and natural scientists) as defined in note 15.

[37] See Helen Ingram *et al.*, "Scientists and Agenda Setting: Advocacy and Global Warming," John Kingdon, *Agendas, Alternatives, and Public Policies* (Golden, CO: Fulcrum Press, 1995): Kai N. Lee, *Compass and Gyroscope; Integrating Science and Politics for the Environment* (Washington, D.C.: Island Press, 1993); and Walter Rosenbaum, *Environmental Politics and Policy*, Third Edition (Washington, DC: CQ press, 1995).

[38] Kathryn Harrison and George Hoberg, "Setting the Environmental Agenda in Canada and the United States: The Cases of Dioxin and Radon," *Canadian Journal of Political Science* (March, 1991): 25.

[39] Authur interviews, 1997.

[40] *Ibid.*

[41] *Ibid.*

[42] *Ibid.*

[43] *Ibid.*

[44] *Ibid.*

[45] *Ibid.*

[46] *Ibid.*

[47] *Ibid.*

[48] Many of the interviewed scientists made a distinction between science and technology, where science was viewed as a social process employing the ideals of the scientific method (causation, objectivity, replication, etc.) and technology was viewed as simply the engineering of the ideas and concepts generated by scientists. In this regard,

some of the interviewees who answered this question yes, stated that they did so because they were considering science and technology together as one entire process. Other interviewees who answered this question no, stated that they did so because they believed that people have faith in technology, but are skeptical of science.

[49]Author interviews, 1997.

[50] *Ibid.*

[51] *Ibid.*

[52] *Ibid.*

[53] *Ibid.*

[54] *Ibid.*

[55] *Ibid.*

[56] *Ibid.*

[57] See Norman J. Vig and Michael E. Kraft, *Environmental Policy in the 1990s*, Third Edition (Washington, DC: CQ Press, 1997), 375-377.

[58] Walter Rosenbaum, *Environmental Politics and Policy*, 8.

[59] Author interviews, 1997.

[60] *Ibid.*

[61] *Ibid.*

[62] *Ibid.*

[63] *Ibid.*

[64] John Kirton, "A Global Partnership: The Canada-United States Political Relationship in the 1990s," in Mel Watkins (ed.) *Handbook to the Modern World: Canada* (New York: Facts on File, 1993), 286.

[65] See Don Munton and Geoffrey Castle, "Air, Water, and Political Fire: Building a North American Environmental Regime," in A. Claire Cutler and Mark Zacher (eds.) *Canadian Foreign Policy and*

International Economic Regimes (Vancouver: University of British Columbia Press, 1992), 221.

[66] Lauren McKinney and Victor Konrad, *Borderlands Reflections: The United States and Canada* (Orono, ME: The Canadian-American Center, 1989), 31.

[67] See Melody Hessing and Michael Howlett, *Canadian Natural Resources and Environmental Policy* (Vancouver: University of British Columbia Press, 1997), 185.

[68] See John E. Carroll, *Canadian-American Public Policy: Transboundary Air Quality Relations* (Orono, ME: The Canadian-American Center, 1990), 3-4.

[69] John Herd Thompson and Stephen J. Randall, *Canada and the United States: Ambivalent Allies (Montreal: McGill-Queen's University Press,* 1994), 281.

[70] Author interviews, 1997.

[71] *Ibid.*

[72] *Ibid.*

[73] *Ibid.*

[74] *Ibid.*

[75] *Ibid.*

[76] *Ibid.*

[77] *Ibid.*

[78] *Ibid.*

[79] *Ibid.*

[80] *Ibid.*

[81] *Ibid.*

[82] *Ibid.*

[83] *Ibid.*

[84] See Helen Ingram *et al.*, "Scientists and Agenda Setting: Advocacy and Global Warming," 5.

[85] Commission for Environmental Cooperation, *Continental Pollutant Pathways: An Agenda for Cooperation to Address Long Range Transport of Air Pollution in North America*, 30-33.

[86] See John Carroll, *Acid Rain: An Issue in Canadian-American Relations* (Washington, D.C.: National Planning Association, 1982), 1-3.

[87] See Don Munton and Goeffrey Castle, *Canadian Foreign Policy and International Economic Regimes*, 221.

[88] The results portrayed in Table 5 also signify a certain ambivalence of United States scientists toward Canada. Much higher percentages of United States natural scientists (9.1%) and Canadian social scientists (9.7%) answered "do not know" to the question about the value of bilateral environmental agreements such as the *Air Quality Accord*. This suggests that Canadian scientists are much more "in tune" to the cross-border consequences of pollution, much more aware of bilateral efforts to reduce pollution, than their United States colleagues.

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