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Lay Perceptions of Global Risk

Public Views of Global Warming in Cross-National Context

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abstract: This article reports results from a 1992 Gallup survey conducted in six nations (Canada, USA, Mexico, Brazil, Portugal and Russia) that explored public perceptions of global warming in some detail. Overall the results tend to support those of the small-scale but in-depth studies on which the present study built: Lay publics in these six nations see global warming as a problem, although not as serious as ozone depletion or rain forest destruction. Most people acknowledge that they do not understand global warming very well, and results from questions about the perceived causes and consequences of global warming illustrate their limited understanding. While often confusing global warming with ozone depletion and air pollution, majorities of respondents in all but Russia believe that it is already occurring and large majorities within all nations believe that it will occur within their lifetimes. Furthermore, as discussions of the 'risk society' suggest, public perceptions of global warming do not vary consistently across differing social strata within the nations. The article ends by discussing implications of the results, and questions whether detailed public understanding of highly complex issues like global warming is feasible or even necessary for effective policy-making.

keywords: environmental attitudes ✦ global environmental change ✦ global warming ✦ policy-making ✦ public opinion ✦ risk perceptions

Despite having been the subject of scientific investigation since the 1800s (Kowalok, 1993), only in the past decade has the possibility of

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human-induced climate change become a widely recognized problem. Growing attention to climate change by scientists, environmental activists and policy-makers – and media coverage of all three – placed global warming on the policy agenda, and the abnormally hot weather in the late 1980s appeared to validate its reality (Ungar, 1992). In the USA, for example, the dramatic increase in media and Congressional attention to global warming in the 1980s (Mazur and Lee, 1993) was accompanied by a rapid rise in public concern. In a 1982 survey only 12 percent of a national sample saw the 'greenhouse effect' as 'very serious', but by 1989 the figure had risen to 41 percent – with another 34 percent saying 'somewhat serious' (Dunlap and Scarce, 1991: 661).

Sociologists have examined in considerable detail the processes by which global warming was rapidly 'constructed' into a major problem.[1] However, the focus has been mainly on the roles played by scientists, environmentalists, industrialists, policy-makers and other 'stakeholders' (see, for example, Mazur and Lee, 1993; Redclift and Benton, 1994; Ungar, 1992). Little effort has been made to investigate how the general public views global warming, which is surprising given the heavy use of public opinion/attitude surveys in sociological research on environmental issues (Buttel, 1987; Lowe and Rudig, 1986). This is even more surprising in view of the significance accorded to global environmental risks such as climate change in the purported emergence of the 'risk society' (Beck, 1992) and ensuing debates over the future course of modernization (Cohen, 1997; Mol and Spaargaren, 1993). It therefore seems that both environmental sociology and the discipline at large should be interested in learning more about how the lay public views global warming and related phenomena.

Unlike the situation in sociology, within the small but growing interdisciplinary community interested in the human dimensions of global environmental change it is widely agreed that public perceptions of global warming are important, for it is assumed that such perceptions will have an impact on policy-making (Kempton, 1993; Morgan, 1995). Yet, knowledge about public perceptions, especially possible variation across nations (a potentially critical factor in international policy-making), remains limited. The few reasonably in-depth surveys conducted with large, representative samples have been limited to single nations such as the USA (Mellman Group, 1997; Research/Strategy/Management, 1989), while the available cross-national data are typically limited to Europe and often consist of only one or two forced-choice items on global warming (Rudig, 1995).

In contrast to the limited data available from studies of large representative samples of the public, results are available from numerous in-depth studies (often involving intensive ethnographic interviews) of small, typically 'convenience' samples of lay persons (see, for example, Bell, 1994;

Bostrom et al., 1994; Kempton, 1991; Kempton et al., 1995; Lofstedt, 1991,1992, 1993; Read et al., 1994). Having now been conducted in several nations, these studies provide rich insights into people's perceptions of global warming and related phenomena. The results of these studies show that people try to make sense of global warming by incorporating it into their existing understandings – and misunderstandings – of environmental problems in general, and that substantial confusions often result. While these detailed portrayals of the mental and cultural 'models' involved in the conceptualization of global warming are very insightful, it is difficult to generalize the results of these studies with any confidence due to their necessary reliance on small, unrepresentative samples from specific communities.

This article reports findings from a study designed to help fill the voids noted above; specifically, it was designed to obtain cross-national data from representative samples of the lay public concerning perceptions of global warming in some detail. By drawing on the results and insights of early in-depth studies employing focus groups or ethnographic interviews (Lake, 1989; Kempton, 1991; Lofstedt, 1991), a set of forced-choice and open-ended items were employed that, in combination, yield a fuller image of public perceptions of global warming than that normally obtained in large – especially cross-national – surveys. In addition to their relevance to scholars and policy-makers interested in the human dimensions of global change, the survey results should also be of interest to sociologists who view societal awareness of global environmental risks as a critical component of the presumed evolution of reflexive modernization (Beck et al., 1994).

The Study

In early 1992 the George H. Gallup International Institute conducted an international survey of public awareness and concern about environmental problems in 24 geographically and economically diverse nations around the world. Involving face-to-face interviews (to limit problems of illiteracy and allow for the use of probability sampling) with representative samples of citizens in each country, Gallup's 'Health of the Planet' survey covered a wide range of environmental issues (for preliminary results see Dunlap, 1994; Dunlap et al., 1993). In six nations (Canada, USA, Mexico, Brazil, Portugal and the Republic of Russia) funding permitted use of a long version of the questionnaire that included six questions on global warming, plus many others not used in the basic questionnaire. The results from these six questions, along with those for a set of items dealing with several global environmental problems included in the basic questionnaire, are reported here. While four of the six nations from which data

were obtained are in the Americas, the six nonetheless encompass a wide range of economic development and considerable variation in geographical location and social, political and cultural characteristics. Comparing the views of global warming held by citizens of these six nations should therefore increase our understanding of public perceptions and opinions regarding global warming.

Toward the middle of the basic questionnaire respondents were given a list of seven global environmental problems, including global warming, and asked to rate the seriousness of each. The long version of the questionnaire then turned specifically to global warming, and respondents were first asked how well they felt they understood the 'issue of global warming or the "greenhouse effect" '. All except those who responded 'not at all' were next asked an open-ended question about the 'main causes of global warming', and their *volunteered* responses were recorded and then coded according to a set of precodes developed from the results of the early, in-depth studies noted earlier. Respondents were then given a list of six 'possible causes of global warming' and asked to indicate the contribution of each to global warming. Next came another open-ended question, this one dealing with the effects of global warming. Again, the responses were recorded and coded into categories developed from early studies. This was followed by a question asking respondents to rate the seriousness of six potential impacts of global warming (on ocean levels, agricultural production, etc.). Finally, respondents were asked to indicate when they expected the effects of global warming to begin.

The cross-national results to this set of items should provide a better reading on how global warming is viewed by lay publics in a wide range of nations than has heretofore been available, and should indicate the degree to which results from small, ethnographic and other in-depth studies hold up in structured interviews given to large, representative samples. Based on the results of these prior studies it is expected that the respondents will express considerable concern over global warming, despite recognizing that they have a limited understanding of it. It is also expected that they will have a poor sense of the causes of global warming (confusing it, in particular, with ozone depletion and tropospheric air pollution) and a vague awareness of its potential impacts. Although detailed comparisons with the results of ethnographic studies are impossible, it should be possible to determine whether the overall pattern of results from this cross-national survey are consistent with the image of public perceptions of global warming painted by these earlier, in-depth studies.

Besides reporting the cross-national frequency distributions for the items just noted, the possibility that perceptions vary across differing social sectors within the six nations is also examined. Specifically, the relationships between global warming perceptions and four demographic

variables – age, sex, education, residence – often found to be related to environmental attitudes are reported.[2] Prior cross-national research on the social bases of environmental awareness and concern suggests that such variables will be of limited utility, as environmental attitudes do not vary greatly according to individuals' location in the social structure (e.g. Skrentny, 1993; Rasinski et al., 1994). This tendency should be especially pronounced for perceptions of global warming since the key feature of global risks is that they potentially affect everyone – as emphasized by advocates of the risk society hypothesis (Beck, 1992).

Results

Global Environmental Problems

Global warming is only one of several global environmental problems, and in order to put public perceptions of it into context respondents were asked (following questions on community and national environmental problems) to rate the seriousness of seven potential worldwide environmental problems – including both systemic and cumulative problems (see Turner et al., 1991). The percentages rating each of these problems as 'very serious' and those responding 'don't know' or providing 'no answer' are shown in Table 1 (see Dunlap, 1994 for comparable results for all 24 nations), along with the mean *rating* (with missing data deleted) for each and the relative *ranking* of the means for the various problems within each nation.

Majorities in four of the nations rate 'global warming or the "greenhouse" effect' as very serious, with Brazil and Portugal having the highest percentages doing so. These ratings are generally comparable to those obtained in Eurobarometer surveys conducted in the early 1990s (Rudig, 1995: 15). Interestingly, the USA and Russia are the two countries in which fewer than half of the respondents rate global warming as very serious, and in Russia more than in the USA this stems from the very large percentage (26 percent) unable to rate it. It is notable, however, that in general respondents rate global warming as substantially less serious than ozone depletion and loss of rain forests. In fact, 'loss of ozone in the earth's atmosphere' tends to be the most highly rated global problem across the nations, followed by 'loss of rain forests and jungles' and 'pollution of rivers, lakes and oceans'. In contrast, global warming and soil-related problems ('soil erosion, polluted land, and loss of farmland') are the two lowest rated problems, trailing 'air pollution and smog' and 'loss of animal and plant species' as well as the three problems noted above. These results clearly indicate that even though large portions (typically majorities) of citizens in the six nations see global warming as a serious problem, it is not seen as one of the most serious global environmental problems.

Table 1 *Rating of Seriousness of World Environmental Problems*[a]

	Canada	USA	Mexico	Brazil	Portugal	Russia
Air pollution						
Very serious	61%	60%	77%	70%	78%	71%
DK/NA	3%	3%	1%	3%	2%	7%
Mean[b]	3.60	3.58	3.74	3.65	3.78	3.74
Rank	4	3	4	5	4	2
Water pollution						
Very serious	76%	71%	78%	69%	81%	74%
DK/NA	2%	2%	2%	3%	2%	6%
Mean	3.76	3.70	3.73	3.64	3.82	3.77
Rank	1	1	6	6	3	1
Soil problems						
Very serious	57%	54%	77%	56%	71%	63%
DK/NA	4%	4%	1%	5%	5%	8%
Mean	3.55	3.47	3.73	3.41	3.71	3.62
Rank	6	5	5	7	6	5
Loss of species						
Very serious	58%	50%	81%	74%	68%	61%
DK/NA	4%	3%	1%	3%	2%	6%
Mean	3.54	3.37	3.78	3.69	3.62	3.61
Rank	7	7	1	3	7	6
Rain forest loss						
Very serious	70%	63%	80%	78%	82%	66%
DK/NA	4%	6%	2%	2%	3%	7%
Mean	3.70	3.59	3.77	3.74	3.82	3.66
Rank	3	2	3	2	2	4
Global warming						
Very serious	58%	47%	62%	71%	72%	41%
DK/NA	9%	12%	20%	8%	10%	26%
Mean	3.56	3.40	3.71	3.69	3.77	3.43
Rank	5	6	7	4	5	7
Loss of ozone						
Very serious	70%	56%	71%	74%	79%	58%
DK/NA	6%	9%	13%	8%	10%	21%
Mean	3.71	3.54	3.78	3.74	3.86	3.68
Rank	2	4	2	1	1	3
N	1011	1032	1502	1414	1000	964

[a] Question wording: 'Now let's talk about the world as a whole. Here is a list of environmental issues that may be affecting the world as a whole. As I read each one, please tell me how serious a problem you *personally* believe it to be in the world – very serious, somewhat serious, not very serious, or not serious at all – or you don't know enough about it to judge?'

[b] Mean of ratings (very serious = 4, somewhat serious = 3, not very serious = 2, not at all serious = 1) with non-responses (DK/NA) deleted.

The relative ratings of ozone depletion and global warming probably reflect the fact that the former is typically seen as more firmly established scientifically (Ungar, 1995) and as posing more of a threat than the latter (McDaniels et al., 1996: 164).

While it is difficult to draw conclusions based solely on frequency distributions (Schuman, 1986), it is tempting to argue that the overall pattern of public responses to these global-level problems lends credibility to arguments that global environmental risks are particularly salient in the contemporary world. Perhaps more directly supportive of the risk society hypothesis is that neither ratings of global warming nor of all seven problems combined correlate significantly and consistently with age, education, sex or residence across the six nations,[3] suggesting that Beck (1992) is justified in arguing that concern over global 'mega-hazards' is broadly diffused throughout society.

That citizens in all six nations rate these global problems as more serious than they do environmental problems within their own communities (Dunlap, 1994: 118–19) could also be seen as validating the emphasis placed on the former in the risk society hypothesis (Beck, 1992). In addition, the fact that national-level, aggregate measures of public perceptions of global problems are *not* related to national wealth (per capita GNP), while national-level perceptions of community problems are negatively (and significantly) related to national wealth, might also be seen as supportive of Beck's thesis.[4] Of course, the latter could also be interpreted as calling into question the logic of the evolution of the risk society, as concern over global environmental risks ought to be higher in wealthier nations – where concern over the inescapability of such risks should be a higher priority than in nations presumably still preoccupied with the distribution of economic goods relative to environmental 'bads' (Cohen, 1997).

Self-Reported Level of Understanding of Global Warming

The long version of the 'Health of the Planet' questionnaire then turned specifically to global warming, beginning with a question measuring self-reported understanding of the phenomenon. Although obviously a weak indicator of knowledge per se,[5] responses to this item are not only interesting in their own right but were used as a 'filter' for subsequent questions (as described in the following paragraph). Prior surveys have found substantial portions of citizens indicating limited – if any – understanding of global warming (Rudig, 1995: 8), and the Gallup results reported in Table 2 are consistent with these. Only small percentages (from 3 percent in Portugal to 13 percent in Canada) say they understand global warming 'very well', and typically far larger percentages say 'not very well' or 'not

Table 2 *Reported Levels of Understanding of Global Warming*[a]

	Canada	USA	Mexico	Brazil	Portugal	Russia
Level of understanding	%	%	%	%	%	%
Very well	13	11	6	10	3	4
Fairly well	47	42	19	34	18	19
Not very well	21	22	13	16	26	20
Not at all	15	22	51	17	36	29
DK/NA	3	4	11	24	18	28
Mean[b]	2.61	2.44	1.78	2.49	1.84	1.95
N	1011	1032	1502	1414	1000	964

[a] Question wording: 'Thinking about the issue of global warming or the "greenhouse effect", how well do you feel you understand this issue – would you say very well, fairly well, not very well, or not at all?'

[b] Mean of ratings (very well = 4, fairly well = 3, not very well = 2, not at all = 1) with non-responses (DK/NA) deleted.

at all'. In addition, in Brazil and Russia about a quarter of the interviewees provided no response to the question. As a result, only in Canada and the USA do majorities report understanding the issue 'very' or even 'fairly well'. At the individual level, it is notable that in all six nations age, education and sex are significantly related to self-reported understanding, as younger adults, the well-educated and males report having a better understanding of global warming than do their counterparts. These results are consistent with past studies of patterns of variation in knowledge about technical issues, and suggest that the measure has at least some validity (Pierce et al., 1989; Sigelman and Yanarella, 1986).

Overall the results in Table 2 confirm the limited degree of lay persons' understanding of global warming reported in prior, small-scale studies (especially taking into account that respondents are likely to overestimate their understanding), and show that it is even lower in less developed nations than in North America. This item was then used as a 'soft' filter, as those who responded 'not at all' or who were unable to give a response were *not* asked the subsequent questions about global warming (accounting for the smaller *N*s reported in the following tables). This was done in order to avoid asking respondents to provide answers to questions that have no meaning for them.

Perceived Causes of Global Warming

An important question from a policy-making perspective is the degree to which the public understands the causal factors that contribute to global

warming (Kempton, 1993). Since the earlier, in-depth studies consistently reported finding much confusion among lay persons concerning the causes of global warming, the Gallup survey used both open-ended and forced-choice items dealing with perceived causes. The first question was an open-ended one that asked the remaining respondents about the 'main causes' of global warming or the greenhouse effect. In order to facilitate data analysis, a detailed scheme of precodes for the *volunteered* responses was developed on the basis of results from the earlier in-depth studies (Lake, 1989; Kempton, 1991; Lofstedt, 1991, 1992). In general the scheme worked quite well, and the results are presented in Table 3. Since respondents were allowed to mention two causes, although many volunteered only one, the table shows the percentages mentioning the various causes

Table 3 *Volunteered Causes of Global Warming: First Response and Total Response (in parentheses)*[a,b]

	Canada	USA	Mexico	Brazil	Portugal	Russia
Causes	%	%	%	%	%	%
Pollution	32	29	28	34	41	31
	(43)	(39)	(34)	(43)	(49)	(36)
CFCs/ozone	25	27	37	17	24	4
	(35)	(34)	(43)	(22)	(31)	(6)
Fossil fuel use	22	12	4	5	6	18
	(31)	(20)	(5)	(10)	(14)	(23)
Land use	5	9	5	23	11	3
	(9)	(13)	(7)	(31)	(16)	(4)
Social causes	1	3	3	1	4	9
	(2)	(3)	(4)	(1)	(6)	(9)
Other causes	3	7	9	2	1	1
	(6)	(9)	(17)	(2)	(1)	(1)
Natural phenomenon	1	0	2	0	4	1
	(1)	(0)	(4)	(0)	(6)	(1)
Not a problem	1	1	0	0	0	0
	(1)	(1)	(0)	(0)	(0)	(0)
DK/NA	11	13	12	19	9	34
	(52)	(58)	(69)	(67)	(62)	(81)
N	832	797	638	862	475	528

[a] Not asked of those who responded 'not at all well' to the prior question in Table 2.
[b] Question wording: 'Just as you understand it, what are the main causes of global warming sometimes called the greenhouse effect?'

as both 'first response' and 'total response' (the latter, shown in parentheses, combines first and second mentions).

Consistent with the results of the now-numerous in-depth studies, the Gallup survey respondents are most likely to mention some form of pollution (the categories include numerous subcodes) or 'CFCs and/or ozone' as the main cause of global warming. That CFCs and ozone are mentioned more often than fossil fuel use in every nation except Russia suggests that the confusion between global warming and ozone depletion found so commonly in American studies (Kempton, 1993: 237) is shared among residents in a wide range of nations. Only in Brazil does a sizable portion (23 percent of the first responses and 31 percent of the total responses) mention land use problems such as forest destruction. In addition, the low level of self-rated understanding of global warming among Russians reported in Table 2 is confirmed by the fact that over a third of the Russian sample are unable to suggest any cause for global warming.

Responses to this open-ended question suggest that throughout the six nations citizens have a poor understanding of the causes of global warming. As found in numerous in-depth studies of small, convenience samples, lay publics are most likely to see global warming as being caused by air pollution or ozone depletion, and in no nation do as many as a third volunteer (in their first response) fossil fuel use or deforestation as the main causes. Interestingly, education is the only demographic variable that correlates significantly with responses to this item in more than a couple of nations. However, while education is positively related to (correctly) volunteering fossil fuel use in four nations (all but Mexico and Portugal), it is also positively related to (incorrectly) volunteering CFCs/ozone in four nations (all but Canada and Russia).[6]

The subsequent forced-choice question provided a list of six 'possible causes' of global warming, and asked respondents to rate each as a 'major cause', 'minor cause' or 'not a cause' of global warming. Table 4 shows the percentages rating each one as a 'major cause'. As found in previous studies (e.g. Bell, 1994; Bostrom et al., 1994; Read et al., 1994), respondents tend to provide somewhat more accurate responses when presented with such a list than they are able to do when asked to come up with causes on their own. Across the nations large majorities rate 'loss of rainforests', 'coal and oil power plants' and 'automobile exhaust' as major causes, and these three are in fact the most significant contributors to global warming included in the list.

Yet, there is ample evidence of misunderstanding regarding the causes of global warming in responses to this set of items. Majorities in every nation incorrectly rate 'aerosol sprays' as a major cause (another indication of the confusion between ozone depletion and global warming), although

Table 4 *Rating of Possible Causes of Global Warming: Percentage Rating Each as 'Major Cause'*[a,b]

	Canada	USA	Mexico	Brazil	Portugal	Russia
Causes	%	%	%	%	%	%
Automobile exhaust	76	68	68	59	77	72
Loss of rainforests	72	64	72	81	89	63
Aerosol sprays	58	54	74	65	67	54
Coal and oil power plants	68	65	79	64	83	68
Nuclear power plants	34	38	75	75	85	43
Refrigerators and air conditioners	42	29	28	27	45	27
N	832	797	638	862	475	528

[a] Not asked of those who responded 'not at all well' to the question in Table 2.
[b] Question wording: 'Here is a list of possible causes of global warming. For each one, please tell me whether you think it is a major cause, a minor cause, not a cause of global warming, or don't you know enough to say?'

only minorities incorrectly rate 'refrigerators and air conditioners' as a major cause. Perhaps the most inconsistent pattern across the nations occurs for 'nuclear power plants'. Although only minorities incorrectly see such plants as a major cause of global warming in three nations, in Mexico, Brazil and Portugal large majorities see them as a major cause. Perhaps the negative 'halo effect' that has come to be associated with nuclear energy in countries such as the USA (see, for example, Rosa and Dunlap, 1994) is even stronger in less economically developed nations.

Interestingly, nuclear power is also the only item whose rating is significantly related to any of the demographic variables in a majority of the nations. In every nation women are significantly more likely than men to see nuclear power as a cause of global warming (although in Portugal the correlation fails to reach significance ($p < .08$), a pattern that is consistent with women's stronger anti-nuclear orientation documented in numerous studies (Davidson and Freudenburg, 1996). Conversely, education is negatively related to seeing nuclear power as a cause in every nation (although not quite reaching significance in Mexico, where $p < .06$), perhaps reflecting a tendency for knowledge of technical issues such as both nuclear power and global warming to increase somewhat with education (Sigelman and Yanarella, 1986; Pierce et al., 1989: 50).

Perceived Effects of Global Warming

The questionnaire then turned to the effects of global warming, first with an open-ended question to elicit volunteered responses. Again, precoding of major categories was based on findings from the early in-depth studies, and the results are shown in Table 5. Various types of 'ecological problems' are the most frequently volunteered effect in four of the nations, with 'weather and climate changes' most often mentioned in the other two (USA and Brazil). Typically coming in third are various responses dealing with human health and welfare effects, and surprisingly seldom mentioned are agricultural problems.

These volunteered responses suggest that people are more likely to see global warming as having an effect on natural systems (either by creating various ecological problems or by changing weather patterns) than on social systems.[7] Of course, had probing been feasible, it is possible that those mentioning weather and climate change would have pointed to the human impacts of such changes. In every nation except Portugal education is positively and significantly related to volunteering some type of ecological effect, and males are significantly more likely to volunteer such effects in Canada, the USA and Brazil.

As was done for the causes of global warming, the open-ended question

Table 5 *Volunteered Effects of Global Warming: First Response and Total Response (in parentheses)*[a,b]

	Canada	USA	Mexico	Brazil	Portugal	Russia
Effects	%	%	%	%	%	%
Ecological problems	31 (46)	25 (38)	29 (35)	25 (38)	33 (43)	48 (58)
Weather/ climate	27 (34)	33 (41)	14 (16)	28 (33)	26 (30)	22 (26)
Human health/ welfare	20 (29)	12 (16)	20 (23)	28 (34)	21 (24)	8 (13)
Agricultural problems	5 (12)	5 (9)	2 (3)	2 (4)	7 (8)	2 (4)
Other impacts	6 (6)	5 (6)	8 (9)	0 (0)	2 (2)	3 (4)
DK/NA	12 (48)	21 (58)	27 (75)	17 (67)	12 (67)	17 (69)
N	832	797	638	862	475	528

[a] Not asked of those who responded 'not at all well' to the question in Table 2.
[b] Question wording: 'Again, as you understand it, what effects, if any, do you think global warming will have?'

was followed with an item listing six areas in which global warming might have harmful effects. Respondents were asked to rate the degree to which they expected such effects during the next 25 years. As shown in Table 6, and consistent with the emphases on ecological impacts in the prior question, 'survival of animal and plant species' is the realm seen as most likely to experience 'very harmful' effects from global warming during the next quarter century. Agricultural production and human health are the next two realms seen as most likely to suffer harm from global warming, followed by levels of the oceans. Choices that people have of where to live and economic well-being are the least likely realms to be seen as being harmed – suggesting that economists' emphasis on economic impacts (see, for example, Nordhaus, 1994) ignores the public's crucial concerns – although it should be noted that in three countries majorities see economic impacts as very harmful.

Somewhat surprisingly, citizens in the less economically developed nations of Portugal, Brazil and Mexico are much more likely to expect economic harm from global warming. Ironically, people in these three countries are also far more likely to see animal and plant species as

Table 6 *Rating of Possible Harmful Impacts of Global Warming: Percentage Rating Each as 'Very Harmful'*[a,b]

	Canada	USA	Mexico	Brazil	Portugal	Russia
Impacts	%	%	%	%	%	%
Human health	47	41	85	90	86	33
Economic well-being	30	27	53	64	68	20
Agricultural production	62	51	76	85	83	36
Choices people have in where to live	30	31	71	70	45	20
Survival of animal and plant species	59	53	82	90	83	45
Levels of the oceans	53	44	74	81	81	52
N	832	797	638	862	475	528

[a] Not asked of those who responded 'not at all well' to the question in Table 2.

[b] Question wording: 'Now, would you tell me how harmful, if at all, you think global warming will be to the following during the next 25 years: very harmful, somewhat harmful, not very harmful, or not at all harmful?'

suffering harm. In fact, the Portuguese, Brazilians and Mexicans are overall much more likely to see global warming as having very harmful effects than are Canadians, Americans or Russians.

In terms of variation among demographic sectors within nations, sex is the only variable that is consistently related to perceived harmful effects. Women rate possible human health effects as significantly more harmful than do men in all six nations; further, in Canada, USA and Brazil women rate all six of the potential effects as significantly more harmful than do men. This suggests that the numerous American studies that have found women to be more concerned than men about the health threats posed by environmental and technological problems reflect a pattern that is not confined to the USA (Davidson and Freudenburg, 1996). The only other social characteristics that correlate consistently with *any* of the potential harmful effects are age, which is positively related to seeing harmful economic effects from global warming in every nation (although not significantly so in the USA, Portugal and Russia), and education, which is negatively related to seeing harmful economic effects in every nation (but insignificantly so in Mexico, Portugal and Russia and barely reaching the .05 level in the USA and Brazil).

Expected Onset of Global Warming

Having examined the perceived causes and effects of global warming via both closed and open-ended questions, the series of global warming items ended by asking respondents 'When do you think the effects of global warming will begin to happen?'. As shown in Table 7 a list of five possible responses was given to respondents, and majorities in all but Russia select 'they have already begun to happen'. Hardly anyone says 'they will never happen', and only small minorities expect that global warming will not happen within their lifetimes but will affect future generations. In fact, 80–90 percent of citizens who feel that they have at least a limited understanding of the phenomenon in all countries but Russia indicate that they expect to see the effects of global warming within their lifetimes. Russians are the most sanguine (as well as the most unsure) about the effects of global warming, followed by Americans.[8] Within nations there is no consistent pattern of relationships between expected onset and any of the demographic variables, as there are small and generally insignificant positive as well as negative correlations for each variable across nations.

That large majorities of citizens in every nation except Russia indicate that they believe global warming is already happening, even when several alternatives are presented to them, is surprising. The idea that global warming has already begun appears to be a relatively consensual belief among lay publics, fairly similar to the situation among scientists involved in climate change research (see, for example, Bray and von Storch, 1996).[9]

Table 7 *Expected Onset of Effects of Global Warming*[a,b]

	Canada	USA	Mexico	Brazil	Portugal	Russia
Expected onset	%	%	%	%	%	%
Already begun to happen	70	62	74	77	84	45
Start happening within few years	8	6	12	12	11	12
Start happening within lifetime	9	10	3	3	3	15
Will affect future generations	6	13	7	6	1	19
Will never happen	1	2	0	1	0	1
DK/NA	5	7	5	2	0	9
N	832	797	638	862	475	528

[a] Not asked of those who responded 'not at all well' to the question in Table 2.
[b] Question wording: 'When do you think the effects of global warming will begin to happen? . . . They have already begun to happen; they will start happening within a few years; they will start happening within my lifetime; they will not happen within my lifetime, but they will affect future generations; they will never happen.'

Thus, despite the serious lack of understanding of global warming among the general public, lay-persons readily acknowledge its current or at least imminent occurrence.

Summary of Results

The results of this six-nation comparison of public perceptions regarding global warming yield a mixed picture. While majorities in four of the nations rate global warming as a 'very serious' problem, it tends to be rated as less serious than ozone depletion, rainforest destruction and both water and air pollution. Few people in any nation feel that they understand global warming 'very well', and sizable minorities say 'not at all' well or are unable to give a response. This limited understanding is reflected by responses – elicited only from those who felt they had at least a limited understanding of global warming – to an open-ended question concerning the main causes of global warming, as in most countries majorities erroneously equate global warming with air pollution or ozone depletion (as consistently found in prior studies as well). However, a subsequent list of possible causes yields a slightly more accurate pattern of responses, as the three major causes of global warming included in the list

are among the most likely to be rated as 'major causes' in a majority of the countries. When we turn to the effects of global warming, we find that across the six nations citizens are more apt to volunteer ecological problems or weather and climatic impacts than human impacts. A rather similar pattern emerges in a subsequent question where respondents rate a set of potentially harmful impacts, as animal and plant species are seen as suffering the most harm. Here, however, human health and agricultural production are seen as quite likely to suffer harmful effects, more so than is the economic realm. Finally, majorities in all but Russia indicate that they believe that the effects of global warming have already begun, and very few feel that such effects will not occur within their lifetime.

Overall the results of this comparative study tend to support the general image of public perceptions of global warming drawn from previous, in-depth surveys of small samples, and thus bear out the expectations reported early in this article. As documented in several in-depth studies, there is substantial confusion among lay-people concerning global warming (see, for example, Bell, 1994; Bostrom et al., 1994; Kempton, 1991; Lofstedt, 1991, 1992, 1993; Read et al., 1994). Especially notable is the confusion between global warming and ozone depletion, obvious in responses to both open-ended and forced-choice items dealing with the causes and likely effects of global warming. The general correspondence between the Gallup results and those of small, in-depth studies tends to support the contention that in-depth interviews with small samples can yield fairly accurate images of the 'mental models' by which lay-persons conceptualize global warming (Morgan, 1995). At the same time, such replication suggests that reasonably detailed questions about global warming can, in fact, be meaningfully answered by the general public – despite lay-persons' relatively poor understanding of the issues involved (e.g. the tendency to confuse climate and weather).

The low levels of citizen understanding of global warming found in this study (replicating findings from several prior studies conducted with far more limited samples) notwithstanding, it should be kept in mind that overall the residents of the six countries do express a good deal of concern about global warming. They see it as a problem (even if less serious than ozone depletion and some other global problems), they perceive it as having harmful impacts *and* think it has already begun. Quite importantly, despite the lower levels of understanding among citizens of the poorer nations in our study, residents of these nations typically express more concern over global warming than do those in the more affluent nations. The lack of a major cleavage between citizens of poor and rich nations in this regard is consistent with a growing amount of data showing that national affluence is *not* – as often assumed – significantly related to public concern about environmental quality (see, for example, Brechin and

Kempton, 1994; Dunlap and Mertig, 1995; Rudig, 1995). Such information should be welcome news to those who seek to foster increased international efforts to halt global warming and other forms of global environmental change.

Discussion

That the public is poorly informed about global warming comes as no surprise. Prior studies of the general public have found only limited understanding of complex scientific and technological issues among citizens of wealthy nations (e.g. Pierce and Lovrich, 1982), and several aspects of global warming (and climate change in general) make it a particularly difficult topic for lay-people: (1) long-term climate patterns are harder to perceive than are short-term, localized changes in weather, and the latter confound the former; (2) the effects of global climate change are difficult to experience because they tend to be distant in both time and space; (3) the science of climate change is complicated, struggles to establish clear-cut cause and effect relationships and is increasingly under challenge; (4) news coverage of climate change is often misleading in content, and the media's penchant for employing 'dueling scientists' to cover both sides of an issue exaggerates the degree of scientific dissensus on key issues; (5) the causal mechanisms producing global warming are less amenable to individual understanding and action than, for example, is the situation regarding CFCs, aerosol sprays and ozone depletion; and (6) global warming lacks the simple and highly symbolic signal conveyed by the computerized map of the 'hole' in the ozone layer or images of massive fires in tropical forests (see, for example, Bell, 1994; Gelbspan, 1997; Kearney, 1994; Kempton, 1993; Ungar, 1992, 1995).

Given the inherent difficulties involved in understanding the scope, causes and consequences of global warming, it comes as no surprise that lay-people seem to make sense of it, the 'Greenhouse Effect', climate change and so forth via existing and more generalized 'frames' or 'mental models', i.e. notions of 'air pollution,' 'ozone depletion' or 'ecological problems' in general. Such phenomena were on the public agenda before global warming, and it is inevitable that information about global warming would be filtered through people's interpretations of prior problems or of generalized ecological deterioration (Stern et al., 1995; Whyte, 1985).

Even though lay-people have very limited understanding of the details of global warming, the issue's appearance as a visible social problem has surely heightened the public's general sense that humans are having a detrimental impact on the environment (locally to globally) and their growing concern over the ramifications (see, for example, Kempton et al.,

1995). Thus, it seems probable that the ambiguities surrounding global warming notwithstanding, its appearance on the public agenda has reinforced the ecological 'worldview' or 'master frame' (e.g. Olsen et al., 1992) that has slowly been evolving in recent decades (Mazur and Lee, 1993). Consequently, although concern over global warming is likely to wax and wane according to dramatic weather events, media attention and policy salience (as Ungar [1995] notes), it is also unlikely to disappear in the foreseeable future because it is woven into the fabric of the 'ecological problematique' that seems firmly – if not deeply – embedded in public consciousness.[10]

Implications and Conclusion

It is common for analysts to decry the limited level of public understanding of global warming, and to argue that effective policy-making and ameliorative action will hinge on efforts to enhance this understanding (e.g. Kempton, 1993; Morgan, 1995). There is in fact some evidence suggesting that intensive efforts can enhance public understanding of complex issues like global warming (Doble, 1995), although their large-scale feasibility remains to be demonstrated. Perhaps more importantly, interest groups and social movement organizations, via what Beck (1992) terms 'sub-politics', will surely continue to stimulate public concern with issues such as global warming (see, for example, Pierce et al., 1992). Still, it seems unrealistic to expect the lay public to become highly interested in and informed about technically complex issues like global warming; fortunately, it may also be unrealistic to expect that effective policy-making will depend upon a highly informed citizenry.

Although there appears to be a relationship between public preferences and policy-making in democratic nations (Page and Shapiro, 1992), the relationship is far from perfect and many other factors influence policy. Furthermore, the 'informed citizenry' model posited by analysts such as Kempton and Morgan may be particularly unrealistic when applied to macro-level, collective problems like global environmental change. This model seems to assume that rational individual actors armed with knowledge about global warming are the key to ameliorating such problems. Yet, it has been well documented that increasing awareness and concern among citizens may *not* translate into effective behavioral changes, due to a variety of cognitive and structural barriers (Gardner and Stern, 1995), and this is especially the case with global-level problems (see, for example, Bord et al., 1998; Jaeger et al., 1993). Reducing carbon dioxide and taking other steps to curtail global warming will require collective action and institutional change (both intra- and internationally) and are unlikely to result primarily from people changing their consumption patterns on an

individual basis.[11] Indeed, one could argue that public support for environmental regulations and incentives, and for politicians who will implement them, is far more essential than voluntary change in individual consumer behaviors when it comes to achieving a global-level 'public good' like a (reasonably) stable climate.

Presumably the more informed the public about environmental problems the more likely they will be to support politicians and policies committed to environmental protection.[12] However, it seems more likely that broad heuristic devices, such as seeing candidates as 'green' or 'anti-green', may play a more crucial role than detailed knowledge of environmental policies and where candidates stand on them (O'Connor et al., 1996) . In the USA, for example, the evidence suggests that environmental quality has become a nearly consensual value, but that environmental issues are seldom highly salient. The result is a 'permissive consensus' in which policy-makers are given considerable flexibility in pursuing environmental policy; however, when it becomes obvious that policy-makers are trying to dismantle environmental protection programs (as in the first term of the Reagan Administration and the 1994–5 Republican-led Congress) the public – mobilized by environmentalists – becomes alarmed and exerts countervailing pressure (Dunlap, 1995).

The permissive consensus model seems especially apt for an age of reflexive modernization in which lay-persons are forced increasingly to rely upon the judgments of scientists and other experts – particularly for highly complex and distant issues such as global warming. It is no coincidence that in the USA, for example, the front-lines of the battle over environmental protection appear to be shifting from politics to science. Having found in the 1980s that their frontal assault on the environmental consensus backfired, even when led by a popular president such as Reagan, the 'environmental opposition' (Switzer, 1997) is placing growing emphasis on trying to undercut the scientific basis of environmental policies. This is especially obvious for global warming, where the evidence is characterized as severely flawed and those producing it are accused of engaging in 'junk science' (see, for example, Brown, 1997; Gelbsbawn, 1997).

One can view the efforts of environmental opponents to challenge the scientific credibility of environmental science as a broad-based attempt to undermine the environmental reflexivity of modern societies – or, in Beck's (1992) terms, to impede the flow of information that helps turn industrialized nations into risk societies. Consequently, the scientific credibility of claims about global warming and other aspects of global environmental change are likely to become even more highly contested in the future as skeptics seek to increase confusion and doubt among the public.[13] While this would seem to place great pressure on creating a truly

informed citizenry, I remain skeptical that public support for environmental protection will hinge upon lay-persons becoming highly informed about the technical aspects of global warming.

Concerns about global climate change have received credibility in large part because they coincide with a growing body of evidence accumulated in recent decades suggesting that human activities are having harmful impacts on local to global ecosystems and that the resulting environmental changes pose threats to human welfare (Kempton et al., 1995; Mazur and Lee, 1993). Global warming not only fits nicely within the umbrella of this 'master frame', but debate over it may well strengthen the credibility of this frame (Dunlap and Catton, 1994). The very confusion between global warming and ozone depletion, for example, implies that debates over climate change may activate concerns over ozone depletion – which the public sees as more serious and threatening. Indeed, if Mazur is correct that public opinion toward technological issues such as nuclear power depends more on the total amount of media coverage than on whether the coverage is slanted toward one side or the other (see, for example, Mazur and Lee, 1993), opponents' and skeptics' ability to generate media attention may well backfire by reinforcing rather than reducing public concern.

In addition, it seems likely that when it comes to mega-hazards affecting health and welfare, especially for future generations, lay-people are less concerned with definitive evidence than are scientists and policy-makers – as apparent, for example, when comparing the results of Henderson-Sellers (1990) with those of Nordhaus (1994). Lay 'irrationality' has often been criticized for deviating widely from that of experts when it comes to technical issues such as nuclear power (often inappropriately – see Freudenburg, 1988), but global warming (and climate change) in general represent an instance in which lay opinion does not differ all that much from the emerging 'consensus' view of the scientific community involved in global change research. Lay-people may not understand the issues very well, but their views seem to mirror the growing scientific consensus that steps should be taken to reduce the possibility of human-induced global warming (Hinrichs, 1997). Such a 'precautionary' view seems consistent with the public's general position that steps should be taken to halt further ecological deterioration (Dunlap et al., 1994).

For example, a recent USA poll of registered voters found 72 percent in favor of 'an international agreement to reduce carbon dioxide emissions by 20 percent by the year 2005', and the same poll found that 75 percent believe that 'most scientists agree that global warming is real and happening' and that the skeptics represent the interests of big oil, coal and gas companies (Mellman Group, 1997). Again, the public may be poorly informed on the details, but presumably they find the cautious view expressed by proponents of ameliorative action far more 'rational' than

the 'not to worry' stance of the skeptics and their backers. In an era of reflexive modernization, it may well be more crucial for the public to know which experts to trust and distrust than to understand the details of their respective arguments.

Notes

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1. For two differing views on the appropriateness and utility of the social constructivist approach compare Dunlap and Catton (1994) with von Storch and Stehr (1997).
2. See Dunlap and Mertig (1997) for information on the coding of the demographic variables.
3. The amount of variation in a seven-item summated rating scale measuring perceived seriousness of global environmental problems (with alphas ranging from 0.79 in Brazil to 0.86 in the USA) accounted for by all four demographic factors range from only 1 to 4 percent across the nations.
4. Among all 24 nations in the Gallup survey, the correlation between a scale combining responses to all seven global-level problems reported in Table 1 (aggregated to provide mean scores for each nation) and national wealth (per capita GNP) is .05 (NS), while a similar measure summing responses to six community-level environmental problems is correlated –.52 ($p < .01$) with national wealth (Dunlap and Mertig, 1995: 129).
5. Pierce et al. (1989: Ch. 2) report that a multi-item measure of self-reported familiarity with technical terms correlates significantly with other measures of technical information on environmental issues.
6. Volunteered responses of pollution, fossil fuel use or CFCs/ozone (the three major categories) were each treated as dummy variables in the regression analyses.
7. This is analogous to the multinational results reported by Rudig (1995: 18) showing that global warming is more likely to be seen as a danger to the environment than to respondents and their families.
8. A recent (1997) poll of 800 registered voters in the USA found 74 percent believe that global warming is either happening now (50 percent) or will happen in the future (24 percent), quite similar to the 76 percent responding to the first three categories in Table 7 in 1992. This may be surprising given that the recent survey found 'only' 24 percent rating it as 'very serious threat' compared to

the 47 percent rating it a 'very serious problem' in the 1992 survey reported in Table 1, although when 'very' and 'somewhat' serious are combined the totals decline only from 74 to 66 percent (Mellman Group, 1997).

9. The survey of scientists conducted by Bray and von Storch (1996) is probably the largest and most representative study of scientists' views of global warming yet available. Yet, like the other studies of the scientific community, its results are heavily influenced by the population of scientists surveyed as well as the sampling procedures employed. For an example of dramatically diverging results stemming from the use of two quite different samples, compare Slade (1990) and Nordhaus (1994).
10. The fact that environmental awareness and concern are related to fundamental value changes that appear to be inherent in modernization processes also bodes well for continued public attention to global warming (e.g. Inglehart, 1997; Stern et al., 1995).
11. Recognition of this fact, along with understandable reluctance to endorse personally costly behavioral change (like giving up private transportation in the USA), may affect the public's general tendency to favor government regulations on industry over those on individual consumers (Mellman Group, 1997; Bord et al., 1998).
12. Evidence from college students suggests that accurate information may be more effective and essential in promoting individual behavioral changes than for supporting governmental regulations to combat global warming (O'Connor et al., 1996).
13. Ironically, it may be that the skeptics of global warming are having more success with policy-makers such as the US Congress (Brown, 1997) than the lay public.

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