NORTH AMERICAN SMOG: SCIENCE-POLICY LINKAGES ACROSS MULTIPLE BOUNDARIES

DEBORA L. VANNIJNATTEN AND W. HENRY LAMBRIGHT

Within the North American context, the problem of ground-level ozone, or "smog," is not yet being addressed adequately. One reason for insufficient action is that there is conflict over what is to be done, and by whom. In the U.S., for example, when the federal Environmental Protection Agency (EPA) sets attainment standards, localities out of compliance often cannot meet their obligations by their own actions alone since their air quality is affected by the actions of other polluters "upwind." The transport of nitrogen oxides and volatile organic compounds – known smog precursors – from the American midwest into the central Canadian provinces and across the Mexican-American border raises even more difficult questions about emission reduction roles and responsibilities.

If smog, and other air quality issues, for that matter, are inherently trans-boundary, they are also extremely complex. There are continuing scientific uncertainties with regard to

*A list of acronyms used in this article is provided on page 35.

long-range air transport as well as to pollutant interactions. What is the nature of the problem? Who is doing what to whom? How? These are technical questions that require effective, managed interplay between the scientific and policy decision processes in order to be resolved. What ought to be done? Whose behavior should be changed? How? These are political questions that involve allocating costs and benefits, and mediating relationships among parties deemed to be polluters and victims.

In an ideal world there would be plenty of time to resolve the science (what is) and feed that into the policy (what ought). But the real world is filled with uncertainties and imperfections. There are technical questions for which the science is rapidly evolving or that are simply beyond the capacities of existing knowledge to answer. There is also the politics of contending groups who have interests at stake involving policy. Some groups, usually environmentalists, want to speed up the process of decision-making and get to policy, which typically involves regulations. Others, usually industry, want to delay the imposition of regulations that may prove costly. Governments frequently stand in the middle, trying to make a decision. In the process science often gets indicted by those who do not like a policy output. On the other hand, everybody likes that science which provides evidence for what they want in policy.

What is to be done about science and policy dilemmas? Finding an answer within a nation is difficult enough where the boundaries are those of states or provinces. Finding an answer where the boundaries are national may be even more problematic owing to sovereignty concerns. We call this dilemma the "dual-boundary"

Debora L. VanNijnatten teaches in the department of political science at Wilfrid Laurier University. She has co-edited Canadian Environmental Policy: Context and Cases *(Toronto, 2001) with Robert Boardman. W. Henry Lambright is director of the Center for Environmental Policy and Administration, Maxwell School for Citizenship and Public Affairs, Syracuse University. The author of numerous articles on science and environmental policy, he and Professor VanNijnatten have also co-authored a chapter in* Canadian Environmental Policy: Context and Cases *titled "Canadian Smog Policy in a Continental Context." E-mail addresses: dvannijn@wlu.ca   whlambri@maxwell.syr.edu*

problem – bridging science and policy, across jurisdictions. Here we examine the role of "boundary mechanisms" created to cope with such quandaries.

In this essay we examine six mechanisms that attempt to address the dual-boundary problem with respect to smog policy on the North American continent. Each of the chosen mechanisms provides a potential setting for judgments that aid in consensus-building for contested environmental policy and help to move the decision-making process forward. Our goal is to identify those factors that are conducive to such consensus-building. Moreover, we have chosen cases that differ according to the spatial level at which they operate in order that we might look at a variety of dual-boundary situations. Two mechanisms are subnational: the Ozone Transport Assessment Group (OTAG) in the U.S. and the Canadian Council of Ministers of the Environment (CCME) in Canada. Two are bilateral, one U.S.-Canada, the other U.S.-Mexico. These are the Air Quality Committee (AQC) and the Big Bend Air Quality Working Group (BBAQWG). The third set of mechanisms is trilateral, engaging Canada, the U.S. and Mexico: the North American Commission on Environmental Cooperation (CEC) and the North American Research Strategy for Tropospheric Ozone (NARSTO).

Our findings indicate that these six cases fall along a continuum of success to failure. While no case offers a perfect dual-boundary mechanism, the AQC and NARSTO appear to have been most successful. More generally, our examination of all cases leads us to conclude that six conditions are necessary for successful consensus-building across the dual-boundary. First, it is important that science-policy timelines intersect and that scientific input is utilized in both the problem definition and policy adoption phases of the policy process. Moreover, some attention must be given to the formalization of structures and processes for science-policy interaction and stakeholder input, although it is important to maintain flexibility. We also find that the presence of leaders (or facilitators) is critical, along with the need to build trust in a 'buffered' context. Finally, stakeholder involvement is a key ingredient for fruitful collaboration across the dual-boundary.

I. SMOG AND THE NORTH AMERICAN CONTEXT

The formulation of smog policy in North America takes place in a context of established or nascent trans-boundary working relationships, structures and processes. In particular, Canada-U.S. negotiations on acid rain reductions spanned more than a decade from the late 1970s to the early 1990s, involved multiple U.S. administrations and Canadian governments along with successive rosters of public officials, engaged the work of numerous domestic and bilateral scientific bodies, and engendered various forms of collaboration among subnational units, both domestically and across national borders.[1] In the course of this activity, much of the groundwork was laid for addressing trans-boundary smog problems in the northern half of the continent. The acid rain story also highlights the complexities and controversies associated with science-policy interaction across borders.[2]

Science conducted in Canada in the 1970s had indicated that acid rain (see Appendix 1) was having an adverse effect on eastern Canadian lakes and forests, and federal officials sought to initiate bilateral negotiations with the U.S. to achieve emissions reductions. Rather than negotiations, however, the U.S. consented to the formation of a bilateral research consultation group to study the issue. The group's final report, issued in 1980, concluded that acid rain was doing "irreversible damage" and that the primary emission sources were thermal generating plants in the midwestern U.S. and smelters in Canada, primarily Ontario.[3] U.S. emission sources, the report also noted, were responsible for 70-80 percent of the pollutants. Thus, while Canada would benefit most from U.S. emission reductions, U.S. actors would bear most of the reduction costs. Shortly thereafter, however, a joint Memorandum of Intent (MOI) was signed in which both countries promised to negotiate an acid rain agreement. The MOI also established a number of technical working groups to lay the scientific groundwork for negotiations.[4] Progress halted with the advent of the deregulatory Reagan administration.

This new administration took the position that the existing science did not support action, and emission reductions were thus premature.[5] When the National Academy of Sciences released a comprehensive report in 1981 on the effects of acid rain and called for a 50 percent reduction in the acidity of precipitation in the northeast, the Reagan administration dismissed the report as "lacking in objectivity."[6] In 1983, another bilateral study on the causes and effects of acid rain failed to reach a consensus on the science and, indeed, each country released differently-worded reports, with the Canadians emphasizing to a greater degree environmental effects.[7] In 1985, Canada and the U.S. appointed special envoys to examine the problem again, and their joint report, issued one year later, recognized acid rain as a serious trans-boundary problem and called for U.S. action.[8] Yet, the U.S. administration, the coal industry, midwestern utilities, and their supporters in Congress took great pains to point out "scientific uncertainties" relating to the causes and effects of acid rain.[9] The science of acid rain had become politicized and scientists were increasingly drawn into cross-border policy debates.[10]

In an effort to encourage American action and ensure that their own hands were 'clean,' Canadian federal and provincial governments sought to fashion a domestic reduction plan. A federal-provincial agreement-in-principle was reached in 1983, but it was not until 1985 that the seven eastern-most provinces formally agreed to the eastern Canadian acid rain program. Then, a few years later, all ten provinces agreed to a national SO2 reduction cap of 3.2 million tonnes.[11] Meanwhile, the northeastern states were unsuccessfully attempting to petition the EPA for improved controls on pollution from upwind states under provisions in Section 126 of the 1977 Clean Air Act. In addition, organizations such as the Northeast States for Coordinated Air Use Management (NESCAUM) were established to encourage cooperation on air quality issues of concern to regional groups of states.[12]

It was not until the election of George H. W. Bush, who had promised to act on air pollution, and the successful reauthorization of the U.S. Clean Air Act in 1990, which set out new emission reduction requirements, that Canada-U.S. bilateral activities bore fruit. In 1991 the Canada-United States Air Quality Agreement was signed, committing both governments to specified SO2 and NOx reductions. The agreement also established a joint Air Quality Committee to monitor implementation and issue progress reports. An interesting feature of the agreement was that, although the original focus had been on reducing emissions of those pollutants implicated in the formation of acid rain, the stated objective was to control all types of trans-boundary air pollution between the two countries. Very quickly, other trans-boundary air quality issues, including smog, found their way onto the Air Quality Committee's agenda.

Looking southward, cooperation on air pollution issues across the U.S.-Mexico border has taken a somewhat different direction. In this case, the U.S. is the major recipient of air pollution and has been eager to draw the Mexicans into cooperative arrangements for addressing air quality issues.[13] The 1983 La Paz Agreement between the U.S. and Mexico established a framework within which the two countries could institutionalize bilateral cooperation on border environmental issues. Under La Paz, two air quality agreements were reached, one involving the reduction of SO2 emissions from copper smelters on the border, and a second which established a framework for studying and regulating air quality.[14] However, the focus remained largely on domestic (even local) initiatives and criticisms of the lack of concrete bi-national action continued. Then, in 1992 the integrated environmental plan for the Mexico-U.S. border area was released, attempting to better coordinate bilateral initiatives. This plan then transmuted into the 1996 Border XXI Program, a comprehensive scheme designed to protect the environment, human health and natural resources. Specific programs in areas such as encouraging interagency cooperation, building capacity, promoting public participation, and addressing particular environmental programs are carried out via nine substantive border-wide working groups. The Big Bend Working Group, one of the cases discussed below, is a sub-group of the larger Air Quality Working Group under Border XXI.

As the North American Commission for Environmental Cooperation (CEC) has pointed out, "the interconnectedness of North American pollution problems is extensive."[15] Indeed, the CEC has itself been involved in trans-boundary air issues through its links to the Border XXI Program and the Canada-U.S. Air Quality Committee and through its own air quality research and technical programs. These various, spatially overlapping mechanisms, which encourage sub-national, bilateral and tri-national coordination, have been employed and adapted to the most prominent air quality issue of the 1990s – the regional transport of ground-level ozone, or smog. Moreover, new mechanisms to deal with this problem have been created such as the North American Research Strategy for Tropospheric Ozone (NARSTO).

The nature of the smog problem (see Appendix 2) is quite similar to that of acid rain and involves many of the same actors. It is a regional trans-boundary issue with ground-level ozone affecting areas as far as 800 kilometres away from pollution sources. As in the acid rain case, emissions from older, coal-burning power plants (exempted from new1990 Clean Air Act requirements) concentrated in the midwestern states of Ohio, Pennsylvania, and Indiana are carried on prevailing winds to the northeastern U.S. states as well as to Ontario and Quebec. Northeastern states have thus pushed for changes to national air quality legislation such that midwestern emissions must be reduced. Central and eastern Canadian provinces have an obvious interest in the outcomes associated with such efforts, as up to half of their airborne pollution originates in the U.S., in particular from the Detroit, Ohio Valley, and Cleveland areas. Atlantic Canada, especially the Saint John, New Brunswick area, receives most of its smog from the northeastern U.S. states, although smog incidences here are less intense and less frequent. In the southern areas of the continent, the regional transport of air pollution moves from the Los Angeles and San Diego areas into Tijuana, Mexico, while Mexican sources are thought to be responsible for higher air pollution levels in southeastern areas of the U.S.[16]

In order to better understand the specific dynamics of science-policy interaction in the smog case, the next section examines more closely the nature of the "dual-boundary."

II. APPROACHING THE 'DUAL-BOUNDARY'

Observers of the science-policy interface have coined terms like "policy-relevant,"[17] "regulatory,"[18] or "mandated" science[19] to indicate a growing concern that mechanisms for effectively linking science and policy be put in place in the decision-making process. Certainly, much of our environmental policymaking experience has consisted of attempts to effectively combine science with the political decision-making process. Moreover, considerable effort has been devoted to finding effective means of communicating policy-relevant science to stakeholders and the public involved in decision-making processes. Jasanoff points to the need for "a more integrative process of decision-making that can accommodate indeterminacy, lack of knowledge, changing perceptions, and fundamental conflicts."[20] Public administration and political science journals are filled with accounts of experiments in combining this triad – policy-making, knowledge production, and public involvement – in such a way that "good" decisions will result.[21]

In assessing such experiments, policy analysts and practitioners have focused on the conditions necessary for achieving "consensus."[22] A consensus process is qualitatively different from other (for example, authoritative) decision processes, as any single interest can prevent a mutually acceptable outcome by vetoing an agreement altogether, as a country may do, or making implementation of an agreement difficult, as a sub-national government may do. Reaching a trans-boundary consensus is critical in the early phases of the policy process, in what might be referred to as the *problem definition* and *policy adoption* stages. Certainly, the presence or absence of consensus at these earlier stages has obvious implications for the succeeding implementation and evaluation phases of decision-making. However, the focus here is on problem definition and adoption, largely because implementation in a trans-boundary context, is most often carried out by individual participating jurisdictions outside the realm of boundary mechanisms.

In problem definition, we need consensus on the scientific nature of a given issue. Consensus-building at this stage requires that scientific knowledge of the problem is developed, synthesized and disseminated among stakeholders; that there is a common understanding among stakeholders of this knowledge; and, that there is some recognition, on the basis of this knowledge, of how the interests of some stakeholders are affected by the actions of others. Necessary to this consensus-building is the establishment of "discursive and analytic conventions" in order to construct "a shared frame of meaning within which knowledge may be interpreted."[23] In other words, it is necessary to get agreement on what problems are important and must be addressed as well as on what constitutes "credible" or "reliable" knowledge regarding these problems.

Once consensus is reached at this stage (no mean feat!), the second stage is to achieve agreement on strategies for solving the problem, i.e., what should be the goals and what policy instruments might be used to achieve these goals? Here both scientific and political realities provide options for action which are then weighed in terms of their costs and benefits to stakeholders, using the discursive conventions already established. Technical knowledge alone cannot improve environmental decision-making, as such knowledge must be accompanied by processes for resolving normative issues.[24]

A. The Science-Policy Boundary

With respect to the science-policy relationship in this multi-stage policy process, three models have been suggested.[25] The first may be called the "science bank" model. In this approach, scientists perform research, generally called basic research, independently and autonomously of the policy process. When needed, the policymakers presumably go to the bank for information. This is equivalent to the classical model justifying governmental support of basic research put forward by Vannevar Bush.[26] This approach has a linear, sequential quality with science being available when needed.

The second model has been termed a "feeder of information" approach. Here, the policymaker sponsors research for specific policy solutions. The science role is applied and also narrower than in the previous model. The policymakers and scientists are strongly linked, with the policymaker "pulling" on the science.

A third model, which is more closely examined here, may be termed "interactive." It assumes a dynamic interplay between science and policy in which sometimes science "pushes" and at other times policymakers "pull," but in which the major characteristic is one of exchange. Problems and solutions are given clarity through a mutual learning process. This model is not necessarily linear or sequential. The "feeding of information" can take place, but in a context that is much broader than the second model would suggest and which in fact may also require consciously developing and drawing on the bank of knowledge as foreseen in the first model. In model 2, scientists supply answers in response to policymakers' questions; in model 3, they may define the questions themselves and seek to inform policymakers of the answers. As Lambright has noted elsewhere, special linkage mechanisms can facilitate this interactive process.

> In policy-relevant science, different processes operate. What scientists do depends on what policymakers need. What policymakers do, depends in part on what scientists can provide. . . Consensus-forming processes are speeded up by special mechanisms, and actions are taken by policymakers on the basis of what may be very tentative technical agreements based on limited data. . . . The result is a model in which science is performed, agreement is negotiated by special mechanisms, and knowledge is transferred to policymakers."[27]

This model can employ an "assessment for policy" approach. The assessment is a particular "product" that extrapolates policy-relevant science from the larger body of research produced. The assessment comes from scientists and this model thus envisions a pro-activity, even policy-entrepreneurial quality on the part of scientists. Leadership is exercised in order to make interaction effective.

B. The Jurisdictional Boundary

The interactive science-policy model requires certain kinds of mechanisms to traverse the boundary. Guston has called some of these boundary mechanisms "organizations" in the sense of their having fairly firm structures. He stresses that such entities "straddle the shifting divide between politics and science."[28] Whether bureaucratic entities or less formal work groups, committees or other kinds of enterprises, these mechanisms can also straddle jurisdictions, and this jurisdictional divide provides the political context within which science and policy interact.

Exploring the conditions, structures, and processes associated with consensus-building via boundary mechanisms is even more complicated in a context in which at least two sovereign jurisdictions must engage in decision-making. The more diverse the jurisdictions and the more heterogeneous their representation, the more complex the context. Here, the science-policy problem gets caught up in the divergent interests of political officials, scientific communities, and stakeholders rooted in often very different cultural contexts.

Most fundamentally, there can be a tension between the need of policymakers and scientists for credibility in international negotiations and their desire to be seen as loyal to home jurisdiction interests. Clarke, for example, finds "scientific information . . . tainted by the political interests of the particular country producing it."[29] Despite this, Haas has found that scientists may constitute a boundary-spanning community capable of overcoming more parochial interests. Writing of "epistemic communities," he studied progress in dealing with environmental problems affecting the Mediterranean Sea and found that certain professional groups showed similar mental models of cause-and-affect relations, tests of truth, as well as particular values regardless of nationality. Their expertise and perspective proved important in reaching trans-border agreements as well as domestically.[30] Both the Clark and Haas views acknowledge the inevitable tensions on individuals involved in trans-boundary decision-making.

Moreover, it is not just scientists and policymakers that are engaged in trans-boundary decision-making activities, but also industry and environmental groups, and even individual citizens can be present. The engagement of such diverse stakeholders undoubtedly complicates the process of reaching agreement across the dual-boundary, as there are more players whose interests have to be accommodated in the consensus. Yet it is also possible that stakeholders may play a "mediator" role in dual-boundary discussions, as, like scientists, they share trans-boundary interests in particular types of policy outcomes. Moreover, institutionalized stakeholder involvement is necessary for the evolution of these mechanisms into new and legitimate centers of trans-boundary political activity.

For each of the six mechanisms explored below, we provide some background on associated structures and actors, as well as the decision-making process as it has unfolded across the dual-boundary. Our approach is inductive; it is the details of the cases that lead us to our conclusions.

III. SUB-NATIONAL MECHANISMS

A. Ozone Transport Assessment Group (OTAG)

The story of the Ozone Transport Assessment Group (OTAG) goes back to the 1990 Clean Air Act in the U.S. There was some awareness at the time among policymakers that ground-level ozone was a regional problem, although the extent of this problem was not known. A number of states in the northeast, concerned about the flow of smog precursors from the midwest into their region, lobbied for authority in the law for some input into federal decision-making on this issue. Hence, in the law, the EPA was granted authority to establish multi-state "ozone transport regions," and an Ozone Transport Commission (OTC) covering a twelve-state region from Maine to Virginia, plus Washington, DC was created in the early 1990s.[31] The OTC was a boundary mechanism striving for a consensus view of the regional transport problem on the part of all involved states. It was more policy-oriented than science-oriented and could recommend policy options to the EPA. However, the EPA remained the final authority.

As the science advanced, it became clearer to scientists and policymakers that the twelve-state region was too small to encompass the ozone transport problem. But how many states were enough? Could the midwestern states, which the northeastern states believed were responsible for their problems, be brought to the table? As this concern grew, the EPA came under pressure by 1994 from environmentalists to impose penalties on non-attainment jurisdictions. At the same time, however, the election of a conservative Republican Congress in November, 1994, dissuaded the EPA from moving too quickly and strongly on enforcement.[32]

In 1995 the EPA, in conjunction with the Environmental Council of the States (ECOS), established a temporary two-year boundary mechanism – the Ozone Transport Assessment Group (OTAG) – consisting of the 37 easternmost states plus the District of Columbia. The goal of the OTAG process was to reach consensus between the EPA, northeastern states and midwestern states on the nature of the ozone transport problem and on necessary emission reductions to achieve EPA air standards. On the basis of this consensus, the EPA would then issue rules requiring states to tighten control measures to prevent transport. However, if no consensus was achieved, the EPA stated that it would use its authority under the Clean Air Act to require emission reductions.[33]

OTAG utilized innovative processes for both science-policy integration and multi-stakeholder consensus-building. Since the states are responsible for developing state implementation plans (SIPs) for attaining federal standards, ultimate decision-making (within the framework of OTAG's limited mandate) rested with state environmental commissioners.[34] It was these state environmental commissioners who exercised "shrewd" and "dynamic" leadership throughout the process.[35] In particular, the Illinois environmental commissioner was a key player in the process. Yet technical and policy staffs from the states and EPA, as well as non-governmental stakeholders from both affected industrial sectors and the environmental community, were actively involved at every stage.

The organization was divided into three levels: a policy group, sub-groups, and work groups. Technical data and policy positions on specific issues were first developed by the work groups, themselves chaired by state regional organizations and EPA representatives, and their subcommittees, often chaired by non-governmental stakeholders. The activities of the work groups and their subcommittees have been described as "the heart of OTAG," due to the nature of multi-stakeholder exchange on both scientific and policy issues.[36] The work groups then submitted their data and policy recommendations for debate by sub-groups, which moved discussion into the realm of policy adoption and hammered out compromise positions for consideration by the policy group. The policy group, consisting of state environmental commissioners, operated mainly on a consensus basis. For the final recommendations, however, a process was developed whereby each state cast a vote, both for individual recommendations and for the final package of recommendations.[37] Throughout the process, OTAG's outreach and communications sub-group worked to educate the public about OTAG's goals and its processes.

In the course of its work, OTAG sponsored numerous studies relevant to its policy mission. Twenty million dollars in funding went to OTAG over the two-year period, with much of it for data gathering, analysis and modeling. In fact, OTAG was "one of the largest air pollution data gathering, analysis, and modeling exercises ever conducted." [38] In the end, OTAG confirmed that the ground-level ozone problem was far broader in scale than perceived by policy makers in 1990. According to a major evaluation of OTAG's work, this body did not produce breakthroughs in science, but its research delineated how and where ground-level ozone moved, thereby producing credible technical information.[39] Most importantly, OTAG's processes enlarged the number of people – researchers, state and federal officials, businessmen – who accepted the reality of long-range transport. This meant progress in the problem definition stage of policymaking.

With regard to its policy recommendations, OTAG set out emission reduction strategies including controls on utilities, non-utility stationary sources, mobile sources, and fuels. To the extent these recommendations came not only from northeastern states, those on the receiving end of pollution, but also from many others to the west emitting large quantities of smog precursors, they were important in moving decision making on to the second stage of policy – adoption. For EPA, which had to worry about Congress, state resistance, and lawsuits in exacting pollution controls, the more consensus for policy, the better.

The price of consensus, however, was weak recommendations. Called "least-common-denominator" agreements by the aforementioned OTAG evaluation, and "vague and ambiguous" by others, recommendations included the need for further research at the sub-regional scale (two to five states) and flexible guidelines for power sector NOx emission reductions.[40] Even with the vagueness, five of the 37 states opposed OTAG's recommendations. When EPA subsequently moved on ground-level ozone policy, five others joined the opposition in challenging EPA's proposed rule, underlining the continuing schism between midwestern and northeastern states.[41] In spite of this split, EPA still could claim a broader base of support linked to greater agreement on science and acceptability through state involvement than if OTAG had not been established.

B. Canadian Council of Ministers of the Environment (CCME)

The boundary mechanism for consultation and coordination among federal and provincial governments in Canada in the environmental policy sphere is the Canadian Council of Ministers of the Environment (CCME). The CCME is aided in its work by an independent secretariat as well as by a plethora of technical and policy task groups and committees. Thus, in contrast to OTAG in the U.S., the CCME is a permanent feature of trans-boundary environmental decision-making in Canada, especially since a 1988 reorganization which gave the Council a larger budget and staff.[42] Moreover, the 1998 Canada-wide Accord on Environmental Harmonization, an agreement designed to enhance environmental protection nationally through coordinated federal-provincial action on a broader level, has further formalized the role of the CCME.

Like OTAG, the CCME is primarily a policy-oriented mechanism. It defines as its "core business sectors" 1) information exchange between federal and provincial environment ministers to assist them with problem solving and change management; 2) harmonization relating to nationally consistent standards and guidelines, process/approach/strategy, data management, policy development; 3) coordinated jurisdictional input into federal, provincial and territorial environmental legislation as appropriate; and, 4) coordinated jurisdictional input on national and international environmental issues and problems.[43] As a boundary mechanism, the CCME's energies are directed equally toward consensus building in the problem definition and policy adoption phases.

The CCME first undertook to address the problem of ground-level ozone – and bring about some coordination in provincial approaches – in the late 1980s. The result was the three- phase 1990 NOx/VOC Management Plan developed in consultation with industry and environmental interests and containing 59 separate initiatives to resolve the problem of ground-level ozone by 2005. During Phase 1 of the Plan (1990-94), a national prevention program was to be established, interim targets for NOx and VOC reductions were to be negotiated, and studies on which to base final reduction targets were to be conducted. During Phase 2 (1994-97) the final caps on NOx and VOCs would be established and additional remedial measures for ozone problems were to be identified. Final adjustments to the caps and remedial measures were to be made during Phase 3 (1997-2000).

The plan also entailed a science problem definition, or assessment, phase. The assessment, led by the federal government, consisted of seven study initiatives. For each initiative, a multi-stakeholder group was established and met twice a year over 1992-95. Federal scientific personnel completed the actual technical work with two Environment Canada staff coordinating their efforts. The results were peer-reviewed in 1995-96. In 1997, a synthesis document was prepared and made available to policymakers. By this time, however, CCME's policy agenda had moved beyond the original intentions of the 1990 NOx/VOC Management Plan and the assessment was no longer associated with CCME activities.[44] In fact, the plan itself was harshly criticized by the federal environmental commissioner as woefully inadequate,[45] and many initiatives appeared to be on hold. Thus, while the assessment had been initially policy-driven, by the time it was done it was out of sync with the policy process and there was no "user pull" to link the completed scientific information back into the decision process.

A year later, circumstances changed and the science was recoupled to decision making. In 1998 CCME moved to developing "Canada-wide Standards" (CWS) for ozone and particulate matter under the new Canada-Wide Accord. Perhaps as a result of prior difficulties in linking science and policy in its discussions, CCME developed a formalized process for science-policy interchange in the standard-setting process.[46] This process focused on a "risk-based" framework and a supporting "toolbox" for integrating scientific, technical and socio-economic factors in the CWS development process. There are four phases in this framework. In the first assessment phase, data for the science, technology and socio-economic components is gathered and analysed. The scientific data is "evaluated and interpreted to provide a nationally consistent risk-based assessment describing the reference concentration (e.g., ambient environmental quality guidelines) at which effects are not expected . . ." In the second integration phase, assessments of all components are brought together and candidate measures for CWS are proposed. In the third decision phase, final consultation and inter-ministerial negotiations take place based on the results of the integration phase. Recommendations for CWS are then made to the ministers, who make the final decision. In the fourth phase, implementation is carried out. It is notable that stakeholder involvement occurs at each stage in this iterative process.

A Standards Development Committee for ozone and particulate matter, consisting of managers/directors (policy personnel) from the federal government and provinces, convened approximately 48 times over 1998-2000 to work through this risk-based process. The committee deliberations were aided by science/technical personnel from the governments, and members consulted on a regular basis with a core advisory group consisting of environmental and industry stakeholders. There was little debate on the science, owing in part to the acceptance of the 1997 Science Assessment. Scientists had a low profile, however. In committee discussions, interestingly, it was environmental and industry stakeholders rather than policymakers who most often drew attention to the science.[47] In the end, in June 2000, new standards were recommended by CCME and policies moved forward to the authoritative adopters in the federal government and provinces.

CCME's experiences suggest that, while a boundary mechanism can initiate problem definition for policy, it must ensure that this analysis is fed back into the policy process. A crucial element here is synchronization, because science assessments need to be tied to policy timelines to have impact. This case reveals a decoupling, then a recoupling of science to policy. It also indicates that the role of science appears to be more readily accepted in the problem definition stage of decision making than later; it is often difficult for scientific personnel to maintain a role in the policy adoption stage. Moreover, non-governmental stakeholders may be key to ensuring that scientific information is given appropriate consideration as the decision-making process moves forward.

IV. BI-NATIONAL MECHANISMS

A. Air Quality Committee (AQC)

In 1991 the Canada-U.S. Air Quality Agreement established a bilateral boundary mechanism for trans-boundary air quality consisting of a coordinating committee – the Air Quality Committee – and a research and monitoring network. As noted above, while the original impetus for the agreement was to reduce acid rain precursor emissions, the stated objective of the agreement is to control all types of trans-boundary air pollution between the two countries.

The Air Quality Committee (AQC) is itself composed of six representatives from Canada and six representatives from the United States which meet at least once a year. The Canadian members all hold significant positions within Environment Canada, provincial environmental agencies or other federal departments, while the American members are from the EPA, the Departments of Energy, Interior and Commerce, and the president's Council on Environmental Quality.[48] There are also two subcommittees – a more policy-related subcommittee 1 and a science-related subcommittee 2 – that engage in detailed activities to fulfil the AQC's mandate. It is the staff on these subcommittees as well as others providing assistance to AQC members who carry out the work of the AQC.

The AQC reviews progress made by the two countries in implementing the agreement; prepares and submits progress reports every two years; refers these progress reports to the International Joint Commission for public comment; and then releases the progress reports to the public after their formal submission to the governments. The AQC also facilitates information exchange among governments relating to monitoring, emissions, technologies, measures and mechanisms for controlling emissions, atmospheric processes and effects of air pollutants. In performing these information collection and dissemination duties, the AQC is also in a position to offer policy advice.

Like OTAG and CCME, the AQC is more policy than science-oriented. The AQC relies on resources that can be made available by the two governments to carry out its activities, i.e., staff and technical assistance are "borrowed" to produce progress reports and support research initiatives. Despite the informal nature of interactions associated with AQC work, and the fact that the AQC must take direction from the highest political levels, the AQC, or more specifically the staff associated with its sub-committees, can move the policy process forward, especially during the problem definition phase. The AQC's activities in moving governments toward a Canada-US "Ozone Annex" are a good illustration of this process.

Beginning in 1995, there were discussions among staff associated with the AQC concerning the possibility of adding an ozone annex to the 1991 Canada-United States Air Quality Agreement.

Ongoing research suggested that ground-level ozone had serious human health impacts. Also, OTAG's technical work was popularizing the whole idea of ozone "transport" across borders, and Canadian research confirmed that Canada's smog problem could be at least partially attributed to such trans-boundary flows from the U.S. Moreover, public input solicited on the 1996 AQC progress report (on its work in acid rain reduction) yielded considerable support for expanding the scope of the agreement to encompass ozone and particulates.[49]

In 1996 a few key Canadian and American officials associated with sub-committee 1 put together a workplan for moving the annex idea forward. First, officials prepared a Joint Plan of Action for Addressing Transboundary Air Pollution, focusing on ozone and particulate matter, in time for a high-level meeting in April, 1997 between the EPA administrator and Canadian environment minister.[50] Both policy leaders signed the plan of action. For the one-year anniversary of the signing of the joint plan of action, AQC staff prepared another document which reviewed progress on the plan of action over the past year and committed the two governments to begin considering possible elements in an ozone annex within a specified time frame. This, too, received policy endorsement.

Meanwhile, sub-committee 1 prepared a report entitled *Ground-Level Ozone: Occurrence and Transport in Eastern North America*. Released in early 1999 and the first joint report of its kind, it reviewed the state of knowledge on ozone transport using Canadian and American data to show trans-boundary flows and concluded that there were substantial trans-boundary regional benefits to controlling nitrogen oxide emissions through bilateral action. Specific recommendations for the ozone annex were also included.[51] This report, put together using whatever resources, agency staff time and technical assistance that could be made available on both sides of the border,[52] was key to cementing a growing consensus on the nature of the Canada-U.S. ozone transport problem and moving the process toward a consideration of policy options. The plan of action and progress report provided a framework within which these processes could occur. Formal negotiations on an ozone annex did indeed begin in the fall of 1999 and continued through 2000.

The negotiations themselves, constituting a policy adoption phase,[53] were subject to the push and pull of domestic influences. On the U.S. side, the EPA's goal was to move forward with its new national ambient air quality standards on ozone and particulate matter, even in the face of ongoing litigation and opposition from midwestern states. On the Canadian side, the federal government needed an interprovincial agreement to bring about ozone-related emission reductions, and the Canada-U.S. negotiations provided an impetus for getting commitments from high-emission provinces, especially Ontario. Perhaps most importantly, both countries acknowledged that the negotiations needed to be completed before the U.S. election and a possible change of administration in January, 2001.

The AQC ozone experience highlights a number of issues associated with the operation of bilateral boundary mechanisms. The informal structures and processes for science-policy interaction characteristic of the AQC, which rely on *ad hoc* cooperation between staff in the two countries, are subject to domestic resource and political constraints. While there is an explicit commitment on the part of each government under the Agreement to undertake scientific and technical activities,[54] there is no pledge to launch such activities jointly or to fund them. Yet joint assessments are a necessary part of trans-boundary decision making, especially in securing a consensus on problem definition. The *Ground-Level Ozone* report was made possible only through the determined efforts and budget sharing of environmental agency staff committed to the process.

In such an informal context, success in moving the process through problem definition to policy adoption is highly dependent on leadership from agency staff in the two countries as well as on effective cooperation. Particularly important are "transition" persons, technically trained people who can translate science into policy in AQC subcommittees.[55] Such policy leaders have less influence in the realm of international negotiations, however, where progress is dependent on a variety of political factors. This constraint was ameliorated somewhat in this case by the boundary people on the staff of the AQC who were also present on the ozone annex negotiating teams of the two countries. The relatively closed nature of this policy adoption process, i.e., the bilateral negotiations, may be problematic to the extent stakeholders whose support is needed in later stages of the process are excluded.

B. Big Bend Air Quality Working Group (BBAQWG)

In 1983, the presidents of the United States and Mexico signed the LaPaz Agreement, described above, which authorized EPA and its Mexican counterpart, SEMARNAP, to cooperate on binational border issues involving the environment. The boundary mechanism was, therefore, an inter-agency collaboration that operated through work groups on specific problems.

Among the border problems increasingly salient to EPA and the U.S. National Park Service (NPS) was the haze that hovered over Big Bend National Park. This park, located in west Texas, is one of the most remote national parks in the U.S. Yet its air pollution was becoming progressively worse. The decision by Mexico to build a huge power utility, Carbon II, near a similar power plant, Carbon I, triggered alarm in EPA and NPS. The plants burned coal and had no scrubbers or other pollution-control devices required of new U.S. utilities. Government-owned, Carbon I and II were 20 miles from the U.S. border, 130 miles east-southeast of Big Bend. Preliminary studies by EPA and NPS in 1993 indicated that the two plants were a serious threat to Big Bend visibility.[56]

Industrial and economic development was Mexico's highest priority in building the utilities in the region selected. The possibility of their causing aesthetic damage to a remote national park used by American tourists was not seen as an urgent issue by Mexico, which faced potentially life threatening environmental problems domestically. However, in 1993 Mexico was engaged in a campaign to help win U.S. approval of NAFTA. Big Bend's deteriorating condition was drawn into the NAFTA debate and given a high profile by U.S. media and congressional hearings.[57] Mexico was anxious to show that it cared about environmental problems at the border. Hence, the inter-agency cross-border mechanism established under LaPaz was extended to include a Big Bend Air Quality Working Group.

The Working Group itself was science-oriented, run by technical representatives from EPA, NPS and SEMARNAP. It was soon clear that the Working Group had to carry out its technical activity in a highly charged political context. Texas, for example, became impatient and sought to pressure the Working Group to speed up its data collection and analysis. In its view, the Working Group was less an effort in science and more a strategy by EPA to delay action and turn a policy issue into a technical matter, thereby taking it "out of the public view." A number of environmental activists agreed, especially when it took the Working Group a year to agree on which way the wind was blowing – i.e., in a direction that implicated Carbon I and II as a possible source.[58]

As research by the Working Group continued, EPA in 1995 sought to persuade Mexico to adopt an experimental pollution control device on the power plants, offering $500,000 as an incentive. Mexico refused the offer. Also in this year EPA attempted to get Big Bend addressed at a summit meeting between the U.S. and Mexican presidents. While the two chief executives said they would work on border environmental problems, they did not publicly mention Big Bend.[59]

Texas, meanwhile, looked to an alternative to the technical Working Group mechanism for redress of its grievances. NAFTA had established the Commission for Environmental Cooperation (CEC) as a vehicle to deal with environmental issues. However, CEC saw its primary mission as coping with environmental issues with a trade connection, as well as with issues that were trilateral. Although Carbon I had U.S. investment and Carbon II would have become involved in future Mexico-U.S. energy exports, Big Bend did not fit comfortably into these criteria.[60]

The Working Group concluded that further research was necessary as a basis for policy—a policy with high stakes given the huge costs that pollution controls for Carbon I and Carbon II would entail for Mexico. More study and analysis were undertaken, and critics of the Working Group found the process "maddeningly slow."[61] When results finally became public in 1998, they pointed not only to Carbon I and Carbon II as potential sources of pollution, but also to certain aging power plants in Texas. As the Mexican plants were legal under Mexican environmental rules, so also were these Texas plants under existing U.S. statutes.[62]

It seemed that the more science came into the picture, the less certainty there was about responsibility for pollution. To get more precise science, Congressman Henry Bonilla of Texas earmarked funds in 1999 for what was called a "tracer" study aimed at identifying as clearly as possible the sources of Big Bend pollution. From a policy standpoint, the issue was not only who was doing the polluting, but also whether the answers could be given some quantification and accountability apportioned.[63]

Initially, this study, known for short as Bravo, was like the earlier ones insofar as being cooperative, science-oriented and policy-relevant. Moreover, it appears to have been far more inclusive than earlier work, involving a number of research entities in addition to the U.S. and Mexican environmental agencies and NPS. These included DOE, NOAA, the Texas National Resource Conservation Commission, Environmental Defense Fund, representatives from the U.S. and Mexican electric power industry, Colorado State University and the University of California, Davis.[64] However, Mexico soon dropped out of the project, arguing that the scientific design was biased against Mexico. Bravo continued, but solely under U.S. auspices.[65]

Big Bend thus illuminates how hard it is to conduct science where the policy setting is intensely politicized. A technical working group, under the auspices of federal agencies on two sides of a border, cannot be expected to solve what is really a high-level political problem. In this context, even the most dynamic and committed leaders or facilitators would find it difficult to move the policy process forward. Big Bend shows the limits of a particular science-oriented mechanism and emphasizes the need to buffer science from political conflict in the problem definition stage. Most significantly, it reveals the requirement among contending parties for trust in one another and the decision mechanisms they use if they are to reach consensus. It is not axiomatic that the policy process always moves forward. Sometimes it stands still, or even goes in reverse.

V. TRI-NATIONAL MECHANISMS

A. Commission For Environmental Cooperation (CEC)

On a broad level, the origins of the NAFTA Commission on Environmental Cooperation (CEC) can be traced to "the increasing intensity, severity, and scientific and public recognition of trilateral environmental interdependencies and problems in the North American region in the 1990s."[66] The CEC emerged out of trilateral negotiations on an environmental side agreement to NAFTA (NAAEC), negotiated in order to assuage the concerns of environmental NGOs and other political actors that increased trade would come at the expense of the environment. As a boundary mechanism, the CEC grew out of and operates within a highly sensitive political environment in which sovereignty concerns exist alongside trade-environment conflicts.

The CEC consists of three structures: the council, the secretariat and the joint public advisory committee. The council is a ministerial-level body that meets at least once annually to discuss the activities of the commission. Generally, it operates on the basis of consensus, but for certain tasks[67] a two-thirds majority is the decision rule. The secretariat is a truly trilateral, permanent organization based in Montreal that carries out the work of the commission. The secretariat possesses an executive director and staff (55 employees in 1997) recruited on the basis of merit. It has investigatory powers, issues public reports on the activities of the Commission, and is answerable only to the council. Although the secretariat has no formal policy advisory responsibilities, its considerable legal and technical expertise, along with the information it possesses on the environmental activities of governments (in a harmonized statistical database), contributes to its influence.[68] Finally, a joint public advisory committee (JPAC), consisting of 15 members appointed by the three countries, contributes public input to the activities of the CEC. It meets at least once per year (but has tended to gather much more often) and also holds public meetings in the three countries on specific issues. The JPAC may advise the Council on any matter within the scope of the agreement and is entitled to review the Commission's annual program, budget or reports.

The NAAEC committed the three governments to sustainable development, high and continuously improving levels of environmental protection, serious enforcement of domestic environmental laws, and public transparency in doing so. The agreement also sets out processes for developing greater compatibility of environmental technical regulations, standards and assessment procedures and encourages the parties to promote scientific research and technology development.[69] These tasks were to be carried out by the CEC. The CEC is thus a policy- oriented mechanism, but, unlike other mechanisms examined above, also has well-defined implementation powers and processes.

While the CEC has attempted to delineate its role in terms of long-range air pollution affecting all three NAAEC countries, in reality there are few pollutants that fit this criterion. The CEC's air issues program, in terms of science and policy activities, is not particularly well-defined at present. Also, the CEC's activities are defined according to three-year workplans approved by the member governments, and deviations from these workplans (unilateral or otherwise) are difficult.[70]

The CEC can, however, undertake independent research under Article 13 of the NAAEC. In the mid-1990s it initiated a study into the nature, extent, and significance of the pathways by which air pollutants travel to, from, and within North America. The study involved an Expert Advisory Panel on Continental Pollutant Pathways (EAPCPP), a group of over 30 North American scientists, which produced a science-based, "general consensus" report of the sources, pathways and effects of air pollution in North America.[71] The CEC also enlisted the aid of a consultative group (of interested stakeholders), a policy group (of air policymakers from all over North America) and the Advisory Group of the CEC air monitoring and modeling project.

The report did receive considerable press at the time of its release in 1997, at least in Canada and the U.S., but it was considered too broad to be policy-relevant by top officials in these countries. This appears to be characteristic of some CEC reports which aim to be general enough to avoid provoking the sensitivities of member governments.[72] The report did not feed directly into any particular policy processes underway in the member governments, although it may have contributed to problem definition in terms of domestic policy processes in Canada and the U.S.[73]

Within the CEC's program area "pollutants and health," which is designed to encourage cooperative initiatives to prevent or correct adverse effects on a North American scale, there are three subprograms: facilitating tri-national coordination in air quality management; developing technical and strategic tools for improved air quality; and tri-national air quality improvement in North American trade and transportation corridors. These programs provide some technical support for governments, although it would be difficult to argue that they are instrumental in moving particular policy processes forward.

As a boundary mechanism, the CEC highlights the complexities inherent in multilateral cooperation; for example, there is little incentive for either Canada or Mexico to cooperate with one another on border issues, as they do not actually share a border.[74] Sovereignty and protectionist concerns also play a strong role given the NAFTA-trade context, and it is difficult to fashion a forum where domestic actors (even those who work within the CEC) can be "protected" from criticism back home. Probably the greatest obstacle facing the

CEC is the ambiguity (sometimes hostility) in some relations it has had with the member governments. Even stakeholder support is uneven.[75]

It has been suggested that the CEC may have a role to play in providing scientific assessments similar to those done under the auspices of the Intergovernmental Panel on Climate Change, which would aid in bringing scientific knowledge together in a policy context.76 Indeed, the CEC has already been very successful in its data-gathering efforts, as the annual *Taking Stock* reports attest.

B. North American Research Strategy For Ground-Level Ozone (NARSTO)

While the other boundary mechanisms discussed above had their origins primarily in policymakers' concerns, NARSTO has been driven by scientists. One year after the Clean Air Act was passed in 1991, the U.S. National Academy of Sciences-National Research Council produced a report, *Rethinking the Ozone Problem in Urban and Regional Air Pollution*. The report declared: "Progress toward reducing ozone concentrations in the United States has been severely hampered by the lack of a coordinated national research program directed at elucidating the chemical, physical and meteorological processes that control ozone formation and concentrations over North America."[77] NAS's message was that the U.S. ozone problem needed to be addressed within a North American context. Also, NAS was implicitly calling for a research program of considerable scope, embracing many disciplines and potential funding agencies. At a minimum, it wanted fragmented activities to be more strategically planned and managed.

Scientists within the U.S. were the drivers behind the creation of NARSTO, and American actors have continued to be the major force behind the organization. Early on, the U.S. founders enlisted colleagues in Canada and Mexico with the aim of creating a research endeavor that crossed national boundaries. In 1994, the founders met in Boulder, Colorado and agreed on a strategy of research. The following year a charter for NARSTO was formally approved and signed at a White House ceremony. Significantly, NARSTO was linked to policymakers through its designation as a presidential initiative under the interagency National Science and Technology Council.[78]

The structure of NARSTO is thus inter-agency, international and—crossing yet another type of boundary—inter-sectoral. Industry is involved as a funder through the U.S. utilities' research arm, EPRI, and other organizations. The U.S. agencies driving NARSTO include DOE, NOAA, and EPA. For Canada, Environment Canada has taken the lead. From Mexico, the Environment Institute and the Petroleum Institute, both governmental organizations, take part in NARSTO. While policy direction for NARSTO lies chiefly with the funders, the mechanism is highly participative in structure, with researchers, environmental organizations, and companies from the three nations involved. NARSTO contains three membership categories: *sponsoring partners* who are charter signatories and contribute financial and other operational resources to the program; *participating partners* who represent the university and contractor communities; and, *affiliated partners* who are organizations or groups representing specific stakeholder communities. In addition, there are numerous committees, with the principal policy group being the executive steering committee.

Once established, NARSTO had to implement a research program that had grown in concept from the "national" effort suggested in the NAS-NRC document. This entity was now supposed to be a genuinely international venture. Also, while science-oriented, it was to be policy-relevant; NARSTO's mission is "to coordinate and enhance policy-relevant research."[79] This meant that NARSTO had to think about how to produce and package research in such a way that it would be used by policymakers. In performing its work, NARSTO produces two kinds of outputs. First, researchers do science and produce papers that are peer-reviewed prior to publication – a traditional process in research. In addition, and more importantly, NARSTO produces "state-of-the-science" assessments which outline in a comprehensive manner scientific advances in particular areas. Assessments are intended to be written in a manner understandable to policymakers and to be delivered on a schedule more timely than the academic process affords.

NARSTO's experience with science assessments can be characterized as a learning process. The first assessment, reviewing advances in the chemical, physical and meteorological science of ground-level ozone, was initiated in 1996. It was considered "state of the art" – seventeen critical review papers were prepared by experts in the relevant research areas, all were peer reviewed, and the results were summarized in a synthesis document for circulation. This first assessment suffered from three weaknesses, however.[80] First, the assessment process itself was too lengthy and evolved beyond policymakers' time frame for addressing ozone decision-making. The peer review process alone took 16 months. Secondly, the first iteration of the synthesis document was too complex for policymakers and needed to be redrafted. It was made available only in late 2000. Finally, stakeholders were not as aware of the ongoing assessment as they might have been. Thus, the science and policy processes were evolving independently of one another.

However, NARSTO has attempted to address these shortcomings in its current project, a science assessment of particulate matter (PM). While NARSTO was originally formed to deal with ground-level ozone, it decided in 1997-98 to expand its mandate and address PM. This evolution of agenda reflects NARSTO's desire to evolve in accord with policymakers' needs, and PM is certainly on policy agendas in North America. In the U.S., the EPA is currently working on new national ambient air quality standards for PM, about which final decisions must be made by mid-2002. In Canada, the minister of the environment has stated his intent to declare PM precursors (SO_2, NOx, ammonia) toxic under the Canadian Environmental Protection Act (CEPA), which would require detailed assessment work. Also, in 2003, the Canada-wide standards for PM are scheduled for review. Given such circumstances, some within NARSTO felt it was necessary to speed up the scientific process, and also the communication of scientific knowledge, however uncertain, to policymakers. Thus, NARSTO decided that a PM assessment should be completed by early 2002 and its time frame has been designed to support the implementation and achievement of domestic PM standards.

In the spring of 2000, a PM assessment team was established with three co-chairs: an Environment Canada official, an American EPA official, and an academic from the University of Minnesota. The co-chairs have taken a very different approach to this assessment. First, they formulated a series of "proposed policy questions" designed to guide the assessment, based on what the team thought policymakers might need to know. Then, over the summer and into the fall of 2000, the co-chairs conducted interviews with key policy stakeholders in U.S. federal and state agencies, Canadian federal and provincial agencies, and Mexican federal officials and industry, with the aim of discovering whether these were indeed the "right" questions from a policy perspective. These questions, which received positive feedback from stakeholders, will guide the PM assessment and frame the material in the final synthesis document. The interviews have also served another purpose: policymakers in all three countries and in industry know that NARSTO's PM assessment is ongoing.

As a science-oriented boundary mechanism, NARSTO is an extremely intriguing experiment. It is not an organization but rather a coalition of organizations and individuals, loosely coupled for purposes of research. It supports a small executive secretariat. The aim of the entity is to be a virtual organization, coordinating research so that the whole is greater than the sum of the parts. Such informal organizational coalitions have a certain vulnerability. What is woven loosely can unravel quickly. At the same time, their lack of bureaucratic structure can be an advantage in times of rapid change. The key, as several people associated with NARSTO have remarked, is the presence and active participation of individuals committed to NARSTO's goals and projects.[81]

Also, having various sectors involved in the research process has probably made NARSTO's assessments more likely to be acceptable and, hence, more usable by policymakers. As one observer has noted, "the policy community gives NARSTO respect because of its cross-sectoral, public-private membership. Stakeholders think, 'if these people can agree on the science and a course of action, then we'll go along with that.'"[82] On the other hand, NARSTO's ability to do its work is hampered by different funding cycles and budget problems of individual sponsors. Its budget has recently approximated $70 million per year – not an insignificant sum, though far less than probably needed. Yet NARSTO has succeeded in mounting larger scale, or, at least, coordinated research projects across agencies and the public-private divide, purely through voluntary contributions from sponsoring partners.

NARSTO has made considerable efforts to overcome the "dual-boundary" problem. It aims to operate on a tri-national basis, although it has evolved in a somewhat lopsided fashion, with the U.S. as the dominant funder and performer by far. Canada's scientific community has been slow to get involved, and Mexico's is somewhat wary. Perhaps most notable have been the linkages NARSTO has developed between its science assessments and the policy process.

Earlier difficulties with ensuring effective science-policy exchange may be overcome at least in part through the more recent PM assessment process, in which linkages across this divide have become more formalized and explicit.

VI. CONCLUSION

These cases, which fall along a continuum from success to failure, highlight six conditions relating to successful interaction (defined as achieving consensus in the problem definition and policy adoption stages of the decision process) across the dual boundary. First, science and policy timelines need to intersect, which means that cooperative planning across this divide must occur to the greatest extent possible. In the cases of CCME's NOx/VOC science assessment, the CEC's continental pollutant pathways report, the Big Bend Work Group and NARSTO's ozone assessment, these projects were conducted without a clear idea of when and how such scientific studies would fit into policymaking activities. Science and policy in the case of CCME became uncoupled, only to connect later – perhaps more by accident than planning. NARSTO's new approach with its PM Assessment and the CCME's standard-setting process may serve as models for more conscious effort, resulting in an assessment process that is "policy-pulled" so that policy will be "science-driven." The OTAG and AQC processes also revealed a commitment to combining scientific and political concerns in the decision process.

Second, while the role of science appears to be readily acknowledged in the problem definition phase of ozone decision-making, the cases examined here indicate that policymakers often fail to see where it fits into the policy adoption (and even less, implementation) phases. The CCME case illustrates this difficulty. Relative agreement on problem definition – the more technical part of policymaking – does not guarantee agreement in the overtly political stage of adopting policy (witness OTAG's inability to get all the states aboard the consensus when it came to making policy recommendations), but it is a critical foundation for consensus-building on policy solutions. Without it, policy adoption may be postponed, as the Big Bend case illustrates. On the basis of our cases, we conclude that the interactive science-policy model does help in moving the decision-making process forward and it makes sense that this interaction be extended, and its usefulness acknowledged, throughout the decision process.

Both the NARSTO PM assessment and AQC processes are examples of successful, multi-stage, science-policy interaction.

Third, there is also a need for more formalized structures and processes – with stable funding – which provide a certain independence for the dual-boundary mechanism along with a consistently interactive role throughout the decision process. The OTAG and CCME processes were positive experiences in this regard. However, there is a delicate balance between institutionalization and flexibility to be achieved here. The structures and processes of decision in the CEC, for example, are highly institutionalized, and the organization itself appears less flexible. On the other hand, the AQC reveals an informality of style that has helped in science-policy exchange with respect to ozone policy activities. However, it also appears to be highly subject to political conditions. That means the AQC lacks autonomy and could fail to function in a less favorable political setting, as was the case with the Big Bend Work Group. NARSTO's PM assessment process straddles this institutionalization-flexibility tension quite successfully, although its weakness lies in a lack of stable resources.

Fourth, the presence of leaders or facilitators are critical to successful cross-border science-policy intereactions. The AQC, NARSTO and OTAG cases in particular show how key individuals, whether science or policy personnel, can work toward the creation of favorable conditions for consensus-building. "Transition" or "boundary" people, who ideally have both technical and policy expertise, help make boundary mechanisms work. Flexibility has a role to play here, too, as potential facilitators may be constrained by mandate, budget or political conditions, as in the cases of the CEC and Big Bend.

Fifth, trust matters enormously in making these trans-boundary mechanisms effective. If one side does not trust the other, it will not only be impossible to reach agreement on policy, but also may be difficult to agree on the nature of the problem. Joint science assessments conducted at the bilateral or trilateral level may contribute to trust-building through the production of credible or reliable knowledge, and nurturing of professional networks in what are called epistemic communities of like-minded individuals. The NARSTO PM assessment process and the AQC's bilateral activities are good examples of jointly conducted scientific activities. By contrast, assessments done exclusively by one country may be regarded as biased by the other. Also, as seen in the Big Bend and CEC cases, political conditions among those concerned with policy can create an almost impossible environment for problem definition by scientists. There has to be a minimal agreement among nations at the political level to find answers if scientists are to do their work. In this respect, it is probably easier to get consensus between the U.S. and Canada than between the U.S. and Mexico, because of relative levels of development and the history of bilateral relations.

Sixth, stakeholders can play an important role in ensuring fruitful science-policy interaction, as they can pull the attention of policymakers away from purely jurisdictional-political concerns and encourage scientific actors to better explain the relevance of their work. This was seen in both the CCME and OTAG processes. By contrast, the lack of broad stakeholder support may be one of the reasons that the CEC finds it difficult to operate in its trilateral environment and why the Big Bend process stalled. Stakeholders may also play a role in communicating scientific findings to their constituencies and the larger policy community. In addition, the early involvement of stakeholders in science-policy interaction may provide dividends later, in the form of support for implementation. Finally, stakeholder involvement and support plays a broader role in building legitimacy for the boundary mechanism more generally, as is evident across all cases.

Overall, then, some of the cases examined here fulfill more of these conditions, some less. The AQC process, which fulfilled almost all of the conditions, was a success. Consensual science-policy interaction led in November, 2000, to the signing of an ozone annex to the Canada-US Air Quality Agreement, under which the U.S. has agreed to reduce its NOx emissions by 35 percent by 2007 and Canada is to undertake an NO2 emission reduction of 50 percent by 2007 in Ontario (the largest smog-producer). Whether this Annex will actually be implemented under the Bush administration remains to be seen. The AQC's vulnerability to the political is its Achilles heel and the Big Bend experience shows what happens when this setting becomes unworkable. In the Big Bend case, neither the science-policy nor the jurisdictional boundaries was successfully traversed.

Our prediction for the ongoing NARSTO PM assessment, which meets all six conditions laid out above, is also success. NARSTO's leaders have clearly moved beyond earlier difficulties and refined their activities such that the ability to reach consensus across the dual-boundary is increased. NARSTO's weakness lies in the lack of a stable, multi-year resource base, although its ability to be relevant to the needs of policymakers may partly shield the organization from future problems in this area. Viewed alongside NARSTO, the CEC provides an interesting comparison. Its research and data-gathering activities are significant, and its potential to be a key mechanism for resolving dual-boundary controversies is enormous. However, it has been drawn into the political orbit of member governments such that the 'buffer' zone necessary for maintaining independence is lacking.

The OTAG and CCME cases were more mixed, with both fulfilling the conditions for science-policy intersection (at least more recently in the case of the CCME), formalized processes for interaction, and stakeholder involvement. Both cases resulted in useful science-policy interaction, although each has, thus far, resulted in mediocre outcomes. Interestingly, maintaining scientific input through to the policy adoption stages of the decision process was problematic.

One might expect that it is harder to get consensus across the dual boundary as one moves 'up' the spatial levels, from the subnational to bilateral to trilateral decision making. However, the cases examined here indicate that this is not necessarily the case. Certainly, the U.S. federal government has power *vis-à-vis* the states (at least in the ground-level ozone case) and can influence their behavior to some extent through providing funds for research and regulatory devices. In the OTAG case, a federal intent to regulate and a concern on the part of states that they have input into any new regulation were instrumental in getting the process off the ground. Although this applies to a lesser extent in Canada, the Canadian federal government does have some leverage over the provinces. Provincial participation in CCME activities has been motivated, at least in part, by federal regulatory intent or federal involvement in international negotiations that will impact subnational governments. Yet it is interesting that the two most successful dual-boundary mechanisms in this study operate bilaterally and trilaterally, respectively. Thus, it is not simply the nature of the jursidictional borders being crossed that pose challenges to successful consensus building.

Jurisdictional boundaries are important; however, as emphasized throughout this paper, the science-policy boundary is also vital. The study of environmental decision-making must seek to be multifaceted in terms of the 'boundaries' that it investigates and should attempt to appreciate the complex interplay across this dual boundary.

VII. APPENDICES

A. Acid Rain

Acid rain is caused by sulphur dioxide (SO2) and nitrogen oxides (NOx) released into the air during the burning of fossil fuels (coal, oil, and gas) in electricity generation, industry, and automobiles. Coal-fired utilities produce the highest levels of SO2, while the sources of NOx emissions are more widely distributed. Within hours to days, these pollutants are oxidized in the air to form acid sulphate and acid nitrate which then fall to the earth in precipitation (rain, snow, dew). The most seriously affected regions have been the northeastern U.S. and southeastern Canada (especially Ontario and Quebec), which receive acidic precipitation from the American midwest and, to a much lesser extent, Canadian sources.

B. Smog

Smog is a term used to describe a smoky, foggy mixture of air pollutants which results in a telltale brownish haze on the horizon. The primary ingredient of smog is ground-level (or tropospheric) ozone, a colorless and highly irritating gas that forms just above the earth's surface. It is a secondary pollutant which is produced when two air pollutants, NOx and volatile organic compounds (VOCs), react with each other in the presence of strong sunlight. VOCs include a diverse class of compounds which also result from fuel combustion as well as from the evaporation of liquid fuels and solvents. Refineries, chemical manufacturers, and dry-cleaning and painting operations are sources of VOCs. High ground-level ozone levels are caused by the presence of NOx and VOCs, hot temperatures, direct sunlight and the stagnation of air over several days.

Ground-level ozone has different impacts from acid rain; most importantly, it has been shown to be harmful to human health. In fact, both the 1996 Canadian NOx/VOC Science Assessment and U.S. Environmental Protection Agency (EPA) research have concluded that there is no safe level of human exposure to ground-level ozone. The health effects of ozone primarily involve respiratory ailments and inhibition or interference of the immune system's ability to defend the body. It is believed that ozone could lead to irreversible changes in the lungs and children, whose immune systems and lungs are still developing, a matter of particular concern. Ozone also damages vegetation and has been linked to a decline in crop and forest productivity.

Airborne particles, or particulate matter, give smog its color and affect visibility. Particulate matter (PM) consists of minute solids or liquids in air that vary in size and chemical composition. Studies and government policy have focused on two groups of particulates: PM10 (less than 10 microns across, about 1/8 the width of human hair) and PM2.5 (less than 2.5 microns across, also known as fine particles). Particles can be both primary (emitted directly to the air) and secondary (formed through chemical reactions involving other air pollutants such as sulphur dioxide, SO2). The main sources of particulates include thermal power plants, vehicle emissions, incineration and industrial activities such as mining or quarrying. Other contaminants such as heavy metals and persistent organic pollutants may be absorbed into particulates, thereby increasing their toxicity. Particles, especially fine particles, also pose a serious health risk, as they can become deeply lodged in the lungs, and the respiratory system has no means of expelling them.

ACRONYMS

AQC	Air Quality Committee
BBAQWG	Big Bend Air Quality Working Group
CEC	NAFTA Commission on Enbironmental Cooperation
CEPA	Canadian Environment Protection Act
CCME	Canadian Council of Ministers of the Environment
CWS	Canada-wide standards
DOE	U.S. Department of Energy
ECOS	Environmental Council of the States
EPA	U.S. Environmental Protection Agency
EPRI	U.S. Electrical Power Research Institute
EAPCPP	Expert Advisory Panel on Continental Pollutant Pathways
JPAC	Joint Public Advisory Committee
MOI	memorandum of intent
NAAEC	North American Agreement on Environment Cooperation
NAFTA	North American Free Trade Agreement
NAS-NRC	U.S. National Academy of Sciences-National Research Council
NOAA	U.S. National Oceanic and Atmospheric Administration
NARSTO	North American Research Strategy for Tropospheric Ozone
NESCAUM	Northeast States for Coordinated Air Use Management
NOx	nitrogen oxides
NPS	U.S. National Park Service
OTAG	Ozone Transport Assessment Group
OTC	U.S. Ozone Transport Commission
PM	particulate matter
SIP	state implementation plans
SEMARNAP	Secretaria de Medio Ambiente, Recursos Naturales y Peosa
VOCs	volatile organic compounds

NOTES

[1] For a detailed overview of the Canada-US. acid rain negotiations, see: Don Munton, "Acid Rain and Transboundary Air Quality in Canadian-American Relations," *The American Review of Canadian Studies* 27 No.3 (Autumn 1997): 327-358.

[2] For a full discussion of science-policy interactions in the acid rain debate, see: Leslie R Alm, *Crossing Borders, Crossing Boundaries: The Role of Scientists in the U.S. Acid Rain Debate.* (Westport, CT: Praeger, 2000).

[3] Don Munton, "Acid Rain and Transboundary Air Quality," 328-329

[4] Ibid, p.329.

[5] Ibid, p.330.

[6] Roy Gould, *Going Sour: Science and Politics of Acid Rain* (Boston, MA: Birkhauser, 1985), p.30.

[7] Ibid, p.31-32.

[8] Don Munton, "Acid Rain and Transboundary Air Quality," 500

[9] Roy Gould, *Going Sour: Science and Politics of Acid Rain*, p89-113.

[10] Leslie R Alm, *Crossing Borders*, 10.

[11] Interprovincial implementation efforts have been coordinated by the National Air Issues Coordinating Committee, established jointly by the Canadian Council of Ministers of the Environment and the Council of Energy Ministers

[12] Moreover, American states and Canadian provinces began cooperating both informally and formally within such bodies as the International Air Quality Advisory Board of the International Joint Commission

[13] Don Munton, "Acid Rain and Transboundary Air Quality," 344

[14] Stephen P Mumme, "Environmental Management on the Mexico-United States Border: NAFTA and the Emerging Bilateral Regime," *The American Review of Canadian Studies* 26 No.2 (Summer 1996): 208.

[15] Ibid, 5.

[16] Commission for Environmental Cooperation, *Continental Pollutant Pathways: An Agenda for Cooperation to Address Long-Range Transport of Air Pollution in North America* (Montreal, 1997), 12.

[17] W Henry Lambright, "NASA, ozone, and policy-relevant science," *research policy* 24 (1995): 747-8.

[18] Sheila Jasanoff, *The Fifth Branch: Science Advisors as Policy-makers* (Cambridge, MA: Harvard University Press, 1990).

[19] Liora Salter, *Mandated Science: Science and Scientists in the Making of Standards* (Boston, MA: Kluwer Academic Publishers, 1988).

[20] Sheila Jasanoff, "The Dilemma of Environmental Democracy," *Issues in Science and Technology Online* (Fall 1996) http://www.nap.edu/issues/13.1/jasano/html 21/08/00.

[21] One source notes that "good decisions" must satisfy three criteria: they must be sound, successfully implemented and have a desirable impact See R. Anne Patterson et al., *Consultation: When the goal is good decisions*. (Ottawa: Canadian Centre for Management Development, June 1992), 2.

[22] Consensus can be defined in various ways, but will be understood here to mean "mutual agreement" such that all parties are supportive of decisions reached Please see: Gerald W. Cormick, "Crafting the Language of Consensus," *Negotiation Journal* (October 1991): 363.

[23] Sheila Jasanoff, "The Dilemma of Environmental Democracy"

[24] Ibid

[25] Jan-Stefan Fritz, "Earthwatch Twenty-Five Years On: Between Science and International Governance," *International Environmental Affairs* 10 No3 (Summer 1998): 185-190.

[26] G. Pascal Zachary, *Endless Frontier: Vannevar Bush, Engineer of the American Century*. (Cambridge, MA: MIT, 1999).

[27] W Henry Lambright, "NASA, ozone, and policy-relevant science," 748.

[28] D Guston, "Introducing Boundary Organizations," *Report of the Workshop on Boundary Organizations in Environmental Policy and Science*. Rutgers University and Harvard Unversity, December 9-10, 1999.

[29] B Clark, "Toward a Research Agenda on Boundary 'Stuff'," *Report of the Workshop on Boundary Organizations in Environmental Policy and Science.*

[30] P. Haas, *Saving the Mediterranean: The Politics of International Environmental Cooperation*. (NY: Columbia, 1990).

[31] Brenda Nordenstam, W H. Lambright, M.E. Berger and M.K. Little, "A Framework for Analysis of Transboundary Institutions for Air Policy in the United States," *Environmental Science and Policy* 1, No. 3 (1998): 231-238.

[32] Terry Keating and Alex Farrell, *Transboundary Environmental Assessment: Lessons from the Ozone Transport Assessment Group* (Knoxville, Tenn: National Center for Environmental Decision-making Research, 1999), p.1.

[33] Larry Parker and John Blodgett , *98-236: Air Quality: EPA's Ozone Transport Rule, OTAG, and Section 126 Petitions – A Hazy Situation?* Congressional Research Service: Updated June 15, 1999

[34] ECOS and Ozone Transport Assessment Group, *OTAG Technical Supporting Document* http://www.epa.gov/ttn/rto/otag/finalrpt/chp1/chap1.htm 00/02/03.

[35] Terry Keating and Alex Farrell, *Transboundary Environmental Assessment*, p149.

[36] *OTAG Technical Supporting Document*

[37] Ibid

[38] Terry Keating and Alex Farrell, *Transboundary Environmental Assessment*, iii

[39] Ibid

[40] Keating and Farrell, op cit Larry Parker and John Blodgett, "Air Quality and the New Ozone NAAQS: the OTAG Process," Congres-

sional Research Service, Report to Congress. (Wash., DC: Committee for National Institute for the Environment, 1998).

[41] Barry Rabe, "Power to the States: The Promise and Pitfalls of Decentralization," In Norman J Vig and Michael E. Kraft, eds., E*nvironmental Policy*, 4th ed. (Wash., DC: Congressional Quarterly, Inc., 2000), 45.

[42] K Harrison, "Prospects for Intergovernmental Harmonization in Environmental Policy," in D.M. Brown and J. Hiebert, eds., *Canada: The State of the Federation 1994.* (Kingston: Institute for Intergovernmental Relations, Queen's University, 1995),185.

[43] http://wwwccme.ca/1e_about/1ed.html 08/15/2000.

[44] Confidential Interview

[45] Commissioner of the Environment and Sustainable Development, *Smog: Our Health at Risk* Chp.4 *1997 Annual Report*, http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c004xe15.html.

[46]http://wwwccme.ca/3e_priorities/3e...n/3ea2_cws/3ea2d_public/3ea2d3.html, 10/16/00.

[47] Confidential Interview

[48] AM. Schwartz, "Canada-U.S. Environmental Relations: A Look at the 1990s," *American Review of Canadian Studies* 24 No.4 (Winter 1994): 501.

[49] International Joint Commission, "The International Joint Commission Releases Report on Canada- United States Air Quality Agreement," Media Release: February 2, 1996

[50] United States-Canada Air Quality Committee, *Canada-United States Air Quality Agreement: 1998 Progress Report*

[51] *Ground-Level Ozone: Occurrence and Transport in Eastern North America* A Report by the United States-Canada Air Quality Committee, Subcommittee 1: Program Monitoring and Reporting, March 1999.

[52] Confidential Interview

[53] It should be noted here that the bilateral negotiations did not formally take place under the auspices of the AQC However, the Negotiating Teams of each country contained many of the AQC members and subcommittee staff who had been key in preparing the ground for the negotiations in the first place.

[54] 1991 *Air Quality Agreement*, Articles VI and VII

[55] It is interesting that, in this case, the process was driven from the policy side, as Subcommittee 2 on science coordination was preoccupied with acid rain issues

[56] US./Mexico Workgroup, (http://www.aqd.nps.gov/ARD/parks/bibe/umexico.html). Frances Sage, "No Closer to a Binational Solution: Ongoing Air Pollution Issues in Big Bend, Texas," *Borderlines* 8, No. 1 (January 2000).

[57] Mary Kelly, "Carbon I/II: An Unresolved Binational Challenge," in Richard Kiy and John Wirth, eds, *Environmental Management on North America's Borders*. (College Station, TX.: Texas A&M Press, 1998), 189-207.

[58] Ibid, 195.

[59] Ibid

[60] Ibid, 197-199.

[61] Sage, op cit.

[62] Ibid

[63] Ibid

[64] "Regional Geographic Initiative Stories," (http://wwwepa.gov/regional/highlightsfin.html).

[65] Alfred David Gidi, "The Mexican Position on the Visibility Problem in Big Bend National Park," *Borderlines* (April 25, 2000)

[66] J Kirton, "The Commission for Environmental Cooperation and Canada-U.S. Environmental Governance in the NAFTA Era," *American Review of Canadian Studies* 27 No.3 (Autumn 1997): 462.

[67] The decision on whether or not to instruct the Secretariat to prepare a factual record on allegations of noncompliance would be one example here

[68] Perhaps because of this influence, an intergovernmental body of "Alternate Representatives" (assistant secretary level) has been created to more closely manage the work of the Secretariat

[69] Ibid, 465.

[70] Confidential Interview

[71] Commission on Environmental Cooperation, *Continental Pollutant Pathways*, pvii.

[72] Confidential Interview It should be noted here that not all CEC reports are general. For example, the CEC's Rio San Pedro study produced a number of concrete policy recommendations that have influenced Mexican government protected area policy and improved coordination of policy amongst binational and U.S. federal agencies dealing with the San Pedro watershed and ecosystem issues.

[73] Debora L VanNijnatten and W. Henry Lambright, "Canadian Smog Policy in a Continental Context: Looking South for Stringency," in Debora L. VanNijnatten and Robert Boardman, eds., *Canadian Environmental Policy: Context and Cases for a New Century*. (Toronto: Oxford University Press, 2001).

[74] Confidential Interview

[75] Stephen P Mumme and Pamela Duncan, "The Commission for Environmental Cooperation and Environmental Management in the Americas," *Journal of Interamerican Studies and World Affairs* 39 (Winter 19997/98): 54.

[76] Confidential Interview

[77] NAS-NRC Committee on Ground-level Ozone Formation and Measurement, *Rethinking the Ozone Problem in Urban and Regional Air Pollution* (Wash, DC: National Academy Press, 1991), 14.

[78] NARSTO: What Is NARSTO? http://wwwcgenv.com/Narsto/whatisnarsto.html. *Research Strategy and Charter*, http://

Narsto.ont.com/Narsto/>/.

[79] National Science and Technology Council, Committee on Environment and Natural Resources, "Fact Sheet: North American Research Strategy for Ground-level Ozone Research Initiative" http://www.whitehouse.gov/WH/EOP/OSTP/Environment/htm/fac_trop_oc.html 10/20/00.

[80] Confidential Interview

[81] Confidential Interviews conducted at the NARSTO 2000 Conference in Queretaro, Mexico, October 24-26, 2000

[82] Confidential Interview conducted at the NARSTO 2000 Conference in Queretaro, Mexico, October 24-26, 2000.

CANADIAN-AMERICAN PUBLIC POLICY

Occasional papers on a wide range of issues in U.S.-Canadian relations

CAPP 1: April 1990 — **Canada-U.S. Relations in the Bush Era**
Joseph T. Jockel

CAPP 2: July 1990 — **Transboundary Air-Quality Relations: The Canada-United States Experience**
John E. Carroll

CAPP 3: October 1990 — **Canadian Culture, the Canadian State, and the New Continentalism**
Allan Smith

CAPP 4: December 1990 — **Forests, Timber, and Trade: Emerging Canadian and U.S. Relations under the Free Trade Agreement**
Thomas R. Waggener

CAPP 5: March 1991 — **Change and Continuity in Canada-U.S. Economic Relations**
William Diebold

* CAPP 6: June 1991 — **Trade Liberalization and the Political Economy of Culture: An International Perspective on FTA**
Graham Carr

CAPP 7: September 1991 — **If Canada Breaks Up: Implications for U.S. Policy**
Joseph T. Jockel

* CAPP 8: December 1991 — **Ogdensburg Plus Fifty and Still Counting: Canada-U.S. Defense Relations in the Post-Cold War Era**
Joel J. Sokolsky

* CAPP 9: March 1992 — **The Regulation of U.S.-Canada Air Transportation: Past, Present and Future**
Martin Dresner

* CAPP 10: June 1992 — **Emerging Issues in the U.S.-Canada Agricultural Trade Under the GATT and FTA**
Theodore H. Cohn

* Out of print

CAPP 11: September 1992 — **Settling U.S. - Canada Disputes: Lessons For NAFTA**
Annette Baker Fox

CAPP 12: December 1992 — **Canada-U.S. Electricity Trade and Environmental Politics**
William Averyt

CAPP 13: June 1993 — **Canadian Politics in a Global Economy**
Gordon T. Stewart

CAPP 14: September 1993—**The Intersection of Domestic and Foreign Policy in the NAFTA Agricultural Negotiations**
Theodore H. Cohn

CAPP 15: November 1993—**A New Global Partnership: Canada-U.S. Relations in the Clinton Era**
John Kirton

CAPP 16: December 1993 — **The Impact of Free Trade on Canadian- American Border Cities**
Peter Karl Kresl

CAPP 17: April 1994 — **North American Social Democracy in the 1990s: The NDP in Ontario**
Mildred A. Schwartz

CAPP 18: August 1994 — **The Politics of Health Care Reform in Canada and the United States**
Antonia Maioni

CAPP 19: October 1994 — **Public Policy and NAFTA: The Role of Organized Business Interests and the Labor Movement**
Henry J. Jacek

CAPP 20: December 1994-- **The Secret of Transforming Art Into Gold: Intellectual Property Issues In Canada-U.S. Relations**
Myra J. Tawfik

CAPP 21: January 1995--**Anticipating The Impact of NAFTA on Health And Health Policy**
Pauline V. Rosenau, Russell D. Jones, Julie Reagan Watson and Carl Hacker

CAPP 22: June 1995--**Regulation, Industry Structure, and the North Atlantic Fishing Industry**
Peter B. Doeringer, David G. Terkla and Audrey Watson

* CAPP 23: November 1995--**The Moral Economy of Health and Aging in Canada and the United States**
Phillip G. Clark

CAPP 24: December 1995--**Multilateralism or Bilateralism in the Negotiation of Trade-Related Investment Measures?**
Elizabeth Smythe

CAPP 25: February 1996--**The Abortion Controversy in Canada and the United States**
Raymond Tatalovich

CAPP 26: May 1996—**Health Care Reform or Health Care Rationing? A Comparative Study**
Joan Price Boase

CAPP 27: September 1996—**Resolving The North American Subsidies War**
Peter Morici

* CAPP 28: December 1996—**Calling Maggie's Bluff: The NAFTA Labor Agreement and the Development of an Alternative to Neoliberalism**
Stephen Herzenberg

* CAPP 29: April 1997—**The Long Journey to Free Trade in U.S.-Canada Airline Services**
Michael W. Pustay

CAPP 30: July 1997—**Are Canadian and U.S. Social Assistance Policies Converging?**
Gerard Boychuk

CAPP 31: November 1997—**Observing the Rules: Canada-U.S. Trade and Environmental Relations**
Annette Baker Fox

CAPP 32: December 1997—**Flights of the Phoenix: Explaining The Durability of the Canada-U.S. Softwood Lumber Dispute**
Benjamin Cashore

* Out of print

CAPP 33: February 1998—**Transboundary Fishery Resources and the Canada-United States Pacific Salmon Treaty**
Gordon Munro, Ted McDorman and Robert McKelvey

CAPP 34: April 1998—**Franchising the Candy Store: Split-Run Magazines and a New International Regime for Trade in Culture**
Ted Magder

CAPP 35: September 1998—**Fearful Asymmetries: The Challenge of Analyzing Continental Systems in a Globalizing World**
Stephen Clarkson

CAPP 36: November 1998—**A Not So Magnificent Obsession: The United States, Cuba, and Canada from Revolution to the Helms-Burton Law**
Stephen J. Randall

CAPP 37: February 1999—**Scientists and Environmental Policy: A Canadian-U.S. Perspective**
Leslie R. Alm

CAPP 38: March 1999—**The Mouse That Roared? Lesson Drawing on Tobacco Regulation Across the Canada-United States Border**
Donley T. Studlar

CAPP 39: July 1999—**Unwarranted Hopes and Unfulfilled Expectations: Canadian Media Policy and the CBC**
Joel Smith

CAPP 40: October 1999—**Cross-Border Travel in North America: The Challenge of U.S. Section 110 Legislation**
Theodore H. Cohn

CAPP 41: February 2000—**Who Decides What? Civil-Military Relations in Canada and the United States**
Douglas L. Bland

CAPP 42: July 2000—**Should the Log and Wood Products Trade by Regulated in the Northeastern Borderlands?**
Lloyd C. Irland

CAPP 43: September 2000—**The Comparative Politics of Military Base Closures**
Lilly J. Goren and P. Whitney Lackenbauer

CAPP 44: December 2000—**Doing the Continental: Conceptualizations of the Canadian-American Relationship in the Long Twentieth Century**
Allan Smith

CAPP 45: April 2001—**North American Smog: Science-Policy Linkages Across Multiple Boundaries**
Debora L. VanNijnatten and W. Henry Lambright

CONTENTS

CANADIAN-AMERICAN PUBLIC POLICY

Occasional papers on a wide range of issues in U.S.-Canadian relations

Canadian-American Center, University of Maine
154 College Avenue, Orono, ME U.S.A. 04473-1591
(207) 581-4220 Fax: (207) 581-4223
ISSN 1047-107