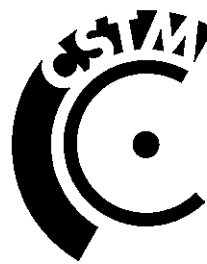


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Institutional and policy responses to uncertainty in environmental policy

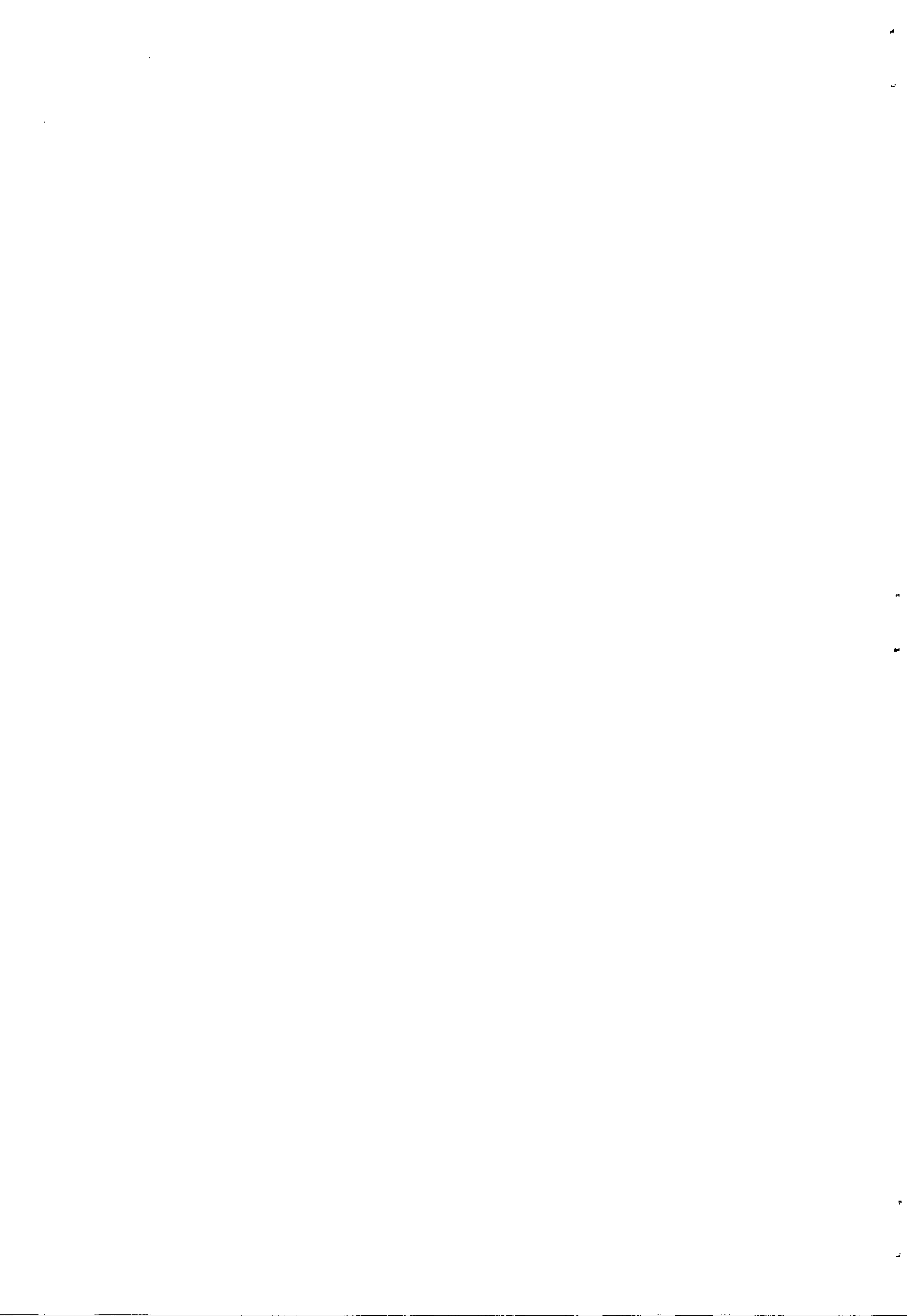
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1. Introduction

In the old days, uncertainties in many fields of environmental policy seemed to be neat and tidy. The classical division between ontological and epistemological uncertainties (e.g., Burrell & Morgan 1979, cf. Quade 1982: 155-158) suggested that large and important parts of the information environmental policy requires are in fact "knowable." For instance, in water management the world seemed to be knowable in the ontological sense, so "only" epistemological uncertainties stood in the way of policy improvements and were expected to be combated through research and monitoring. With the social variables that inevitably entered the scope of water managers, dependent as they found themselves on the cooperation of farmers, consumers and a score of other organizations (Bressers & O'Toole 1995), their world became less knowable. That means that in their perception uncertainties grew in size and frequency, and their subjective ability to cope with them diminished. In environmental policy the low predictability of human choices is reinforced by natural science challenges that often also have to deal with "chaotic systems" of some kind, like that of climate or the combined effects of a multiplicity of chemical substances. All in all, there is a growing acceptance that the world is not knowable, only "conceivable" - apprehendable from perceptions, not realities. All this leads to an uncertainty that sometimes is converted into an absolute trust in "experts" and sometimes to a fundamental skepticism, if not distrust (e.g., Scarlett 1991). Often both politicians and ordinary citizens are unsure whether we should ask ourselves "are we gamblers in a global casino?" (Middeton 1995) or "but is it really true?" (Wildavsky 1995).

In this paper we deal with the sources of uncertainties in environmental policy and discuss and assess some ways to deal with them.

2. Sources and types of environmental policy uncertainties

A certain degree of uncertainty is inevitable in all decision-making processes. Environmental problems have, in addition, some fundamental characteristics that cause uncertainties to play an especially large role.

(A) First, there are the uncertainties about what the problem to be tackled actually is.

The most important environmental problems are not directly experienced by ordinary citizens in the developed world, but more or less convincingly presented or predicted to them by media on the basis of scientific experts. This leads to greatly divergent problem perceptions as inputs in the policy process.

(B) Second, there are the uncertainties about how to escape from them. What is necessary to bring the demand for natural resources (energy, raw materials, nature as "sink") in line with the sustainability principle (almost no matter how operationalized) is more than is presently feasible from a combined technical, economical, behavioral and political perspective. This leads to a need for continuous multi-loop learning in both the policy process and other processes targeted for intervention.

So basic information is lacking on both the input (A) and the output (B) side of the environmental policy process. Furthermore, the uncertainties involved are not only about empirical information gaps, but also about normative confusion. In the case of (A) this may increase the divergence of problem perceptions (e.g.: to what extend

precisely is a problem for future generations a problem for us now?). In the case of (B) even more clearly, various ways of stimulating societal change and the change itself have normative implications that are by no means crystallized. These points have profound implications for the way environmental problems are dealt with as policy problems. In almost every respect, many environmental issues are "wicked problems."

They are also "wicked" in the sense of malicious: both their origins and the consequences of combating them penetrate into the realm of numerous other aspects of societal life. The point of view of "industrial structure" and its development, explaining much of the environmental "profile" of countries in terms of resource use (Jänicke et al. 1992), makes the widespread origins of burdening the environment very clear. Pollution is not a matter of isolated polluters, but an integral part of how production is organized in an exchange between many firms and even industrial sectors. The same hold for consumption. Decreasing energy consumption - for instance energy consumption by traffic - that surpasses pure technical adaptations is a good example of the possibly extensive side-effects of policies. The "side effects" of environmental problem solving are often more politically sensitive than the policy goals and direct costs themselves. Because of their widespread nature they extend the uncertainties in the issues that are discussed in the decision-making process.

Other characteristic aspects, such as the international and intergenerational (in any case long-term) nature of the most important problems, reinforce the uncertainties involved in the policy process, of both the A and the B type. Thus Hempel (1996:122) mentions the following specific features of environmental policy:

- I. Part of the policy objective is aimed at the interests of plants and animals rather than those of people;
- II. Moreover, part of the policy objective is aimed at the interests of future generations;
- III. Science is given a major role in drawing up the agenda, policy-making and evaluation, which leads to some tension with the dynamics of the political process;
- IV. Environmental policy tends to be less incremental than most other policies, except when it is implemented.

In view of the first two characteristics (I and II), environmental policy in Lowi's typology should be characterized not only as a regulatory policy, but also in a very specific sense a redistributive one. Basically, redistributive policies add tension to the policy process. But in the case of environmental policy the "recipients" of the redistribution do not have a voice. Those who represent their interests in the decision-making process cannot speak for themselves. They too should base themselves on the outcomes of science and prognoses for the future. This leads to an extra source of uncertainty at the input stage of the process.

The lengthy time horizon of much of environmental policy (another aspect of point II) makes for extra uncertainty both at the input and at the evaluation stages of environmental policy. Policy problems are sometimes discovered only when it is nearly too late (thinning of the ozone layer) or remain difficult to prove until it may be too late (increase in global warming). Whether the effects of the policy will be sufficient, or even to what extent they will have an impact on living conditions in a hundred years, cannot be unequivocally predicted due to the "chaotic" nature of the systems to be influenced. Such predictions remain estimates which can best be characterized as "intermediate scores" or even rivaling positions within a continuous

scientific debate.

This reintroduces point III, the inevitably important role of science in the political process. It is not just that the various rationalities of the political process (a form of competitive rationality) and of science (a form of cognitive rationality) clash; a more serious aspect which affects the degree of uncertainty in the decision-making process is that they also tend to mix. The increased influence of science on the political debate may lead to a level of technocracy which alienates major groups and ignores any contribution they may make. Vice versa, the great political importance of scientific knowledge may result in corruption of cognitive rationality and may be cause for those involved in the political debate to no longer trust even the information presented to them as fact (viz. Rosenbaum 1995).

Lindblom defended incrementalism as being, among other things, a way of dealing with insufficient information and uncertainty. But in environmental policy, incrementalism in its pure form of stepwise mutual adjustment is not satisfactory (point IV) - not only because it should not be assumed that all interests are reasonably represented in the policy-making process, but because the extent of the required changes is so considerable that a gradual, step-by-step progression is just as certain a recipe for disaster as a forceful but one-sided urge for action. The reliance on agreement as a criterion for assessing the policy's quality - a standard common in incrementalism - might even be dangerous. Under conditions of high rate change incrementalism could produce agreement on a catastrophic policy (cf. Dror 1968). Large-scale systemic responses are needed to ensure controllability of the high percentage of environmental problems which involve an accumulation of environmental pollution.

For other environmental problems which mainly involve a risk of serious incidents, an incremental approach is not suitable either, because when such incidents occur political decision making has to react under conditions of crisis. As specific aspects of environmental policy, Rosenau (1993: 260-261) mentions not only the scientific context, the temporal context and the political context (viz. points II, III and IV, respectively), but also the "disaster as context," mentioning well-known examples such as Chernobyl, Three Mile Island and Bhopal. He points out the enormous consciousness-raising effects of such disasters, which may lead to seismic shocks in all channels of the political system. But he also points out the temptation resulting from this possibility to manipulate data in such a way that the general public is activated by fear of disasters, which entails the major risk that eventually it will just become apathetic, resigned to an overwhelming uncertainty which leaves room only for the cynical view of political decision making as no more than just another competitive game.

3. Policy responses to uncertainties

Examples of both types of uncertainties - A, problem perception and B, remedy seeking - are ubiquitous. An example of an A-type issue is posed by the question of the combined effects of the proliferation of the thousands of different chemical substances in the environment. The issue is barely decipherable by the most astute experts, who shall continue to discover - or debate - wildly complex interactive effects; there is simply no way for the requisite information to be perceived and absorbed directly by citizens. Indeed, the huge growth in the numbers of chemicals

deemed potentially important has outstripped experts' abilities to catalogue effects, let alone communicate them to a broader public (thus implying further complications on the output side as well). An example of a B-type issue is the question of how to limit the growth of automobile mobility in any way other than to let the congestion itself do the job - thus making "mobility" a ridiculous phrasing of the issue. Despite the omnipresence of uncertainty, there is a sort of "taboo" about decision making under uncertainty, because it seems to defy the rationalistic ideal of a well-considered choice. Operating under such a restriction does not necessarily imply that the presence of uncertainty itself is denied, but rather that the "approved" way out is sought in the direction of decreasing uncertainty, rather than through responses that provide alternatives avoiding the need for this-uncertain information. A middle ground - as usual - is provided by Quade, who is both strongly oriented towards methods to reduce uncertainty, but also interested in providing ways to deal with its inevitability. He even warns against the tendency of policy analysts to let relatively well-conceived uncertainties "absorb their attention out of all proportion to their importance, as compared with the more serious uncertainties about which little is known" (Quade 1980: 32-33). Besides the option of "buy[ing] information," he suggests other alternatives, including "buy[ing] time" (deliberate delay, even if that itself entails a cost); taking a "conservative" approach (a worst-case scenario - and in this regard, "buy[ing] superfluous resources" if possible); and "buy[ing] flexibility" (Quade 1982: 349-350).

In addition, Mintzberg (1979) sees flexibility as a preferred response to problems that can be characterized as "changeable." But for another difficulty for those facing "wicked" problem solving, namely complexity, he proposes an additional device: decentralization. Of course changeability and complexity are not the same as uncertainty, but they are surely related. Likewise, decentralization as such can also create new forms of uncertainty (see below). What is nevertheless important here is that some form of increased participation is considered as a device to improve the information-gathering and information-processing capacity of the policy system. Van Heffen (1995) argues that situations that are complex and uncertain need a "learning policy design (and implementation) strategy." For such a strategy to succeed the public managers need relatively much freedom to adapt. So both horizontal and vertical decentralization might be crucial. Other authors take the consequences of uncertainty even further in this direction and plea for a large degree of self-regulation as the only way to handle situations where uncertainties abound (e.g., Hommes 1988). Perhaps here an additional condition for gaining benefits from such arrangements should be taken into account: a certain degree of willingness to compromise between the actors involved, including the new actors. This feature might make the difference in achieving either net benefits or net losses, in terms of uncertainty as a result of "opening up" decision making to more partners. Indeed, what this last point suggests is that flexibility and decentralization bring important advantages - and/but may need to be supported by appropriate institutional arrangements to encourage and enable their most productive use for enhancing information gathering and processing.

In another approach to this issue Schön (1983) presents complexity and uncertainty as a reason why "problem setting" is as important as "problem solving." This implies a redefinition of the role of professionals. His view is that, because "the knowing of professionals is in their action" and stems from a permanent exchange between theory and action, a more open "model of action" involving more participation and

inputs from various sides improves the possibilities of learning. By contrast, the application of rigorous methods to decrease the uncertainties apt for this treatment may lead only to a disproportionate attention to uncertainties of minor importance. In a later publication with Martin Rein he points to the importance of a "consensual framework of reference" for policy learning capacity and to the fact that intractable controversies that often stem from uncertainties tend to undermine such a joint framework of reference (a negative spiral). As a way out they point to the importance of mediated negotiation" to prevent rhetorical "frames" (policy discourses) and action "frames" congealing inaction due to stalemates or disruptive "pendulum swings" (Schön & Rein 1994). One should search for possibilities for "cross frame discourse" (cf. Habermas).

Indeed, it might be possible eventually to consider more systematically the varieties of uncertainties - and sources of uncertainties - as outlined in part 2, above, and to determine if appropriate or optimal decision responses or strategies can be associated with each. It might be possible, for instance, to consider an analysis distinguishing A and B types of uncertainty - as well as cases in which these are combined in a single issue - in terms of policy and institutional approaches that would seem most appropriate for responding to - or avoiding - their impacts. Alternatively, it could be interesting to explore whether greater or lesser levels of uncertainty and/or issues facing empirical or normative uncertainty - or both - can be mapped onto appropriate kinds of institutional and/or policy responses. Such an effort, which would require a thorough analysis of uncertainty forms and characteristics, as well as of policy strategies themselves, could be highly useful but is necessarily beyond the scope of the present article. (The same point can be considered with regard to relationships between features of different sources and types of uncertainty, on the one hand, and the relative appropriateness of different institutions or institutional features, on the other.)

This point suggests, in turn, two themes necessary to develop briefly here. One has to do with the initial kinds of institutional lessons to be drawn from a serious attention to flexibility and decentralization as means of enhancing openness and learning in policy systems. This line of discussion is begun in the present section, developed through Dutch and U.S. evidence and case examples, and revisited near the end of this article. The other, related, theme is a cautionary note: that without such careful additional institutional consideration, flexibility and decentralization can catalyze or exacerbate serious problems of uncertainty. This second point is explained briefly in the present section and then considered in the penultimate portion of the article.

An initial step toward considering the former theme might be made by noting that in both the U.S. and Europe, recent years have seen a number of policy and - especially - institutional responses consistent with efforts to expand flexibility and decentralization in policy systems. Some though not all of these have been developed with the express purpose of grappling more effectively with uncertainty, but all may offer lessons for how to do so.

On both sides of the Atlantic, for instance, a range of public-participation and - involvement efforts have been mounted. Patterns of advisory committees and interagency collaboration have become common, as well. Particularly in the U.S., but also in somewhat different forms in several nations of Europe, additional institutional supports for flexibility and decentralization have long been known: delegated authority, federalism, and interactive policy making and implementation are obvious instances. Further illustrations are more apparent in one place than

another. A characteristic example from the United States is its process of regulatory rule making, a device that typically contains provisions for opening up the decision-making process (but see also the coverage in section 5, below). An instance drawn from countries like the Netherlands is green planning, including Agenda 21 processes, which have attained widespread use. Furthermore, other elements of policy settings can contribute to openness and learning in environmental policy making. Strictly speaking, these may not be so much institutional elements, in the usual sense, as much as broader understandings common in many nations. Political culture and policy style, as these have often been considered by analysts, can either assist or hinder the encouragement of flexibility and decentralization in the interest of openness and learning. Political cultures and policy styles that encourage the opening of decision processes and - but - also the stimulation of consensus-seeking seem to offer possibilities in this regard. If nothing else, this list expresses the line of thinking increasingly common among environmental policy experts nowadays concerning the question of how to deal with uncertainty.

Opening up decision making to various types of relevant actors is a way of dealing with uncertainties that cannot be "solved." It introduces more sources of information into the process, thereby increasing the cognitive-informational capacity of the system in another way than through the scientific community and the media. Beyond the potential advantage of openness in dealing with empirical elements of uncertainty of types A and B both, there can be advantages associated with normative uncertainty as well. Relevant here is the venerable theme of cooptation, a concept often misunderstood as referencing the act of involving participants in decision processes with the object of restraining their contributions and disempowering them.

As Selznick pointed out in his classic formulation (1949), a degree of openness may or may not involve the actual dispersal of control, but it is often helpful in generating support in a setting of continuing normative disagreement, or political conflict. Cooptation, or broadened involvement in decision making with a view of expanding support if not consensus, can be seen as an institutional response to continuing normative uncertainty as well: a way of requiring dialogue as a standard part of policy discussion, since continuing normative uncertainty can be expected to persist - or be regularly regenerated - as a part of the ongoing process of decision making.

Not surprisingly, among the additional aspects of political democracy mentioned by Jänicke (1996) as empirically important for "progress" in environmental policy are the following: the degree of openness to inputs, the strength and professionalism of the green movement, policy cooperation and policy integration and institutions for long-term planning. These aspects point to participation of not only expert communities, but also the general public and green interest groups, other governments, and industries and other target groups.

Most of these aspects have an informational as well as a participation side. Even if one accepts that part, maybe many, of the short-term benefits of these devices regarding uncertainties derive from their bringing more information directly into the decision-making process, it seems clear that in the longer run other contributions could prove to be more important. It is not simply a question of being nice to industry or striving for cooptation for political reasons; there are other reasons to move in this direction, based in the need to improve decisions and also enhance the capacity of the system to learn to deal with uncertainty generally. When more open processes occur in combination with a cooperation-oriented policy style, these developments improve the system's capacity to innovate, thereby encouraging "learning by doing"

and "conceptual learning" in environmental policy (cf. Jänicke 1997: 14).

Still, as is alluded to below, features encouraging "mere" decentralization and flexibility can also challenge learning and openness, unless there are additional encouragements - institutional, policy, or more broadly cultural or stylistic - towards using flexibility and multiple perspectives to approach some ultimately coherent purpose. In connection with this point, such elements as the quality of the scientific community and media reporting, as well as other devices to increase the cognitive-informational capacity of the system, can increase political-institutional capacity (cf. Jänicke 1997: 11-14), rather than merely its likelihood to engage in decentral but ultimately unproductive discussion.

In a sense, this treatment of uncertainty and how it might be dealt with via differing arrangements touches upon recent trends in institutional analysis. As Arentsen has pointed out, the clusters of rule structures (see Ostrom 1986) commonly referred to as markets, hierarchies, and networks can be considered institutional forms that are likely to optimize different criteria - efficiency (via competition), effectiveness (via authority), and legitimacy (via cooperation), respectively - and each in pure form is likely to entail some sacrifices of the others (Arentsen 1997). The potentially tricky balance needed for wrestling with virtually permanent uncertainty in environmental matters - a requirement for openness and flexibility coupled with a need to find consensus-forming approaches - would seem to require hybrid institutions, structures that combine or balance features characteristic of some features of markets, hierarchies, and networks simultaneously. Once again, this point is a start rather than an end to a kind of analysis needed. The next two sections of the paper, which treat some specifics in two countries, provide instances for consideration in demarcating the territory in which appropriate institutional arrangements may be found. To anticipate a theme developed there, it can be said that when nations rely on mechanisms that emphasize market and to some extent hierarchy at the expense of networked encouragements toward cooperation, openness and decentralization can threaten to catalyze rather than manage uncertainty (see the U.S. case, below). To consider the issue of a balanced approach somewhat further, this section now turns to complications that can be engendered under some circumstances of openness. What of the ways that flexibility and decentralization - leading to apparent openness and learning - create *difficulties* in coping with uncertainty? A first point to consider is that it is important that the learning processes for environmental policy are not confined to direct information on specific issues. This kind of learning might seem the quickest route out of uncertainties but can actually create by its narrow scope severe risks when put into use. Not only can (a) the empirical basis be flawed, but also the "lessons" may (b) neglect the absence of institutional and cultural preconditions to successful adjustments, (c) neglect the value of continued variation as a laboratory for future learning, (d) improve only some aspects ("away from the problem") while this shift is only productive in combination with improvements in others, and (e) lack consideration of differences between the subjects of the empirical basis and those to which these lessons are to be applied (then and now, here and there, this and that) (cf. Rose 1993). These points apply generally to what Rose calls "lesson drawing in public policy" but are likely to apply in spades for environmental issues - for the reasons explained in section 2, above. All these risks underscore the necessity of broader and more conceptual learning and - above all - that it is necessary to support the learning capacity of the policy process, rather than replace it by information and advice based on external problem analysis and policy

analysis.

Indeed, despite the best efforts of those seeking to stimulate learning and openness in environmental policy processes, some of these problems can be expected. Note, for instance, the observation in the realm of international environmental agreements that treaty revisions after reviewing several years of experience have sometimes drawn the apparently "wrong" lessons and have resulted thereby in unintendedly maladaptive "learning," a result that could follow from any or all the difficulties listed above.

Internationalizing environmental decision making is clearly necessary, and this trend might be seen as one institutional (and policy) response to uncertainty. But it also opens up new possibilities for uncertainty to increase. Internationalization can build connections that might even *exceed* (or be more tightly coupled than) the interdependence of the environmental question at stake. Note the argument of Wildavsky (1995), and that of some other (mostly) Americans, that environmentalists push for policy and institutional responses enacting or forcing more interdependence than environmental issues often require, with negative consequences - including on the system's ability to manage the interdependence thereby required. Furthermore, forging such international links can create the likelihood that political and social agreement will decline, at least in the short- to medium-term, when decisions encompass international rather than national jurisdictions - thus increasing uncertainty along a normative dimension.

Both these examples point toward the challenge of developing appropriately open and learning-oriented policy systems in settings in which political incentives are crafted to emphasize the short term or - to put the matter in different terms - steep discount rates. The clash of adapting to longer-term uncertainties in the face of policy games fixed toward steep discounting is, of course, a major theme of current debate.

4. Responses in the Netherlands

Consensus building and negotiation as characteristic Dutch response. In coping with both type A and type B problems, previous sections of this paper suggested open and learning-oriented policy systems with cooptation and consensus building as dominant devices. The Dutch system seems to incorporate conditions for learning, because of its corporatist tradition. Although the classic pre- and postwar manifestations of corporatism have disappeared, cooptation and consensus-building through negotiation still dominate the Dutch mode of governance. In a sense, consensus building seems to be "genetic" in the Netherlands, given the meaning of the Dutch word for "policy": "beleid." The word not only means "course of action" but also "prudence," "discretion" and "tact" and is related to the Dutch word "overleg" which means "deliberation," "judgement," "forethought," but also, "consultation," "concertation" and "to take council together." In contrast, the Anglo-Saxon word "policy" is related to policing and control, words that refer basically to conflict and hierarchy types of relationships (Van Waarden, 1992), although the same root references the "polis" from Greece as well.

It cannot be denied that the Dutch institutional environment - its values, norms, rules and structures - is well equipped for consensus building, whether the discourse is socio-economic, educational, religious, environmental or royal. Self organization and

self regulation by societal groups has been dominant in the political process for years, and in a sense still is. Almost every societal interest, no matter its size or significance, is organized and finds its way into the political process, whether national, regional or local. An extended structure of advisory boards is but one heritage of post war corporatism. Until recently, some 400 advisory boards supported policy formation in the Netherlands. The extended number of political parties represented in Parliament (about 14 at present) is another manifestation of the tradition in consensus seeking and building. So the Dutch institutional structure, inherited from postwar corporatism, seem to incorporate conditions for adaptive learning. This section illustrates how these institutional conditions work out differently in environmental policy processes. The first example, the agrarian case, illustrates how ones-adaptive institutional structures actually blocked environmental awareness and effective environmental policy making in the agricultural system. The second example, the case of general agreements, illustrates how the Dutch society put lessons from classical corporatism into practice to regulate the environmental impact of Dutch industry.

Environment and agriculture. In spite of its limited geographic reach, the Netherlands has been home to the development of a huge and extensive agricultural industry, ranging from covered and open cultivation to intensive livestock farming. Dutch flowers, cheese, eggs, and meats (beef, pork, and chicken) are produced partly for domestic consumption and partly for export throughout the European continent and beyond. To succeed within confined geographic conditions, Dutch agribusiness has been and remains very innovative. Yields per hectare are one of the highest in the world, and Dutch farmers are champions in keeping the largest number of cows, pigs or chickens per square meter. The economic significance of Dutch agribusiness is unquestionable; business and exports contribute heavily to economic growth, national income, and domestic employment. Productivity rates have increased tremendously during the last three decades, a period during which traditional Dutch agriculture was transformed from an industry producing primarily for local markets into a modern, highly complex, and technologically innovative sector providing a wide range of agricultural products for transnational markets. Dutch (agri)corporatism was the dominant institutional medium for this economic success. The main characteristics of the agri-corporatist model are: (a) strong internal coherence and group-mindedness as a gatekeeper to the outside world, (b) tight and extensive internal organization of all agricultural interests, (c) private and public sharing of problem perceptions and solutions, (d) joint policy making by public and private actors, and (e) the assumption by the sector itself of primary responsibility for policy implementation (Frouws 1994). However, this institutional environment facilitating effective policy making to enhance productivity, economic efficiency, and technological innovation badly failed in enhancing the environmental awareness of the agrarian sector.

Domestically, for more that ten years the agricultural sector as a whole (a) "refused" to recognize the environmental damage caused by agricultural activities and (b) desperately gave priority to maintaining and expressing one unified voice for the sector as a whole in environmental discussions with the "hostile" outside world. With the help of the Ministry for Agricultural Affairs, farmers and their spokesman were able to avoid the environmental challenge for quite a period, arguing for farmers as "the only real and legitimate experts in natural resource management." The

formulation offered, in addition, a whole range of detailed, scientifically based economic and technological arguments supporting a strategy of nonactivity on the part of the agrarian sector towards environmental awareness. For the most part, these arguments were produced by research organizations within or closely related to the sector. For a long time the sector did not even accept information, scientific or not, from non-agrarian research institutes.

For several years the sector as a whole resisted environmental learning and was supported in that position by "in group" information that blocked "out group" information of a conflicting nature. Almost every proposal or initiative to reduce harmful environmental impacts "got lost" or eroded in the agricultural institutions. In the end, a series of incidents (including: the appointment of a "fresh" Minister for Agricultural Affairs not burdened with an agricultural preoccupation, the appearance of infectious swine fever in the southern part of the country, and the erosion of agriculture's credibility in the eyes of the public) forced the sector towards increased environmental awareness. The Minister supported this growing awareness with a long-term and innovative program aiming at a restructuring the sector towards "sustainability" and world market competitiveness. In formulating his plans, he ignored opinions within the sector as much as possible. He actually delayed consultations with the sector in the policy process. He refrained from asking the sector for ideas from the very beginning, as had been common under the Christian Democratic minister; but he did resume the typically Dutch consultation process once his program was outlined. As a response to the extensive swine fever outbreak in the southern part of the country, the Minister announced a program aiming at an overall nationwide reduction of the total pig population by one quarter. He invited the sector to offer alternatives but has recently rejected a counteroffer from the sector that had included a scheme of differentiated production rights with a projected cut of only 15%. The swine fever, in combination with the documentation of economically-motivated but risky behavior on the part of some farmers in the infected area, enhanced the societal and political credibility of the Minister's reduction plan. The agrarian case shows that open and productive institutional structures do not guarantee learning-oriented policy processes. Actually, the open and once-productive corporatist structures came to block environmental awareness in the agricultural system. The internal openness of the system, which was able to facilitate a broad and differentiated policy input, became counterproductive because the system as a whole ignored external environmental signals. For several years, the agricultural system developed as an island defending itself against a "hostile" outside world. This isolated position in the environmental debate was facilitated and supported by a mindset among those in the system that stimulated for too long the "wrong" kinds of environmentally-oriented learning processes. In spite of the learning-oriented institutional structures. In spite of the learning oriented institutional structures, the system itself was unable to face the environmental challenge. In the end, the system was forced from outside to enhance its environmental awareness. At the local level, the environmental crisis in the agricultural system has been answered by new initiatives of mostly young farmers, who have been joining local discussions between public authorities and environmental groups regarding how to combine and integrate agricultural activities with eco-management, recreation, and the establishment and maintenance of landscapes. Many of these initiatives have already resulted in local agreements. These initiatives of young farmers illustrate how the agricultural system now is searching for new learning capacities.

Agreements with industry Another example illustrates a search for new learning capacities from a totally different point of departure. It describes how the Dutch sought adaptive and learning-oriented structures to manage environmental problems caused by Dutch industry. Between 1970 and 1985, these problems were combated primarily by environmental legislation. At the end of the eighties, when the limits of public regulation became manifest, new interactive styles of regulation came into being.

The negotiated agreement between government and societal groups is the recent manifestation of this regulatory style. In environmental policy, negotiated agreements became common in the mid-eighties. At that time it became clear that cooperation and negotiation with the private sector were needed to manage domestic environmental problems. It turned out that the then-common practice of overt regulation by directives was not very effective, especially due to a lack of public administrative capacity. Environmental laws had become very extensive, complex and differentiated, resulting in a need for regulatory harmonization and integration (Klok & Kuks 1994).

To overcome these problems, the conservative-liberal then-Minister for the environment initiated a more open and responsive mode of governance that was new in Dutch environmental policy processes, but that in a way inhabited "old" corporatist traditions. He opened structured communication with almost every sector of the Dutch economy, a process resulting in what is called "target group policy": a policy of open communication with economic sectors and branches of Dutch industry to negotiate and to agree about environmental efforts. This change to interactive styles of regulation was possible because (a) every economic or societal interest was well organized, and representatives were able to participate on behalf of well-organized groups in the process of negotiation; (b) spokespersons had the full confidence of the organizations they represented, enabling these individuals to negotiate with a certain degree of freedom; (c) public and private participants shared a minimum perception of environmental problems and the need to meet these problems; and (d) public authorities were willing to take a certain risk (uncertainty) in not achieving goals. Four conditions, strongly related to traditional Dutch corporatist structures, successfully facilitated the open and communicative environmental policy making, initiated by the Minister for the Environment. These open and goal-seeking processes, accounting for different interests, meet Habermas' criteria of communicative rationality, as manifested by their high degree of legitimacy. Results of these open processes have always been, and almost by definition must be, compromises; and repeating the process (game) allows for a rotation of winners and losers over time: today's winners will be tomorrow's losers. So by changing the policy style in the mid-eighties, the Dutch opened the policy process, thus enabling decision makers to deal with environmental problems and solutions by communication and compromise. This open policy style contributed to the effectiveness of Dutch environmental policy, by actually enhancing the legitimacy of the policy process. This can be illustrated by looking more closely to some results of the open Dutch style in environmental policy.

A study by the Dutch General Account Office on the effectiveness of agreements concludes, for example: "Most often, the covenants evaluated by the Council do not guarantee compliance with the agreements and the attainments of agreed goals. Half of the policy covenants lacked guarantees for goal attainment" (Dutch General

Account Council 1996, p. 19). In line with this argument, a recent evaluation of the Dutch CO₂ policy stressed the need for additional measures to meet emission standards set for the year 2000. CO₂ emissions had increased, and not only due to economic growth. Between 1990 and 1995 the annual increase of CO₂ emissions was 1.3% instead of 0.3% as had been predicted and expected. It was concluded that a 3% reduction by the year 2000 would require additional measures. The actual pace of implementing cutbacks lagged, especially in industry, mobility, and transportation. Low energy prices impede both the need for and the speed of energy saving investments in industry. So from an instrumental perspective, negotiated regulation has not yet been very successful in reducing CO₂-emissions caused by Dutch industry.

However, these limited results do not challenge Dutch ambitions in CO₂-reduction policies. During the first half of 1997, the Netherlands initiated sizable European CO₂-reduction targets (of 15% cuts by 2010 by comparison with 1990 emission figures) as they chaired the European Union. This figure will be the offer of the full European Union in the Kyoto climate change conference late 1997. The Netherlands will commit to a 10% share of the overall European reduction target. Nationally, this 10% share is perceived as very ambitious; attaining this goal would be expected to challenge the Dutch society tremendously. Success would require efforts far beyond existing programs and technologies. For that reason the Dutch Ministry for the Environment invited target groups to participate in the (domestic) preparations for the Kyoto conference. The public authority used this open dialogue (a) as an early test of new ideas and measures in case Kyoto agrees on the reduction goal, (b) to develop sensitivity regarding measures unacceptable to target groups and thus assist in defining the national range for negotiation in Kyoto, and (c) to prepare target groups for future efforts in an early stage of policy development. The process culminated in a national conference on climate change, to exchange ideas and proposals.

The common practice of negotiating agreements in environmental policy was primarily motivated by poor results produced by traditional rule making.

Environmental policy shifted toward a style of regulation consistent with the traditional pattern of "open" policy making as was once common in classical Dutch corporatism. The open policy style spread through a new domain of public policy (management of the natural environment) and was put into practice nationwide. The results are ambiguous thus far. The regulatory style is accepted as a fully legitimate approach, but environmental improvements are mainly achieved step by step, through the slow accumulation of compromises. However, the open style of environmental regulation has also improved the national climate and setting for further environmental policy making. In only two decades environmental awareness in Dutch industry has increased significantly, and public authorities have learned to integrate green and economic targets. Even the "natural" public partner of Dutch industry, the Ministry for Economic Affairs, recently has exhibited an increased green- and even sustainable-awareness. The Ministry, long resistant to environmental efforts for Dutch industry, now chairs an extensive technology program of about 70 million Dutch guilders annually, for sustainable technology development. In short, the transformation to an open policy style in the environmental domain has facilitated policy making over the longer haul by increasing the legitimacy of the policy process even inside the bureaucracy. A continuous dialogue with organized groups, and especially the "free" communication

on environmental goals, contributes to the improvement of conditions for dealing with uncertainty effectively in the policy process.

Both examples, agriculture and industry, illustrate how the Dutch searched for openness and adaptation to enhance learning capacities in environmental policy. The routes each sector took differed, due to different starting points and institutional conditions for learning. In the agrarian sector learning resulted from the bankruptcy of the (agri)corporatist structures which had been hindering openness to and communication with the outside world. Among other factors, new local initiatives contributed to an increased external openness on the part of the agrarian sector by redefining environmental problems as challenges of eco-management. Dutch industry, on the other hand, was not forced but invited to participate in environmental policy making. Here, government and industry adopted traditional corporatist patterns of consultation, dialogue, and compromise, for environmental policy making. It turns out that these modern manifestations of classical corporatism have facilitated policy outcomes by increasing the legitimacy of the policy process.

Hazards from radioactive and chemical substances. The final example illustrates the argument made by Quade - "to let relatively well-conceived uncertainties absorb [their] attention out of all proportion to their importance, as compared with the more serious uncertainties about which little is known" (see section 3). In the Netherlands the use of both radioactive and chemical substances (the former used in medicine, science and industry) has been heavily regulated to protect against hazards. In both fields extensive information has been at the heart of the regulation - information about the locations and types of use, types of substance, and kinds of hazardous features. Organizations using radioactive substances have been forced into extensive record keeping and reporting their whole supply on a monthly base to the public authority, even if the stock of nuclides remained constant for years. This expensive information exchange was legitimized by the need for adequate policy responses under all circumstances. It turns out that the information has not been used at all. The efforts of the organizations supplying the information became disproportional to ensuing policy actions - which were never actually taken (Arentsen 1988).

In regulating the industrial use of chemical substances, the national government requires the provision of information on types of substances and extent of hazard presented by them. Here too, the information systems and the policy measures actually taken are disproportional. For existing chemicals (in use before 1987), the policy concentrates on a very intensive, narrowly focused and highly scientific debate on the hazards of only a few chemicals, while neglecting the hazards presented by a tremendous number of chemicals in use worldwide. Before introducing a new chemical (in use after 1987) on the market, Dutch industry is forced to prepare an extensive document on hazards for submission to the public authority for approval. This very costly exercise (about \$100,000 for each new chemical) was authorized to prevent the introduction of hazardous chemicals - if necessary by means of a legal ban. As of now, only a very few of the hundreds of new chemicals introduced since 1986 have actually been banned. Industry has "learned" to avoid bans by developing less hazardous chemicals and limiting the application of hazardous chemicals to fully closed technical systems (Arentsen 1991).

The examples of radioactive and chemical wastes illustrate how experts, dominating

both policy domains with almost no public involvement, tend to act primarily according to their own "in group" professional standards in determining how to cope with hazards. Professional standards rely on highly scientific, narrowly focused results and conclusions on the hazard of every individual chemical with a degree of precision entailing at least two or three decimal places, whereas society is more in need of a wide range of protection at a more general level, given the tremendous number of chemicals in use. In problem solving, professionals sometimes are primarily motivated by the solutions at hand, instead of finding solutions for problems perceived by society.

5. Responses in the United States

Many policy, and also some institutional, responses to uncertainty are quite similar in the United States to those adopted in the Netherlands. There are a number of potential explanations for this observation, of course. These include cross-national policy-oriented learning (cf. Sabatier and Jenkins-Smith 1993), roughly similar levels of problem severity, at least for a number of environmental issues, as well as explanations based in features of uncertainty driving characteristics of responses. And, although one theme to emerge from this section is to be the complicated challenge of making decentralization and flexibility serve the interests of appropriately productive openness and learning - with the U.S. offering some sobering instances of problematic decentralization and flexibility -, it is true that there have been significant American efforts to take uncertainty into account in designing policies and policy processes that are open and flexible in innovative and creative ways.

Negotiated rulemaking. One example is the process of negotiated rulemaking, which has been adopted often in recent years as regulatory environmental policies are put into place in the American context. The more traditional American regulatory pattern has involved proposed rulemaking by formal authorities, followed by a period for formal comments and then revisions by interested parties and possibly the broader public, followed by the issuance of final rules - often followed by litigation challenging the rules; and thence months or years of policy uncertainty as claims are processed, decided, and appealed; and sometimes thereafter new rule-drafting efforts in regulatory bodies. Negotiated rulemaking, on the other hand, involves interested parties early in the process, with the interests of mutually-productive consensus that can be implemented with considerable support or acquiescence; and, not unimportantly, with the understanding that the parties involved are joined on a process of problem solving under conditions of uncertainty and have the potential to engage in continuing discussions and potential revisions as learning takes place. Negotiated rule making can be abused, of course, and its selection is not neutral toward the outcomes under consideration. But its growing acceptance even in the highly pluralistic U.S. signals a parallel growing recognition that flexibility may be an increasingly necessary element of productive environmental policy making.

Still, many responses in the U.S. are different from those typical in the Netherlands. At least three features of the broad institutional and policy context help to characterize, and perhaps to explain, some of the response differences: the prominence of pluralism rather than neocorporatism, the constitutional principle of

federalism (and perhaps the associated feature of scale), and the (policy style) prominence of regulation as a typical mode of resolving many policy challenges. These themes have often been treated elsewhere and do not require thorough exposition here. It can simply be said, first, that the pluralistic policy setting in the United States provides a multitude of openings for actors to influence, and especially derail, policy initiatives - without creating much incentive, or many opportunities, for concertation and consensus formation. Second, the federal structure ensures a further kind of decentralization, one based on area rather than function. This institutional feature does indeed encourage experimentation and some degree, even, of competition across subnational jurisdictions, as well as the possibility for additional flexibilities of response that can be advantageous under some conditions. But federalism enshrines as a constitutional principle continuing interaction without necessarily encouraging cooperation. And third - and partially as a consequence of the background institutional features just discussed -, policy response in environmental as well as some other sectors has often taken on the character of fairly rulebound and heavy-handed regulation. (This regulation is not always rigidly enforced, but the rulebound nature of the policy often frames the tactics adopted by the parties at contest.)

The upshot is that some basic characteristics of the U.S. institutional and policy setting help to drive certain policy responses; these responses often reflect decentralization and certain features of flexibility; and yet the lack of concertation and minimal encouragements for productive and continuous engagement can limit the possibilities for open and learning-based responses to environmental uncertainty. A few instances of U.S. policy response are offered here to illustrate and expand this theme. They are included here for their value in exposing some elements of potential contrast with Dutch examples and (in one case) for supporting the claim that more consensual and learning-friendly policy responses might offer more effective responses than those often chosen.

Regulation and litigation as characteristic American response. It is well known that regulatory approaches are heavily used policy responses in the United States. Indeed, the U.S. has been characterized this way in other policy sectors as well (see, for instance, Kelman 1981; Bardach and Kagan 1982). Certainly regulation has been a particularly prominent feature of American approaches to environmental policy regarding air, water, nuclear waste, wetlands, and numerous other environmental issues. And the use of courts, involving procedures of litigation, is a particularly American phenomenon - one widely adopted by actors involved in environmental policy making and disputes. A small example: no sooner did the U.S. President announce a new regulatory policy during 1997 regarding particulates implicated in air pollution - an action placed under his authority via previous legislation - than informed observers predicted rounds of litigation stretching years into the future (*New York Times*, June 1997).

There is no denying, furthermore, that regulatory pressures can produce a certain kind of (short-term) "learning." Aside from the obvious point of stressful conditions producing tactical problem solving under deadline pressure of sanctions, additional forms of a kind of learning accompany regulatory pressure and dispute. Much of this "learning," nonetheless, comes in the form of knowledge about case law, precedent, skill in building defensible decisions in adversarial processes, and ability to withstand appeals. In processes of litigation, in particular, the kinds of uncertainty outlined in

section 2, above, are relevant to discussion but largely forced into a mold of bilateral, highly structured disputes. The system of litigation is substantially "protected" from broad opinion, and it is also somewhat difficult for many kinds of non-legal expert knowledge to penetrate the legal context. The familiar kinds of conflicts among scientific experts and between experts and the general public on environmental questions are further influenced by a layering of legal expertise onto the discussion. Courts in the U.S. are generally not equipped, therefore, to consider the kinds of uncertainty outlined earlier.

To complicate the situation, the American system of regulation and especially litigation is decentralized, with appeals processes potentially important and both state and national court systems having jurisdiction on important environmental questions.

The American-style processes of regulation and litigation carry some advantages, including formal authoritativeness. So decisions can be required, even despite resource constraints and political disagreement (thus normative uncertainty). Uncertainties of type B, therefore, can be addressed to some extent through such responses. Regulatory and litigious responses, however, do little to address uncertainty A productively. Perhaps more interestingly, litigation processes of the type used in the U.S. are actually designed to deal with *another* type of uncertainty: what might be termed "responsibility uncertainty." Processes of litigation place legal accountability in the hands of specific parties as determined by interpretation of the relevant law and regulations. Such responses provide authoritative decisions regarding the official determination of legal responsibility. Litigation and processes associated with it provide "an answer" regarding who can be legally blamed but does not assist much in either scientific learning or encouraging behavioral and technological changes toward sustainability. (And this limitation obtains even if one ignores questions about the efficiency of such processes.) In the interest of fairness, therefore, such approaches sacrifice many of the criteria mentioned earlier in the coverage of institutional variations, with the partial exception of authoritativeness.

In this fashion, litigation can discourage cooperation in the sharing of information, the exposure and open consideration of the complexity of causal processes (which tend to be reduced to two sides and one winner), and the reduction of uncertainty in environmental decision making into the future. Regulation and litigation tend to encourage protective and institutionally conservative decision making, plus the elevation of legal techniques and considerations into the highest realms of decision making.

One specific example of this kind of approach, and these manifestations of the difficulties it presents, is the Superfund program, which is supposed to identify and remediate hazardous waste sites throughout the country. In the years since the program has been underway, Superfund has resulted in the solution of a relatively small number of waste sites, the identification of thousands more, and endless streams of litigation and costly challenges. Under the program, uncertainty as a general phenomenon escalated for years, and most observers agree that the results have been seriously disappointing (see, for instance, Church and Nakamura 1993).

Comparative risk assessment. Processes of comparative risk assessment, in which under ideal circumstances both public and scientific inputs are integrated into a concerted effort to identify and consider the relative risks of multiple environmental challenges, offer the prospect of helping nations, and policy settings, learn to deal

with uncertainties of both types A and B, and of both empirical and normative components. Under the right conditions, such risk assessments create forums and a reasonably focused dialogue that can educate both specialized and broadly public participants regarding the perspectives, information, and concerns of other groups. Comparative risk assessment, and the institutional settings in which it takes place, can therefore be considered an important locus of innovation for how to cope with uncertainty.

Some experience from the U.S. is instructive, nonetheless, regarding the importance of the institutional context for such an effort and for improving the management of uncertainty connected with inputs and outputs to the policy process. Approximately half the American states have now established some kind of comparative risk assessment process for dealing with environmental questions (see *Governing* 1997).

Numerous local governments have also gotten involved in such efforts. The primary aim of these initiatives seems implicitly to be to reduce uncertainties of type A. In the (typical) absence of institutional mechanisms to encourage cooperation and concertation, however, one result frequently has been to exacerbate uncertainties of type B. Comparative risk assessment efforts have been used not infrequently by businesses and pro-market ideologues to weaken environmental enforcement. As often used in the U.S. context, comparative risk assessment has at best only weak mechanisms holding actors to commitments; the result can make the process prone to increasing rather than reducing politicization.

More specifically, it can be observed that those political leaders who stimulate and champion comparative risk assessment efforts can be the bearers of large political costs, as those who enter into the process become disenchanted with results, or as diverse groups and interests begin to perceive their own preference orderings differing significantly from those being pursued by government. The objective is coordination of distinct assessments and preferences, but the result can often be polarizing and rendering more salient the differences that exist. Or, to put the point in somewhat different terms, processes intended to concert preferences can instead catalyze and expand normative uncertainty.

Some local officials, for instance, who have led the way to introduce comparative risk assessment have unintentionally mobilized opposition from business and environmental actors both, despite their own best efforts to use the process to reduce the range of disagreement and uncertainty. The public itself can become cynical even from such efforts to take their own preferences seriously into account - at least under institutional conditions common in the U.S.

Technology-forcing policies. A kind of policy response sometimes adopted in the United States, as well as in other nations of course, is the enactment of policies requiring changes in behavior or outputs for which technologies are not (yet?) known, and/or policies explicitly ignoring some information: the marginal costs of compliance or implementation success. Some famous instances of this kind of response can be found in the annals of American environmental policy. This kind of policy strategy can be understood as committing government and others to a position eliminating consideration of uncertainty A, with the idea that treating that issue as not subject to discussion will force rapid innovation and thus a reduction or elimination of uncertainty B. Experience suggests that this approach can force some technological, expert-based learning and is therefore likely to be beneficial in the short term, if one considers the issue narrowly, when it is fairly clear that the actors

required to innovate have been operating with some resistance to the objectives of the policy. Placing the uncertainty burden on them can force action; but it is also likely to reduce opportunities for cooperation and the building of trust - circumstances that can assist in reducing and managing uncertainty over the longer term.

More generally, technology-forcing policies can have some success with the particular issue under contest but are unlikely to encourage broader learning across stakeholders and diverse clusters of actors. Such policies, especially in a heavily regulatory and litigious context, provide little encouragement toward concertation and the building of trust outside of expert groups.

Policies on toxic releases. One final, and somewhat more specific, policy example can provide a counter-instance essentially supportive of the overall theme of this section. Although it is true that U.S. institutions and environmental policy responses often share some of the characteristics outlined above, not all policies can be so easily typed. Research conducted on toxic release policies in the U.S. provides a convenient illustration of the advantages of information-generating and -sharing processes for dealing with uncertainty-laden issues, particularly when compared with heavy-handed regulation (see O'Toole, et al. 1997; Yu, et al. 1997).

In the U.S., the national government requires businesses and others who release significant quantities of any of hundreds of toxic wastes to report the type and amount of waste emptied into the environment, the manner of its disposition, and (now) any waste-reduction efforts undertaken to control potential harm to the environment. There are data gaps, but the Toxic Release Inventory (TRI), which has been compiled for a number of years, constitutes the largest and most reliable source of information on toxics in the U.S. National policy does not specify any quantitative-regulatory targets for the reduction of such wastes, although of course reductions are encouraged. (One way has been the use of an entirely voluntary program, the so-called 33/50 Program, to stimulate businesses to self-commit to changes in exchange for favorable publicity.) Many additional groups, including nongovernmental organizations, pay considerable attention to the data distributed in various forms on an annual basis; and they use publicity and other persuasive tools to draw attention to the worst "offenders" and cajole polluters to reduce their load on the environment.

The states can enact their own toxics policies, as well. Many have done so, to require additional information reporting and dissemination and/or to regulate toxics release and disposal: public disclosure, distribution of data to public libraries, information provided to interested community groups, and so forth. A number of approaches have been implemented, thus demonstrating that decentralization can certainly catalyze experimentation.

Two research-based findings on the outcomes of such policies are worthy of note in this discussion. First, national-level voluntary reduction efforts based solely in information-sharing and voluntary concertation with national policy can stimulate significant reductions in polluting behavior, but only where the field structure of the implementing organization (in this case, the U.S. Environmental Protection Agency) is itself committed to the goal and works actively to inform polluters and assist them in changing behavior (O'Toole, et al. 1997). Secondly, and more interestingly from the perspective of the argument advanced in this article, states relying on information-dissemination and openness policies to encourage reductions in toxic-polluting behavior have been more successful than states emphasizing regulation

alone, without much attention to information. (Regulation combined with a strong emphasis on openness is the most effective strategy, according to evidence derived from recent TRI data. See Yu, et al. 1997.) This result flies in the face of some current assumptions in the U.S. among policy specialists regarding what makes for more effective pollution-reduction behavior. Policies on this issue that treat learning and dissemination seriously, that encourage discussion and debate, are more adaptive to the policy problem than the more standard approach. Therefore, and partly by accident, U.S. policy experience on toxics provides evidence that a response oriented toward openness and learning can be somewhat effective, and moreso than sheer regulation in this case.

6. Learning to deal with uncertainty

To cope with uncertainties, learning is essential. For envisioning a sustainable society, "learning our way out" may seem the only path (Milbrath 1989). For Milbrath this learning is not confined to direct information gathering and processing. It includes the change in perspectives that is necessary to re-frame the problem in such a way that a new understanding of the relevance of information can occur. For instance a change in the dominant paradigm from a human health perspective to an ecosystems integrity perspective might lessen the need for information on the (sometimes minuscule) risks of environmentally-induced cancer but increase the need for information on the interwovenness of ecosystems and their habitat. Milbrath (1993) claims no less than that "the world is relearning its story about how the world works." In a less dramatic way, Jänicke (1997: 12) points as well to the importance of the leading paradigm of policy actors and its influence on information needs.

When discussing 24 cases of "successful environmental policies" Jänicke and Weidner (1995) clearly do not emphasize the separate lessons to be learned about the efficacy of specific policies under various circumstances, but look for the underlying dimensions that support new ways of thinking about environmental problems and policies, thus contributing to political modernization. In later work they stress the importance of global environmental policy learning (Jänicke and Weidner 1997) as a process of "innovation and diffusion," deliberately using terms that are more often used when discussing technological modernization.

For this reason learning to cope with uncertainties does not simply mean gathering and processing information, but also creating institutions that provide capacity for continuous and long-term conceptual learning. That need not necessarily be institutions in the sense of organizations, like Milbrath's "systemic and futures thinking unit" (Milbrath 1989: 282). At least as important is to guide environmental policy discourse into the direction of an open exchange of views (cf. Bach and Hall 1986). Mutual trust, or at least respect by and among the parties involved, is essential here, as are tactics and appeals in the public debate that empower rather than downplay the inputs of all the participants (e.g., Spangle and Knapp 1996). These analysts emphasize that it is important to reduce moral positioning, focus on common ground, downplay or refashion the drama and create new models for data disputes - that is be willing to discuss the methodology.

All in all, scientific experts or epistemic communities are of great importance for environmental policy, as decision makers cope with various types of uncertainties.

But their role is not confined to trying to present in a credible way timely and correct information. On the one hand epistemic communities can possess a body of integrated knowledge that has some stability, but on the other hand there is the risk of "group think" that creates false certainties (cf. the nuclear energy community). The contribution of science to learning capacity needs to include open communication with other societal actors. Only in so doing can they take a responsible role in the emerging "civic society."

Learning to deal with uncertainty can be enhanced by additional research along a number of lines. Three promising instances can be mentioned. First, the development of a logically coherent and empirically sound connection between sources and types of uncertainty, on the one hand (section 2 above) and appropriate - or even likely - policy and institutional responses, on the other (section 3 above) could be an important step in improving knowledge on this significant link. It may also be a requisite of substantially improved practical responses to uncertainty in the political system.

Second, recognizing the significance of sociopolitical agreement/disagreement can enable analysts to begin the development of theoretical explanations for why differences (for instances cross-nationally) in policy responses or policy processes can be observed for ostensibly "similar" environmental issues. Since the study of organizations as well as of environmental decision making suggests that the most appropriate institutional form varies, depending on the extent of knowledge and agreement regarding means and ends (Thompson 1967; Rip 1985), theoretical expectations can be developed regarding how different national systems are likely to respond to empirically common environmental problems. Where environmental-scientific "knowledge" is widely shared, and basically similar across jurisdictions, one could expect institutional responses and policy choices to vary as well, in somewhat predictable fashions. And such variation should be able to be explained in part on the basis of varying amounts of normative uncertainty across the systems.

And third, of course, analysis can also be performed on different environmental-policy topics within a single country or jurisdiction, with the object of seeking and testing theoretical explanations for how varying levels and kinds of uncertainty even within the same broad setting can evoke different policy and institutional (at a more fine-grained level) responses. This line of inquiry, as well, is likely to enhance understanding of the links between uncertainty and policy system response.

One of the factors that makes this set of issues even more interesting, salient, and complex is well illustrated by some of the empirical information contained in Sections 4 and 5 of this article, especially the discussion of institutional arrangements and responses in the United States. For these instances demonstrate somewhat more concretely the broad point made in Section 2, that not *all* decentral and flexible responses facilitate openness and learning. On the positive side, the U.S. situation shows that the sheer diversity of economic conditions, political contexts, and institutional/policy conditions means inevitably the fostering of "laboratories" through which some important kinds of learning are continuously actualized. But learning and adapting productively to uncertainty are not inevitable under these conditions.

Note, in particular, the following points in this regard:

- the key role of elites beyond the substantive experts in how uncertainty is processed and managed. Legal expertise and media roles can be particularly instructive. (The former is illustrated in Section 5, the latter could also be explored in depth.) Taking these actors' institutional settings and decision

approaches into account can be very important.

- institutions and standard approaches in the U.S. often discourage concertation and coordination. There has been a tendency towards a potpourri of approaches and decisions, with experimentation aplenty but often little cumulation. "Learning," if and when it occurs, is overly abstract and needs always to be considered in (at least) national context. (Note in this regard the types of maladaptive learning listed in Section 3.)
- decentralization and flexibility are characteristics of U.S. policy, particularly flexibility across jurisdictions. But difficulties of appropriate control emerge under such circumstances. Consider the analysis of "control deficits" by Scharpf, Reissert, and Schnabel (1976): choosing instruments that do not encourage sufficient coordination, or coordination at the appropriate level. Mismatches involving overly decentral institutional arrangements can tie interdependent parties together in unproductive situations in which appropriate learning and decision making become difficult or impossible. In some settings, including the U.S., costs can include (a) flexibility across jurisdictions but rigidity within them (adjudicatory and regulatory approaches), (b) an increase in cross-jurisdictional environmental uncertainties (as the left hand undoes what the right hand is doing), and other perverse impacts.

And these points emphasize more explicitly what has been a theme overall of this article: it is clear that learning is the most appropriate way to deal with uncertainty on a continuous basis, some policy and institutional responses offer promise in doing so, but this recognition is simply the beginning of careful work. For there is no policy or institutional template to induce and replicate the right kinds of openness and learning in all environmental settings. The theme, then, is the importance of learning how to induce the right forms of learning, in ways that can be applied - in certain senses at least - across times, jurisdictions, and environmental policy circumstances. This metalearning is therefore a crucial agenda for the future of environmental policy.

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