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SCIENTISTS, RESEARCHERS, AND ACID RAIN

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ABSTRACT

John Kingdon's recent assessment of "agenda setting" has brought a richer analysis to the entire process of establishing public policy. In particular, Kingdon introduces what he calls the *hidden* participants. These hidden participants (academic specialists, career bureaucrats, researchers, consultants, and analysts) use their special expertise to fashion ideas that directly influence the agenda-setting process. This article extends Kingdon's analysis to the environmental field by attempting to demonstrate the role that researchers and scientists have played in transforming acid rain from an unknown issue to one that is on the formal governmental agenda. Special attention is given to how successful researchers and scientists have been in generating viable solutions to the acid rain problem.

Until recently, it has been suggested that the key participants in the agenda-setting process have been those people who receive considerable press and public attention. These include the President, high-level executive appointees, key members of Congress, the media, and such elections-related groups as political parties and campaigners. However, in 1984 John Kingdon suggested that there are other people who play a less visible, but just as significant role in the agenda-setting process [1]. He called these people the "hidden participants" to differentiate them from the visible participants described above who receive a lot of press and public attention. They are "hidden" in the sense that they do not receive the notoriety and public acclaim that the visible participants do. Included in this hidden cluster of participants are such specialists as academics and researchers, career bureaucrats, congressional staffers, consultants, and administration appointees below the top level. Kingdon claims that it is these relatively hidden participants, who do most of their work behind the scenes,

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that generate the alternatives, proposals, and solutions that pave the way for successful public policy formulation [1].

The emphasis by Kingdon is clearly on the importance that ideas play in the agenda-setting process and the necessity of the hidden participants to delineate these ideas with respect to particular issues. Kingdon describes the importance of academics and researchers in determining policy alternatives as follows:

> Much of the time the agenda is set by forces and actors outside the research-analysts community. Then politicians turn to that community for proposals that would be relevant to their concerns and that might constitute solutions to their problems [1].

While academics may not be responsible for the prominence of problems on the agenda, they play a key role in setting alternative solutions to those problems.

Long-term effects are discussed in light of creating a general climate of ideas which, in turn, affects policy makers' thinking. Kingdon describes this as a "long process of softening up the system." This process is characterized by several important functions served by academics and researchers:

1. the gradual accumulation of knowledge and perspectives among specialists in a given policy area and the generation of policy proposals by such specialists;
2. the occurrence of a scientific discovery by a previously obscure researchers which may affect a public policy agenda; and
3. the ability of specialists to generate viable alternatives through some degree of expertise and a willingness to concern oneself with minute details [1].

While academics and researchers have their greatest impact on the long-term climate of ideas, they also have an impact on the short-term climate. For example, policy makers in government listen to academics most when their analysis and proposals are directly related to problems that are already occupying the policy makers' attention. Kingdon states that this linkage is most effective when researchers and academics serve roles within the government, taking leaves of absence from their universities or research organizations to occupy responsible positions in government.

Finally, it is important to note the tools and devices used by researchers and academics in their agenda-setting roles. In developing ideas that affect alternative specifications, academics try out proposals in a variety of ways:

> . . . through speeches, bill introductions, congressional hearings, leaks to the press, circulation of papers, conversations, and lunches. They float their ideas, criticize one another's work, hone and revise their ideas, and float new versions [1].

All in all, Kingdon has fashioned a comprehensive model of agenda setting that includes a focus on the importance of hidden participants such as academics

and researchers. However, Kingdon suggests two possible caveats with respect to all the attention he has given these parties. First, there may be limits to their effectiveness. As Kingdon points out, in some quarters there is "a distruct of, and even a disdain for, academic work" [1]. Second, there is concern that no matter what the value of the work done by academics, sooner or later "practical people realize that [academic] recommendations cannot always be implemented" and that there comes a time when politicians take over [1].

Nevertheless, Kingdon established an area that needs a closer look. His analysis and empirical research were based on the examination of health and transportation issues. The concern of this article is to investigate the role of these hidden participants in an environmental field. In particular, this article focuses on the role of academics (especially researchers and scientists) in the transformation of acid precipitation from an almost unknown phenomenon in the United States two decades ago to an issue that is currently on the formal governmental agenda [2, 3]. Special attention is given to how successful researchers and scientists have been in generating viable solutions to the acid rain problem.

THE ACID RAIN ISSUE

Twenty years ago acid deposition (commonly called acid rain) was not considered a serious environmental problem in the United States. Today, it is referred to as "the most important and controversial problem of the decade" [4], as well as "one of the most prominent, complex, and diverse policy issues of the 1980s" [5]. Moreover, acid rain has been transformed from an issue restricted to scientific and technical journals [6], to one that is being seriously considered by the United States Congress [3].

Throughout this transformation process, researchers and scientists (Kingdon's "hidden participants") have played a major role. It was a debate among scientific researchers over the unconventional ideas and general atmospheric theory of Swedish agriculturalist Svante Oden that first brought the acid rain issue into international prominence [2]. Furthermore, it was the academic specialists of major American universities that helped make acid rain a major U.S. environmental concern of the 1970s. Today, it is these same academic specialists and researchers that are keeping the acid rain issue on the public agenda [7]. The importance of these hidden participants cannot be overlooked by any author wishing to describe the process of agenda setting.

KINGDON'S MODEL AND ACID RAIN

John Kingdon believes that a relatively hidden cluster of participants including academics, researchers, and scientists) directly affects agenda setting by determining alternatives, proposals, and solutions to public policy problems [1].

These hidden participants accomplish this by contributing to the gradual accumulation of knowledge and through the occurrence of scientific discovery. Moreover, there exists an academic-government linkage in which these researchers and scientists provide the policy makers with the information and expertise needed to solve problems. Of particular importance are the tools available for scientists and researchers to affect public policy. These tools include giving testimony before Congress, writing professional papers, preparing speeches, providing information to the press, and criticizing one another's work [1]. With the use of these tools, scientists and researchers are supposed to help decision-makers solve whatever serious problems are facing the nation.

But is this true? What role have researchers and scientists played in the development (and solution) of the acid rain issue? Are they truly of central importance in developing alternatives and solutions to this complex environmental issue? Tracing the evolution of the acid rain issue provides a unique opportunity to also view the role of scientists and researchers in the public policy-making process. Moreover, the results of this review suggest that Kingdon's concerns about the limits of researchers and scientists to affect public policy may be closer to reality than the prominence given to these hidden participants' abilities to effectively generate viable solutions.

ANALYSIS

The Beginning

Scientists and researchers have always been a major source of knowledge and expertise in the development of complex issues that affect our everyday lives. However, in the instance of acid rain, they played a unique and active role in bringing the issue to the public's and government's attention in the United States. Early on, scientists did not just turn their research findings over to policy makers and go about their work as usual. They actively sought publicity for their concerns about acid rain and used not only the presentation of papers and lectures among their learned colleagues, but used the media to dramatize the possible catastrophic consequences of the continued presence of acid rain.

Although it was in the 1870s that Englishman Robert Smith coined the term "acid rain" and provided the first comprehensive analysis of acid rain's effect [4], it was another Englishman, Eville Gorham (a professor of ecology at the University of Minnesota), who built the major foundations for our present understanding of the causes and impacts of acid rain [2]. Through a long series of papers published in the late 1950s and early 1960s, he documented the effects of acid precipitation and concluded that acid precipitation was related not only to the deterioration of soils and lakes but to the incidence of bronchitis in humans.

But Gorham's work went largely unnoticed by the scientific community, as well as the public at large. It has been suggested that this was probably due to the fact that Gorham's work was essentially restricted only to the scientific community and to scientific journals [2]. It was only when Swedish scientist Svante Oden published a newspaper account about acid rain leading to a "chemical war" among the nations of Europe that the issue of acid rain captured the attention of both the public and consequently, governments [2, 4]. However, it was a series of fourteen lectures presented by Oden in the United States in 1971 that proved to be the needed stimulus for significant interest in the acid rain issue [6]. In fact, with Oden's unconventional ideas as the impetus, the scientific community responded with a tremendous increase in research and publication in the acid rain field.

In the early 1970s, serious scientific work involving acid rain finally began in the United States [8]. "By the mid-1970s, numerous publications about acid rain were appearing in technical journals as well asiin such popular magazines as *Scientific American*" [6]. Comprehensive research projects were started at major universities (Cornell and North Carolina State) and an entire series of publications proliferated the scientific community from such scientists as Gene Likens, Charles Cogbill, James Galloway, and Carl Schofield [2]. The work of these researchers in documenting acid rain as one of the most important environmental problems to face mankind played a major role in transforming "acid rain from an esoteric topic of scientific research in certain specialized fields of ecology and atmospheric chemistry into a household word" [9].

In short, acid rain did not emerge as a policy issue until scientific research into the basic nature of the problem became available [3]. Scientists were responsible for defining the acid rain issue and setting the context in which the debate would be held. The acid rain issue did not come into prominence because of a political speech or scare headline, but because a small international community of acid rain researchers kept telling us of the potential devastating effects of acid rain [3].

Disagreements: Policy, Politics, and Science

Up to this point, it has been relatively easy to document the role of researchers and scientists in bringing acid rain to the attention of policy makers. However, their most important role is supposed to be generating alternatives, proposals, and solutions once the issue is identified by the policy makers as a serious problem needing governmental attention [1]. In the case of acid rain, it has not quite worked out in this manner.

What would have been nice to report is that after acid rain was identified as a problem worthy of attention, the scientific community took the lead and produced a consensus opinion regarding a possible solution. It did not happen. Robert Smith's eternal optimism and faith that acid rain would be cured by the

patient application of science proved to be a false hope [4]. In fact, a good argument can be made that by airing the debate in front of both Congress and the public as a whole (through the media) that there is more confusion today than ever before on an appropriate acid rain solution. The accumulation of scientific evidence itself may be responsible for the continuing stalemate over acid rain.

According to the Office of Technology Assessment, the acid rain policy question centers around whether to act now or wait for results from on-going research [10]. Delaying action would risk further ecological damage, while acting now may result in a waste of millions of dollars on a deficient abatement problem. The heart of this problem lies within two scientific controversies that pervade the scientific debate about acid rain:

1. the linearity vs. nonlinearity issue–whether further reduction in sulfur dioxide (SO_2) and nitrogen oxides (NO_x) would produce equivalent reduction in sulfate and nitrate deposition; and
2. the local vs. long-range sources issue–do the "local" emissions of SO_2 and NO_x influence acid deposition levels in sensitive areas as much, or more than, "long-range" transportation of SO_2 and sulfates [11]?

Instead of scientific consensus in these two areas of concern, we have had emotional scientific disagreements that have been aired publicly. Take the question of a possible linear relationship between emissions and deposition. Since the two major man-made precursors of acid deposition are sulfur dioxide and nitrogen oxides [12], it would appear that reducing the levels of these two pollutants would lead to a proportional reduction in acid rain. Schmandt and Roderick certainly believe that a 1983 National Academy of Sciences (NAS) report, *Acid Deposition: Atmospheric Processes in Eastern North America*, has put this question to rest, once and for all. They state that:

> According to a report published in 1983, we can now unequivocally conclude that average annual emissions in eastern North America of sulfur dioxide from power plants and other industrial facilities are roughly proportional to deposition of sulfate [3].

However, this unquestionable faith in the conclusion of this NAS report is not shared by all. Parker and Blodgett argued that the 1977 Amendments to the Clean Air Act were inadequate in dealing with acid deposition because they address only the emitted pollutants (SO_2 and NO_x) and not the different chemical forms of sulfates (SO_4) and nitrates (NO_4) which actually make up acid rain [13]. In another case which surfaced after the release of the NAS report, Gibian (after analyzing the reliabilities of several long-range transport models) argued that "even such drastic measures as total elimination of sulfur dioxide emissions from all power plants is predicted to result in a small decrease in rainfall acidity–even by the most 'optimistic' model" [14]. It is obvious that the 1983 NAS report did not solve the linearity puzzle. In fact, if one goes

by the furor carried out in the media shortly following the release of this report, one could easily draw the conclusion that it created more confusion than consensus.

Archie Kahan detailed what happened when two prominent and well-respected researchers (Jack Calvert and Bernard Manowitz) publicly clashed over the results of the NAS report [6]. Jack Calvert, the senior scientist at the National Center for Atmospheric Research, chaired the National Academy of Sciences National Research Council which published the 1983 NAS report that concluded that there was an approximate 1:1 linearity between emissions of sulfur dioxide and acid rainfall. Despite the fact that this conclusion was corroborated by a group of scientists assembled under the direction of the White House Office of Science and Technology Policy, the results were questioned by Don Fuqua, chairman of the Science and Technology Committee of the House of Representatives. He requested an independent evaluation of the NAS report by the Department of Energy. To complete this evaluation, the National Laboratory Consortium was formed under the leadership of Bernard Manowitz from the Brookhaven National Laboratory.

This consortium consisted of scientists from Brookhaven, Argonne National Laboratory, Oak Ridge National Laboratory, and Battelle Northwest Laboratory. Manowitz's scientific research group, after careful analysis of the NAS research, not only disagreed with the methods that the Calvert group had used to base their findings, but using the same data, came to just the opposite conclusion—that a nonlinear relationship existed. What really fueled the debate was the wide circulation that the Manowitz report received. Apparently, Manowitz distributed his report to the leadership and research arms of the power industry and related industries as well as to the administrative and legislative staffs of both the federal and state governments. The results were introduced into the *Congressional Record* and, of course, were adopted by the electric utility industry as being clear evidence that reducing SO_2 and NO_x would not solve the acid rain problem.

Moreover, the debate, contrary to normal scientific procedures, ended up being carried out in the media. *The Energy Daily* carried the results of the Manowitz study, which undermined the original study by Calvert. Despite the consternation of Calvert that "*The Energy Daily* [was] not well suited to scientific debate" [6], he, nevertheless, carried out the debate in the media. In reply to Manowitz's claim that the NAS report was incorrect, Calvert claimed that the Manowitz review was "seriously flawed scientifically" and that "Manowitz and friends have presented a most unscientific, unprofessional, and erroneous critique of our efforts" [6]. Calvert went on to argue that his report had the consensus of such scientific groups as the National Research Council Committee on Acid Deposition, the Interagency Task Force on Acid Rain, and the Acid Rain Peer Review Panel appointed by the President's science advisor.

Thus, a scientific debate carried out in the national media helped transform what had appeared to be a scientific consensus on the relationship between

emissions of acid rain precursors (SO_2 and NO_x) and acid deposition into an argument over which scientific groups were correct in their analysis and who did, or did not, use improper scientific research procedures. Scientific debates of this nature certainly are part of the reason that the acid rain dispute has ended up in political stalemate at virtually every governmental level of decision making.

The local vs. long-range issue (whether it is the local emissions of SO_2 and NO_x or the long-range transported pollutants that cause the most significant damage) is another example of how public scientific debate can cast doubt on the ability of scientists to produce a solution to the acid deposition problem. This time it is Roy Gould who provided the details of how a few nationally known scientists and researchers can cast doubt on what is a presumably scientific consensus on the source of acid rain [4].

Again, it was the NAS report and the conclusions of Jack Calvert that were at the center of disagreement. In an article in *The New York Times*, Dr. A. Gordon Everett (who was hired by Consolidated Edison Company) reported that his studies had convinced him that "while there might be acid coming down in rainfall, the predominant cause of acidity in the Adirondack waters was the naturally acid materials in the region being flushed into lakes by the rain" [4], and not the transported pollutants. This conclusion was counter to other scientific studies whose results had indicated clearly "that in order to significantly reduce acid rain in the Adirondacks, one would have to reduce emissions in the Ohio Valley/Midwest" [4].

Uncertainty over this issue was furthered when a scientist from the original study, Dr. Volker Mohnen, took to the National Public Radio and argued along the lines of Dr. Everett. That is, he suggested that reducing SO_2 emissions from midwestern power plants would not necessarily reduce acid rain in the Adirondacks. (Dr. Mohnen is the director of the Atmospheric Sciences Research Laboratory at the State University of New York at Albany and had been retained by Peabody Coal—the nation's largest coal company—to testify on the company's behalf at E.P.A. hearings concerning acid rain.) Furthermore, in contrast to the conclusions of Jack Calvert in the NAS report, Mohnen reported that "on the basis of currently available empirical data, we cannot in general determine the relative importance for the net deposition of acids in specific locations of long-range transport from sources or more direct influences of local sources" [4]. In addition, Mohnen sent letters to *The New York Times* and *Time* arguing that the NAS report was being misinterpreted and that "the contribution of midwestern sources to acid rain in the Northeast remains unknown" [4].

The debate took another turn when Dr. Kenneth Rahn (a researcher from Rhode Island) reported in the Research News column of *Science* that his research data suggested that the Midwest may not be responsible for all of the Northeast's acid rain. But Rahn's techniques apparently fell apart under scrutiny from George Wolff, a scientist from General Motors, who called into

question two erroneous assumptions made by Rahn and stated that "Rahn's hypothesis concerning the local contribution of (acid) sulfate aerosol is contrary to observations and (computer) modeling results that demonstrate the importance of long range transport of (acid) sulfate" [4]. The question again appears to be—which of these qualified and well-respected scientists is to be believed?

Many other public debates involving acid rain have also occurred. For instance, Michael Oppenheimer (a physicist) who suggested that because of acid rain "the clock is running on our priceless but fragile forests and waters" and Donald Stedman (professor of chemistry at the University of Denver) who argued that "Western acid rain reports are greatly exaggerated" carried out their debate over the seriousness of Western acid rain in the *Rocky Mountain News* [6]. Another example is the public discussion of differences between Thomas Crocker and James Regens (who argue the merits of benefit-cost analysis with respect to the acid rain issue) and Stephen Peck (who disagrees with the analysis of Crocker and Regens) carried out in *Environmental Science and Technology* [15].

At first glance, these differences appear to be genuine scholarly disagreements between scientists and researchers who have come to disparate conclusions. However, a careful reading of these public disagreements suggests a much deeper meaning with a far more reaching effect that just scholarly dissonance. Despite all of Kingdon's accolades for the prominence and effectiveness that these hidden participants (researchers and scientists) play in the generation and selection of solutions [1], it is the briefly discussed politicization of academic work that appears to carry the day. Kingdon warned us of a possible distrust and disdain for academic work [1]. The public airing of the uncertainties and disagreements among scientists and researchers involving the acid rain issue has not only led to a distrust in scientific findings, but in the extensive use of scientific disagreements to serve self interest and political expediency.

One result of these scientific disagreements is the absence of any substantive policy in acid rain. Because of the uncertainty of science, proponents of inaction have been able to stall policy decisions. Since the initial enactment of the National Acid Precipitation Act (establishing a ten-year national program of scientific research into the causes and consequences of acid precipitation) in 1980, not a single acid rain law has been passed although many bills have been proposed. During the ninety-seventh and ninety-eighth Congresses alone, thirty-seven bills were proposed and debated without a single one reaching a vote in the House or Senate [16]. What we have at the present time is a political stalemate brought about in large part because of the inability of scientists to reach a consensus on a solution.

Industry spokesmen (especially for coal and utility industries), as well as the Reagan administration, have been able to use scientific disagreements over acid rain to call for further research and study before evoking any abatement action.

As Regens and Rycroft point out, "the scientific information currently available does not lead unequivocally to a conclusion about whether it is appropriate to begin additional control measures now or to await better understanding" [9]. Reagan seized upon this uncertainty and used it for the basis of his belief that further research was necessary before substantive action could be taken [9]. In fact, the Reagan administration has consistently taken advantage of the disagreement in the scientific community to substantiate its lack of abatement activities. After a NAS report came out in 1981 calling for a 50 percent reduction in the acidity of rain in the Northeast, the Reagan administration dismissed the Academy's report as "lacking in objectivity" and the E.P.A. specifically warned that becuase of the "scientific uncertainties in the causes and effects of acid rain," there must be a clear avoidance of premature action [4].

At times, the Reagan administration appears to have taken an even more direct role in dealing with scientific research. When the National Acid Precipitation Assessment Report was released in the fall of 1987 with a general conclusion that the nation faces little immediate danger from acid rain [12], sharp criticism followed by scientists who believed that the Reagan administration had mislead the public and that the summary report "was aimed more at buttressing the Reagan administration's opposition to expensive pollution controls than at clarifying scientific knowledge" [7]. Lawrence Kulp, a scientist who directed the filing of the summary report for the Reagan administration, defended the report's conclusions; however, many other scientists claimed that the report's conclusions flew in the face of current scientific data [17], and that the findings "did not accurately reflect the bulk of science on acid rain that has emerged in recent years" [7].

Special interest groups have used scientific evidence to refute claims that acid rain is a severe problem. Carl Bagge, president of the National Coal Association, went so far as to call acid rain "a facade for the forces who would deliberately destroy the carefully-crafted balance of environmental and economic goals that have been achieved by the Clean Air Act during the last decade" [4]. Dr. Robert Brocksten, representing the Electric Power Research Institute, supported the position that no immediate implementation of SO_2 and NO_x emission control measures should be taken because of the complexity and uncertainty of the present scientific research results [3]. William Karis, vice president for corporate planning of the Consolidated Coal Company, presented a list of recent scientific papers to Congress which showed "that the charge of widespread acid deposition damage in the United States cannot be substantiated by the evidence" [6]. There appears no end to the confusion created because the scientific community cannot agree on a solution (or even a true definition of the problem) with respect to the acid rain issue.

However, the tragedy of this does not necessarily lie with the scientific community per se. It may lie in the perception that scientists cannot produce

viable alternatives and solutions and, hence, parties that wish to delay or inhibit action are left with just enough confusion and uncertainty to justify inaction. Disagreement in the scientific community over acid rain has indeed led to what Kingdon called a distrust and even disdain for academic work.

Roeder and Johnson state that concerned and interested citizens are "unlikely to gain much guidance or to reduce [their] uncertainties on acid rain by analyzing the judgments of scientific experts" [18]. Parker and Blodgett speak of "a genuine inadequacy of scientific understanding of the nature of the [acid rain] problem" [13], and Kahan argues that [6]:

> Confidence in the ability of science and technology to solve the important environmental problems of the future is not nearly as widespread today as it once was. It has been replaced, in the minds of many people, by the conviction that too much reliance on science and technology has put mankind on a fast track to catastrophe. This diminished confidence in society's ability to cope contributes to the sense of urgency about acid rain.

This lack of faith in researchers and academics is summed up by John Gibbons (Director of the Office of Technology Assessment), which he states that "in OTA's judgment, even substantial additional scientific research is unlikely to provide significant, near-term policy guidance, or resolve value conflicts" [10]. At least with respect to the acid rain issue, it appears that the perception of scientists and researchers is one of not having the capacity to provide solutions. Perhaps Mangun puts it best [19]:

> Although one would assume that the solution to the acid rain problem would appear to lie with scientific researchers, this does not appear to be the case. Any positive control action requires action by politicians responsible for drafting the laws and these people, largely lawyers, tend to lack technical competence.

CONCLUSION

It is the substantiated scientific certainty that sulfur dioxide and nitrogen oxides are the major precursors of acid deposition [12], which has been the basis for the most substantial legislation proposed in the United States Congress [11]. However, it is the scientific uncertainty surrounding the effects of these precursors that has produced the legislative stalemate in Congress. Remember, not a single acid rain bill has become law during the Reagan administration.

The role of scientists and researchers, as identified by Kingdon and other academics, is to help the policy makers access the seriousness of the problem and to distinguish between technically workable and impractical solutions [3]. In attempting to accomplish this task with respect to the acid rain issue, it appears that scientists and researchers have left us more in a state of confusion than in a position to act.

For some scientists, there appears to be enough of a scientific consensus to act on acid rain. Gould suggests that the "evidence is now massive and convincing that acid rain and related forms of air pollution are taking a serious toll on lakes and streams, forests and soils, water supplies, air quality and human health" and that "the problem has been allowed to fester [too] long" [4]. A national survey of 1027 United States acid-deposition researchers revealed that 80 percent of the responding scientists were in favor of immediate and decisive steps to curtail emissions [6]. There has been "solid agreement among experts . . . that burning fossil fuel is at the root of the acid rain problem in North America" [3].

On the other hand, some researchers doubt that there is enough evidence to act. Roeder and Johnson declare that "a scientific consensus on the causes of acid rain appears to be lacking" [18]. Ihara contends that "the scientific understanding [about acid rain] remains incomplete" and that the absence of a scientific consensus around the acid rain issue is the reason that "the prospect for a resolution of any of these policy issues [involving acid rain] by Congress in the near future is exceedingly problematic" [5].

One can see that there is a great divergence between scientific beliefs. It was not the purpose of this article to condemn scientists for disagreeing about the solutions to important environmental issues. These disagreements are important and necessary for the proper functioning of a democratic society. However, it was the purpose of this article to illustrate the confusion and uncertainty that scientific disagreements can cause among both the public and the legislative bodies of our nation when they are aired in an inadequate forum.

Jack Calvert was right when he vehmently criticized the fact that scientific debate had to be carried out in such a public forum as *The Energy Daily*. But he obviously felt obligated to answer the charges that his work was scientifically flawed, and answer them in the medium he had criticized. The instances where scientists aired their debates in public and belittled the work of their peers as unscientific and inadequate served no useful purpose. It only made the public wary of all scientific findings and allowed opposition parties to use such public disagreements to foster the idea that inaction may be the best policy until all such scientific disagreements can be worked out. For if the scientists cannot agree on a technically complex solution, how can we expect our policy makers to make the correct choice?

In his analysis of the acid rain issue, Roy Gould sets forth four suggestions to insure that policy is better served by science. His final suggestion is especially worthy of consideration. Gould suggests that "we need an accurate forum for resolving scientific disputes that have a strong political component" and that this forum should feature "a mechanism for converging on accurate science" [4]. After witnessing the way that the acid rain issue has been cast about in a sea of uncertainty, at least partly because of the scientific community's inability to acceptably explain its position, this idea carries tremendous potential.

Although the enormity of the task is quite substantial, the political stalemate over acid rain suggests that something along these lines must at least be attempted. If scientists and researchers could be convinced that disagreements be resolved outside the emotional climate of the mass media, public policy would be better served. Publicly castigating each other's research does not contribute to needed solutions. It only embitters opponents, who then steadfastly defend their positions in fear of damaging their professional reputations. There must be room for compromise and for the careful, unbiased evaluation of scientific data within a scientific community unburdened by caustic public displays of emotional disagreement. Certainly, it is worth trying.

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